

Chapter 166

Scatter Plots with Error Bars from Summary Data

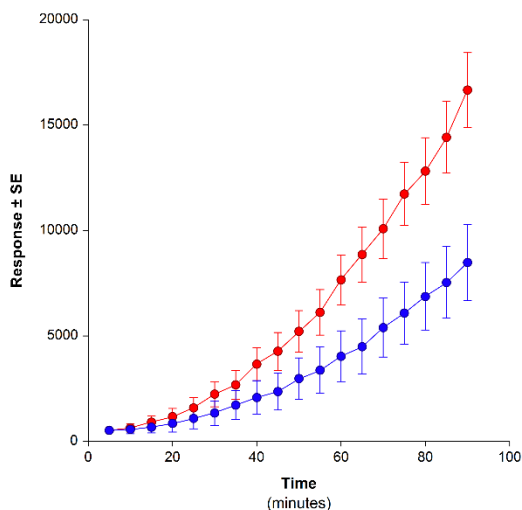
Introduction

The Scatter Plots with Error Bars from Summary Data procedure extends the capability of the basic scatter plot by allowing you to plot the variability in Y and/or X corresponding to each point. This procedure allows you to enter the error for both X and Y separately in two ways: 1. as a single magnitude of error, called *delta*, (e.g. standard deviation, standard error, etc.), or 2. by entering the upper and lower error bounds for each point directly, which allows for asymmetric error bars.

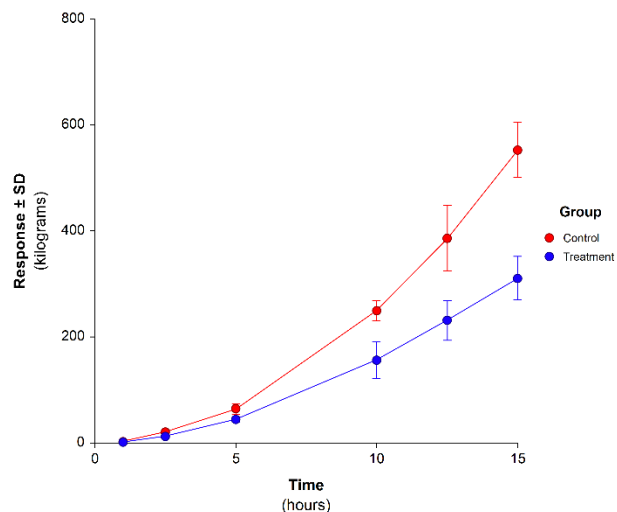
This procedure makes use of all of the additional enhancement features available in the basic scatter plot, including trend lines (least squares), confidence limits, polynomials, splines, loess curves, and border plots.

The following graphs are examples of scatter plots with error bars from summary data that you can create with this procedure. This chapter contains information only about options that are specific to the Scatter Plots with Error Bars from Summary Data procedure. For information about the other graphical components and scatter-plot specific options available in this procedure (e.g. regression lines, border plots, etc.), see the chapter on Scatter Plots.

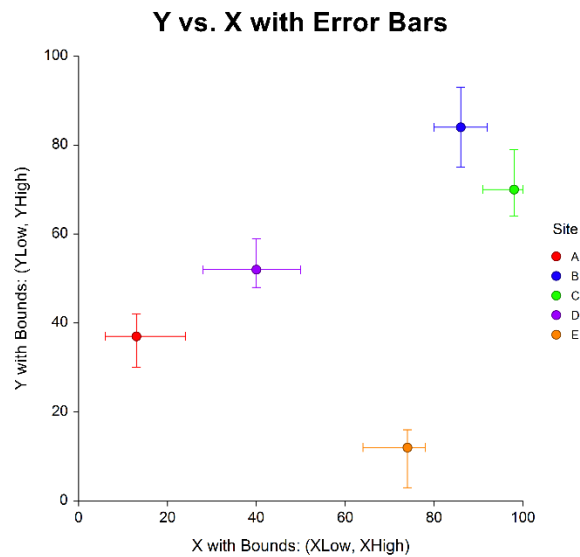
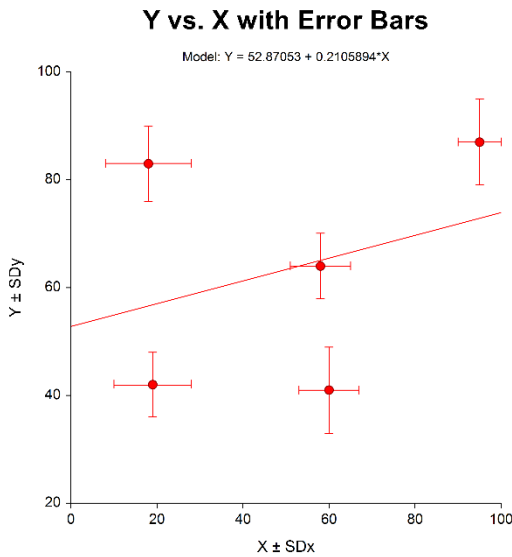
Response vs. Time with Error Bars



