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NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION
PATUXENT RIVER, MARYLAND



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NATOPS TABULAR INTERACTIVE GRAPHICS SYSTEM USER'S MANUAL

by

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2 September 1997

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Naval Air Warfare Center Aircraft Division
Patuxent River, Maryland

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SUMMARY

NAWCAD Patuxent River, Maryland, has periodically been requested by Weapon System Managers to provide engineering data changes to the Chapter 11 Performance Section of the NATOPS Flight Manuals. A part of the requested engineering data can be obtained by using a NATOPS Tabular Interactive Graphics System developed by NAWCAD Patuxent River for use in supporting the revising of aircraft tactical manuals. This report will present a user's guide for the proper implementation of this graphics system.

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1.0 INTRODUCTION

NAWCAD Patuxent River, Maryland has periodically been requested by Weapon System Managers to provide engineering data changes to the Chapter 11 Performance Section of the NATOPS Flight Manuals. A part of the requested engineering data can be obtained by using a NATOPS Tabular Interactive Graphics System (NTIGS) developed by NAWCAD Patuxent River for use in supporting the revising of aircraft tactical manuals. This report will present a user's guide for the proper implementation of this graphics system.

2.0 GETTING STARTED WITH NATOPS TABULAR INTERACTIVE GRAPHICS SYSTEM

The NTIGS program is run using the executable file NTIGS.EXE and a data file. The data file contains tabular data that are used by NTIGS to generate graphical presentation(s) of the data. The executable can be in any directory provided the directory is in the "PATH" command. The user types NTIGS into the computer. The following information will then be displayed in the upper left corner of the screen:

```
UTIGS VER 2.2 3 JAN 95 (U.S. PATENT 4578766 1986)  
NATOPS VERSION, OUTPUT WITH MAX DECIMALS ON TAPE7.DAT FILE  
DATA backup will be ZZZZZZ.BAK  
WARNING CORRECTED FILE WILL OVERWRITE INPUT  
Specify NTIGS file name:
```

The version number of the program, the date it was written, and the U.S. patent covering its development are listed on the screen. NTIGS is a NATOPS-based version of PCTIGS. As indicated above, NTIGS makes a copy of the original data file loaded into the program and saves it under the name **ZZZZZZ.BAK** before any changes are made to the file. After the desired changes have been made, the file will automatically be saved under its original file name. Using this approach, a backup copy of the data file will be maintained in case a mistake was made to the data file loaded into NTIGS. This process will be repeated every time a file is loaded into NTIGS. Therefore, if the user wants to save a particular backup file for later use, then the name of the backup file should be changed. Otherwise, the next backup file generated by NTIGS, named **ZZZZZZ.BAK**, will replace it.

The NTIGS program will then prompt the user to specify the file name to be entered into the program. The exact file name (with an extension if present) must be entered. Otherwise, the program will be unable to find the file and will prompt the user to enter the file name again. After the file name has been entered into the program, the plot(s) contained in the file will be displayed on the screen. In addition, a blue box with the words **ENTER PLOT # TO EDIT (0, PLOT ALL), (-1 QUIT)** will be located along the bottom of the screen.

The NTIGS program assigns a number to each plot displayed on a screen. This number corresponds to the order in which the plot data are organized within in the file. The first plot in the file will be assigned a value of one, the second a value of two, and so forth. The value assigned to each plot is independent of its actual location on the screen. In addition, each line on a plot will be assigned a particular letter. This letter is used to represent the data points of that individual line and is used to reference the line in various NTIGS commands.

The user has a choice of three options once the blue box mentioned above is displayed on the screen. First, one of the plots can be selected for editing by entering the number corresponding to the plot into the program. If this option is selected, the program will automatically put the user in the LINE-POINT MODE. Then, only the selected plot can be edited. The plot can be redrawn by itself using the "P" command after the crosshairs have been positioned over the plot. Second, if a value of 0 is entered into the program, all of the plots contained in the file will be replotted on the screen at the same time. Finally, the execution of the NTIGS program can be terminated by entering a value of -1 into the program. Termination also causes all plots and changes to be sent back into the original filename.

