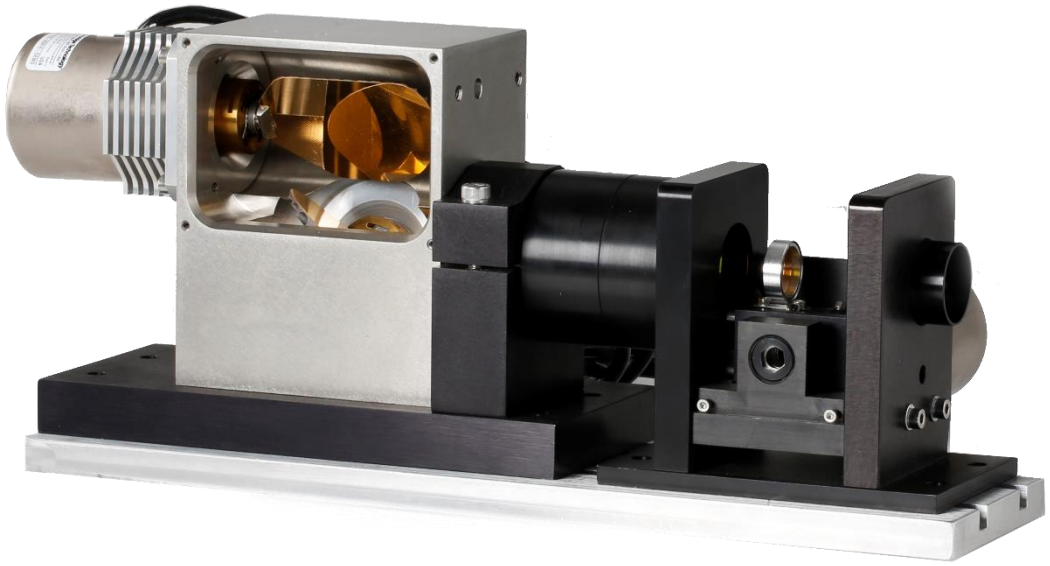
ScanMaster Designer

3D Extensions User Guide

Version 3.1

User Manual



Read carefully before using.
Retain for future reference.

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CAMBRIDGE TECHNOLOGY

Novanta
PHOTONICS

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1 IMPORTANT INFORMATION

For your protection, carefully read these instructions before installing and operating the scan head.
Retain these instructions for future reference.

Novant reserves the right to update this user manual at any time without prior notification.

If product ownership changes, this manual should accompany the product.

1.1 SAFETY SYMBOLS

This manual uses the following symbols and signal words for information of importance.

DANGER

Indicates a hazardous situation which, if not avoided, will result in serious injury or death.

WARNING

Indicates a hazardous situation which, if not avoided, could result in serious injury or death.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

IMPORTANT

Indicates information considered important but not directly hazard related (e.g. security, hygiene, or equipment or property damage).

1.2 SAFETY LABELS

DANGER

Laser radiation
can cause severe retinal and corneal burns, burns on the skin, and may pose a fire risk.

- To avoid injury and reduce risk of fire, please follow the control measures and safety guidelines provided by the laser's manufacturer, and those established by your Laser Safety Officer (LSO), Radiation Safety Officer (RSO), or safety department of your business or institution.

ESD WARNING

Electrostatic discharge and improper handling
can damage MOVIA scan head's electronics.

- Keep the equipment sealed until it is located at a proper static control station.

1.3 CUSTOMER SUPPORT

Before contacting Novanta for assistance, review appropriate sections in the manual that may answer your questions.

After consulting this manual, please contact one of our worldwide offices between 9 AM and 5 PM local time.

Americas, Asia Pacific

Novanta Headquarters, Bedford, USA
Phone: +1-781-266-5700
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2 INTRODUCTION

2.1 GENERAL NOTES

Novanta reserves the right to make changes to the products covered in this manual to improve performance, reliability or manufacturability.

Although every effort has been made to ensure accuracy of the information contained in this manual, Novant assumes no responsibility for inadvertent errors. Contents of the manual are subject to change without notice.

2.2 USING THIS MANUAL

2.2.1 Purpose

The aim of this manual is to provide a brief description of the ScanMaster™ Designer software and its functions. This document will mainly focus on the 3D laser marking processes and the capabilities of ScanMaster™ Designer software to do surface marking and engraving processes. Furthermore this document will guide you through a three step process to achieve the final 3D laser marking. You will learn the options to create a 3D model, modify as desired and then to perform the process. The features of this application will be demonstrated using simple scenarios which will be helpful for you to understand the process more effectively. You will also find some main points that you should remember when managing a 3D laser marking project in ScanMaster™ Designer software.

Note: To understand this application and its features perfectly you are required to have a general knowledge about the ScanMaster™ Designer 2D application.

2.2.2 Document Conventions

This document uses the following typographical conventions to present command line syntax and data file formats.

Convention	Description
Command Object	Words in bold formatting indicate commands, features or shortcut names appearing exactly as shown in the application.

2.2.3 Revision History

The following table shows the revision history for this document.

REVISION	DATE	Changes from previous revision
A	October 1, 2014	First publication of this manual per ECO 8250
B	June 26, 2015	Increased permissible cooling air pressure to 2 PSIG per ECO 8639.
C	August 8, 2016	Corrected error in Figure 44 and added note on cooling water (pg. 44)

2.3 OBTAINING TECHNICAL ASSISTANCE

If you encounter a problem refer to section “1.3 Customer Support” on page 2.

2.4 WARRANTY INFORMATION

The Customer shall examine each shipment within 10 days of receipt and inform Novanta of any shortage or damage. If no discrepancies are reported, the shipment will be considered as delivered complete and defect-free. Novant warranties products against defects up to 1 year from manufacture date, barring unauthorized modifications or misuse. Repaired product is warrantied for 90 days after the repair is made, or one year after manufacture date - whichever is longer.

Contact Customer Service at +1-781-266-5700 to obtain a Return Materials Authorization (RMA) number before returning any product for repair.

All orders are subject to the Terms and Conditions and Limited Warranty. Contact your local sales office for the latest version of these documents and other useful information.

Customers assume all responsibility for maintaining a laser-safe working environment. OEM customers must assume all responsibility for CDRH (Center for Devices and Radiological Health) certification.

3 SAFETY

Please read all operating instructions completely before installing and using a 3-Axis scanning system.

3.1 SAFETY LABELS AND SYMBOLS

The following safety labels and symbols are used throughout the system documentation:

Label	Meaning
	Serious bodily injury or death
	Potential for serious bodily injury
	Potential for property damage and/or minor bodily injury
	SHOCK HAZARD—Electrical voltage is present. Take appropriate measures to protect yourself from electrical shock.
	LASER HAZARD

3.2 GENERAL SAFETY GUIDELINES

Laser Radiation
Do not stare directly into a laser beam.
Follow all system laser safety requirements during installation and operation.

Shutter Safety

Where practical, Novanta recommends the use of an internal shutter mechanism to prevent unwarranted emission of laser radiation. If this is not possible, consult the laser vendor to design a proper safety shutter that, when activated, will eliminate all possibility of exposure exceeding Class 1 limits.

The safety shutter should be located between the laser and the input aperture of the 3-Axis system. This is the user's responsibility Use of controls, adjustments, or procedures other than those specified in this manual without consulting a competent safety professional may result in component damage, and/or exposure to potential hazards. Always follow established industrial safety practices when operating equipment.

This system is designed to be operated in conjunction with a laser. Therefore, all applicable rules and regulations for safe operation of lasers must be known and applied when installing and operating the system. Since Novanta Inc. has no influence over the employed laser or the overall system, the customer is solely responsible for the laser safety of the entire system.

3.3 SAFETY/CAUTIONS

WARNING	Use of controls, adjustments, or procedures other than those specified in this manual, without consulting a competent safety professional, may result in component damage, and/or exposure to potential hazards. Always follow established industrial safety practices when operating equipment.
CAUTION	Always check your application program BEFORE running it. Errors can cause system damage.
CAUTION	Electronic boards are fragile! Handle and store with care. Protect electronic components from dust, humidity, electromagnetic fields, static electricity, chemicals, and mechanical stress.

3.4 SYSTEM SAFETY

CAUTION	To avoid damage to optics (such as lenses or mirrors), do not use a laser power setting that exceeds the laser power handling limit for each optic.

3.4.1 Back-Reflections

Any flat or curved surface (including protective windows) between scanning mirrors and the work field will have back-reflections where some percentage of the beam propagating toward the work field will reflect from this surface and will travel back towards the scanning system. Although, the absolute laser power of the backwards propagating beam may be low, the beam may come to a

focus on or close to a scanning system optic and the laser damage may occur due to the power density of the laser beam. **It is the user's responsibility to make sure that any back-reflections from any surface downstream of the scanning system is managed properly.**

3.4.2 Direct Laser Damage

The power handling limits of mirrors and lenses can vary depending on laser parameters such as beam size, laser power, pulse duration, and pulse energy. **It is the user's responsibility to ensure that the laser parameters are appropriate for the exact scanning system that he or she is using. The standard warranty does not cover damage caused by laser power settings that are above the maximum limits for each optic.**

Please contact Novanta if you are not sure about the power limitations of your scanning system.

3.5 ESD CAUTION

⚠ CAUTION ⚠ 	ESD HAZARD! The electronics that Novanta manufactures—including the galvanometers and servo controllers in 3-Axis scanning systems—are electrostatic discharge (ESD) sensitive. Use appropriate anti-static wrist straps and/or work area equipment to prevent damage to the scanning system.

Upon receiving your components, note that they are packaged in an ESD-protected container with the appropriate ESD warning labels. The equipment should remain sealed until it is in a proper static control station.

- A proper static control station should include the following:
- A soft grounded conductive tabletop or grounded conductive mat on the tabletop
- A grounded wrist strap with the appropriate (1 Meg) series resistor connected to the tabletop mat and ground
- An adequate earth ground connection such as a water pipe or AC ground
- Conductive bags, trays, totes, racks, or other containers used for storage
- Properly grounded power tools

Personnel handling ESD items should wear ESD protective garments and ground straps.

NOTE: Any equipment returned to the factory must be shipped in anti-static packaging.

4 PRODUCT INTRODUCTION

4.1 WHAT IS LASER MARKING?

3D laser marking refers to the laser marking performed on a 3D workspace. 3D laser marking comprises a range of 3D related processes including all types of Surface Markings, Engraving, Sub Layer Laser Engraving and Prototyping. 3D laser marking technology is widely used by many industries such as packaging, automobile manufacturing, jewelry and etc.

ScanMaster™ Designer software allows you to create a digital 3D model and apply 2D images to a 3D surface. This application facilitates 3D marking with either projection or wrapping styles.

This application also enables you to do laser engravings by specifying different sections and layers. More detailed information about these features will be discussed in this document.

The marking procedure can be customized using the ScanScript language in which you can experience the advanced capabilities not available through the user interface.

Note: A detailed description about **Projection** and **Wrapping** styles and their differences will be discussed in the appendix of this document. Refer Appendix A of this document.

4.2 SCAN CONTROLLER CARDS

There are four different Scan Control cards available which are supported by ScanMaster™ Designer software:

1. ScanMaster Controller - The SMC is a self-contained controller that provides advanced hardware and software control technology to drive laser scanning systems. The Ethernet-

connected SMC board is designed to permit remote embedding and control of a scan-head and laser system. It is capable of controlling two scan-heads with up to three motion axes each with concurrent laser timing control. It also provides integrated synchronization I/O for connection to factory automation equipment.

2. EC1000 - The EC1000 is a self-contained controller that provides advanced hardware and software control technology to drive laser scanning systems. The EC1000 control board is specifically designed for remote embedding and control of a scan-head and laser system. It is capable of controlling two scan-heads with up to three motion axes each with concurrent laser timing control. It also provides integrated synchronization I/O for connection to factory automation equipment. The EC1000 controller card is the core of the SM1000 Controller Module.

5 GETTING STARTED

Use information in this section to install and start the ScanMaster™ Designer software. This section will also introduce the key features of the program as well as recommended tips for establishing a good workflow.

5.1 SYSTEM REQUIREMENTS

The following software and hardware specifications are the minimum system requirements to install and run ScanMaster™ Designer software on your computer:

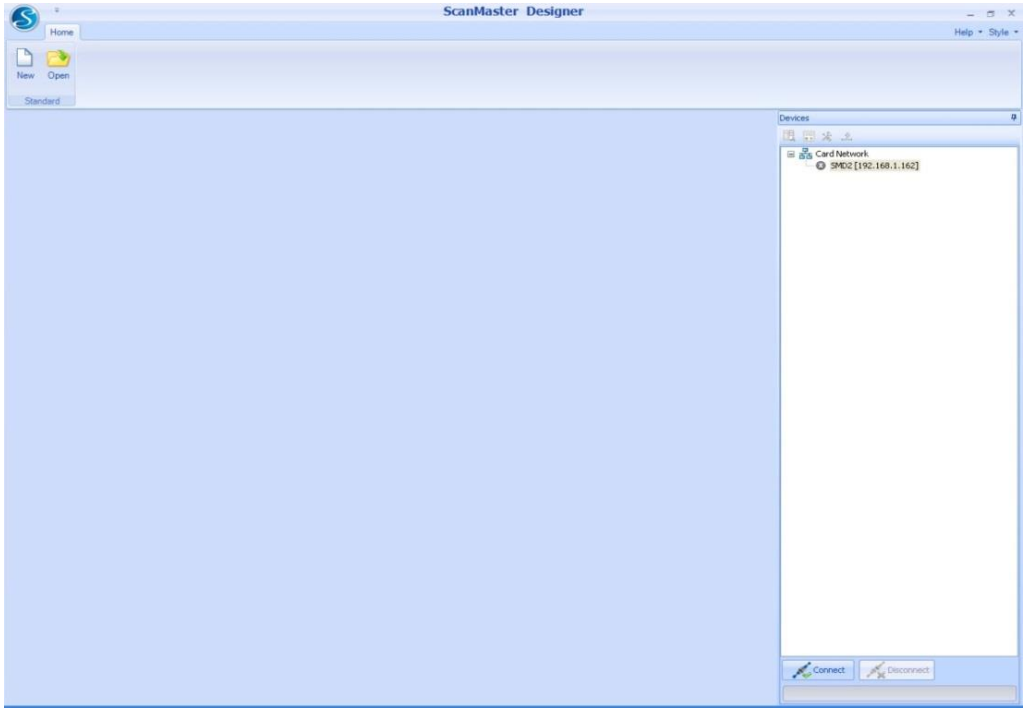
- Processor: 1GHz
- Memory: 1GB
- Hard Disk Space: 1GB
- Display: 1024 x 768 High Color (16-bit)
- Windows XP Professional SP3 / Windows Vista SP2 / Windows 7 SP1

5.2 STARTING SCANMASTER™ DESIGNER SOFTWARE

To open ScanMaster™ Designer:

1. Click **Start** on the taskbar.
2. Select **Programs** and locate the **CTI** folder and then the **ScanMaster™ Designer** sub-folder.
3. Click **the ScanMaster™ Designer** icon.

The following window will appear:



1- FIGURE START-UP SCREEN

To start a new project click **New** from the **Home** tab.

A basic marking job is created by placing different basic shapes such as a box, sphere, cone, or a cylinder on the canvas. Each 3D shape has its own unique properties which can be modified. See **Error! Reference source not found.** in this document, for detail information about creating projects.

To exit ScanMaster™ Designer, click the **Close** button on the top right of the screen or select **Exit** from the **ScanMaster™ Designer** button.

5.3 WORKSPACE ELEMENTS

Before you can begin using the software you need to be familiar with the ScanMaster™ Designer user interface. Let's start by taking a look at the main application window and how it's laid out.

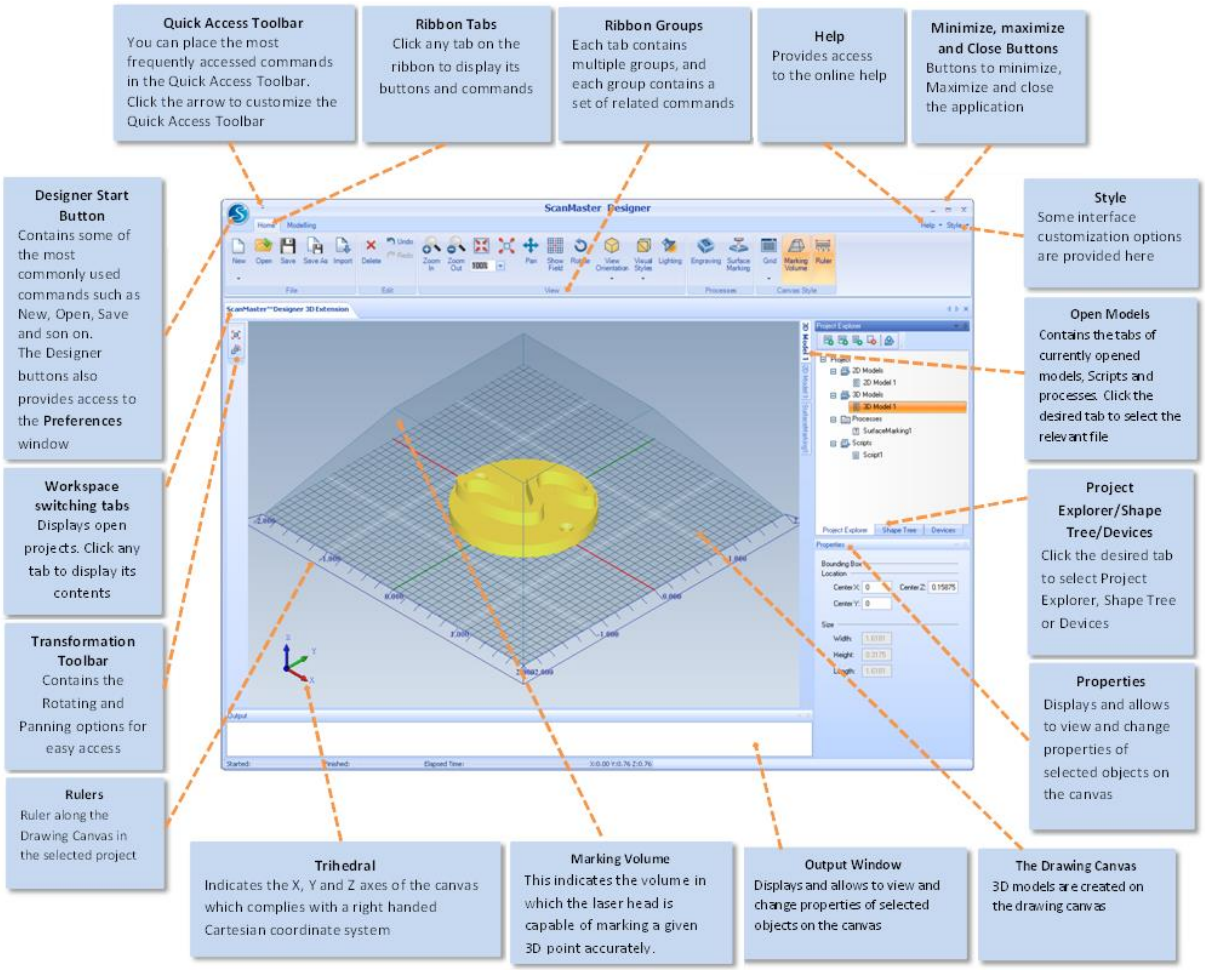


FIGURE 2- WORKSPACE ELEMENTS

5.4 RECOMMENDED WORKFLOW

The figure below shows the recommended workflow for ScanMaster™ Designer projects.

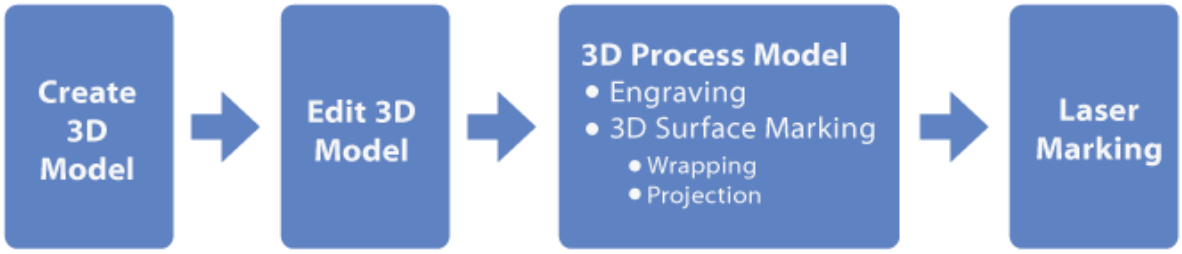


FIGURE 3- RECOMMENDED WORKFLOW

1. **Create a 3D Model**

A "Job" is a simple program that contains Models, Processes and Scripts that are executed in the prescribed order. You might want to create a job to make a Surface Marking process or an Engraving process. The options in ScanMaster™ Designer software, allows you to do these tasks easily.

Insert basic shapes to the drawing canvas by selecting any desired basic 3D shape from the Basic panel of the Modeling tab. You can insert many shapes to create one 3D model.

Note: Refer Creating 3D Models to check detailed information on creating 3D models in a 3D project

2. **Edit the 3D Model**

After you have inserted shapes you can edit them as preferred. ScanMaster™ Designer software is equipped with a rich collection of editing tools which you can use to edit your 3D models. The options in the Modeling tab of the Ribbon will enable you to modify the 3D shapes according to your requirements.

Note: Refer Modifying 3D Models to check detailed information on how to modify 3D models

3. Preparation of the 3D Process

To prepare a 3D model to be processed on the laser marking, the commands in the Engraving tab and Surface Marking will enable you to set the specifications thereby preparing the model to be processed in order to achieve the output according to your requirements.

