Department of the Interior
U.S. Geological Survey

345 Middlefield Road
Menlo Park, CA 94025

EQPLT and ZEQPLT: Interactive computer plotting
programs for earthquake and geophysical data.

by
Fred W. Klein

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This report is intended as a user's guide for the related plot programs EQPLT and ZEQPLT. Both are presently implemented in FORTRAN on the Data General Eclipse computer at the USGS Hawaiian Volcano Observatory. The programs produce point-symbol plots from earthquake data, and line and bar-graph plots from earthquake and general time series data. General XY plots are also possible.

The two programs are written for two different plot devices. EQPLT is written for the Tektronix 4014 graphics terminal using the PLOT10 subroutine package. ZEQPLT is written for the Zeta 3600S incremental pen plotter, using the manufacturer supplied software which is similar to Calcomp's. The structure of the two programs differs in that each takes advantage of special features of the plot device. For example, EQPLT has several cursor commands (the Zeta plotter has no cursor) and ZEQPLT has commands to define the plot size in inches (EQPLT fills the Tektronix screen with the plot). Differences in program structure also stem from differences in capabilities of the two sets of plot routines, such as availability of absolute, relative and virtual plotting in the Tektronix routines.

From the user standpoint, EQPLT and ZEQPLT are very similar. Most commands are identical in the two programs, except for special differences such as cursor and plot size commands. Both programs can function in interactive, prepro- grammed, or combined modes. The programs can communicate with each other, in that a plot can be partially set up with EQPLT, and a series of plot commands saved on disk for later execution by ZEQPLT. This manual is in two independent but similar parts, the first for EQPLT and the second for ZEQPLT. To use only one program, it is not necessary to read the other part.

Conversion of the programs to an Eclipse driving another plot device should be easy, providing the structure of plot subroutines is similar to either Tektronix or incremental pen style. Conversion to another computer or different version of FORTRAN may be more time consuming. Both programs make use of nonstandard statements such as ENCODE, DECODE, OPEN, CLOSE, ACCEPT and TYPE. ZEQPLT presently requires overlays to fit in 32K of memory, and uses an OVERLAY statement. A list of subroutines for both programs is given in the appendix. A source listing is available from the author. Though comment lines in the code are numerous, no special attempt has been made to make everything completely self explanatory or universally convertible. The program EQPLT requires the ASCII command files EQINST and HPLTLOOP to run normally, and the files ZEQINST and HPLTLOOP are required by the ZEQPLT program.

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Table 1a.

Codes for Point Symbols

0	No symbol (blank)
1	Square
2	'X'
3	Diamond
4	Octagon
5	Plus
6	Square and 'X'
7	Diamond and Plus
8	Triangle (point up)
9	Triangle (point down)
10	Star
11	Solid square
12	Square 1 screen unit on a side
13	Solid diamond
14	Solid octagon

Be sure to read this section carefully for the basic rules of syntax.

EQPLT makes several different kinds of geophysical plots on the TEKTRONIX 4014 graphics terminal. It can plot earthquakes in map, cross-section, space-time, depth-time, and magnitude-time views, plot seismic counts or moments in cumulative or bar graph form, make time series, bar graph and XY plots.

EQPLT operates in interactive, pre-programmed, or combination modes. The program stores a number of parameters and flags, such as scales, map center, etc., which are used when a plot command is given. At any time, one parameter can be changed, a new plot made, and all other parameters will be kept from before.

EQPLT recognizes about 100 commands, which are explained below in sections where logical classes of commands are grouped together. Most commands come in two flavors: 1) interactive, which begin with the letter G (for get) and prompt interactively for what they need, and 2) formatted, which have the command and all parameters on the same line and which can be executed automatically without user responses. All commands can be executed from a disk file instead of the keyboard. Plots can thus be programmed, setting some parameters directly with formatted commands, and requesting others with interactive keyboard prompts. All commands are 4 letters. If other arguments or parameters are expected on the same line as the command, the 4 letters are always followed by a blank space before·the number or letter fields begin. (For example, the GFIL command causes the computer to type "DATA INPUT FILENAME?", to which you answer with the alphabetic filename, for example MYDATA. The equivalent formatted command is FILE MYDATA).

In this manual, each type of plot is listed with its corresponding plot command and reference to sections where the relevant parameter commands are explained. The first sections deal with all types of plots, later ones with time series and XY plots, and the last ones deal with earthquake plots. The interactive and formatted commands are underlined for quick reference. When only one command is given (i.e. FULL instead of GFIL or FILE), there are never arguments and interactive and formatted commands are the same. The interactive (prompting) commands always begin with the letter G.

TYPES OF PLOTS	PLOT COMMAND	REFER TO SECTIONS
		1,2 AND:
1) Earthquake points in map view	PLOT	6,7,8
2) Earthquake points in cross-section	XSEC	6,7,9
3) Earthquake points in space-time	STPL	3,6,7,9,10
4) Earthquake points in depth-time	ZTPL	3,6,7,9,10
5) Earthquake points in magnitude-time	MTPL	3,4,6,7,10
6) Cumulative earthquake numbers	NOPL	3,4,6,11
7) Cumulative earthquake moment	MOPL	3,4,6,11
8) Bar graph of earthquake numbers	NBPL	3,4,6,11
9) Bar graph of earthquake moment	MBPL	3,4,6,11
10) General time series	TSPL	3,4
11) General bar graph time series	TBPL	3,4
12) X-Y plot	TSPL	4,5

COMMANDS FOR ALL PLOT TYPES

1) Data file control and hard copy commands.

You must always identify the file name, be it tape or disk, from which data in either earthquake or time series format is to be plotted. Use the GFIL or FILE commands to set the filename. If the file name given does not exist, a non-fatal error will be given and no data will be plotted. Format is (FILE 12A2), and filenames can be up to 24 characters long. All short records are blank-padded on input. The format of time series data plotted with the TSPL or TBPL commands is assumed to be standard slow format (read month, day, year, hour, minute, and from 1 to 15 data values in (5(I2, 1X), 2X, 15F7.0) format). This slow format can be changed with the GFOR and FORM commands described in section 4. Earthquake data is assumed to be in standard HYPOINVERSE format (see appendix). At any time a hardcopy can be made of what is on the screen by the HDCP command.

Imbedded data records with the year given special values have special meanings as follows:

year = 00 Skip this record
year = -1 Start a new plot, continuing to read subsequent data.
year = -2 Change point symbol on time series, XY, vector, or scalar plots (type=month, size=day).

2) Program flow commands

The normal sequence in a plot is to first erase the screen, draw the frame and plot the data. This is the full plot condition set by the FULL command. Alternatively, many data sets can be put on the same plot if the partial plot flag was set by the PART command. Plots made under the part condition skip plotting the frame and don't erase the screen. You want to plot the first plot under the FULL condition, then make successive additions to the screen under the PART command. To stop the program type STOP.

Files which contain a predetermined sequence of any commands can be built with the editor and executed by typing JUMP, followed by 1 space, followed by the filename containing the commands. The format is (JUMP 12A2). The last command in the file must be either STOP, REPT, or JUMP HPLTLOOP, or a jump to another file if you want to chain the files together.

The command SAVE in format (SAVE 12A2) writes out to the disk file named all of the parameters which are currently set such as filenames, limits, scales, etc. The file consists of formatted commands which can be read back into the program with a JUMP command. Thus a plot can be set up, the parameters saved by typing for example SAVE KEEPIT, more work done, and the original parameters reinstalled with the command JUMP KEEPIT.

Two levels of command files are allowed. The main file is always jumped to with a JUMP command, or is the file driving the command prompts on the screen. A "subroutine" file can be executed with a CALL command. Supply the filename, just like the JUMP command, in format (CALL 12A2). The "subroutine" file must end in a RETN command. This returns control back to the calling point in the main file, or to the keyboard if the call was typed in directly.

Other commands useful in command files are PAUS, which pauses the program until any key is pressed, REPT, which rewinds the current main or subroutine command

file, and COMD, which types a COMMAND? prompt and accepts any command in the program's vocabulary from the keyboard. Inserting a COMD command in a control file allows you to pause and decide whether to continue, execute a command, or break out of the file with either a JUMP or CALL and do something else. The normal interactive mode of the program is repeated execution of the COMD command, as read from the required file HPLTLOOP containing the COMD and REPT commands. The other required file, EQINST, usually contains commands to set defaults, and ends in a JUMP HPLTLOOP command to drive the program in interactive mode.

Another program (a save file on disk) can be executed from the plot program. A copy of the plot program and all its constants is saved on disk and restored when the new program executes a STOP statement. A program is "swapped" to with the SWAP command. Supply the filename, such as TEST.SV in (SWAP 12A2) format. If you want to return temporarily to the command line interpreter (CLI) of the RDOS operating system, swap to CLI.SV. Type POP to return to EQPLT.

COMMANDS FOR TIME SERIES & XY PLOTS

3) Time axis commands

The time axis length in days is set with the GLEN or TLEN commands, in format (TLEN F7.2). Normally the time axis runs from top to bottom on the screen. It can be made to run from left to right using the EXCH command. EXCH exchanges time and Y axes, and merely changes the current configuration to the opposite one. The EXCH command does not affect the time axis on earthquake point plots.

The beginning time of the axis can either be set explicitly, or determined by when the data starts. The year, month, day, hour, and minute of start time are set with the GBEG or TBEG commands in format (TBEG 5I2). If all 5 values are zero (the default), then the plot begins a set number of days earlier than the first data value. The delay in days of the first data value into the plot (default = 1) is set by the GDLY and DELY commands in format (DELY F7.2). This permits several data sets to be plotted in successive identical plots without resetting the beginning time for each plot. At any time, the current values of the time (X) axis and Y axis parameters can be displayed on the screen by typing SHOT.

Both time series and earthquake data can be selected for plotting on the basis of date and time. Only data within a specified interval will be plotted. Use the GDAT or DATE commands. Supply the beginning date (year, month, day, hour and minute) and ending date in (DATE 10I2) format. These dates do not affect the time axis unless the data determines the starting date of the time axis. In that case, data before the beginning date set with GDAT or DATE is skipped, and the time axis is started with the first point after the beginning date. If either year is 0, all data are plotted (the default).

When a time axis or date selection is involved in a plot, the data is assumed to be in chronological order.

4) Y axis commands

Scaling on the Y axis is determined using the GLIM or SLIM commands to set the minimum and maximum data values covered on the plot. The format is (SLIM 2F7.2).