Response vs. Time with Error Bars



Scatter Plots with Error Bars from Summary Data



Data Structure

This procedure accepts data in two different input formats. Both data formats involve a single column of paired X and Y values. The difference is due the way that the error is entered. You may enter either a single column containing error values, called *delta*, (e.g. standard deviation, standard error, etc.), which results in symmetric error bars, or you may enter the upper and lower error bounds for each point directly, which allows for asymmetric error bars. You may enter error for the X variable, the Y variable, or both. Rows with missing X or Y values are ignored. Rows with missing error values are plotted, but error bars for the corresponding points are not drawn.

A grouping variable may be used to divide the points into groups (e.g., age group or gender).

Enter Error as ΔY (or ΔX) (Error Bounds = $Y \pm \Delta Y$ (or $X \pm \Delta X$))

In this type, X and Y values are contained in two separate columns. Enter a single column containing the error values for the X and/or Y variables (ΔX 's and ΔY 's). The X error bar bounds for each point are computed as

$$X \text{ Error Upper Bound} = X + \Delta X$$

$$X \text{ Error Lower Bound} = X - \Delta X$$

The Y error bar bounds for each point are computed as

$$Y \text{ Error Upper Bound} = Y + \Delta Y$$

$$Y \text{ Error Lower Bound} = Y - \Delta Y$$

These bounds result in horizontal error bars that are symmetric about each plotted point.

X and Y with Error Entered as ΔX and ΔY

X	Y	SDx	SDy
18	83	10	7
19	42	9	6
95	87	5	8
60	41	7	8

Scatter Plots with Error Bars from Summary Data

Enter Upper and Lower Error Bounds Separately

In this type, X and Y values are contained in two separate columns. The upper and lower error bounds for X and/or Y are entered directly, each using two additional input columns. With this input type, it is possible to enter asymmetric error bounds.

X and Y with Upper and Lower Error Bounds

X	Y	XLow	XHigh	YLow	YHigh
13	37	6	24	30	42
86	84	80	92	75	93
98	70	91	100	64	79
40	52	28	50	48	59

Procedure Options

This section describes the options available in the Scatter Plot with Error Bars from Summary Data procedure.

Variables Tab

This panel specifies which variables are used in the scatter plot with error bars.

Variables

Y (Vertical) Variable

Specify a column with numeric values to be plotted on the vertical axis.

X (Horizontal) Variable

Specify a column with numeric values to be plotted on the horizontal axis.

Grouping (Symbol) Variable

This variable may be used to separate the observations into groups. For example, you might want to use different plotting symbols to distinguish observations from different groups. You designate the grouping variable here. Each unique value of this column is plotted with a different symbol. The symbols are selected by clicking on the plot format button and then clicking on the symbol format button.

Data Label Variable

A data label is text that is displayed beside each point. A column containing the data labels is specified here. The values may be text or numeric. The data labels will not be shown unless you activate them by clicking the plot format button and checking "Labels."

Frequency Variable

Specify an optional frequency (count) variable. This data column contains integers that represent the number of observations (frequency) associated with each row of the dataset. If this option is left blank, each dataset row has a frequency of one. This variable lets you modify that frequency. This may be useful when your data are tabulated and you want to enter counts.

Scatter Plots with Error Bars from Summary Data

Weight Variable

The weight variable contains the (non-negative) weight given to each observation in regression calculations. By default, each observation receives an equal weight of $1/n$ (where n is the sample size). This variable allows you to specify different weights for different observations. The weight variable is commonly created in the Robust Regression procedure. NCSS automatically scales the weights so they sum to one. Hence, you can enter integer numbers and NCSS will scale them to appropriate fractions.

Error Input and Variables

Y Error Input Type

Specify how the error for the Y (vertical) axis variable will be entered. The choices are

- **None**
No error bars will displayed for the Y (vertical) variable.
- **Enter Y Error as ΔY (Y Error Bounds = $Y \pm \Delta Y$)**
Enter a single column containing the error values for the Y variable (ΔY 's). The Y error bar bounds for each point are computed as

$$\text{Upper Y Error Bound} = Y + \Delta Y$$

$$\text{Lower Y Error Bound} = Y - \Delta Y$$

These bounds result in vertical error bars that are symmetric about the center point.

- **Enter Upper and Lower Y Error Bounds Separately**
Enter the upper and lower Y error bounds directly using two input columns. With this input type, it is possible to enter asymmetric error bounds.

