

In-Cave Data Logger Project (DLP)

Sponsored by the
Central Connecticut Grotto

www.ctcavers.org
www.ctcavers.org/datalogger

This project is a work in progress, is frequently updated, and done entirely by unpaid volunteers. For more information, updates, and other documents, please contact info@ctcavers.org and put "CCG Data Logger" in the subject line. If you don't get a reply within a week, please call 860-621-2080.

CCG DLP - Excel Charting

Contents:

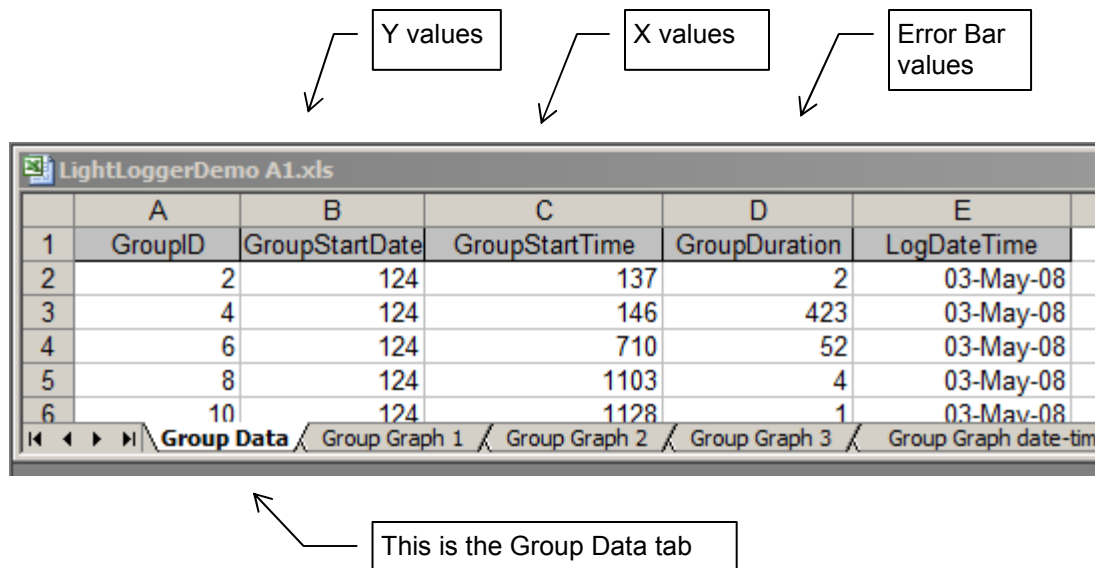
- Copy the processed data from MS Access to Excel for charting
- Discussion of worksheet
- Setup of Chart of Group Data - the X value axis
- Setup of Chart of Group Data - the X Secondary Axis
- Setup of Chart of Group Data - the Y value axis
- Setup of Chart of Point Data - Secondary Axis
- Sample of Chart: Group On Time
- Reference: Charting using Excel
- Sample of Chart: Point On Time
- Sample of Chart: Freq of Event Duration Length
- Sample of Chart: Freq of Group Duration Length

Copy the processed data from MS Access to Excel for charting

Copy the results of the Access table tGroupToPlot into the Excel worksheet "Group Data"

Note: column names may be different, but usage is the same

Below is a section of the Excel worksheet.



Note: About 5 weeks of data can be shown in one chart. You may need more than one graph to clearly show the results for a period of time longer than about 5 weeks. These charts use the same data worksheet.

Below is a worksheet that you can use to get the values needed for the following pages.

Worksheet to get Excel date values and to split data into reasonable sized graphs

Break into groups of about 35 days
 for each graph, include a day before and a day after.

