IGEMS Release 10

CAD/CAM/NEST

Reference manual
1 General functions ................................................................. 6
  1.1 System menu ................................................................. 6
  1.2 Ribbon menu ................................................................. 6
  1.3 Quick access toolbar ....................................................... 6
  1.4 Shortcuts ........................................................................ 7
  1.5 Command line area ........................................................... 7
  1.6 Multiple drawings ............................................................ 7
  1.7 Ortho mode ...................................................................... 8
  1.8 Zoom and Pan ................................................................. 8
  1.9 Coordinate input .............................................................. 8
  1.10 Distance input ............................................................... 9
  1.11 Object snap .................................................................... 10
  1.12 Select objects .................................................................. 11
  1.13 Auto base point .............................................................. 13
2 Program menu ..................................................................... 14
  2.1 New ............................................................................... 14
  2.2 Templates ........................................................................ 14
  2.3 Open ............................................................................... 15
  2.4 Import ............................................................................. 15
  2.5 Recover ............................................................................ 16
  2.6 Recent files ....................................................................... 16
  2.7 Save ................................................................................ 16
  2.8 Save as ........................................................................... 17
  2.9 Save as template ................................................................ 17
  2.10 Dump image .................................................................... 17
  2.11 Export ............................................................................ 18
  2.12 Close ............................................................................. 18
  2.13 Close all ......................................................................... 18
  2.14 Plot ............................................................................... 18
  2.15 Limits ............................................................................ 19
  2.16 Preferences .................................................................... 20
  2.17 Password ....................................................................... 23
  2.18 Drawing units .................................................................. 23
  2.19 Point style ...................................................................... 23
  2.20 Dimension style .............................................................. 24
  2.21 About ............................................................................. 24
  2.22 Exit ............................................................................... 25
3 System menu ....................................................................... 26
  3.1 Undo ............................................................................... 26
  3.2 Redo ............................................................................... 26
  3.3 Purge ............................................................................... 26
  3.4 Status ............................................................................. 27
  3.5 User data folder .............................................................. 27
  3.6 Shared folder ................................................................. 28
  3.7 Service center ............................................................... 28
  3.8 Support .......................................................................... 28
4 CAD commands ................................................................... 30
  4.1 Line ............................................................................... 30
  4.2 Circle ............................................................................. 30
  4.3 Rectangle .......................................................................... 30
  4.4 Point ............................................................................... 31
  4.5 Arc .................................................................................. 31
  4.6 Polyline ........................................................................... 32
  4.7 Spline ............................................................................... 32
  4.8 Ellipse (Shift+E) .............................................................. 32
  4.9 Solid ............................................................................... 33
  4.10 Hatch ............................................................................. 33
  4.11 Parametric shape ........................................................... 34
  4.12 N-gon ............................................................................ 35
  4.13 Obround .......................................................................... 36
  4.14 Swell ............................................................................. 36
  4.15 Puzzle ............................................................................ 36
General functions

4.16 Boundary poly ................................................................. 37
4.17 Offset ........................................................................ 37
4.18 Fillet ............................................................................. 37
4.19 Trim ............................................................................... 38
4.20 Zero fillet ......................................................................... 38
4.21 Chamfer .......................................................................... 39
4.22 Lengthen ......................................................................... 39
4.23 Extend ............................................................................... 39
4.24 Boolean ........................................................................... 39
4.25 Polyline editor ................................................................. 40
4.26 Break .............................................................................. 40
4.27 Erase ............................................................................... 41
4.28 Join .................................................................................. 41
4.29 Layer ............................................................................... 41
4.30 Explode ............................................................................ 42
4.31 Create block .................................................................... 42
4.32 Insert block ...................................................................... 43
4.33 Group ............................................................................... 43
4.34 Save block ........................................................................ 43
4.35 Define attributes .............................................................. 44
4.36 Move ............................................................................... 45
4.37 Rotate ............................................................................. 45
4.38 Copy ............................................................................... 45
4.39 Mirror ............................................................................. 45
4.40 Scale ............................................................................... 46
4.41 Quick move ...................................................................... 46
4.42 Stretch ............................................................................. 46
4.43 Skew ............................................................................... 47
4.44 Array ............................................................................... 47
4.45 Zoom extents .................................................................... 48
4.46 Pan .................................................................................. 49
4.47 Zoom ............................................................................... 49
4.48 Zoom window ................................................................... 49
4.49 Color ............................................................................... 49
4.50 Line type .......................................................................... 50
4.51 Line weight ...................................................................... 51
4.52 Quick select ...................................................................... 51
4.53 Send to back ..................................................................... 52
4.54 Bring to front .................................................................... 52
4.55 Regenerate ....................................................................... 52
4.56 Info .................................................................................. 52
4.57 Distance ........................................................................... 53
4.58 Id .................................................................................... 54

5 Dimension ........................................................................... 55
5.2 Linear ............................................................................... 56
5.3 Diameter .......................................................................... 56
5.4 Text .................................................................................. 56
5.5 Rotated dimension ............................................................ 57
5.6 Radius .............................................................................. 57
5.7 Angular dimension ............................................................ 57
5.8 Leader ............................................................................... 57
5.9 Dimension style ............................................................... 58

6 CAM-Tools .......................................................................... 59
6.1 Clean up ............................................................................ 59
6.2 Edgefix ............................................................................. 59
6.3 Replace ............................................................................... 59
6.4 Analyze ............................................................................ 60
6.5 Boundary scan ................................................................. 60
6.6 Boundary trim ................................................................. 60
6.7 Curvefit ............................................................................ 61
6.8 Poly joint .......................................................................... 61
6.9 Vectorize .......................................................................... 61

Page 3
General functions

6.10 Pocketing ......................................................... 62
6.11 Convex hull ...................................................... 62
7 SignMaker .................................................................. 63
  7.1 Font tracer ......................................................... 63
  7.2 Image ............................................................... 64
  7.3 Image tracer ....................................................... 65
8 Tile maker .................................................................. 66
  8.1 Tile ...................................................................... 66
  8.2 Tile cut ............................................................... 66
  8.3 Inlay .................................................................... 68
9 Data Exchange ........................................................... 73
  9.1 Import .................................................................. 73
  9.2 NC reader ........................................................... 73
10 CAM .................................................................... 75
   10.1 Select setup ...................................................... 75
   10.2 Machine ............................................................ 75
   10.3 Material ............................................................. 76
   10.4 Part create ........................................................ 76
   10.5 Quality .............................................................. 79
   10.6 Tool setup ........................................................ 80
   10.7 Properties ........................................................ 82
   10.8 Part text ............................................................. 82
   10.9 Browser ............................................................. 83
   10.10 Join .................................................................. 84
   10.11 Split .................................................................. 84
   10.12 View in 3D ....................................................... 84
   10.13 Contour ............................................................. 85
   10.14 Quick ............................................................... 93
   10.15 Marking ............................................................ 95
   10.16 Holes ............................................................... 95
   10.17 Manual ............................................................. 96
   10.18 Bridges ............................................................ 101
   10.19 Common cutlines .............................................. 101
   10.20 Cutoff ............................................................... 105
   10.21 Break toolpath .................................................. 107
   10.22 Edit toolpath .................................................... 107
   10.23 Erase toolpath .................................................. 109
   10.24 Micro joints ...................................................... 110
   10.25 Chain .............................................................. 110
   10.26 Disconnect ....................................................... 111
11 5X CAM ................................................................. 112
   11.1 Define bevel ....................................................... 112
   11.2 Cut bevel ........................................................... 118
12 CAM - Material setup .................................................. 121
   12.1 Material groups .................................................. 122
   12.2 Material qualities ............................................... 125
   12.3 Material thickness .............................................. 127
   12.4 General import .................................................. 133
13 CAM - Sheet commands .............................................. 134
   13.1 Sheet Create ...................................................... 134
   13.2 From hole ........................................................ 136
   13.3 Lock sheet ......................................................... 136
   13.4 Unlock ............................................................... 137
   13.5 Divide ............................................................... 138
   13.6 Sheet export ...................................................... 138
   13.7 Sheet open ........................................................ 139
   13.8 History .............................................................. 139
   13.9 Inventory .......................................................... 140
   13.10 Migrate ............................................................ 141
14 CAM - Process .......................................................... 142
   14.1 Process ............................................................. 142
   14.2 Order ............................................................... 147
1 General functions

1.1 System menu

Use the IGEMS system menu to handle standard functions like "Open", "Save", "Plot" and "Settings". Most of these commands are self describing. Picture 2 shows more detailed instructions for each command.

1.2 Ribbon menu

IGEMS R10 is developed with a new menu system called "Ribbons". As default, IGEMS will display the menus horizontally on the top of screen after installing.

1.3 Quick access toolbar

Frequently used commands can be grouped into the "Quick access toolbar" to save time with fewer mouse clicks. To add a command, right mouse click on the command and select "Add to Quick Access tools".
To remove the command from the Quick access toolbar, simply move the mouse pointer over the command and right mouse click to delete.

### 1.4 Shortcuts

Hold the mouse pointer over a command to see the shortcut for this command. Shortcuts are available for most commonly used commands.

To repeat a previously used command, simply press the spacebar or Enter key.

### 1.5 Command line area

On the bottom left side will be the name of the actual command. On the bottom right side will be actual coordinates or other relevant geometry information.

The command information is below the drawing area. Commands that have different options have actual shortcuts inside brackets [X/B]. The sign for less and greater <Example> shows the "Default" option that can be accepted by pressing the spacebar or Enter keys. Further explanation can be found in the command description section.

### 1.6 Multiple drawings

Click on the "Drawing selection" button to easily switch between all drawings that are currently open.
1.7 Ortho mode

The drawing direction can be locked to be fixed to horizontal or vertical only or in angle steps (Ortho step).

Click the "Ortho" button to activate. It is also possible to activate and deactivate the mode by pressing function key F8. The Ortho settings are made in the "Preference" setup. Right mouse click to start the "Preference" command.

1.8 Zoom and Pan

A mouse with scroll wheel is needed to work properly with IGEMS.
- Zoom: Zoom in and out by scrolling the mouse wheel.
- Pan: Press and hold the mouse wheel down to pan.
- Zoom extents: Double click the scroll wheel and the drawing will zoom to full screen.
If the scroll wheel is not working in this way then check the mouse settings in the control panel. The mouse wheel button should be configured as "Mid" button.

The value between < > indicates the width of the screen.

1.9 Coordinate input

The coordinate system in IGEMS supports the Cartesian coordinate system. This coordinate system is used by the most common CAD/CAM-systems.
When IGEMS expects a numeric value input and any digit is typed, it will show the following dialog box for input of values.

![Dialog Box](image)

**Absolute coordinates**
Always refer to IGEMS fixed zero point. It is typed X, Y as in the following example: 110.5, 220.18

**Relative coordinates**
This refers to the last used point as a distance rather than a coordinate. To use relative coordinates check the "Relative" checkbox.

![Relative Coordinates](image)

**Absolute polar coordinate**
Always refer to IGEMS fixed zero point.

![Absolute Polar Coordinate](image)

**Relative polar coordinate**
Always refer to the last used point.

![Relative Polar Coordinate](image)

**Direction coordinate**
This is the fastest way to enter coordinates and is used for one value. This method uses the pointing direction and it is often used together with Ortho mode.

**1.10 Distance input**

Several commands in IGEMS ask for a numerical value that refers to a distance, for example the "Offset" command.

![Offset Command](image)

These options are available when a command asks for a distance:
Press the spacebar or Enter to accept the value inside <>
Enter another value by using the numerical keyboard.
Pick two points and the distance between the points will be the input.

### 1.11 Object snap

Use "Object snap" to snap exactly to different geometrical points on existing objects. The "object snap" can be used inside other commands when a point is required. The "object snap" can be selected from a menu opened with the right mouse button, when IGEMS asks for a point.

Available object snaps:

<table>
<thead>
<tr>
<th>Snap</th>
<th>Shortcut</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endpoint</td>
<td>E</td>
<td>Snap to endpoint of all drawn objects.</td>
</tr>
<tr>
<td>Midpoint</td>
<td>M</td>
<td>Snap to midpoint of all drawn objects.</td>
</tr>
<tr>
<td>Center</td>
<td>C</td>
<td>Snap to center of Circles, Arcs and Ellipses.</td>
</tr>
<tr>
<td>Intersection</td>
<td>I</td>
<td>Snap to Intersection between drawn objects.</td>
</tr>
<tr>
<td>Nearest</td>
<td>N</td>
<td>Snap to an object near the selected point.</td>
</tr>
<tr>
<td>Perpendicular</td>
<td>P</td>
<td>Snap to a perpendicular point on the picked object from the direction of the previous position.</td>
</tr>
<tr>
<td>Quadrant</td>
<td>Q</td>
<td>Snap to point on 0, 90, 180 or 270 degrees from center on Arcs, Circles or Ellipses.</td>
</tr>
<tr>
<td>Tangent</td>
<td>T</td>
<td>Snap to a Tangential position on an Arc, Circle or Ellipse.</td>
</tr>
<tr>
<td>Grip</td>
<td>G</td>
<td>Snap to Grip points on object.</td>
</tr>
<tr>
<td>Centroid</td>
<td>R</td>
<td>Snap to the center of gravity on an object.</td>
</tr>
<tr>
<td>Off</td>
<td>O</td>
<td>Turn off the Auto snap temporarily for next given point.</td>
</tr>
</tbody>
</table>

### Auto snap

Use "Auto snap" to snap to selected geometrical points.
This is activated or deactivated from the "Snap" button or by pressing F9.
The same dialog box can also be started from the "Preference" command on the system menu.

**Point filter**

Use the "Point filter" option to retrieve individual X and Y coordinates from different points on the drawing to create a new composite point.

The "Point filter" is activated by right clicking in the context menu or by pressing "X" on the keyboard when IGEMS asks for a point.

**Snap from**

The "Snap from" option asks for a point that will be used as the last point. This option should be used together with relative coordinates.

The "Snap from" can be activated by right clicking in the menu or by pressing "S" on the keyboard when IGEMS asks for a point.

**1.12 Select objects**

Many commands need objects as input, for example: Erase, Move and Copy. Right click to see the menu for different options. The "Select object" function in IGEMS works as follows:
General functions

Note! The fastest way to select different options is to use keyboard shortcuts (P, L, Ctrl-A, C, W, F and E).

Selecting Objects

Click on an object to select it. To unselect, hold down the SHIFT key while selecting the object.

Previous (P)
This option selects the same object from the previous time "Select object" was used.

Last (L)
This option selects the last object that was drawn.

All (CTRL-A)
This option selects all objects on the drawing.

Crossing

This option uses two points to describe a rectangle. The second point must be to the left of the first point. If an object is inside or if the objects are crossing the rectangle then the object is selected. Hold down the SHIFT key to de-select the objects.

Crossing polygon (C)

This option uses optional number of points to describe a polygon. If an object is inside or if an object is crossing the polygon, the object will be selected. This feature does not work with the SHIFT key.
**Window**

![Picture 27](image)

This option uses two points to describe a rectangle. The second point must be to the right of the first point. The object must be completely inside the rectangle to be selected. Hold down the SHIFT key while using "Window" and the objects are de-selected.

**Window polygon (W)**

![Picture 28](image)

This function uses optional number of points to describe a polygon. The objects must be completely inside the polygon to be selected. This function does not work with the SHIFT key.

**Fence (F)**

![Picture 29](image)

The "Fence" option allows a multi-segment line (polyline) to be drawn. All objects which cross the fence will be selected in the same order as the line crosses the objects. See Picture 29 - the "Fence" option is used to draw a fence line through points (1), (2) and (3). Objects (A) to (E) are then selected.

### 1.13 Auto base point

Many CAD commands like Move, Copy and, Scale have an automatic base point selection.

![Picture 30](image)

The "Auto base point" is always located in the center of a bounding box of the selected objects.

Specify base point <86.901,111.0224>: MOVE

**Picture 31**

To use the "Auto base point" press the spacebar or Enter key.
2 Program menu

The "Program" menu handles many standard features and also some IGEMS specific commands.

2.1 New

Use this command to start a new drawing.

2.2 Templates

A template is a normal IGEMS drawing (DIG) file. A template is used to start IGEMS with custom settings, for example, to switch between metric and inches. This option shows the following dialog box. See also "Save template" on page 17.
Use the star button to set a template to default, there is also buttons to rename or delete existing templates. The template will be used every time to start a new drawing.

? Are there other reasons to use templates?
*It is a simple way to customize IGEMS. All settings like layers, colors, line types, dimension settings are saved in a template. Use a template to set these values once.*

### 2.3 Open

![Image of Open command]

Use the "Open" command to open existing geometry files:

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.DIG</td>
<td>IGEMS R10 standard drawing format</td>
</tr>
<tr>
<td>.ACD</td>
<td>IGEMS R3 to R9 drawing format</td>
</tr>
<tr>
<td>.DWG</td>
<td>AutoCAD Drawing files</td>
</tr>
<tr>
<td>.DXF</td>
<td>Drawing Exchange Format</td>
</tr>
</tbody>
</table>

**Note!** When "Data Exchange" module is activated 9 more file types can open. See page 73 for more information.

The command shows a windows standard open file dialog box.

IGEMS creates a drawing session for each file if multiple files are opened using CTRL or SHIFT.

![Image of Open command dialog]

? Is it possible to write an application that can read other kinds of files?
*Yes, such applications can be made in ILISP script languages.*

### 2.4 Import

![Image of Import command]

The "Import" command inserts selected drawing files into the current drawing.
Hold down CTRL or SHIFT while inserting the part to also insert the name of the file as text. This text can be used to identify the name when making parts. The "Import" command can use the same files as "Open".

2.5 Recover

![Image of the Recover command](Image 40)

The "Recover" command can be used to recover drawings (DIG files) in the event of a system failure. The "Recover" opens a file dialog box with all Auto saved files. The interval (minutes) for auto save is set in the "Preferences" menu and if this value is set to zero (standard) then the "Recover" command is disabled. **Note**! Auto saved files older than 24 hours will automatically be deleted from the list.

2.6 Recent files

![Image of the Recent files command](Image 41)

This command shows the fastest way to view and find a list of recently opened files.

2.7 Save

![Image of the Save command](Image 42)

This command saves the active drawing into an IGEMS DIG file.
2.8 Save as

This command saves the active drawing under another name.

2.9 Save as template

A template is a normal IGEMS drawing that can be used to start IGEMS in different predefined modes. A template’s settings can be modified to create layers, limit values, modify colors or draw objects desired as the drawing’s default. Select “Save as template” to have IGEMS ask for a name of the template, Picture 45.

All template drawing is saved in a Shared folder that can be used by other users. See also “Templates” on page 14.

2.10 Dump image

This command creates a bitmap image out of the geometry. Select the geometry to be included and enter width and height of the image before saving the file. The values are defined in pixels.

Supported file formats are PNG, JPG, BMP and EMF files.
2.11 **Export**

This command exports selected objects or the whole drawing to another format, such as a DIG, DXG, WMF or EMF file.

```
Select objects <all>:
EXPORT
```

**2.12 Close**

"Close" will close the active drawing. A prompt will ask to leave the file unsaved or saved before closing if the file was modified since the last "Save".

**2.13 Close all**

This command will close all open files. A prompt will ask to leave the file unsaved or saved before closing if the file was modified since the last "Save".

**2.14 Plot**

The "Plot" command is used to print out drawings from IGEMS to a PDF file to use to print out to any type of printer/plotter.

```
Plot PDF
Paper size Method
AA

Style
(Default)

Portrait Landscape
OK Cancel
```

Plotting in IGEMS creates a PDF file as an intermediate step before sending it to the printer/plotter.

**Paper size**
Select the paper size used for the plotting.
Method
This describes the method that will be used in the plotting area.
- Paper size: Select the proper paper size to use for the plotting.
- Method: Set the proper area to plot.
- Plot Style: Customize the plotting result with line weights and color settings.

Style

Picture 54
Select the style to use from the drop down list. Create new or delete existing styles by using the "plus" and "minus" buttons. Change parameters in the selected style by the "..." button.

Press the "plus" button and create a style called "TEST".

Picture 55
Press the "Edit" button

Picture 56
From this dialog box, map the colors on the screen to different colors on the paper. Use the line weight to apply different thickness to different colors. The color mode controls how the different colors should be plotted on the paper.

2.15 Limits

"Limits" predefines a rectangular plotting area by selecting 2 points diagonally on the drawing area. The limits area is saved in the drawing and is visible when the grid is activated.
2.16 Preferences

The "Preferences" command includes functions to customize the drawing environment for language, units and dimensioning.

2.16.1 Display

Background
This setting allows users to customize the preferred background color(s). Checking the gradient checkbox enables different colors to be shown in the top and bottom of the screen.

Grips
When no command is active and an object is selected IGEMS will show the grip points on the objects. This setting customizes the size and the color of the grips. See limits on page 18.

Cursor
This controls the size of the crosshair and the size of the selection box (Pickbox). The Pickbox is used when selecting objects and by the "Object snap".
These settings control how the grid is shown (by points or lines), the color and the distance between the grids. The grid area is the same as the limits area.

