Understanding & Working with Layers in Origin - Part 2

- **January 1999, *Ryan Toomey***

Up this month is Part 2 of our four part series on layers. If you missed the previous installment of this series, and are somewhat unfamiliar with the concept of layers, I encourage you to check out Part 1 before moving on. While there, you'll find a discussion on the basics of layers which includes the following:

- **Definition & properties**
- **Adding data to a layer**

Including this article, the last three articles of this series will cover:

- **Displaying the same data plot on two different axis scales: The Link Axes Dialog Box - Part 2**
- **The Double Y Axis graph - Part 2**
- **Creating an inset graph - Part 3**
- **The Zoom graph template - Part 3**
- **Creating and arranging multi-panel graph windows - Part 4**

Begin Part 2 =>

Displaying the same data plot on two different axis scales using the Link Axes dialog box

As those of you who read Part 1 know, Origin has the capability to create axis links between layers. One type of link that can be created is a "custom" axis link. In this lesson, we will utilize the versatility of having multiple layers on a graph window and the power of the custom axis link to display data on two different temperature scales, Fahrenheit and Celsius.

The Steps

To begin, open an empty graph window by clicking on the **New Graph** button on the **Standard** toolbar. Next, select **Edit:New Layer(Axes):(Linked): Top X**. Alternatively, select **Tools:Layer** and then click on the third button on the **Add** tab as illustrated here:

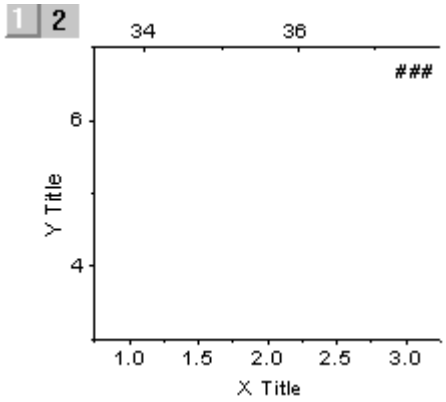
Performing either method adds a second layer and displays the top X axis of that layer directly on top of the first layer.

Next, open the **Layer Properties** dialog box (or Plot Details dialog box at the Layer level) for layer 2 by holding down the CTRL key and double-clicking on the layer 2 icon. Or, use any of the other three options outlined in Part 1 of this series. Once in Layer Properties, click on the **Link Axes** button (or **Link Axes Scales** tab depending on what version of Origin you have). Select the **Custom** radio button from the **X Axis Link** group and enter the following for X1 and X2:

X1 =	9/5*X1+32
X2 =	9/5*X2+32

> **Note: Any expression can be entered for a custom axis link. However, due to the limited number of Scale Types (linear, log10, probability, probit, reciprocal, offset reciprocal, logit, ln, and log2), the visual presentation of the axis link may not be acceptable. Therefore, it may be in your best interest to stay within the limitations of the Scale Types offered.**

Click OK to close out of all dialog boxes. At this point, your graph should look *something* like the following:



To make the graph more meaningful, make the following alterations:

- Click on the Y axis title and press the Delete key to eliminate it.
- Double-click on the bottom X axis title and change it to read Celsius. Click OK to close out of the Text Control dialog box and update the X axis title.

- Double-click on the top X axis and go to the **Title & Format** tab. In the **Title** text box, enter Fahrenheit. In Origin 4.1, double-click on the top X axis and click the **Top Axis** button. Enter Fahrenheit in the **Axis Title** text box. Click OK to close out of the dialog box.

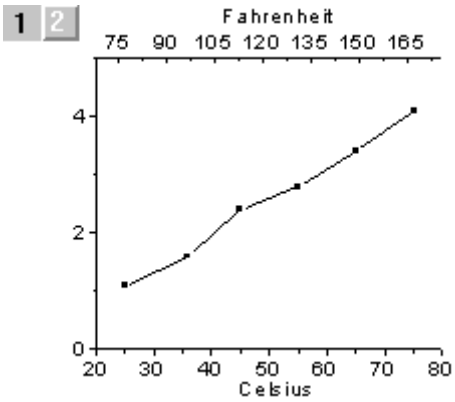
  Note: You may have to change the size of the Fahrenheit text label to match the Celsius label. To do so, double-click on it and select a font size from the drop-down list provided.

