What’s New

Overview

SAS/GRAPH Statistical Graphics Procedures has the following changes and enhancements for SAS 9.2 Phase 2:

- A new VECTOR plot type is available for the SGPLOT and SGPANEL procedures.
- A new JOIN plot type is available for the COMPARE and PLOT statements for the SGSCATTER procedure.
- New panel layout types are available for the SGPANEL procedure.
- New options are available for the PANELBY statement of the SGPANEL procedure.
- The COMPARE, PLOT, and MATRIX statements for the SGSCATTER procedure now support transparency.

New VECTOR Plot Type for the SGPLOT and SGPANEL Procedures

A new VECTOR statement for the SGPLOT and SGPANEL procedures enables you to create vector plots. Vector plots create arrows between two points.

New JOIN Plot Type for the SGSCATTER Procedure

A new JOIN option for the COMPARE and PLOT statements of the SGSCATTER procedure enables you to create a join plot.

New Panel Layout Types

The SGPANEL procedure supports two new layout types. The LAYOUT= option on the PANELBY statement enables you to specify the COLUMNLATTICE and ROWLATTICE layout types.
New Options for the SGPANEL PANELBY Statement

The PANELBY statement for the SGPANEL procedure has the following new options:
- BORDER | NOBORDER specifies whether borders are displayed around each cell.
- COLHEADERPOS= specifies the location of the column headings.
- ONEPANEL disables automatic paging for panels.
- ROWHEADERPOS= specifies the location of the row headings.
- START= specifies the order in which data crossings are assigned to the panel.

New Axis Options for the SGPANEL and SGPLOT Procedures

The axis control statements for the SGPANEL and SGPLOT procedures contain the following new options:
- INTERVAL= specifies the tick interval for time axes.
- OFFSETMAX= specifies the spacing between the last tick value on the axis and the edge of the plot area.
- OFFSETMIN= specifies the spacing between the first tick value on the axis and the edge of the plot area.
- TICKVALUEFORMAT= specifies the data format for the axis tick values.

Transparency for Output from the SGSCATTER Procedure

The COMPARE, MATRIX, and PLOT statements for SGSCATTER now support the TRANSPARENCY= option. You can use the TRANSPARENCY to specify the amount of transparency for your plot elements.
Introduction

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Chapter 2. SAS/GRAPH Statements That Are Used with Statistical Graphics Procedures 13
SAS/GRAPH statistical graphics procedures (SG procedures) enable you to easily create complex statistical graphics that use the principles of effective graphics* to accurately communicate the results of your analysis to your consumers. The SG procedures require minimal coding, which enables you to focus on your statistical analysis instead of the visual appearance of your graphs.

Default appearance attributes such as colors, fonts, and line styles are set by the current ODS style. SAS provides a set of styles that have been optimized to produce clear and effective graphics. Attributes have been chosen to ensure that graph elements have sufficient visibility and contrast, even when color is not used. Graphs elements are visually balanced so that no one element unintentionally appears to be more important than any other. Graphs produced by the SG procedures are clean and uncluttered, which enables you to make easy comparisons and interpret information accurately.

The SG procedures use the Graph Template Language (GTL) to create the most commonly used graphs. The GTL is a comprehensive language for defining statistical graphics. For more information about the GTL, see SAS/GRAPH: Graph Template Language User's Guide.

There are four SAS/GRAPH statistical graphics procedures, each with a specific purpose. Each procedure supports BY processing and the paging of large paneled graphs where applicable.

- The SGPLOT procedure is designed to create a single-celled graph, with multiple plots overlaid within a single set of axes. The procedure syntax supports many different types of plots and graph features.
- The SGPANEL procedure creates classification panels for one or more classification variables. Each graph cell in the panel can contain either a simple plot or multiple, overlaid plots.

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* For more information about the principles of effective graphics, see Cleveland (1993) and Robbins (2005).
The SGSCATTER procedure creates paneled graphs with multiple scatter plots. You can create three different types of layouts.

The SGRENDER procedure is a utility procedure that produces graphs from templates that are written in the Graph Template Language.

Introduction to the SGPLOT Procedure

The SGPLOT procedure is optimized to display overlaid plots on a single set of axes. The procedure syntax supports the following features:

- Basic plots: scatter plots, series plots, band plots, needle plots, and vector plots.
- Fit and confidence plots: loess curves, regression curves, penalized B-spline curves, and ellipses.
- Distribution plots: histograms, box plots, and density curves.
- Categorization plots: bar charts, dot plots, and bar-line charts.
- Insets, legends, and reference lines.

All of the plot statements that are used in the SGPLOT procedure share a single set of axes. You can customize these axes by using axis statements such as XAXIS and YAXIS.

The following images show examples of types of graphs that you can create with the SGPLOT procedure:

This is an example of two series plots that are overlaid in a single graph. Each plot is assigned to a different vertical axis. Data labels and curve labels have been added for direct reference.
This is an example of a graph that uses a histogram, a kernel density curve, and a normal density curve.

For more information about the SGPLOT procedure and the procedure syntax, see Chapter 4, “The SGPLOT Procedure,” on page 121.

**Introduction to the SGPANEL Procedure**

The SGPANEL procedure creates a panel for the values of one or more classification variables. Each graph cell in the panel can contain either a single plot or multiple overlaid plots. The procedure syntax supports the following features:

- four types of panel layouts: PANEL, LATTICE, COLUMNLATTICE, and ROWLATTICE
- basic plots: scatter plots, series plots, band plots, needle plots, and vector plots
- fit and confidence plots: loess curves, regression curves, and penalized B-spline curves
- distribution plots: histograms, box plots, and density curves
- categorization plots: bar charts, dot plots, and bar-line charts
- legends and reference lines

The SGPANEL procedure can create several layouts, depending on the value of the LAYOUT= option. You can specify the PANEL layout, the LATTICE layout, the COLUMNLATTICE layout, or the ROWLATTICE layout.

The following examples show some types of layouts that you can create with the SGPANEL procedure.
This is an example of the default PANEL layout. In the PANEL layout, each graph cell represents a specific crossing of values for one or more classification variables. A label above each cell identifies the crossing of values that is represented in the cell. By default, cells are created only for crossings that are represented in the data set.

This is an example of the LATTICE layout. In the LATTICE layout, the graph cells are arranged in rows and columns by using the values of two classification variables. Labels above each column and to the right of each row identify the classification value that is represented by that row or column. A cell is created for each crossing of classification values.
This is an example of the COLUMNLATTICE layout. In the COLUMNLATTICE and ROWLATTICE layouts, the graph cells are arranged in a single row or column by using a single classification variable. A cell is created for each value of the classification variable.

For more information about the SGPANEL procedure and the procedure syntax, see Chapter 3, “The SGPANEL Procedure,” on page 27.

**Introduction to the SGSCATTER Procedure**

The SGSCATTER procedure creates a paneled graph for multiple combinations of variables. The procedure syntax supports the following features:

- three types of graph layouts: PLOT, COMPARE, and MATRIX
- basic scatter plots
- fit and confidence plots: loess curves, regression curves, penalized B-spline curves, and ellipses
- distribution plots: histograms, box plots, and density curves
- legends
The SGSCATTER procedure has three plot statements that create different types of layouts, as shown in the following examples:

The PLOT statement creates a paneled graph with multiple independent cells. A cell is created for each combination of X and Y variables that you specify.

The COMPARE statement creates a paneled graph that uses common axes for each row and column of cells.
The MATRIX statement creates a matrix of scatter plots, in which each cell represents a different combination of variables. In the diagonal cells, you can place labels, histograms, or density curves.

For more information about the SGSCATTER procedure and the procedure syntax, see Chapter 5, “The SGSCATTER Procedure,” on page 223.

Introduction to the SGRENDER Procedure

The SGRENDER procedure creates graphical output from templates that are created using the Graph Template Language (GTL). You can use the GTL to create many different types of plots, paneled graphs, and matrices, some of which cannot be created with the other SG procedures.

For more information about the SGRENDER procedure, see Chapter 6, “The SGRENDER Procedure,” on page 253. For more information about the GTL, see SAS/GRAPH: Graph Template Language User’s Guide.

The following example shows a layout that you can create by using the GTL and the SGRENDER procedure.
SAS/GRAPH statistical graphics procedures (SG procedures) are a part of the ODS Graphics System—a set of SAS/GRAPH features that enable you to create and edit statistical graphics.

The ODS Graphics System contains the following features:

**SAS/GRAPH statistical graphics procedures**
provide a concise syntax for creating effective statistical graphs. The SG procedures provide a traditional SAS procedure interface for the most commonly used features of the Graph Template Language.

**SAS/GRAPH Graph Template Language (GTL)**
provides a comprehensive language for creating statistical graphics. You can use the Graph Template Language to create customized layouts and graphs that are beyond the scope of the SG procedures.

For more information about the Graph Template Language, see the *SAS/GRAPH: Graph Template Language Reference* and the *SAS/GRAPH: Graph Template Language User’s Guide*.

**SAS/GRAPH ODS Graphics Editor**
enables you to edit and enhance graphs that are produced by the SG procedures or by the Graph Template Language.

The ODS graphics editor is an interactive editor that enables you to modify the elements of a graph or to add new features, such as titles, arrows, and text boxes.

For more information about the ODS Graphics Editor, see the *SAS/GRAPH: ODS Graphics Editor User’s Guide*.

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**Statistical Graphics Procedures and the Output Delivery System (ODS)**

Output from the SAS/GRAPH statistical graphics procedures (SG procedures) is generated by the Output Delivery System (ODS). An ODS destination must be open to create output from the SG procedures.
The SG procedures automatically obtain their default appearance options from the current ODS style. The ODS styles are optimized to produce effective graphics without any changes to the defaults. However, you can use appearance options in your plot statements to override the default style settings, such as colors and fonts.

The ODS GRAPHICS statement enables you to set the output options for your statistical graphics. For example, you can use options in the ODS GRAPHICS statement to specify the size and format of your output images. For more information about the ODS GRAPHICS statement, see “Using the ODS GRAPHICS Statement” on page 284.

<table>
<thead>
<tr>
<th>Traditional SAS/GRAPH</th>
<th>Statistical Graphics Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Properties for text, markers, and lines can be set with global statements such as GOPTIONS, AXIS, LEGEND, PATTERN, SYMBOL, and NOTE.</td>
<td>User control over visual properties is set with statements or options within the procedure.</td>
</tr>
<tr>
<td>For some graphs, the plot type is determined by global options. For example, the INTERPOL= option in the SYMBOL statement might determine whether a graph is a scatter plot or a box plot.</td>
<td>The plot type is determined by the plot statement only.</td>
</tr>
<tr>
<td>The default graph output is produced as a GRSEG entry in a SAS catalog. Other output formats, such as an image or metagraphics file, can be created by selecting an appropriate device driver.</td>
<td>Only image files are created—GRSEGS and device drivers are not used. You can select your image format by using the IMAGEFMT= option in the ODS GRAPHICS statement.</td>
</tr>
<tr>
<td>The size and format of graphical output is controlled with options such as the HSIZE=, VSIZE=, and DEVICE= options in the GOPTIONS statement.</td>
<td>The size, format, and name of output images can be controlled with the HEIGHT=, WIDTH=, IMAGEFMT=, and IMAGENAME= options in the ODS GRAPHICS statement. The ODS GRAPHICS statement is similar in purpose to the GOPTIONS statement, but it is used with the Statistical Graphics procedures only.</td>
</tr>
<tr>
<td>All of the ODS destinations are supported. For the LISTING destination, a GRSEG node is created in the Results tree and the image appears in the Graph window.</td>
<td>All of the ODS destinations are supported. For the LISTING destination, an image node is created for the graph in the Results tree. You can open the graph in an external viewer or in the ODS Graphics Editor.</td>
</tr>
</tbody>
</table>

Differences between Statistical Graphics Procedures and Traditional SAS/GRAPH Procedures

In SAS 9.2, the default appearance of all graphs is determined by the ODS style that is currently in use. In general, this provides an effective default graph with minimal coding. When SAS/GRAPH coding is added to modify fonts, colors, line properties, or marker properties, it overrides the defaults that are defined by the style. This is true for both traditional SAS/GRAPH procedures and the statistical graphics procedures.

The following table lists some of the differences between traditional SAS/GRAPH and statistical graphics procedures:
Traditional SAS/GRAPH | Statistical Graphics Procedures
---|---
All options for the TITLE and FOOTNOTE statements are supported. | Some options for the TITLE and FOOTNOTE statements are not supported. See “TITLE and FOOTNOTE Statements” on page 19.
Both SAS/GRAPH fonts (such as SWISSB) and system fonts (such as Arial) are supported. | Only system fonts are supported.
Marker symbols can be either created from fonts or selected from a predefined set of named marker symbols. | Marker symbols can be selected only from a predefined set of named marker symbols. The named marker symbols are different from the named marker symbols in traditional SAS/GRAPH.
Area fills can use either solid colors or patterns such as crosshatching. | Area fills can use solid colors only. Transparent fills are supported.
Anti-aliasing is not supported. | Anti-aliasing is used for text and lines by default. You can disable anti-aliasing by using the NOANTIALIAS option in the ODS GRAPHICS statement.
Transparency is not supported. | You can specify the degree of transparency for many graphics elements.
Scaling of fonts and markers is not supported. | Scaling of fonts and markers is on by default. This means that the sizes of fonts and markers are adjusted as appropriate to the size of your graph. You can disable scaling by using the NOSCALE option in the ODS GRAPHICS statement.
Some procedures support RUN-group processing. | RUN-group processing is not supported.
The Annotate facility is supported. | The Annotate facility is not supported. However, you can use the ODS Graphics Editor to annotate your graphs.

References

Overview of SAS/GRAPH Statements That Are Used with Statistical Graphics Procedures

SAS/GRAPH Statistical Graphics Procedures support these statements in addition to statements that are unique to each procedure:

**BY**
- processes your data by using one or more classification variables, and produces a separate graph for each unique combination of values.

**FORMAT**
- associates SAS formats or user-defined formats with variables.

**FOOTNOTE**
- adds footnotes to your graphs.

**LABEL**
- associates descriptive labels with variables.

**ODS GRAPHICS**
- enables you manage the settings for your graphics output.

**TITLE**
- adds titles to your graphs.

The ODS GRAPHICS, TITLE, and FOOTNOTE statements are global statements. That is, they can be specified anywhere in your program and they remain in effect until you explicitly cancel or change them. The BY, FORMAT, and LABEL statements are associated with a specific procedure step.

**Note:** Some of the statements that can be used with traditional SAS/GRAPH procedures are not used with statistical graphics procedures.
BY Statement

Creates a separate graph for each BY group.

Used by:  SGPLOT, SGSCATTER, SGPANEL, and SGRENDER procedures

Syntax

BY <DESCENDING> variable-1 <... <DESCENDING> variable-n><NOTSORTED>;

Required Arguments

variable

specifies the variable that the procedure uses to form BY groups. You can specify more than one variable. By default, observations in the data set must either be sorted in ascending order by all the variables that you specify, or be indexed appropriately.

Options

DESCENDING

specifies that the data set is sorted in descending order by the specified variable. This option affects only the variable that immediately follows it—you must specify the DESCENDING option before each variable that is sorted in descending order.

For example, the following code specifies a BY group that uses two variables that are both sorted in descending order:

by descending variable1 descending variable2;

NOTSORTED

specifies that the observations in the data set that have the same BY values are grouped together, but are not necessarily sorted in alphabetical or numeric order. For example, the observations might be sorted in chronological order using a date format such as DDMMYY.

The NOTSORTED option applies to all of the variables in the BY statement. You can specify the NOTSORTED option anywhere within the BY statement.

The requirement for ordering or indexing observations according to the values of BY variables is suspended when you use the NOTSORTED option. In fact, the procedure does not use an index if you specify the NOTSORTED option. For the NOTSORTED option, the procedure defines a BY group as a set of contiguous observations that have the same values for all BY variables. If observations that have the same value for the BY variables are not contiguous, then the procedure treats each new value it encounters as the first observation in a new BY group and creates a graph for that value.

Restriction:  The NOTSORTED option is not supported by the SGPANEL procedure.

Preparing Data for BY-Group Processing

Unless you specify the NOTSORTED or DESCENDING options, observations in the input data set must be in ascending numeric or alphabetic order. To prepare the data set, either sort it with the SORT procedure using the same BY statement that you plan to use in the target SAS/GRAPH procedure or create an appropriate index on the BY
variables. For more information about indexes, see “Understanding SAS Indexes” in the SAS Data Files chapter of the SAS Language Reference: Concepts.

If the procedure encounters an observation that is out of order, an error message is generated.

If you need to group data in some other order, such as chronological order, you can still use BY-group processing. To do so, process the data so that observations are arranged in contiguous groups that have the same BY-variable values and specify the NOTSORTED option in the BY statement.

**Controlling BY Lines**

By default, the BY statement prints a BY line above each graph that contains the variable name followed by an equal sign and the variable value. For example, if you specify BY SITE in the procedure, the default heading when the value of SITE is London would be SITE=London.

To suppress the BY line, use the NOBYLINE option in an OPTION statement.

To display only the BY value, use the NOBYLINE option and then use the #BYVAL1 substitution in a TITLE statement.

**Using the BY Statement with the SGPLOT Procedure**

You can use the UNIFORM= option in the PROC SGPLOT statement to produce the same group markers, the same axis scaling, or both for all graphs in a BY group. By default, the group markers and axis scales might vary from graph to graph.

**Using the BY Statement with the TITLE and FOOTNOTE Statements**

The TITLE and FOOTNOTE statements can automatically include the BY variable name, BY variable values, or BY lines in the text that they produce. To insert BY variable information into the text strings used by these statements, use the #BYVAR, #BYVAL, and #BYLINE substitution options. For more information, see the description for the text-string argument in “TITLE and FOOTNOTE Statements” on page 19.

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**FORMAT Statement**

Associates SAS formats or user-defined formats with variables.

**Used by:** SGPANEL, SGPLOT, SGSCATTER, SGRENDER procedures

**Details**

All features of the FORMAT statement are supported. For more information, see “FORMAT Statement” in the SAS Language Reference: Dictionary.
The following SAS formats are supported by the SG procedures:

### Table 2.1  Character Formats Supported By Java

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### Table 2.2  Numeric Formats Supported By Java

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### Table 2.3  Date and Time Formats Supported By Java

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<td>NLTIME</td>
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<tr>
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<td>NORDFNN</td>
<td>NORDFDT</td>
<td>NORDFWDN</td>
<td>NORDFMN</td>
</tr>
</tbody>
</table>
LABEL Statement

 Associates descriptive labels with variables.

 Used by:  SGPLOT, SGPANEL, SGSCATTER, SGRENDER procedures.

 Details

 All features of the LABEL statement are supported. For more information, see “LABEL Statement” in the SAS Language Reference: Dictionary.

ODS GRAPHICS Statement

 Specifies the settings for your graphics output.

 Used by:  SGPLOT, SGPANEL, SGSCATTER, SGRENDER procedures

 Valid:  anywhere in your program

 For information about using the ODS GRAPHICS statement, see “Using the ODS GRAPHICS Statement” on page 284. For the complete statement syntax, see “ODS GRAPHICS Statement” in the “Dictionary of ODS Language Statements” chapter of SAS Output Delivery System: User’s Guide.
TITLE and FOOTNOTE Statements

The TITLE and FOOTNOTE statements control the content, appearance, and placement of title and footnote text.

Used by:  SGPLOT, SG PANEL, and SGSCATTER procedures

Valid:  anywhere in your program

Syntax

TITLE <1...10> <text-options> "text-string<1...10> ... <text-options>";

FOOTNOTE <1...10> <text-options> "text-string<1...10> ... <text-options>
 >="text-string<1...10>";

text-options can be one or more of the following:

□ appearance options:
  BOLD
  COLOR= color
  FONT= “system-font”
  HEIGHT= numeric-value <units>
  ITALIC

□ placement and spacing options:
  JUSTIFY= LEFT | CENTER | RIGHT
  LSPACE= numeric-value <units>

□ boxing and drawing options:
  BCOLOR= color
  BOX= numeric-value
  BSPACE= numeric-value <units>

The following options are not supported by statistical graphics procedures:

ANGLE=
BLANK=
DRAW=
LANGLE=
LINK=
MOVE=
ROTATE=
UNDERLIN=
WRAP
Arguments

text-string

is a text string that can contain up to 200 characters. You must enclose text strings in either single or double quotation marks. The text appears exactly as you type it in the statement, including uppercase and lowercase characters and spaces. Titles and footnotes automatically wrap to additional lines if necessary.

To use single quotation marks or apostrophes within the title, you can either:

- use a pair of single quotation marks together:

  footnote ‘All’’s well that ends well’;

- enclose the text in double quotation marks:

  footnote "All’s well that ends well";

Because the FOOTNOTE and TITLE statements concatenate all text strings, the strings must contain the correct spacing. With a series of strings, add spaces to the beginning of a text string rather than at the end, as in this example:

  footnote color=red "Sales:" color=blue " 2000";

With fonts that support Unicode, you can produce specific characters by specifying a hexadecimal value. A trailing x identifies a string as a hexadecimal value. You must also enclose the character specification in a special ODS handler string, in the format (*ESC*)(unicode 'hexadecimal-value'x). For example:

  title "Regression with Confidence Limits ( (*ESC*)(unicode '03B1'x)=.05 )";

This statement produces the title, "Regression with Confidence Limits (α = .05)" because '03B1'x is the hexadecimal value for the lowercase Greek letter alpha in all Unicode fonts.

In addition, if you are using a BY statement, then you can include special options. For more information, see “Substituting BY Line Values in a Text String” on page 23.

Note: The Listing destination does not honor the (*ESC*) statement.

Options

BOLD

specifies that the font weight is bold for the text string.

Default: For titles, the default font weight is specified by the FONTWEIGHT attribute of the GraphTitleText style element in the current style.

For footnotes, the default font weight is specified by the FONTWEIGHT attribute of the GraphFootnoteText style element in the current style.

BCOLOR= color

specifies the background color for a box that you created with the BOX= option.

For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter of SAS/GRAPH: Reference.

This option has no effect if you do not also specify the BOX= option. By default, the background color is the same color as the background of the graph.

Alias: BC=

BOX= 1 | 2 | 3 | 4

draws a box around one line of text. Specify a value between 1 and 4, where 1 specifies the thinnest line and 4 specifies the thickest line. Only the last BOX= option is used. The color of the box outline is determined by the GraphBorderLines element of the current style.
Alias:  BO

BSPACE=numeric-value<units>
specifies the amount of space between the text and the border of a box that you create with the BOX= option.

You can also specify the unit of measure. See “Measurement Units for TITLE and FOOTNOTE Statement Options” on page 24 for a list of the units that are supported.

If you do not specify a unit, then the size of the space is approximately 12n points. For example, if you specify BSPACE=2, then the space is approximately 24 points.

Alias:  BS=

Default:  0

COLOR= color
specifies the color for the text. The COLOR= option affects all of the text strings that follow it in your TITLE or FOOTNOTE statement. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter of SAS/GRAPH: Reference.

You can use multiple colors by specifying multiple COLOR= options. For example, the following code produces a title where the first word is red and the second word is blue:

title color=red "Red" color=blue " Blue";

Alias:  C=

Default: For titles, the default text color is specified by the COLOR attribute of the GraphTitleText style element in the current style.

For footnotes, the default font color is specified by the COLOR attribute of the GraphFootnoteText style element in the current style.

FONT= “system-font”
specifies a system font for the text string.

Note: SAS/GRAPH software fonts such as SWISS cannot be used with statistical graphics procedures. △

Alias:  F=

Default: For titles, the default font is specified by the FONTFAMILY attribute of the GraphTitleText style element in the current style.

For footnotes, the default font is specified by the FONTFAMILY attribute of the GraphFootnoteText style element in the current style.

HEIGHT= numeric-value <units>
specifies the size of the text. You can also specify the unit of measurement. The following table lists the measurement units that are supported:

You can also specify the unit of measure. See “Measurement Units for TITLE and FOOTNOTE Statement Options” on page 24 for a list of the units that are supported.

If you do not specify a unit, then the size of the text is approximately 12n points. For example, if you specify HEIGHT=2, then the text size is approximately 24 points.

Alias:  H=

Default: For titles, the default font size is specified by the FONTSIZE attribute of the GraphTitleText style element in the current style.

For footnotes, the default font size is specified by the FONTSIZE attribute of the GraphFootnoteText style element in the current style.
ITALIC
specifies that the font style is italic for the text string.

Default: For titles, the default font style is specified by the FONTSTYLE attribute of the GraphTitleText style element in the current style.

For footnotes, the default font style is specified by the FONTSTYLE attribute of the GraphFootnoteText style element in the current style.

JUSTIFY= LEFT | CENTER | RIGHT
specifies the alignment of the text string. You can specify one of the following values:

LEFT | L
aligns the text to the left.

CENTER | C
aligns the text in the center.

RIGHT | R
aligns the text to the right.

The JUSTIFY= option affects all of the text strings that follow it in your TITLE or FOOTNOTE statement. You can specify multiple alignments by using more than one JUSTIFY= option. For example, the following code creates a footnote where the first string is aligned to the left and the second string is aligned to the right:

footnote justify=left "Example 2" justify=right "Graph 3";

Alias: J=

LSPACE= numeric-value <units>
specifies the amount of space above the title text and below the footnote text.

You can also specify the unit of measure. See “Measurement Units for TITLE and FOOTNOTE Statement Options” on page 24 for a list of the units that are supported.

If you do not specify a unit, then the size of the space is approximately 12n points. For example, if you specify LSPACE=2, then the space is approximately 24 points.

Alias: LS

Interaction: The LSPACE= option has no effect if you also specify the BOX= option.

Default: 0

Using TITLE and FOOTNOTE Statements

You can define TITLE and FOOTNOTE statements anywhere in your SAS program. They are global and remain in effect until you cancel them or until you end your SAS session. All currently defined FOOTNOTE and TITLE statements are displayed automatically.

You can define up to ten TITLE statements and ten FOOTNOTE statements in your SAS session. A TITLE or FOOTNOTE statement without a number is equivalent to a TITLE1 or FOOTNOTE1 statement. It is not necessary to use sequential statement numbers—skipping a number in the sequence leaves a blank line.

You can use an unlimited number of text strings and options. Ensure that each option is placed before the text strings that you want it to modify.

The most recently specified TITLE or FOOTNOTE statement of any number completely replaces any other TITLE or FOOTNOTE statement of that number. In addition, it cancels all TITLE or FOOTNOTE statements of a higher number. For example, if you define TITLE1, TITLE2, and TITLE3, then submitting a new TITLE2 statement cancels TITLE3.
The most recently specified TITLE or FOOTNOTE statement of any number completely replaces any other TITLE or FOOTNOTE statement of that number. In addition, it cancels all TITLE or FOOTNOTE statements of a higher number. For example, if you define TITLE1, TITLE2, and TITLE3, resubmitting the TITLE2 statement cancels TITLE3.

```sas
title4;
```

But remember that this cancels all other existing statements of a higher number. To cancel all current TITLE or FOOTNOTE statements, use the TITLE1; or FOOTNOTE1; statement:

### Substituting BY Line Values in a Text String

These options are available if a BY statement is in effect:

- **#BYLINE**
  - Substitutes the entire BY line without leading or trailing blanks for #BYLINE in the text string. The BY line uses the format `variable-name=value`.

- **#BYVALn | #BYVAL(BY-variable-name)**
  - Substitutes the current value of the specified BY variable for #BYVAL in the text string. Specify the variable with one of these:
    - `n` specifies a variable by its position in the BY statement. For example, #BYVAL2 specifies the second variable in the BY statement.
    - `BY-variable-name` specifies a variable from the BY statement by its name. For example, #BYVAL(YEAR) specifies the BY variable, YEAR. `variable-name` is not case sensitive.

- **#BYVARn | #BYVAR(BY-variable-name)**
  - Substitutes the name of the BY-variable or the label associated with the variable (whatever the BY line would normally display) for #BYVAR in the text string. Specify the variable with one of these:
    - `n` specifies a variable by its position in the BY statement. For example, #BYVAR2 specifies the second variable in the BY statement.
    - `BY-variable-name` specifies a variable from the BY statement by its name. For example, #BYVAR(SITES) specifies the BY variable, SITES. `Variable-name` is not case sensitive.

**Note:** A BY variable name displayed in a title or footnote is always in uppercase. If a label is used, then it appears as specified in the LABEL statement.

To use the #BYVAR and #BYVAL substitutions, insert the item in the text string at the position where you want the substitution text to appear. Both #BYVAR and #BYVAL specifications must be followed by a delimiting character, either a space or other non-alphanumeric character, such as the quotation mark that ends the text string. If not, then the specification is ignored and its text remains intact and is displayed with the rest of the string. To allow a #BYVAR or #BYVAL substitution to be followed immediately by other text, with no delimiter, use a trailing dot (as with macro variables). The trailing dot is not displayed in the resolved text. If you want a period to be displayed as the last character in the resolved text, use two dots after the #BYVAR or #BYVAL substitution.

If you use a #BYVAR or #BYVAL specification for a variable that is not named in the BY statement (such as #BYVAL2 when there is only one BY-variable or #BYVAL(ABC)
when ABC is not a BY-variable or does not exist), or if there is no BY statement at all, then the substitution for #BYVAR or #BYVAL does not occur. No error or warning message is issued, and the option specification is displayed with the rest of the string. The graph continues to display a BY line at the top of the page unless you suppress it by using the NOBYLINE option in an OPTION statement.

**Measurement Units for TITLE and FOOTNOTE Statement Options**

Some of the options in the TITLE and FOOTNOTE statements give you the option to specify the unit of measurement. The following table lists the units that are supported:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM</td>
<td>centimeters</td>
</tr>
<tr>
<td>IN</td>
<td>inches</td>
</tr>
<tr>
<td>PCT or %</td>
<td>percentage</td>
</tr>
<tr>
<td>PT</td>
<td>point size, calculated at 100 dots per inch</td>
</tr>
</tbody>
</table>
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# Chapter 3

## The SGPANEL Procedure

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Overview

The SGPANEL procedure creates a panel of graph cells for the values of one or more classification variables. For example, if a data set contains three variables (A, B and C) and you want to compare the scatter plots of B*C for each value of A, then you can use the SGPANEL to create this panel. The SGPANEL procedure creates a layout for you automatically and splits the panel into multiple graphs if necessary.

The SGPANEL procedure can create a wide variety of plot types, and overlay multiple plots together in each graph cell in the panel. It can also produce several types of layout. Table 3.1 on page 29 contains some examples of panels that the SGPANEL procedure can create.
Table 3.1 Examples of Panels that Can Be Generated by the SGPANEL Procedure

The following code creates a panel of loess curves:
```
title1 "Cholesterol Levels for Age > 60";
proc sgpanel data=sashelp.heart(
    where=(AgeAtStart > 60))
    panelby sex / novarname;
loess x=weight y=cholesterol / clm;
run;
```

The following code creates a panel of vertical bar charts:
```
title1 "Product Sales";
proc sgpanel data=sashelp.prdsale;
    panelby quarter;
    rowaxis label="Sales";
    vbar product / response=predict stat=mean
                   transparency=0.3;
    vbar product / response=actual stat=mean
                   barwidth=0.5 transparency=0.3;
run;
```

The following code creates a panel of box plots in a lattice layout:
```
title1 "Distribution of Cholesterol Levels";
proc sgpanel data=sashelp.heart;
    panelby weight_status sex / layout=lattice
                   novarname;
    hbox cholesterol;
run;
```

The following code creates a panel of cells with a histogram and a normal density curve:
```
title1 "Weight Distribution in the Heart Study";
proc sgpanel data=sashelp.heart noautolegend;
    panelby sex / novarname;
    histogram weight;
    density weight;
run;
```
Panel Creation

The SG PANEL procedure has a required PANELBY statement that is used to define the classifier variables for the panel. This statement must be specified before any plot, axis, or legend statement or else an error occurs. You can use options in the PANELBY statement to control the attributes of the panel. For example, you can use the COLUMNS= option to specify the number of columns in the panel.

SGPANEL can use four different layouts, which are specified by the LAYOUT= option in the PANELBY statement. The layout determines how your classifier variables are used to create the panel, and also affects the number of classifier variables that you can specify.

The default layout is PANEL. With this layout, you can specify any number of classifier variables. The graph cells in the panel are arranged automatically, and the classifier values are displayed above each graph cell in the panel. When you specify multiple classifier variables, the order of the classifier variables determines how the graph cells are sorted.

Figure 3.1 on page 30 shows an example of the PANEL layout.

Another layout is called LATTICE. This layout requires exactly two classifier variables. The values of the first variable are assigned as columns, and the values of the second variable are assigned as rows. The classifier values are displayed above the columns and to the right side of the rows.

Figure 3.2 on page 31 shows an example of the LATTICE layout.
Two additional layouts are available, which are called COLUMNLATTICE and ROWLATTICE. These layouts require exactly one classifier variable. The values of the classifier variable are assigned as cells in a single row or column.

*Note:* The COLUMNLATTICE and ROWLATTICE layouts are available with SAS 9.2 Phase 2 and later. Δ

Figure 3.3 on page 31 shows an example of the COLUMNLATTICE layout.

If you have a large number of classifier variables, then the best method for creating a panel is to choose one or two classifiers for the PANELBY statement and specify the
remaining variables in a BY statement. This method maximizes the space for the plots and generates results that are easier to interpret.

**Plot Content**

Each graph cell in your panel contains one or more plots, and there are four basic types of plots that you can create with the SGPANEL procedure:

- **Basic plots**
  - scatter, series, step, band, needle plots, and vector plots

- **Fit and confidence plots**
  - loess, regression, and penalized B-spline curves

- **Distribution plots**
  - box plots, histograms, normal density curves, and kernel density estimates

- **Categorization plots**
  - dot plots, bar charts, and line charts

Not all of the plot types can be used together in the same PROC SGPANEL step. The following table shows which of the plot types can be used together:

<table>
<thead>
<tr>
<th>Basic</th>
<th>Fit and Confidence</th>
<th>Distribution</th>
<th>Categorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Fit and Confidence</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Distribution</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Categorization</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

**Note:** Box plots cannot be combined with any other plot types.

If you submit a PROC SGPANEL step that combines two incompatible plot statements, then an error appears in the log.

The SGPANEL procedure draws the plots in your graph in the same order that you specify the plot statements. Because of this, it is important to consider the order of your plot statements so that your plots do not obscure one another. For example, if you specify a BAND statement after a SCATTER statement, then the band plot might obscure the markers in your scatter plot. You can also avoid obscuring your data by using the TRANSPARENCY= option to make your plots partially transparent.

**Plot Axes**

The SGPANEL procedure contains two statements that enable you to change the type and appearance for the axes of the graph cells in your panel: COLAXIS and ROWAXIS.

By default, the type of each axis is determined by the types of plots that use the axis and the data that is applied to the axis.
The SGPANEL procedure supports the following axis types:

**Discrete**
The axis contains independent data values rather than a range of numeric values. Each distinct value is represented by a tick mark. Discrete is the default axis type for character data.

**Linear**
The axis contains a linear range of numeric values. Linear is the default axis type for numeric data.

**Logarithmic**
The axis contains a logarithmic range of values. The logarithmic axis type is not used as a default.

**Time**
The axis contains a range of time values. Time is the default axis type for data that uses a SAS time, date, or datetime format.

Some types of plot do not support all of the axis types. For example, needle plots cannot use a discrete vertical axis. See the documentation for each plot statement to determine whether any axis type restrictions apply.

---

### Panel Legends

The SGPANEL procedure creates a legend automatically based on the plot statements and options that you specify. The automatic legend functionality determines which information is likely to be useful in the legend. You can override this behavior by defining your own legend with the KEYLEGEND statement or by specifying the NOAUTOLEGEND option in the PROC SGPANEL statement.

You can specify the labels that represent your plots in the legend by using the LEGENDLABEL= option in the corresponding plot statements.

You can create customized legends by using one or more KEYLEGEND statements. You can specify which plot statements are assigned to the legend, and use options to control the title, location, and border of the legend. For more information, see “KEYLEGEND Statement” on page 66.

---

### Automatic Differentiation of Visual Attributes

Depending on the plots and options that you specify, the SGPANEL procedure can automatically assign different style attributes to the plots in your graph. For example, if you specify two series plots, then each series plot automatically uses a different line pattern and line color by default. If different attributes are not assigned by default, you can force the procedure to assign different style attributes by using the CYCLEATTRS option in the PROC SGPANEL statement. You can also disable automatic attribute differentiation by using the NOCYCLEATTRS option in the PROC SGPANEL statement.
Units of Measurement

Some options such as LINEATTRS enable you to specify the unit of measurement as part of the value. The following table contains the units that are available:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM</td>
<td>centimeters</td>
</tr>
<tr>
<td>IN</td>
<td>inches</td>
</tr>
<tr>
<td>MM</td>
<td>millimeters</td>
</tr>
<tr>
<td>PCT or %</td>
<td>percentage</td>
</tr>
<tr>
<td>PT</td>
<td>point size, calculated at 100 dots per inch</td>
</tr>
<tr>
<td>PX</td>
<td>pixels</td>
</tr>
</tbody>
</table>

Marker Symbols

The MARKERATTRS= option on some of the plot statements enables you to specify the marker symbol that is used to represent your data. Figure 3.4 on page 34 shows the marker symbols that you can use.

Line Patterns

The LINEATTRS= option on some plot statements enables you to specify the line pattern that is used for the lines in your plot. Figure 3.5 on page 35 shows the line patterns that you can use.
The SGPANEL Procedure  △  Procedure Syntax  35

Procedure Syntax

Requirements:  The PANELBY statement and at least one plot statement are required.

PROC SGPANEL < option(s)>;
   PANELBY variable(s)</option(s)>;
   BAND X= variable | Y= variable
      UPPER= numeric-value | numeric-variable LOWER= numeric-value | numeric-variable
      </option(s)>;
   COLAXIS <option(s)>;
   DENSITY response-variable </option(s)>;
   DOT category-variable </option(s)>;
   HBAR category-variable </option(s)>;
   HBOX response-variable </option(s)>;
   HISTOGRAM response-variable </option(s)>;
   HLINE category-variable </option(s)>;
   KEYLEGEND <"name(s)"> </option(s)>;
   LOESS X= numeric-variable Y= numeric-variable </option(s)>;
   NEEDLE X= variable Y= numeric-variable </option(s)>;
   PBSPLINE X= numeric-variable Y= numeric-variable </option(s)>;
   REFLINE value(s) </option(s)>;
   REG X= numeric-variable Y= numeric-variable </option(s)>;
   ROWAXIS <option(s)>;
   SCATTER X= variable Y= variable </option(s)>;
   SERIES X= variable Y= variable </option(s)>;
   STEP X= variable Y= variable </option(s)>;
   VBAR category-variable </option(s)>;
   VBOX response-variable </option(s)>;

Figure 3.5  List of Line Patterns

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td>1</td>
</tr>
<tr>
<td>ShortDash</td>
<td>2</td>
</tr>
<tr>
<td>MediumDash</td>
<td>4</td>
</tr>
<tr>
<td>LongDash</td>
<td>5</td>
</tr>
<tr>
<td>MediumDashShortDash</td>
<td>8</td>
</tr>
<tr>
<td>DashDashDot</td>
<td>14</td>
</tr>
<tr>
<td>DashDotDot</td>
<td>15</td>
</tr>
<tr>
<td>Dash</td>
<td>20</td>
</tr>
<tr>
<td>LongDashShortDash</td>
<td>26</td>
</tr>
<tr>
<td>Dot</td>
<td>34</td>
</tr>
<tr>
<td>ThinDot</td>
<td>35</td>
</tr>
<tr>
<td>ShortDashDot</td>
<td>41</td>
</tr>
<tr>
<td>MediumDashDotDot</td>
<td>42</td>
</tr>
</tbody>
</table>
VECTOR X= numeric-variable Y= numeric-variable /option(s>);
VLINE category-variable /option(s>);

PROC SGPANEL Statement

Identifies the data set that contains the plot variables. The statement also gives you the option to specify a description, and control automatic legends and automatic attributes.

Requirements: An input data set is required.

Syntax

PROC SGPANEL <DATA= input-data-set>
   <CYCLEATTRS | NOCYCLEATTRS>
   < DESCRIPTION=“text-string”>
   <NOAUTOLEGEND>
;

Options

CYCLEATTRS | NOCYCLEATTRS
specifies whether plots are drawn with unique attributes in the graph. By default, the SGPANEL procedure automatically assigns unique attributes in many situations, depending on the types of plots that you specify. If the plots do not have unique attributes by default, then the CYCLEATTRS option assigns unique attributes to each plot in the graph. The NOCYCLEATTRS option prevents the procedure from assigning unique attributes.

For example, if you specify the CYCLEATTRS option and you create a graph with a SERIES statement and a SCATTER statement, then the two plots have different colors.

If you specify the NOCYCLEATTRS option, then plots have the same attributes unless you specify appearance options such as the LINEATTRS= option.

DATA=input-data-set
specifies the SAS data set that contains the variables to process. By default, the procedure uses the most recently created SAS data set.

DESCRIPTION= “text-string”
specifies a description for the output image. The description identifies the image in the following locations:

- the Results window
- the alternate text for the image in HTML output
- the table of contents that is created by the CONTENTS option on an ODS statement
The default description is “The SGPANEL Procedure”.

Note: You can disable the alternate text in HTML output by specifying an empty string. That is, DESCRIPTION="". △

Note: The name of the output image is specified by the IMAGENAME= option in the ODS GRAPHICS statement. △

Alias: DES

NOAUTOLEGEND

disables automatic legends from being generated. By default, legends are created automatically for some plots, depending on their content. This option has no effect if you specify a KEYLEGEND statement.

---

**PANELBY Statement**

Specifies one or more classification variables for the panel, the layout type, and other options for the panel.

**Syntax**

```
PANELBY variable(s) < / option(s) >;
```

*option(s)* can be one or more of the following:

- BORDER | NOBORDER
- COLHEADERPOS= TOP | BOTTOM | BOTH
- COLUMNS= n
- LAYOUT= LATTICE | PANEL | ROWLATTICE | COLUMNLATTICE
- MISSING
- NOVARNAME
- ONEPANEL
- ROWHEADERPOS= RIGHT | LEFT | BOTH
- ROWS= n
- SPACING= n
- SPARSE
- START= TOPLEFT | BOTTOMLEFT
- UNISCALE= ROW | ALL

**Required Arguments**

*variable(s)*

specifies one or more classification variables for the panel.
Options

**BORDER | NOBORDER**
specifies whether borders are displayed around each cell in the panel. BORDER adds the borders. NOBORDER removes the borders. Depending on the current ODS style, the borders might be present by default.

*Style element:* The default status of the cell borders is determined by the FrameBorder attribute of the GraphWalls element in the current style.

*Restriction:* This option is available with SAS 9.2 Phase 2 and later.

**COLHEADERPOS= TOP | BOTTOM | BOTH**
specifies the location of the column headings in the panel. Specify one of the following values:

- **TOP** places column headings at the top of each column.
- **BOTTOM** places column headings at the bottom of each column.
- **BOTH** places column headings at the top and bottom of each column.

*Default:* TOP

*Interaction:* This option has no effect if the panel uses the PANEL layout.

*Restriction:* This option is available with SAS 9.2 Phase 2 and later.

**COLUMNS= n**
specifies the number of columns in the panel. By default, the number of columns is determined automatically based on the number of classifier values and the layout type.

*Tip:* The SGPANEL procedure automatically splits the panel into multiple graphs (pages) as needed when your panel contains a large number of cells. You can control the number of cells in each graph by using the COLUMNS= and the ROWS= options.

**LAYOUT= LATTICE | PANEL | COLUMNLATTICE | ROWLATTICE**
specifies the type of layout that is used for the panel.

Select one of the following values:

- **LATTICE** when you specify two classification variables, arranges the cells so that the values of the first variable are columns and the values of the second variable are rows. You can use LATTICE only when you specify exactly two classification variables.

- **PANEL** arranges the cells in rows and columns. The headings for each cell are placed at the top of the cell.

- **COLUMNLATTICE** arranges the cells in a single row. You can use the COLUMNLATTICE layout only with a single classification variable.

*Restriction:* This value is available with SAS 9.2 Phase 2 and later.

- **ROWLATTICE** arranges the cells in a single column. You can use the ROWLATTICE layout only with a single classification variable.

*Restriction:* This value is available with SAS 9.2 Phase 2 and later.
Default: PANEL

MISSING
processes missing values as a valid classification value and creates cells for it. By default, missing values are not processed as a classification value.

NOVARNAME
removes the variable names from the cell headings of a panel layout, or from the row and column headings of a lattice layout. For example, a row heading might “NorthEast” instead of “Region=NorthEast” when you specify the NOVARNAME option.

ONEPANEL
places the entire panel in a single output image. If you do not specify this option, then the panel is automatically split into multiple images as appropriate.

Note: This option is recommended only for panels with a small number of cells. If your panel is too large for the output image, then a blank image is created.

Interaction: When you use ONEPANEL with the PANEL layout, only one of the ROWS= and COLUMNS= options can be used. If you specify both options, then the value for COLUMNS= is used.
When you use ONEPANEL with the LATTICE layout, the ROWS= and COLUMNS= options have no effect.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

ROWHEADERPOS= LEFT | RIGHT | BOTH
specifies the location of the row headings in the panel. Specify one of the following values:

LEFT
places row headings at the left side of each row.

RIGHT
places row headings at the right side of each row.

BOTH
places row headings at the left side and the right side of each row.

Default: TOP

Interaction: This option has no effect if the panel uses the PANEL layout.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

ROWS= n
specifies the number of rows in the panel. By default, the number of rows is determined automatically based on the number of classifier values and the layout type.

Tip: The SGPANEL procedure automatically splits the panel into multiple graphs (pages) as needed when your panel contains a large number of cells. You can control the number of cells in each graph by using the COLUMNS= and the ROWS= options.

SPACING= n
specifies the number of pixels between the rows and columns in the panel.

Default: 0

SPARSE
enables the SGPANEL procedure to create empty cells for crossings of the classification variables that are not present in the input data set. By default, empty cells are not created for the panel layout.

Interaction: This option has no effect if you specify LAYOUT=LATTICE.
START= TOPLEFT | BOTTOMLEFT
specifies whether the first cell in the panel is placed at the upper left corner or the lower left corner. Specify one of the following values:

TOPLEFT places the cell for the first data crossing in the upper left corner. Cells are placed from left to right, starting in the top row. Each additional row is placed below the previous row.

The following figure shows the placement of nine cells in a panel where START= TOPLEFT:

```
  1  2  3
  4  5  6
  7  8  9
```

BOTTOMLEFT places the cell for the first data crossing in the lower left corner. Cells are placed from left to right, starting in the bottom row. Each additional row is placed above the previous row.

The following figure shows the placement of nine cells in a panel where START= BOTTOMLEFT:

```
  7  8  9
  4  5  6
  1  2  3
```

Default: TOPLEFT
Restriction: This option is available with SAS 9.2 Phase 2 and later.

UNISCALE= COLUMN | ROW | ALL
scales the shared axes in the panel to be identical. Specify one of the following values:

COLUMN scales all of the column axes in the panel to be identical.
ROW scales all of the row axes in the panel to be identical.
ALL scales all of the column axes to be identical, and also scales all of the row axes to be identical.

Default: ALL
The SGPANEL Procedure  △  BAND Statement

BAND Statement

Creates a band that highlights part of the plot.

Restriction:  The axis that the UPPER and LOWER values are placed on cannot be a discrete axis. For example, if you specify a variable for Y, the plot cannot use a discrete horizontal axis.

