

## In-Cave Data Logger Project (DLP)

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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](mailto: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

This version is based on the X axis for the date, the Y axis for the time. It also charts all "On" events and the group events.

### Contents:

- Copy the Group Data and the Point Data from MS Access to Excel for charting
- Group Series and Point Series
- Source Data
- Worksheet to determine chart properties.
- Setup of Chart - Group Data - Series 1
- Setup of Chart - The Point Data - Series 3
- Setup of Chart - Group Data - Value X Axis
- Setup of Chart - Group Data - Value Y Axis
- Setup of Chart - Group Data - Secondary Value X axis
- Setup of Chart - Group Data - Secondary Value Y axis
- Description of the Chart objects

## Copy the Group Data and the Point Data from MS Access to Excel for charting

### Group Data - This is in Series 1

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

	A	B	C	D	E	F
1	GroupID	GroupStartDate	GroupStartTime	GroupDuration	LogDateTime	
2	2	4	809	1	04-Jan-09	
3	4	17	703	1	17-Jan-09	
4	6	17	710	1	17-Jan-09	
5	8	17	790	2	17-Jan-09	
6	10	17	797	1	17-Jan-09	
7	12	17	798	1	17-Jan-09	

This is the Group Data tab

### Point Data - This is in Series 3

Copy the results of the Access query "qOnPointsForPlotting" into the Excel worksheet "Point Data"

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

	A	B	C	D	E
1	LogID	PointStartDate	PointStartTime	StateLength	
2	49	82	869	7	
3	51	82	870	1	
4	53	82	870	1	
5	55	82	870	2	
6	57	82	870	1	
7	59	82	870	2	

This is the Point Data tab

## Group Series and Point Series

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

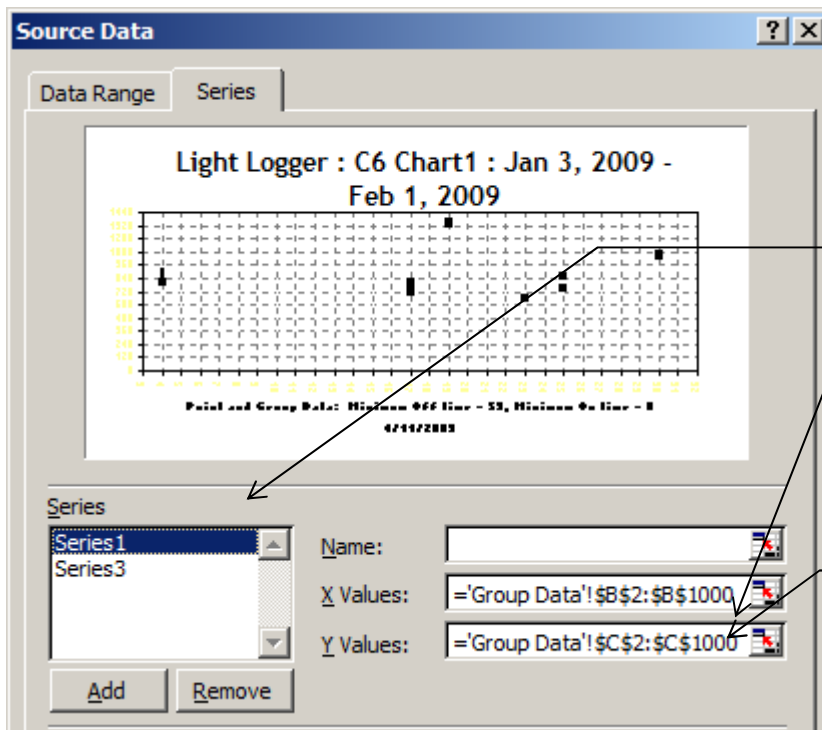
There are 2 series that are charted:

Group series. In these examples this is series 1.

Point series. In these examples this is series 3.

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

### Group Data - This is in Series 1



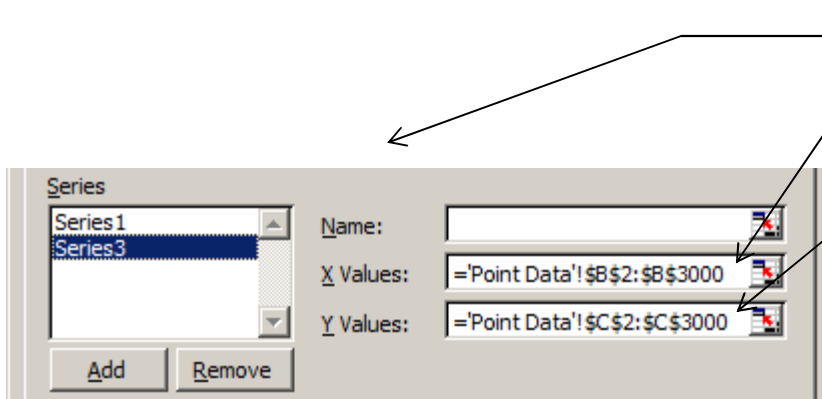
Note: The ending row number must be equal or greater than that of the last row of data being charted. It can be a row beyond the data, and using a large number means it doesn't need to be changed with every new chart.

Data Series 1

This column is GroupStartDate

This column is GroupStartTime

### Point Data - This is in Series 3 (could be series 2)



Data Series 3

This column is PointStartDate

This column is PointStateTime



## Worksheet to determine chart properties.

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

Note: About 35 days of data is the most that can be charted on a page with the date still readable. 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.