Note: Refer Preparation of 3D process to check detailed information on preparing the 3D model to be processed

6 SCANMASTER DESIGNER INTERFACE

Across the top of the window is the Ribbon. All the application's functions can be accessed from here and it's the first place you should look if you're new to the software and want to get an idea of what you can do with it. As your mouse passes over the menu, tool tips will be displayed.

Each item is described in further detail in this section.

6.1 THE RIBBON

The **Ribbon** provides easy access to the ScanMaster™ Designer tools that can be used to create and edit 3D models. Tools are logically grouped into a collection of **Tabs**. Each tab contains multiple **Groups**, and each group contains a set of related commands. The **Ribbon** is docked on top of the ScanMaster™ Designer drawing canvas.

6.1.1 Home

The **Home** tab on the **Ribbon** contains the **File**, **Edit**, **View**, **Processes** and **Canvas Style** groups.

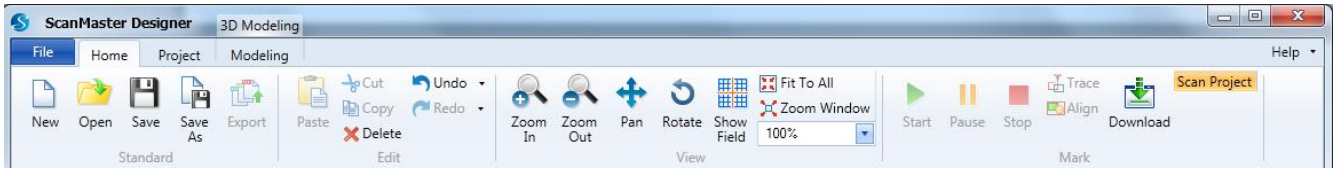


FIGURE 3- HOME TAB

6.1.2 File

The **File** panel allows you to create new, open, save or import 3D and 2D files into the workspace.

Icon	Command	Description
	New	Opens a new project
	Open	Opens a saved project

	Save	Saves the current project
	Save As	Saves a new project or an existing project which is already opened, in a different name
	Export	Disabled for 3D

6.1.3 Edit

The commands in this panel are designed to help you to delete, undo or redo the changes you make to the shapes inserted into the models.

Icon	Command	Description
	Paste	Disabled for 3D
	Cut	Disabled for 3D
	Copy	Disabled for 3D
	Delete	Deletes all selected objects
	Undo	Reverse the last action performed. You may also undo the last few actions that were performed by clicking the arrow next to Undo
	Redo	Re-apply the actions that you undid last

6.1.4 Veiw

The options in this panel enable you to view the drawing canvas in different ways according to your requirement.

Icon	Command	Description
	Zoom In	Enlarges the display size of the workspace on the screen
	Zoom Out	Reduce the display size of the workspace on the screen
	Fit to All	Adjust the zoom level to fit the entire contents of the drawing in to the current view
	Zoom Window	Zoom Window offers a quick way to zoom a certain area of the drawing canvas
	Pan	Panning allows you to quickly move around the canvas at the same magnification you have currently set
	Show Field	Resets the drawing canvas to the default viewing configurations

100%	Zoom Factor	The Zoom Factor allows you to zoom in or out by the specified zoom factor
	Rotate	Rotates the drawing canvas

6.1.5 Mark

Icon	Command	Description
	Start	Start marking
	Pause	Pause marking
	Stop	Stop marking
	Trace	Trace the outer line of the drawing
	Align	Trace the bounding box of the current job
	Download	Download scanning jobs to a flash memory in the card or to a USB memory
Scan Project	Scan Project	Scans the whole project including execution of the script

6.1.6 Project

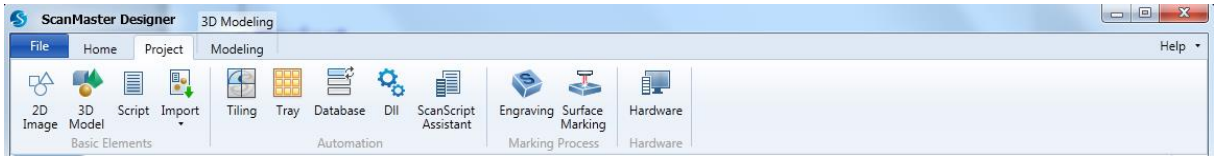


FIGURE 5- PROJECT TAB

6.1.7 Basic Elements

Add new elements to the project.

Icon	Command	Description
	2D Image	Add new 2D Image to the project
	3D Model	Add new 3D model to the project

	Script	Add new script to the project
	Import	Allows you to import 2D image, 3D model or script from file

6.1.8 Marking Processes

The Marking Processes panel gives you the options of the start of the 3D marking processes.

Icon	Command	Description
	Surface Marking	Creates a new surface marking process on the project
	Engraving	Creates a new engraving process on the project

6.1.9 Modeling

The **Modeling** tab on the **Ribbon** enables you with many attractive options to modify the 3D shapes to create complex 3D models easily

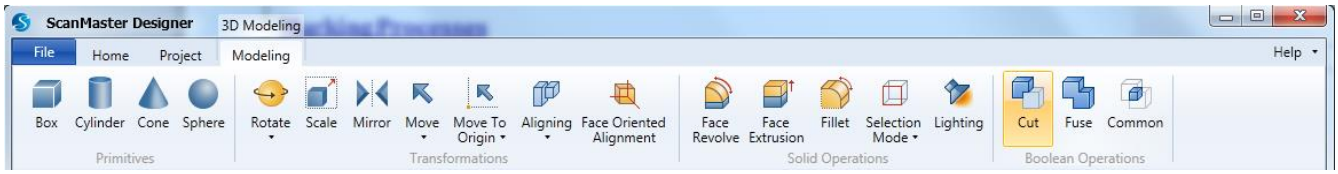


FIGURE 4- MODELING TAB

6.1.10 Basic

The **Basic** panel displays, the four basic 3D shapes to insert into the workspace which then you can modify them using the other options in the **Modeling** tab.

Icon	Command	Description
	Box	Inserts a three-dimensional cube on the drawing canvas according to the given width, height and length.
	Cylinder	Creates a cylindrical shape according to the given radius and height.
	Cone	Inserts a cone shape according to the specified base and top radius and the height.

	Sphere	Inserts a sphere on the drawing canvas according to the defined radius

6.2 TRANSFORMATIONS

The **Transformations** panel guides you on transforming the 3D shapes as required.

Icon	Command	Description
	Rotate	Rotates a shape around a specified axis on the canvas
	Scale	Changes the size of any object drawn or loaded to the canvas
	Mirror	Creates a symmetrical mirror image of the selected shape according to the specified mirror axis
	Move	Moves a shape to a new position you specify related to the current position
	Move to Origin	Moves the selected shape(s) to the origin of the canvas
	Aligning	Aligns two or more objects' bounding boxes to any of the given alignments
	Face Oriented Alignment	Changes the alignment of a selected face so that it is oriented perpendicular to the given axis

6.2.1 Solid Operations

The **Solid Operations** panel allows you to modify the 3D shapes in different ways.

Icon	Command	Description
	Face Revolve	Revolves the selected face of the object according to a specified x, y or z axis or arbitrary axis values.
	Face Extrusion	Changes the dimension of an object by extending a selected face according to a specified extrusion length.
	Fillet	Curves the shape of the selected mode, by a given radius
	Selection Mode	Selects the 3D shapes by faces, edges, vertices or neutral.

	Lighting	Changes the lighting effects from different directions.

6.2.2 Boolean Operations

This panel allows you to modify two selected 3D shapes in terms of Cut, Fuse and Common.

Icon	Command	Description
	Cut	This command gives you the option of cutting a particular overlapped section of the first selected 3D shape
	Fuse	The fuse command allows you to join two or more 3D objects together to make one particular 3D shapes
	Common	Extracts the common section of two selected 3D shapes

6.3 ENGRAVING

The **Engraving** tab on the **Ribbon** provides you the capability to make adjustments to the 3D model for engraving.

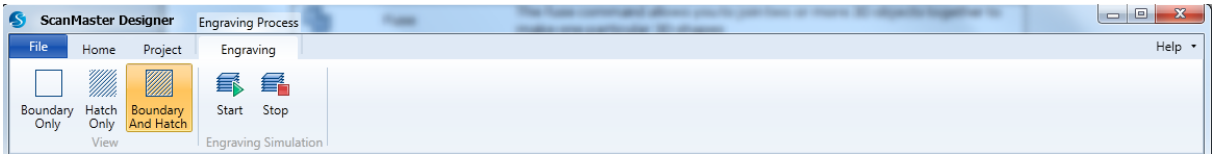


FIGURE 5- ENGRAVING TAB

6.3.1 View

The options in this panel enable you to view engraved objects in different views.

Icon	Command	Description
	Boundary Only	Allows you to view only boundary of the engraving object
	Hatch Only	Allows you to view only the hatch of the engraving object
	Boundary and Hatch	Allows you to view both the boundary and hatch of the engraving object.

6.3.2 Engraving Simulation

The options in this panel allow you to preview specified sections of your engraving process.

Icon	Command	Description
	Start	Starts the preview of the engraving process
	Stop	Stops the preview of the engraving process

6.4 SURFACEMARKING

The **SurfaceMarking** tab on the **Ribbon** provides the capability to adjust the 3D model for surface marking.

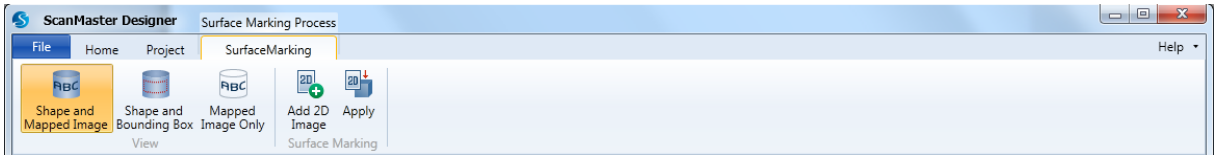


FIGURE 8- SURFACEMARKING TAB

6.4.1 View

The options in the **Viewing Surface Marking Objects** panel, provides different ways to visualize the 3D model.

Icon	Command	Description
	Shape and Mapped image	Displays the 3D model and the mapped image
	Bounding Box and Shape	Displays the 3D model and the bounding box of the mapped image
	3D Image only	Displays only the mapped image

6.4.2 Surface Marking

Icon	Command	Description

	Add 2D Image	This command allows you to add a 2D image to the canvas for processing
	Apply	The Apply command allows you to apply the 2D image to your 3D model that you have created

7 LAYOUT OF 3D CANVAS

7.1 DRAWING CANVAS

The 3D drawing canvas is the 3D workspace which allows users to see the graphical representation of a 3D model and work with it.

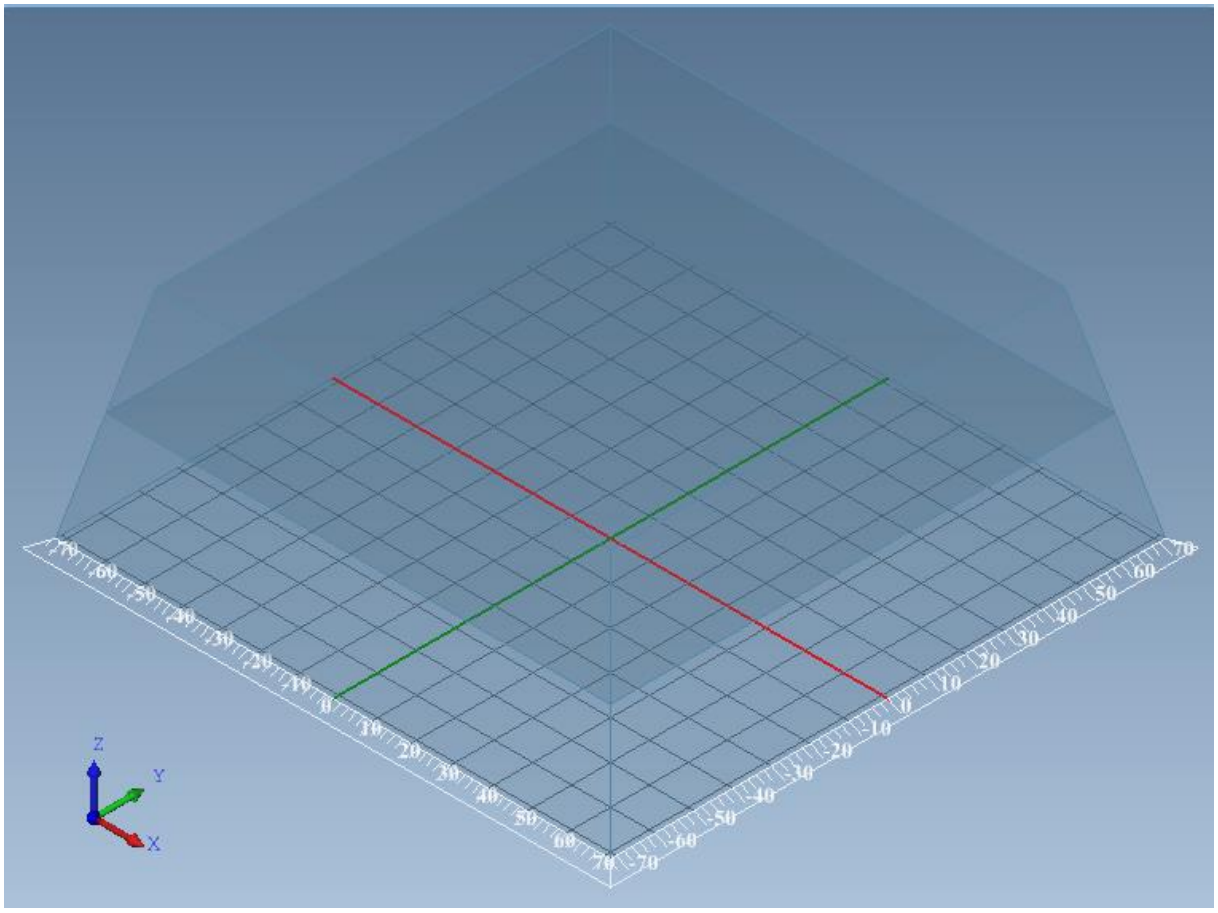


FIGURE 6- 3D DRAWING CANVAS

7.2 MARKING VOLUME

The marking volume is indicated by a transparent pyramid shape. This represents the volume in which the scan head is capable of marking a given 3D point accurately.

You can access the **Marking Volume**  button below the canvas. Click on the **Marking Volume** button to show/hide the marking volume. The following images show the appearance with and without Marking Volume.

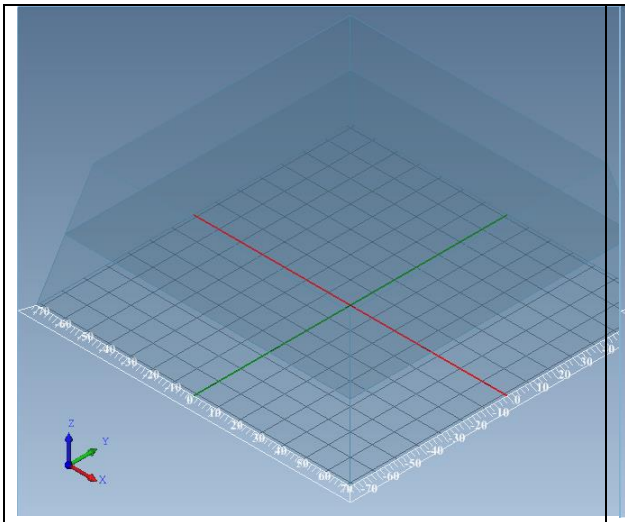


FIGURE 7- CANVAS WITH MARKING VOLUME

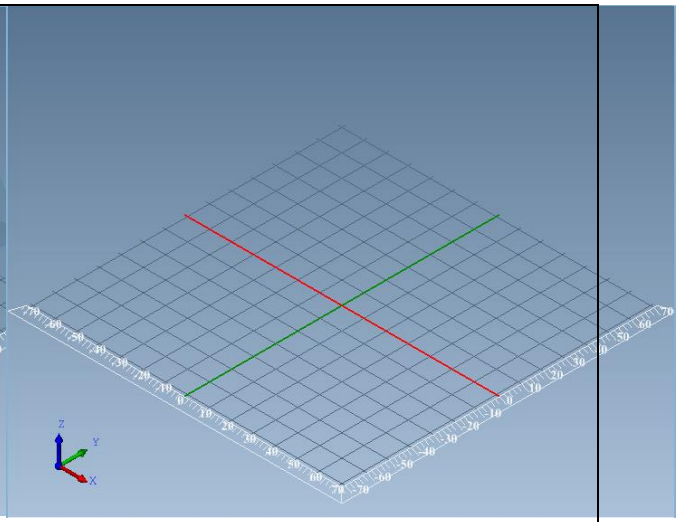


FIGURE 8- CANVAS WITHOUT MARKING VOLUME

Any 3D models or sections of 3D models which are placed beyond the marking volume will not be marked by the scan head.

7.2.1 Ruler

Click on the **Ruler**  button below the canvas to show/hide the ruler. The following images show the appearance with and without the ruler.

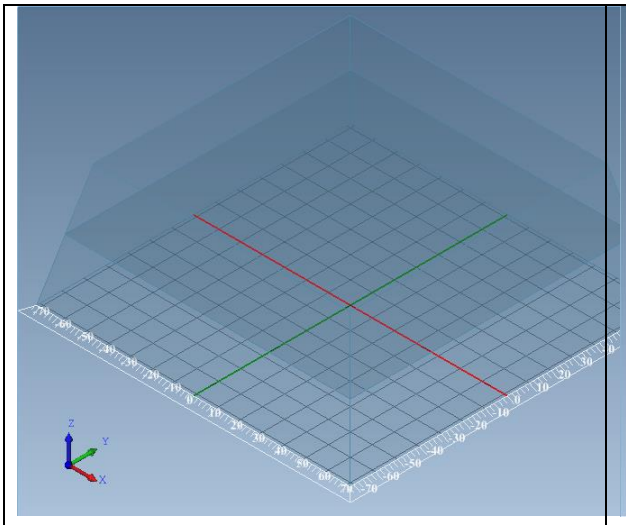


FIGURE 9- CANVAS WITH RULER

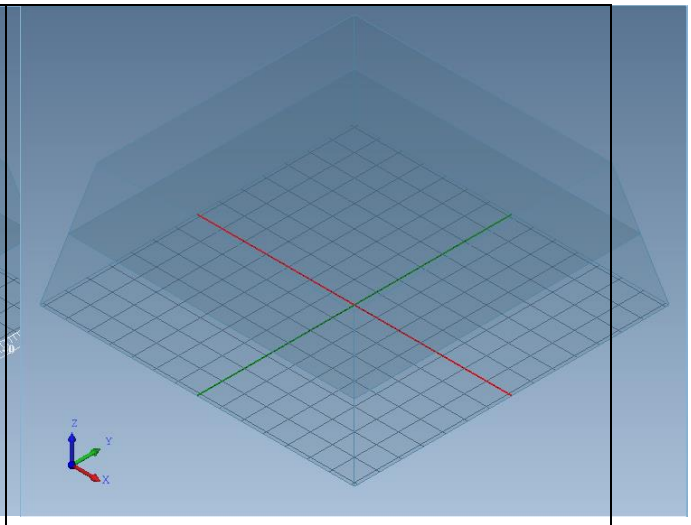


FIGURE 10- CANVAS WITHOUT RULER

A ruler is displayed along the **X** and **Y** axis of the drawing canvas in order to help you adjust the position of the 3D model in the drawing canvas.

The position of the 3D model can be specified by defining the **X** and **Y** values in the **Properties** of the 3D model.

7.2.2 Trihedral

The trihedral  at the bottom left corner of the canvas indicates **X**, **Y** and **Z** axes of the grid which complies with a right handed Cartesian coordinate system.

7.2.3 Grid

The **Grid** options are accessible by clicking on the **Grid**  button below the canvas. This command helps you to perfectly align shapes and drawings along the grid lines and points.

Layout of 3D Canvas

ScanMaster™ Designer software allows you to choose from three different grid styles. Select the desired grid option from the drop-down menu accessible by clicking on the **Grid** button.

The following images show the appearance of the different grid styles.

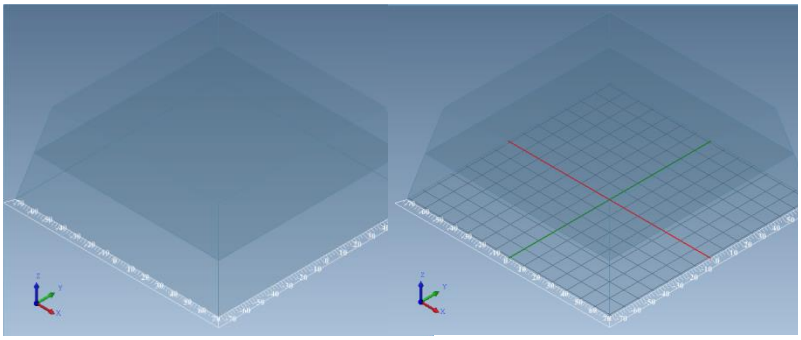


FIGURE 11- BLANK GRID

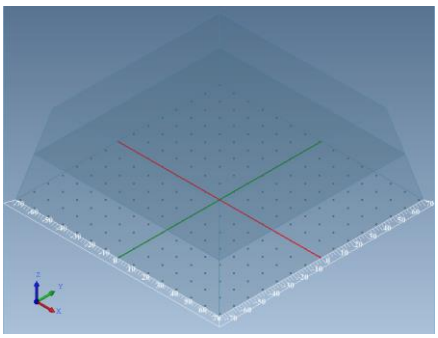


FIGURE 12- DOTTED GRID

FIGURE 15- LINE GRID

7.3 VIEW ORIENTATION

The **View Orientation** options are accessible by clicking on the **View Orientation**  button below the canvas. This command helps you to change the view of the drawing canvas in different directions.