BAND X= variable | Y= variable
UPPER= numeric-value | numeric-variable LOWER= numeric-value | numeric-variable
<option(s)>;

option(s) can be one or more options from the following categories:

- Band options:
  - FILL | NOFILL
  - FILLATTRS= style-element | ( COLOR=color)
  - LINEATTRS= style-element < (options) > | (options)
  - MODELNAME= "plot-name"
  - NOEXTEND
  - NOMISSINGGROUP
  - OUTLINE | NOOUTLINE

- Plot options:
  - GROUP= variable
  - LEGENDLABEL= “text-string”
  - NAME= “text-string”
  - TRANSPARENCY= value

Required Arguments

X= variable | Y=variable
specifies a variable that is used to plot the band along the x or y axis.

LOWER= numeric-value | numeric-variable
specifies the lower value for the band. You can specify either a constant numeric value or a numeric variable.

UPPER= numeric-value | numeric-variable
specifies the upper value for the band. You can specify either a constant numeric value or a numeric variable.

Options

FILL | NOFILL
specifies whether the area fill is visible. The FILL option shows the area fill. The NOFILL option hides the area fill.
Default: The default status of the area fill is specified by the DisplayOpts style attribute of the GraphBand style element in the current style.

**FILLATTRS=** *style-element | (COLOR= *color*)*

specifies the appearance of the area fill for the band. You can specify the color of the fill by using a style element or by using the COLOR= suboption. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.

*Note:* This option has no effect if you specify the NOFILL option. 

**Default:** For ungrouped data, the default color is specified by the Color attribute of the GraphConfidence style element in the current style.

For grouped data, the default color is specified by the Color attribute of the GraphData1 ... GraphDatan style elements in the current style.

**GROUP=** *variable*

specifies a variable that is used to group the data. A separate band is created for each unique value of the grouping variable.

**LEGENDLABEL=** "*text-string*"

specifies a label that identifies the elements from the band plot in the legend. By default, the label “Band” is used for ungrouped data, and the group values are used for grouped data.

**Interaction:** The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

**LINEATTRS=** *style-element* *(options)* | *(options)*

specifies the appearance of the lines in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

*options* can be one or more of the following:

**COLOR=** *color*

specifies the color of the line. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphDatan style elements in the current style.

**PATTERN=** *line-pattern*

specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.

**Default:** For ungrouped data, the default line pattern is specified by theLineStyle attribute of the GraphDataDefault style element in the current style.

For grouped data, the default line pattern is specified by theLineStyle attribute of the GraphData1 ... GraphDatan style elements in the current style.

**THICKNESS=** *n* *(<units>)*

specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

**Default:** For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphDataDefault style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphDatan style elements in the current style.
MODELNAME= "plot-name"
specifies that the band should be interpolated in the same way as the specified plot.
If you do not specify the MODELNAME option, then the band is interpolated in the
same way as a series plot.

NAME= “text-string”
specifies a name for the plot. You can use the name to refer to this plot in other
statements.

NOEXTEND
when you specify numeric values for UPPER= and LOWER=, specifies that the band
does not extend beyond the first and last data points in the plot. By default, the band
extends to the edges of the plot area.
Interaction: This option has no effect if you do not specify numeric values for the
UPPER= and LOWER= options.
Restriction: This option is available with SAS 9.2 Phase 2 and later.

NOMISSINGGROUP
specifies that missing values of the group variable are not included in the plot.
Restriction: This option is available with SAS 9.2 Phase 2 and later.

OUTLINE | NOOUTLINE
specifies whether the outlines of the band are visible. The OUTLINE option shows
the outlines. The NOOUTLINE option hides the outlines.
Default: The default status of the band outlines is specified by the DisplayOpts
attribute of the GraphBand style element in the current style.

TRANSPARENCY= numeric-value
specifies the degree of transparency for the area fill. Specify a value from 0.0
(completely opaque) to 1.0 (completely transparent).
Default: 0.0

Details
The MODELNAME= option fits a band to another plot. This is particularly useful for
plots that use a special interpolation such as step plots.
The following code fragment fits a band to a step plot:

```sas
band x=t upper=ucl lower=lcl / modelname="myname" transparency=.5;
step x=t y=survival / name="myname";
```
DENSITY Statement

Create a density curve that shows the distribution of values in your data.

Interaction: The DENSITY statement can be combined only with the DENSITY and HISTOGRAM statements in the SGPANEL procedure.

Featured in: Example 1 on page 116

Syntax

DENSITY response-variable < / option(s)>;

option(s) can be one or more options from the following categories:

- DENSITY options:
  - FREQ= numeric-variable
  - LINEATTRS= style-element < (options) > | (options)
  - SCALE= scaling-type
  - TYPE= NORMAL(option(s)) | KERNEL(option(s))

- Plot options:
  - LEGENDLABEL= “text-string”
  - NAME= “text-string”
  - TRANSPARENCY= numeric-value

Required Arguments
response-variable
specifies the variable for the x axis. The variable must be numeric.

Options

FREQ= numeric-variable
specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.

LEGENDLABEL= "text-string"
specifies a label that identifies the density plot in the legend. By default, the label identifies the type of density curve. If you specify TYPE=NORMAL, then the default label is “Normal.” If you specify TYPE=KERNEL, then the default label is “Kernel.”

Note: User-specified parameters from the TYPE= option are included in the label by default.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the density line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: The default color is specified by the ContrastColor attribute of the GraphFit style element in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.

Default: The default line pattern is specified by the LineStyle attribute of the GraphFit style element in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

Default: The default line thickness is specified by the LineThickness attribute of the GraphFit style element in the current style.

NAME= "text-string"
specifies a name for the plot. You can use the name to refer to this plot in other statements.

SCALE= COUNT | DENSITY | PERCENT | PROPORTION
specifies the scaling that is used for the response axis. Specify one of the following values:

COUNT
the axis displays the frequency count.

DENSITY
the axis displays the density estimate values.

PERCENT
the axis displays values as a percentage of the total.

PROPORTION
the axis displays values in proportion to the total.

Default: PERCENT

TRANSPARENCY = numeric-value
specifies the degree of transparency for the density curve. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Default: 0.0

TYPE = NORMAL < (normal-opts)> | KERNEL < (kernel-opts)>
specifies the type of distribution curve that is used for the density plot. Specify one of the following keywords:

NORMAL < (normal-opts)>
specifies a normal density estimate, with a mean and a standard deviation.

normal-opts can be one or more of the following values:

MU = numeric-value
specifies the mean value that is used in the density function equation. By default, the mean value is calculated from the data.
SIGMA= numeric-value
specifies the standard deviation value that is used in the density function equation. The value that you specify for the SIGMA= suboption must be a positive number. By default, the standard deviation value is calculated from the data.

KERNEL < (kernel-opts)>
specifies a non-parametric kernel density estimate.
kernel-opts can be:

C= numeric-value
specifies the standardized bandwidth for a number that is greater than 0 and less than or equal to 100.
The value that you specify for the C= suboption affects the value of \( \lambda \) as shown in the following equation:

\[
\lambda = cQn^{-\frac{1}{2}}
\]

In this equation \( c \) is the standardized bandwidth, \( Q \) is the interquartile range, and \( n \) is the sample size.

WEIGHT= NORMAL | QUADRATIC | TRIANGULAR
specifies the weight function. You can specify either normal, quadratic, or triangular weight function.

Default: NORMAL

Details

Normal Density Function
When the type of the density curve is NORMAL, the fitted density function equation is as follows:

\[
p(x) = \frac{100h\%}{\sigma \sqrt{2\pi}} \exp \left( -\frac{1}{2} \left( \frac{x - \mu}{\sigma} \right)^2 \right) \text{ for } -\infty < x < \infty
\]

In the equation, \( \mu \) is the mean, and \( \sigma \) is the standard deviation. You can specify \( \mu \) by using the MU= suboption and \( \sigma \) by using the SIGMA= suboption.

Kernel Density Function
When the TYPE of the density curve is KERNEL, the general form of the kernel density estimator is as follows:

\[
\tilde{f}_\lambda(x) = \frac{100h\%}{n\lambda} \sum_{i=1}^{n} K_0 \left( \frac{x - x_i}{\lambda} \right)
\]

In the equation, \( K_0 (\cdot) \) is the weight function, \( \lambda \) is the bandwidth, \( n \) is the sample size, and \( x_i \) is the \( i \)th observation. You can use the C= suboption to specify the bandwidth and the WEIGHT= suboption to specify the weight function \( K_0 (\cdot) \).
Kernel Density Weight Functions
The formulas for the weight functions are as follows:

NORMAL
\[ K_0(t) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{1}{2}t^2\right) \text{ for } -\infty < t < \infty \]

QUADRATIC
\[ K_0(t) = \frac{3}{4} (1 - t^2) \text{ for } |t| \leq 1 \]

TRIANGULAR
\[ K_0(t) = 1 - |t| \text{ for } -|t| \leq 1 \]

DOT Statement

Creates a dot plot that summarizes the values of a category variable.

Interaction: The DOT statement can be combined only with other horizontal categorization plot statements in the SGPANEL procedure. See “Plot Content” on page 32.

Syntax

DOT category-variable < / option(s)>;

option(s) can be one or more options from the following categories:

- Dot options:
  - ALPHA= numeric-value
  - DATALABEL <= variable>
  - FREQ= numeric-variable
  - LIMITATRGS= style-element <(options)> | (options)
  - LIMITS= UPPER | LOWER | BOTH
  - LIMITSTAT= CLM | STDERR | STDDEV
  - MARKERATRGS= style-element <(options)> | (options)
  - MISSING
  - NOSTATLABEL
  - NUMSTD= n
  - RESPONSE= numeric-variable
  - STAT= FREQ | SUM | MEAN
  - URL= character-variable
  - WEIGHT= numeric-variable
Plot options:
- GROUP= variable
- LEGENDLABEL= "text-string"
- NAME= "text-string"
- TRANSPARENCY= numeric-value

Required Arguments

category-variable
specifies the variable that classifies the observations into distinct subsets.

Options

ALPHA= numeric-value
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).
Default: .05
Interaction: This option has no effect if you do not specify LIMITSTAT=CLM. If your plot is overlaid with other categorization plots, then the first ALPHA value that you specify is used for all of the plots.

DATALABEL <= variable>
displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the calculated response are used for the data labels.
Restriction: This option is available with SAS 9.2 Phase 2 and later.

FREQ= numeric-variable
specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.
Interaction: If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.

GROUP= variable
specifies a classification variable to divide the values into groups. A separate plot is created for each unique value of the classification variable.
Interaction: If you specify more than one categorization plot statement, then all of the plots must specify the same GROUP variable. If you do not specify the same GROUP= option for all of the categorization plots, then the GROUP= option has no effect.

LEGENDLABEL= "text-string"
specifies the label that identifies the dot plot in the legend. By default, the label of the RESPONSE= variable is used. If there is no response variable label, then the name of the response variable and the computed statistic (SUM or MEAN) is used. If the RESPONSE= option is not used, the legend label is “Frequency”.
Interaction: The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.
LIMITATTRS= style-element <(options)> | (options)

specifies the appearance of the limit lines in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color

specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: The default color is specified by the ContrastColor attribute of the GraphError style element in the current style.

PATTERN= line-pattern

specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.

Default: The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.

THICKNESS= n <units>

specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

Default: The default line thickness is specified by the LineThickness attribute of the GraphError style element in the current style.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

LIMITS= UPPER | LOWER | BOTH

specifies which limit lines to display. Limits are displayed as heavier line segments with a serif at the end extending horizontally from each dot. Upper limits extend to the right of the dot and lower limits extend to the left of the dot. By default, no limits are displayed unless you specify either the LIMITS= or LIMITSTAT= option. Specify one of the following values:

BOTH

adds lower and upper limit lines to the plot.

LOWER

adds lower limit lines to the plot.

UPPER

adds upper limit lines to the plot.

By default, no limit lines are displayed. However, if you specify the LIMITSTAT= option, then the default is BOTH.

Interaction: Limit lines are displayed only when you specify STAT= MEAN.

LIMITSTAT= CLM | STDDEV | STDERR

specifies the statistic for the limit lines. Specify one of the following statistics:

CLM

confidence limits

STDDEV

standard deviation

STDERR

standard error

Default: CLM

Interaction: If you specify the LIMITSTAT= option only, then the default value for the LIMITS= option is BOTH.
Limits lines are displayed only when you specify STAT=MEAN.

**MARKERATTRS=** *style-element <(options)> | (options)*

specifies the appearance of the markers in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

*options* can be one or more of the following:

**COLOR=** *color*

specifies the color of the markers. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the *SAS/GRAPH: Reference*.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphDatann style elements in the current style.

**SIZE=** *n <units >*

specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

**SYMBOL=** *symbol-name*

specifies the symbol for the markers. See “Marker Symbols” on page 34 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphDatann style elements in the current style.

**MISSING**

processes missing values as valid category value and creates a dot for it.

**NAME=** "*text-string*

specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOSTATLABEL**

removes the statistic name from the axis and legend labels.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**NUMSTD=** *n*

specifies the number of standard units for the limit lines, when you specify LIMITSTAT= STDDEV or LIMITSTAT= STDERR. You can specify any positive number, including decimals.

**Default:** 1

**RESPONSE=** *response-variable*

specifies a numeric response variable for the plot. The summarized values of the response variable for each category value are displayed on the horizontal axis.

**STAT=** *FREQ | MEAN | SUM*

specifies the statistic for the horizontal axis. Specify one of the following statistics:

**FREQ**

the frequencies for the category variable. This is the default value when you do not specify the RESPONSE= option.
MEAN
the mean of the response variable.

SUM
the sum of the response variable. This is the default value when you specify the RESPONSE= option.
    If you do not specify the RESPONSE= option, then only the FREQ statistic can be used. If you specify the RESPONSE= option, then you can use either the SUM or MEAN statistics.

TRANSPARENCY= numeric-value
specifies the degree of transparency for the plot. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).
    Default: 0.0

URL= character-variable
specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.
    Interaction: This option affects graphics output that is created through the ODS HTML destination only.
    This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.
    Default: By default, no HTML links are created.
    Restriction: This option is available with SAS 9.2 Phase 2 and later.

WEIGHT= numeric-variable
specifies that each observation is weighted by a factor of $w$ for computational purposes, where $w$ is the value of the numeric variable. $w$ can be any numeric value.
    If $w$ is 0, negative or missing, then that observation is excluded from the analysis.
    Interaction: If your plot is overlaid with other categorization plots, then the first WEIGHT variable that you specified is used for all of the plots.

---

**HBAR Statement**

Creates a bar chart that summarizes the values of a category variable.

**Interaction:** The HBAR statement can be combined only with other categorization plot statements in the SGPANEL procedure. See “Plot Content” on page 32.

**Featured in:** Example 3 on page 118

**Syntax**

HBAR category-variable <\ option(s)>

*option(s)* can be one or more options from the following categories:

- Bar options:
  - ALPHA= numeric-value
  - BARWIDTH= numeric-value
The SGPANEL Procedure

HBAR Statement

DATALABEL
FILL | NOFILL
FILLATTRS= style-element | (options)
FREQ= numeric-variable
LIMITATTRS= style-element <(options)> | (options)
LIMITS= BOTH | LOWER | UPPER
LIMITSTAT= CLM | STDDEV | STDERR
MISSING
NOSTATLABEL
NUMSTD= n
OUTLINE | NOOUTLINE
RESPONSE= response-variable
STAT= FREQ | MEAN | SUM
URL= variable
WEIGHT= numeric-variable

Plot options:
GROUP= variable
LEGENDLABEL= “text-string”
NAME= “text-string”
TRANSPARENCY= numeric-value

Required Arguments

category-variable
specifies the variable that classifies the observations into distinct subsets.

Options

ALPHA= numeric-value
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).
Default: .05
Interaction: This option has no effect if you do not specify LIMITSTAT=CLM.
If your plot is overlaid with other categorization plots, then the first ALPHA value that you specify is used for all of the plots.

BARWIDTH= numeric-value
specifies the width of the bars as a ratio of the maximum possible width. The maximum width is equal to the space between the center of each bar and the centers of the adjacent bars. Specify a value between .1 and 1.
For example, if you specify a width of 1, then there is no distance between the bars. If you specify a value of .5, then the width of the bars is equal to the space between the bars.
Default: .8

DATALABEL
adds data labels for bars. The values of the response variable appear at the end of the bars.
Restriction: This option is available with SAS 9.2 Phase 2 and later.

FILL | NOFILL
specifies whether the bars are filled. The FILL option shows the fill color for the bars. The NOFILL option hides the fill color for the bars.

Default: FILL

FILLATTRS= style-element | (COLOR= color)
specifies the appearance of the fill for the bars. You can specify the color of the fill by using a style element or by using the COLOR= suboption. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.

Note: This option has no effect if you specify the NOFILL option. △

Default: For ungrouped data, the default color is specified by the Color attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the Color attribute of the GraphData1 ... GraphData\n style elements in the current style.

FREQ= numeric-variable
specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.

Interaction: If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.

GROUP= variable
specifies a grouping variable.

LEGENDLABEL= "text-string"
specifies the label that identifies the bar chart in the legend. By default, the label of the RESPONSE= variable is used. If there is no response variable label, the name of the response variable and the computed statistic (SUM or MEAN) is used. If the RESPONSE= option is not used, the legend label is “Frequency”.

Interaction: The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

LIMITATTRS= style-element <(options)> | (options)
specifies the appearance of the limit lines in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: The default color is specified by the ContrastColor attribute of the GraphError style element in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.

Default: The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.
**Default:** The default line thickness is specified by the LineThickness attribute of the GraphError style element in the current style.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**LIMITS= BOTH | LOWER | UPPER**
specifies which limit lines to display. Limits are displayed as heavier line segments with a serif at the end extending from each bar. Upper limits extend to the right of the bar and lower limits extend to the left of the bar. By default, no limits are displayed unless you specify either the LIMITS= or LIMITSTAT= option. If you specify the LIMITSTAT= option only, then LIMITS=BOTH is the default. Specify one of the following values:

**BOTH**
adds lower and upper limit lines to the plot.

**LOWER**
adds lower limit lines to the plot.

**UPPER**
adds upper limit lines to the plot.

By default, no limit lines are displayed. However, if you specify the LIMITSTAT= option, then the default is BOTH.

**Interaction:** Limit lines are displayed only when you specify STAT=MEAN.

**LIMITSTAT= CLM | STDDEV | STDERR**
specifies the statistic for the limit lines. Specify one of the following statistics:

**CLM**
confidence limits

**STDDEV**
standard deviation

**STDERR**
standard error

**Default:** CLM

**Interaction:** If you specify the LIMITSTAT= option only, then the default value for the LIMITS= option is BOTH.

Limits lines are displayed only when you specify STAT=MEAN.

**MISSING**
processes missing values as valid category value and creates a bar for it.

**NAME= "text-string"**
specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOSTATLABEL**
removes the statistic name from the axis and legend labels.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**NUMSTD= n**
specifies the number of standard units for the limit lines, when you specify LIMITSTAT= STDDEV or LIMITSTAT= STDERR. You can specify any positive number, including decimals.

**Default:** 1

**OUTLINE | NOOUTLINE**
specifies whether the bars have outlines. The OUTLINE option shows the outlines. The NOOUTLINE option hides the outlines.
Default: OUTLINE

**RESPONSE= response-variable**
specifies a numeric response variable for the plot. The summarized values of the response variable are displayed on the horizontal axis.

**STAT= FREQ | MEAN | SUM**
specifies the statistic for the horizontal axis. Specify one of the following statistics:

- **FREQ**
  - the frequencies for the category variable. This is the default value when you do not specify the RESPONSE= option.

- **MEAN**
  - the mean of the response variable.

- **SUM**
  - the sum of the response variable. This is the default value when you specify the RESPONSE= option.

If you do not specify the RESPONSE= option, then only the FREQ statistic can be used. If you specify the RESPONSE= option, then you can use either the SUM or MEAN statistics.

**TRANSPARENCY= numeric-value**
specifies the degree of transparency for the bars and limits, if displayed. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Default: 0.0

**URL= character-variable**
specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.

Interaction: This option affects graphics output that is created through the ODS HTML destination only.

This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.

Default: By default, no HTML links are created.

**WEIGHT= numeric-variable**
specifies that each observation is weighted by a factor of \( w \) for computational purposes, where \( w \) is the value of the numeric variable. \( w \) can be any numeric value. If \( w \) is 0, negative or missing, then that observation is excluded from the analysis.

Interaction: If your plot is overlaid with other categorization plots, then the first WEIGHT variable that you specified is used for all of the plots.

### HBOX Statement

Creates a horizontal box plot that shows the distribution of your data.

Interaction: The HBOX statement cannot be used together with other plot statements in the SGPANEL procedure.
Description
Horizontal and vertical box plots display the distribution of data by using a rectangular box and whiskers. Whiskers are lines that indicate a data range outside of the box.

Figure 3.7 Parts of a Box Plot

- □ ← FAROUTLIER
- 3(IQR) above 75th percentile
- □ ← OUTLIER
- 1.5(IQR) above 75th percentile
- □ ← MAX
- Q3 (75th percentile)
- MEAN
- MEDIAN
- Q1 (25th percentile)
- MIN
- 1.5(IQR) below 25th percentile

Figure 3.7 on page 57 shows a diagram of a vertical box plot. The bottom and top edges of the box indicate the intra-quartile range (IQR). That is, the range of values between the first and third quartiles (the 25th and 75th percentiles). The marker inside the box indicates the mean value. The line inside the box indicates the median value.

The elements that are outside the box are dependent on your options. By default, the whiskers that extend from each box indicate the range of values that are outside of the intra-quartile range, but are close enough not to be considered outliers (a distance less than or equal to 1.5*IQR). If you specify the EXTREME option, then the whiskers indicate the entire range of values, including outliers.

Any points that are a distance of more than 1.5*IQR from the box are considered to be outliers. By default, these points are indicated by markers. If you specify DATALABEL= option, then the outlier points have data labels. If you also specify the LABELFAR option, then only outliers that are 3*IQR from the box have data labels.

Syntax

HBOX response-variable / option(s);

option(s) can be one or more options from the following categories:
Box options:

- **BOXWIDTH= numeric-value**
- **CATEGORY= category-variable**
- **DATALABEL <= variable>**
- **EXTREME**
- **FREQ= numeric-variable**
- **LABELFAR**
- **MISSING**
- **PERCENTILE= 1|2|3|4|5**
- **SPREAD**

Plot options:

- **LEGENDLABEL= "text-string"**
- **NAME= "text-string"**
- **TRANSPARENCY= numeric-value**

**Required Arguments**

**response-variable**

specifies the response variable for the plot. If you do not specify the CATEGORY= option, then one box is created for the response variable.

**Options**

**BOXWIDTH= n**

specifies the width of the box. Specify a value between 0.0 (0% of the available width) and 1.0 (100% of the available width).

Default: 0.4

**CATEGORY= category-variable**

specifies the category variable for the plot. A box plot is created for each distinct value of the category variable.

**DATALABEL <= variable>**

adds data labels for the outlier markers. If you specified a variable, then the values for that variable are used as data labels. If you do not specify a variable, then the values of the response variable are used.

*Note:* This option has no effect if the plot does not contain outlier points.

**EXTREME**

specifies that the whiskers can extend to the maximum and minimum values for the response variable, and that outliers are not identified. When you do not specify the EXTREME option, the whiskers cannot be longer than 1.5 times the length of the box.

**FREQ= numeric-variable**

specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.

**Interaction:** If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.
LABELFAR
specifies that only the far outliers have data labels. Far outliers are points whose
distance from the box is more than three times the length of the box.

Note: This option has no effect if you do not specify the DATALABELS option, or
if there are no far outliers. △

LEGENDLABEL= “text-string”
specifies a label that identifies the box plot in the legend. By default, the label of the
response variable is used.

MISSING
processes missing values as a valid category value and creates a box for it.

NAME= “text-string”
specifies a name for the plot. You can use the name to refer to this plot in other
statements.

PERCENTILE= 1 | 2 | 3 | 4 | 5
specifies a method for computing the percentiles for the plot. For descriptions of each
method, see “Calculating Percentiles” in the UNIVARIATE Procedure chapter of Base
Default: 5

SPREAD
relocates outlier points that have identical values to prevent overlapping.

Note: This option has no effect if your data does not contain two or more outliers
with identical values for the response variable. △

TRANSPARENCY= numeric-value
specifies the degree of transparency for the plot. Specify a value from 0.0 (completely
opaque) to 1.0 (completely transparent).
Default: 0.0

HISTOGRAM Statement

Creates a histogram that displays the frequency distribution of a numeric value.

Interaction: The HISTOGRAM statement can be combined only with DENSITY
statements in the SGPANEL procedure.

Note: The range of the response variable is automatically divided into an appropriate
number of bins.

Featured in: Example 1 on page 116

Syntax

HISTOGRAM response-variable < / option(s)>;

option(s) can be one or more options from the following categories:

- Histogram options:
BOUNDARY= UPPER | LOWER
FILL | NOFILL
FILLATTRS= style-element | (COLOR= color)
FREQ= numeric-variable
OUTLINE | NOOUTLINE
SCALE= PERCENT | COUNT | PROPORTION

Plot options:
  LEGENDLABEL= "text-string"
  NAME= "text-string"
  TRANSPARENCY= numeric-value

Required Arguments

response-variable
  specifies a response variable for the histogram.

Options

BOUNDARY= LOWER | UPPER
  specifies how boundary values are assigned to bins.
  LOWER
    specifies that boundary values are assigned to the lower bin.
  UPPER
    specifies that boundary values are assigned to the upper bin.
  Default:  UPPER

FILL | NOFILL
  specifies whether the area fill is visible. The FILL option shows the area fill. The NOFILL option hides the area fill.
  Default:  The default status of the area fill is specified by the DisplayOpts style attribute of the GraphHistogram style element in the current style.

FILLATTRS= style-element | (COLOR= color)
  specifies the appearance of the area fill. You can specify the color of the fill by using a style element or by using the COLOR= suboption. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.
  Note:  This option has no effect if you specify the NOFILL option. △
  Default:  For ungrouped data, the default color is specified by the Color attribute of the GraphDataDefault style element in the current style.
            For grouped data, the default color is specified by the Color attribute of the GraphData1 ... GraphDataN style elements in the current style.

FREQ= numeric-variable
  specifies that each observation is repeated \( n \) times for computational purposes, where \( n \) is the value of the numeric variable. If \( n \) is not an integer, then it is truncated to an integer. If \( n \) is less than 1 or missing, then it is excluded from the analysis.
LEGENDLABEL= "text-string"
   specifies a label that identifies the histogram in the legend. By default, the label of
   the response variable is used.

NAME= "text-string"
   specifies a name for the plot. You can use the name to refer to this plot in other
   statements.

OUTLINE | NOOUTLINE
   specifies whether outlines are displayed for the bars. The OUTLINE option shows
   the outlines. The NOOUTLINE option hides the outlines.
   Default: The default status of the bar outlines is specified by the DisplayOpts
          attribute of the GraphHistogram style element in the current style.

SCALE= COUNT | PERCENT | PROPORTION
   specifies the scaling that is applied to the vertical axis. Specify one of the following
   values:
   COUNT
      the axis displays the frequency count.
   PERCENT
      the axis displays values as a percentage of the total.
   PROPORTION
      the axis displays values as proportions (0.0 to 1.0) of the total.
   Default: PERCENT

TRANSPARENCY= numeric-value
   specifies the degree of transparency for the histogram. Specify a value from 0.0
   (completely opaque) to 1.0 (completely transparent).
   Default: 0.0

### HLINE Statement

Creates a horizontal line chart (the line is vertical). You can use the HLINE statement with the
HBAR statement to create a horizontal bar-line chart.

Interaction: The HLINE statement can be combined only with other categorization plot
statements in the SGPANEL procedure. See “Plot Content” on page 32.

### Syntax

**HLINE** category-variable < / option(s)>;

*option(s)* can be one or more options from the following categories:

- Line options:
  - ALPHA= numeric-value
  - BREAK
  - CURVELABEL <= text-string>

...
CURVELABELPOS= MIN | MAX | START | END
DATALABEL <= variable
FREQ= numeric-variable
LIMITATTRS= style-element <(options)> | (options)
LIMITS= BOTH | LOWER | UPPER
LIMITSTAT= CLM | STDDEV | STDERR
LINEATTRS= style-element <(options)> | (options)
MARKERATTRS= style-element <(options)> | (options)
MARKERS
MISSING
NOSTATLABEL
NUMSTD= n
RESPONSE= response-variable
STAT= FREQ | MEAN | SUM
URL= character-variable
WEIGHT= numeric-variable

Plot options:
GROUP= variable
LEGENDLABEL= “text-string”
NAME= “text-string”
TRANSPARENCY= numeric-value

Required Arguments

category-variable
specifies the variable that classifies the observations into distinct subsets.

Options

ALPHA= numeric-value
specifies the confidence level for the confidence limits. Specify a number between
0.00 (100% confidence) and 1.00 (0% confidence).

Default: .05

Interaction: This option has no effect if you do not specify LIMITSTAT=CLM.
If your plot is overlaid with other summary plots, then the first ALPHA value
that you specify is used for all of the plots.

BREAK
creates a break in the line for each missing value for the category variable.

CURVELABEL <=“text-string”>
adds a label for the line. You can also specify the label text. If you do not specify a
label, then the label from the response variable is used.
CURVELABELPOS= MIN | MAX | START | END
specifies the location of the curve label. Specify one of the following values:

MIN
places the curve label at the minimum value for the response axis.

MAX
places the curve label at the maximum value for the response axis.

START
places the curve label at the first point on the curve.

END
places the curve label at the last point on the curve.

Default: END

DATALABEL <= variable>
displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the calculated response are used for the data labels.

FREQ= numeric-variable
specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.

Interaction: If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.

GROUP= variable
specifies a category variable to divide the values into groups. A separate plot is created for each unique value of the category variable.

Interaction: If you specify more than one categorization plot statement, then all of the plots must specify the same GROUP variable. If you do not specify the same GROUP= option for all of the categorization plots, then the GROUP= option has no effect.

LEGENDLABEL= "text-string"
specifies the label that identifies the line chart in the legend. By default, the label of the response variable is used. If there is no response variable label, then the name of the response variable and the computed statistic (SUM or MEAN) are used. If you do not specify a response variable, then the legend label is “Frequency”.

Interaction: The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

LIMITATTRS= style-element <(options)> | (options)
specifies the appearance of the limit lines in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: The default color is specified by the ContrastColor attribute of the GraphError style element in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.
Default: The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

Default: The default line thickness is specified by the LineThickness attribute of the GraphError style element in the current style.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

LIMITS= BOTH | LOWER | UPPER
adds limit lines to the plot. Specify one of the following values:

BOTH
adds lower and upper limit lines to the plot.

LOWER
adds lower limit lines to the plot.

UPPER
adds upper limit lines to the plot.

By default, no limit lines are displayed. However, if you specify the LIMITSTAT= option, then the default is BOTH.

Note: Limit lines are displayed only when you specify STAT= MEAN.

LIMITSTAT= CLM | STDDEV | STDERR
specifies the statistic for the limit lines. Specify one of the following:

CLM
confidence limits

STDDEV
standard deviation

STDERR
standard error

Default: CLM

Interaction: If you specify the LIMITSTAT= option, then the default value for the LIMITS= option is BOTH.

LINEATRIS= style-element <(options)> | (options)
specifies the appearance of the lines in the line chart. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.

Default: For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphDataDefault style element in the current style.
For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData\(n\) style elements in the current style.

**THICKNESS**= \(n <\text{units}>\)
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

**Default:** For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphDataDefault style element in the current style. For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData\(n\) style elements in the current style.

**MARKERATTRS**= *style-element *(<options>)* | *(options)*
specifies the appearance of the markers in the plot. This option has no effect unless you also specify the MARKERS option. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

*options* can be one or more of the following:

**COLOR**= *color*
specifies the color of the markers. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style. For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData\(n\) style elements in the current style.

**SIZE**= \(n <\text{units}>\)
specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

**SYMBOL**= *symbol-name*
specifies the symbol for the markers. See “Marker Symbols” on page 34 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style. For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData\(n\) style elements in the current style.

**MARKERS**
adds data point markers to the plot.

**MISSING**
processes missing values as a valid category value and creates a line for it.

**NAME**= "*text-string*
 specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOSTATLABEL**
removes the statistic name from the axis and legend labels.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.
NUMSTD= \( n \)
specifies the number of standard units for the limit lines, when you specify
LIMITSTAT= STDDEV or LIMITSTAT= STDERR. You can specify any positive
number, including decimals.

Default: 1

RESPONSE= \textit{response-variable}
specifies a numeric response variable for the plot. The summarized values of the
response variable are displayed on the horizontal axis.

STAT= FREQ | MEAN | SUM
specifies the statistic for the horizontal axis. Specify one of the following:

FREQ
the frequencies for the category variable. This is the default value when you do
not specify the RESPONSE= option.

MEAN
the mean of the response variable.

SUM
the sum of the response variable. This is the default value when you specify the
RESPONSE= option.

If you do not specify the RESPONSE= option, then only the FREQ statistic can be
used. If you specify the RESPONSE= option, then you can use either the SUM or
MEAN statistics.

TRANSPARENCY= \textit{numeric-value}
specifies the degree of transparency for the lines and markers. Specify a value from
0.0 (completely opaque) to 1.0 (completely transparent).

Default: 0.0

URL= \textit{character-variable}
specifies a character variable that contains URLs for web pages to be displayed when
parts of the plot are selected within an HTML page.

Interaction: This option affects graphics output that is created through the ODS
HTML destination only.

This option has no effect unless you also specify IMAGEMAP in the ODS
GRAPHICS statement.

Default: By default, no HTML links are created.

WEIGHT= \textit{numeric-variable}
specifies that each observation is weighted by a factor of \( w \) for computational
purposes, where \( w \) is the value of the numeric variable. \( w \) can be any numeric value.
If \( w \) is 0, negative or missing, then that observation is excluded from the analysis.

Interaction: If your plot is overlaid with other categorization plots, then the first
WEIGHT variable that you specified is used for all of the plots.

---

KEYLEGEND Statement

Adds a legend to the plot.
Syntax

KEYLEGEND <"name-1" ... "name-n"> </option(s)>;

option(s) can be any of the following:
ACROSS= n
BORDER | NOBORDER
DOWN= n
POSITION= position-value
TITLE= “text-string”

Optional Arguments

"name-1" ... “name-n”
specifies the names of one or more plots that you want to include in legend. Each name that you specify must correspond to a value that you entered for the NAME= option in a plot statement.

Note: If you do not specify a name, then the legend contains references to all of the plots in the graph. △

Options

ACROSS= n
specifies the number of columns in the legend. By default, the number of columns is determined automatically.

Note: Depending on the number of legend entries and the number of columns and rows that you specify, the legend might not fit in your graph. If your legend does not appear, then you might need to specify a different value for the ACROSS= option. △

BORDER | NOBORDER
specifies whether the border around the legend is visible. The BORDER option shows the border. The NOBORDER option hides the border.
Default: BORDER

DOWN= n
specifies the number of rows in the legend. By default, the number of rows is determined automatically.

Note: Depending on the number of legend entries and the number of columns and rows that you specify, the legend might not fit in your graph. If your legend does not appear, then you might need to specify a different value for the DOWN= option. △

POSITION= position-value
specifies the position of the legend within the plot. The positions are as follows:
BOTTOM places the legend at the bottom of the plot.
LEFT places the legend at the left side of the plot.
RIGHT places the legend at the right side of the plot.
TOP places the legend at the top of the plot.

Note: By default, if you use more than one KEYLEGEND statement, then each legend is placed in a different position. △
**Default:** BOTTOM

**TITLE=** "text-string"

adds a title to the legend.

---

**LOESS Statement**

Creates a fitted loess curve.

**Syntax**

```
LOESS X= numeric-variable Y= numeric-variable / option(s);
```

`option(s)` can be one or more options from the following categories:

- **LOESS options:**
  - `ALPHA= numeric-value`
  - `CLM <= "text-string"`  
  - `CLMATTRS= style-element`
  - `CLMTRANSPARENCY= numeric-value`
  - `CURVELABEL <= "text-string"`  
  - `CURVELABELPOS= MIN | MAX | START | END`
  - `DATALABEL <= variable`
  - `DEGREE= 1 | 2`
  - `INTERPOLATION= CUBIC | LINEAR`
  - `LINEATTRS= style-element < (options) > | (options)`
  - `MARKERATTRS= style-element < (options) > | (options)`
  - `MAXPOINTS= n`
  - `NOLEGCLM`
  - `NOLEGFIT`
  - `NOMARKERS`
  - `REWEIGHT= n`
  - `SMOOTH= numeric-value`
  - `WEIGHT= numeric-variable`

- **Plot options:**
  - `GROUP= variable`
  - `LEGENDLABEL= "text-string"`
  - `NAME= "text-string"`

**Required Arguments**

- **X= numeric-variable**
  
  specifies the variable for the x axis.
Y= numeric-variable
specifies the variable for the y axis.

Options

ALPHA= numeric-value
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

Note: This option has no effect if you do not specify the CLM option.

Default: .05

CLM <= “text-string”>
creates confidence limits for a mean predicted value for each observation. The optional text string overrides the default legend label for the confidence limit.

CLMATRMS = style-element
specifies the appearance of the confidence limits by using an ODS style element.

Default: The default appearance of the confidence limits is specified by the GraphConfidence style element in the current style.

CLMTRANSPARENCY= numeric-value
specifies the degree of transparency for the confidence limits. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Note: This option has no effect if you do not specify the CLM option.

Default: 0.0

CURVELABEL <= “text-string”>
adds a label for the loess curve. You can also specify the label text. If you do not specify a label, the label from the Y variable is used.

CURVELABELPOS= MIN | MAX | START | END
specifies the location of the curve label. Specify one of the following values:

MIN
places the curve label at the minimum value for the X axis.

MAX
places the curve label at the maximum value for the X axis.

START
places the curve label at the first point on the curve.

END
places the curve label at the last point on the curve.

Default: END

DATALABEL <= variable>
displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.

Interaction: This option has no effect if you also specify the NOMARKERS option.

DEGREE= 1 | 2
specifies the degree of the local polynomials to use for each local regression. 1 specifies a linear fit and 2 specifies a quadratic fit.

Default: 1
GROUP= variable
specifies a classification variable to divide the values into groups. A separate plot is
created for each unique value of the classification variable.

Interaction: If you specify the GROUP= option in multiple fit plot statements, then
the first GROUP= variable is used for all of the fit plots that specify GROUP=.

INTERPOLATION= CUBIC | LINEAR
specifies the degree of the interpolating polynomials that are used for blending local
polynomial fits at the kd tree vertices.

Default: CUBIC

LEGENDLABEL= “text-string”
specifies a label that identifies the fit line in the legend. By default, the label “Loess”
is used, along with the value of the SMOOTH= option if specified.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the fit curve. You can specify the appearance by using a
style element or by using suboptions. If you specify a style element, you can
additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the
“SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphFit style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute
of the GraphData1 ... GraphData n style elements in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number
or by name. See “Line Patterns” on page 34 for a list of line patterns.

Default: For ungrouped data, the default line pattern is specified by the LineStyle
attribute of the GraphFit style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle
attribute of the GraphData1 ... GraphData n style elements in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The
default unit is pixels. See “Units of Measurement” on page 34 for a list of the
measurement units that are supported.

Default: For ungrouped data, the default line thickness is specified by the
LineThickness attribute of the GraphFit style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness
attribute of the GraphData1 ... GraphData n style elements in the current style.

MARKERATTRS= style-element <(options)> | (options)
specifies the appearance of the markers in the plot. You can specify the appearance
by using a style element or by using suboptions. If you specify a style element, you
can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the markers. For more information about specifying colors,
see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphDataN style elements in the current style.

**SIZE=** *n* <units >

specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

**SYMBOL=** symbol-name

specifies the symbol for the markers. See “Marker Symbols” on page 34 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphDataN style elements in the current style.

**MAXPOINTS=** *n*

specifies the maximum number of predicted points for the loess fit and the corresponding limits.

**Default:** 201

**NAME=** “text-string”

specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOLEGCLM**

hides the legend entry for the mean value confidence limits.

**NOLEGFIT**

hides the legend entry for the fit line.

**NOMARKERS**

removes the scatter markers from the plot.

**REWEIGHT=** *n*

specifies the number of iterative reweighting steps to apply to the data.

**Note:** This option has no affect if you do not specify the WEIGHT option.

**Default:** 0

**SMOOTH=** numeric-value

specifies a smoothing parameter value. If you do not specify this option, a smoothing value is determined automatically.

**WEIGHT=** numeric-variable

specifies that each observation is weighted by a factor of *w* for computational purposes, where *w* is the value of the numeric variable. *w* can be any numeric value. If *w* is 0, negative or missing, then that observation is excluded from the analysis.

**Details**

For the SMOOTH= option, the smoothing parameter value must be greater than the minimum value that is determined by the following equation:

\[
\text{minimum} = \frac{\text{degree} + 1}{\text{number of observations}}
\]
NEEDLE Statement

Creates a plot with needles connecting each point to the baseline.

Restriction: The vertical axis that is used with the NEEDLE statement cannot be a discrete axis.

Syntax

NEEDLE X= variable Y= numeric-variable < / option(s)>;

option(s) can be one or more options from the following categories:

- **NEEDLE options:**
  - BASELINE= numeric-value
  - DATALABEL <= variable >
  - LINEATTRS= style-element < (options) > | (options)
  - MARKERATTRS= style-element < (options) > | (options)
  - MARKERS
  - NOMISSINGGROUP
  - URL= character-variable

- **Plot options:**
  - GROUP= variable
  - LEGENDLABEL= "text-string"
  - NAME= "text-string"
  - TRANSPARENCY= numeric-value

Required Arguments

- **X= variable**
  - specifies the variable for the x axis.

- **Y= numeric-variable**
  - specifies a numeric variable for the y axis.

Options

- **BASELINE= numeric-value**
  - specifies a value on the Y axis for the baseline.

- **DATALABEL <= variable >**
  - displays a label for each data point. If you specify a variable, the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.
GROUP= variable
specifies a classification variable to divide the values into groups. A separate plot is
created for each unique value of the classification variable.

LEGENDLABEL= **"text-string"**
specifies a label that identifies the needle plot in the legend. By default, the label of
the Y variable or the group value for each marker is used.

**Interaction:** The LEGENDLABEL= option has no effect if you also specify the
GROUP= option in the same plot statement.

LINEATTRS= **style-element (options) | (options)**
specifies the appearance of the needle lines. You can specify the appearance by using
a style element or by using suboptions. If you specify a style element, you can
additionally specify suboptions to override specific appearance attributes.

**options** can be one or more of the following:

COLOR= **color**
specifies the color of the line. For more information about specifying colors, see the
"SAS/GRAPH Colors and Images" chapter in the **SAS/GRAPH: Reference**.

**Default:** For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute
of the GraphData1 ... GraphDataN style elements in the current style.

PATTERN= **line-pattern**
specifies the line pattern for the line. You can reference SAS patterns by number
or by name. See “Line Patterns” on page 34 for a list of line patterns.

**Default:** For ungrouped data, the default line pattern is specified by the LineStyle
attribute of the GraphDataDefault style element in the current style.
For grouped data, the default line pattern is specified by the LineStyle
attribute of the GraphData1 ... GraphDataN style elements in the current style.

THICKNESS= **n <units>**
specifies the thickness of the line. You can also specify the unit of measure. The
default unit is pixels. See “Units of Measurement” on page 34 for a list of the
measurement units that are supported.

**Default:** For ungrouped data, the default line thickness is specified by the
LineThickness attribute of the GraphDataDefault style element in the current style.
For grouped data, the default line thickness is specified by the LineThickness
attribute of the GraphData1 ... GraphDataN style elements in the current style.

MARKERATTRS= **style-element (options) | (options)**
specifies the appearance of the markers in the plot. This option has no effect unless
you also specify the MARKERS option. You can specify the appearance by using a
style element or by using suboptions. If you specify a style element, you can
additionally specify suboptions to override specific appearance attributes.

**options** can be one or more of the following:

COLOR= **color**
specifies the color of the markers. For more information about specifying colors,
see the “SAS/GRAPH Colors and Images” chapter in the **SAS/GRAPH: Reference**.

**Default:** For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute
of the GraphData1 ... GraphDataN style elements in the current style.
SIZE= n <units >
specifies the size of the markers. You can also specify the unit of measurement.
The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

Default: The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

SYMBOL= symbol-name
specifies the symbol for the markers. See “Marker Symbols” on page 34 for a list of valid marker symbols.

Default: For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.
For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData n style elements in the current style.

MARKERS
adds markers to the tips of the needles.

NAME= "text-string"
specifies a name for the plot. You can use the name to refer to this plot in other statements.

NOMISSINGGROUP
specifies that missing values of the group variable are not included in the plot.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

TRANSPARENCY= numeric-value
specifies the degree of transparency for the needle plot. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Default: 0.0

URL= character-variable
specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.

Interaction: This option affects graphics output that is created through the ODS HTML destination only.
This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.

Default: By default, no HTML links are created.

---

**PBSPLINE Statement**

Creates a fitted penalized B-spline curve.

**Syntax**

PBSPLINE x= numeric-variable y= numeric-variable < / options>;
option(s) can be one or more options from the following categories:

- **PBSPLINE options:**
  - **ALPHA=** numeric-value
  - **CLI <= “text-string”**
  - **CLIAATTRS= style-element**
  - **CLM <= “text-string”**
  - **CLMMATTRS= style-element**
  - **CLMTTRANSPARENCY= numeric-value**
  - **CURVELABEL <= “text-string”**
  - **CURVELABELPOS= MIN | MAX | START | END**
  - **DATALABEL <= variable**
  - **DEGREE=** n
  - **FREQ= numeric-variable**
  - **LINEATTRS= style-element < (options) > | (options)**
  - **MARKERATTRS= style-element < (options) > | (options)**
  - **MAXPOINTS=** n
  - **NKNOTS=** n
  - **NOLEGCLI**
  - **NOLEGCLM**
  - **NOLEGFIT**
  - **NOMARKERS**
  - **SMOOTH= numeric-value**
  - **WEIGHT= numeric-variable**

- **Plot options:**
  - **GROUP= variable**
  - **LEGENDLABEL= “text-string”**
  - **NAME= “text-string”**

### Required Arguments

- **X= numeric-variable**
  - specifies the variable for the x axis.

- **Y= numeric-variable**
  - specifies the variable for the y axis.

### Options

- **ALPHA= numeric-value**
  - specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

  *Note:* This option has no effect if you do not specify either the CLI option or CLM option. △

  *Default:* .05
CLI <= “text-string”>
creates prediction limits for the individual predicted values. The optional text string overrides the default legend label for the prediction limits.

CLIATTRS = style-element
specifies the appearance of the individual value prediction limits by using an ODS style element.

Default: The default appearance of the prediction limits is specified by the GraphPredictionLimits style element in the current style.

CLM <= “text-string”>
creates confidence limits for the mean predicted values. The optional text string overrides the default legend label for the confidence limits.

CLMATTRS = style-element
specifies the appearance of the mean value confidence limits by using an ODS style element.

Default: The default appearance of the confidence limits is specified by the GraphConfidence style element in the current style.

CLMTRANSPARENCY= numeric-value
specifies the degree of transparency for the confidence limits. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Note: This option has no effect if you do not specify the CLM option.

Default: 0.0

CURVELABEL <= “text-string”>
adds a label for the spline curve. You can also specify the label text. If you do not specify a label, then the label from the Y variable is used.

CURVELABELPOS= MIN | MAX | START | END
specifies the location of the curve label. Specify one of the following values:

MIN
places the curve label at the minimum value for the X axis.

MAX
places the curve label at the maximum value for the X axis.

START
places the curve label at the first point on the curve.

END
places the curve label at the last point on the curve.

Default: END

DATALABEL <= variable>
displays a label for each scatter point. If you specify a variable, the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.

Interaction: This option has no effect if you also specify the NOMARKERS option.

DEGREE= n
specifies the degree of the spline transformation.