3.0 NATOPS TABULAR INTERACTIVE GRAPHICS SYSTEM INTERACTIVE COMMANDS

3.1 INTRODUCTION

Tabular data can be created by the NTIGS program by using a set of interactive commands. In addition, the graphical presentation of the existing tabular data can be enhanced to the user's satisfaction by using these same commands. Various features such as grid options, shading, labeling, and arrow placements allow the user to "customize" a plot to their specific requirements.

When working with NTIGS, there are two working modes available: the LINE-POINT MODE and the LABEL MODE. When a plot is first accessed, it is in the LINE-POINT MODE. This mode allows the user to work with data points, curve-types, plot size, and grid options. The LABEL MODE allows the user to enter, move, copy, and delete labels. Four different types of labels, text (character) labels, arrows, boxes, and circles, are utilized by NTIGS. Each of these label types can be modified using various interactive commands available in the LABEL MODE. The user is free to move back and forth between the LINE-POINT MODE and LABEL MODE. In order to terminate the execution of the NTIGS program, the user must be in the LINE-POINT MODE. The interactive commands available in the LINE-POINT MODE and LABEL MODE are described in detail in the following sections.

In the LABEL MODE, the "A" (arrow), "C" (copy), "M" (move), and "N" (new label) commands require that more than one location on the plot be selected. In these cases, any of the alphabetical keys on the keyboard (keys A through Z) or the left mouse button can be used to select these points on the plot. The first point required is based on the position of the crosshairs when the command is selected.

3.2 LINE-POINT MODE COMMANDS

3.2.1 A (Add Point After)

The “A” command is used to add a new point to a line after an existing point on that line. First, the “C” command in the LINE-POINT MODE must be used to identify the nearest data point on the line to the crosshairs. This selected point then becomes the reference point for adding the new point to the line. The crosshairs are moved to the desired location of the new point, and the “A” command is selected. The system will respond by drawing the appropriate data point letter at this new location. The “P” command in the LINE-POINT MODE can be used to see the resulting changes to the line.

3.2.2 B (Add Point Before)

The “B” command is used to add a new point to a line before an existing point on that line. The same procedure described previously for the “A” command in the LINE-POINT MODE is also followed for the “B” command. The only difference is that the new point will be located before the selected (reference) point on the line instead of after it.

3.2.3 C (Position Pointer)

The “C” command is used to locate or identify the nearest data point to the crosshairs. After the “C” command has been selected, the data point that is the closest to the crosshairs will be displayed on the plot. This command does not change the position of the crosshairs.

Several other LINE-POINT MODE commands can be used after the “C” command has been selected. Some commands require that the “C” command be selected first. For instance, new points can be added to a line very rapidly by using the “A,” “B,” or “V” commands in succession, such as “CAABBVVVAA.” The selected point can be moved to a new location by using the “M” command.

3.2.4 D (Delete Point)

The “D” command is used to delete the data point that is the closest to the crosshairs. Since this is a one-step process, it is not necessary to use any additional commands in order to remove the point. However, if care is not taken, the wrong point can easily be removed. Therefore, the “C” command in the LINE-POINT MODE should be used to locate the data point before the “D” command is selected. Using this approach, the user can verify which data point will be deleted if the “D” command is selected. After the “D” command has been selected, the data point removed will be displayed on the plot. The “P” command in the LINE-POINT MODE can then be used to see the changes resulting from this action.

3.2.5 E (End)

The "E" command is used to end or terminate the editing of the current plot in the LINE-POINT MODE. After the "E" command has been selected, a blue box with the words **ENTER PLOT # TO EDIT (0, PLOT ALL), (-1 QUIT)** will then be displayed along the bottom of the screen. As stated in Section 2.0, the user then has the option to either select one of the plots in the file for editing, replot all of the plots in the file at once, or terminate NTIGS.

3.2.6 F (Format)

The "F" command is used to format or change the characteristics of one or all of the lines on the plot. When this command is selected, the program prompts the user for the color, dash type, and mode type of the line(s). The dash type input determines whether the line(s) will be solid, dashed, dotted, or a combination of these. Two inputs are utilized for the mode type option. The first input controls the display of the data point symbols on the line(s), the drawing of line(s) outside the plot, and shading below the line(s). The second input is used to define the type of curve fit for the line(s).