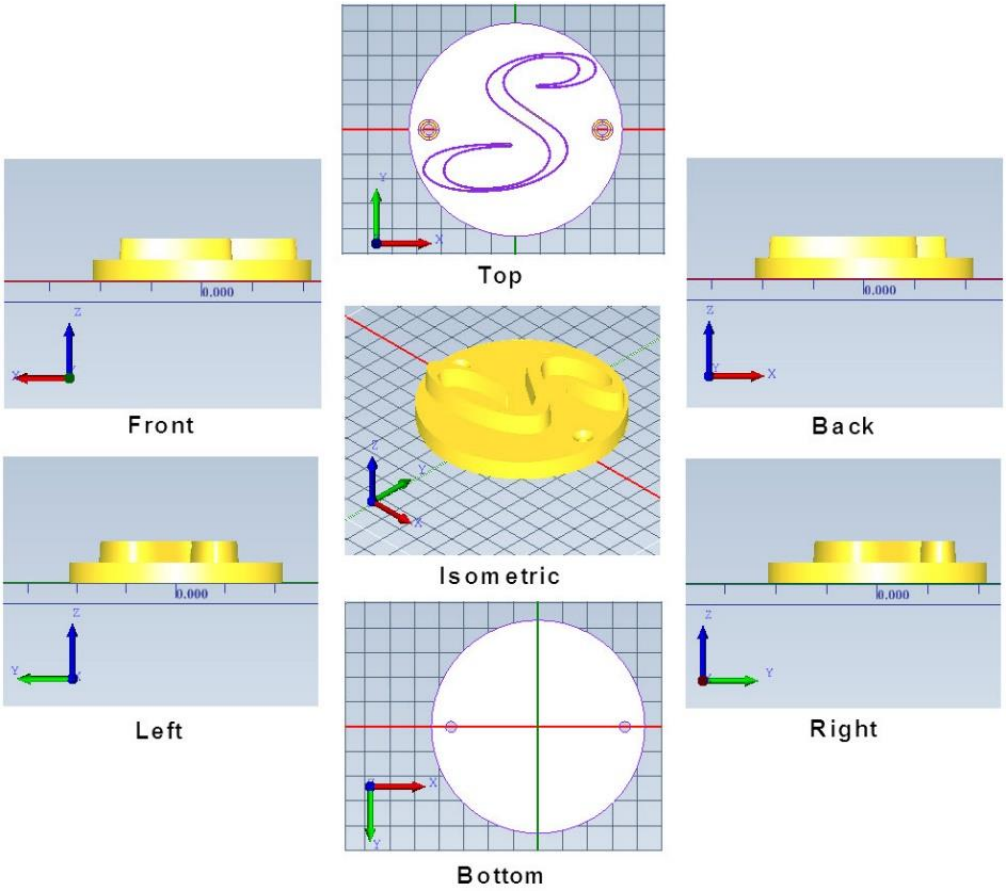


FIGURE 13- THE VIEWING ORIENTATIONS

Note: The objects in the canvas will be displayed in the Isometric view by default

7.4 VISUAL STYLES

The **Shaded** and **Wire Frame** options are accessible by clicking on the **Visual Styles**  button below the canvas.

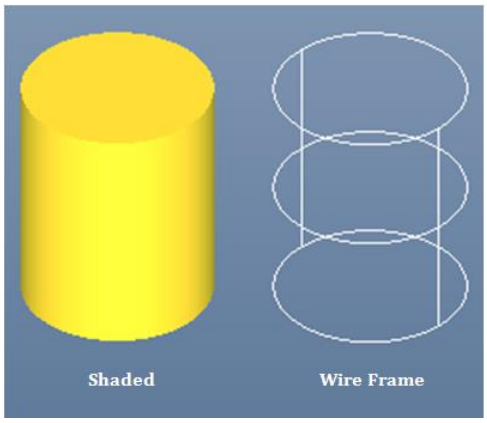
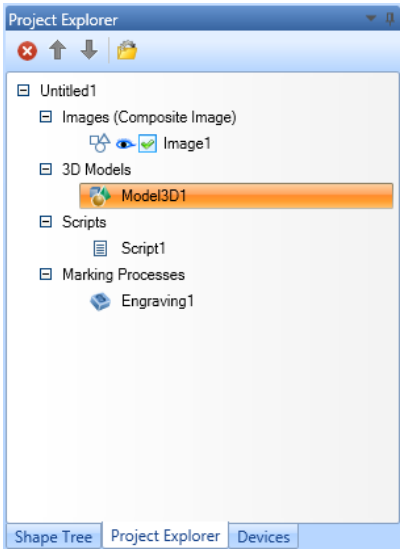


FIGURE 14- VISUAL STYLES

7.5 PROJECT EXPLORER



A project can have several 3D models and 2D images, marking processes and scripts. Any 2D image, 3D model, project or script created in the ScanMaster™ Designer software is visible on the **Project Explorer** tab, in a hierarchical structure. The current project is visible in the top level with corresponding 2D images, 3D models, processes and the script files below it.

To view the elements on the project explorer, click on the **Project Explorer** tab which is on the top-right corner of the application.

FIGURE 19- PROJECT EXPLORER

The following table describes the commands and icons displayed in the **Project Explorer** tab.

Icon	Command	Description
	Delete	This command deletes any selected element in the project explorer
	Move Up	This command will move the selected item one step up in the current list
	Move Down	This command will move the selected item one step down in the current list
	Project Settings	This command allow you to customize the project settings

7.6 SHAPE TREE

The **Shape Tree** displays all the shapes inserted on the current model or process. To access the shape tree, click on the **Shape Tree** tab which is on the top-right corner of the application.

7.6.1 Hide/Show/Rename/Delete

The shape can be hidden, shown using the / icons and rename or delete the shapes using the right-click options in the **Shape Tree** tab.

1. Right-click on the particular shape from the **Shape Tree**
2. You will see the menu as shown in the figure below

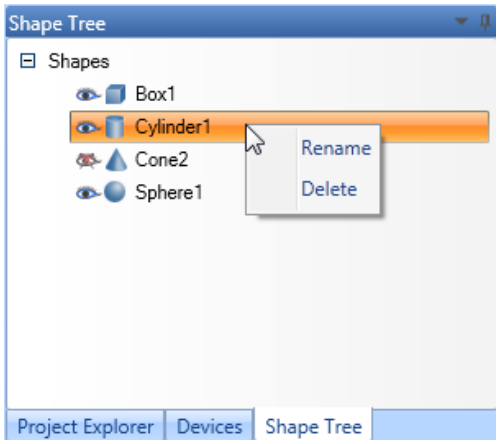


FIGURE 15- SHAPE TREE RIGHT-CLICK MENU

1. Click the **Rename** command to change the default name of the selected shape of the shape tree
2. Click the **Delete** command to delete the selected shape from the project

8 MANAGING PROJECTS

A clear understanding of 3D project management in ScanMaster™ Designer will ensure an efficient work flow. This section guides you on certain basic areas which should be considered when managing a 3D project.

8.1 BEFORE YOU BEGIN

Before you create a new 3D project, you need to understand and focus on certain areas to gain optimal results:

1. You should be familiar with the basics of ScanMaster™ Designer software interface. Refer *Starting ScanMaster™ Designer Software* and the *Workspace Elements* sections of this document to have a clear idea about the application.
2. Get familiar with the supportive 3D file formats, project structure and the project default settings.
3. You can import 3D models from **STEP**, **IGES** and **STL** formats.
4. Understand the concept of changing the measurement units of the projects. The measurement units of the 3D models that you insert into your canvas depend on the settings of the **Default Units** and **Grid Spacing** that you set in **Project Settings** therefore make sure that you have an idea about your measurement settings when you specify the parameters of any 3D models in your project.

Note: Please refer section 5 Managing Projects in the ScanMaster™ Designer 2D user manual to check more facts that you should consider before you begin a 2D project in ScanMaster™ Designer 3D Extension.

8.2 PREFERENCES

Preferences are the project default settings for any new project created in ScanMaster™ Designer software. They are organized as **General, Editors, 2D Scanning and 3D Scanning** tabs.

The **Preferences** window is accessed by clicking the **ScanMaster™ Designer** button on the upper-left corner of the screen.

You will find the following **Application Preferences** window.

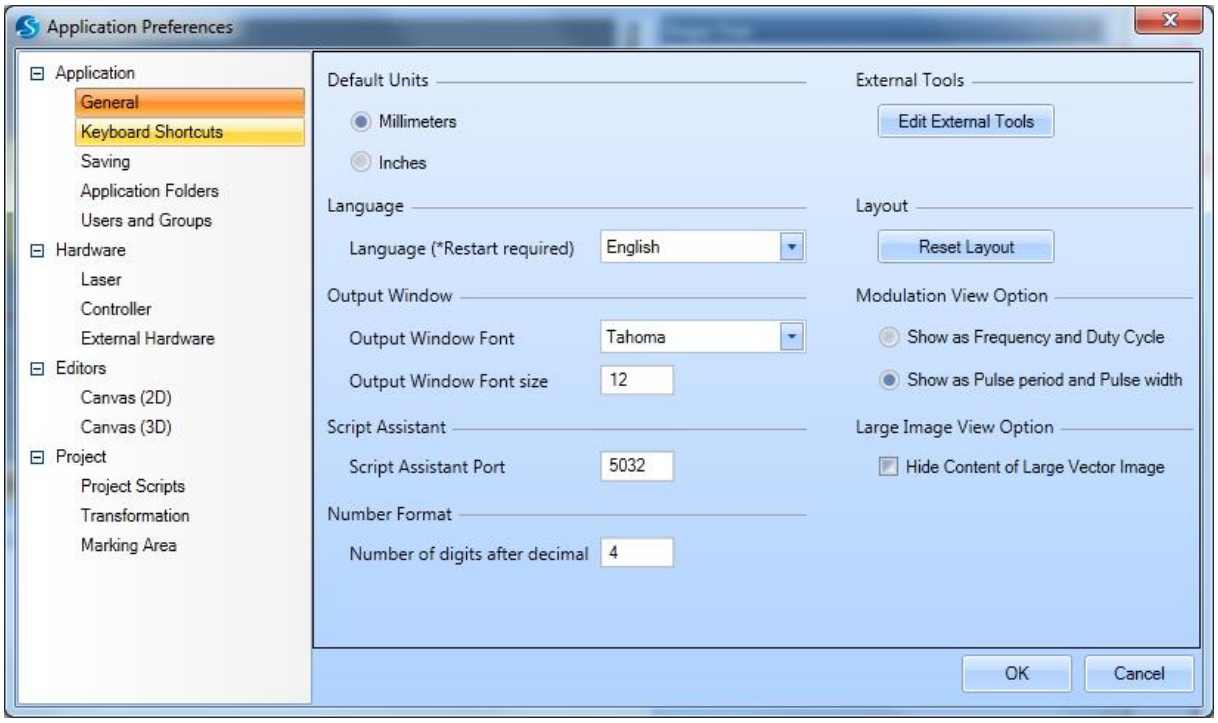


FIGURE 16- APPLICATION PREFERENCES

8.3 CANVAS 3D COLORS

The **Designer Colors (3D)** tab allows adjustment of the colors of the 3D workspace. As seen in the figure below, the application allows you to customize the colors of the objects in the drawing canvas, the rulers, ruler text, marking area, marking area lines, upper and lower backgrounds, grid lines and the surface marking logo.

To change the color of an element, click the drop down color chart button and select the required color from either the preset colors or by means of the **More Colors** option, where you could specify RGB values to match a specific color.

1. Click the **Use Defaults** button to reset the colors to their original state
2. Click on the **OK** button to save the changes you made to the colors of the layout and exit
3. Click **Cancel** if you want to exit without saving

8.4 GRID SPACING

You can display the **Grid** as a rectangular pattern of lines or dots. The spacing between the grid lines is called "**Grid spacing**". Grid spacing can be measured in either millimeters or inches.

Note: Refer the Chapter 5 Managing Projects of the 2D user manual for details on General, 2D Scanning and Editors| Designer Colors (2D) tabs.

8.5 CREATING A NEW PROJECT

8.5.1 To create a new project

1. Choose **New**  from the **Home** tab or press **Ctrl + N.** A new drawing canvas will be opened.

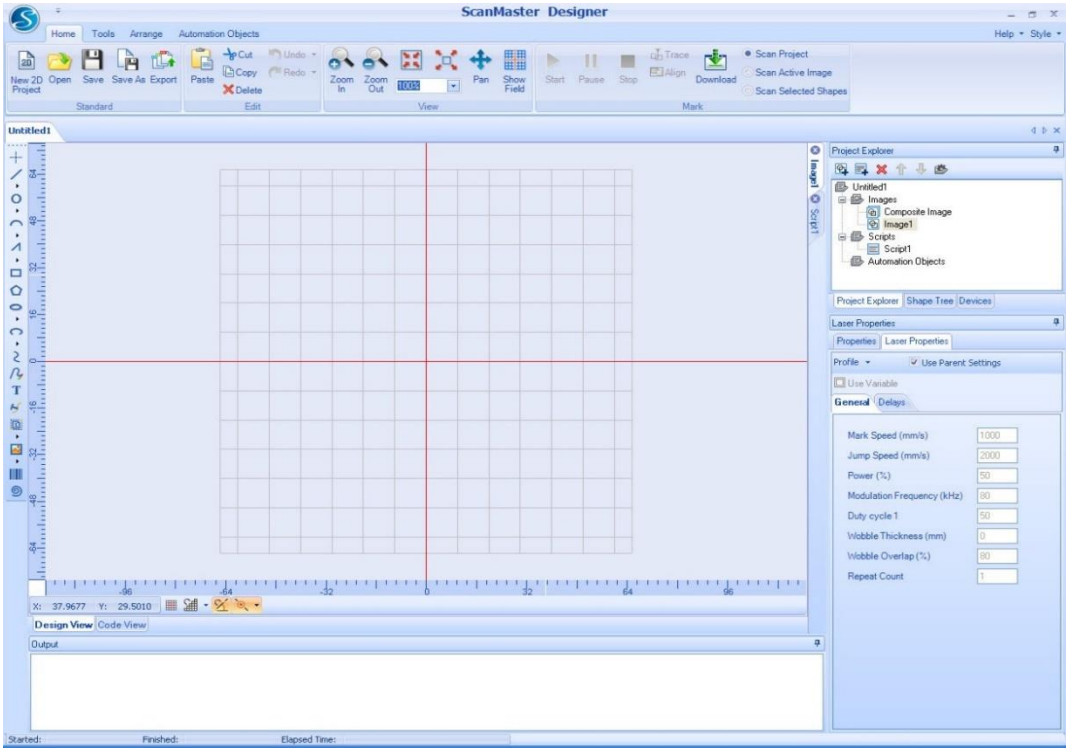


FIGURE 22- CREATING A NEW PROJECT

8.5.2 To add 3D models to a project

You may create several 3D model per project.

2. Go to Project Ribbon tab.
3. Click the 3D model button on the Basic Elements group. A new 3D model will be added to the project and it will be visible on the Project Explorer window as well.

Note: Refer to "**Creating 3D Models**" on this document to get more details on creating 3D models on your 3D project.

- Refer the Chapter 5 Managing Projects of the 2D user manual for details on Opening, Saving a project..

9 CREATING 3D MODELS

The first step in the 3D model marking process is creating a 3D model. The ScanMaster™ Designer software allows you to create 3D models according to your requirements in different ways. You can create a 3D model from the beginning or you can import an existing 3D model to your project.

9.1 CREATING A BLANK 3D MODEL

To create a new 3D model of your own:

1. Go to **Project Ribbon tab**.
2. Click the 3D model  button on the Basic Elements group. A new 3D model will be added to the project and it will be visible on the Project Explorer window as well.

A 3D model can be a collection of many 3D shapes. ScanMaster™ Designer software allows you to create any kind of 3D models using the basic 3D shapes provided to you.

9.1.1 Inserting Basic 3D Shapes

The ScanMaster™ Designer software comprises four basic 3D shapes including **Box**, **Cylinder Cone** and **Sphere**. You can access these shapes in the **Basic** panel of the **Modeling** tab. Each shape can be inserted on to the drawing canvas by specifying the relevant geometrical parameters.

9.1.2 Inserting a Box

To insert a 3D box shape, click on the **Box** command on the **Basic** panel. The figure below shows the specifications of the parameters associated with the box shape and its output.

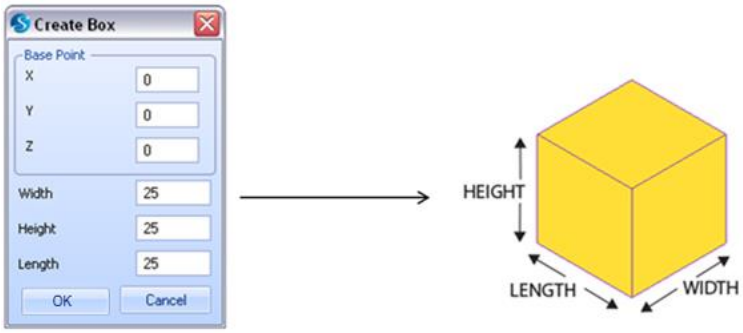


FIGURE 23- CREATE BOX

1. The **Base Point** refers to the position of the **Box** on the drawing canvas. The base point is defined as the minimum **X**,**Y** and **Z** point of the box
2. The **Length** refers to the distance along the x axis
3. The **Width** refers to the distance along the y axis
4. The **Height** refers to the distance along the z axis
5. Click **OK** to confirm your specifications

9.1.3 Inserting a Cylinder

To insert a cylindrical shape select the **Cylinder** command on the **Basic** panel of the **Modeling** tab. The figure below shows the specifications of the parameters associated with the **Cylinder** shape and its output.

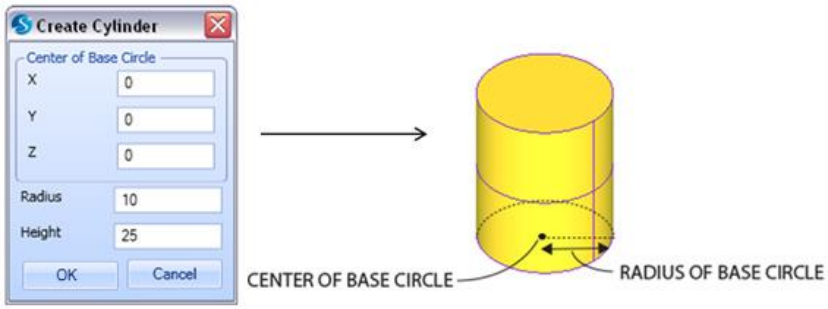


FIGURE 24- INSERT CYLINDER

1. The **Center of Base Circle** represented by the **X, Y** and **Z** coordinates refers to the center point of the base circle
2. The **Radius** refers to the radius of the base circle
3. The **Height** refers to the distance measured along the axis of the cylinder

9.1.4 Inserting a Cone

To insert a cone shape to the drawing canvas, select the **Cone** command from the **Basic** panel. The figure below shows the specifications of the parameters associated with the **Cone** shape and its output.

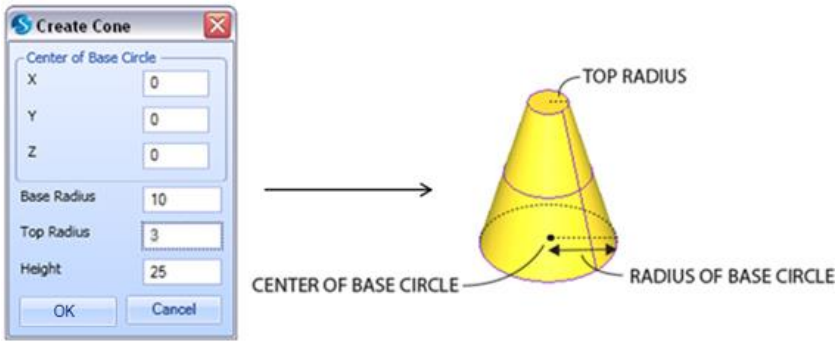


FIGURE 25- INSERT CONE

1. The **Center of Base Circle** represented by the **X**, **Y** and **Z** coordinates refers to the center point of the base circle
2. The **Base Radius** refers to the radius of the base circle
3. The **Top Radius** refers to the radius of the top circle

9.1.5 Inserting a Sphere

To insert a sphere shape on the drawing canvas, select the **Sphere** command from the **Basic** panel. The figure below shows the specifications of the parameters associated with the **Sphere** and its output.

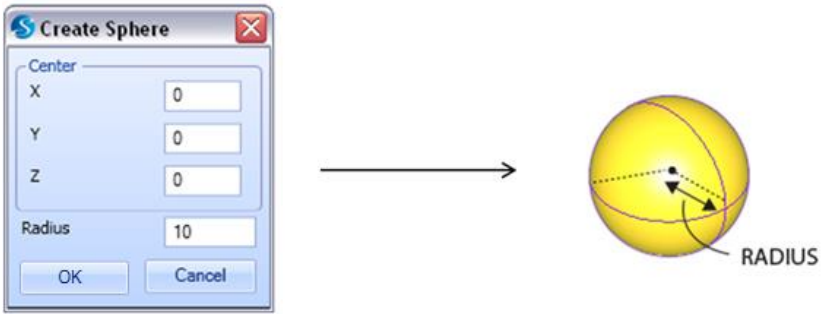


FIGURE 26- INSERT SPHERE

1. The **Center** represented by the **X**, **Y** and **Z** coordinates refers to the center point of the **Sphere** on the drawing canvas
2. The **Radius** refers to the radius of the **Sphere**

Note: You can create complex 3D models by inserting many 3D shapes and modifying them to make one whole 3D model. Refer **Error! Reference source not found.** for more information on modifying 3 D models.

9.2 CREATE A 3D MODEL FROM AN EXISTING FILE

ScanMaster™ Designer software allows you to import existing 3D models to your project.