After the alterations have been made, enter the following values into a worksheet:

Celsius(X)	B(Y)
25	1.1
35	1.6
45	2.4
55	2.8
65	3.4
75	4.1

Note: You do not have to rename the first column to Celsius. Also, the numbers in column B are arbitrary.

Click on the title for column B to highlight (select) the column. Make the graph window active and click on the layer 1 icon to make layer 1 active. Select **Graph:Add Plot to Layer:Line + Symbol**. At this point your graph should look *something* like this:



Note: You may have to change the axis scale increment slightly if you want to view the same tick labels. To do so, double-click on the axis and select the Scale tab. (In Origin 4.1 this is the Scale Group.) Enter the appropriate value in the Increment text box and either click Apply to view your changes (Origin 5.0 or later) without exiting the dialog box or click OK when you are done.

At this point you are pretty much done with the important aspects of displaying the same data plot on different axis scales. Now, how about checking out a tip that goes along with this lesson.

Tip

For more accurate estimations of the Fahrenheit values that correspond to each Celsius value, flip-flop the two X axes and enable the vertical drop lines.

Note: The drop line feature does not allow you to direct the drop lines upward. This is the reason why the X axes need to be exchanged.

To better understand this tip, perform the following operations on your graph.

Turn off the bottom X axis for layer 1

Double-click on the bottom X axis to open the **X Axis** dialog box for layer 1.

In Origin 5.0 or 6.0, select the Title & Format tab and uncheck the Show Axis & Ticks check box. Then, select the Tick Labels tab and uncheck the Show Major Labels check box.

In Origin 4.1, simply uncheck the Bottom Axis and Tick Labels check boxes.

Click the OK button to make the changes.

Turn on the bottom X axis for layer 2

Make layer 2 active by clicking on the layer 2 icon. Then, select **Format:Axes:X Axis**.

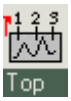
In Origin 5.0 or 6.0, click on the Title & Format tab and select the 

icon in the Selection box if it isn't already selected. Check the Show Axis & Ticks check box. Then, click on the Tick Labels tab and check the Show Major Labels check box.

In Origin 4.1, simply check the Bottom Axis and Tick Labels check boxes.

Click the Apply button in Origin 5.0 or 6.0 to make the changes. Do nothing in Origin in Origin 4.1, but make sure you leave the dialog box open.

Turn off the top X axis for layer 2

In Origin 5.0 or 6.0, click on the 

icon in the Selection box to select the top X axis. If an attention message pops up, click OK. Then, uncheck the Show Major Labels check box. Finally, click on the Title & Format tab and uncheck the Show Axis & Ticks check box.

In Origin 4.1, uncheck the Top Tick Labels and Axis check boxes.

Click OK to finish off the changes for layer 2.

Turn on the top X axis for layer 1

Click on the layer 1 icon to make layer 1 active. Then, select **Format:Axes:X Axis**.

In Origin 5.0 or 6.0, click on the Title & Format tab and make sure that the **Top** icon is selected in the Selection box. Then, check the Show Axis & Ticks check box. Finally, select the Tick Labels tab and check the Show Major Labels check box.

In Origin 4.1, simply check the Top Axis and Tick Labels check boxes.

Click OK to finish off the flip-flop.

Enable the drop lines

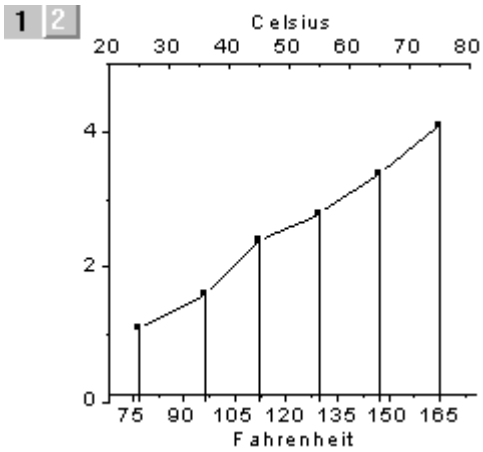
To complete the basic requirements of this process, double-click on the data plot and select the **Drop Line** check box in Plot Details. If using Origin 6.0, select the **Drop Line** tab and then the **Vertical** check box. Click OK to make the change. At this point you should see that a rough estimate of the Fahrenheit value for each experimental value can be determined by quickly glancing at each drop line.

