CREATING SCREENING DESIGNS

WITH STATGRAPHICS PLUS

To Create A Screening Design

1. Choose SPECIAL... EXPERIMENTAL DESIGN... CREATE DESIGN... from the Menu bar to display the Create Design Options dialog box shown in Figure 3-1.

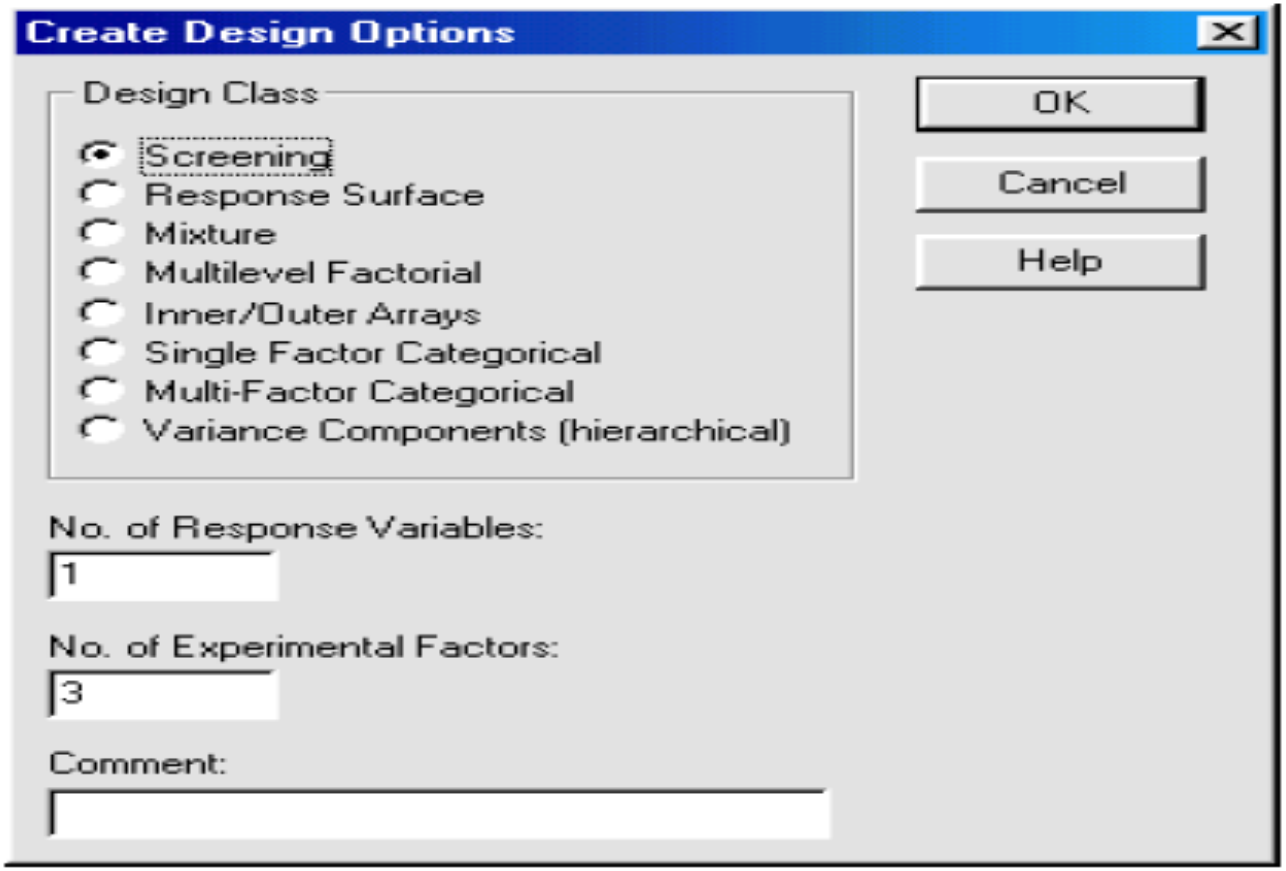

Figure 3-1. Create Design Options Dialog Box (Screening Designs)

2. Complete the dialog box by choosing the Screening design option, entering a number for the response variable(s) and number of experimental factors, then, optionally, entering a descriptive comment that will identify the design.

3. Click OK to display the Factor Definition Options dialog box shown in Figure 3-2.

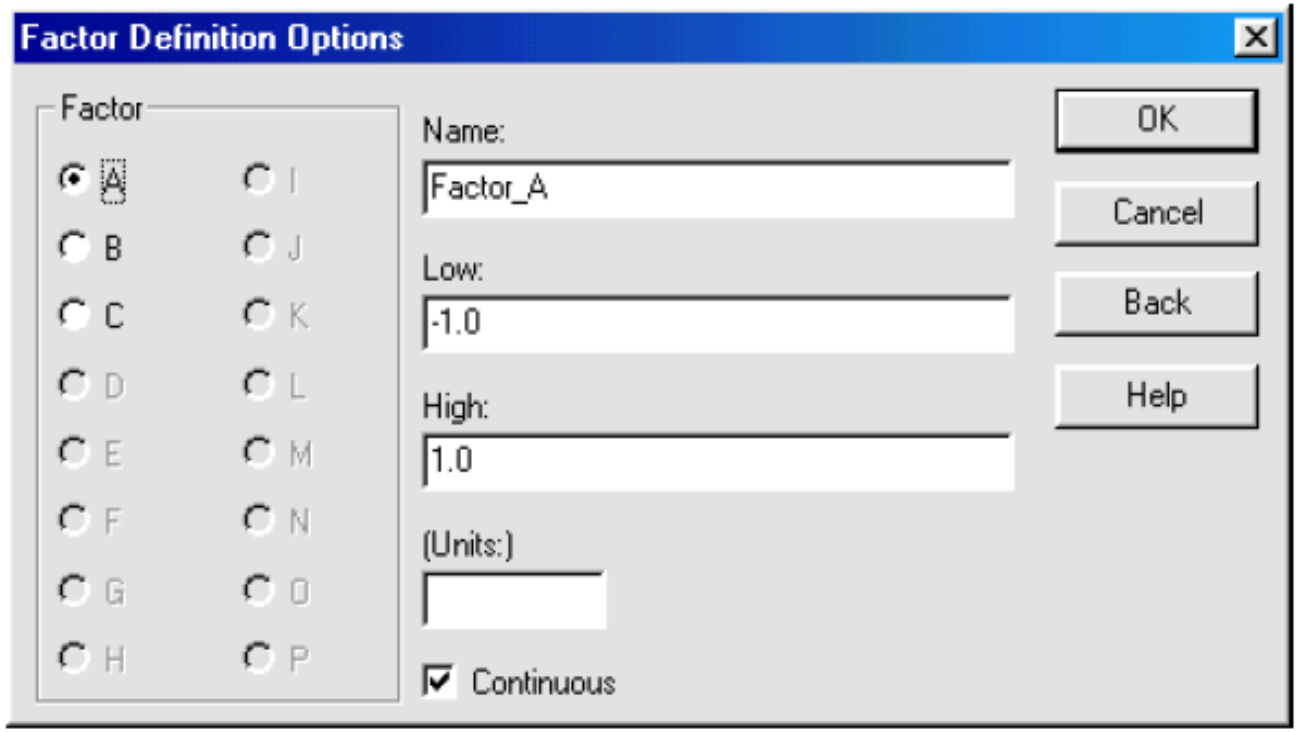

Figure 3-2. Factor Definition Options Dialog Box

4. Complete the dialog box by either accepting the defaults or choosing a factor and entering a name for it, as well as entering the lowest and highest values for the factor in the Low and High text boxes, and, if applicable, entering a value for the units of measure. Then indicate if you want the factor to be Continuous (Quantitative) or Categorical (Qualitative). The default is Continuous (check box marked).

