

CHAPTER 1 Introduction

DATAPLOT is an interactive command driven language for:

1. graphics (continuous or discrete);
2. fitting (nonlinear or linear);
3. general data analysis;
4. mathematics.

DATAPLOT commands are high-level, English-syntax, and self-descriptive, such as

```
PLOT Y X
PLOT EXP(-X**2) FOR X = -3 .1 3
FIT Y = A + B*EXP(-ALPHA*X)
BOX PLOT Y X
ANOVA Y X1 X2 X3
LET A = ROOTS SIN(X**2) + EXP(-X) FOR X = 0 TO 5
```

The three most important commands are PLOT, FIT, and LET. The “average” analyst commonly uses about 20 or so commands. However, the language as a whole consists of over 500 commands. These 500+ commands can be categorized as follows:

1. Graphics;
2. Diagrammatic Graphics;
3. Analysis;
4. Plot Control;
5. Support;
6. Output Devices;
7. Keywords;
8. I/O;
9. SET subcommands.

This reference manual documents the syntax for each individual command by category. There are a few additional chapters documenting topics such as available line types and the use of Greek characters.

The reference manual is a two volume set consisting of:

1. DATAPLOT Reference Manual Volume I: Commands;
2. DATAPLOT Reference Manual Volume II: LET Subcommands and Library Functions.

The above are intended as reference manuals, not tutorials. A User’s Guide is being planned to provide a tutorial introduction to DATAPLOT.

Overview of DATAPLOT's capabilities

DATAPLOT can be used to generate both analysis and presentation quality graphics. In addition to standard line and scatter plots, it supports many specialized graph formats. Graphical capabilities include the following.

- x-y plots of data or functions (both line and symbol formats)
- analysis of proportions plot
- box plots
- box-cox plots (for normality, homoscedasticity, and linearity)
- complex demodulation plots
- contour plots
- control charts
- correlation plots
- error bar plot
- experiment design plots
- histograms, rootograms, frequency polygons, stem and leaf plots
- jackknife and bootstrap plots
- i plots
- lag plots
- percent point plot
- probability plots (over 20 distributions)
- probability plot correlation coefficient plot (9 distributions)
- spectral plots
- star and profile plots
- three-dimensional plots (functions or points)
- diagrammatic graphics (word charts, lines, and predefined geometric figures)
- some specialized charts not listed above

DATAPLOT supports several types of fitting. Residuals and predicted values are automatically saved whenever a fit is done. Fitting capabilities include the following.

- linear and multi-linear fits
- polynomial fits
- non-linear fits
- spline fits
- exact rational fits
- weighted fits
- robust fits (via bi-weight or tri-cube weighting of residuals)

Other data analysis capabilities include the following.

- analysis of variance (up to 5 levels, balanced data only)
- confidence intervals and t-tests
- median polish
- runs analysis
- smoothing (moving average, Tukey smoother, and locally weighted least squares)
- summary statistics
- tabulation and cross-tabulation

- Yates analysis

Mathematical capabilities include:

- random number generation (over 25 distributions)
- user-defined functions
- built-in library functions (trigonometric functions, Bessel functions, Chebyshev polynomials, cumulative distribution functions, probability density functions, percent point functions, and various others)
- statistical calculations
- cubic spline interpolation
- derivatives (for some functions) and integrals
- Fourier and fast Fourier transforms
- convolution and deconvolution
- data transformations

One of DATAPLOT's strengths is the ability to control the attributes of a chart. Plot control capabilities include:

- support for seven Hershey fonts
- Greek/math symbols
- data traces can be plotted as lines, symbols, spikes, or bars (attributes of each of these can be controlled by user)
- titles, labels, and legends
- color (if available on the hardware)
- control of line width
- control of tic marks and tic mark labels

Although DATAPLOT has a wide variety of capabilities, it does NOT do:

- database management (it reads data either from the terminal or from ASCII text files)
- image processing
- shaded 3D graphics
- symbolic mathematics (the one exception is that derivatives are computed symbolically)