Data values may be clipped to stay below a value set by the GCLP or CLIP commands in format (CLIP F7.2). This is to prevent curves or bar graphs in the same plot frame from overlapping. Plotted data is always clipped at the plot frame. A linear trend may be removed from time series or cumulative curve plots. The trend in user units per day is the first parameter set by the GTIM and STIM commands. The other parameters are for bar graphs, which require a time interval for the bar width. The bar graph will then sum all data values which occur during that time interval and plot a bar whose height is the sum. For example, to plot daily totals of earthquake counts which are hourly in the data file, set the time interval to 1 day. The 2nd, 3rd, and 4th parameters on the STIM command are this interval in days, hours and minutes. Format is (STIM 4F7.2). If the bar graph time interval is 0, then a single spike of correct height is plotted at the time of each data value read.

The actual plot is made by the TSPL command for time series line plots and by the TBPL command for time series bar graphs. The TSHD and TBHD commands make plots and an automatic hard copy. In the default case, the data must be in standard slow format, which contains month, day, year, hour, minute, and from 1 to 15 data values read in the format (5(I2,1X),2X,15F7.0). The parameter number to plot (1-15) is identified in one of 2 ways. It can be set or reset as the first number in the GXYP or SXYP commands, or given as an argument in the plot commands TSPL or TBPL. The format in each case is (TSPL I2, TBPL I2, SXYP I2), for example SXYP 02 or TSPL 07. The second parameter on the GXYP and SXYP commands is the parameter number to plot on the X axis on XY plots. Use zero for plotting time on the X axis. The GXYP, SXYP, TSPL and TBPL commands all set and store the plot parameter for subsequent use, so that the plain command TSPL or TBPL with no numbers merely plots the parameter previously defined. The default parameter is 1. The axes on time series plots always fill the whole screen. Data values of -999.0 should be used where there is missing data and a gap in plotting is desired. The program will not plot to or from data values of -999.0. Dummy values of -998.0 should be used to connect the previous and next valid points with a line.

The standard time series data format of (5(I2,1X),2X,15F7.0) may be changed at will with the GFOR or FORM commands. The format is (FORM 34A2), and the data format supplied must be enclosed in parentheses. The format must contain 5 integer fields (month, day, year, hour, minute) and from 1 to 15 F descriptor or real fields. Fewer than 15 fields may be specified, but the user is cautioned that errors will result if you ask to plot a field number larger than the number given in the format. For example, giving a TSPL Ø6 command when using the format (5(I2,1X),2X,4F10.0) will result in errors.

The TSPL and TBPL commands have an additional feature that allows several fields to be added and the sum plotted. Just list the fields to be summed (up to 15 values allowed) in the format (TSPL 15I2) or (TBPL 15I2). EQPLT can plot either solid or dashed lines. The line type is selected with the GDSH or DASH commands in format (DASH I4). The basic line types are: 0 = solid line (the default), 1 = dotted, 2 = dash-dot, 3 = short dash, 4 = long dash. The integer value supplied is passed directly to the DASHA subroutine, and so can take on other values to customize line types as explained in the PLOT10 manual.

5) Commands for XY plots

Making an XY plot is the same as making a time series plot, except that you must specify which parameter you want on the X axis in place of time, and what

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the X axis limits are. The commands to do this are GXYP and SXYP in format
(SXYP 2I2, 2F7.2). The first argument is the Y axis parameter (1-15) as
explained above. The second is the X axis parameter (0-15), and should be 0 if
you want a time axis (the default case). The next arguments are the minimum
and maximum values of the X axis in user units.

The default is to simply plot the time series or XY data points connected by
lines in the order in which they are read in the data file. Either point
symbols, lines, or both can be plotted by use of the GPNT and PNTS commands.
The format is (PNTS 2L1,2I2). The first 2 arguments are 1 letter logical
fields, the first for whether to connect points by lines (T or F), and the
second whether to draw a symbol at the point (T or F). Both fields cannot be
F. If you are drawing points, also specify the symbol type (1-12, see table 1)
and symbol half-size in screen units. Specifying 5 for the size draws a symbol
within a square roughly .10 inch on a side. The program will not draw point
symbols outside the frame nor will it draw lines to or from points outside the
frame.

GENERAL COMMANDS FOR EARTHQUAKE PLOTS

6) Selection commands on all plots which read an earthquake file.

Earthquakes can be selected for plotting only if all relevant parameters fall
within prescribed limits. These commands define those limits: a) MAGNITUDE:
Set the minimum and maximum magnitude of events to plot with the GMAG and SMAG
commands. The format is (SMAG 2F7.2). The default is all events. b) DEPTH:
Set the minimum and maximum depth of events to plot using the commands GDEP and
SDEP. The format is (SDEP 2F7.2). The default is all events. c) HORIZONTAL
ERROR: Set the maximum horizontal location error of events to plot using the
GERH and SERH commands. The format is (SERH F7.2) and the default is 99 (all
events). d) DEPTH ERROR: Set the maximum depth error of events to plot using
the GERZ and SERZ commands. The format is (SERZ F7.2) and the default is 99
(all events). e) EVENT CLASSES BASED ON LOCATION: If the user supplies an
integer function KLASS which determines a value of KLASS (1-20) based on
numeric or other arguments passed to it, the earthquake will be plotted only
if its KLASS matches one of a list of preset values (see appendix for arguments).
The list of classes is set by commands GCLS and CLAS, which is in format
(CLAS 20I2). The GCLS command interactively allows you to add and delete
classes from the list of values in use. If the first argument is 0, all events
are plotted.

Both time series and earthquake data can be selected for plotting on the basis
of date and time. Only data within a specified interval will be plotted. Use
the GDAT or DATE commands. Supply the beginning date (year, month, day, hour
and minute) and ending date in (DATE 10I2) format. These dates do not affect
the time axis unless the data determines the starting date of the time axis.
In that case, data before the beginning date set with GDAT or DATE is skipped,
and the time axis is started with the first point after the beginning date. If
either year is 0, all data are plotted (the default).

When a time axis or date selection is involved in a plot, the data is assumed
to be in chronological order.

7) Commands for earthquake point-symbol plots

The size of plot symbols always depends on earthquake magnitude. From 1 to 10 different sizes are allowed, and of course all magnitudes could be plotted with the same symbol size if you want to. The commands are GSIZ and SIZE, in format (SIZE I2, 2X, 10(F5.1, I2)). The first argument is the number of sizes (1-10), followed by pairs of a) lower magnitude limits for each size, and b) symbol half-sizes in screen units. Events with magnitudes smaller than the first lower magnitude will not be plotted. Symbols of size less than 0 are not plotted, and symbols of size 0 plot as a dot. The default is 7 sizes, with lower magnitude limits 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0 and sizes 1,3, 5,8,12,16, and 20.

The commands GSYM or SYMB are used to set the symbol type dependence. Format is (SYMB 2I2,10(F5.1,I2)). The symbol type can be made to depend on different parameters, depending on the first argument as follows:
1 - average of amplitude and duration magnitudes
2 - depth
3 - three principal error bars only - no symbol
4 - error bars and depth symbol
5 - time in days after the first earthquake read

The second argument is the number of symbols to use (ignored if option 3 is used), followed by the pairs of a) lower magnitude/depth/time limits for each symbol, and b) the corresponding symbol type code (see Table 1.). Events with magnitude/depth/time smaller than the first value will not be plotted. The defaults are option 2 (depth dependence) and 4 symbols with lower depth limits 0.0, 5.0, 13.0, 20.0 and symbols 5, 1, 3, and 8. The GSIZ and GSYM commands allow you to interactively set or change one or more of the symbol limits and sizes/types.

A symbol key illustrating the different symbol types and sizes in use can be added to plots with the GKEY or SKEY commands. The format is (SKEY 3I2). The first argument is a flag as follows: 0 for no symbol key, 1 for type key only, 2 for size key only, 3 for both. The second argument is the symbol size on the type key, and the third is the type on the size key. The SKEY and GKEY commands store parameters and causes the key to appear on each successive plot.

8) Commands for map plots.

The map area is completely specified by two things which must be defined before making a map plot: the map scale, a dimensionless number (default 450000.0); and latitude and longitude of map center, north and west positive (default is 19 degrees 21 minutes N, 155 degrees 10 minutes W). At any time, giving the SHOW command will display the current filename, map parameters, cutoff values, etc.

The map always fills the full screen. The map scale is set by the GSCL and SCAL commands, in format (SCAL F15.2). Be sure to supply the decimal point in the proper place with both the GSCL and SCAL commands, since scales are usually in the tens or hundreds of thousands and too large for the computer to insert a decimal point at the end of a string of numbers. The scale refers to that of the hardcopy and not the terminal screen itself. The size of the full screen frame in inches on the hardcopy can be reset using the GSCR or SCRN 2F7.2 commands. Supply the X and Y sizes of the full screen on the hardcopy in

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inches. Currently the values are XIN=8.31 inch, YIN=6.51 inch. The map center is set by either the GCTR or CNTR commands. Format is (CNTR 4F7.2). The arguments are latitude in degrees and minutes (positive north) and longitude in degrees and minutes (positive west). If a map is on the screen and the stored scale corresponds to it, a new center can be set using the graphic cursor. Use the SCTR command, adjust the wheels for a new center, and press any letter key followed by return.

The map center may be shifted a set distance from its present position without changing the scale. The commands are GSHF and SHIF, in format (SHIF 2F7.2). Give the northward and eastward shifts of the center in km.

Additional output on the map plot may be defined beforehand to appear on all subsequent map plots. This output may be seismic stations or other locations to plot as points, linear data such as geology or coastlines, and a scale in kilometers. Linear, station, and earthquake data will be plotted regardless of whether the PART or FULL flags have been set (see Section 2). This allows the user to interactively or automatically build a plot consisting of different types of data from different files, etc. The plot frame and kilometer scale are only plotted when the FULL flag is set, so that these items only appear when the first plot command is made and the program erases the previous plot.

Station plotting is enabled with the GSTA and STAS commands. The format is (STAS 3I2,12A2). The 24 space alphabetic field is the name of the file containing the station data in either HYPOINVERSE or HYPO71 station format (see appendix). If the file does not exist, no stations will be plotted, and no error given. Thus to disable plotting of stations, use a fictitious name such as "NONE". The 3 integer arguments are a) label flag (1 to label the symbol with the up to 4 letter station name, 0 for symbol only), b) the symbol type (see Table 1), c) the symbol size.

The plotting of linear data is enabled with the GLIN or LINE commands, in format (LINE 12A2). The filename may be up to 24 characters long, and is only plotted if the file exists. Lines can be disabled by giving a non-existent filename such as "LINE NONE". The coordinates of the linear data to be plotted must be in decimal degrees with 6 latitude-longitude pairs per record (respectively). If the BNRY command is given, the program reads linear data in binary files with 6 real number pairs per record. If the ASCI command is given (the startup or default condition), the program reads ASCII files in format (6(F6.4, F7.4)). One or more sequential coordinate points of (0,0) will be interpreted as a separator causing a jump without drawing a line.

