Lesson 3 - Creating a Contour Map

The Map | Contour Map command creates a contour map based on a grid file.

To create a contour map of the TUTORWS.GRD file created in the previous lesson:

1. Choose the Map | Contour Map | New Contour Map command, or click the button.
2. The Open Grid dialog is displayed. The grid file you just created (TUTORWS.GRD) should appear in the File name box. If the file does not appear in the File name box, select it from the file list.
3. Click the Open button to create a contour map.
4. The map is created using the default contour map properties.
5. If you want the contour map to fill the window, choose the View | Fit to Window command.

Opening the Map Properties

After creating a map, you can change the map properties. There are several ways to open an object's properties. The most common method is to double-click on the object. Refer to Object Properties in Chapter 21, Creating, Selecting, and Editing Objects for alternative methods of opening properties.

Changing Contour Levels

After you create a contour map, you can easily modify any of the map features. For example, you might want to change the contour levels displayed on the map.

To change the contour levels of the map you just created:

1. Place the pointer inside the limits of the contour map and double-click to open the contour map properties dialog.
2. In the contour map properties dialog, click the Levels page to display the contour levels and contour line properties for the map. In this example, the contour levels begin at \( Z = 20 \). Click on the scroll bar at the right to scroll to the bottom. You can see that the maximum contour level is \( Z = 105 \) for this map and that the contour interval is 5.

3. To change the contour range and interval, click the Level button and the Contour Levels dialog is displayed. This shows the Minimum and Maximum contour level for the map and the contour Interval.
4. Double-click in the *Interval* box and type the value 10. Click the OK button and the *Levels* page is updated to reflect the change.

![Contour Levels dialog](image1)

*Open the Contour Levels dialog by clicking on the Level button on the Levels page.*

5. Click OK in the contour map properties dialog and the map is redrawn with the new contour levels.

![Contour Map](image2)

*After completing step 5, the contour map is redrawn using 10-foot contour intervals.*
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Changing Contour Line Properties
You can double-click any of the elements in the list on the Levels page to modify the individual element. For example, you can double-click an individual Z value in the list to change the Z value for that particular contour level. You can also double-click the line style for an individual level to modify the line properties for the selected level. This provides a way to emphasize individual contour levels on the map.

Double-click on a fill sample to change the fill properties for a level.
Double-click on Yes or No to control the display of contour labels and hachures for a level.

Double-click on the level value to enter a new Z value for a level.
Double-click on a line to change line properties for a level.

You can double-click on individual elements on the Levels page to set specific parameters for the selected level.
To change contour line properties:

1. Double-click the contour map to open the map properties.

2. On the Levels page, double-click the line sample for the contour level at Z = 70 to open the Line Properties dialog.

3. You can select the line color, style, or width for the selected line in the Line Properties dialog. In the Width box, click the up arrow, and change the width value to 0.030 in. (A width of 0.000 in is equivalent to one pixel width.)

4. Click OK in the Line Properties dialog and the Levels page is updated to reflect the change.

5. Click OK in the map properties dialog and the map is redrawn. The contour line at Z = 70 is drawn with a thicker line.

The contour line at Z = 70 appears bolder than the other contour lines on this map after changing the line properties.
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Adding Color Fill between Contour Lines
Color fill can be assigned to individual levels in the same way as line properties. Alternatively, you can assign colors based on a gradational spectrum between two colors.

The Levels page in the contour map properties dialog shows a correspondence between a level (under the Level button) and a color (under the Fill button). The colors are used to fill in the space between the corresponding level and the next higher level. For example, if the contour levels are 20, 30, 40,..., etc., then the color corresponding to level 20 is used to fill in the space between the level 20 contour and the level 30 contour.

To change color fill:
1. Double-click the contour map and to open the contour map properties dialog.
2. Click the Fill Contours check box on the General page.

Make sure the Fill Contours box is checked on the General page to add fill between the contour lines.
3. On the **Levels** page, click the **Fill** button to open the **Fill** dialog.

   ![Fill Dialog]
   
   You can use the **Fill** dialog to set the contour level, foreground, and background fill.

4. Click the **Foreground Color** button to open the **Color Spectrum** dialog. This dialog allows you to select colors to assign to specific Z values.

   - Click on the left anchor point button above the spectrum, click on blue in the color palette, and then click OK. The **Foreground Color** button is now displayed as a gradation from blue to white in the **Fill** dialog.