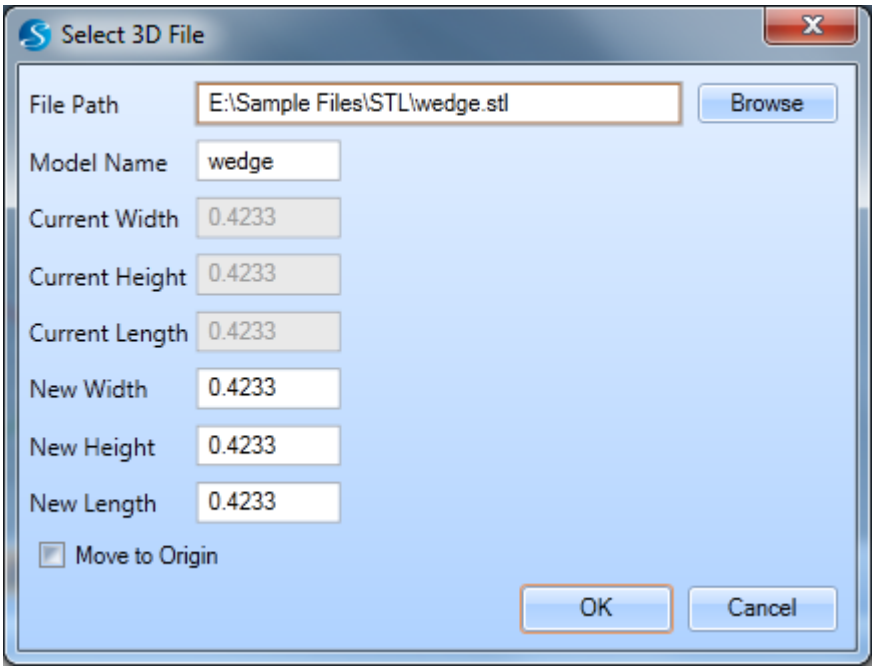


FIGURE 27- SELECT 3D FILE DIALOG

1. Go to **Project Ribbon** tab.
2. Select the **3D model** button from the import drop down button.
3. The 3D file dialog will be opened.
4. Click **Browse** button to browse the existing 3D model file location. The **Open** dialog box will be displayed
5. Select the desired 3D model file and click **Open**. The location of the file will be identified and displayed in the **File Path**
6. The current width, height and length of the 3D model will be identified automatically by the system
7. If you want to change the width, height and length of the importing model, specify the values in the respective **New Width**, **Height** and **Length** fields
8. Check the **Move to Origin** check box to move the importing 3D model to the origin of the canvas
9. Click **OK**

9.2.1 Supportive Files

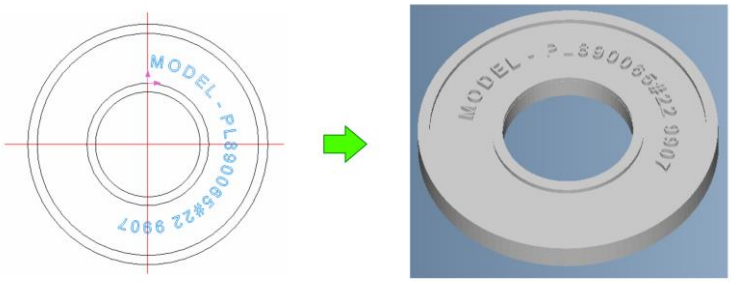
ScanMaster™ Designer software supports the following file formats to be imported to the 3D projects.

1. Standard for the Exchange of Product data (STEP)
2. Initial Graphics Exchange Specification (IGES)

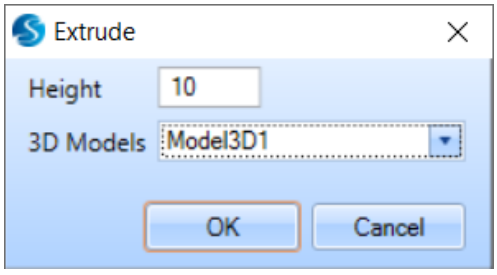
STereo Lithography (STL)

9.3 CREATING A 3D MODEL USING 2D SHAPES

The ScanMaster™ Designer supports 2D shape extrusion to create 3D shapes. Any simple or composite closed shape can be extruded in the Z axis direction to form a 3D shape by simply specifying the height of the expected 3D shape.



1. With a 3D model in place
2. Select the desired 2D shape from the 2D canvas
3. Right click on the selected shape and select Extrude from the pop up menu



4. Specify the desired height for the extruded 3D shape
5. Select the 3D model from the drop-down list, onto which this extruded shape adds.

You may use the multiple shape selection facility of the canvas either by drawing a selection box using the mouse or by selecting the required shapes while pressing the SHIFT button. Right click anywhere on the selected shapes to access the extrude menu.

Note: Only closed shapes or closed composite shapes are allowed. For example, any lines or open polylines will not be allowed.

10 MODIFYING 3D MODELS

Once the 3D model is created, the next step is to modify the created models in order to create more complex 3D models and thereby achieve the desired output. This chapter will guide you through various modification features provided by ScanMaster™ Designer software.

10.1 VIEWING OPTIONS

The **View** panel in the **Home** tab provides a rich set of view port oriented operations. You can change the view of the 3D canvas according to your requirements in order to help you navigate to each location of the model and observe it in detail.

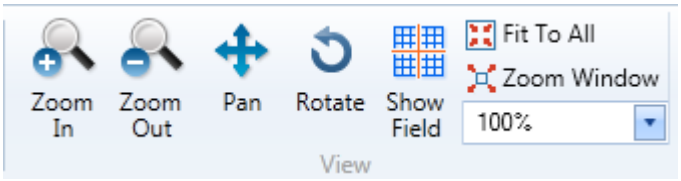


FIGURE 28- VIEW PANEL

10.1.1 Zoom

The **Zoom** commands are available in the **Home** | **View** section. **Zoom** commands are very useful when having to go back and forth between editing small details at a magnified level and for checking the overall picture at a minimized level.

10.1.2 To Zoom In/ Zoom Out

3. Go to the **Home** | **View** panel.
4. Click **Zoom In** /**Zoom Out** , or select a more exact zoom percentage in the **Zoom Factor** percentage menu.
5. **Zoom In**: Increases the magnification level of a drawing on the canvas.

6. **Zoom Out**: Reduces the magnification level of a drawing on the canvas.

Note: You can also use the mouse wheel to increase or reduce the magnification level of the canvas.

10.1.3 Zoom Window

Zoom Window offers a quick way to view a certain area of the drawing.

4. Click **Zoom Window** 
5. Select a certain area of the drawing

10.1.4 Zoom Factor

The **Zoom Factor** allows you to zoom in or out by the specified zoom factor. The default size is achieved by a 100% zoom factor.

In the **Zoom Factor** box 

type or select a zoom factor.

10.1.5 Fit to All

Fit to All allows resizing the drawing canvas width/height to display it in any screen size.

6. Click **Fit to All** 

10.1.6 Pan

Panning allows you to quickly move around the canvas at the same magnification you have currently set.

1. Go to the Home | View panel
2. Click Pan 
3. Click on the drawing canvas and drag it away to the location you desire and release

Or

1. Click the middle mouse button
2. Drag the cursor on the canvas and release the mouse when the drawing is at the position you desire.

Note: The cursor image changes to a hand cursor when panning is activated.

10.1.7 Show Field

The **Show Field** command in the **Home** | **View** panel resets the drawing canvas to the default viewing configurations.

1. Click on the **Show Field** button to view the default viewing configurations of the drawing canvas.

10.1.8 Rotate

The **Rotate** function allows you to rotate the drawing canvas according to your requirements.

1. Click on the Rotate button on the View panel of the Home tab
2. Click and drag on the drawing canvas to rotate into the desired angle

10.2 TRANSFORMATIONS

Transformation options can be accessed from the **Transformations** panel of the **Modeling** tab. This panel provides basic transformation options including rotation, scaling, mirroring, moving to the origin, moving to a desired location and face oriented aligning.

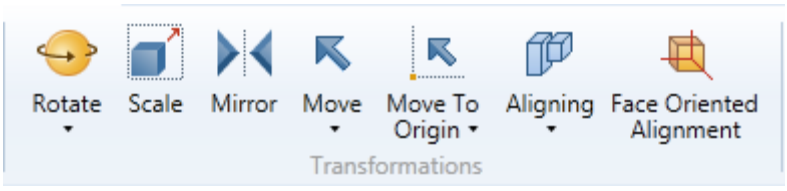


FIGURE 29- TRANSFORMATIONS PANEL

10.2.1 Rotate

You can use the **Rotate** command to rotate the 3D model around a specified **X**, **Y** and **Z** axis or an arbitrary axis and the angle.

To rotate a 3D model select the appropriate model and click on the **Rotate** command on the **Transformations** panel.

You can either specify the **Standard Axis** parameters or else specify the **Arbitrary Axis** parameters to rotate a 3D model

10.2.2 Standard Axis

1. To rotate a 3D model by specifying the standard axes select the desired axis and define an **Angle** to be rotated
2. Click **OK** to confirm

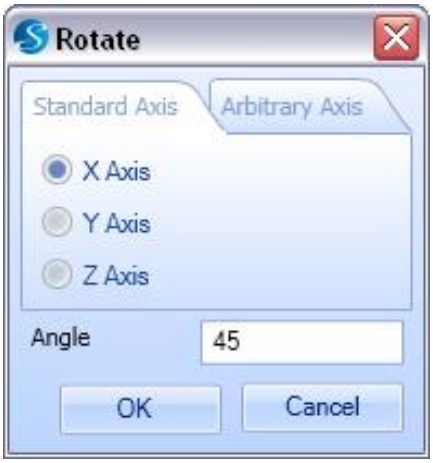


FIGURE 30- STANDARD AXIS

10.2.3 Arbitrary Axis

Rotation by an **Arbitrary Axis** can be done in two ways. You can either select to rotate by defining a point and a vector or by defining two points on the 3D workspace.

10.2.4 Point and a Vector

1. To rotate by a point and a vector select the **Point and Vector** option from the Arbitrary Axis tab.
2. Define the point by specifying the **X**, **Y** and **Z** values.
3. Define the direction vector by specifying the **I**, **J** and **K** values.
4. Define the rotation **Angle**
5. Click **OK**

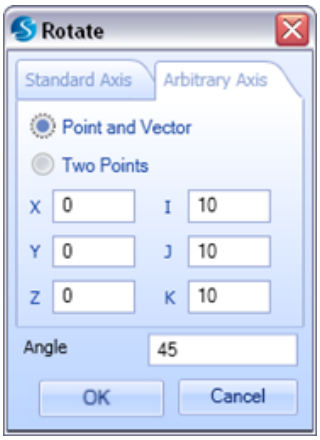


FIGURE 31- POINT AND VECTOR

10.2.5 Two Points

You can rotate 3D models by defining two 3D points as shown in the figure below.

1. Define the first point by specifying the **X**, **Y** and **Z** values
2. Define the second point by specifying the **X2**, **Y2** and **Z2** values

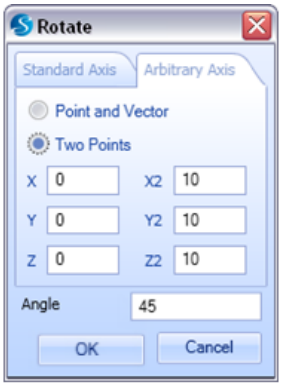


FIGURE 32- TWO POINTS

Note: Refer Appendix B for more details on specifying the arbitrary axes.

10.2.6 Scale

This function allows you to change the size of any 3D model on the canvas. To access the **Scale** command, click the **Scale** button of the **Transformations** panel. You will see the following **Scale** dialog box.

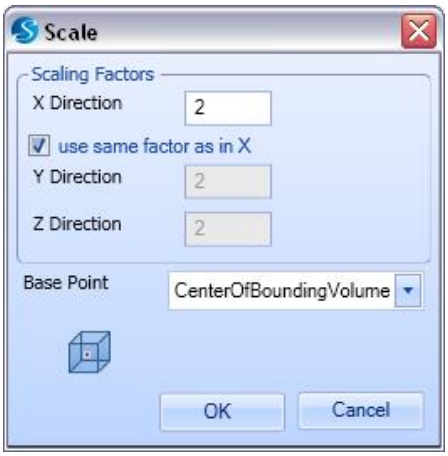


FIGURE 33- SCALING FACTORS

1. The **Scale** button of the **Transformations** panel. You will see the following **Scale** dialog box.
2. To scale a 3D model, select a 3D shape that you want scale
3. Click the **Scale** button from the **Transformations** panel
4. Define scale factors for **X**, **Y** and **Z** directions in the appropriate text boxes
5. Check the **use same factors as in X** check box to use the same scale factor given for the x direction for the other two directions also. Select the **Base Point** as required. The selected base point will be kept fixed while scaling .

Note: The **Scaling Factors** should be greater than zero and if the value of the scale factor is 1 then there will be no change to the size of the object.

10.2.7 Mirror

This option will create a symmetrical mirror image of the selected 3D model according to the specified values in the **Standard Axis** or **Arbitrary Axis** tabs. You can access the **Mirror** command from the **Transformations** tab.

1. Select the 3D model you want to mirror.
2. Click the **Mirror** command from the **Transformations** panel.
3. Define the **Standard Axis** values on the **Mirror** dialog box or select the **Arbitrary Axis** tab to mirror with respect to an arbitrary axis.
4. Select either **Point Vector** or **Two Points** options and define the respective values of the mirror axis.
5. If you check **Keep Original Object,** the original 3D model will remain on the drawing canvas.

FIGURE 34- MIRROR

10.2.8 Move

This function allows you to move a 3D model relatively to a specified direction. The **Move** command can be accessed from the **Transformations** panel.

- To move a 3D shape select the 3D shape you want to move and click the **Move** command found on the **Transformations** panel
- Specify the values of the **X**, **Y** and **Z** directions
- Click **OK** to confirm

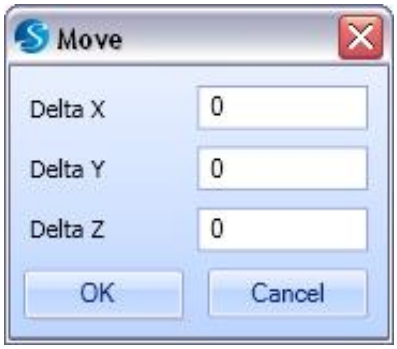


FIGURE 35- MOVE

The Delta **X**, Delta **Y** and Delta **Z** values represent the relative values of the move along the respective directions.

10.2.9 Move to Origin

This command in the **Transformations** panel allows you to the move the reference point of the 3D object to the origin.

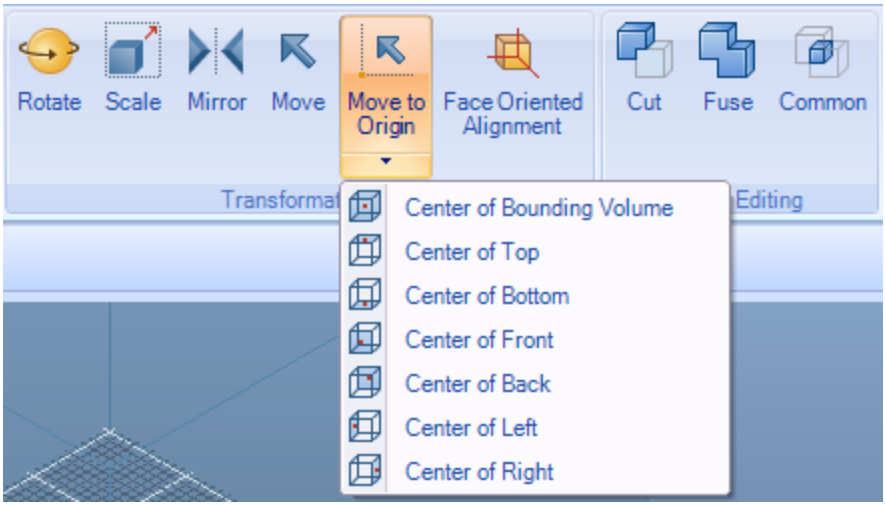


FIGURE 36- MOVE TO ORIGIN

10.2.10 Aligning

This function allows you to align two or more objects by their bounding boxes according to any of the given alignments.

You can access the **Aligning** command from the **Transformations** panel of the **Modeling** tab.

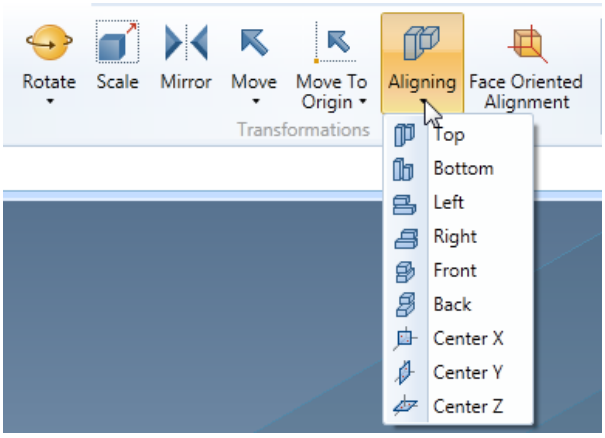
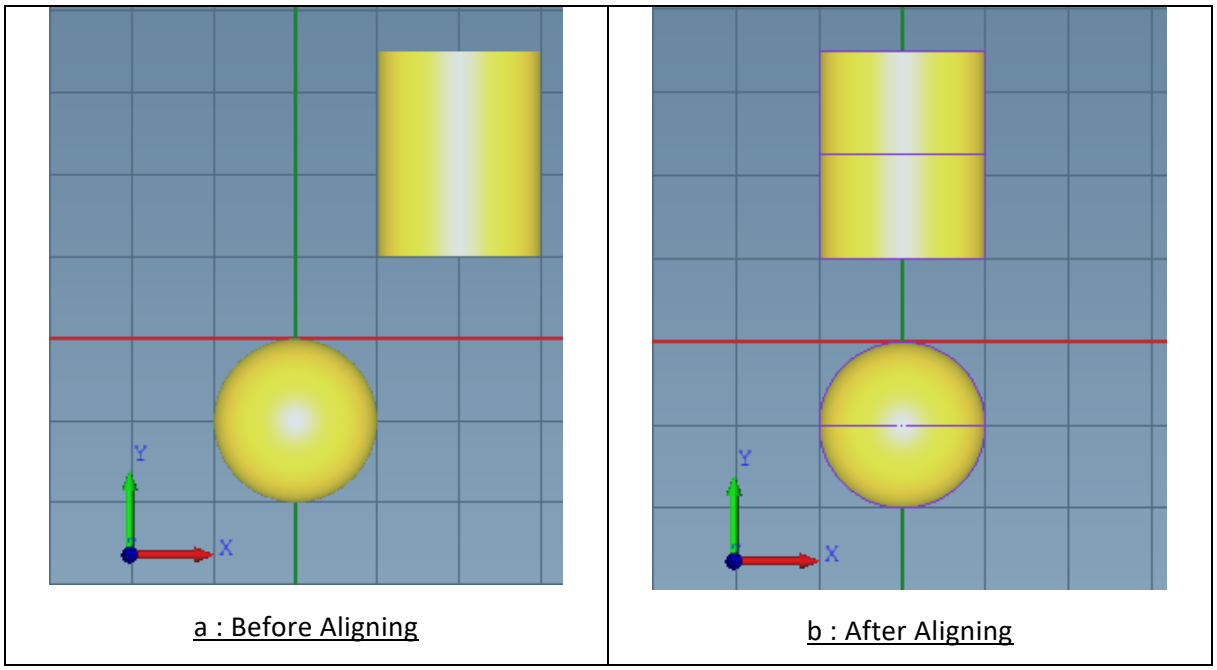


FIGURE 37- ALIGNING

To align the objects:

1. Select the desired 3D objects you want to align
2. Click on the drop-down arrow of the **Aligning** command to view the available alignment options
3. Select a suitable alignment option from the **Aligning** list

The **Center X Align** function will align the center of the bounding boxes of the two selected shapes to the center **X** value of the first selected shape.



a : Before Aligning

b : After Aligning

FIGURE 38- CENTER X ALIGN

The **Center Y Align** function will align the center of the bounding boxes of the two selected shapes to the center **Y** value of the first selected shape.

The **Center Z Align** function will align the center of the bounding boxes of the two selected shapes to the center **Z** value of the first selected shape.

10.2.11 Face Oriented Alignment

This function will change the orientation of the 3D shape in a way that the selected face will be turned to the specified direction.

To change the face oriented alignment of a selected object click the **Face Oriented Alignment** command from the **Transformations** panel

You will find the following window as you click on the **Face Oriented Alignment** command.

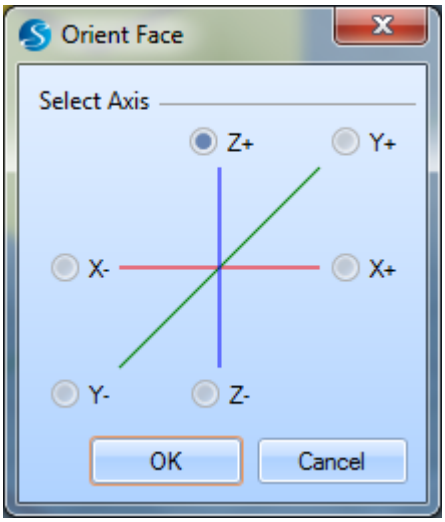


FIGURE 39- ORIENT FACE

1. To change the face oriented alignment you have to first select the **Faces** command from the **Selection Mode** list on the **Solid Operations** panel
2. Select the 3D shape which you want change the face oriented alignment
3. Select any of the face oriented alignment options from the **Face Oriented Alignment** list

Note: For more details on Solid Operations panel refer the Solid Operations section in this document

10.3 BOOLEAN OPERATIONS

Boolean Operations allows you to modify the 3D objects by cutting, fusing and extracting common areas of the 3D objects.