Default: 3

FREQ= numeric-variable
specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.
GROUP= variable
specifies a classification variable to divide the values into groups. A separate plot is created for each unique value of the classification variable.

**Interaction:** If you specify the GROUP= option in multiple fit plot statements, then the first GROUP= variable is used for all of the fit plots that specify GROUP=.

LEGENDLABEL= “text-string”
specifies a label that identifies the b-spline curve in the legend. By default, the label “Penalized B-Spline” is used with the SMOOTH= value if specified, or else the group value for each b-spline is used.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the fitted curve. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

**options** can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphFit style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.

**Default:** For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphFit style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData n style elements in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

**Default:** For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphFit style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData n style elements in the current style.

MARKERATTRS= style-element <(options)> | (options)
specifies the appearance of the markers in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

**options** can be one or more of the following:

COLOR= color
specifies the color of the markers. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.
SIZE= n <units >
specifies the size of the markers. You can also specify the unit of measurement.  
The default unit is pixels. See “Units of Measurement” on page 34 for a list of the 
measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the 
GraphDataDefault style element in the current style.

**SYMBOL= symbol-name**
specifies the symbol for the markers. See “Marker Symbols” on page 34 for a list of 
valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the 
MarkerSymbol attribute of the GraphDataDefault style element in the current 
style.

For grouped data, the default marker symbol is specified by the 
MarkerSymbol attribute of the GraphData1 ... GraphData n style elements in 
the current style.

**MAXPOINTS= n**
specifies the maximum number of predicted points for the spline curve and for any 
confidence limits.

**Default:** 201

**NAME= “text-string”**
specifies a name for the plot. You can use the name to refer to this plot in other 
statements.

**NKNOTS= n**
specifies the number of evenly spaced internal knots.

**Default:** 100

**NOLEGCLI**
hides the legend entry for the individual value prediction limits.

**NOLEGCLM**
hides the legend entry for the mean value confidence limits.

**NOLEGFIT**
hides the legend entry for the fit line.

**NOMARKERS**
removes the scatter markers from the plot.

**SMOOTH= numeric-value**
specifies a smoothing parameter value. If you do not specify this option, a smoothing 
value is determined automatically.

**WEIGHT= numeric-variable**
specifies that each observation is weighted by a factor of w for computational 
purposes, where w is the value of the numeric variable. w can be any numeric value. 
If w is 0, negative or missing, then that observation is excluded from the analysis.

**Details**

For the SMOOTH= option, the smoothing parameter value must be greater than the 
minimum value that is determined by the following equation:

\[
\text{minimum} = \frac{\text{degree } + 1}{\text{number of observations}}
\]
**REFLINE Statement**

Creates a horizontal or vertical reference line.

**Syntax**

```rulenew
REFLINE variable | value-1 <... value-n> <option(s)>;
```  

`option(s)` can be one or more options from the following categories:

- **REFLINE options:**
  - `AXIS= X | Y`
  - `LABEL <= ("text-string-1" ... "text-string-n")>`
  - `LABELPOS= MIN | MAX`
  - `LINEATTRS= style-element <(options)> | (options)`
  - `NOCLIP`

- **Plot options:**
  - `LEGENDLABEL= "text-string"`
  - `NAME= "text-string"`
  - `TRANSPARENCY= numeric-value`

**Required Arguments**

- **variable**
  - draws a reference line for each value of the specified variable.
  - **Restriction:** This argument is available with SAS 9.2 Phase 2 and later.

- **value-1 <... value-n>**
  - draws one or more reference lines at the values that you specify.

**Options**

- **AXIS= X | Y**
  - specifies the axis that contains the reference line values. For example, if you specify `AXIS= X`, vertical reference lines are drawn at points on the X axis.
  - **Default:** Y

- **LABEL <= ("text-string-1" ... "text-string-n")>**
  - creates labels for each reference line. If you do not specify a label for a line, the reference value for that line is used as the label.

- **LABELPOS= MIN | MAX**
  - specifies the position of the labels. MIN specifies the label is placed at the minimum value of the data axis. MAX specifies that the label is placed at the maximum value of the data axis.
LEGENDLABEL= “text-string”
specifies a label that identifies the markers from the plot in the legend. By default, the label “Reference Line” is used.

Interaction: This option has no effect unless you also specify the NAME= option.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the reference line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: The default color is specified by the ContrastColor attribute of the GraphReference style element in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.

Default: The default line pattern is specified by the LinePattern attribute of the GraphReference style element in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

Default: The default line thickness is specified by the LineThickness attribute of the GraphReference style element in the current style.

NAME= “text-string”
specifies a name for the plot. You can use the name to refer to this plot in other statements.

NOCLIP
extends the plot axes to contain the reference lines. By default, if a reference line is created outside of the data range, then the reference line is not visible. This option has no effect if you do not create reference lines that are outside of the data range.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

TRANSPARENCY= numeric-value
specifies the degree of transparency for the reference lines. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Default: 0.0
REG Statement

Creates a fitted regression line or curve.

Interaction: A linear regression (DEGREE=1) cannot be used with logarithmic axes.

Featured in: Example 2 on page 117

Syntax

REG X= numeric-variable Y= numeric-variable < /option(s)>;

option(s) can be one or more options from the following categories:

- REG options:
  - ALPHA= numeric-variable
  - CLI <= “text-string”>
  - CLIATTRS= style-element
  - CLM <= “text-string”>
  - CLMATTRS= style-element
  - CLMTRANSPARENCY= numeric-value
  - CURVELABEL <= “text-string”>
  - CURVELABELPOS= MIN | MAX | START | END
  - DATALABEL <= variable
  - DEGREE= n
  - FREQ= variable
  - LINEATTRS= style-element < (options) > | (options)
  - MARKERATTRS= style-element < (options) > | (options)
  - MAXPOINTS= n
  - NOLEGCLI
  - NOLEGCLM
  - NOLEGFIT
  - NOMARKERS
  - WEIGHT= numeric-variable

- Plot options:
  - GROUP= variable
  - LEGENDLABEL= “text-string”
  - NAME= “text-string”

Required Arguments

X= numeric-variable
specifies the variable for the x axis.
Y= numeric-variable
  specifies the variable for the y axis.

Options

ALPHA= numeric-value
  specifies the confidence level for the confidence limits. Specify a number between
  0.00 (100% confidence) and 1.00 (0% confidence).

    Note: This option has no effect if you do not specify either the CLI option or CLM
           option. △

    Default: .05

CLI <= “text-string”>
  creates prediction limits for the individual predicted values. The optional text string
  overrides the default legend label for the prediction limits.

CLIATTRS = style-element
  specifies the appearance of the individual value prediction limits by using an ODS
  style element.

    Default: The default appearance of the prediction limits is specified by the
             GraphPredictionLimits style element in the current style.

CLM <= “text-string”>
  creates confidence limits for the mean predicted values. The optional text string
  overrides the default legend label for the confidence limits.

CLMATTRS = style-element
  specifies the appearance of the mean value confidence limits by using an ODS style
  element.

    Default: The default appearance of the confidence limits is specified by the
             GraphConfidence style element in the current style.

CLMTRANSPARENCY= numeric-value
  specifies the degree of transparency for the confidence limits. Specify a value from
  0.0 (completely opaque) to 1.0 (completely transparent).

    Note: This option has no effect if you do not specify the CLM option. △

    Default: 0.0

CURVELABEL <=“text-string”>
  adds a label for the regression curve. You can also specify the label text. If you do
  not specify a label, then the label from the Y variable is used.

CURVELABELPOS= MIN | MAX | START | END
  specifies the location of the curve label. Specify one of the following values:

    MIN
      places the curve label at the minimum value for the X axis.

    MAX
      places the curve label at the maximum value for the X axis.

    START
      places the curve label at the first point on the curve.

    END
      places the curve label at the last point on the curve.

    Default: END
DATALABEL <= variable>
displays a label for each scatter point. If you specify a variable, the values of that variable are used for the data labels. If you do not specify a variable, then the value of the Y variable is used for the data label.

Interaction: This option has no effect if you also specify the NOMARKERS option.

DEGREE= n
specifies the degree of the polynomial fit. For example, 1 specifies a linear fit, 2 specifies a quadratic fit, and 3 specifies a cubic fit.

Default: 1

FREQ= numeric-variable
specifies a variable whose values represent the number of occurrences of each observation. Values for the FREQ= variable are rounded down to the nearest integer. Values for the FREQ= variable that are less than 1 are not used.

GROUP= variable
specifies a classification variable to divide the values into groups. A separate plot is created for each unique value of the classification variable.

Interaction: If you specify the GROUP= option in multiple fit plot statements, then the first GROUP= variable is used for all of the fit plots that specify GROUP=.

LEGENDLABEL= “text-string”
specifies a label that identifies the regression curve in the legend. By default, the label “Regression” is used.

Interaction: The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the fit line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphFit style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.

Default: For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphFit style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData n style elements in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

Default: For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphFit style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData n style elements in the current style.
MARKERATTRS= style-element <(options)> | (options)
specifies the appearance of the markers in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the markers. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.

SIZE= n <units >
specifies the size of the markers. You can also specify the unit of measurement.
The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

Default: The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

SYMBOL= symbol-name
specifies the symbol for the markers. See “Marker Symbols” on page 34 for a list of valid marker symbols.

Default: For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.
For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData n style elements in the current style.

MAXPOINTS= n
specifies the maximum number of predicted points for the regression curve and for any confidence limits.

Default: 10

NAME= “text-string”
specifies a name for the plot. You can use the name to refer to this plot in other statements.

NOLEGCLI
hides the legend entry for the individual predicted value confidence limits.

NOLEGCLM
hides the legend entry for the mean value confidence limits.

NOLEGFIT
hides the legend entry for the fit line.

NOMARKERS
removes the scatter markers from the plot.

WEIGHT= numeric-variable
specifies that each observation is weighted by a factor of w for computational purposes, where w is the value of the numeric variable. w can be any numeric value. If w is 0, negative or missing, then that observation is excluded from the analysis.
SCATTER Statement

Creates a scatter plot.

Syntax

SCATTER X= variable Y= variable < / option(s)>;

Option(s) can be one or more options from the following categories:

- SCATTER options:
  - DATALABEL <= variable>
  - ERRORBARATTRS= style-element <(options)> | (options)
  - FREQ= numeric-variable
  - MARKERATTRS= style-element <(options)> | (options)
  - MARKERCHAR= variable
  - MARKERCHARATTRS= style-element <(options)> | (options)
  - NOMISSINGGROUP
  - URL= character-variable
  - XERRORLOWER= numeric-variable
  - XERRORUPPER= numeric-variable
  - YERRORLOWER= numeric-variable
  - YERRORUPPER= numeric-variable

- Plot options:
  - GROUP= variable
  - LEGENDLABEL= “text-string”
  - NAME= “text-string”
  - TRANSPARENCY= numeric-value

Required Arguments

X= variable
  specifies the variable for the x axis.

Y= variable
  specifies the variable for the y axis.

Options

DATALABEL <= variable>
  displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.
ERRORBARATTRS= style-element <(options)> | (options)
specifies the appearance of the error bars in the plot. You can specify the appearance
by using a style element or by using suboptions. If you specify a style element, you
can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the
“SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.
Default: The default color is specified by the ContrastColor attribute of the
GraphError style element in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number
or by name. See “Line Patterns” on page 34 for a list of line patterns.
Default: The default line pattern is specified by the LineStyle attribute of the
GraphError style element in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The
default unit is pixels. See “Units of Measurement” on page 34 for a list of the
measurement units that are supported.
Default: The default line thickness is specified by the LineThickness attribute of
the GraphError style element in the current style.
Restriction: This option is available with SAS 9.2 Phase 2 and later.

FREQ= numeric-variable
specifies a variable whose values represent the number of occurrences of each
observation. Values for the FREQ= variable are rounded down to the nearest integer.
Values for the FREQ= variable that are less than 1 are not used.

GROUP= variable
specifies a classification variable to divide the values into groups. A separate plot is
created for each unique value of the classification variable.

LEGENDLABEL= “text-string”
specifies a label that identifies the markers from the plot in the legend. By default,
the label of the Y variable or the group value for each marker is used.
Interaction: The LEGENDLABEL= option has no effect if you also specify the
GROUP= option in the same plot statement.

MARKERATTRS= style-element <(options)> | (options)
specifies the appearance of the markers in the plot. You can specify the appearance
by using a style element or by using suboptions. If you specify a style element, you
can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the markers. For more information about specifying colors,
see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.
Default: For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute
of the GraphData1 ... GraphData n style elements in the current style.

SIZE= n <units >
specifies the size of the markers. You can also specify the unit of measurement.
The default unit is pixels. See “Units of Measurement” on page 34 for a list of the
measurement units that are supported.
**Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

`Symbol= symbol-name`

specifies the symbol for the markers. See “Marker Symbols” on page 34 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData$n$ style elements in the current style.

`MarkerChar= variable`

specifies a variable whose values replace the marker symbols in the plot. If a format is associated with the variable, then the formatted values are used as the marker symbols. If there is not a format associated with the variable and the variable contains numeric data, then the BEST6. format is used.

**Note:** The `MarkerChar=` option overrides the `DatLabel=` option and the `Symbol=` suboption of the `Markers=` option.

`MarkerCharAttrs= style-element <(options)> | (options)`

specifies the appearance of the markers in the plot when you use the `MarkerChar=` option. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

`options` can be one or more of the following:

- `Color= color`
  specifies the color of the marker characters. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.
  **Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataText style element in the current style.
  For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData$n$ style elements in the current style.

- `Family= "font-family"`
  specifies the font family for the marker characters.
  **Default:** The default font family is specified by the FontFamily attribute of the GraphDataText style element in the current style.

- `Size= n < units >`
  specifies the font size of the marker characters. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.
  **Default:** The default font size is specified by the FontSize attribute of the GraphDataText style element in the current style.

- `Style= ITALIC | NORMAL`
  specifies whether the marker characters are italic (ITALIC) or normal (NORMAL).
  **Default:** The default font style is specified by the FontStyle attribute of the GraphDataText style element in the current style.

- `Weight= BOLD | NORMAL`
  specifies whether the marker characters are bold (BOLD) or normal (NORMAL).
  **Default:** The default font weight is specified by the FontWeight attribute of the GraphDataText style element in the current style.
NAME= "text-string"
   specifies a name for the plot. You can use the name to refer to this plot in other
   statements.

NOMISSINGGROUP
   specifies that missing values of the group variable are not included in the plot.
   
   Restriction: This option is available with SAS 9.2 Phase 2 and later.

TRANSPARENCY= numeric-value
   specifies the degree of transparency for the markers and error bars. Specify a value
   from 0.0 (completely opaque) to 1.0 (completely transparent).
   
   Default: 0.0

URL= character-variable
   specifies a character variable that contains URLs for web pages to be displayed when
   parts of the plot are selected within an HTML page.
   
   Interaction: This option affects graphics output that is created through the ODS
   HTML destination only.
   
   This option has no effect unless you also specify IMAGEMAP in the ODS
   GRAPHICS statement.
   
   Default: By default, no HTML links are created.

XERRORLOWER= numeric-variable
   specifies a variable that contains the lower endpoints for the X error bars.

XERRORUPPER= numeric-variable
   specifies a variable that contains the upper endpoints for the X error bars.

YERRORLOWER= numeric-variable
   specifies a variable that contains the lower endpoints for the Y error bars.

YERRORUPPER= numeric-variable
   specifies a variable that contains the upper endpoints for the Y error bars.

---

**SERIES Statement**

Creates a series plot.

**Syntax**

SERIES X= variable Y= variable < / option(s)>;

*option(s)* can be one or more options from the following categories:

- SERIES options:
  
  BREAK
  CURVELABEL <= text-string>
  CURVELABELPOS= MIN | MAX | START | END
  DATALABEL <= variable>
  LINEATTRS= style-element < (options) > | (options)
  MARKERATTRS= style-element < (options) > | (options)
MARKERS
NOMISSINGGROUP
URL= character-variable

Plot options:
GROUP= variable
LEGENDLABEL= “text-string”
NAME= “text-string”
TRANSPARENCY= numeric-value

Required Arguments

\textbf{X= variable}
specifies the variable for the x axis.

\textbf{Y= variable}
specifies the variable for the y axis.

Options

\textbf{BREAK}
creates a break in the line for each missing value for the Y variable.

\textbf{CURVELABEL <= text-string>}
adds a label for the series curve. You can also specify the label text. If you do not specify a label, then the label from the Y variable is used.

\textbf{CURVELABELPOS= MIN | MAX | START | END}
specifies the location of the curve label. Specify one of the following values:

\textbf{MIN}
places the curve label at the minimum value for the X axis.

\textbf{MAX}
places the curve label at the maximum value for the X axis.

\textbf{START}
places the curve label at the first point on the curve.

\textbf{END}
places the curve label at the last point on the curve.

Default: END

\textbf{DATALABEL <= variable>}
displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.

\textbf{GROUP= variable}
specifies a classification variable to divide the values into groups. A separate plot is created for each unique value of the classification variable.

\textbf{LEGENDLABEL= “text-string”}
specifies a label that identifies the series plot in the legend. By default, the label of the Y variable or the group value for each marker is used.
LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the series line. You can specify the appearance by using a
style element or by using suboptions. If you specify a style element, you can
additionally specify suboptions to override specific appearance attributes.

*options* can be one or more of the following:

**COLOR= color**
specifies the color of the line. For more information about specifying colors, see the
"SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.

**Default:** For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute
of the GraphData1 ... GraphData n style elements in the current style.

**PATTERN= line-pattern**
specifies the line pattern for the line. You can reference SAS patterns by number
or by name. See “Line Patterns” on page 34 for a list of line patterns.

**Default:** For ungrouped data, the default line pattern is specified by the LineStyle
attribute of the GraphDataDefault style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle
attribute of the GraphData1 ... GraphData n style elements in the current style.

**THICKNESS= n <units>**
specifies the thickness of the line. You can also specify the unit of measurement. The
default unit is pixels. See “Units of Measurement” on page 34 for a list of the
measurement units that are supported.

**Default:** For ungrouped data, the default line thickness is specified by the
LineThickness attribute of the GraphDataDefault style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness
attribute of the GraphData1 ... GraphData n style elements in the current style.

**NAME= “text-string”**
specifies a name for the plot. You can use the name to refer to this plot in other
statements.

MARKERAATTRS= style-element <(options)> | (options)
specifies the appearance of the markers in the plot. This option has no effect unless
you also specify the MARKERS option. You can specify the appearance by using a
style element or by using suboptions. If you specify a style element, you can
additionally specify suboptions to override specific appearance attributes.

*options* can be one or more of the following:

**COLOR= color**
specifies the color of the markers. For more information about specifying colors,
see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

**Default:** For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute
of the GraphData1 ... GraphData n style elements in the current style.

**SIZE= n <units>**
specifies the size of the markers. You can also specify the unit of measurement.
The default unit is pixels. See “Units of Measurement” on page 34 for a list of the
measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the
GraphDataDefault style element in the current style.
SYMBOL= symbol-name
    specifies the symbol for the markers. See “Marker Symbols” on page 34 for a list of valid marker symbols.

Default: For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.
    For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData n style elements in the current style.

MARKERS
    adds data point markers to the series plot data points.

NOMISSINGGROUP
    specifies that missing values of the group variable are not included in the plot.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

TRANSPARENCY= numeric-value
    specifies the degree of transparency for the lines and markers. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Default: 0.0

URL= character-variable
    specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.

Interaction: This option affects graphics output that is created through the ODS HTML destination only.
    This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.

Default: By default, no HTML links are created.

---

**STEP Statement**

Creates a step plot.

Restriction: The vertical axis that is used with the STEP statement cannot be a discrete axis.

---

**Syntax**

STEP X= variable Y= numeric-variable < / option(s)>;

option(s) can be one or more options from the following categories:

- STEP options:
  - BREAK
  - CURVELABEL <= text-string>
  - CURVELABELPOS= MIN | MAX | START | END
  - DATALABEL <= variable>

**ERRORBARATTRS=**  
**LINEATTRS=**  
**MARKERATTRS=**  
**MARKERS**  
**NOMISSINGGROUP**  
**URL=**  
**YERRORLOWER=**  
**YERRORUPPER=**

**Plot options:**

- **GROUP=**
- **LEGENDLABEL=** "text-string"
- **NAME=** "text-string"
- **TRANSPARENCY=** numeric-variable

### Required Arguments

**X=** variable

specifies the variable for the x axis.

**Y=** numeric-variable

specifies the variable for the y axis.

### Options

**BREAK**

creates a break in the line for each missing value.

**CURVELABEL <= text-string>**

adds a label for the step curve. You can also specify the label text. If you do not specify a label, then the label from the Y variable is used.

**CURVELABELPOS=** MIN | MAX | START | END

specifies the location of the curve label. Specify one of the following values:

- **MIN**
  places the curve label at the minimum value for the X axis.

- **MAX**
  places the curve label at the maximum value for the X axis.

- **START**
  places the curve label at the first point on the curve.

- **END**
  places the curve label at the last point on the curve.

**Default:** END

**DATALABEL <= variable>**

displays a label for each data point. If you specify a variable, the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.
ERRORBARATTRS= style-element <(options)> | (options)
specifies the appearance of the error bars in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

*options* can be one or more of the following:

COLOR= *color*
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.

*Default:* The default color is specified by the ContrastColor attribute of the GraphError style element in the current style.

PATTERN= *line-pattern*
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.

*Default:* The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.

THICKNESS= *n* <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

*Default:* The default line thickness is specified by the LineThickness attribute of the GraphError style element in the current style.

*Restriction:* This option is available with SAS 9.2 Phase 2 and later.

GROUP= *variable*
specifies a classification variable to divide the values into groups. A separate plot is created for each unique value of the classification variable.

JUSTIFY= LEFT | CENTER | RIGHT
specifies the location of each step relative to its data point. Figure 3.8 on page 93 shows the effect of each option:

**Figure 3.8** Values for JUSTIFY=

LEFT | CENTER | RIGHT

LEGENDLABEL= “*text-string*”
specifies a label that identifies the step plot in the legend. By default, the label of the Y variable or the group value for each marker is used.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the step line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

*options* can be one or more of the following:

COLOR= *color*
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.

*Default:* For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData\textsubscript{n} style elements in the current style.

**PATTERN=** *line-pattern*

specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.

**Default:** For ungrouped data, the default line pattern is specified by theLineStyle attribute of the GraphDataDefault style element in the current style.

For grouped data, the default line pattern is specified by theLineStyle attribute of the GraphData1 ... GraphData\textsubscript{n} style elements in the current style.

**THICKNESS=** *n <units>*

specifies the thickness of the line. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

**Default:** For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphDataDefault style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData\textsubscript{n} style elements in the current style.

**MARKERATTRS=** *style-element <(options)> | (options)*

specifies the appearance of the markers in the plot. This option has no effect unless you also specify the MARKERS option. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

*options* can be one or more of the following:

**COLOR=** *color*

specifies the color of the markers. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData\textsubscript{n} style elements in the current style.

**SIZE=** *n <units>*

specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

**SYMBOL=** *symbol-name*

specifies the symbol for the markers. See “Marker Symbols” on page 34 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData\textsubscript{n} style elements in the current style.

**MARKERS**

adds markers to the step plot data points.
NAME= “text-string”
  specifies a name for the plot. You can use the name to refer to this plot in other statements.

NOMISSINGGROUP
  specifies that missing values of the group variable are not included in the plot.
  Restriction:  This option is available with SAS 9.2 Phase 2 and later.

TRANSPARENCY= numeric-value
  specifies the degree of transparency for the lines. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).
  Default:  0.0

URL= variable
  specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.
  Interaction:  This option affects graphics output that is created through the ODS HTML destination only.
  This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.
  Default:  By default, no HTML links are created.

YERRORLOWER= numeric-variable
  specifies a variable that contains the lower endpoints for the Y error bars.

YERRORUPPER= numeric-variable
  specifies a variable that contains the upper endpoints for the Y error bars.

---

VBAR Statement

Creates a vertical bar chart that summarizes the values of a category variable.

Interaction:  The VBAR statement can be combined only with other vertical categorization plot statements in the SGPANEL procedure. See “Plot Content” on page 32.

---

Syntax

VBAR category-variable < / option(s)>;

option(s) can be one or more options from the following categories:
  □ Bar options:
    ALPHA= numeric-value
    BARWIDTH= numeric-value
    DATALABEL
    FILL | NOFILL
    FILLATTRS= style-element <(fill-options) >| (fill-options)
    FREQ= numeric-variable
    LIMITATTRS= style-element <(options)> | (options)
LIMITS= BOTH | LOWER | UPPER
LIMITSTAT= CLM | STDDEV | STDERR
MISSING
NOSTATLABEL
NUMSTD= n
OUTLINE | NOOUTLINE
RESPONSE= response-variable
STAT= FREQ | MEAN | SUM
URL= character-variable
WEIGHT= numeric-variable

Plot options:
GROUP= variable
LEGENDLABEL= “text-string”
NAME= “text-string”
TRANSPARENCY= numeric-value

Required Arguments

category-variable
specifies the variable that classifies the observations into distinct subsets.

Options

ALPHA= numeric-value
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).
Default: .05
Interaction: This option has no effect if you do not specify LIMITSTAT=CLM.
If your plot is overlaid with other categorization plots, then the first ALPHA value that you specify is used for all of the plots.

BARWIDTH= numeric-value
specifies the width of the bars as a ratio of the maximum possible width. The maximum width is equal to the distance between the center of each bar and the centers of the adjacent bars. Specify a value between .1 and 1.
For example, if you specify a width of 1, then there is no distance between the bars. If you specify a width of .5, then the width of the bars is equal to the space between the bars.
Default: .8

DATALABEL
adds data labels for bars. The values of the response variable appear at the end of the bars.
Restriction: This option is available with SAS 9.2 Phase 2 and later.

FILL | NOFILL
specifies whether the bars are filled. The FILL option shows the fill color for the bars. The NOFILL option hides the fill color for the bars.
**Default:** FILL

**FILLATTRS= style-element | (COLOR= color)**

Specifies the appearance of the fill for the bars. You can specify the color of the fill by using a style element or by using the COLOR= suboption. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

*Note:* This option has no effect if you specify the NOFILL option. △

**Default:** For ungrouped data, the default color is specified by the Color attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the Color attribute of the GraphData1... GraphData*n* style elements in the current style.

**FREQ= numeric-variable**

Specifies that each observation is repeated *n* times for computational purposes, where *n* is the value of the numeric variable. If *n* is not an integer, then it is truncated to an integer. If *n* is less than 1 or missing, then it is excluded from the analysis.

**Interaction:** If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.

**GROUP= variable**

Specifies a variable that is used to group the data. The plot elements for each group value are automatically distinguished by different visual attributes.

**LEGENDLABEL= “text-string”**

Specifies the label that identifies the bar chart in the legend. By default, the label of the RESPONSE= variable is used. If there is no response variable label, the name of the response variable and the computed statistic (SUM or MEAN) is used. If the RESPONSE= option is not used, the legend label is “Frequency”.

**Interaction:** The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

**LIMITATTRS= style-element <(options)> | (options)**

Specifies the appearance of the limit lines in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

*options* can be one or more of the following:

**COLOR= color**

Specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

**Default:** The default color is specified by the ContrastColor attribute of the GraphError style element in the current style.

**PATTERN= line-pattern**

Specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.

**Default:** The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.

**THICKNESS= n <units>**

Specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

**Default:** The default line thickness is specified by the LineThickness attribute of the GraphError style element in the current style.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.
LIMITS= BOTH | LOWER | UPPER
specifies which limit lines to display. Limits are displayed as heavier line segments with a serif at the end extending from each bar. Upper limits extend to the right of the bar and lower limits extend to the left of the bar. By default, no limits are displayed unless you specify either the LIMITS= or LIMITSTAT= option. If you specify the LIMITSTAT= option only, then LIMITS=BOTH is the default. Specify one of the following values:

BOTH
  adds lower and upper limit lines to the plot.

LOWER
  adds lower limit lines to the plot.

UPPER
  adds upper limit lines to the plot.
  By default, no limit lines are displayed. However, if you specify the LIMITSTAT= option, then the default is BOTH.

Interaction: Limit lines are displayed only when you specify STAT= MEAN.

LIMITSTAT= CLM | STDDEV | STDERR
specifies the statistic for the limit lines. Specify one of the following statistics:

CLM
  confidence limits

STDDEV
  standard deviation

STDERR
  standard error

Default: CLM

Interaction: If you specify the LIMITSTAT= option only, then the default value for the LIMITS= option is BOTH.
  Limits lines are displayed only when you specify STAT=MEAN.

MISSING
processes missing values as a valid category value and creates a bar for it.

NAME= "text-string"
specifies a name for the plot. You can use the name to refer to this plot in other statements.

NOSTATLABEL
removes the statistic name from the axis and legend labels.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

NUMSTD= n
specifies the number of standard units for the limit lines, when you specify LIMITSTAT= STDDEV or LIMITSTAT= STDERR. You can specify any positive number, including decimals.

Default: 1

OUTLINE | NOOUTLINE
specifies whether the bars have outlines. The OUTLINE option shows the outlines. The NOOUTLINE option hides the outlines.

Default: OUTLINE
RESPONSE= response-variable
  specifies a numeric response variable for the plot. The summarized values of the
  response variable are displayed on the vertical axis.

STAT= FREQ | MEAN | SUM
  specifies the statistic for the vertical axis. Specify one of the following statistics:

FREQ
  the frequencies for the category variable. This is the default value when you do
  not specify the RESPONSE= option.

MEAN
  the mean of the response variable.

SUM
  the sum of the response variable. This is the default value when you specify the
  RESPONSE= option.
  If you do not specify the RESPONSE= option, then only the FREQ statistic can be
  used. If you specify the RESPONSE= option, then you can use either the SUM or
  MEAN statistics.

TRANSPARENCY= numeric-value
  specifies the degree of transparency for the bars and limits, if displayed. Specify a
  value from 0.0 (completely opaque) to 1.0 (completely transparent).
  Default: 0.0

URL= character-variable
  specifies a character variable that contains URLs for web pages to be displayed when
  parts of the plot are selected within an HTML page.
  Interaction: This option affects graphics output that is created through the ODS
  HTML destination only.
  This option has no effect unless you also specify IMAGEMAP in the ODS
  GRAPHICS statement.
  Default: By default, no HTML links are created.

WEIGHT= numeric-variable
  specifies that each observation is weighted by a factor of $w$ for computational
  purposes, where $w$ is the value of the numeric variable. $w$ can be any numeric value.
  If $w$ is 0, negative or missing, then that observation is excluded from the analysis.
  Interaction: If your plot is overlaid with other categorization plots, then the first
  WEIGHT variable that you specified is used for all of the plots.

---

VBOX Statement

Creates a vertical box plot that shows the distribution of your data.

Interaction: The VBOX statement cannot be used together with other plot statements in
the SGPANEL procedure.

---

Description
Horizontal and vertical box plots display the distribution of data by using a rectangular
box and whiskers. Whiskers are lines that indicate a data range outside of the box.
Figure 3.9 on page 100 shows a diagram of a vertical box plot. The bottom and top edges of the box indicate the intra-quartile range (IQR). That is, the range of values between the first and third quartiles (the 25th and 75th percentiles). The marker inside the box indicates the mean value. The line inside the box indicates the median value.

The elements that are outside the box are dependent on your options. By default, the whiskers that extend from each box indicate the range of values that are outside of the intra-quartile range, but are close enough not to be considered outliers (a distance less than or equal to 1.5*IQR). If you specify the EXTREME option, then the whiskers indicate the entire range of values, including outliers.

Any points that are a distance of more than 1.5*IQR from the box are considered to be outliers. By default, these points are indicated by markers. If you specify DATALABEL= option, then the outlier points have data labels. If you also specify the LABELFAR option, then only outliers that are 3*IQR from the box have data labels.

Syntax

VBOX response-variable </option(s)>;

option(s) can be one or more options from the following categories:

- Box options:
  - BOXWIDTH= numeric-value
  - CATEGORY= category-variable
  - DATALABEL <= variable>
EXTREME
FREQ= numeric-variable
LABELFAR
MISSING
PERCENTILE= 1|2|3|4|5
SPREAD

Plot options:
- LEGENDLABEL= "text-string"
- NAME= "text-string"
- TRANSPARENCY= numeric-value

Required Arguments

response-variable
specifies the response variable for the plot. If you do not specify the CATEGORY= option, then one box is created for the response variable.

Options

BOXWIDTH= numeric-value
specifies the width of the box. Specify a value between 0.0 (0% of the available width) and 1.0 (100% of the available width).

Default: 0.4

CATEGORY= category-variable
specifies the category variable for the plot. A box plot is created for each distinct value of the category variable.

DATALABEL <= variable>
adds data labels for the outlier markers. If you specified a variable, then the values for that variable are used as data labels. If you do not specify a variable, then the values of the response variable are used.

Note: This option has no effect if the plot does not contain outlier points.

EXTREME
specifies that the whiskers can extend to the maximum and minimum values for the response variable, and that outliers are not identified. When you do not specify the EXTREME option, the whiskers cannot be longer than 1.5 times the length of the box.

FREQ= numeric-variable
specifies that each observation is repeated \( n \) times for computational purposes, where \( n \) is the value of the numeric variable. If \( n \) is not an integer, then it is truncated to an integer. If \( n \) is less than 1 or missing, then it is excluded from the analysis.

Interaction: If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.

LABELFAR
specifies that only the far outliers have data labels. Far outliers are points whose distance from the box is more than three times the length of the box.

Note: This option has no effect if you do not specify the DATALABELS option, or if there are no far outliers.
LEGENDLABEL= "text-string"
  specifies a label that identifies the box plot in the legend. By default, the label of the response variable is used.

MISSING
  processes missing values as a valid category value and creates a box for it.

NAME= "text-string"
  specifies a name for the plot. You can use the name to refer to this plot in other statements.

PERCENTILE= 1 | 2 | 3 | 4 | 5
  specifies a method for computing the percentiles for the plot. For descriptions of each method, see “Calculating Percentiles” in the UNIVARIATE Procedure chapter of Base SAS Procedures Guide: Statistical Procedures.
  Default: 5

SPREAD
  relocates outlier points that have identical values to prevent overlapping.
  Note: This option has no effect if your data does not contain two or more outliers with identical values for the response variable.

TRANSPARENCY= numeric-value
  specifies the degree of transparency for the plot. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).
  Default: 0.0

VECTOR Statement

Creates a vector plot that draws arrows from a point of origin to each data point.

Restriction: This statement is available for SAS 9.2 Phase 2 and later.

VECTOR X= numeric-variable Y= numeric-variable </ option(s)>;

option(s) can be one or more of the following:

- Vector options:
  ARROWDIRECTION= OUT | IN | BOTH
  ARROWHEADSHAPE= shape
  DATALABEL <= variable>
  LINEATTRS= style-element <(options)> | (options)
  NOARROWHEADS
  NOMISSINGGROUP
  XORIGIN= numeric-value | numeric-variable
  YORIGIN= numeric-value | numeric-variable

- Plot options:
  GROUP= variable
LEGENDLABEL= “text-string”
NAME= “text-string”
TRANSPARENCY= numeric-value
X2AXIS
Y2AXIS

Required Arguments

X= numeric-variable
  specifies a numeric variable for the x axis.

Y= numeric-variable
  specifies numeric variable for the y axis.

Options

ARROWDIRECTION= IN | OUT | BOTH
  specifies the location of the arrowheads for the vectors. Specify one of the following:
  IN places the arrowheads at the origin of the vector.
  OUT places the arrowheads at the ending point of the vector.
  BOTH places arrowheads at both the origin and the ending point of the vector.
  Default: OUT

ARROWHEADSHAPE= shape
  specifies the shape of the arrowheads for the vectors. Specify one of the following:
  OPEN resembles the letter "V".
  CLOSED an outline of a triangle.
  FILLED a solid triangle.
  BARBED a solid triangle with an indent at the base.
  Default: OPEN

DATALABEL <= variable>
  displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.

GROUP= variable
specifies a variable that is used to group the data. A separate plot is created for each unique value of the grouping variable. The plot elements for each group value are automatically distinguished by different visual attributes.

**LEGENDLABEL= “text-string”**
specifies a label that identifies the vector plot in the legend. By default, the label of the Y variable or the group value for each plot element is used.

**Interaction:** The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

**LINEATRMS= style-element <(options)> | (options)**
specifies the appearance of the vector line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

*options* can be one or more of the following:

**COLOR= color**
specifies the color of the line. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the *SAS/GRAPH: Reference*.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphDatann style elements in the current style.

**PATTERN= line-pattern**
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.

**Default:** For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphDataDefault style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphDatann style elements in the current style.

**THICKNESS= n <units>**
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

**Default:** For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphDataDefault style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphDatann style elements in the current style.

**NAME= “text-string”**
specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOARROWHEADS**
removes the arrowheads from the vectors.

**NOMISSINGGROUP**
specifies that missing values of the group variable are not included in the plot.

**TRANSPARENCY= numeric-value**
specifies the degree of transparency for the lines. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

**Default:** 0.0

**X2AXIS**
assigns the X variable to the secondary (top) horizontal axis.
XORIGIN= numeric-value | numeric-variable
specifies the X coordinate of the origin for the vectors. You can specify either a numeric value or a numeric variable.
**Default:** 0

**Y2AXIS**
assigns the Y variable to the secondary (right) vertical axis.

YORIGIN= numeric-value | numeric-variable
specifies the Y coordinate of the origin for the vectors. You can specify either a numeric value or a numeric variable.
**Default:** 0

---

**VLINE Statement**

Creates a vertical line chart (the line is horizontal). You can use the VLINE statement with the VBAR statement to create a bar-line chart.

**Interaction** The VLINE statement can be combined only with other categorization plot statements in the SGPANEL procedure. See “Plot Content” on page 32.

**Featured in:** Example 4 on page 119

**Syntax**

VLINE category-variable < / option(s)>;

*option(s)* can be one or more options from the following categories:

- Line options:
  - ALPHA= numeric-value
  - BREAK
  - CURVELABEL <= text-string>
  - CURVELABELPOS= MIN | MAX | START | END
  - DATALABEL <= variable>
  - FREQ= numeric-variable
  - LIMITATTRS= style-element <(options)> | (options)
  - LIMITS= BOTH | LOWER | UPPER
  - LIMITSTAT= CLM | STDDEV | STDERR
  - LINEATTRS= style-element <(options)> | (options)
  - MARKERATTRS= style-element <(options)> | (options)
  - MARKERS
  - MISSING
  - NOSTATLABEL
  - NUMSTD= n
  - RESPONSE= response-variable
  - STAT= FREQ | MEAN | SUM
URL= character-variable
WEIGHT= numeric-variable

Plot options:
GROUP= variable
LEGENDLABEL= “text-string”
NAME= “text-string”
TRANSPARENCY= numeric-value

Required Arguments

category-variable
specifies the variable that classifies the observations into distinct subsets.

Options

ALPHA= numeric-value
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).
Default: .05
Interaction: This option has no effect if you do not specify LIMITSTAT=CLM. If your plot is overlaid with other summary plots, then the first ALPHA value that you specify is used for all of the plots.

BREAK
creates a break in the line for each missing value.

CURVELABEL <=text-string>
adds a label for the line chart. You can also specify the label text. If you do not specify a label, the label from the response variable is used.
CURVELABELPOS= MIN | MAX | START | END
specifies the location of the curve label. Specify one of the following values:
MIN
places the curve label at the minimum value for the response axis.
MAX
places the curve label at the maximum value for the response axis.
START
places the curve label at the first point on the curve.
END
places the curve label at the last point on the curve.
Default: END

DATALABEL <=variable>
displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the calculated response are used for the data labels.

FREQ= numeric-variable
specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.
**Interaction:** If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.

**GROUP= variable**
specifies a category variable to divide the values into groups. A separate plot is created for each unique value of the category variable.

**Interaction:** If you specify more than one categorization plot statement, then all of the plots must specify the same GROUP variable. If you do not specify the same GROUP= option for all of the categorization plots, then the GROUP= option has no effect.

**LEGENDLABEL= "text-string"**
specifies the label that identifies the line chart in the legend. By default, the label of the response variable is used. If there is no response variable label, then the name of the response variable and the computed statistic (SUM or MEAN) are used. If you do not specify a response variable, then the legend label is “Frequency”.

**Interaction:** The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

**LIMITATTRS= style-element <(options)> | (options)**
specifies the appearance of the limit lines in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

- **options** can be one or more of the following:
  - **COLOR= color** specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.
    - **Default:** The default color is specified by the ContrastColor attribute of the GraphError style element in the current style.
  - **PATTERN= line-pattern** specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.
    - **Default:** The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.
  - **THICKNESS= n <units>** specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.
    - **Default:** The default line thickness is specified by the LineThickness attribute of the GraphError style element in the current style.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**LIMITS= BOTH | LOWER | UPPER**
adds limit lines to the plot. Specify one of the following values:

- **BOTH** adds lower and upper limit lines to the plot.
- **LOWER** adds lower limit lines to the plot.
- **UPPER** adds upper limit lines to the plot.

By default, no limit lines are displayed. However, if you specify the LIMITSTAT= option, then the default is BOTH.

**Note:** Limit lines are displayed only when you specify STAT= MEAN.
LIMITSTAT= CLM | STDDEV | STDERR
specifies the statistic for the limit lines. Specify one of the following statistics:

CLM
  confidence limits
STDDEV
  standard deviation
STDERR
  standard error
**Default:** CLM

**Interaction:** If you specify the LIMITSTAT= option, then the default value for the LIMITS= option is BOTH.

LINEATTRS= **style-element <(options)> | (options)**
specifies the appearance of the lines in the line chart. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

**options** can be one or more of the following:

**COLOR=** color
  specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.
  **Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.
  For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData_n style elements in the current style.

**PATTERN=** line-pattern
  specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 34 for a list of line patterns.
  **Default:** For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphDataDefault style element in the current style.
  For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData_n style elements in the current style.

**THICKNESS=** n <units>
  specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.
  **Default:** For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphDataDefault style element in the current style.
  For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData_n style elements in the current style.

MARKERATTRS= **style-element <(options)> | (options)**
specifies the appearance of the markers in the plot. This option has no effect unless you also specify the MARKERS option. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

**options** can be one or more of the following:

**COLOR=** color
  specifies the color of the markers. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.
  **Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData\textsubscript{n} style elements in the current style.

**SIZE=** \( n \) <units >
specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 34 for a list of the measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

**SYMBOL=** symbol-name
specifies the symbol for the markers. See “Marker Symbols” on page 34 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData\textsubscript{n} style elements in the current style.

**MARKERS**
adds data point markers to the plot.

**MISSING**
processes missing values as a valid category value and creates a line for it.

**NAME=** \textquote{"text-string"}
specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOSTATLABEL**
removes the statistic name from the axis and legend labels.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**NUMSTD=** \( n \)
specifies the number of standard units for the limit lines, when you specify LIMITSTAT= STDDEV or LIMITSTAT= STDERR. You can specify any positive number, including decimals.

**Default:** 1

**RESPONSE=** response-variable
specifies a numeric response variable for the plot. The summarized values of the response variable are displayed on the vertical axis.

**STAT=** FREQ | MEAN | SUM
specifies the statistic for the vertical axis. Specify one of the following statistics:

- **FREQ**
  the frequencies for the category variable. This is the default value when you do not specify the RESPONSE= option.

- **MEAN**
  the mean of the response variable.

- **SUM**
  the sum of the response variable. This is the default value when you specify the RESPONSE= option.

If you do not specify the RESPONSE= option, then only the FREQ statistic can be used. If you specify the RESPONSE= option, then you can use either the SUM or MEAN statistics.
TRANSPARENCY= numeric-value
specifies the degree of transparency for the lines and markers. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).
Default: 0.0

URL= character-variable
specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.
Interaction: This option affects graphics output that is created through the ODS HTML destination only.
This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.
Default: By default, no HTML links are created.

WEIGHT= numeric-variable
specifies that each observation is weighted by a factor of $w$ for computational purposes, where $w$ is the value of the numeric variable. $w$ can be any numeric value. If $w$ is 0, negative or missing, then that observation is excluded from the analysis.
Interaction: If your plot is overlaid with other categorization plots, then the first WEIGHT variable that you specified is used for all of the plots.

COLAXIS, ROWAXIS Statements

Specify the axis options for each plot axis.

Description
The COLAXIS and ROWAXIS statements specify options for the plot axes. You can control the features of the axis (for example, the axis label, grid lines, and minor tick marks) and you can also control the structure of the axis (for example, the data range, data type, and tick mark values).

The COLAXIS statement specifies the properties for each X axis in the panel and the ROWAXIS statement specifies the properties for each Y axis in the panel.

Syntax

COLAXIS option(s);
ROWAXIS option(s);

option(s) can be one or more options from the following:
ALTERNATE
DISCRETEORDER= DATA | FORMATTED | UNFORMATTED
DISPLAY= ALL | NONE | (options)
FITPOLICY= policy-value
GRID
INTEGER
INTERVAL= interval-value
LABEL= “text-string ”
LOGBASE= 2 | 10 | e
LOGSTYLE= LINEAR | LOGEXPAND | LOGEXPONENT
MAX= numeric-value
MIN= numeric-value
MINOR
NOTIMESPLIT
OFFSETMAX= numeric-value
OFFSETMIN= numeric-value
REFTICKS
TICKVALUEFORMAT= DATA | SAS-format
TYPE= DISCRETE | LINEAR | LOG | TIME
VALUES= ( value-1 < ... value-n > )
VALUESHINT

Options

ALTERNATE
adds reference ticks to each side of the panel and alternates the tick values for each row or column between the two sides.

DISCRETEORDER= DATA | FORMATTED | UNFORMATTED
specifies the order in which discrete tick values are placed on the axis. Specify one of the following values:

DATA places the values in the order that they appear in the data.
FORMATTED sorts the formatted values in ascending character order.
UNFORMATTED sorts the unformatted values in ascending character order.

Default: UNFORMATTED
Restriction: This option affects only box plots, dot plots, bar charts, and line charts, or for any axis where TYPE=DISCRETE.

DISPLAY= ALL | NONE | (options)
specifies which features of the axis are displayed. ALL displays all of the features of the axis. NONE specifies that none of the features of the axis are displayed. You can also hide specific features:

NOLABEL hides the axis label
NOLINE hides the axis line
NOTICKS hides the tick marks on the axis
NOVALUES hides the tick mark values on the axis

Default: ALL
Restriction: This option is available with SAS 9.2 Phase 2 and later.

FITPOLICY= policy-value
specifies the method that is used to fit tick mark values on a horizontal axis when there is not enough room to draw them normally. Select one of the following values:

ROEATE
rotates the value text 45 degrees. This is the default for discrete axes.
ROTATETHIN
attempts to use ROTATE, and then THIN to fit the values.

STAGGER
shifts the values up and down.

STAGGERROTATE
attempts to use STAGGER, and then ROTATE to fit the values.

STAGGERTHIN
attempts to use STAGGER, and then THIN to fit the values.

THIN
removes some of the values from the axis. This is the default for linear and time axes.

*Note:* This option does not affect vertical axes; only the THIN fit policy is used for vertical axes. △

*Restriction:* This option does not affect logarithmic axes.

GRID
creates grid lines at each tick on the axis.

INTEGER
specifies that only integers are used for tick mark values. This option affects only linear axes.

INTERVAL= *interval-value*
specifies the tick interval for a time axis. Specify one of the following values:

AUTO
determines the tick interval automatically based on the data.

SECOND
places ticks one second apart. The default tick value format is TIME8.

MINUTE
places ticks one minute apart. The default tick value format is TIME8.

HOUR
places ticks one hour apart. The default tick value format is TIME8.

DAY
places ticks one day apart. The default tick value format is DATE9.

WEEK
places ticks one week apart. The default tick value format is DATE9.

TENDAY
places ticks ten days apart. The default tick value format is DATE9.