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 so logged events don't end up on the graph border.						
first day of year FDOY	1/1/2009					
<b>C6</b>	Month/Day/Year	Excel Date	Days inclusive from FDOY	Days in graph inclusive	Day of Week	
Graph1 start date	1/3/2009	39816	3		Saturday	
Graph1 end date	2/1/2009	39845	32	29	Sunday	
Graph2 start date	1/31/2009	39844	31		Saturday	
Graph2 end date	3/1/2009	39873	60	29	Sunday	
Graph3 start date	2/28/2009	39872	59		Saturday	
Graph3 end date	3/29/2009	39901	88	29	Sunday	

### Note on min and max dates:

For the actual chart, the days don't need to be the same as the start and end dates of the data from the above worksheet.

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.

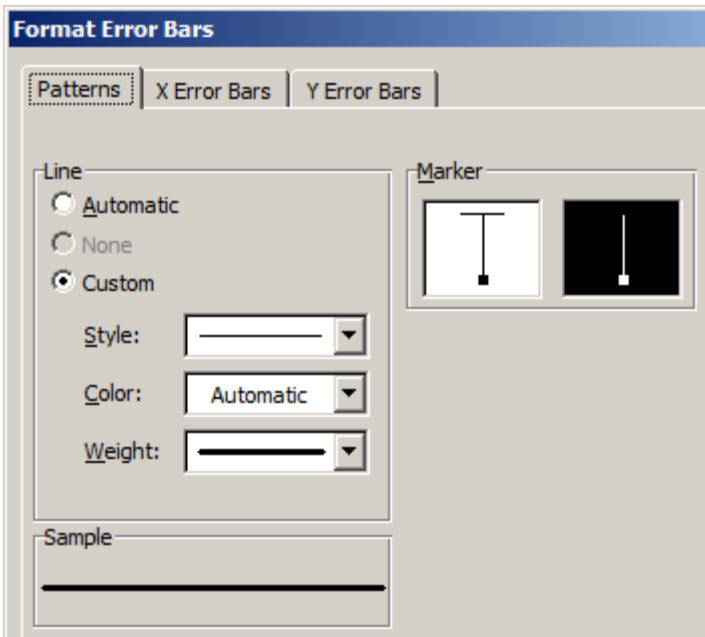


## Setup of Chart - Group Data - Series 1

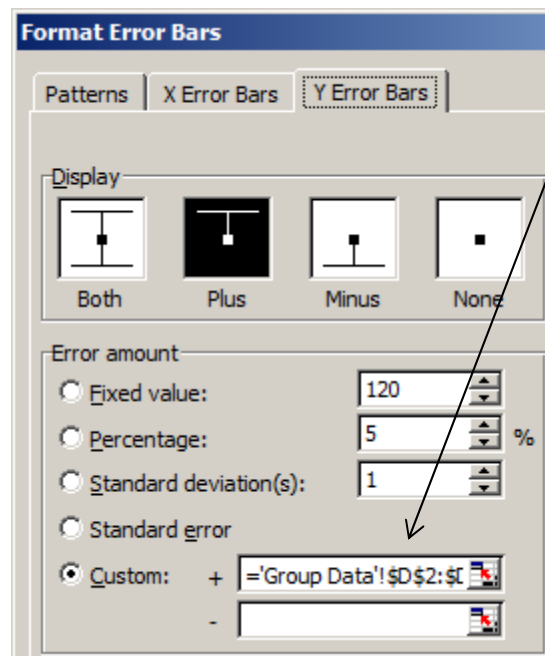
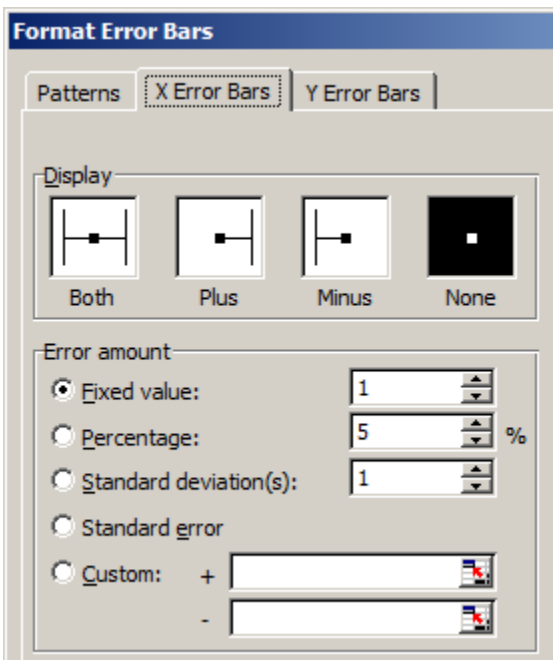
Note: You don't need to change these values once set except for the Y Error Bar custom error amount.

To get to these properties from toolbar properties dropdown, select Series 1 Error Bar, then click the properties icon.