The command (KBAR F7.2) sets the length in km of a kilometer scale to plot in the lower left corner of the map. Ticks appear every km, with longer ticks every 10 km. If the length is zero, no bar is plotted.

The actual map plot is made with the PLOT command. The PLHD command makes a plot and a hard copy. Whatever station, linear, or earthquake data previously set up will be plotted. If the FULL switch is set, the screen will be erased, and a frame and distance scale will be plotted.

Coordinate points can be digitized from the screen and output in two formats. The DIGI command outputs coordinate pairs in decimal degrees in the format (6(F6.4,F7.4)) (see LINE command above). Pressing any letter key followed by return digitizes a point and outputs the coordinates of the cursor position on

the current map on the screen. A line connecting successive points will be plotted on the screen. If a point is digitized with the Ø (zero) key, a pen lift or dark vector is inserted in the string of points. No vector is plotted to this point from the last, and on output a 0,0 pair is inserted before the current coordinates. Using the . (period) key terminates digitizing. Output goes to the file LINEOUT, which is appended to. Points can be digitized only after the PLOT command has put a map on the screen.

The CURS command also digitizes points, but the key pressed when digitizing is used as a one character label for that point. The output consists of the label, north latitude in degrees and minutes, and west longitude in degrees and minutes in format (A1,4X,I2,1X,F5.2,1X,I3,1X,F5.2). Note that this format is compatible with two things: 1) This is format used to plot seismic stations with the STAS command of section 8. Each point digitized can be replotted as a point symbol with a one character label. 2) Coordinate pairs with identical labels can be used to define the endpoints of a vertical cross-section. Thus a typical sequence might be to plot a map using the PLOT command, define cross-section endpoints A with the CURS command, and plot section A with the XSEC A command. A period character terminates digitizing, and all connecting lines are plotted while digitizing. Digitized points are appended to the file CURSOUT, one line per point.

9) Cross-section commands.

A cross-section is completely specified by the dimensionless scale, the latitude and longitude of the endpoints, and the vertical exaggeration. The left section endpoint falls at the left side of the screen and the plot extends to the right endpoint or right side of the screen, whichever is closer to the left side. The depth axis always fills the screen from top to bottom. At any time, the end- ⁄ points and other relevant parameters may be displayed on the screen using the SHOX command.

The section endpoints may be defined either by a one letter code referenced in a disk file (see the XSEC command below) or directly by the GEND or ENDP commands. The format is (ENDP 8F7.2). The first 4 numbers set the left endpoint, the next 4 the right. Specify the latitude in degrees and minutes, and longitude in degrees and minutes in that order.

The depth axis is defined by its upper depth limit (default is 0), which is set by the GZLM and ZLIM commands. The format is (ZLIM F7.2). The depth scaling is determined by the dimensionless scale and the vertical exaggeration. The default is equal horizontal and vertical scaling (vertical exaggeration = 1). Use the commands GVEX or VTEX in format (VTEX F7.2).

Normally all earthquakes which project onto the section plane are plotted, unless only earthquakes within a certain distance range in a zone parallel to the section plane are desired. This is done with the GWID and SWID commands using the format (SWID 2F7.2). First set the near section limit in km, then the far section limit. These limits define two planes parallel to the section, between which earthquakes will be plotted. Limits toward the viewer are negative, and limits on the far side of the section are positive. Thus the limits of -2.0 and 2.0 select earthquakes within 2 kilometers of the section, and limits of 2.0 and 99.0 plot all earthquakes behind a plane which is 2 km behind the section.

The actual cross-section is plotted with the XSEC command. If XSEC is given by itself, the program assumes the endpoints are the same as the previous plot or as defined by the GEND or ENDP commands. If a command such as XSEC A or XSEC B is given, the program retrieves the endpoints from a diskfile called CURSOUT which must be supplied in advance. The file may contain several pairs of coordinates, each identified by one letter. If XSEC A is typed, the first point labeled by A becomes the left endpoint, and the second the right. Any later points labeled by A are ignored, but the file may contain other points labeled by other letters. Once a command such as XSEC A is given, subsequent XSEC commands still use the endpoints A. The file CURSOUT may be created or added to either with the text editor or by interactively using the cursor on the Tektronix screen (using CURS command in the program EQPLT). Tick marks in km are plotted on both axes. The XSHD command functions in exactly the same way as XSEC, except that it also makes a hard copy automatically.

It is possible to plot the section in pieces taken along the section, or to slide the section parallel to itself without changing endpoints. This is done first by setting the section limits in km relative to the left endpoint and along the direction of the other endpoint. Thus for two endpoints 10 km apart, limits of 0.0 and 10.0 will plot this section, and limits of -10.0 and 0.0 will plot the section of equal length which adjoins on the left. Use the GLIM or SLIM commands (see section 4 above) to set the limits and plot by typing XSEC Ø. The zero must be included in the command each time this option is wanted.

10) Space-time, depth-time, and magnitude-time commands.

To make a space-time plot, set up a time axis as described in section 3. You can also establish section endpoints explicitly as described in section 9, or define a section when the plot command is given, also as described in section 9. The time axis is positive downwards, and the space axis runs across the screen as with a cross-section. The space-time plotting command is STPL, and the same options as described in section 9 such as STPL A, STPL B, and STPL Ø also apply.

To make a depth-time plot, set up a time axis as described in section 3 and a depth axis as described in section 9. The depth axis fills the screen as with cross-sections. Use the ZTPL command to make a depth-time plot. The command REVZ can be used to reverse the depth axis so that depth will increase to the left instead of to the right, or vice versa.

Magnitude-time plots are made with the MTPL command. Set up a time axis as described in section 3 and a Y axis as described in section 4. The commands STHD, ZTHD, and MTHD are the same as those above and in addition also make a hard copy.

11) Earthquake number and moment commands.

These commands read earthquake summary data in standard format, and make all the selections of earthquakes based on magnitude, depth, class, etc. that the earthquake pointplots make (see section 6). Before plotting, set up a time axis as described in section 3 and a Y axis as described in section 4. A plot of cumulative earthquake numbers is produced with the NOPL command. A linear trend may be removed from the curve by setting the trend with the GTIM or STIM commands (see section 4). A bar graph of daily or other time interval totals, plotted as a function of time, is produced with the NBPL command. The GTIM or

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STIM commands are used to set the time interval of a bar and over which earthquakes are summed. The NOHD and NBHD commands additionally make hardcopies.

A plot of cumulative seismic moment is produced with the MOPL command, and a bar graph of seismic moment is plotted with the MBPL command. The MOHD and MBHD commands additionally make hardcopies. Again, a linear trend and bar time interval can be set with the GTIM and STIM commands. Earthquakes of zero (no) magnitude are automatically excluded from moment plots. Seismic moment is a function of magnitude as follows:

$$Mo = 10^{**}(A+B^{*}\text{magnitude})$$

The values of A and B are set with the GREL and MREL commands. A and B are given in that order, and the format is (MREL 2F7.2). Useful values are A=-4 and B=1.4 (the defaults) which plots moments in units of $10^{**}21$ dyne-cm. A value of A=-6 will be appropriate when larger magnitude (M>4.5) events are plotted.

These are plotted moment values for B=1.4:

MAGNITUDE	Mo (A=-4)	Mo (A=-6)
1	.0025	–
2	.063	.0006
3	1.58	.016
4	40.	.4
5	1000.	10.
6	25120.	251.

Alphabetical·Command Index Giving Primary Section Where Command Is Explained

BRIEF SUMMARY OF EQPLT COMMANDS
* denotes default
G commands are prompting. Formats are indicated where arguments are required. Arguments always start in column 6.

COMMANDS FOR ALL PLOT TYPES

1) Data file control and hardcopy commands.
GFIL, FILE 12A2 - Set data input filename.
HDCP - Make a hardcopy.

2) Program flow commands.
FULL - Turn on flag to draw frame and advance pen each plot.*
PART - Skip drawing frame and return pen to origin each plot.
STOP - Stop the program.
JUMP 12A2 - Execute commands in a file.
CALL 12A2 - Execute commands in a subroutine file, and return to calling point of main file.
RETN - Return control to main file.
PAUS - Pause the program.
REPT - Rewind the current command file.
COMD - Prompt the keyboard for a command.
SWAP 12A2 - Swap to another program (use name .SV).
SAVE 12A2 - Saves current plot parameters on a disk file.

COMMANDS FOR TIME SERIES & XY PLOTS

3) Time axis commands.
GLEN, TLEN F7.2 - Length of time axis in days (30)*
EXCH - Interchange the time and data axes.
GBEG,. TBEG 512 - Set beginning year, month, day, hour, minute. If year is zero, use first datum. (0,0,0,0,0)*.
GDLY, DELY F7.2 - Set delay in days of first point into plot if beginning year is 0 (1).*
SHOT - Display current time series plot parameters.
GDAT, DATE 10I2 - Set beginning date (Y, M, D, H, MIN) and ending date of data to plot. If either year is 0, plot all data (all 0's)*.

4) Y axis commands.
GLIM, SLIM 2F7.2 - Set Y axis limits in user units (0,10)*.
GCLP, CLIP F7.2 - Set value above which to clip data for plotting (99000)*.
GTIM, STIM 4F7.2 - Set linear trend to subtract from line graphs, and interval for bar graphs in days, hours, and minutes (0,1,0,0)*.
TSPL - Make a time series or XY plot.
TSHD - Make a time series or XY plot and a handcopy.
TBPL - Make a time series bar graph.
TBHD - Make a time series bar graph and a handcopy.
(Optionally supply new parameter number like TSPL 01).
GFOR, FORM 34A2 - Reset the standard time series data input format. (5(I2,1X),2X,15F7.0)*.
GDSH, DASH I4 - Set line type: 0 = solid, 1 = dotted, 2 = dash-dot, 3 = short dash, 4 = long dash (0)*.

5) Commands for XY plots.
GXYP, SXYP 2I2,2F7.2 - Y axis parameter (1-15) (also can be used for time series plots), X axis parameter [0 for time] (0-15), min and max X axis values (1,0,0,10)*.
GPNT, PNTS 2L1,2I2 - Set points on XY or time series plots. Flags to connect points with lines (T or F), use symbols (T or F), point type and size (T,F,0,0)*.

6) Selection commands for all plots which read an earthquake file.

GMAG, SMAG 2F7.2 - Set min and max magnitude (0,9)*.

GDEP, SDEP 2F7.2 - Set min and max depth (0,99)*.