2.16.2 Ortho and snap

These settings control the "Ortho" and the "Auto snap". See pages 8 and 10.

2.16.3 General

Regen accuracy
Regen is a function that regenerates a drawing that is zoomed in/out possibly causing the geometry to not be visually perfect. This is only visual and will not affect the final result. Use the shortcut SHIFT+R to
regenerate the drawing and update the screen. If the object is too rough on the screen then set the accuracy to medium or fine.

**Note** This may slow down the system.

**Undo steps**
This is the number of Undo/Redo steps that will be possible to make. Default number is 20. Increasing the value may slow down the system on large drawings.

**Auto Save**
When working in an unstable environment it can be helpful for IGEMS to automatically save the drawing in a timed interval. If the value is 0 then the function is disabled. Open an auto saved drawing from the "Recover" command. See page 16.

**Language**

The language will automatically be set to the same language of the operating system but can also be changed here. If that language is currently not yet supported IGEMS will default to English.

**Convert unitless drawings to inches**
Some files (WMF, DXF and DWG) have no information about units. This setting controls which format these files should be converted to. If the setting is Auto then it will be converted to the same as the default drawing units.

**Shared folder**
The shared folder includes all settings that can be shared with other users in the same network (machine settings, material settings, post processor settings, etc.). To change the location of the shared folder press the "..." button and select the folder to use.

**Note** If an empty folder is selected then all information in the current folder will be copied to the new folder. If a non-empty folder is selected, nothing will be copied.

**Transparent images**
When "Copy" and "Paste" are used to copy geometry in IGEMS, an image is created that can be inserted into other documents. This setting defines whether the background of this image should be transparent or not.

**Expert user**
To change machine or material settings check the "Export user" box or the following message will be shown:
2.17 Password

See separate “Install” documentation for more information about this command. The document can be downloaded from our web-site.

2.18 Drawing units

The drawing units are saved in the drawing. IGEMS will open a file in the same units used when the drawing was saved.

IGEMS stores all numerical values as high precision (0.0000). These settings only affect what is displayed to the user on screen. Use this dialog box to specify special units for dimensions and other outputs.

**Length units**
Select if the units should be in Millimeter or Inches and set how many decimals to show.

**Angle**
Select if the angles should be in Degrees or Radians and set how many decimals to show.

2.19 Point style
"Point style" controls how points will appear on the screen.

![Point style dialog box](image)

Select the type of point and the size; a larger value means a larger point.

### 2.20 Dimension style

![Preferences menu](image)

Read more about this in Section 5.

### 2.21 About

![About dialog box](image)

This command displays the following information.
Version
This is the actual version that installed. Click on the version number to connect to the internet to see if a newer version is available. This shows a revision history and what will be included in the next update.

<table>
<thead>
<tr>
<th>NEXT RELEASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Now possible to set quality for different edges on bevel cutting. For example X and K type can have different quality on top and bottom edges. The selected quality is visible in EdPart.</td>
</tr>
<tr>
<td>- DXF Files which had comment group codes (699) in the header section now works.</td>
</tr>
<tr>
<td>- Ruled bevel parts are now supported for all nesting methods.</td>
</tr>
<tr>
<td>- Visual enhancements in ‘Load App’ command window</td>
</tr>
<tr>
<td>- Fixed directional bevel cutting, wrong direction when piercing corrected.</td>
</tr>
</tbody>
</table>

R10.0.912  120627
- Circle remembers radius or diameter mode when IGEMS is restarted. |
- This document is now properly published. |
- Better handling if report folder does not exist.

2.22 Exit

Use this command to close IGEMS and all open drawings.
3 System menu

The "System menu" includes commands for maintenance and file management.

3.1 Undo

When working with IGEMS press the "Undo" button to correct mistakes and remove changes made with the last command. Up to 20 commands can be undone. Use backspace as a keyboard shortcut instead of CTRL-Z.

3.2 Redo

Use "Redo" if too many steps were "undone". Redo can only be used directly after the Undo has been used.

3.3 Purge

IGEMS will not remove unused layers or blocks when saving a drawing. To fully remove unused information use "Purge". The following information will be written on the command line:

```
Select mode [A/N/B/L] <Anonymous blocks>: PURGE
```

Right click on this command line to get more information.
Select "All" to remove Anonymous blocks, Blocks and Layers.

3.4 Status

The "Status" command shows current use of RAM memory, the number of rows that have been used on the command line and the number of objects on the drawing.

3.5 User data folder

This is a shortcut to the user data path. The folder has information about default values and other settings. This shortcut will probably be removed in coming versions.
3.6 Shared folder

The Shared folder includes all user settings and customizations such as materials, machine settings, postprocessors, lead in/outs and more. It is recommended to make a backup copy of the shared folder from time to time in case of a computer breakdown.

3.7 Service center

The "Service center" opens to a website to download the latest version, drivers, etc. "Service center" can only be used if the computer is connected to the internet and there's a valid license of IGEMS.

3.8 Support

Use the "Support" command if a question or problem needs to be reported to IGEMS support team.
Fill in information about a problem, using the "Browse" button to include any necessary files. Press "Save". The command will create a ZIP file with all needed files and other information.

Send the ZIP file to a local IGEMS reseller or to IGEMS AB.

**3.8.1 Run support files**

Use the "Run" button to load support files. IGEMS starts up in the same mode with the same files and settings used when the support file was created.

Some general information will show before the drawing is loaded.
4 CAD commands

When using the CAD commands, be sure to read the information on the command line.

When using the CAD commands, be sure to read the information on the command line. Points can be given by entering coordinates using the keyboard, by clicking on the screen or by object snap. Distance can be given by values or by clicking two points. See Section 1 to see how to enter this information.

4.1 Line

Shortcut "L"
"Line" command asks for a starting point and then the next point. The command is cancelled by using the spacebar, Enter or ESC keys. Backspace can be used to undo the last line segment.

4.2 Circle

Shortcut "C"
The normal "Circle" command requires a center point and a radius or a diameter as input. Toggle between diameter and radius input using "D" and "R" keys on the keyboard.

The "Draw" menu shows three other ways to create a circle.

4.3 Rectangle

Shortcut "N"
The normal "Rectangle" command creates a rectangular polyline from 2 opposite points.

The "Draw" menu shows two other ways to create a rectangle.

**4.4 Point**

Shortcut "SHIFT+P"
"Point" command asks for input of point positions. To cancel the command, press the spacebar, Enter or ESC. See page 23 for more information how to change the point style.

**4.5 Arc**

Shortcut "A"
"Arc" entities can be described in many ways. The default Arc mode needs input for a 3 point arc. Six other methods can be used. Other "ARC" options can be found by selecting the "Arc" command and then click on the arrow to activate the pull down menu.
4.6 Polyline

Shortcut "P"
A polyline is a chain of lines and arcs that are joined together into one object. When drawing a polyline toggle between "Line" (type "L") and "Arc" mode (type "A") or SHIFT+C to close the object.

4.7 Spline

The "Spline" command makes a curve that goes through a set of points. Tangent condition for start and end point can be selected at the end of the command. If no tangent condition applies, then press the spacebar to execute the command.

4.8 Ellipse (Shift+E)

Shortcut "SHIFT+E"
The "Ellipse" command creates an elliptic shape by defining major and minor axis length/radius.

Default
The default command will ask for two points on the major axis length 1 and 2 and the minor axis radius 3, Picture 103 below.

Center mode
Select mode "S: Center" and input a major axis distance starting from center point of ellipse 1, the radius of the major axis 2 and the radius of minor axis 3.
**Arc mode**
The "Arc" mode creates an open ellipse when defining a start angle and end angle. Select the "Ellipse" command and select "A: Arc" before defining the ellipse and the angles.

My CNC-controller can't handle ellipses, how can I convert the object to arcs or lines? You don't have to. It is done automatically by the postprocessor when you make the CNC-file.

**4.9 Solid**

Use the "Solid" command to fill closed geometries with a selected color.

**4.10 Hatch**

Use "Hatch" command to create a hatch pattern, for example to help illustrate sectioning.
**Angle**  
This is the angle of the Hatch lines.

**Spacing**  
This is the distance between the hatch lines.

**Style**
![Hatch styles](image)

The style can be Diagonal, Cross or Solid.

**Select objects**  
Select a closed object and the Hatch will be inside the objects.

**Pick points**  
Pick a point in that area that should be hatched.

### 4.11 Parametric shape

![Parametric shape](image)

This command has 60 predefined shape types and 8 different kinds of pipe unfolding shapes.

![Parametric shapes](image)

Parametric shapes can be modified by simply opening the selected shape and entering the requested dimensions before inserting the shape into the drawing.
4.12 **N-gon**

Use this command to create symmetrical polygons (triangles, squares, hexagons, etc.). Input the number of sides followed by the center position on the drawing.

Press the "O" key to control if the N-gon should be inscribed or circumscribed.
4.13 Obround

Specify starting point, radius and a distance (length) to create an obround profile.

IGEMS will then automatically create the outline contour.

4.14 Swell

The "Swell" command makes a closed polyline around the selected object.

The command asks for center objects and a radius.

4.15 Puzzle

This command shows the following dialog box.

Enter two opposite points in a rectangle that describe the outside dimension. Press "OK". The command will create a random puzzle, like Picture 121.
Can the geometry be used to generate a toolpath?

Yes, this can be done with the "Quick" command.

### 4.16 Boundary poly

![Boundary poly](image)

"Boundary poly" command is used to extract enclosed contours out of existing geometry. Activate the command and select the contour to extract.

![Picture 123](image)

The command will generate a polyline around the darker area when position 1 is selected, like in Picture 123.

### 4.17 Offset

![Offset](image)

Shortcut "O"

This command creates an offset contour from the selected object with a specified distance. It asks for a distance, object and what side to create the new object.

Select "G" for chamfering or "A" to make a fillet on outside corners.

![Offset with default, Chamfer and Arc option](image)

### 4.18 Fillet

![Fillet](image)

Shortcut "F"

This command creates a tangential arc between two objects after having entered the size of the fillet radius.
To fillet all corners on a polyline with one click, first enter the fillet radius and then select "P: Polyline" option and select the objects.

### 4.19 Trim

**Picture 128**

Shortcut "T"

The "Trim" command deletes the portion of an object that intersects with other objects. It is necessary to have at least 2 objects to be able to trim.

**Picture 129**

In Picture 129, clicking on the objects at position 1 and 2 gives the result shown in B.

Use the "Fence" option to select many objects at the same time

**Picture 130**

**SHIFT Trim**

Use the SHIFT key while picking the geometry to invert the trimming to the opposite side.

**Picture 131**

The picking points indicate the portion of the object that should be not trimmed.

### 4.20 Zero fillet

**Picture 132**

Shortcut "SHIFT+F"

This command will extend or trim 2 segments to intersect with a zero radius.
4.21 Chamfer

The "Chamfer" command extends or trims 2 segments to intersect and create a chamfer corner.

Define the chamfer length on the first segment and then the chamfer length on second segment before accepting.

A polyline is chamfered by holding down the SHIFT button when selecting object.

4.22 Lengthen

This command dynamically changes length on the selected object. Select near the end of the side to extend and drag the object to desired length.

4.23 Extend

"Extend" an object to the next intersecting object.

4.24 Boolean

Shortcut "B"

This command can make Boolean functionality on closed objects.

The command is set to "Union" mode by default which means that two objects will be merged together into one. The "Intersect" option creates a polyline of the area shared by the two objects. The "Subtract" option removes the overlapping area between the two geometries.
4.25 Polyline editor

This command is used to check the information in a polyline and the following dialog box is shown:

This dialog box shows information about the complete polyline and the different segments in the polyline.

The actual segment is displayed in red, Picture 140, with an arrow indicating the direction of the object.

**Reverse**
This will reverse the direction of the polyline.

**Open/Close**
This option is only visible if the polyline is closed or if this option is changed to closed.

**First**
This will show the first object in the polyline

**Previous/Next**
This shows information about the next or previous segment.

**Delete**
This will delete the actual segment.

4.26 Break
This command breaks objects up into several portions. The command asks for an object and a break point and splits the object at the selected point.

### 4.27 Erase

**Shortcut "DEL"**

This command deletes the selected objects from the drawing.  
**Note** Use the "Undo" to restore objects that have been mistakenly deleted. See page 27.

### 4.28 Join

**Shortcut "J"**

This command joins multiple objects into a single polyline. The command first asks for the objects then for a tolerance. The start or endpoints of the objects must be closer than this tolerance to be joined together.

### 4.29 Layer

**Shortcut "Y"**

Some imported file types include layer information. The several layers on the drawing will be in the list. Click on one of the layers to activate. Press the "Edit" option or the shortcut and the following dialog box will be shown.

The "Layer" dialog box is used to create or modify existing layers with default line type and line weights. Layers can be "locked" to prevent modifying layer geometry or to block from being printed.
**Layer for dimension**
The "Dimension" style defines a layer to automatically use for all dimension objects.

### 4.30 Explode

**Shortcut "X"**

This command explodes a block, polyline or other composite object into separate objects. The opposite command to "Explode" is the "Join" command (see page 41).

### 4.31 Create block

**Shortcut "CTRL+B"**

Use this command to define a set of objects that can be reused by inserting the block into the drawing.

1. Create a figure, like Picture 149.

2. Start the "Create block" command.

#### Name
This is the name of the block.

#### Base point
This is the base point when later inserting the block into the drawing.

#### Objects
Press this button to select the figure.

#### Retain
This leaves the figure intact as it is. The block has been saved in the block table.

#### Convert to block
This converts the figure to an insert and saves the information in the block table.
Delete
This removes the figure from the drawing and saves the block in the block table.

? Can the block be inserted into other drawings?
No, it must be defined in the drawing or in the template drawing. See pages 14 and 17. Then it can be used on all drawings that use that template.

4.32 Insert block

Shortcut "INSERT"
Use the "Insert block" command to insert a previously defined block. The following dialog box is shown.

Select the named block to be inserted. It is then possible to position, scale or rotate the block while inserting it into the drawing.

Insert DIG files
To insert DIG files as blocks press the "Folder" button in the dialog box and select the file to be inserted.

4.33 Group

The "Group" command asks for objects. All selected objects will be a member of that group and can now be easily handled together. The "Explode" command breaks up the group into individual segments.

4.34 Save block
This command works the same way as the "Create block" command but it stores the block as a DIG file. It asks for the objects and a base point.

4.35 Define attributes

Create a block and include a text string that can be modified when later inserting the block in the drawing.

Create a figure with a text "TOWN"

Start the command and select the text.

Enter a prompt and a default value.

Save the figure as a block

Insert the block.

The following dialog box is shown.

Change the value to "Gothenburg".

When the block is inserted it will appear as follows:

What can these attributes be used for?

For example to fill in information in a title block.
Can it be inserted in other drawings?

If you use "Create block" then it must be defined in the drawing or in the template drawing, see pages 14 and 17. Then it can be used on all drawings that use that template. If you use the "Save block" (save it on disk) option then you can use it on all drawings.

### 4.36 Move

Shortcut "M"

![Picture 159]

This command asks for an object to move, then a base point and finally a new position. The selected object will be moved to the new position.

### 4.37 Rotate

Shortcut "R"

![Picture 160]

This command rotates an object around a specified point. Use the "Reference" option instead of entering the new rotation angle. After the command is completed there will be a request to "Keep original" or not.

### 4.38 Copy

Shortcut "SHIFT+C"

![Picture 161]

This command asks for an object to copy, then a base point and finally a new position. The command must be interrupted by the ESC-key.

### 4.39 Mirror

Shortcut "SHIFT+M"

![Picture 162]

This command asks for an object and then a mirror line. After the command is completed there will be a request to "Keep original" or not.
4.40 Scale

Shortcut "S"
This command asks for an object to scale, then a base point and a scale factor. Instead of entering the "Scale" factor, right mouse click to see the following options:

- **Reference by X**
  This option automatically calculates the scale factor. Enter the outermost size in X.

- **Reference by Y**
  This option automatically calculates the scale factor. Enter the outermost size in Y.

- **Reference**
  Asks for a reference length and then a new length. All objects will be scaled by reference to this length.

- **Non-uniform**
  Define a scale factor in X and in Y. An input of 2, 3 will make the object two times the original size in X and three times in Y.

- **Box scale**
  This option lets different entries for the outermost size in X and Y. In this option it is best to have the zero point at the lower left corner of the selected objects.

4.41 Quick move

Shortcut "CTRL-M"
"Quick move" automatically selects an object by moving the cursor near the object. Unlike the "Move" command, there is no need to select or input a base point to move the object. The object will highlight a light blue color when the mouse cursor gets close to the object.

4.42 Stretch
This command changes part of an object's length while keeping other parts the same. The command is mostly used together with the "Crossing" option in the select object.

![Picture 167]

Using Picture 167 as an example, objects completely inside will be moved. Objects that intersect with the crossing rectangle are changed. Objects that are completely outside will remain unchanged.

### 4.43 Skew

![Picture 168]

This command asks for objects to be skewed, a base point to skew from and the skew angle in Y and X.

![Picture 169]

Picture 169 shows an example where Y is skewed 30 degrees (60 degrees from X).

### 4.44 Array

![Picture 170]

This command is a simple form of nesting that copies objects in a rectangular or polar array. The command asks for which objects to use then shows the following dialog box:

![Picture 171]

#### 4.44.1 Rectangular

This option copies the selected objects in rows and columns.

**Delta**

"Delta X" and "Delta Y" are the distances between the rows and columns
**Spacing**
To have a space between each line and column press the "Space" button and enter the space. The "Delta" between the lines and columns is calculated from the dimension of the selected objects.

**4.44.2 Polar**
This option copies the selected objects in a polar layout.

**Center**
Enter the center of the array. Use the "Pick" button to pick a point.

**Method**
There are several methods to describe the angles between each copy.

**Rotate**

If the selected objects are rotated around the center then the command does not need any more information.

If the objects are copied without rotation then the command needs a base point for the objects.

**4.45 Zoom extents**

Shortcut "CTRL+SHIFT+E"
Click this button for IGEMS to zoom out so all objects are shown on the screen.

**Note!** Zoom extents by double clicking the mouse wheel if preferred.

### 4.46 Pan

Shortcut "CTRL+SHIFT+P"
The "Pan" command is used to reposition the drawing area in X and Y by selecting a base point and a second point for new position.

**Note!** Hold down the mouse wheel while moving the mouse to pan.

### 4.47 Zoom

Start the command and then pick a point to zoom in. To zoom out hold down the CTRL key while selecting.

**Note!** Roll the mouse wheel to zoom out.

### 4.48 Zoom window

This command needs two points to describe a rectangle. IGEMS will zoom up that area.

### 4.49 Color

The currently active color is shown at the lower left corner on the screen. The "Color" command is also started by clicking on this button.

Use different color to visually separate information on the screen. To make paper drawings on a printer then use different plot line weights that are bound to different colors. There are two major ways of using colors:
**Layer controlled**
Bind different colors to different layers so changing layers also changes color. If a template is set up predefined layers then color doesn't need to change. The "Layer" command is described on page 41.

**Different color on same layer**
Use this command if layering does not matter but items need to be separated on the screen.

![Color Palette](image1.png)

**By block**
Objects with color "By block" have the same color as the insert.

**By layer**
Objects with color "By layer" have the same color as the insert.

### 4.50 Line type

**Layer controlled**
Bind different line types to different layers. The linetype will then be changed when you change layer. If a template is configured with predefined layers and line types, line type will never have to be changed manually. The "Layer" command is described on page 41.

**Different line types on same layer**
Use this command if layering does not matter but items need to be separated on the screen.
Add or remove line types from the selection list by using the "plus" and "minus" buttons. Scales can be set globally for all lines or local to modify the style on a specific object. Press "OK" button to select line type.

4.51 Line weight

Use this command to show different line weight on the CAD screen.

The "Display thick lines" checkbox must be activated to see the different weights on the screen. The "By block" and "By layer" works in the same ways as for color and line type.

4.52 Quick select

Use this command to sort out objects by object type, color or by segment available on the active drawing.

The following dialog box is shown:
Select the filter for object types, color or length and use the "Add" button to select the objects. The "New" button starts the selection again from the beginning. The selected parts remain selected when the "Close" button is chosen. Now other commands can be used on the selected objects.

### 4.53 Send to back

Use this command to control which object should be visible when two objects are on top of each other. This command is often used for pictures or similar objects on the screen.

### 4.54 Bring to front

This command works opposite to "Send to back" command. Select object and pick the command to place it on top of other objects.

### 4.55 Regenerate

This command "regenerates" the entire drawing and updates the screen coordinates for all objects. "Regenerate" is often done automatically when zooming in or out.

### 4.56 Info

The "Info" command is the fastest way to get information from objects on the drawing.

Draw two circles. Start the "Info" command and select the circles.
This command shows the following information:

**Information about the selection**
The upper area of the box provides information about how many objects are selected and their total length. The bounding box gives information about the area and the size needed for the objects.

? Can this information be used for calculating cutting costs?
Yes it can, but you have more exact tools if you make a complete cost calculation, which needs more time. This “Info” command is very quick.

