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Release v3.00

Xmgr Release v3.00

This is xmgr Release 3.00, a plotting tool for workstations using Motif/X.Source code is available via anonymous ftp to:

  ftp.ccalmr.ogi.edu [129.95.72.34]:/CCALMR/pub/acegr/xmgr–3.00.tar.Z

To build xmgr, cd to xmgr–3.00/src, edit the Makefile and type 'make', or use the Imakefile. I don't use imake in the course of development so there are most likely problems with the Imakefile.

Xmgr 3.00 has been compiled on SGIs, RS6000s, Decstations, DECAlpha, Suns (SunOS 4.1.x and Solaris), HP 7xx, and Linux. I'm very interested in compilation on other platforms.

On some systems, the file pars.c will need to be compiled separately. Use the 'cc' command provided in the Makefile to compile pars.c, then 'make' to resume the compilation.

There is now a mailing list for users of ACE/gr send mail to:majordomo@admin.ogi.edu with a body of (not in the "Subject:" line):subscribe acegr to subscribe. Majordomo is a mail list management package, and automatically handles additions and removals from the list.

Use the address, acegr@admin.ogi.edu, to send mail to the list. Please use the mailing list for comments, suggestions, and bug reports.

1.0 Introduction

ACE/gr is an XY plotting tool for workstations or X–terminals using X. A few of its features are:

User defined scaling, tick marks, labels, symbols, line styles, colors.
Batch mode for unattended plotting.
Read and write parameters used during a session.
Polynomial regression, splines, running averages, DFT/FFT, cross/auto–correlation.
Hardcopy support for PostScript, HP–GL, and FrameMaker .mif format.

While ACE/gr has a convenient point–and–click interface, most parameter settings and operations are available through a command line interface (found in Files/Commands).

1.1 Terminology

Sets – Sets are collections of points, with optional associated values at these points. The associated values can be used to display error bars, high–low open–close plots and several other features. Sets are connected to a graph, and, by default, there are 30 sets per graph and each set is numbered from 0 to the maximum number of sets less one. The number of points in a set is limited by the size of virtual memory and are numbered from 1 to N where N is the total number of points in the set. Operations to manipulate sets are found in **Data/Set operations**, and features such as line styles, symbol types, and others can be changed from **Graph/Symbols**.

Graphs – Graphs are the collection of data sets, tick marks, titles, etc. drawn to display the data. By default, there are 10 graphs with each graph owning 30 sets (both the number of graphs and the number of sets are adjustable via command line parameters). Operations on graphs are found in the **Graphs/Graph operations** popup.

There are numerous popups accessible through Graphs pulldown menu that allow the manipulation of graph parameters. Most graph operations work on what is referred to as the 'current graph', marked by small filled rectangles at the corners of one graph. The 10 graphs available by default in this version of ACE/gr are numbered from 0 to 9.

Regions – Regions are sections of the graph defined by the interior or exterior of a polygon, or a half plane defined by a line. A region defined by a line can be above, below, to the right, or left of the line. Defining regions and operations on points inside regions are found in **Data/Region operations**.

Parameters – Parameters are the settings of symbols, line styles, colors, fonts, etc. used to define graphs and the display of the active sets.

1.2 Installation

To install ACE/gr, refer to the document INSTALL found in the ACE/gr distribution. This will describe the details to successfully install ACE/gr.

Contacting the author :

For bug reports, comments, etc., send mail to the mailing list acegr@admin.ogi.edu
As a last resort (don't expect an answer), send mail to pturner@amb4.ccalmr.ogi.edu

The home of ACE/gr sources and documentation is ftp.ccalmr.ogi.edu [129.95.72.34] in CCALMR/pub/acegr.

2.0 Using ACE/gr

2.1 Execution

The interactive **ACE/gr** program is called **xmgr**, if used in batch mode, grbatch. If grbatch is not found, contact your system administrator, or see the section on installation. For grbatch to work properly it is important that it be called grbatch as it is the name that distinguishes xmgr from grbatch. They are the same program, but when executed as grbatch, the X interface is not initialized and grbatch terminates at the end of execution without user intervention.

Please note that grbatch does not read the any X resource files, so that it can be run from dumb terminals and over phone lines. Don't expect resource settings used for xmgr to work for grbatch. See the section on setting defaults using a .xmgrrc file.

2.2 Command line parameters

–autoscale *x* or *y* or *xy*
　　　　Autoscale the x axis, y axis, or both axes, overriding the settings for axes scaling and tick mark spacing given in any parameter file specified by the –p option.

Example:

xmgr –autoscale x –p params.par data.dat

Reads parameters from params.par and data from data.dat, but overrides any settings for the X axis found in the parameter file.

–noauto *x* or *y* or *xy*
　　　　Suppress autoscaling on the given axis (axes). Use this when a data file has imbedded commands that provide axes scaling and tick mark spacing.

–arrange *rows columns*
　　　　Arrange graphs in column major order starting from the lower left corner in a grid *rows* by *columns*. For example, –arrange 2 2 will position the first four graphs (0, 1, 2, 3) in a 2x2 matrix of graphs starting with graph 0 in the lower left corner of the plotting surface. This function is not as complete as the similar function found in Graph/Graph operations/Arrange and gives a sightly different result.

Example:　xmgr –arrange 2 2
　　　　Creates a 2x2 matrix of graphs.

–rows *rows*
　　　　Arrange the first *rows* graphs in *rows* rows.

–cols *column*s

> Arrange the first *columns* graphs in *columns* columns.

–results *results_file*

> Write the results of regression and anything else that gets written to the results popup
to file *results_file*.

–device *device_number*

> Set the hardcopy device to *device_number*. The device numbering follows:
> 1 .. PostScript landscape
> 2 .. PostScript portrait
> 3 .. FrameMaker .mif landscape
> 4 .. FrameMaker .mif portrait
> 5 .. HPGL landscape
> 6 .. HPGL portrait
> 7 .. Interleaf landscape
> 8 .. Interleaf portrait

Example:

xmgr –device 2

Sets the hardcopy device to PostScript portrait.

–eps

> Tell the PostScript driver to produce EPS.

–printfile *graphics_output_file*

> Write the graphics output to file *graphics_output_file* rather than spool graphics data
to a printer.

–fixed *width height*
–portrait
–landscape
–free

> Set the dimensions of the drawing area. Presently, there is no connection between the
hardcopy drivers and these settings. This means that the printer needs to be set to conform to the
dimensions of the drawing area.
>   –fixed *width height* – set the drawing area to have dimensions *width* and *height*
>   –portrait – set the drawing area to be 8.5x11 in portrait.
>   –landscape – set the drawing area to be 8.5x11 in landscape.
>   –free – allow the drawing area to be resized (no scrollbars will appear).

–batch *batch_file*

Execute the commands in *batch_file* on startup. This command line switch is not the same as executing ACE/gr in batch mode as grbatch.

–noask

Assume the answer is yes to all requests, This means that files will be overwritten without asking if they exist, and, if Exit is selected in the GUI, ACE/gr will exit abruptly. This option can be used to overwrite existing files in batch mode. Be careful.

–graph *graph_number*

Make *graph_number* the current graph. *Graph_number* is an integer between 0 and maxgraph–1 (by default maxgraph, the maximum number of graphs, is 10).

For example, to activate four graphs and read data to each graph:

xmgr –arrange 2 2 data0.dat –graph 1 data1.dat –graph 2 data2.dat –graph 3 data3.dat

This command creates 4 graphs arranged in a 2x2 matrix, and reads a file into each graph.

–graphtype *graph_type*

Set the current graph type to *graph_type*. Where *graph_type* is one of:

    xy linear scaling along both x and y.
    logx linear scaling in y, log scaling in x.
    logy linear scaling in x, log scaling in y.
    logxy log scaling in both x and y.
    bar vertical bar chart.
    hbar horizontal bar chart.
    stackedbar vertical stacked bar chart.
    stackedhbar horizontal stacked bar chart.

–type *data_set_type*

The format of the next data source is *data_set_type*. Where *data_set_type* is one of:

xydx (XY data with error bars along X)
xydy (XY data with error bars along Y)
xydxdx (XY data with error bars along X of differing values)
xydydy (XY data with error bars along Y of differing values)
xydxdy (error bars along X and Y)
xyr (a circle drawn at XY of radius R)
xyhilo (XY data with high–low open–close data)

This setting remains in effect until a new format type is specified.

–ihl

IHL_formatted_file Assume IHL_formatted_file or the next source of data is in IHL format (a local format).

–nxy

The format of the next data source is X1, Y1, Y2, ..., Yn.

–xydx

The format of the next data source is X Y DX

–xydy

The format of the next data source is X Y DY

–xydxdx

The format of the next data source is X Y DX1 DX2

–xydydy

The format of the next data source is X Y DY1 DY2

–xydxdy

The format of the next data source is X Y DX DY

–xyz

The format of the next data source is X Y Z where Z is a value drawn as text at X, Y.

–xyr

The format of the next data source is X Y R, where a circle of radius R is drawn at X, Y.

–xybox

The format of the next data source is XMIN YMIN XMAX YMAX VALUE, where (XMIN, YMIN) is the lower left–hand corner of a rectangle and (XMAX, YMAX) are the upper right–hand corner of a rectangle. VALUE is an integer used to specify the color to use to fill the rectangle. To set the fill, use Graph/Symbols and set the fill style to anything but None.

–boxplot

The format of the next data source is X AVG

–ihl

The format of the next data source is in IHL format, this format leads to a data set of type XY.

–hilo

The format of the next data source is X HIGH LOW OPEN CLOSE, where a symbol denoting the open, close, the high and the low values for an observation is drawn at X.

–netcdf *netCDF file*
–netcdfxy [*xvar* or "*null*"] *yvar*

Where *xvar* and *yvar* are the names of the variables to read. If *xvar* == "null", then load the index of yvar. These command line options may be used to read variables from a netCDF file. For example:

xmgr –netcdf t.nc –netcdfxy null y

Reads y from t.nc and loads to X the index (starting from 1).

xmgr –netcdf t.nc –netcdfxy x y –netcdfxy x1 y1

Reads x and y from t.nc, then x1 and y1 from the same file. 2 sets are created, both of type XY, one with (x, y), the other composed of (x1, y1). another example reading data from 2 CDF files:

xmgr –netcdf t.nc –netcdfxy x y –netcdf t2.nc –netcdfxy x1 y1

–saveall *filename*

Write all active sets to filename.

–wd

Set the current working directory. This option can be used to read files from several different directories. For example:

xmgr –wd examples mlo.dat –wd ../moredat brw.d hilo.dat

Unfortunately, this option not allow wild cards, as they are expanded in the current directory only.

–image

X_window_dump_file Read the window dump file X_window_dump_file. The format is the same as generated by xwd or Frame's capture utility.

–imagexy *X Y*

Set the upper left–hand corner position of the image at screen coordinates (X, Y). Note that screen coordinates have as their origin the upper left–hand corner of the drawing area and positive, increasing Y points down.

–block

Assume the format of the next data file is block data. No sets are formed by reading

block data, and only one set of block data is allowed in an active session. To create sets from the block data, use Edit/Block data.

–bxy *col1:col2*

Create sets from a previously read block data. Using –bxy col1:col2, will create a set using the current set type (default is XY) and using column *col1* and column *col2* from the most recently read set of block data. *Col1* and *col2* are integers indicating the numbers of the columns – column numbers start from 1. For example:

xmgr –block block.d –bxy 1:4 –bxy 2:6

will read block.d and generate 2 sets of type XY using columns 1 and 4 for the first set, and 2 and 6 for the second set.

xmgr –block block.d –type xydy –bxy 1:3:4

will read block.d and generate a set of type XYDY (an XY set with error bars) using column 1 and 3 for X and Y, and column 4 for the error bars.

–log *x* or *y* or *xy*

Set the current graph type to logarithmic depending the the string *x* or *y* or both axes by *xy.*

–parameter *parameter_file*
–p *parameter_file*

Read the parameter file *parameter_file*.

–pexec *parameter_string*

Interpret *parameter_string* as a parameter setting.

–result *result_file*

Write results from regression to *result_file*.

–rvideo

Exchange the color indices for black and white.

–mono

Limit colors to black and white, affects the display only.

–dc

Allow double click canvas operations, overriding any application default setting.

–nodc

Disallow double click canvas operations.

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–redraw

        Redraw the entire page if ACE/gr receives an Expose event.

–noredraw

        Do not redraw the entire page when Expose events are received.

–maxcolors *number_of_colors*

        Set the maximum number of colors allocated.

–world *xmin ymin xmax ymax*

        Set the scaling of the axes for the current graph. The X axis will run from (*xmin*, *xmax*) the Y axis from (*ymin*, *ymax*)

–view *xmin ymin xmax ymax*

        Set the viewport of the current graph to a rectangle described by (*xmin*, *ymin*) and (*xmax*, *ymax*).

–source *data_source*

        Set source for the next data file, the argument takes on the following values:

   disk – Data file is on disk.
   pipe – Read from a pipe.
   stdin – ACE/gr is in a pipe, read from standard input.

The source setting stays in effect until the next –source command is given.

–pipe

        Read from standard input and plot each set when the end of the set is seen. Use the –pipe option to monitor the results coming from a model or other data stream.

–remove

        Erase the most recently read file. Use this option when using ACE/gr to read a temporarily constructed file that is not needed once read. Note that this option does not request confirmation.

–legend *load*

        For each data set read, make the set legend label the same as the filename the data set originated.

–seed *seed_value* Initialize the random number generator using seed *seed_value*. This value is used in a call to the math library function srand48().