Y Error (ΔY) Variable (Shown if Y Error Input Type = Enter Y Error as ΔY)

Specify a column that contains error values to be plotted with the corresponding points in the Y (vertical) direction. These values are used to draw symmetric error bars about the center point.

The Y error bounds are calculated using these error values as

$$\text{Upper Y Error Bound} = Y + \Delta Y$$

$$\text{Lower Y Error Bound} = Y - \Delta Y$$

If this variable is left blank, no Y error-bar lines will be plotted.

Lower Y Error Bound Variable (Shown if Y Error Input Type = Enter Upper and Lower Y Error Bounds Separately)

Specify a column that contains lower error values to be plotted with the corresponding points in the Y (vertical) direction. The values in this variable should be less than the corresponding values in the Upper Y Error Bound Variable. If this variable is left blank, no lower Y error bar lines will be plotted.

Upper Y Error Bound Variable (Shown if Y Error Input Type = Enter Upper and Lower Y Error Bounds Separately)

Specify a column that contains upper error values to be plotted with the corresponding points in the Y (vertical) direction. The values in this variable should be greater than the corresponding values in the Lower Y Error Bound Variable. If this variable is left blank, no upper Y error bar lines will be plotted.

Scatter Plots with Error Bars from Summary Data

X Error Input Type

Specify how the error for the X (horizontal) axis variable will be entered. The choices are

- **None**
No error bars will displayed for the X (horizontal) variable.
- **Enter X Error as ΔX (X Error Bounds = $X \pm \Delta X$)**
Enter a single column containing the error values for the X variable (ΔX 's). The X error bar bounds for each point are computed as

$$\text{Upper X Error Bound} = X + \Delta X$$

$$\text{Lower X Error Bound} = X - \Delta X$$

These bounds result in horizontal error bars that are symmetric about the center point.

- **Enter Upper and Lower X Error Bounds Separately**
Enter the upper and lower X error bounds directly using two input columns. With this input type, it is possible to enter asymmetric error bounds.

X Error (ΔX) Variable (Shown if X Error Input Type = Enter X Error as ΔX)

Specify a column that contains error values to be plotted with the corresponding points in the X (horizontal) direction. These values are used to draw symmetric error bars about the center point.

The X error bounds are calculated using these error values as

$$\text{Upper X Error Bound} = X + \Delta X$$

$$\text{Lower X Error Bound} = X - \Delta X$$

If this variable is left blank, no X error-bar lines will be plotted.

Lower X Error Bound Variable (Shown if X Error Input Type = Enter Upper and Lower X Error Bounds Separately)

Specify a column that contains lower error values to be plotted with the corresponding points in the X (horizontal) direction. The values in this variable should be less than the corresponding values in the Upper X Error Bound Variable. If this variable is left blank, no lower X error bar lines will be plotted.

Upper X Error Bound Variable (Shown if X Error Input Type = Enter Upper and Lower X Error Bounds Separately)

Specify a column that contains upper error values to be plotted with the corresponding points in the X (horizontal) direction. The values in this variable should be greater than the corresponding values in the Lower X Error Bound Variable. If this variable is left blank, no upper X error bar lines will be plotted.

Format Options

Variable Names

This option selects whether to display variable names, labels, or both.

Value Labels

This option selects whether to display only values, value labels, or both. Use this option if you want the group variable to automatically attach labels to the values (like 1=Yes, 2=No, etc.).

Scatter Plots with Error Bars from Summary Data

Scatter Plot with Error Bars Format

Format

Click the format button to change the plot settings (see Scatter Plot with Error Bars Window Options below).

Edit During Run

Checking this option will cause the Scatter Plot Format window to appear when the procedure is run. This allows you to modify the format of the graph with the actual data.

Symbol Size Options

Symbol Size Variable

This optional variable can be used to specify a proportional size for the data points.

Scatter Plot with Error Bars Window Options

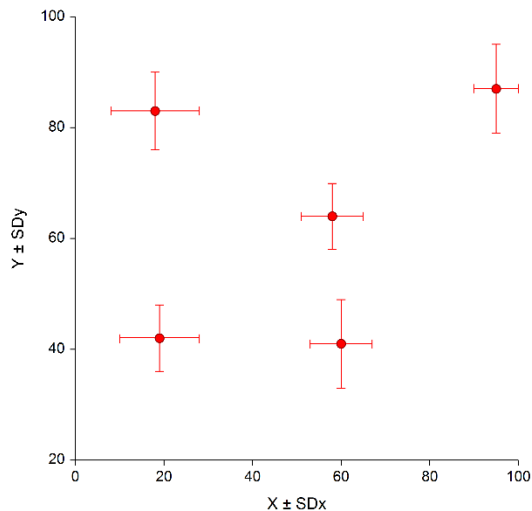
This section describes the specific options available on the Scatter Plot with Error Bars window, which is displayed when the Plot Format button is clicked. For information about the other graphical components and scatter-plot specific options available in this procedure (e.g. symbols, regression lines, data labels, etc.), see the chapter on Scatter Plots. Common plot options, such as axes, labels, legends, and titles are documented in the Graphics Components chapter.

