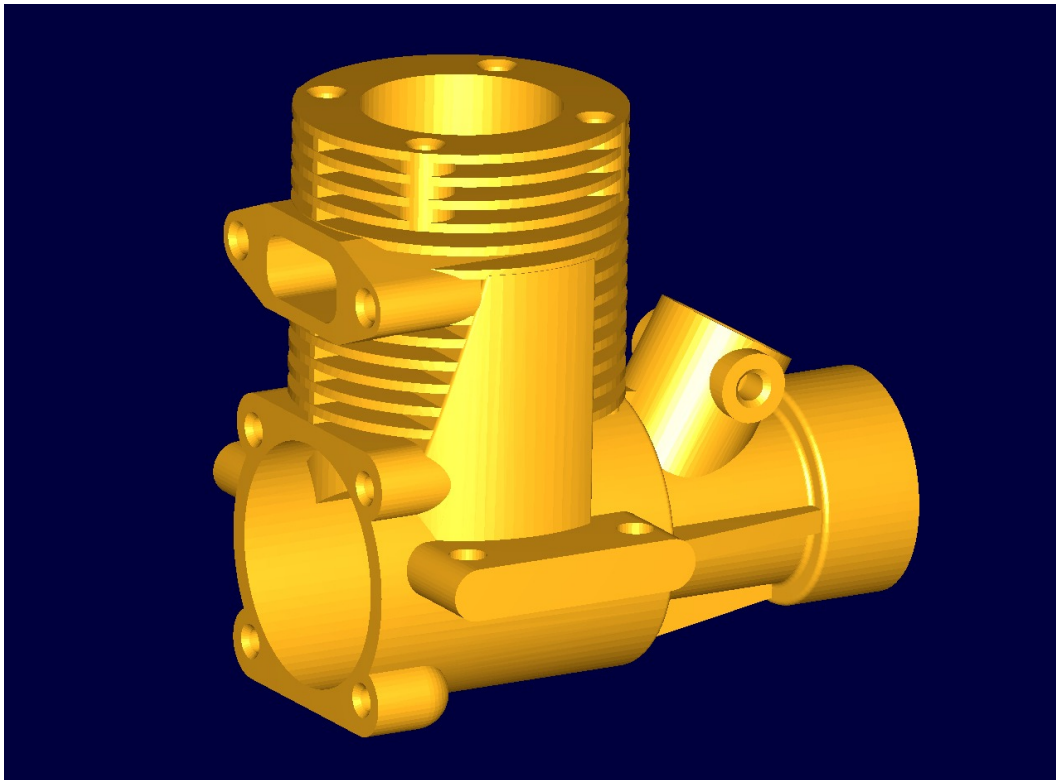


# *EasyViewStl*

**Version 0.7.5.0**

Installation and User Manual



October 2021 Edition

<https://www.gcad3d.org/EasyViewStl.htm>

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## 3. System Requirements, Installation, and Operating Instructions

For operation of the software, the following system requirements, recommendations and hints are valid:

- A conventional PC with x64 architecture, at least 6 GB RAM, 3 GHz CPU recommended, keyboard and mouse.
- Graphics adapter with at least 1 GB DDR RAM and device driver support for OpenGL® Version 2.0.
- A Monitor with at least 1024x768 pixels resolution

- Microsoft Windows® 7 x64, or Windows® 8 x64, or Windows® 10 x64. Any Windows® 32-Bit System is unsuitable.
- The performance of *EasyViewStl* heavily depends on the capability of the hardware used and on the number of triangles of the model. A STL file may contain up to 10,000,000 triangles.
- The software does not need any installation. Just unpack the distribution file to an appropriate folder. About 6 MB of storage space are needed.
- The file type STL will not be registered by *EasyViewStl*, because Microsoft Windows® uses this file type for another purpose.
- To read this User Manual, software for viewing files in PDF format has to be installed.
- All permanent settings of *EasyViewStl* are stored and updated in the configuration file *EasyViewStl075.cfg*, which is created automatically when the program is started at the very first time. This file can be found at the local, **user specific “AppData” folder on your system disk**. Delete this file to reset all custom settings.

## 4. Overview

*EasyViewSTL* is an easy to use tool for viewing files in 3D STL format, designed with performance in mind, and available completely free of charge. No installation is required; just unpack the small sized distribution file.

The Software offers support for viewing, analysis, and preparation of geometrical data stored in files in STL format. Both the BINARY and the ASCII version of this format can be read and written. Up to 10,000,000 triangles can be processed.

Additionally, some other 3D geometry file formats can be converted to BINARY STL format.

There are many options to display the STL geometry, and to print or store the model image:

- 3D Standard Views, functions for dynamic change of the current view at any time in any direction: Zoom (-In), Rotate (with selectable center point or axis), Pan, Center, Line of Sight. Adjustable speed for Zooming and Rotating
- Simple handling of view changes by mouse and/or keyboard. Direct switching between orthogonal and perspective view
- Setting of pixel dimensions of the viewport for snapshots and printing
- Different model presentations: shaded, wireframe, wireframe-overlay
- Selection of color / material / transparency to be used for display of geometry
- Selection of background color, line width and point size
- Dimming / lightening of back faces of triangles
- Different presentations of the axis system
- Show / No-Show of meshes, back faces of triangles, axis system
- Printing with Print Preview, image centering, blank out of background, scaled and full-page printing with all paper sizes of the installed printers
- Copying of view image to the dashboard or to a BMP (DIB) file

Features to analyze the geometrical quality of the STL data:

- Automatic analysis of the topological situation when reading the STL file

- Model statistics: dimensions, number meshes, number triangles and points, number degenerated or isolated triangles, number boundary segments, number missing or wrong oriented normal vectors
- Display of boundary segments for detection of ‘holes’ and ‘gaps’, with/without limiting points of segments, optional transparent display of triangles
- Show / No-Show of normal vectors of triangles
- Show / No-Show of 3D grid with 3D TTF labeling, dynamically adjusting to view changes
- Splitting of geometry along sliding sectional planes. Optional presentation of one half in transparent mode. Sliding of sectional plane by keyboard, tool buttons, or slider.

Features to prepare the geometrical data and to improve data quality:

- Renewed analysis of geometry using different identical point tolerance values
- Renewed check / computation of normal vectors of triangles
- Inversion of normal vectors
- Elimination of degenerated triangles, option to eliminate duplicate triangles
- Automatic rectification of normal vectors within meshes
- Automatic supplement of missing normal vectors
- 3D transformations of geometrical model: moving, positioning, rotating, scaling, mirroring, change of dimensions.