GERH, SERH F7.2 - Set max horizontal error (99)*.

GERZ, SERZ F7.2 - Set max depth error (99)*.

GCLS, CLAS 20I2 - Select classes of events to plot. (0 for all)(0)*.

GDAT, DATE 10I2 - Set beginning date (Y, M, D, H, MIN) and ending date of data to plot. If either year is 0, plot all data (all 0's)*.

7) Commands for earthquake point-symbol plots.

GSIZ, SIZE I2,2X,10(F5.1,I2) - Set number of symbol sizes and pairs of lower magnitude limits and size in screen units (7 sizes for mags 0-6 are 1,3,5,8,12,16,20)*.

GSYM, SYMB 2I2,10(F5.1,I2) - Set symbol type dependence code (1=magnitude,2=depth,3=error bars,4=depth and error bars, 5=time in days), number of symbols, and pairs of lower limits and symbol types. (code=2,4 symbols for depths 0,5,13,20 are types 5,1,3,8)*.

0 blank	5 plus	10 star
1 square	6 square & X	11 solid square
2 "X"	7 diamond & +	12 .01" square
3 diamond	8 triangle up	13 solid diamond
4 octagon	9 triangle down	14 solid octagon

GKEY, SKEY 3I2 - Symbol key flag (0=no key, 1=types, 2=sizes, 3=both), size on type key, and type on size key. (0,0,0)*.

8) Commands for map plots.

SHOW - Display current map and selection parameters.

GSCL, SCAL F15.2 - Dimensionless scale, supply decimal point (450000)*.

GCTR, CNTR 4F7.2 - Center latitude (deg,min) and longitude (deg,min) (19,21,155,10)*.

SCTR - Set center coordinates using graphic cursor.

GSHF, SHIF 2F7.2 - Shift map center. Give north and east shift in km.

GSTA, STAS 3I2,12A2 - Plot stations from a file. Also supply flag (0=symbol only, 1=label with name), symbol type and size.

GLIN, LINE 12A2 - Set file name for linear or coastal data. (LINE GEOLOGY)*.

ASCI - Plot lines from ASCII (formatted) file*.

BNRY - Plot lines from binary file.

KBAR F7.2 - Length of km distance scale (20)*.

PLOT - Plot a map.

PLHD - Plot a map and make a hardcopy.

DIGI - Digitize points and output in line format to file LINEOUT (any letter digitizes, Ø skips, . (period) stops).

CURS - Digitize points and output with one character label in station format to file CURSOUT (period stops).

GSCR, SCRN 2F7.2 - Set screen size on hardcopy in inches (8.31,6.51)*.

9) Cross-section commands.

SHOX - Display current cross-section parameters.

GEND, ENDP 8F7.2 - Specify latitude in deg. and min. (positive north) and longitude in deg. and min. (positive west) for the left section endpoint, then the right.

GZLM, ZLIM F7.2 - Specify the top section depth in km (0)*.

GVEX, VTEX F7.2 - Set vertical exaggeration (1)*.

GWID, SWID 2F7.2 - Set near and far limits relative to section plane between which earthquakes are plotted (-99,99)*.

XSEC - Plot a cross-section. XSEC A plots section A and XSEC Ø
      uses endpoints in km set with the GLIM command.
XSHD - Plot a cross-section and make a hardcopy.

10) Space-time, depth-time and magnitude-time commands.
      STPL - Make a space-time plot. STPL A and STPL Ø function as with XSEC.
      STHD - Make a space-time plot and a hardcopy.
      ZTPL - Make a depth-time plot.
      ZTHD - Make a depth-time plot and a hardcopy.
      MTPL - Make a magnitude-time plot.
      MTHD - Make a magnitude-time plot and a hardcopy.
      REVZ - Reverse the depth axis.

11) Earthquake number and moment plot commands.
      NOPL - Plot cumulative number of quakes versus time.
      NOHD - Plot cumulative number of quakes versus time and make a hardcopy.
      NBPL - Plot a number bar graph versus time.
      NBHD - Plot a number bar graph versus time and make a hardcopy.
      MOPL - Plot cumulative seismic moment.
      MOHD - Plot cumulative seismic moment and make a hardcopy.
      MBPL - Plot a seismic moment bar graph.
      MBHD - Plot a seismic moment bar graph and make a hardcopy.
      GREL, MREL 2F7.2 - Set A and B in moment = $10^{**}(A+B*magnitude)$.
          For A,B=(-4,1.4)* moment units are $10^{**}21$ dyne cm.

CONTENTS

COMMANDS FOR ALL PLOT TYPES

COMMANDS FOR TIME SERIES & X-Y PLOTS

GENERAL COMMANDS FOR EARTHQUAKE PLOTS

COMMANDS FOR SPECIFIC EARTHQUAKE PLOTS

APPENDIX TO PARTS 1 & 2

Data formats
List of subroutines
ZEQPLT overlay notes
Special FORTRAN statements used in EQPLT and ZEQPLT

Table 1b.

Codes for Point Symbols

0	No symbol (blank)
1	Square
2	'X'
3	Diamond
4	Octagon
5	Plus
6	Square and 'X'
7	Diamond and Plus
8	Triangle (point up)
9	Triangle (point down)
10	Star
11	Solid square
12	Square 0.01" on a side
13	Solid diamond
14	Solid octagon

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Be sure to read this section carefully for the basic rules of syntax.

ZEQPLT makes several different kinds of geophysical plots on the ZETA four pen
plotter. It can plot earthquakes in map, cross-section, space-time,
depth-time, and magnitude-time views, plot seismic counts or moments in
cumulative or bar graph form, make time series, bar graph, and XY plots, and
plot vectors and scalars on a map.

ZEQPLT operates in interactive, pre-programmed, or combination modes. The
program stores a number of parameters and flags, such as scales, pen color,
etc., which are used when a plot command is given. At any time, one parameter
can be changed, a new plot made, and all other parameters will be kept from
before.

ZEQPLT recognizes over 120 commands, which are explained below in sections
where logical classes of commands are grouped together. Most commands come in
two flavors: 1) interactive, which begin with the letter G (for get) and prompt
interactively for what they need, and 2) formatted, which have the command and
all parameters on the same line and which can be executed automatically without
user responses. All commands can be executed from a disk file rather than the
keyboard. Plots can thus be programmed, setting some parameters directly with
formatted commands, and requesting others with interactive keyboard prompts.
All commands are 4 letters. If other arguments or parameters are expected on
the same line.as the command, the 4 letters are always followed by a blank
space before the number or letter fields begin. (For example, the GFIL command
causes the computer to type "DATA INPUT FILENAME?", to which you answer with
the alphabetic filename, for example MYDATA. The equivalent formatted command
is FILE MYDATA.)

In this manual, each type of plot is listed with its corresponding plot command
and reference to sections where the relevant parameter commands are explained.
The first sections deal with all types of plots, later ones with time series
and XY plots, and the last ones deal with earthquake plots. The interactive
and formatted commands are underlined for quick reference. When only one
command is given (i.e. FULL instead of GFIL or FILE), there are never arguments
and interactive and formatted commands are the same. The interactive
(prompting) commands always begin with the letter G.

	TYPES OF PLOTS	PLOT COMMAND	REFER TO SECTIONS
			1,2,3 AND:
1)	Earthquake points in map view	PLOT	7,8,9
2)	Earthquake points in cross-section	XSEC	7,8,10
3)	Earthquake points in space-time	STPL	4,7,8,10,11
4)	Earthquake points in depth-time	ZTPL	4,7,8,10,11
5)	Earthquake points in magnitude-time	MTPL	4,5,7,8,11
6)	Cumulative earthquake numbers	NOPL	4,5,7,12
7)	Cumulative earthquake moment	MOPL	4,5,7,12
8)	Bar graph of earthquake numbers	NBPL	4,5,7,12
9)	Bar graph of earthquake moment	MBPL	4,5,7,12
10)	General time series	TSPL	4,5

11)	General bar graph time series	TBPL	4,5
12)	X-Y plot	TSPL	5,6
13)	Vectors on map view	VCPL	9,13
14)	Scalars or alphameric labels in map view	SCPL	9,13

COMMANDS FOR ALL PLOT TYPES

1) Data file control command

You must always identify the file name, be it tape or disk, from which data in either earthquake or time series format is to be plotted. Use the GFIL or FILE commands to set the filename. If the file name given does not exist, a non-fatal error will be given and no data will be plotted. Format is (FILE 12A2), and filenames can be up to 24 characters long. All short records are blank-padded on input. The format of time series data plotted with the TSPL or TBPL commands is assumed to be standard slow format (read month, day, year, hour, minute, and from 1 to 15 data values in (5(I2, 1X), 2X, 15F7.0) format). This slow format can be changed with the GFOR and FORM commands described in section 5. Earthquake data is assumed to be in standard HYPOINVERSE format (see appendix). Vector data plotted with the VCPL command must be in vector format, i.e. month, day, year, hour, minute, latitude and longitude in decimal degrees (positive north and west), and northward and eastward vector components in (5(I2,1X), 2X, 4F10.4) format. Scalar data plotted with the SCPL command has date, time, latitude and longitude in the same format as for vectors in vector format. There can be from 1 to 8 additional fields of alphanumeric data of 10 columns each. The format is thus (5(I2,1X),2X,2F10.4, 8(5A2))

Imbedded data records with the year given special values have special meanings as follows:
    year = 00   Skip this record
    year = -1   Start a new plot, continuing to read subsequent data.
    year = -2   Change point symbol on time series, XY, vector, or scalar plots (type=month, size=day).
    year = -3   Change pen color (pen = month)
    year = -4   Return pen to origin and pause for a pen position reset on long plots (earthquake point plots only)

2) Pen control commands

ZEQPLT assumes that the initial position of the pen is the lower left corner of the final plot, with the +X axis along the paper and +Y axis directed from right to left across the paper. The current pen position (which is the origin of the next plot) can be changed manually or with the GMOV or MOVE commands. Give the X and Y distance in inches to move the pen from its current position in the format (MOVE 2F7.2). The pen can be changed anytime to a different pen or color. The commands are GPEN and SPEN. Our 4 pens by convention are 1=black,2=red,3=blue,4=green. The format is (SPEN I2).

Lettering can be put on the plot with the GMES or MESG commands. Specify 1) the X coordinate and 2) Y coordinate of the lower left corner of the lettering. X and Y are in inches relative to current message origin. Also specify 3) the character height in inches and 4) angle of the message in degrees north of east. You can either keep the pen origin fixed and specify the actual X and Y coordinates, or move the pen to the desired position manually and use coordinates of 0,0. Format is (MESG 4F7.2, 40A2).