If the "F" command is selected while the crosshairs are positioned anywhere over the plot, the line characteristic options will cover all of the lines on the plot (i.e., all of the lines will have the same format). However, if the "P" command in the LINE-POINT MODE is first used to list the lines on the plot, only one line on the plot will be affected (see Section 3.2.12 for further details). After the listing of the lines has been displayed to the left of the plot, the crosshairs can be moved to the row in the listings that contains the specific line to be formatted. Then, when the "F" command is selected, only this line on the plot can be changed. The other line(s) on the plot will not be affected.

After the user has selected the "F" command, a red **LINE CHAR.** (characteristics) box will be displayed in the upper left corner of the screen. The current values for color, dash type, and mode type of the line(s) are listed inside this box. These inputs are listed as follows:











COLOR (0-8)
DASH TYPE (0-6)
MODE (0-3),(0,4)

Each available option is represented by a specific number. The numbers corresponding to the color, dash type, and mode type options are as follows:

COLORS (LINE THICKNESS)

- | | |
|----------------|-------------------------|
| 0 - WHITE | 5 - PURPLE |
| 1 - DULL WHITE | 6 - BRIGHT BLUE |
| 2 - RED | 7 - CYAN |
| 3 - DARK BLUE | 8 - DARK YELLOW (BROWN) |
| 4 - GREEN | 9 - INVISIBLE |

DASH TYPE

- | | |
|-------------------------|--|
| 0 - SOLID LINE |  |
| 1 - SHORT DASH |  |
| 2 - DASH |  |
| 3 - DASH-DOT |  |
| 4 - LINE-DOT |  |
| 5 - DASH-2 SHORT DASHES |  |
| 6 - LINE-SPACE |  |
| 7 - LINE-2 SHORT DASHES |  |
| 8 - LINE-SHORT DASH |  |
| 9 - DOTS |  |

MODE TYPE

(two numbers are required)

First (Left) Number Required:

- 0 (or no prefix) - DATA POINT SYMBOLS ARE PRINTED ON THE CURVE
- 1 - CURVE ONLY; DATA POINT SYMBOLS ARE NOT PRINTED
- 2 - THICK (WIDE) LINE WITH NO SYMBOLS
- 3 - SHADED WITH NO SYMBOLS
- 4 - ABSOLUTE LINE (ONE DRAWN OUTSIDE OF PLOT, NO SYMBOLS)

Second (Right) Number Required - represents curve type:

- 0 - DEFAULT; SAME AS TYPE 2
- 1 - STRAIGHT SEGMENT FIT (LINEAR)
- 2 - SMOOTH, SPLINE-LIKE FIT WITH RESPECT TO X-AXIS
- 3 - SMOOTH, SPLINE-LIKE FIT WITH RESPECT TO Y-AXIS
- 4 - DATA ARE MULTIVALUED; FIT WITH RESPECT TO ARC LENGTH ALONG CURVE
- 5 - DATA ARE MULTIVALUED AND FORM A CLOSED FIGURE; FIT WITH RESPECT TO ARC LENGTH AND JOINED AT THE ENDS (i.e., A CLOSED FIGURE)

Examples:

- 1 (or 10) - Points printed, straight segment fit
- 14 - No points printed, fit with respect to arc length
- 25 - Thick line, closed figure
- 32 - Shading, smooth spline-like fit
- 35 - Closed figure shading
- 41 - Allows user to extend line outside grid

SHADING

Patterns available (use color option):

- 1 - MODERATE SLANT UP TO THE RIGHT, MEDIUM LINE SPACING
- 2 - MODERATE SLANT DOWN TO THE RIGHT, MEDIUM LINE SPACING
- 3 - STEEP SLANT UP TO THE RIGHT, CLOSE LINE SPACING
- 4 - STEEP SLANT DOWN TO THE RIGHT, CLOSE LINE SPACING
- 5 - GENTLE SLANT UP TO THE RIGHT, DISTANT LINE SPACING
- 6 - GENTLE SLANT DOWN TO THE RIGHT, DISTANT LINE SPACING

Although different colors can be selected for the line(s) on the plot using the color option, the plot can ONLY be printed in black and white (lines are black). Color is used by NTIGS to represent line thickness. The larger the number entered for the color option, the thicker the line will be when the plot is printed. On the screen, the lines will appear to have the same thickness. The color input is also used to determine the pattern(s) inside any shaded area(s) on the plot.