SEMIMONTH
places ticks at the first and sixteenth day of each month. The default tick value format is DATE9.

MONTH
places ticks one month apart. The default tick value format is MONYY7.

QUARTER
places ticks three months apart. The default tick value format is YYQC6.

SEMIYEAR
places ticks six months apart. The default tick value format is MONYY7.
YEAR
places ticks one year apart. The default tick value format is YEAR4.

Default:  AUTO
Restriction:  This option is available with SAS 9.2 Phase 2 and later.

LABEL= “text-string”
specifies a label for the axis.

LOGBASE= 2 | 10 | e
specifies the base value for the logarithmic scale.
Default:  10
Interaction:  This option has no effect unless you also specify TYPE=LOG.

LOGSTYLE= LINEAR | LOGEXPAND | LOGEXPONENT
specifies how to scale and format the values for the major tick marks for logarithmic axes. Specify one of the following values:

LOGEXPAND  places the tick marks at integer powers of the base. For example, if you specified LOGBASE=2, the tick marks might be at 1, 2, 4, 8, 16. See Figure 3.10 on page 113.

Figure 3.10  Graph Axes with LOGEXPAND

LOGEXPONENT  places the tick marks at integer powers of the base, but identifies the values by the exponent. For example, if you specified LOGBASE=10, the tick marks might be at 1, 10, 100, 1000, but the tick values would read 0, 1, 2, 3. See Figure 3.11 on page 113.

Figure 3.11  An Axis with LOGEXPONENT

LINEAR  places the tick marks at uniform linear intervals, but spaces them logarithmically. In some cases an intermediate tick mark is placed between the first and second marks.

For example, if the data on this axis range from 14 to 1154, and you specify LOGBASE=10, then the tick marks might be at 10, 40, 200, 400, 600, 800, 1000, 1200. See Figure 3.12 on page 113.

Figure 3.12  An Axis with LINEAR
Default: LOGEXPAND

Interaction: This option has no effect unless you also specify TYPE=LOG.

**MAX= numeric-value**

specifies the maximum value for the axis.

Interaction: This option has no effect if you specify the VALUES= option and you do not also specify the VALUESHINT option.

Restriction: This option affects linear and time axes only.

**MIN= numeric-value**

specifies the minimum value for the axis.

Interaction: This option has no effect if you specify the VALUES= option and you do not also specify the VALUESHINT option.

Restriction: This option affects linear and time axes only.

**MINOR**

adds minor tick marks to the axis.

Interaction: This option has no effect if you specify the VALUES= option.

Restriction: This option has no effect on discrete axes.

**NOTIMESPLIT**

prevents a time axis from splitting the time, date, or datetime values into two rows.

Restriction: This option applies to time axes only.

**OFFSETMAX= numeric-value**

specifies the amount of offset space between the last tick mark on the axis and the edge of the plot area. Specify a value between 0 and 1. The value represents the offset as a proportion to the total length of the axis. For example, .12 specifies that the offset space for the last tick mark is twelve percent of the total axis length.

By default, the offset space is determined automatically based on the tick mark values, markers, and labels that are inside of the plot area.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

**OFFSETMIN= numeric-value**

specifies the amount of offset space between the first tick mark on the axis and the edge of the plot area. Specify a value between 0 and 1. The value represents the offset as a proportion to the total length of the axis. For example, .12 specifies that the offset space for the first tick mark is twelve percent of the total axis length.

By default, the offset space is determined automatically based on the tick mark values, markers, and labels that are inside of the plot area.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

**REFTICKS**

adds tick marks to the side of the panel that is opposite from the specified axis. For example, if you specify the REFTICKS option in the COLAXIS statement, then tick marks are added to the top side of the panel.

**TICKVALUEFORMAT= DATA | SAS-format**

specifies the format for the axis tick values. You can either specify a SAS format or specify DATA, which indicates that the format from axis variable is used.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

**TYPE= DISCRETE | LINEAR | LOG | TIME**

specifies the type of axis. Specify one of the following values:

- **DISCRETE** specifies an axis with discrete values. If a character variable is assigned to an axis, then that the default type for that axis is
discrete. Additionally, all categorization plots use a discrete axis for the category variable.

**LINEAR** specifies a linear scale for the axis. This is the default axis type for numeric variables that do not have date or time formats.

**LOG** specifies a logarithmic scale for the axis. This axis type is never a default.

**Interaction:** A logarithmic scale cannot be used with linear regression plots (REG statement where DEGREE=1).

**TIME** specifies a time scale for the axis. If the variable assigned to an axis has a time, date, or datetime format associated with it, then time is the default axis type.

**VALUES= (values-list)** specifies the values for the ticks on the axis.

For values on a numeric axis, the values list can be one of the following:

- **value <...value-n>** creates ticks for specific values. For example, **VALUES= (0 50 100)** places tick marks at 0, 50, and 100.

- **value-1 TO value-2 BY increment-value** creates ticks for a range of values. The start of the value range is specified by `value-1` and the end of the range is specified by `value-2`. The `increment-value` specifies the interval between the ticks. For example, **VALUES= (0 to 100 by 50)** creates tick marks at 0, 50, and 100.

  You can also create ticks in descending order by using a negative increment value. For example, **VALUES= (100 to 0 by -25)** creates tick marks at 100, 75, 50, 25, and 0.

- **<value ... value-n> value-1 TO value-2 BY increment-value <value ... value-n>** creates ticks for specific values, and additionally creates ticks for a range of values. The start of the value range is specified by `value-1` and the end of the range is specified by `value-2`. The `increment-value` specifies the interval between the ticks.

  For example, **VALUES= (-5 10 to 50 by 20 75)** creates tick marks at -5, 10, 30, 50, and 75.

  For values on a time axis, the values list can be one of the following:

- **value <...value-n>** creates ticks for specific values. For example, **VALUES= ("25MAY08"d "04JUL08"d "23AUG08"d)** places tick marks at 25MAY08, 04JUL08, and 23AUG08.

- **value-1 TO value-2 BY increment-value** creates ticks for a range of values. The start of the value range is specified by `value-1` and the end of the range is specified by `value-2`. The `increment-value` specifies the interval between the ticks. For example, **VALUES= ("01JAN08"d to "01MAY08"d by month)** creates tick marks at 01JAN08, 01FEB08, 01MAR08, 01APR08, and 01MAY08.

  For a list of the interval values that you can specify, see the INTERVAL= on page 112 option.

**Restrictions:** This option has no effect on discrete and logarithmic axes.

If your **VALUES=** option creates more than 1000 values, then the option has no effect.

**VALUESHINT** specifies that the minimum and maximum axis values are determined independently of the values you specify in the **VALUES=** option. The values from the **VALUES=**
option are displayed only if they are located between the minimum and maximum values.

**Note:** This option has no effect unless you also specify the VALUES= option.

---

### Examples

---

#### Example 1: Creating a Panel of Graph Cells with Histograms and Density Plots

**Procedure features:** HISTOGRAM statement, DENSITY statement

**Sample library member:** GSGPNHST

---

![Cholesterol Distribution in Heart Study](image)

This example shows a panel of graph cells with histograms and density plots.

**Create the panel and specify the title.**

```plaintext
proc sgpanel data=sashelp.heart noautolegend;
  title "Cholesterol Distribution in Heart Study";
```

**Specify the classification variable for the panel.**

```plaintext
panelby sex;
```
Create the histogram and density plots.

```sas
histogram cholesterol;
density cholesterol;
run;
```

**Example 2: Creating a Panel of Regression Curves**

Procedure features: REG statement
Sample library member: GSGPNREG

---

This example shows a panel of regression curves. The COLUMNS= option in the PANELBY statement specifies that the panel has three columns of graph cells.

Create the panel and specify the title.

```sas
proc sgpanel data=sashelp.iris;
  title "Scatter plot for Fisher iris data";
```

Specify the classification variable for the panel. The COLUMNS= option specifies the number of columns in the panel.

```sas
panelby species / columns=3;
```

Create the regression curve. The CLI option creates individual predicted value confidence limits. The CLM option creates mean value confidence limits.

```sas
reg x=sepallength y=sepalwidth / cli clm;
run;
```
Example 3: Creating a Panel of Bar Charts

Procedure features: HBAR statement
Sample library member: GSGPNBAR

This example shows a panel of bar charts. The COLUMNS= option in the PANELBY statement specifies that the panel contains a single column of cells.

Create the panel and set the title.

```sas
proc sgpanel data=sashelp.prdsale;
  title "Yearly Sales by Product";
```

Specify the classification variable for the panel. The NOVARNAME option specifies that the variable name is not shown in the heading for each cell. The COLUMNS= option specifies the number of columns in the panel.

```sas
  panelby year / novarname columns=1;
```
Create the horizontal bar chart. The `RESPONSE=` option specifies the response variable for the chart.

```
  hbar product / response=actual;
  run;
```

---

**Example 4: Creating a Panel of Line Charts**

**Procedure features:** VLINE statement  
**Sample library member:** GSGPNLIN

This example shows a panel of line charts with grouped data.

**Create the panel and specify a title.**

```
  proc sgpanel data=sashelp.prdsale;
    where product in ("CHAIR" "SOFA");
    title "Yearly Sales by Product";
  panelby year / spacing=5 novarname;
```

**Specify the classification variable for the panel.** The `SPACING=` option specifies the number of pixels between the panels in the plot. The `NOVARNAME` option specifies that the classification variable name is not shown in the headings for each cell.

```
  panelby year / spacing=5 novarname;
```

**Create the vertical line chart.** The `RESPONSE=` option specifies the response variable. The `GROUP=` option specifies the group variable.

```
  vline month / response=actual group=product;
  run;
```
CHAPTER 4

The SGPLOT Procedure

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Overview

The SGPLOT procedure creates one or more plots and overlays them on a single set of axes. You can use the SGPLOT procedure to create statistical graphics such as histograms and regression plots, in addition to simple graphics such as scatter plots and line plots. Statements and options enable you to control the appearance of your graph and add additional features such as legends and reference lines.

The SGPLOT procedure can create a wide variety of plot types, and can overlay plots together to produce many different types of graphs. Table 4.1 on page 123 contains some examples of graphs that the SGPLOT procedure can create.
The SGPLOT Procedure

Table 4.1  Examples of Graphs that Can Be Generated by the SGPLOT Procedure

The following code creates an ellipse plot:
```
proc sgplot data=sashelp.class;
  scatter x=height y=weight;
  ellipse x=height y=weight;
run;
```

The following code creates a horizontal box plot:
```
proc sgplot data=sashelp.cars;
  hbox weight / category=origin;
run;
```

The following code creates a graph with two series plots:
```
proc sgplot data=sashelp.electric(where=(customer="Residential");
   xaxis type=discrete;
   series x=year y=coal;
   series x=year y=naturalgas / y2axis;
run;
```
The following code creates a graph with a histogram, a normal density curve, and a kernel density curve:

```sas
proc sgplot data=sashelp.class;
    histogram height;
    density height;
    density height / type=kernel;
run;
```

The following code creates a graph with two bar charts:

```sas
proc sgplot data=sashelp.prdsale;
    yaxis label="Sales" min=200000;
    vbar country / response=predict;
    vbar country / response=actual
        barwidth=0.5
        transparency=0.2;
run;
```

---

**Concepts**

**Plot Content**

There are four basic types of plots that you can create with the SGPLOT procedure:

- **Basic plots**
  - scatter, series, step, band, needle, and vector plots

- **Fit and confidence plots**
  - loess, regression, and penalized B-spline curves, and ellipses

- **Distribution plots**
  - box plots, histograms, and normal and kernel density estimates

- **Categorization plots**
  - dot plots, bar charts, and line charts

Not all of the plot types can be used together in the same PROC SGPLOT step. The following table shows which of the plot types can be used together:
Table 4.2  Plot Type Compatibility

<table>
<thead>
<tr>
<th>Basic</th>
<th>Fit and Confidence</th>
<th>Distribution</th>
<th>Categorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Fit and Confidence</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Distribution</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Categorization</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

Note: Box plots cannot be combined with any other plot types.

If you submit a PROC SGPLOT step that combines two incompatible plot statements, then an error appears in the log.

The SGPLOT procedure draws the plots in your graph in the same order that you specify the plot statements. Because of this, it is important to consider the order of your plot statements so that your plots do not obscure one another. For example, if you specify a BAND statement after a SCATTER statement, then the band plot might obscure the markers in your scatter plot. You can also avoid obscuring your data by using the TRANSPARENCY= option to make your plots partially transparent.

Plot Axes

The SGPLOT procedure contains statements that enable you to change the type and appearance of your axes: XAXIS, X2AXIS, YAXIS, and Y2AXIS.

By default, the type of each axis is determined by the types of plots that use the axis and the data that is applied to the axis.

The SGPLOT procedure supports the following axis types:

- **Discrete**
  - The axis contains independent data values rather than a range of numeric values.
  - Each distinct value is represented by a tick mark. Discrete is the default axis type for character data.

- **Linear**
  - The axis contains a linear range of numeric values. Linear is the default axis type for numeric data.

- **Logarithmic**
  - The axis contains a logarithmic range of values. The logarithmic axis type is not used as a default.

- **Time**
  - The axis contains a range of time values. Time is the default axis type for data that uses a SAS time, date, or datetime format.

Some types of plot do not support all of the axis types. For example, needle plots cannot use a discrete vertical axis. See the documentation for each plot statement to determine whether any axis type restrictions apply.

Legends in the SGPLOT Procedure

The SGPLOT procedure creates a legend automatically based on the plot statements and options that you specify. The automatic legend functionality determines which
information is likely to be useful in the legend. You can override the automatic legend functionality by defining your own legend with the KEYLEGEND statement or by specifying the NOAUTOLEGEND option in the PROC SGPLOT statement.

You can create customized legends by using one or more KEYLEGEND statements. You can use the KEYLEGEND statement to control the contents, title, location, and border of the legend. See “KEYLEGEND Statement” on page 160.

You can specify the labels that represent your plots in the legend by using the LEGENDLABEL= option in the corresponding plot statements.

---

**Automatic Differentiation of Visual Attributes**

Depending on the plots and options that you specify, the SGPLOT procedure can automatically assign different style attributes to the plots in your graph. For example, if you specify two series plots, then each series plot automatically uses a different line pattern and line color by default. If different attributes are not assigned by default, then you can force the procedure to use different style attributes by using the CYCLEATTRS option in the PROC SGPLOT statement. For example, you can use the CYCLEATTRS option to assign different colors to a series plot and a scatter plot. You can also disable automatic attribute differentiation by using the NOCYCLEATTRS option in the PROC SGPLOT statement.

---

**Units of Measurement**

Some options such as the LINEATTRS= option enable you specify the unit of measurement as part of the value. The following table contains the units that are available:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM</td>
<td>centimeters</td>
</tr>
<tr>
<td>IN</td>
<td>inches</td>
</tr>
<tr>
<td>MM</td>
<td>millimeters</td>
</tr>
<tr>
<td>PCT or %</td>
<td>percentage</td>
</tr>
<tr>
<td>PT</td>
<td>point size, calculated at 100 dots per inch</td>
</tr>
<tr>
<td>PX</td>
<td>pixels</td>
</tr>
</tbody>
</table>

---

**Marker Symbols**

The MARKERATTRS= option on some of the plot statements enables you to specify the marker symbol that is used to represent your data. Figure 4.1 on page 127 shows the marker symbols that you can use.
The SGPLOT Procedure

Figure 4.1 List of Marker Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓</td>
<td>ArrowDown</td>
</tr>
<tr>
<td>♣</td>
<td>HomeDown</td>
</tr>
<tr>
<td>™</td>
<td>HomeDownFilled</td>
</tr>
<tr>
<td>ᵉ</td>
<td>Astensk</td>
</tr>
<tr>
<td>™</td>
<td>HomeDown</td>
</tr>
<tr>
<td>™</td>
<td>HomeDownFilled</td>
</tr>
<tr>
<td>†</td>
<td>Plus</td>
</tr>
<tr>
<td>☐</td>
<td>Square</td>
</tr>
<tr>
<td>☐</td>
<td>SquareFilled</td>
</tr>
<tr>
<td>▶</td>
<td>GreaterThan</td>
</tr>
<tr>
<td>★</td>
<td>Star</td>
</tr>
<tr>
<td>★</td>
<td>StarFilled</td>
</tr>
<tr>
<td>#</td>
<td>Hash</td>
</tr>
<tr>
<td>⊔</td>
<td>Tack</td>
</tr>
<tr>
<td>⊣</td>
<td>Triangle</td>
</tr>
<tr>
<td>⌢</td>
<td>TriangleFilled</td>
</tr>
</tbody>
</table>

Line Patterns

The LINEATTRS= option on some plot statements enables you to specify the line pattern that is used for the lines in your plot. Figure 4.2 on page 127 shows the line patterns that you can use.

Figure 4.2 List of Line Patterns

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td>1</td>
</tr>
<tr>
<td>ShortDash</td>
<td>2</td>
</tr>
<tr>
<td>MediumDash</td>
<td>4</td>
</tr>
<tr>
<td>LongDash</td>
<td>5</td>
</tr>
<tr>
<td>MediumDash:ShortDash</td>
<td>8</td>
</tr>
<tr>
<td>DashDashDot</td>
<td>14</td>
</tr>
<tr>
<td>DashDotDot</td>
<td>15</td>
</tr>
<tr>
<td>Dash</td>
<td>20</td>
</tr>
<tr>
<td>LongDash:ShortDash</td>
<td>26</td>
</tr>
<tr>
<td>Dot</td>
<td>34</td>
</tr>
<tr>
<td>ThinDot</td>
<td>35</td>
</tr>
<tr>
<td>ShortDashDot</td>
<td>41</td>
</tr>
<tr>
<td>MediumDashDotDot</td>
<td>42</td>
</tr>
</tbody>
</table>

Procedure Syntax

Requirements: At least one plot statement is required.

PROC SGPLOT < option(s)>;
  BAND X= variable | Y= variable
  UPPER= numeric-value | numeric-variable LOWER= numeric-value | numeric-variable
  <option(s)>;
  DENSITY response-variable <option(s)>;
  DOT category-variable <option(s)>;
  ELLIPSE X= numeric-variable Y= numeric-variable <option(s)>;
  HBAR category-variable <option(s)>;
PROC SGPLOT Statement

Identifies the data set that contains the plot variables. The statement also gives you the option to specify a description, write template code to a file, control the uniformity of axes, and control automatic legends and automatic attributes.

Requirements: An input data set is required.

Syntax

**PROC SGPLOT** <DATA= input-data-set>
   <CYCLEATTRS | NOCYCLEATTRS>
   <DESCRIPTION="text-string”>
   <NOAUTOLEGEND>
   <TMPLOUT= “filename”>
   <UNIFORM= GROUP | SCALE | ALL>;
Options

CYCLEATTRS | NOCYCLEATTRS
specifies whether plots are drawn with unique attributes in the graph. By default, the SGPLOT procedure automatically assigns unique attributes in many situations, depending on the types of plots that you specify. If the plots do not have unique attributes by default, then the CYCLEATTRS option assigns unique attributes to each plot in the graph. The NOCYCLEATTRS option prevents the procedure from assigning unique attributes.

For example, if you specify the CYCLEATTRS option and you create a graph with a SERIES statement and a SCATTER statement, then the two plots will have different colors.

If you specify the NOCYCLEATTRS option, then plots have the same attributes unless you specify appearance options such as the LINEATTRS= option.

DATA=input-data-set
specifies the SAS data set that contains the variables to process. By default, the procedure uses the most recently created SAS data set.

DESCRIPTION= "text-string"
specifies a description for the output image. The description identifies the image in the following locations:
- the Results window
- the alternate text for the image in HTML output
- the table of contents that is created by the CONTENTS option on an ODS statement

The default description is “The SGPLOT Procedure”.

Note: You can disable the alternate text in HTML output by specifying an empty string. That is, DESCRIPTION="".

Note: The name of the output image is specified by the IMAGENAME= option in the ODS GRAPHICS statement.

Alias: DES

NOAUTOLEGEND
disables automatic legends from being generated. By default, legends are created automatically for some plots, depending on their content. This option has no effect if you specify a KEYLEGEND statement.

TMPLOUT= "filename"
writes the Graph Template Language code for your graph to a file.
Writing your template code to a file can be useful for building larger Graph Template Language definitions.

UNIFORM= GROUP | SCALE | ALL
specifies how to control axis scaling and marker attributes when you use a BY statement.
Specify one of the following values:

ALL specifies that both the legend group values and the axis scaling are shared between all of the levels of the BY variable(s).

GROUP specifies that the legend group values are shared between all of the levels of the BY variable(s).

SCALE specifies that the axis scaling is shared between all of the levels of the BY variable(s).
By default, each level of the BY variable(s) can have different legend group values and different axis scaling.

Note: This option has no effect if you do not use a BY statement.

---

**BAND Statement**

**Creates a band that highlights part of the plot.**

Restriction: The axis that the UPPER and LOWER values are placed on cannot be a discrete axis. For example, if you specify a variable for Y, the plot cannot use a discrete horizontal axis.

Featured in: Example 5 on page 217

**Syntax**

```
BAND X= variable | Y= variable
UPPER= numeric-value | numeric-variable LOWER= numeric-value | numeric-variable
<option(s)>
```

`option(s)` can be one or more options from the following categories:

- **Band options:**
  - FILL | NOFILL
  - FILLATTRS= style-element | (COLOR=color)
  - LINEATTRS= style-element <(options)> | (options)
  - MODELNAME= "plot-name"
  - NOEXTEND
  - NOMISSINGGROUP
  - OUTLINE | NOOUTLINE

- **Plot options:**
  - GROUP= variable
  - LEGENDLABEL= “text-string”
  - NAME= “text-string”
  - TRANSPARENCY= numeric-value
  - X2AXIS
  - Y2AXIS

**Required Arguments**

- **X= variable | Y=variable**
  specifies a variable that is used to plot the band along the x or y axis.

- **LOWER= numeric-value | numeric-variable**
  specifies the lower value for the band. You can specify either a constant numeric value or a numeric variable.
The SGPLOT Procedure

BAND Statement

**UPPER= numeric-value | numeric-variable**
specifies the upper value for the band. You can specify either a constant numeric value or a numeric variable.

**Options**

**FILL | NOFILL**
specifies whether the area fill is visible. The FILL option shows the area fill. The NOFILL option hides the area fill.

**Default:** The default status of the area fill is specified by the DisplayOpts attribute of the GraphBand style element in the current style.

**FILLATTRS= style-element | (COLOR= color)**
specifies the appearance of the area fill for the band. You can specify the color of the fill by using a style element or by using the COLOR= suboption. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

*Note:* This option has no effect if you specify the NOFILL option. △

**Default:** For ungrouped data, the default color is specified by the Color attribute of the GraphDataConfidence style element in the current style.

For grouped data, the default color is specified by the Color attribute of the GraphData1... GraphDataN style elements in the current style.

**GROUP= variable**
specifies a variable that is used to group the data. A separate band is created for each unique value of the grouping variable. The plot elements for each group value are automatically distinguished by different visual attributes.

**LEGENDLABEL= "text-string"**
specifies a label that identifies the elements from the band plot in the legend. By default, the label “band” is used for ungrouped data, and the group values are used for grouped data.

**Interaction:** The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

**LINEATTRS= style-element <(options)> | (options)**
specifies the appearance of the outlines for the band. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

*Note:* This option has no effect unless you also specify the OUTLINES option. △

**options** can be one or more of the following:

**COLOR= color**
specifies the color of the line. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphConfidence style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphDataN style elements in the current style.

**PATTERN= line-pattern**
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.

**Default:** For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphConfidence style element in the current style.
For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData n style elements in the current style.

**THICKNESS=** *n* <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default:** For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphDataDefault style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData n style elements in the current style.

**MODELNAME=** "plot-name"
specifies a plot that is used as a model for the interpolation for the band. If you do not specify the MODELNAME= option, then the band is interpolated in the same way as a series plot.

**NAME=** "text-string"
specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOEXTEND**
when you specify numeric values for UPPER= and LOWER=, specifies that the band does not extend beyond the first and last data points in the plot. By default, the band extends to the edges of the plot area.

**Interaction:** This option has no effect if you do not specify numeric values for the UPPER= and LOWER= options.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**NOMISSINGGROUP**
specifies that missing values of the group variable are not included in the plot.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**OUTLINE | NOOUTLINE**
specifies whether the outlines of the band are visible. The OUTLINE option shows the outlines. The NOOUTLINE option hides the outlines.

**Default:** The default status of the band outlines is specified by the DisplayOpts attribute of the GraphBand.

**TRANSPARENCY=** *value*
specifies the degree of transparency for the plot. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

**Default:** 0.0

**X2AXIS**
assigns the variables that are assigned to the primary (bottom) horizontal axis to the secondary (top) horizontal axis.

**Y2AXIS**
assigns the variables that are assigned to the primary (left) vertical axis to the secondary (right) vertical axis.

**Details**
The MODELNAME= option fits a band to another plot. This is particularly useful for plots that use a special interpolation such as step plots.

The following code fragment fits a band to a step plot:
The SGPLOT Procedure  △  DENSITY Statement  133

band x=t upper=ucl lower=lcl / modelname="myname" transparency=.5;
step x=t y=survival / name="myname";

Figure 4.3  Fitted Band Plot Example

DENSITY Statement

Creates a density curve that shows the distribution of values for a numeric variable.

Restriction:  The DENSITY statement cannot be used with discrete axes.
Interaction:  The DENSITY statement can be combined only with DENSITY and HISTOGRAM statements in the SGPLOT procedure.
Featured in:  Example 7 on page 219

Syntax

DENSITY response-variable < / option(s)>;

option(s) can be one or more options from the following categories:

- Density options:
  FREQ= numeric-variable
  LINEATTRS= style-element <(options)> | (options)
  SCALE= scaling-type
  TYPE = NORMAL < (normal-opts)> | KERNEL < (kernel-opts)>

- Plot options:
  LEGENDLABEL= "text-string"
  NAME= "text-string"
  TRANSPARENCY= numeric-value
X2AXIS
Y2AXIS

**Required Arguments**

`response-variable`
specifies the variable for the x axis. The variable must be numeric.

**Options**

**FREQ= numeric-variable**  
specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.

**LEGENDLABEL= "text-string"**  
specifies a label that identifies the density plot in the legend. By default, the label identifies the type of density curve. If you specify TYPE=NORMAL, then the default label is "Normal." If you specify TYPE=KERNEL, then the default label is "Kernel."  
*Note:* User-specified parameters from the TYPE= option are included in the label by default.

**LINEATTRS= style-element <(options)> | (options)**  
specifies the appearance of the density line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.  
*options* can be one or more of the following:  
- **COLOR= color**  
  specifies the color of the line. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.  
  *Default:* The default color is specified by the ContrastColor attribute of the GraphFit style element in the current style.  
- **PATTERN= line-pattern**  
  specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.  
  *Default:* The default line pattern is specified by the LineStyle attribute of the GraphFit style element in the current style.  
- **THICKNESS= n <units>**  
  specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.  
  *Default:* The default line thickness is specified by the LineThickness attribute of the GraphFit style element in the current style.  
- **NAME= "text-string"**  
  specifies a name for the plot. You can use the name to refer to this plot in other statements.  
- **SCALE= scaling-type**  
  specifies the scaling that is used for the response axis. Specify one of the following values:  
  - **COUNT**  
    the axis displays the frequency count.
DENSITY
the axis displays the density estimate values.

PERCENT
the axis displays values as a percentage of the total.

PROPORTION
the axis displays values in proportion to the total.

Note: The PROPORTION scale can be used only when you combine a density plot and a histogram together.

Default: DENSITY

TRANSPARENCY= numeric-value
specifies the degree of transparency for the density curve. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Default: 0.0

TYPE = NORMAL < (normal-opts)> | KERNEL < (kernel-opts)>
specifies the type of distribution curve that is used for the density plot. Specify one of the following keywords:

NORMAL < (normal-opts)>
specifies a normal density estimate, with a mean and a standard deviation.

normal-opts can be one or more of the following values:

MU= numeric-value
specifies the mean value that is used in the density function equation. By default, the mean value is calculated from the data.

SIGMA= numeric-value
specifies the standard deviation value that is used in the density function equation. The value that you specify for the SIGMA= suboption must be a positive number. By default, the standard deviation value is calculated from the data.

KERNEL < (kernel-opts)>
specifies a non-parametric kernel density estimate.

kernel-opts can be:

C= numeric-value
specifies the standardized bandwidth for a number that is greater than 0 and less than or equal to 100.

The value that you specify for the C= suboption affects the value of $\lambda$ as shown in the following equation:

$$\lambda = cQn^{-\frac{1}{3}}$$

In this equation $c$ is the standardized bandwidth, $Q$ is the interquartile range, and $n$ is the sample size.

WEIGHT= NORMAL | QUADRATIC | TRIANGULAR
specifies the weight function. You can specify either normal, quadratic, or triangular weight function.

Default: NORMAL

Default: NORMAL
**X2AXIS**
assigns the X variable to the secondary (top) horizontal axis.

**Y2AXIS**
assigns the calculated result to the secondary (right) vertical axis.

**Details**

**Normal Density Function**
When the type of the density curve is NORMAL, the fitted density function equation is as follows:

\[
p(x) = \frac{100h\%}{\sigma\sqrt{2\pi}} \exp\left( -\frac{1}{2} \left( \frac{x - \mu}{\sigma} \right)^2 \right) \text{ for } -\infty < x < \infty
\]

In the equation, \(\mu\) is the mean, and \(\sigma\) is the standard deviation. You can specify \(\mu\) by using the MU= suboption and \(\sigma\) by using the SIGMA= suboption.

**Kernel Density Function**
When the TYPE of the density curve is KERNEL, the general form of the kernel density estimator is as follows:

\[
\hat{f}_\lambda (x) = \frac{100h\%}{n\lambda} \sum_{i=1}^{n} K_0 \left( \frac{x - x_i}{\lambda} \right)
\]

In the equation, \(K_0 (\cdot)\) is the weight function, \(\lambda\) is the bandwidth, \(n\) is the sample size, and \(x_i\) is the \(i\)th observation. You can use the C= suboption to specify the bandwidth and the WEIGHT= suboption to specify the weight function \(K_0 (\cdot)\).

**Kernel Density Weight Functions**
The formulas for the weight functions are as follows:

**NORMAL**

\[
K_0 (t) = \frac{1}{\sqrt{2\pi}} \exp\left( -\frac{1}{2} t^2 \right) \text{ for } -\infty < t < \infty
\]

**QUADRATIC**

\[
K_0 (t) = \frac{3}{4} (1 - t^2) \text{ for } |t| \leq 1
\]

**TRIANGULAR**

\[
K_0 (t) = 1 - |t| \text{ for } -1 \leq |t| \leq 1
\]
DOT Statement

Creates a dot plot that summarizes the values of a category variable.

Interaction: The DOT statement can be combined only with other horizontal categorization plot statements in the SGPLOT procedure. See “Plot Content” on page 124.

Featured in: Example 6 on page 218

Syntax

DOT category-variable </ option(s)>;

option(s) can be one or more options from the following categories:

- Dot options:
  - ALPHA= numeric-value
  - DATALABEL <= variable>
  - FREQ= numeric-variable
  - LIMITATTRS= style-element <(options)> | (options)
  - LIMITS= BOTH | LOWER | UPPER
  - LIMITSTAT= CLM | STDERR | stderr
  - MARKERATTRS= style-element <=(options)> | (options)
  - MISSING
  - NOSTATLABEL
  - NUMSTD= n
  - RESPONSE= numeric-variable
  - STAT= FREQ | MEAN | SUM
  - URL= character-variable
  - WEIGHT= numeric-variable

- Plot options:
  - GROUP= variable
  - LEGENDLABEL=“text-string”
  - NAME= “text-string”
  - TRANSPARENCY= numeric-value

Required Arguments

category-variable
specifies the variable that classifies the observations into distinct subsets.
Options

**ALPHA= numeric-value**
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

**Default:** .05

**Interaction:** This option has no effect if you do not specify LIMITSTAT=CLM.

If your plot is overlaid with other categorization plots, then the first ALPHA value that you specify is used for all of the plots.

**DATALABEL <= variable>**
displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the calculated response are used for the data labels.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**FREQ= numeric-variable**
specifies that each observation is repeated \( n \) times for computational purposes, where \( n \) is the value of the numeric variable. If \( n \) is not an integer, then it is truncated to an integer. If \( n \) is less than 1 or missing, then it is excluded from the analysis.

**Interaction:** If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.

**GROUP= variable**
specifies a variable that is used to group the data. The plot elements for each group value are automatically distinguished by different visual attributes.

**Interaction:** If you specify more than one categorization plot statement, then all of the plots must specify the same GROUP variable. If you do not specify the same GROUP= option for all of the categorization plots, then the GROUP= option has no effect.

**LEGENDLABEL= “text-string”**
specifies the label that identifies the dot plot in the legend. By default, the label of the response variable is used. If there is no response variable label, then the name of the response variable and the computed statistic (SUM or MEAN) is used. If the RESPONSE= option is not used, then the legend label is “Frequency”.

**Interaction:** The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

**LIMITATTRS= style-element <(options)> | (options)**
specifies the appearance of the limit lines in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

- **options** can be one or more of the following:
  - **COLOR= color** specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.
    - **Default:** The default color is specified by the ContrastColor attribute of the GraphError style element in the current style.
  - **PATTERN= line-pattern** specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.
    - **Default:** The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.
THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The
default unit is pixels. See “Units of Measurement” on page 126 for a list of the
measurement units that are supported.

Default: The default line thickness is specified by the LineThickness attribute of
the GraphError style element in the current style.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

LIMITS= BOTH | LOWER | UPPER
specifies which limit lines to display. Limits are displayed as heavier line segments
with a serif at the end extending horizontally from each dot. Upper limits extend to
the right of the dot and lower limits extend to the left of the dot. By default, no
limits are displayed unless you specify either the LIMITS= or LIMITSTAT= option.
Specify one of the following values:

BOTH
adds lower and upper limit lines to the plot.

LOWER
adds lower limit lines to the plot.

UPPER
adds upper limit lines to the plot.

By default, no limit lines are displayed. However, if you specify the LIMITSTAT= option, then the default is BOTH.

Interaction: Limit lines are displayed only when you specify STAT= MEAN.

LIMITSTAT= CLM | STDDEV | STDERR
specifies the statistic for the limit lines. Specify one of the following statistics:

CLM
confidence limits

STDDEV
standard deviation

STDERR
standard error

Default: CLM

Interaction: If you specify the LIMITSTAT= option only, then the default value for
the LIMITS= option is BOTH.

Limits lines are displayed only when you specify STAT=MEAN.

MARKERATTRS= style-element <(options)> | (options)
specifies the appearance of the markers in the plot. You can specify the appearance
by using a style element or by using suboptions. If you specify a style element, you
can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the markers. For more information about specifying colors,
see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute
of the GraphData1 ... GraphDataN style elements in the current style.
SIZE= n <units >
specifies the size of the markers. You can also specify the unit of measurement.
The default unit is pixels. See “Units of Measurement” on page 126 for a list of the
measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the
GraphDataDefault style element in the current style.

SYMBOL= symbol-name
specifies the symbol for the markers. See “Marker Symbols” on page 126 for a list
of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the
MarkerSymbol attribute of the GraphDataDefault style element in the current
style.

For grouped data, the default marker symbol is specified by the
MarkerSymbol attribute of the GraphData1 ... GraphData\n style elements in
the current style.

MISSING
processes missing values as valid category value and creates a dot for it.

NAME= “text-string”
specifies a name for the plot. You can use the name to refer to this plot in other
statements.

NOSTATLABEL
removes the statistic name from the axis and legend labels.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

NUMSTD= n
specifies the number of standard units for the limit lines, when you specify
LIMITSTAT= STDDEV or LIMITSTAT= STDERR. You can specify any positive
number, including decimals.

**Default:** 1

RESPONSE= response-variable
specifies a numeric response variable for the plot. The summarized values of the
response variable for each category value are displayed on the horizontal axis.

STAT= FREQ | MEAN | SUM
specifies the statistic for the horizontal axis. Specify one of the following:

FREQ
the frequencies for the category variable. This is the default value when you do
not specify the RESPONSE= option.

MEAN
the mean of the response variable.

SUM
the sum of the response variable. This is the default value when you specify the
RESPONSE= option.

If you do not specify the RESPONSE= option, then only the FREQ statistic can be
used. If you specify RESPONSE=, then you can use either the SUM or MEAN
statistics.

TRANSPARENCY= numeric-value
specifies the degree of transparency for the plot. Specify a value from 0.0 (completely
opaque) to 1.0 (completely transparent).

**Default:** 0.0
URL= character-variable
specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.

**Interaction:** This option affects graphics output that is created through the ODS HTML destination only.
This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.

**Default:** By default, no HTML links are created.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**WEIGHT= numeric-variable**
specifies that each observation is weighted by a factor of \( w \) for computational purposes, where \( w \) is the value of the numeric variable. \( w \) can be any numeric value. If \( w \) is 0, negative or missing, then that observation is excluded from the analysis.

**Interaction:** If your plot is overlaid with other categorization plots, then the first WEIGHT variable that you specified is used for all of the plots.

---

**ELLIPSE Statement**

Adds a confidence or prediction ellipse to another plot.

**Featured in:** Example 4 on page 216

**Restriction:** The ELLIPSE statement must be used with another plot statement that uses numeric axes.

**Syntax**

ELLIPSE X= numeric-variable Y= numeric-variable <option(s)>;

*option(s)* can be one or more options from the following categories:

- **Ellipse options:**
  - ALPHA= numeric-value
  - CLIP
  - FILL | NOFILL
  - FILLATTRS= style-element | (COLOR=color)
  - FREQ= numeric-variable
  - LINEATTRS= style-element <(options)> | (options)
  - OUTLINE | NOOUTLINE
  - TYPE = MEAN | PREDICTED

- **Plot options:**
  - LEGENDLABEL= “text-string”
  - NAME= “text-string”
  - TRANSPARENCY= numeric-value
  - X2AXIS
  - Y2AXIS
**Required Arguments**

\[ X= \text{numeric-variable} \]
specifies a numeric variable for the X axis.

\[ Y= \text{numeric-variable} \]
specifies a numeric variable for the Y axis.

**Options**

\[ \text{ALPHA=} \text{numeric-value} \]
specifies the confidence level for the ellipse. Specify a number between 0.00 (100\% confidence) and 1.00 (0\% confidence).

Default: .05

\[ \text{CLIP} \]
specifies that the data for the ellipse is ignored when determining the data ranges for the axes. By default, the data for the ellipse is considered when determining the data ranges for the axes.

Interaction: This option is automatically set if you specify \text{UNIFORM=SCALE} or \text{UNIFORM=ALL} option in the PROC SGPLOT statement.

\[ \text{FILL} \mid \text{NOFILL} \]
specifies whether the area fill is visible. The FILL option shows the area fill. The NOFILL option hides the area fill.

Default: The default status of the area fill is specified by the DisplayOpts attribute of the GraphEllipse style element in the current style.

\[ \text{FILLATTRS=} \text{style-element} \mid (\text{COLOR=} \text{color}) \]
specifies the appearance of the area fill for the ellipse. You can specify the color of the fill by using a style element or by using the COLOR= suboption. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Note: This option has no effect if you specify the NOFILL option.

Default: The default color is specified by the Color attribute of the GraphDataDefault style element in the current style.

\[ \text{FREQ=} \text{numeric-variable} \]
specifies that each observation is repeated \( n \) times for computational purposes, where \( n \) is the value of the numeric variable. If \( n \) is not an integer, then it is truncated to an integer. If \( n \) is less than 1 or missing, then it is excluded from the analysis.

\[ \text{LEGENDLABEL=} \text{“text-string”} \]
specifies a label that identifies the ellipse in the legend. By default, the label describes the confidence value of the ellipse and the type of ellipse. For example, “95\% Prediction Ellipse.”

\[ \text{LINEATTRS=} \text{style-element} \langle\text{options}\rangle \mid \langle\text{options}\rangle \]
specifies the appearance of the outlines for the ellipse. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.
options can be one or more of the following:

**COLOR=** color
specifies the color of the line. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.

**Default:** The default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

**PATTERN=** line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.

**Default:** The default line pattern is specified by the LineStyle attribute of the GraphDataDefault style element in the current style.

**THICKNESS=** n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default:** The default line thickness is specified by the LineThickness attribute of the GraphDataDefault style element in the current style.

**NAME=** “text-string”
specifies a name for the plot. You can use the name to refer to this plot in other statements.

**OUTLINE | NOOUTLINE**
specifies whether the outlines of the ellipse are visible. The OUTLINE option shows the outlines. The NOOUTLINE option hides the outlines.

**Default:** The default status of the outlines is specified by the DisplayOpts attribute of the GraphEllipse style element in the current style.

**TRANSPARENCY=** numeric-value
specifies the degree of transparency for the area fill and outline, if displayed. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

**Default:** 0.5

**TYPE =** MEAN | PREDICTED
specifies the type of ellipse. MEAN specifies a confidence ellipse for the population mean. PREDICTED specifies a prediction ellipse for a new observation. Both ellipse types assume a bivariate normal distribution.

**Default:** PREDICTED

**X2AXIS**
assigns the X variable to the secondary (top) horizontal axis.

**Y2AXIS**
assigns the Y variable to the secondary (right) vertical axis.
HBAR Statement

Creates a horizontal bar chart that summarizes the values of a category variable.

Interaction: The HBAR statement can be combined only with other categorization plot statements in the SGPLOT procedure. See “Plot Content” on page 124.

Syntax

HBAR category-variable < / option(s)>;

option(s) can be one or more options from the following categories:

- Bar options:
  - ALPHA= numeric-value
  - BARWIDTH= numeric-value
  - DATALABEL
  - FILL | NOFILL
  - FILLATTRS= style-element <(fill-options)> | (fill-options)
  - FREQ= numeric-variable
  - LIMITATTRS= style-element <(options)> | (options)
  - LIMITS= BOTH | LOWER | UPPER
  - LIMITSTAT= CLM | STDDEV | STDERR
  - MISSING
  - NOSTATLABEL
  - NUMSTD= n
  - OUTLINE | NOOUTLINE
  - RESPONSE= response-variable
  - STAT= FREQ | MEAN | SUM
  - URL= variable
  - WEIGHT= numeric-variable

- Plot options:
  - GROUP= variable
  - LEGENDLABEL= "text-string"
  - NAME= "text-string"
  - TRANSPARENCY= numeric-value

Required Arguments

category-variable

specifies the variable that classifies the observations into distinct subsets.
Options

**ALPHA= numeric-value**
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

Default: .05

Interaction: This option has no effect if you do not specify LIMITSTAT=CLM.

If your plot is overlaid with other categorization plots, then the first ALPHA value that you specify is used for all of the plots.

**BARWIDTH= numeric-value**
specifies the width of the bars as a ratio of the maximum possible width. The maximum width is equal to the distance between the center of each bar and the centers of the adjacent bars. Specify a value between .1 and 1.

For example, if you specify a width of 1, then there is no distance between the bars. If you specify a width of .5, then the width of the bars is equal to the space between the bars.

Default: .8

**DATALABEL**
adds data labels for bars. The values of the response variable appear at the end of the bars.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

**FILL | NOFILL**
specifies whether the bars are filled. The FILL option shows the fill color for the bars. The NOFILL option hides the fill color for the bars.

Default: FILL

**FILLATTRS= style-element | (COLOR= color)**
specifies the appearance of the fill for the bars. You can specify the color of the fill by using a style element or by using the COLOR= suboption. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.

Note: This option has no effect if you specify the NOFILL option.

Default: For ungrouped data, the default color is specified by the Color attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the Color attribute of the GraphData1... GraphDataN style elements in the current style.

**FREQ= numeric-variable**
specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.

Interaction: If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.

**GROUP= variable**
specifies a variable that is used to group the data. The plot elements for each group value are automatically distinguished by different visual attributes.

**LEGENDLABEL= “text-string”**
specifies the label that identifies the bar chart in the legend. By default, the label of the RESPONSE= variable is used. If there is no response variable label, the name of the response variable and the computed statistic (SUM or MEAN) is used. If the RESPONSE= option is not used, the legend label is “Frequency”.
Interaction: The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

LIMITATTRS= style-element <(options)> | (options)
specifies the appearance of the limit lines in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
    specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.
    Default: The default color is specified by the ContrastColor attribute of the GraphError style element in the current style.

PATTERN= line-pattern
    specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.
    Default: The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.

THICKNESS= n <units>
    specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.
    Default: The default line thickness is specified by the LineThickness attribute of the GraphError style element in the current style.

LIMITS= BOTH | LOWER | UPPER
specifies which limit lines to display. Limits are displayed as heavier line segments with a serif at the end extending from each bar. Upper limits extend to the right of the bar and lower limits extend to the left of the bar. By default, no limits are displayed unless you specify either the LIMITS= or LIMITSTAT= option. If you specify the LIMITSTAT= option only, then LIMITS=BOTH is the default. Specify one of the following values:

    BOTH
        adds lower and upper limit lines to the plot.
    LOWER
        adds lower limit lines to the plot.
    UPPER
        adds upper limit lines to the plot.

    By default, no limit lines are displayed. However, if you specify the LIMITSTAT= option, then the default is BOTH.

Interaction: Limit lines are displayed only when you specify STAT= MEAN.

LIMITSTAT= CLM | STDDEV | STDERR
specifies the statistic for the limit lines. Specify one of the following statistics:

    CLM
        confidence limits
    STDDEV
        standard deviation
    STDERR
        standard error
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Default: CLM

Interaction: If you specify the LIMITSTAT= option only, then the default value for the LIMITS= option is BOTH. Limits lines are displayed only when you specify STAT=MEAN.

MISSING
processes missing values as a valid category value and creates a bar for it.

NAME= “text-string”
specifies a name for the plot. You can use the name to refer to this plot in other statements.

NOSTATLABEL
removes the statistic name from the axis and legend labels.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

NUMSTD= n
specifies the number of standard units for the limit lines, when you specify LIMITSTAT= STDDEV or LIMITSTAT= STDERR. You can specify any positive number, including decimals.

Default: 1

OUTLINE | NOOUTLINE
specifies whether the bars have outlines. The OUTLINE option shows the outlines. The NOOUTLINE option hides the outlines.

Default: OUTLINE

RESPONSE= response-variable
specifies a numeric response variable for the plot. The summarized values of the response variable are displayed for each value on the horizontal axis.

STAT= FREQ | MEAN | SUM
specifies the statistic for the horizontal axis. Specify one of the following statistics:

FREQ
the frequencies for the category variable. This is the default value when you do not specify the RESPONSE= option.

MEAN
the mean of the response variable.

SUM
the sum of the response variable. This is the default value when you specify the RESPONSE= option.

If you do not specify the RESPONSE= option, then only the FREQ statistic can be used. If you specify RESPONSE=, then you can use either the SUM or MEAN statistics.

TRANSPARENCY= numeric-value
specifies the degree of transparency for the bars and limits, if displayed. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Default: 0.0

URL= character-variable
specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.

Interaction: This option affects graphics output that is created through the ODS HTML destination only.

This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.
**Default:** By default, no HTML links are created.

**WEIGHT= numeric-variable**

specifies that each observation is weighted by a factor of \( w \) for computational purposes, where \( w \) is the value of the numeric variable. \( w \) can be any numeric value. If \( w \) is 0, negative or missing, then that observation is excluded from the analysis.

**Interaction:** If your plot is overlaid with other categorization plots, then the first WEIGHT variable that you specified is used for all of the plots.

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**HBOX Statement**

creates a horizontal box plot that shows the distribution of your data.

**Interaction:** The HBOX statement cannot be used with other plot statements in the SGPLOT procedure.

**Featured in:** Example 8 on page 220

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**Description**

Horizontal and vertical box plots display the distribution of data by using a rectangular box and **whiskers**. Whiskers are lines that indicate a data range outside of the box.