Other features:

- Conversion of other 3D file formats to STL- BINARY format: IV, OBJ, OFF, PLY and VRML 97 / WRL.

## 5. Display of Geometry

*EasyViewStl* displays the geometric model in the graphical viewport of the main window. There are a number of standard model views, like “Top”, “Front”, “Left”, and “ISO”. When a STL file is opened, always the „Top” view is activated, and the whole model is shown (automatic Zoom-In).

The graphical representation corresponds to the last settings made by the user, which are permanently kept.

At any time the current view can be dynamically changed by use of mouse and/or keyboard. The 4 main methods are:

- **Move mouse with left button pressed down:** the view is 2D translated (panned), following the movement of the mouse
- **Move mouse with right button pressed down:** the view is 3D rotated around the center point or axis, following the movement of the mouse.
- **Rotate mouse wheel or click “Page Up” / “Page Down” key:** Zoom +/-
- **Left mouse button double-click or hit the “Insert” key:** Zoom-In (fit entire model into viewport)

For a complete list of methods to dynamically change the view, see chapter”**Help**“.

## 6. Operation and Help

All functions of *EasyViewStl* can be activated by Main Menu and/or Toolbars. Hotkeys are available for many functions. Tooltips are shown for every function.

Use the “**Help**” menu to

- Show this user manual
- Show copyright and contact information
- Display a dialog window, which contains a complete list of hotkeys
- Display a dialog window with a list of all methods for dynamic manipulation of 3D views

It is possible to keep these dialog windows open during operation of the software.

Hint: Use the F5-key to permanently hide / show the blinking copyright text in the lower left corner of the viewport.

## 7. Definitions

- As defined in the STL file format, a **facet** is another notation for a 3D **triangle**, formed by 3 **boundary segments**, which connect 3 corner points. Each facet has a front and back face, and a dedicated **normal vector**. If the direction of the normal vector points to the eye of the observer, the **front face** of the facet is visible.

*EasyViewStl* offers the option to display front and back faces with different brightness, to ease distinction. Usually the angle between the facet and the dedicated normal vector has a value of 90 degrees.

If the deviation from 90 degrees is big, abnormal effects in color shading of the geometric model can be observed. *EasyViewStl* can recompute the normal vectors to solve this problem.

- A **mesh** is a cluster of more than one **connected facets**. Each triangle of the mesh has at least one neighboring triangle with identical boundary segment. No more than 1 triangle may connect to each boundary segment of a triangle of a mesh.
- If a triangle owns a boundary segment without any connected neighbor, this segment is named a **free boundary segment**.
- A facet without connected neighbors is denominated an **isolated triangle**.
- A facet with 2 identical corner points is called **degenerated**. Such triangles are removed automatically by *EasyViewStl*. Triangles with collinear, but different corner points are treated as normal facets, as they are sometimes used to connect different meshes to one mesh by mesh generator software.
- If the corner points of a triangle are identical to those of another triangle, the triangle is named a **duplicate**. If desired, *EasyViewStl* removes duplicates from the model at any time.

## 8. The Main Menu

The Main Menu consists in a set of menu items with related submenus. The function of all menu and submenu items will be explained in sequence.

If a function can be started alternately by an icon of a toolbar, or by a hotkey, this will be specified after its caption. Related dialog windows are illustrated.

### 8.1 Menu File

#### 8.1.1 New / Empty Model (Strg+N)



Opens a new, empty, unnamed model. This can be used as an intermediate step to discard all changes of the current open file and open the model file again.

#### 8.1.2 Open (Strg+O)



Opens a STL file, reads and analyzes the geometrical data, and displays the facets in “Top” view.

If the *Show Statistics* option is set in *Basic Setup*, a window is shown containing the result of analysis (*Model Statistics*). See *Model / Model Statistics* for details.

Degenerated triangles are automatically removed from the model.

#### 8.1.3 Save (Strg+S)



Saves the geometrical data of the model to an STL file. Filename and folder are suggested according to the preferences made in *File / Basic Setup*.

#### 8.1.4 Save ASCII



Basically same function as *File / Save*, but the data are strictly written in ASCII format. Each subsequent *Save* will write the data in ASCII format.

#### 8.1.5 Save BINARY



Same function as *File / Save ASCII*, but the format is BINARY

#### 8.1.6 Save as BMP

The current view of the model is saved as BMP (DIB) picture file.

#### 8.1.7 Print (Strg+P)



The current view of the model is printed according the settings in *File / Print Layout* and *File / Printer Setup*.

#### 8.1.8 Printer Setup

Setup the printer to be used.

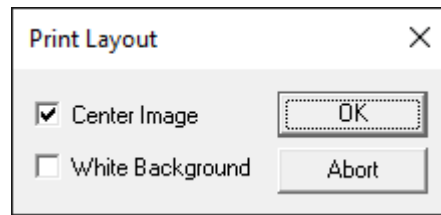
#### 8.1.9 Print Preview

Shows the preview of the print and offers start of printing.



### 8.1.10 Print Layout

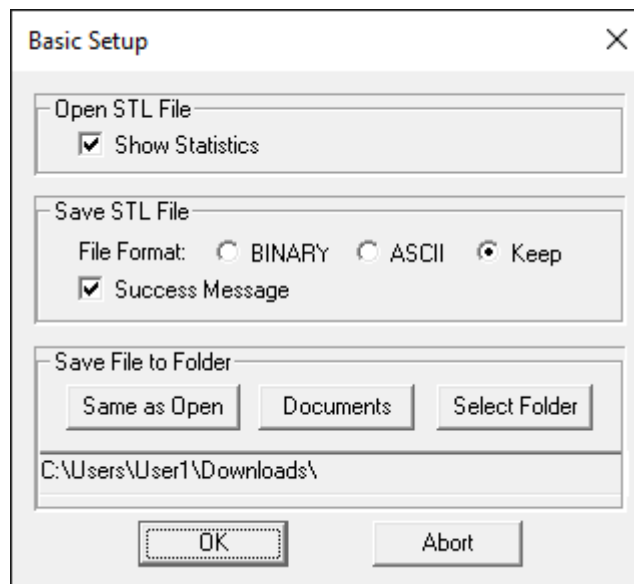
A dialog window is shown where some options can be set to influence the appearance of the print.