Series 1 Error Bar properties



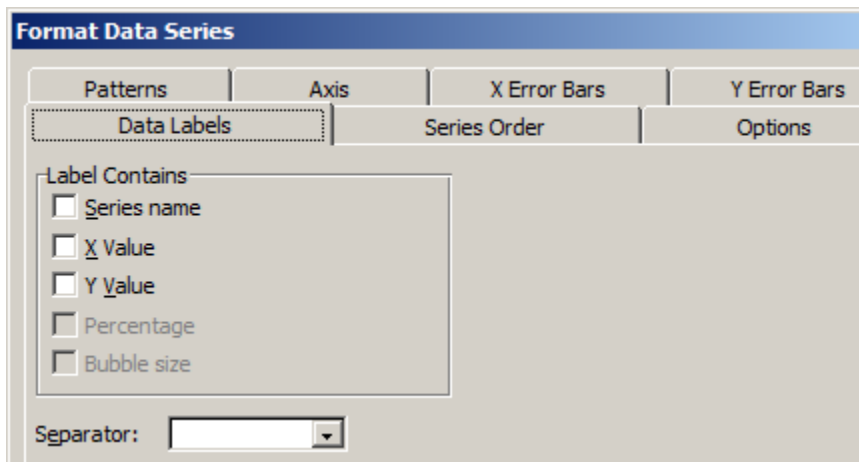
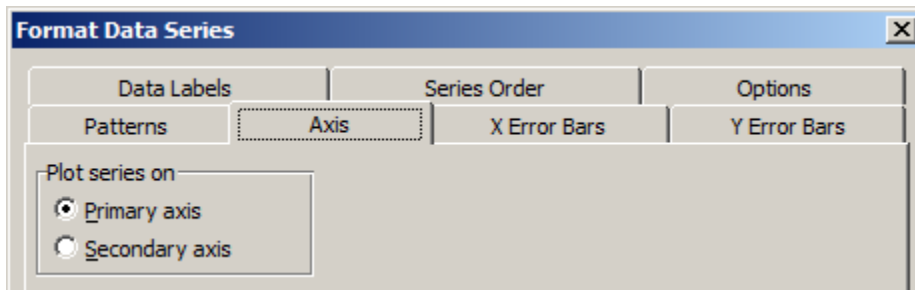
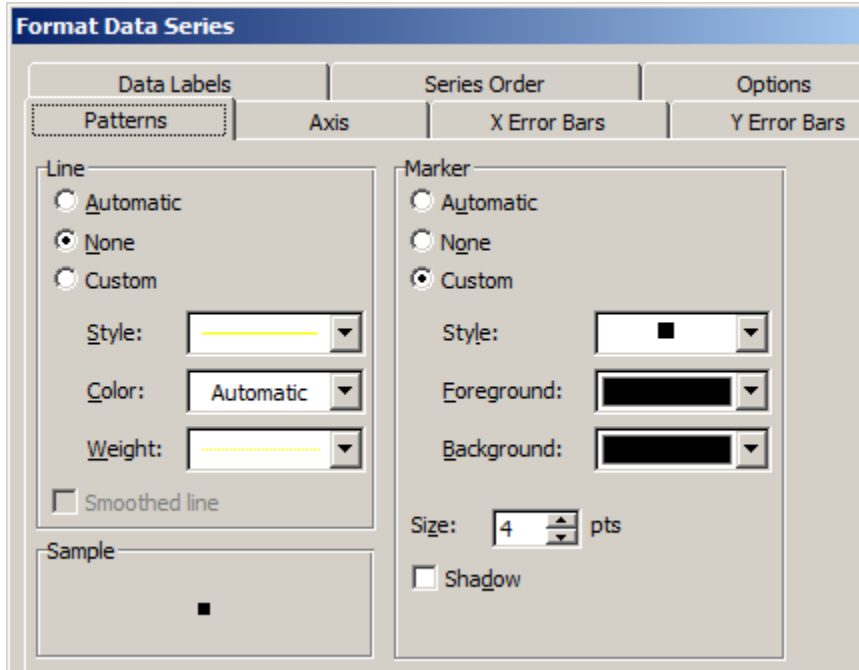
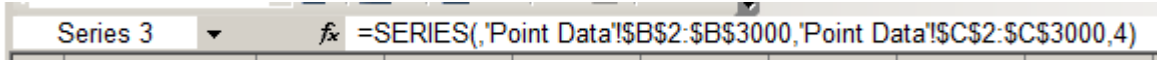
='Group Data'!\$D\$2:\$D\$1000



## Setup of Chart - The Point Data - Series 3

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

To get to these properties from toolbar properties dropdown, select Series 1 Data, then click the properties icon.



## Setup of Chart - Group Data - Value X Axis

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

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

### Value X Axis

**Format Axis**

Patterns | **Scale** | Font | Number | Alignment

Value (X) axis scale

Auto

Minimum: 114

Maximum: 147

Major unit: 1

Minor unit: 1

Value (Y) axis

Crosses at: 114

Display units: None  Show display units

Logarithmic scale

Values in reverse order

Value (Y) axis crosses at maximum value

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

The last day to show on chart from Jan 1 inclusive

This is the same as minimum, this puts the Value Y text at the left of the chart.

**Format Axis**

Patterns | Scale | Font | **Number** | Alignment

Category:

- General
- Number
- Currency
- Accounting
- Date
- Time
- Percentage
- Fraction
- Scientific
- Text
- Special
- Custom