**Figure 4.4** Parts of a Box Plot

- **Far Outlier**: 3(IQR) above 75th percentile
- **Outlier**: 1.5(IQR) above 75th percentile
- **Max**: 3(IQR) above 75th percentile
- **Median**: Q3 (75th percentile)
- **Mean**: Q1 (25th percentile)
- **Min**: 1.5(IQR) below 25th percentile
- **Lower Fence**: 1.5(IQR) below 25th percentile
- **Upper Fence**: 1.5(IQR) above 75th percentile
Figure 4.4 on page 148 shows a diagram of a vertical box plot. The bottom and top edges of the box indicate the *intra-quartile range* (IQR). That is, the range of values between the first and third quartiles (the 25th and 75th percentiles). The marker inside the box indicates the mean value. The line inside the box indicates the median value.

The elements that are outside the box are dependent on your options. By default, the whiskers that extend from each box indicate the range of values that are outside of the intra-quartile range, but are close enough not to be considered outliers (a distance less than or equal to $1.5\times$IQR). If you specify the EXTREME option, then the whiskers indicate the entire range of values, including outliers.

Any points that are a distance of more than $1.5\times$IQR from the box are considered to be outliers. By default, these points are indicated by markers. If you specify DATALABEL= option, then the outlier points have data labels. If you also specify the LABELFAR option, then only outliers that are $3\times$IQR from the box have data labels.

**Syntax**

HBOX response-variable <\! option(s)>;

*option(s)* can be one or more options from the following categories:

- **Box options:**
  - BOXWIDTH= numeric-value
  - CATEGORY= category-variable
  - DATALABEL <= variable>
  - EXTREME
  - FREQ= numeric-variable
  - LABELFAR
  - MISSING
  - PERCENTILE= numeric-value
  - SPREAD

- **Plot options:**
  - LEGENDLABEL= “text-string”
  - NAME= “text-string”
  - TRANSPARENCY= numeric-value
  - X2AXIS
  - Y2AXIS

**Required Arguments**

*response-variable*  
specifies the response variable for the plot. If you do not specify the CATEGORY= option, then one box is created for the response variable.

**Options**

**BOXWIDTH= numeric-value**  
specifies the width of the box. Specify a value between 0.0 (0% of the available width) and 1.0 (100% of the available width).
Default: 0.4

CATEGORY= category-variable
specifies the category variable for the plot. A box plot is created for each distinct value of the category variable.

DATALABEL <= variable>
adds data labels for the outlier markers. If you specified a variable, then the values for that variable are used for the data labels. If you do not specify a variable, then the values of the response variable are used.

Note: This option has no effect if the plot does not contain outlier points.

EXTREME
specifies that the whiskers can extend to the maximum and minimum values for the response variable, and that outliers are not identified. When you do not specify the EXTREME option, the whiskers cannot be longer than 1.5 times the length of the box.

FREQ= numeric-variable
specifies that each observation is repeated $n$ times for computational purposes, where $n$ is the value of the numeric variable. If $n$ is not an integer, then it is truncated to an integer. If $n$ is less than 1 or missing, then it is excluded from the analysis.

Interaction: If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.

LABELFAR
specifies that only the far outliers have data labels. Far outliers are points whose distance from the box is more than three times the length of the box.

Note: This option has no effect if you do not specify the DATALABEL option, or if there are no far outliers.

LEGENDLABEL= “text-string”
specifies a label that identifies the box plot in the legend. By default, the label of the response variable is used.

MISSING
processes missing values as a valid category value and creates a box for it.

NAME= “text-string”
specifies a name for the plot. You can use the name to refer to this plot in other statements.

PERCENTILE= 1 | 2 | 3 | 4 | 5
specifies a method for computing the percentiles for the plot.

For descriptions of each method, see “Calculating Percentiles” in the UNIVARIATE Procedure chapter of Base SAS Procedures Guide: Statistical Procedures.

Default: 5

SPREAD
relocates outlier points that have identical values to prevent overlapping.

Note: This option has no effect if your data does not contain two or more outliers with identical values for the response variable.

TRANSPARENCY= value
specifies the degree of transparency for the plot. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Default: 0.0

X2AXIS
assigns the response variable to the secondary (top) horizontal axis.
Y2AXIS
assigns the category variable to the secondary (right) vertical axis.

HISTOGRAM Statement

Creates a histogram that displays the frequency distribution of a numeric variable.

Interaction: The HISTOGRAM statement can be combined only with DENSITY statements in the SGPLOT procedure.

Note: The range of the response variable is automatically divided into an appropriate number of bins.

Featured in: Example 7 on page 219

Syntax

HISTOGRAM response-variable </option(s)>;

option(s) can be one or more options from the following categories:

- Histogram options:
  BOUNDARY= LOWER | UPPER
  FILL | NOFILL
  FILLATTRS= style-element | (COLOR= color)
  FREQ= numeric-variable
  OUTLINE | NOOUTLINE
  SCALE= COUNT | PERCENT | PROPORTION
  SHOWBINS

- Plot options:
  LEGENDLABEL= “text-string”
  NAME= “text-string”
  TRANSPARENCY= numeric-value
  X2AXIS
  Y2AXIS

Required Arguments

response-variable
specifies the response variable for the histogram.

Options

BOUNDARY= LOWER | UPPER
specifies how boundary values are assigned to bins.
LOWER
  specifies that boundary values are assigned to the lower bin.

UPPER
  specifies that boundary values are assigned to the upper bin.

Default: UPPER

FILL | NOFILL
  specifies whether the area fill is visible. The FILL option shows the area fill. The
  NOFILL option hides the area fill.

Default: The default status of the area fill is specified by the DisplayOpts attribute
  of the GraphHistogram style element in the current style.

FILLATTRS= style-element | (COLOR= color)
  specifies the appearance of the area fill. You can specify the color of the fill by using
  a style element or by using the COLOR= suboption. For more information about
  specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the
  SAS/GRAPH: Reference.

  Note: This option has no effect if you specify the NOFILL option.

Default: The default color is specified by the Color attribute of the
  GraphDataDefault style element in the current style.

FREQ= numeric-variable
  specifies that each observation is repeated n times for computational purposes, where
  n is the value of the numeric variable. If n is not an integer, then it is truncated to
  an integer. If n is less than 1 or missing, then it is excluded from the analysis.

LEGENDLABEL= "text-string"
  specifies a label that identifies the histogram in the legend. By default, the label of
  the response variable is used.

NAME= "text-string"
  specifies a name for the plot. You can use the name to refer to this plot in other
  statements.

OUTLINE | NOOUTLINE
  specifies whether outlines are displayed for the bars. The OUTLINE option shows
  the outlines. The NOOUTLINE option hides the outlines.

Default: The default status of the outlines is specified by the DisplayOpts attribute
  of the GraphHistogram style element in the current style.

SCALE= COUNT | PERCENT | PROPORTION
  specifies the scaling that is applied to the vertical axis. Specify one of the following
  values:

  COUNT
    the axis displays the frequency count.

  PERCENT
    the axis displays values as a percentage of the total.

  PROPORTION
    the axis displays values as proportions (0.0 to 1.0) of the total.

Default: PERCENT

SHOWBINS
  specifies that the midpoints of the value bins are used to create the tick marks for
  the horizontal axis. By default, the tick marks are created at regular intervals based
  on the minimum and maximum values.
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TRANSPARENCY= numeric-value
specifies the degree of transparency for the histogram. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Default: 0.0

X2AXIS
assigns the response variable to the secondary (top) horizontal axis.

Y2AXIS
assigns the calculated values to the secondary (right) vertical axis.

HLINE Statement

Creates a horizontal line chart. You can use the HLINE statement with the HBAR statement to create a horizontal bar-line chart.

Interaction: The HLINE statement can be combined only with other categorization plot statements in the SGPLOT procedure. See “Plot Content” on page 124.

Syntax

HLINE category-variable < / option(s)>;

option(s) can be one or more options from the following categories:

- Line options:
  - ALPHA= numeric-value
  - BREAK
  - CURVELABEL <= text-string>
  - CURVELABELPOS= MIN | MAX | START | END
  - DATALABEL <= variable>
  - FREQ= numeric-variable
  - LIMITATTRS= style-element<(options)> | (options)
  - LIMITS= BOTH | LOWER | UPPER
  - LIMITSTAT= CLM | STDDEV | STDERR
  - LINEATTRS= style-element <(options)> | (options)
  - MARKERATTRS= style-element <(options)> | (options)
  - MARKERS
  - MISSING
  - NOSTATLABEL
  - NUMSTD= n
  - RESPONSE= response-variable
  - STAT= FREQ | MEAN | SUM
  - URL= character-variable
  - WEIGHT= numeric-variable

- Plot options:
  - GROUP= variable
**Required Arguments**

category-variable

specifies the variable that classifies the observations into distinct subsets.

**Options**

**ALPHA= numeric-value**

specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

Default: .05

Interaction: This option has no effect if you do not specify LIMITSTAT=CLM.

If your plot is overlaid with other summary plots, then the first ALPHA value that you specify is used for all of the plots.

**BREAK**

creates a break in the line for each missing value for the category variable.

**CURVELABEL <=“text-string”>**

adds a label for the line. You can also specify the label text. If you do not specify a label, then the label from the response variable is used.

**CURVELABELPOS= MIN | MAX | START | END**

specifies the location of the curve label. Specify one of the following values:

MIN

places the curve label at the minimum value for the response axis.

MAX

places the curve label at the maximum value for the response axis.

START

places the curve label at the first point on the curve.

END

places the curve label at the last point on the curve.

Default: END

**DATALABEL <= variable>**

displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the calculated response are used for the data labels.

**FREQ= numeric-variable**

specifies that each observation is repeated \( n \) times for computational purposes, where \( n \) is the value of the numeric variable. If \( n \) is not an integer, then it is truncated to an integer. If \( n \) is less than 1 or missing, then it is excluded from the analysis.

Interaction: If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.
GROUP= variable
specifies a variable that is used to group the data. A separate plot is created for each unique value of the grouping variable. The plot elements for each group value are automatically distinguished by different visual attributes.

Interaction: If you specify more than one categorization plot statement, then all of the plots must specify the same GROUP variable. If you do not specify the same GROUP= option for all of the categorization plots, then the GROUP= option has no effect.

LEGENDLABEL= "text-string"
specifies the label that identifies the line chart in the legend. By default, the label of the response variable is used. If there is no response variable label, then the name of the response variable and the computed statistic (SUM or MEAN) are used. If you do not specify a response variable, then the legend label is “Frequency”.

Interaction: The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

LIMITATTRS= style-element <(options)> | (options)
specifies the appearance of the limit lines in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: The default color is specified by the ContrastColor attribute of the GraphError style element in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.

Default: The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

Default: The default line thickness is specified by the LineThickness attribute of the GraphError style element in the current style.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

LIMITS= BOTH | LOWER | UPPER
adds limit lines to the plot. Specify one of the following values:

BOTH
adds lower and upper limit lines to the plot.

LOWER
adds lower limit lines to the plot.

UPPER
adds upper limit lines to the plot.

By default, no limit lines are displayed. However, if you specify the LIMITSTAT= option, then the default is BOTH.

Note: Limit lines are displayed only when you specify STAT= MEAN.
LIMITSTAT= CLM | STDDEV | STDERR
specifies the statistic for the limit lines. Specify one of the following statistics:

CLM
confidence limits
STDDEV
standard deviation
STDERR
standard error
Default: CLM
Interaction: If you specify the LIMITSTAT= option, then the default value for the LIMITS= option is BOTH.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the lines in the line chart. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:
COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphDatann style elements in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.

Default: For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphDataDefault style element in the current style.
For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphDatann style elements in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

Default: For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphDataDefault style element in the current style.
For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphDatann style elements in the current style.

MARKERAATTRS= style-element <(options)> | (options)
specifies the appearance of the markers in the plot. This option has no effect unless you also specify the MARKERS option. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:
COLOR= color
specifies the color of the markers. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphDataₙ style elements in the current style.

**SIZE=** \( n \ < \text{units} > \)

specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

**SYMBOL=** symbol-name

specifies the symbol for the markers. See “Marker Symbols” on page 126 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData₁ ... GraphDataₙ style elements in the current style.

**MARKERS**

adds markers to the plot.

**MISSING**

processes missing values as a valid category value and creates a line for it.

**NAME=** "text-string"

specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOSTATLABEL**

removes the statistic name from the axis and legend labels.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**NUMSTD=** \( n \)

specifies the number of standard units for the limit lines, when you specify LIMITSTAT= STDDEV or LIMITSTAT= STDERR. You can specify any positive number, including decimals.

**Default:** 1

**RESPONSE=** response-variable

specifies a numeric response variable for the plot. The summarized values of the response variable are displayed for each value on the horizontal axis.

**STAT=** FREQ | MEAN | SUM

specifies the statistic for the horizontal axis. Specify one of the following statistics:

- **FREQ**
  - the frequencies for the category variable

- **MEAN**
  - the mean of the response variable

- **SUM**
  - the sum of the response variable

If you do not specify the RESPONSE= option, then the FREQ statistic is the default. If you specify RESPONSE=, then the SUM statistic is the default.

**TRANSPARENCY=** numeric-value

specifies the degree of transparency for the lines and markers. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).
Default: 0.0

URL=character-variable
specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.

Interaction: This option affects graphics output that is created through the ODS HTML destination only.
This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.
Default: By default, no HTML links are created.

WEIGHT=numeric-variable
specifies that each observation is weighted by a factor of $w$ for computational purposes, where $w$ is the value of the numeric variable. $w$ can be any numeric value. If $w$ is 0, negative or missing, then that observation is excluded from the analysis.

Interaction: If your plot is overlaid with other categorization plots, then the first WEIGHT variable that you specified is used for all of the plots.

X2AXIS
assigns the response variable to the secondary (top) horizontal axis.

Y2AXIS
assigns the category variable to the secondary (right) vertical axis.

---

**INSET Statement**

Adds a text box inside of the axes of the plot.

**Syntax**

```
INSET "text-string-1" <... "text-string-n"> / option(s);
INSET (label-list) / option(s);
```

*option(s)* can be one or more of the following:
- BORDER | NOBORDER
- LABELALIGN= LEFT | CENTER | RIGHT
- POSITION= position-value
- TEXTATTRS= style-element
- TITLE= "text-string"
- TITLETEATTRS= style-element
- VALUEALIGN= LEFT | CENTER | RIGHT

**Required Arguments**

```
text-string-list | (label-list)
t```

you must specify one of the following arguments:

```
text-string-list
```
specifies one or more quoted text strings. Each string is placed on a separate line in the text box. For example, ‘‘My line 1’’ ‘‘My line 2’’.
(label-list)
specifies a series of quoted labels and values for the text box.

Specify your label-value pairs as follows:

("label-1" = "value-1" ... "label-n" = "value-n")

For example, (''My label 1'' = ''My value 1'' ''My label 2'' = ''My value 2'').

Options

BORDER | NOBORDER
specifies whether to display a border around the text box. The BORDER option
displays the border. The NOBORDER option hides the border.

LABELALIGN= LEFT | CENTER | RIGHT
specifies how the labels are aligned when you specify label-value pairs. Specify one of
the following:

LEFT
aligns the text to the left.

CENTER
aligns the text to the center.

RIGHT
aligns the text to the right.

Default: LEFT

POSITION= position-value
specifies the position of the text box within the plot. The position values are as
follows:

BOTTOM places the text box at the bottom of the graph.

BOTTOMLEFT places the text box at the bottom left corner of the graph.

BOTTOMRIGHT places the text box at the bottom right corner of the graph.

LEFT places the text box at the left side of the graph.

RIGHT places the text box at the right side of the graph.

TOP places the text box at the top of the graph.

TOPLEFT places the text box at the top left corner of the graph.

TOPRIGHT places the text box at the top right corner of the graph.

If you do not specify a position, then a position is determined automatically.

TEXTATTRS= style-element
specifies the appearance of the text in the text box.

Default: The default appearance of the text is specified by the GraphValueText style
element in the current style.

Tip: The GraphDataText style element makes the text slightly smaller. The
GraphLabelText style element makes the text slightly larger.

TITLE= "text-string"
specifies a title for the text box. The title text is always center-aligned.

TITLEATTRS= style-element
specifies the appearance of the title for the text box.
**KEYLEGEND Statement**

**Adds a legend to the plot.**

**Featured in:** Example 4 on page 216, Example 5 on page 217, Example 7 on page 219

**Syntax**

```plaintext
KEYLEGEND <"name-1" ... "name-n"> <\ option(s)>;
```

*option(s)* can be any of the following:
- `ACROSS= n`
- `BORDER | NOBORDER`
- `DOWN= n`
- `LOCATION= OUTSIDE | INSIDE`
- `POSITION= position-value`
- `TITLE= "text-string"`

**Optional Arguments**

*"name-1" ... "name-n"*

specifies the names of one or more plots that you want to include in legend. Each name that you specify must correspond to a value that you entered for the NAME= option in a plot statement.

**Note:** If you do not specify a name, then the legend contains references to all of the plots in the graph.
Options

**ACROSS= n**
specifies the number of columns in the legend. By default, the number of columns is determined automatically.

*Note:* Depending on the number of legend entries and the number of columns and rows that you specify, the legend might not fit in your graph. If your legend does not appear, then you might need to specify a different value for the ACROSS= option.

**BORDER | NOBORDER**
specifies whether the border around the legend is visible. The BORDER option shows the border. The NOBORDER option hides the border.

Default: BORDER

**DOWN= n**
specifies the number of rows in the legend. By default, the number of rows is determined automatically.

*Note:* Depending on the number of legend entries and the number of columns and rows that you specify, the legend might not fit in your graph. If your legend does not appear, then you might need to specify a different value for the DOWN= option.

**LOCATION= OUTSIDE | INSIDE**
specifies whether the legend is placed outside or inside of the axis area. The OUTSIDE option places the legend outside of the axis area. The INSIDE option places the legend inside of the axis area.

Default: OUTSIDE

**POSITION= position-value**
specifies the position of the legend within the graph. The positions are as follows:

- **BOTTOM** places the legend at the bottom of the graph.
- **BOTTOMLEFT** places the legend at the bottom left corner of the graph.
- **BOTTOMRIGHT** places the legend at the bottom right corner of the graph.
- **LEFT** places the legend at the left side of the graph.
- **RIGHT** places the legend at the right side of the graph.
- **TOP** places the legend at the top of the graph.
- **TOPLEFT** places the legend at the top left corner of the graph.
- **TOPRIGHT** places the legend at the top right corner of the graph.

*Note:* By default, if you use more than one KEYLEGEND statement, then each legend is placed in a different position.

*Note:* If you specify more than one legend with the same position, then all of your legends are placed at that position.

Default: BOTTOM

**TITLE= “text-string”**
specifies a title for the legend.
LOESS Statement

Creates a fitted loess curve.

Syntax

\[ \text{LOESS} \ X= \text{numeric-variable} \ Y= \text{numeric-variable} \ / \text{option(s)}>; \]

\text{option(s)} can be one or more options from the following categories:

- **LOESS options:**
  - ALPHA= numeric-value
  - CLM <= “text-string”>
  - CLMATTRS= style-element
  - CLMTRANSPARENCY= numeric-value
  - CURVELABEL <= “text-string”>
  - CURVELABELLOC= OUTSIDE | INSIDE
  - CURVELABELPOS= MIN | MAX | START | END
  - DATALABEL <= variable>
  - DEGREE= 1 | 2
  - INTERPOLATION= CUBIC | LINEAR
  - LINEATTRS= style-element <(options)> | (options)
  - MARKERATTRS= style-element <(options)> | (options)
  - MAXPOINTS= n
  - NOLEGCLM
  - NOLEGFIT
  - NOMARKERS
  - REWEIGHT= n
  - SMOOTH= numeric-value
  - WEIGHT= numeric-variable

- **Plot options:**
  - GROUP= variable
  - LEGENDLABEL= “text-string”
  - NAME= “text-string”
  - X2AXIS
  - Y2AXIS

**Required Arguments**

- **X= numeric-variable**
  - specifies the variable for the x axis.

- **Y= numeric-variable**
  - specifies the variable for the y axis.
Options

ALPHA= numeric-value
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

Note: This option has no effect if you do not specify the CLM option.
Default: .05

CLM= "text-string">
creates confidence limits. The optional text string overrides the default legend label for the confidence limit.

CLMATTRS = style-element
specifies the appearance of the confidence limits by using an ODS style element.
Default: The default appearance of the confidence limits is specified by the GraphConfidence style element in the current style.

CLMTRANSPARENCY= numeric-value
specifies the degree of transparency for the confidence limits. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Note: This option has no effect if you do not specify the CLM option.
Default: 0.0

CURVELABEL <= "text-string">
adds a label for the loess curve. You can also specify the label text. If you do not specify a label, the label from the Y variable is used.

CURVELABELLOC= OUTSIDE | INSIDE
specifies whether the curve label is placed inside the plot axes (INSIDE) or outside of the plot axes (OUTSIDE).
Default: INSIDE

CURVELABELPOS= MIN | MAX | START | END
specifies the location of the curve label. Specify one of the following values:

MIN
places the curve label at the minimum value for the X axis.

MAX
places the curve label at the maximum value for the X axis.

START
places the curve label at the first point on the curve.

END
places the curve label at the last point on the curve.
Default: END

DATALABEL <= variable>
displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.
Interaction: This option has no effect if you also specify the NOMARKERS option.

DEGREE= 1 | 2
specifies the degree of the local polynomials to use for each local regression. 1 specifies a linear fit and 2 specifies a quadratic fit.
Default:  1

GROUP= variable

specifies a variable that is used to group the data. A separate plot is created for each
unique value of the category variable. The plot elements for each group value are
automatically distinguished by different visual attributes.

Interaction:  If you specify the GROUP= option in multiple fit plot statements, then
the first GROUP= variable is used for all of the fit plots that specify GROUP=.

INTERPOLATION= CUBIC | LINEAR

specifies the degree of the interpolating polynomials that are used for blending local
polynomial fits at the kd tree vertices.

Default:  CUBIC

LEGENDLABEL= "text-string"

specifies a label that identifies the fit line in the legend. By default, the label “Loess”
is used, along with the value of the SMOOTH= option if specified.

LINEATTRS= style-element <(options)> | (options)

specifies the appearance of the fit curve. You can specify the appearance by using a
style element or by using suboptions. If you specify a style element, you can
additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color

specifies the color of the line. For more information about specifying colors, see the
“SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default:  For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphFit style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute
of the GraphData1 ... GraphData n style elements in the current style.

PATTERN= line-pattern

specifies the line pattern for the line. You can reference SAS patterns by number
or by name. See “Line Patterns” on page 127 for a list of line patterns.

Default:  For ungrouped data, the default line pattern is specified by the LineStyle
attribute of the GraphFit style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle
attribute of the GraphData1 ... GraphData n style elements in the current style.

THICKNESS= n <units>

specifies the thickness of the line. You can also specify the unit of measure. The
default unit is pixels. See “Units of Measurement” on page 126 for a list of the
measurement units that are supported.

Default:  For ungrouped data, the default line thickness is specified by the
LineThickness attribute of the GraphFit style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness
attribute of the GraphData1 ... GraphData n style elements in the current style.

MARKERATTRS= style-element <(options)> | (options)

specifies the appearance of the markers in the plot. You can specify the appearance
by using a style element or by using suboptions. If you specify a style element, you
can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color

specifies the color of the markers. For more information about specifying colors,
see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.
**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData$n$ style elements in the current style.

**SIZE=** $n <$units $>$

specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

**SYMBOL=** symbol-name

specifies the symbol for the markers. See “Marker Symbols” on page 126 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData$n$ style elements in the current style.

**MAXPOINTS=** $n$

specifies the maximum number of predicted points for the loess fit and the corresponding limits.

**Default:** 201

**NAME=** "text-string"

specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOLEGCLM**

hides the legend entry for the mean value confidence limits.

**NOLEGFIT**

hides the legend entry for the fit line.

**NOMARKERS**

removes the scatter markers from the plot.

**REWEIGHT=** $n$

specifies the number of iterative reweighting steps to apply to the data.

*Note:* This option has no affect if you do not specify the WEIGHT option.

**Default:** 0

**SMOOTH=** numeric-value

specifies a smoothing parameter value. If you do not specify this option, a smoothing value is determined automatically.

**WEIGHT=** numeric-variable

specifies that each observation is weighted by a factor of $w$ for computational purposes, where $w$ is the value of the numeric variable. $w$ can be any numeric value. If $w$ is 0, negative or missing, then that observation is excluded from the analysis.

**X2AXIS**

assigns the X variable to the secondary (top) horizontal axis.

**Y2AXIS**

assigns the Y variable to the secondary (right) vertical axis.
Details

For the SMOOTH= option, the smoothing parameter value must be greater than the minimum value that is determined by the following equation:

\[
\text{minimum} = \frac{\text{degree} + 1}{\text{number of observations}}
\]

NEEDLE Statement

Creates a plot with needles connecting each point to the baseline.

Restriction: The vertical axis that is used with the NEEDLE statement cannot be a discrete axis.

Syntax

```
NEEDLE X= variable Y= numeric-variable </ option(s)>;
```

`option(s)` can be one or more options from the following categories:

- **NEEDLE options**:
  - BASELINE= numeric-value
  - DATALABEL <= variable>
  - LINEATTRS= style-element <(options)> | (options)
  - MARKERATTRS= style-element <(options)> | (options)
  - MARKERS
  - NOMISSINGGROUP
  - URL= character-variable

- **Plot options**:
  - GROUP= variable
  - LEGENDLABEL= “text-string”
  - NAME= “text-string”
  - TRANSPARENCY= numeric-value
  - X2AXIS
  - Y2AXIS

Required Arguments

- **X= variable**
  
  specifies the variable for the x axis.

- **Y= numeric-variable**
  
  specifies the variable for the y axis.
Options

**BASELINE= numeric-value**
specifies a value on the Y axis for the baseline.

**DATALABEL <= variable>**
displays a label for each data point. If you specify a variable, the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.

**GROUP= variable**
specifies a variable that is used to group the data. A separate plot is created for each unique value of the grouping variable. The plot elements for each group value are automatically distinguished by different visual attributes.

**LEGENDLABEL=" text-string"**
specifies a label that identifies the needle plot in the legend. By default, the label of the Y variable or the group value for each marker is used.

**Interaction:** The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

**LINEATTRS= style-element <(options)> | (options)**
specifies the appearance of the needle lines. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

- **COLOR= color**
specifies the color of the line. For more information about specifying colors, see the "SAS/GRA\textit{P}H Colors and Images" chapter in the \textit{SAS/GRA\textit{P}H: Reference}.

  **Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

  For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData\textit{n} style elements in the current style.

- **PATTERN= line-pattern**
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.

  **Default:** For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphDataDefault style element in the current style.

  For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData\textit{n} style elements in the current style.

- **THICKNESS= \textit{n} <units>**
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

  **Default:** For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphDataDefault style element in the current style.

  For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData\textit{n} style elements in the current style.

**MARKERATTRS= style-element <(options)> | (options)**
specifies the appearance of the markers in the plot. This option has no effect unless you also specify the MARKERS option. You can specify the appearance by using a
style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

_options_ can be one or more of the following:

**COLOR=** *color*

specifies the color of the markers. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData*n* style elements in the current style.

**SIZE=** *n <units>*

specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

**SYMBOL=** *symbol-name*

specifies the symbol for the markers. See “Marker Symbols” on page 126 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData*n* style elements in the current style.

**MARKERS**

adds markers to the tips of the needles.

**NAME=** "*text-string*"

specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOMISSINGGROUP**

specifies that missing values of the group variable are not included in the plot.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**TRANSPARENCY=** *numeric-value*

specifies the degree of transparency for the needle plot. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

**Default:** 0.0

**URL=** *character-variable*

specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.

**Interaction:** This option affects graphics output that is created through the ODS HTML destination only.

This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.

**Default:** By default, no HTML links are created.

**X2AXIS**

assigns the X variable to the secondary (top) horizontal axis.
**Y2AXIS**
assigns the Y variable to the secondary (right) vertical axis.

---

**PBSPLINE Statement**

Creates a fitted penalized B-spline curve.

**Syntax**

```plaintext
PBSPLINE x= numeric-variable y= numeric-variable < / options>
```

`option(s)` can be one or more options from the following categories:

- **PBSPLINE options:**
  - ALPHA= numeric-value
  - CLI <= "text-string”>
  - CLIATTRS= style-element
  - CLM <= “text-string”>
  - CLMATTRS= style-element
  - CLMTRANSPARENCY= value
  - CURVELABEL <= “text-string”>
  - CURVELABELLOC= OUTSIDE | INSIDE
  - CURVELABELPOS= MIN | MAX | START | END
  - DATALABEL <= variable>
  - DEGREE= n
  - FREQ= numeric-variable
  - LINEATTRS= style-element (<options>) | (options)
  - MARKERATTRS= style-element (<options>) | (options)
  - MAXPOINTS= n
  - NKNOTS= n
  - NOLEGCLI
  - NOLEGCLM
  - NOLEGFIT
  - NOMARKERS
  - SMOOTH= numeric-value
  - WEIGHT= numeric-variable

- **Plot options:**
  - GROUP= variable
  - LEGENDLABEL= “text-string”
  - NAME= “text-string”
  - X2AXIS
  - Y2AXIS
Required Arguments

\textbf{X=} \texttt{numeric-variable} \\
\hspace{1em} specifies the variable for the x axis.

\textbf{Y=} \texttt{numeric-variable} \\
\hspace{1em} specifies the variable for the y axis.

Options

\textbf{ALPHA=} \texttt{numeric-value} \\
\hspace{1em} specifies the confidence level for the confidence limits. Specify a number between 0.00 (100\% confidence) and 1.00 (0\% confidence).

\textit{Note:} This option has no effect if you do not specify either the CLI option or CLM option. △

\textbf{Default:} .05

\textbf{CLI <= “text-string”> } \hspace{1em} creates prediction limits for the individual predicted values. The optional text string overrides the default legend label for the prediction limits.

\textbf{CLIATTRS = style-element} \\
\hspace{1em} specifies the appearance of the individual value prediction limits by using an ODS style element.

\textbf{Default:} The default appearance of the prediction limits is specified by the GraphPredictionLimits style element in the current style.

\textbf{CLM <= “text-string”> } \hspace{1em} creates confidence limits for the mean predicted values. The optional text string overrides the default legend label for the confidence limits.

\textbf{CLMATTRS = style-element} \\
\hspace{1em} specifies the appearance of the mean value confidence limits by using an ODS style element.

\textbf{Default:} The default appearance of the confidence limits is specified by the GraphConfidence style element in the current style.

\textbf{CLMTRANSPARENCY= numeric-value} \\
\hspace{1em} specifies the degree of transparency for the confidence limits. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

\textit{Note:} This option has no effect if you do not specify the CLM option. △

\textbf{Default:} 0.0

\textbf{CURVELABEL <= “text-string”> } \hspace{1em} adds a label for the spline curve. You can also specify the label text. If you do not specify a label, then the label from the Y variable is used.

\textbf{CURVELABELLOC= OUTSIDE | INSIDE} \\
\hspace{1em} specifies whether the curve label is placed inside the plot axes (INSIDE) or outside of the plot axes (OUTSIDE).

\textbf{Default:} INSIDE
CURVELABELPOS= MIN | MAX | START | END
specifies the location of the curve label. Specify one of the following values:

MIN
places the curve label at the minimum value for the X axis.

MAX
places the curve label at the maximum value for the X axis.

START
places the curve label at the first point on the curve.

END
places the curve label at the last point on the curve.
Default: END

DATALABEL <= variable>
displays a label for each scatter point. If you specify a variable, the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.
Interaction: This option has no effect if you also specify the NOMARKERS option.

DEGREE= n
specifies the degree of the spline transformation.
Default: 3

FREQ= numeric-variable
specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.

GROUP= variable
specifies a variable that is used to group the data. A separate plot is created for each unique value of the grouping variable. The plot elements for each group value are automatically distinguished by different visual attributes.
Interaction: If you specify the GROUP= option in multiple fit plot statements, then the first GROUP= variable is used for all of the fit plots that specify GROUP=.

LEGENDLABEL= “text-string”
specifies a label that identifies the b-spline curve in the legend. By default, the label “Penalized B-Spline” is used with the SMOOTH= value if specified, or else the group value for each b-spline is used.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the fitted curve. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.
options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.
Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphFit style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.
**PBSPLINE Statement**

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**Default**: For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphFit style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData n style elements in the current style.

**THICKNESS**= n <units>

specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default**: For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphFit style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData n style elements in the current style.

**MARKERATTRS**= style-element <(options)> | (options)

specifies the appearance of the markers in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

**options** can be one or more of the following:

**COLOR**= color

specifies the color of the markers. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

**Default**: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.

**SIZE**= n <units>

specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default**: The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

**SYMBOL**= symbol-name

specifies the symbol for the markers. See “Marker Symbols” on page 126 for a list of valid marker symbols.

**Default**: For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData n style elements in the current style.

**MAXPOINTS**= n

specifies the maximum number of predicted points for the spline curve and for any confidence limits.

**Default**: 201

**NAME**= “text-string”

specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NKNOTS**= n

specifies the number of evenly spaced internal knots.

**Default**: 100
**Range:** 1 to 1000

**NOLEGCLI**
- hides the legend entry for the individual value prediction limits.

**NOLEGCLM**
- hides the legend entry for the mean value confidence limits.

**NOLEGFIT**
- hides the legend entry for the fit line.

**NOMARKERS**
- removes the scatter markers from the plot.

**SMOOTH= numeric-value**
- specifies a smoothing parameter value. If you do not specify this option, a smoothing value is determined automatically.

**WEIGHT= numeric-variable**
- specifies that each observation is weighted by a factor of \( w \) for computational purposes, where \( w \) is the value of the numeric variable. \( w \) can be any numeric value. If \( w \) is 0, negative or missing, then that observation is excluded from the analysis.

**X2AXIS**
- assigns the X variable to the secondary (top) horizontal axis.

**Y2AXIS**
- assigns the Y variable to the secondary (right) vertical axis.

**Details**

For the SMOOTH= option, the smoothing parameter value must be greater than the minimum value that is determined by the following equation:

\[
\text{minimum} = \frac{\text{degree} + 1}{\text{number of observations}}
\]

---

**REFLINE Statement**

Creates a horizontal or vertical reference line.

**Syntax**

```
REFLINE variable | value-1 <... value-n> / option(s);
```

- `option(s)` can be one or more options from the following categories:
  - **REFLINE options:**
    - `AXIS= X | X2 | Y | Y2`
    - `LABEL <= ("text-string-1" ... "text-string-n")>`
    - `LABELLOC= INSIDE | OUTSIDE`
    - `LABELPOS= AUTO | MIN | MAX`
    - `LINEATTRS= style-element <(options)> | (options)`
    - `NOCLIP`
REFLINE Statement

Plot options:

- LEGENDLABEL="text-string"
- NAME="text-string"
- TRANSPARENCY= numeric-value

Required Arguments

variable
draws a reference line for each value of the specified variable.

Restriction: This argument is available with SAS 9.2 Phase 2 and later.

value-1 <... value-n>
draws one or more reference lines at the values that you specify.

Options

AXIS= X | X2 | Y | Y2
specifies the axis that contains the reference line values. For example, if you specify AXIS= X, vertical reference lines are drawn at points on the X axis.

Default: Y

LABEL <= ("text-string-1" ... "text-string-n")>
creates labels for each reference line. If you do not specify a label for a line, the reference value for that line is used as the label.

LABELLOC= INSIDE | OUTSIDE
specifies whether the labels are placed inside or outside of the plot area. The INSIDE option places the labels inside of the plot area. The OUTSIDE option places the labels outside of the plot area.

Default: INSIDE

LABELPOS= AUTO | MIN | MAX
specifies the position of the labels. MIN specifies the label is placed at the minimum value of the data axis. MAX specifies that the label is placed at the maximum value of the data axis. AUTO places the label automatically.

Default: AUTO

LEGENDLABEL= “text-string”
specifies a label that identifies the markers from the plot in the legend. By default, the label “Reference Line” is used.

Interaction: This option has no effect unless you also specify the NAME= option.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the reference line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

Default: The default color is specified by the ContrastColor attribute of the GraphReference style element in the current style.
**REG Statement**

Creates a fitted regression line or curve.

Interaction: A linear regression (DEGREE=1) cannot be used with logarithmic axes.

Featured in: Example 3 on page 215

Syntax

`REG X= numeric-variable Y= numeric-variable < / option(s)>;`

`option(s)` can be one or more options from the following categories:

- **REG options:**
  - `ALPHA= numeric-value`
  - `CLI <= "text-string”>`
  - `CLIATTRS= style-element`
  - `CLM <= "text-string”>`
  - `CLMATTRS= style-element`
  - `CLMTRANSPARENCY= value`
  - `CURVELABEL <= "text-string”>`
  - `CURVELABELLOC= OUTSIDE | INSIDE`
CURVELABELPOS= MIN | MAX | START | END
DATALABEL <= variable >
DEGREE= n
FREQ= numeric-variable
LINEATTRS= style-element <(options)> | (options)
MARKERATTRS= style-element <(options)> | (options)
MAXPOINTS= n
NOLEGCLI
NOLEGCLM
NOLEGFIT
NOMARKERS
WEIGHT= numeric-variable
□ Plot options:
  GROUP= variable
  LEGENDLABEL= "text-string"
  NAME= "text-string"
X2AXIS
Y2AXIS

Required Arguments

X= numeric-variable
  specifies the variable for the x axis.

Y= numeric-variable
  specifies the variable for the y axis.

Options

ALPHA= numeric-value
  specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

  Note: This option has no effect if you do not specify either the CLI option or CLM option. △
  Default: .05

CLI <= "text-string”>
  creates prediction limits for the individual predicted values. The optional text string overrides the default legend label for the prediction limits.

CLIATTRS = style-element
  specifies the appearance of the individual value prediction limits by using an ODS style element.
  Default: The default appearance of the prediction limits is specified by the GraphPredictionLimits style element in the current style.

CLM <= "text-string”>
  creates confidence limits for the mean predicted values. The optional text string overrides the default legend label for the confidence limits.
CLMATTRS = style-element
specifies the appearance of the mean value confidence limits by using an ODS style element.

Default: The default appearance of the confidence limits is specified by the GraphConfidence style element in the current style.

CLMTRANSPARENCY= numeric-value
specifies the degree of transparency for the confidence limits. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Note: This option has no effect if you do not specify the CLM option. △

Default: 0.0

CURVELABEL <="text-string”>
adds a label for the regression curve. You can also specify the label text. If you do not specify a label, then the label from the Y variable is used.

CURVELABELLOC= OUTSIDE | INSIDE
specifies whether the curve label is placed inside the plot axes (INSIDE) or outside of the plot axes (OUTSIDE).

Default: INSIDE

CURVELABELPOS= MIN | MAX | START | END
specifies the location of the curve label. Specify one of the following values:

MIN
  places the curve label at the minimum value for the X axis.

MAX
  places the curve label at the maximum value for the X axis.

START
  places the curve label at the first point on the curve.

END
  places the curve label at the last point on the curve.

Default: END

DATALABEL <= variable>
displays a label for each scatter point. If you specify a variable, the values of that variable are used for the data labels. If you do not specify a variable, then the value of the Y variable is used for the data label.

Interaction: This option has no effect if you also specify the NOMARKERS option.

DEGREE= n
specifies the degree of the polynomial fit. For example, 1 specifies a linear fit, 2 specifies a quadratic fit, and 3 specifies a cubic fit.

Default: 1

FREQ= numeric-variable
specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.

GROUP= variable
specifies a variable that is used to group the data. A separate plot is created for each unique value of the grouping variable. The plot elements for each group value are automatically distinguished by different visual attributes.

Interaction: If you specify the GROUP= option in multiple fit plot statements, then the first GROUP= variable is used for all of the fit plots that specify GROUP=. 
LEGENDLABEL= "text-string"
specifies a label that identifies the regression curve in the legend. By default, the
label “Regression” is used.

Interaction: The LEGENDLABEL= option has no effect if you also specify the
GROUP= option in the same plot statement.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the fit line. You can specify the appearance by using a
style element or by using suboptions. If you specify a style element, then you can
also specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the
“SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphFit style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute
of the GraphData1 ... GraphData_n style elements in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number
or by name. See “Line Patterns” on page 127 for a list of line patterns.

Default: For ungrouped data, the default line pattern is specified by the LineStyle
attribute of the GraphFit style element in the current style.
For grouped data, the default line pattern is specified by the LineStyle
attribute of the GraphData1 ... GraphData_n style elements in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The
default unit is pixels. See “Units of Measurement” on page 126 for a list of the
measurement units that are supported.

Default: For ungrouped data, the default line thickness is specified by the
LineThickness attribute of the GraphFit style element in the current style.
For grouped data, the default line thickness is specified by the LineThickness
attribute of the GraphData1 ... GraphData_n style elements in the current style.

MARKERATTRS= style-element <(options)> | (options)
specifies the appearance of the markers in the plot. You can specify the appearance
by using a style element or by using suboptions. If you specify a style element, you
can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the markers. For more information about specifying colors,
see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute
of the GraphData1 ... GraphData_n style elements in the current style.

SIZE= n <units>
specifies the size of the markers. You can also specify the unit of measurement.
The default unit is pixels. See “Units of Measurement” on page 126 for a list of the
measurement units that are supported.

Default: The default marker size is specified by the MarkerSize attribute of the
GraphDataDefault style element in the current style.
The SGPLOT Procedure

SCATTER Statement

SYMBOL= symbol-name
specifies the symbol for the markers. See “Marker Symbols” on page 126 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData n style elements in the current style.

MAXPOINTS= n
specifies the maximum number of predicted points for the regression curve and for any confidence limits.

**Default:** 10

NAME= “text-string”
specifies a name for the plot. You can use the name to refer to this plot in other statements.

NOLEGCLI
hides the legend entry for the individual value confidence limits.

NOLEGCLM
hides the legend entry for the mean value confidence limits.

NOLEGFIT
hides the legend entry for the fit line.

NOMARKERS
removes the scatter markers from the plot.

WEIGHT= numeric-variable
specifies that each observation is weighted by a factor of w for computational purposes, where w is the value of the numeric variable. w can be any numeric value. If w is 0, negative or missing, then that observation is excluded from the analysis.

X2AXIS
assigns the X variable to the secondary (top) horizontal axis.

Y2AXIS
assigns the Y variable to the secondary (right) vertical axis.

SCATTER Statement

Creates a scatter plot.

**Featured in:** Example 1 on page 213, Example 4 on page 216, Example 5 on page 217

**Syntax**

**SCATTER X= variable Y= variable < / option(s)>;**
option(s) can be one or more options from the following categories:

- **SCATTER options:**
  - `DATALABEL <= variable>`
  - `ERRORBARATTRS= style-element<(options)> | (options)`
  - `FREQ= numeric-variable`
  - `MARKERATTRS= style-element <(options)> | (options)`
  - `MARKERCHAR= variable`
  - `MARKERCHARATTRS= style-element <(options)> | (options)`
  - `NOMISSINGGROUP`
  - `URL= character-variable`
  - `XERRORLOWER= numeric-variable`
  - `XERRORUPPER= numeric-variable`
  - `YERRORLOWER= numeric-variable`
  - `YERRORUPPER= numeric-variable`

- **Plot options:**
  - `GROUP= variable`
  - `LEGENDLABEL= “text-string”`
  - `NAME= “text-string”`
  - `TRANSPARENCY= numeric-value`
  - `X2AXIS`
  - `Y2AXIS`

### Required Arguments

- **X= variable**
  - specifies the variable for the x axis.

- **Y= variable**
  - specifies the variable for the y axis.

### Options

#### `DATALABEL <= variable>`
- displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.

#### `ERRORBARATTRS= style-element<(options)> | (options)`
- specifies the appearance of the error bars in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.
  - `options` can be one or more of the following:
    - `COLOR= color`
      - specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.
      - **Default:** The default color is specified by the ContrastColor attribute of the `GraphError` style element in the current style.
PATTERN= line-pattern
    specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.
    **Default:** The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.

THICKNESS= n <unit>
    specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.
    **Default:** The default line thickness is specified by the LineThickness attribute of the GraphError style element in the current style.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

FREQ= numeric-variable
    specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.

GROUP= variable
    specifies a variable that is used to group the data. A separate plot is created for each unique value of the grouping variable. The plot elements for each group value are automatically distinguished by different visual attributes.

LEGENDLABEL= "text-string"
    specifies a label that identifies the markers from the plot in the legend. By default, the label of the Y variable or the group value for each marker is used.
    **Interaction:** The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

MARKERATTRS= style-element <(options)> | (options)
    specifies the appearance of the markers in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.
    **options** can be one or more of the following:

    COLOR= color
        specifies the color of the markers. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.
        **Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.
        For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.

    SIZE= n <unit>
        specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.
        **Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

    SYMBOL= symbol-name
        specifies the symbol for the markers. See “Marker Symbols” on page 126 for a list of valid marker symbols.
        **Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.
For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphDataN style elements in the current style.

**MARKERCHAR= variable**
specifies a variable whose values replace the marker symbols in the plot. If a format is associated with the variable, then the formatted values are used as the marker symbols. If there is not a format associated with the variable and the variable contains numeric data, then the BEST6. format is used.

**Note:** The MARKERCHAR= option overrides the DATALABEL= option and the SYMBOL= suboption of the MARKERS= option.

**MARKERCHARATTRS= style-element <(options)> | (options)**
specifies the appearance of the markers in the plot when you use the MARKERCHAR= option. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

**options** can be one or more of the following:

**COLOR= color**
specifies the color of the marker characters. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataText style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphDataN style elements in the current style.

**FAMILY= “font-family”**
specifies the font family for the marker characters.

**Default:** The default font family is specified by the FontFamily attribute of the GraphDataText style element in the current style.

**SIZE= n < units >**
specifies the font size of the marker characters. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default:** The default font size is specified by the FontSize attribute of the GraphDataText style element in the current style.

**STYLE= ITALIC | NORMAL**
specifies whether the marker characters are italic (ITALIC) or normal (NORMAL).

**Default:** The default font style is specified by the FontStyle attribute of the GraphDataText style element in the current style.

**WEIGHT= BOLD | NORMAL**
specifies whether the marker characters are bold (BOLD) or normal (NORMAL).

**Default:** The default font weight is specified by the FontWeight attribute of the GraphDataText style element in the current style.

**NAME= “text-string”**
specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOMISSINGGROUP**
specifies that missing values of the group variable are not included in the plot.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.
TRANSPARENCY= numeric-value
specifies the degree of transparency for the markers and error bars. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).
Default: 0.0

URL= character-variable
specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.
Interaction: This option affects graphics output that is created through the ODS HTML destination only.
This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.
Default: By default, no HTML links are created.

X2AXIS
assigns the X variable to the secondary (top) horizontal axis.

XERRORLOWER= numeric-variable
specifies a variable that contains the lower endpoints for the X error bars.

XERRORUPPER= numeric-variable
specifies a variable that contains the upper endpoints for the X error bars.

Y2AXIS
assigns the Y variable to the secondary (right) vertical axis.

YERRORLOWER= numeric-variable
specifies a variable that contains the lower endpoints for the Y error bars.

YERRORUPPER= numeric-variable
specifies a variable that contains the upper endpoints for the Y error bars.

---

SERIES Statement

Creates a line plot.

Featured in: Example 2 on page 214

Syntax

SERIES X= variable Y= variable < / option(s)>;

option(s) can be one or more options from the following categories:

- SERIES options:
  BREAK
  CURVELABEL <= text-string>
  CURVELABELLOC= INSIDE | OUTSIDE
  CURVELABELPOS= MIN | MAX | START | END
  DATALABEL <= variable>
  LINEATTRS= style-element <(options)> | (options)
  MARKERATTRS= style-element <(options)> | (options)
MARKERS
NOMISSINGGROUP
URL= character-variable

☐ Plot options:
  GROUP= variable
  LEGENDLABEL= “text-string”
  NAME= “text-string”
  TRANSPARENCY= numeric-value
  X2AXIS
  Y2AXIS

Required Arguments

X= variable
specifies the variable for the x axis.

Y= variable
specifies the variable for the y axis.

Options

BREAK
creates a break in the line for each missing value for the Y variable.

CURVELABEL <=“text-string”>
adds a label for the series curve. You can also specify the label text. If you do not specify a label, then the label from the Y variable is used.

CURVELABELLOC= OUTSIDE | INSIDE
specifies whether the curve label is placed inside the plot axes (INSIDE) or outside of the plot axes (OUTSIDE).
  Default: INSIDE

CURVELABELPOS= MIN | MAX | START | END
specifies the location of the curve label. Specify one of the following values:
  MIN
  places the curve label at the minimum value for the X axis.
  MAX
  places the curve label at the maximum value for the X axis.
  START
  places the curve label at the first point on the curve.
  END
  places the curve label at the last point on the curve.
  Default: END

DATALABEL <= variable>
displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.
GROUP= variable
specifies a variable that is used to group the data. A separate plot is created for each
unique value of the grouping variable. The plot elements for each group value are
automatically distinguished by different visual attributes.

LEGENDLABEL= “text-string”
specifies a label that identifies the series plot in the legend. By default, the label of
the Y variable or the group value for each marker is used.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the series line. You can specify the appearance by using a
style element or by using suboptions. If you specify a style element, you can
additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the
"SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute
of the GraphData1 ... GraphDataN style elements in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number
or by name. See “Line Patterns” on page 127 for a list of line patterns.

Default: For ungrouped data, the default line pattern is specified by the LineStyle
attribute of the GraphDataDefault style element in the current style.
For grouped data, the default line pattern is specified by the LineStyle
attribute of the GraphData1 ... GraphDataN style elements in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The
default unit is pixels. See “Units of Measurement” on page 126 for a list of the
measurement units that are supported.

Default: For ungrouped data, the default line thickness is specified by the
LineThickness attribute of the GraphDataDefault style element in the current style.
For grouped data, the default line thickness is specified by the LineThickness
attribute of the GraphData1 ... GraphDataN style elements in the current style.

MARKERATTRS= style-element <(options)> | (options)
specifies the appearance of the markers in the plot. This option has no effect unless
you also specify the MARKERS option. You can specify the appearance by using a
style element or by using suboptions. If you specify a style element, you can
additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the markers. For more information about specifying colors,
see the "SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor
attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute
of the GraphData1 ... GraphDataN style elements in the current style.
SIZE= n <units >
specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

SYMBOL= symbol-name
specifies the symbol for the markers. See “Marker Symbols” on page 126 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData n style elements in the current style.

**MARKERS**
adds data point markers to the series plot data points.

**NAME= “text-string”**
specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOMISSINGGROUP**
specifies that missing values of the group variable are not included in the plot.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**TRANSPARENCY= numeric-value**
specifies the degree of transparency for the lines and markers. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

**Default:** 0.0

**URL= character-variable**
specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.

**Interaction:** This option affects graphics output that is created through the ODS HTML destination only.

This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.

**Default:** By default, no HTML links are created.

**X2AXIS**
assigns the X variable to the secondary (top) horizontal axis.

**Y2AXIS**
assigns the Y variable to the secondary (right) vertical axis.

---

**STEP Statement**

**Creates a step plot.**

**Restriction:** The vertical axis that is used with the STEP statement cannot be a discrete axis.
### Syntax

**STEP** `X= variable Y= numeric-variable < / option(s)>;`  

*option(s)* can be one or more options from the following categories:

- **STEP options:**
  - **BREAK**
  - **CURVELABEL <= text-string>**
  - **CURVELABELLOC= INSIDE | OUTSIDE**
  - **CURVELABELPOS= MIN | MAX | START | END**
  - **DATALABEL <= variable>**
  - **ERRORBARATTRS= style-element <(options)> | (options)**
  - **JUSTIFY= LEFT | CENTER | RIGHT**
  - **LINEATTRS= style-element <(options)> | (options)**
  - **MARKERATTRS= style-element <(options)> | (options)**
  - **MARKERS**
  - **NOMISSINGGROUP**
  - **URL= character-variable**
  - **YERRORLOWER= numeric-variable**
  - **YERRORUPPER= numeric-variable**

- **Plot options:**
  - **GROUP= variable**
  - **LEGENDLABEL= “text-string”**
  - **NAME= “text-string”**
  - **TRANSPARENCY= numeric-value**
  - **X2AXIS**
  - **Y2AXIS**

### Required Arguments

- **X= variable**  
  specifies the variable for the x axis.

- **Y= numeric-variable**  
  specifies the variable for the y axis.

### Options

- **BREAK**  
  creates a break in the line for each missing value for the Y variable.

- **CURVELABEL <=“text-string”>**  
  adds a label for the step curve. You can also specify the label text. If you do not specify a label, then the label from the Y variable is used.

- **CURVELABELLOC= OUTSIDE | INSIDE**  
  specifies whether the curve label is placed inside the plot axes (INSIDE) or outside of the plot axes (OUTSIDE).
**Default:** INSIDE

**CURVELABELPOS= MIN | MAX | START | END**
specifies the location of the curve label. Specify one of the following values:

**MIN**
places the curve label at the minimum value for the response axis.

**MAX**
places the curve label at the maximum value for the response axis.

**START**
places the curve label at the first point on the curve.

**END**
places the curve label at the last point on the curve.

**Default:** END

**DATALABEL <= variable>**
displays a label for each data point. If you specify a variable, the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.

**ERRORBARATTRS= style-element <(options)> | (options)**
specifies the appearance of the error bars in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

**options** can be one or more of the following:

**COLOR= color**
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

**Default:** The default color is specified by the ContrastColor attribute of the GraphError style element in the current style.

**PATTERN= line-pattern**
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.

**Default:** The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.

**THICKNESS= n <units>**
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default:** The default line thickness is specified by the LineThickness attribute of the GraphError style element in the current style.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**GROUP= variable**
specifies a variable that is used to group the data. A separate plot is created for each unique value of the grouping variable. The plot elements for each group value are automatically distinguished by different visual attributes.
JUSTIFY= LEFT | CENTER | RIGHT
specifies the location of each step relative to its data point. Figure 4.5 on page 189 shows the effect of each option:

Figure 4.5  Values for JUSTIFY=