–GXinvert
–GXxor

GXinvert and GXxor set the type of graphics operation used to draw rubberband lines and draw the graph focus markers. In a color mapped display, the xor of a source and destination pixel may not generate a color visible on the drawing area. The default is to use xor to draw rubberband lines, if the lines don't show, try –GXinvert. This draw mode can be set via X resource settings (see below).

–maxplot *number_of_sets*

Set the maximum number of data sets per graph. *Number_of_sets* must be greater than 30. If –maxplot is used in conjunction with –maxgraph, then the –maxplot setting must precede the –maxgraph setting.

–maxgraph *number_of_graphs*

Set the maximum number of graphs per session. *Number_of_graphs* must be greater than 10. If –maxgraph is used in conjunction with –maxplot, then –maxplot must precede the use of –maxgraph.

–nonl

Activate the Non–linear curve fitting module. WARNING, this module is a prototype and should not be used for analysis.

–digit

Activate the Digitizing module. WARNING, this module is a prototype and should not be used for analysis.

–usage

Display a brief explanation of command line settings

data_files

The files or commands in the case of a pipe from which data are read.

2.3 Setting ACE/gr defaults

On startup ACE/gr will look for a .xmgrrc file in the users' home directory allowing changes to the default behavior of ACE/gr. The construction of the ACE/gr default file is the same as for a parameter file.

2.4 Setting ACE/gr X defaults

The following X resource settings are supported:

Xmgr.invertDraw: False

Use GXinvert to draw rubberband lines and the graph focus markers if this resource is set to True.

Xmgr.reverseVideo: False

> A boolean resource used to exchange the color indices for black and white.

Xmgr.maxSets: 30

> Set the number of sets per graph.

Xmgr.maxGraphs: 10

> Set the number of graphs.

Xmgr.maxColors: 17

> Set the number of colors allocated. There is no support in the graphical portion of the user interface for more than 16.

Xmgr.verifyAction: No

> Applies to the Pick set operations and allows an opportunity to accept or cancel any operation performed.

Xmgr.allowDoubleClick: Yes

> When Yes, allow double clicks on the canvas to bring up various popups depending on the location of the pointer when the double click occurs. Double clicking to the right of a graph brings up the View/Ticks popup set to the Y–axis, below the graph brings up the View/Ticks pop-up set to the X–axis, inside the graph brings up the files popup if no sets are active or the View/ Symbols popup set to the set nearest the pointer. Double clicking above the graph brings up the View/Title–subtitle popup, to the right of the graph, the View/Legend popup. The command line option to set this resource is –dc or –nodc.

Xmgr.autoscaleOnRead: No

> When this resource is Yes or True, allow autoscaling to occur each time a set is read from the File/Read sets popup.

Xmgr.backingstore: No

> Have ACE/gr handle backing store if the server doesn't. The command line option for this is –bs or –nobs.

2.5 Environment variables

GR_HOME

> Set the location of ACE/gr. This will be where help files, auxiliary programs, and examples are located. If you are unable to find the location of this directory, contact your system administrator.

GR_PS_PRSTR

> Set the command string to use for spooling to a PostScript printer. The default (unless changed during the build process) is "lpr –h".

GR_MIF_PRSTR

       Set the command string to use for printing the FrameMaker .mif format. The default (unless changed during the build process) is "cat >acegr.mif < ", i.e., output is to a file.

GR_HPGL_PRSTR

       Set the command string to use for spooling to an HPGL capable printer or plotter.

GR_HDEV

       Select the hardcopy device.

The device numbering is as follows:

1. PostScript landscape
2. PostScript portrait
3. FrameMaker interchange format (.mif) landscape
4. FrameMaker interchange format (.mif) portrait.
5. HPGL landscape
6. HPGL portrait
7. Interleaf landscape
8. Interleaf portrait

2.6 Batch printing

Executing ACE/gr as grbatch suppresses the initialization of the graphical user interface and allows hardcopy plots to be made without intervention.

2.7 Fonts

To change fonts within a string precede the font number listed below by a backslash. To turn subscripting or superscripting on or off use \s for subscripts and \S for superscripting. Font selection is current for the remainder of the string or until the next font change. Subscripts and superscripts remain for the remainder of the string or until \N is seen. To print a backslash use \\. To backspace use \b. To begin underlining use \u, to stop underlining use \U. \+ increases the size of the characters and \– decreases the size of the characters.

ACE/gr uses the Hershey fonts to draw text on the screen, but PostScript fonts for hardcopy. There are discrepancies between the two sets of fonts and of this writing, there are problems with the mapping of Greek and special characters.

Font #   Font
0 ....   Complex Roman on screen, maps to Times–Roman.
1 ....   Triplex Roman on screen, maps to Times–Bold.

2	Complex Italic on screen, maps to Times–Italic.
3	Triplex Italic on screen, maps to Times–Bold–Italic.
4	Simplex on screen, maps to Helvetica.
5	Duplex on screen, maps to Helvetica–Bold
6	Complex Italic on screen, maps to Helvetica–Oblique.
7	Triplex Italic on screen, maps to Helvetica–Bold–Oblique.
8	Simplex Greek on screen, maps to the lower 128 characters of the Symbol font.
9	Symbols on screen, maps to the upper 128 characters of the Symbol font.
x	Special symbols

Summary of other special commands

+ .... increase size
– .... decrease size
b .... backspace length of previous character
s .... begin subscripting S .... begin superscripting
u .... begin underline
U .... stop underline
N .... return to normal

Example:\0F\sX\N(\8e\0) = sin(\8e\0)*e\S(–X)\N*cos(\8e\0)

prints roughly FX(e) = sin(e)*e –X*cos(e)
using font 0 and e prints as epsilon from the Simplex Greek font.

NOTE: Special characters are mapped to the keyboard, the present mapping is not very well organized and may change.

3.0 Guide to Menus and Popups

3.1 Main panel

There are 5 main areas in the display, the menu bar at the top, the locator bar just below, the toolbar along the lefthand side of the display, the status bar at the bottom, and the drawing area where graphics are drawn. The following items describe the locator bar, the toolbar, the status bar and hot keys for ACE/gr. Sections 3.2–3.5 describe the pull down options and corresponding menus where applicable.

3.1.1 Tool bar

The toolbar runs along the lefthand side of the display, and provides functions to manipulate the axes scaling of active graphs, by scrolling and mouse powered zooms.

3.1.1.1 Draw

Click on **Draw** to freshen up the drawing area with the current set of graphs, parameters and active sets. Most operations perform an automatic redraw, this may be undesirable in the cases where the sets are large or there are several active graphs. By playing with the options in **Graph/ Draw options** and using the **Draw** button, much of the tedium associated with slow redraw rates can be alleviated. If you feel something should have happened after performing an operation, press this button to force a draw operation to freshen up the display. If the X display being used does not do backing store, then **Draw** will give a clean picture if the graphics get damaged when overlaid by popups or other applications.

3.1.1.2 Zoom

Click on Zoom to zoom in on the plot. Then specify the zoom area by selecting one corner and then the other.

3.1.1.3 Autoscale

Click on Autoscale to generate a default scaling for both the X and Y axes in the current graph.

3.1.1.4 Expand

Click on Expand to incrementally zoom in on the data.

3.1.1.5 Shrink

Click on Shrink to incrementally zoom out from the data.

3.1.1.6 Page left

Click on Left to incrementally shift the axes to the left.

3.1.1.7 Page right

Click on Right to incrementally shift the axes to the right.

3.1.1.8 Page down

Click on Down to incrementally shift the axes down.

3.1.1.9 Page up

Click on Up to incrementally shift the axes up.

3.1.1.10 Auto ticks

Using any of the buttons that affect the scale of the axes, it is likely that unpleasing tick marks will result. By clicking on AutoT,the tick spacing will be set using the current autoscaling parameters(set in Graph/Autoscale).

3.1.1.11 Auto scale on a picked set

Click on AutoO then click near a point in the set of interest to autoscale the current graph with respect to the selected sets bounding box.

3.1.1.12 Zoom X

Select a Zoom line used to scale the X axis of the current graph.

3.1.1.13 Zoom Y

Select a Zoom line used to scale the Y axis of the current graph.

3.1.1.14 Auto X

Autoscale the X axis only.

3.1.1.15 Auto Y

Autoscale the Y axis only.

3.1.1.16 Push 'n zoom

Save the current graph's axes scales and tick mark settings, and prepare for a zoom. This function can be used to zoom in on an area of interest, then restore the previous graph scale.

3.1.1.17 Push

Save the current graph's axes scales and tick mark settings for later retrieval. Use Pop to restore.

3.1.1.18 Pop

Restore the current graph's axes scale saved from the most recent use of Push.

3.1.1.19 Cycle

Cycle allows the contents of the current graph's world stack to be displayed in stack order. The contents of the stack are unaffected.

3.1.1.20 Stack depth

Report on the current depth of the stack. Each graph has its own stack.

3.1.1.21 Current world

When cycling through the current graph's world stack, display the position in the stack.

3.1.1.22 Exit

Exit ACE/gr.

3.1.2 Locator bar

The Locator bar, found directly under the main menu bar, displays the current graph and the position of the pointer. To set properties of the locator display text, see **View/Locator props**.

3.1.3 Status bar

The Status bar, at the bottom of the display, reports on items of interest and provides a line of help when the mouse is used in any operation.

3.1.4 Hot keys

When the mouse is on the canvas (where the graph is drawn), there are some shortcuts that can be taken to bring up several popups. They are:

   ^A – autoscale plot
   ^B – draw a box (using the current settings for boxes)
   ^D – delete an object (string, line, or box)
   ^N – move an object (string, line, or box)
   ^P – draw a line (using the current settings for lines)
   ^V – set the viewport with the mouse

^W – write a string (using the current settings for strings)
^X – exit ACE/gr
^Z – enable zoom

3.2 File

Read data from disk or pipes, read variables from netCDF or HDF files, read and write plot parameters, read block data, write one or more ACE/gr data sets, set the current working directory, set the printer options, print (hardcopy), access the command line interpreter, describe the status of data sets, graphs and regions, and display results of computations and other operations.

3.2.1 Read sets

Read one or more data sets. The list item at the top of the popup displays the contents of the current directory. Select a file or directory by clicking on the item with the right mouse button. The selection is placed in the text item labeled 'File:' and checked to see if it is a directory or a file. Selecting a directory causes ACE/gr to change to the new directory and reload the file list with the contents of the new directory. Selecting a file does nothing until the 'Accept' button is pressed or is entered. Before 'Accepting the file, the items describing the file type, file source, and the graph in which to read the data need to be properly set. The type of data file can be one of several formats:

A 2 column multi–data set file. Sets are separated by a line containing non–numeric characters, that are neither comment lines(lines with a '#' in column 1) nor parameter lines (lines beginning with an '@'). The sets generated from this file type are all of type XY.

A multi column data file. X is assumed to be in the first column,and Y1, Y2, ..., up to Y30 in the remaining columns. The sets generated with this data file format are all of type XY.

IHL format. A 3 column data file with the first line an integer value with the number of points to follow.

Binary format. – not defined as of this writing.

X Y DX format. A 3 column data file consisting of X, Y and a quantity used to form an error bar parallel to the X–axis, i.e., the point will be plotted with an error bar at (X+–DX, Y).

X Y DY format. A 3 column data file consisting of X, Y and a quantity used to form an error bar parallel to the Y–axis, i.e., the point will be plotted with an error bar at (X, Y+–DY).

X Y DX1 DX2 format. A 4 column data file consisting of X, Y, and the errors in X. The error bar riser is drawn from (X+DX1,Y) to(X–DX2,Y). If both DX1 and DX2 are >0 then the error bar will bracket the datum. If DX2 is <0 and DX1 > 0 the error bars are drawn to the right

of the datum. Likewise, if DX1 < 0 and DX2 > 0 the error bar is drawn to the left of the datum. There are 4 cases for the error bars' position with respect to the datum:

       1. DX1 > 0 and DX2 > 0 ... Error bars bracket the datum.
       2. DX1 > 0 and DX2 < 0 ... Error bars are drawn to the right of the datum.
       3. DX1 < 0 and DX2 > 0 ... Error bars are drawn to the left of the datum.
       4. DX1 < 0 and DX2 < 0 ... Error bars bracket the datum, but reversed from case 1.

       X Y DY1 DY2 format. A 4 column data file consisting of X, Y, and the errors in Y. The error bar riser is drawn from (X, Y+DY1) to (X,Y–DY2). If both DY1 and DY2 are >0 then the error bar will bracket the datum. If DY2 is <0 and DY1 > 0 the error bars are drawn to the right of the datum. Likewise, if DY1 < 0 and DY2 > 0 the error bar is drawn to the left of the datum. There are 4 cases for the error bars position with respect to the datum:

       1. DY1 > 0 and DY2 > 0 ... Error bars bracket the datum.
       2. DY1 > 0 and DY2 < 0 ... Error bars are drawn above the datum.
       3. DY1 < 0 and DY2 > 0 ... Error bars are drawn below the datum.
       4. DY1 < 0 and DY2 < 0 ... Error bars bracket the datum, but reversed from case 1.

X Y DX DY format. A 4 column data file consisting of X, Y, and the errors in X and Y. The error bar risers are drawn from (X+DX, Y) to(X–DX, Y) and (X, Y+DY) to (X, Y–DY).

X Y Z format. A 3 column data file consisting of X, Y, Z. Sets with this type are drawn with the Z value in text at (X, Y).

X Y R format. A 3 column data file consisting of X, Y, R. Sets with this type are drawn with a circle of radius R at (X, Y).