   Clicking the Back... button redisplays the previous dialog box.

5. Click OK to display the Response Definition Options dialog box shown in Figure 3-3.

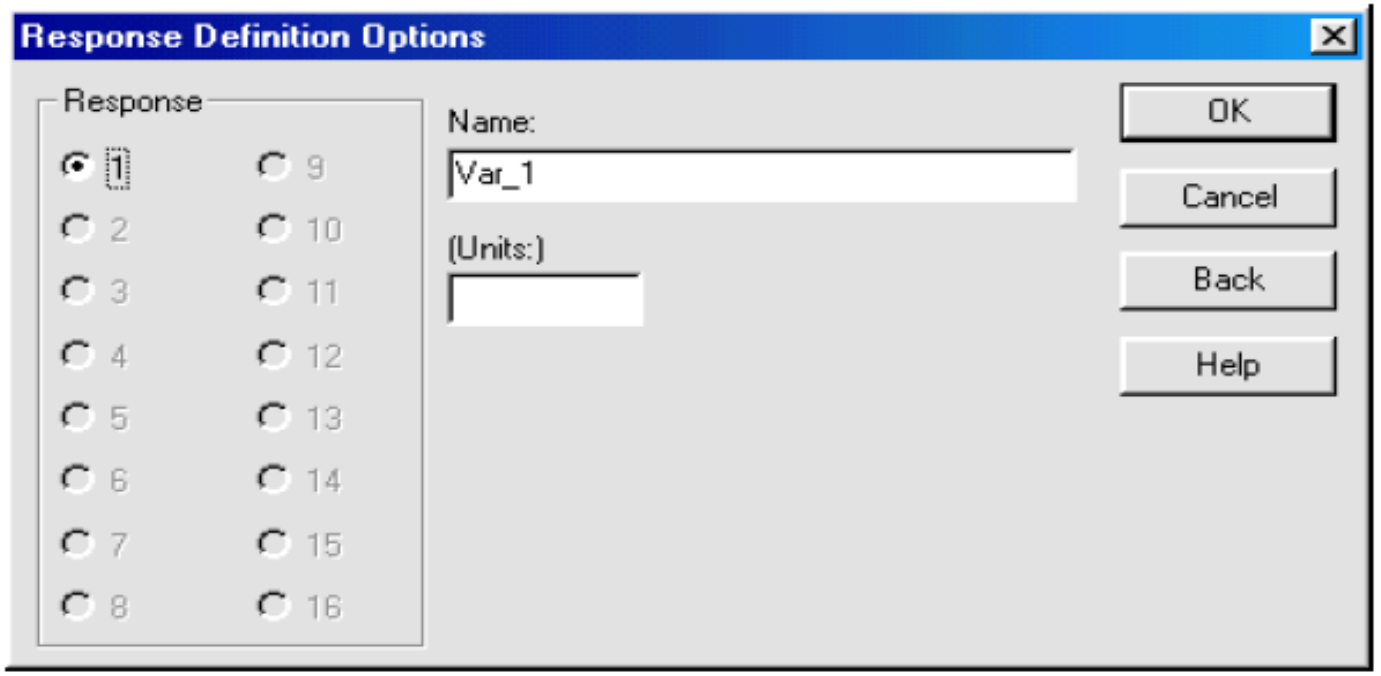

Figure 3-3. Response Definition Options Dialog Box

6. Complete the dialog box by either accepting the defaults or choosing a response variable and defining it by entering a name for it, as well as, if applicable, entering a value for the units of measure.

   Clicking the Back... button redisplays the previous dialog box.

7. Click OK to display the Screening Design Selection dialog box shown in Figure 3-4.

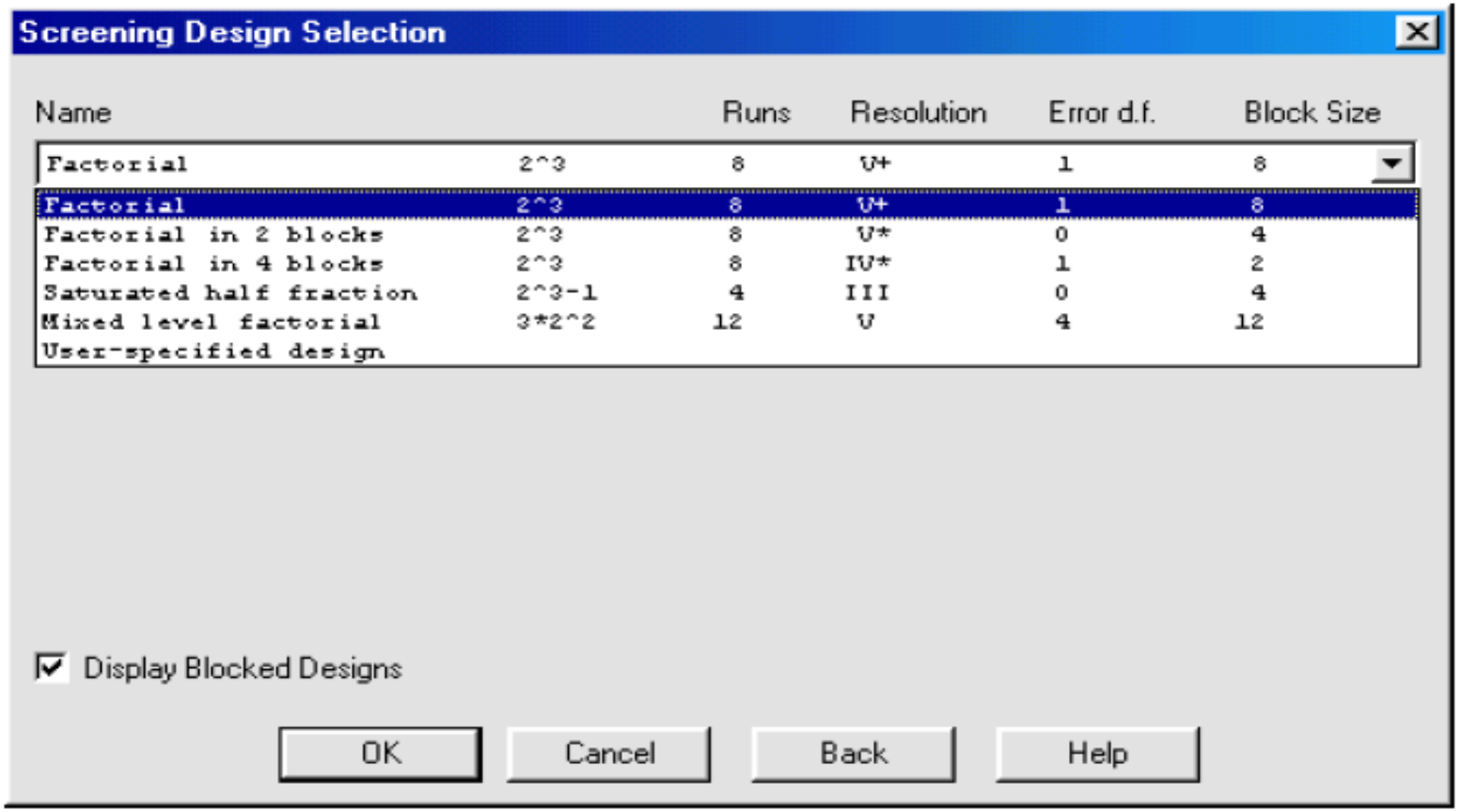

Figure 3-4. Screening Design Selection Dialog Box

8. Indicate if you want the list to include blocked designs by either selecting or deselecting Display Blocked Designs, then choose a design from the list of designs. Displaying Blocked Designs is the default. *For a list of the available designs, see the section, Selecting a Screening Design below.*

   Clicking the Back... button redisplays the previous dialog box.