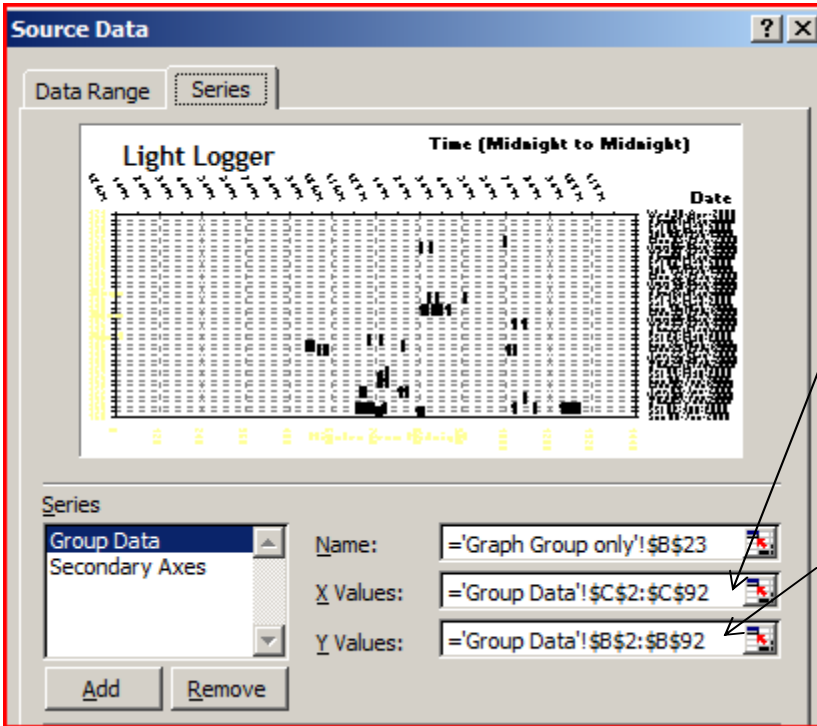
first day of year FDOY 1/1/2008

	Month/Day/Year	Excel Date	Days inclusive from FDOY	Days in graph inclusive	Day of Week
Graph1 start date	5/2/2008	39570	123		Friday
Graph1 end date	5/23/2008	39591	144	21	Friday
Graph2 start date	5/22/2008	39590	143		Thursday
Graph2 end date	6/9/2008	39608	161	18	Monday
Graph3 start date		0	-39447		Saturday
Graph3 end date		0	-39447	0	Saturday

Setup of Chart of Group Data - the X value axis

Note: These are examples. You need to use values that work for your data.

Group Data - data source for X and Y axis

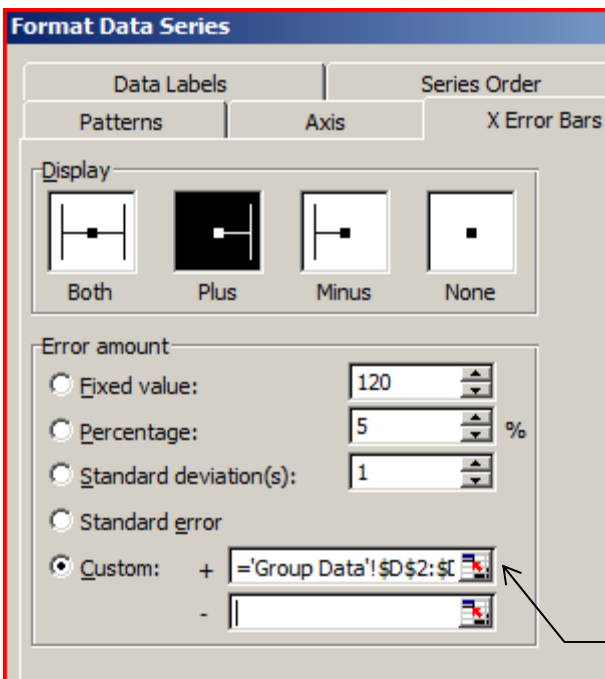


To get to these properties from the chart, right-click on chart in the Chart Area, then select Source Data.

This column is GroupStartTime
 Change the ending row number to that of the last row of data (even if not charting all of it)

This column is GroupStartDate
 Change the ending row number to that of the last row of data (even if not charting all of it)

Group Data - Error Bar data source



To get to these properties from toolbar properties dropdown, select Series Group Data, then click the properties icon.

