Grasp Explained

Camel Software

AN OVERVIEW

Grasp for the AMSTRAD CPC464 is a utility which has a myriad of uses for educational, business, and general home use. With it's rapid presentation of data in graphical form it provides the ideal means of picking out trends, demonstrating principles, and enhancing the presentation of your ideas. Using inexpensive screen photographs, everyone can now utilise the techniques which have been used to great effect by advertising agencies, public speakers and professional writers.

Grasp is essentially a graphing program, but includes some powerful calculation options which widen it's scope. The aim of this manual is to provide a comprehensive step-by-step guide to all the options. If this seems long-winded at times, it is an inevitable consequence of catering for all users.

The manual begins with a reference list of the special control keys used in Grasp, and a primer which explains how to get going quickly on Grasp. We recommend that you read this fully before continuing with the later chapters.

Chapter 3 deals with simple data entry. This is followed by a chapter explaining the details of the most complex page in Grasp, the Command screen. This is essentially a reference chapter, and may be just skimmed through on first reading. However, you will need to refer back to it as you gain familiarity with the package.

The final chapter, cahpter 5, deals with further details of data entry, including the use of functions, transforms and trend lines.

1.1 SOME TERMS USED IN THIS MANUAL.

In this section, we outline some conventions used in the remainder of the manual. To distinguish responses that the user is expected to type in, we have enclosed these in dollar signs, e.g. 1.5. The dollars themselves are not typed. Where the ENTER key is needed, this is indicated by an 'E' in angle brackets, e.g. $1.5<E>$.

Throughout the manual we have used the term 'prompt' to indicate that the computer has placed a message on the screen, and is awaiting some user response.

1.3 GENERAL PRINCIPLES OF GRAPH PLOTTING.

1.3.1 Line Graphs.

A line graph requires two data values for each point plotted. For example, you may want to plot the fuel consumption of a central heating system against external air temperature. One of the values is chosen as the 'independent variable' and plotted on the X-axis of the graph. The other is plotted along the Y-axis.

Frequently you will want to join up points with a continuous line, the computer equivalent of drawing a smooth line on the graph. It is not often realised that this can be done in either of two ways, with very different-looking results. Suppose the central heating example had the following series of measurements, taken over 7 days.

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DAY	!	TEMPERATURE DEG. C	!	FUEL USED KWH.
Monday	!	8	!	40
Tuesday	!	11	!	25
Wednesday	!	10	!	30
Thursday	!	9	!	33
Friday	!	7	!	45
Saturday	!	12	!	18
Sunday	!	13	!	13

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Figure 1. Data example.

A strange spell of weather, perhaps, but it will serve to demonstrate the principles. On the graph points could be joined up on a daily basis (Mondays to Tuesdays etc.), or on a temperature basis (i.e. join the lowest temperature point to the next lowest etc.). This would be the more usual way, but there are occasions when the first method would be more appropriate.

• In Grasp, points are joined up in the order of entry, unless the SORT option is used (see Chapter 4). Thus if the data were entered day-by-day, the points would be joined up on the same basis. You must make sure that SORT is used if you want the more usual method of joining.

1.3.2 Bar Charts (Histograms).
The Bar chart only requires one set of data values, unlike the line graph. In the example of Fig. 1 the daily temperature or fuel values might be plotted in

intervals or 'slots' representing days of the week. In general, such 'slots' can represent any set of events or objects, not just numeric quantities.

1.3.3 Pie Charts.

The pie chart is an effective means of showing the relative proportions of a set of values. As in Bar charts, only one set of values is required.

MAJOR CONTROL KEYS. A REFERENCE LIST.

KEY	!	FUNCTION
Arrow Keys	!	Moving Text mode cursor,
	!	setting Size/Position,
	!	and Data Editing.
CTRL G	!	Select Graph page.
CTRL I	!	Select Input page.
CTRL P	!	Select colour Pallete page.
CTRL E	!	Select Error page.
CTRL C	!	Select Command page.
CTRL A	!	Select data entry menu.
CTRL T	!	Select Text mode.