The X axis titles

Instead of simply renaming the axis titles to correspond to the correct axis, recreate them so that they are in the correct layers. First, delete both X axis titles. Then, in Origin 5.0 or 6.0, double-click on one of the X axes, select the Title & Format tab, and enter in the correct title in the Title text box. Click OK once you are done and do the same for the other X axis. In Origin 4.1, double-click on the top X axis (which is in layer 1 now). Click the Top Axis button and enter a title in the Axis Title text box. Do the same for the bottom X axis (now layer 2) by clicking on the Bottom Axis button once you have double-clicked on the bottom X axis.

> **Note: If the titles appear too small, change the font size. To do so, try the following trick (Origin 5.0 or 6.0 only):**
>
> **Click once on one of the X axis titles. Next, hold down the Shift key and click on the other X axis title. Finally, click on the Increase Font button on the Object Edit toolbar until you obtain a font size you like. If you can not find the toolbar, go to View:Toolbars in Origin 5.0 or Tools:Toolbars in Origin 4.1, select the toolbar from the list, and click OK. The Increase Font button appears as follows:**
>
> 
>
> **If you are working with Origin 4.1, you'll have to do it the old fashioned way (since the Increase Font button was not implemented yet). Double-click on each title and change the Pt size drop-down list selection manually.**

At this point you have completed the flip-flop of the axes. Your graph should now look something like this:



If so, you're done! If not, you may need to go through the steps again. When you're sure you are done, check out another example of the use of layers, the Double Y Axis graph.

The Double Y Axis Graph

The double Y axis graph is a good example of the use of layers in a graph window. This graph template consists of two layers and requires at least two Y datasets in order to plot. It is very helpful in situations where the two or more Y datasets to be plotted exhibit significantly different Y scales, but similar X scales (although it can also be used when the X axis scales differ). One example of a situation that lends itself to a double Y axis graph would be if one had two sets of data, one collected in millivolts and the other in volts. Although they differ in magnitude by a factor of 3, plotting them in the double Y axis graph would allow them to be displayed as if they were collected in the same units, thus allowing easier comparison.

The double Y axis graph is also a good example of the use of a ***straight*** (1 to 1) axis link. To see what I mean, when you create a double Y axis graph, CTRL + double-click on the layer 2 icon and click the Link Axes button (or Link Axes Scales tab). Once you do, you will see that there is a predefined 1 to 1 link between the X axes.

> **Note: The top X axis of a double Y axis graph actually resides in layer 1. This fact becomes important when changing an attribute of the bottom axis. In particular, if the Scale Type is changed for layer 1, the Scale Type for layer 2 does not automatically update to match.**

To see how the double Y axis graph works, suppose you have a worksheet set up in the following manner:

A(X)	B(Y)	C(Y)
1	1	23
2	1.5	23
3	2	27
4	2.5	28
5	4	28
6	4.25	29
7	4.5	31
8	4.75	38
9	5	40
10	6	43

Create it from scratch

Highlight the first Y column and choose **Plot:Line + Symbol**. Then, select **Edit:New Layer(Axes):(Linked): Right Y**. Next, go back to the worksheet and highlight the second Y column. Finally, go back to the graph and select **Graph:Add Plot to Layer:Line + Symbol**. Alternatively, add the dataset through the Layer 2 dialog box by placing it in the Layer Contents. Either way, the second dataset is added to the second layer. At this point you should see the two datasets appear as if on the same scale. This is due to the fact that they were placed in two different layers whose X axes are linked 1 to 1, but whose Y axes are independent.

To include additional datasets in the graph, add them by highlighting the column in the worksheet, making the appropriate layer active in the graph window, and selecting **Graph:Add Plot to Layer** again. Alternatively, add them through the Layer *n* dialog box.

> **Note: You can also select (Linked): Top X + Right Y when adding the set of linked axes.**

Create it from the 2D Graphs toolbar

Highlight the two Y columns and click on the **Double Y Axis** button  on the **2D Graphs toolbar**.