- Check **Center Image** to print the image in the middle of the paper.
- Check **White Background** to omit the background color

### 8.1.11 Basic Setup

A dialog window pops up, defining the behavior of *EasyViewStl* when reading and writing STL files. These settings are permanently used until the next change.



- If **Show Statistics** is checked, the Model Statistics are presented after the file was read and analyzed.
- Section **Save STL File** determines the standard **File Format** to be used for writing: **BINARY**, **ASCII**, or **Keep** (same as disk file). This setting is ignored when menu *File / Save ASCII* or *File / Save BINARY* is used. A **Success Message** is shown after writing STL files, if the checkbox is checked.
- Section **Save File to Folder** defines the folder to be used for writing STL files: **Same as Open**, **Documents**, or **Select Folder** (if another folder is desired). The path for the folder currently set for writing is shown.

## 8.2 Menu Edit

### 8.2.1 Screenshot (*Strg+C*)



An image of the model shown in the viewport is copied to the dashboard.

## 8.3 Menu View

### 8.3.1 Standard View

A submenu pops up, where one of the standard model views can be activated:

- ISO (Ctrl+Shift+I)
- Top (Ctrl +Shift+T or Ctrl +Numpad 8)
- Bottom (Ctrl +Shift+O or Ctrl +Numpad 2)
- Left (Ctrl +Shift+L or Ctrl +Numpad 4)
- Right (Ctrl +Shift+R or Ctrl +Numpad 6)
- Front (Ctrl +Shift+F or Ctrl +Numpad 5)
- Back (Ctrl +Shift+B or Ctrl +Numpad 0)

### 8.3.2 Perspective (*Alt+P*)



Toggles between Orthogonal and Perspective View.

### 8.3.3 Back-Face Culling (*Alt+F*)



Toggles Back-Face Culling (display / hide back-faces of facets)

### 8.3.4 Wireframe (*Alt+W*)



Toggles between shaded and Wireframe representation of the model

### 8.3.5 Wireframe Overlay (*Alt+Y*)



Toggles between shaded and shaded + Wireframe representation of the model

### 8.3.6 Axis System (*Alt+A*)

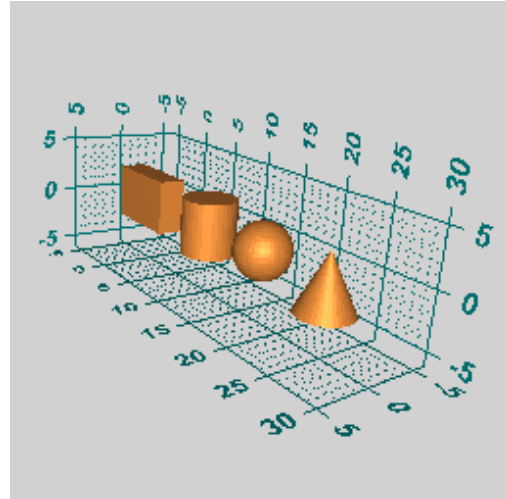
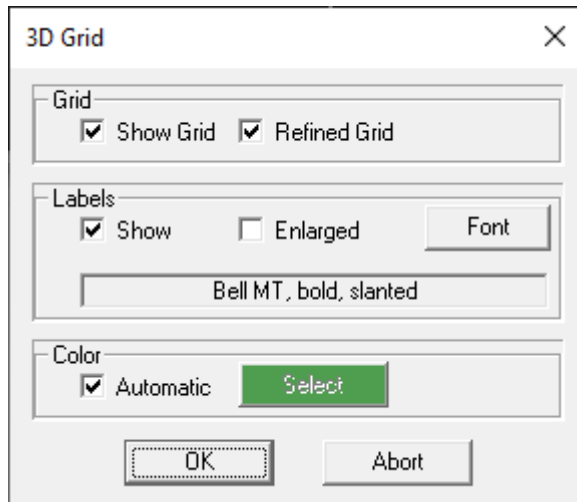


Controls Show / No-Show of the Axis System

### 8.3.7 3D Grid



This function enables the display of a 3D grid near the geometry, automatically adjusting to the model dimensions and to dynamical modifications of the model view. The grid never obscures the model.



- Switch **Show Grid** in section **Grid** controls the display of the grid. Check **Refined Grid** to raise the level of detail.
- Section **Labels** determines if grid labeling has to be **Shown**, if **Enlarged** presentation of numbers is wanted, and which **Font** has to be used. The font and its attributes currently set are indicated.
- Section **Color** offers 2 methods to define the color of the grid. If checked, **Automatic** derives the color value from background and model color. Otherwise click **Select** to use the system color dialog for color selection.

### 8.3.8 Toolbar ,Standard‘

Toggles the display of the ‘Standard’ toolbar.



### 8.3.9 Toolbar ,Show / No-Show‘

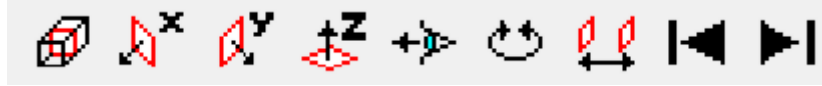
Toggles the display of the ,Show / No-Show‘ toolbar.



### 8.3.10 Toolbar ,Cross-Section‘



Toggles the display of the ,Cross-Section‘ toolbar.

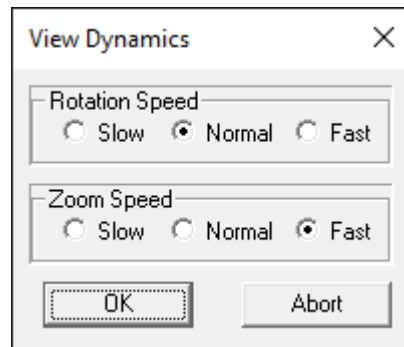


### 8.3.11 Status Bar

Toggles display of the status bar at the lower border of the main window.

### 8.3.12 View Dynamics

This menu item activates a dialog window to adjust the speed used for dynamic change of views: **Slow**, **Normal**, and **Fast** are available for **Rotation** and **Zoom** (see also *Help / Dynamic Views*).