X HI LO OPEN CLOSE format. A 5 column data file consisting of the high, low, open and close values for an observation at X. A data set of this type uses the line style, line width and line color for a normal set when the symbol is drawn.

Read from: sets the source of the data, either a disk file or a pipe. In the case of a pipe, the information provided by the file filter item is not used, as the 'file' in this case will be a command as typed at the UNIX prompt.

Read to graph: selects a particular graph to serve as the repository for the incoming data. The 'Current' graph is the graph that has the focus, and can be any of the available graphs. If you aren't sure which graph is current, the locator item on the main panel displays the current graph number.

Selecting **Autoscale on read**: forces an autoscale of the target graph each time a set is read.

Note: Data are read into the next available set. All data are assumed to be delimited by tabs or blanks.

For the xy, xydx, xydy, xydxdx, xydydy, xydxdy, xyz, xyr data file formats, sets are separated by a line containing non–numeric characters, that are neither comment lines (lines with a '#' in column 1) nor parameter lines (lines beginning with an '@'). Data files can have imbedded comments by placing a '#' in the first column of the comment line. Plot parameters can be set by placing a '@' in the first column of the line followed immediately by the parameter name and setting. See the command line reference for a description of plot parameters and other commands that may be placed in a data file using the '@' character. Comment lines and parameter lines can occur at any place in the data file, and are not used to indicate data set separators. I recommend a single '&' on a line to use as a data set separator.

Press **Accept** to read the data. If the read was successful, the graph of the data is drawn using the current plot scaling parameters. If the data lies outside the current plotting limits, the new set(s) will not be visible until the plotting limits are changed by autoscaling or manually through the View/Define world popup.

Press **Cance**l to close the popup.

Open the Status popup to get information on the state of sets. If reading the file generates more than 10 errors you'll be prompted by an alert requesting whether or not you'd like to continue. These errors generally arise when an attempt is made to read a text file – ACE/gr relies on the interpretive capabilities of sscanf() to parse the data. ACE/gr will read data sets until there are no more sets available, after the maximum number of sets have been used, you'll need to free some sets using the [Kill] or [Kill all] items in the Edit/Set operations pull right.

3.2.2 Read netCDF

File/Read netCDF
Select X: Select Y:
netCDF file:
Load to set:
Autoscale on read
Accept Files... Update Query Done

Enter the name of the netCDF file in the text item labelled netCDF file: then click on "Update" (note that if –netcdf [filename] was used on the command line, this step is not needed, as the lists will be loaded automatically). This will read the names of all one dimensional variables into the two scrolled lists. The leftmost list is for X and the rightmost for Y. There is an additional item in the X list called INDEX (I'm hoping here that no one names a variable INDEX, maybe I need to change this) that indicates that for X, use the index of the Y variable (numbering starts from 1).

Select on a variable from the X list to use for X and select a variable from the Y list (only single selections for now).

If information about the selected variables is desired, click on Query.

Select a set using "Load to set:" – the default is to load to the next available set.

If things look OK, click on Accept to read the data and load the set. Use "Autoscale on read" to set/unset autoscaling after a successful read.

To read data from a new CDF file, enter the filename, or use File... to scan the directory. Click on Update to freshen up the X and Y selection lists.

Note: Presently, only sets of type XY are created.

Note: ACE/gr scans and replaces commas with blanks and the 'D' in FORTRAN double precision exponential formats with 'e'.

3.2.3 Read parameters

Enter the parameter file name on the line labeled "File:", press "Accept" to read a saved state of adjustable parameters, legends, strings, etc., to the graph selected by the 'Read to graph' cycle. As the graph number is saved in the parameter file this isn't used at the present time.

3.2.4 Read block data

Select the data source, either Disk or Pipe and enter the block data file name in the text item labeled "File:" to read a data set in block data file format. The block data file format consists of columns of data. For example, the following is a block data file consisting of 4 columns:

```
1  2  3  4 5
6  7  8  9 10
11 12 13 14 15
```

After reading the file of block data, the popup will close if no errors were found, and the Edit/ Block data popup will take its place. Use the functions in the Edit/Block data popup to create sets from the block data.

NOTE: All items are assumed delimited by spaces or tabs. There is presently a 30 column limit. Only one set of block data per session, i.e., reading another set of block data will obliterate the previous set of block data.

3.2.5 Write sets

Write one or all sets to disk. Select the set to write using the cycle displaying the set numbers (there is an item for selecting all active sets). The item denoted "Format" is the C language format string that will be used to format the data for output – the default should work well for most cases.

Enter the file name on the line labeled "File:" and press the button marked [Accept], to write the data. The item, 'Imbed parameters,' causes ACE/gr to write not only the data, but the parameters describing the graph or graphs as well.

A complete dump of the contents of ACE/gr may be accomplished by selecting all sets, imbed parameters, and all active graphs. The file generated this way can then be read as a normal data file, and should recreate the originating environment.

3.2.6 Write parameters

Select the graph from which to save the parameters. This can be the current graph, any particular graph, or all active graphs. Enter the parameter file name on the line labeled "Write parameters to", press "Accept" to write the current state of adjustable parameters, legends, strings, etc. A prompt will appear if the action would overwrite an existing file. allowing the operation to be cancelled.

3.2.7 Save all

Perform a 'Write sets' using all active sets, all active graphs, and imbed parameters. Use this to save the current session.

3.2.8 Clear all

Kill all sets, graphs, and annotative text, lines, and boxes. After performing this action, it will be necessary to activate a graph using View/Graphs/Activate graphs.

3.2.9 Print

Generate a hardcopy of the current plot on the device specified in the File/Printer set-up popup.

3.2.10 Printer setup

Set the hardcopy device parameters. Select the device, where to print (either the printer or a file), and the string to use as a spooling command for the print job, or file name if output is directed to disk. Click on the 'Accept' button to make the selections above current, or 'Done' to close the popup and cancel the operation. If the selection is accepted, the next time File/Print is selected, hardcopy output will be to the selected device. Click on the 'Print' button to accept the settings and print a hardcopy.

3.2.11 Command interpreter

Command driven version of the interface to ACE/gr. Here, commands are typed at the 'Command:' text item and executed when is entered. The command will be parsed and exe-

cuted, and if no errors are found, the command line is placed in the history list. Items in the history list can be recalled by simply clicking on them with the left mouse button. Save a history list by clicking on the 'Save...' button popping up the 'Save commands' popup. Clicking on 'Read...' will open the 'Read commands' popup and allows previously stored commands to be loaded into the history list for future access. 'Clear' empties the history list. 'Replay' cycles through each item in the history list and executes each instruction in the list. See the command line reference for a description of the command line syntax.

3.2.12 Status

The **Status** popup displays useful information about the state of sets, regions, and graphs. In addition to this, several useful operations are provided to manipulate sets and graphs.At the bottom of the popup are the controls for displaying what appears in the top portion of the popup. Directly this above is a panel that provides operations on the objects displayed in the scrolled region.

Starting with the bottom panel, from left to right, the selections are:

Close Close the Status popup.

Update Freshen up the status display.

Write Write the contents of the status display to the Results popup, from there, the information provided by Status can be written to disk.

Page+ Page forward through the status display. There is a limit as to how many sets can be displayed in the Status popup at one time. By default, the maximum is 30. When the number of sets is less than 30, this button is not needed, use the scroll bars to view the status of the sets that are not shown in the display.

Page– Page backward through the status display. There is a limit as to how many sets can be displayed in the Status display region at one time. By default, the maximum is 30. When the number of sets is less than 30, this button is not needed, use the scroll bars to view the status of the sets that are not shown in the display.

Home Go to the first page of the status display.

End Go to the last page of the status display.

Display An option menu used to select the object types to view, sets, graphs, or regions. The operations panel directly above will change as the object type in this item is changed.

Operations in the **Status** popup are performed by clicking on the operation, then clicking on one or more set numbers shown in the display. There is a status line provided that will

give a bit of help on what actions to take to perform a given operation. Generally, the cursor will change to reflect the nature of the operation.

When the selection for **Display** is **Sets**, the operations provided are:

Kill   Clicking on Kill activates the pointer such that clicking on a set number shown in the display of the Status popup kills the set. After a set is Killed, the point remains hot, the Kill operation can be performed again, until the Cancel button is pressed.

Deact   Clicking on Deact followed by clicking on a set number in the scrolled window will deactivate the set (deactivation merely hides the set, the data is not released). The function can be useful when there are lots of sets being drawn, and the interest is in a subset of the sets being display in the drawing area.

React   Clicking on React followed by clicking on a set number in the scrolled window will reactivate the set if it has previously be deactivated.

Copy   Clicking on Copy followed by clicking on a set number in the scrolled window will select the set to copy from. Click again on another set number to perform the copy. One trick that can be performed here is that this operation can be used to copy sets from one graph to another by changing the current graph. The current graph must be changed by either clicking on the graph to receive the focus on the drawing area, or using Graph/Graph operations.

Move   Clicking on Move followed by clicking on a set number in the scrolled window will select the set to move. Click again on another set number to perform the move. One trick that can be performed here is that this operation can be used to move sets from one graph to another by changing the current graph. The current graph must be changed by either clicking on the graph to receive the focus on the drawing area, or using Graph/Graph operations.

Auto   Clicking on Auto followed by clicking on a set number in the scrolled window will select autoscale the graph axes such that the set in its entirety is displayed in the drawing area.

Reverse   Clicking on Reverse followed by clicking on a set number in the scrolled window will select reverse the order of the points in the set.

Join   Clicking on Join followed by clicking on a set number in the scrolled window will select the set to join to, Click again on another set number to complete the join.

Pack   Clicking on Pack renumbers sets such that there are no gaps in the set structure. If the active sets are 0, 3, 5, following the pack operation, the sets will be numbered 0, 1, 2.

Cancel   Clicking on Cancel cancels any of the operations above that require more than a single set to function (Copy, Move, Join). Also, most of the operations stay in effect until Cancel is pressed.

When the selection for **Display** is **Graphs**, the operations provided are:

Activate   Clicking on Activate then clicking on a graph number activates the graph.

Copy   Clicking on Copy then clicking on a graph number selects the graph to copy from. Clicking on another graph selects the graph to copy to.

Move   Clicking on Move then clicking on a graph number selects the graph to move from. Clicking on another graph selects the graph to move to.

Swap   To swap 2 graphs, click on Swap then click on a graph number to select the first graph, then click again on the second graph to perform the swap.

Hide   To hide a graph, click on Hide then click on a graph number.

Show   To undo the effect of Hide, click on Show then click on a graph number.

Focus   To set the graph focus (the graph with the focus is referred to as the current graph), click on Focus then click on a graph number.

Kill   To kill a graph, click on Kill then click on a graph number.

Cancel   Cancel operations that require 2 selections and take the pointer out of whatever operation was previously selected.

When the selection for **Display** is **Regions**, no operations are provided at the present time.

3.2.13 Results

Display the results of the regression routine and the output of the 'Write' button in File/ Status in the monitor window.

3.2.14 Exit

Click on the Exit button to terminate the session with ACE/gr.

3.3 Data

3.3.1 Status

See Section 3.1.12 Status (under File menu).

3.3.2 Results

See Section 3.1.13 Results (under File menu).

3.3.3 Transformations

Some of these operations generate new sets, if you run out of sets use Edit/Set operations (described below) to kill unneeded sets. Also, the scaling of the world coordinate system may be inappropriate for the results of many of these operations. Use the Status popup to determine the appropriate scaling factors to use in "Define world" (above), or use "Autoscale..." (in View/Autoscale above). Most functions operate on active sets only.

3.3.3.1 Evaluate expressions

Evaluates a formula defined in infix fashion.

Select the set on which the formula will operate, (set must be active, use File/Status to find the current state of sets). If you desire the result be loaded to a new set rather than overwriting the set used for computations, use the panel cycle denoted 'Result to' to inform ACE/gr you'd like the result placed in a new set (if there is one). A new set is created only if a single set is selected from step 1. If 'All sets' are selected then the results will overwrite all active sets.

Enter the formula, the syntax is:

(x,y,a,b,c,d)=

where (x,y,a,b,c,d) are defined as the x and y of the currently selected set and a,b,c,d are scratch arrays that can be used to perform operations between sets. Case is ignored, so X=COS(X) is correct.

Click on Accept when you are satisfied with everything.

Variables:
        a == reference to scratch array
        b == reference to scratch array
        c == reference to scratch array
        d == reference to scratch array

Functions:
        abs(x) == absolute value
        acos(x) == arccosine
        asin(x) == arcsine
        atan(x) == arctangent
        atan2(y,x) == FORTRAN ATAN2
        ceil(x) == greatest integer function
        cos(x) == cosine

deg == 180.0/PI
dx == span of world coordinate system in x
dy == span of world coordinate system in y
erf(x) == error function
erfc(x) == complement of error function
exp(x) == e^x
floor(x) == least integer function
index == the index of the current point in the selected set
int(x) == truncation
invn(p) == inverse of standard normal (p in [0,1])
invt(p,id) == inverse of Student's t with id degrees of freedom
irand(n) == random integer less than n
lgamma(x) == log of gamma function
ln(x) == natural log (should be log)
log(x) == log base 10 (should be log10)
max(x,y) == returns greater of x and y
min(x,y) == returns lesser of x and y
mod(x,y) == mod function (also x % y)
norm(x) == gaussian density function
normp(x) == cumulative gaussian density (–inf,x)
pi == constant PI
rad == PI/180.0
rand == pseudo random number distributed uniformly on (0.0,1.0)
rnorm(xbar,s) == psuedo random number distributed N(xbar,s)
sin(x) == sine function
sqr(x) == x^2
sqrt(x) == x^0.5
tan(x) == tangent function
x == currently selected set X
y == currently selected set Y

Note: See pars.yacc for the yacc grammar.