The Group Data X value is the time of day (in minutes from midnight) the group started. The Group Data Y value is the day of year (days from Jan 1, inclusive) the group started.

The intersection of the X value (the time) and the Y value (the day) provides the visual representation of the start of the group.

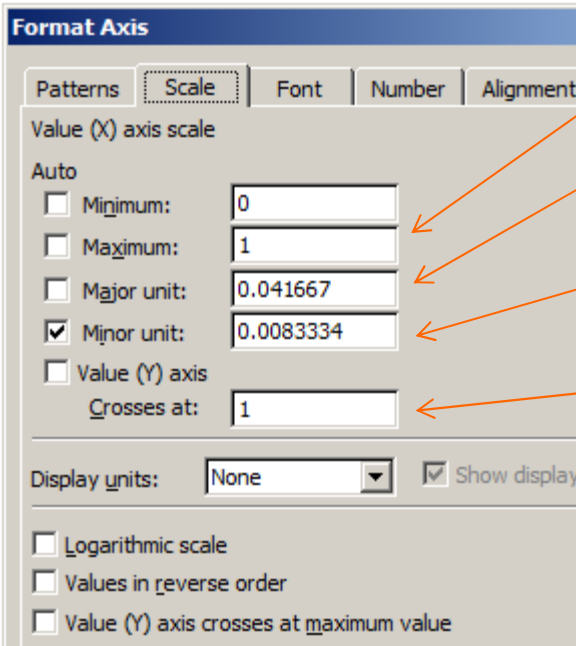
The Error Bar value is used to show the duration of the group. The Error Bar property of the chart is used solely as a charting convenience, it has no connection with any error value.

This column is GroupDuration
 Change the ending row number to that of the last row of data (even if not charting all of it)

Setup of Chart of Group Data - the X Secondary Axis

Note: You don't need to change these values once set

Secondary Value X Axis, this shows the time

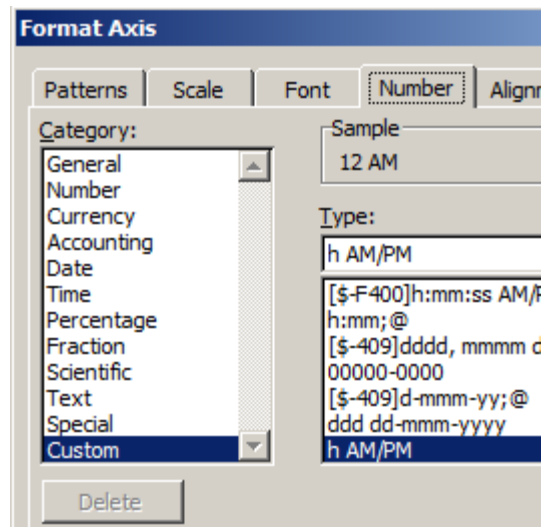


1 = 1 day

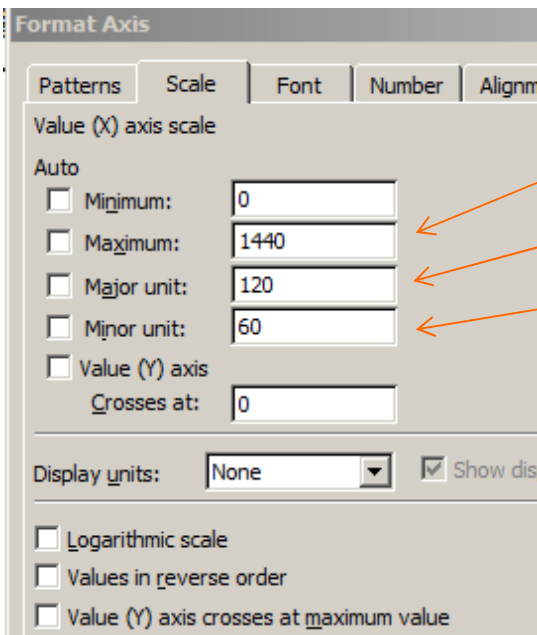
0.041667 = 1 day / 24 hours = 1/24
 Equiv of 1 hour