**Object information**
The lower area of the box provides information about each object in the selection.

Select one object in the list to highlight that object on the screen.

The green rectangle shows the bounding box, the yellow object is the selected object on the screen.

**4.57 Distance**

This command needs two points and will display the information on the command line area, Picture 196.
CAD commands

4.58  Id

"ID" shows the absolute coordinate in X and Y for the selected position. "Absolute" means the coordinate position in relation to IGEMS fixed zero point.
5 Dimension

IGEMS R10 includes a basic "Dimension" command. Follow the steps below to make proper paper drawings where the dimension objects are correctly sized and the drawings are in an exact scale:

5.1.1 Step 1: Draw geometry
Draw the geometry to print out in natural size. Be sure to include the outermost geometry. Remove any unneeded objects that may change the extents of the drawing.

5.1.2 Step 2: Make dimensions
When the following dialog box shows add the dimensions:

Set the plot size and the paper orientation. IGEMS will now suggest the best plot scale for the drawing. Press OK.

Read this section if interested in how dimension scaling is done automatically. The command will compare the plot size and the orientation of the paper with the extents of the drawing and will suggest a plot scale for the drawing. In the examples below the paper size is described with dotted lines, the extents are the gray areas in size 160 by 250.

In example A the drawing should print out in Portrait on an A4. The area fits well inside the paper and IGEMS will suggest plot scale 1:1 (Drawing units: plot units). The dimension scale will be set to 1.0 and text height can be 3.5 arrow length 3mm and so on.

In example B the same drawing should print out in Landscape mode on an A4. Since the area on the paper does not fit when the paper is oriented like this IGEMS recommends example C.

In example C the plot scale will be 2:1 and all dimensions are scaled to double size (dimension scale will be set to 2.0). Text height will be set to 7.0 and arrows to 6 mm and so on. When the drawing is plotted, the size will be reduced to 50% and the geometry and the dimension object will be in correct size.

5.1.3 Step 3 Plot
To plot in correct scale use the "Scaled" method.
Set the Paper size, plot scale and orientation to the same as in step 2. Press "OK" to place a scaled paper rectangle on the screen. The drawing and the dimension will automatically be in correct size. Read more about the "Plot" command on page 18.

5.2 Linear

The linear dimension is used for horizontal, vertical or tilted dimensions. To enter the dimension either select an object or press the spacebar and then enter two points.

5.3 Diameter

This command is used to add dimensions on circles and arc objects. Select a point on the arc or circle and place the dimension.

5.4 Text

Use this command to insert text into the drawing area. Instead of selecting the start point of the text press "F" to select the font to be used.

Select font style, insertion base point, height and type the text. Right mouse click while writing the text to control the angle, height and justification.
It is also possible to show a character map of all characters in actual font.

### 5.5 Rotated dimension

Use this command to place a dimension line that is not aligned to the measurement.

Select the angle of the dimension line and then select the object or two points.

### 5.6 Radius

This command creates a dimension showing the Radius for an arc or circle.

### 5.7 Angular dimension

This command creates an angle dimensioning between 2 linear segments. Move the cursor before placing the dimension to select which quadrant to use.

### 5.8 Leader
This command will add a leader with information text to an existing object. Select the command and enter the text. Place the text on the drawing area or press the spacebar or Enter to select an object.

5.9 Dimension style

Click to show the dimension style dialog box. Read more on this command on page 55.

Click on the "three dot" button to set the behavior and the design of the dimensions.
6 CAM-Tools

The "CAM-Tools" module includes commands for analyzing, preparing and optimizing the geometry before starting to make a toolpath. To use these commands there must be a license for the "CAM-Tools" module.

6.1 Clean up

![Clean up image]

This command removes double objects, overlapping geometry and closes gaps that may occur in the selected geometry. Start the command and enter a tolerance to fit a new curve and select objects.

![Segments before/after: 48/3/975]

The command line area shows a summary of the operation.

6.2 Edgefix

![Edgefix image]

This command replaces a portion of a polyline with an arc or line to increase the quality and smoothness of the curve.

![Picture 217]

Picture 217 shows a start point A and an end point B. Place the cursor between points and press the spacebar to select position C for the new curve which will replace the old curve with an arc or a line.

6.3 Replace

![Replace image]

This command replaces objects with other objects.

![Picture 219]

The command asks for a source object (A) and then target objects (B). All target objects will be replaced by the source object. The position is calculated by the center of gravity position.
6.4 **Analyze**

This command asks for objects and creates red circles on gaps between objects and yellow circles if the objects are overlapped.

The circles are joined in a group. Select one circle and then press delete.

6.5 **Boundary scan**

This command extracts closed polylines from enclosed areas.

Specify a tolerance for automatically closing gaps. Select the objects and click inside the area that describes the wanted geometry (A). Press spacebar or Enter and move the geometry (B). Select a color by using shortcut "C" while picking the point.

6.6 **Boundary trim**

This command trims or deletes objects that are inside or outside a closed geometry.

Start the command and select a point on the circle (A). Everything inside the circle is deleted. Objects that are intersecting with the circle are trimmed. Hold down the SHIFT key while selecting the circle to make the opposite result.
6.7 Curvefit

This command converts a polyline consisting of many short objects into a smooth curve with lines and arcs based on a given tolerance. The feature is useful to eliminate short line segments that may cause the machine not to operate as it should. It also may reduce file size.

The command line area shows a summary of the operation.

6.8 Poly joint

This command is used to join areas together or to split areas. The function must be applied on closed polylines.

The command asks for a width and then for points. Picture 229 is an example: Select a point outside (A) to outside (B) and the geometry is split up in two geometries. Select a point inside geometry (C) to another inside geometry (C) and the command will join the two geometries.

6.9 Vectorize

The "Vectorize" command gives an opposite result as the "Curvefit" command.
Select the command and enter a tolerance. The tolerance decides how much the new curve will deviate from the original curve (A). A small tolerance (C) will create more and shorter line segments and will stay closer to the original curve compared to entering a large tolerance (B).

**6.10 Pocketing**

"Pocketing" generates a zigzag pattern that can later be used to create a toolpath for milling.

This command expects input for angle and a value for the step over before selecting the closed contour to apply the pocket pattern.

**6.11 Convex hull**

"Convex hull" creates an enclosing polygon around selected objects.

"Convex hull" has only convex geometry - no concave.
7 SignMaker

This module includes commands for making signs. For example: Converting images to CAD vectors, converting true type fonts, etc. There must be a license for the "SignMaker" module to use these commands.

7.1 Font tracer

This command converts true type fonts into vector graphics so text can be linear follow an existing curved object such as a polyline. The following dialog box is shown:

Select the font
The preview area will show example text of differing fonts.

Linear cursor
Click on this button to set the start point for the text.

Object cursor
Use this option to select an object to follow.

Symbols
Use the "Symbols" button to expand the dialog box:
Double click on the sign to insert it onto the drawing.

7.1.1 Explode
Use the "Explode" command (described on page 42) to convert the text to CAD vectors.

7.2 Image
Use the "Image" command to insert images into the IGEMS drawing. The image can be scaled to correct size and used as a background. A common method is to draw an object on the image. These objects can be used to generate a toolpath that cuts the geometry in correct size.
7.3 Image tracer

"Image tracer" reads and converts a raster file into lines and arc segments.

Open
Use this button to select the file and the image will show on the right side of the dialog box. Supported files are PNG, JPG and BMP.

Threshold
Use this setting to control the brightness of the image.

Centerline
This option should be used on scanned drawings when the geometry is drawn by pen or something similar. Alternative (B) in next Picture 245 is typical for a centerline scanning.

Alternative B shows an outline scanned example. This option will draw objects around black areas.

Note! The Image tracer does not run any automatic "Curvefit". For smoother geometry use the "Curvefit" command afterwards. See page 61.
8 Tile maker

The "Tile maker" module includes a set of commands especially designed for tile cutting. There must be a license for the "Tile maker" module to use these commands.

8.1 Tile

The "Tile" command creates a grid of rectangle or hexagon shapes with a specified part distance. The following dialog box is shown.

Pattern

The "Tile" command supports the pattern type: Grid (A), Jagged Grid (B) and Hexagons (C).

Dimensions

The "Height" and "Width" is the X and Y sizes of the tiles and the "Joint size" is the distance between the tiles.

Number of tiles

Press "OK" and IGEMS asks for two corner points (A) and (B) that describe the area for the tiles.

8.2 Tile cut
The "Tile cut" command extracts patterns from a drawing and automatically nests and cuts the extracted parts.

Prepare a drawing like the above Picture 251.
Make 9 tiles with the "Tile" command.
Make three circles: blue, red and yellow.
Start the "Cut" command.
This command needs information from the machine and material. If no machine is selected the following dialog box appears.

After selecting "Machine" and "Material" the dialog box for "Tile cut" command is shown:

**Joint size**
This is the distance between the tiles.

**Cutting information**
See the "2D-CAM" module for more information about leadin, leadout and piercing type. When the compensation checkbox is activated the toolpath will be compensated for the tool radius.

Press the "OK" button

IGEMS will now nest all tiles by color, all toolpaths are added and the job will be ready to post.
8.2.1 Tile fixture
The "Tile fixture" is simple fixture to locate the tiles at correct positions on the cutting machine. The fixture can be made of optional material. The rectangles in the fixture should have the same size as the tiles to be cut.

When ready to cut tiles, place them in the fixture. The machine will cut tile 1,2,3,4,5,6,7 and 8 then the machine will go to stop position (P) and stop. It is now possible to unload and load the next 8 tiles, then start the machine again.

When the postprocessing is started then another dialog box appears that will handle all tile fixture parameters. Read more about the post processing in Section 14.

Input the positions of the tiles on the fixture. When tiles are cut the zero point is located on the lower left corner on tile rectangle number one.

8.3 Inlay
The "Inlay" command is an advanced tool that allows designing of tile floors or other tile decorations by adding textures or colors before extracting the parts.

Open the sample file "Inlay.dig" located in the Sample directory.

Start the "Inlay" command.
IGEMS will now randomly add textures on different areas.

On the top of the dialog is a list with all parts in the Inlay. Selected parts are highlighted on the drawing.

The parts are named as follows: The first character stands for the texture material. Number one indicates the first part in this texture and number 2 the second and so on. The last number is the quantity of that part. Press the "plus" or "minus" signs to change the scale of the texture.

**Textures**
The "Randomize" button randomly changes the texture on all parts. Select a material on the texture list to preview it on the left.

Load or delete textures in the list with the "plus" and "minus" sign. To add new texture files add to the "IGEMS_R10/Res/Texture" folder.

The "edit" button can be used to change the description of the texture. It will not change the texture itself.

It is also possible to add solid colors to the texture list. Press the button and select the color to add.

This button temporarily closes the dialog box. Hold down the CTRL key to choose different areas on the drawing to have that selected texture. Press the spacebar or Enter to go back to the dialog box.

Select a texture and use the button to attach textures to the drawing.

Use the checkbox "No gap" to control cutting with or without gaps.

**With gaps**

To cut with gaps cut the parts with no tool radius compensation (no kerf). This means that all external measurements will be smaller and all internal measurements larger.

The size of the gap will be the same as the diameter of the jet.

**No gaps**

To cut with no gaps is normally much more difficult. Cut all parts with tool radius compensation.

Since the jet cannot make sharp inside corners manual work at positions (A) and (B) in Picture 271 or at (a) and (b) in Picture 272 are required. Without doing this job the parts will not have proper fit.
With "No gaps" activated then all outside corners that cause a fitting problem will be adjusted by IGEMS automatically (a) and (b).

The radius (A) and (a) and the radius (B) and (b) now have the same size and the parts will fit together.

What setting do I use if I want to modify the inside corners manually (A) and (B)?

In that case you should cut with gap and with tool radius compensation (with kerf).

If the text height is larger than 0 then the command will automatically place a text with the name on each part. This can be used as identification of the parts.

The "Render" button creates a more photorealistic image of the layout.

This is controlled by the checkbox "Create parts inplace"

In the above example, Picture 276, the command will create 4 different parts with different rotation. When the parts are mounted the grain direction will be the same for all parts.

For material with solid colors the grain direction may not be important.
In the above example, Picture 277, the command will create one part with the quantity flag set to 4. When the parts are mounted the grain direction will be in different directions.

**8.3.2 Report**

Click the "Report" button to generate a complete report of the inlay.

**8.3.3 Generate inlay parts**

Press "OK" to generate all parts from the drawing.

The parts are lined up by material. The final step is to use the normal "Nesting" and "CAM" commands to create the CNC file.
9 Data Exchange

The "Data Exchange" module includes commands that allow the import of extended file formats and analyzing and conversion of existing CNC files. There must be a license for the "Data Exchange" module to use these commands.

9.1 Import

The "Import" command the user to import previously saved drawings and place them in the current drawing. The following file formats can be imported:

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>IGEMS</th>
<th>Data Exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>.DIG</td>
<td>IGEMS R10 standard drawing format</td>
<td>Yes</td>
<td>Data Exchange</td>
</tr>
<tr>
<td>.ACD</td>
<td>IGENS R3 to R9 drawing format</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>.DWG</td>
<td>AutoCAD Drawing files</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>.DXF</td>
<td>Drawing Exchange Format</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>.WMF</td>
<td>Windows Meta Files</td>
<td></td>
<td>Required</td>
</tr>
<tr>
<td>.PS</td>
<td>Postscript (level 1 and some objects in level 2)</td>
<td></td>
<td>Required</td>
</tr>
<tr>
<td>.EPS</td>
<td>Encapsulated Post Script (level 1 and some objects in level 2)</td>
<td></td>
<td>Required</td>
</tr>
<tr>
<td>.GEN</td>
<td>Tribon Generic Files</td>
<td></td>
<td>Required</td>
</tr>
<tr>
<td>.GEO</td>
<td>TOPS CAD/CAM system from Trumpf.</td>
<td></td>
<td>Required</td>
</tr>
<tr>
<td>.IGS</td>
<td>IGES Files (a subset of 2D object)</td>
<td></td>
<td>Required</td>
</tr>
<tr>
<td>.MEC</td>
<td>Files from Lantek</td>
<td></td>
<td>Required</td>
</tr>
<tr>
<td>.ORD</td>
<td>CNC-Files from Flow</td>
<td></td>
<td>Required</td>
</tr>
<tr>
<td>.TAG</td>
<td>Files from Taglio</td>
<td></td>
<td>Required</td>
</tr>
</tbody>
</table>

Note!
The imported parts can include a file name just as when using the import menu described on page 15.

9.2 NC reader

This command imports CNC files and creates lines and arcs according to coordinates in the CNC file. Only the most common format is supported in this command and it will not understand sub-program calls or jumps. The command asks for a zero point and then the name of the CNC-file.

The whole geometry of the file is displayed in gray on the drawing area.
Select a line in the dialog box and the gray object will be replaced by a red or blue object up to that position. The actual movement is highlighted. Click on an object in the drawing area and this line is selected in the dialog box. The NC-reader is a perfect tool to analyze an existing CNC-file.

If the geometry looks strange, change the settings of the arc mode. The checkbox "Rapid" determines if the blue rapid lines are displayed or not. The bottom line is a summary of the selected line / total number of lines and the file size.
This chapter contains information about the most common "CAM" commands. It includes all the tools required to setup the machine and material database, prepare CNC files for the cutting process, postprocessing, calculate cutting times and much more.

10.1 Select setup

When any "CAM" command is started that needs information from the "Machine" or the "Material" then this dialog box is automatically shown.

To select this information at the beginning of the process gives IGEMS possibilities to suggest the best default values. Select another machine or material at any time.

The actual filename and selections are shown at IGEMS title row at the top of the program and at the Drawing File Selector at the lower right corner of the screen.

10.2 Machine

This command is used to set up the actual Machine equipment. The command is covered completely in Section 16.
10.3 Material

This command handles all cutting parameters that are related to the material. Detailed information about this is found in Section 12.

10.4 Part create

Shortcut "1"
The "Part create" command creates parts from existing geometry on the screen. The parts are used to extract toolpath and are also used by the "Nesting" commands.

Make geometries like below. The rectangle should be about 300-400 mm in X. Add the text "ABC" inside the second part.

Start the command and select all objects.

10.4.1 Name

The name of the part is used by the postprocessor and the organizer and doesn't have to be unique. There are two ways of giving parts automatic names:
By increasing number
If the name includes a "#" sign then this sign will be replaced by the counter on the button. The counter will be increased by one for every new part created.

By text information inside the geometry
If the checkbox "Use text as name" is activated then the actual text will be the part name. See the "Import" command on page to read more about how to generate names from imported files.

10.4.2 Quantity
Enter the number of parts to produce. The information is used by the "Nesting" and the "Organizer". When importing a file with several identical geometries there are two choices:

- By quantity
  Set the quantity to 1 and generate 16 identical parts with different names.

- Auto quantity
  By activating the checkbox the command will count all identical parts and handle the quantity information automatically. This means that only one part with a quantity of 16 will be created when using this option. All other identical parts are deleted.

Must the part be oriented in the same angle?
No, the part can be rotated in optional directions.

10.4.3 Production information
The production information is saved on the part. Change production information using the "Part properties" command. The information can be used by the "Organizer", "Applications" and the "Postprocessor".

Date
The date information is used for production date or delivery date. The information is useful if using the "Organizer" module.
Select an existing customer name in the list. Use the "plus" and "minus" button to add new and delete existing names.

10.4.4 Geometry

Geometry optimization <value>
It is recommended that the "Geometry optimization" is always activated. The optimization guarantees that the toolpath created on the part is possible to cut with a tool diameter smaller than the optimization value. The value can be changed in the geometry section in the machine setting. See Max tool diameter on page 182.

Curvfit
If this checkbox is activated then "Create" is performing an automatic "Curvfit" operation on the selected geometry. More information on the "Curvfit" command is on page 61.

10.4.5 Other objects

Click the "Other objects" button to select optional objects to include in the part.

Press the button and select the arc and the text.

The selected objects are now included in the parts and can be used by other functions in the "2D-CAM" module.

Object located outside external geometry

To add "Other objects" that are located outside an external geometry, like in Picture 304 above, then only one part can be created at a time.

Quality settings

The default attaches different cutting quality to external, internal and other objects.

Press "OK"
The gray color indicates that the parts are correctly described. Other commands will know what is inside and outside.

## 10.5 Quality

This command allows the user to change cutting quality on a part. When the command is started, the quality setting on all geometry is shown.

Start the command and select the rectangular part.

There are 5 different quality levels for abrasive waterjet cutting. The difference in cutting speed can be up to 500% or more between the roughest and the finest quality. Therefore it is important to never use a finer quality than necessary. The "X-rough" cut should only be used for separation of material and the "X-fine" is only used when extreme finish is required.

Select a quality.

**Paint**

Use the "Paint" option to add the quality on optional positions of the part. Press the "Paint" button and set the start point (A) and end point (B) for the paint. The third point (C) or (D) controls what portion of the geometry should be painted.
**On part**  
When using this option the whole part gets the selected quality.

**Area**

![Polygon](image)

The "Area" option defines a polygon by clicking on optional points. Everything inside the polygon will have the selected quality.

**In object**

![Closed object](image)

This is a similar option as the "Area". Use a closed object to describe the area instead of defining a polygon.

### 10.5.1 Relations between parts

When there are several copies of the same part then it is sufficient to modify the quality on just one part. All sister parts will automatically get the same quality.

**References**

The "Create" command sets the base quality. See page 76.  
Modify the cutting parameters for different qualities in the material. See page 131.

### 10.6 Tool setup

![Tool setup](image)

Use this command for Machines equipped with more than one cutting tool when information needs to be added about which tool should be used and the distance between each tool.

#### 10.6.1 Active tool

Use the checkboxes to control what tools should be active. Above tool number 1, 3 and 4 is activated. This should result in following:
10.6.2 Distance

The distance should be given as distance between each tool. The total distance between the two outermost tools are given as information in the top of the dialog.

Pick

Click on this button to pick the distance between each tool.

Minimize

This option puts the tools as close together as possible. Select the part and enter the distance between the parts. The distance will be calculated by the size information on the part.

Equal on sheet

Click on the sheet. The distance will be calculated so all tools get equal distance on the sheet.

Pipette

Select a part. All settings in the dialog will be the same as the selected part.

10.6.3 Layout

IGEMS supports different layouts on the tool alignments.

The number of tools and layout is set in the "Machine" setup. All layouts are compatible on all machines. This means that a completed job done for a machine with three tools can also be run on a machine with one tool or on a machine with a different layout.

References

Configure machine layout on the "Machine" setup. See page 169. The "Auto nesting" command makes an own tool configuration.
10.7 Properties

To change the property of the parts afterwards use the "Properties" command.

Start the command and select one or several parts.

The command shows a lot of information for the part; however it is only possible to change the information below:

Multi selection of parts is possible with the properties command. If multiple parts are chosen at once, the quantity will not be able to be changed.

10.8 Part text

The "Part text" command is used to display the name of the part graphically.

Start the command and select parts and enter a text height.
The name or an index number can be written on the parts.

**10.9 Browser**

The "Browser" command will open a dialog box showing information about all existing parts on the drawing.