Shading on the plot is always produced below a line. Shading over an area that is already shaded on the plot will result in that area of shading being unshaded. This allows closed figures to be shaded on the inside only.

In order to enter a new value into the program, the user must move the crosshairs to the current value in the red box that will be changed, select this value by using the mouse, and then enter the new value into the program. The user can also change additional line values at this time. Finally, after all of the format changes to the line(s) have been made, the ACCEPT block within the red box must be selected by using the mouse. The "P" command in the LINE-POINT MODE can then be used to see the changes to the plot.

3.2.7 G (Grid Options)

The "G" command is used to specify the type of grid, if any, to be drawn on the plot. This command can also be used to define the overall size of the plot on the screen. Options available to the user include the number of major and minor tick marks, the locations of the X-axis and Y-axis, and the orientation of the grid on the plot. The location of the crosshairs when the "G" command is selected does not matter.

After the "G" command has been selected, a red **GRID/PLOT SIZE DATA** box will be displayed in the upper left corner of the screen. This box lists the current grid/plot size values assigned to the plot. These grid/plot size inputs are listed as follows:

OF X MAJOR TICKS
OF Y MAJOR TICKS
OF X MINOR TICKS
OF Y MINOR TICKS
X GRID FLAG
Y GRID FLAG
PLOT CELL SIZE(1=1")
X AXIS LOCATION
Y AXIS LOCATION
ORIENT 1=PORT,0=LAND
AXIS LABEL SIZE
X LABEL SKIP FACTOR
Y LABEL SKIP FACTOR

where:

- # OF X MAJOR TICKS** - Number of major tick marks along the X-axis of the grid from the origin. A negative value will reverse the order of the X-axis labels.
- # OF Y MAJOR TICKS** - Number of major tick marks along the Y-axis of the grid from the origin. A negative value will reverse the order of the Y-axis labels.
- # OF X MINOR TICKS** - Number of minor tick marks located between two major tick marks along the X-axis of the grid.
- # OF Y MINOR TICKS** - Number of minor tick marks located between two major tick marks along the Y-axis of the grid.
- X GRID FLAG** - Spacing between vertical grid lines.

flag = 0: no vertical grid lines at major X-axis tick marks

flag = 1: vertical grid lines at each major X-axis tick mark

flag = n: vertical grid lines at every nth major X-axis tick mark
where n>1:

Note: Vertical grid line spacing is from right to left.

Y GRID FLAG - Spacing between horizontal grid lines.

flag = 0: no horizontal grid lines at major Y-axis tick marks

flag = 1: horizontal grid lines at each major Y-axis tick mark

flag = n: horizontal grid lines at every nth major Y-axis tick mark
where n>1:

Note: Horizontal grid line spacing is from top to bottom.

- PLOT CELL SIZE** - Actual size of one cell on the grid (distance between two major X-axis or Y-axis tick marks in inches).
- X AXIS LOCATION** - Horizontal screen number location of the X-axis of the grid based on the origin.
- Y AXIS LOCATION** - Vertical screen number location of the Y-axis of the grid based on the origin.
- ORIENT** - Orientation of the grid.
 - 0 - landscape
 - 1 - portrait
- AXIS LABEL SIZE** - Size of the X-axis and Y-axis labels to be displayed at the major axis tick marks (default = .12).
- X LABEL SKIP FACTOR** - Number of X-axis labels to be “skipped over” before another X-axis label is displayed below the grid. If a negative value is entered, no labels will be displayed along the X-axis.

Note: X-axis label “skipping” is from left to right.

- Y LABEL SKIP FACTOR** - Number of Y-axis labels to be “skipped over” before another Y-axis label is displayed to the left of the grid. If a negative value is entered, no labels will be displayed along the Y-axis.

Note: Y-axis label “skipping” is from bottom to top.

All input values must be integers except for the **PLOT CELL SIZE** input.