These notes explain the basic structure of the GRASP program, and how to get graphs drawn with the minimum of fuss. If all you wish to do is plot single graphs with automatic axis scaling and labelling in the standard colours, you will never need to go beyond this primer. However, this will mean you are only using a fraction of the extensive range of options for creating multiple and/or overlayed graphs, setting colour, size and position on screen, sorting data, defining your own axis scaling, and many more.

The Structure of Grasp

There are five basic pages which can be called up in Grasp as follows:-
1. The Input page
2. The Graph page.
3. The Error page.
4. The Command page.
5. The Pallet page.

Any page can be called up from any other simply by holding down the Control key on the keyboard, and pressing the appropriate letter (I for Input, G for Graph etc.). Some pages can access sub-pages. If you are in a sub-page you will need to return to the main page before you are able to change pages, but this need not be of concern at present. However, it is worth remembering that whenever you are on a main page, there will be a flashing square on the top left of the screen, so there can be no confusion.

To use GRASP in the simplest way, you will need only to understand the first 3 pages. When first loaded, Grasp enters the Input page ready for you to type in data, so let us now look at the loading procedure.

Loading Grasp.

Before doing anything, make sure the computer is in a reset state. If you have been running other programs prior to loading Grasp, the machine may be in an unsuitable condition. It is easy to reset. Simply type:-
$CALL 0 <E>$
In all that follows, material which you must type on the keyboard will be enclosed in dollar signs $$. DO NOT TYPE THE DOLLAR SIGNS THEMSELVES. Also the sign <E> means type the ENTER key.

As an alternative means of resetting, you can of course simply turn the machine off and on again.

Next type:-

$RUN"GRASP"<E>$

then load the tape, and press the PLAY button. Finally press ENTER again to start loading. When loading is complete, the tape will stop permanently, and the loading screen will be replaced by the Input page. Rewind the tape and remove it for safety.

Plotting a Bar chart or Histogram.

Grasp contains space for four seperate data files each of up to 100 entries. These are initially named f1,f2,f3, and f4, though it is possible to rename them. There are also 9 different graph definition files labelled 1 to 9 which are used to define all the details such as size and position, colour, type of graph (pie,bar chart, line graph) and so on. Any data file can be linked to any of the graph definition files, so that there is great flexibility for plotting the same data in different ways once the definitions have been set up.

However, there are inevitably a lot of options to worry about when you are setting up graph definitions. Fortunately the first three graph def. files (1 to 3) have already been set up to give you a bar chart on graph 1, a line graph on graph 2, and a pie chart on graph 3. All you need do is supply some data.

Graph 1 (the Bar chart) is linked to data file f1. You should after loading the program be in the Input page, with file f1 (currently empty) displayed. The file name will be shown near the top right of the screen. Entering data is simple. Just type in the numbers, for example:-

$1.5<E>
2.7<E>
3.5<E>
6.4<E>
5.3<E>
5.7<E>$

As you type these in, notice what happens on the screen. An arrow just to the left of the numbers will move down the screen. This in fact is your edit cursor, and can be moved up and down the list of numbers using the arrow keys. If you have made a mistake, simply move the arrow back to the offending number, type in the correct number followed by enter, then move the arrow down to the end of the list again. The cursor can also be used to insert numbers in the middle of a list and to delete entries, but we will leave this to later.

You will be pleased to know that your Bar chart can now be plotted with just two more key presses! Hold down the Control key (marked CTRL to the right of the

Space bar) and press key G (to get the Graph page). The screen will clear, and the machine is waiting for you to tell it which graph to draw, i.e. one of the graphs 1 to 9. Since we are working with graph 1, press key 1 and the graph should be drawn and labelled. After plotting the graph, you could ask for another graph simply by hitting one of the other digit keys 1 to 9, but at the moment there is no data set up for these. The additional graphs can either be added to the picture, or the screen cleared first by using $CTRL K$. (From now on we shall use this abbreviated form for the action of holding down the Control key and pressing some other key.)

Plotting a Line graph.

The Bar chart only needs data from a single data file. A line graph plots one set of values against another, and therefore needs two data files. One is plotted along the 'X' axis (usually horizontal) with corresponding values from the other file plotted along the 'Y' axis. Consequently the two files should normally have the same number of entries.