**10.9.1 Information**

Hold the mouse pointer over a part to see information about the part in a hint window. The selected part is highlighted on the screen.

In Picture 329, the name of this part is "PART-18". The quantity is set to 10 and 5 of these parts are located on sheets.

**10.9.2 Nesting**

Double click on a part to use the "Quick nest" command.

**10.9.3 Import**

If there are multiple drawings using the same material in the IGEMS session, then they can be imported to active drawing.
10.10 Join

This command merges several parts into one part.

The command will ask for the master part (A) and then for parts that should be joined to this part (B) and (C). The result will be one part with three external geometries with name (A).

10.11 Split

“Split” is used to separate a part that has previously been joined together.

10.12 View in 3D

This command can view the part in 3D. The viewer has no other purpose then to visually display the 2D part in 3D. The different colors show the cutting qualities.
10.13 Contour

Shortcut "2"

This command can be used on all closed geometries that should be cut all the way around.

10.13.1 Tool compensation (kerf)

Picture 337 above shows Alternative (A) with the Tool on left option. This will move the jet on the left side of the geometry when looking in the direction of the movement. This is the same as clockwise (CW) for external geometry and counter clockwise (CCW) for internal geometries. Alternative B shows the Tool on right option. This option makes the movement in opposite directions. In a waterjet machine the result will be the same on G41 and G42 but it is more common to use the "G41" option.

Without tool compensation

When cutting without tool compensation: the external geometry will be too small and the internal geometry too large.

10.13.2 Lead selection

It is possible to predefine leads and to give them optional names, creating a library of leads that can be selected in the lead lists.
IGEMS can be set to use different leads for external and internal geometries. It is also possible to use a special lead if the lead is placed in a sharp corner. If these leads cannot be used, then an alternative lead can be used.

Lead 1 is an external lead, lead 2 is an internal lead, lead 3 is a corner lead and lead 4 is an alternative lead.

Lead 4 seems to damage the material?
No, this is a blind lead and is not used for cutting. Read more in "Lead definitions" on page 90.

Use the "Favorites" button to save and restore sets of lead definitions.

This option is also available in other commands. When the toolpath is connected then it is bound to the part. When the part is moved, then the toolpath should be moved. A toolpath that handles more than one part cannot be connected, for example "Common cutline". In the example below the same toolpaths are used for 10 parts.

By deactivating this checkbox a toolpath is created that is disconnected from the parts.

You can then create several toolpath on the same part in order to assign different tools on the same parts.
Only the internal cut is in the example above. The contours on the left side (A) are connected to the part, and the contours on the right side (B) are not. It is now possible to assign two different tools to these two geometries.

10.13.4 Single mode

Load the sample file "SINGLE.DIG".

Use the "Single mode" to manually attach leads to geometries.

Attach the leads on desired positions by clicking the "Single" button. Start with internal geometries and take the external geometry as the last. The geometries on the part will be cut in the order inputted.

Change position of leads
Change the position of the lead by re-clicking on the same contour.

Can I change the cutting order?
Not in the "Single" mode. This is done in "Auto" mode and using "Edit" toolpath.

10.13.5 Auto mode

Activate or deactivate the checkboxes "External", "Internal", "Corner" and "Alternative" to control which contours the leads are attached to.

Rules
With the "Auto mode" leads can be set automatically on one or many parts at the same time. Use the following rules to get the desired result.
**Outer placement**

This setting controls where the lead should be placed on external geometry.

The "Automatic" option (A) will try to put the external lead as close as possible to the last internal lead. If the external geometry has one or several sharp outside corners then the lead will be placed on the closest corner.

The "Right on outer" (B) will try to put the external lead on the farthest right position as possible. The "Left on outer" option will put the external lead on the farthest left side of the part (C).

**Sorting**

This setting controls where the lead is placed on the internal geometries.

Alternative (A) is the option "Closest". The algorithm starts from the external position and looks for the closest internal geometry until all geometries are found. Alternative (B) is the "Zig zag" option and has several sub settings.

The user selects "Start corner", "Direction" and "Mode". Picture 356 shows the different options.
The (C) shows the "Right to left" option and (D) the "Left to right" option with outer placement set to "automatic".

The (E) shows the "Spread" options that can be used on thermal cutting, so the heat is spread out as much as possible.

### 10.13.6 Contours

This settings controls which contours the leads are attached to.

**Add new and replace existing**

This method adds new and replaces all existing leads on the selected parts. Do not use this option if some leads are placed with other commands that shouldn't change.

**Replace existing**

In parts with no leads, this choice will not produce anything since it replaces existing leads with the defined leads. This method uses the same lead positions as the already existing leads.

**Add new**

This method adds leads on contours that have no lead. Use this method when leads were placed by other commands.

**Individual**

Use this method to select contours transparently inside parts.

This method adds new and replaces existing leads.
10.13.7 Lead definitions

Click on one of the "edit" buttons to change the settings of the piercing methods and lead geometries. The following dialog box is shown:

Create new or delete existing definitions

Click on these buttons to manage the list of lead definitions. Delete leads that are never used to make as short a list of leads as short as possible. Press the "New" button to create a new definition based on current settings.

Leadin

The dynamic picture located in the dialog box shows the result of different parameters. When using tool radius compensation (kerf with G41 or G42) in the machine it is important that the linear part of the leadin is longer than the tool radius.
Dynamic leads

When the Dynamic lead is activated the linear length of the leadin is variable. In Picture 364 the length is between 8 to 20 millimeters. This setting can be used with as long a lead as possible.

Picture 364

When cutting in material that could break during the cutting. This method moves the piercing point out from the geometry. It is mostly used in AWJ cutting of stone or glass.

In Picture 365 the lead has different lengths depending on where it is placed.

In which case is dynamic leadin usable?

Piercing

A piercing type must be attached to every lead definition. The piercing controls how the jet cuts through the material. The following methods are available:

Blind lead

With this option the Jet On is delayed until after the leadin position is reached. This method should never have any lead geometry with a radius. Movements are as follows: Rapid to point (A); Activate the kerf (G41/G42) with a linear movement to point (B); At this point the jet is opened and without any delays the movement continues to cut the geometry; After some distance (C) the jet cuts through the material. In AWJ cutting this piercing method can be used on more or less all material. The benefit is that it does not require any leadin that can damage parts and material.

Never use a radius on this kind of piercing. The angle should be between 0 and 5 degrees. There is no benefit of this piercing type if an angle around 90 is used. It is important to use an overcut (see page 92) that is longer than the distance between (B) and (C).
Linear piercing

With this method the jet is opened at point (A) and then continues to point (B) without any delay. If the distance between point (A) and (B) is so short that the jet cannot cut through the material then the jet goes back and forth between (A) and (B) as many times as needed. The kerf (G41/G42) is activated with the last movement between (A) to (B). The linear piercing is the fastest way to cut through the material with a lead. The length of the linear piercing can be set individually on each material and thickness. Read more about the linear piercing on the material settings on page 129.

Stationary piercing

The jet goes to point (A) with rapid transport. At this point the jet is open and remains there for a time period. Since this method takes the longest time to cut through the material it is recommended to not use it. It is still supported for compatibility reasons. The stationary piercing time can be set on each material (see page 128 for more information).

Circular piercing

This is not the fastest method but probably the most common. The jet goes to point (A) with rapid transport. At this point the jet is opened and then it goes to point (B). The jet now makes circular movements around point (A) until the jet has cut through the material. This is an excellent method to use on thick material. All parameters like the radius, speed of the movement and time can be set individually for each material. See page 128 for more information.

Drilling

Since there can be problems using traditional piercing in laminated material use this method to perform the piercing with a drill. If the machine has no drilling unit then IGEMS uses circular piercing. Set drilling parameters on the "material setup" (see page 124) and control the drilling sequences in the "Strategy" command (see page 162).

Air start
This method is used when a piercing is not needed. For example: Starting outside a sheet or in an existing hole. This method is automatically used for cutting when the start hole has been drilled.

**User piercing**
This method is specified in the postprocessor for customization of a special process. Do not use this method if the postprocessor is not developed for this method.

**Overcut**

A zero value means that the cut will complete the contour. A positive value will extend the cut to cover more than a full lap. If a negative value is entered, the toolpath will stop before a full lap is completed and create a tab.

Activate the checkbox "From material" when using the piercing type "Blind lead". This will use the overcut value from the material (see page 129 for more information).

**10.14 Quick**

The "Quick" command can be used on all kinds of geometries but is mostly used when it is necessary to only cut contours partially. The command can be used to cut slits or contours. Slit geometry can be created by the "Other object" button in the "Create part" command (see page 78).

**10.14.1 Slit**

The "Slit" option can be used to cut open or closed objects. Since the geometry itself is used as the leadin it is only possible to use the piercing type "Blind lead". Read more on this on page 91.
Picture 378 is a typical example. The arcs should be cut with the "Slit" command and the rectangle with "Normal" command.

**Overcut**
The "Slit" option of the "Quick" command can only use the blind lead. The overcut value is the same length it takes the jet to cut through the material.

![Image 1](image1.png)

Picture 379 shows an open slit. The cutting starts at point (A) and continues to point (B). At this point the jet has cut through the material and then moves to point (C). The distances that have been cut two times (A) to (B) is the overcut distance.

![Image 2](image2.png)

Picture 380 shows a closed slit. The cutting starts at point (A) and continues all the way around back to (A) and then to (D). The distance between (A) and (D) is the overcut distance.

10.14.2 **Contours**

![Image 3](image3.png)

Since this option uses a leadin all piercing types can be used. See page 91 for more information about different piercings.

**Connect to part**

![Image 4](image4.png)

Page 86 has more information about connected and disconnected toolpath. Make disconnected toolpath when creating toolpath from Lines, Arcs and other CAD objects. This object will have the selected quality.

**Lead angle**
Only use this option together with the "Contour" option. The command also asks for the leadin and leadout angles.

**Multi or Single**
The "Multi" button is used to select multiple objects at the same time. When the "Single" button is used each object must be clicked on. The starting position will then be at the position where the cursor is placed.
10.15 Marking

The "Marking" command makes it possible to cut a mark in the material rather than cutting through. Marking of text and contours is made with abrasive waterjet or pure waterjet or with other marking equipment. Marking geometries is created by the "Other object" button in the "Create part" command (see page 78).

Attribute
The "Attribute" supports extended functionality. The postprocessors must be specially developed to support such equipment.

Connect to part
See page 87 for more on the "Create" command.

Exclude contours
When this checkbox is activated no geometries that belong to the contours can be selected.

Multi or Single
Use the "Multi" button to select multiple objects at the same time. Select the "Single" button and click on each object. The starting position will then be at the position where the cursor is placed.

10.16 Holes

This command is used for different types of cutting processes on point or circular objects. It can be used to control drilling devices or for special waterjet cutting. The following dialog box is shown:

Select the option from the drop down menu at the bottom.
Drilling
This option makes a drilling hole at an optional position.

Marking
This option makes a marking point at an optional position.

Piercing
This option makes a circular piercing hole.

Cutting
This option makes a circular hole. The holes are machined in a spiral from inside out in order to get a precision hole.

10.16.1 Filter

Picture 387
Press "OK" and IGEMS first asks for a filter object. When one of the small circles below is selected as a filter, then a window is made around the whole drawing. Only objects that are identical with the filter object will be used. Press Enter <No filter> and all selected objects will be used.

10.17 Manual

Picture 388
The "Manual" command is extremely flexible, but requires more manual input from the user. The command can mix created toolpath from IGEMS parts and normal CAD geometry such as lines and arcs. All points and information needed is entered the same way as using "CAD" commands. "Ortho" or "Snap" can be used.

When the command starts there is the following:

Add movement to a disconnected toolpath
The command only works on disconnected toolpath. To continue to work on an existing toolpath select the disconnected toolpath.

Make a new toolpath
Press "Enter" to create a new toolpath. Then there is an additional question:

Specify zero point:

Picture 390
Specify a point for the zero point of the new toolpath.

What is this zero point used for?
The selected position normally has no impact on the result but it can be used by the postprocessors. Set the point as close as possible to desired toolpath.
Use this command to create a toolpath step by step. All movements in the machine will be in the same order as the inputted sub-commands.

10.17.1 Rapid

Press this button to add "rapid movements". The jet will always be off when the machine executes this movement. Use the same methods to enter the coordinates as for the "Line" command. Interrupt the "Rapid" command by pressing the spacebar or Enter.

10.17.2 Start

The "Start" command ends the "rapid", activates compensation and turns on the jets. The following dialog box is shown:

**Compensation**
Select one of the following tool radius compensation to use: "Tool on left", "Tool on right" or "No compensation". Read more about compensation on page 85.

**Piercing**
Select one of the 7 different piercing types. Read more about piercing types on page 91.

**Fixed leadin length**

When "Fixed length" box is checked the lead length is always fixed to this value.
The "fixed length" is used on example (1) in Picture 395 above. When at point (A) and want to start cutting at point (C) then the piercing will be at point (B). The distance from (B) to (C) is the fixed lead length. If this option is not activated (2) then the piercing point will be at the last rapid position.

**Start point**
Press "OK" to pick a point on the geometry to follow. To use commands that follow other objects, put the start point on the object. One example to do this is by using "Object snap" commands.

**Note!** When using tool radius compensation the lead length must be longer than the tool radius or else there may be an error message in the CNC-controller.

**Start without leadin**

The only way to start "without lead" is when cutting without tool compensation and the "Fixed length" is not activated.

**Note!** If piercing type is "Linear" the postprocessor will use stationary piercing.

### 10.17.3 Line

The "Line" option can only be used when the jet is on.

Enter as many lines as needed and move the jet to any position. Interrupt the "Line" command by pressing the spacebar or Enter.
10.17.4  Next

The "Next" option is used when existing objects are located in a chain. For every click on the "Next" button the cursor moves one step forward. To be able to use this function the cursor must be located on an object. When there is more than one object that can be used the path to use must be selected.

Click to select either path A or B.

After deciding the path direction then use the "next" button to add one step with every click.

10.17.5  Follow to

Use the "Follow to" option instead of clicking on the "Next" button.

The coordinates show the current position and if accepted the cursor goes all the way around the part and back to current position.

When a position on the contour (A) is selected then all objects up to that position will be added. Use "object snap" when selecting this point.

Note! If there is a different solution on how to come to that position, there may be a prompt to select path as described on the "Next" option (see page 99).
10.17.6 Cutting quality

The toolpath will have the selected cutting quality which can be changed at any time. The new quality is valid from the current position. Use the "Quality" command to change the cutting quality (see page 79).

10.17.7 Undo

The "Undo" only works on actual toolpath and will undo one step backwards for each time clicked.

10.17.8 Loops

The "Loops" function activates loops on outside corners. The following dialog box is shown:

The size of the loops is controlled by the "Radius" setting. Loop (A) is on a 90 degree corner and (B) is on a 45 degree corner. The (C) corner is 25 degrees and less than the "Threshold angle" so no loops are added.

Uncompensated side
When cutting with "No compensation" on CAD objects it is impossible for the function to know what corner is outside. Use this setting to control which corner is treated as outside.

10.17.9 Done

The "Done" button closes the command. Start the command again to continue the same cutting.
10.18 Bridges

This command creates a disconnected toolpath and connects parts with a bridge. This kind of toolpath is ideal when cutting small parts that can fall down in the tank.

The command shows the following dialog box:

**Lead**
The "Lead" uses the same settings as the "Contour" command. Read about the lead definitions on page 90.

**Compensation**
Use normal methods for tool radius compensation (kerf). Read more about the compensation on page 85.

**Bridge**
This value is the width of the bridge which may look wider on the screen since the toolpath shows the center of the tool.

**Geometry optimization**
This guarantees the part is able to be cut. Read more about this on page 78.

Click on the position to put the lead (A) then on the position for the bridges (B), (C) and (D).

10.19 Common cutlines
The "Common cutlines" command is used for separating parts with only one cut. This cutting method is much faster than traditional cutting. The following settings are common for all methods:

**Tool radius compensation (kerf)**
Common cutline generates a toolpath without kerf information. The coordinates in the CNC-file always describe the center position of the jet.

**Relation between part distance and tool diameter**
The tool center is located between the parts to be separated.

![Picture 420]

It is important that the distance between the parts are the same as the dimension of the jet. If the distance between the parts (C) is closer then no toolpath are generated between the parts. If the parts have a larger distance then (A) and (B) will be cut separately and the (C) portions will be cut two times. The tolerances for the distance are approximately plus/minus 0.01 to 0.05 millimeters.

**Cutting quality**

![Picture 421]
The cutting quality is inherited from the parts. When cutting between two parts that have different cutting quality the toolpath which is common for the part will have the best quality.

**Trim to sheet**

![Picture 422]
If the tolerance of a part is not critical, possibly save time by using the edge of the sheet as the edge of the part.

![Picture 423]
To use this, the parts must be nested close to the edge of the sheet. Check the "Trim to sheet" box.

**Mix between normal cutting and sheetwise**

![Picture 424]
When internal geometries already have a toolpath the command will skip these holes. Cut holes with another command before using the common cut. In the example in Picture 424 the holes are cut with the "Contour" command.
10.19.1 Sheetwise

This method needs material free from stresses when there is no risk that the sheet will be moved during the cutting.

**Lead length and piercing**
Use any length leadin and use any piercing method. Information about piercings is described on page 91.

**Cross ramping quality**

If the material is thick then the jet will make a jump when crossing a path that is already cut. There is a risk that the material will not be cut at these points.

Set the cross ramping quality to a finer value and the cutting speed will slow down at these points (A).

**Cutting order**

Sheetwise method cuts all holes in all parts and then cuts the lines between the parts. Then the external geometries are cut.
Mix between normal cutting and sheetwise

When internal geometries already have a toolpath the command will skip these holes. Cut holes with another command before using the common cut.

10.19.2 Partwise

Most of the settings are identical as for the "Sheetwise" method.

This method cuts each part before starting to cut the next part. The sorting algorithm is similar to the sorting algorithm in the "Contour" command (see page 88).

Piercing

This method tries to start in an existing toolpath using the piercing type "Air start". If this is not possible it uses the piercing method selected in the dialog. Read more about piercing types on page 91.

Mix between normal cutting and partwise

In "partwise" mode it is possible to cut holes with other commands. The command will not add any toolpath for internal geometries that already have a toolpath. This will be adopted by the toolpath for each part.
The example above shows a possible result of a mix between "normal" cutting and "common cut partwise".

### 10.19.3 Lines

This method only adds CAD objects between the parts and does not add any toolpath. These objects can later be used by other commands like the "Quick" or "Manual" commands.

When internal geometries already have a toolpath the command will skip these holes. Cut holes with another command before using the "Line" option.

### 10.20 Cutoff

The "Cutoff" command is used to divide a sheet into one or several portions.
In Picture 438 the sheet needs to be "cutoff" into two portions (A) and (B). To do this make a line or a polyline (C) that describes the cutoff geometry. Start the command and select the cutoff object (C).

The command will cut off the sheet at point (A) and (B) below. It will not destroy the internal geometry of the part.

**Quality**
Since the cutoff is only used for separation the X-rough cutting quality may be used to make the fastest cut.

**Piercing**
Read more about piercings on page 91. The "Blind lead" is probably sufficient in most cases.

**Shortest cut**
There will only be a cut made if the length of the cut is longer that this value. In Picture 441 the distance between the two parts at point (A) is too short so no cutting will be done there.

**Distance**
This value controls the distance between the parts, the center of the starts and the end of the cutoffs. Setting the distance to more than 1.5 times tool diameter leaves a small bridge between the cutting paths (A).
If the parts are located on the machine when the machine cuts the toolpath and the value is a smaller distance value than the tool radius the parts are destroyed (B).

**Different methods**
There are three different methods to use the "Cutoff":

**Cutoff first**
Do the cutoff first and then cut the parts on the sheet. Be sure the distance value is large enough to not destroy the parts. In this case run the cutoff first in the "Order" command (see page 148).

**Cut part first**
Cut all parts first and then the cutoff. If the parts are not unloaded from the machine be sure the distance value is large enough. In this case run the cutoff at the end in the "Order" command (see page 148).

**Cut part first, unload and then cut**
To first cut and then unload all parts set the distance value to zero. In this case there will be no bridges.

### 10.21 Break toolpath

![Break toolpath](image)

This command breaks a disconnected toolpath in two by dividing at the selected "rapid".

![Click point](image)

Click point (A) to get two disconnected toolpaths.

### 10.22 Edit toolpath

![Edit toolpath](image)

Use the "Edit part" command to modify, reorder and apply the "Sort" command after the toolpath has been assigned to a part. IGEMS shows all cutting directions of all parts on the drawing.

![Select part](image)

Select the part to edit
Cutting order

The internal cutting sequence is sorted manually by selecting a contour and moving it up or down in the list using the "arrow" buttons.

To re-order using a predefined sorting algorithm select the algorithm and press "Apply". Read more about the sorting on the "Contour" command on page 88.

Delete a toolpath

Use the "X" button to delete a toolpath from a contour. This can also be done by using the "Erase Toolpath" command (see page 109).