Examples:

y=–y
y=x*cos(2*x*PI/100)+sqr(x)
x=(index>10)*(x–5)+(index<=10)*x

If the index of the current point is greater than 10 then x=x–5 else x=x. Conditionals evaluate to 0 if false, anything else is true.

a=y

Store y of the current set into scratch array "a" you may now select another set and perform the operation y=some function of(a)

3.3.3.2 Load values

Load a sequence to (x,y) or (a,b,c,d).

3.3.3.3 Load and evaluate

Evaluate parametric functions.

Enter the functions to be used to define X and Y.
Select the independent variable (x,y,a,b,c,d).
Enter the start, stop and the number of points items.
Press the button **Apply** to evaluate the functions and load the result to a new set.

3.3.3.4 Histogram

Compute a frequency histogram.

Select the set.
Enter the width of a bin (all bin widths are the same).
Enter the minimum and maximum values of the portion of the data you wish histoed (sic). Note that Xmin and Xmax refer to the RANGE (or Y) of the set, not the domain (or X).
Press **Accept** to compute the histogram.

3.3.3.5 Fourier

Compute the Discrete Fourier transform.

Select the set
Select the type of data window, the default is the rectangular window in which case the data is transformed unmodified. The data windows are defined as follows:

None: Use the default rectangular window
Triangular: $1.0 – |(i–0.5*(N–1))/(0.5*(N–1))|$
Hanning: $0.5 * [1–cos(2*pi*i/(N–1))]$
Welch: $1–((i–0.5*(N–1))/(0.5*(N+1)))^2$
Hamming: $0.54–0.46*cos(2*pi*i/(N–1))$
Blackman: $0.42–0.5*cos(2*pi*i/(N–1))+0.08*cos(4*pi*i/(N–1))$
Parzen: $1.0 – |(i–0.5*(N–1))/(0.5*(N+1))|$

Select the form of the output, magnitude (spectrum), phase, or the coefficients. The spectrum is computed by sqrt(x*x + y*y) where x, y are the coefficients computed by the DFT or FFT. Only N/2 values (representing frequencies 0 to PI) are loaded to the resulting set.

If the magnitude or phase is selected, then the next item, 'X = ', determines what values should be loaded to X. The index runs from 0 to n/2, the frequency is the cyclical ith fourier frequency, the period is the reciprocal of the frequency with the period of the 0th fourier frequency plotted at T+delt, where T is the total length of the data and delt is the sampling interval.

Select transform or inverse transform.
Select real or complex data.

If real is selected, then the data to be transformed is assumed to be in Y, X is assumed equally spaced and is ignored. If complex is selected then the real part is assumed to be in X and the imaginary part in Y.

Press DFT (for small data sets whose length is not a power of 2) – or FFT (for data sets whose length is a power of 2).

Click on **Window only** to generated a windowed version of the data in a new set.
NOTE: Small for the DFT is < 1000 points. The DFT is O(N**2) and can be quite time consuming to compute for large N.

3.3.3.6 Running averages

Compute a running average, median, minimum, maximum, or standard deviation.

Select the method.
Select the set.
Set the length of the running method in the text item marked **Length**, it must be less than the set length.
Click on **Accept**.

3.3.3.7 Regression

Perform linear or polynomial regression.

Select the set.
Select the degree of fit.
Select fitted curve or residuals to load.
Press the button marked "Regress".
A set is loaded (if there is one) with the resulting curve and a summary of the statistical results are written to the **Result** popup.

3.3.3.8 Differences

Numerical differentiation.

Select the set.
Select the method – one of forward, backward, or centered difference. Assumes unevenly spaced data, increasing in X.
Click on **Accept**.
A set is loaded (if there is one) with the resulting curve.

3.3.3.9 Seasonal differences

Difference a set by a given lag.

Select the set.
Enter the value for the lag.
Assumptions are evenly spaced data, increasing in X.
Press the button marked **Accept**.
Use **Pick** to use the mouse to select the set by clicking near a point in the set as displayed in the drawing area.
A set is loaded (if there is one) with the resulting curve.

3.3.3.10 Integration

Numerical integration.

Select the set.
Select the form of the results, the item marked **cumulative sum** will construct a set composed of the current value of the integral at a given X. Sum only reports just the value on the next line. Assumes unevenly spaced data, increasing in X.
Press the button marked **Integrate**.
A set is loaded (if there is one) with the resulting curve if **cumulative sum** is chosen.

3.3.3.11 X–corr

Cross/auto–correlation

Select both sets (use the same set if auto–correlation is desired).
Select the lag, N/3 is a reasonable value (your mileage may vary).
Select bias – generally this will not make any difference for large data sets with lags << the length of the set, I was just curious. The difference is division by N (biased) or N–lag (unbiased).
A set is loaded (if there is one) with the resulting curve.

3.3.3.12 Spline

Compute a spline fit to a set

Select the set.
Select the starting value of X for the fitted curve.
Select the ending value of X.
Select the number of samples. The spline curve will be evaluated at X+i*(MaxX – MinX)/Nsteps
for each i in (0, Nsteps–1).
Press "Spline"
A set is loaded (if there is one) with the resulting curve.
Notes: The code to compute the spline is a literal translation of the code in FMM.

3.3.3.13 Sample

Sample a set pointwise or by a logical expression.

Select the set.
Select the type of sample, either Start/step or Logical expression. If Start/step is selected then
enter the starting index to begin the sample.

Select the number of points to skip between samples in Step. If Logical expression is selected,
enter the expression in the text item denoted Expr:. Values of the expression not equal to zero are
interpreted as TRUE, and the point is accepted. Any expression evaluating to zero will result in
the point being ignored.

3.3.3.14 Digital filter

Apply a digital filter to a set.

Select the set to be filtered
Select the set with the filter weights.

3.3.3.15 Linear convolution

Perform convolution of 2 sets.

3.3.3.16 Geometric transformations

Apply rotations, scaling, and translations to a set.

Select the order in which to apply the transformations.
Press the button **Apply** to perform the transformation.
Restrictions: Only the set X and Y are transformed, additional vectors attached to a set, such as
error bars, are not transformed.

3.3.4 Set operations

Set operations allow sets to be created, destroyed, written to disk, sorted.

3.3.4.1 Pick operations

Pick ops uses the point in a set nearest to the location of the pointer when clicked to select the set for the chosen operation. The nearest point is determined by the Euclidian distance which can be very different from the point that is visually closer. As long as there are sets with points, the operation will always be performed, which means that a bit of care should be exercised using these operations.

Kill nearest set – Kill the set nearest the pointer.

Copy nearest set – Select a set to copy with one click, and the destination, which may be in another graph, with another click.

Move nearest set – Select a set to move with one click, and the destination, which may be in another graph, with another click.

Reverse nearest set – Select a set to reverse by clicking near a point in a set. The result is that the order of the points is reversed (point N becomes point 1, and point 1 becomes point number N, etc.).

De–activate nearest set – Select a set to deactivate by clicking near a point in a set. The result is that the set will act as if undefined for most operations, and will not be drawn even if the line or symbol selections would cause it to be drawn. The data is not destroyed, and the set can be reactivated using the functions in File/Status or Data/Set ops.

Join nearest sets – Click near a point in one set to use for the join, then click again near a point in another set to select the second set. The second set will be appended to the end of the first set.

Delete range in nearest set – Click near a point in one set to use for the start of the range to delete, then again near the point at the end of the range to delete. The result is that all points between the 2 selected points will be removed from the set, including the 2 points selected.

Cancel operation – Cancel any operation in progress.

The remaining items in the Set ops toolbox allow sets to be created, destroyed, written to disk, moved, sorted, deactivated, reactivated.

3.3.4.2 Activate

Make a set active and able to participate in operations.
To activate a set, select the set number, specify the number of points in the set and click on **Accep**t.

3.3.4.3 Deactivate

Make a set inactive and unable to participate in operations. The data associated with a deactivated set are still available and all plot parameters associated with the set are unchanged. Use the Re–activate set item below to make the set known to ACE/gr again. This item is include for those situations where a set is to be ignored temporarily, but needed later in the session.

Select the set to Deactivate.
Press the button marked **Accept**.

3.3.4.4 Re–activate

Undo the effect of Deactivate.

Select the set to Reactivate, it is a no–op to Reactivate an unused set.
Press the button marked **Accept**.

3.3.4.5 Set length

Set the length of a set.

Select the set.
Fill in the item marked Length.
Press the button marked **Accept**.

3.3.4.6 Change Set type

Set the type of a set.

Select the set
Select the type to set
Press the button marked **Accept**

3.3.4.7 Copy

Copy one set to another in a possibly different graph.

Select the set to copy from.
Select the set to copy to.
Select the graph to receive the copy.
Press the button marked **Accept**.

3.3.4.8 Move

Move one set to another in a possibly different graph.

Select the set to move from.
Select the set to move to.
Select the graph to receive the set.
Press the button marked **Accept**.

3.3.4.9 Drop points

Drop points from a set.

Select the set.
Fill in the items "Start drop" and "End drop".
Press the button marked **Accept**.
NOTE: Points in a set are numbered from 1 to N, where N is the number of points in the set (as opposed to sets which are numbered from 0).

3.3.4.10 Join

Merge 2 sets together.

Select the set that will be appended.
Select the set accepting the previous set.
Press the button marked **Accept** to append the first set to the second.

3.3.4.11 Split

Divide a set into other sets.

Select the set to split.
Enter the length of the resulting sets (say N).
Press the button marked **Accept** to divide the selected set into (length of selected set) / N sets with the remainder to the last set.

The first set will be the set selected to split and will contain the first N points.

3.3.4.12 Kill

Eliminate a set.

Select the set to kill or All to kill every active set.
To save the parameter settings, toggle 'Preserve parameters.'
Press the button **Accept**.
NOTE: This operation is final.

3.3.4.13 Kill all

Kill all active sets.

This is an action item, you'll be asked if it is OK to kill all active sets.

3.3.4.14 Sort

Sort x or y of a set.

Select set to sort.
Select which component (x or y) as a key.
Select the order of the sort.
Press the button marked **Accept** to sort the set in place.

3.3.4.15 Write set(s)

Write a set(s) to disk.

Select the set to write or "All" for all sets
.Fill in the format to use to write, syntax is C, default is "%lf %lf".
Fill in the item marked "Write to file" with the filename to write.
Press the button marked **Accept**.
Note: A complete dump of ACE/gr may be accomplished by selecting All sets, All active graphs and toggling Imbed parameters. The generated file may be read as a normal data file and will contain the necessary information to completely reconstruct all graphs in the current session.

3.3.4.16 Reverse order

Exchange points in a set.

Select set to reverse.
Press the button marked **Accept** to reverse the order of a set.

3.3.4.17 Coalesce sets

Merge active sets to an inactive set.

Select set to receive points from all active sets. This selected set should not be an active set.
Press the button marked **Accept** to merge all sets to the selected set.

3.3.4.18 Swap

Exchange one set with another.

Select the sets and the graphs these sets reside.
Click on **Accept**.
The contents of the sets plus all parameters associated with the display of the sets are exchanged.

3.3.4.19 Pack

Clicking on Pack renumbers sets such that there are no gaps in the set structure.

This is an action item, you'll be asked if it is OK to pack the sets.

3.3.5 Region operations

3.3.5.1 Define region

Define a region of interest on a graph or graphs.

Select the region, there are 5.

Select the type of region:
Inside polygon – Points inside a closed, non–intersecting polygon are considered inside the region.
Outside polygon – Points outside a closed, non–intersecting polygon are considered inside the region.
Above, below, to the left, and to the right – Regions defining a half–plane, points inside the half–plane are considered in the region.

Select the type of linkage, either a particular graph or all graphs, the default is the current graph.

Press **Accept** to make the pointer ready for the region definition. In the polygonal region type, define the region by successive clicks with the left mouse button, use the right mouse button to register the polygon. In the line case, define the line by clicking on the beginning point and end point of the line.

3.3.5.2 Evaluate in region

Evaluate an expression applied to points within a region.

Select the region to use.
Enter the expression, regions are referred to by Rn.x or Rn.y where 'n' is the number of the region to use. Functions available are the same as those in 'Evaluate expressions' described above.

Examples: R0.X = R0.X – 1

3.3.5.3 Clear region

Remove a defined region.

Select the region to remove and press **Apply**.

3.3.5.4 Extract points

Extract points from a region to a set

Select the region to use.
Select the set to receive the points.
Select the graph to put the set.
Click on **Accept** to combine all points within the specified region to the specified set and graph.

3.3.5.5 Delete points

Delete points in a region.

Select the region to use.
Click on **Accept** to delete all points in all sets within the specified region.

3.3.5.6 Area/perimeter

Compute the area and perimeter of a region. This item doesn't belong here as it does not use the region structures.
Click on **Area** or **Perimeter** and use the mouse to define the region. The area or perimeter will be displayed in the text items *Area* = or *Perimeter* = whichever the case may be.
Use the right mouse button to close the region.

3.3.6 Edit/Create Sets

Allows loading of a set created using the vi editor.

Opens a vi edit window.
Enter the points to go in the new set.
Exit the editor with :x or :wq
A new set will be created with the points entered into the file.

3.3.7 Point operations

Operations in Point operations use the pointer to query sets about points, delete points in a set, and move points. In all cases where interaction is required, pressing the right mouse button with the pointer in the drawing area cancels the operation.