9. Click OK to display the Screening Design Options dialog box shown in Figure 3-5.

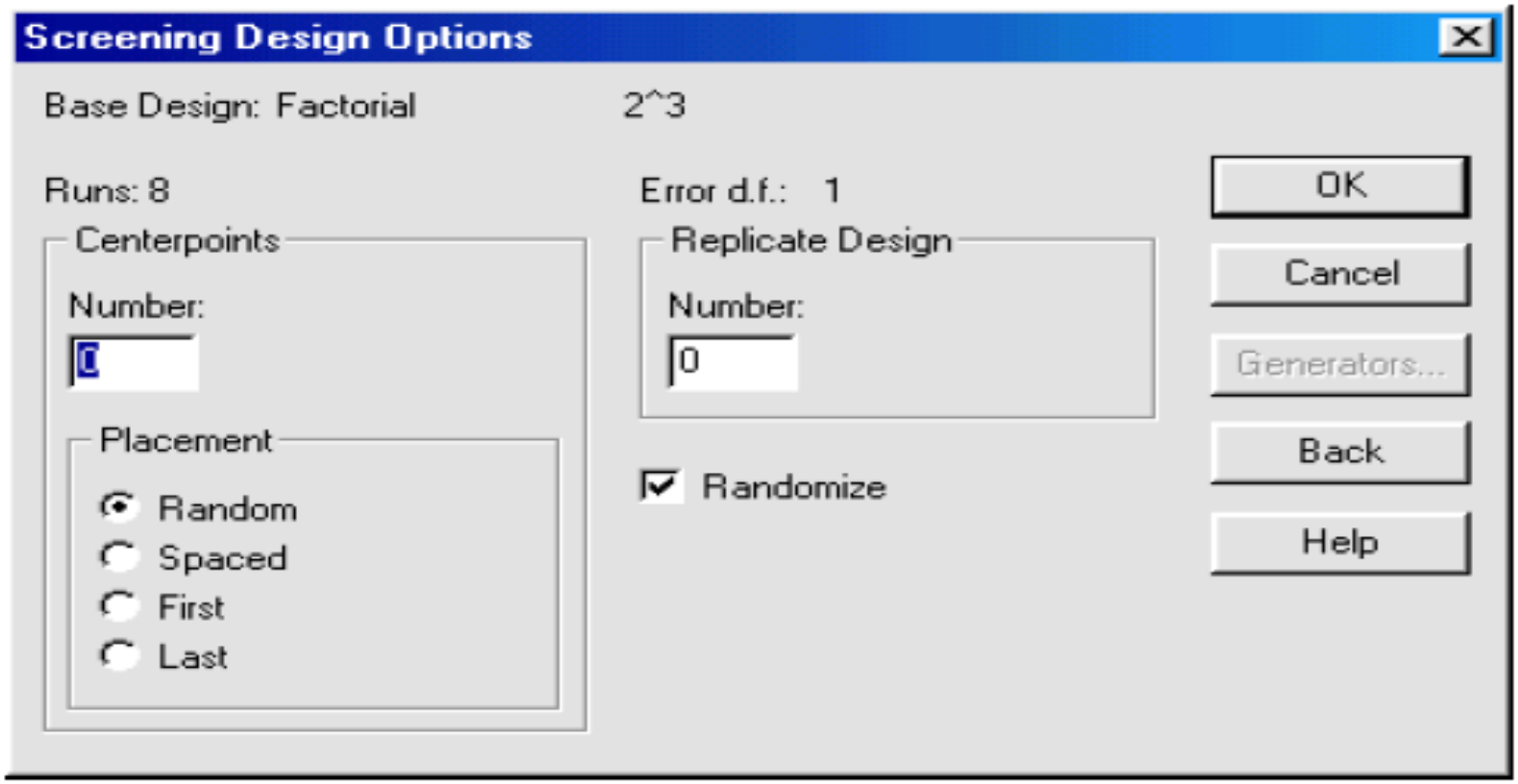

Figure 3-5. Screening Design Options Dialog Box

10. Complete the dialog box. Notice that the dialog box displays the name of the base design, indicates the total number of experimental runs, and the degrees of freedom available for the error. Choose the number of centerpoints that will be used and where they will be placed in the design. If the design will be replicated, enter the number of times, then indicate if the runs should be created in random order by selecting or deselecting the Randomize check box.

If you click OK now, the experimental runs will be placed in the DataSheet and the Design Summary will display in the Design Summary window.

For some design classes, you may be able to press the Generators... button and display the Design Generators dialog box, which lists the design generators used to create the last column(s) of the design matrix. When you click OK, the Screening Design Options dialog box redisplays.

Selecting a Screening Design

STATGRAPHICS *Plus* allows you to set up and analyze highly structured designs and includes predefined designs. You can generate both blocked and unblocked designs. You can also create and analyze your own designs.

Your entries on two dialog boxes determine which designs will display: Create Design and Screening Design Selection. On the first, enter parameters that fit the data you are using; on the latter ensure that the check box for Display

Blocked Designs is either checked or unchecked, then click the Down Arrow to the right of the list on the dialog box, and select a design.

A brief description of the available designs follows; the description also indicates if the design is blocked or unblocked.

- **Two-Level and Fractional Factorial**
  Factorial designs include all combinations of the factor level. Fractional Factorial designs are regular fractions such as 1/2, 1/4, 1/8, and so on or an irregular unbalanced fraction of a complete factorial design.

- **Mixed-Level Factorial**
  Use to study factorial designs based on one or more blocked or unblocked factors that are fixed and where one or more are random.

- **Irregular Saturated Half Fraction**
  Designs of an orthogonal property used to study factorial designs based on half of all combinations of blocked or unblocked factors. Creates a design of resolution III by inundating all the interactions of a full factorial design with additional factors.

- **Plackett-Burman**
  Designs that can be generated in steps of 4 runs, from 4 to 100 runs. The designs have the same number of runs as an equivalent fractional factorial; they are identical to fractional factorials with rows and columns reordered. Those designs of intermediate size are orthogonal.

- **User-Specified Design**
  Designs created by the user that can be blocked or unblocked.

Choosing Tabular Options for a Selected Design Class

Several helpful report options provide additional information about the design you select. However, not all of the options are available for every design class. For example, for Screening Designs, the available tabular options are a Design Summary, a Worksheet, an Alias Structure, and a Correlation Matrix; while for other design classes, the available tabular options are a Design Summary and a Worksheet. Also, a Power Curve graphical option is available for Screening Designs. The four possible tabular options and the graphical option are described next. The descriptions of the options are the same, regardless of the design class you use.

Design Summary

The Design Summary option displays a summary of the design you select (see Figure 3-6). The summary information includes the design class, design name, and file name. Other information about the base design includes the number of experimental factors, blocks, responses, runs, error degrees of freedom, and indicates if the factors were randomized. A table shows the lowest and highest values for each of the factors, and indicates if the factors are Continuous. The name of the response variable is shown.