Scatter Plot Tab

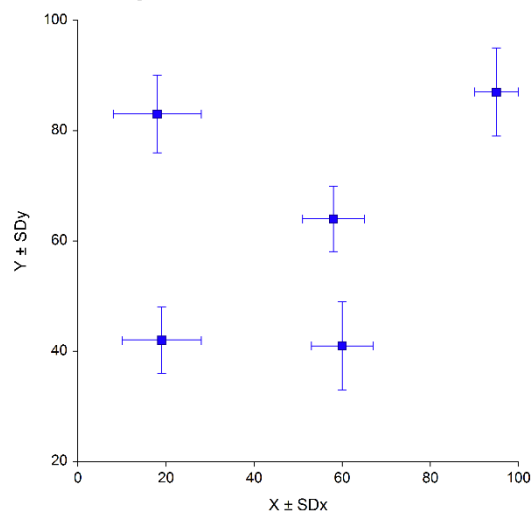
Symbols

You can also modify the appearance of all symbols on the plot. By default, the error bars have the same color as the symbols.

Red Symbols with Red Bars



Blue Symbols with Blue Bars



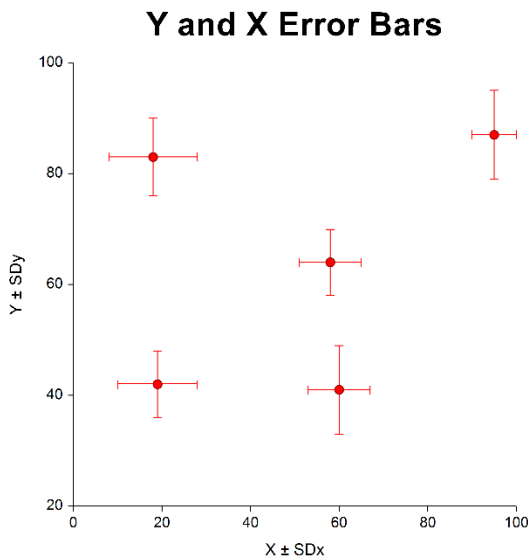
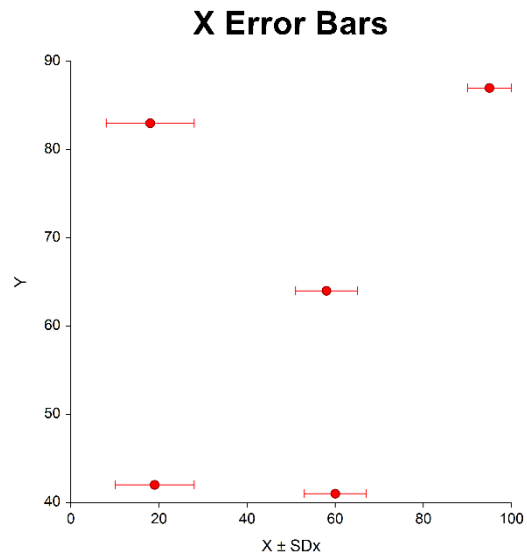
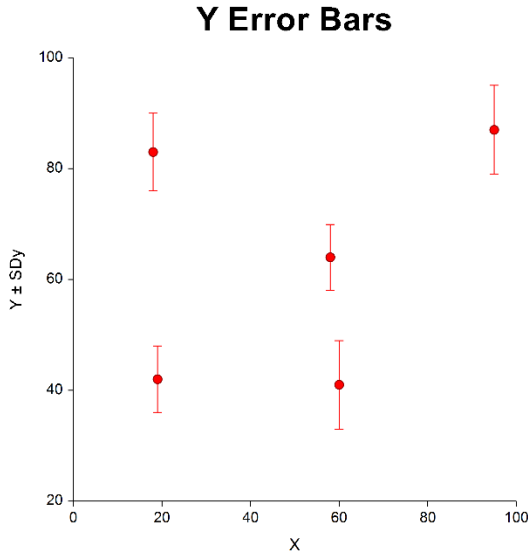
Scatter Plots with Error Bars from Summary Data

Variation (Error Bars)

You can modify the content and appearance of the vertical and horizontal error bars using these options. We will highlight the most commonly-used options.