3.3.7.1 Find points

Report on a point in a set

Click on Find points.
Position the pointer close to the data point to identify.

Press the left mouse button.
The set, the location in the set, and (X, Y) for the datum nearest to the pointer will be displayed in a popup. Press the right mouse button to shut off the **Find point** feature.

3.3.7.2 Tracker

Track points in a set.

Visit each point of a set in a sequential manner. Click nearest the set to track, and use the left mouse button to go forward through the set and the middle mouse button to go backwards through the set. The right mouse button exits tracking.

3.3.7.3 Delete points

Deletes points in a set.

Press **Delete point** with the left mouse button to activate.
Position the pointer close to the data point to delete.
Press the left mouse button.

3.3.7.4 Add points

Add points to a set.

Select the set and press **Add points** to append points to the selected set by clicking on the location where the point is desired. This can be used to (crudely) digitize data from pages pasted on the screen.

3.3.7.5 Move points

Move point to a new location.

Press **Move** with the left mouse button to activate.
Position the pointer close to the data point to move.
Press the left mouse button.
Move the pointer to the new location and press the left mouse button again to register the point's new location.

3.3.7.6 Move X only

Move point X value location.

Click on **Move X** only to activate.
Position the pointer close to the data point to move.

Press the left mouse button.
Move the pointer to the new location and press the left mouse button again to register the point's new location.

3.3.7.7 Move Y only

Move point Y value location.

Click on **Move Y** only to activate.
Position the pointer close to the data point to move.
Press the left mouse button.
Move the pointer to the new location and press the left mouse button again to register the point's new location.

3.3.7.8 Distance, dy/dx, angle

Calculates distance, dx, dy or angle of 2 specified points.

Click on Distance, dy/dx, angle to activate.
Position the pointer close to the starting point. Press the left mouse button. Click again at another point to form a straight line. The results are the distance, slope, and the angle from horizontal.

3.3.7.9 Goto

Puts the pointer in the specified location.

Enter the X, Y of the point to go to, and press **Goto point** to have the pointer warp to that position on the drawing area.

3.3.8 Block data

Create sets from block data.

Select the type of set and the columns to use for each vector of the new set.
Press **Accept** to create the set.
Note that reading block data does not affect the scaling of the graph so when a set is created using this popup, the set may not appear within the graph's scaling limits – use AS (Autoscale) to set the scale of the graph if needed (or use View/Define world).

3.4 Graph

The selections in the Graph pulldown menu allow the modification of graph parameters. There are popups for setting the scaling of the axes, the number of tick marks to display, legends, writing annotative text, and drawing objects such as lines and boxes.

ACE/gr uses 3 coordinate systems in drawing a graph. These are the world, viewport, and device coordinate systems (following Foley and Van Dam). The world coordinates system is the one in which the data are defined and constitutes the user's coordinate system. The viewport coordinate system (in ACE/gr), is a rectangle defined by the points (0.0, 0.0) or the lower left corner of the device and (1.0, 1.0) or the upper right corner of the device. The pipeline for drawing objects on the screen or hardcopy device is a pair of linear transformations that carry points in world coordinates to the viewport and then on to the device coordinate system. The upshot is that an object located in world coordinates can be drawn in various parts of the screen or hardcopy device depending on the scaling while an object located in viewport coordinates remains in the same spot regardless of the world scaling. Strings, lines, boxes, and the graph legend can be located in either world or viewport coordinates.

3.4.1 Graph operations

3.4.1.1 Activate

Make a graph eligible for receiving the graph focus and other operations.

Select the graph to activate and press **Accept**.

3.4.1.2 Copy

Copy a graph to another graph.

Select the graph to copy from and the graph to copy to and press **Accept**.
Note: Copying a graph will automatically conceal one of the graphs as they will both have the same viewport settings. Some adjustments in the viewport settings of either or both graphs will be required for each graph to be displayed in a non–overlapping manner.

3.4.1.3 Swap

Exchange two graphs.

Select the first graph then the second and press **Accept** to exchange the contents of the two graphs. This can be used to adjust the order in which graphs are drawn, as graphs are drawn in numerical order starting with graph 0.

3.4.1.4 Kill

Make a graph inactive and free all storage associated with sets.

Select the graph to kill and press **Accept**.

3.4.1.5 Focus

Set the graph focus, the focus policy and toggle the display of focus markers.

Select the graph to have the focus, the focus policy, and the toggle for the focus markers and press **Accept**.
Note: Most operations in ACE/gr act on the current graph. Not noticing which graph has the current focus can be a source of frustration when working with ACE/gr – if you plan to work extensively with a particular graph, it might be useful to set the focus policy to **Set** to fix ACE/gr's notion of the current graph.

3.4.1.6 Show

Toggle the display of a one or more graphs.

Select which graph or graphs to show, then press **Accept**.
The default is to show all active graphs.
This item can relieve some of the drudgery when working with multiple graphs, especially when some of the graphs contain large data sets.

3.4.1.7 Set graph type

Set the current graph type to XY, log–linear, linear–log, log–log, bar or stacked bar.

Select the graph type, and press **Accept**.
Note: As of this writing, very little is done to ensure that the data is acceptable for log plots.

3.4.1.8 Arrange graphs

Place several graphs in a non–overlapping manner.

Select the number of rows and the number of columns, the packing method, the vertical and horizontal spacing between graphs in viewport coordinates, the start of the first graph in viewport coordinates, and how wide and how tall each graph should be. Graphs are laid out in column major order starting from the lower left. So, given 3 columns and 2 rows the graphs will be laid out as follows:

        1 3 5
        0 2 4
Given 3 columns and 3 rows:

        2 5 8
        1 4 7
        0 3 6
Note that graphs are numbered from 0.
The packing selection packs the graphs vertically, horizontally or both. Use this item when there

are several graphs with the same X or Y axis scaling so graphs on the outside of the packing arrangement provide the tick and axis labelling for all graphs in that row or column. In the 3x3 example above, selecting packing 'both', graphs 3, 6 will have X–axis tick labels, and graphs 1, 2 will have Y–axis tick labels. Graphs 4, 5, 7, 8 will have neither X or Y axis tick labels, while graph 0 will have both.

3.4.1.9 Overlay

Overlay one graph onto another. This can be used to plot sets of different scale in what will appear to be the same graph.

3.4.1.10 Invert/flip axes

Reverse the direction of the X or Y axes or exchange the X and Y axes.

3.4.1.11 Image

Read and place an X window dump file on the drawing area. At the present time, only one image per session is allowed.

3.4.2 World scaling

Define the world coordinate system by filling in the items Xmin, Xmax, Ymin, and Ymax. The plot is drawn in world coordinates in a rectangle described by the two points (Xmin, Ymin), (Xmax, Ymax). The input is scanned for arithmetic expressions so setting Xmin = –PI and Xmax = PI is legal input (see the section on transformations for a description of the syntax and available functions). The tick spacing can also be set in this popup by filling in the items for the major and minor spacing for each axis. 'Update world/ticks' is used, when, occasionally, the state of the items used to define the world scaling get out of sync with what is actually used to draw the graph, clicking on this item synchronizes the internal values with the displayed values. Press the button marked **Accept** to inform ACE/gr of the changes.

3.4.3 Viewport

Define the viewport by filling in the items Xmin, Xmax, Ymin, Ymax. Viewport coordinates run from (0.0,0.0), the lower left corner of the screen or hardcopy device, to (1.0,1.0), the upper right corner of the screen or hardcopy device. Press the button marked **Accept** to make the change to the new viewport. Press the **Pick view** button to use the mouse to define the viewport. Take the mouse to the lower left corner of the desired viewport and press the left button (there is no need to hold the button down). A rubberband box will show you the current size of the viewport you may select. When you are satisfied with the view, press the left mouse button again to activate the new viewport.
Press the button marked **Close** to close the **Viewport** popup.

3.4.4 Autoscale

Use the Autoscale popup to set parameters associated with autoscaling. Select the axis to scale, or none. Selecting none allows the autoscale type and the number of ticks to create to be set but no autoscaling is done. Select the particular set to use or All. The Autoscale type sets the method of autoscaling, either Heckbert or fixed. Heckbert uses a method based on routines posted to the net by Paul Heckbert and generates nice looking tick spacing, but alters the scaling of the axes. The fixed option uses the minimum and maximum values in the set (or over all sets) to set the scale of the axes. Select the number of tick marks to use for defining the tick mark spacing (in the case of Heckbert scaling, these settings are advisory only). The item labeled **Apply to:** allows the autoscaling of the current graph, or all active graphs.

3.4.5 Draw options

Set the amount of scrolling, linked scrolling (scrolling the current graph scrolls all graphs), automatic redraw, and whether the screen is erased before refreshing the screen.

3.4.6 Title/subtitle

The title and subtitle are strings that appear centered at the top of the plot. Fill in the items indicated and press the button marked **Accept**. To change the font, color, or character size used for titles use the items from the popup denoted **Props....**

3.4.7 Ticks/tick labels

Set the spacing and type of major and minor tick marks, definition of axes labels, and toggle features associated with the drawing of the graph axes.

The top item, **Edit**, selects the axis for which the feature selections will apply. There are two axes defined for each co–ordinate direction, the primary axis and the zero axis. The primary axis will be used the most, the zero axis is, by default, turned off. The button to the right of the Edit item labelled **Props...** allows the axis to be offset by a specified amount in viewport co–ordinates. The item **Axis label** accepts the definition of the label to be used when drawing the axis. Various properties of the label may be set in the popup just below labeled **Axis label props....**

The two items 'Major tick spacing' and 'Minor tick spacing' set the spacing of major and minor ticks. Tick labels are drawn based on the setting for the major tick spacing. These items are duplicated in the 'Define world' popup described previously. Fill in the appropriate blanks and press **Accept** to refresh the display. The units are positive deltas starting with the world minimums. Input is run through the scanner so expressions are allowed. The are special symbols **dx** and **dy** for setting a prescribed number of tick marks. Dx is the distance along the X–axis and dy is the distance along the Y–axis, as defined in the current window of the world coordinate system. Typ-

ing at **Major tick spacing** "dx/10" will give 10 major tickmarks.Tick labels, tick marks, the axis bar, may be toggled by the check boxes. Properties for each of these can be set by the **Props...** popups associated with each item.

Properties for tick labels are:

Font – Which font to use when drawing the labels.

Color – Which color to use.

Line width – Width of line to use when drawing the label.

Char size – Size of characters to use.

Format – Decimal, exponential, power, general plus several time and date formats. To use the time and date formats, the data is required to be in Julian Date format, the long version. Two auxiliary programs, jul2greg and greg2jul, are available with the distribution to assist in the conversion from Julian to Gregorian date formats.

Stagger – Each tick label may be offset with respect to its neighbor, the levels of staggering ranging from 0 to 3, This is especially useful with some of the time and date formats.

Precision – Sets the number of places to display to the right of the decimal point for the labels.

Skip every – Tick labels are drawn at every major tick mark, use the skip factor to circumvent this.

Start labels at – Graph minimum, or specified. To start the labels at some other point than the graph minimum, fill in the text item to the immediate right with the value where tick labels are to begin. There is a similar item in the property sheet for tick marks that can be used to set where the major tick marks begin. between these two, there should be sufficient flexibility.

Stop labels at – Same as above only works at the other end of the axis.

Layout – Allows the tick labels to be drawn horizontally, vertically, or a specified angle (in degrees).

Draw tick labels – Which side of the graph to draw tick labels, either the normal side (the bottom of the graph in the case of the X–axis, or to the left of the graph in the case of the Y–axis), The opposite side, or both. This can be handy when using multiple axes, or overlaying graphs with differing scales.

Sign – Allows the numerical value of the label to be displayed as is, as its absolute value, or negated. This can be used to effectively reverse the sense of the axis (negate), or reflect the axis about zero (absolute value).

Apply to – Override the selected axis from the Ticks/tick label popup, causing the settings to be selected for all axes in the current graph, the current axis for all graphs, or all axes in all graphs.

Press the button **Accept** when everything is OK, or **Close** to close the popup.

Properties for tick marks are:

Tick mark direction – In, out, or both. Which direction the ticks point.

Tick marks on – Which side of the graph to draw ticks. The normal side is the bottom of the graph

in the case of the X–axis, or to the left of the graph in the case of the Y–axis, the default is to draw ticks on both sides.

Major tick length – Sets the length of major tick marks

Minor tick length – Sets the length of minor tick marks

Major grid lines – A check box that when toggled on, grid lines will be drawn at the settings for major tick marks.

Minor grid lines – A check box that when toggled on, grid lines will be drawn at the settings for minor tick marks.

Color, line width, and line style – These items set the characteristics of the lines use to draw ticks and grid lines.

Apply to – Allows the axis select in the Ticks/tick label popup to be overridden, causing the settings to be selected for all axes in the current graph, the current axis for all graphs, or all axes in all graphs.

Press the button **Accept** when everything is OK, or **Cancel** to close the popup.

Properties for the axis bar are:

Color, line width, and line style – Set the characteristics of the lines use to draw ticks and grid lines.

Press the button **Accept** when everything is OK, or **Cancel** to close the popup.

IMPORTANT NOTE FOR LOG PLOTS: When log scaling is selected for a particular axis or axes, the meaning of major and minor ticks changes slightly. Major ticks should be set to integer values. Use minor ticks to set the number of inter–decade tick marks, these should be set to integer values ranging from 0 (no inter–decade tick marks) to 5. A value of 1 will draw each inter–decade position, 2 will skip every other position, etc.

3.4.8 Frame

The frame is the box drawn around the clipping region of the graph, and the region inside. Items in the frame popup are:

Frame – Turn the frame on or off.