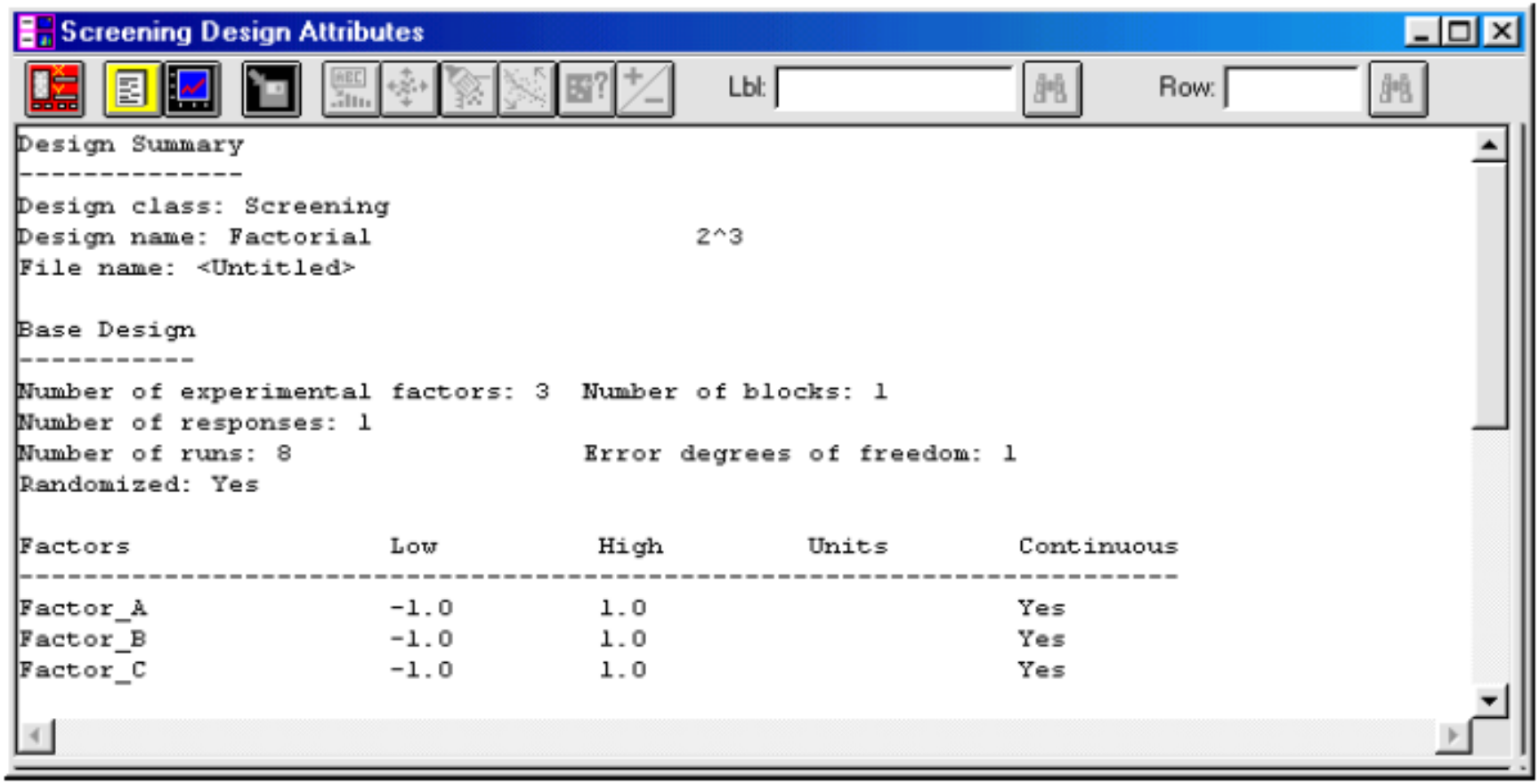

Figure 3-6. Design Summary

Use the *Screening Design Options* dialog box to choose another design. *See Figure 3-4 for an example of this dialog box.*

Worksheet

The Worksheet option displays a Worksheet that contains the experimental runs that will be performed, as well as the order in which you should run them (see Figure 3-7).

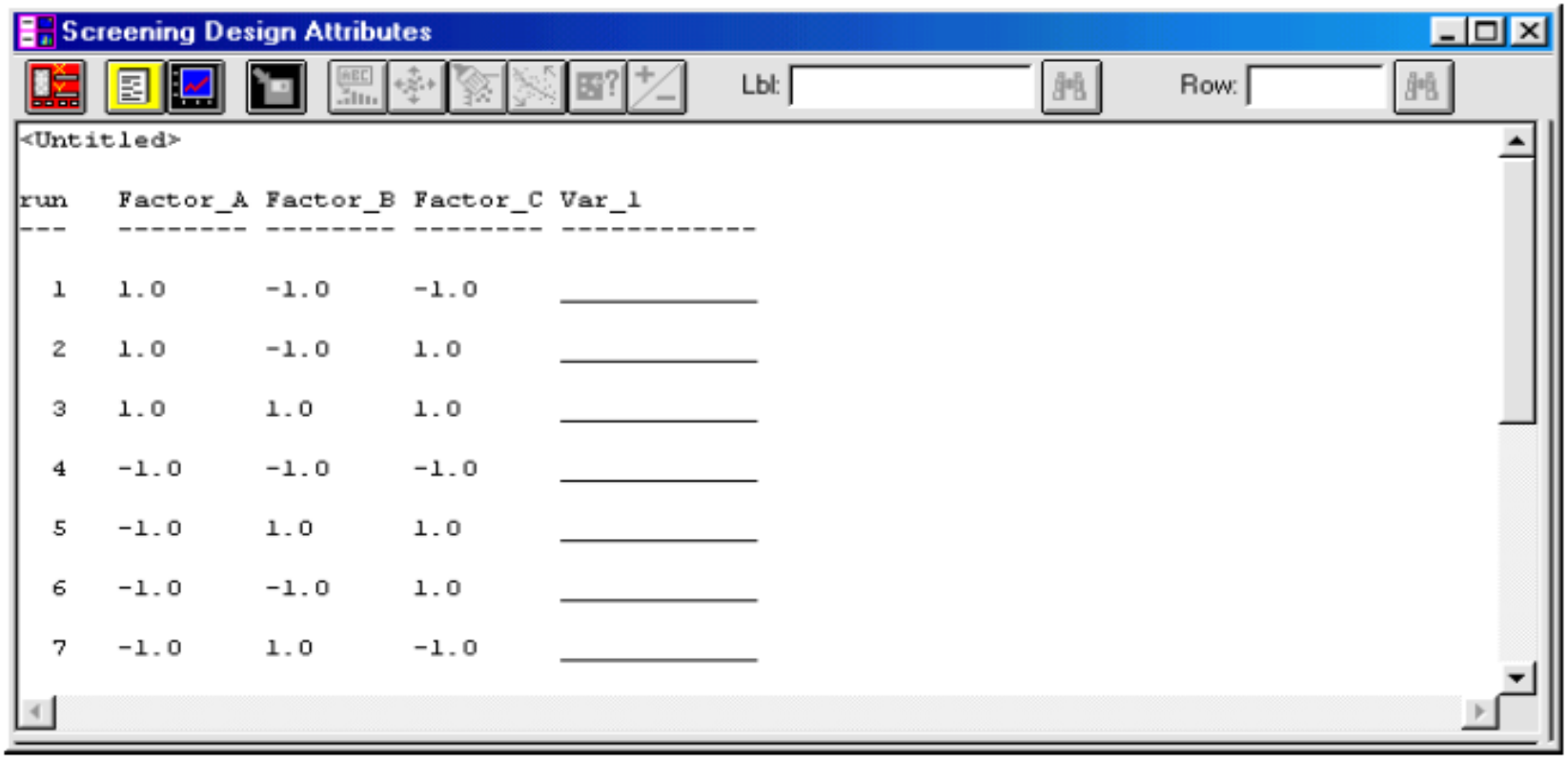

Figure 3-7. Worksheet

Use the *Screening Design Options* dialog box to choose another design. *See Figure 3-4 for an example of this dialog box.*

Worksheet

The Worksheet option displays a Worksheet that contains the experimental runs that will be performed, as well as the order in which you should run them (see Figure 3-7).