Y and X Error Bar Lines

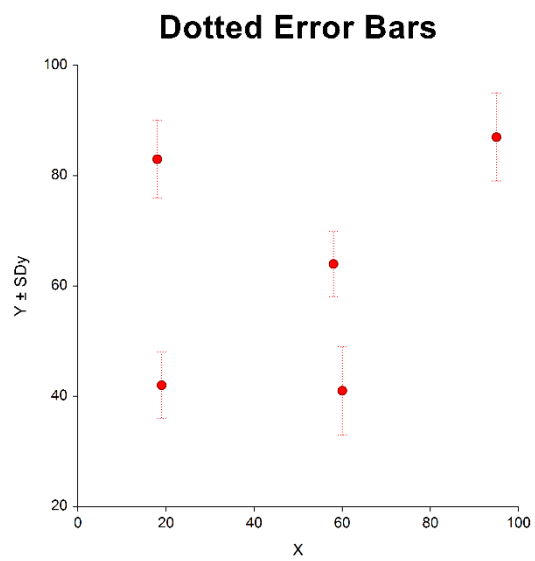
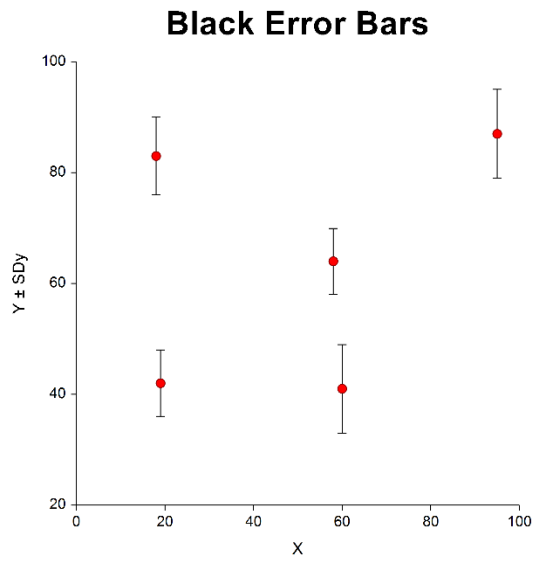
Select the error bars to be displayed.



Scatter Plots with Error Bars from Summary Data

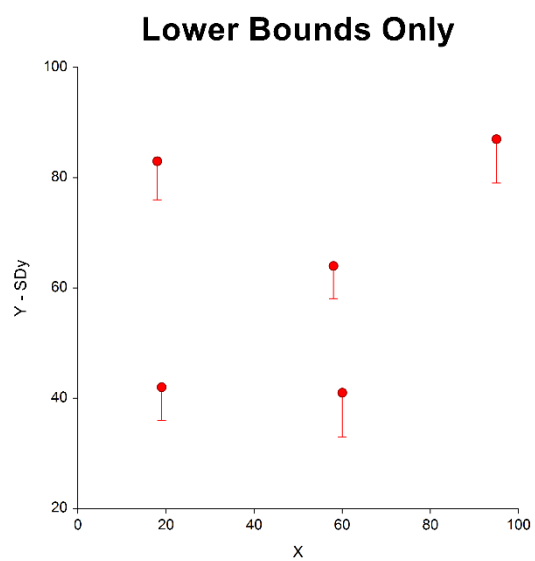
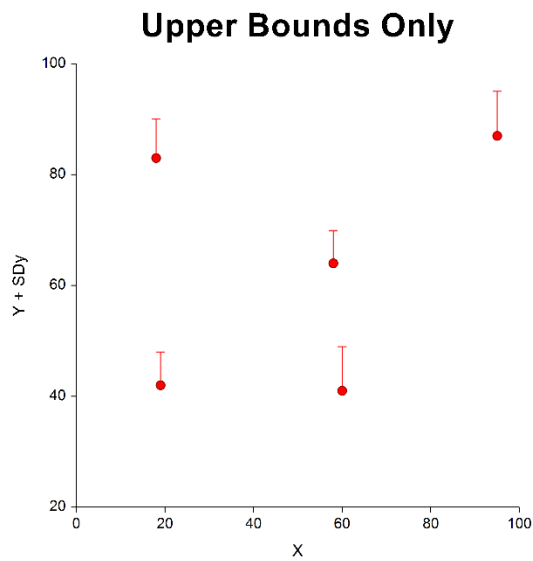
Line Color and Style

Specify the color and style of error bar lines. The lines and symbols are completely customizable.