(Auto is checked) 0.0083334 = 1/120
 Equiv to 1/5 hour

this puts the Dates (the secondary Y Axis) on the right side of the chart



Value X Axis, this is the numerical value of the time



1440 = minutes / 1 day

120 = minutes / 2 hours

60 = minutes / 1 hours

Setup of Chart of Group Data - the Y value axis

Note: These are examples. You need to use values that work for your data.

Value Y Axis

Format Axis

Patterns Scale Font Number Alignment

Value (Y) axis scale

Auto

Minimum: 40

Maximum: 83

Major unit: 1

Minor unit: 1

Value (X) axis

 Crosses at: 83

Display units: None Show display units

Logarithmic scale

Values in reverse order

Value (X) axis crosses at maximum value

To get to these properties from toolbar properties dropdown, select Value (Y) axis, then click the properties icon.

The first day to show on chart, from Jan 1 inclusive

The last day to show on chart from Jan 1 inclusive

same as maximum, this puts the Value X text (the Excel date values) at the bottom of the chart

Note on min and max dates:

These don't need to be the same as the start and end dates of the data.

Using a smaller range shows fewer days. This may be desired as about 35 days is the most that can be charted on a page with the date still readable.

Starting the range with the prior day and ending the range with the next allows some space between the edge of the chart and the data. These extra days should be noted as such so they are not interpreted as having no events.

This puts oldest date at top of chart

Secondary Value Y Axis

Format Axis

Patterns Scale Font Number Alignment

Value (Y) axis scale

Auto

Minimum: 39487

Maximum: 39530

Major unit: 1

Minor unit: 1

Value (X) axis

 Crosses at: 39487

Display units: None Show display units

Logarithmic scale

Values in reverse order

Value (X) axis crosses at maximum value

To get to these properties from toolbar properties dropdown, select Secondary Value (Y) axis, then click the properties icon.

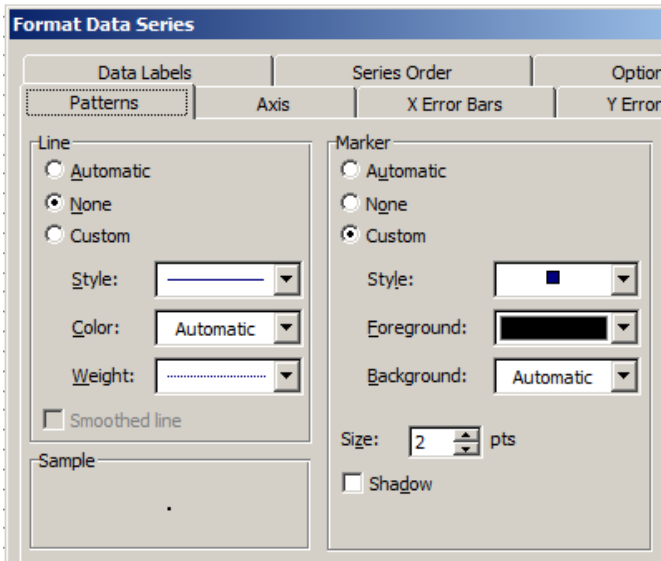
Excel date value equiv to Primary Y Axis date