Style – Either 'closed' or 'open.

Color – Set the color of the line drawn around the graph.

Line width – Set the width of the line around the graph.

Line style – Set the line style of the line.

Fill graph background – Toggle the filling of the frame.

Background color – The color with which to fill the frame.

Press **Accept** to register the settings, **Close** to close the popup.

3.4.9 Symbols

The items in the symbols popup allow the selection of symbols, lines, and fill style to be used when drawing a set.

Items in the symbols popup are:
Select set – The set to which the following items will apply.

Symbol:

        Symbol – Select the symbol to use, or none for no symbol.

        Fill – Select the fill option, none, filled, or opaque. The opaque option allows the symbol to be filled with the background color (white as of this writing) overwriting the line used to connect each point.

        Size – Set the size of the symbol.

        Char – Select a character to use instead of a symbol (not active)

        Skip – Select the number of points to skip when drawing symbols

        Legend A string defining the legend to use for this set

        Apply to – Either this set or all sets

Line:

        Style – Select the line style for the lines connecting the points in the set.

        Width – Select the line width for the lines.

        Color – The color to use when drawing lines.

Fill:

        Fill – Select the type of fill, none, as polygon, to y=0.0, x=0.0, x=graph Xmin, x=graph Xmax, y=graph Ymin, y=graph Ymax.

        Fill using – Either Color or Pattern.

Color select the color to use, or none.

        Pattern – Select the pattern to use or none. There are three additional buttons in this popup that can be used to set the colors, symbols, and line widths in an incremental fashion, avoiding the need to specify a each.

NOTE: There are limits on how large a set can be for the fill to operate correctly. The limit for the display is approximately 8000 points, for the hardcopy drivers, this limit drops to around 800–1000.

Symbols descriptions:
        1. No symbol
        2. Dot
        3. Circle

4. Square
5. Diamond
6. Triangle up
7. Triangle left
8. Triangle down
9. Triangle right
10. Plus
11. X
12. Star
13. Impulse at X
14. Impulse at Y
15. Vertical line at X
16. Horizontal line at Y
17. Histogram X
18. Histogram Y
19. Stair step X
20. Stair step Y
21. Bar X
22. Bar Y
23. Range
24. Location
25. Set #
26. Set #, location
27. Bar and whisker (not active as of this writing)
28. Segments
29. Character
30. String (not active as of this writing)
31. Hi low X
32. Hi low Y
33. Open/close X
34. Open/close Y

NOTE: symbols 16–29 do not appear in the legends

3.4.10 Error bars

Error bars are created by reading in the data as a set with error bars (see Files above). Properties of error bars are set by opening the 'Error bar props' popup.

Size – Set the length of the error bar.
Line width – Set the line width of the error bar.

Line style – Set the line style of the error bar.
Riser – Toggle the display of the line connecting the error bar with the data point.
Riser line width – Set the width of the riser.
Riser line style – Set the riser line style.
Display – Toggle the display of the error bar.

3.4.11 Legends

Legend items:
Legend on/off – Toggle the display of the graph legend
Legend location type – Select the coordinate system to use when interpreting the legend x, and legend y items described below. Either the world or viewport coordinates. Legends placed in viewport coordinates make the legends stay put as the plot scale changes. Legends placed in world coordinates will float as the graph scaling is changed.
Legend gap – Specify the vertical gap between legend entries
Legend length – Specify how long the line representing the set should be.
Legend X – X value of legend location
Legend Y – Y value of legend location
Font – Specify the font for the legend labels
Frame – Toggle a box drawn around the legend. The three items below set the line color, line width, and line style of the box.
Fill frame – Toggle the fill of the box around the legend. The frame fill will obliterate anything beneath, grid lines, sets, etc. Set the type of fill either color or pattern and the corresponding color or pattern.
Legend gap and Legend length – These items refer to the gap between legend items and the length of the legend in units of characters (arbitrary).

Clicking **Place** is a convenient method of placing the legend on the canvas. After pressing this button, move the mouse pointer to the desired location and press again with the left button. The location will be in world or viewport coordinates as selected above.

Press **Load comments** to make the set comment (generally the file name from where the set originated) the legend label. This affects all active sets in the current graph.

Press the button marked **Accept** to register the legend settings.

Press the button marked **Close** to close the popup.

3.4.12 Strings & Things

The numbers of strings, lines, and boxes are fixed, open File/About to see what the limits are for your version of ACE/gr. To define a text string to be drawn on the canvas:

Select font, pen, justification, rotation (in integer degrees [0,360]), size. Press the button marked "Text" to activate the text writing routines. Move the mouse to the canvas and press the left mouse button at the desired location and type away. Press to advance to the next line – the right mouse button to stop. The text cursor does not behave properly for rotated strings. To redefine string parameters you'll need to press the right button to leave text mode – adjust the parameters and press "Text" again to inform ACE/gr of the changes and resume writing. The cycle "Position in: World | viewport coordinates" allows the string position to be defined in the world coordinate system or viewport coordinates. The difference is that in World coordinates the string position on the display will change as the plot is re–scaled. Placing the string in viewport coordinates will force the string to remain in the same place as the plot scale is changed.

NOTE: It is necessary to press to register the string.

To define a line or box to be drawn on the canvas:
The cycle "Position in: World | viewport coordinates" allows the line (box) position to be defined in the world coordinate system or viewport coordinates. The difference is that in World coordinates the line (box) position on the display will change as the plot is re–scaled. Placing the line (box) in viewport coordinates will force the line (box) to remain in the same place as the plot scale is changed.

Lines:
Set the properties of the line using View/Strings & things/Line props if needed.
Click on Line.
Click at the start of the line, and again at the end of the line to define the line.

Boxes:
Set the properties of the line using View/Strings & things/Line props if needed.
Click on Box.
Click on one corner of the box, then click again on the opposite corner to define the box

Move:
To move a line, box or string, press the button marked **Move**, this should change the cursor to the "move" cursor.
Press the left mouse button near the object to be moved.
Move the cursor to the new location and press the left mouse button.

Delete:
To delete a line, box, or string, press the button marked **Delete**, this should change the cursor to a bulls eye cursor.
Press the left mouse button near the object to be deleted.

NOTE: The right mouse button cancels all operations (true throughout ACE/gr with respect to mouse operations).

Lines and boxes drawn in world coordinates scale with the plot, to draw fixed length boxes and lines, use viewport coordinates.

3.4.13 Flip X–Y

Release the right mouse button on "Flip X–Y" to swap the positions of X and Y (all sets, tick marks, and labels will be swapped).

3.4.14 Invert X

Reverse the sense of the X–axis making increasing X toward the left. This is performed by making the graph viewport minimum greater than the maximum.

3.4.15 Invert Y

Reverse the sense of the Y–axis making increasing Y toward the left. This is performed by making the graph viewport minimum greater than the maximum.

3.5 Page

Set the dimensions of the drawing area. Presently, there is no connection between the hardcopy drivers and these settings. This means that the printer needs to be set to conform to the dimensions of the drawing area if WYSIWYG is required.

3.5.1 Free

Allow the drawing area to be resized to fit the main ACE/gr window (no scrollbars will appear).

3.5.2 Landscape

Set the drawing area dimensions to landscape, generally this will be larger than the window allocated for ACE/gr, and scroll bars will appear.

3.5.3 Portrait

Set the drawing area dimensions to portrait, generally this will be larger than the window allocated for ACE/gr, and scroll bars will appear.

3.5.4 Fixed

Set the drawing area dimensions to a specified number of pixels, if the drawing area is larger than the ACE/gr window, then scroll bars will appear.

3.5.5 Size...

Open a popup that allows the dimensions of the drawing area to be set to a specified number of pixels in both directions, this only applies when the drawing area orientation is set to **Fixed**.

3.6 View

Set the display of the status bar, tool bar, locator bar, and properties associated with the display of the pointer position in the Locator bar.

3.6.1 Status bar

Toggle the visibility of the Status bar that appears at the bottom of the display.

3.6.2 Tool bar

Toggle the visibility of the Tool bar at the left of the display.

3.6.3 Locator bar

Toggle the visibility of the Locator bar, at the top of the display.

3.6.4 Set fixed point

Select this item, then click on the drawing area to set the position of the fixed point. To set the position more precisely, use the Locator props popup described below. When the fixed point is set, and the display format is (DX, DY), (DIST), or (R, Theta) then give the location relative to the fixed point.

3.6.5 Clear fixed point

Set the fixed point to (0.0, 0.0).

3.6.6 Locator props

Set properties associated with the display of the pointer position in the locator bar.

The choice item at the top of the popup, **Locator: ON/OFF** toggles the continuous update of the pointer as it moves across the drawing area. **Locator display type** is a choice item the sets the display of the position. There are several options:
[X,Y] The default, display the position in the coordinate system of the current graph.
[DX, DY] Display the delta in X and Y of the position of the mouse relative to the fixed point, or (0, 0) if no fixed point has been selected. The position is given relative to the scaling of the current graph. DX = (CX − FX) and DY = (CY − FY).
[Distance] Display the position of the mouse as the distance from the fixed point, or (0, 0) if no

fixed point has been selected. The distance is computed as SQRT((FX – CX)^2 + (FY – CY)^2) where (FX, FY) are the coordinates of the fixed point, and (CX, CY) is the position of the pointer.

[R, Theta] Display the position of the mouse in polar coordinates (R, Theta) relative to the fixed point, or (0, 0) if no fixed point has been selected. R = SQRT((FX – CX)^2 + (FY – CY)^2) and Theta = ATAN2(DY, DX).
[VX, VY] Display the position of the mouse in viewport coordinates. This position is independent of the scaling of the current graph.
[SX, SY] Display the position of the mouse in screen coordinates. This position is independent of the scaling of the current graph.

The next two categories in the popup set the format and fixed point positions for each coordinate direction and, as they are identical, only setting the format and position of X is described here. The description for Y is identical save that ordinate is replaced by abscissa.

Format X: is a choice item selecting the format of the display of the X position of the pointer. There are several selections here:

> Decimal
> Exponential
> Power (displayed as Decimal)
> General
> DD–MM–YY
> MM–DD–YY
> MM–YY
> MM–DD
> Month–DD
> DD–Month
> Month (abrev.)
> Month
> Day of week (abrev.)
> Day of week
> Day of year
> HH:MM:SS.s
> MM–DD HH:MM:SS.s
> MM–DD–YY HH:MM:SS.s
> Degrees (lon)
> DD MM' (lon)
> DD MM' SS.s (lon)
> MM' SS.s (lon)

Degrees (lat)
DD MM' (lat)
DD MM' SS.s (lat)
MM' SS.s (lat)

The Date format requires that the axis be scaled with respect to the long form of the Julian date. The Degrees format is for latitude and longitude. Below the equator latitudes are negative. Longitude is assumed positive east of Greenwich and negative to the west.

Precision X: sets the number of places to display to the right of the decimal point.

Fixed point X: defines the position of the ordinate of the Locator fixed point.

If everything looks OK, click on **Accept** to register the selections, **Reset** to restore the startup values, and **Close** to close the popup.

4.0 Command interpreter reference and parameter file format

ACE/gr provides a command line interface and the ability to save plot parameters in a file for later retrieval. The syntax for the command line interpreter and parameter files is the same. It is instructive to read a parameter file into the command line interpreter and press the **Replay** button to verify this feature.

4.1 Reference

Case is ignored by the command line interpreter.

Description of parameters:

color – integer value from 0 to 29.
string – double quote enclosed character string.
integer – any integer >= 0
number – any floating point value >= 0.0
expr – any expression (includes negative floating point values)
onoff – ON or OFF
torf – TRUE or FALSE
setnum – Set descriptor in the form Sn where n is the number of the set.
graphno – Graph descriptor in the form Gn where n is the number of the graph.
direction – One of UP, DOWN, LEFT, RIGHT, IN, OUT.
opchoice – One of TOP, BOTTOM, LEFT, or RIGHT.
formatchoice – One of:

        DECIMAL – 0.0
        EXPONENTIAL – 0e+–0
        POWER – 1010
        GENERAL – varies between 0.0 and 0e+0
        DDMMYY – requires data in Julian date format
        MMDDYY – requires data in Julian date format
        MMYY – requires data in Julian date format
        MMDD – requires data in Julian date format
        MONTHDAY – requires data in Julian date format
        DAYMONTH – requires data in Julian date format
        MONTHS – requires data in Julian date format
        MONTHL – requires data in Julian date format
        DAYOFWEEKS – requires data in Julian date format
        DAYOFWEEKL – requires data in Julian date format
        DAYOFYEAR – requires data in Julian date format
        HMS – requires data in Degrees format

MMDDHMS – requires data in Degrees format
MMDDYYHMS – requires data in Degrees format
DEGREESLON – requires data in Degrees format
DEGREESMMLON – requires data in Degrees format
DEGREESMMSSLON – requires data in Degrees format
MMSSLON – requires data in Degrees format
DEGREESLAT – requires data in Degrees format
DEGREESMMLAT – requires data in Degrees format
DEGREESMMSSLAT – requires data in Degrees format
MMSSLAT – requires data in Degrees format

The **Julian date format** is the long form. There are 2 programs in the subdirectory aux/ that can be used to convert data from Gregorian to Julian and vice versa. The **Degrees format** is for latitude and longitude. Below the equator latitudes are negative. Longitude is assumed positive east of Greenwich and negative to the west.

4.2 EXIT

Abruptly leave ACE/gr.