Direction

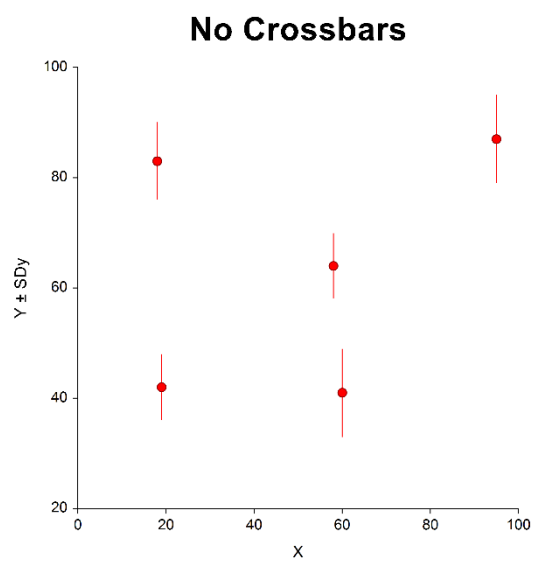
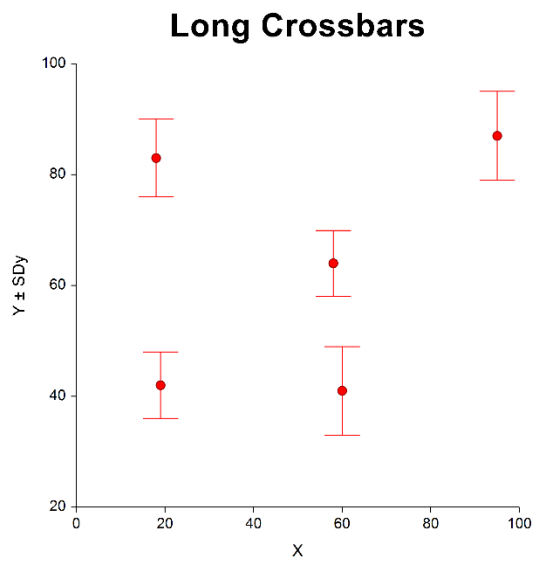
Specify whether error bars extend up or down (right or left) from the center point.



Scatter Plots with Error Bars from Summary Data

Crossbars

Specify whether or not to include crossbars and their size.



Example 1 – Creating a Scatter Plot with Error Bars from Summary Data by Entering Delta

This example demonstrates how to generate a simple scatter plot with error bars from data that includes standard error measurements for the Y variable. The data used are contained in the ScatPlotErrorSum1 dataset. In this example, Response is the Y variable and Time is the X variable.

You may follow along here by making the appropriate entries or load the completed template **Example 1** by clicking on Open Example Template from the File menu of the Scatter Plots with Error Bars from Summary Data procedure window.

1 Open the ScatPlotErrorSum1 dataset.

- From the File menu of the NCSS Data window, select **Open Example Data**.
- Click on the file **ScatPlotErrorSum1**.
- Click **Open**.

2 Open the Scatter Plots with Error Bars from Summary Data window.

- Using the Graphics menu or the Procedure Navigator, find and select the **Scatter Plots with Error Bars from Summary Data** procedure.
- On the menus, select **File**, then **New Template**. This will fill the procedure with the default template.

3 Specify the variables and error type.

- For **Y (Vertical) Variable** enter “**Response**”.
- For **X (Horizontal) Variable** enter “**Time**”.
- For **Grouping (Symbol) Variable** enter “**Rate**”.
- For **Y Error Input Type** leave “**Enter Y Error as ΔY (Y Error Bounds = $Y \pm \Delta Y$)**” selected.
- For **Y Error (ΔY) Variable** enter “**SE**”.