The number of major tick marks along the X-axis and Y-axis and the size of a plot cell determines the overall size of the plot. The user can use different combinations of the “G” command inputs listed above to produce a grid with the desired features. However, changing just one grid input value can substantially change the plot. In order to maintain the overall look of the plot, the user may need to change additional inputs. For instance, moving the location of the plot using the **X AXIS LOCATION** input and/or the **Y AXIS LOCATION** input will also move the labels associated with it. If the **X GRID FLAG** input is changed, the number of major tick marks along the X-axis may also need to be changed using the **# of X MAJOR TICKS** input in order to keep the spacing between all of the major vertical grid lines the same.

The procedure for selecting, changing, and accepting the input values in the red **GRID/PLOT SIZE DATA** box is the same as the procedure described in Section 3.2.6 for the values in the red **LINE CHAR.** box when the “F” command is selected. The “P” command in the LINE-POINT MODE can then be used to see the changes to the plot.

3.2.8 K (Kill Line)

The “K” command is used to remove or “kill” an entire line on the plot that contains the point closest to the crosshairs. The “K” command must be selected twice in order to remove a line. This two-step procedure is designed to reduce the chances of a line being accidentally removed from the plot.

The first “K” command is used to identify the nearest data point to the crosshairs (just like the “C” command in the LINE-POINT MODE). If the correct line has been selected, the user can immediately select the “K” command again without moving the crosshairs. All of the data points for the deleted line will then be highlighted. After the “P” command in the LINE-POINT MODE has been selected, the line will be removed from the screen.

However, if a data point for the “wrong” line is displayed on the screen after the first “K” command is selected, then a different LINE-POINT MODE command should be selected before another attempt is made to remove the line. Any other command selected after the first “K” command will automatically cancel the line removal process. Simply moving the crosshairs and selecting the “K” command again should not be tried. If the closest point to the new location of the crosshairs belongs to the same line as the previous point, then the “wrong” line will still be removed.

3.2.9 L (Label Mode)

The “L” command is used to enter the LABEL MODE from the LINE-POINT MODE. After this command has been selected, the program will automatically put the user in the LABEL MODE. The LABEL MODE commands described in Sections 3.3.1 thru 3.3.10 can then be used to edit the plot.

3.2.10 M (Move Point)

The "M" command is used to move a data point on an existing line to a new location on the plot. First, the "C" command in the LINE-POINT MODE must be used to select a data point on the line. If the selected point is the one that the user wishes to move, the crosshairs can then be moved to the desired new location of the point and the "M" command selected. The appropriate data point letter will then be displayed at the new location. In order to move a different point, the "C" command in the LINE-POINT MODE must first be used to locate it. Otherwise, the same point will be moved each time the "M" command is selected. The "P" command in the LINE-POINT MODE can be used to see the changes to the plot.

3.2.11 N (New Line)

The "N" command is used to create a new line on the plot, beginning at the location indicated by the crosshairs. After this command has been selected, a line data point will be displayed at the location of the crosshairs. This point marks the beginning of the new line. The next available letter in the alphabet not currently being used by another line is automatically assigned to this point. In addition, a red **NEW LINE FEATURES** box will be displayed in the upper left corner of the screen. The input values required to define the characteristics of the new line are listed inside this red box. These inputs are listed as follows:

LINE Y VALUE
COLOR (0-8)
DASH MODE (0-6)
TYPE (0-3)&(0-5)

The **LINE Y VALUE**, the value assigned to the line, is NOT used in the NTIGS program. The color (line thickness), dash type, and mode type options available for the "N" command are the same as those available for the "F" command in the LINE-POINT MODE. The procedure for selecting, changing, and accepting the input values in the red **NEW LINE FEATURES** box is the same as the procedure described in Section 3.2.6 for the values in the red **LINE CHAR.** box when the "F" command is selected.

After the appropriate line values have been entered and accepted into the program, the "A," "B," or "V" commands in the LINE-POINT MODE can be used to add other points to this line. The "C" command in the LINE-POINT MODE is not required since the starting point of the line has already been located by the program. After the user has entered the desired line points, the "P" command in the LINE-POINT MODE can be used to display the complete line on the screen.