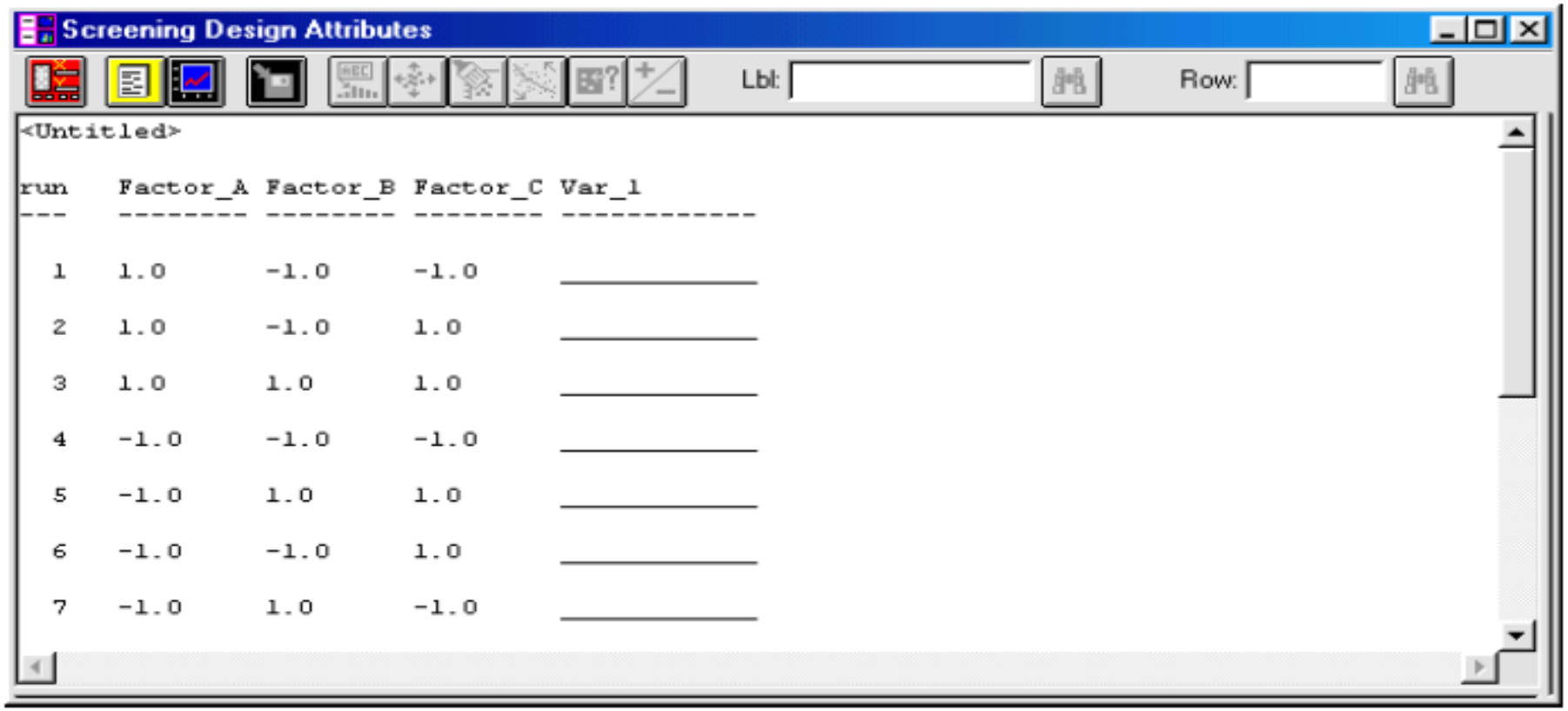

Figure 3-7. Worksheet

Print the Worksheet to record the information, then record the values for the responses in the blank spaces provided. Restore the DataSheet and enter the values into the appropriate column(s) of the DataSheet, then analyze the design.

Use the *Worksheet Options* dialog box to choose the spacing between the runs for the worksheet, to enter values for the starting and ending rows, and to choose the response variables that will be included (see Figure 3-8).