Initially the message origin is the same as the plot origin. The message origin can be reset such that all subsequent message output will be relative to the new origin. This allows shifts of entire blocks of messages such as axis labels and captions. The commands are GORG and ORIG, and the X and Y origin in inches relative to the plot origin is given in (ORIG 2F7.2) format.
Message output of special symbols not found on the keyboard can be achieved with the GMSM and MSYM commands. The symbol to plot is identified by its ASCII code found in figure A-2 of the Zeta FORTRAN manual. You must supply the symbol's code, X and Y coordinates (relative to the message origin), symbol height in inches and angle in degrees N of E. The format is (MSYM I4,4F7.2).

3) Program flow commands

The normal sequence in a plot is to first draw the frame, plot the data, and advance the paper to 2" plus the X plot size and make this the new origin for the next plot. This is the full plot condition set by the FULL command. Alternatively, many data sets can be put on the same plot if the partial plot flag was set by the PART command. Plots made under the part condition skip plotting the frame and don't advance to a new origin. You want to plot all curves or data but the last, including lettered messages, under the part condition, then plot the last data and finish the plot under the full condition.

The program normally pauses before each plot to give you a chance to check the plot size, pen priming, etc. You can abort the plot, redefine something, and try again if you wish. If you don't want this automatic pause, turn the pause flag off with the NPAS command. Pausing is turned on again with the SPAS command. To stop the program type STOP.

Files which contain a predetermined sequence of any commands can be built with the editor and executed by typing JUMP, followed by 1 space, followed by the filename containing the commands. The format is (JUMP 12A2). The last command in the file must be either STOP, REPT, or JUMP HPLTLOOP, or a jump to another file if you want to chain the files together.

The command SAVE in format (SAVE 12A2) writes out to the disk file named all of the parameters which are currently set such as filenames, limits, scales, etc. The file consists of formatted commands which can be read back into the program with a JUMP command. Thus a plot can be set up, the parameters saved by typing for example SAVE KEEPIT, more work done, and the original parameters reinstalled with the command JUMP KEEPIT.

Two levels of command files are allowed. The main file is always jumped to with a JUMP command, or is the file driving the command prompts on the screen. A "subroutine" file can be executed with a CALL command. Supply the filename, just like the JUMP command, in format (CALL 12A2). The "subroutine" file must end in a RETN command. This returns control back to the calling point in the main file, or to the keyboard if the call was typed in directly.

Other commands useful in command files are PAUS, which pauses the program until any key is pressed, REPT, which rewinds the current main or subroutine command file, and COMD, which types a COMMAND? prompt and accepts any command in the program's vocabulary from the keyboard. Inserting a COMD command in a control file allows you to pause and decide whether to continue, execute a command, or break out of the file with either a JUMP or CALL and do something else. The normal interactive mode of the program is repeated execution of the COMD command,

as read from the required file HPLTLOOP containing the COMD and REPT commands. The other required file, ZEQINST, usually contains commands to set defaults, and ends in a JUMP HPLTLOOP command to drive the program in interactive mode.

Another program (a save file on disk) can be executed from the plot program. A copy of the plot program and all its constants is saved on disk and restored when the new program executes a STOP statement. A program is "swapped" to with the SWAP command. Supply the filename, such as TEST.SV in (SWAP 12A2) format. If you want to return temporarily to the command line interpreter (CLI) of the RDOS operating system, swap to CLI.SV. Type POP to return to ZEQPLT.

COMMANDS FOR TIME SERIES & XY PLOTS

4) Time axis commands

The X and Y dimensions of the plot in inches must be given with the GTIN or STIN commands. Time is always on the X axis. The format is (STIN 2F7.2) and the default size is X = 9.5, Y = 7. For narrow paper, Y must be less than or equal to 10 inches, and less than or equal to 32 for wide paper.

The time axis length in days is set with the GLEN or TLEN commands, in format (TLEN F7.2). Although the time scale factor is just the ratio of lengths in inches and days, a scale factor in inches/day can be prescribed directly with the GTSC or TMSC commands. Either command must be given after the GLEN command, since the scale factor is used with the current length in days to determine a new length in inches. Format is (TMSC F7.2).

The beginning time of the axis can either be set explicitly, or determined by when the data starts. The year, month, day, hour, and minute of start time are set with the GBEG or TBEG commands in format (TBEG 5I2). If all 5 values are zero (the default), then the plot begins a set number of days earlier than the first data value. The delay in days of the first data value into the plot (default = 1) is set by the GDLY and DELY commands in format (DELY F7.2). This permits several data sets to be plotted in successive identical plots without resetting the beginning time for each plot. At any time, the current values of the time (X) axis and Y axis parameters can be displayed on the screen by typing SHOT. Annotation of ticks on the time axis is possible. See the GANO and ANOT commands under section 5.

Both time series and earthquake data can be selected for plotting on the basis of date and time. Only data within a specified interval will be plotted. Use the GDAT or DATE commands. Supply the beginning date (year, month, day, hour and minute) and ending date in (DATE 10I2) format. These dates do not affect the time axis unless the data determines the starting date of the time axis. In that case, data before the beginning date set with GDAT or DATE is skipped, and the time axis is started with the first point after the beginning date. If either year is 0, all data are plotted (the default).

When a time axis or date selection is involved in a plot, the data is assumed to be in chronological order.

5) Y axis commands

Scaling on the Y axis is determined by the axis length in inches (set by the GTIN and STIN commands) and by using the GLIM or SLIM commands to set the

minimum and maximum data values covered on the plot. The format is (SLIM 2F7.2). Although the data limits and axis length in inches determine the scale factor, the scale factor can be set directly by the GYSC or YSCL commands in format (YSCL F7.2). Either command must be given after the GLIM command, since the scale factor is used with the current data limits to determine a new axis length in inches.

Data values may be clipped to stay below a value set by the GCLP or CLIP commands in format (CLIP F7.2). This can be used to prevent curves or bar graphs in the same plot frame from overlapping. Plotted data is always clipped at the plot frame. A linear trend may be removed from time series or cumulative curve plots. The trend in user units per day is the first parameter set by the GTIM and STIM commands. The other parameters are for bar graphs, which require a time interval for the bar width. The bar graph will then sum all data values which occur during that time interval and plot a bar whose height is the sum. For example, to plot daily totals of earthquake counts which are hourly in the data file, set the time interval to 1 day. The 2nd, 3rd, and 4th parameters on the STIM command are this interval in days, hours and minutes. Format is (STIM 4F7.2). If the bar graph time interval is zero, then a single spike of correct height is plotted at the time of each data value read.

The actual plot is made by the TSPL command for time series line plots and by the TBPL command for time series bar graphs. In the default case, the data must be in standard slow format, which contains month, day, year, hour, minute, and from 1 to 15 data values read in the format (5(I2,1X),2X,15F7.0). The parameter number to plot (1-15) is identified in one of 2 ways. It can be set or reset as the first number in the GXYP or SXYP commands (see section 6), or given as an argument in the plot commands TSPL or TBPL. The format in each case is (TSPL I2, TBPL I2, SXYP I2), for example SXYP Ø2 or TSPL Ø7. The second parameter on the GXYP and SXYP commands is the parameter number to plot on the X axis on XY plots. Use zero for plotting time on the X axis. The GXYP, SXYP, TSPL and TBPL commands all set and store the plot parameter for subsequent use, so that the plain command TSPL or TBPL with no numbers merely plots the parameter previously defined. The default parameter is 1. Data values of -999.0 should be used where there is missing data and a gap in plotting is desired. The program will not plot to or from data values of -999.0. Dummy values of -998.0 should be used to connect the previous and next valid points with a line.

The standard time series data format of (5(I2,1X),2X,15F7.0) may be changed at will with the GFOR or FORM commands. The format is (FORM 34A2), and the data format supplied must be enclosed in parentheses. The format must contain 5 integer fields (month, day, year, hour, minute) and from 1 to 15 F descriptor or real fields. Fewer than 15 fields may be specified, but the user is cautioned that errors will result if you ask to plot a field number larger than the number given in the format. For example, giving a TSPL Ø6 command when using the format (5(I2,1X),2X,4F10.0) will result in errors.

The TSPL and TBPL commands have an additional feature that allows several fields to be added and the sum plotted. Just list the fields to be summed (up to 15 values allowed) in the format (TSPL 15I2) or (TBPL 15I2). ZEQPLT can plot either solid or dashed lines. The line type is selected with the GDSH or DASH commands in format (DASH I4). The basic line types are: 2 = solid line (the default), 4 = medium dash, 5 = short dash, 6 = long dash, 7 = short dash-dot, 8 = medium dash-dot, 9 = long dash-dot. See the Zeta subroutine manual for examples.

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Additional time and Y axes may be drawn anywhere in the plot as long as the final data and frame have not been drawn. The commands for drawing an extra time axis are GTAX and TAXS, and the format is (TAXS I2, F7.2). The first argument is a plot type flag which is = 1 for earthquake space-time plots, = 2 for earthquake depth-time plots, and = 3 for all other types. Also give the value in data units at which the axis is to be drawn. The time axis commands require that the plot size in inches, Y axis limits, length in days, and an explicit starting date be set. The commands for drawing an extra Y axis are GYAX and YAXS, and the format is (YAXS 6I2). The first argument is same plot flag used with the TAXS command, and the remaining 5 are year, month, day, hour, and minute. The Y axis commands also require that the plot size in inches, Y axis limits, length in days, and explicit starting date be set.

Annotation of ticks on both axes is possible. Once axis annotation has been requested, it will appear on all successive plots until explicitly cancelled. Annotation is done at the time the axes are plotted, and so always reflects the current scaling. Axis annotation of all plot types except maps is invoked with the GANO and ANOT commands. Supply the following arguments in (ANOT 4I2, F7.2) format: 1) X axis annotation code. Use -1 for the bottom axis, 1 for the top axis, and ∅ for both. 2) X axis completeness code. If this is a time axis, use ∅ for no labels, 1 for years only, 2 for years and months, and 3 for days also. 3) Y axis annotation code (-1 left, 1 right, ∅ both). 4) Y axis completeness code. ∅ produces no labels, 1 labels all 1000's ticks, 2 also labels hundreds ticks, 3 add tens, and 4 adds units. If the X axis is not a time axis, its completeness codes are defined as above for the Y axis. 5) The fifth argument is the lettering height in inches.

6) Commands for XY plots

Making an XY plot is the same as making a time series plot, except that you must specify which parameter you want on the X axis in place of time, and what the X axis limits are. The commands to do this are GXYP and SXYP in format (SXYP 2I2, 2F7.2). The first argument is the Y axis parameter (1-15) as explained above. The second is the X axis parameter (0-15), and should be 0 if you want a time axis (the default case). The next arguments are the minimum and maximum values of the X axis in user units.