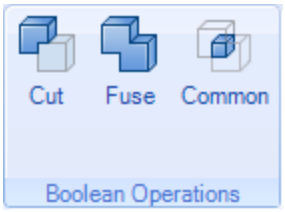


FIGURE 40- BOOLEAN OPERATIONS

The following **Boolean Operations** were done by inserting a **Cylinder** with a **Height** of 25 and a **Radius** of 10 and a **Sphere** with a **Radius** of 10 and **Center Z** as 25

Note: When you perform any Boolean Operation the original shapes will become a single 3D object. The Shape Tree will display it as one shape as shown in the figure below.

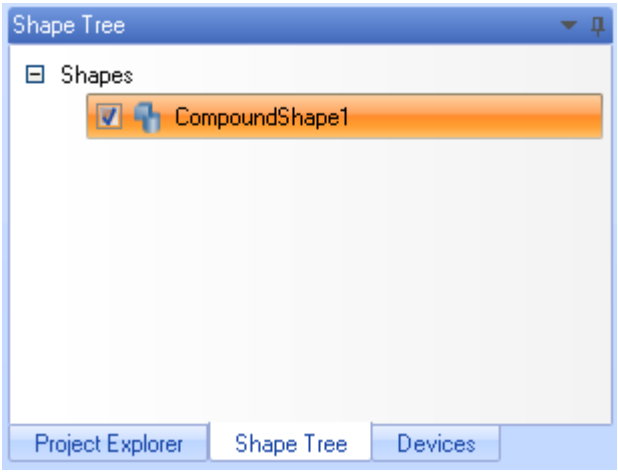


FIGURE 41- COMPOUND SHAPE ON SHAPE TREE

10.3.1 Cut

The **Cut**  command gives you the option of cutting a particular overlapped section of the first selected 3D shape from the other selected 3D shape.

You can access this command from the **Boolean Operations** panel of the **Modeling** tab.

To cut an overlapped section of an object:

1. Place the 3D shapes such that one shape overlaps the other
2. Select the 3D shape that you want to modify. (Select the Cylinder)
3. Select the other 3D shape that you use to cut. (Ctrl + click the object)
4. After you have selected the two 3D shapes, click the **Cut** button on the **Boolean Operations** panel

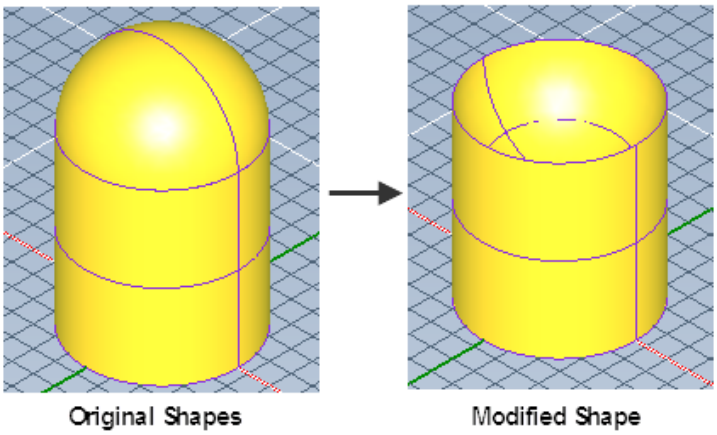


FIGURE 42- CUT SHAPE

10.3.2 Fuse

The **Fuse**  command gives you the option of joining two 3D objects together to make a single 3D shape.

You can access the **Fuse** command from the **Boolean Operations** panel of the **Modeling** tab.

To fuse two 3D objects:

1. Select the two 3D objects you want to fuse
2. Click on the **Fuse** button on the **Boolean Operations** panel

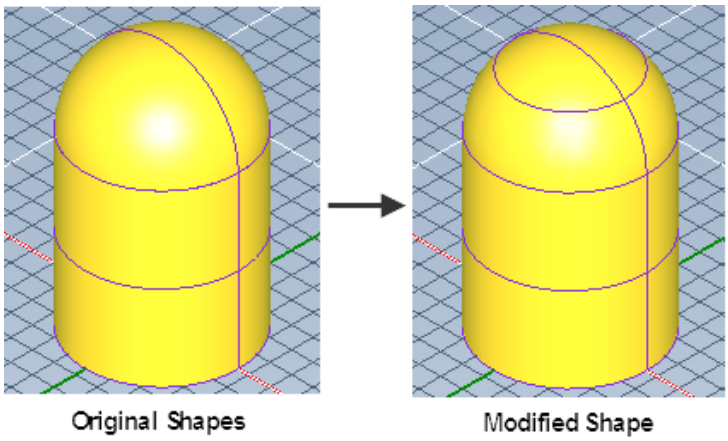


FIGURE 43- FUSE SHAPE

10.3.3 Common

The **Common**  command gives you the option to extract the common section of two selected 3D shapes.

You can access the **Common** command from the **Boolean Operations** panel.

To extract the common section using the **Common** operation:

1. Select the two 3D shapes
2. Click the **Common** button on the **Boolean Operations** panel

Note: ScanMaster™ Designer software allows you to select only two shapes at a time to make a Boolean Operation.

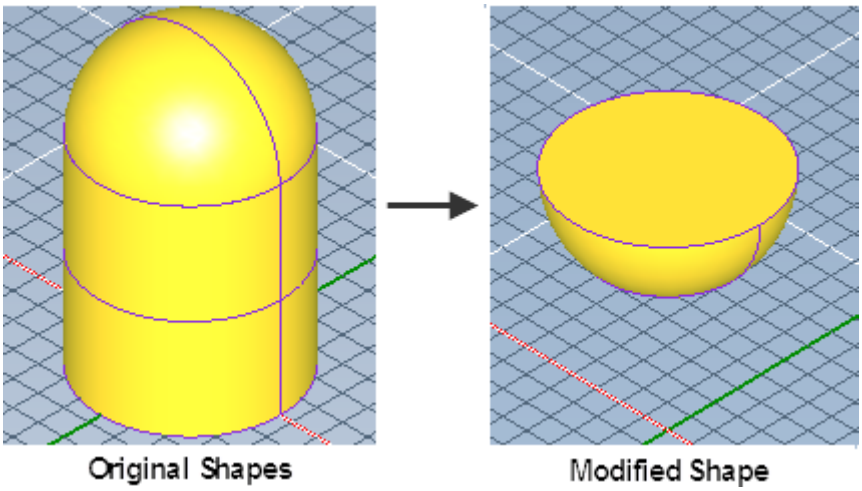


FIGURE 44- EXTRACTING THE COMMON PART OF THE TWO 3D SHAPES

10.4 SOLID OPERATIONS

You can do certain modifications to the basic 3D models using the options in **Shape Operations** panel in the **Modeling** tab.

FIGURE 45- SOLID OPERATIONS

Note: These functions will form compound shapes in the Shape Tree same like in Boolean Operations

10.4.1 Face Revolve

Face revolving function allows you to revolve a face of a 3D object over an axis. The revolving axis can be defined by specifying the values on the **Standard Axis** or an **Arbitrary axis** tabs.

To revolve a face of an object:

1. Select the desired 3D object
2. To change the **Selection Mode** to **Faces** selection mode to, click the **Faces** option from the **Selection Mode** list of the **Shape Operations** panel
3. Select the particular face you want to revolve
4. Click on the preferred face of the3D object
5. Click the **Face Revolve** command on the **Shape Operations** panel
6. You will find the **Revolve** dialog box as you see in the figure below
7. Define the axis that you want revolve on the **Standard Axis** tab or select the **Arbitrary Axis** to revolve with respect to an arbitrary axis

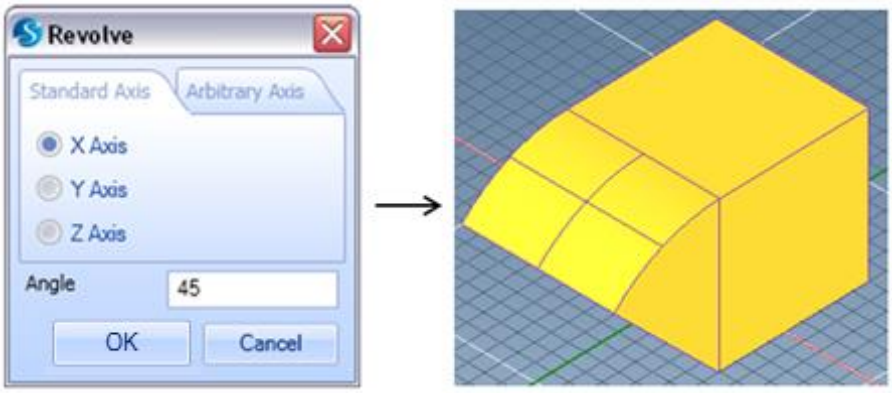


FIGURE 46- FACE REVOLVED BY A STANDARD AXIS

1. Select either **Point and Vector** or **Two Points** options and define the respective values of the revolving axis
2. Define the revolving angle in the **Angle** text box
3. Click **OK**

10.4.2 Face Extrusion

This function allows you to change the dimensions of an object by extending a selected face according to a specified extrusion length.

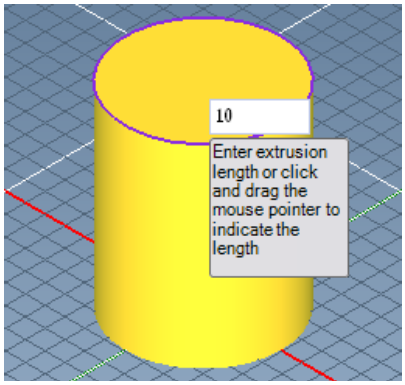


FIGURE 47- DEFINE THE EXTRUSION LENGTH

You can access the **Face Extrusion** command from the **Shape Operations** panel on the **Modeling** tab.

To extrude a selected face of an object:

1. First change the **Selection Mode** to **Faces** selection mode. Click the **Faces** option from the **Selection Mode** list of the **Shape Operations** panel
2. Select the particular face you want to extrude
3. Click the **Face Extrusion** button on the **Shape Operations** panel
4. Click on the particular face of the object and specify the length to be extruded on the given text box as shown in the figure
5. You can also click and drag the mouse pointer on the selected face until you reach the desired length that you need to extrude as you see in the next figure. Click on the canvas after you reach the desired length

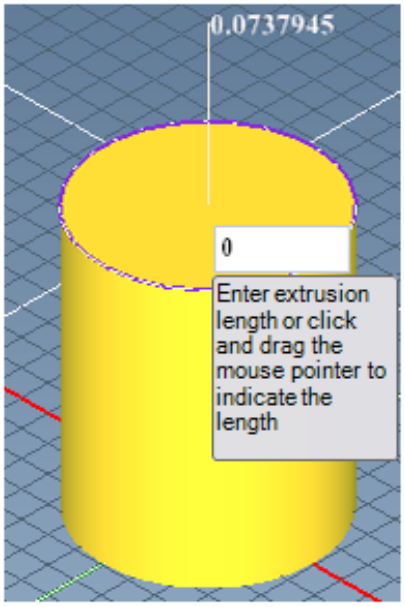


FIGURE 48- DRAG TO THE DESIRED EXTRUSION LENGTH

10.4.3 Fillet

This function allows you to modify the edges of a selected 3D object.

To fillet a 3D object:

1. Change the **Selection Mode** according to your requirements
2. Select the 3D object on which you want to perform the filleting operation
3. Click the **Fillet**  command
4. Specify the fillet **Radius** on the **Fillet** dialog box

FIGURE 49- FILLET

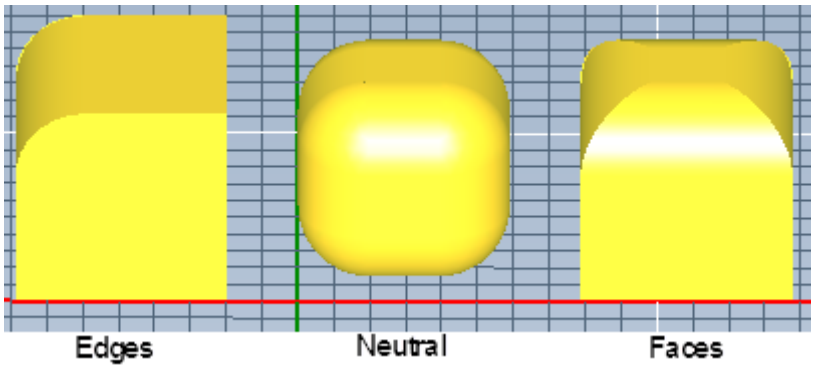


FIGURE 50- FILLETS ON DIFFERENT SELECTION MODES

The above figure shows how a **Box** with the dimensions of 12, 12, 12 will be modified according to its different selection modes when the **Fillet** command was used with a **Radius** of 5.

Note: The Fillet function will not be applicable to the Vertices selection mode.

10.4.4 Selection Mode

This command in the **Solid Operations** panel allows you to specify the selection mode.

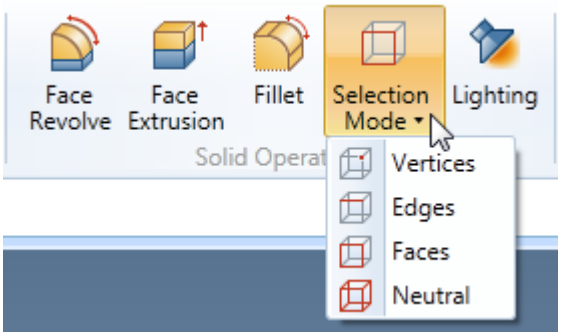


FIGURE 51- SELECTION MODE

Note: Neutral mode is the default selection mode which enables the selection of whole 3D shapes.

10.4.5 Lighting

The **Lighting** command allows you to change the lighting effects of the 3D object on the 3D drawing canvas.

Click on the **Lighting**  button on the **View** panel of the **Home** tab. The following window will be displayed.

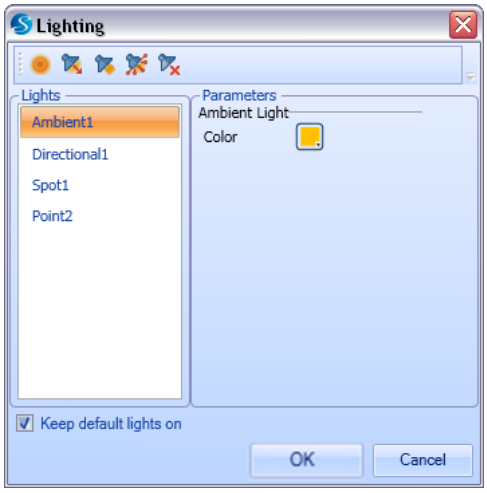


FIGURE 52- LIGHTING WINDOW

10.4.6 Ambient Light

Ambient Light effect illuminates uniform light rays around the object from every direction.

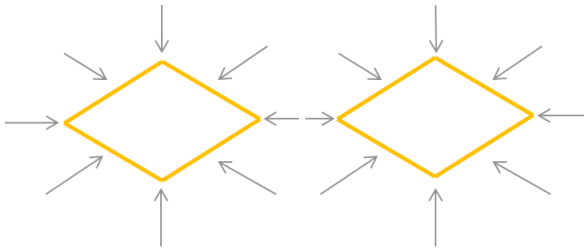


FIGURE 53- ILLUSTRATION OF AMBIENT LIGHT

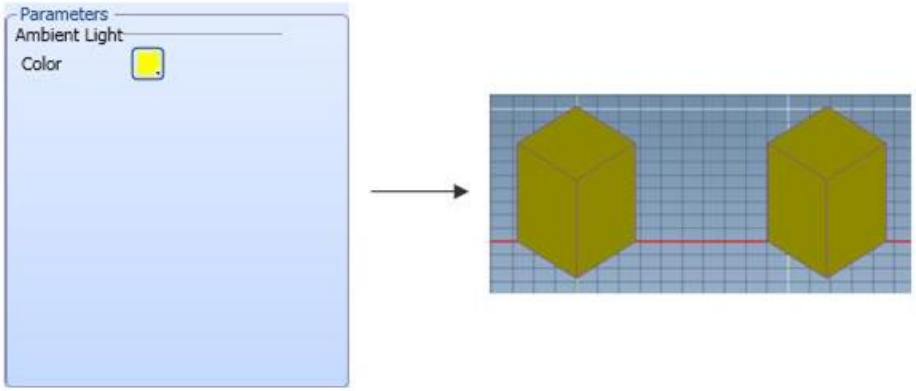


FIGURE 54- AMBIENT LIGHT

Note: You can select any color of the light from the Color option in the Parameters Panel.

10.4.7 Directional Light

Directional Light emits light rays from a particular defined direction.

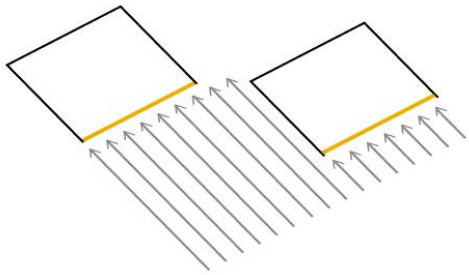


FIGURE 55- ILLUSTRATION OF DIRECTIONAL LIGHT

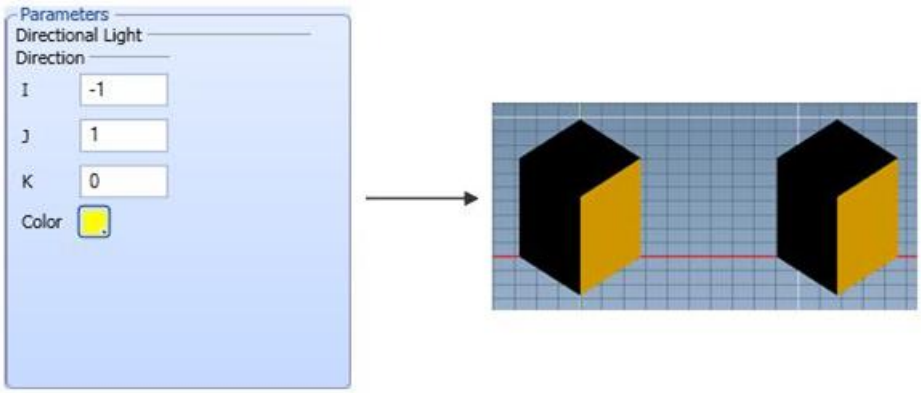


FIGURE 56- DIRECTIONAL LIGHT

10.4.8 Spot Light

The **Spot Light** effect spots the light ray on to a particular specified position on the canvas.

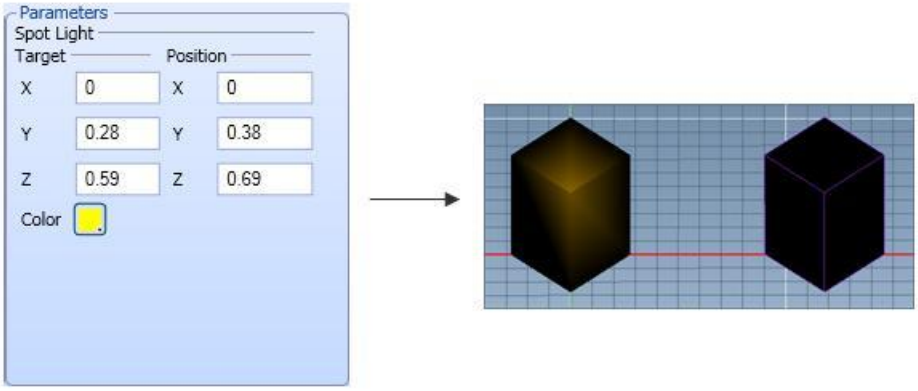


FIGURE 57- SPOT LIGHT

1. **Target** : Specifies the targeting position
2. **Position** : Specifies the position of the light

10.4.9 Point Light

The **Point Light** command enables you to spread light rays towards the drawing canvas from a specified position of the light.

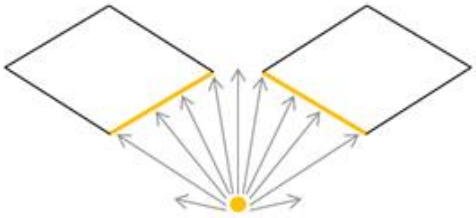


FIGURE 58- ILLUSTRATION OF POINT LIGHT

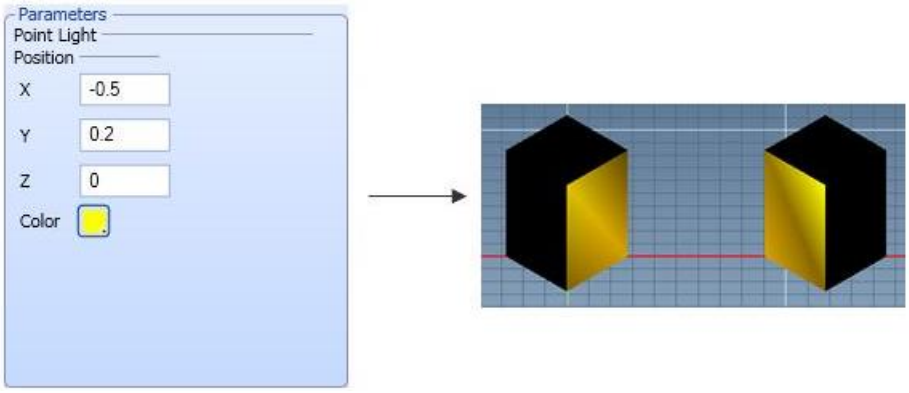


FIGURE 59- POINT LIGHT

Deleting the Light Effects

To delete any inserted light effect on the drawing canvas:

1. Select the light effect you want to delete from the **Lighting** Window
2. Click on the **Delete Light** button

Note: Select the Keep default light on check box on the bottom-left of the window to reset the light effects to the default settings.