Excel date value equiv to Primary Y Axis date

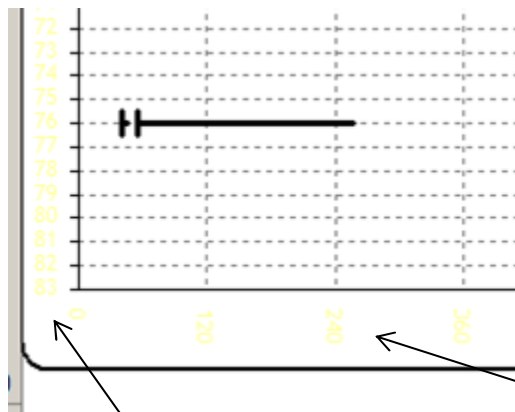
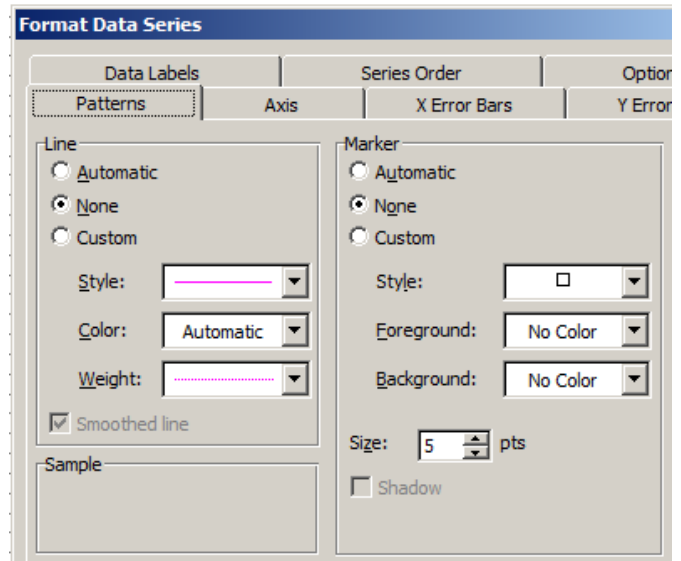
same as minimum, this puts the Secondary Value X text (the dates) at the top of chart

This puts oldest date at top of chart

Series "Group Data"



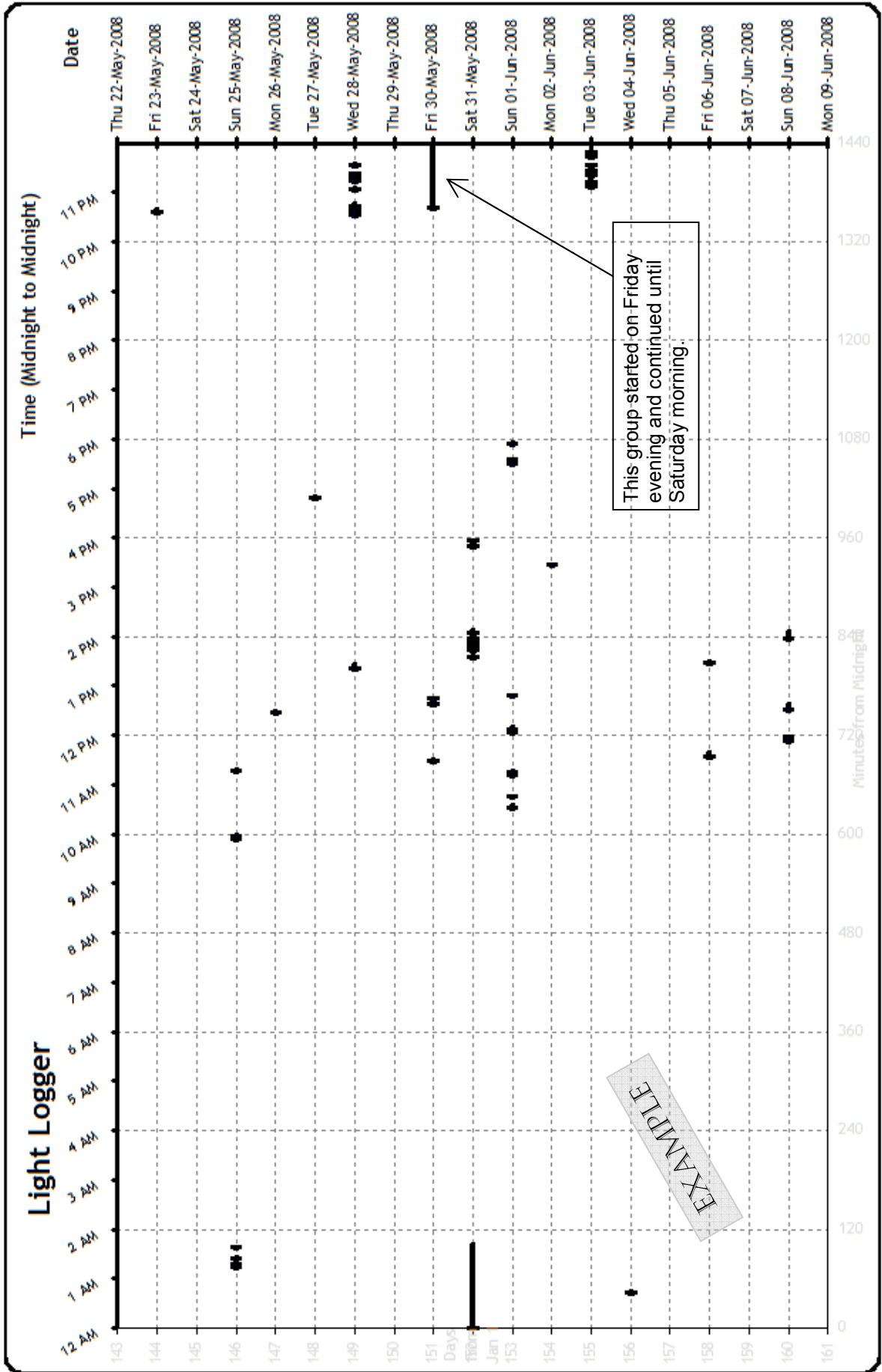
Series "Secondary Axis"