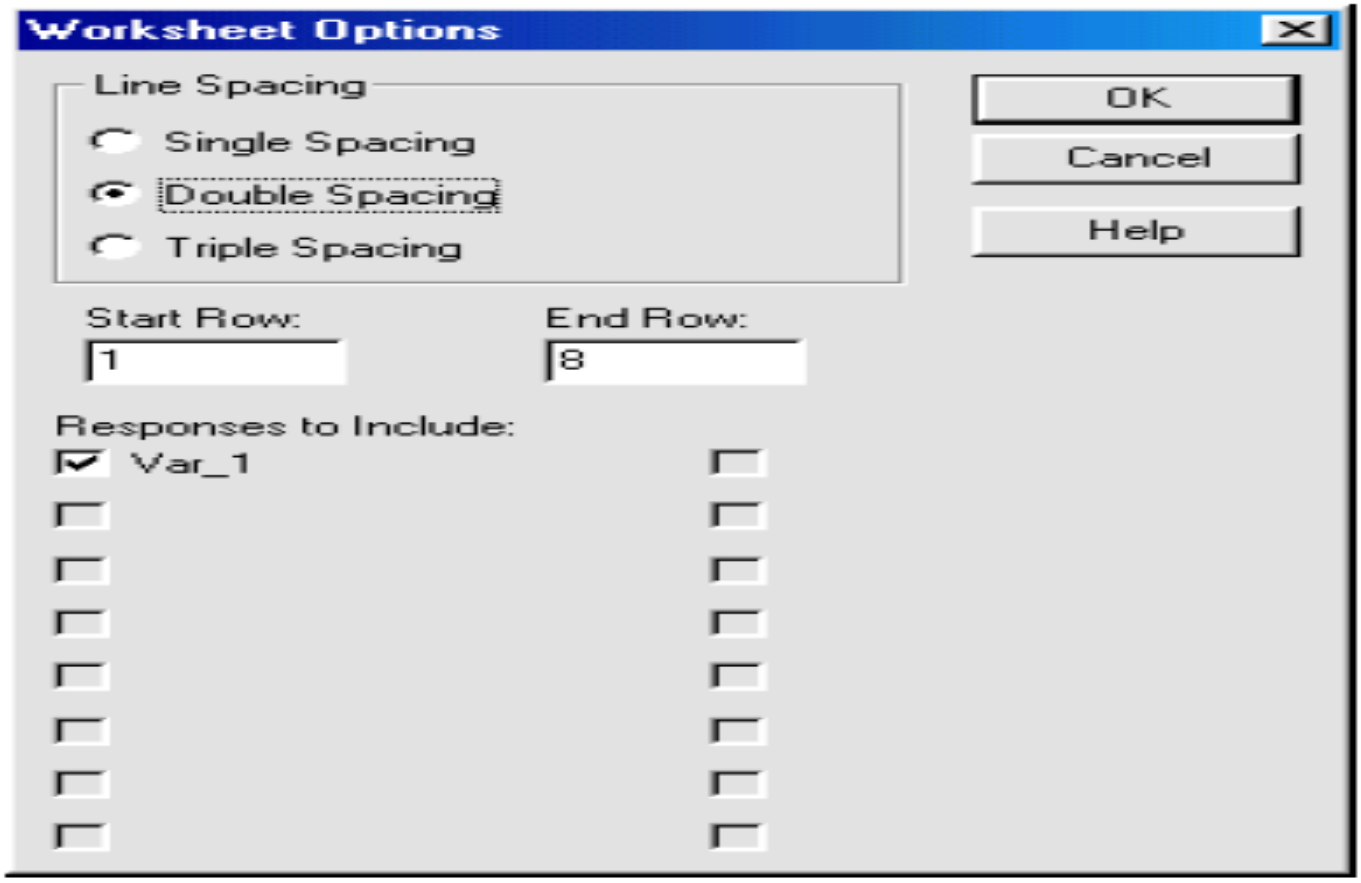

Figure 3-8. Worksheet Options Dialog Box

Alias Structure

The Alias Structure option displays the alias pattern for the design, which shows the main effects, interactions, and any confounding that involves them (see Figure 3-9). If the main effects and interactions are clear of confounding, an appropriate message displays. Confounded effects are joined by a plus sign; for example, A + BC indicates that the main effect, A, is confounded with the two-factor interaction, BC.

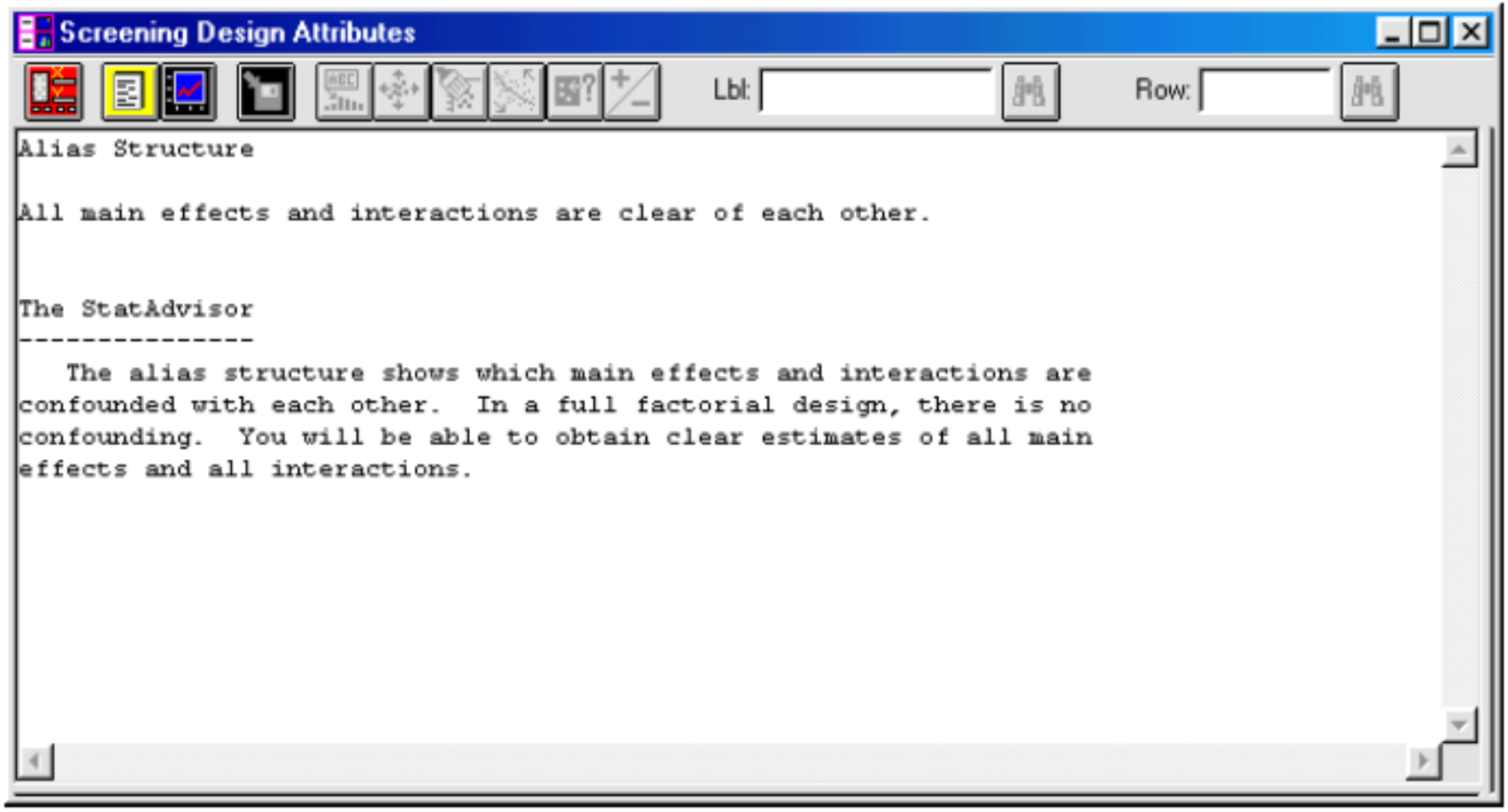

Figure 3-9. Alias Structure

Use the *Alias Structure Options* dialog box to enter a number for the highest-order interaction; these are the highest-order interactions shown in the report (see Figure 3-10). Enter any positive integer, up to the number of factors in the design.

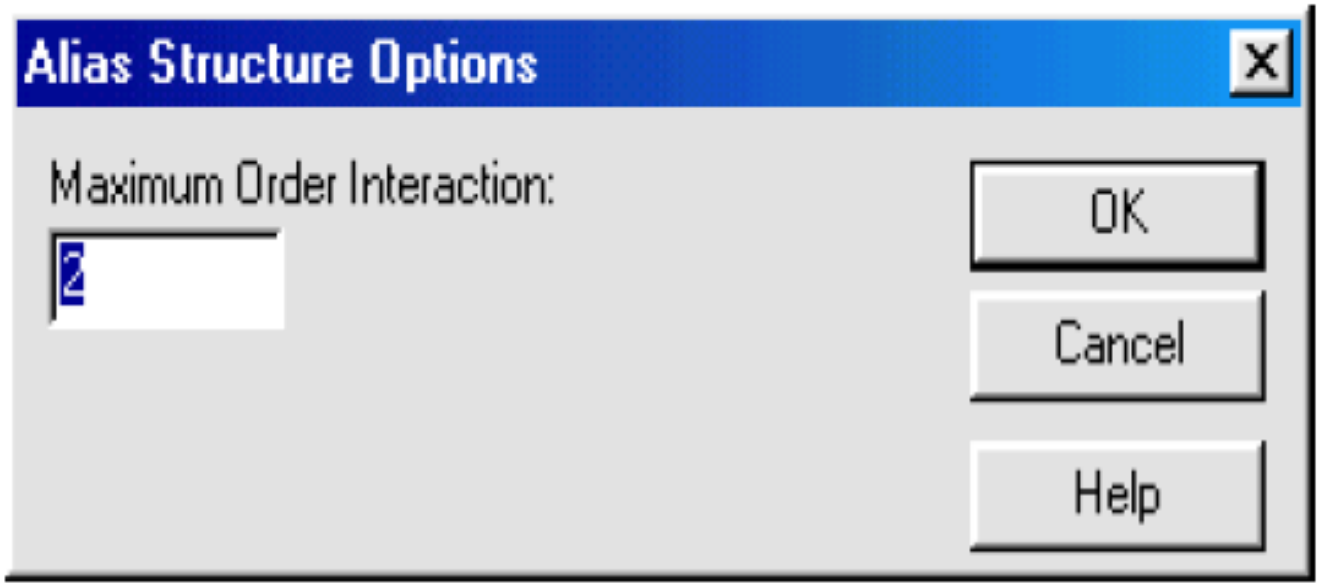

Figure 3-10. Alias Structure Options Dialog Box

Correlation Matrix

The Correlation Matrix option displays a correlation matrix for all the factor and interaction effects, based on the actual design matrix (see Figure 3-11).