### 8.3.13 Viewport Dimensions

If selected, a submenu pops up allowing selection of pixel dimensions for the model viewport. Thus a series of screenshots or printouts may be created with exactly the same dimensions:

1024 x 768, 800 x 600, 640 x 480, 256 x 256, 128 x 128

A special function in this submenu is **Full-Page Printing**. Use this to set the pixel dimensions to achieve full-page printing with maximum graphical quality. The computation of the pixel dimensions for this purpose is performed in following steps:

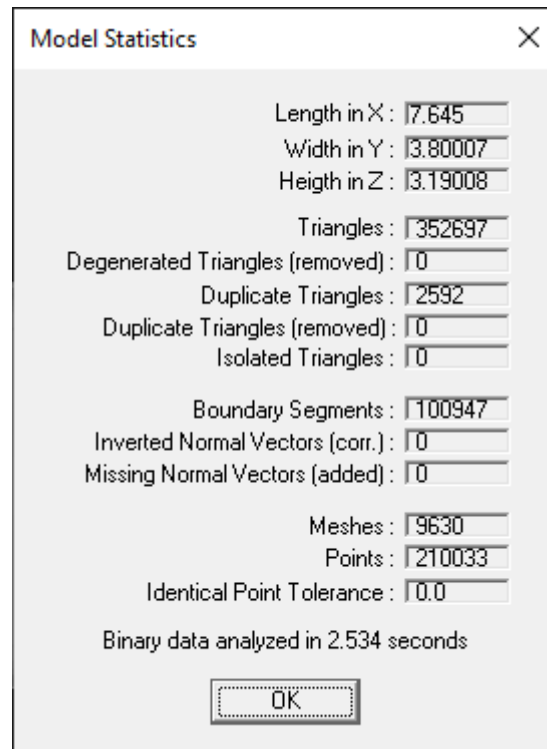
1. Read the dimensions of the printable area of the current paper size of the active printer from the *Printer Setup*
2. Compute ratio *longer side / shorter side*
3. Compute pixel dimensions for the model viewport with identical ratio *horizontal / vertical*, and maximized Main Window

If the Paper Orientation (Portrait or Landscape) set by the Printer Setup does not correlate to the needs for printing, a message is shown, and the Paper Orientation has to be set accordingly. The correctness of the settings can be verified by function *Print Preview*.

## 8.4 Menu Model

### 8.4.1 Model Statistics (Alt+S)

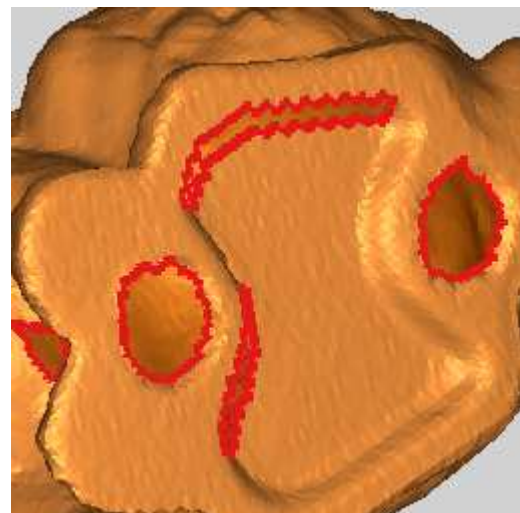
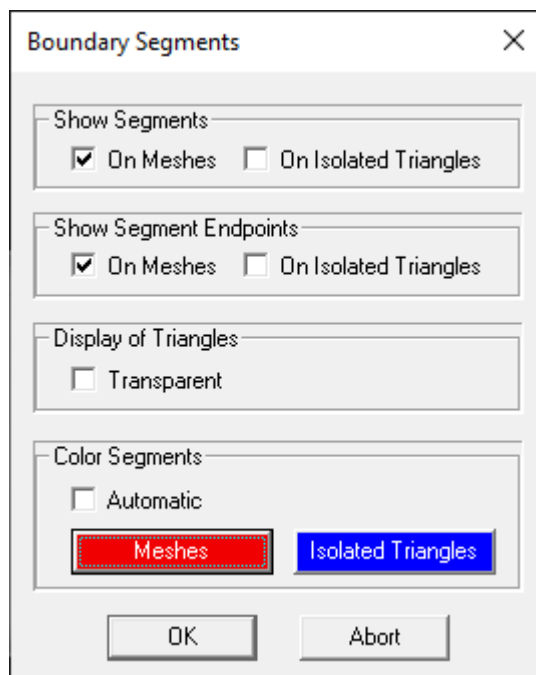
A dialog window pops up presenting the compiled statistics of the geometric model. Any changes made on the original model (e.g. transformations) are observed



### 8.4.2 Boundary Segments (Alt+B)



Use this function, to highlight all Free Boundary Segments of the model.

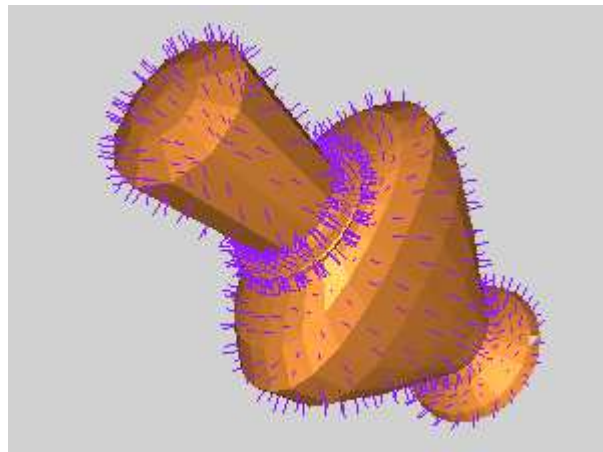
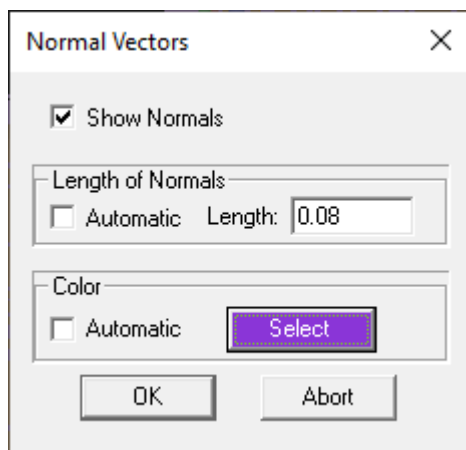


- Section **Show Segments** offers two check-boxes to enable highlighting of Free Boundary Segments **On Meshes** and/or **On Isolated Triangles**. Uncheck both to suppress highlighting.
- Section **Show Segment Endpoints** additionally enables marking of the endpoints of each Free Boundary Segment.
- Section **Display of Triangles** contains the check-box **Transparent**. If checked, all the triangles are shown in transparent mode, simplifying visual localization of the segments.
- Section **Color Segments** offers 2 methods to define the colors. If checked, **Automatic** derives the color values from background and model color. Otherwise click **Meshes** or **Isolated Triangles** to use the system color dialog for color selection.