The default is to simply plot the time series or XY data points connected by lines in the order in which they are read in the data file. Either point symbols, lines, or both can be plotted by use of the GPNT and PNTS commands. The format is (PNTS 2L1,2I2). The first 2 arguments are 1 letter logical fields, the first for whether to connect points by lines (T or F), and the second whether to draw a symbol at the point (T or F). Both fields cannot be F. If you are drawing points, also specify the symbol type (1-14, see table 1) and symbol half-size in .01 inch. Specifying 5 for the size draws a symbol within a square .10 inch on a side. The program will not draw point symbols outside the frame nor will it draw lines to or from points outside the frame. Annotation of the axis ticks is done with the GANO and ANOT commands. See section 5.

GENERAL COMMANDS FOR EARTHQUAKE PLOTS

7) Selection commands on all plots which read an earthquake file.

Earthquakes can be selected for plotting only if all relevant parameters fall within prescribed limits. These commands define those limits: a) MAGNITUDE:

Set the minimum and maximum magnitude of events to plot with the GMAG and SMAG commands. The format is (SMAG 2F7.2). The default is all events. b) DEPTH: Set the minimum and maximum depth of events to plot using the commands GDEP and SDEP. The format is (SDEP 2F7.2). The default is all events. c) HORIZONTAL ERROR: Set the maximum horizontal location error of events to plot using the GERH and SERH commands. The format is (SERH F7.2) and the default is 99 (all events). d) DEPTH ERROR: Set the maximum depth error of events to plot using the GERZ and SERZ commands. The format is (SERZ F7.2) and the default is 99 (all events). e) EVENT CLASSES BASED ON LOCATION: If the user supplies an integer function KLASS which determines a value of KLASS (1-20) based on numeric or other arguments passed to it, the earthquake will be plotted only if its KLASS matches one of a list of preset values (see appendix for arguments). The list of classes is set by commands GCLS and CLAS, which is in format (CLAS 20I2). The GCLS command interactively allows you to add and delete classes from the list of values in use. If the first argument is 0, all events are plotted.

Both time series and earthquake data can be selected for plotting on the basis of date and time. Only data within a specified interval will be plotted. Use the GDAT or DATE commands. Supply the beginning date (year, month, day, hour and minute) and ending date in (DATE 10I2) format. These dates do not affect the time axis unless the data determines the starting date of the time axis. In that case, data before the beginning date set with GDAT or DATE is skipped, and the time axis is started with the first point after the beginning date. If either year is 0, all data are plotted (the default).

When a time axis or date selection is involved in a plot, the data is assumed to be in chronological order.

8) Commands for earthquake point-symbol plots

The size of plot symbols always depends on earthquake magnitude. From 1 to 10 different sizes are allowed, and of course all magnitudes could be plotted with the same symbol size if you want to. The commands are GSIZ and SIZE, in format (SIZE I2, 2X, 10(F5.1, I2)). The first argument is the number of sizes (1-10), followed by pairs of a) lower magnitude limits for each size, and b) symbol half-sizes in units of .01 inch. Events with magnitudes smaller than the first lower magnitude will not be plotted. Symbols of size less than 0 are not plotted, and symbols of size 0 plot as a dot. The default is 7 sizes, with lower magnitude limits 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0 and sizes 1,3, 5,8,12,16, and 20.

The commands GSYM or SYMB are used to set the symbol type dependence. Format is (SYMB 2I2,10(F5.1,I2)). The symbol type can be made to depend on different parameters, depending on the first argument as follows:
      1 - average of amplitude and duration magnitudes
      2 - depth
      3 - three principal error bars only - no symbol
      4 - error bars and depth symbol
      5 - time in days after the first earthquake read

The second argument is the number of symbols to use (ignored if option 3 is used), followed by the pairs of a) lower magnitude/depth/time limits for each symbol, and b) the corresponding symbol type code (see Table 1.). Events with magnitude/depth/time smaller than the first value will not be plotted. The

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defaults are option 2 (depth dependence) and 4 symbols with lower depth limits 0.0, 5.0, 13.0, 20.0 and symbols 5, 1, 3, and 8. The GSIZ and GSYM commands allow you to interactively set or change one or more of the symbol limits and sizes/types.

A symbol key illustrating the different symbol types and sizes in use can be added to plots with the GKEY or SKEY commands. The format is (SKEY 3I2,2F7.2). The first argument is a flag as follows: 0 for no symbol key, 1 for type key only, 2 for size key only, 3 for both. The second argument is the symbol size on the type key, and the third is the type on the size key. The two remaining arguments are the X and Y coordinates in inches of where to place the top left corner of the key. The SKEY command stores parameters and causes the key to appear on each successive plot. The GKEY command can do the same, but alternatively can simply plot a key immediately on the current plot without affecting later plots.

9) Commands for map plots.

The map area is completely specified by three things which must be defined before making a map plot: the size of the plot in inches (default is X=9.5", Y=7"); the map scale, a dimensionless number (default 450000.0); and latitude and longitude of map center, north and west positive (default is 19 degrees 21 minutes N, 155 degrees 10 minutes W). At any time, giving the SHOW command will display the current filename, map parameters, cutoff values, etc.

The map size·in inches is set with the GMIN or SMIN commands in format (SMIN 2F7.2). The arguments are the X (longitude) and Y (latitude) size in inches. The map scale is set by the GSCL and SCAL commands, in format (SCAL F15.2). Be sure to supply the decimal point in the proper place with both the GSCL and SCAL commands, since scales are usually in the tens or hundreds of thousands and too large for the computer to insert a decimal point at the end of a string of numbers. The map center is set by either the GCTR or CNTR commands. Format is (CNTR 4F7.2). The arguments are latitude in degrees and minutes (positive north) and longitude in degrees and minutes (positive west).

The map area can also be defined by its scale and by the latitude and longitude of the map edges. First, use the GSCL or SCAL commands to set the scale. Important: the scale must be set before the map edges are given, since the latitude and longitude of the edges are immediately converted, using the current scale, to the center coordinates and a plot size in inches. The map edges are defined with the GMAP or SMAP commands. The format is (SMAP 8F7.2). The arguments are: left longitude (deg and min), right longitude (deg and min), top latitude (deg and min), and bottom latitude (deg and min). Be careful not to define a plot larger than the paper width you are using.

Two map projections are available. The default projection is conic, which has converging meridians and matches 15 minute and 7.5 minute quadrangles. This option is the default, but can be set by typing CONC. A Mercator projection is also available with non-linear latitude scaling and parallel meridians. This will match the 1:250000 AMS maps and is selected for subsequent maps by typing the MERC command.

The map center may be shifted a set distance from its present position without changing the scale or plot size. The commands are GSHF and SHIF, in format (SHIF 2F7.2). Give the northward and eastward shifts of the center in km.

Additional output on the map plot may be defined beforehand to appear on all subsequent map plots. This output may be seismic stations or other locations to plot as points, linear data such as geology or coastlines, and a scale in kilometers. Linear, station, earthquake, vector, and scalar data will be plotted regardless of whether the PART or FULL flags have been set (see Section 3). This allows the user to interactively or automatically build a plot consisting of types of data in different colors, from different files, etc. The plot frame and kilometer scale are only plotted when the FULL flag is set, so that these items only appear when the last plot command is made and the program advances to the next plot.

Station plotting is enabled with the GSTA and STAS commands. The format is (STAS 3I2,12A2). The 24 space alphabetic field is the name of the file containing the station data in either HYPOINVERSE or HYPO71 station format (see appendix). If the file does not exist, no stations will be plotted, and no error given. Thus to disable plotting of stations, use a fictitious name such as "NONE". The 3 integer arguments are a) label flag (1 to label the symbol with the up to 4 letter station name, 0 for symbol only), b) the symbol type (see Table 1), c) the symbol half size in units of .01 inch. The letter height is that set by the annotation commands ANOT, ANOM, GANO or GANM (default .1).

The plotting of linear data is enabled with the GLIN or LINE commands, in format (LINE 12A2). The filename may be up to 24 characters long, and is only plotted if the file exists. Lines can be disabled by giving a non-existent filename such as "LINE NONE". The coordinates of the linear data to be plotted must be in decimal degrees with 6 latitude-longitude pairs per record (respectively). If the BNRY command is given, the program reads linear data from binary files with 6 real number pairs per record. If the ASCI command is given (the default state), the program reads ASCII files in format (6(F6.4,F7.4)). One or more sequential coordinate points of (0,0) will be interpreted as a separator causing a jump without drawing a line.

The command (KBAR F7.2) sets the length in km of a kilometer scale to plot in the lower left corner of the map. Ticks appear every km, with longer ticks every 10 km. If the length is zero, no bar is plotted.

The actual map plot is made with the PLOT command. Whatever station, linear, or earthquake data previously set up will be plotted. If the FULL switch is set, a frame and distance scale will be plotted and the paper advanced to the next plot.

An additional latitude or longitude axis can be plotted on the current plot using the GMAX or MAXS commands. The format is (MAXS I2,2F7.2). These commands plot the axis as soon as the command is given. Supply the direction code (1 for EW axis with ticks down, 2 for NS axis with ticks right, 3 for EW axis with ticks up, and 4 for NS axis with ticks left). The other two arguments are the position in degrees and minutes at which the axis is to be drawn.

Annotation of axis ticks can be invoked with the GANM and ANOM commands. Once annotation has been requested, it will appear on all successive plots until explicitly cancelled. Annotation is done at the time the axes are plotted, and so always reflects the current scaling. Supply the following arguments in (ANOM 4I2,F7.2) format: 1) Longitude annotation code. Use −1 to label the bottom axis, 1 for the top axis, and Ø for both. 2) Longitude completeness code. Use Ø for no labels, 1 for degrees only, 2 adds tens of minutes and 3

adds minutes. 3) Latitude annotation code. Use -1 for left, 1 for right, 0 for both. 4) Latitude completeness code, defined as for longitude. 5) Lettering height in inches.

10) Cross-section commands.

A cross-section is completely specified by the dimensionless scale, the latitude and longitude of the endpoints, the top and bottom depth limits, and the vertical exaggeration. There is no way to specify the plot size in inches directly, and you must be careful not to define a plot which is too large for the paper. At any time, the endpoints and other relevant parameters may be displayed on the screen using the SHOX command.

The section endpoints may be defined either by a one letter code referenced in a disk file (see the XSEC command below) or directly by the GEND or ENDP commands. The format is (ENDP 8F7.2). The first 4 numbers set the left endpoint, the next 4 the right. Specify the latitude in degrees and minutes, and longitude in degrees and minutes in that order.