5. Click OK and the fill colors on the **Levels** page are updated to reflect the change.

6. Click OK and the contour map is redrawn with color fill between the contours.

   ![Color Spectrum]
   
   To change the color spectrum, click the left anchor button and then click blue in the color palette.
Chapter 2 - Tutorial

Add, Delete, and Move Contour Labels

Contour label locations can be changed on an individual basis. Labels can be added, deleted, or moved.

To add, delete, and move contour labels:

1. Right-click on the contour map and choose the Edit Contour Labels option. You can also edit labels of a selected contour map using the Map | Contour Map | Edit Labels command. The pointer changes to a black arrowhead ▲ to indicate that you are in edit mode.

2. To delete a label, click on the label and press the DELETE key on the keyboard. For example, click on a 70 label and then click the DELETE key on your keyboard.

3. To add a label, press and hold the CTRL key on the keyboard and click on the location on the contour line where you want the new label located. Add a 60 contour label to the lower left portion of the map.

4. To move a contour label, click on the label, hold down the left mouse button, and drag the label. Move the 70 contour label on the right portion of the map to the north.

5. To exit the Edit Contour Labels mode, press the ESC key.
Modifying an Axis

Every contour map is created with four axes: the bottom, right, top, and left axes. You can control the display of each axis independently of the other axes on the map. In this example, we will change the contour spacing and add an axis label.

To modify an axis:
1. Move the pointer over one of the axis tick labels on the bottom X axis and left-click the mouse. In the status bar at the bottom of the plot window, the words "Map: Bottom Axis" are displayed. This indicates that you have selected the bottom axis of the contour map.

Additionally, hollow handles appear at each end of the axis, and solid green handles appear surrounding the entire map. This indicates that the axis is a "sub-object" of the entire map.

Eight solid green handles appear around the selected map, and hollow handles appear at the ends of the selected sub-object. In this case, the bottom axis is the sub-object.

Double-click on the bottom axis to display the bottom axis properties dialog.
3. In the Title box on the General page, type "Bottom Axis" (without quotes) and then click the Apply button. This places a title on the selected axis.

4. If you cannot see the axis title, select View | Zoom | Selected. Notice that you do not have to close the properties dialog to select menu commands, toolbar buttons, or objects in the plot window.
5. Click on the Scaling page to display the axis scaling options. In the Major Interval box, type the value 1.5 and then click the Apply button. This changes the spacing between major ticks along the selected axis.

Enter 1.5 for the Major Interval to space the ticks 1.5 units apart.

6. Click on the General page and then click the Label Format button to open the Label Format dialog.

7. In the Label Format dialog, select the Fixed option in the Type group. Click on the down arrow on the Decimal Digits box and change the value to 1. This indicates that only one digit follows the decimal point for the axis tick labels.

8. Click OK in the Label Format dialog to return to the axis properties dialog.

Set the label format to Fixed with one Decimal Digit in the Label Format dialog.
9. Click OK in the axis properties dialog and the map is redrawn. The axis tick spacing and labels are changed, and the axis title is placed below the map.

![Map Diagram]

You can use the axis properties dialog to change the tick mark and axis title properties.

Saving a Map

When you have completed the map or drawing in the plot window, you can save the map to a Surfer file [.SRF] containing all the information necessary to reproduce the map. When you save a map, all the scaling, formatting, and parameters for the map are preserved in the file.

To save a map:

1. Choose the File | Save command, or click the button. The Save As dialog is displayed because the map has not been previously saved.
2. In the File name box, type TUTORWS.
3. Click Save and the file is saved to the current directory with an [.SRF] extension. The saved map remains open and the title bar changes reflecting the changed name.
Chapter 2 - Tutorial

Exporting 3D Contours
When you have completed a contour map in the plot window, you can export the contour lines with associated Z values to an AutoCAD DXF file.

To export contour lines:
1. Select the map by clicking on the map in the plot window or by clicking on the word "Contours" in the Object Manager.
2. Choose Map | Contour Map | Export Contours.
3. In the Save As dialog, type TUTORWS into the File name box.
4. Click Save and the file is exported to the current directory. This creates a file titled TUTORWS.DXF that can be opened in any program with an AutoCAD DXF import option.

Lesson 4 - Creating a Wireframe
Wireframes are three-dimensional representations of a grid file. Wireframes are block diagrams generated by drawing lines representing the grid X and Y lines (the grid columns and rows). At each intersection of a column and row (i.e. at each grid node), the height of the surface is proportional to the grid Z value at that point. The number of columns and rows in the grid file determines the number of X and Y lines drawn on the wireframe.