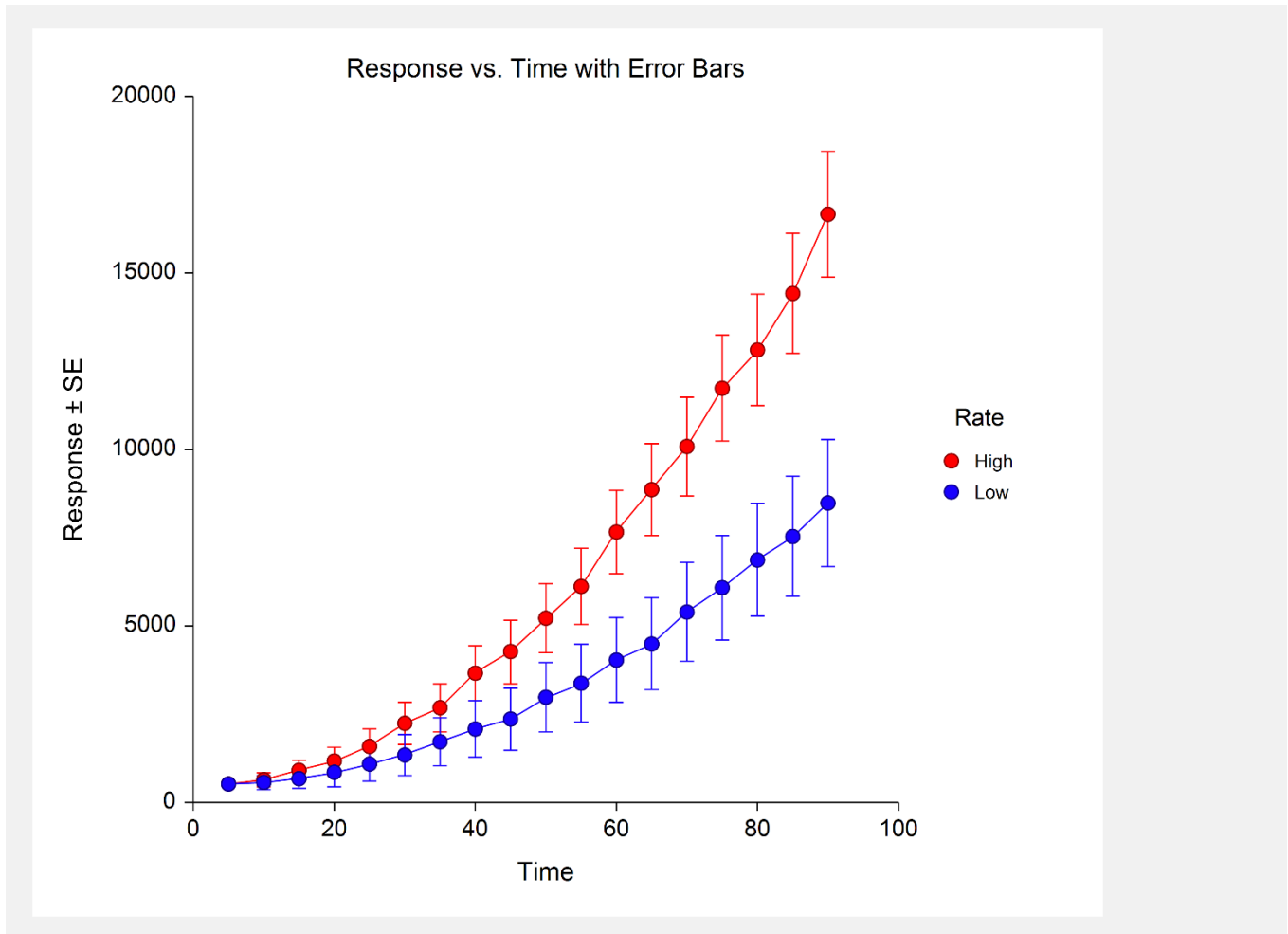
4 Edit the Plot.

- Click on the **Plot Format** button.
- Select the **More Lines** tab, and put a checkmark next to **Line** under **Connect Data Points**.
- Click **OK** to save the plot settings.

5 Run the procedure.

- From the Run menu, select **Run Procedure**. Alternatively, just click the green Run button.

Scatter Plot Output



Example 2 – Creating a Scatter Plot with Error Bars from Summary Data by Entering Upper and Lower Error Bounds

This example demonstrates how to generate a simple scatter plot with error bars from data that includes upper and lower bounds for both the X and Y variables. The data used are contained in the ScatPlotErrorSum2 dataset.

You may follow along here by making the appropriate entries or load the completed template **Example 2** by clicking on Open Example Template from the File menu of the Scatter Plots with Error Bars from Summary Data procedure window.

1 Open the ScatPlotErrorSum2 dataset.

- From the File menu of the NCSS Data window, select **Open Example Data**.
- Click on the file **ScatPlotErrorSum2**.
- Click **Open**.

2 Open the Scatter Plots with Error Bars from Summary Data window.

- Using the Graphics menu or the Procedure Navigator, find and select the **Scatter Plots with Error Bars from Summary Data** procedure.
- On the menus, select **File**, then **New Template**. This will fill the procedure with the default template.