To plot a line graph, return to the Input page by typing $CTRL I$. You will see file f1 being displayed with the numbers you typed in for the Bar chart.

Graph 2 has been set up for a line graph, and is linked to data files f2 and f3. f2 is plotted on the 'X' axis, and f3 on the 'Y' axis. To input data to file f2, simply hit the right arrow key on the keyboard. This moves you into file f2 (the left arrow, of course, will move you back again). Now type in some numbers, for example:-

$1<E>
2<E>
3<E>
4<E>
5<E>
6<E>$

This sets up the f2 file. Now bring in the f3 file by hitting the right arrow key. Then type in 6 corresponding numbers, e.g.:-

$0.5<E>
3.8<E>
1.7<E>
4.5<E>
4.3<E>
7.3<E>$

To plot the graph, hit $CTRL G$ and then press digit key 2 to plot graph 2. After the graph is plotted, you may like to plot the bar chart on top, though it will look a bit messy! However the Command page allows you full control over the size and position of graphs, so you could set these up onto different parts of the

screen. Nevertheless, we will not complicate the issue at present.

Plotting a Pie chart.

Like Bar charts, pie charts only need one data file. Graph 3 is set up as a pie, and linked to file f4. To enter data, proceed as before, returning to Input page (CTRL I) and bringing up file f4 using the right arrow key. Enter some data to file f4, e.g.:-
$1<E>
2<E>
3<E>
4<E>
5<E>$

Then call the Graph page and press key 3 to plot the Pie. Filled-in pies take some time to draw, but there is an option on the graph definitions to draw a skeleton outline only. Also, you can terminate plotting of the Pie (or any other graph) by pressing $CTRL A$ at any time.

Hardcopy on MX80 series printers.

After plotting graph(s) you can obtain a screen copy output onto any printer which conforms to the Epson MX80 double resolution pin graphics conventions. Simply hit $CTRL D$ (D for Dump), but be prepared for a few minutes wait!

Text mode.

You will probably want to add some text onto the graphs after they are drawn. This is done by hitting $CTRL T$ anytime you are in the Graph page. This takes you into the text sub-page from which the only escape is by typing $CTRL T$ again.

In text mode, you have a cursor (initially on the top left of the screen) which can be moved about using the four arrow keys. When positioned, simply type in your text. As well as appearing on the screen the text is stored in the computers memory, so that next time you enter the text page any previously typed text will be added to the picture. The text page may be cleared by hitting $CTRL K$.

Exit from text mode is by hitting $CTRL T$. Remember that you do not neccesarily have to add more text when you call the text sub-page. If you just want to add previously typed text to the picture, just hit $CTRL T$ twice.

(CTRL E) The Error page.

Most errors will be reported immediately, for example if you have tried to access

a non-existent file. However, when plotting graphs any errors are added to a list which retains the last 5 errors. Typical errors might be trying to plot an empty file, or setting up a graph with no axis defined. In all the previous examples, we have been using the auto-scaling facilities so many of the possible errors cannot occur. As long as there is some data in the files, some kind of graph is virtually assured. However, when setting up your own graph definitions, it is possible to ask for the impossible!

Any error that does occur is accompanied by a warbling error tone. To see what the error is, you can view the last 5 errors by pressing $CTRL E$.

Mathematical Functions

A unique feature of Grasp which takes it out of the class of run-of-the-mill graph plotting software is the ability to generate practically any mathematical function or transform involving trig. and log functions. This is ideal for a wide range of educational and scientific work.

The mathematical functions and operators which can be used are:-
SIN,COS,TAN
ATN (Arctan)
LOG (Natural logs), LOG10
EXP (Exponential)
    (Raise to the power, e.g. X 3.4)
SQR (Squareroot)
+,-,/,*

These can be combined in any expression of length less than about 200 characters.

Mathematical functions are on a sub-page of the Input page. First get into the Input page, then type $CTRL A$. (You will see a reminder of this displayed in the small box on the lower left of the Input page screen). This brings up a menu of 6 options, option 4 being Functions. Hit key 4 to bring up the Functions screen.