Creating a New Wireframe
To create a new wireframe:
1. Select the File | New command, or click the button.
2. Select Plot Document, in the New dialog and click OK. A new empty plot window is displayed.
3. Select the Map | Wireframe command or click the button.
4. Choose the grid file TUTORWS.GRD from the list of files in the Open Grid dialog, click Open, and the map is created. (TUTORWS.GRD, created in Lesson 2 - Creating a Grid File, is located in Surfer's SAMPLES folder.)
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Changing the Orientation of a Wireframe

Although this example uses a wireframe to illustrate rotation and tilt, you can perform this operation on most map types in Surfer.

To change rotation and tilt:
1. Click on the map once to select it.
2. Click the Map | Trackball command or click the button.
3. Click the left mouse button and hold it while moving the mouse to the left and right. This changes the rotation of the wireframe. The rotation is listed in the status bar.
4. Click the left mouse button and hold it while moving the mouse up and down. This changes the tilt of the map. The tilt is listed in the status bar.
5. Once you have rotated and tilted the map, click the ESC key on your keyboard to end trackball mode.

Changing the rotation, tilt, field of view, and projection can also be accomplished by double clicking the wireframe and using the options on the View page.

This is the wireframe at a new rotation and tilt.
Changing the Scaling of a Wireframe

You can change the scaling of wireframes and surfaces in three dimensions. In this example, the Z scaling is changed, and the wireframe becomes somewhat exaggerated in the Z dimension.

To change the Z scaling:
1. Double-click the wireframe to open the map properties.
2. Click the Scale page. You can set scaling by entering the number of map units per inch or by entering the length for the map in page coordinates.
3. In the Length box of the Z Scale group, change the value to 3 by scrolling to 3 or by highlighting the existing value and typing 3. The Map units value changes to reflect the change you made.
4. Click OK and the wireframe is redrawn exaggerated in the Z dimension.
Adding Color Zones to a Wireframe

You can change the line colors of any wireframe by applying color zones. In this example, we will change color zones gradationally and individually.

To add a color zone to a wireframe:
1. Double-click on the wireframe, to display the wireframe properties dialog.
2. Click on the Color Zones page.
3. Click on the Line button to display the Line Spectrum dialog.
4. Click on the Minimum Line Properties button to open the Line Properties dialog. From here, you can select the line color, style, or thickness.

5. Click on the Color button and select blue.
6. Click OK to return to the Line Spectrum dialog.
7. Click on the Maximum Line Properties button and change the line color to red using the steps above.
8. Click OK in the Line Spectrum dialog to return to the Color Zones page.
9. In the wireframe properties dialog, check the Apply Zones to Lines of Constant X and Y boxes by clicking in them.
10. Click Apply and the wireframe is displayed with gradational colors varying by the Z variable. (Leave the dialog open.)
To change the properties of an individual Z value:

1. On the Color Zones page, double-click the line sample for the contour level at $Z = 70$.
2. You can select the line color, style, or width for the selected line in the Line Properties dialog. In the Width box, click the up arrow and change the width value to 0.030 in.
3. Click OK in the Line Properties dialog and the Color Zones page is updated to reflect the change.
4. Click OK in the wireframe properties dialog and the map is redrawn. The color zone at $Z = 70$ is drawn with a thicker line, and is emphasized on the map. (If you need to zoom in on the map, click the button and then click on the map. Click the ESC key on the keyboard after you are finished zooming in.)

[Double-click on the 70 level line sample to emphasize the $Z = 70$ contour level.]
Lesson 5 - Posting Data Points and Working with Overlays

Post maps are created by placing symbols representing data points on a map. Posting data points on a map can be useful in determining the distribution of data points, as well as placing data or text information at specific points on the map. Data files contain the XY coordinates used to position the points on the map. Data files can also contain the labels associated with each point.

Creating Post Maps

When a new post map is created, it is independent of any other map in the current plot window. When the two maps are displayed, notice that two sets of axes are also displayed, one set for each map. When you use the Map | Overlay Maps command, the two maps are combined into a single composite map with one set of axes.

To create a post map:

1. Choose File | Open to display the Open dialog. Choose TUTORIAL.SRF in the SAMPLES directory and then click the Open button. TUTORIAL.SRF opens and contains a contour map.