#### 8.4.3 Display Normal Vectors (Alt+N)



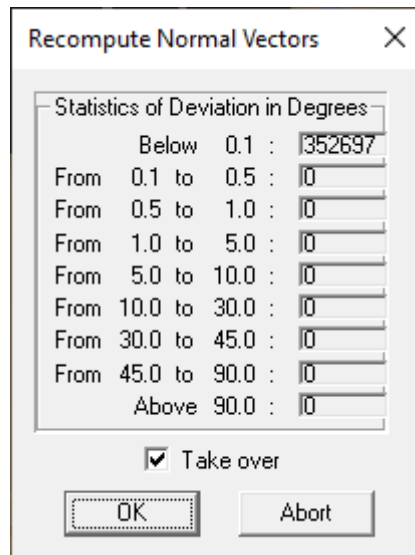
Use this function to display the oriented normal vectors of all triangles.



- Use check-box **Show Normals** to toggle display of normal vectors.
- The **Length of Normals** can be computed in **Automatic** mode, or **entered**.
- Section **Color** offers 2 methods to define the color of the normals. If checked, **Automatic** derives the color value from background and model color. Otherwise click **Select** to use the system color dialog for color selection.

#### 8.4.4 Recompute Normal Vectors

In a first step, this function will recompute the normal vectors of each triangle, measures the angular deviation values between original and recomputed normal vectors, and list the result.



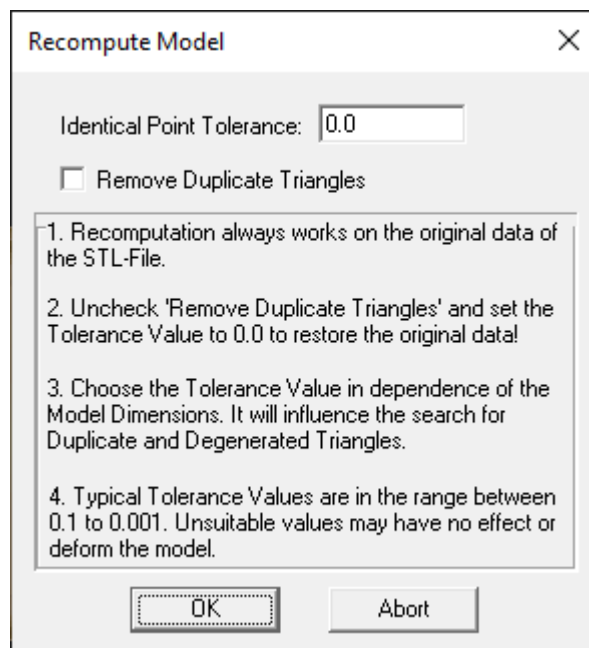
Set a checkmark on **Take Over** and click **OK** to replace the original vectors by the computed ones.

#### 8.4.5 Invert Normal Vectors

Use this function to invert the orientation of the normal vectors of the triangles. A warning message pops up giving a hint about the consequences on the model. Click OK to invert the orientation of the normal vectors.

#### 8.4.6 Recompute Model

To eliminate small deviations in coordinate values of the corner points of adjacent triangles, the whole model is newly analyzed and changed according the **Identical Point Tolerance**.

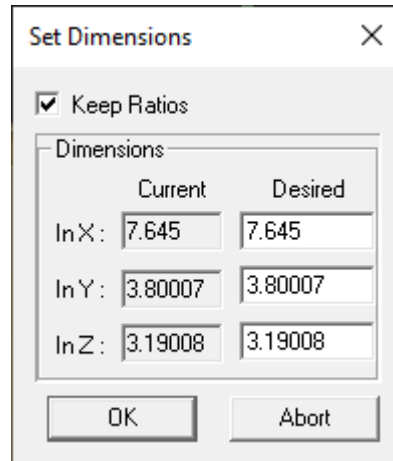


Enter the value for **Identical Point Tolerance** and set a checkmark on **Remove Duplicate Triangles**, if desired. Click **OK** to perform a new computation of the model. **Degenerated triangles are removed automatically.**

## 8.5 Menu Transform

### 8.5.1 Dimensions

This function is used to change the model dimensions measured in X-, Y-, and Z-direction.



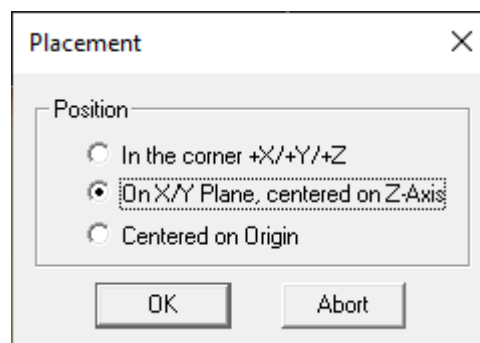
The 'Set Dimensions' dialog box has a title bar with a close button (X). It contains a checked checkbox labeled 'Keep Ratios'. Below this is a section titled 'Dimensions' containing a table with two columns: 'Current' and 'Desired'. The rows are for 'In X:', 'In Y:', and 'In Z:'. The 'Current' values are 7.645, 3.80007, and 3.19008 respectively. The 'Desired' values are also 7.645, 3.80007, and 3.19008. At the bottom are 'OK' and 'Abort' buttons.

	Current	Desired
In X :	7.645	7.645
In Y :	3.80007	3.80007
In Z :	3.19008	3.19008

Put a checkmark on **Keep Aspect Ratio**, if model proportions shall be kept.

### 8.5.2 Placement

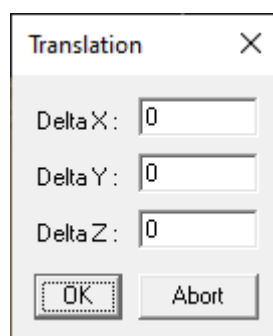
There are 3 options to define the **Position** of the model in relation to the axis system. Select the desired place and click the **OK** button.