Value Y Axis has font set to a light yellow

Value X Axis has font set to a light yellow

Group On Time



Reference: Charting using Excel

These comments apply to the Group On Time chart, and most can be applied to similar charts showing events over a period of days.

The ideal chart would be linear, with the date and time as a continuous axis and have a scale that clearly shows events of one second duration. However, using 0.1 inch of linear chart for the smallest event of one second (so we can easily see it) and showing 5 weeks, this would take 48 miles of linear chart, which is obviously not practical.

The chart used is an Excel X-Y scatter chart, with the addition of error bars. The choice of the X for time and Y for date is one of convenience and appearance. In Excel, any data that falls outside of the chart is not displayed, which can lead to missing and truncated data. Since the chart time line breaks at midnight, groups that extend past midnight are charted only until midnight, and while the next day starts on the next line, Excel will not automatically continue the group. To fix this, any group that extends beyond midnight is broken into smaller groups, each contained within one day and none longer than 24 hours. Note that these subgroups are only done for charting, and the actual groups are used for the analysis part.

The Error Bar property of the chart is used solely as a charting convenience, it has no connection to any error. The X-axis Error Bar value is used to show the duration of the group. The width of the Excel error bar cannot be set as wide as desired, this is why it appears as a thin line coming from the thicker starting point.

The Excel chart uses two pairs of XY axis, which Excel calls the Value axis and the Secondary axis.