Shapes in the ScanMaster™ Designer 2D user manual for more on editing 2D shapes

11 3D PROCESS PREPARATION

The final step before you mark your 3D model is the preparation of the 3D process. This chapter guides you on the process of preparing the 3D model for your laser marking.

11.1 SURFACE MARKING PROCESS

After you have created the 2D and 3D models you can start working on your 3D marking process. The surface marking options in ScanMaster™ Designer software are designed to mark 2D models on a non-uniform 3D surface. This software enables you to project or wrap a 2D model on to the 3D model.

Note: Refer Appendix A for more details about the differences between the **Projection** and **Wrapping** features in 3D surface marking.

1. To start a surface marking process, select the 3D model from the **Project Explorer** which you want to process
2. Click on the **Surface Marking**  button on the Marking **Processes** panel of the **Project** tab

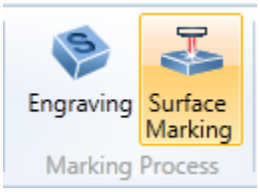


FIGURE 60- SURFACE MARKING

3. You will find the new surface marking process element on the **Project Explorer** once you create a surface marking process

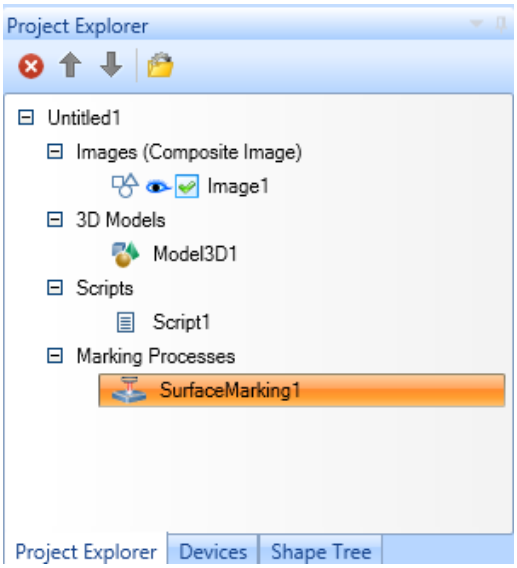


FIGURE 61- SURFACE MARKING PROCESS

4. If you click on the **Surface Marking** button before selecting the particular 3D model you will find the following **Properties** tab which will direct you to select the desired 3D model

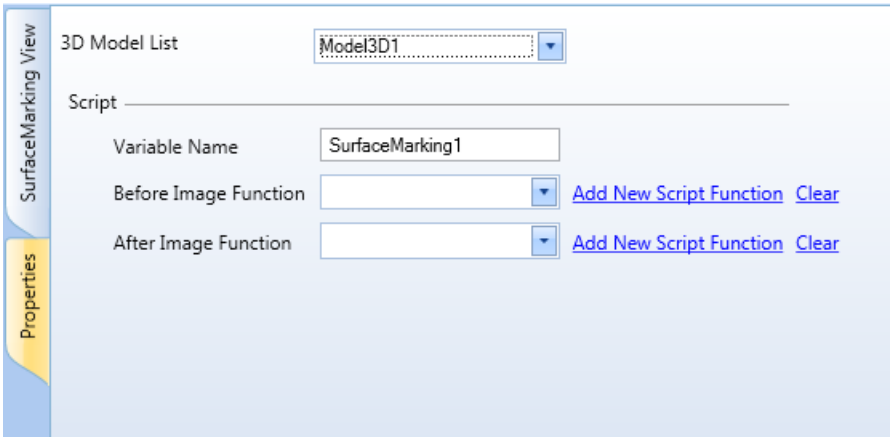


FIGURE 62- SURFACE MARKING PROPERTIES TAB

5. The **Properties** tab allows you to select the appropriate 3D model from the given **3D Model List**
6. Click on the **3D Model List** drop-down arrow to select the 3D model you want to process
7. Move to the **Model** tab to proceed. Then you will see the surface marking 3D model that you selected.

11.1.1 Adding a 2D image

To add the 2D image to the 3D model on the surface marking process:

1. Click on the **Add 2D Image** button on the **Surface Marking panel** of the **SurfaceMarking** tab

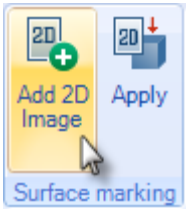


FIGURE 63- ADD 2D IMAGE BUTTON

2. You will find the following **Add 2D Image** dialog box

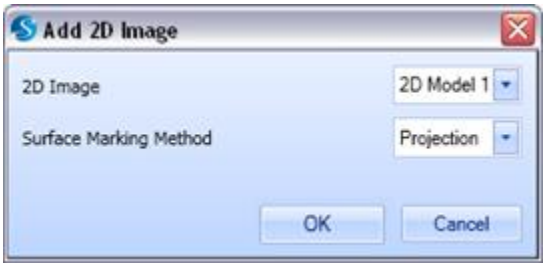


FIGURE 64- ADD 2D IMAGE

3. Select the appropriate 2D model from the **2D Image** drop-down list
4. Select the method you want to map the 2D model from the **Surface Marking Method** drop-down list
5. Select either **Projection** or **Wrapping** and click **OK** to confirm and proceed

11.2 GENERATE 3D SURFACE MARKING MODEL

11.2.1 Placement of 2D Image

You can apply transformations to the 2D image before you do the marking to obtain the correct position and scaling of the 2D image. ScanMaster™ Designer software allows you to **Move**, **Scale** and **Rotate** the 2D model to adjust and fix it to the 3D model according to your requirements.

1.

1. Click on the **Shape Tree** tab
2. Select the desired 2D model

You will be able to find the **Properties** panel in the right-bottom of the window

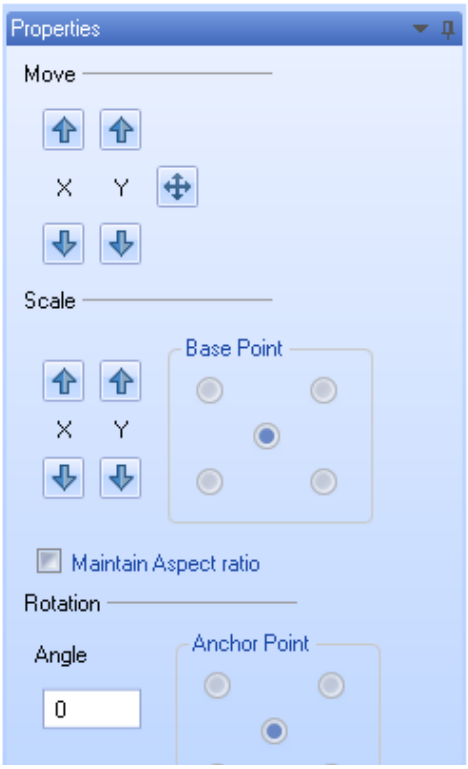


FIGURE 65- PROPERTIES OF 2D IMAGE

11.2.2 Moving 2D Images

You can use the options in the **Move** section of the **Properties** panel to move the 2D image into the desired place.

The arrows as shown in the figure above, allow you to move the 2D image along the **X** and **Y** directions of the 2D image.

You can use the **Move 2D Image** command to move the 2D. Click and drag the mouse on the 2D image. **Move 2D Image** command functions only before you apply the 2D image to your 3D model.

Note: The amount of units in which the 2D image moves at each click of the arrows will be as configured in the Moving Step option in the Miscellaneous 3D page of the Application Preferences wizard.

11.2.3 Scaling 2D Images

You can use the options in the **Scale** section of the **Properties** panel to scale the 2D image according to your requirements.

The arrows shown in the figure of the **Properties** tab in the previous page allow you to scale the 2D image along the **X** and **Y** directions of the 2D image.

The options in the **Base Point** panel allow you to select a desired base point. The selected base point will be kept fixed while you scale the 2D image.

Check the **Maintain Aspect Ratio** option to keep the **X** and **Y** scale factors both similar.

Note: The amount of units in which the 2D image scales at each click of the arrows will be as configured in the Scaling Percentage option in the Miscellaneous 3D page of the Application Preferences wizard.

11.2.4 Rotating 2D Images

You can use the options in the **Rotation** section of the **Properties** panel to rotate the 2D image to the desired angle.

Specify the angle to be rotated on the **Angle** text box and select the desired anchor point from the **Anchor Point** panel. The object will be rotated around the selected anchor point.

You can use the **Rotate clockwise** and **Rotate Anticlockwise buttons** to rotate to the 2D image in the desired direction.

11.2.5 Viewing Surface Marking Objects

ScanMaster™ Designer software provides you various viewing options of the surface marking objects.

You can find these options in the **View** panel of the **SurfaceMarking** tab.

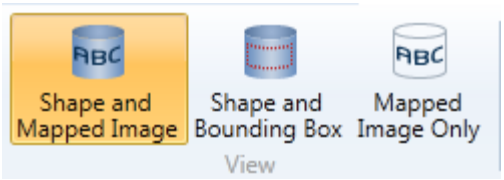


FIGURE 66- VIEWING SURFACE MARKING OBJECTS

11.2.6 Shape and Mapped Image

The **Shape and Mapped Image**  function allows you to view the 3D model and the mapped 2D image both on the drawing canvas.

You will find this viewing option by default in a surface marking process.

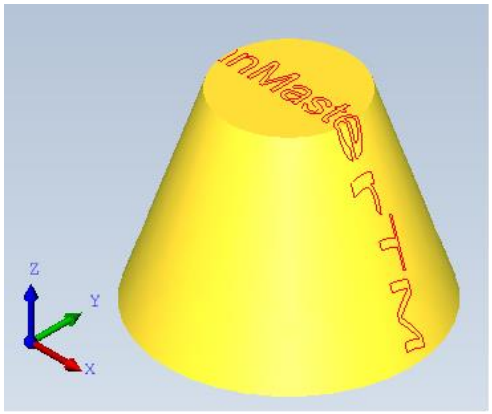


FIGURE 67- SHAPE AND MAPPED IMAGE

11.2.7 Bounding Box and Shape

The **Bounding Box and Shape**  function allows you to view the bounding box of the mapped 2D image along with the 3D model.

This feature efficiently adjusts a 2D image especially when you handle complex models.

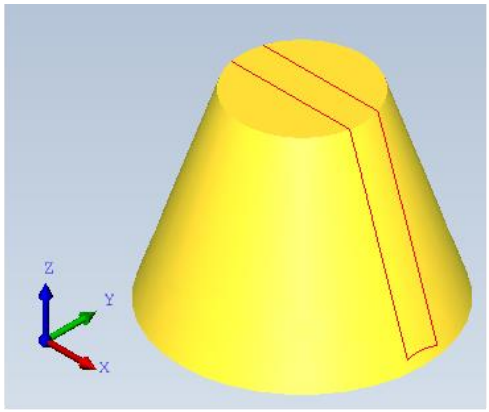


FIGURE 68- BOUNDING BOX AND SHAPE

11.2.8 Mapped Image Only

The **Mapped Image Only**  function allows you to view only the mapped image on the drawing canvas.

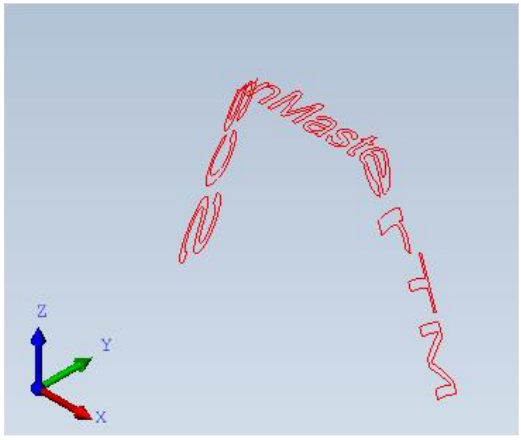


FIGURE 69- MAPPED IMAGE ONLY

11.2.9 Running the surface marking project

Once the surface marking process is configured you can proceed to laser marking. The ScanMaster™ Designer provides a very flexible way of managing and controlling the laser marking processes through the script object of the project.

By default, the script will contain a single command to laser mark all the objects in the project tree. To run only the surface marking process, simply delete the default “ScanAll()” command and insert <ScriptVariableName>.Start() command to the script. The command starts with the surface marking object name and followed by a “.Start()” command. For example, to start “SurfaceMarking1” object simply insert SurfaceMarking1.Start() command to the script.

11.3 ENGRAVING PROCESS

Engraving is the process of implementing any desired 3D model by removing material from a 3D object. The process of engraving in ScanMaster™ Designer software enables you to do a laser engraving project.

11.3.1 Create an Engraving Process

To create an engraving, click the **Engraving**  command on the Marking **Processes** panel of the **Project** tab

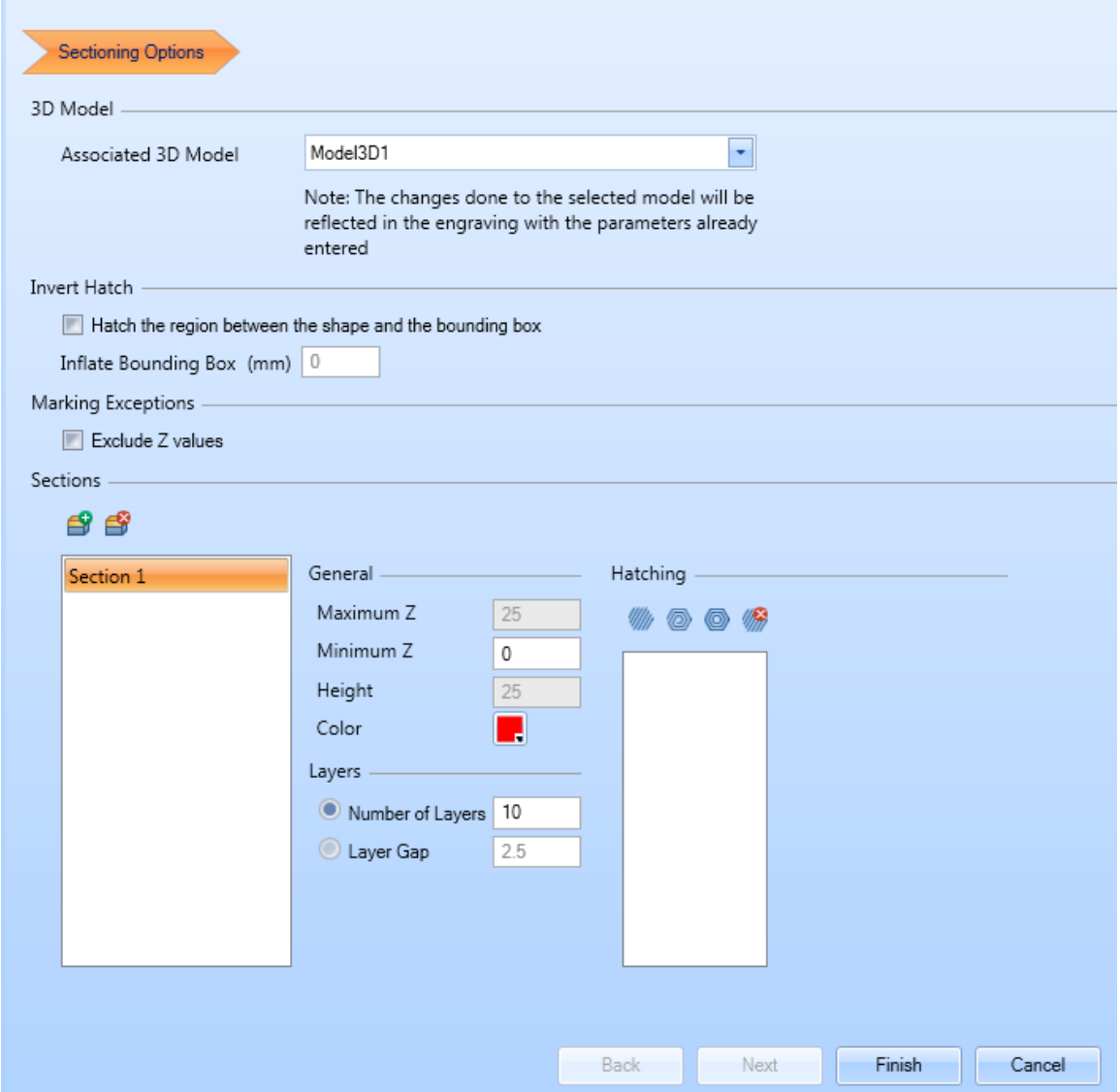


FIGURE 70- ADD ENGRAVING MODEL WIZARD

1. Click the **3D Model List** drop-down arrow to select the 3D model that you want to perform the engraving
2. Specify the settings of the sections and hatching styles of the engraving process.

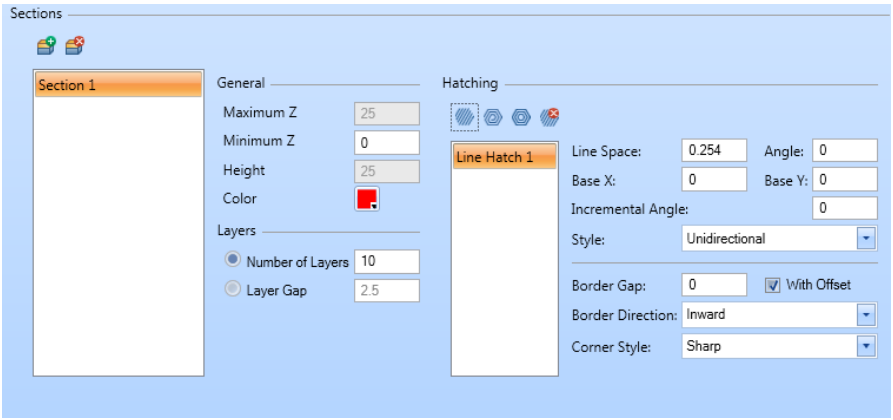


FIGURE 70- SECTIONING OPTIONS

The **Sections** refers to a collection of layers in the engraving 3D model. Initially the 3D model is in a single section. You can split the 3D model into different sections if required. Dividing the 3D model into different sections is useful when there are variations in the properties of the materials, across the cross-section of the 3D model.

The number of layers in a section affects the quality of the output. The number of layers in a section depends on the materials. The harder the material, higher the number of layers should be.

You can specify the properties of the section(s) from the **Sectioning options** wizard.

To add a new **Section**:

1. Click on the **Add Section** button on the **Sections** panel

To change the properties of the **Section**:

1. Specify the **Minimum Z** value of the section. The **Minimum Z** and **Maximum Z** values define the total **Z** range of the section by specifying the top-most and bottom-most values
2. Select either **Number of Layers** or **Layer gap** to specify the number of layers in which the engraving will be processed
3. Select a color for different sections so that you can identify the difference of the applied sections
4. Click the **Delete Section** button to delete any sections from the process
5. Add a hatching style from the given **Hatch** styles in the **Hatching** panel
6. Specify the properties of the **Hatching** styles
7. Click the **Delete Hatch** button to delete a **Hatch**
8. Click **Finish**

Note: Refer the ScanMaster™ Designer 2D user manual Hatch Operations in Chapter 8 Shape Operations, for more details on specifying the Hatching Styles.

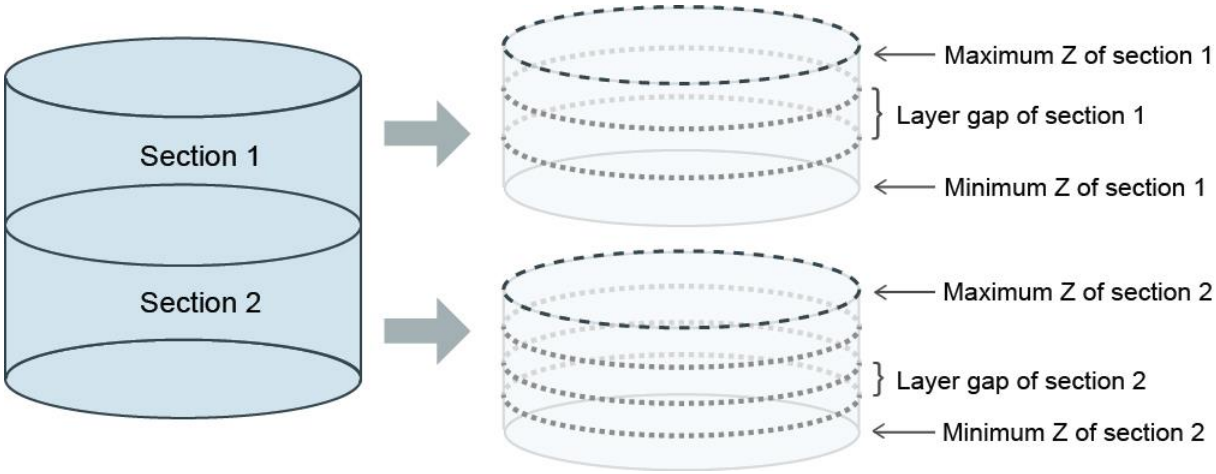


FIGURE 17- SECTIONS AND LAYERS OF ENGRAVING

11.3.2 Modify an Engraving

From the **Properties** tab engraving properties can be changed even after creating the Engraving process. The changes made through the properties tab will be added while navigating back to **Engraving View**.