4.3 Devices

In the discussion to follow, printer refers to one of:
PSMONOP – PostScript portrait.
PSMONOL – PostScript landscape
MIFP – Maker Interchange Format portrait.
MIFL – Maker Interchange Format landscape.
HPGLP – HPGL portrait.
HPGLL – HPGL landscape.
FILE – print to a file rather than to the device.
HARDCOPY – the current hardcopy device.

PRINT *printer string*
Set the *printer* command string to *string*.
Example: print psmonop ”lpr –Pps”

PRINT TO HARDCOPY
Spool hardcopy output to the printer. This command sets the output destination, but does not generate a hardcopy, see the HARDCOPY command.

PRINT TO FILE
Spool hardcopy output to a file, using the current value of the printer file string (see PRINT TO

string above). This command sets the output destination, but does not generate a hardcopy, see the HARDCOPY command.

PRINT TO FILE *string*

Spool hardcopy output to a file named *string*. This command sets the output destination, but does not generate a file, see the HARDCOPY command.

Example: print to file "hardcopy.out"

PRINT TO *printer*

Set the hardcopy device to *printer*.

HARDCOPY

Print to the current hardcopy device or file.

DEVICE *integer*

Set the screen device to *integer*. At the present time 0 (the X server) is the only value.

4.4 Display

REDRAW

Refresh the display.

AUTO REDRAW *onoff*

Toggle the automatic redrawing of the display.

BACKGROUND COLOR *color*

Set the background color of the drawing area.

CMAP *color, integer, integer, integer*

Set the RGB values of a colormap entry. The value of color ranges from 2 to 29, The three integer values following the color number are values from 0 to 255 and represent red, green, and blue resp. Colors 0 and 1 are black and white (reversed if the –rvideo command line option was selected), and cannot be changed. Xmgr presently dumps core when using this command after startup, colormap entries can be initialized only.

Example: To set colormap entry 5, use

cmap 5, 0, 0, 255

This sets color 5 to solid blue.

PAGE *direction*

Page left, right, up, down, in. out.

PAGE *integer*

Set the amount of scrolling, and integer value giving the amount of scroll in percent of the graph

scaling.

Example: PAGE 100

would set the amount to scroll left, right, up, down to 100 percent of the graph axis
scaling.

PAGE INOUT *integer*

Set the amount to increase or decrease the graph scaling when using the In/Out buttons on the
main panel. An integer value expressing the percent to expand or shrink.

LINK PAGE *onoff*

Toggle linked scrolling. Linked scrolling affects the scroll buttons on the main panel, when
linked scrolling is on, all graphs are scrolled simultaneously. Linked scrolling OFF makes scroll-
ing affect the current graph only.

4.5 Set operations

ACTIVATE *setnum number*

Activate a set in the current graph and set the length

COPY *setnum* **TO** *setnum*

Copy a set to another set

COPY *graphno.setnum* **TO** *graphno.setnum*

Copy a set from a particular graph to a set in another graph

Example   copy g0.s0 to g1.s5

MOVE *setnum* **TO** *setnum*

Move a set to another set.

Example   move s0 to s1

MOVE *graphno.setnum* **TO** *graphno.setnum*

Move a set from a particular graph to a set in another graph

Example   move g0.s0 to g1.s5

KILL *setnum*

Kill a set. Plot parameters are set to their default values.

setnum **POINT** *expr, expr*
graphno.setnum **POINT** *expr, expr*

Add a point to a set, create the set if the set is inactive. The first version adds a point to set *setnum*
in the current graph, the second adds a point to *setnum* in the graph *graphno*.

4.6 Block data

The two block data commands allow block data to be read and sets formed from the active set of block data.

READ BLOCK *string*
Read a file of block data from file *string*.

BLOCK *xytype string*
Create a set of type *xytype* using columns coded in *string*. *String* describes columns as: "c1:c2:..."
Where c1, c2, ... are the numbers of the columns to use in the construction of the set from the block data.
Examples:
Create a set with error bars using x from column 1, y from column 2 and the errors in column 5:.
            read block "block2.dat"
            block xydy "1:2:5"

Create an XY type data set from columns 7 and 2.
            block xy "7:2"

4.7 Graph operations

KILL *graphno*
Kill graph *graphno*.

KILL GRAPHS
Kill all graphs and sets, but not annotative text, lines, and boxes.

FLUSH
Kill all graphs, sets, and annotation.

4.8 Transformations

LOAD VAR *setnum, expr, expr*
Load a set sequentially

REGRESS (*setnum, number***)**
Regress a set where number is the degree of the fit in the range 1–5.

DIFFERENCE (*setnum, number***)**
DIFF (*setnum, number***)**
Difference a set using the method specified by number.
            0 – forward difference.
            1 – backward difference
            2 – centered difference

INTEGRATE (*setnum*)
INT (*setnum*)
Integrate a set using a trapezoid rule.

SPLINE(*setnum, start, stop, integer*)
ffttype(*setnum, integer*)
Compute a DFT either forward or inverse, using the DFT or FFT. ffttype is one of:
> DFT – compute the DFT using the definition.
> FFT – compute the DFT using an FFT.
> INVDFT – compute the inverse DFT.
> INVFFT – compute the inverse using the FFT.

runtype(*setnum, number*)
Compute a running average, standard deviation, median, maximum, or minimum. runtype is one of the following:
> RUNAVG – running average.
> RUNSTD – running standard deviation.
> RUNMED – running median.
> RUNMAX – running maximum.
> RUNMIN – running minimum.

HISTO(*setnum, xmin, xmax, integer*)
Compute a histogram using set setnum. Xmin and xmax are the bounds of the histogram and the integer is how many bins to create in this range.

4.9 Autoscaling

AUTOSCALE
Autoscale the current graph

AUTOSCALE *setnum*
Autoscale the current graph on a particular set

AUTOSCALE XAXES
Autoscale the X–axis and the axis at Y = 0 in the current graph.

AUTOSCALE YAXES
Autoscale the Y–axis and the axis at X = 0 in the current graph.

AUTOSCALE *torf*
Suppress autoscaling on startup. Use this command in a data file that uses imbedded parameter settings to set the axes scaling.

4.10 Graph focus

FOCUS *graphno*
Set the current graph to *graphno*.

FOCUS SET
Focus fixed on the current graph.

FOCUS *onoff*
Turn the drawing of the focus indicators on or off.

FOCUS FOLLOWS
Focus follows the pointer.

FOCUS CLICK
Set the focus by clicking on a graph.

4.11 Locator

LOCATOR *onoff*
Turn the locator on the front panel on or off.

4.12 IO

SOURCE *sourcetype*
Set the source (disk or pipe) for reading XY data sets.

READ *string*
Read an XY data set.

READ BATCH *string*
Read a batch file.

READ *xytype string*
Read a data set of a particular type.

READ *xytype sourcetype string*
Read a data set of type *xytype* from source *sourcetype*.

GETP *string*
Read a parameter file.

PUTP *string*
Write a parameter file.

4.13 Boxes

NOTE: Boxes, used or not, are numbered from 0 to the maximum number of boxes. This is also true of lines and strings.

WITH BOX
Get the next available box and make it current. A box needs to be current before any of the following commands will apply.

WITH BOX *integer*
Get the box numbered *integer* and make it the current box

BOX *onoff*
Toggle the display of the current box.

BOX *expr, expr, expr, expr*
Set the location of the box in world or viewport coordinates depending on the value of BOX LOCTYPE. The 4 values represent *xmin, ymin, xmax, ymax* respectively.

BOX LOCTYPE *worldview*
Set the location type of the next box created. World or viewport coordinates.

BOX *graphno*
If the LOCTYPE is WORLD, set the graph to use.

BOX LINESTYLE *integer*
Set the line style to use for the next box created.

BOX LINEWIDTH *integer*
Set the line width of the next box created.

BOX COLOR *integer*
Set the color to use for the box lines.

BOX FILL *filltype*
Set the type of fill to either COLOR or PATTERN.

BOX FILL COLOR *integer*
Set the color to use to fill the next box created.

BOX FILL PATTERN *integer*
Set the pattern to use for the next box created.

BOX DEF
Define the current box using the values set above.

CLEAR BOX
Remove all boxes

4.14 Lines

ACE/gr uses an array of a data type called lines internally to hold the definition of lines. The actual construction of this data type is not important, but it is important to note that lines, used or not, are numbered from 0 to the maximum number of lines.

WITH LINE
Make the next available line the current line.

WITH LINE *integer*
Make line *integer* the current line.

LINE *onoff*
Toggle the display of the current line.

LINE *expr, expr, expr, expr*
Set the location of the current line created. The four expressions represent (X1, Y1), (X2, Y2) respectively.

LINE LOCTYPE *worldview*
Set the location type of the current line created. World or viewport coordinates.

LINE *graphno*
If the line LOCTYPE is WORLD, set the graph to use for scaling.

LINE LINEWIDTH *integer*
Set the line width of the current line created.

LINE LINESTYLE *integer*
Set the line style of the current line created.

LINE COLOR *integer*
Set the color of the current line created.

LINE ARROW *integer*
Define a line with or without arrow(s) and where they are located.

> 0 – no arrow
> 1 – arrow at start of line
> 2 – arrow at end of line
> 3 – arrow at both ends.

LINE ARROW SIZE *number*

Set the size of the current line's arrowhead.

LINE DEF

Define a line using the current set of line settings.

CLEAR LINE

Remove all lines.

4.15 Strings

ACE/gr uses an array of a data type called plotstr internally to hold the definition of strings. The actual construction of this data type is not important, but it is important to note that strings, used or not, are numbered from 0 to the maximum number of strings.

WITH STRING

Get the next available string

WITH STRING *integer*

Get the particular string numbered *integer.*

STRING *onoff*

Toggle the display opf the current string.

STRING *expr, expr*

Location of the string, in world or viewport coordinates depending on the value of LOCTYPE.

STRING LOCTYPE *worldview*

Set the location type of the string, either world or viewport coordiantes. If the setting is WORLD, then the strings position is affected by changes in the axes scaling, if VIEW, then the string is fixed to that spot in viewport coordinates.

STRING *graphno*

Set the graph to uses for scaling when the LOCTYPE is WORLD.

STRING LINEWIDTH *integer*

Set the line width of the current string.

STRING COLOR *integer*

Set the color of the current string.

STRING ROT *integer*

Set the rotation of the current string from–360 to 360 in degrees

STRING FONT *integer*
Set the font of the current string.

STRING JUST *integer*
Set the justification for the current string.
>   0 is left justified
>   1 is right justified
>   2 is centered.

STRING CHAR SIZE *number*
Set the character size of the current string.

STRING DEF *string*
Define the current string using the values set above.

CLEAR STRING
Remove all strings

4.16 World

WORLD *xmin, ymin, xmax, ymax*
Set the scaling limits for the current graph.

WORLD XMIN *xmin*
WORLD XMAX *xmax*
WORLD YMIN *ymin*
WORLD YMAX *ymax*
World stack

PUSH
Push the current graph scaling limits and tick spacing onto the graph's world stack.

POP
Pop the current graph's world stack and set the new scaling limits and tick spacing from the new stack top.

CYCLE
Cycle through the current graph's world stack.

STACK *integer*
Set the current graph's scaling limits and tick spacing to the value at position *integer* of the current graph's world stack.

STACK WORLD *expr, expr, expr, expr* **TICK** *expr, expr, expr, expr*
Push specific values onto the current graph's world stack – primarily for use in parameter files generated by ACE/gr.

CLEAR STACK
Clear the current graph's world stack.

4.17 Viewport

VIEW *xmin, ymin, xmax, ymax*
Set the current graph's viewport (where on the device the graph is displayed).

VIEW XMIN *expr*
VIEW XMAX *expr*
VIEW YMIN *expr*
VIEW YMAX *expr*

4.18 Title and subtitle

TITLE *string*
Set the graph title.

TITLE FONT *integer*
Set the font for the graph title.

TITLE SIZE *number*
Set the character size for the graph title.

TITLE COLOR *integer*
Set the color for the graph title.

SUBTITLE *string*
Set the graph subtitle.

SUBTITLE FONT *integer*
Set the font for the graph subtitle.

SUBTITLE SIZE *number*
Set the character size for the graph subtitle.

SUBTITLE COLOR *integer*
Set the color for the graph subtitle.