The computer calculates values of Y in the equation:-
Y = F(X)
where the function F is supplied by the user. Values for Y are calculated over a range of values of X as specified by the user. For example, you may choose to have X go from -10 to 10 using 20 intervals. Each interval would therefore be 20/20, or 1.

Two data files must be specified, one to hold X and the other to hold Y. As an example, type in the following in response to the series of prompts:-

Name of file for X ? $f2$
Name of file for Y ? $f3$
Starting value for X $-15(E)$
End value of X $15(E)$

Number of intervals over range of X $99<E>$
Enter the function $exp(-X*X/100)*sin(4*x/3)<E>$

In the function, you must use X as the variable, and no spaces should be inserted.
If the calculation is impossible, you will get an error message. Otherwise the
function will be calculated and the results loaded into the data files. In either
case the program returns to the option menu. To get back to the Input page, select
option 6. You can now plot the graph (remember graph 2 is set up for a line graph,
and we have used files f2 and f3 for that reason).

ENTERING DATA - PART 1

Before plotting a graph Grasp needs to be fed with some data. This chapter takes data entry a bit further, and shows how to use editing. You will have already used and understood the four data files available, and seen how data is entered and corrected. However, you will almost certainly at some stage want to change the names of the data files, delete file entries, and insert extra entries into the middle of a file.

Deletion and insertion are very simple. Just move the arrow cursor to the entry you wish to delete, or to the position at which you want to insert one or more entries, then press the 'D' key to delete the entry, or the 'I' key to insert an entry. The inserted entry(s) will have a value of zero, so you will then have to type in the relevant values by moving the cursor to the first inserted entry and entering the value(s).

To change a file name, you will need to call up the Data Entry menu, by pressing CTRL A. Then select the Change filename option, and follow the prompts. To get back to the Input page, select the Exit option.

The other options on the Data Entry menu will be covered in a later chapter. By now, you will have appreciated the ease with which data can be entered and corrected in Grasp.

The COMMAND screen.

The Command page has been given a special chapter, due to the large number of options that can be called up. In general each option is called up by typing the letter indicated on each option. We shall explain the function of each option seperately, and where the particular option is only meaningful for a particular graph type (Bar chart, Line graph etc.) this will be made clear.

(g) GRAPH NO.
The various options can be set up seperately for each of the 9 graphs. To call up a particular graph, hit the G key, followed by the graph number as prompted, followed by ENTER.

(x) FILE and (y) FILE.
These two select a data file for the horizontal (x) or vertical (y) axis. Obviously, for Bar charts or Pie charts, only the (y) FILE is relevant.

(d) SIZE/POS.
This allows you to set up the size and position on the screen for the graph, these becoming effective next time you draw the graph. So that you can set it up relative to other graphs, ALL of the graphs 1 to 9 which can be drawn are first drawn on the screen. Then four cursors are shown at the centre of the screen. When you exit back to the command screen, the rectangle enclosed by these cursors will be the size and position of the graph.
You can move the cursors around the screen using the arrow keys. To change the size of the rectangle enclosed, first hit key 'E' (for Expand). The arrow keys will now expand or contract the cursors in both directions. To get back to the 'move' mode, just hit the 'M' key. Continue this way until you have the right position. Then hitting the '@' key will return you to the Command page.

(f) FORMAT.
Each time you press this key, the format indicator changes from H to G to P and back to H. Try it and see. H stands for Histogram (Bar chart), G for Line Graph, and P for Pie chart.

(c) CLEAR.
This allows the screen to be cleared automatically before the graph is plotted, if desired. It is normally set at 'N' for No clear, but can be switched between 'N'

and 'Y' just by hitting the 'c' key. When at 'Y', the screen is always cleared before plotting.

(o) ORIENT.
Not a free trip to China, but a means of plotting a line graph with the axis swapped over. The small arrow shows the orientation, and should always be horizontal for pie and bar charts. For line graphs, you can make it vertical if desired. Just press key 'o' repeatedly to see the effect.

(s) SORT.
As explained in the Primer section, often you will want to join points in numeric order along the horizontal axis. Pressing the (s) key will achieve this. However, remember that if you change the (x) FILE data in any way, by editing it or selecting a different data file, you must re-do the sort otherwise the effects will be uncertain.