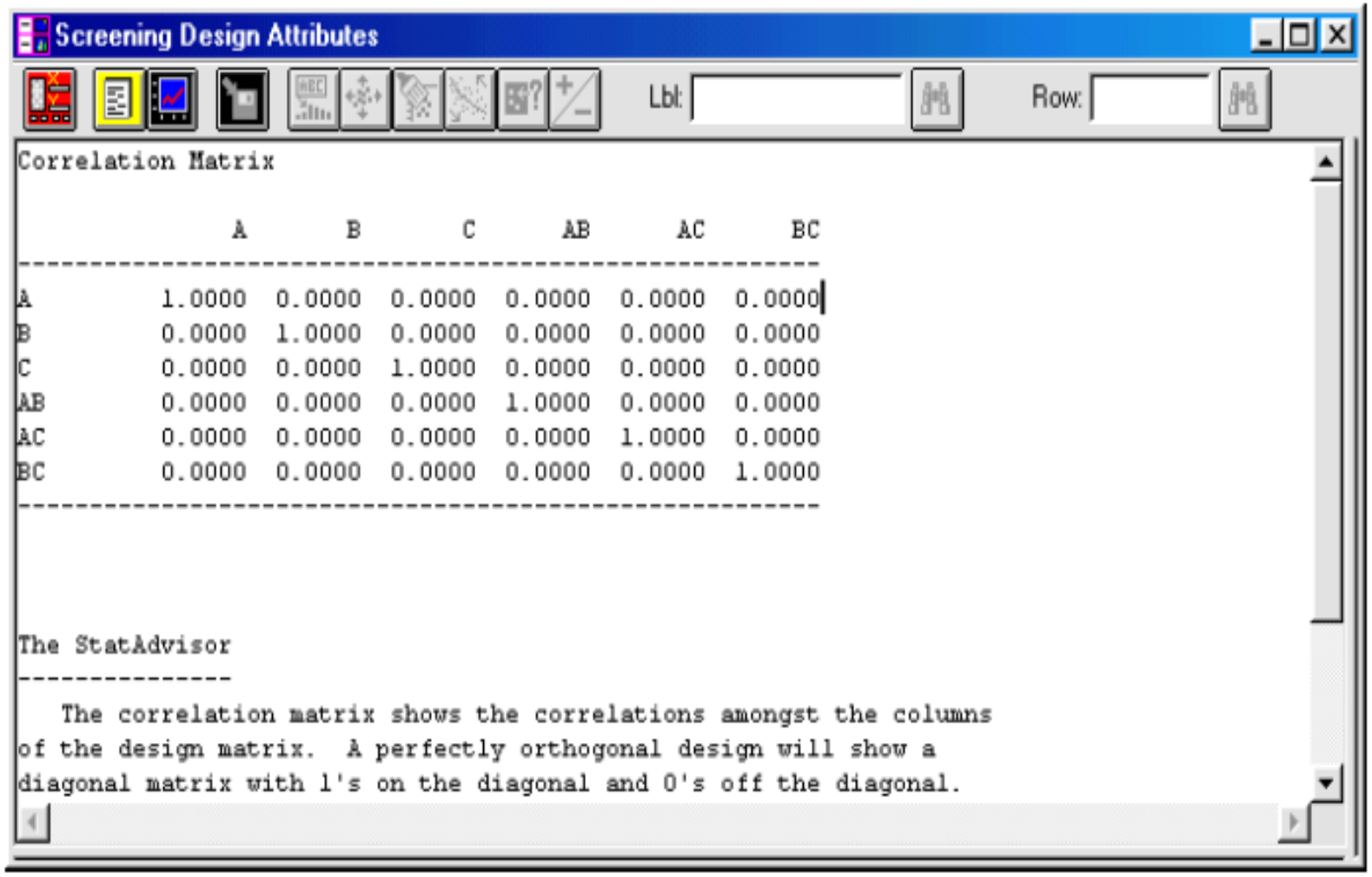

Figure 3-11. Correlation Matrix

Use the *Correlation Matrix Options* dialog box to enter a number that will determine the highest-order effects that will display (see Figure 3-12). Enter a positive integer, up to the number of factors in the design.

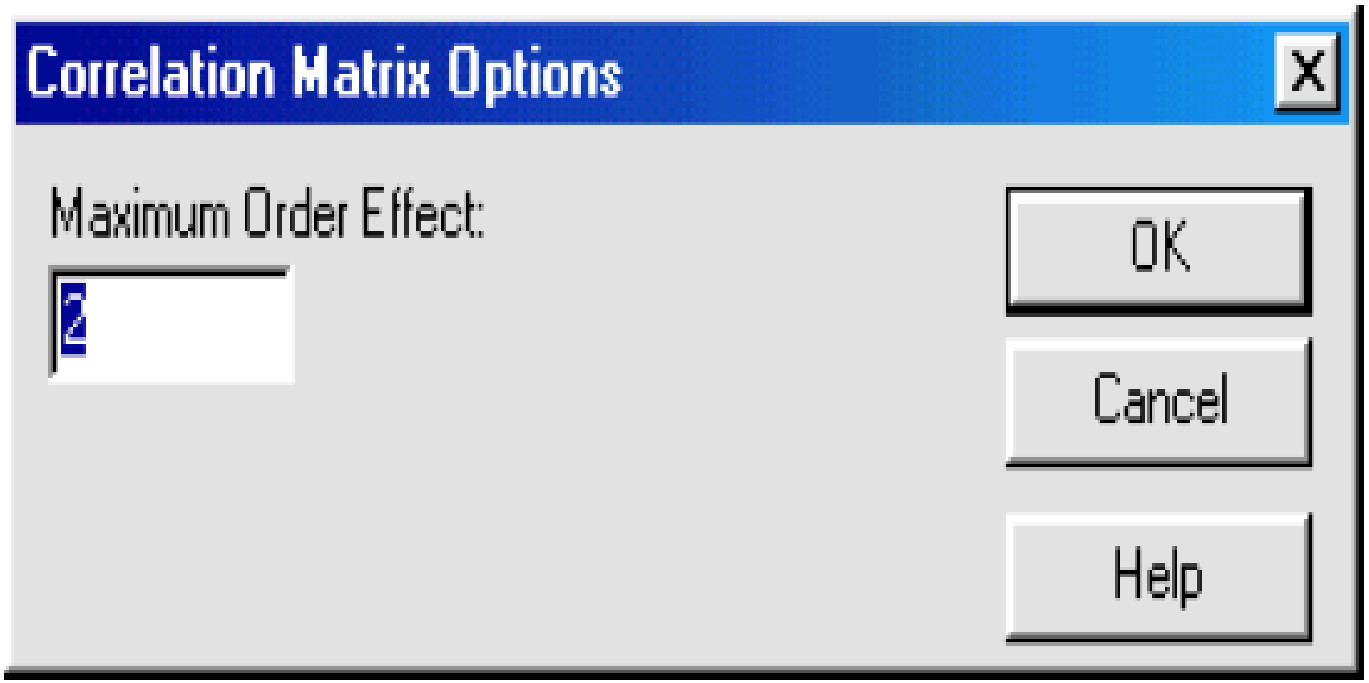

Figure 3-12. Correlation Matrix Options Dialog Box

Choosing Graphical Options for a Selected Design Class

Power Curve

The Power Curve option displays a plot that determines whether or not an experiment can detect effects of the magnitude you expect (see Figure 3-13).