4.19 Sets

Setnum, in the following descriptions, refer to the symbolic name of each set, i.e., the letter 's' followed by the integer number of the set. S0 would refer to set 0, s1 to set 1, etc. The following commands for setting set parameters have two prefixes, GRAPHS and SETS, that allow the setting to be made for all graphs, all sets, or a given set in all graphs. So, to set the line width for set 0 to be 3 in all graphs that have a set 0 active, the command would be:

> graphs s0 linewidth 3

Likewise, to set the line width for all sets in the current graph, give the command:

> sets linewidth 3

To set the line width for all sets in all graphs to 3, execute:

> graphs sets linewidth 3

***setnum* ON**
***setnum* IGNORE**
Toggle the active/inactive status of sets. This can be used to force ACE/gr to ignore a set(s), even though data are still attached to the set. For example, assuming S0 is an active set:

> S0 ignore

will allow ACE/gr to ignore S0 for all purposes, except any operation that kills a set. Autoscaling will ignore this set, etc – in effect, S0 is dead. To bring it back to life:

> S0 on

will reintroduce the set with its data intact. This operation may be performed in either Edit/Set operations/De–activate or in the File/Status popup.

setnum* TYPE *xytype
Set the type of set setnum to *xytype*, where xytype is one of xy, xydx, xydy, xydxdx, xydydy, xydxdy, xyz, xyr, or xyhilo

setnum* FONT *integer
Set the font to use when the set type is xyz.

setnum* PREC *integer
Set the precision when the set type is xyz.

setnum* FORMAT *formatchoice
Set the format to use when the set type is xyz.

setnum* SYMBOL *integer
Set the symbol for the set.

setnum* SYMBOL SIZE *number
Set the size of the symbol.

setnum **SYMBOL CHAR** *integer*

Set the character to use when using the symbol type character. The value is the decimal representation of the character using the ASCII collating sequence.

setnum **LINESTYLE** *integer*

Set the lines style for the set.

setnum **LINEWIDTH** *integer*

Set the line width for the set.

setnum **COLOR** *integer*

Set the color to use to draw the lines and symbol.

setnum **FILL** *integer*

Set the type of fill for the set.

setnum **FILL WITH COLOR**

Set the type of fill for the set.

setnum **FILL WITH PATTERN**

Set the type of fill for the set.

setnum **FILL COLOR** *integer*

Set the color for the fill if the fill selected is color.

setnum **FILL PATTERN** *integer*

Set the color for the fill if the fill selected is color.

setnum **SKIP** *integer*

Set the number of points to skip before placing a symbol.

setnum **ERRORBAR TYPE** *opchoice*

Set the the error bar display type. *Opchoice* is one of RIGHT, LEFT, or BOTH if the error bar type is xydx or xydxdx, or TOP, BOTTOM, or BOTH if the type is xydy or xydydy. The default in either case is BOTH, i.e. display both error bars.

setnum **ERRORBAR LENGTH** *number*

Set the length of the error bar.

setnum **ERRORBAR LINEWIDTH** *integer*

Set the line width for the error bar.

setnum **ERRORBAR LINESTYLE** *integer*

Set the linestyle for the error bar.

setnum **ERRORBAR RISER** *onoff*
Toggle the display of the error bar riser.

setnum **ERRORBAR RISER LINESTYLE** *integer*
Set the line style for the error bar riser.

setnum **ERRORBAR RISER LINEWIDTH** *integer*
Set the line width for the error bar riser.

setnum **COMMENT** *string*
Set the comment string for the set.

4.20 Legend

LEGEND *onoff*
Toggle display of the legend.

LEGEND LOCTYPE *worldview*
Position the legend in either world or viewport coordinates.

LEGEND VGAP *integer*
Set the vertical gap between legend entries in characters.

LEGEND HGAP *integer*
Specify the gap between the display of the symbol and the legend label in units of characters.

LEGEND LENGTH *integer*
Set the length of the legend in units of characters.

LEGEND *expr, expr*
Set the location of the legend.

LEGEND X1 *expr*
Set the X value of the location.

LEGEND Y1 *expr*
Set the Y value of the legend.

LEGEND FONT *integer*
Set the font to use for the legend labels.

LEGEND CHAR SIZE *number*
Set the size of the characters in the legend label.

LEGEND LINEWIDTH *integer*
Set the line width to use to draw the legend labels.

LEGEND COLOR *integer*
Set the color of the legend labels.

LEGEND BOX *onoff*
Toggle the display of the bounding box for the legend.

LEGEND BOX FILL *onoff*
Toggle the filling of the bounding box for the legend.

LEGEND BOX LINEWIDTH *integer*
Set the line width to use to draw the bound box for the legend.

LEGEND BOX LINESTYLE *integer*
Set the line style to use to draw the bound box for the legend.

LEGEND BOX COLOR *integer*
Set the color of the legend bounding box.

LEGEND BOX FILL COLOR *integer*
Set the color to use for the filled legend bounding box.

LEGEND BOX FILL PATTERN *integer*
Set the pattern to use for the filled legend bounding box.

LEGEND BOX FILL WITH *colpat*
Set the type of fill for the bounding box, either COLOR or PATTERN.

LEGEND STRING *integer string*
Set the legend label for setnum integer.

4.21 Graph frame

FRAME *onoff*
Toggle the display of the current graph's frame.

FRAME TYPE *number*
Set the type of frame for the current graph:
      0 = rectangle
      1 = Lines along the left and bottom of the graph.

FRAME LINESTYLE *number*
Set the line style of the current graph's frame.

FRAME LINEWIDTH *number*
Set the width of the line for the current graph's frame.

FRAME COLOR *number*
Set the color of the current graph's frame.

FRAME FILL *onoff*
Toggle the fill of the graph frame.

FRAME BACKGROUND COLOR *number*
Set the color to use for filling the current graph's frame.

4.22 Graph axes

The are two axes in each coordinate direction. In the case of the X coordinate direction, there is one that follows the world scaling, one at Y = 0 and another that may be used to display an alternate scale. The names used by ACE/gr to refer to these axes are, XAXIS, ZEROXAXIS, respectively. Likewise along Y there is the YAXIS, ZEROYAXIS. There are names that can be used to refer to all the axes along a coordinate direction or to both directions or to all graphs, these being AXES (both coordinate directions, current graph), XAXES (along X in the current graph), YAXES (along Y in the current graph), and preceding these with the key word GRAPHS, will cause the setting to be made throughout all the active graphs. In the following descriptions, axis refers to the choices described above.

axis onoff
Toggle the display of the axis or axes referred to by axis.

axis **COLOR** *integer*
Set the color for the axis or axes specified by axis.

axis **LINEWIDTH** *integer*
Set the line width for the axis or axes specified by axis.

axis **LINESTYLE** *integer*
Set the line style for the axis or axes specified by axis.

axis **FONT** *integer*
Set the font to use for text for the axis or axes specified by axis.

axis **CHAR SIZE** *number*
Set the character size for text for the axis or axes specified by axis.

4.23 Tick marks

axis **TICK MAJOR** *onoff*
axis **TICK MINOR** *onoff*
axis **TICK MAJOR** *expr*
Set the tick spacing for major tick marks.

axis **TICK MINOR** *expr*
Set the spacing for minor tick marks.

axis **TICK OFFSETX** *number*
Set the amount to offset the axis, in viewport coordinates in the X direction.

axis **TICK OFFSETY** *number*
Set the amount to offset the axis in viewport coordinates in the Y direction.

axis **TICK ALT** *onoff*
Toggle the use of the alternate map for the axis scaling.

axis **TICK MIN** *number*
Specify the minimum value to use for the alternate map.

axis **TICK MAX** *number*
Specify the maximum value to use for the alternate map.

axis **TICK DEFAULT** *number*
Set the default number of ticks to use when autoscaling.

axis **TICK** *inout*
Set the display of tick marks to IN, OUT, or BOTH.

axis **TICK SIZE** *number*
Set the size of tick marks.

axis **TICK MAJOR SIZE** *number*
Set the size of major tick marks.

axis **TICK MINOR SIZE** *number*
Set the size of minor tick marks.

axis **TICK COLOR** *number*
Set the color to use for tick marks.

axis **TICK MAJOR COLOR** *number*
Set the color to use for major tick marks.

axis **TICK MINOR COLOR** *number*
Set the color to use for minor tick marks.

axis **TICK MAJOR LINEWIDTH** *number*
Set the line width to use for grid lines at major tick marks.

axis **TICK MAJOR LINESTYLE** *number*
Set the line style to use for grid lines at major tick marks.

axis **TICK MINOR LINEWIDTH** *number*
Set the line width to use for grid lines at minor tick marks.

axis **TICK MINOR LINESTYLE** *number*
Set the line width to use for grid lines at minor tick marks.

axis **TICK MAJOR GRID** *onoff*
Toggle the display of grid lines at major tick marks.

axis **TICK MINOR** *GRID onoff*
Toggle the display of grid lines at minor tick marks.

axis **TICK OP** *opchoice*
Set the display of tick marks on the axis to LEFT, RIGHT, or BOTH if the axis is in the X direction, or TOP, BOTTOM, or BOTH if the axis is in the Y direction. The default is BOTH in either case.

axis **TICK TYPE AUTO**
Use the values for major and minor spacing for draw the tick marks. See the next it for tick marks at specified locations.

axis **TICK TYPE SPEC**
Use specified values for drawing tick marks. These values are for major tick marks only.

axis **TICK SPEC** *integer*
Give the number of specified tick marks.

axis **TICK** *number, expr*
Set the value of specified tick mark number integer to value, expr.

4.24 Tick labels

axis **TICKLABEL PREC** *integer*
Set the number of places to the right of the decimal point when drawing tick labels.

axis **TICKLABEL FORMAT** *format*
Set the format to use for drawing tick labels.

axis **TICKLABEL LAYOUT HORIZONTAL**
Set the angle of the axis tick labels to be horizontal.

axis **TICKLABEL LAYOUT VERTICAL**
Set the angle of the axis tick labels to be vertical.

axis **TICKLABEL SPEC**
Specify the use of the specified tick label angle.

axis **TICKLABEL ANGLE** *number*
Specify the angle to use for drawing the tick labels in degrees from 0 to 360.

axis **TICKLABEL JUST** *justify*
Specify the type of justification to use when drawing the tick label.

axis **TICKLABEL SKIP** *integer*
Set the number of major tick marks to skip before drawing a tick label.

axis **TICKLABEL STAGGER** *integer*
Set the number of characters to use to offset the tick labels.

axis **TICKLABEL OP** *opchoice*
Set the side(s) to draw tick labels, LEFT, RIGHT, or BOTH for tick labels in the Y direction and TOP, BOTTOM, or BOTH for tick labels in the X direction. The default is LEFT for the Y axis tick labels and BOTTOM for the X axis tick labels.

axis **TICKLABEL SIGN** *signchoice*
Set the function to use on the numeric value used to create the tick mark label. One of NORMAL, ABSOLUTE, or NEGATE. The default is NORMAL, i.e., no transformation is applied. ABSOLUTE indicates that the absolute value of the tick label location is used, NEGATE is the negative of the tick mark location. The latter two can be used to achieve a reversal of axis or a reflection effect of the axes. Of course, the data will need to be transformed also.

axis **TICKLABEL START** *expr*
Set the value to use to begin drawing tick labels.

axis **TICKLABEL STOP** *expr*
Set the value to stop drawing tick labels.

axis **TICKLABEL START TYPE SPEC**
Use the specified starting value for drawing tick mark labels.

axis **TICKLABEL STOP TYPE SPEC**
Use the specified stopping value for drawing tick mark labels.

axis **TICKLABEL START TYPE AUTO**
Use the graph minimum to use as the starting point for drawing tick labels, this is the default.

axis **TICKLABEL STOP TYPE AUTO**
Use the graph maximum as the stopping point for drawing tick mark labels. This is the default.

axis **TICKLABEL VGAP** *number*
axis **TICKLABEL HGAP** *number*
axis **TICKLABEL CHAR SIZE** *number*
Set the size of characters to use when drawing the tick mark labels.

axis **TICKLABEL FONT** *integer*
Set the font to use when drawing tick mark labels.

axis **TICKLABEL COLOR** *integer*
Set the color to use for drawing tick mark labels.

axis **TICKLABEL LINEWIDTH** *integer*
Set the line width to use for drawing tick mark labels.

axis **TICKLABEL TYPE AUTO**
Use the values of major tick marks for position the tick mark labels.

axis **TICKLABEL TYPE SPEC**
Specify the tick mark label to use at each major tick mark.

axis **TICKLABEL** *integer, string*
Set the value for the *integer*'th tick mark label.

4.25 Axes label strings

axis **LABEL** *string*
Set the text string to use for the axis label.

axis **LABEL LAYOUT PERP**
Set the layout of the axis label to be perpendicular to the axis.

axis **LABEL LAYOUT PARA**
Set the layout of the axis label to be parallel to the axis.

axis **LABEL CHAR SIZE** *number*
Set the character size of the text used for the axis label.

axis **LABEL FONT** *integer*
Set the font to use for the axis label.

axis **LABEL COLOR** *integer*
Set the color to use for the axis label.

axis **LABEL LINEWIDTH** *integer*
Set the line width to use for drawing the axis label.

4.26 Axes bar

axis **BAR** *onoff*
Toggle the display of the axis bar. The default is OFF.

axis **BAR COLOR** *integer*
Set the color to use for the axis bar.

axis **BAR LINEWIDTH** *integer*
Set the line width to use when drawing the axis bar.

axis **BAR LINESTYLE** *integer*
Set the line style to use for drawing the axis bar.

4.27 Graphs

WITH *graphno*
Set the current graph to graphno.

graphno onoff
Set graphno on or off.

graphno **AUTOSCALE TYPE AUTO**
Set the method of autoscaling to a type developed by Paul Heckbert. This method makes nice tick spacing, but fiddles with scales of the axes.

graphno **AUTOSCALE TYPE SPEC**
Set the method of autoscaling to use the minimum and maximum values of the data.

graphno **HIDDEN** *torf*
Toggle the display of graphno.

graphno **TYPE** *graphtype*
Set the type of graphno to graphtype, where graphtype is one of:
        XY – Linear scaling on both X and Y axes (the default).

BAR – bar chart.
STACKEDBAR – stacked bar chart.
LOGX – logarithmic X axis, linear Y axis.
LOGY – linear X axis, logarithmic Y axis.
LOGXY – Log–log graph.

graphno **FIXEDPOINT** *onoff*
Toggle the use of the graph fixed point, i.e., the point used as a reference for the locator display.

graphno **FIXEDPOINT XY** *number, number*
Set the value of the graph fixed point.

graphno **FIXEDPOINT TYPE** *number*
Set the type of display for the locator on the main panel.

graphno **FIXEDPOINT FORMAT** *format format*
Select the format to use for both X and Y in the locator display.

graphno **FIXEDPOINT PREC** *integer, integer*
Set the number of places to display to the right of the decimal point in the locator display for both X and Y.