Make a Stop

Press the "Stop" button to add a stop in the CNC-file. The stop will take place before the geometry should be cut. If the CNC-controller supports messages the message will be displayed for the operator.
A red circle in front of the text indicates that a stop has been assigned to the node. To remove the stop, press the "Stop" button again. The stop will be done only during the cutting (not on pre-piercing or drilling).

**Zero point**

![Image](image5)

As default the zero point of each part is located in the lower left corner. There is no reason to move this point, unless there are special applications that will not use this point. The selected geometry (A) is always highlighted on the drawing.

**Lead and piercings**

![Image](image6)

Change the lead and piercings the same way as in the "Contour" command. See pages 90 and 91 for more information.

**Add extra rapids between contours**

![Image](image7)

When it is necessary to add extra rapids between nodes in the part to avoid collisions, for example then click on the node to move and press the "Rapid" button. Add as many rapids as needed and press the spacebar to interrupt. To delete an extra rapid press the "rapid" again without giving any points.

? What does the thick area around the rapid points mean?

*This is the outside tool diameter. The value can be set in the machine setup (see page 172).*

**10.23 Erase toolpath**

![Image](image8)

To easily delete an existing toolpath, start the command and select the leads to delete and press Enter.
This will erase the toolpath on these two holes.

### 10.24 Micro joints

Use this command to add several leading on the same geometry. The lead's design can prevent small parts from falling down into the water tank of the machine. It can also be used to fix the part in the sheet so the parts are not moved because of stresses in the material.

Click the "Edit" button to make lead definitions and piercing settings in the same way as on the "Contour" command described on pages 90 to 93. Click on the "Insert" button to attach the lead to the part.

The standard lead is inserted at (A). The other three are micro joints with the same settings as (A).

### 10.25 Chain

This command can only be used on parts that already have a toolpath. The command joins the different toolpaths together by replacing Rapid movements to cutting. The "Chain cut" command creates a toolpath with only one piercing for all selected parts. "Chain" is often use in materials which are difficult to pierce.
First, use the "Single" command and place the lead on good positions.

Enter the cutting quality to use for the rapids that will be converted to cutting objects.

IGEMS will automatically use the "Fence" option on selected parts. The parts are selected in the same order the fence line crosses the parts.

10.26 Disconnect

A toolpath connected to the part is simple to work with. The toolpath is attached and will move with the part. In some specific cases, it is necessary to disconnect the toolpath from the part. This command will separate the part and toolpath into individual units.
11 5X CAM

IGEMS "5X-CAM" module provides tools to prepare cutting in a 5-axis cutting machine. Strategies supported are cutting with fixed or various angles in flat material.

11.1 Define bevel

This command is used to setup the bevel parameters by selecting a 2D part made by the "Create" command and then applying requested bevel angles on individual contours.

11.1.1 Standard bevel

The "Standard bevel" command works on normal parts. Add different types of bevel on different edges of the part.

Hold down the mouse wheel while moving the mouse to pan and roll the mouse wheel to zoom.
**Perpendicular**

This method is cuts the part with a perpendicular cut. The angle of the jet will never cut with a larger angle then defined. The following perpendicular modes are available:

![Images](image1)

Select desired method and set the other values for the bevel.

![Images](image2)

Select the edges on the part that the bevel setting will be attached to.

![Images](image3)

Select a Contour node and all edges on that node will be selected. Select a single node or select multiple nodes by using SHIFT or CTRL.

![Images](image4)

The CAD window shows graphically which nodes are selected.

![Images](image5)

Press "Apply" to attach the bevel settings to the part.

**Fixed bevel**

![Images](image6)

Use the fixed bevel to cut whole contours or edges with a fixed angle.
The A value is the Bevel angle and the C value is the slope down direction of the fixed angle.

The first picture above has slope down direction 0 degree and the second slope down direction of 180 degrees.

Clone

Use the "Clone" option to have many identical holes.

Attach all bevel settings to one hole.

After activating the Contour node press the "Clone" button.

Select all identical holes on the part.
All six holes have now identical setting.

### 11.1.2 Ruled bevel

In "Ruled bevel" the bevel part is described by a top and bottom geometry. The part contours is always the top. The bottom geometry can be defined by "Other objects" in the "Create" command or by the "Uniform" option in this command.

1. Open the file sample file "FANWHEEL.DIG".

2. Use a material that is about 10 mm thick and create a part. Select one of the outside geometries as "Other objects" (see page 78 for more information).

3. Start the command and select the part.

**Add from other object**

Select the "Add" button and select a point on the top geometry then a point on the bottom geometry.
The selected points will create a connection line between the two geometries which is the start position for the cutting.

Define a second connection if the "ruled bevel" should not be all the way around. This will be the end of the cut and this bevel will be all around the parts. Press the spacebar or Enter to accept the "Close" option.

The final information is to select the direction of the cut. Click near (A) to have a CCW direction. Click near (B) to have a CW direction.

The bevel will now be defined as in Picture 491 above.

**Add by uniform offset**
This option will create the "Other objects" from the part geometry.

Open the sample file "UNIFORM.DIG".

Use a material thickness around 10 mm and create a part. Start the "Define" command and select the part.
**Angle**
The offset will be calculated depending on the angle and thickness of the material. Only positive angles are supported so the outside bottom measurements will be wider.

**Max angle**

![Diagram](image)

Part (A) is the part before any bevel is added.
Part (B) is the result when the "Angle" and "Max angle" are equal. The cutting angle will be the same on all edges on the part.

**Note!** Inside corners may be modified (D).
Part (C) has an "Angle" of 10 degrees and "Max angle" of 45 degrees so the outside corners are extended. If the edge at (E) uses a "Max angle" more than allowed the offset will be rounded.

**Delete**

![Image](image)

All ruled definitions are shown in the list, and the actual bevel is highlighted in the graphic screen.
Press the "Delete" button to delete a definition.

**Note!** Deleting a uniform bevel that has changed the part geometry will not restore the original contour.
Close the "Define" command and use "Undo" to do that.

**Connect**

![Image](image)

Use the "Connect" command to manually add connection lines. This feature is usable when there is an advance part where the geometry on top and bottom side is very different.
If the top and bottom geometries are symmetric then no more connection lines are needed.

![Image](image)

Picture 497 shows the window where the top and bottom geometry by lines can be connected. Hold down the right mouse button for extra functions.
The "Auto" button automatically makes connection lines on the parts. It may be helpful to use this command and then change the connection lines by using the "Connect" command.

**Reverse**
This command will probably be removed.

### 11.2 Cut bevel

The "Cut bevel" command is used to add toolpaths to bevel parts.

Before adding the toolpath set the following parameters:

**Piercing**

Set the type of piercing to use. Read more about different piercings on page 91.

When it is necessary to make a tilted pierce, the tilting direction will be the same as the first point on the contour. Typically it is better to use a vertical pierce instead of a tilted pierce.
Quality and speed

Normally the cutting quality is inherited from the part. Check the "Quality override" for different qualities on different cuts. This is usable for a two or three time bevel cut.

Side (A) shows a two time bevel and (B) a three time bevel.

Example (A) shows the thickness of the material in the actual tilted angle. Example (B) shows the edge length. In one time bevel cutting the result will be the same. In two or three time bevel the cutting speed can be very different.

Overcut or micro joints

Overcut (positive values) cannot be used when leads are placed in sharp corners. If the value is negative then micro joints can be made. This is very useful when making two or three time bevels.

The negative overcut value will make a micro joint (A). The leadout (B) can be in a direction that will create a micro joint.

Applying toolpaths on Standard bevels

These four buttons show the major standard bevel cutting method (YDS, YAS, X and K is a combination of these methods). Methods that are not present on the part are disabled.

Select the start point (A) and the end point (B). The command then asks for (C) the piercing point (leadin) and the end of the leadout (D).
If there is the same type of bevel around the part, then accept the "Close" option by pressing spacebar or Enter.

**Applying toolpaths on Ruled bevels**

![Ruled bevels](image512)

The ruled bevels already contain information about start and endpoint of the cut. Select specific bevel and the position of the piercing point.

![Select bevels](image513)

All ruled bevels contain only lines. The "Accuracy" controls the tolerance of this vectorization. "Rough" settings are better than 0.01 mm, "Medium" is better than 0.005 mm and "Fine" is better than 0.001 mm. It is not always true that the finest accuracy will give the best cutting quality.

![Accuracy settings](image514)

Press the "OK" button to set the leadin and leadout length. The leadin position will be the position for the piercing.

**Clone**

This feature is helpful when cutting many identical contours. The command asks for a master and then for holes on which to clone the master.

![Clone feature](image515)

In the example above (A) is the master. The toolpath has been cloned to all other selected holes. Bevel definition must be added to all holes. Clone the toolpath to the contours which have a similar geometry and bevel definition.

**11.2.1 Assign bevel cutting to a tool**

All parts and toolpaths are assigned to tool one by default. If the 5-axis cutting head is located on another tool then change the default tool assignment in the "machine" settings.
The "Material setup" is started from the "Material" command on the Setup menu.

Use the "Material" command to create, delete and change material parameters.

Note! The information in this document is only describing the NON-US version of IGEMS.

On the left side is a tree view. Change the options in the upper left drop down lists to look at the database in several views.
12.1 Material groups

![Material setup interface](image)

12.1.1 Add or delete groups

All material in a group has the same cutting properties. If a group is selected then add a new group or delete an existing group by clicking on the "plus" or "minus" buttons.

Press the "plus" button and enter the name "Test" for the new material group.

The new group "Test" will be an identical copy of the selected material. Delete the group and the material file will be deleted.

12.1.2 General properties

On the "General" tab edit all properties that are common for all qualities, thickness and machine types.

- **Name**
  Change the name of the group by changing this field.

- **Density**
  IGEMS needs this information to calculate weight on parts. The "question mark" button will show a list of densities for some common materials.
Machinability

This is a material property that describes how easy the material can be cut with abrasive water jet. Material with a high value is more difficult to cut than materials with a low value.

The "question mark" button will show a list of machinability values for some common materials.

If the Machinability is unknown then calculate the value by making a test cut and then calculate the value.

Follow these steps:
1. Place the new material on the machine table.
2. Make a straight cut with a speed that is so high that the jet cannot cut thru the material.
3. Measure the depth of the cut.
4. Press the "Calculate" button.

Enter the depth of the cut and the actual cutting speed. The calculator shows the actual machinability value.

Is the machinability depending of other cutting parameters than depth and speed?
Yes, it uses the pressure, orifice size, size of the mixing tube and other parameters defined in the Cutting parameters.
12.1.3 AWJ

Marking
"Marking" affects only the surface of the material and the information is identical for all thicknesses in this group.

Abrasive flow
On an AWJ machine select whether or not to use abrasive. Select the amount of abrasive in gram/minute or lbs/min. With the "As cutting" option the amount of abrasive will be the same as for cutting.

Pressure
Select the pressure to use for "marking". With the "As cutting" option the pressure will be the same as for cutting.

Marking speed:
This controls the speed for the marking.

All machine types other than AWJ have only the Marking speed input.

Drilling
The drilling information is identical for all thicknesses.

Most drilling units on waterjet machines are pneumatic and so it is difficult to control the rotation and velocity. If the machine has the possibility to use these parameters then the postprocessor writes this information to the CNC-file.
Rotation speed
Enter the rpm/min.

Drilling speed
With a servo controlled drilling spindle this value will be used. This value affects the time calculation.

Step
These inputs make it possible to use a peck drilling cycle.

The value controls the depth of each step (see the A value on the picture).

Note! Not all machines support this feature.

12.1.4 Water, Plasma, Oxyfuel and Laser

The settings for these four machine types are identical.

Marking
This value controls the marking speed.

Drilling
These values have the same meaning as for the AWJ machine.

12.2 Material qualities

The material qualities are used to handle material cost and the "Sheet" commands handle the material stock. The quality information is saved as different tags on each thickness in the material. The information is identical for all machine types.
12.2.1  **Add or delete qualities**  
If a quality is selected then add a quality or delete an existing quality by clicking on the "plus" or "minus" buttons.

Press the "plus" button and enter the name "My private" for the new quality.

The new quality "My private" will be an identical copy of the selected quality. Press the "minus" button to delete the quality.

12.2.2  **Quality properties**

<table>
<thead>
<tr>
<th>Test / My private</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name</strong></td>
</tr>
<tr>
<td>My private</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
</tr>
<tr>
<td>6.00</td>
</tr>
<tr>
<td><strong>Group</strong></td>
</tr>
<tr>
<td>Test</td>
</tr>
<tr>
<td><strong>Density</strong></td>
</tr>
<tr>
<td>8000 kg/m³</td>
</tr>
<tr>
<td><strong>Machinability</strong></td>
</tr>
<tr>
<td>82.0</td>
</tr>
</tbody>
</table>

- **Name**  
  Use this field to change the name of the quality.

- **Cost**  
  This value is used in the cost calculations.

- **Thickness**  
  Check the thickness that should be available for the quality.

  - Why can't I change the density and machinability?
    *If your material has different weight or machinability, then you should add a new group instead.*
12.3 Material thickness

12.3.1 Add or delete thickness
If a thickness is selected in the list then add a new thickness or delete an existing thickness by clicking on the "plus" or "minus" buttons.

Press the "plus" button and enter the thickness "12.50".

Press the "minus" button to delete.

12.3.2 General
On the general tab change the thickness and control what machine types can be used for this specific material.
12.3.3 AWJ

**Piercings**

IGEMS supports different methods to pierce through material. Read more about piercings on page 91.

**Individual piercing parameters**

To use a different amount of abrasive or a different pressure for the piercing enter values here:

![Image](Picture 542)

Check the two boxes "As cutting" to not use any special values. When cutting brittle material, piercing at a lower pressure is often needed.

**Stationary piercing**

![Image](Picture 543)

The jet will stay in the same position during the entire pierce. The value is the length of time in seconds that the jet will be on. This piercing method works best on very thin material.

**Circular piercing**

The jet goes around a small circle during the entire pierce. This is one of the most common methods of piercing on an AWJ machine and works well on thin and thick material.

![Image](Picture 544)

**Circular piercing**

This controls the piercing time it takes for the jet to cut through the material.

**Circular piercing diameter**

This is the movement diameter. The diameter in the material will be this value plus the diameter of the jet.

**Circular piercing speed**

This value is in mm/min. The faster the speed the more number of revolutions is used.

**Note!** If the diameter is too small, or the speed too high, then the centrifugal acceleration may exceed the acceleration limits. In this case the text will change to red.
Hold the pointer on the text to see a tooltip with information about the actual accelerations.
The maximum acceleration is set in the machine setup.

**Linear piercing**

<table>
<thead>
<tr>
<th>Linear piercing distance</th>
<th>8.000 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear piercing speed</td>
<td>273.0 mm/min</td>
</tr>
</tbody>
</table>

The jet makes a linear movement during the entire piercing. If the distance is longer that the length of the lead then the movement will go back and forth until the specified distance is reached.

**Linear piercing distance**

This is the length needed for the piercing to be able to cut through the material.

**Linear piercing speed**

This is the speed that is used for the piercing.

**Overcut distance**

This value is used as the default overcut distance when the cutting starts directly on the geometry (Lind lead).

| Overcut distance | 7.000 mm |

This value controls the length of the overlapped cut.

**Dynamic leads**

Dynamic leads are used to have the piercing position as far away as possible from the geometry. It is a nice feature when cutting material that often breaks on the bottom side during the piercing.

| Dynamic lead min length | 3.000 mm |
| Dynamic lead max length | 10.000 mm |

**Dynamic lead min length**

This should be the shortest acceptable lead length for this material.

**Dynamic lead max length**

Set this value to the maximum required lead length. While safer to have a longer lead this takes time to cut.

**Cutting**

The information in this area controls the thickness depending information for the cutting process.

**Fixed speed**

This value is used when "Fixed speed" is selected in the Machine setup. When using fixed speed there is no possibility to use qualities or speed ramping. The value is only used on an AWJ machine without using the "AWJ" module.
CAM – Material setup

**Individual cutting parameters**
It may be an advantage for certain materials to use other cutting parameters than the machine uses as standard. If that case, set up the individual cutting parameters here.

<table>
<thead>
<tr>
<th>Abrasive flow</th>
<th>350 c/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>3800 bar</td>
</tr>
</tbody>
</table>

**Abrasive flow**
This controls the amount of abrasive. To use the standard amount of abrasive check the box "By machine".

**Pressure**
This value controls the pressure. To use the standard pressure for cutting check the box "By machine".

**Note!** If there is no machine equipment to automatically change the abrasive amount or the pump pressure then check these boxes, allowing fewer changes for the machine operator.

**Taper Angle Control**
Depending on material properties and cutting parameters the cut through the material is not always 100% straight.

By using the Taper Angle Control feature manually adjust the inclination of the nozzle. IGEMS does not use any mathematic formula to calculate the taper. Make a test cut to adjust the TAC parameters.

Cut a small test part without TAC using cutting quality Rough and X-Fine.

Measure the Rough side A and B. Measure the X-Fine side C and D.
Start the "TAC Calculator" by clicking on the button.

The TAC Calculator calculates the angles. If the measurements are smaller on the bottom side on an outside geometry then the angles are negative else positive.
**TAC for Rough**
Enter the angle for the "rough" measurement.

**TAC for X-Fine**
Enter the angle for the "X-fine" measurements.

**Note!** To use the "TAC" option a standard CNC machine is needed with at least 4 or 5-axes controlled by the CNC and the nozzle can be tilted in different directions.

**Automatic speed optimizing**
The automatic speed optimizing adjusts the cutting speed depending on cutting parameters, material properties and geometry to be cut. Straight lines and large arcs are cut with a higher speed than sharp corners or small arcs. The automatic speed optimizing uses another algorithm than earlier versions of IGEMS. The speeds are therefore not the same as before, but still divided into five qualities.

![Auto Speed Opti](image)

At IGEMS R&D Center, we are constantly updating and fine-tuning cutting parameters. Updating IGEMS may also update cutting speed parameters. The automatic speed optimizing is activated when the checkbox "Automatic" is checked.

**Manual speed optimizing**
The manual speed optimizing uses the same formulas as IGEMS R8 and R9. Use this option to fine-tune parameters. The values are not changed in an update of IGEMS.

![Manual Speed Opti](image)

The following parameters can be adjusted:

**High speed**
This speed is used by straight lines and arc radius larger than the thickness of the material.

**Low speed**
The low speed is dependent on the geometry. The sharper the corner or the smaller radius size of an arc the lower speed will be used. The speed will never be lower than this value.

**Steps**
This value is only used if when using the ramping method "Speed interpolation by CNC-file" (defined in the machine setup).

**Acceleration distance**
This is the total length of all speed increasing steps when the speed changes from low to high speed.

**Deceleration distance**
This is the total length of all speed decreasing steps when the speed changes from high to low speed.

**High speed factor**
The speed is calculated by known parameters such as: Machinability, Pressure, Orifice size, Abrasive quality, Amount of abrasive, Nozzle size, Cutting quality and the thickness of the material. If the actual high speed is
according to this algorithm then the height factor is 1.00. If the high speed is changed it will also change the high speed factor.

**Low speed factor**
This factor does the same as "High speed factor" but for the "Low speed" values.

**Arc factor**

This value controls the cutting speed in the arcs. If this value is set to a higher value then the small arcs will use a higher speed. Normal value is 1.00

**Default**

Press this button to reset the values to default. This will change all values on this material according to the algorithm.

**Import**
The database in R10 is different from previous versions. To use old values in IGEMS R10 use the import function.

**Shared folder**
When using this command for the first time, select the location of the shared folder. IGEMS R10 will then remember this location.

**Material and Thickness**
Be sure to use the same material and thicknesses as in IGEMS R10. Repeat these steps for every material imported to IGEMS R10.

### 12.3.4 Nesting

Some nesting parameters can be saved in the material database.

**Collar width**
This value sets the default value used when creating new sheets.

**Part distance**
This value sets the default value for the part distance. The value is used in the "Nesting" commands.

### 12.3.5 Various

The "Technology", "Options" and "User" settings are read by the postprocessor for handling different equipment or functions in the postprocessor.

**Plasma, Oxyfuel and Laser settings**
IGEMS is developed for Abrasive Water Jet Cutting, but also supports other machine types such as Plasma, Oxyfuel and Laser machines. These machines have similar inputs.
12.4 General import

If there is an older version of IGEMS then import the complete material database.
13 CAM – Sheet commands

13.1 Sheet Create

This command creates and inserts sheets onto the drawing area.

13.1.1 Standard sheets

When the command is started there is the following question:

select objects <standard sheet>: CREATE

Press the spacebar or Enter for a list of standard sheets.

Modify list of standard sheet

Press the "plus" or "minus" buttons to modify the list of standard sheets.

Press the "plus" button to add a new sheet size.

Sheet properties

Select a size in the drop down list and press "OK". Add additional information about the sheet in the following dialog box:

Name

To track all sheets it is important to use a unique name for the sheet. The "#" sign uses an automatic counter in the same way as on "Part create" (see page 77 for more information).
Info
This information is used by the postprocessors and in the reports.