3.2.12 P (Replot)

The "P" command is used to redraw the plot on the screen in the current scale or to list all of the lines on the plot. If the "P" command is selected while the crosshairs are located anywhere over the plot, the plot will be redrawn, and the latest changes made to the plot using other LINE-

POINT MODE commands will be shown on the screen. However, when the crosshairs are positioned to the immediate left of the plot (left of the Y-axis) and the "P" command is selected, a listing of the lines on the plot by assigned letter and corresponding value will be displayed to the left of the plot. As mentioned in Section 3.2.6, this feature of the "P" command is often used along with the "F" command to format a specific line on the plot.

3.2.13 R (Rescale)

The "R" command is used to rescale a plot to its original size. This command is used in conjunction with the "Z" command in the LINE-POINT MODE. After the "R" command has been selected, the plot will be redrawn to its original size (the size before the first "Z" command was selected). The latest changes made to the plot using other LINE-POINT MODE commands will be shown on the screen.

3.2.14 S (Show)

The "S" command is used to show the coordinate values at the crosshairs position relative to the origin of the plot that is currently displayed on the screen. This command can be used to display the coordinate values at any location along a line or at any other location on or off the plot. However, the "S" command cannot be used to locate or modify the data point closest to the crosshairs (the "C" command in the LINE-POINT MODE should be used for that purpose). The "S" command will only give the exact location of a data point when the crosshairs are positioned exactly over that point.

The crosshairs are positioned at a particular location on or off the plot, and the "S" command is selected. The coordinate values at this location, relative to the origin of the plot displayed on the screen, will be listed along the left side of the screen. This command can be selected many times in a row for any crosshairs location. The coordinate values for each location will be listed on the screen below the values for the previous location.

3.2.15 V (Value Input)

The "V" command is used to add a new point to an existing line by entering the exact coordinate values of the point into the program. First, the "C" command in the LINE-POINT MODE must be used to identify the line data point closest to the crosshairs. This selected point will then become the reference point for adding a new point to the line. After the "V" command has been selected, a red **ADD POINT EXACTLY** box will be displayed in the upper left corner of the screen. The following inputs are listed inside this box:

X VALUE (REAL UNITS)
Y VALUE (REAL UNITS)

The X and Y coordinate values for the new point are expressed in terms of real units. Real units allow the point to be positioned relative to the rest of the plot. Therefore, if the plot is later rescaled or moved, this point will be moved in order to keep it in the same location with respect to the plot.

The procedure for selecting, changing, and accepting the input values in the red **ADD POINT EXACTLY** box is the same as the procedure described in Section 3.2.6 for the values in the red **LINE CHAR.** box when the "F" command is selected. After the coordinate values for the new point have been entered and accepted, the program will respond with the following:

A OR B MODE?

The user must then select either "A" or "B" to add the point after or before the reference line point, respectively. Once this choice has been made, the data point will be displayed on the screen at the specified coordinate values. The "P" command in the LINE-POINT MODE can then be used to see the resulting changes to the line.

3.2.16 W (Window Plot)

The "W" command is used to rescale the X- and Y-axis of the plot while maintaining the same grid characteristics. Therefore, the overall size of the grid will not change. However, only the data points (and lines) that fit within the rescaled plot will be displayed on the screen. The data outside the rescaled plot will not be shown. When the "W" command is selected, the position of the crosshairs on the screen does not matter.

After the "W" command has been selected, a red **X & Y AXIS VALUES** box will be displayed in the upper left corner of the screen. The values currently assigned to the plot are listed inside this red box. These inputs are listed as follows:

**X AXIS BEGINNING
X AXIS DELTA
Y AXIS BEGINNING
Y AXIS DELTA**

where:

- X AXIS BEGINNING** - The lowest value on rescaled X-axis.
- X AXIS DELTA** - The increment between the major tick marks on the rescaled X-axis.
- Y AXIS BEGINNING** - The lowest value on rescaled Y-axis.
- Y AXIS DELTA** - The increment between the major tick marks on the rescaled Y-axis.

The procedure for selecting, changing, and accepting the input values in the red **X & Y AXIS VALUES** box is the same as the procedure described in Section 3.2.6 for the values in the red **LINE CHAR.** box when the “F” command is selected. After the axis values have been entered and accepted, the program will automatically readjust the X-axis and Y-axis based on these new values and redraw the plot. After the “W” command has been completed, the labels associated with the plot may need to be moved in order to “clean up” the plot.