The depth axis is defined by its upper and lower depth limits (defaults are 0 and 20 km), which are set by the GZLM and ZLIM commands. The format is (ZLIM 2F7.2). The depth scaling is determined by the dimensionless scale and the vertical exaggeration. The default is equal horizontal and vertical scaling (vertical exaggeration = 1). Use the commands GVEX or VTEX in format (VTEX F7.2).

Normally all earthquakes which project onto the section plane are plotted, unless only earthquakes within a certain distance range in a zone parallel to the section plane are desired. This is done with the GWID and SWID commands using the format (SWID 2F7.2). First set the near section limit in km, then the far section limit. These limits define two planes parallel to the section, between which earthquakes will be plotted. Limits toward the viewer are negative, and limits on the far side of the section are positive. Thus the limits of -2.0 and 2.0 select earthquakes within 2 kilometers of the section, and limits of 2.0 and 99.0 plot all earthquakes behind a plane which is 2 km behind the section.

The actual cross-section is plotted with the XSEC command. If XSEC is given by itself, the program assumes the endpoints are the same as the previous plot or as defined by the GEND or ENDP commands. If a command such as XSEC A or XSEC B is given, the program retrieves the endpoints from a diskfile called CURSOUT which must be supplied in advance. The file may contain several pairs of coordinates, each identified by one letter. If XSEC A is typed, the first point labeled by A becomes the left endpoint, and the second the right. Any later points labeled by A are ignored, but the file may contain other points labeled by other letters. Once a command such as XSEC A is given, subsequent XSEC commands still use the endpoints A. The file CURSOUT may be created or added to either with the text editor or by interactively using the cursor on the Tektronix screen (using CURS command in the program EQPLT). Tick marks in km are plotted on both axes. Annotation of the axis ticks is done with the GANO and ANOT commands of section 5.

It is possible to plot the section in pieces taken along the section, or to slide the section parallel to itself without changing endpoints. This is done first by setting the section limits in km relative to the left endpoint and

along the direction of the other endpoint. Thus for two endpoints 10 km apart, limits of 0.0 and 10.0 will plot this section, and limits of -10.0 and 0.0 will plot the section of equal length which adjoins on the left. Use the GLIM or SLIM commands (see section 5 above) to set the limits and plot by typing XSEC 0. The zero must be included in the command each time this option is wanted.

11) Space-time, depth-time, and magnitude-time commands.

To make a space-time plot, set up a time axis as described in section 4. You can also establish section endpoints explicitly as described in section 10, or define a section when the plot command is given, also as described in section 10. The time axis runs in the X direction (along the paper), and its length in inches is set by the GTIN or STIN commands. The space axis runs in the Y direction (across the paper), and its length is determined by section endpoints and scale as before. The space-time plotting command is STPL, and the same options as described in section 10 such as STPL A, STPL B, and STPL 0 also apply.

To make a depth-time plot, set up a time axis as described in section 4 and a depth axis as described in section 10. The length of the time axis in inches is set explicitly, but the length of the depth axis is determined by the upper and lower depth limits, the scale, and the vertical exaggeration. Use the ZTPL command to make a depth-time plot.

Magnitude-time plots are made with the MTPL command. Set up a time axis as described in section 4 and a Y axis as described in section 5. Annotation of the axis ticks for all 3 plot types is done with the GANO and ANOT commands. See section 5.

12) Earthquake number and moment commands.

These commands read earthquake summary data in standard format, and make all the selections of earthquakes based on magnitude, depth, class, etc. that the earthquake pointplots make (see section 7). Before plotting, set up a time axis as described in section 4 and a Y axis as described in section 5. A plot of cumulative earthquake numbers is produced with the NOPL command. A linear trend may be removed from the curve by setting the trend with the GTIM or STIM commands (see section 5). A bar graph of daily or other time interval totals, plotted as a function of time, is produced with the NBPL command. The GTIM or STIM commands are used to set the time interval of a bar and over which earthquakes are summed.
A plot of cumulative seismic moment is produced with the MOPL command, and a bar graph of seismic moment is plotted with the MBPL command. Again, a linear trend and bar time interval can be set with the GTIM and STIM commands. Earthquakes of zero (no) magnitude are automatically excluded from moment plots. Seismic moment is a function of magnitude as follows:

$$Mo = 10**(A+B*magnitude)$$

The values of A and B are set with the GREL and MREL commands. A and B are given in that order, and the format is (MREL 2F7.2). Useful values are A=-4 and B=1.4 (the defaults) which plots moments in units of 10**21 dyne-cm. A value of A=-6 will be appropriate when larger magnitude (M>4.5) events are plotted. Annotation of the axis ticks is done with the GANO and ANOT commands. See section 5.

These are plotted moment values for B=1.4:

MAGNITUDE	Mo (A=-4)	Mo (A=-6)
1	.0025	-
2	.063	.0006
3	1.58	.016
4	40.	.4
5	1000.	10.
6	25120.	251.

13) COMMANDS TO PLOT VECTORS AND SCALARS IN MAP VIEW

Tilt or other vectors and scalars or other labels may be plotted on a map if
the data is supplied in a special plotting format. The date and time fields
are the same as standard slow format, but there are up to 10 additional 10
column fields. For both vectors and scalars, the first two fields are the
station latitude and longitude (respectively) in decimal degrees. Positive is
north and west. When plotting vectors, the first and second fields after the
latitude and longitude fields are the north and east components (respectively)
of the vector in user's units such as microradians. Any later 10 column fields
are ignored. When plotting scalars or labels, the first to the eighth fields
after the latitude and longitude fields may contain any alphanumeric
information, including a scalar, used to label the point plotted. Thus the
vector format is (5(I2,1X),2X,4F10.4) and the scalar format is
(5(I2,1X),2X,2F10.4,8(5A2)).

For both vector and scalar maps, the map size, scale, and center coordinates
must be defined as described in section 9. All other outputs such as lines and
stations are available, and in fact the only difference is that vectors or
scalars are plotted instead of earthquakes.

A point symbol can be plotted at the geographic point. The vector or scalar
label will then emanate from the center of the symbol. Use the GPNT or PNTS
commands, as described in section 6, to define the symbol type (see table 1)
and size. Even though line and point flags must be supplied to these commands,
the flags are ignored when plotting vector or scalar points. Vector and scalar
plots also honor the special year flags in the data file to change color,
symbol, etc., as described in section 1. The default is for no points (size =
type = 0).

To plot vectors, a vector scale must be defined using the GVSC or VECT
commands. Format is (VECT F7.2). The scale factor is in units of inches per
user unit, and the default is 0.1. The plot itself is made with the VCPL
command.

Before making scalar or alphameric label plots, you must identify the field
from which to get the label (1-8), the angle at which to draw the label (in
degrees north of east), and the character height in inches. The commands are
GANG and SANG, and the format is (SANG I2,2F7.2). Scalar or label plots are
made with the SCPL command. Note that the same data file may contain both
vector, scalar, and label information. If labeling a point with fields 1 or 2,
however, only the numerical vector components will be used as labels. Map axis
annotation can be invoked as described in section 9.

Alphabetical Command Index Giving Primary Section
Where Command Is Explained

BRIEF SUMMARY OF ZEQPLT COMMANDS
* denotes default
G commands are prompting. Formats are indicated where arguments are required. Arguments always start in column 6.

COMMANDS FOR ALL PLOT TYPES

1) Data file control commands.

GFIL, FILE 12A2 - Set data input filename.

2) Pen control commands.

GMOV, MOVE 2F7.2 - X & Y inches to move pen.

GPEN, SPEN I2 - Set new pen number (1-4) (1)*.

GMES, MESG 4F7.2,40A2 - Set X & Y inches of start of message, character height, angle, and message.

GMSM, MSYM I4, 4F7.2 - Set ASCII symbol code, X & Y in inches, height and angle.

GORG, ORIG 2F7.2 - Set X and Y origin for message and symbol output (0,0)*.

3) Program flow commands.

FULL - Turn on flag to draw frame and advance pen each plot*.

PART - Skip drawing frame and return pen to origin each plot.

NPAS - Don't pause before each plot.

SPAS - Pause before each plot*.

STOP - Stop the program.

JUMP 12A2 - Execute commands in file.

CALL 12A2 - Execute commands in a subroutine file, and return to calling point of main file.

RETN - Return control to main file.

PAUS - Pause the program.

REPT - Rewind the current command file.

COMD - Prompt the keyboard for a command.

SWAP 12A2 - Swap to another program (use name .SV).

SAVE 12A2 - Saves current plot parameters on a disk file.

COMMANDS FOR TIME SERIES & XY PLOTS

4) Time axis commands.

GTIN, STIN 2F7.2 - Set X and Y plot size in inches (9.5,7)*

GLEN, TLEN F7.2 - Length of time axis in days (30)*

GTSC, TMSC F7.2 - Set time scale factor in inches per day using current length in days.

GBEG, TBEG 5I2 - Set beginning year, month, day, hour, minute. If zero, use first datum. (0,0,0,0,0)*.

GDLY, DELY F7.2 - Set delay in days of first point into plot if beginning year is set to 0 (1).*

SHOT - Display current time series plot parameters.

GDAT, DATE 10I2 - Set beginning date (Y, M, D, H, MIN) and ending date of data to plot. If either year is 0, plot all data (all 0's)*.

5) Y axis commands.

GLIM, SLIM 2F7.2 - Set Y axis limits in user units (0,10)*.

GYSC, YSCL F7.2 - Set Y axis scale factor in inches per unit, assuming current limits.

GCLP, CLIP F7.2 - Set value above which to clip data for plotting (99000)*.

GTIM, STIM 4F7.2 - Set linear trend to subtract from line graphs, and interval for bar graphs in days, hours, and minutes (0,1,0,0)*.

TSPL - Make a time series or XY plot.

TBPL - Make a time series bar graph.
(Optionally supply new parameter number TSPL 01 or TBPL 06).

GTAX, TAXS, I2,F7.2 - Draw extra time axis. Flag = 1 for space-time, 2 for depth-time, 3 for others. Supply data value at which to draw axis.

GYAX, YAXS 6I2 - Draw an extra Y axis. Supply same flag, and year day, hour and minute at which to draw axis.

GANO, ANOT 4I2,F7.2 - Set up axis annotation for non map plots. For the X axis give code (-1 bottom, 1 top, Ø both) and completeness (Ø none, 1 years, 2 months, 3 days). Also code for Y axis and completeness (Ø none, 1 1000's, 2 hundreds, 3 tens, 4 units) and character height.