2. Select the Map | Post Map | New Post Map command or click the button.

3. Choose TUTORWS.DAT from the list of files in the Open dialog. (TUTORWS.DAT is located in Surfer's SAMPLES folder.)

4. Click Open and the post map is created using the default properties.

The contour map and post map are two separate maps on the page. If you look closely at the X axis, you will notice the two sets of axis tick labels for the two maps. Also, there are two map frames and axes sets listed in the Object Manager. We will line up the maps with the Overlay command after changing the post map properties.

Changing the Post Map Properties

To change the post map properties:

1. Open the Object Manager if it is not already open. The Object Manager is open if there is a check mark displayed next to the words Object Manager in the View menu. If there is no check mark, click on the command once.

2. Right click on the word “Post” in the Object Manager.

3. Select Properties from the context menu.
4. In the post map properties dialog **General** page, click the symbol button to open the **Symbol Properties** dialog.

5. Choose the filled circle symbol from the palette and click OK. The selected symbol appears in the symbol button.

6. Click the **Apply** button and the symbol appears at the posted data points on the map.

7. In the **Fixed Size** box (Symbol Size group), specify a size of 0.09 in.

8. Click OK and the post map is drawn with the new symbol size.

You can change the symbol size to 0.09 inches on the **General** page.
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Overlaying Maps

To overlay maps:

1. To see the two separate maps, place the mouse pointer in the center of the maps and click. Press and hold the left mouse button and move the pointer slightly in any direction. Release the button and the two maps are offset.

The two maps are offset to show that the contour map and post map are separate maps. They also appear as two separate maps in the Object Manager as shown on the right.

2. Click Edit | Select All to select both maps.

3. Choose the Map | Overlay Maps command to combine the two maps into a single composite map.

The contour and post maps are combined into a single composite map after using Overlay Maps. Notice that the Object Manager displays one "Map" containing a post map, four axes, and the contour map.
Selecting an Overlay and Assigning an Object ID

After creating a composite map, you can still modify the individual overlays in the map.

Selecting Maps

An individual overlay can be selected in the composite map by clicking on the overlay in the plot window or clicking on the overlay in the Object Manager.

The easiest way to select an overlay in a composite map is to click on the overlay name in the Object Manager. However, you can also select the overlay in the plot window with the mouse. Whenever two or more objects occupy the same position in the plot window, use the CTRL key and the left mouse button to select the desired object. The CTRL key allows you to cycle through the selection of overlapping objects. For example, if you want to select a text block behind a rectangle, hold down the CTRL key and click until the text is selected. You can use the status bar to help you determine which object is selected.

Renaming the Post Map

To select an overlay and assign an ID:

1. Make sure the Object Manager is open. If the Object Manager is not open, click View | Object Manager.
2. Click the overlay name in the Object Manager. In this case, click the word “Post.” The status bar should now report “Map: Post.”
3. Choose Edit | Object ID.
4. In the Object ID dialog, type the name “Tutorial Post Map” and click OK. The status bar, Object Manager, and properties dialog title reflect the name change.

You can change the name of the selected object using Edit Object ID.
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If you double-click on Tutorial Post Map in the Object Manager, notice that the properties dialog title changes to Map: Tutorial Post Map Properties. When you rename an object in Surfer 8, the object's properties dialog reflects the same change making it easier for you to keep track of the object you are editing. For example, if you have eight post maps in the plot window, it is beneficial to change the post map names to something meaningful to save time when trying to edit them. This is especially important because the properties dialog can stay open when changing selections.

Adding Labels to the Post Map

You can add labels to the data points on post maps. The post map can be selected by a few different methods, though only the Object Manager method is discussed here.

To add labels:
1. Right-click on "Tutorial Post Map" in the Object Manager and choose Properties.
2. Click on the Labels page. In the Worksheet Column for Labels group, click the drop-down arrow and a list of columns in TUTORWS.DAT is displayed.
3. Select Column C: Elevation from the list.
4. Click the Format button to open the Label Format dialog.
5. Change the Type to Fixed and the Decimal Digits value to zero.
6. Click OK to return to the post map properties dialog.
7. Click OK and the overlay is redrawn with labels on each of the data points.
Lesson 6 - Introducing Surfaces

Surfaces are new to Surfer 8. They are similar to wireframes, except that surfaces are three-dimensional shaded renderings of a grid file. Surfaces provide an impressive visual interpretation of data. Surfaces can be overlaid with other surfaces, so that the surfaces will intersect with each other. Surfaces can also have overlays of other map types, excluding wireframes.

You can control the color, lighting, overlay blending, and wire mesh grid of a surface.