(m) FILL.
The fill option is set to a non-zero value to achieve certain effects for each type of graph. For line graphs, a non-zero value causes the plotted points to be joined up with a line. On Bar charts, it causes a 3-D effect to be drawn in on the bars. For pie charts, the segments become filled in with various colours and patterns.

(u) UNSORT.
The complementary option to SORT. Unsorting simply causes points to be plotted in the order they were entered in the data file. Unlike SORT which must be redone if the x-file changes, UNSORT need only be done once.

(k) SHAPE.
This simply cycles through the several different point shapes which can be used to plot points on a line graph. Just press the key several times or hold it down to see the effect.

(n) SLOTS.
This option is only relevant to Bar charts, and must be 1 or more for a successful plot. It sets the number of different plots which can be included on the same axis. For example, you may have values for gross and net profit for each of 12 months. To compare these, it would be useful to plot both values in the same monthly interval. Thus the 12 horizontal intervals for months would each be subdivided into 2 sub-intervals or 'slots'. You might plot gross profit in slot 1, and net profit in slot 2, giving side-by-side comparison. The next option selects which slot to plot into.

(n) INDENT.
This must be set to a value between 0 and (SLOTS-1) to select which slot to plot
into.

(q) START.
This option is relevant only to Bar and Pie charts. In conjunction with the XGRID
option below, it selects the first item to be plotted in the data file. Thus if
XGRID was 5 and START was 3, the bar or pie chart would plot items 3 to 7 in the
(y) FILE.

(i) INK D.
Selects the ink (0 to 3) for plotting the actual data.

(t) INK T.
Selects the ink for Text, and certain fill options.

(w) INK TA.
Selects the ink for the main axis.

(a) AXIS DETAILS.
This option takes you through several sub-options as follows:-
XLOW. The left-hand limit of the X axis for Line graphs.
XHI. The right-hand limit of X axis for Line graphs.
XORIG. The position of the origin on the X axis. Should be between XLOW and XHI.
XGRID. The number of intervals to be marked along the the X axis, and the number
of items to be plotted for Bar and Pie charts. If XGRID is zero, the axis will be
scaled automatically, and XLOW, XHI will be set by the computer. If XGRID is
negative, the grid lines will be replaced by small tik marks.
YLOW, YHI, YORIG, YGRID. Similar function to those for the X axis.

(z) XLBL.
Pressing (z) turns this option on and off. If turned on (Y), the X axis will be
labelled with numbers.

(b) YLBL.
Similar action to (z), but for the Y axis.

(1) SAVE/LOAD.
This option allows the current graphs and data files to be saved to or loaded from
cassette.

This completes Chapter 4, which is essentially a reference chapter. You will need

to refer back to it from later chapters.

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CHAPTER 5.
MORE ON DATA ENTRY.

Although we have covered the basic data enty facilities, there remain the use of straight-line (least squares) fits and transforms. The Functions option has already been covered in the primer section.

TRANSFORMS OPTION.

The Transforms option is very similar to the Functions option, except that whereas the functions option calculates $Y=F(X)$ over a range of X values selected by the user, the transforms option takes it's X values from an existing data file. You will be asked for the file name for X, and the file name to store the Y values (this can be the same as the X file, in which case the original contents will be lost). Finally, you must type in the transform function in the same way as explained for Functions.

STRAIGHT-LINE FITS.

Technically, this calculates the regression line of Y on X for the selected pair of data files, both of which must have the same number of entries. When the calculation is complete, the slope and intercept of the straight line will be displayed as numbers, and you will have the option to calculate a set of points along the line for later plotting, and store them in a data file.

EPILOGUE.

Well, we have reached the end at last. We hope you will enjoy using this package and exploring its many capabilities. One of the most significant results of the revolution in computing brought about by microchips has been the corresponding reduction in the price of high quality software, and we feel that Grasp carries on this process. Equivalent graph-plotting packages for minicomputers were (and still are) priced at well over a thousand pounds. Whether software can continue to be supplied at such low cost depends solely on the willingness of users to buy it in sufficient quantities. So please keep all your perhaps less forward-thinking friends and colleagues aware of how useful application software such as Grasp can be, and how it can be employed.