Collar width

![Collar width](image)

This value controls the distance between the edge of the parts and the edge of the sheets when using "Nesting" commands.

Show name

![Show name](image)

With these settings control height and the name of the sheet is visible on the lower left corner on the sheet.

Subtext

![Subtext](image)

This setting controls the height of the text placed on the sheet when using the "Lock sheet" command.

Insert sheet

Press "OK" to insert the sheet into the drawing.

![Insert sheet](image)

Pick the position for the lower left corner (A) then the orientation of the sheet (B) or (C).

13.1.2 Irregular sheets

If a sheet has complex geometry, be sure that the geometries are closed before starting the command.

Select objects <Standard sheet>: CREATE

Select the objects that describe the sheet.
The sheet can contain holes and it is also possible to use the "Text as names" function. See page 77 for more information.

### 13.1.3 Edit sheet properties

To change any parameters on an existing sheet use the same command to change the parameters. Select the sheet instead of geometry. It is also possible to double click on the sheet without starting the command.

### 13.2 From hole

In parts with large internal contours, use this command to keep the internal areas and store as "rest sheets". The new sheet inherits all the properties from the original sheet.

Start the command and click inside a hole in the part (A). This creates a new sheet with same geometry as the hole. Move the mouse and the sheet to a position (B). The new sheet (B) has the same properties as its parent.

### 13.3 Lock sheet

Use this function to convert parts located on sheets to holes.
The sheet now looks as follows:

The external contour and the toolpath creates a hole in the sheet. The text located in the hole is the name of the part. This text height is controlled by the "Subtext height" in the "Sheet create command". See page 135 for more information.

The exact geometry of the part and the piercing geometry (A) are shown on the sheet.

**Automatic divide**
If a cutoff crosses the sheet, then the sheet automatically will be divided into two. See page 105 for more information about "Cutoff" command.

Both sheets (A) and (B) have the same properties.

### 13.4 Unlock

To modify the position of the part on the sheet, use the "Unlock" command. Start the command and select the sheet to unlock.

Now move the geometry on the sheet. When the geometry is in the correct position, lock the sheet again.

Why is it important to move the geometry afterwards?

*It is only important if there is some space left on the sheet and you plan to use the sheet again.*
Why can the hole be in the wrong position?
For example: If the sheet was not aligned correctly on the machine or the zero point was wrong. Use "rotate" or "move" to correct this.

13.5 Divide

The "Lock sheet" command automatically divides a sheet into several parts. To divide a sheet manually, use the "Divide" command.

Make a polyline that describes how to divide the sheet.

The command creates two sheets (B) and (C) with the same properties. The "Divide" command also works with toolpaths from the "Cutoff" command. See page 105.

13.6 Sheet export

IGEMS has an excellent way to handle the library of sheets and rest sheets.
For every material there is a corresponding DIG file that contains the sheets. If the actual material is: "Stainless Steel" quality "304" and thickness 10.00, then the corresponding "DIG" file is "Stainless Steel_304_10.00 mm.dig".

Use this command to export Sheets, rest sheets, parts or locked sheets from the drawing into the corresponding file. Save the file after exporting.

If the corresponding file does not exist then IGEMS will create a file. All sheet files are normal IGEMS drawing files located in the Sheet directory in the Shared folder. See Section 3.6 for more information about the shared folder). The file will contain all rest sheets.
Should I lock the sheet before I use the "Export" command?

*Do this before or after.*

Can I make the nesting and toolpath in the Sheet file?

*Yes, handle this file as any other file.*

### 13.7 Sheet open

This command opens the corresponding file but will not export any information. See Section 13.6. Use this command to look in the rest sheet library.

### 13.8 History

This command asks for the selection of one or several sheets. It then shows information about sheets and the parts that have been located on the sheet.

Select a part in the dialog box and the location will be highlighted on the sheet.

If the parts were registered in the "Organizer" module then the DBID flag has a positive number. Double click on that line and the "Organizer" shows more detailed information about the part.

**Sheets**

Select the "sheet tab" to see information about the sheets.
**Search**

If there are many parts and sheets use the Search function to find the information.

Use the "Search" function to make a search on all.

---

### 13.9 Inventory

"Inventory" locates rectangular areas on a locked sheet and gives information on area and weight of the rest of the material based on the size. Different colors show the categorized size of each rectangle.

Picture 596 above shows the screen after using "Inventory". Areas are different colors depending on the size of the rectangles. The command shows the following dialog box:

**Reports**

The following options are available in the "Inventory" command:

**Reports**

This option creates a full report on selected sheets.
Draw
This command creates rectangles around the different colors.

Settings
The "Settings" option defines the categorized size of the areas used in the Inventory.

13.10 Migrate
Use the "Migrate" command to migrate sheets/rest sheets previously stored in the "Organizer" from older IGEMS versions into IGEMS R10. Before using this command run the "Open" command in the sheet menu and select the name of material and thickness. Then select the "Migrate" command and the correct "Shared" folder to import from.

After the migration is completed, the previously stored sheets are imported into the IGEMS R10 sheet files.
This chapter contains detailed information about the commands and possibilities for postprocessing.

14 CAM - Process

Prepare something to process before starting the postprocessing.

- Create a closed geometry to be cut.
- Create the part.
- Add a toolpath using the "Auto" command.

14.1 Process

The postprocessor system in IGEMS R10 is built around our internal LISP language called ILISP. The postprocessor is used for creating CNC-files, estimate cutting times, making reports and simulations.

- Press the "Process" button
  The "Process" command needs a cut order to continue.

- Select the parts to cut.
  This creates a cut order with the default settings from the "Order" command.

The tool radius compensation (kerf) can be calculated in IGEMS or at the CNC-controller. If the kerf is calculated in IGEMS then there is the following dialog box about the Tool diameter to use:

IGEMS automatically calculates the toolpath to obtain the correct measurements of the job. If the kerf needs to be calculated in the CNC-controller there will not be this question.
The postprocessor window shows the selected parts. The process window has the following choices:

### 14.1.1 Create CNC-file

Press the "Process" button.
The postprocessor asks for the name of the CNC-file. When the file has been created it is shown in the process window.

How can I change to another postprocessor?
The postprocessor is controlled by the machine setup. To make a file for another machine then change to another machine in the "Select" command.

Can I modify or make my own postprocessor?
Yes, modify or make new postprocessors or make applications. Contact IGEMS Software for more information.
14.1.2 Cost estimate

The "Cost estimate" calculates a cutting time, the cost for the cutting and the cost for the material.

Press the "Cost estimate" button

The postprocessor shows the following:

![Image of Cost estimate window](image)

**Cutting cost**

The cutting cost for an AWJ machine depends on the following cost parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine cost/hour</td>
<td>100.00</td>
</tr>
<tr>
<td>Tool cost/hour</td>
<td>10.00</td>
</tr>
<tr>
<td>Abrasive cost (kg)</td>
<td>1.00</td>
</tr>
<tr>
<td>Machine speed (mm/min)</td>
<td>1000.00</td>
</tr>
<tr>
<td>Length (mm)</td>
<td>2173</td>
</tr>
<tr>
<td>Time (h)</td>
<td>00:00:01</td>
</tr>
<tr>
<td>Filling</td>
<td>00:01:05</td>
</tr>
<tr>
<td>Marking</td>
<td>00:00:00</td>
</tr>
<tr>
<td>Cutting</td>
<td>00:19:10</td>
</tr>
<tr>
<td>Drilling</td>
<td>00:00:00</td>
</tr>
<tr>
<td>Total</td>
<td>00:20:17 (0.34)</td>
</tr>
</tbody>
</table>

**Machine cost/hour**

This cost is the general cost for the machine equipment

**Tool cost/hour**

To use a machine with several cutting heads is more expensive than using one head. On the other hand it cut double when using two heads. To make it possible to calculate this IGEMS needs to know the cost for each head. The hourly cost should be the sum of the following:

- Water
- Orifice
- Mixing tube
- Other costs related to the head

**Abrasive cost**

This cost should include cost for deposit or recycling. The cost for the grid can also be added to the abrasive cost.

**Material cost**

The material cost is loaded from the quality level in the material database.
There are different ways to calculate the area for the material cost:

**Sheet**
This option uses the whole sheet. The option is only available if the cut order is placed on a sheet.

**Bounding box**
This option uses the area of a bounding box around the parts. When using this option add an extra border around the area.

**Outer**
This option calculates the area of all parts. It will not reduce the area of the holes in the parts.

**Parts**
This option calculates the net area of all parts.

**Material cost/kg**
Click on the "dot" button to change the units to square meters.

**Bounding box border**
This option is only available when the "Bounding box" option is selected.

The bottom of the window shows the total cost of the job.

Press the "Report" button
This shows a report that can be printed out and used as base for a quotation.

Are the values calculated here the price or the cost?
*That is up to you.*

Can the report be customized?
*Yes, Chapter X will contain more information about the reports.*

### 14.1.3 Job report
Use this command to make a job report.

Press the "Report" button

![Image](58x519 to 238x771)

Chapter X will have more information about the job reports.

### 14.1.4 Simulation

The "Simulation" command visualizes the motions as they will come out in the machine. The simulation will show a simple layout of the machine with cutting heads, drilling and marking units.

Press the "Simulate" command

```plaintext
specify point <834.268,448.8941>
PROCESS
```

The point places the machine on the selected position.

![Image](58x345 to 263x375)

Use these different buttons to play, stop and go forwards or backwards one movement or one geometry at a time.
The right slider controls the simulation speed in play mode.

The "1x" button sets the simulation speed to 1. The simulation then takes the same time as the cutting time.

14.1.5 View code

This command opens the output file by using Notepad.

*Note* Create a CNC file before pressing this button.

14.2 Order

If cutting only one part or if the cutting order between parts is not important, then skip this command and use the "Process" command directly. Prepare parts before starting.

Start a new drawing and create three parts in the form of a disk, square and a triangle.

Add toolpath.

Start the "Order" command.

The following is shown:

Start the "Order" command.

The following is shown:

Select the parts. The following window is shown:
What does the number in parentheses after the part name mean?

*This is the tool number that will be used to cut the part.*

### Manual adjustment of the cut order

The list shows the cutting order of the parts. The DISK will be cut first and the TRIANGLE will be the last part cut. To change the cutting order use the "arrow" buttons to move the parts up or down. To remove or add parts to the cut order use the "plus" or "minus" buttons.

### Stop between parts

Use the "Stop" button to add a program stop in front of the parts. If the machine supports "stops" then there will be a program stop just before this part is cut.

### Pre-defined cutting orders

When cutting many parts use pre-defined methods to set up the cut order. The result of the "strategies" depends on the quantity and geometry of the parts and sheets. Select a strategy from the drop down list and press the "Sort" button to sort the cut order in the following ways:
**Closest**
This method looks from the start point to the next closest point and then to the next closest point again and so on. If optimizes the order to avoid long movements at the end.

![Picture 631]

**Zig zag**
This method has different sub-settings:

![Picture 632]

**Left to right**
This method starts with the most left part and ends with the most right parts.

![Picture 633]

**Right to Left**
This method starts with the most right part and ends with the most left part.
As placed
This method takes the parts in the order they have been placed on the sheet.

This method is mostly used together with other applications.

Manual
Use this method to select the parts in the order they should be cut.

Spread
This method takes the parts randomly and not close to each other. The method is mostly used by Plasma cutting machines to spread the heat out over the whole sheet.

Tool optimization
This example uses only one tool. If a machine is equipped with several tools then this feature is useful since it keeps parts together that use the same tools resulting in less tool changes. Read more about cutting with multiple tools in CHAPTER X.

14.2.1 Zero point
The program has a default location of the zero point that is setup in the "Strategy". Click on this button or enter coordinates to change the zero point to an optional point.
14.2.2 Zone detection

This feature divides the material into working zones with the equal number of tools the machine is equipped with. If zone detection is not activated all parts are cut with tool number 1.

The list will look like this:

The number inside the parentheses shows the tool number to be used. Activate the checkbox and then press the button to apply. Tool 1 primarily works in zone 1 and tool 4 in zone 4 as illustrated in the below pictures:

The above picture shows how tools 1-2-3-4 are assigned with the zone detection feature.

14.2.3 Start rapids

“Start rapids” defines extra rapids from the zero point to the first contour. This feature supports special sheet alignment tools.

Add different "Attributes" for the postprocessor to support different options.
Note! The postprocessor must be specially designed to support this kind of feature.

14.2.4 End rapid

When it is necessary to make a final movement of the tool away from the material, click on the "End rapid" button.

14.2.5 Tip up avoidance

Use this button to detect and avoid collision and redefine a rapid transportation to avoid crossing parts that are smaller than a specified size in X and Y.

Press the "Tip up avoidance" button

Define the smallest parts to avoid by entering the values for DX and DY.

Click on the "Find collisions" button

If there is a part smaller than the values and a rapid over this part, then define a way around this part.

Click the "Find collisions" button to redefine a rapid toolpath around parts that are smaller from what is defined in the DX, DY.

Box rapid

This method automatically generates extra rapids to avoid moving over existing parts. For best results the cut order should be sorted from left to right and the internal cut order on the part should also be sorted in left to right.

When should this be used?

*It is not possible on some older machines to lift the nozzle between each cut. In that case it is important to move around parts to avoid a crash. On modern machines it is not necessary to use this feature.*
14.2.6 Rapids

Click this button to add extra rapids to the selected part on the list.

When should this be used?

*It makes it possible to move around clamps and other things.*
15 Cutting parameters and Strategy

15.1 Cutting parameters

This command shows the following dialog box:

![Image](Picture 653)

**Plus button**

Press the "plus" button to create a new parameter setup. IGEMS asks for a name for the new setup. Save the setup with a name that corresponds to the size of orifice and mixing tube.

![Image](Picture 654)

**Minus button**

This button will delete the actual parameter setup.

**Tool diameter**

![Image](Picture 655)

This is the actual "tool diameter" used as default when IGEMS calculates the tool radius compensation. It is also the default value for the part distance when using commands for common cutline. If the checkbox "Use mixing tube" is active, then the tool diameter automatically is the same as the diameter of the mixing tube.
The "Pressure" value should be the pressure the pump is set to (the pressure loss is handled by IGEMS). All these settings are used in the mathematical formula to calculate the cutting speed. Click the "Lamp" button to have some hints of good combinations of Nozzle/Orifice/Abrasive.

Where do I select the parameters I want to use?
When you select machine and material in the "select" command then you also select cutting parameters.

15.2 Strategy
The "Strategy" command affects how the postprocessor generates the CNC-file, the strategy and workflow for the cutting in the machine.

Press the "Strategy" button.
The "Strategy" is divided into 7 groups. Select the group in the drop down list located at the top:

**15.2.1 Settings**

**Default zero corner**

When a cut order is created then the program zero point is automatically set to the default corner. Lower left, Lower right, Upper left and Upper right.

If there is a sheet it will be located at the corner of the sheet; if there is no sheet it will be located at the corner of a bounding including all parts.

? Can I change the zero point to an optional point?  
Yes, please see the "Order" command.

**Stand off**

This value or feature is not implemented as standard on all postprocessors.
The value is used to control the distance between the end of the nozzle to the material.

**Z-axis mode**

In the machine setup select up to 4 different Z-axis modes. Only the options available for the machine are in this list.

The implementation of these modes can be different depending of the machine supplier.

**Fixed Z-axis**

This method is used to not have any Z-axis movement at all.

**CNC-controlled**

Use this method to move the Z-axis up and down using coordinates.

**By height sensor**

Use this method to use the height sensor.

When this mode is activated choose one of four different "Sensoring modes":

**Sheetwise**

The height sensor measures the height once in the beginning of the process and not again.

**Partwise**

The sensor measures the height once when starting to cut on a new part.

**Dragging**

The sensor measures the height constantly and the sensor ring is dragged on the material.

**Stamping**

The sensor measures the height on a time period or a cutting distance.

The time period is calculated from the "Stamping distance", which is the time it takes to cut this distance in medium quality.

**By measuring**

Use this method when there is a separate height measuring system. This is mostly used on 5-axis machines.

**Check part distance**

This feature checks the distance between all parts before starting the process.
If parts interfere with each other or are closer than tool distance there is the following message:

Modify the position of the part to avoid cutting damaged parts.

Is there any reason to not having this feature always activated?

If you have extremely large jobs then this check can take some time.

15.2.2 Various

This group of setting handles various functions in the postprocessor.

All drop down menus handle 4 different options:

The choices "No" and "Yes" activate different options in the postprocessor. If "No but ask" or "Yes but ask" is used then there is an extra question during the postprocessing.

Example: If the drop downs are set as follows:

When the postprocessing starts the following dialog box is shown:
All options that were set to "No" or "Yes" are not visible.
All options that were set to "Yes but ask" are shown and checked.
All options that were set to "No but ask" are shown but not checked.

Start pump automatically
This option is only enabled if the machine can be turned on/off from the CNC-file.

Skip pressure init
There is always a pressure initialization if the start pressure is not the same as the cutting pressure. Set this value to "Yes" to always have a pressure initialization.

Skip pressure changes
If the job contains different pressures, then turn of the changes by setting the value to "Yes".

Skip abrasive flow changes
If the job contains different amount of abrasive then turn off this by setting the value to "Yes".

Skip tool init
If the job starts with several tools or not with T1 then there is always a tool distance initialization. To not have a tool distance initialization when starting with T1 only then set this option to "Yes".

Stop after first cut
This option provides a stop after the first geometry has been cut. The reason to have this stop is to check and adjust dimensions.

Stop after first part
This option provides a stop after the first geometry has been cut. The reason to have this stop is to check the part before starting to cut next parts.

Serial production
This option is only possible when cutting parts with high and low pressure. When checked the machine will end with low pressure ensuring that the pressure is correct when starting to cut with the same program again.

Stop pump automatically
This option is only enabled if the machine can be turned on/off from the CNC-file. The feature is helpful if the machine runs in unmanned mode during the night. The instruction in the CNC-file turns off the pump when the job is done.

Use parking position
This feature has the machine go to this position after the job has been done. The position will be taken from the "Parking position".

The coordinates are given from the "machine zero position" ensuring that the position will be the same no matter where the zero point is for the job.

15.2.3 IFPC IEGMS Flexible Process Control
Drilling, marking and pre-piercing can use a feature called IFPC (IEGMS Flexible Process Control)
The IFPC controls when an operation should be executed. The process control can be used on drilling, marking and pre-piercings.
The "By sheet" (A) operations will always be executed first, then the "By tool setup" (B) operations followed by the "By part" (C) operations. The rest of the operations (D) will be done as the last step.

The options below are the same for drilling, marking and pre-piercing:

**By sheet**
With this option the operations will be done on the whole sheet before the other process is started.

When several kinds of operations (drilling, marking and pre-piercing) are set to "By sheet" then the internal order between the operations are controlled by the priority. The priority 1 will be executed before priorities 2 and 3.
If the priority is set to the same for different operations then it will be executed internally in the order defined in the toolpath.

Is there any typical machine configuration that should not use this optimizing?
*The distance between the heads may need to be changed several times when using this method. If you don't have servo controlled tool distance on the machine then use "By tool setup" instead. That will save jobs for the operator.*

**By tool setup**
These options will be done after the "By sheet" step.

After the (B) operation is done the process goes to next step and makes all (C) and (D) operations.
If more than one type of operation is set to "By tool setup" then the internal order between the operations is controlled by the priority. The priority 1 will be executed before priorities 2 and 3.

**By part**

Use the "By part" to control the processing order of the remaining operations on a part level. If more than one type of operation is set to "By tool setup" then the internal order between the operations is controlled by the priority. The priority 1 will be executed before priorities 2 and 3.

**No optimization**

The cutting process is always executed as the last operation. If another kind of operation (drilling, marking, pre-piercing) needs to be executed in the order the toolpath is added then select "No optimization".

**Example 1:**
First all drillings need to be made over the whole sheet, and then the markings made over the whole sheet. Then the pre-piercings are made over the whole sheet and finally the cutting is done last.

\((\text{drilling, drilling, drilling}) (\text{marking, marking, marking}) (\text{pre-piercing, pre-piercing, pre-piercing}) (\text{cutting, cutting and cutting}))\)

**Example 2:**
In this example the optimization is as follows:
(Marking, pre-piercing, drilling and cutting together)
(Marking, pre-piercing, drilling and cutting together)
(Marking, pre-piercing, drilling and cutting together)

**Example 3:**
Set marking to "By part" priority 1. Set the pre-piercing to "By part" priority 2. Set the drilling to "No optimization".

\(\text{(Marking, pre-piercing, drilling and cutting together)}\)
15.2.4 Drilling

If the machine does not have a drilling unit then this option is not in the "Strategy".

The IFPC for drilling

The IFPC controls when the drillings are executed in the process. The IFPC feature is described on page 159.

Drill diameter
When a drilling position thru a "Piercing" or the "Hole" command is added then this is represented as a circle on the screen. This setting controls the size of that circle.

Lift Z-axis between drillings
This option controls if the drilling tool is lifted between every hole. The drop down list is disabled if the machine does not have this option available.

Pneumatic stroke between drillings
This option controls if a pneumatic stroke up and down is done between every hole. The drop down list is disabled if the machine does not have this option available.