The 'Placement' dialog box has a title bar with a close button (X). It contains a section titled 'Position' with three radio button options: 'In the corner +X/+Y/+Z', 'On X/Y Plane, centered on Z-Axis' (which is selected), and 'Centered on Origin'. At the bottom are 'OK' and 'Abort' buttons.

### 8.5.3 Translation

Enter the delta values in X-, Y-, and Z direction to be used for translating the model and click the **OK** button.

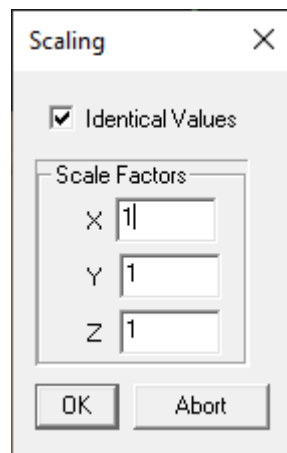


The 'Translation' dialog box has a title bar with a close button (X). It contains three input fields labeled 'Delta X:', 'Delta Y:', and 'Delta Z:', each with the value '0'. At the bottom are 'OK' and 'Abort' buttons.



#### 8.5.4 Scaling

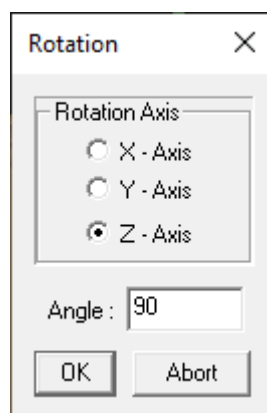
This function is used to change the model dimensions measured in X-, Y-, and Z direction by scaling.



Put a checkmark on **Identical Values**, to use the same scaling value in each direction. Enter the **Scale Factors** and click the **OK** button.

#### 8.5.5 Rotation

This dialog window enables a rotation around a system axis using an angle measured in degrees. Select the appropriate **Rotation Axis**, enter the rotation **Angle**, and click the **OK** button.



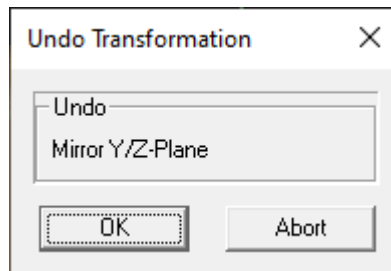
#### 8.5.6 Mirror Plane

The model can be mirrored on the X/Y-, X/Z-, or Y/Z plane of the axis system. Select the **Mirror Plane** to be used and click the **OK** button.



### 8.5.7 Undo

To undo transformations applied to the model one by one, click the **OK** button.



## 8.6 Menu Graphics

### 8.6.1 Background Color

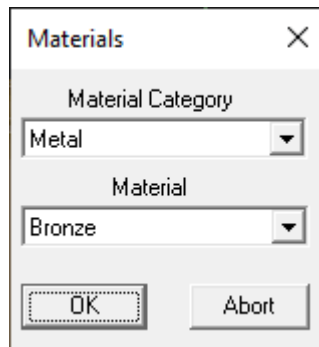
The Window standard dialog is shown for selection of the background color of the viewport.

### 8.6.2 Color of Objects

The Window standard dialog is shown for selection of the color of all facets of the model.  
Hint: an alternative method for coloring is to pick a material.

### 8.6.3 Material

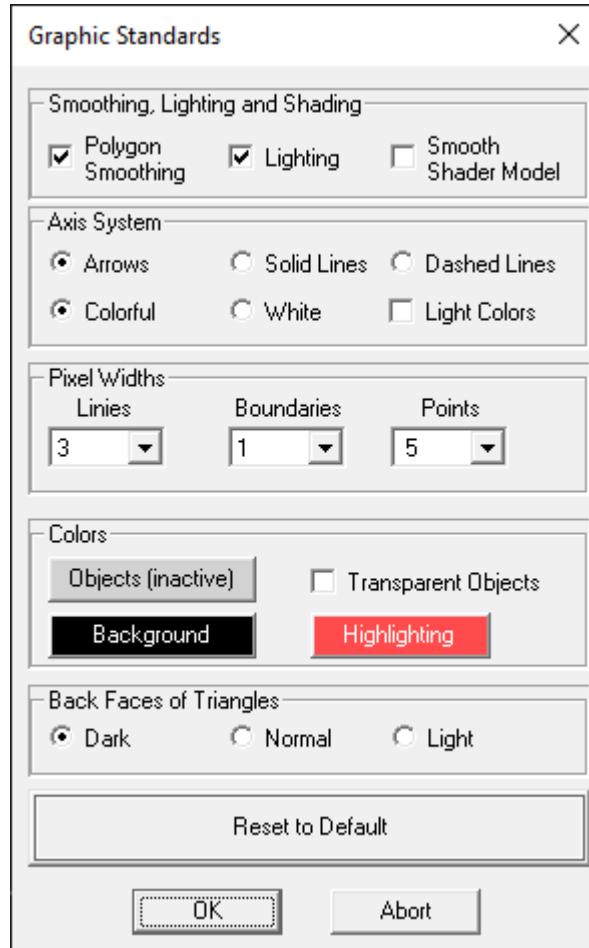
This function assigns to the model the attributes of a material.



Select one material out of three **Material Categories**: *Plastic*, *Metal*, and *Gems*. Category *Gems* consists of materials with different transparency.

### 8.6.4 Graphic Standards

Use this dialog to declare the standards for graphical representation of different elements in the viewport.



- If checked, **Polygon Smoothing** turns on anti-aliasing for oblique lines, and **Lighting** turns on lighting of the model. If **Smooth Shader Model** is wanted, the method for color shading is *smooth*, otherwise *flat*.
- Section **Axis System** offers different types of presentation and coloring of the axis system.
- Section **Pixel Widths** is used to set the thickness in pixels for display of **Lines**, **Boundaries** of triangles, and **Points**. These values are independent of zooming.
- Section **Colors** gives access to selection of default colors for geometrical **Objects** and viewport **Background**. If a certain material is already assigned to the objects, the color selection for objects is labeled *inactive*. Additionally the geometry can be shown as **Transparent Objects**.

Button **Highlighting** is used to define the color for geometrical items like points and segments, which are highlighted during a selection process (e.g. for definition of a viewport transformation). Selection can be applied on any part of a triangle, axis system, grid line and label.