GFOR, FORM 34A2 - Reset the standard time series data input format. (5(I2,1X),2X,15F7.0)*.

GDSH, DASH I4 - Set line type: 2 = solid. Dashes: 4 = medium, 5 = short, 6 = long. Dash-dot: 7 = short, 8 = medium, 9 = long.

6) Commands for XY plots.

GXYP, SXYP 2I2,2F7.2 - Y axis parameter (1-15) (also can be used for time series plots), X axis parameter, 0 for time (0-15), min and max X axis values (1,0,0,10)*.

GPNT, PNTS 2L1,2I2 - Set points on XY or time series plots. Flags to connect with lines (T or F), use symbols (T or F), point type and size (T,F,0,0)*.

GENERAL COMMANDS FOR EARTHQUAKE PLOTS

7) Selection commands for all plots which read an earthquake file.

GMAG, SMAG 2F7.2 - Set min and max magnitude (0,9)*.

GDEP, SDEP 2F7.2 - Set min and max depth (0,99)*.

GERH, SERH F7.2 - Set max horizontal error (99)*.

GERZ, SERZ F7.2 - Set max depth error (99)*.

GCLS, CLAS 20I2 - Select classes of events to plot. (0 for all)(0)*.

GDAT, DATE 10I2 - Set beginning date (Y, M, D, H, MIN) and ending date of data to plot. If either year is 0, plot all data (all 0's)*.

8) Commands for earthquake point-symbol plots.

GSIZ, SIZE I2,2X,10(F5.1,I2) - Set number of symbol sizes and pairs of lower magnitude limits and size in .01" (7 sizes for mags 0-6 are 1,3,5,8,12,16,20)*.

GSYM, SYMB 2I2,10(F5.1,I2) - Set symbol type dependence code (1=magnitude,2=depth,3=error bars,4=depth and error bars, 5=time in days), number of symbols, and pairs of lower limits and symbol types. (code=2,4 symbols for depths 0,5,13,20 are types 5,1,3,8).

0 blank	5 plus	10 star
1 square	6 square & X	11 solid square
2 "X"	7 diamond & +	12 .01" square
3 diamond	8 triangle up	13 solid diamond
4 octagon	9 triangle down	14 solid octagon

GKEY, SKEY 3I2,2F7.2 - Symbol key flag (0=no key, 1=types, 2=sizes, 3=both), size on type key, type on size key, upper left X & Y (0,0,0,0,0)*. GKEY will plot now or on each plot.

9) Commands for map plots.

SHOW - Display current map and selection parameters.

GMIN, SMIN 2F7.2 - X and Y map size in inches (9.5,7)*.

GSCL, SCAL F15.2 - Dimensionless scale, supply decimal point (450000)*.

GCTR, CNTR 4F7.2 - Center latitude (deg,min) and longitude (deg,min) (19,21,155,10)*.

GMAP, SMAP 8F7.2 - Set map limits assuming current scales. Supply left lon.(deg,min), right lon., top lat., bottom lat.

CONC — Use a conic (quadrangle) projection.*

MERC — Use a Mercator (AMS) projection.

GSHF, SHIF 2F7.2 — Shift map center. Give north and east shift in km.

GSTA, STAS 3I2,12A2 — Plot stations from a file. Also supply flag
(0=symbol only, 1=label with name), symbol type and size.

GLIN, LINE 12A2 — Set file name for linear or coastal data.
(LINE GEOLOGY)*.

ASCI — Plot lines from ASCII (formatted) file.*

BNRY — Plot lines from binary file.

KBAR F7.2 — Length of km distance scale (20).*

PLOT — Plot a map.

GMAX, MAXS I2,2F7.2 — Draw an extra map axis. Direction code (1=E
(ticks down), 2=N, 3=W, 4=S) and position in degrees, mins.

GANM, ANOM 4I2,F7.2 — Set up axis annotation for map plots. For the
longitude axis give code (-1 bottom, 1 top, 0 both) and complete-
ness (0 none, 1 degrees, 2 tens of minutes, 3 minutes). For the
latitude axis give code (-1 left, 1 right, 0 both), completeness
and character height. (0,0,0,0,0.)*

10) Cross-section commands.

SHOX — Display current cross-section parameters.

GEND, ENDP 8F7.2 — Specify latitude in deg. and min. (positive north)
and longitude in deg. and min. (positive west) for first the left
section endpoint, then the right.

GZLM, ZLIM 2F7.2 — Specify the top and bottom section depths in
km (0,20)*.

GVEX, VTEX F7.2 — Set vertical exaggeration (1)*.

GWID, SWID 2F7.2 — Set near and far limits relative to section plane
between which earthquakes are plotted (-99,99)*.

XSEC — Plot a cross-section. XSEC A plots section A and XSEC 0
uses endpoints in km set with the GLIM command.

11) Space-time, depth-time and magnitude-time commands.

STPL — Make a space-time plot. STPL A and STPL 0 function as with XSEC.

ZTPL — Make a depth-time plot.

MTPL — Make a magnitude-time plot.

12) Earthquake number and moment plot commands.

NOPL — Plot cumulative number of quakes versus time.

NBPL — Plot a number bar graph versus time.

MOPL — Plot cumulative seismic moment.

MBPL — Plot a seismic moment bar graph.

GREL, MREL 2F7.2 — Set A and B in moment = 10**(A+B*magnitude).
For A,B=(-4,1.4)* moment units are 10**21 dyne cm.

13) Commands to plot vectors and scalars in map view.

GVSC, VECT F7.2 — Set vector scale in inches per unit (0.1)*.

VCPL — Plot a map with vectors.

GANG, SANG I2,2F7.2 — On scalar or label plots, set field from which
to get label (1-8), angle of label in deg N of E, and character
height in inches (1,0,0.1)*.

SCPL — Plot a map with scalars or labels.

HYPOINVERSE earthquake summary format (78 spaces)

Item	Format for reading
Year, month, day, hour and minute	5I2, 4X,
Latitude: degrees, S (for south) or blank, minutes of latitude	F2.0, A1, F4.2,
Longitude: degrees, E (for east) or blank, minutes of longitude	F3.0, A1, F4.2,
Depth	F5.2,
First (amplitude) magnitude	F2.1, 13X,
Azimuth, dip and size (in km) of two smallest standard errors	2(F3.0,F2.0,F4.2),
Second (duration) magnitude	F2.1, 3X,
Size of largest standard error (assumed perpendicular to other two)	F4.2

HYPOINVERSE or HYPO71 station location format

Station name	A4, 1X,
Latitude: degrees, minutes, and S (for south) or blank	F2.0, 1X, F5.2, A1
Longitude: degrees, minutes, and E (for east) or blank	F3.0, 1X, F5.2, A1

Subroutines required by program EQPLT

EQPLT	Main program, interprets commands.
PLOT1	Makes earthquake point-symbol plots.
PLOT2	Makes line and bar-graph plots.
FRAME	Plots a map frame with ticks.
XFRAM	Plots an XY or cross section frame with ticks.
TFRAM	Plots a frame with a time axis with ticks.
DAYJL	Returns Julian day (days relative to 1/1/60) given year, month and day.
SMBL	Plots point-symbols.
SAVE	Outputs current parameters (see SAVE command).
EQBDA	Block data.
KLASS	Integer function taking values 1-20 depending on arguments Y, X, Z. Y = latitude in decimal degrees, X = east longitude in decimal degrees, Z = depth.
FDELY	(This system routine on the Eclipse is required to introduce a half second delay between terminal output using the high and low speed interfaces).

The Tektronix PLOT10 subroutine package

Subroutines required by program ZEQPLT

ZEQPLT	Main program, interprets commands.
ZPL1	Makes earthquake point-symbol plots.
ZPL2	Makes line and bar-graph plots.
MFRAM	Plots a mercator map frame.
CFRAM	Plots a conic map frame.
TAXIS	Plots a time axis in the X direction.
YAXIS	Plots a linear axis in the Y direction.
XAXIS	" " " " " " X " .
ZSAVE	Outputs current parameters (see SAVE command).
DAYJL	Returns a Julian day (days relative to 1/1/60) given year, month and day.
SYMBL	Plots point symbols.
ZEQBDA	Block data.
KLASS	Integer function taking values 1-20, depending on arguments Y, X and Z. Y = latitude in decimal degrees, X = east longitude in decimal degrees, Z = depth.
IASC	Integer function, returns a 2-digit ASCII code for a 2-digit decimal integer.
SKEY	Plots a symbol key.

ZEQPLT overlay notes

ZEQPLT presently requires overlays to fit in 32K of memory. The Eclipse overlay manager allows several nodes, or memory areas, each of which can be shared by 2 or more subroutines which are loaded when called. An efficient overlay scheme has the main plot routines ZPL1 and ZPL2 alternately sharing a node, and the routines MFRAM, CFRAM, TAXIS, YAXIS, XAXIS and ZSAVE sharing another node. The routines TAXIS, YAXIS and XAXIS can all be loaded when any one of the three is called. All other routines are always present in memory. The Eclipse overlay manager also requires 3 different names for each subroutine: 1) the subroutine name given in the SUBROUTINE statement, 2) an overlay name given in an OVERLAY statement in the subroutine, and 3) the name given in the CALL statement. A table associating the 3 names is also required:

Subroutine name	Overlay name	Calling name
ZPL1	OPL1	ZPL10
ZPL2	OPL2	ZPL20
MFRAM	OMFRA	MFRAO
CFRAM	OCFRA	CFRAO
TAXIS	OTAX	TAXIO
YAXIS	OYAX	YAXIO
XAXIS	OXAX	XAXIO
ZSAVE	OSAVE	SAVEO

Special Fortran statements used in EQPLT and ZEQPLT

INCLUDE	Includes some text from an external file into the source code at compile time
OPEN	Associates an external file name with a number internal to the program. Branching to a statement number indicated by ERR= occurs if the file does not exist or if the name is illegal. Attributes are given by ATT=. B stands for blank padding of short records on input and I stands for input (read only)

CLOSE   Terminates reading or writing to a file
GCIN   Subroutine returns the device code of the current keyboard, so that it
            can be opened with blank padding, which is not the default.
DECODE   Reads ASCII text from core under format control
ENCODE   Writes ASCII text to core
TYPE   Outputs text or numbers to the terminal in free format
ACCEPT   Outputs text prompts and reads the terminal under free format until the
            input list is satisfied

FORTRAN unit numbers
    11   terminal keyboard
    10   terminal screen or printer
     1   input instruction file
     2   input data file to plot
     3   line input on maps
     4   station input on maps
     5   input 1 letter from the keyboard when using the cursor
     6   output file for coordinates measured from the screen,
         saved output commands, and other temporary files
     7   subordinate input instruction file