Sample: 147

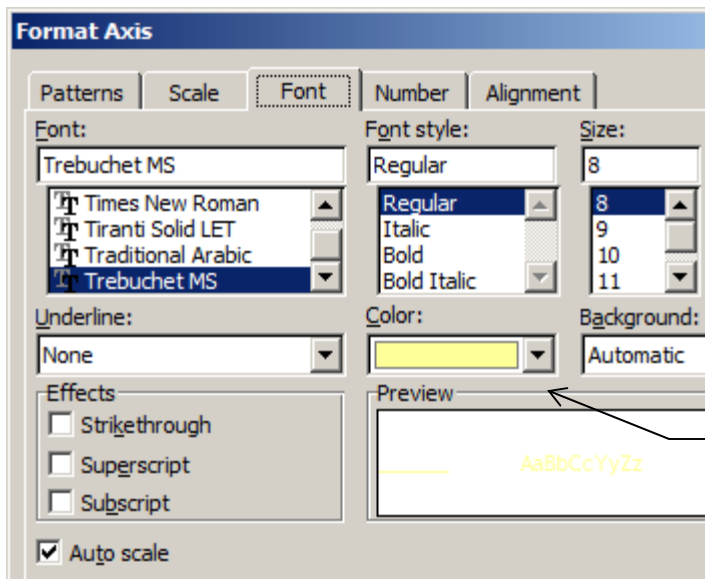
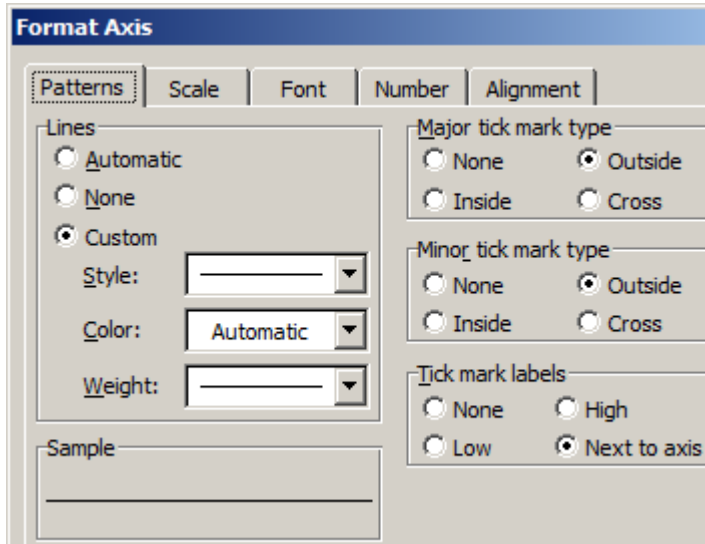
General format cells have no specific number format.

Linked to source

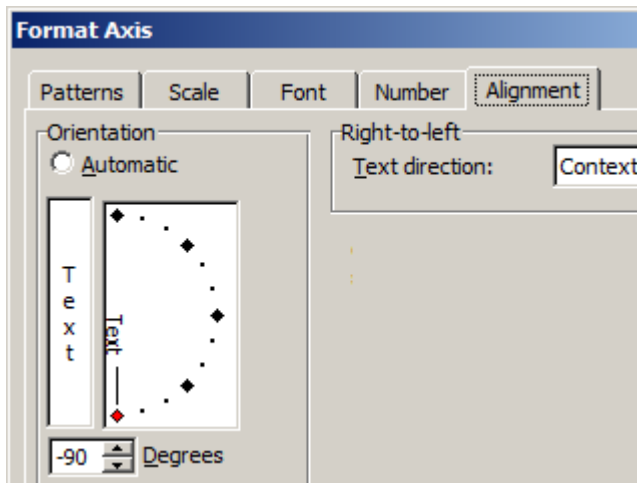
## Setup of Chart - Group Data - Value X Axis