- Section **Back Faces of Triangles** controls coloring of back faces of triangles in relation to the front faces: **Darkened**, **Normal** or **Lightened**.
- Click on **Reset to Default** to restore all custom settings to the factory settings.

### 8.6.5 Cursor Crosshairs

If checked, crosshairs are used as mouse pointer instead of an arrow.

## 8.7 Menu Show

Meshes and isolated triangles can be excluded from display or made visible again by use of menu **Show** or the toolbar **Show / No-Show**.



After activation of function **No-Show** or **Show Only**, press down the **Ctrl-key** and the **left mouse button** to select a mesh or isolated triangle.

A mouse cursor consisting of small crosshairs and an X is shown during the selection process.

### 8.7.1 No-Show



Select a mesh or isolated triangle to be hidden. Repeat selection as often as desired. When finished, deactivate the function.

### 8.7.2 Show Only



After selection of a mesh or an isolated triangle, all other meshes and triangles are hidden. The function is deactivated automatically.

### 8.7.3 Invert Visibility



Use this function to invert the visibility of all meshes and triangles.

### 8.7.4 Show All



Make all hidden meshes and triangles of the model visible again.

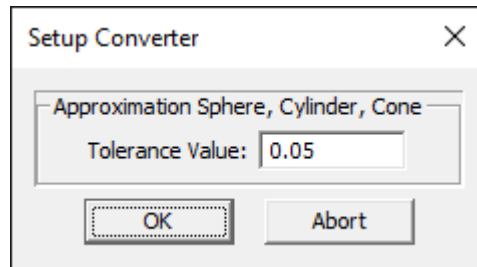
## 8.8 Menu Convert

This menu allows converting data stored in different 3D file formats to the STL format.

**Restriction:** If the file to be converted contains data for animations, conversion will be rejected.

### 8.8.1 Setup

Some 3D file formats define objects like spheres, cylinders, and cones by property values. So *EasyViewStl* has to generate approximating triangle mesh data automatically. Set the ***Tolerance Value*** to adjust the precision of such approximations.



### 8.8.2 File Formats

At the moment, the following 3D file formats can be converted to STL format.

<i>Name</i>	<i>File Type</i>
Open Inventor	*.iv
Alias/Wavefront	*.obj
Princeton	*.off
Stanford	*.ply
VRML 97	*.wrl

## 8.9 Menu Help

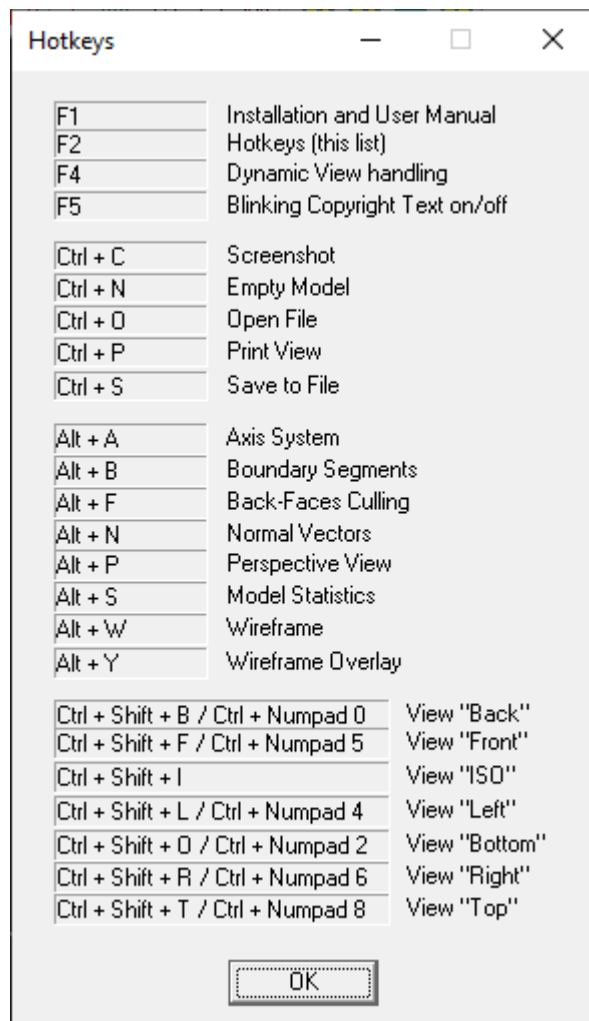
### 8.9.1 User Manual (F1)

If any software is installed to display documents stored in PDF format, this user manual is shown.

### 8.9.2 Hotkeys (F2)

If clicked, the list of all available hotkeys is shown.

Hint: This dialog window can be kept open during operation of *EasyViewStl*.

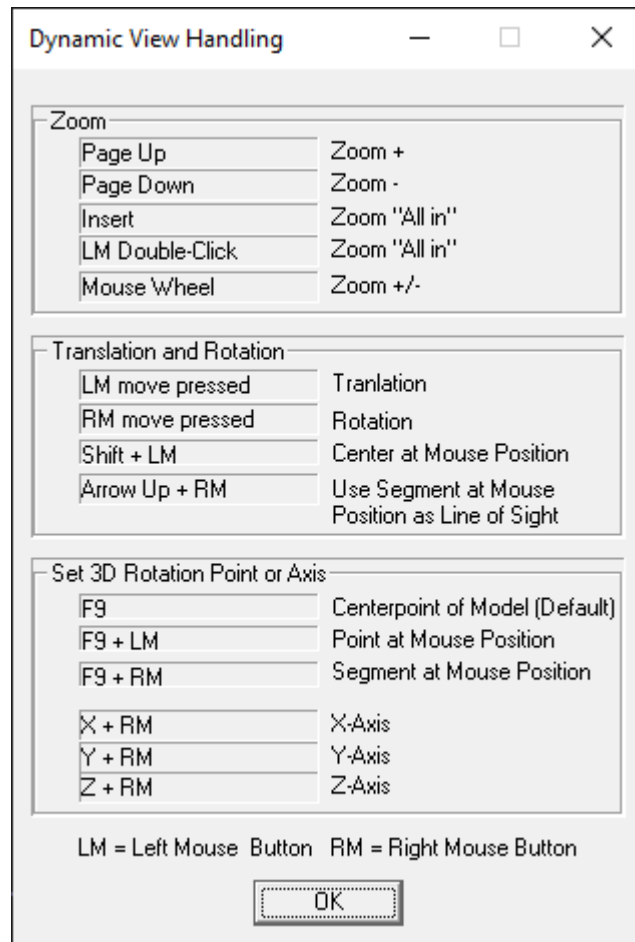


### 8.9.3 Dynamic Views (F4)

This dialog window lists all possible methods to dynamically change the current view of the model.