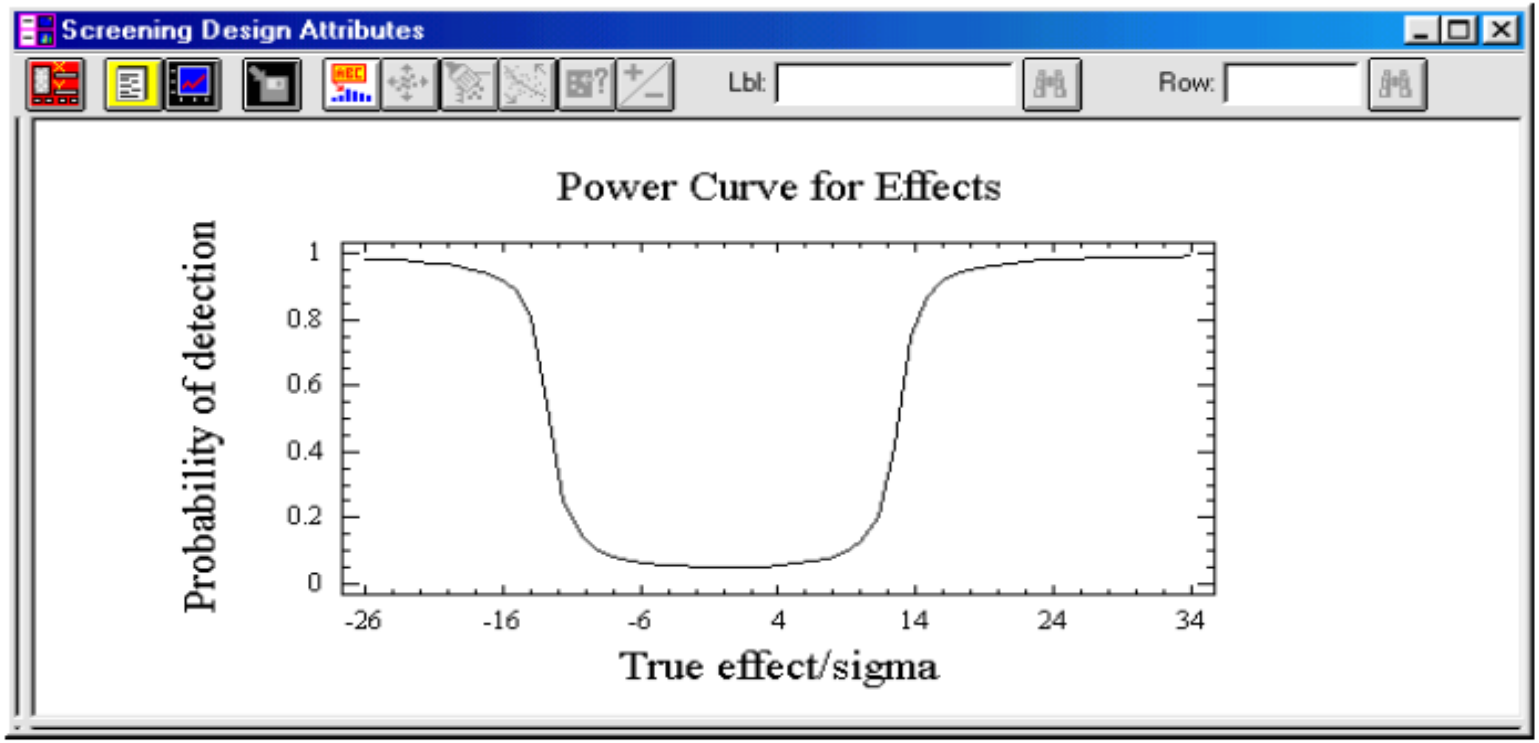

Figure 3-13. Power Curve

Use the *Power Curve Options* dialog box to change the number of degrees of freedom for the error, and to enter a number for the alpha risk (see Figure 3-14). The alpha risk determines the probability of declaring an effect significant when, in fact, it is not.

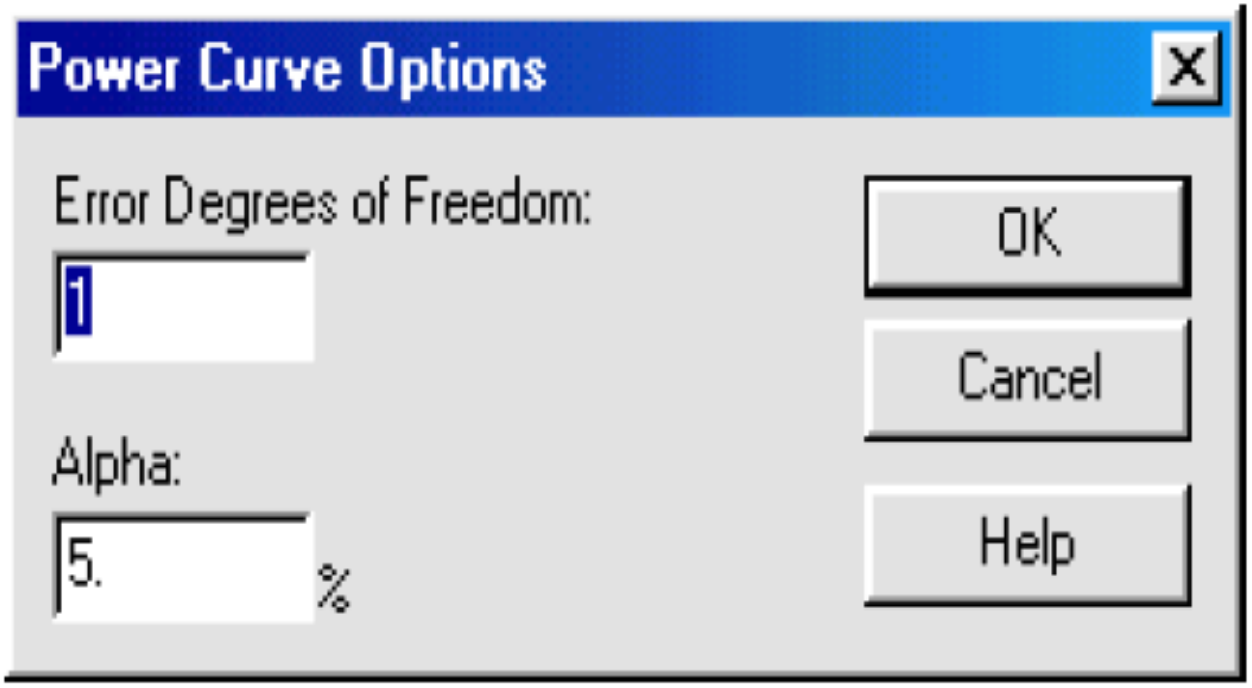

Figure 3-14. Power Curve Options Dialog Box