```
  LEFT | CENTER | RIGHT
```

LEGENDLABEL= “text-string”
specifies a label that identifies the step plot in the legend. By default, the label of the Y variable or the group value for each marker is used.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the step line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

- **COLOR= color**
specifies the color of the line. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.

  Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.
  
  For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData\(n\) style elements in the current style.

- **PATTERN= line-pattern**
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.

  Default: For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphDataDefault style element in the current style.
  
  For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData\(n\) style elements in the current style.

- **THICKNESS= n <units>**
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

  Default: For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphDataDefault style element in the current style.
  
  For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData\(n\) style elements in the current style.

MARKERATTRS= style-element <(options)> | (options)
specifies the appearance of the markers in the plot. This option has no effect unless you also specify the MARKERS option. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.
options can be one or more of the following:

**COLOR=** *color*

specifies the color of the markers. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData*n* style elements in the current style.

**SIZE=** *n* <units >

specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

**SYMBOL=** *symbol-name*

specifies the symbol for the markers. See “Marker Symbols” on page 126 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData*n* style elements in the current style.

**MARKERS**

adds markers to the step plot data points.

**NAME=** “*text-string***

specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOMISSINGGROUP**

specifies that missing values of the group variable are not included in the plot.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**TRANSPARENCY=** *numeric-value*

specifies the degree of transparency for the lines. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

**Default:** 0.0

**URL=** *character-variable*

specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.

**Interaction:** This option affects graphics output that is created through the ODS HTML destination only.

This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.

**Default:** By default, no HTML links are created.

**X2AXIS**

assigns the X variable to the secondary (top) horizontal axis.

**YERRORLOWER=** *numeric-variable*

specifies a variable that contains the lower endpoints for the Y error bars.
YERRORUPPER= numeric-variable  
specifies a variable that contains the upper endpoints for the Y error bars.

Y2AXIS  
assigns the Y variable to the secondary (right) vertical axis.

---

**VBAR Statement**

Creates a vertical bar chart that summarizes the values of a category variable.

Interaction: The VBAR statement can be combined only with other categorization plot statements in the SGPLOT procedure. See “Plot Content” on page 124.

Featured in: Example 9 on page 221

---

**Syntax**

VBAR category-variable < / option(s)>;

option(s) can be one or more options from the following categories:

- Bar options:
  - ALPHA= numeric-value
  - BARWIDTH= numeric-value
  - DATALABEL
  - FILL | NOFILL
  - FILLATTRS= style-element < (fill-options) > | (fill-options)
  - FREQ= numeric-variable
  - LIMITATTRS= style-element < (options) > | (options)
  - LIMITS= BOTH | LOWER | UPPER
  - LIMITSTAT= CLM | STDDEV | STDERR
  - MISSING
  - NOSTATLABEL
  - NUMSTD= n
  - OUTLINE | NOOUTLINE
  - RESPONSE= response-variable
  - STAT= FREQ | MEAN | SUM
  - URL= character-variable
  - WEIGHT= numeric-variable

- Plot options:
  - GROUP= variable
  - LEGENDLABEL= “text-string”
  - NAME= “text-string”
  - TRANSPARENCY= numeric-value
Required Arguments

category-variable
specifies the variable that classifies the observations into distinct subsets.

Options

ALPHA= numeric-value
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).
Default: .05

Interaction: This option has no effect if you do not specify LIMITSTAT=CLM.
If your plot is overlaid with other categorization plots, then the first ALPHA value that you specify is used for all of the plots.

BARWIDTH= numeric-value
specifies the width of the bars as a ratio of the maximum possible width. The maximum width is equal to the distance between the center of each bar and the centers of the adjacent bars. Specify a value between .1 and 1.
For example, if you specify a width of 1, then there is no distance between the bars. If you specify a width of .5, then the width of the bars is equal to the space between the bars.
Default: .8

DATALABEL
adds data labels for bars. The values of the response variable appear at the end of the bars.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

FILL | NOFILL
specifies whether the bars are filled. The FILL option shows the fill color for the bars. The NOFILL option hides the fill color for the bars.

Default: FILL

FILLATTRS= style-element | (COLOR= color)
specifies the appearance of the fill for the bars. You can specify the color of the fill by using a style element or by using the COLOR= suboption. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.

Note: This option has no effect if you specify the NOFILL option. △

Default: For ungrouped data, the default color is specified by the Color attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the Color attribute of the GraphData1... GraphData n style elements in the current style.

FREQ= numeric-variable
specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.

Interaction: If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.
GROUP= variable
specifies a variable that is used to group the data. The plot elements for each group value are automatically distinguished by different visual attributes.

LEGENDLABEL= “text-string”
specifies the label that identifies the bar chart in the legend. By default, the label of the RESPONSE= variable is used. If there is no response variable label, the name of the response variable and the computed statistic (SUM or MEAN) is used. If the RESPONSE= option is not used, the legend label is “Frequency”.

Interaction: The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

LIMITATTRS= style-element <(options)> | (options)
specifies the appearance of the limit lines in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: The default color is specified by the ContrastColor attribute of the GraphError style element in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.

Default: The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

Default: The default line thickness is specified by the LineThickness attribute of the GraphError style element in the current style.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

LIMITS= BOTH | LOWER | UPPER
specifies which limit lines to display. Limits are displayed as heavier line segments with a serif at the end extending from each bar. Upper limits extend to the right of the bar and lower limits extend to the left of the bar. By default, no limits are displayed unless you specify either the LIMITS= or LIMITSTAT= option. If you specify the LIMITSTAT= option only, then LIMITS=BOTH is the default. Specify one of the following values:

BOTH
adds lower and upper limit lines to the plot.

LOWER
adds lower limit lines to the plot.

UPPER
adds upper limit lines to the plot.

By default, no limit lines are displayed. However, if you specify the LIMITSTAT= option, then the default is BOTH.

Interaction: Limit lines are displayed only when you specify STAT= MEAN.
LIMITSTAT= CLM | STDDEV | STDERR
specifies the statistic for the limit lines. Specify one of the following statistics:

CLM
  confidence limits

STDDEV
  standard deviation

STDERR
  standard error

Default: CLM

Interaction: If you specify the LIMITSTAT= option only, then the default value for the LIMITS= option is BOTH.
  Limits lines are displayed only when you specify STAT=MEAN.

MISSING
processes missing values as a valid category value and creates a bar for it.

NAME= "text-string"
specifies a name for the plot. You can use the name to refer to this plot in other statements.

NOSTATLABEL
removes the statistic name from the axis and legend labels.
  Restriction: This option is available with SAS 9.2 Phase 2 and later.

NUMSTD= n
specifies the number of standard units for the limit lines, when you specify LIMITSTAT= STDDEV or LIMITSTAT= STDERR. You can specify any positive number, including decimals.

Default: 1

OUTLINE | NOOUTLINE
specifies whether the bars have outlines. The OUTLINE option shows the outlines. The NOOUTLINE option hides the outlines.

Default: OUTLINE

RESPONSE= response-variable
specifies a numeric response variable for the plot. The summarized values of the response variable are displayed on the vertical axis.

STAT= FREQ | MEAN | SUM
specifies the statistic for the vertical axis. Specify one of the following statistics:

FREQ
  the frequencies for the category variable. This is the default value when you do not specify the RESPONSE= option.

MEAN
  the mean of the response variable.

SUM
  the sum of the response variable. This is the default value when you specify the RESPONSE= option.
  If you do not specify the RESPONSE= option, then only FREQ can be used. If you specify RESPONSE=, then you can use either SUM or MEAN.

TRANSPARENCY= numeric-value
specifies the degree of transparency for the bars and limits, if displayed. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).
**URL= character-variable**

specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.

**Interaction:** This option affects graphics output that is created through the ODS HTML destination only.

This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.

**Default:** By default, no HTML links are created.

**WEIGHT= numeric-variable**

specifies that each observation is weighted by a factor of $w$ for computational purposes, where $w$ is the value of the numeric variable. $w$ can be any numeric value. If $w$ is 0, negative or missing, then that observation is excluded from the analysis.

**Interaction:** If your plot is overlaid with other categorization plots, then the first WEIGHT variable that you specified is used for all of the plots.

---

**VBOX Statement**

Creates a vertical box plot that shows the distribution of your data.

**Interaction:** The VBOX statement cannot be used together with other plot statements in the SGPLOT procedure.

**Description**

Horizontal and vertical box plots display the distribution of data by using a rectangular box and *whiskers*. Whiskers are lines that indicate a data range outside of the box.
Figure 4.6 on page 196 shows a diagram of a vertical box plot. The bottom and top edges of the box indicate the *intra-quartile range* (IQR). That is, the range of values between the first and third quartiles (the 25th and 75th percentiles). The marker inside the box indicates the mean value. The line inside the box indicates the median value.

The elements that are outside the box are dependent on your options. By default, the whiskers that extend from each box indicate the range of values that are outside of the intra-quartile range, but are close enough not to be considered outliers (a distance less than or equal to 1.5*IQR). If you specify the EXTREME option, then the whiskers indicate the entire range of values, including outliers.

Any points that are a distance of more than 1.5*IQR from the box are considered to be outliers. By default, these points are indicated by markers. If you specify DATALABEL= option, then the outlier points have data labels. If you also specify the LABELFAR option, then only outliers that are 3*IQR from the box have data labels.

**Syntax**

```
VBOX response-variable </option(s)>;
```

*option(s)* can be one or more options from the following categories:

- **Box options:**
  - BOXWIDTH= numeric-value
  - CATEGORY= category-variable
  - DATALABEL <= variable>
EXTREME
FREQ= numeric-variable
LABELFAR
MISSING
PERCENTILE= numeric-value
SPREAD

Box options:
  LEGENDLABEL= “text-string”
  NAME= “text-string”
  TRANSPARENCY= numeric-value
  X2AXIS
  Y2AXIS

Required Arguments

response-variable
  specifies the response variable for the plot. If you do not specify the CATEGORY= option, then one box is created for the response variable.

Options

BOXWIDTH= numeric-value
  specifies the width of the box. Specify a value between 0.0 (0% of the available width) and 1.0 (100% of the available width).
  Default: 0.4

CATEGORY= category-variable
  specifies the category variable for the plot. A box plot is created for each distinct value of the category variable.

DATALABEL <= variable>
  adds data labels for the outlier markers. If you specified a variable, then the values for that variable are used for the data labels. If you do not specify a variable, then the values of the response variable are used.

  Note: This option has no effect if the plot does not contain outlier points.

EXTREME
  specifies that the whiskers can extend to the maximum and minimum values for the response variable, and that outliers are not identified. When you do not specify the EXTREME option, the whiskers cannot be longer than 1.5 times the length of the box.

FREQ= numeric-variable
  specifies that each observation is repeated n times for computational purposes, where n is the value of the numeric variable. If n is not an integer, then it is truncated to an integer. If n is less than 1 or missing, then it is excluded from the analysis.

  Interaction: If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.

LABELFAR
  specifies that only the far outliers have data labels. Far outliers are points whose distance from the box is more than three times the length of the box.
VECTOR Statement

Creates a vector plot that draws arrows from a point of origin to each data point.

Restriction: This statement is available with SAS 9.2 Phase 2 and later.

VECTOR X= numeric-variable Y= numeric-variable <option(s)>;

option(s) can be one or more of the following:

- Vector options:
  ARROWDIRECTION= OUT | IN | BOTH
  ARROWHEADSHAPE= shape
  DATALABEL <= variable>
  LINEATTRS= style-element <(options) | (options)

Note: This option has no effect if you do not specify the DATALABEL option, or if there are no far outliers.

LEGENDLABEL= "text-string"
specifies a label that identifies the box plot in the legend. By default, the label of the response variable is used.

MISSING
processes missing values as a valid category value and creates a box for it.

NAME= "text-string"
specifies a name for the plot. You can use the name to refer to this plot in other statements.

PERCENTILE= 1 | 2 | 3 | 4 | 5
specifies a method for computing the percentiles for the plot. For descriptions of each method, see “Calculating Percentiles” in the UNIVARIATE Procedure chapter of Base SAS Procedures Guide: Statistical Procedures.

Default: 5

SPREAD
relocates outlier points that have identical values to prevent overlapping.

Note: This option has no effect if your data does not contain two or more outliers with identical values for the response variable.

TRANSPARENCY= value
specifies the degree of transparency for the plot. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Default: 0.0

X2AXIS
assigns the category variable to the secondary (top) horizontal axis.

Y2AXIS
assigns the response variable to the secondary (right) vertical axis.
NOARROWHEADS
NOMISSINGGROUP
XORIGIN= numeric-value | numeric-variable
YORIGIN= numeric-value | numeric-variable

Plot options:
GROUP= variable
LEGENDLABEL= "text-string"
NAME= "text-string"
TRANSPARENCY= numeric-value
X2AXIS
Y2AXIS

Required Arguments

X= numeric-variable
  specifies a numeric variable for the x axis.

Y= numeric-variable
  specifies numeric variable for the y axis.

Options

ARROWDIRECTION= IN | OUT | BOTH
  specifies the location of the arrowheads for the vectors. Specify one of the following:
  IN       places the arrowheads at the origin of the vector.
  OUT      places the arrowheads at the ending point of the vector.
  BOTH     places arrowheads at both the origin and the ending point of the vector.
  Default: OUT

ARROWHEADSHAPE= shape
  specifies the shape of the arrowheads for the vectors. Specify one of the following:
  OPEN      resembles the letter "V".
            \arrow{\uparrow}
  CLOSED   an outline of a triangle.
            \arrow{\uparrow}
  FILLED   a solid triangle.
            \arrow{\uparrow}
  BARBED   a solid triangle with an indent at the base.
            \arrow{\uparrow}
  Default: OPEN
DATALABEL <= variable>
displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the Y variable are used for the data labels.

GROUP= variable
specifies a variable that is used to group the data. A separate plot is created for each unique value of the grouping variable. The plot elements for each group value are automatically distinguished by different visual attributes.

LEGENDLABEL= “text-string”
specifies a label that identifies the vector plot in the legend. By default, the label of the Y variable or the group value for each plot element is used.

Interaction: The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the vector line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphDatann style elements in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.

Default: For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphDataDefault style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphDatann style elements in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

Default: For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphDataDefault style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphDatann style elements in the current style.

NAME= “text-string”
specifies a name for the plot. You can use the name to refer to this plot in other statements.

NOARROWHEADS
removes the arrowheads from the vectors.

NOMISSINGGROUP
specifies that missing values of the group variable are not included in the plot.
TRANSPARENCY= numeric-value
specifies the degree of transparency for the lines. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).
Default: 0.0

X2AXIS
assigns the X variable to the secondary (top) horizontal axis.

XORIGIN= numeric-value | numeric-variable
specifies the X coordinate of the origin for the vectors. You can specify either a numeric value or a numeric variable.
Default: 0

Y2AXIS
assigns the Y variable to the secondary (right) vertical axis.

YORIGIN= numeric-value | numeric-variable
specifies the Y coordinate of the origin for the vectors. You can specify either a numeric value or a numeric variable.
Default: 0

VLINE Statement

Creates a vertical line chart (the line is horizontal). You can use the VLINE statement with the VBAR statement to create a bar-line chart.

Featured in: Example 9 on page 221

Interaction: The VLINE statement can be combined only with other categorization plot statements in the SGPLOT procedure. See “Plot Content” on page 124.

Syntax

VLINE category-variable < / option(s)>;

option(s) can be one or more options from the following categories:

- Line options:
  - ALPHA= numeric-value
  - BREAK
  - CURVELABEL <= text-string>
  - CURVELABELPOS= MIN | MAX | START | END
  - DATALABEL <= variable>
  - FREQ= numeric-variable
  - LIMITATTRS= style-element<options> | (options)
  - LIMITS= BOTH | LOWER | UPPER
  - LIMITSTAT= CLM | STDDEV | STDERR
  - LINEATTRS= style-element <options> | (options)
  - MARKERATTRS= style-element <options> | (options)
MARKERS
MISSING
NOSTATLABEL
NUMSTD= \( n \)
RESPONSE= \text{response-variable} 
STAT= FREQ | MEAN | SUM
URL= \text{character-variable} 
WEIGHT= \text{numeric-variable} 

- **Plot options:**
  - GROUP= \text{variable} 
  - LEGENDLABEL= “\text{text-string}” 
  - NAME= “\text{text-string}” 
  - TRANSPARENCY= \text{numeric-value} 
  - X2AXIS 
  - Y2AXIS 

**Required Arguments**

\textit{category-variable}  
specifies the variable that classifies the observations into distinct subsets.

**Options**

\textit{ALPHA= numeric-value}  
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).  
**Default:** .05  
**Interaction:** This option has no effect if you do not specify LIMITSTAT=CLM. If your plot is overlaid with other summary plots, then the first ALPHA value that you specify is used for all of the plots.

\textit{BREAK}  
creates a break in the line for each missing value.

\textit{CURVELABEL <="text-string"}>  
adds a label for the line chart. You can also specify the label text. If you do not specify a label, the label from the response variable is used.

\textit{CURVELABELPOS= MIN | MAX | START | END}  
specifies the location of the curve label. Specify one of the following values:

- \textit{MIN} 
  places the curve label at the minimum value for the response axis.

- \textit{MAX} 
  places the curve label at the maximum value for the response axis.

- \textit{START} 
  places the curve label at the first point on the curve.
END places the curve label at the last point on the curve.

**Default:** END

**DATALABEL <= variable>**
displays a label for each data point. If you specify a variable, then the values of that variable are used for the data labels. If you do not specify a variable, then the values of the calculated response are used for the data labels.

**FREQ= numeric-variable**
specifies that each observation is repeated \( n \) times for computational purposes, where \( n \) is the value of the numeric variable. If \( n \) is not an integer, then it is truncated to an integer. If \( n \) is less than 1 or missing, then it is excluded from the analysis.

**Interaction:** If your plot is overlaid with other categorization plots, then the first FREQ variable that you specified is used for all of the plots.

**GROUP= variable**
specifies a variable that is used to group the data. A separate plot is created for each unique value of the grouping variable. The plot elements for each group value are automatically distinguished by different visual attributes.

**Interaction:** If you specify more than one categorization plot statement, then all of the plots must specify the same GROUP variable. If you do not specify the same GROUP= option for all of the categorization plots, then the GROUP= option has no effect.

**LEGENDLABEL= ”text-string”**
specifies the label that identifies the line chart in the legend. By default, the label of the response variable is used. If there is no response variable label, then the name of the response variable and the computed statistic (SUM or MEAN) are used. If you do not specify a response variable, then the legend label is “Frequency”.

**Interaction:** The LEGENDLABEL= option has no effect if you also specify the GROUP= option in the same plot statement.

**LIMITATTRS= style-element <(options)> | (options)**
specifies the appearance of the limit lines in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

**options** can be one or more of the following:

**COLOR= color**
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

**Default:** The default color is specified by the ContrastColor attribute of the GraphError style element in the current style.

**PATTERN= line-pattern**
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.

**Default:** The default line pattern is specified by the LineStyle attribute of the GraphError style element in the current style.

**THICKNESS= n <units>**
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default:** The default line thickness is specified by the LineThickness attribute of the GraphError style element in the current style.
**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**LIMITS= BOTH | LOWER | UPPER**
adds limit lines to the plot. Specify one of the following values:

- **BOTH**
  adds lower and upper limit lines to the plot.
- **LOWER**
  adds lower limit lines to the plot.
- **UPPER**
  adds upper limit lines to the plot.

By default, no limit lines are displayed. However, if you specify the LIMITSTAT= option, then the default is BOTH.

*Note:* Limit lines are displayed only when you specify STAT= MEAN.

**LIMITSTAT= CLM | STDDEV | STDERR**
specifies the statistic for the limit lines. Specify one of the following statistics:

- **CLM**
  confidence limits
- **STDDEV**
  standard deviation
- **STDERR**
  standard error

**Default:** CLM

**Interaction:** If you specify the LIMITSTAT= option, then the default value for the LIMITS= option is BOTH.

**LINEATTRS= style-element <(options)> | (options)**
specifies the appearance of the lines in the line chart. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

*options* can be one or more of the following:

- **COLOR= color**
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

  **Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

  For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData*n* style elements in the current style.

- **PATTERN= line-pattern**
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 127 for a list of line patterns.

  **Default:** For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphDataDefault style element in the current style.

  For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData*n* style elements in the current style.

- **THICKNESS= n <units>**
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.
**Default:** For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphDataDefault style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphDataN style elements in the current style.

**MARKERATTRS= style-element <(options)> | (options)**
specifies the appearance of the markers in the plot. This option has no effect unless you also specify the MARKERS option. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

*options* can be one or more of the following:

**COLOR= color**
specifies the color of the markers. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphDataN style elements in the current style.

**SIZE= n <units>**
specifies the size of the markers. You can also specify the unit of measurement. The default unit is pixels. See “Units of Measurement” on page 126 for a list of the measurement units that are supported.

**Default:** The default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

**SYMBOL= symbol-name**
specifies the symbol for the markers. See “Marker Symbols” on page 126 for a list of valid marker symbols.

**Default:** For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphDataN style elements in the current style.

**MARKERS**
adds markers to the plot.

**MISSING**
processes missing values as a valid category value and creates a line for it.

**NAME= “text-string”**
specifies a name for the plot. You can use the name to refer to this plot in other statements.

**NOSTATLABEL**
removes the statistic name from the axis and legend labels.

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

**NUMSTD= n**
specifies the number of standard units for the limit lines, when you specify LIMITSTAT= STDDEV or LIMITSTAT= STDERR. You can specify any positive number, including decimals.

**Default:** 1
**RESPONSE= response-variable**
specifies a numeric response variable for the plot. The summarized values of the response variable are displayed on the vertical axis.

**STAT= FREQ | MEAN | SUM**
specifies the statistic for the vertical axis. Specify one of the following statistics:

- **FREQ**
  - the frequencies for the category variable. This is the default value when you do not specify the RESPONSE= option.

- **MEAN**
  - the mean of the response variable.

- **SUM**
  - the sum of the response variable. This is the default value when you specify the RESPONSE= option.
  - If you do not specify the RESPONSE= option, then only FREQ can be used. If you specify RESPONSE=, then you can use either SUM or MEAN.

**TRANSPARENCY= numeric-value**
specifies the degree of transparency for the lines and markers. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

- **Default:** 0.0

**URL= character-variable**
specifies a character variable that contains URLs for web pages to be displayed when parts of the plot are selected within an HTML page.

- **Interaction:** This option affects graphics output that is created through the ODS HTML destination only.
  - This option has no effect unless you also specify IMAGEMAP in the ODS GRAPHICS statement.

- **Default:** By default, no HTML links are created.

**WEIGHT= numeric-variable**
specifies that each observation is weighted by a factor of \( w \) for computational purposes, where \( w \) is the value of the numeric variable. \( w \) can be any numeric value.

- **Interaction:** If your plot is overlaid with other categorization plots, then the first WEIGHT variable that you specified is used for all of the plots.

**X2AXIS**
assigns the category variable to the secondary (top) horizontal axis.

**Y2AXIS**
assigns the response variable to the secondary (right) vertical axis.

---

**XAXIS, X2AXIS, YAXIS, Y2AXIS Statements**
specify the axis options for each plot axis.

**Description**
The XAXIS, X2AXIS, YAXIS, and Y2AXIS statements specify options for the plot axes. You can control the features of the axis (for example, the axis label, grid lines, and
minor tick marks) and you can also control the structure of the axis (for example, the data range, data type, and tick mark values).

The XAXIS, X2AXIS, YAXIS, and Y2AXIS statements correspond to the axes as follows:

- XAXIS specifies options for the X axis.
- X2AXIS specifies options for the X2 axis.
- YAXIS specifies options for the Y axis.
- Y2AXIS specifies options for the Y2 axis.

**Syntax**

```
XAXIS option(s);
X2AXIS option(s);
YAXIS option(s);
Y2AXIS option(s);
```

`option(s)` can be one or more options from the following:

- `DISCRETEORDER= DATA | FORMATTED | UNFORMATTED`
- `DISPLAY= ALL | NONE | (options)`
- `FITPOLICY= policy-value`
- `GRID`
- `INTEGER`
- `INTERVAL=interval-value`
- `LABEL= "text-string "`
- `LOGBASE= 2 | 10 | e`
- `LOGSTYLE= LINEAR | LOGEXPAND | LOGEXPONENT`
- `MAX= numeric-value`
- `MIN= numeric-value`
- `MINOR`
- `NOTIMESPLIT`
- `OFFSETMAX= numeric-value`
- `OFFSETMIN= numeric-value`
- `REFTICKS`
- `TICKVALUEFORMAT= DATA | sas-format`
- `TYPE= DISCRETE | LINEAR | LOG | TIME`
- `VALUES= ( value-1 < ... value-n > )`
- `VALUESHINT`

**Options**

`DISCRETEORDER= DATA | FORMATTED | UNFORMATTED`

specifies the order in which discrete tick values are placed on the axis. Specify one of the following values:

- `DATA` places the values in the order that they appear in the data.
FORMATTED sorts the formatted values in ascending character order.

UNFORMATTED sorts the unformatted values in ascending character order.

**Default:** UNFORMATTED

**Restriction:** This option affects only box plots, dot plots, bar charts, and line charts, or for any axis where TYPE=DISCRETE.

**DISPLAY= ALL | NONE | (options)**

specifies which features of the axis are displayed. ALL displays all of the features of the axis. NONE specifies that none of the features of the axis are displayed. You can also hide specific features:

- **NOLABEL** hides the axis label
- **NOLINE** hides the axis line
- **NOTICKS** hides the tick marks on the axis
- **NOVALUES** hides the tick mark values on the axis

**Default:** ALL

**FITPOLICY= policy-value**

specifies the method that is used to fit tick mark values on a horizontal axis when there is not enough room to draw them normally. Select one of the following values:

- **ROTATE**
  rotates the value text 45 degrees. This is the default for discrete axes.

- **ROTATETHIN**
  attempts to use ROTATE, and then THIN to fit the values.

- **STAGGER**
  shifts the values up and down.

- **STAGGERROTATE**
  attempts to use STAGGER, and then ROTATE to fit the values.

- **STAGGERTHIN**
  attempts to use STAGGER, and then THIN to fit the values.

- **THIN**
  removes some of the values from the axis. This is the default for linear and time axes.

  **Note:** This option does not affect vertical axes; only the THIN fit policy is used for vertical axes.

**GRID**

creates grid lines at each tick on the axis.

**INTEGER**

specifies that only integers are used for tick mark values. This option affects only linear axes.

**INTERVAL= interval-value**

specifies the tick interval for a time axis. Specify one of the following values:

- **AUTO**
  determines the tick interval automatically based on the data.

- **SECOND**
  places ticks one second apart. The default tick value format is TIME8.
MINUTE
places ticks one minute apart. The default tick value format is TIME8.

HOUR
places ticks one hour apart. The default tick value format is TIME8.

DAY
places ticks one day apart. The default tick value format is DATE9.

WEEK
places ticks one week apart. The default tick value format is DATE9.

TENDAY
places ticks ten days apart. The default tick value format is DATE9.

SEMIMONTH
places ticks at the first and sixteenth day of each month. The default tick value format is DATE9.

MONTH
places ticks one month apart. The default tick value format is MONYY7.

QUARTER
places ticks three months apart. The default tick value format is YYQC6.

SEMIYEAR
places ticks six months apart. The default tick value format is MONYY7.

YEAR
places ticks one year apart. The default tick value format is YEAR4.

Default: AUTO
Restriction: This option is available with SAS 9.2 Phase 2 and later.

LABEL="text-string"
specifies a label for the axis.

LOGBASE=2 | 10 | e
specifies the base value for the logarithmic scale.
Default: 10
Interaction: This option has no effect unless you also specify TYPE=LOG.

LOGSTYLE=LINEAR | LOGEXPAND | LOGEXPONENT
specifies how to scale and format the values for the major tick marks for logarithmic axes. Specify one of the following values:

LOGEXPAND places the tick marks at integer powers of the base. For example, if you specified LOGBASE=2, the tick marks might be at 1, 2, 4, 8, 16. See Figure 4.7 on page 209.

Figure 4.7 Graph Axes with LOGEXPAND

\[ \begin{array}{cccccc}
1 & 2 & 4 & 8 & 16 & 32 \\
1 & 2 & 4 & 8 & 16 & 32 \\
1 & 2 & 4 & 8 & 16 & 32 \\
\end{array} \]  \quad \{ \text{LOGBASE = 10} \}

\[ \begin{array}{cccccc}
1 & 2 & 4 & 8 & 16 & 32 \\
1 & 2 & 4 & 8 & 16 & 32 \\
1 & 2 & 4 & 8 & 16 & 32 \\
\end{array} \]  \quad \{ \text{LOGBASE = 2} \}

\[ \begin{array}{cccccc}
e^0 & e^1 & e^2 & e^3 & e^4 & e^5 \\
e^0 & e^1 & e^2 & e^3 & e^4 & e^5 \\
e^0 & e^1 & e^2 & e^3 & e^4 & e^5 \\
\end{array} \]  \quad \{ \text{LOGBASE = E} \}
LOGEXPONENT places the tick marks at integer powers of the base, but identifies the values by the exponent. For example, if you specified LOGBASE=10, the tick marks might be at 1, 10, 100, 1000, but the tick values would read 0, 1, 2, 3. See Figure 4.8 on page 210.

Figure 4.8 An Axis with LOGEXPONENT

LINEAR places the tick marks at uniform linear intervals, but spaces them logarithmically. In some cases an intermediate tick mark is placed between the first and second marks.

For example, if the data on this axis range from 14 to 1154, and you specify LOGBASE=10, then the tick marks might be at 10, 40, 200, 400, 600, 800, 1000, 1200. See Figure 4.9 on page 210.

Figure 4.9 An Axis with LINEAR

Default: LOGEXPAND

Interaction: This option has no effect unless you also specify TYPE=LOG.

MAX= numeric-value specifies the maximum value for the axis.

Interaction: This option has no effect if you specify the VALUES= option and you do not also specify the VALUESHINT option.

Restriction: This option affects linear and time axes only.

MIN= numeric-value specifies the minimum value for the axis.

Interaction: This option has no effect if you specify the VALUES= option and you do not also specify the VALUESHINT option.

Restriction: This option affects linear and time axes only.

MINOR adds minor tick marks to the axis.

Interaction: This option has no effect if you specify the VALUES= option.

Restriction: This option has no effect on discrete axes.

NOTIMESPLIT prevents a time axis from splitting the time, date, or datetime values into two rows.

Restriction: This option applies to time axes only.

OFFSETMAX= numeric-value specifies the amount of offset space between the last tick mark on the axis and the edge of the plot area. Specify a value between 0 and 1. The value represents the offset as a proportion to the total length of the axis. For example, .12 specifies that the offset space for the last tick mark is twelve percent of the total axis length.

By default, the offset space is determined automatically based on the tick mark values, markers, and labels that are inside of the plot area.
Restriction: This option is available with SAS 9.2 Phase 2 and later.

OFFSETMIN= numeric-value
specifies the amount of offset space between the first tick mark on the axis and the edge of the plot area. Specify a value between 0 and 1. The value represents the offset as a proportion to the total length of the axis. For example, .12 specifies that the offset space for the first tick mark is twelve percent of the total axis length.

By default, the offset space is determined automatically based on the tick mark values, markers, and labels that are inside of the plot area.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

REFTICKS
adds tick marks to axis that is opposite from the specified axis. For example, if you specify the REFTICKS option in the XAXIS statement, then tick marks are added to the X2 axis.

Note: This option has no effect if the target axis already contains data. 

TICKVALUEFORMAT= DATA | SAS-format
specifies the format for the axis tick values. You can either specify a SAS format or specify DATA, which indicates that the format from the axis variable is used.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

TYPE= DISCRETE | LINEAR | LOG | TIME
specifies the type of axis. Specify one of the following:

DISCRETE specifies an axis with discrete values. If a character variable is assigned to an axis, then the default type for that axis is discrete. Additionally, all categorization plots use a discrete axis for the category variable.

LINEAR specifies a linear scale for the axis. This is the default axis type for numeric variables that do not have date or time formats.

LOG specifies a logarithmic scale for the axis. This axis type is never a default.

Interaction: A logarithmic scale cannot be used with linear regression plots (REG statement where DEGREE=1).

TIME specifies a time scale for the axis. If the variable assigned to an axis has a time, date, or datetime format associated with it, then time is the default axis type.

VALUES= (values-list)
specifies the values for the ticks on the axis.

For values on a numeric axis, the values list can be one of the following:

value <...value-n>
creates ticks for specific values. For example, VALUES= (0 50 100) places tick marks at 0, 50, and 100.

value-1 TO value-2 BY increment-value
creates ticks for a range of values. The start of the value range is specified by value-1 and the end of the range is specified by value-2. The increment-value specifies the interval between the ticks. For example, VALUES= (0 to 100 by 50) creates tick marks at 0, 50, and 100.

You can also create ticks in descending order by using a negative increment value. For example, VALUES= (100 to 0 by -25) creates tick marks at 100, 75, 50, 25, and 0.
creates ticks for specific values, and additionally creates ticks for a range of values. The start of
the value range is specified by \texttt{value-1} and the end of the range is specified by \texttt{value-2}. The \texttt{increment-value} specifies the interval between the ticks.

For example, \texttt{VALUES= (-5 10 to 50 by 20 75)} creates tick marks at -5, 10, 30, 50, and 75.

For values on a time axis, the values list can be one of the following:

\texttt{value} \texttt{<...value-n>}

creates ticks for specific values. For example, \texttt{VALUES= ("25MAY08"d "04JUL08"d 
"23AUG08"d)} places tick marks at 25MAY08, 04JUL08, and 23AUG08.

\texttt{value-1} \texttt{TO} \texttt{value-2} \texttt{BY} \texttt{increment-value}

creates ticks for a range of values. The start of the value range is specified by \texttt{value-1} and the end of the range is specified by \texttt{value-2}. The \texttt{increment-value} specifies the interval between the ticks. For example, \texttt{VALUES= ("01JAN08"d to 
"01MAY08"d by month)} creates tick marks at 01JAN08, 01FEB08, 01MAR08, 
01APR08, and 01MAY08.

For a list of the interval values that you can specify, see the \texttt{INTERVAL=} option
on page 208.

\textbf{Restrictions:} This option has no effect on discrete and logarithmic axes.

If your \texttt{VALUES=} option creates more than 1000 values, then the option has no
effect.

\texttt{VALUESHINT}

specifies that the minimum and maximum axis values are determined independently
of the values you specify in the \texttt{VALUES=} option. The values from the \texttt{VALUES=} 
option are displayed only if they are located between the minimum and maximum
values.

\textbf{Note:} This option has no effect unless you also specify the \texttt{VALUES=} option. \triangle
Example 1: Grouping a Scatter Plot

Procedure features:
- SCATTER statement
- Sample library member: GSGPLSCT

This example shows a simple scatter plot with grouped data.

Create the scatter plot. In the SCATTER statement, the GROUP= option groups the data by the SEX variable.

```
proc sgplot data=sashelp.class;
  scatter x=height y=weight / group=sex;
run;
```
Example 2: Plotting Three Series

Procedure features:
SERIES statement
Sample library member: GSGPLSER

This example shows a series plot with three series on the Y axis.

Specify the data set and the title.

```latex
proc sgplot data=sashelp.stocks
  (where=(date >= "01jan2000"d and stock = "IBM"));
title "Stock Trend";
```

Create the series plots.

```latex
series x=date y=close;
series x=date y=low;
series x=date y=high;
run;
```
Example 3: Adding Prediction and Confidence Bands to a Regression Plot

Procedure features: REG statement
Sample library member: GSGPLREG

This example shows a regression plot with prediction and confidence limits.

Create the regression plot. The CLM option adds confidence limits for the mean predicted values. The CLI option adds confidence limits for the individual predicted values.

```
proc sgplot data=sashelp.class;
  reg x=height y=weight / CLM CLI;
run;
```
Example 4: Adding a Prediction Ellipse to a Scatter Plot

Procedure features:
- SCATTER statement
- ELLIPSE statement
- KEYLEGEND statement

Sample library member: GSGPLELI

This example shows a scatter plot with a prediction ellipse.

Set the title and create the scatter plot.

```
proc sgplot data=sashelp.iris;
  title "Iris Petal Dimensions";
  scatter x=petallength y=petalwidth;
```

Create the ellipse.

```
ellipse x=petallength y=petalwidth;
```

Position the Legend. The LOCATION= option places the legend inside of the plot area. The POSITION= option places the legend at the bottom right.

```
keylegend / location=inside position=bottomright;
run;
```
Example 5: Creating Lines and Bands from Pre-Computed Data

Procedure features:
- BAND statement
- KEYLEGEND statement
- SCATTER statement
- SERIES statement

Sample library member: GSGPLBND

This example shows how to use pre-computed data to create a scatter plot, fit line, and confidence bands. The data set was created by the REG procedure. This technique is useful for more complex fit models.

**Set the title and create the first band plot.** The LEGENDLABEL= option in the BAND statement specifies the label for the band plot in the legend.

```
proc sgplot data=sashelp.classfit;
   title "Fit and Confidence Band from Precomputed Data";
   band x=height lower=lower upper=upper /
      legendlabel="95% CLI" name="band1";
```

**Create the second band plot.** The LEGENDLABEL= option specifies the label for the band plot in the legend. The FILLATTRS= option specifies the style element for the fill.

```
   band x=height lower=lowermean upper=uppermean /
      fillattrs=GraphConfidence2
      legendlabel="95% CLM" name="band2";
   scatter x=height y=weight;
```
Example 6: Adding Statistical Limits to a Dot Plot

Procedure features: DOT statement
Sample library member: GSGPLDT1

This example shows a dot plot with a response variable and statistical limits. Each dot represents the mean for each value of the category variable, and bands represent the standard deviation.
Create the dot plot. The RESPONSE= option specifies the response variable. The STAT= option specifies that the mean statistic is used to analyze the graph. The LIMITSTAT= option specifies that the limit statistic is the standard deviation. The NUMSTD= option specifies that one standard deviation is used.

```plaintext
proc sgplot data=sashelp.class(where=(age<16));
   dot age / response=height stat=mean
      limitstat=stddev numstd=1;
run;
```

Example 7: Combining Histograms with Density Plots

Procedure features:
- HISTOGRAM statement
- DENSITY statement
- KEYLEGEND statement

Sample library member: GSGPLHST

This example shows a histogram combined with two density plots. One density plot uses a normal density estimate and the other density plot uses a kernel density estimate.

Set the title, set a label for the X axis, and create the histogram.

```plaintext
proc sgplot data=sashelp.heart;
   title "Cholesterol Distribution";
   histogram cholesterol;
```
Create the density plots. The TYPE= option specifies which density equation is used.

```plaintext
density cholesterol;
density cholesterol / type=kernel;
```

Position the Legend The LOCATION= option places the legend inside of the plot area. The POSITION= option places the legend at the top right.

```plaintext
keylegend / location=inside position=topright;
run;
```

---

**Example 8: Creating a Horizontal Box Plot**

**Procedure features:** HBOX statement  
**Sample library member:** GSGPLBOX

This example shows a horizontal box plot.

Create the box plot. The CATEGORY= option specifies the category variable.

```plaintext
proc sgplot data=sashelp.heart;
   title "Cholesterol Distribution by Weight Class";
   hbox cholesterol / category=weight_status;
run;
```
Example 9: Creating a Bar-Line Chart

Procedure features: VBAR statement, VLINE statement
Sample library member: GSGPLBAR

This example creates a bar-line chart.

Create the Bar-line Chart. The Y2AXIS option assigns the line chart to the Y2 axis.