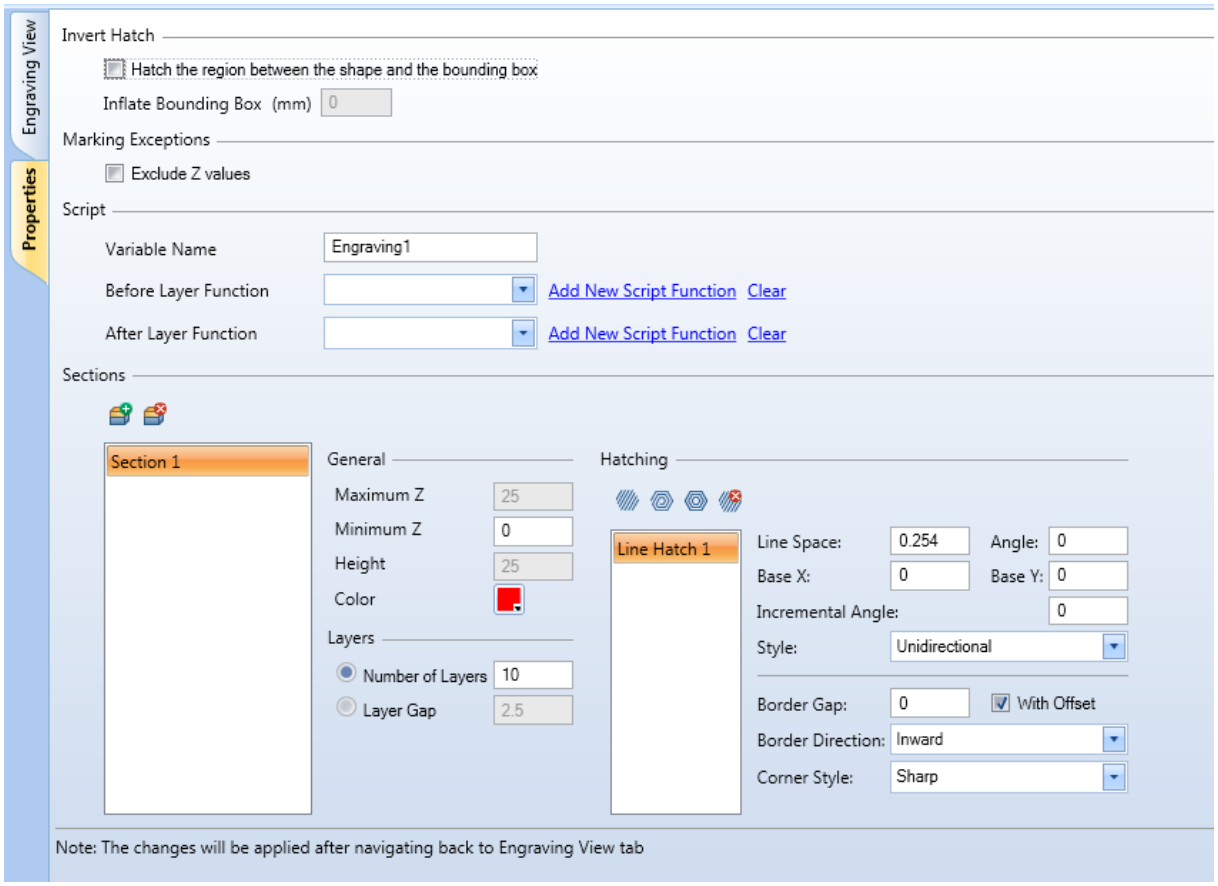


FIGURE 73- ENGRAVING PROPERTIES

11.3.3 Modify a Section

You can also change the properties of the hatching styles and the colors of the sections.

1. Select the section(s) from the **Engraved Layers** tab

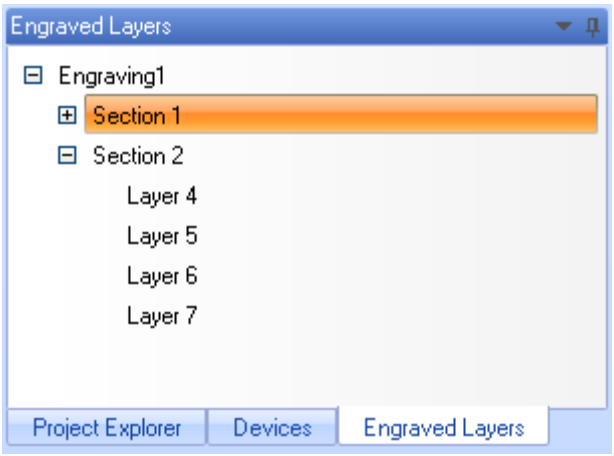


FIGURE 74- ENGRAVING PROCESS TREE

2. Edit the properties of the section from the options in the **Properties** panel below the **Engraved Layers**

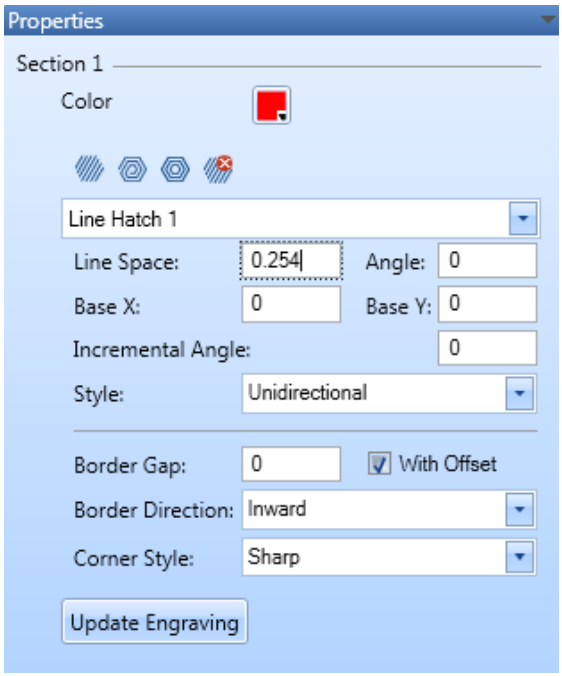


FIGURE 75- SECTION PROPERTIES

3. Click on the **Update Engraving** button to confirm the changes.

11.3.4 Viewing Engraved Objects

The options in the **Viewing Engraved Objects** panel of the **Processed Model** tab are featured in a way that enables you to view the engraved objects in three different styles.

The **Boundary Only**  function allows you to view only the boundary of the engraving sections

The **Hatch Only**  function allows you to view only the hatch applied to the 3D shape.

The **Boundary and Hatch**  function allows you to view both the boundary and the hatch of the 3D shape which is to be engraved.

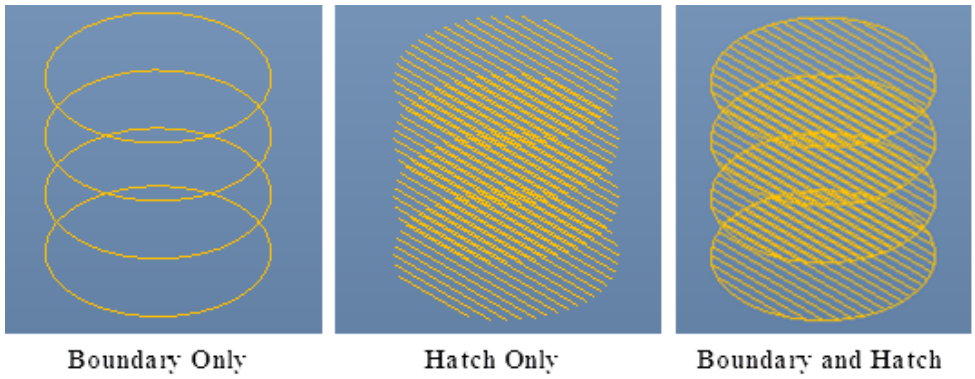


FIGURE 76- VIEWING ENGRAVED OBJECTS

11.3.5 Engraving Simulations

After you have specified the sections of your engraving process you can preview the engraving process using the options in the **Engraving Simulations** panel of the **Processed Model** tab.

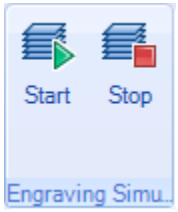


FIGURE 77- ENGRAVING SIMULATIONS

1. Select the desired section(s) from the **Engraved Layers** tab.

2. Click on the **Start**  button to see the order of the engraving process
3. Click the **Stop**  to stop the simulation

The simulation will depend on your selection of the section(s) from the **Engraved layers** tab.

If you want to preview the whole 3D model engraving process select the engraving process from the **Engraved Layers** tab**,** or select the desired section only to view the simulation of that particular section only.

11.3.6 Running the Engraving project

Once the engraving process is configured you can proceed to laser marking. The ScanMaster™ Designer provides a very flexible way of managing and controlling the laser marking processes through the script object of the project.

By default, the script will contain a single command to laser mark all the objects in the project tree. To run only the engraving process, simply delete the default “ScanAll()” command and insert <ScriptVariableName>.Start() command to the script. The command starts with the engraving object name and followed by a “.Start()” command. For example, to start “Engraving1” object simply insert Engraving1.Start() command to the script.

11.4 SAMPLE SURFACE MARKING

In this section you will be provided an example considering a simple scenario in 3D surface marking process.

Scenario: Create a model of a pipe, project and wrap a text ScanMaster to the internal surface of the pipe.

To try this sample you need to :

1. Start ScanMaster™ Designer
2. Create the 3D Model
3. Modify the 3D Model
4. Transform the 3D Model
5. Create the 2D Model
6. Change the Viewing Orientation
7. Process

8. Edit the 2D Model

11.4.1 Starting ScanMaster™ Designer

1. Click **Start | Programs | CTI | ScanMaster™ Designer**
2. Click **New| New 3D Project**

11.4.2 Create the 3D model

1. To insert a cylinder shape to the drawing canvas click on the **Cylinder**  command on the **Basic** panel of the **Home** tab.
2. Specify the **Radius** and **Height** of the **Cylinder**
3. Click **OK**

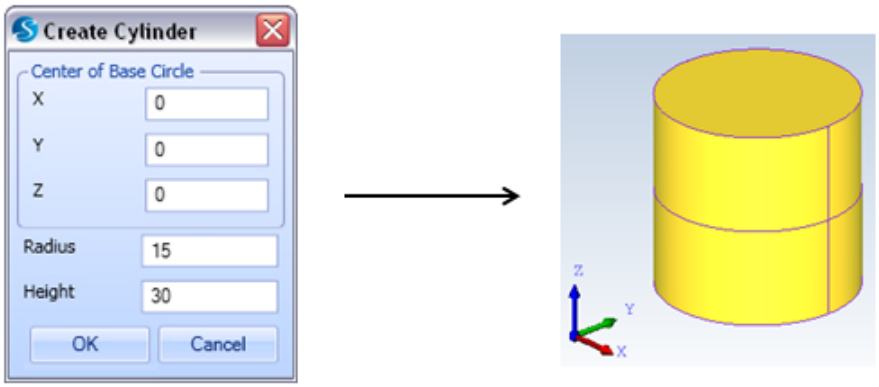


FIGURE 78- CYLINDER ON THE CANVAS

4. To insert a box shape click on the **Box**  command on the **Basic** panel of the **Home** tab
5. Specify the **Base Point**, **Width**, **Height** and **Length** of the **Box**
6. Click **OK**

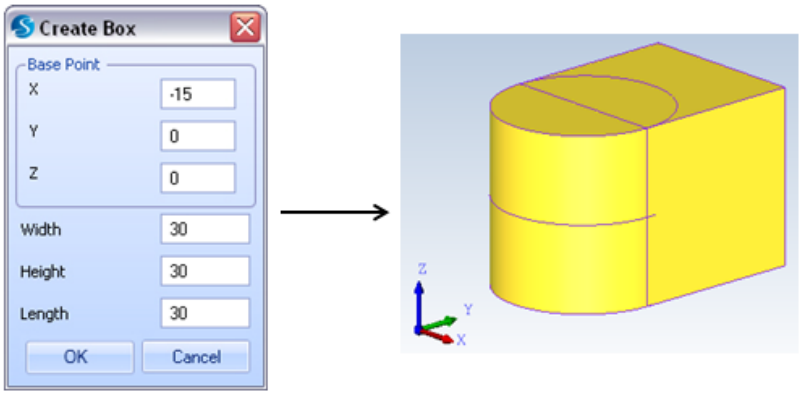


FIGURE 79- BOX SHAPE ON THE CANVAS

11.4.3 Modify the 3D model

1. Select both the shapes

Note: Select the **Cylinder** shape initially and then select the **Box shape** as you are about to cut the **Cylinder** using the **Box** shape.

2. Click **Cut**  from the **Boolean Operations** panel of the **Modeling** tab

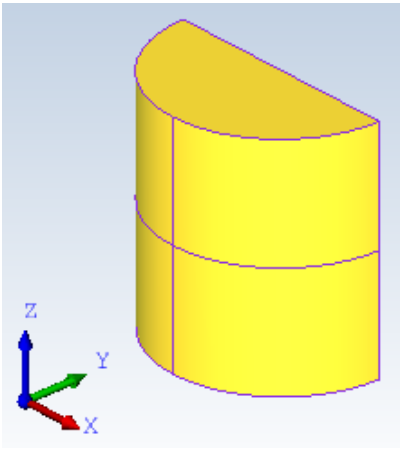


FIGURE 80- EDITED CYLINDER

3. Insert another **Cylinder**  shape
4. Specify the **Radius** and **Height** of the **Cylinder**
5. Click **OK**

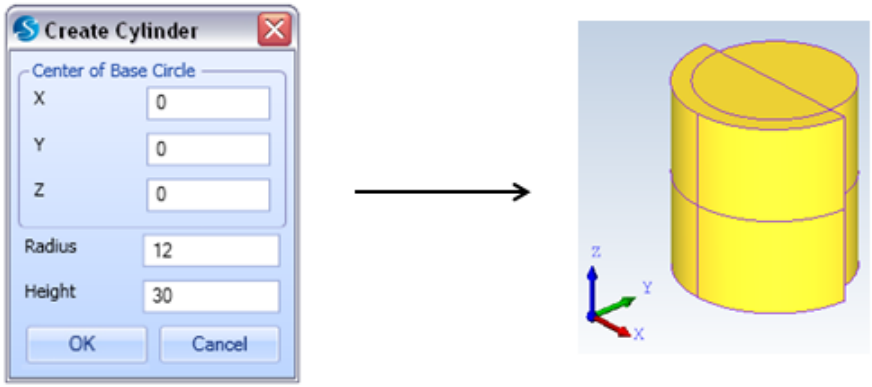


FIGURE 81- THE TWO CYLINDERS

6. Select both shapes
7. Click **Cut**  from the **Boolean Operations** panel of the **Modeling** tab

The result will be as shown in the figure below.

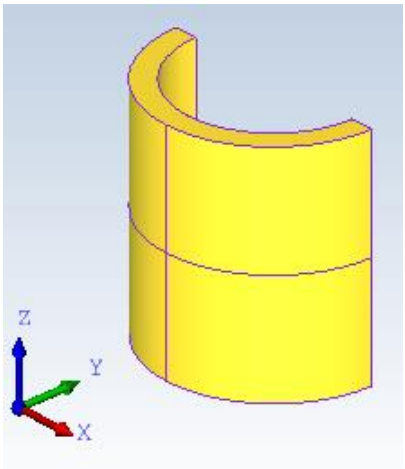


FIGURE 82- THE EDITED CYLINDER

11.4.4 Transform the 3D Model

Rotate

1. Select the 3D model
2. Click on the **Rotate** option in the **Transformations** panel of the **Modeling** tab
3. Specify the **Standard Axis** and the **Angle** to be rotated

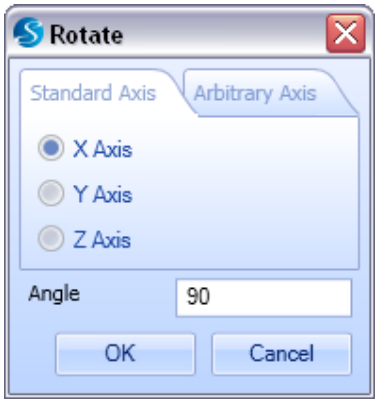


FIGURE 83- ROTATING PARAMETERS

Move to Origin

1. Click the **Move To Origin** button in the **Transformations**
2. Select the **Center of Bottom** option from the list

11.4.5 Create the 2D Image

1. Click the 2D image that is already added to the project by default
2. Click the **Insert Text** T button

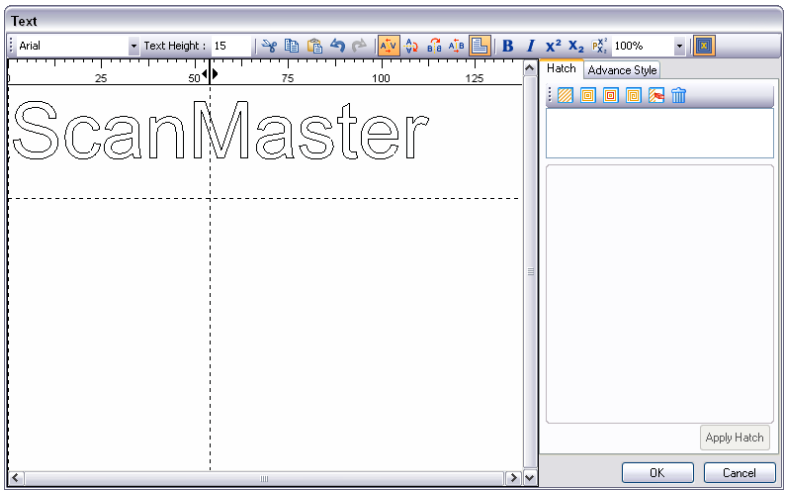


FIGURE 84- TEXT EDITOR

3. Specify the **Text Height** and press **Enter**

4. Type “ScanMaster” as the text
5. Click **OK**

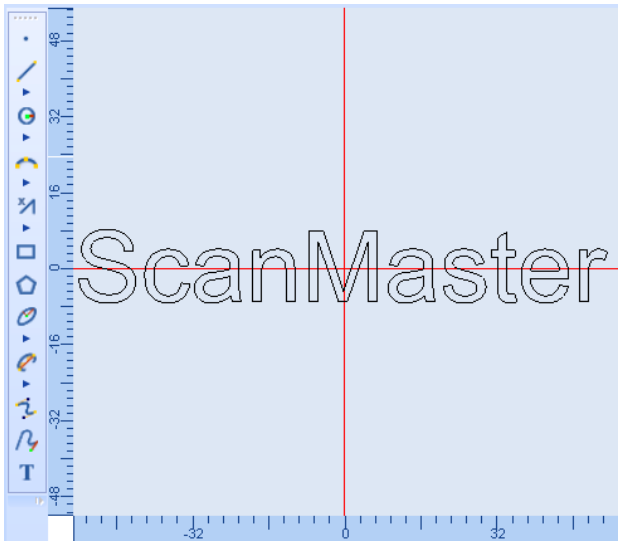


FIGURE 85- 2D IMAGE

11.4.6 Change the Viewing Orientation

Before you start the process change the viewing orientation to **Top** in order to make your work much easier.

1. Click **View Orientation** button on the **View** panel
2. Select **Top** from the **View Orientation** list

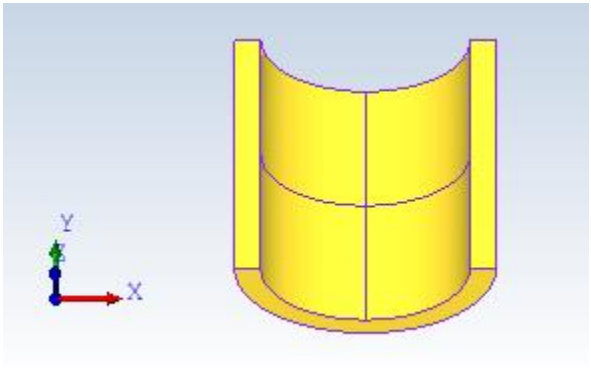


FIGURE 86- TOP ORIENTATION

11.4.7 Process

To do a Projection:

1. Click the **Surface Marking** button from the **Processes** panel of the **Home** tab
2. Select the **Surface Marking1** process from the **Project Explorer** tab

Click the **Add 2D Image** button on the **Surface Marking** panel of the **Processed Model** tab

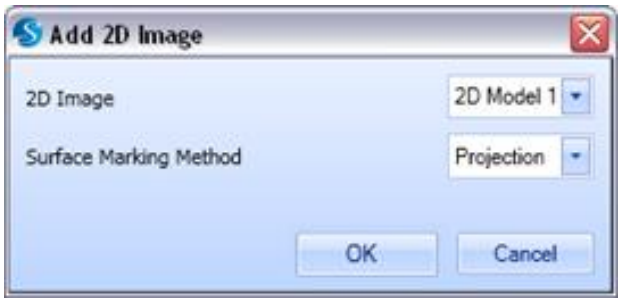


FIGURE 87- ADD 2D IMAGE

1. Select the **2D Model 1**
2. Select **Projection** from the **Surface Marking Method** drop-down menu
3. Click **OK**

11.4.8 Edit the 2D Image

1. Select the **Shape Tree** tab
2. Select the **2D Model 1**
3. Select the **Properties** tab of the **Shape Tree**
4. Check the **Maintain Aspect Ratio** check box
5. **Scale** down the 2D image across the **X** axis to adjust according to the 3D model
6. Click on the **Apply**  button to project the 2D image to the 3D model

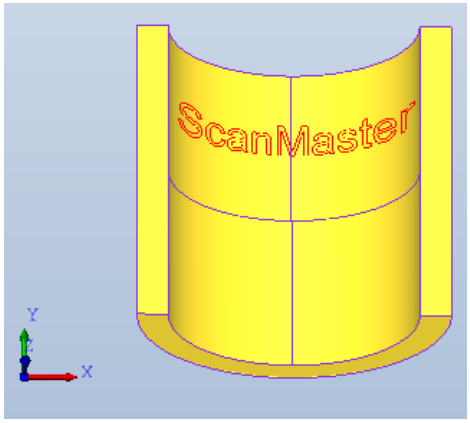


FIGURE 88- APPLY PROJECTION

To do a **Wrapping**:

1. Click **Add 2D Image**  button on the **Surface Marking** panel of the **Processed Model** tab
2. Select the **2D Model 1**
3. Select **Wrapping** from the **Surface Marking Method** drop-down menu
4. Select the desired face of the 3D model where you need to wrap the 2D image

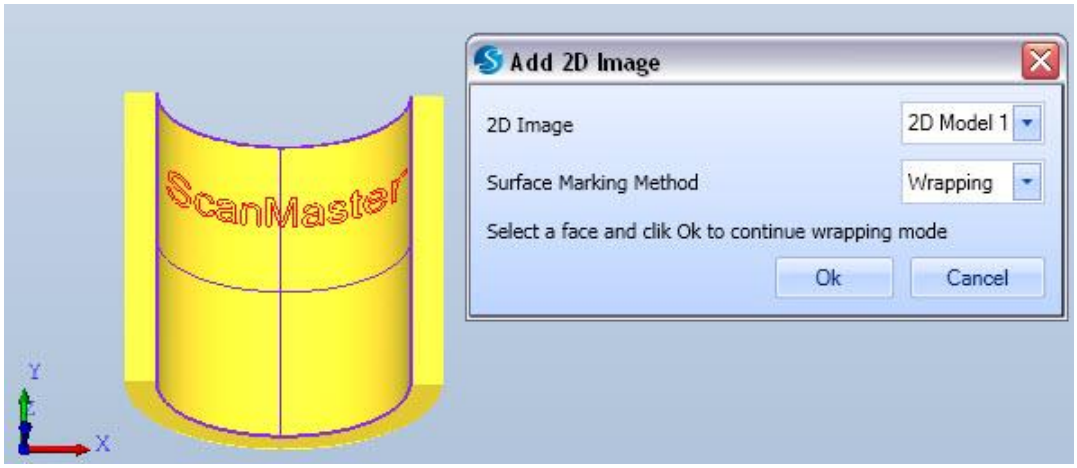


FIGURE 89- SELECT THE DESIRED FACE

5. Click **Ok**.
6. Adjust using the **Scale** and **Move** functions in the **Properties** panel
7. Click **Apply** button to wrap the 2D image to the 3D model

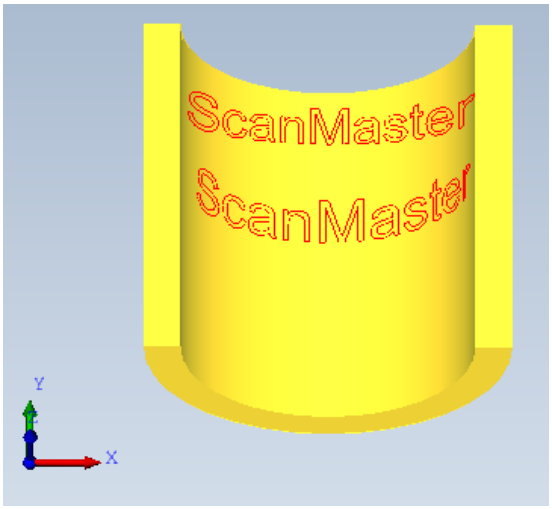
2. 