3.2.17 Z (Zoom)

The “Z” command is used to zoom in on a particular region of the plot (i.e., “blow up” a portion of the plot) based on the location of the crosshairs. After the crosshairs have been positioned in the middle of the area to be enlarged, the “Z” command is selected. The program will then automatically zoom in on this region of the plot. All plot features within this area (lines, labels, grid marks, etc.) will be enlarged so that the proportions remain the same. Several “Z” commands can be selected in series, each one enlarging the previous view. In addition, most of the **LINE-POINT MODE** and **LABEL MODE** commands can be utilized while the plot is enlarged. As mentioned in Section 3.2.13, the “R” command is used to restore the plot to its original size in one step.

3.3 LABEL MODE COMMANDS

3.3.1 A (Arrow)

The “A” command is used to place an arrow on the plot. The arrow consists of two straight segments, joined together at a bend in the arrow, with the arrow’s head located at the tip of the second segment. The arrow is constructed tail first, starting at the crosshairs location. The three steps required to place an arrow on the plot are as follows:

1. The crosshairs are positioned at the desired location of the arrow’s tail, and the “A” command is selected. A dot will then appear at this location.
2. The crosshairs are moved to the location on the plot where the bend in the arrow will be located. This spot is then selected. A second dot will appear at this location.
3. The crosshairs are moved again to the location on the plot where the arrow’s head will be located. This spot is then selected. A third dot will briefly appear at this location.

After the above steps have been followed, an arrow will be located on the screen based on the positions of the three dots. These dots are removed after the arrow has been created. A straight arrow (without a bend) can be constructed by locating the first and second points, or the second and third points of the arrow, at the same position on the plot.

For editing purposes, NTIGS treats an arrow on the plot as a label. Therefore, many of the **LABEL MODE** commands can be used for arrows. First, the “L” command should be used to locate the arrow, either at its bend or tail. The “C,” “D,” “M,” or “S” command can then be used

to copy, delete, move, or modify the arrow, respectively. Only these LABEL MODE commands should be used for arrows on the plot. The user should follow the procedures described for each of these commands.

3.3.2 C (Copy)

The "C" command is used to copy (duplicate) an existing label to a new location on the plot. This command can be used to copy the four different types of labels that are utilized by NTIGS: text labels, arrows, boxes, and circles. For text labels, three points, the "C" command point and two slope points, are required to define the position of the label. The three steps required to copy a text label are as follows:

1. The "L" command in the LABEL MODE should be used to select the text label on the plot that is the closest to position of the crosshairs. This label is the one that can be copied (the last label selected by the "L" command is copied).
2. The crosshairs are moved to the location on the plot where the text label will be copied to. The "C" command is then selected. A dot will appear at this location.
3. The crosshairs are moved to two different locations on the plot where a left and then a right slope point are selected. The exact location of these points on the plot does not matter, only their position relative to one another. These two points MUST be selected from left to right across the plot. Otherwise, the text label will be printed upside down.

After these steps have been followed, an exact copy of the selected text label will be located on the plot at the "C" command point. The slope of the label is determined by the position of the two slope points relative to one another. The location of the original text label on the plot does not change.

The "C" command can be used to copy an arrow on the plot. However, since the copied arrow will be based on the position of the three points required for its construction, the arrow will not be an exact copy of the original (see Section 3.3.1 for further details). First, the "L" command in the LABEL MODE should be used to locate the tail or bend of the arrow to be copied. The "C" command point will then serve as the location for the new arrow's tail. The second and third points selected on the plot will then be used to locate the arrow's bend and tip, respectively. For an arrow, these final two points are not used to define a slope. An arrow will then be drawn at the new location on the plot.

Finally, the "C" command can also be used to copy a box or circle on the plot. Since the copied box or circle will be based on the position of the two points required for its construction, it will not be an exact copy of the original (see Section 3.3.7 for further details). First, the "L" command in the LABEL MODE should be used to locate the lower left corner of the box or the center of the circle to be copied. The "C" command point will then serve as the location for either the lower left corner of the new box or the center of the new circle. The second point

selected on the plot will then be used to either locate the upper right corner of the box or define the radius of the circle. The selection of a third point is not required. The box or circle will then be drawn at the new location on the plot based on the “C” command point.