> **Note: To open the 2D Graphs toolbar, select View:Toolbars, check the 2D Graphs check box, and click OK (Origin 5.0 or 6.0). In Origin 4.1 select Tools:2D Graphs. If 2D Graphs is already checked, the toolbar is already open.**

If there were any additional Y datasets you wanted to plot, the best way to do so would be to add them through the Layer *n* dialog box or use the **Graph:Add Plot to Layer** menu. If you attempted to plot them along with the first two Y datasets (i.e. when clicking the button), the additional datasets would all be placed in layer 1 (regardless of whether or not it is the appropriate layer).

Create it from the menu (Plot:Template:Doubley.OTP)

Selecting the two Y columns first

Highlight the two Y columns, select **Plot:Template** and choose the template called **Doubley.OTP** from the Open dialog box. As with the two previous methods, if there were any additional Y datasets that you wanted to plot, the best way to do so would be to either add them through the Layer *n* dialog box or use the **Graph:Add Plot to Layer** menu. If you attempted to plot them along with the first two datasets, they would be added to layers 1 and 2 in an alternating fashion. To better understand what I mean, consider the case where you have 5 Y datasets (B, C, D, E, and F). If you highlight all five Y columns and select **Plot:Template:Doubley.OTP**, the datasets that would be added to layer 1 are B, D, and F, while the datasets that would be added to layer 2 are C and E.

Without selecting the two Y columns first

Without highlighting the two Y columns, select **Plot:Template** and choose the **Doubley.OTP** template.

In Origin 4.1, the two Y datasets will be plotted in separate layers as expected. If there were any additional Y datasets to be plotted, they would be added to the two layers in alternating fashion as described in the **Selecting the two Y columns first** example.

In Origin 5.0 or 6.0, the Select Columns for Plotting dialog box will open. Instead of assigning both datasets, only assign the second dataset to be plotted (C(Y)). To do so, select A(X) and click the **<=> X** button. Next, select C(Y) and click the **<=> Y** button. Once you have done so, click OK and C(Y) will be placed in layer 2. To add the first dataset, highlight the column in the worksheet. Then, go back to the graph and make layer 1 active. Finally, select **Graph:Add Plot to Layer:Line + Symbol**. Doing so automatically adds the selected dataset to layer 1. If there were additional Y datasets, the best way to add them would be to use the **Graph:Add Plot to Layer** menu. Otherwise, if all datasets were added in the beginning (when the Select Columns for Plotting dialog box opened), all datasets would be added to layer 2.

This completes the lesson on the double Y axis graph. However, if you did any experimenting with the graph after you created it, you might have noticed that the legend that is created is actually composed of two legends (4.1 and 5.0 only – Origin 6.0 actually creates one compreshensive legend). Continue reading to find out how to combine multiple legends into one comprehensive legend.

Tip - 4.1 and 5.0 only

When creating a double Y axis graph in Origin 4.1 or 5.0, you might notice that the legend that is created is actually two legends placed closely together. If these two legends were not automatically created when you created the graph, you would have to manually create them by making each layer active and clicking the New Legend button each time. (Alternatively, you could select **Graph:New Legend** after making each layer active.) Although this is not significantly time consuming for a two layer graph, it is time consuming for users that create graphs with several layers. For this reason, a script has been created.

Copy the script below into the Script window (**Window:Script Window**). Make the graph you are interested in active. Highlight the script and press the **ENTER** key on your keyboard to execute it. A comprehensive legend will be created that displays the plot type icons and dataset names of every dataset contained in every layer of the graph window.

```
// Beginning of script
%Z="";
doc -e LW {
ii=1;
doc -e D {
%Z=%Z
\L($(page.active).$(ii)) %C;
ii++;
}
label -r Legend;
}
label -q 1 -s -sa -n FullLegend %Z;
doc -uw;
// End of script
```

> **Note: For definitions and descriptions of the commands used in this script, consult the most current LabTalk manual.**

Coming Up

This completes Part 2 of this four part discussion on layers. Be sure to check back soon for Part 3. The areas covered will be:

- **Creating an inset graph**
- **The Zoom graph template**