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

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



Light tan or similar shade

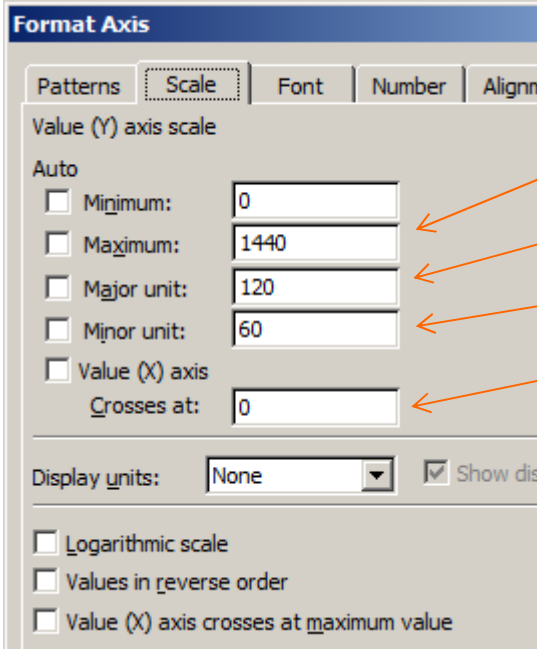


## Setup of Chart - Group Data - Value Y Axis

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

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

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

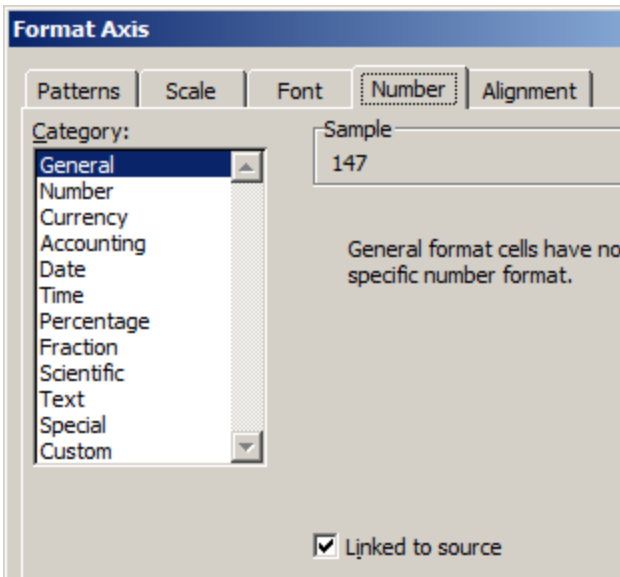


1440 = minutes / 1 day

120 = minutes / 2 hours

60 = minutes / 1 hours

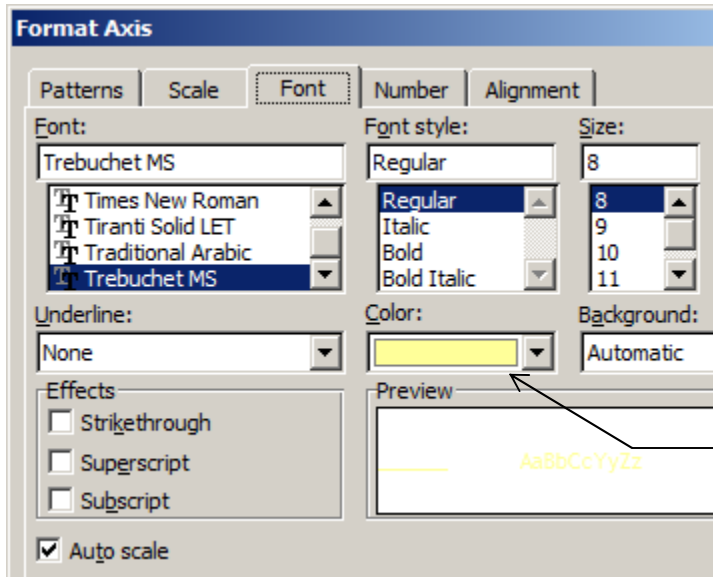
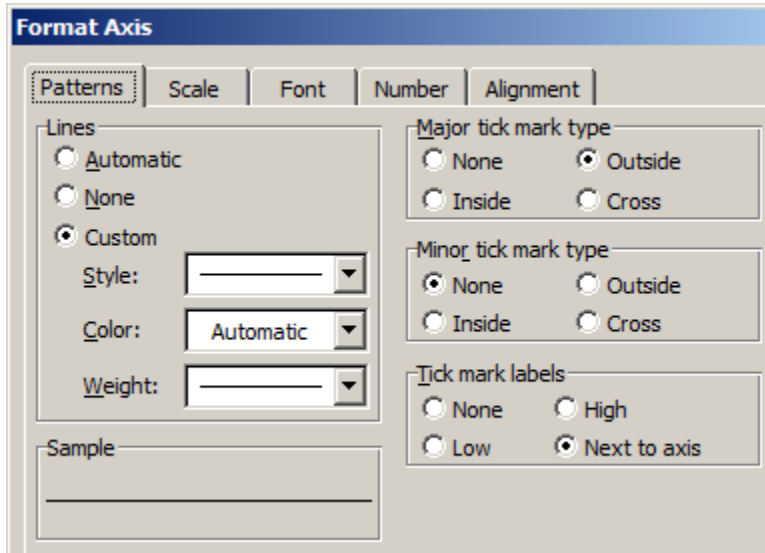
This is the same as minimum, this puts the Value X text at the bottom of the chart.



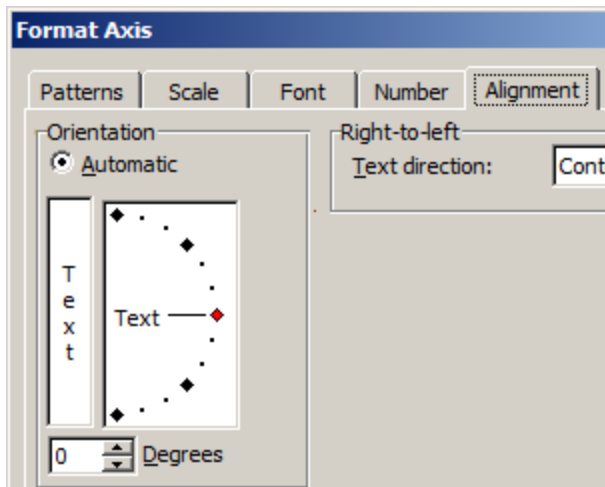
## Setup of Chart - Group Data - Value Y Axis

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

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



Light tan or similar shade



## Setup of Chart - Group Data - Secondary Value X axis

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

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

### Secondary Value X Axis

**Format Axis**

Patterns Scale Font Number Alignm

Value (X) axis scale

Auto

Minimum: 39561

Maximum: 39594

Major unit: 1

Minor unit: 1

Value (Y) axis crosses at: 39594

Display units: None  Show display units

Logarithmic scale

Values in reverse order

Value (Y) axis crosses at maximum value

Excel date value equiv to Primary X Axis date

Excel date value equiv to Primary X Axis date

This is the same as maximum, this puts the Secondary Value Y text (the time) at the right of chart.

**Format Axis**

Patterns Scale Font Number Alignm

Category:

- General
- Number
- Currency
- Accounting
- Date
- Time
- Percentage
- Fraction
- Scientific
- Text
- Special
- Custom

Sample: Mon May 26

Type: ddd mmm dd

[\$-409]d-mmm-yy;@  
ddd dd-mmm-yyyy  
h AM/PM  
dd-mmm-yy  
ddd dd-mmm  
ddd, mmm dd  
ddd mmm dd