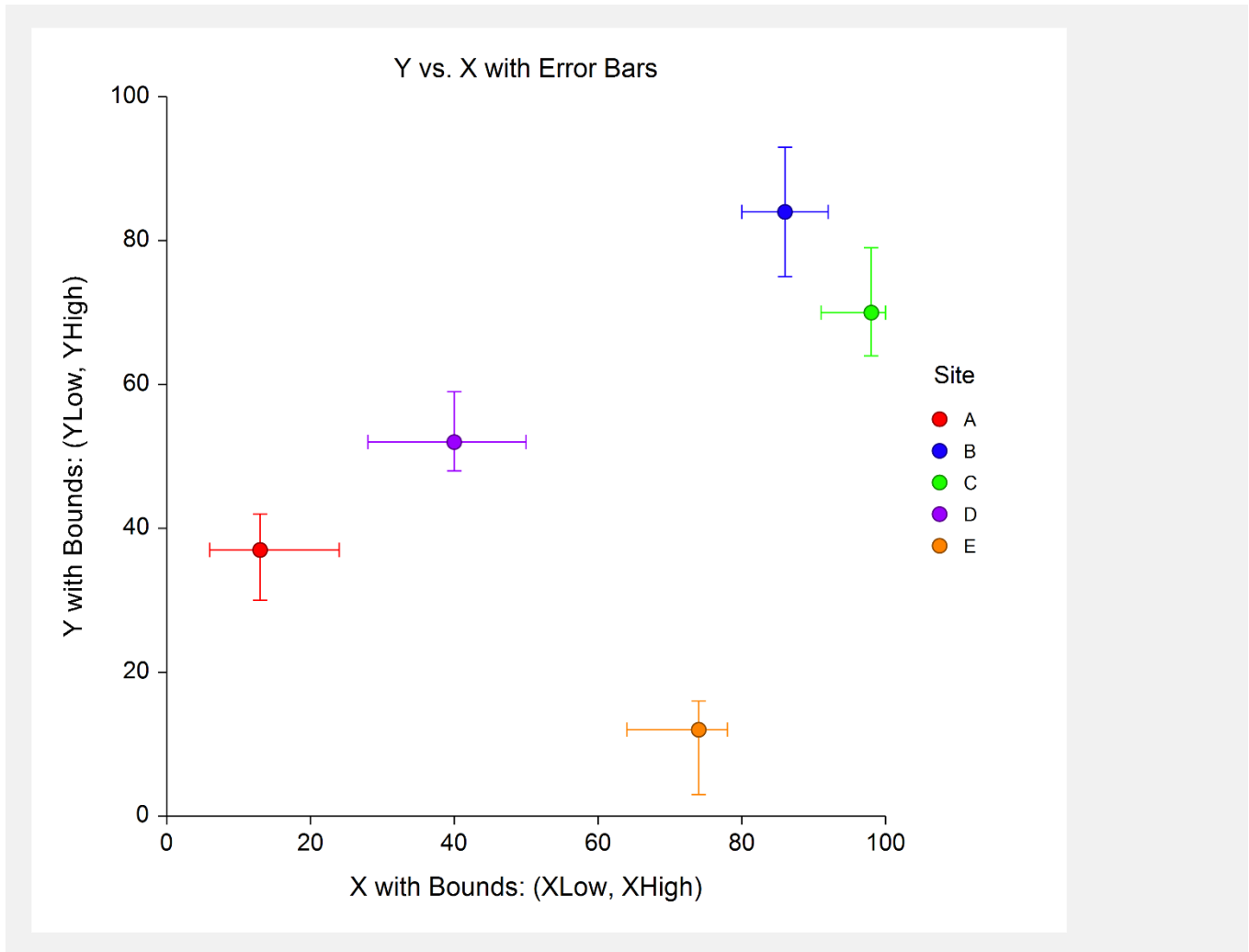
3 Specify the variables and error type.

- For **Y (Vertical) Variable** enter “**Y**”.
- For **X (Horizontal) Variable** enter “**X**”.
- For **Grouping (Symbol) Variable** enter “**Site**”.
- For **Y Error Input Type** select “**Enter Upper and Lower Y Error Bounds Separately**”.
- For **Lower Y Error Bound Variable** enter “**YLow**”.
- For **Upper Y Error Bound Variable** enter “**YHigh**”.
- For **X Error Input Type** select “**Enter Upper and Lower X Error Bounds Separately**”.
- For **Lower X Error Bound Variable** enter “**XLow**”.
- For **Upper X Error Bound Variable** enter “**XHigh**”.

4 Run the procedure.

- From the Run menu, select **Run Procedure**. Alternatively, just click the green Run button.

Scatter Plot Output



Example 3 – Creating a Scatter Plot from Summary Data with X Error Bars

This example demonstrates how to generate a simple scatter plot with X error bars only. The data used are contained in the ScatPlotErrorSum3 dataset.

You may follow along here by making the appropriate entries or load the completed template **Example 3** by clicking on Open Example Template from the File menu of the Scatter Plots with Error Bars from Summary Data procedure window.

1 Open the ScatPlotErrorSum3 dataset.

- From the File menu of the NCSS Data window, select **Open Example Data**.
- Click on the file **ScatPlotErrorSum3**.
- Click **Open**.

2 Open the Scatter Plots with Error Bars from Summary Data window.

- Using the Graphics menu or the Procedure Navigator, find and select the **Scatter Plots with Error Bars from Summary Data** procedure.
- On the menus, select **File**, then **New Template**. This will fill the procedure with the default template.

3 Specify the variables and error type.

- For **Y (Vertical) Variable** enter “**Y**”.
- For **X (Horizontal) Variable** enter “**X**”.
- For **Y Error Input Type** select “**None**”.
- For **X Error Input Type** select “**Enter X Error as ΔX (X Error Bounds = $X \pm \Delta X$)**”.
- For **X Error (ΔX) Variable** enter “**SDx**”.

4 Run the procedure.

- From the Run menu, select **Run Procedure**. Alternatively, just click the green Run button.

Scatter Plot Output