Lift height

This setting controls the lift height between each hole. If the machine does not have this possibility then lift height setting is disabled.

Drilling tool offset

These values set up the distance between the cutting tool and the drill in X, Y and Z. On many machines this offset is controlled on the CNC-controller. These values are also used by the 2D-simulation to define the drilling tool position.

15.2.5 Marking

This option is only visible if there are any marking devices defined on the machine.
The IFPC controls when the marking should be executed in the process. The IFPC feature is described on page 159.

**Lift Z-axis between markings**
This controls if the Z-axis is lifted between markings. This control is disabled if the machine cannot use this option. To move the marking tools up and down may take longer time then the marking itself.

**Pneumatic stroke between markings**
This controls if "pneumatic stroke" should be used between the markings.

**Lift height**
If the machine has the possibility to move the marking tool to different heights then set this height here. The value is an incremental value from the position above the material.

### 15.2.6 Pre-piercing

The IFPC controls when the marking is executed in the process. The IFPC feature is described on page 159.

If the machine does not have possibilities to use marking then this option is not visible.
**Lift Z-axis between piercings**
This controls if the Z-axis is lifted between piercings. This control is disabled if the machine cannot use this option. If the IFPC makes all piercings before the cutting there is little risk to have the nozzle close to the material during pre-piercings.

**Pneumatic stroke between piercings**
This option controls if a pneumatic stroke up and down is done between pre-piercing. The drop down list is disabled if the machine does not have this option available.

**Lift height**
If the machine has the possibility to move the marking tool to different heights then set this height here. The value is an incremental value from the position above the material.

### 15.2.7 Cutting

**TAC**
To use the TAC function the user must have a 5-axis cutting machine and a CNC-controller that can tilt the cutting head in different directions.

![Picture 693]

How much the nozzle should be tilted in different material can be set in the material database for each material. The functionality to use a 5-axis machine to obtain a straight cut has been used on plasma cutting machines for more than 20 years.

**Lift Z between cuttings**

![Picture 695]

If the machine cannot move the nozzle to different heights then this option is disabled. The lift settings are divided into two settings.
Control the lift height between different cuts in the parts and set the lift height between the parts. The line between the parts.

**Pneumatic stroke between cuttings**
This option controls if a pneumatic stroke up and down is done between pre-piercing. The drop down list is disabled if the machine does not have this option available.

**Service position before 5-axis cutting**

When cutting with tilted jets it is difficult to use a protector and is often not used in combination with 5-axis cutting. To cut without a protector will damage the equipment, add more noise and dust to the environment. Activate this feature to use a protector. The IFPC function will do all piercing before cutting starts. When it comes to the first tilted cutting then the machine will first go to the service position and stop. The operator can then remove the protector and restart the machine that will do the final 5-axis cutting.

The postprocessor uses these coordinates to write instruction for the movement. Use the machine coordinate system and the machine goes to the same position no matter where the local program zero point is located.

**Costs**

"Cost per tool" and "Abrasive cost" is only available if the machine is an AWJ machine. The costs are used to calculate cutting costs in the "Cost estimate" function in the postprocessing.
15.2.8 Output

The location of the CNC-file

When using a fixed folder, IGEMS suggests the default directory every time a new CNC-file is created. If "Use a fixed folder" is not selected, then IGEMS remembers the last used directory.

Add comments
This setting controls if comments are added to the CNC-file.
N100 M03 (WATER ON)
N105 G04 F0.5
N110 M06 (ABRASIVE ON)
The text inside the parentheses is an example of comments that can be turned on or off if the postprocessor uses the provided MSG function.

Is there any reason to not always add these comments?
*It makes the CNC-file larger but that is probably not very important.*

View output file
This "No-Yes" option handles if the CNC-file is viewed in the process window.

Is there any reason to not always view the file?
*Not really, the viewings of the file take a little longer time.*

Copy to backup folder
This feature copies the final CNC-file to a backup folder or a USB-drive. If no USB is connected or if the backup folder does not exist then the procedure is skipped. There is not any disk error.
Settings for the reports

Include detailed part information
This setting controls if the job report includes only a summary or more information about each part.

Create report automatically
If this function is activated then it is not necessary to press the "Report" button to make a report as it is created automatically. Decide if the report should be generated as a DOC file or as a PDF file.

Is there any benefit to use DOC file?
The DOC file can be opened and changed by Word, but the PDF file is read only.

Report folder
All reports are created in this directory:

This feature can copy the report file to a backup folder or an USB-drive. If no USB is connected, or if the backup folder does not exist, then the procedure is skipped. There is not any disk error.
This chapter contains information how to setup the machine and the equipment. The "Machine setup" command is started from the "Machine" command in the Setup menu.

The following dialog box is shown:

**NOTE!** If you do not have enough knowledge about the machine you should not change any parameters on an existing machine. If you want to play with this setting then first make a test machine and make the changes in that machine.

Select "Create new" and set the new name to "TEST" and press the "Create" button.

TEST is now the active machine.

Press the "Edit" button.
16.1 **Table layout**

![Diagram of table layout]

**Machine orientation on the screen**
In IGEMS R10 the user defines the machine coordinate system independent on how the coordinate system is defined in IGEMS. Since new computer screens are much wider now it is recommend that the machine layout in IGEMS is defined so that the long side of the machine is rotated as the long side of the screen.

![Diagram of machine orientation]

**Width**
Enter the length of the side of the machine that is oriented horizontal on the screen.

**Height**
Enter the length of the side of the machine that is oriented vertical on the screen.

**Bar length**
This value should be the maximum movement from the left tool in the most left position to the right tool in the most right position.
This value is used by the simulation functionality in the postprocessing. All the settings in the Table layout should now describe the fundamental dimensions of the machine.

### Coordinate system

![Coordinate system diagram](image)

In IGEMS R10 there is no relation between the CAD coordinate system and the Machine coordinate system. Select the coordinate system according to the machine layout on the screen.

### Swap G2 and G3

According to chosen coordinate system 0-7 the G2/G3 Arc directions are swapped automatically. To manually change the direction, activate this function.

### 16.2 Cutting tools

![Cutting tools interface](image)

If the machine is equipped with more than one tool, then the postprocessor needs to know how to handle the equipment.

![Number of tools input](image)

Enter the number of cutting tools. Do not include marking and drilling utilities.

### 16.2.1 Automatic tool selection

![Automatic tool selection checkbox](image)

If a job handles different tools, the postprocessor needs to know how to instruct the machine as to which tool is on and off. Old machines may only have manual switches to select tools. If active tools can be changed by the CNC-file then activate this setting.
If you don't have automatic tool selection what will then happen when changing tools?

Then the machine will stop (M00) and the operator must change tool manually.

16.2.2 To handle the distance between the tools

### Fixed or normal distance
This value is used as default distance in the "Tool setup" command and in "Auto nest". Using a fixed distance is important for a machine that does not have the ability to change the tool distance.

### Min tool distance
This value is used by the dynamic tool distance function in "Auto nest". "Auto nest" never uses a smaller distance than this value.

### Max tool distance
This value is also used by the dynamic tool distance function in "Auto nest". "Auto nest" never uses a larger distance than this value.

### Manual movable tool distance
Use this option to stop the machine so the operator can change tool distance manually.

### CNC-movable tool distance
Select this option if the machine can move the tools on the cross beam automatically.

### Moving speed
This is the speed that is used when the tools are moved on the cross beam if the tools can be moved by the CNC. The value can be used by the postprocessor and for the time calculations.

### Closest tool spacing
This settings controls how non-used tools are packed on the cross beam.

If not activated then all tools on the beam will have the same distances.
In this example T2 and T3 are used for cutting and the distance should be 500mm.

### Park non-used tools
Some machine constructions put non-used tools in a parking position. This means that they are not moved on the cross beam if they are not in use. This information is used to make a more correct simulation.
**Calculate tool offsets**

When using Tool 1 then the coordinates will always be calculated to this tool. When using another tool then this setting controls how the coordinates should be given.

Example:
When using tool number 3 only and the distance between each tool is 300mm the position is X1000:
Coordinates to first tool gives the value in the CNC-file: 1000-300-300=X400
Coordinates to first used tools gives the value in the CNC-file: X1000

---

**16.2.3 Tool outside diameter**

This value is used in the "Tip up avoidance" feature in the "Order" command. It has no affect on the final CNC-file or the postprocessor.

---

**16.3 Z-axis control**

IGEMS R10 supports five different methods of controlling the Z-axis. Select all methods supported by the machine. In the "Strategy" command select which method to use depending on the actual material and working strategy.

**16.3.1 Fixed Z-axis**

Check this method if the machine cannot move the Z-axis from instructions in the CNC-file or if the cutting tool is to be in the same Z-axis position all time.
16.3.2 CNC-controlled

The CNC-controlled method has three options:

**Automatic**
This option is used if the tools go up and down with the same codes for cutting on and off. This means that the machine will always move the tool to the upper position defined by the "Max Z-axis movement" between each cut. The different settings in the strategy that control the lifting of the tools are disabled. The reports calculate the time depending on the "Max Z-axis movement", "Z-axis speed" and "Acceleration".

**By M-codes**
Use this if separate M-codes are used to move the cutting equipment up and down. The strategy controls if the tool lifts between different operations or not. The user cannot control how much the tool lifts. The reports calculate the time depending of the "Max Z-axis movement", "Z-axis speed" and "Acceleration".

**By Z-coordinates**
Activate this if the machine supports movement with Z-coordinates. These settings allow the user to have different Z-axis values for different operations in the "Strategy" settings (Drilling, Marking, Pre-piercing and Cutting and movements between parts). The reports calculate the time based on all given information.

**Max Z-axis movement**
This is the limit setting for the Z-axis value. The value should be measured from the table surface up to the most upper position. To not over travel in Z, decrease this value by some millimeters.

The maximum Z-axis movement that is used by the machine is this value minus the material thickness.

**Number of movable Z-axis**
It is possible to add more than one tool on each Z-axis. Picture 730 shows 6 cutting heads, but only two movable axes. If the number of tools and the number of Z-axis is different, there is a manual tool distance movement.

**Z-axis speed**
The Z-axis speed (axis up and down) is used in the CNC-file. It is also used by the simulation and the time calculation.

**Acceleration**
The acceleration for the Z-axis is used to get a more exact time calculation. It does not affect the CNC-file.
16.3.3 By height sensor

Activate this option if the machine has a Height sensor that controls the Z-axis. This option has three choices:

**Automatic**
This option is used if the height sensor is activated and deactivated with the same codes for cutting on and off. This means that the machine will always move the tool to the upper position defined by the "Max Z-axis movement" between each cut. The different settings in the strategy that control the lifting of the tools are disabled. The reports calculate the time depending on the "Max Z-axis movement", "Z-axis speed" and "Acceleration".

**By M-codes**
This code is used if separate M-codes activate and deactivate the height sensor. The strategy controls if the height sensor is turned on and off between different operations. The user cannot control how much the tool lifts. The reports calculate the time depending on the "Max Z-axis movement", "Z-axis speed" and "Acceleration".

**By Z-coordinates**
Activate this if the height sensor can be used together with Z-coordinates. These settings allow the user to have different Z-axis values for different operations in the "Strategy" settings (Drilling, Marking, Pre-piercing and Cutting and movements between parts). The reports calculate the time based on all given information.

**Min Z-axis movement**

Set this value to the distance the Z-axis must move up before the sensor starts to lift up from the material. Depending on the postprocessor this value is also used when the Z-axis is moved down.

16.3.4 Measuring in advance

This feature is mainly developed for 5-axis machines that cannot be equipped with a height sensor and when controlling the height during the cutting is needed.

This option is used on a machine that has no height sensor to use during the cutting.
**By sheet**

This method measures the whole sheet in advance. It only measures points that are close to the cutting geometry and that will be used by the cutting.

**By part**

This method is a combination of measuring and cutting. It measures the geometry and then cuts the geometry; then it measures again and then cuts again, and so on.

**Measure data**

<table>
<thead>
<tr>
<th>Max number of measure points</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance between measure points</td>
<td>100.000 mm</td>
</tr>
</tbody>
</table>

**Max number of measure points**

This value affects the size of the measuring grid when using the "By sheet" option. 200 points means a grid of 10x20 or 12x16 points, depending of the ratio of the sheet.

**Note!** The system only measures the points that are closest to the geometry.

**Distance between measure points**

This value sets up the maximum distance between measuring parts when using the "By part" option.

**Offsets**

IGEMS can adjust distance from the measuring equipment to the cutting position. This is important to get the measurement or correct positions.

<table>
<thead>
<tr>
<th>X-offset from cutting tool</th>
<th>200.000 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-offset from cutting tool</td>
<td>0.000 mm</td>
</tr>
</tbody>
</table>

If these distances are controlled by the controller then set these values to zero.

**16.3.5  Pneumatic stroke**

Some machines are equipped with a "pneumatic stroke" that moves the cutting equipment very fast up and down.

The "pneumatic stroke" can be combined with all other measurement methods above.
16.4 Marking tools

Markings can be used in combinations with cutting. Marking is useful for identifications, bending lines, welding position and much more. The following options are available:

**No marking tools**
IGEMS will skip all marking information in the CNC-file. Use this for toolpath that contain markings but there is no marking equipment.

**Use cutting tool as marking tool**
This is the most common alternative that is used on water jet machines and lasers.

**Use special marking tools**
Use this option if the marking equipment does not use the cutting head as the marking tool. The marking equipment can be powder, inkjet, etc.

**Offsets**

**Offset handled by controller**
Use this option if the offset from the cutting head to the marking unit is handled by the controller.

**Offset controlled by the CNC-file**
Use this option if the CNC-file should write information that handles the distance between the cutting head and the marking unit.

**X-offset from cutting tool**
Enter the value related to how the machine is oriented on the screen.

**Y-offset from cutting tool**
Enter the value related to how the machine is oriented on the screen.
**Z-offset from cutting tool**
Enter the Z-axis difference between the cutting tool and the marking equipment.

### 16.5 Drilling tool

![Drilling tool setup](image)

If the machine has drilling units then activate the checkbox "Has drilling tools".

**Offsets**

**Offset handled by controller**
Use this option if the offset from the cutting head to the drilling unit is handled by the controller.

**Offset controlled by the CNC-file**
Use this option if the CNC-file should write information that handles the distance between the cutting head and the top of the drilling unit.

**Adjustable offsets**
If the drilling tools are adjustable, then it is important that the offsets can be adjusted easily. If this checkbox is activated then the offsets can also be adjusted from the "strategy" window. If not activated, then the offsets can only be changed from the "machine setup".

![Drilling tool offsets](image)

**X-offset from cutting tool**
Enter the value related to how the machine is oriented on the screen.

**Y-offset from cutting tool**
Enter the value related to how the machine is oriented on the screen.

**Z-offset from cutting tool**
Enter the Z-axis difference between the cutting tool and the marking equipment.

**Location**

![Location settings](image)
IGEMS supports drilling tools placed on all heads or one head. The single drilling tool can be located on an optional head.

**Report extra delay**

When calculating the drilling time IGEMS uses the information from different speeds related to the X, Y movement and the actual Z-axis options. The "Drilling delay" is used to fine-tune the estimated cutting time.

### 16.6 Speeds

16.6.1 Rapid

To have a better estimation of the cutting time provide the "Rapid speed" and the "Acceleration and deceleration" parameters.

**Rapid speed**

Set the value of the rapid speed supported by the machine. The values entered here do not affect the final CNC-file and is only used for calculations.

**Acceleration and deceleration**

If X and Y axis have different values, then use the smallest value of the two.

16.6.2 Cutting speed

**Max cutting speed**

Set this value to the maximum cutting speed desired. If the database generates a faster speed then IGEMS reduces the speed to the "Max cutting speed" value.

**Min cutting speed**

If the database generates values that are too low then IGEMS will round up the speeds to this value.

16.6.3 Max speed for 5-axis heads

In IGEMS the primary axis is always called A and the secondary axis called B. The A and B speeds are calculated from the motion and the speeds of X and Y (A and B axis are slaves to the X and Y movements).
Kinematic constructions (when the primary axes are in vertical direction) may sometimes need extremely high rotation speed. By specifying the maximum A and B speed it is possible for IGEMS to calculate a XY speed that never exceeds the maximum speed for A and B.

16.6.4 Speed modes

IGEMS works with 4 different speed modes:

No speed

![Simulation speed](image)

This mode is used when the CNC-controller calculates all speeds. IGEMS internally uses a speed called "Simulation speed". This speed is the same and never changes, no matter if material or cutting quality changes. IGEMS needs this speed to present reports and for making simulations.

? Are there any disadvantages to calculating the speed in the controller?

Yes, you can’t make cost estimations and other reports in advance.

Fixed speed

The "Fix speed" value can be stored on every thickness for every material in the material database. When this mode is selected IGEMS uses this speed. The speed will not change depending on the cutting quality.

Speed interpolation by CNC-file.

To obtain a good cutting result with a fast production then the cutting speed must be optimized for the material, thickness and the geometry. When speed optimizing is used IGEMS takes care of all speed optimizing. This gives a fast production, a very good cutting result and also gives correct cutting times, reports and simulations.

![Speed interpolation by CNC-file](image)

When using "speed optimizing" IGEMS controls all kind of speeds in the CNC-file. To be able to have a smooth acceleration and deceleration linear and circular movements are split up into shorter movement, each movement changes the speed a little step.

![Speed interpolation by machine](image)

To make a smooth acceleration the movements are divided into shorter steps. In the example above it will need 13 lines in the CNC-file to create this movement. More or less all controllers can use this method.

Speed interpolation by machine

Some controllers have a functionality to make it possible to interpolate with the speed.
IGEMS’ technology for feed interpolation is working on Siemens FLIN/FNORM functions but other controllers provide similar functionality. The result will be smoother movements, shorter CNC-files, better cutting results and shorter cutting time.

**Note!** This speed mode is unusable if the machine does not support cutting speed interpolation.

### 16.7 Postprocessor

These settings handle the fundamentals in the postprocessing, such as naming the file and different formats.

#### 16.7.1 Postprocessor selection

The postprocessor is an open text file written in ILISP syntax. The ILISP documentation has detailed information on how to change or develop postprocessors. To make a new postprocessor press the "New" button and enter a name of the new postprocessor.

#### 16.7.2 Output file

The postprocessor creates a file that can be used by the CNC-machine. The settings below describe the rules for how the file can be named:

**Suggest drawing name as output file**

In this case IGEMS will suggest that the output file name will be the same name as the actual drawing. The extension of the file is defined below.

**Suggest a number as output file**

Many users want to have the output files named as a number (100.CNC, 101.CNC, 102.CNC). With this setting the actual number will be increased by one for every new output file created.

**File prefix**

Specify here if there should be any prefix added before the number.
Max name length
Specify longest acceptable file name.
Note! This controls only the name not the extension of the file.

File extension
This is the extension of the output file.
The following table describes the result of different settings:

<table>
<thead>
<tr>
<th>File prefix</th>
<th>Max name length</th>
<th>Number</th>
<th>Extension</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>8</td>
<td>100</td>
<td>.CNC</td>
<td>100.CNC</td>
</tr>
<tr>
<td>P</td>
<td>8</td>
<td>101</td>
<td>.CNC</td>
<td>P0101.CNC</td>
</tr>
<tr>
<td>P0000000000</td>
<td>8</td>
<td>102</td>
<td>.CNC</td>
<td>P0000102.CNC</td>
</tr>
<tr>
<td>P00</td>
<td>10</td>
<td>103</td>
<td></td>
<td>P00103</td>
</tr>
<tr>
<td>O</td>
<td>6</td>
<td>1010</td>
<td>.CNC</td>
<td>010.CNC</td>
</tr>
<tr>
<td>O</td>
<td>6</td>
<td>104</td>
<td>.DNC</td>
<td>O104.DNC</td>
</tr>
</tbody>
</table>

Add information where the CNC-file will be saved in the "Strategy" command.

16.7.3 Format

Decimals for movements
This setting controls how many decimals are used to present the movements in the output file. The value is generated by the (RTS <value>) function in the postprocessor.

Decimals for speed
This setting controls how many decimals are used to present the speed in the output file. The value is generated by the (RTF <value>) function in the postprocessor.

Decimals for angles
If using a 5-axis machine this value controls the number of decimals. The value is generated by the (ATS <radian>) function in the postprocessor.

Decimals for delays
This controls how many decimals are used for delays in the output file. The value is generated by the (RTT <second>) function in the postprocessor.

Supress trailing zeros
If this checkbox is activated then all trailing zeros will be removed.
Example: 10.000 will be 10. and 10.100 will be 10.1.

Supress trailing dots
This feature is only useful if "Supress trailing zeros" is activated.
Example: 10.000 will be 10 and 10.100 will be 10.1.

16.7.4 Line numbers

This option controls the ILISP function (NTXT). The function generates a text with increasing numbers.
Example: N10, N15, N20, N25 and so on. The numbers are used on many controllers. Check the box to control if the line numbers should be used. Set the start value and the increment.
16.7.5 Output units

![Image of output units settings]

By setting this to "Automatic" the output file is in the same units as the drawing. The output can also be set to Metric or Imperial. If this setting is different than the units on the drawing then IGEMS will scale the output dimensions.