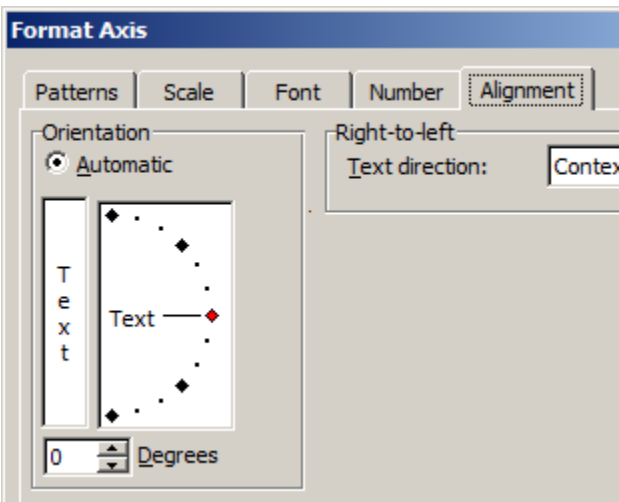
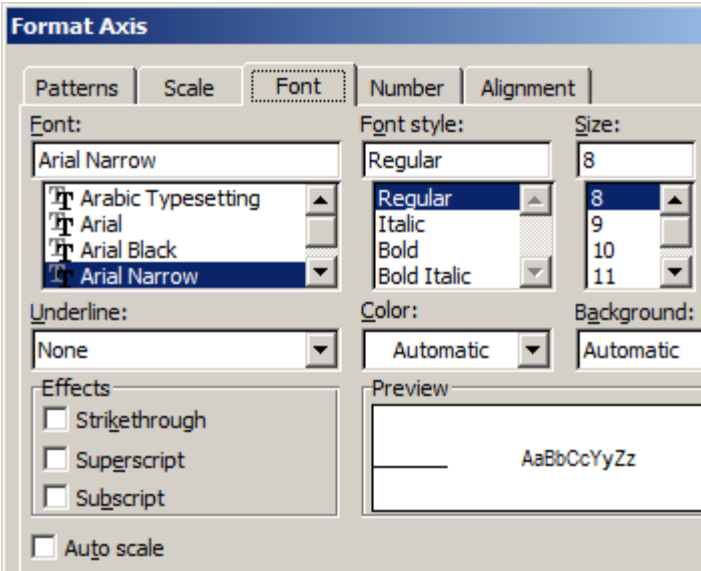
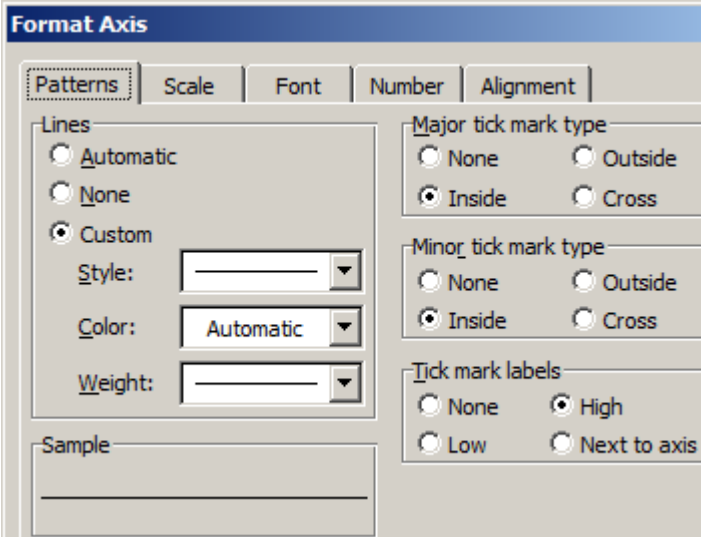
Delete