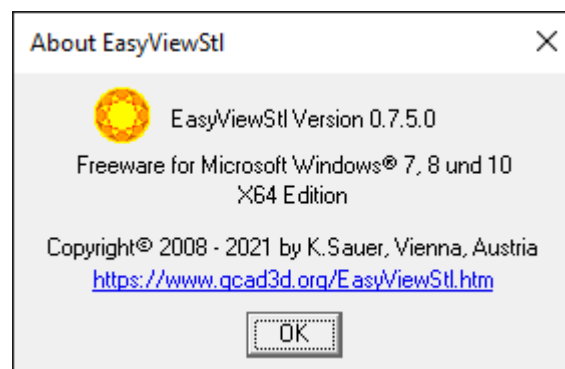
Hint: Whenever a key and a mouse button shall be used together, **press down the key first**.

Hint: This dialog window can be kept open during operation of *EasyViewStl*.



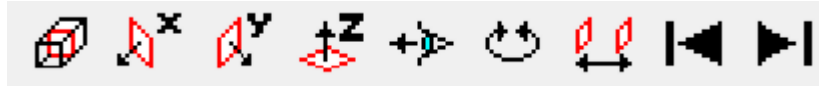
### 8.9.4 About EasyViewStl

The copyright information of *EasyViewStl* is displayed.



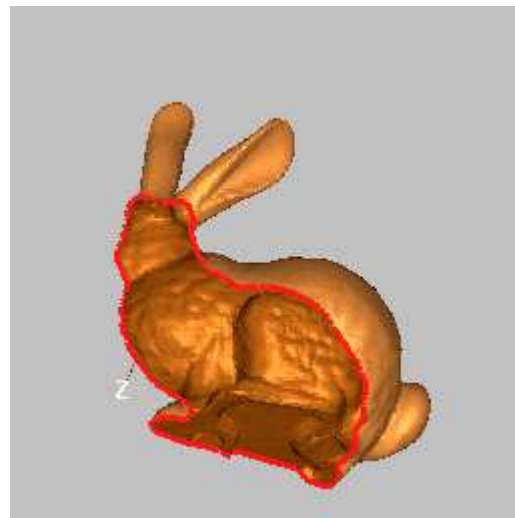
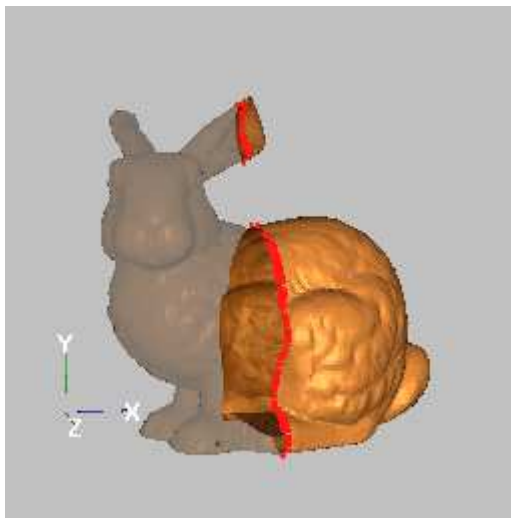
## 8.10 Cross-Sections

If menu *View / Toolbar*, *Cross-Section* is selected, a toolbar is displayed offering a set of functions to create planar cross-sections of the model.



A planar cross-section separates the model into 2 parts. The part lying behind the plane is hidden or shown in transparent mode, as desired. The intersecting line marks the border between the 2 parts of the model.

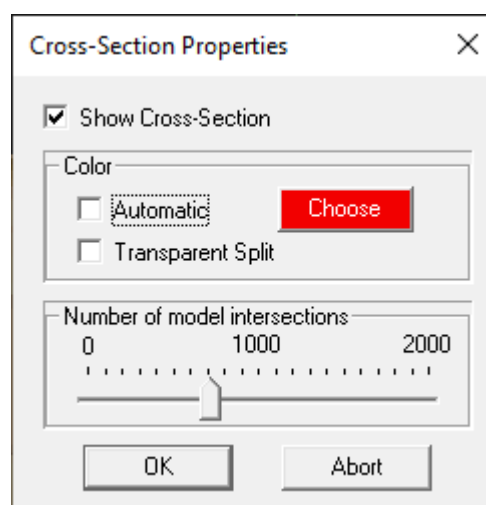
The sectional plane is movable along its normal direction, either in steps, or by a slider. The orientation of the plane is invertible.



### 8.10.1 Cross-Section Properties



The dialog window shows the different options to create cross-section representations.



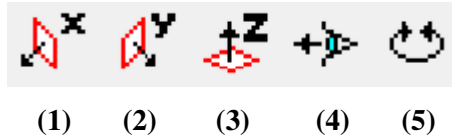


- Switch **Show Cross-Section** turns on/off display of the cross-section and model splitting.
- Section **Color** offers 2 methods to define the color of the intersecting line. If checked, **Automatic** derives the color value from background and model color. Otherwise click **Choose** to use the system color dialog for color selection

Check-box **Transparent Split** controls the transparent display of the model part lying behind the sectional plane.

- Slider **Number of model intersections** sets the number of steps necessary to move the sectional plane from one end of the model geometry to the opposite end. The higher the value, the smaller is the step size when moving the sectional plane.

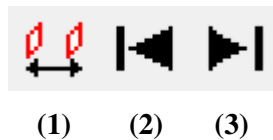
#### 8.10.2 Definition of Sectional Planes



When a sectional plane is defined, the plane always passes through the midpoint of the model. Choose direction **X**-, **Y**-, or **Z-Axis** of the Axis System (1) – (3), or the direction of the current **line of sight** (4) as normal vector of the plane.

The orientation of the sectional plane is invertible at any time (5).

#### 8.10.3 Move a Sectional Plane.



Moving a sectional plane can be done by use of a slider, by the single step buttons, or by the cursor-left and cursor-right keys.

Click on a button of the toolbar to active a slider (1) or to move the plane one step backward (2) or forward (3).