General Considerations

- DATAPLOT is not case sensitive, so commands can be entered in either upper or lower case. There are a few exceptions (primarily dealing with file names or operating system dependent commands) that are noted in the documentation. The one general exception is in the specification of file names (this applies primarily to Unix systems). On Unix systems, DATAPLOT attempts to open a specified file as entered. If this fails, it attempts to open the file as all upper case characters. If this fails, it attempts to open the file as all lower case characters.
- In general, file names are identified by the appearance of a period (“.”) somewhere in the file name. On systems that do not support file extensions, place a trailing period at the end of the file name. DATAPLOT strips off this period when trying to open the file on systems where this is appropriate. On Unix systems (where a period is a valid file name character), DATAPLOT first attempts to open the file with the period present and if this fails it then attempts to open the file with the period stripped off.
- The default graphics device is a Tektronix 4014. See the Output Devices chapter for details on how to change the graphics device and for a list of supported devices.
- DATAPLOT can execute commands stored in a file. See the CALL command, documented in the Support chapter, for details. These files are simply ASCII text files that can be created with any text editor. The CREATE command, also documented in the Support chapter, can be used to save commands that are entered interactively. An ASCII text file is created that can be edited with any text editor.

- The LIST, REPEAT, and SAVE commands can be useful when typing commands interactively. The LIST command lists the previous 20 (or more) commands, REPEAT allows you to re-execute one or more of those commands, and SAVE allows you to designate one or more of those commands to be re-executed with a single key stroke. These commands are all documented in the Support chapter.
- DATAPLOT is written to be both portable and device independent. DATAPLOT has been installed on a wide variety of computers ranging from an IBM 386 PC to a Cray Y-MP supercomputer. Device independence is discussed in the introduction to the Output Devices chapter.
- For most commands, entering the first four characters will suffice. There are a few exceptions where there are potential conflicts with other command names.
- DATAPLOT uses spaces as delimiters to separate arguments in commands. Using commas, tabs, or other punctuation marks results in errors.
- DATAPLOT supports 5 data types:

| | | |
|------------|---|---------------------------------------|
| Numbers | = | unnamed constants |
| Parameters | = | named constants |
| Variables | = | named vectors (i.e., columns of data) |
| Matrices | = | named matrix |
| Functions | = | named strings |

This topic is discussed in more detail in chapter 1 of Volume II of the Reference Manual.

- Names used for parameters, variables, matrices, and functions can be up to 8 characters long, must start with an alphabetic character, and can, thereafter, be any combination of the 26 alphabetic characters and the 10 numeric characters. Names longer than 8 characters can be used, but all characters after the first 8 are ignored.
- DATAPLOT is a declaration free language. One does not need to pre-define parameter, variable, matrix, and function names. DATAPLOT determines the type the first time a name is used. However, once used, the type cannot be changed without deleting the name first using the DELETE command. The DELETE command is documented in the Support Commands chapter.

Previous Documentation

The following DATAPLOT documentation is still available and can be obtained from Alan Heckert (see the Preface for information on where to contact him):

1. DATAPLOT--Introduction and Overview, J. J. Filliben, NBS SP 667, 1984.
2. DATAPLOT--Graphics Primer, J. J., Filliben, unpublished document, 1978.
3. DATAPLOT--An Interactive High-level Language for Graphics, Non-Linear Fitting, Data Analysis, and Mathematics, J. J. Filliben, Proceedings of the Third Annual Conference of the National Computer Graphics Association, NCGA, 1982.
4. Techniques for Fitting and Verification of Linear/Non-Linear Models using DATAPLOT, J. J. Filliben, unpublished document, 1978.
5. DATAPLOT--New Features 87.1, J. J. Filliben, unpublished document, 1987.
6. New Mathematics Enhancements to DATAPLOT, J. J. Filliben, unpublished document, 1987.

The NCGA paper [3] provides an excellent summary of DATAPLOT's basic capabilities and is a good starting point for new users who want to know if DATAPLOT will serve their needs. The "Introduction and Overview" [1] was the previous reference manual. The "Graphics Primer" [2] and the "Techniques for Fitting" [4] documents provide many examples of DATAPLOT's graphical and fitting capabilities respectively and, until the DATAPLOT User's Guide is published, remain the primary tutorial documentation for DATAPLOT.