Linked to source

## Setup of Chart - Group Data - Secondary Value X axis

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

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

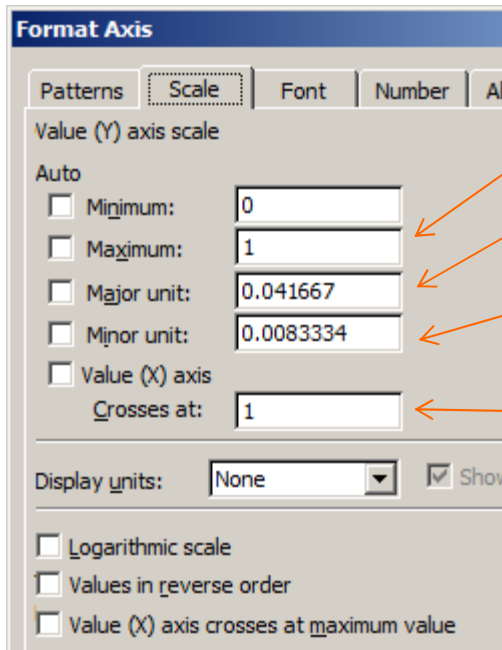


## Setup of Chart - Group Data - Secondary Value Y axis

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

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

Secondary Value Y Axis, this shows the time

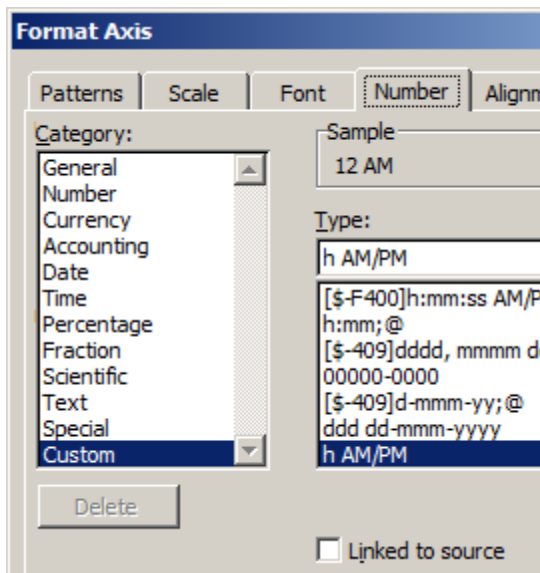


1 = 1 day

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

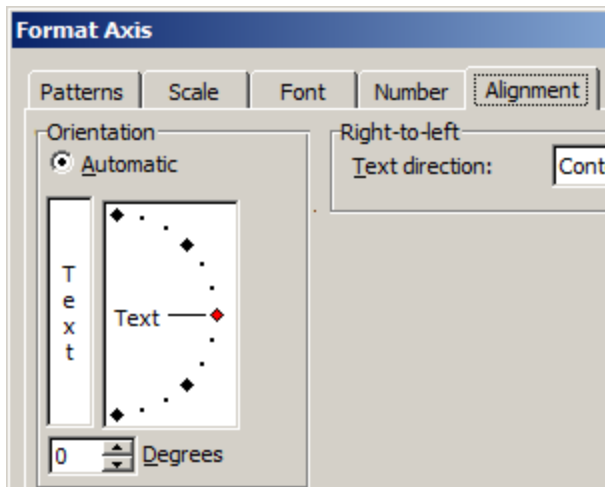
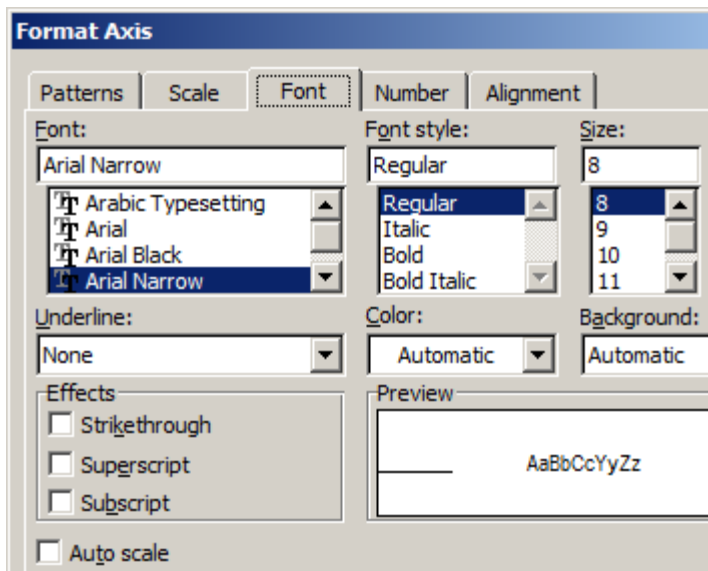
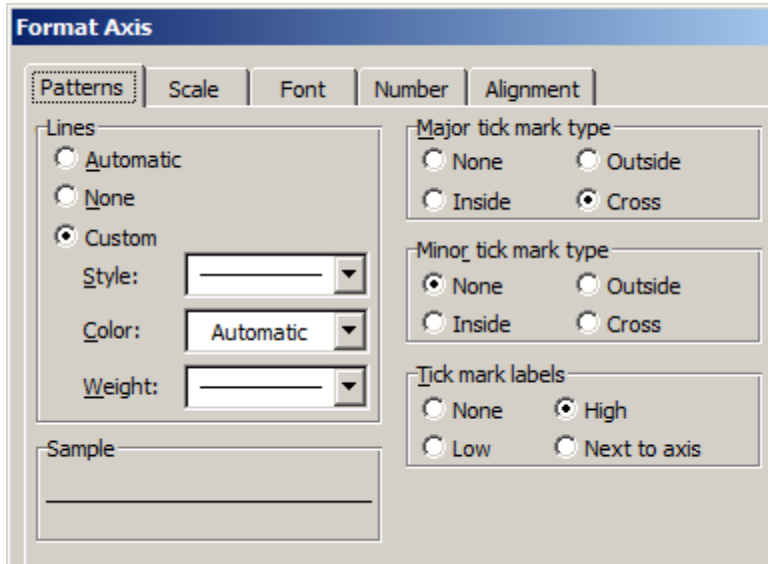
(Auto is checked) 0.0083334 = 1/120  
Equiv to 1/5 hour

This is the same as maximum, this puts the Secondary Value X text (the date) at the top of chart.



## Setup of Chart - Group Data - Secondary Value Y axis

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



## Description of the Chart objects

Note that this description uses a chart with simulated data.

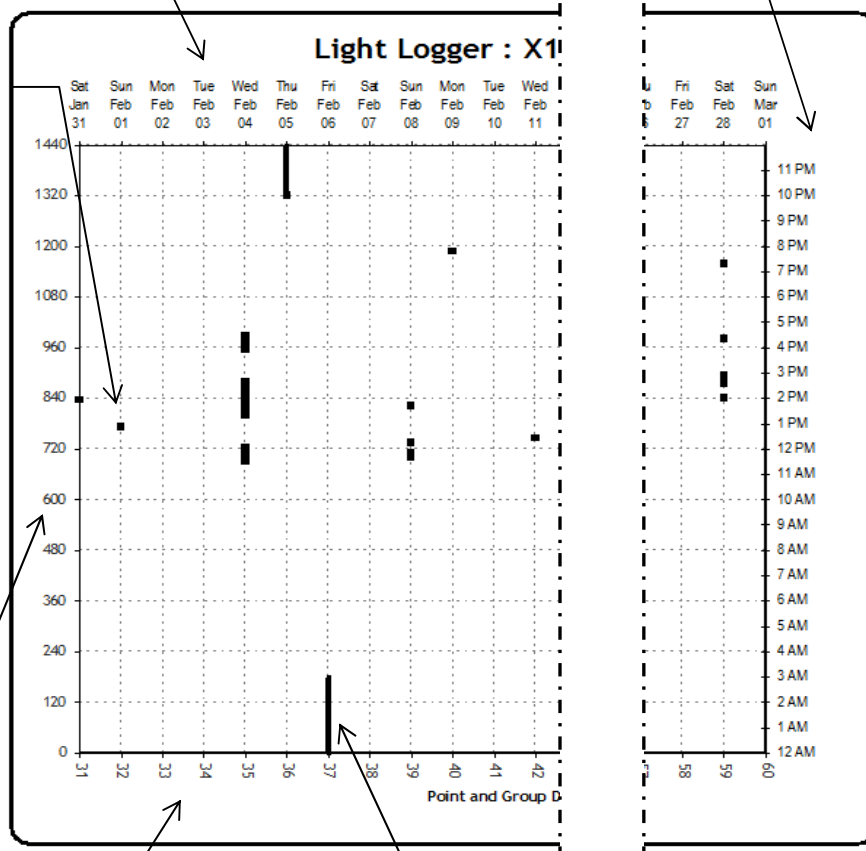
Secondary X Axis - shows dates as we expect to see it.