```
proc sgplot data=sashelp.stocks (where=(date >= "01jan2000"d
    and date <= "01jan2001"d
    and stock = "IBM"));
    title "Stock Volume vs. Close";
    vbar date / response=volume;
    vline date / response=close y2axis;
run;
```
CHAPTER 5

The SGSCATTER Procedure

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Overview

The SGSCATTER procedure creates a paneled graph of scatter plots for multiple combinations of variables, depending on the plot statement that you use. You can use options to overlay fit plots and ellipses on your scatter plots.

The SGSCATTER procedure can create many different types of paneled graphs. The following table shows some of the types of graphs that you can create:
Table 5.1 Examples of Graphs that Can Be Generated by the SGSCATTER Procedure

The following code creates a paneled graph of scatter plots:

```sas
proc sgscatter data=sashelp.cars;
  plot mpg_highway*weight msrp*horsepower;
run;
```

The following code creates a paneled graph of scatter plots with shared axes:

```sas
proc sgscatter data=sashelp.cars;
  compare y=mpg_highway x=(weight enginesize horsepower )
    / group=type;
run;
```

The following code creates a scatter plot matrix with prediction ellipses and a diagonal with histograms and density plots:

```sas
proc sgscatter data=sashelp.iris
  (where=(species eq "Virginica"));
  matrix petallength petalwidth sepallength
    / ellipse=(type=mean)
    diagonal=(histogram kernel);
run;
```

**Note:** The graphs that you create with the SGSCATTER procedure can have many individual graph cells. As the number of cells increases, the overall graph size does not automatically increase. To increase the graph size, use the HEIGHT= and WIDTH= options of the ODS GRAPHICS statement.
Statements for Creating Panels

The SGSCATTER procedure contains three statements that you can use to create a paneled graph of scatter plots:

- PLOT
- COMPARE
- MATRIX

Each of the statements is specialized for creating a different type of paneled graph.

PLOT Statement

The PLOT statement is used to create a paneled graph of scatter plots where each graph cell has its own independent set of axes. Each variable pair that you specify in the PLOT statement creates an independent graph cell. You can also overlay fit plots and ellipses on each cell by using options.

For example, Figure 5.1 on page 226 shows a graph that contains two independent cells. Each cell contains a scatter plot and a loess curve.

Figure 5.1 Example Graph from the PLOT Statement

By default, the axis ranges of each cell are independent from the other cells. However, you can use the UNISCALE= option to specify that all of the cells use the same axis ranges for the X axis, the Y axis, or both axes.

Note: It is possible to create a single scatter cell with the PLOT statement, but the SGPLOT procedure is better suited to creating a single-celled graph.
COMPARE Statement

The COMPARE statement is used to create a shared axis panel, also called an MxN matrix. The list of X and Y variables are crossed to create each cell in the graph. All cells in a row share the same row axis range. All cells in a column share the same column axis range.

When using the COMPARE statement, you can add fit plots and confidence ellipses to each cell in the panel by using options.

The COMPARE statement can also be used to do simple X or Y axis sharing by specifying only one X or Y variable, as in the following example:

Figure 5.2 Example Graph from the COMPARE Statement

MATRIX Statement

The MATRIX statement is used to create a scatter plot matrix. Each of the variables that you specify are graphed against each other to create the graph. You can use the ELLIPSE option to overlay a confidence ellipse on each cell in the panel.

The MATRIX statement also has an option called DIAGONAL= that enables you to display the distribution of your variables in the diagonal cells of the matrix. You can place histograms in the diagonal cells, and overlay those histograms with normal density curves or kernel density estimates.

For example, the following example shows a graph with histograms and normal density curves in the diagonal cells.
Legends in the SGSCATTER Procedure

The SGSCATTER procedure creates a legend automatically when you specify a GROUP= variable. You can use the NOLEGEND option to disable the legend.

For all of the graph creation statements, you can use the LEGEND= option to specify the attributes of the legend.

Line Patterns

The LINEATTRS= option on some plot statements enables you to specify the line pattern that is used for the lines in your plot. Figure 5.4 on page 228 shows the line patterns that you can use.
**Marker Symbols**

The MARKERATTRS= option on some of the plot statements enables you to specify the marker symbol that is used to represent your data. The markers that you can use are shown in the following figure:

**Figure 5.5  List of Marker Symbols**

- ArrowDown
- HomeDown
- Tilde
- CircleFilled
- Asterisk
- Ibeam
- Triangle
- DiamondFilled
- Circle
- Plus
- Union
- HomeDownFilled
- Diamond
- Square
- Star
- StarFilled
- GreaterThan
- T
- Tack
- Z
- TriangleFilled

**Units of Measurement**

Some options such as LINEATTRS enable you specify the unit of measurement as part of the value. The following table contains the units that are available:

**Table 5.2  Measurement Units**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM</td>
<td>centimeters</td>
</tr>
<tr>
<td>IN</td>
<td>inches</td>
</tr>
<tr>
<td>MM</td>
<td>millimeters</td>
</tr>
<tr>
<td>PCT or %</td>
<td>percentage</td>
</tr>
<tr>
<td>PT</td>
<td>point size, calculated at 100 dots per inch</td>
</tr>
<tr>
<td>PX</td>
<td>pixels</td>
</tr>
</tbody>
</table>

**Procedure Syntax**

**Requirements:** One COMPARE, MATRIX, or PLOT statement is required.

PROC SGSCATTER < options>;

COMPARE X= variable | (variable-1 ... variable-n) Y= variable | (variable-1 ... variable-n) </options>;

MATRIX variable-1 variable-2 < ... variable-n > </options>;

PLOT plot-request(s) </options>;;
PROC SGSCATTER Statement

Identifies the data set that contains the plot variables. The statement also gives you the option to specify a description and write template code to a file.

Requirements: An input data set is required.

Syntax

PROC SGSCATTER <DATA= input-data-set>
   <DESCRIPTION= "text-string">
   <TMPLOUT= "filename">
;

Options

DATA=input-data-set
   specifies the SAS data set that contains the variables to process. By default, the procedure uses the most recently created SAS data set.

DESCRIPTION= "text-string"
   specifies a description for the output image. The description identifies the image in the following locations:
   - the Results window
   - the alternate text for the image in HTML output
   - the table of contents that is created by the CONTENTS option on an ODS statement

   The default description is “The SGSCATTER Procedure”.

   Note: You can disable the alternate text in HTML output by specifying an empty string. That is, DESCRIPTION= "". △

   Note: The name of the output image is specified by the IMAGENAME= option on the ODS GRAPHICS statement. △

Alias: DES

TMPLOUT= "filename"
   specifies a file destination for the template code that is generated by the SGSCATTER procedure.
COMPARE Statement

Creates a comparative panel of scatter plots with shared axes.

Featured in:  Example 3 on page 251, Example 4 on page 252

Syntax

COMPARE X= variable | (variable-1 ... variable-n) Y= variable | (variable-1 ... variable-n) </options>;

options can be one or more of the following:
DATALABEL <= variable>
ELLIPSE <= (options)>
GRID
GROUP= variable
JOIN <= (options)>
LEGEND = (options)
LOESS <= (options)>
MARKERATTRS= style-element <(options)> | (options)
NOLEGEND
PBSPLINE <= (options)>
REFTICKS
REG <= (options)>
SPACING= n
TRANSPARENCY= numeric-value

Required Options

X= variable | (variable-1) ... (variable-n)
specifies one or more variables for the X axis. To specify more than one variable,
enclose the list of variables in parentheses.

Y= variable | (variable-1) ... (variable-n)
specifies the one or more variables for the Y axis. To specify more than one variable,
enclose the list of variables in parentheses.

Options

DATALABEL <= variable>
displays a label for each data point. If you specify a variable, the values of that
variable are used for the data labels. If you do not specify a variable, the value of the
Y variable is used for the data label.
ELLIPSE <= (options) >

Adds a confidence or prediction ellipse to the scatter plot.

options can be one or more of the following:

ALPHA= numeric-value

specifies the confidence level for the ellipse. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

Default: .05

TYPE= MEAN | PREDICTED

specifies the type of ellipse. MEAN specifies a confidence ellipse for the population mean. PREDICTED specifies a prediction ellipse for a new observation. Both ellipse types assume bivariate normal distribution.

Default: PREDICTED

Interaction: The GROUP option does not affect the creation of ellipses. The SGSCATTER procedure always uses all of the data points to calculate the confidence or prediction ellipse.

Restriction: To use this option, all of the X and Y variables must be numeric.

GRID

creates grid lines for each tick on both axes.

GROUP= variable

specifies a classification variable to divide the values into groups. If a fit line is requested, then the GROUP= variable is also applied to the fit plot unless you specify the NOGROUP suboption in the option for the fit plot.

JOIN <= (options)> 

specifies that line segments join all of the scatter points. The line segments connect the scatter points in increasing order along the X axis. The data order of the input data set has no effect on the order of the lines.

You can specify the following options:

LINEATTRS= style-element <(options)> | (options)

specifies the appearance of the join lines. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color

specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphFit style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData_n style elements in the current style.

PATTERN= line-pattern

specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 228 for a list of line patterns.

Default: For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphFit style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData_n style elements in the current style.
THICKNESS= \textit{n} <units>
specifies the thickness of the line. You can also specify the unit of measure. The
default unit is pixels. See “Units of Measurement” on page 229 for a list of the
measurement units that are supported.

\textbf{Default:} For ungrouped data, the default line thickness is specified by the
LineThickness attribute of the GraphFit style element in the current style.

For grouped data, the default line thickness is specified by the
LineThickness attribute of the GraphData1 ... GraphData\textit{n} style elements in
the current style.

\textbf{Restriction:} This option is available with SAS 9.2 Phase 2 and later.

\textbf{LEGEND=} \textbf{(options)}
specifies the appearance of the legend for the scatter plot.

\textit{options} can be one or more of the following:

\texttt{ACROSS=} \textit{n}
specifies the number of columns in the legend.

\texttt{DOWN=} \textit{n}
specifies the number of columns in the legend.

\textbf{Interaction:} If you specify both the ACROSS= and DOWN= suboptions, then the
DOWN= suboption has no effect.

\texttt{NOBORDER}
removes the border from the legend.

\texttt{NOTITLE}
removes the label from the legend.

\texttt{POSITION=} \textit{position-value}
specifies the position of the legend within the graph. The positions are as follows:

\texttt{BOTTOM} places the legend at the bottom of the graph.

\texttt{LEFT} places the legend at the left side of the graph.

\texttt{RIGHT} places the legend at the right side of the graph.

\texttt{TOP} places the legend at the top of the graph.

\textit{Note:} If you specify more than one legend with the same position, then all of
your legends are placed at that position.  

\textbf{Default:} BOTTOM

\texttt{TITLE=} "text-string"
specifies the label for the legend. By default, the label of the group variable is used.

\textbf{LOESS <= (options)>}
Adds a loess fit to the scatter plot. You can specify the following options:

\texttt{ALPHA=} \textit{numeric-value}
specifies the confidence level for the confidence limits. Specify a number between
0.00 (100\% confidence) and 1.00 (0\% confidence).

\textit{Note:} This option has no effect if you do not specify the CLM option.  

\textbf{Default:} .05

\texttt{CLM}
creates confidence limits for a mean predicted value for each observation.

\texttt{DEGREE=} 1 | 2
specifies the degree of the local polynomials to use for each local regression. 1
specifies a linear fit and 2 specifies a quadratic fit.
Default: 1

INTERPOLATION= CUBIC | LINEAR
specifies the degree of the interpolating polynomials that are used for blending local polynomial fits at the kd tree vertices.

Default: CUBIC

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the fit line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

**options** can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphFit style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData<sub>n</sub> style elements in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 228 for a list of line patterns.

**Default:** For ungrouped data, the default line pattern is specified by theLineStyle attribute of the GraphFit style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData<sub>n</sub> style elements in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 229 for a list of the measurement units that are supported.

**Default:** For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphFit style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData<sub>n</sub> style elements in the current style.

**Restriction:** This suboption is available with SAS 9.2 Phase 2 and later.

NOGROUP
specifies that the fit does not use the group variable from the scatter plot.

SMOOTH= numeric-value
specifies a smoothing parameter value. If you do not specify a value, the value is determined automatically.

**Restriction:** To use this option, all of the X and Y variables must be numeric.

MARKERATTRS= style-element <(options)> | (options)
specifies the appearance of the markers in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.
options can be one or more of the following:

COLOR= color  
specifies the color of the markers. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.
For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.

SIZE= n  
specifies the size of the markers in pixels.

Default: For ungrouped data, the default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.
For grouped data, the default marker size is specified by the MarkerSize attribute of the GraphData1 ... GraphData n style elements in the current style.

SYMBOL= symbol-name  
specifies the symbol for the markers. See “Marker Symbols” on page 229 for a list of valid marker symbols.

Default: For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.
For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData n style elements in the current style.

NOLEGEND  
removes the legend from the plot.

PBSPLINE <= (options)>  
adds a fitted, penalized B-spline curve to the scatter plot.

options can be one or more of the following:

ALPHA= numeric-value  
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

Note: This option has no effect if you do not specify either the CLI option or the CLM option. △

Default: .05

CLI  
creates confidence limits for individual predicted values for each observation.

CLM  
creates confidence limits for a mean predicted value for each observation.

DEGREE= n  
specifies the degree of the spline transformation.

Default: 3

LINEATTRS= style-element <=(options)> | (options)  
specifies the appearance of the curve line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.
**options** can be one or more of the following:

**COLOR=** *color*

specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphFit style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData*n* style elements in the current style.

**PATTERN=** *line-pattern*

specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 228 for a list of line patterns.

**Default:** For ungrouped data, the default line pattern is specified by theLineStyle attribute of the GraphFit style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData*n* style elements in the current style.

**THICKNESS=** *n* <units>

specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 229 for a list of the measurement units that are supported.

**Default:** For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphFit style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData*n* style elements in the current style.

**Restriction:** This suboption is available with SAS 9.2 Phase 2 and later.

**NKNOTS=** *n*

specifies the number of evenly-spaced internal knots.

**Default:** 100

**NOGROUP**

specifies that the curve does not use the group variable from the scatter plot.

**SMOOTH=** *numeric-value*

specifies a smoothing parameter value. If you do not specify this option, then a smoothing value is determined automatically.

**Restriction:** To use this option, all of the X and Y variables must be numeric.

**REFTICKS**

duplicates the tick marks from the X and Y axes on the opposite sides of the graph.

**REG <= (options)>**

adds a regression fit to the scatter plot.

**options** can be one or more of the following:

**ALPHA=** *numeric-value*

specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

**Note:** This option has no effect if you do not specify either the CLI option or the CLM option.

**Default:** .05
CLI
creates confidence limits for individual predicted values for each observation.

CLM
creates confidence limits for a mean predicted value for each observation.

DEGREE= n
specifies the degree of the polynomial fit. For example, 1 specifies a linear fit, 2 specifies a quadratic fit, and 3 specifies a cubic fit.

Default: 1

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the fit line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphFit style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.

PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 228 for a list of line patterns.

Default: For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphFit style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData n style elements in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 229 for a list of the measurement units that are supported.

Default: For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphFit style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData n style elements in the current style.

Restriction: This suboption is available with SAS 9.2 Phase 2 and later.

NOGROUP
specifies that the fit does not use the group variable from the scatter plot.

Restriction: To use this option, all of the X and Y variables must be numeric.

SPACING = n
specifies the amount of spacing (in pixels) that is placed between the cells in the graph.

Default: 0

TRANSPARENCY= numeric-value
specifies the degree of transparency for the plot components. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).
MATRIX Statement

Creates a scatter plot matrix.

Featured in: Example 1 on page 249

Syntax

**MATRIX** numeric-variable-1 numeric-variable-2 < ... numeric-variable-n> </options>;

*options* can be one or more of the following:

- `DATALABEL= variable`
- `DIAGONAL= (graph-list)`
- `ELLIPSE <= (options)`
- `GROUP= variable`
- `LEGEND = (options)`
- `MARKERATTRS= style-element <(options)> | (options)`
- `NOLEGEND`
- `START= BOTTOMLEFT | TOPLEFT`
- `TRANSPARENCY= numeric-value`

Required Options

`numeric-variable-1 numeric-variable-2 < ... numeric-variable-n>`

specifies two or more numeric variables for the matrix.

Options

**DATALABEL= variable**

specifies a variable that is used to create data labels for each point in the plot.

**DIAGONAL= (graph-list)**

adds graphs to the diagonal cells of the plot matrix. If you do not specify the DIAGONAL option, the diagonal cells contain the variable names.

*graph-list* can be one or more of the following:

- `HISTOGRAM` specifies a histogram.
- `KERNEL` specifies a kernel density estimate.
- `NORMAL` specifies a normal density curve.
ELLIPSE <= (options) >
Adds a confidence or prediction ellipse to each cell that contains a scatter plot.

options can be one or more of the following:

ALPHA= numeric-value
specifies the confidence level for the ellipse. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

Default: .05

TYPE= MEAN | PREDICTED
specifies the type of ellipse. MEAN specifies a confidence ellipse for the population mean. PREDICTED specifies a prediction ellipse for a new observation. Both ellipse types assume bivariate normal distribution.

Default: PREDICTED

Interaction: The GROUP option does not affect the creation of ellipses. The SGSCATTER procedure always uses all of the data points to calculate the confidence or prediction ellipse.

GROUP= variable
specifies a classification variable to divide the values into groups. If a fit line is requested, then the GROUP= variable is also applied to the fit plot unless you specify the NOGROUP suboption in the option for the fit plot.

LEGEND= (options)
specifies the appearance of the legend for the scatter plot.

options can be one or more of the following:

ACROSS= n
specifies the number of columns in the legend.

DOWN= n
specifies the number of columns in the legend.

Interaction: If you specify both the ACROSS= and DOWN= suboptions, then the DOWN= suboption has no effect.

NOBORDER
removes the border from the legend.

NOTITLE
removes the label from the legend.

POSITION= position-value
specifies the position of the legend within the graph. The values are as follows:

BOTTOM places the legend at the bottom of the graph.

LEFT places the legend at the left side of the graph.

RIGHT places the legend at the right side of the graph.

TOP places the legend at the top of the graph.

Note: If you specify more than one legend with the same position, then all of your legends are placed at that position. 

Default: BOTTOM

TITLE= "text-string"
specifies the label for the legend. By default, the label of the group variable is used.

MARKERATTRS= style-element <(options)> | (options)
specifies the appearance of the markers in the plot. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.
options can be one or more of the following:

COLOR= color
specifies the color of the markers. For more information about specifying colors, see the "SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphDataDefault style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.

SIZE= n
specifies the size of the markers in pixels.

Default: For ungrouped data, the default marker size is specified by the MarkerSize attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker size is specified by the MarkerSize attribute of the GraphData1 ... GraphData n style elements in the current style.

SYMBOL= symbol-name
specifies the symbol for the markers. See “Marker Symbols” on page 229 for a list of valid marker symbols.

Default: For ungrouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphDataDefault style element in the current style.

For grouped data, the default marker symbol is specified by the MarkerSymbol attribute of the GraphData1 ... GraphData n style elements in the current style.

NOLEGEND
removes the legend from the graph.

START= BOTTOMLEFT | TOPLEFT
specifies whether the diagonal starts in the top left corner or the bottom left corner.

Default: TOPLEFT

TRANSPARENCY= numeric-value
specifies the degree of transparency for the plot components. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

Default: 0.0

Restriction: This option is available with SAS 9.2 Phase 2 and later.

---

**PLOT Statement**

Creates a paneled graph that contains multiple independent scatter plots.

**Featured in:** Example 2 on page 250

**Syntax**

```
PLOT plot-request(s) / options;
```
The SGSCATTER Procedure

PLOT Statement 241

options can be one or more of the following:
- `COLUMNS= n`
- `DATALABEL <= variable>`
- `ELLIPSE <= (options)>`
- `GRID`
- `GROUP= variable`
- `JOIN <= (options)>`
- `LEGEND = (options)`
- `LOESS <= (options)>`
- `MARKERATTRS= style-element <(options)> | (options)`
- `NOLEGEND`
- `PBSPLINE <= (options)>`
- `REFTICKS`
- `REG <= (options)>`
- `ROWS= n`
- `SPACING= n`
- `TRANSPARENCY= numeric-value`
- `UNISCALE= X | Y | ALL`

**Required Arguments**

`plot-request-1 < ... plot-request-n>`
specifies one or more plot requests. Each plot request specifies the variables to plot and produces a separate cell. All variables must be in the input data set. Multiple plot requests are separated with blanks. You can plot character or numeric variables. A plot request can be either of these:

- `y-variable*x-variable`
  plots the values of two variables.
  - `y-variable`
    variable plotted on the left vertical axis.
  - `x-variable`
    variable plotted on the horizontal axis.

- `(y-variable(s))*(x-variable(s))`
  plots the values of two or more variables and produces a separate cell for each combination of Y and X variables. That is, each Y*X pair is plotted on a separate set of axes.
  - `y-variable(s)`
    variables plotted on the left vertical axes.
  - `x-variable(s)`
    variables plotted on the horizontal axes.

If you use only one `y-variable` or only one `x-variable`, omit the parentheses for that variable, for example,

`plot (temp rain)*month;`

This plot request produces two cells, one for TEMP and MONTH and one for RAIN and MONTH.
Options

COLUMN= n
specifies the number of columns in the graph.

DATALABEL <= variable>
displays a label for each data point. If you specify a variable, the values of that variable are used for the data labels. If you do not specify a variable, the value of the Y variable is used for the data label.

ELLIPSE <= (options)>
Adds a confidence or prediction ellipse to the scatter plot.

options can be one or more of the following:

ALPHA= n
specifies the confidence level for the ellipse. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

Default: .05

TYPE= MEAN | PREDICTED
specifies the type of ellipse. MEAN specifies a confidence ellipse for the population mean. PREDICTED specifies a prediction ellipse for a new observation. Both ellipse types assume bivariate normal distribution.

Default: PREDICTED

Interaction: The GROUP option does not affect the creation of ellipses. The SGSCATTER procedure always uses all of the data points to calculate the confidence or prediction ellipse.

Restriction: To use this option, all of the X and Y variables must be numeric.

GRID
creates grid lines for each tick on both axes.

GROUP= variable
specifies a classification variable to divide the values into groups. If a fit line is requested, then the GROUP= variable is also applied to the fit plot unless you specify the NOGROUP suboption in the option for the fit plot.

JOIN <= (options)>
specifies that line segments join all of the scatter points. The line segments connect the scatter points in increasing order along the X axis. The data order of the input data set has no effect on the order of the lines.

You can specify the following options:

LINEATTRS= style-element <(options)> | (options)
specifies the appearance of the join lines. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphFit style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.
PATTERN= line-pattern
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 228 for a list of line patterns.

Default: For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphFit style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData n style elements in the current style.

THICKNESS= n <units>
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 229 for a list of the measurement units that are supported.

Default: For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphFit style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData n style elements in the current style.

Restriction: This option is available with SAS 9.2 Phase 2 and later.

LEGEND= (options)
specifies the appearance of the legend for the scatter plot.

options can be one or more of the following:

ACROSS= n
specifies the number of columns in the legend.

DOWN= n
specifies the number of columns in the legend.

Interaction: This suboption has no effect if you also specify the ACROSS= suboption.

LOCATION= CELL | OUTSIDE
specifies whether the legend is placed inside of the plot area (CELL) or outside of the plot area (OUTSIDE).

NOBORDER
removes the border from the legend.

NOTITLE
removes the label from the legend.

POSITION= position-value
specifies the position of the legend within the graph. The positions are as follows:

BOTTOM places the legend at the bottom of the graph.
LEFT places the legend at the left side of the graph.
RIGHT places the legend at the right side of the graph.
TOP places the legend at the top of the graph.

Note: If you specify more than one legend with the same position, then all of your legends are placed at that position. △

Default: BOTTOM

TITLE= "text-string"
specifies the label for the legend. By default, the label of the group variable is used.
**LOESS <= (options)>**
Adds a loess fit to the scatter plot. You can specify the following options:

**ALPHA= numeric-value**
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

*Note:* This option has no effect if you do not specify the CLM option. △

**Default:** .05

**CLM**
creates confidence limits for a mean predicted value for each observation.

**DEGREE= 1 | 2**
specifies the degree of the local polynomials to use for each local regression. 1 specifies a linear fit and 2 specifies a quadratic fit.

**Default:** 1

**INTERPOLATION= CUBIC | LINEAR**
specifies the degree of the interpolating polynomials that are used for blending local polynomial fits at the kd tree vertices.

**Default:** CUBIC

**LINEATTRS= style-element <(options)> | (options)**
specifies the appearance of the fit line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes. **options** can be one or more of the following:

**COLOR= color**
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the *SAS/GRAPH: Reference*.

**Default:** For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphFit style element in the current style. For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData\textsubscript{n} style elements in the current style.

**PATTERN= line-pattern**
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 228 for a list of line patterns.

**Default:** For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphFit style element in the current style. For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData\textsubscript{n} style elements in the current style.

**THICKNESS= n <units>**
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 229 for a list of the measurement units that are supported.

**Default:** For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphFit style element in the current style. For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData\textsubscript{n} style elements in the current style.

**Restriction:** This suboption is available with SAS 9.2 Phase 2 and later.
NOGROUP
  specifies that the fit does not use the group variable from the scatter plot.

SMOOTH= numeric-value
  specifies a smoothing parameter value. If you do not specify a value, then a
  smoothing value is determined automatically.

Restriction:  To use this option, all of the X and Y variables must be numeric.

MARKERATTRS= style-element <(options)> | (options)
  specifies the appearance of the markers in the plot. You can specify the appearance
  by using a style element or by using suboptions. If you specify a style element, you
  can additionally specify suboptions to override specific appearance attributes.
  options can be one or more of the following:

  COLOR= color
    specifies the color of the markers. For more information about specifying colors,
    see the "SAS/GRAPH Colors and Images" chapter in the SAS/GRAPH: Reference.
    Default: For ungrouped data, the default color is specified by the ContrastColor
    attribute of the GraphDataDefault style element in the current style.
    For grouped data, the default color is specified by the ContrastColor attribute
    of the GraphData1 ... GraphData style elements in the current style.

  SIZE= n
    specifies the size of the markers in pixels.
    Default: For ungrouped data, the default marker size is specified by the
    MarkerSize attribute of the GraphDataDefault style element in the current
    style.
    For grouped data, the default marker size is specified by the MarkerSize
    attribute of the GraphData1 ... GraphData style elements in the current style.

  SYMBOL= symbol-name
    specifies the symbol for the markers. See “Marker Symbols” on page 229 for a list
    of valid marker symbols.
    Default: For ungrouped data, the default marker symbol is specified by the
    MarkerSymbol attribute of the GraphDataDefault style element in the current
    style.
    For grouped data, the default marker symbol is specified by the MarkerSymbol attribute
    of the GraphData1 ... GraphData style elements in the current style.

NOLEGEND
  removes the legend from the graph.

PBSPLINE <= (options)>
  adds a fitted, penalized B-spline curve to the scatter plot.
  options can be one or more of the following:

  ALPHA= numeric-value
    specifies the confidence level for the confidence limits. Specify a number between
    0.00 (100% confidence) and 1.00 (0% confidence).
    Note:  This option has no effect if you do not specify either the CLI option or
    the CLM option. △
    Default: .05

CLI
  creates confidence limits for individual predicted values for each observation.
CLM
  creates confidence limits for a mean predicted value for each observation.

DEGREE= \( n \)
  specifies the degree of the spline transformation.

  Default: 3

LINEATTRS= style-element <(options)> | (options)
  specifies the appearance of the curve line. You can specify the appearance by using
  a style element or by using suboptions. If you specify a style element, you can
  additionally specify suboptions to override specific appearance attributes.

  options can be one or more of the following:

  COLOR= color
    specifies the color of the line. For more information about specifying colors, see
    the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference

    Default: For ungrouped data, the default color is specified by the ContrastColor
    attribute of the GraphFit style element in the current style.

    For grouped data, the default color is specified by the ContrastColor
    attribute of the GraphData1 ... GraphData\( n \) style elements in the current
    style.

  PATTERN= line-pattern
    specifies the line pattern for the line. You can reference SAS patterns by
    number or by name. See “Line Patterns” on page 228 for a list of line patterns.

    Default: For ungrouped data, the default line pattern is specified by the
    LineStyle attribute of the GraphFit style element in the current style.

    For grouped data, the default line pattern is specified by the LineStyle
    attribute of the GraphData1 ... GraphData\( n \) style elements in the current
    style.

  THICKNESS= n \( <\text{units}> \)
    specifies the thickness of the line. You can also specify the unit of measure. The
    default unit is pixels. See “Units of Measurement” on page 229 for a list of the
    measurement units that are supported.

    Default: For ungrouped data, the default line thickness is specified by the
    LineThickness attribute of the GraphFit style element in the current style.

    For grouped data, the default line thickness is specified by the LineThickness
    attribute of the GraphData1 ... GraphData\( n \) style elements in the current
    style.

  Restriction: This option is available with SAS 9.2 Phase 2 and later.

NKNOTS= \( n \)
  specifies the number of evenly-spaced internal knots.

  Default: 100

NOGROUP
  specifies that the curve does not use the group variable from the scatter plot.

SMOOTH= numeric-value
  specifies a smoothing parameter value. If you do not specify this option, then a
  smoothing value is determined automatically.

  Restriction: To use this option, all of the X and Y variables must be numeric.

REFTICKS
  duplicates the tick marks from the X and Y axes on the opposite sides of each cell.
REG <= (options)>  adds a regression fit to the scatter plot.

options can be one or more of the following:

ALPHA= numeric-value  
specifies the confidence level for the confidence limits. Specify a number between 0.00 (100% confidence) and 1.00 (0% confidence).

Note: This option has no effect if you do not specify either the CLI option or the CLM option. △

Default: .05

CLI  
creates confidence limits for individual predicted values for each observation.

CLM  
creates confidence limits for a mean predicted value for each observation.

DEGREE= n  
specifies the degree of the polynomial fit. For example, 1 specifies a linear fit, 2 specifies a quadratic fit, and 3 specifies a cubic fit.

Default: 1

LINEATTRS= style-element <(options)> | (options)  
specifies the appearance of the fit line. You can specify the appearance by using a style element or by using suboptions. If you specify a style element, you can additionally specify suboptions to override specific appearance attributes.

options can be one or more of the following:

COLOR= color  
specifies the color of the line. For more information about specifying colors, see the “SAS/GRAPH Colors and Images” chapter in the SAS/GRAPH: Reference.

Default: For ungrouped data, the default color is specified by the ContrastColor attribute of the GraphFit style element in the current style.

For grouped data, the default color is specified by the ContrastColor attribute of the GraphData1 ... GraphData n style elements in the current style.

PATTERN= line-pattern  
specifies the line pattern for the line. You can reference SAS patterns by number or by name. See “Line Patterns” on page 228 for a list of line patterns.

Default: For ungrouped data, the default line pattern is specified by the LineStyle attribute of the GraphFit style element in the current style.

For grouped data, the default line pattern is specified by the LineStyle attribute of the GraphData1 ... GraphData n style elements in the current style.

THICKNESS= n <units>  
specifies the thickness of the line. You can also specify the unit of measure. The default unit is pixels. See “Units of Measurement” on page 229 for a list of the measurement units that are supported.

Default: For ungrouped data, the default line thickness is specified by the LineThickness attribute of the GraphFit style element in the current style.

For grouped data, the default line thickness is specified by the LineThickness attribute of the GraphData1 ... GraphData n style elements in the current style.

Restriction: This suboption is available with SAS 9.2 Phase 2 and later.
NOGROUP
  specifies that the fit does not use the group variable from the scatter plot.

**Restriction:** To use this option, all of the X and Y variables must be numeric.

ROWS= n
  specifies the number of rows in the graph.

**Interaction:** This option has no effect if you specify the COLUMNS= option.

SPACING = n
  specifies the amount of spacing (in pixels) that is placed between the cells in the graph, if the PLOT statement creates multiple cells.

**Default:** 10

TRANSPARENCY= numeric-value
  specifies the degree of transparency for the plot components. Specify a value from 0.0 (completely opaque) to 1.0 (completely transparent).

**Default:** 0.0

**Restriction:** This option is available with SAS 9.2 Phase 2 and later.

UNISCALE= X | Y | ALL
  specifies that the X axis, Y axis, or both axes are scaled uniformly for all of the cells in the graph. By default, no scaling is performed. If this option is used, then all variables on the specified axis must be of the same type (all numeric or all character).
Example 1: Creating a Scatter Plot Matrix

Procedure features:
  MATRIX statement
  GROUP option

Sample library member: GSGSCMAT

This example shows a scatter plot matrix with grouped data.

Set the title and footnote and create the scatter plot matrix. On the MATRIX statement, the GROUP = option groups the data by the SPECIES variable.

```sas
proc sgscatter data=sashelp.iris;
  title "Scatterplot Matrix for Iris Data";
  matrix sepal_length petal_length sepal_width petal_width
    / group=species;
run;
```
Example 2: Creating a Graph with Multiple Independent Scatter Plots and Spline Curves

Procedure features:
- PLOT statement
- PBSPLINE option

Sample library member: GSGSCPLT

This example shows a graph with multiple independent scatter plots with fitted splines.

Create the scatter plots. On the PLOT statement, the PBSPLINE option fits the spline curves to the scatter points.

```sql
proc sgscatter data=sashelp.iris(where=(species="Virginica"));
   title "Multi-Celled Spline Curve for Species Virginica";
   plot (sepallength sepalwidth)*(petallength petalwidth)
      / pbspline;
run;
```
Example 3: Creating a Simple Comparative Panel

Procedure features:
- COMPARE statement
- GROUP option

Sample library member: GSGSCCMP

This example shows a comparative scatter plot with grouped data.

Create the scatter plot. On the COMPARE statement, the GROUP= option groups the data by the SPECIES variable.

```
proc sgscatter data=sashelp.iris;
    title "Iris Data: Length and Width";
    compare x=(sepallength petallength)
        y=(sepalwidth petalwidth)
        / group=species;
run;
```
Example 4: Creating a Comparative Panel with Regression Fits and Confidence Ellipses

Procedure features:
- COMPARE statement
- REG option
- ELLIPSE option
- SPACING option

Sample library member  GSGSCCM1

This example shows a comparative panel of scatter plots with regression fits and confidence ellipses.

Create the scatter plot. On the COMPARE statement, the REG option fits the regression lines and the ELLIPSE option creates the confidence ellipses and sets the ellipse type to MEAN. The SPACING= option adds spacing between plots.

```
proc sgscatter data=sashelp.iris(where=(species="Versicolor"));
  title "Versicolor Length and Width";
  compare y=(sepalwidth petalwidth)
    x=(sepallength petallength)
    / reg ellipse=(type=mean) spacing=4;
run;
```
Overview

The SGRENDER procedure produces graphical output from templates that are created with the Graph Template Language (GTL). The GTL is a comprehensive language for creating statistical graphics, which can be used to create customized layouts and graphs that are beyond the scope of the Statistical Graphics procedures. For more information about the GTL, see the SAS/GRAPH: Graph Template Language Reference and the SAS/GRAPH: Graph Template Language User’s Guide.

Procedure Syntax

PROC SGRENDER < option(s)>;
   DYNAMIC variable-assignment(s);

PROC SGRENDER Statement

Identifies the data set that contains the plot variables and the StatGraph template. The statement also gives you the option to specify the name of the output object and the label for the output object.

Requirements: An input data set and a template are required.
**Syntax**

```
PROC SGRENDER TEMPLATE= statgraph-template <DATA= input-data-set>
   <OBJECT= object-name>
   <OBJECTLABEL=“text-string”>;
```

**Required Arguments**

- **TEMPLATE= statgraph-template** specifies a StatGraph template that defines one or more graphs. The SGRENDER procedure applies the StatGraph template to your data to create the output graphs.

  *Note:* Specifying a template that is not a StatGraph template is not supported. If you specify a non-StatGraph template, then the SGRENDER procedure might produce unpredictable results.

**Options**

- **DATA= input-data-set** specifies the SAS data set that contains the variables to process. By default, the procedure uses the most recently created SAS data set.

- **OBJECT= object-name** specifies a name for the ODS output object.

  *Note:* To specify the filename of the output image, use the IMAGENAME= option on the ODS GRAPHICS statement.

  *Alias:* NAME=

  *Default:* SGRender

- **OBJECTLABEL= “text-string”** specifies a description for the output image. The description identifies the image in the following locations:
  - the Results window
  - the alternate text for the image in HTML output
  - the table of contents that is created by the CONTENTS option on an ODS statement

  The default description is “The SGRENDER Procedure”.

  *Alias:* DES=, DESCRIPTION=

---

**DYNAMIC Statement**

Defines the values for dynamic variables in your StatGraph template code.

*Featured in:* Example 2 on page 257
**Description**

The DYNAMIC statement defines values for dynamic variables that are used in your StatGraph template.

You can either specify variables on multiple DYNAMIC statements, or specify all of your variables on a single DYNAMIC statement.

*Note:* If your template uses dynamic variables to specify required attributes, and you do not define values for those variables in a DYNAMIC statement, then the SGRENDER procedure might produce errors.

**Syntax**

```
DYNAMIC variable-assignment(s);
```

**Required Options**

`variable-assignment(s)`

specifies the values for one or more dynamic variables. The variables that you assign must also be declared in a DYNAMIC statement within the StatGraph template.

You can specify either a numeric value or a quoted text string. For example, the following statement defines one string variable and one numeric variable:

```
dynamic region="Europe" limit=3000;
```

**Details**

Some special dynamic variables can be declared and referenced in a StatGraph template and do not need to be assigned in the DYNAMIC statement of the SGRENDER procedure:

- `_LIBNAME_` represents the name of the library that contains the data set.
- `_MEMNAME_` represents the name of the library member that contains the data set.
- `_BYLINE_` represents the complete BY line, when you specify a BY statement.
- `_BYVAR_` represents the name of the first BY variable, when you specify a BY statement.
- `_BYVARn_` represents the name of the nth BY variable, when you specify a BY statement with multiple variables.
- `_BYVAL_` represents the first BY value, when you specify a BY statement.
- `_BYVALn_` represents the value of the nth BY variable, when you specify a BY statement with multiple variables.
Example 1: Generating a Graph from a Simple GTL Template

Sample library member: GSGRENDR

This example creates a simple StatGraph template by using Graph Template Language and then generates a graph from the template by using the SGRENDER procedure.

Create the Statgraph Template.

```
proc template;
    define statgraph surface;
    begingroup;
        layout overlay3d;
        surfaceplotparm x=height y=weight z=density;
        endlayout;
    endgraph;
end;
run;
```
Example 2: Defining Dynamic Variables

Procedure features: DYNAMIC Statement
Sample library member: GSGREND1

This example uses dynamic variables to set values within the StatGraph template. By using dynamic variables to set the variable names, variable labels, and other parameters, the StatGraph template can be used with different data sets.

The first PROC SGRENDER statement generates a graph for the SASHELP.HEART data set:

```
proc sgrender data=sashelp.gridded template=surface;
run;
```

Create the Statgraph Template.

```
proc template;
define statgraph distribution;
dynamic VAR VARLABEL TITLE NORMAL _BYLINE_;
begingroup;
   entrytitle TITLE;
   entrytitle _BYLINE_;
   layout lattice / columns=1 rows=2 rowgutter=2px rowweights=(.9 .1) column datarange=union;
columnaxes;
```

```
Note: 5057
Mean: 237.42
StdDev: 44.936
```

Framingham Heart Study

<table>
<thead>
<tr>
<th>Percent</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol (LDL)</td>
<td>100</td>
<td>140</td>
<td>180</td>
<td>220</td>
</tr>
</tbody>
</table>

This graph shows the distribution of cholesterol levels in the Framingham Heart Study dataset.
Example 2: Defining Dynamic Variables

columnaxis / label=VARLABEL;
endcolumnaxes;
layout overlay / yaxisopts=(offsetmin=.035);
layout gridded / columns=2 border=true autoalign=(topleft topright);
  entry halign=left "Nobs";
  entry halign=left eval(strip(put(n(VAR),8.)));  
  entry halign=left "Mean";
  entry halign=left eval(strip(put(mean(VAR),8.2)));  
  entry halign=left "StdDev";
  entry halign=left eval(strip(put(stddev(VAR),8.3)));  
endlayout;
histogram VAR / scale=percent;
if (exists(NORMAL))
  densityplot VAR / normal( );
endif;
fringeplot VAR / datatransparency=.7;
endlayout;
boxplot y=VAR / orient=horizontal;
endlayout;
endgraph;
end;
run;

Generate the first graphics output from the template using the SASHELP.HEART data set. The DYNAMIC statement defines dynamic variables in the template.

proc sgrender data=sashelp.heart template=distribution;
  dynamic var="cholesterol" varlabel="Cholesterol (LDL)" normal="yes"
    title="Framingham Heart Study";
run;

The second PROC SGRENDER statement generates multiple graph for the CARS data set by using BY grouping. The first graph is displayed here.
Sort the SASHELP.CARS data set. The data set must be sorted by the same variable that the following PROC SGRENDER block uses in its BY statement.

```sas
proc sort data=sashelp.cars out=cars;
  by origin;
run;
```

Generate the second graphics output from the template using the WORK.CARS data set. The BY statement generates multiple graphs for each value of the BY variable. The DYNAMIC statement defines dynamic variables in the template.

```sas
proc sgrender data=cars template=distribution;
  by origin;
    dynamic var="weight" varlabel="Weight in LBS"
      title="Distribution of Vehicle Weight";
run;
```
Customizing ODS Graphics

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Overview

Along with table and page attributes, ODS styles contain a collection of graphical attributes such as color, marker shape, line pattern, fonts, and so on. Many carefully designed styles are shipped with SAS that enhance the visual impact of the graphics. In addition to creating visually appealing graphics, many key elements of effective graphics are built into the various elements of the styles, such as:

- Provide maximum contrast between backgrounds and data
- Provide for ease of discrimination between different groups
- Provide equal emphasis for data with equal importance

These default styles are used to produce professional looking graphics without the need for further modification. Every ODS output destination has a default style associated with it. These default styles are different for each destination, therefore your output might look different depending on which destination you use. For information about how to specify styles and the default style for each destination, see “Specifying a Style” on page 264. For information about permanently changing the default style, see “Changing the Default Style in the SAS Registry” on page 268.

You can customize your graphical output at three levels. The following table shows the three levels of customization.
### Table 7.1: Levels of Customization

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Level of Complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change the style template. See “Specifying a Style” on page 264.</td>
<td>Specify a style template with the STYLE= option to change the appearance of the entire graph. Requires no further modification.</td>
<td>low</td>
</tr>
<tr>
<td>Use Appearance options. See “Using the Statistical Graphics Procedures Options” on page 269.</td>
<td>Specify an appearance option in the SG procedure to change various aspects of your graph. Appearance options override the corresponding defaults from the current style. Note that not all appearance attributes can be specified in this way.</td>
<td>low</td>
</tr>
<tr>
<td>Modify individual style elements. See “Modifying Styles” on page 273.</td>
<td>Specify or change style attributes in order to modify a style element. This require the use of PROC TEMPLATE style statements.</td>
<td>high</td>
</tr>
</tbody>
</table>

---

## Specifying a Style

### About Style Templates

An ODS style is a collection of named style elements that provides specific visual attributes for the presentation aspects (color, font face, font size, and so on) of your graphical and tabular SAS output. Each style element is a named collection of style attributes such as color, marker symbol, line style, font face, as well as many others. The style elements of a style are designed to ensure the goals of effective graphics, as stated above. The colors used for drawing the markers in a scatter plot are designed to contrast well against the data wall color. Each graphical element of a plot, such as a marker, a bar, a line or a title, derives its visual attributes from a specific style element from the active style. Changing the style for an ODS destination is the easiest, simplest way of changing a graphic's appearance. Changing the current style requires only the use of the STYLE= option on an ODS destination statement.

*Note:* The style that a destination uses is applied to tabular output as well as graphical output. △

Every ODS output destination has a default style associated with it. These default styles are different for each destination, therefore your output might look different depending on which destination you use.

If your program does not specify a style to use, then the following styles are in effect:
### Table 7.2 Default Style Templates

<table>
<thead>
<tr>
<th>ODS Destination</th>
<th>Default Style Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCUMENT</td>
<td>N/A</td>
</tr>
<tr>
<td>LISTING</td>
<td>Listing</td>
</tr>
<tr>
<td>OUTPUT</td>
<td>N/A</td>
</tr>
<tr>
<td>HTML</td>
<td>Default</td>
</tr>
<tr>
<td>LATEX</td>
<td>Default</td>
</tr>
<tr>
<td>PRINTER</td>
<td>ColorPrinter for PDF and PS,</td>
</tr>
<tr>
<td></td>
<td>monochromePrinter for PCL</td>
</tr>
<tr>
<td>RTF</td>
<td>RTF</td>
</tr>
<tr>
<td>Measured RTF</td>
<td>RTF</td>
</tr>
</tbody>
</table>

**Note:** You can change the default style template for each destination by modifying the SAS registry. See “Changing the Default Style in the SAS Registry” on page 268.

SAS ships a set of styles that have been designed by GUI experts to address the needs of different situations, while ensuring the principles of effective graphics. The following is a subset of the styles shipped with SAS that are particularly suited for statistical graphics:

### Table 7.3 Recommended Style Templates

<table>
<thead>
<tr>
<th>Desired Output</th>
<th>Recommended Styles</th>
<th>Additional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Color</td>
<td>Default</td>
<td>gray background, optimized for HTML output</td>
</tr>
<tr>
<td></td>
<td>Analysis</td>
<td>yellow background</td>
</tr>
<tr>
<td></td>
<td>Statistical</td>
<td>white background, colored fills</td>
</tr>
<tr>
<td></td>
<td>Listing</td>
<td>white background, optimized for color format on white paper</td>
</tr>
<tr>
<td></td>
<td>Printer</td>
<td>optimized for PS and PDF output</td>
</tr>
<tr>
<td>Gray Scale</td>
<td>Journal</td>
<td>interior filled areas are gray scale</td>
</tr>
<tr>
<td>Black and White</td>
<td>Journal2</td>
<td>interior filled areas have no color</td>
</tr>
</tbody>
</table>

You can view the styles that SAS provides by using the command line or the SAS Windowing Environment.

1. Using the SAS Windowing Environment
   - In the Results window, select the Results folder. Right-click and select Templates to open the Templates window.
   - Double-click `Sashelp.Tmplmst` to view the contents of that directory.
   - Double-click `Styles` to view the contents of that directory.
   - Double-click the style definition that you want to view. For example, the Default style definition is the template store for HTML output. Similarly, the RTF style definition is the template store for RTF output.
Changing the Current Graph Style by Using the STYLE= Option in ODS Destination Statements

Each ODS destination has a default style that is set by SAS. By specifying only STYLE=style-definition in your ODS destination statement, you can create an entirely different appearance for your graphs. For example, you can specify that ODS apply the Styles.Journal style template to all HTML output with one of the following statements:

```ods html style=styles.journal;
ods html style=journal;
```

This style is applied to all output for that destination until you change or close the destination or start a new SAS session.

To view the supplied ODS styles, open the Template window, and navigate to Templates ➤ Sashelp.tmplmst ➤ Styles. You can open the Template window by specifying ODSTEMPLATE in the command line or from the Results window. To open the Template window from the Results window, open the Results window, select the Results folder. Right-click and select Templates.

Style templates are created and modified with the TEMPLATE procedure. For more information, refer to SAS Output Delivery System: User's Guide.

Examples of Style Templates

SAS provides styles that are recommended for use with statistical graphics. Each of the following graphs was created using a different style, with the HTML destination:
Display 7.1  HTML Output Using the Default Style

Display 7.2  HTML Output Using the Analysis Style
Chapter 7

Display 7.3  HTML Output Using the Journal Style

Display 7.4  HTML Output Using the Statistical Style

Changing the Default Style in the SAS Registry

By default, the SAS registry is configured to apply a default style to the output for each ODS destination. The default style for each destination can be different. For example, the default style for the PRINTER destination is “Printer” while the default style for the RTF destination is “RTF”. To permanently change the default style, you can change the setting of Selected Style in the SAS registry. For more information on ODS and the SAS registry, see Changing SAS Registry Settings for ODS in SAS Output Delivery System: User's Guide.

To permanently change the default style for a particular destination:
1. Select **Solutions ▶ Accessories ▶ Registry Editor**, or issue the command REGEDIT in the command line.

2. Select **ODS ▶ Destinations**

3. Select the destination you want to change the default style for.

4. Select Selected Style, click the right mouse button, and select Modify. The Edit String Value window appears.

5. Type the style in the Value Data text box and select OK.

**CAUTION:**
If you make a mistake when you modify the SAS registry, then your system might become unstable or unusable.

Display 7.5 SAS Registry Showing Selected Style Setting

---

**Using the Statistical Graphics Procedures Options**

**Overview**

ODS styles control the overall appearance of the graphs. Visual attributes of various elements of the graph are derived from specific style elements within the style unless explicitly specified in your procedure code. You can make a specific appearance change
to one or more aspects of your graph without making changes to the overall style by using appearance options in your procedure options.

Many SG procedure statements have options and suboptions that control the appearance of different parts of a graph. For example, the option LINEATTRS=, the suboption PATTERN=, and the suboption COLOR= in the following DENSITY statement specify that the density curve has a blue dashed line, no matter what style is being used:

```plaintext
density xvar / lineattrs=(pattern=dash color=blue);
```

**Note:** Although you can hardcode values with appearance options, it is not always appropriate to do so. See “Specifying Hardcoded Values” on page 272 for more information.

The appearance options and their values are specific to each statement. For complete documentation for the statements and their options, see the syntax section for the appropriate procedure and statement.

## Specifying Appearance Option Values

Default visual attributes of various graphical elements of a graph are derived from the specific style elements of the active style. For example, the text of the markers of a non-grouped scatter plot derive their visual attributes from the GraphDataText style element. Although there are many graphical elements that derive their visual attributes from specific style elements, the following figure shows the style elements that affect graphical text:

![Default Style Elements Affecting Graphical Text](image)

However, you can explicitly specify the visual attributes to be used for the various graphical style elements by using the appropriate appearance option for the statement. For example, the MARKERATTRS= appearance option controls the attributes of markers for the SCATTERPLOT statement. All appearance options have suboptions that control a specific aspect of the graphical element. For example, for markers, the MARKERATTRS= option has the suboptions SYMBOL=, COLOR=, and SIZE=, which control those aspects of the marker.
You can specify values for appearance options by using three different methods. The first method uses style element references to set visual attributes. The second method uses hardcoded values. The third method combines the first two methods. It is strongly recommended that you use style references to ensure that your graphs are stylistically robust. Use the hardcoded method only when absolutely necessary. The methods are:
- specifying a style element reference with an appearance option
- specifying hardcoded values with an appearance option
- specifying a style element, but overriding an attribute with a hardcoded value.

It is recommended that you use style references with appearance options. This is because the style attributes that are referenced by the style element reference are chosen to provide consistency and appropriate emphasis based on display principles for statistical graphics. If you hardcode a value into a style element, you are overriding the style and you might create a graph that is inconsistent with the style. For a table of valid style elements to use with ODS statistical graphics, see “Style Elements for Use with ODS Statistical Graphics” on page 273.

**Specifying Style Element References**

You can change the visual attributes used for a graphical element of your plot by using the relevant appearance option for a specific statement. You can use style elements as values for any appearance option. Style elements are a collection of style attributes that apply to a particular part of the graph. For example, a style element might contain instructions for the presentation of marker, such as color, symbol, and size. They are contained within the style. For more information on style elements, see the chapter on creating styles in *SAS Output Delivery System: User’s Guide*. When you reference a style element, all of the attributes in that element are used to modify the visual attributes of the graphical feature.

For example, the graph shown in Display 7.6 on page 271 is a histogram with a normal density curve. By default, the visual attributes of the density curve are specified by the style attributes within the style element GraphFit.

**Display 7.6** Histogram with Default Density Curve

You can use the LINEATTRS= option in the first DENSITY statement to change the style element that is used for the line attributes. For example, when you are using the Default style, specifying the GraphData5 style element causes the density curve line to use the DashDashDot line pattern and the color blue.


In general, it is recommended to specify the entire style element this way to derive all of the relevant visual attributes. In this case, the line pattern and color are both derived from the specified style element.

### Specifying Hardcoded Values

In some cases it is important to have a specific visual effect, but it is not necessary for the plot to be reused with different styles. In such a case you can specify hardcoded values for the visual attributes in the appearance option. In the above example from “Specifying Style Element References” on page 271, you could have used the following statement to set the density curve attributes:

\[
density / \text{lineattrs}=(\text{pattern=dashdashdot color=blue});
\]

However, if you use the \texttt{STYLE=} option to change the overall style to Journal, which only uses gray scale colors, the color for this curve is still blue:

\[
density / \text{lineattrs}=(\text{pattern=dashdashdot color=blue});
\]
Also, a hardcoded color could be exactly the same color as the wall color of another style, and become indistinguishable from the wall.

### Modifying Styles

With the TEMPLATE procedure, you can use the DEFINE STYLE statement to create your own style from scratch or from an existing style. When you create styles from existing styles, you can modify the individual style elements.

For example, the following program shows the style element GraphDataDefault, as defined in the Default style:

```
proc template;
    define style Styles.Default;
    ...
    class GraphDataDefault /
        endcolor = GraphColors("gramp3cend")
        neutralcolor = GraphColors("gramp3cneutral")
        startcolor = GraphColors("gramp3cstart")
        markersize = 7px
        markersymbol = "circle"
        linethickness = 1px
        linestyle = 1
        contrastcolor = GraphColors("gcdata")
        color = GraphColors("gdata");
end;
run;
```

You can use the DEFINE STYLE statement to create a new style from the Default style and modify the GraphDataDefault style element.

The following program creates the new style MyStyleDefault, which inherits all of its style elements and style attributes from the Default style, and customizes the GraphDataDefault style element:

```
proc template;
    define style MyStyleDefault;
    parent=Styles.Default;
    style GraphDataDefault from GraphDataDefault /
        markersize = 10px
        markersymbol = "square";
    end;
run;
```

For complete documentation on using PROC TEMPLATE to modify and create styles, see TEMPLATE Procedure: Creating a Style Definition in SAS Output Delivery System: User’s Guide.

For a list of the style elements that you can use with ODS Statistical Graphics, see “Style Elements for Use with ODS Statistical Graphics” on page 273.

### Style Elements for Use with ODS Statistical Graphics

The following style elements affect statistical graphics and can be specified by GTL appearance options or used in styles.
Certain style elements were created to be used with specific plots. For example, the style element `GraphFit2` is best used to modify secondary fit lines. The style element `GraphConfidence2` was created to modify secondary confidence bands. The table below lists each style element, the portion of the graph it affects or was created to use with, and the default attribute values. Attribute values can be changed with PROC TEMPLATE, as stated above.

### Table 7.4  Graph Style Elements: General Graph Appearance

<table>
<thead>
<tr>
<th>Style Element</th>
<th>Portion of Graph Affected</th>
<th>Recognized Attributes</th>
<th>Attribute Values in DEFAULT Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graph</td>
<td>Graph size and outer border appearance</td>
<td>OutputWidth</td>
<td>Not set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OutputHeight</td>
<td>Not set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BorderColor</td>
<td>Inherited</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BorderWidth</td>
<td>Inherited</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CellPadding</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CellSpacing</td>
<td>Inherited</td>
</tr>
<tr>
<td>GraphAnnoLine</td>
<td>Annotation lines</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gdata&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>1px</td>
</tr>
<tr>
<td>GraphAnnoShape</td>
<td>Annotation closed shapes such as circles, and squares</td>
<td>Color</td>
<td>GraphColors(&quot;gdata&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gdata&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>2px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transparency</td>
<td>Not set</td>
</tr>
<tr>
<td>GraphAnnoText</td>
<td>Annotation text</td>
<td>Font</td>
<td>GraphFonts(&quot;annofont&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>font-attributes</em></td>
<td>Not set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Color</td>
<td>GraphColors(&quot;gtext&quot;)</td>
</tr>
<tr>
<td>GraphAxisLines</td>
<td>X, Y and Z axis lines</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gaxis&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>1px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TickDisplay</td>
<td>“Outside”</td>
</tr>
<tr>
<td>GraphBackground</td>
<td>Background of the graph</td>
<td>Color</td>
<td>Colors(&quot;docbg&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transparency</td>
<td>Not set</td>
</tr>
<tr>
<td>GraphBorderLines</td>
<td>Border around graph wall, legend border, borders to complete axis frame</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gborderlines&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>1px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>1</td>
</tr>
<tr>
<td>GraphDataText</td>
<td>Text font and color for point and line labels</td>
<td>Font</td>
<td>GraphFonts(&quot;GraphDataFont&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>font-attributes</em></td>
<td>Not set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Color</td>
<td>GraphColors(&quot;gtext&quot;)</td>
</tr>
<tr>
<td>GraphFootnoteText</td>
<td>Text font and color for footnote(s)</td>
<td>Font</td>
<td>GraphFonts(&quot;GraphFootnoteFont&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>font-attributes</em></td>
<td>Not set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Color</td>
<td>GraphColors(&quot;gtext&quot;)</td>
</tr>
<tr>
<td>Style Element</td>
<td>Portion of Graph Affected</td>
<td>Recognized Attributes</td>
<td>Attribute Values in DEFAULT Style</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------------------------------------</td>
<td>--------------------------------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>GraphGridLines</td>
<td>Horizontal and vertical grid lines drawn at major tick marks</td>
<td>ContrastColor LineStyle LineThickness</td>
<td>GraphColors(&quot;ggrid&quot;) 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transparency DisplayOpts</td>
<td>1px</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not set &quot;Auto&quot;</td>
</tr>
<tr>
<td>GraphHeaderBackground</td>
<td>Background color of the legend title</td>
<td>Color Transparency</td>
<td>Color(&quot;gheader&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not set</td>
</tr>
<tr>
<td>GraphLabelText</td>
<td>Text font and color for axis labels and legend titles</td>
<td>Font * or font-attributes* Color</td>
<td>GraphFonts(&quot;GraphLabelFont&quot;) Not set</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;glabel&quot;)</td>
</tr>
<tr>
<td>GraphLegendBackground</td>
<td>Background color of the legend</td>
<td>Color Transparency</td>
<td>Color(&quot;glegend&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not set</td>
</tr>
<tr>
<td>GraphOutlines</td>
<td>Outline properties for fill areas such as bars, pie slices,</td>
<td>Color</td>
<td>GraphColors(&quot;goutlines&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ContrastColor LineStyle LineThickness</td>
<td>GraphColors(&quot;goutlines&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1px</td>
</tr>
<tr>
<td>GraphReference</td>
<td>Horizontal and vertical reference lines and drop lines</td>
<td>ContrastColor LineStyle LineThickness</td>
<td>GraphColors(&quot;greferencelines&quot;) 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1px</td>
</tr>
<tr>
<td>GraphTitleText</td>
<td>Text font and color for title(s)</td>
<td>Font * or font-attributes* Color</td>
<td>GraphFonts(&quot;GraphTitleFont&quot;) Not set</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gttext&quot;)</td>
</tr>
<tr>
<td>GraphUnicodeText</td>
<td>Text font for unicode values</td>
<td>Font * orfont-attributes* Color</td>
<td>GraphFont(&quot;GraphUnicodeFont&quot;) Not set</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gtext&quot;)</td>
</tr>
<tr>
<td>GraphValueText</td>
<td>Text font and color for axis tick values and legend values</td>
<td>Font * or font-attributes* Color</td>
<td>GraphFonts(&quot;GraphValueFont&quot;) Not set</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gtext&quot;)</td>
</tr>
<tr>
<td>GraphWalls</td>
<td>Vertical wall(s) bounded by axes</td>
<td>Color</td>
<td>GraphColors(&quot;gwalls&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transparency FrameBorder LineThickness</td>
<td>Not set &quot;On&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ContrastColor</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1px</td>
</tr>
</tbody>
</table>

* Font-attributes can be one of the following: FONTFAMILY=, FONTSIZE=, FONTSTYLE=, FontWEIGHT=.
Table 7.5 Style Elements Affecting Graphical Data Representation

<table>
<thead>
<tr>
<th>Style Element</th>
<th>Portion of Graph Affected</th>
<th>Recognized Attributes</th>
<th>Attribute Values in DEFAULT Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>GraphBoxMean</td>
<td>Marker for mean</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gcdata&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSize</td>
<td>9px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSymbol</td>
<td>“Diamond”</td>
</tr>
<tr>
<td>GraphBoxMedian</td>
<td>Line for median</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gcdmed&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>1px</td>
</tr>
<tr>
<td>GraphBoxWhisker</td>
<td>Box whiskers and serifs</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gcdata&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>1px</td>
</tr>
<tr>
<td>GraphConfidence</td>
<td>Primary confidence lines and bands, colors for bands and lines</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gconfidence&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Color</td>
<td>GraphColors(&quot;gconfidence&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSize</td>
<td>7px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSymbol</td>
<td>“Diamond”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>1px</td>
</tr>
<tr>
<td>GraphConfidence2</td>
<td>Secondary confidence lines and bands, color for bands, and</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gconfidence2&quot;)</td>
</tr>
<tr>
<td></td>
<td>contrast color for lines</td>
<td>Color</td>
<td>GraphColors(&quot;gconfidence2&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSize</td>
<td>7px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSymbol</td>
<td>“Triangle”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>1px</td>
</tr>
<tr>
<td>GraphConnectLine</td>
<td>Line for connecting boxes or bars</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;connectLine&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>1px</td>
</tr>
<tr>
<td>GraphDataDefault</td>
<td>Primitives related to non-grouped data items, colors for</td>
<td>Color</td>
<td>GraphColors(&quot;gdata&quot;)</td>
</tr>
<tr>
<td></td>
<td>filled areas, markers, and lines</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gdata&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSymbol</td>
<td>&quot;circle&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSize</td>
<td>7px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>1px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>StartColor</td>
<td>GraphColors(&quot;gramp3cstart&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NeutralColor</td>
<td>GraphColors(&quot;gramp3cneutral&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EndColor</td>
<td>GraphColors(&quot;gramp3cend&quot;)</td>
</tr>
<tr>
<td>GraphError</td>
<td>Error line or error bar fill, ContrastColor for lines, Color</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gerror&quot;)</td>
</tr>
<tr>
<td></td>
<td>for bar fill</td>
<td>Color</td>
<td>GraphColors(&quot;gerror&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transparency</td>
<td>Not set</td>
</tr>
<tr>
<td>Style Element</td>
<td>Portion of Graph Affected</td>
<td>Recognized Attributes</td>
<td>Attribute Values in DEFAULT Style</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>--------------------------------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td>GraphFit</td>
<td>Primary fit lines such as a normal density curve</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gcfit&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Color</td>
<td>GraphColors(&quot;gfit&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSize</td>
<td>7px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSymbol</td>
<td>“Circle”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>2px</td>
</tr>
<tr>
<td>GraphFit2</td>
<td>Secondary fit lines such as a kernel density curve</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gcfit&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Color</td>
<td>GraphColors(&quot;gfit&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSize</td>
<td>7px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSymbol</td>
<td>“X”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>2px</td>
</tr>
<tr>
<td>GraphMissing</td>
<td>Properties for graph items representing missing values</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gcmissing&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Color</td>
<td>GraphColors(&quot;gmissing&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSymbol</td>
<td>“square”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSize</td>
<td>7px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>1px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transparency</td>
<td>Not set</td>
</tr>
<tr>
<td>GraphOutlier</td>
<td>Outlier data for the graph</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;goutlier&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Color</td>
<td>GraphColors(&quot;gcoutlier&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSize</td>
<td>7px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSymbol</td>
<td>“Circle”</td>
</tr>
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<td></td>
<td></td>
<td>LineStyle</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>2px</td>
</tr>
<tr>
<td>GraphPrediction</td>
<td>Prediction lines</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gcpredict&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Color</td>
<td>GraphColors(&quot;gpredict&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineStyle</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LineThickness</td>
<td>2px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSize</td>
<td>7px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSymbol</td>
<td>“Plus”</td>
</tr>
<tr>
<td>GraphPredictionLimits</td>
<td>Fills for prediction limits</td>
<td>ContrastColor</td>
<td>GraphColors(&quot;gpredictlim&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Color</td>
<td>GraphColors(&quot;gpredictlim&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSize</td>
<td>7px</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MarkerSymbol</td>
<td>“Chain”</td>
</tr>
<tr>
<td>Style Element</td>
<td>Portion of Graph Affected</td>
<td>Recognized Attributes</td>
<td>Attribute Values in DEFAULT Style</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>-----------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>GraphSelection</td>
<td>For interactive graphs, visual properties of selected item. Color for selected fill area, ContrastColor for selected marker or line</td>
<td>ContrastColor, Color, MarkerSymbol, MarkerSize, LineStyle, LineThickness</td>
<td>GraphColors(&quot;gcdata&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gdata&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>“Square”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>11px</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5px</td>
</tr>
<tr>
<td>ThreeColorAltRamp</td>
<td>Line contours, markers, and data labels with segmented range color response</td>
<td>StartColor, NeutralColor, EndColor</td>
<td>GraphColors(&quot;gconramp3start&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gconramp3cneutral&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gconramp3end&quot;)</td>
</tr>
<tr>
<td>ThreeColorRamp</td>
<td>Gradient contours, surfaces, markers, and data labels with continuous color response</td>
<td>StartColor, NeutralColor, EndColor</td>
<td>GraphColors(&quot;gramp3cstart&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gramp3cneutral&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gramp3cend&quot;)</td>
</tr>
<tr>
<td>TwoColorAltRamp</td>
<td>Line contours, markers, and data labels with segmented range color response</td>
<td>StartColor, EndColor</td>
<td>GraphColors(&quot;gconramp2cstart&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gconramp2cend&quot;)</td>
</tr>
<tr>
<td>TwoColorRamp</td>
<td>Gradient contours, surfaces, markers, and data labels with continuous color response</td>
<td>StartColor, EndColor</td>
<td>GraphColors(&quot;gramp2cstart&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gramp2cend&quot;)</td>
</tr>
</tbody>
</table>

Table 7.6  Graphical Style Elements: Data Related (Grouped)

<table>
<thead>
<tr>
<th>Style Element</th>
<th>Portion of Graph Affected</th>
<th>Recognized Attributes</th>
<th>Attribute Values in DEFAULT Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>GraphData1</td>
<td>Primitives related to 1st grouped data items. Color applies to filled areas. ContrastColor applies to markers and lines.</td>
<td>Color, ContrastColor, MarkerSymbol, LineStyle</td>
<td>GraphColors(&quot;gdata1&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gcdata1&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Circle&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>GraphData2</td>
<td>Primitives related to 2nd grouped data items</td>
<td>Color, ContrastColor, MarkerSymbol, LineStyle</td>
<td>GraphColors(&quot;gdata2&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gcdata2&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Plus&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>GraphData3</td>
<td>Primitives related to 3rd grouped data items</td>
<td>Color, ContrastColor, MarkerSymbol, LineStyle</td>
<td>GraphColors(&quot;gdata3&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gcdata3&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;x&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>GraphData4</td>
<td>Primitives related to 4th grouped data items</td>
<td>Color, ContrastColor, MarkerSymbol, LineStyle</td>
<td>GraphColors(&quot;gdata4&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GraphColors(&quot;gcdata4&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Triangle&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>
### Table 7.7 Display Style Elements

<table>
<thead>
<tr>
<th>Style Element</th>
<th>Portion of Graph Affected</th>
<th>Recognized Attributes</th>
<th>Possible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>GraphAltBlock</td>
<td>Alternate fill color for block plots</td>
<td>Color</td>
<td>GraphColors(&quot;gablock&quot;)</td>
</tr>
<tr>
<td>GraphBand</td>
<td>Display options for confidence bands</td>
<td>DisplayOpts</td>
<td>&quot;Fill &quot;</td>
</tr>
<tr>
<td>GraphBox</td>
<td>Display options for box plots</td>
<td>DisplayOpts, CapStyle, Connect</td>
<td>&quot;Fill caps mean Median outliers &quot; &quot;Serif&quot; &quot;Mean&quot;</td>
</tr>
<tr>
<td>Style Element</td>
<td>Portion of Graph Affected</td>
<td>Recognized Attributes</td>
<td>Possible Values</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------------</td>
<td>-----------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>GraphBlock</td>
<td>Fill color for block plots</td>
<td>Color</td>
<td>GraphColors(&quot;gblock&quot;)</td>
</tr>
<tr>
<td>GraphEllipse</td>
<td>Display options for confidence ellipses</td>
<td>DisplayOpts</td>
<td>“Outline”</td>
</tr>
<tr>
<td>GraphHistogram</td>
<td>Display options for histograms</td>
<td>DisplayOpts</td>
<td>“Fill outline”</td>
</tr>
</tbody>
</table>
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      ODS Destination Statement Options 283
Using the ODS GRAPHICS Statement 284
   Introduction 284
      Controlling the Size of Your Graph 286
         Overview 286
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Introduction

The Output Delivery System (ODS) manages all output created by procedures and enables you to display the output in a variety of forms, such as HTML, PDF, and RTF. SAS/GRA PH Statistical Graphics Procedures and many SAS Analytical procedures use the Statistical Graphics Framework (SGF) for creation of the graphs. The ODS destination statements and the ODS GRAPHICS statement provide options for control of many relevant features.

This describes techniques for managing this graphical output in the following sections:

- “Specifying a Destination” on page 282
- “Using the ODS GRAPHICS Statement” on page 284
Specifying a Destination

Overview

For creation of these graphs, a valid ODS destination must be active. By default, the Listing destination is active. You can use an ODS destination statement, such as ODS HTML, to specify where you want your output to be displayed and where you want your image files to be stored. You can also specify some appearance options for the graphics output such as image DPI, width, height, and style. For more information about this topic, see “Using the ODS GRAPHICS Statement” on page 284.

The following ODS HTML statement specifies that the Journal style is used, the output is sent to the HTML destination, and images are stored in the folder "C:\myfiles\images". For the complete program, see Example Code 8.1 on page 285.

```sas
ods html file="BoxPlot-Body.html"
  gpath="C:\myfiles\images" style=journal;
...
ods html close;
```

The output is written to the file ```BoxPlot-Body.html``` , which is saved in the SAS current folder. At start up, the SAS current folder is the same directory in which you start your SAS session. If you are running SAS with the windowing environment in the Windows operating system, then the current folder is displayed in the status line at the bottom of the main SAS window. Images created by the output are stored in the folder "C:\myfiles\images". The STYLE= option changes the style from Default.Styles to Journal.Styles. For more information on changing the appearance of your graphics, see Chapter 7, “Controlling The Appearance of Your Graphs,” on page 263. The ODS HTML CLOSE statement closes the HTML destination, which enables you to see your output.

If you do not specify a file name for your output, then SAS provides a default file that is determined by the ODS destination. This file is saved in the SAS current folder. You can check the SAS log to verify the name of the file in which your output is saved.

The following table lists the ODS destinations and the type of output that results from each destination.

<table>
<thead>
<tr>
<th>Destinations</th>
<th>Results</th>
<th>Default Style</th>
<th>Default ImgFmt</th>
<th>Default DPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCUMENT</td>
<td>ODS document</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>LISTING¹</td>
<td>SAS output listing</td>
<td>Listing</td>
<td>PNG</td>
<td>100</td>
</tr>
<tr>
<td>OUTPUT</td>
<td>SAS data set</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>HTML</td>
<td>HTML file for online viewing</td>
<td>Default</td>
<td>PNG</td>
<td>100</td>
</tr>
<tr>
<td>LATEX²</td>
<td>LaTeX file</td>
<td>Default</td>
<td>PostScript</td>
<td>200</td>
</tr>
</tbody>
</table>
ODS Destination Statement Options

There are several destination statement options that you can use to control where your files or graphics should be written, as well as specifying a new style, and specifying the appropriate image resolution in DPI for your output images. For example, the following ODS HTML statement:

\[
\text{ods html path=\"c:\myfiles\"} \\
\text{gpath=\"c:\myfiles\" (url=\"images/\")} \\
\text{image_dpi=150} \\
\text{style=journal;} \\
\]

These options are specified on ODS destination statements, using the following form:

\text{ODS destination <option(s);>}

\text{GPATH= option} specifies the location for all graphics output that is generated while the destination is open. You can specify an external file, a fileref, or use the \text{URL=} suboption to specify a URL. The \text{GPATH=} option is valid for the Listing destination and the Markup family of destinations. If the \text{GPATH} option is not specified, the images are written to the location specified by the \text{PATH} option. For complete documentation on \text{GPATH=} option, see the ODS LISTING statement.

**PATH=** option

specifies the location of an external file or a SAS catalog for all markup files. You can specify an external file, a fileref, or use the URL= suboption to specify a URL. The PATH= option is valid for the RTF, Measured RTF, and Markup family of destinations. If the PATH option is not specified, images are written to the current working directory. For complete documentation on PATH= option, see the ODS LISTING statement, ODS MARKUP statement, or TAGSET.RTF statement in SAS Output Delivery System: User's Guide.

**IMAGE_DPI= | DPI=** options

specifies the image resolution in DPI for the output images. Each ODS destination has a default DPI that is appropriate for output format. If a DPI is specified, then the image is scaled linearly from a baseline DPI of 100. The IMAGE_DPI= option is valid for the Listing, RTF, Markup family, and Measured RTF destinations. The DPI= option is valid for Printer family destinations. For complete documentation for the IMAGE_DPI= option, see the valid ODS destination statement in SAS Output Delivery System: User's Guide.

**STYLE=** option

specifies a style to be used for the output. Each ODS destination has a default style for the formatting of output. The style specifies a collection of visual attributes that are used for the rendering of the output. The STYLE= option is valid for all ODS destinations except the Document destination and the Output destination. For complete documentation for the STYLE= option, see the ODS statements in SAS Output Delivery System: User's Guide. For more information on using the STYLE= option with GTL based graphics, see Chapter 7, “Controlling The Appearance of Your Graphs,” on page 263.

---

**Using the ODS GRAPHICS Statement**

**Introduction**

You can use the ODS GRAPHICS statement options to control many aspects of your graphics. The settings you specify remain in effect for all graphics until you change or reset these settings with another ODS GRAPHICS statement. When you use the GTL language or SAS/GRAPH Statistical Graphics procedures, the ODS GRAPHICS is always ON. However, you can use the ODS GRAPHICS statement to control the following:

- the size of the image
- the type and name of the image created
- whether features such as data tips, scaling, and anti-aliasing are used

The basic syntax for the ODS GRAPHICS statement is:

```
ODS GRAPHICS < OFF | ON> / <option(s)>;
```

For a table of options for the ODS GRAPHICS statement, see “ODS GRAPHICS Statement Options” on page 290.
The following program uses the ODS GRAPHICS statement to illustrate several techniques for controlling your graphics. These techniques are discussed in the following sections:

- “Controlling the Size of Your Graph” on page 286
- “Adding Data Tips and Other Features” on page 288
- “Accessing Graphs as Separate Files” on page 288

Example Code 8.1 Controlling Graphics with the ODS GRAPHICS Statement

```plaintext
ods graphics on /
    width=3.25in
    imagefmt=gif
    imagemap=on
    imagename="MyBoxplot"
    border=off;
ods html file="Boxplot-Body.html" style=journal gpath="your-file-path";

proc sgplot data=sashelp.heart;
    title "Cholesterol Distribution by Weight Class";
    hbox cholesterol / category=weight_status;
run;
ods html close;

ods graphics on / reset=all imagename="MyResetplot";
ods html file="BoxPlotReset-Body.html" style=journal gpath="your-file-path";

proc sgplot data=laborforce;
    hbox unemplrate / category=state datalabel=year;
run;
ods html close;
```

Display 8.1 3.25 Inch Graph with Data Tips and No Border
Controlling the Size of Your Graph

Overview

The output size of a graph is determined by the following:

- For SGRENDER output, the design size for the graph as specified in the StatGraph template. The default sizes defined in the registry are:
  - Default design width=640px
  - Default design height=480px
  - Default aspect ratio is 4/3

- For SGPLOT, SGPANEL, or SGSCATTER output, the preceding default sizes are used.

- DPI settings for the output destinations, as specified by the IMAGE_DPI= or DPI= options

- User specified settings for width and height, as specified by the WIDTH= option and the HEIGHT= option for the ODS GRAPHICS statement.

When modifying the size of your graph, it is important to take into consideration the image scaling and aspect ratio, as well as the width and height of the graph. For example, rendering a graph to the Listing destination at the default design size and default DPI of 100, produces a graph that is 640 by 480 pixels. If the same graph is rendered to the RTF destination, which has a default DPI of 200, the graph size is 1280 by 960 pixels. In both cases, when this image is embedded into an RTF document, its size in the document is 6.4 in. by 4.8 in, since DPI data is included in the image. The aspect ratio of the graph is retained.
**Graph Scaling for DPI**

When the DPI of a graph is changed due to a change in output destination or user specification, the graph is scaled using a baseline DPI of 100. All graphical elements such as marker size, line thickness, font sizes, and gutters are also scaled.

**Specifying Output Size with the ODS GRAPHICS statement**

You can control the output size of a graph by specifying the WIDTH= or HEIGHT= options in the ODS GRAPHICS statement. In the ODS GRAPHICS statement below, taken from Example Code 8.1 on page 285, the WIDTH= option (③) changes the width of the graph to 3.25 inches:

```plaintext
ods graphics on /
   width=3.25in
   imagefmt=gif
   imagemap=on
   imagename="MyBoxplot"
   border=off;
```

**Retaining Aspect Ratio**

Although you can use the ODS GRAPHICS statement to specify the WIDTH= option, the HEIGHT= option, or both, it is highly recommended that only one of these options be specified at a time. Using one option at a time ensures that the design aspect ratio of the graph is maintained.

When only width is specified, SAS uses the design aspect ratio of the graph to compute the appropriate height. Retaining the design aspect ratio of the graph is important in many cases as the graph might have a specific layout. For example, a plot that has multiple columns, or that has a statistics table on the side needs a wide aspect ratio. Changing the aspect ratio for this plot by specifying both width and height might produce unpredictable results.

**Graph Scaling For User Specified Image Size**

When the size of a graph is changed by specifying the WIDTH= option in the ODS GRAPHICS statement, the output size of the graph is computed based on the new size, and the active DPI, using a baseline of DPI of 100. All graphical elements such as marker size, line thickness, font size, and gutters are scaled using a non-linear scale. This is done to prevent rapid shrinking or growth of the fonts and markers.

Scaling of graph elements for change in graph size can be disabled by the ODS GRAPHICS statement options NOSCALE or SCALE=OFF. By default, scaling is on. Specifying NOSCALE or SCALE=OFF prevents the scaling of the graph elements. If you want to shrink your graph and keep the default sizes for fonts, use the NOSCALE or SCALE=ON option in the ODS GRAPHICS statement.

**Tip For Embedding Images in Documents**

It is often useful to produce a graph that fits in one column of a two column page. In this case, the column size might be 3.25 inches wide. You can place a default output image, which is 640 by 480 pixels, in this space, but then all graphical elements scale down. This results in small markers and unreadable small fonts.

In this case, it is useful to render the graph to the exact size required, and specify the correct DPI. In the situation above, you would specify a width of 3.25 inches and use the IMAGE_DPI= destination statement option to specify a DPI of 200. Then, the
graph produced can be placed in the 3.25" wide column and the fonts and markers are readable.

Note: To get exactly the specified font sizes, use the NOSCALE option in the ODS GRAPHICS statement.

---

### Adding Data Tips and Other Features

With ODS GRAPHICS statement options you can control different features of your graphs, such as borders and data tips. In the ODS GRAPHICS statement below, taken from Example Code 8.1 on page 285, the BORDER=OFF option specifies that there be no border around the graph and the IMAGEMAP=ON option enables the generation of data tips and any drill downs:

```plaintext
ods graphics on /
   width=3.25in
   imagefmt=gif
   imagemap=on
   imagename="MyBoxplot"
   border=off;
```

When viewing HTML output, data tips appear when you move a mouse over certain features of the graph. Data tips and URL drill down functionality are available only for the HTML destination. You can also specify the maximum number of distinct mouse over areas allowed before data tips are disabled by using the TOOLTIPMAX= option. There are many other ODS GRAPHICS options you can use to control other aspects of your graphics. See “ODS GRAPHICS Statement Options” on page 290 for a table of ODS GRAPHICS statement options.

---

### Resetting ODS GRAPHICS Options

You can specify the RESET option to change the values for these options back to their defaults. In Example Code 8.1 on page 285, the second ODS GRAPHICS statement uses the RESET=ALL option to set all options back to their defaults for a new graph:

```plaintext
ods graphics on / reset=all imagename="MyResetplot"
```

You can also reset ODS GRAPHICS options individually. For a list of values valid for the RESET= option, see “ODS GRAPHICS Statement Options” on page 290.

Note: When you specify the RESET= option, ensure that it is the first option specified in the ODS GRAPHICS statement. Otherwise, you might reset some of other options in the statement.

For the complete documentation on all ODS GRAPHICS statement options, see “ODS GRAPHICS Statement Options” on page 290.

---

### Accessing Graphs as Separate Files

ODS allows you to change the ODS destination where you are sending your output to result in different output formats such as RTF or PDF. There might also be times when you want to access your graphs as individual image files.

The default image file type is determined by the ODS destination. You can use the IMAGEFMT= option to specify a different image file format. The type of image allowed is dependent on the destination you have specified. See “Supported Image File Types” on page 290.
for Output Destinations” on page 289 for a table of ODS destinations and their valid file types.

You can also specify names for your graphics image files and the directory in which you want to save them. The IMAGENAME= option specifies the base image filename and the GPATH= option specifies a directory for your images.

In the ODS GRAPHICS statement below, taken from Example Code 8.1 on page 285, the IMAGEFMT= option (\textcircled{2}) specifies that the file type is a GIF, and the IMAGENAME= option (\textcircled{3}) specifies that the name of the image is “MyBoxplot”:

```
ods graphics on /
    \textcircled{2}imagefmt=gif
    imagemap=on
    \textcircled{3}imagename="MyBoxplot"
    border=off;
```

The resulting filename for the image created is MyBoxplot.GIF. If there is more then one image, they are named MyBoxplot1.GIF, MyBoxplot2.GIF, and so on.

The second ODS GRAPHICS statement (\textcircled{4}) specifies the filename “MyBoxplot” for the second image. However, because the RESET=ALL option is used, the file type is PNG, which is the default file type for the HTML destination:

```
ods graphics on / reset=all
    imagename="MyBoxplot";
```

For the ODS destinations that generate graphic image files, these image files are saved by default into the SAS current working directory. You can use the GPATH= option to specify a directory for saving your graphics image files. For example, in Example Code 8.1 on page 285 the GPATH= option on both of the ODS HTML statements specifies that all images be saved in the directory C:\myfiles\images.

For more information about ODS destinations, see SAS Output Delivery System: User’s Guide.

### Supported Image File Types for Output Destinations

The following table lists all of the supported image file types for ODS output destinations.

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<tr>
<th>Output Destination</th>
<th>Supported Image File Types</th>
</tr>
</thead>
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<td>HTML</td>
<td>PNG (default), GIF, JPEG, JPG</td>
</tr>
<tr>
<td>Listing</td>
<td>PNG (default), BMP, DIB, EMF, EPSI, GIF, JFIF, JPEG, JPG, PBM, PDF, PS, SASEMF, STATIC, TIFF, WMF</td>
</tr>
<tr>
<td>LATEX</td>
<td>PS (default), EPSI, GIF, PNG, PDF, JPG</td>
</tr>
<tr>
<td>Printer Family</td>
<td>PNG (default), JPEG, JPG, GIF</td>
</tr>
<tr>
<td>RTF</td>
<td>PNG (default), JPEG, JPG, JFIF</td>
</tr>
<tr>
<td>Markup Tagsets</td>
<td>All Markup family tagsets have the default \textit{imagefmt} value built in.</td>
</tr>
</tbody>
</table>
## Description of Supported Image File Types

<table>
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<tr>
<th>Image File Type</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td>BMP (Microsoft Windows Device Independent Bitmap)</td>
<td>Supports color-mapped and true color images that are stored as uncompressed or run-length encoded data.</td>
</tr>
<tr>
<td>DIB (Microsoft Windows Device Independent Bitmap)</td>
<td>See the description of BMP. DIB is supported only under the OS/2 operating system.</td>
</tr>
<tr>
<td>EMF (Microsoft NT Enhanced Metafile)</td>
<td>Supported only under Windows 95, Windows 98, and Windows NT.</td>
</tr>
<tr>
<td>EPSI (Microsoft NT Enhanced Metafile)</td>
<td>An extended version of the standard PostScript (PS) format. Files that use this format can be printed on PostScript printers and can also be imported into other applications. Notice that EPSI files can be read, but PS files cannot be read.</td>
</tr>
<tr>
<td>GIF (Graphics Interchange Format)</td>
<td>Supports only color-mapped images.</td>
</tr>
<tr>
<td>JFIF (JPEG File Interchange Format)</td>
<td>Supports JPEG image compression.</td>
</tr>
<tr>
<td>JPEG or JPG (Joint Photographic Experts Group)</td>
<td>A file format that is used for storing noninteractive images.</td>
</tr>
<tr>
<td>PBM (Portable Bitmap Utilities)</td>
<td>Supports gray, color, RGB, and bitmap files.</td>
</tr>
<tr>
<td>PNG (Portable Network Graphic)</td>
<td>Supports true color, gray-scale, and 8-bit images.</td>
</tr>
<tr>
<td>PS (PostScript Image File Format)</td>
<td>The Image classes use only PostScript image operators. A level II PS printer is required for color images.</td>
</tr>
<tr>
<td>SASEMF (Enhanced Metafile)</td>
<td>EMF image tuned for RTF output.</td>
</tr>
<tr>
<td>STATIC</td>
<td>Chooses the best image format for the current ODS destination.</td>
</tr>
<tr>
<td>TIFF (Tagged Image File Format)</td>
<td>Internally supports a number of compression types and image types, including bitmapped, color-mapped, gray-scaled, and true color.</td>
</tr>
<tr>
<td>WMF (Microsoft Windows Metafile)</td>
<td>Supported only under Microsoft Windows operating systems.</td>
</tr>
</tbody>
</table>

### ODS GRAPHICS Statement Options

The following options can be used with the ODS GRAPHICS statement.
Table 8.2  ODS GRAPHICS Option Summary Table

<table>
<thead>
<tr>
<th>Task</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify whether anti-aliasing is applied to the rendering of the line and markers in any graph.</td>
<td>ANTIALIAS=</td>
</tr>
<tr>
<td>Specify the maximum number of markers or lines to be anti-aliased before anti-aliasing is disabled.</td>
<td>ANTIALIAS</td>
</tr>
<tr>
<td>Specify whether to draw a border around each graph.</td>
<td>BORDER=</td>
</tr>
<tr>
<td>Specify the maximum number of discrete values to be shown in any graph.</td>
<td>DISCRETE</td>
</tr>
<tr>
<td>Specify the maximum number of group values to be shown in any graph.</td>
<td>GROUP</td>
</tr>
<tr>
<td>Specify the height of any graph.</td>
<td>HEIGHT</td>
</tr>
<tr>
<td>Specify the image format used to generate image files.</td>
<td>IMAGEFMT=</td>
</tr>
<tr>
<td>Specify whether data tips are generated.</td>
<td>IMAGEMAP=</td>
</tr>
<tr>
<td>Specify the base image filename.</td>
<td>IMAGENAME=</td>
</tr>
<tr>
<td>Specify the maximum number of labeled areas before labeling is disabled.</td>
<td>LABELMAX=</td>
</tr>
<tr>
<td>Specify an integer that is interpreted as the maximum percentage of the overall graphics area that a legend can occupy.</td>
<td>MAXLEgend</td>
</tr>
<tr>
<td>Specify the maximum number of cells in a graph panel where the number of cells is determined dynamically by classification variables.</td>
<td>PANELCELLMAX=</td>
</tr>
<tr>
<td>Reset one or more ODS GRAPHICS options to its default.</td>
<td>RESET=</td>
</tr>
<tr>
<td>Specify whether the content of any graph is scaled proportionally.</td>
<td>NOSCALE</td>
</tr>
<tr>
<td>Specify the maximum number of distinct mouse—over areas allowed before data tips are disabled.</td>
<td>TIPMAX=</td>
</tr>
<tr>
<td>Specify the width of any graph.</td>
<td>WIDTH=</td>
</tr>
</tbody>
</table>

**ANTIAlIAS= | ANTIALIAS | NOANTI**

specifies whether anti-aliasing is applied to the rendering of the line and markers in any graph. Anti-aliasing smooths the appearance of diagonal lines and some markers. Text displayed in the graph is always anti-aliased. For graphical displays that plot large numbers of points it is recommended that **ANTIAlIAS=OFF** be specified for performance considerations.

**ANTIAlIAS= OFF | ON**

specifies whether anti-aliasing is applied to the rendering of the line and markers in the graph.

**OFF**

does not smooth jagged edges of components other than text in the graph.

**Alias:** NO
ON

smoothes jagged edges of all components in the graph.

Alias: YES

ANTIALIAS

smoothes jagged edges of all components in the graph.

NOANTIALIAS

do not smooth jagged edges of components other than text in the graph.

Default: ON

Restriction: If the number of markers or curve points in the plot exceeds the
number specified by the ANTIALIASMAX= option, then the ANTIALIAS option
is turned off, even if you specify the option ANTIALIAS=ON or ANTIALIAS.

ANTIALIASMAX= n

specifies the maximum number of markers or lines to be anti-aliased before
anti-aliasing is disabled. For example, if there are more than 400 scatterpoint
markers to be anti-aliased and ANTIALIASMAX=400, then no markers are
anti-aliased.

n
specifies a positive integer.

Default: 600

BORDER= | BORDER | NOBORDER

specifies whether to draw a border around any graph.

BORDER= OFF | ON

specifies whether to draw the graph with a border on the outermost layout.

ON

specifies to draw a border around the graph.

Alias: YES

OFF

specifies not to draw a border around the graph.

Alias: NO

BORDER

specifies to draw a border around the graph.

NOBORDER

specifies not to draw a border around any graph.

Default: BORDER or BORDER=ON

DISCRETEMAX= n

specifies the maximum number of discrete values to be shown in any graph. Bar
charts and box plots are examples of affected plot types. Scatter plots and other
plot types might be affected if the data to be plotted is discrete or the axis is
discrete.

n
specifies a positive integer.

Default: 1000

Tip: Some plot layers might be unaffected by the DISCRETEMAX= option, and
those layers are still rendered. If all layers are affected, then a blank graph is
rendered.

Tip: If the value specified by the DISCRETEMAX= option is exceeded by any plot
layer in the graph, that layer is not drawn and a warning message is issued.
GROUPMAX=$n$

specifies the maximum number of group values to be shown in any graph. Any graph that supports the GROUP= option is affected.

$n$

specifies a positive integer.

**Default:** 1000

**Tip:** If the value specified by the GROUPMAX= option is exceeded by any plot layer in the graph, that layer is rendered ignoring the GROUP= option and a warning message is issued.

HEIGHT=$dimension$

specifies the height of any graph.

$dimension$

is a nonnegative number.

**See:** $dimension$ on page 296

**Default:** The value of the SAS registry entry “ODS > STATISTICAL GRAPHICS > Design Height” or the value of the DesignHeight= option in a STATGRAPH template. Typically, the value is 480px.

IMAGEFMT= $image-file-type$ | STATIC

specifies the image format to be used. If the image format is not valid for the active output destination, the format is automatically changed to the default image format for that destination.

$image-file-type$

is the image format to be generated. See “Supported Image File Types for Output Destinations” on page 289.

**STATIC**

uses the best quality static image format for the active output destination. This is the default.

**Default:** STATIC

IMAGEMAP= | IMAGEMAP | NOIMAGEMAP

controls data tips generation. Data tips are pieces of explanatory text that appear when you mouse-over the data portions of a graph contained in an HTML page.

**IMAGEMAP= ON | OFF**

controls data tips generation.

**OFF**

specifies not to generate data tips.

**Alias:** NO

**ON**

specifies to generate data tips.

**Alias:** YES

**IMAGEMAP**

specifies to generate data tips.

**NOIMAGEMAP**

specifies not to generate data tips.

**Default:** OFF or NOIMAGEMAP

**Restriction:** This option applies only when the ODS HTML destination is used.

**IMAGENAME=“filename”**

specifies the base image filename.

If more than one image is generated, each is assigned filename as a base name followed by a number in order to create unique names. This numbering can be
reset with the RESET=INDEX option. Path information (if needed) can be set with the GPATH= option in the ODS destination statement. The default path is the current output directory. A file extension for filename is automatically generated based on the IMAGEFMT= option.

**Requirement:** You must enclose `filename` in quotation marks.

**Restriction:** `filename` must be a single name. It must not include any path specification or image-format name extension.

**Default:** The name of the output object.

**LABELMAX= n**

specifies the maximum number of labeled areas before labeling is disabled. For example, if there are more than 50 points to be labeled and LABELMAX=50, then no points are labeled.

\[ n \]

specifies a positive integer.

**Default:** 200

**MAXLEGENDAREA= n**

specifies an integer that is interpreted as the maximum percentage of the overall graphics area that a legend can occupy.

\[ n \]

specifies a positive integer.

**Default:** 20

**Tip:** To turn off the legend, specify MAXLEGENDAREA=0. No warning is issued when the legend is turned off in this way.

**PANELCELLMAX= n**

specifies the maximum number of cells in a graph panel where the number of cells is determined dynamically by classification variables.

\[ n \]

specifies a positive integer.

**Default:** 10000

**Tip:** If the value specified by the PANELCELLMAX= option is exceeded by either of these layouts, an empty graph is rendered and a warning message is issued.

**RESET | RESET= option**

resets one or more ODS GRAPHICS options to its default.

**RESET**

resets all of the `options` to their defaults.

**RESET=**

resets one of the following to its default:

- **ALL**
  
  resets all of the `reset-options` to their defaults.

- **ANTIALIAS**
  
  resets the ANTIALIAS option to its default.

- **ANTIALIASMAX**
  
  resets the ANTIALIASMAX option to its default.

- **BORDER**
  
  resets the BORDER= option to its default.
IMAGEMAP
resets the IMAGEMAP= option to its default.

INDEX
resets the index counter that is appended to static image files.

HEIGHT
resets the HEIGHT= option to its default.

IMAGEMAP
resets the IMAGEMAP= option to its default.

Note: Not all output destinations support this feature.

LABELMAX
resets the LABELMAX= option to its default.

SCALE
resets the SCALE= option to its default.

TIPMAX
resets the TIPMAX= option to its default.

WIDTH=
resets the WIDTH= option to its default.

NOSCALE | SCALE | SCALE=
specifies whether the content of any graph is scaled proportionally.

NOSCALE
does not scale the components of graph proportionally.

SCALE
scales the components of graph proportionally.

SCALE=
specifies whether the content of the graph is scaled proportionally.

OFF does not scale the components of graph proportionally.

Alias: NOSCALE

Alias: NO

ON scales the components of graph proportionally.

Alias: YES

Default: ON or SCALE

TIPMAX=n
specifies the maximum number of distinct mouse-over areas allowed before data
tips are disabled. For example, if there are more than 400 points in a scatterplot,
and TIPMAX=400, then no data tips appear.

n
specifies a positive integer.

Default: 500

WIDTH=dimension
specifies the width of any graph.

dimension
is a nonnegative number.
Default: The value of the SAS registry entry ‘ODS > STATISTICAL GRAPHICS > Design Width’ or the value of the DesignWidth= option in a STATGRAPH template. Typically, this value is 640px.

See: dimension on page 296

dimension is a nonnegative number, which can be followed by one of these units of measure:

- cm: centimeters
- in: inches
- mm: millimeters
- pt: a printer’s point
- px: pixels
Glossary

cell
a distinct rectangular subregion of a graph that can contain plots, text, or legends.

classification panel
a multi-cell graph in which the cell layout is driven by one or more classification
variables. The number of the cells and their layout are determined by the unique
values of the classification variables. Each cell of the panel has the same types of
plots.

classification variable
a variable whose values classify the observations in a data set into different groups
that are meaningful for analysis.

global statement
a SAS statement that you can specify anywhere in a SAS program.

Graph Template Language
an extension to the Output Delivery System (ODS) that enables users to create
sophisticated analytical graphics. Short form: GTL.

ODS Graphics system
an extension to ODS that is used to create analytical graphs using the Graph
Template Language.

Output Delivery System
a component of SAS software that can produce output in a variety of formats such as
markup languages (HTML, XML), PDF, listing, RTF, PostScript, and SAS data sets.
Short form: ODS.

panel
a multi-cell graph.

plot
a visual representation of data such as a scatter plot, a series line, or a histogram. In
the ODS Graphics context, a plot is the graphical representation of individual GTL
plot statements. Multiple plots can be overlaid in a cell to create a graph.

style attribute
A visual property such as color, font properties, and line characteristics that have
reserved names and values defined in ODS. Style attributes are collectively
referenced by a style element.
**style element**

A collection of style attributes that each pertain to a particular part of some ODS output.

**system font**

A font that can be used by any SAS procedure and by other software, such as Microsoft Word. These fonts include TrueType and Type1 fonts. Examples of system fonts include Albany AMT, Monotype Sorts, and Arial. Some system fonts, such as Helvetica, can also be present as device-resident fonts. System fonts generally provide the highest quality output.
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