16.8 Geometry

![Geometry settings screenshot]

16.8.1 Tool radius compensation

Max tool diameter
This is a very important setting that controls IGEMS geometry optimizing. The value should always be larger than the largest tool diameter used on the machine.

What will happen if this value is smaller?
The machine will stop with a contour error.

Kerf compensation
IGEMS supports three different options:

Calculated in IGEMS

![Kerf compensation diagram]

With this option the toolpath is internally offset by IGEMS. The size of the compensation is the same as the Tool Radius (TR). There are no kerf instructions in the CNC-file (it will use G40 mode or similar). The
coordinates in the CNC-file is the same as the movement of the machine. To change the measurements of the parts run the postprocessor again.

**Calculated in IGEMS and Controller**

![Picture 764]

With this option the toolpath is internally offset by IGEMS. The size of the compensation is the same as the Tool Radius (TR). The postprocessor adds kerf instructions (G41, G42 or similar). The idea behind this is that IGEMS controls the major part of the kerf compensation (TR) and the machine controller adds a smaller kerf (K) just to fine-tune the measurements. This option makes it possible to adjust the size of the part without creating a new CNC-file.

**Calculated in Controller**

![Picture 765]

When using tool radius compensation Right or Left (G41 or G42) the coordinates in the CNC-file describe the size of the part (not the machine movement). The Kerf (K) will be added in the CNC-controller. This option makes it possible to adjust the size of the part without creating a new CNC-file.

**16.8.2 Cutting speed on circular movements**

![Picture 766]

When the kerf is calculated in IGEMS the speed is always calculated from the tool center. When using tool compensation in the machine then the controller has two choices.

In the examples the hole has diameter 1.5 and the jet diameter 1.0.

![Picture 767]

In example A the programmed path speed is on the tool center point (dashed circle). In example B the programmed path speed is set to the work piece contour. This programmed path is three times longer. To have an optimal result it is important for IGEMS to know which method the controller will use.

**16.8.3 Cancel kerf compensation**

![Picture 768]

Some controllers need to make an extra movement to cancel the kerf compensation. If this option is activated, then an extra movement will be added after the kerf compensation has been turned off. The length of the movement is the same as the tool diameter and the speed is the same as maximum cutting speed.

**16.8.4 Corner radius**

![Picture 769]

The following pictures show the center of the tool. When the kerf compensation is calculated in the machine then the machine will always make radius on outside corners:
**No radius (example A)**
Only use this solution when the kerf compensation is calculated in IGEMS.

**Radius on inside corner only (example B)**
If the kerf is calculated in IGEMS then the inside radius size will be half of the difference between "Max tool diameter" and the actual tool diameter. If the kerf is calculated in the controller then the radius will be half of "Max tool diameter".

**Radius on outside corner only (example C)**
If the kerf is calculated in the controller then the machine will always make this arc. If the kerf is controlled in IGEMS then turn this radius on or off.

**Radius on inside and outside (example D)**
See example B and C

Which combination will give the best cutting result?
*Example A: Do not use any radius on inside or outside.*

What is the other alternative used for?
*IGEMS supports many machines and some machines need the other options.*

### 16.8.5 Remove short lines

| Shortest line | 0.001 mm |

Using very short lines in combination with using kerf compensation can sometimes cause geometry problems. Linear movements shorter than this value will be removed from the CNC-file.

### 16.8.6 Divide long objects

| Longest object | 200.000 mm |

This feature splits up long lines or circular movements into shorter steps. It should be easier to restart the machine on a good position if the machine is stopped.

### 16.8.7 Circle movements

<table>
<thead>
<tr>
<th>Circular movements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental circle center</td>
</tr>
<tr>
<td>Absolute circle center</td>
</tr>
<tr>
<td>Shortest chord</td>
</tr>
<tr>
<td>Largest chord</td>
</tr>
<tr>
<td>Smallest radius</td>
</tr>
<tr>
<td>Veneering accuracy</td>
</tr>
<tr>
<td>Largest segment angle</td>
</tr>
</tbody>
</table>

**Circle center**
The postprocessor gives the possibilities to hardcode one of these two options. If the machine supports both of these methods, then select which method to use.
Example 1 describe the “Incremental circle center” and example 2 the “Absolute circle center”. On many controllers the circle center can be described by the radius. This method is also available in the postprocessor.

**Shortest chord**
Almost all CNC controllers are using the same G-code (G02 and G03) to describe an arc and a circle. If the distance from the start point to the end point is close then the machine will make a circle.

If (B) is a short arc then the machine may make an unwanted circle movement (C). The value of the shortest chord must be high enough so no unwanted circles are created. Chords that are too short will be replaced by a linear movement.

**Largest radius**
Enter the size of the largest arc or circle that is supported by the CNC-controller. If the radius is larger, then it will be vectorized.

**Vectorizing accuracy**
The differences between the original arc geometry and the lines will not exceed the vectorizing accuracy.

**Largest segment angle**
This value controls the largest segment angle that will be generated by the postprocessor. The value can be in range 1 to 360 degree. If the segment angle is larger then this value the arc will be divided into parts.

In the example (A) the value is set to 360 degrees and the circle movement is not divided. In example (B) the value is set to 180 degrees and in example (C) the value is set to 120 degrees.
16.9 5-Axis kinematic

Set the choice to "None" if the machine does not a 5-axis cutting head. The arrows describe the positive axis directions.

16.9.1 Supported 5-axis heads

IGEMS has an inbuilt kinematic model for most kinds of 5-axis cutting heads. Other constructions than below can be defined in the postprocessor.

**Vertical-Horizontal**

In this construction the primary rotation is vertical and the secondary horizontal. Set the zero rotation of the vertical axis as the layout and axis direction are defined on the screen.

**Vertical-Tilted**

In this construction the primary rotation is vertical. The secondary angle can be set to 45 or 30. It is possible to define other angles in the postprocessor. Set the zero rotation of the vertical axis as the layout and axis direction are defined on the screen.
In this construction the primary axis is tilted and the second is horizontal. The tilt angle from vertical is 50 degree. Other tilt angles can be defined in the postprocessor. Set the direction of the primary axis as the layout and axis direction are defined on the screen.

**I-HEAD**

In this construction the primary axis is tilted and the second is horizontal. The tilt angle from vertical is 65 degree. Other tilt angles can be defined in the postprocessor. Set the direction of the primary axis as the layout and axis direction are defined on the screen.

In this construction both axes are horizontal. Set the direction of the primary axis as the layout and axis direction are defined on the screen.

**Other settings**

**Full rewind**

When the primary axis has rotation limits it may be necessary to make a rewind when the rotation reaches the limits. There are two options to make 360 degree or 180 degree rewind. Check "Full rewind" for 360 degrees.

? Which is best?

This depends of how much you can rotate. Full rewind gives better re-position of the nozzle and gives best quality and accuracy.
Parking position

This setting is only important if the primary axis is vertical. It controls the angle the primary axis should be when in "parking position" (when it is not in use).

16.9.2 Primary axis

If the construction has rotation limits for the primary axis then activate the checkbox. Set the max and minimum rotations for the axis. The system will automatically generate a rewind if needed. The axis direction should always be given as "Right hand rules" as the layout and axis direction are defined on the screen.

Reverse direction

If the primary axis is defined in the opposite direction in the controller then activate this checkbox.

16.9.3 Secondary axis

Enter the "minimum" and "maximum" angle for the secondary axis. If the axis direction is defined in opposite directions then check the "Reverse secondary axis".

16.10 Cutting equipment

IGEMS is designed for Abrasive waterjet but also supports other kinds of cutting machines. Select what machine type the machine should be set up for.
16.10.1 Abrasive waterjet

**General machine speed factor**
If it seems that all cutting values in the material setting are too low or too high then change them globally by changing the "General machine speed factor".
The example below shows High speed and Low speed for Stainless steel 12mm.

When the "General machine speed factor" is changed to 1.20 the speed will be increased by 20%.

The values below are for the same material and cutting parameters.

? Why can't they all use the same speed factor? *There are many manufacturers of cutting equipment on the market and there is a big difference in qualities.*

16.10.2 Pump and pressure settings

**Pump on/off controlled from CNC-file**
Check this option if the system can turn on or off the pump from the CNC file. It is possible to control whether or not this should done in the "strategy.

**Pressure handled manually**
If the system cannot change the pressure then the machine will stop and the operator can change pressure manually.

**High and Low pressure control**
Many systems have two levels of pressure - High and Low. Check this option if the system can switch between these two by using M-codes.
Variable pressure
Select this option if the system can handle the pressure steeple.

Reduce pressure
Check this option if the system reduces the pressure by a "Bleed out valve".
If the system does not have any equipment to release the pressure then it is possible to reduce the pressure by making an extra piercing. The extra piercing will be done in an already pierced position.

Pump size
This refers to the motor size; the value is not used for the moment.

Max pump pressure
Set the value to the highest supported pressure. It will not be possible to set a higher pressure than this in the "Strategy" or at the "Material" settings.

Min pump pressure
Set the value to the lowest supported pressure. It will not be possible to set a lower value than this in the "Strategy" or at the "Material" settings.

Pressure loss
Estimate the pressure loss between the pump and the nozzle.

Some examples:

<table>
<thead>
<tr>
<th>Bar</th>
<th>Heads</th>
<th>Orifice</th>
<th>Pipe</th>
<th>Length</th>
<th>Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>3800</td>
<td>1</td>
<td>0.25 (10)</td>
<td>1/4</td>
<td>10</td>
<td>6 bar</td>
</tr>
<tr>
<td>4100</td>
<td>2</td>
<td>0.25 (10)</td>
<td>1/4</td>
<td>10</td>
<td>23 bar</td>
</tr>
<tr>
<td>4100</td>
<td>4</td>
<td>0.36 (14)</td>
<td>1/4</td>
<td>30</td>
<td>825 bar</td>
</tr>
</tbody>
</table>

16.10.3 Abrasive settings

Abrasive handled manually
Check this option if the system cannot change the amount of abrasive from instructions in the CNC-file. To change amount of abrasive the machine will stop and the operator can manually adjust the abrasive.

High and low abrasive amount
Check this option if the system can switch between two different amounts of abrasive.

Variable abrasive control
Check this option if the system can handle the amount of abrasive steeple.

Water and Abrasive controlled by different codes.
Check this option if using separate M-codes for water and abrasive.

Min and Max abrasive
Enter the "minimum" and "maximum" amount of abrasive that can be used on the system.

Orifices, mixing tubes and abrasive qualities
To avoid selecting unsupported equipment, check the available items in the list below.
Marking delays
This information is needed if the cutting tool is used as a marking tool.

<table>
<thead>
<tr>
<th>Marking</th>
<th>1.1 s</th>
<th>1.1 s</th>
<th>1.1 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before abrasive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before moving</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The first two values are needed only if abrasive is used for marking. "Before moving" is a delay time between Jet On and the first move.

Pre-piercing delays

<table>
<thead>
<tr>
<th>Pre-piercing</th>
<th>0.5 s</th>
<th>0.5 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before abrasive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before moving</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These values handle the delay between water and abrasive On/Off.

Cutting delays

<table>
<thead>
<tr>
<th>Cutting</th>
<th>0.0 s</th>
<th>0.0 s</th>
<th>0.0 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before abrasive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before moving</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These values handle the delay between water and abrasive On/Off. "Before moving" is the same as "minimum piercing time".

Why are there separate delays for pre-piercing and cutting?
Pre-piercing often uses other pressure and abrasive settings. For this reason it is common to use different values.

Various

<table>
<thead>
<tr>
<th>Various</th>
<th>1.0 s</th>
<th>9.0 s</th>
<th>10.0 s</th>
<th>1.2 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure up</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure down</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After cutting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Report extra
This is extra time added to the cutting time for every marking, pre-piercing and cutting. This gives the possibility to fine-tune the estimated cutting time.

Pressure up
This is the delay time used if the pressure is increasing.

Pressure down
This is the delay time used when the pressure is decreasing.

After cutting
This is the delay time between Jet off and the rapid movement.
16.10.4 Pure waterjet

This machine type does not have as many settings.

**Max pump pressure**
Set the value to the highest possible on the machine.

**Pump on/off controlled from CNC-file**
Check this option if the system can turn the pump on/off from the CNC file. Control if this is done or not in the "Strategy".

**After piercing and cutting**

"After piercing" is the same as "minimum piercing time". "After cutting" is the delay time between Jet off and the rapid movement.
17 Organizer

"Organizer" is a separate module in IGEMS used to store part files and relevant information tied to the parts. Information about the parts is stored in an embedded SQL database. The parts themselves are stored in the Parts directory in the Shared folder. (See 3.6).

17.1 Register

The "Register" command adds information to the database and saves the part as a separate DIG file.

Start the command and select the parts above and the following dialog box is shown:

Press the "Register" button if the information is correct.

Registered parts are then displayed in blue color.

? Can a part be registered with an attached toolpath?
Yes, but you will probably have a better nesting result if you have no toolpath attached.

17.1.1 Part information

Edit the part information by double clicking on a registered part.
Except for the field "Produced" the information is identical for non-registered and registered parts. The "produced" value will be a count up if a Cut order is included with the registration.

**Extended part properties**

Add extra information to the parts.

---

**Note!** This is free text information that can be used by the reports or by the postprocessors.

**Files**

It is possible to add links to files located on the computer or on the network. Double click on the file and the file type is associated to a program. Then start programs from here.

**Release for production**

It may be efficient to register a created part for estimation of prices. If a confirmation is needed before cutting starts, uncheck this box. Check the box when the part is ready for production.
User variables

The "User variables" can be defined in the "Advance" options in the "Organizer" dialog box. The "user variables" contains 5 different variable types: Lists, real's, integers, strings and dates.

17.2 Organizer

Use the "Organizer" command to view and insert all stored parts into the drawing.

This dialog box handles all the features in "Organizer".

17.2.1 Predefined profiles

Filters are used to quickly sort out part information with certain criteria such as material, thickness or production dates. The profile contains rules for which parts should be shown, which columns should be visible and the sorting order. Profiles that start and end with an "*" are predefined and cannot be changed.

The following two profiles are predefined:

*Show all*
This profile shows all parts in the database.

*Insert*
This profile shows all parts with the same material activated in IGEMS to be produced.

17.2.2 User defined profiles

Click on the "plus" button to create a new filter profile.
Enter the name of the new filter profile.

**Filters**

Use the filter dialog box to define rules for what parts should be visible on the screen.

**Visible columns**

Use the checkboxes to control which columns are visible.

**Column position**

Hold down and move the mouse pointer at a column to modify the order of the different columns.

**Sorting**

Sort the list by clicking on a column. Click on the same column several times to switch between increasing or decreasing order. Hold down the CTRL key while clicking on another column to define sub-sorting orders. If some values in column (A) are the same then these will be sorted by column (B) and so on.
Save

Press the "Save" button when the new profile is defined.

### 17.2.3 Insert parts to the drawing

Check the parts to insert and then press the "Insert" button.

IGEMS will prompt to select the insertion point for each part.

### 17.2.4 User variables

Press the "Settings" button to create "user variables" that can be located in the parts.

These settings are currently not described in this manual. Please contact IGEMS for information about user variables.

### 17.2.5 Various

Clicking on the "Properties" button is the same as double clicking on a part in the list. This will show information about the part.
Delete
Parts can be deleted from the database when checked in the list. However it is recommended to never delete parts from the database.

Report
The "Report" button creates a report with all checked parts.

New database
"Organizer" is pre-installed with a sample database. To start with a new empty database, delete the complete "Organizer" directory. A new empty database will then automatically be created when starting IGEMS. The "Organizer" directory is located in the Shared folder. See Section 3.6 for more information.

Backup
It is recommended to backup a copy of the "Organizer" database on a regular base. Copy the entire "Shared" folder and store it in a safe place. See Section 3.6 for more information.

17.2.6 Update material and machine

This function changes the selected parts to the material and machine that are activated in IGEMS. The function is useful the name of a material is changed in IGEMS or if updating from an older "Organizer".

17.3 Automatic count down

Include a cut order (see Section 14.2) while selecting the parts to have the "Organizer" make an automatic countdown of remain parts to produce value.

This example shows a mix of parts. Some are already defined in "Organizer" while others are not. When this information is registered the following dialog box is shown:

This will make a mix of new parts that will be registered and it will count up the produced value on these parts.
18 Nest commands

The "Nest" commands are used to automatically or semi-automatically place parts on a sheet of material and minimize the material waste.

18.1 Quick nest

Shortcut "Q"
This command positions individual parts/geometry with a pre-defined distance in relation to other parts/geometries. "Quick nest" works with parts or closed geometries.

Start the command and select the part that should be moved (A).

Move the part that it overlapping part (B).

Part (A) automatically moves out from part (B) to a correct distance. Click on the right mouse button for a list of different available options.

Most of these options are self describing.

K: Reset
When a part is rotated, this command rotates the part to its original angle.

**M: Toggle move/copy**
The normal mode is copy. Use this command to switch between these two modes.

**A: Align**
This automatically aligns the part to an edge.

![Image](image1)

Hold the edges of part (A) on the edges of part (B) at the point (C).

![Image](image2)

Press the shortcut A and the two parts will be aligned.

**D: Toggle part distance**
The material settings define a part distance (0) and there can be a custom distance. The D-key will toggle between these two distances.

**C: Custom distance**
Use this option to define the custom distance.

## 18.2 Single nest

![Image](image3)

The "Single nest" nests one type of geometry on a rectangular area described by two points. It is possible to nest parts and closed geometries. There is no counter; the command will nest as many as possible.

Make a part from a circle. Start the command and select the part.

![Image](image4)

Set the wanted distance and rotation steps (not important for a circle). Press "OK" and define two corner points of the nesting area.

![Image](image5)

This could be the result when nesting disks.
Press ESC when nesting irregular geometries to interrupt the nesting function.

Information about the number of parts and the utilization inside the nesting area is in the lower left corner.

18.3 Rectangle nest

"Rectangle nest" is especially designed to work well when nesting rectangular parts. Select several parts at the same time. The command has a counter to avoid too many parts being nested.

This example uses these four parts. The quantity is set to 10 on all parts. Start the command and select the parts.

With the "Auto nest" module select one or several sheets. Otherwise only a rectangular nesting area by two points can be defined.

The lower left corner of the screen will show how many parts were nested and a utilization percentage based on the enclosed rectangular area used. Press ESC to interrupt the nesting.
"Auto nest" is a true shape nest module that automatically nests multiple parts to a sheet. "Auto nest" also supports nesting with multiple heads in different combinations. It can nest parts in holes of other parts.

Start the command and select the parts that to nest.

The following parameters can be changed individually on each part. Select one or several parts in the list (by 
CTRL or SHIFT key)

"Remaining": This shows the number of parts that still remains to nest out of the requested quantity.
"Rotation": IGEs sets the rotation to Automatic as a default rotation. Change the rotation from the drop down menu.

18.4.2 General settings
The following settings are common for all parts and sheet used in the nesting:

Part distance
This command always suggests the part distance specified by the material.

Number of tools

Select the number of tools to use for this nest. To use a variable number of tools set the maximum number of tools to use. If the "variable" number of tools will be used then some parts may be cut with 4 tools, other with 3, 2 or 1 tool. The algorithm always tries to use as many tools as possible.

Tool distance

"Value": The same distance will be used the whole time and the distance can be set manually. 
"Dynamic": A variable distance between the minimum and maximum limitation described in the machine setting.
"Equal": The sheet is divided into the number of tools and the distance is the result.

Start corner

Various
"Grid accuracy": Auto nest internally creates a square grid on the area used for nesting. A high value means that the nesting takes longer time but part distances may be more accurate. A low value gives a quick nesting but part distances may not be as accurate.

18.4.3 Execute nest
Press the "Nesting" button and select the sheets the parts are placed on. If some sheets already have some parts on, then these must be selected as well.

The nesting result is updated in real time. When the optimal result is reached press the "Stop" button.
Picture 857 shows a possible nesting result.

**18.5 Nest Report**

The "Nest report" is one of several reports generated from IGEMS. Start the command and select the sheet and the parts to generate a report.
This section can be used to develop special applications and commands for IGEMS by using the programming language ILISP as developer tools. The information on how to write applications will only be available in English and is not covered in this documentation. Only information on how to load applications is provided:

### 19.1 Load app

Start this command and the following dialog box is shown:

![Image](Image)

Press the "Add" button and select the LSP file to add. A small sample is in the APP folder in IGEMS program directory. Select `...\IGEMS_R10\APP\ANIMALDEMO\ANIMALDEMO.LSP`

Give the application a name.

The applications can be grouped together on the menu.
Press the "Image" button and select an image in the same folder as the LSP file. Click "OK to load the first application.

This is just an example on how to load apps.

If interested in how to make applications, download ILISP programming handbook from [www.igems.se](http://www.igems.se)
20 Final words

This manual describes the software at the time of publishing. Our goal with the software is to have a high development pace. If you have an older version of the software there may be parts that do not coincide with this manual.