Creating a Surface

To create a surface:

1. Select the File | New command, or click the button.
2. Select Plot Document, in the New dialog and click OK. A new empty plot window is displayed.
3. Select the Map | Surface command or click the button.
4. Choose the grid file TUTORWS.GRD from the list of files in the Open Grid dialog, click Open, and the surface is created using the default settings. (TUTORWS.GRD, created in Lesson 2 - Creating a Grid File, is located in Surfer's SAMPLES folder.)

Adding an Overlay

You can overlay base, contour, post, image, shaded relief, and vector maps on surfaces. All overlays, except other surfaces, are converted into a type of bitmap known as a texture map. This texture map is then applied to the surface by stretching it and shrinking it as necessary. When these maps are overlaid, you have a choice on how to treat the texture map. You can use the colors from overlays only, from the surface only, or blend colors from the overlays and surface. For example, you could create a color filled contour map, overlay the contour map and surface, and then use the colors from the contour map only.
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When multiple surfaces of differing elevations are overlaid, the surfaces can intersect and overlap each other. If the surfaces are adjacent to each other in the X or Y direction, the surfaces are drawn side-by-side after using Map | Overlay Maps. In this example, we will overlay a plane with the surface you just created.

First, create the surface plane:

1. Select the Map | Surface command or click the button.
2. In the Open Grid dialog, open Surfer’s SAMPLES folder and select TUTORPL.GRD.
3. Click Open, and the surface is created using the default settings.
4. Right click on the upper 3D Surface in the Object Manager, choose Object ID and add the text TUTORPL.GRD to the end of the 3D Surface label to make it easier to distinguish the two surfaces in the Object Manager list.

Next, overlay the surfaces:

1. Click Edit | Select All to select both surfaces.
2. Click Map | Overlay Maps to overlay the surfaces.

You can overlay two or more surfaces. Depending on each surface’s XYZ range, the surfaces may overlap or intersect each other.
Adding a Mesh

Mesh lines can be applied to surfaces.

To add a mesh:
1. Double-click on the surface to open the surface properties.
2. Click the Mesh page.
3. Check the X and Y boxes.
4. Change the Frequency to 5 for the X and Y lines.
5. Click the OK or Apply button to add a mesh to the selected surface.

Notice that the mesh is applied to the selected surface within the composite map, not to both surfaces. With all map types, you can only change the map-specific properties of one map at a time. Properties that apply to all overlays in the composite map include View, Scale, Limits, and Background.

The mesh is applied to the selected overlay in the composite map.
Changing Colors

Changing color schemes on surfaces is similar to changing colors on other map types such as image maps or contour maps. The Color Spectrum dialog is used to load previously defined color schemes, and it is also used to create your own color schemes. The Color Spectrum dialog is discussed in greater detail in Chapter 16, Adding Color to Maps.

Before experimenting with color, let’s create a new surface map in a new plot window:

1. Click File | New or click the button.
2. In the New dialog, select Plot Document and then click OK.
3. Select the Map | Surface command or click the button.
4. In the Open Grid dialog, open Surfer’s SAMPLES folder and select any grid file [.GRD]. HEIENS2.GRD is a good choice for experimenting with color.
5. Click Open, and the surface is created using the default settings.

To change the surface material color:
1. Double-click on the surface to open the surface properties.
2. There is a Material Color group on the General page. Click the Upper button.

![Click the Upper button in the Material Color group to change the surface material color.](image)
3. Click the *Load* button in the *Color Spectrum* dialog.

![Color Spectrum dialog]

*Click the Load button to use a different color spectrum file [.CLR] for the surface material color.*

4. The color schemes are stored in color spectrum files containing a [.CLR] extension. By default, *Surfer* opens in the SAMPLES folder, which contains many predefined color spectrums. (Browse to the SAMPLES folder if it is not open.) Click on one of the [.CLR] files to select it and then click the *Open* button.

5. Notice that the colors and anchor node positions have changed in the *Color Spectrum* dialog. Click *OK* in the *Color Spectrum* dialog to return to the surface map properties dialog.

6. Click the *Apply* button in the surface map properties dialog to see your color changes. Drag the surface map properties off to the side if you cannot see the map.

You can continue to experiment with the colors by clicking the *Upper* button and loading other color spectrum files.

**Need More Information?**

If you find you still have questions after you have completed the tutorial, you should consider reviewing the material in the rest of the User’s Guide or accessing *Surfer*’s extensive online help. Usually, the answers to your questions are found in these locations. However, if you find you still have questions, do not hesitate to contact Golden Software’s technical support. We are happy to answer your questions before they become problems.