Secondary Y Axis - shows time as we expect to see it.

A square represents a point recorded as the start of a light on event. Often multiple points appear as one wide line as the image detail necessitates that points cover a time period larger than the represent. This is analogous to a road map, where the width of roads are not shown do scale.

Value Y Axis - shows time as a units of seconds. The font set to a light color and is not visible on reports.

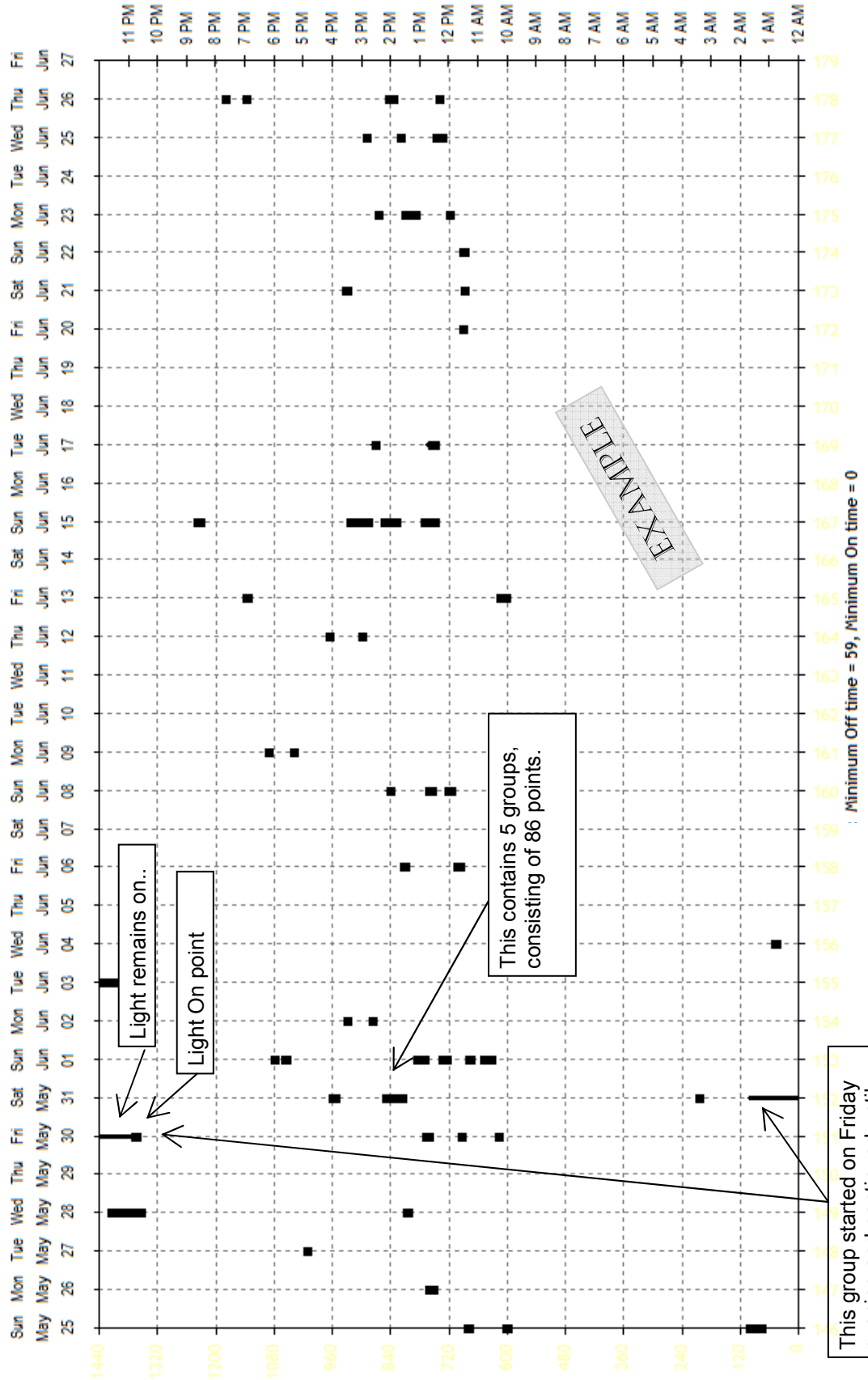
Value X Axis - shows the date as date from Jan 1. The font set to a light color and is not visible on reports.



A line, thinner than a square, represents the duration of an "On Group". In this example, no on events occurred after the initial on event, and the group duration was 5 hours. The group began with the On event (point) on Feb 5 at 10 pm, shown as a square.

### Point and Group Chart

Light Logger :  : May 26, 2008 - June 26, 2008



## Reference: Charting using Excel

Note: This page was written for a version of the charts that used the X axis for time, Y axis for date, and did not show individual light on events.

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.