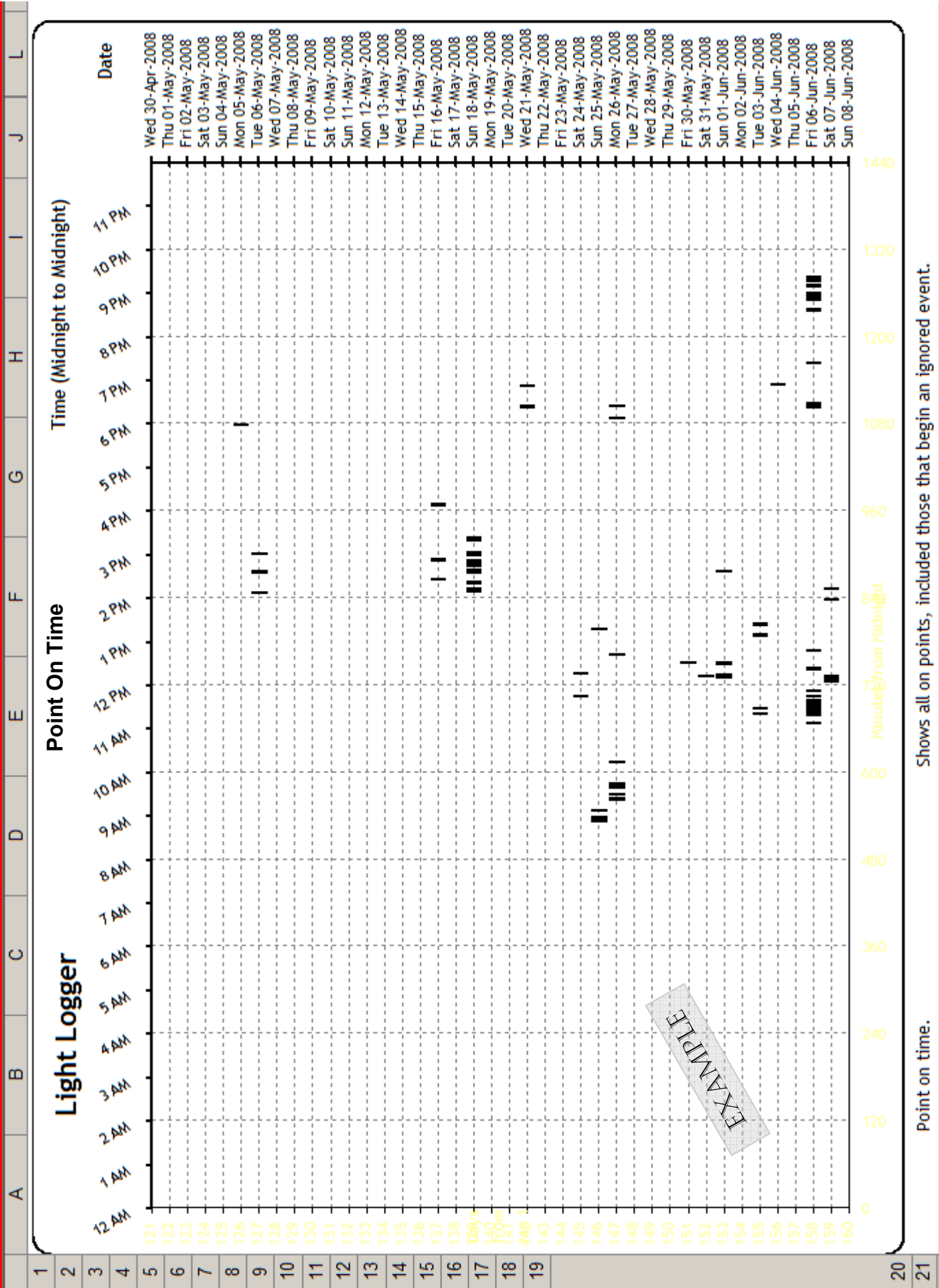
The X-Y Value axis uses the X-axis to show the time of each day, expressed in minutes from 0 to 1440 (as there are 1440 minutes in a day). The Y axis shows each day, from start to end of data (plus a day on either end so start/end days don't plot on the border). The days are the Excel date number value, which is the way Excel stores and handles dates. The start of each group is the intersection of the X and Y values for that group. The X and Y axis labels are not shown (the text is set to a light color), as the Secondary X-Y axis is used for the visible axis labels.

The Secondary X-Y axis shows the user-friendly representation for the time (on the X) and the date (on the Y). There is no data for these axis, just the X and Y labels are used. The number of divisions in each Secondary axis needs to be the same as the respective Value axis, so that the charted values correspond with the secondary axis division labels.

The Excel Chart is not directly connected with the data analysis. The data being charted is copied from Access (where the analysis is done) to Excel.