FIGURE 90- PROJECTION AND WRAPPING

11.5 SAMPLE ENGRAVING

In this section you will find a sample engraving process performed using ScanMaster™ Designer software. The expected output of this sample scenario is to create a physical logo using a work piece of two metals including aluminum and brass.

FIGURE 91- PREDESIGNED ENGRAVING MODEL

Assume that you have a cylindrical work piece with a combination of two metal layers as aluminum and brass. To create this physical logo you need to remove the unnecessary sections by engraving.

For you to get this output you have to create an appropriate mold that tells the system which parts to be engraved and which parts are not to be engraved. The mold should consist only the sections that needs to be engraved. A predesigned 3D model which looks exactly as the actual output will be required to extract some sections from the mold which are not supposed to be engraved.

The ultimate result of this process should remain a “S” shape on the aluminum layers and make two screw holes in the brass layer.

Refer the following sections to check how this sample engraving can be performed using ScanMaster Designer 3D Extension.

To try this sample you need to:

1. Open ScanMaster™ Designer 3D project

2. Create the mold
3. Modify the model
4. Prepare the engraving process
5. Check the engraving simulation

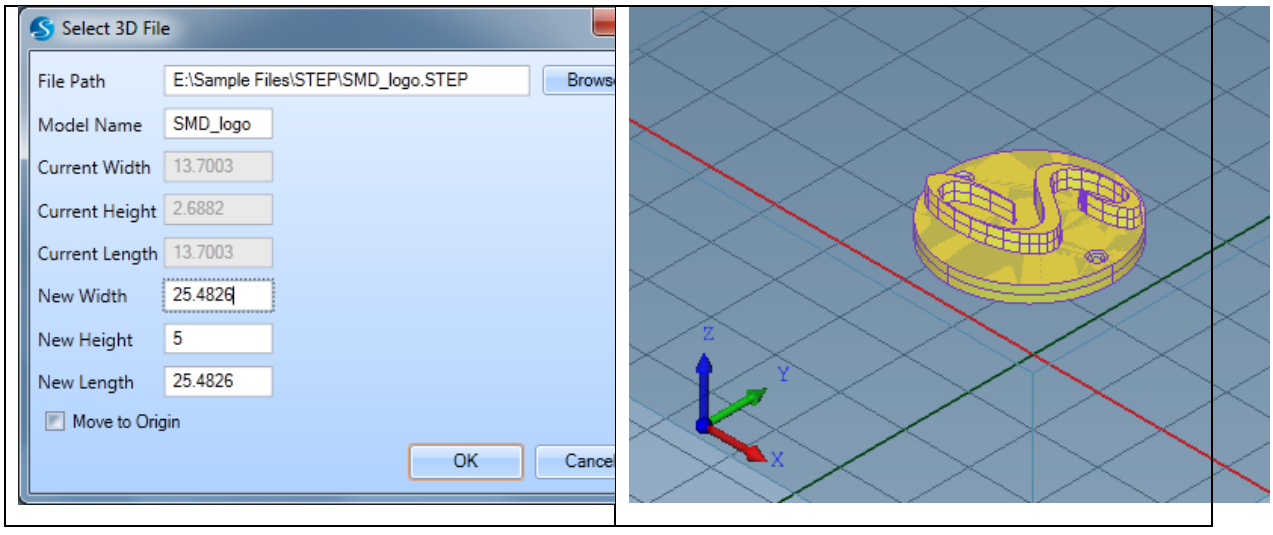
11.5.1 Open ScanMaster™ Designer 3D Project

1. Click **Start** | **Programs** | **CTI** | **ScanMaster™ Designer**
2. Click **New**

Note: Check the Before You Begin section of this document to revise the facts that you should keep in mind when handling a 3D project using ScanMaster™ Designer.

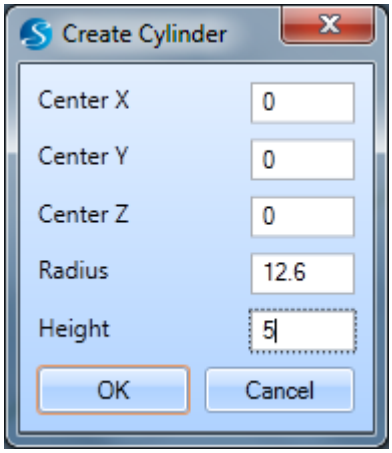
11.5.2 Create the Mold

3. The aim of creating this mold is to extract an appropriate virtual model that allows you to engrave the desired structure on the original material.
4.
5. Import the predesigned 3D model:
    1. Go to **Project** Ribbon tab.
    2. Select 3D model button from the import drop down button.
    3. Click the **Move to Origin** | **Center of Bottom** option of the transformations panel if required.



To insert a cylinder:

1. Insert a **Cylinder**  from the **Basic** panel of the **Home** tab.
2. Define the **Radius** and **Height** as 12.6 and 5



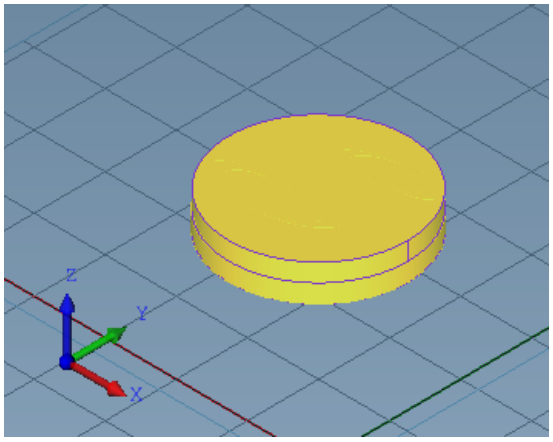


FIGURE 92- INSERTED CYLINDER

11.5.3 Modify the Mold

8. Make sure that you have moved both the models to the origin of the drawing canvas.

   Note: The cylinder shape is inserted to the origin of the drawing canvas by default and the imported model should be moved to the origin. Both models will be place in the same position of the canvas in order to perform the **Boolean Operation**.

9.
   1. Select the two models. First select the **Cylinder** and then the imported 3D model.
   2. Click **Cut**  command in the **Boolean Operations** panel of the **Modeling** tab.

   The figure below shows the mold that was created.

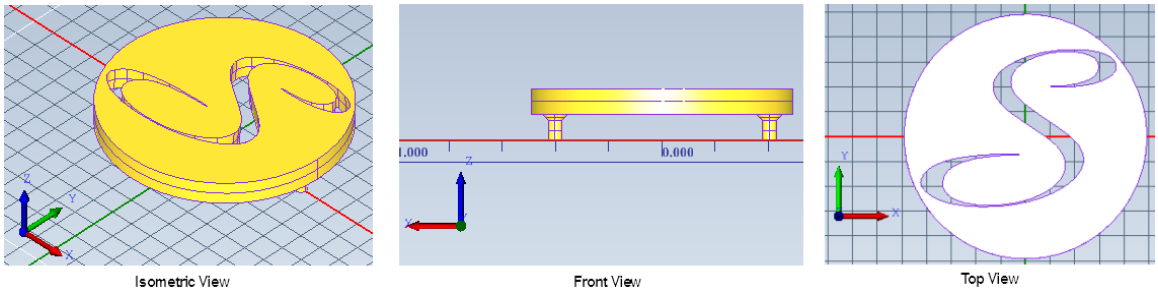


FIGURE 93- MODIFIED IMAGE IN DIFFERENT VIEW ORIENTATIONS

11.5.4 Prepare for the Engraving Process

The next step in this scenario is to prepare the model for the engraving process.

1. Click the **Engraving** command on the Marking **Processes** panel of the **Project** tab

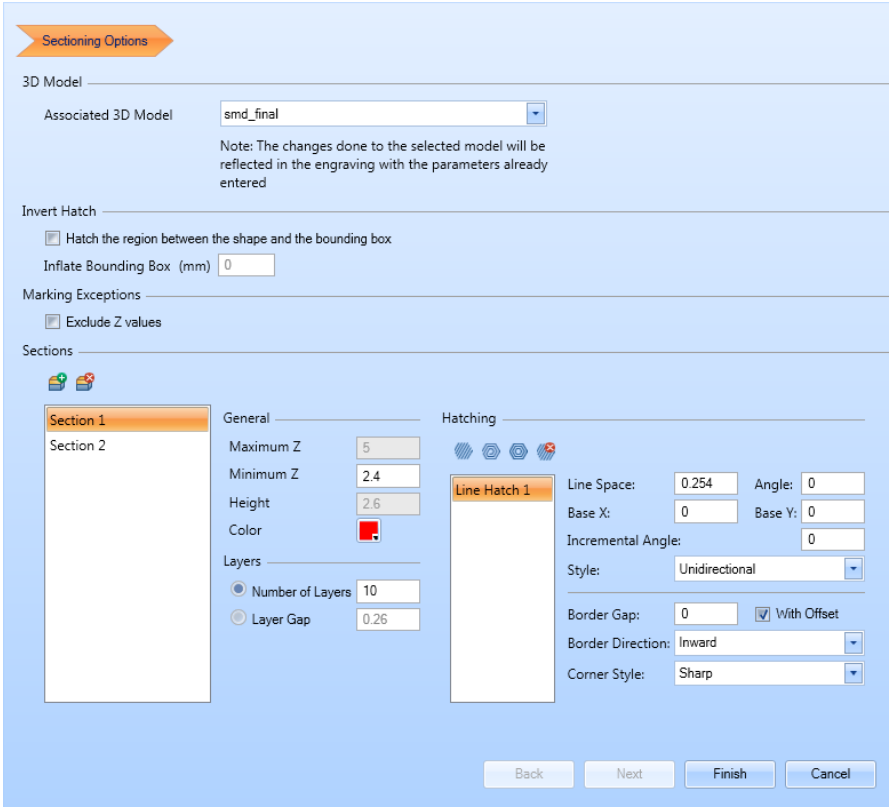


FIGURE 94- SPECIFICATIONS OF SECTION 1

2. Specify the **Minimum Z** of **Section 1** as 2.4.

Note: The height of the sections depends on the heights of the two materials. Measure the height of the original materials and specify the heights of the sections respectively.

3. Define appropriate number of layers to each section depending on the materials of the sections.
4. Insert a desired type of hatch for both of the sections from the given hatching styles
5. Click **Finish**

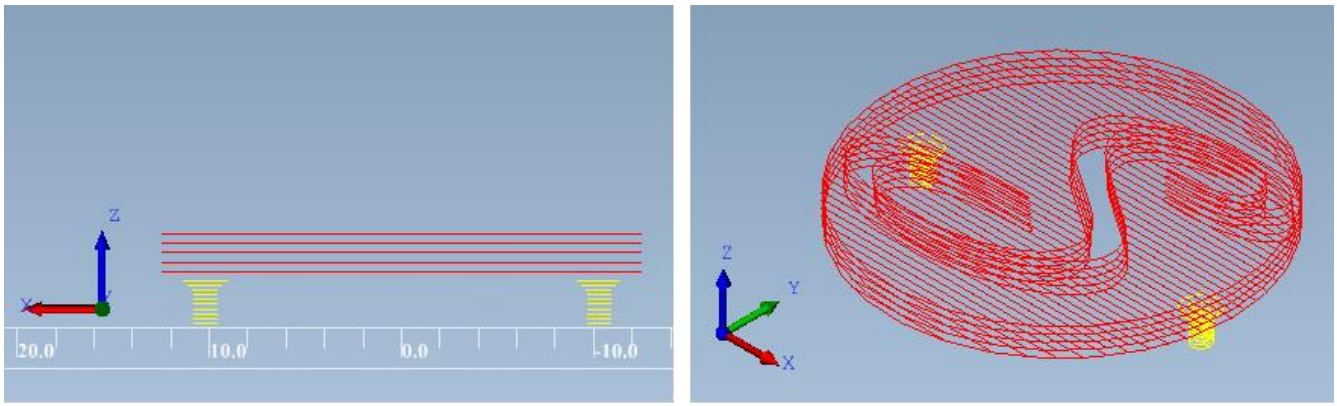


FIGURE 95- ENGRAVING LAYERS AND SECTIONS OF THE 3D MODEL

11.5.5 Check the Engraving Simulation

After you specified the parameters for your engraving process you can use the **Engraving Simulation** commands to view the simulation and make adjustments if needed.

1. Click **Start**  command of the **Processed Model** | **Engraving Simulation** panel to view the engraving simulation
2. Click **Stop**  command to stop the simulation

12 APPENDIX A

12.1 SURFACE MARKING

Surface marking is one of the available 3D scanning processes. **Surface Marking** in 3D scanning projects refers to mapping a 2D image to a 3D surface there by obtaining a quality 3D marking. ScanMaster™ Designer provides you features that enable you to do surface markings in two different styles.

1. Projection
2. Wrapping

Multiple 2D images can be projected or wrapped to a 3D model in different viewpoints according to the users requirements.

12.1.1 Projection

Projection is used to project a 2D image to a 3D surface. Projection in 3D surface marking refers to mapping a 2D image to a 3D surface in a way that the resulting 3D image will be undistorted when viewing in the direction of the projection. If you view the projected image in a different direction you will see that the edges of the image have extended beyond the border or line.

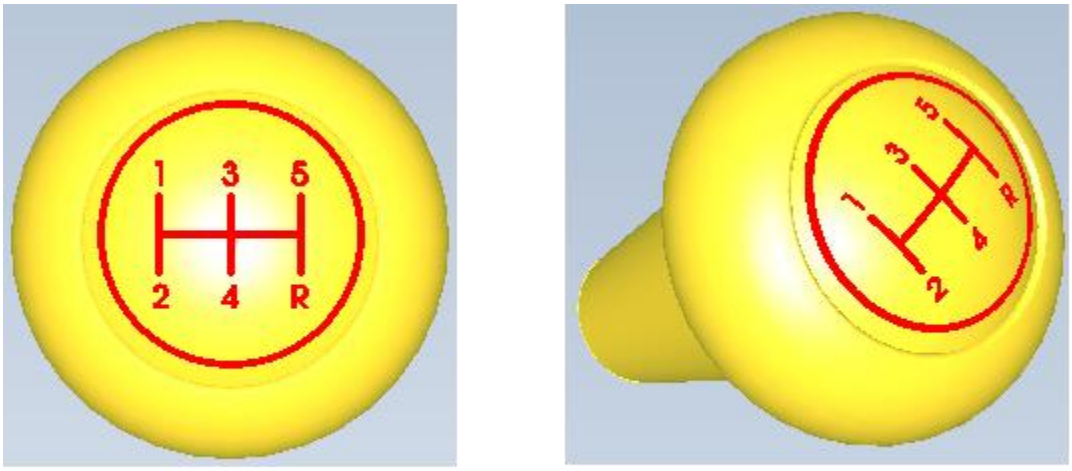


FIGURE 96- PROJECTION

12.1.2 Wrapping

This technology is used to wrap a 2D image to a 3D surface. Wrapping in 3D surface marking refers to mapping a 2D image in a way that the resulting image will have the minimum distortion locally when viewed in any direction.

FIGURE 97- WRAPPING

13 APPENDIX B

13.1 SPECIFYING THE AXES

Most of the functions in ScanMaster™ Designer allow you to select the **Standard Axis** or the **Arbitrary Axis**. This section will help you to understand the difference between the standard axes and the arbitrary axes.

13.1.1 Standard Axis

The standard axes are defined by the **X**, **Y** and **Z** values as you see in the figure below. These axes refer to the normal axes to define the position on the drawing canvas.

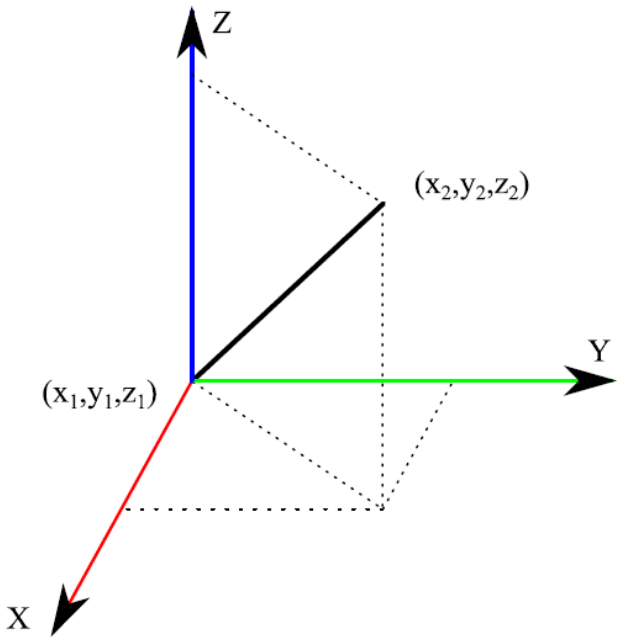


FIGURE 98- STANDARD AXES

13.1.2 Arbitrary Axis

To define the **Arbitrary Axis** you can specify in two ways. You specify either the **Point and Vector** or the **Two Points**.

Point and Vector can be used in situations where you want to specify a position and the vector or the direction from that point onwards

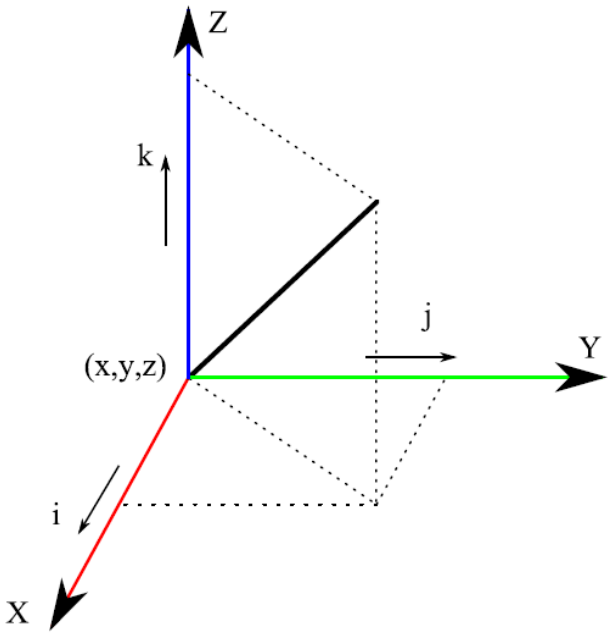


FIGURE 99- ARBITRARY AXES – POINT AND VECTOR

Two Points can be used in situations where you want to specify two points to define a direction across the defined two points which includes the starting points and the end points on the drawing canvas.

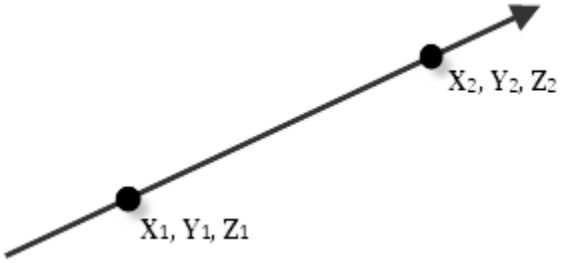


FIGURE 100- ARBITRARY AXES - TWO POINTS

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