Ideally, the chart would be tightly connected to the data. The chart would also be programmable (that is, be able to set all properties via code). Also, the chart would be a part the data analysis program (currently in Access).

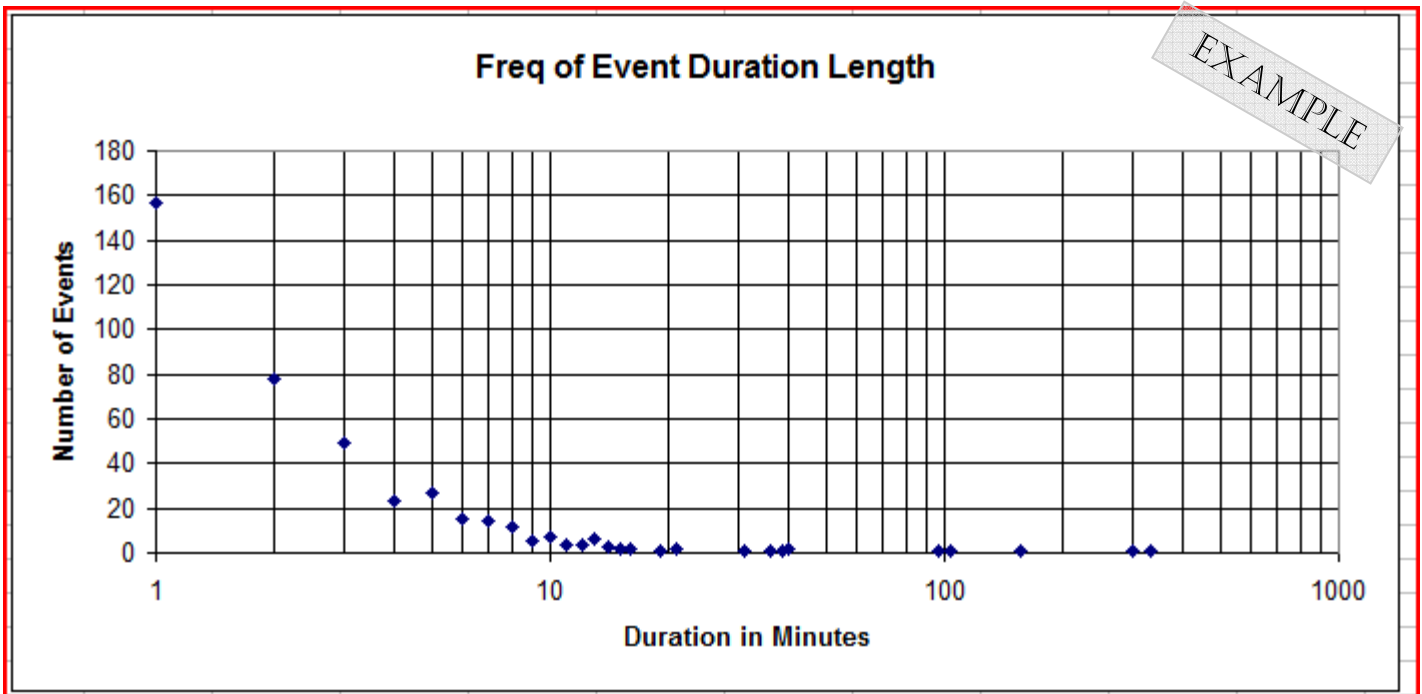
At some point the application may be written in as a self contained program and not require Microsoft Office. Then each chart can be remade and the use of the error bar for duration would not be needed, instead, there could be a line connecting the start and end point of each group. The width of the group event line could be better controlled. The secondary axis might not be needed if the value (primary) axis can chart the dates and times directly.



EXAMPLE

Shows all on points, included those that began an ignored event.

Point on time.



Notes on Chart Freq of Event Duration Length. These are all On events, including those not meeting minimum on time.
Duration in Minutes is charted on a logarithmic scale.