3.3.3 D (Delete)

The “D” command is used to delete the label that is the closest to the crosshairs. This command will also remove an arrow from the plot if the arrow’s tail or bend is the closest point to the crosshairs. Since this is a one-step process, it is not necessary to use any additional commands in order to remove the label. However, if care is not taken, the wrong label can easily be removed. Therefore, the “L” command in the LABEL MODE should be used to locate the label before the “D” command is selected. Using this approach, the user can verify which label will be deleted if the “D” command is selected. After the “D” command has been selected, the label will automatically be removed from the plot.

3.3.4 H (Horizontal Label Move)

The “H” command is used to move an existing label to a new location and position it horizontally on the plot. Using this command, only one point is required to position the label. Since the label will be positioned horizontally on the plot, the two points used to define the slope of a text label are not required (see Section 3.3.6 for further details).

First, the label should be located using the “L” command in the LABEL MODE. The crosshairs are then moved to the desired new location of the label, and the “H” command is selected. The label will then be repositioned horizontally at the new location on the plot. If the H key is continuously held down, the label will move with the crosshairs. The label will continue to move across the screen until the user releases the H key. The “L” command must be used each time the user wishes to move a different label.

In order to move a box or circle, the user must first locate the lower left corner of the box or the center of the circle using the “L” command. After the “H” has been selected, this selected point will be moved to the new location of the crosshairs. The same box or circle will then be repositioned on the plot according to this point.

3.3.5 L (Locate)

The “L” command is used to locate the nearest label or arrow on the plot to the crosshairs. This command serves the same function as the “C” command in the LINE-POINT MODE. If the “L” command is selected while the tail or bend of an arrow is the closest point to the crosshairs, then that arrow will be chosen. After the “L” command has been selected, a dot will appear at the center or left justification position of the label or at the tail of an arrow that was located by the command. This dot identifies which label or arrow the next LABEL MODE command will affect.

3.3.6 M (Move)

The "M" command is used to move an existing label or arrow to a new location on the plot. This command can also be used to resize a box or circle on the plot. The same steps outlined in Section 3.3.2 for copying a text label or arrow on the plot using the "C" command should be followed. The procedure required to move a box or circle on the plot is also the same. However, the "M" command should be used instead of the "C" command, and the old text label, arrow, box, or circle will be removed from the plot after the "M" command point has been selected. Once again, close attention should be paid to the location of the slope points on the plot in order to avoid printing a text label upside-down. After the appropriate steps have been followed, the text label, arrow, box, or circle will be redrawn at the new location on the plot.

3.3.7 N (New Label)

The "N" command is used to add a new label to the plot. This label can consist of several lines of text. In addition, the "N" command can be used to add a box or circle to the plot. First, the crosshairs must be moved to the desired location of the new label and the "N" command selected. The first line of the text label, the lower left corner of the box, or the center of the circle will be located at this spot, depending upon which option is selected. A red **LABEL SIZE/UNITS/JUST./COLOR** box will then be displayed in the upper left-hand corner of the screen. The inputs inside this red box are listed as follows:

**CHARACTER SIZE (.125 DEFAULT)
UNITS 0-RL, 1-SCRN, 2-BOX, 3-CIR
JUSTIFY 0-CENTER, 1-LEFT SET
COLOR (0-8) (LINE SIZE)**

where:

CHARACTER SIZE

- Size or height of the text characters in inches. Since text cannot be located inside a box or circle using the "N" command, this input is NOT used in those cases. The default size is 0.125.

UNITS 0-RL, 1-SCRN, 2-BOX, 3-CIR

- Defines the units for the text label and contains the control switches for adding a box or circle (CIR) to the plot. Either real (RL) or screen (SCRN) unit can be used for a text label by entering a value of 0 or 1, respectively. Real and screen units are defined as follows:

Real Units - The position of the text label is relative to the plot. If the plot is rescaled or moved, the label will also be rescaled or moved to keep it in the proportions with respect to the plot.

Screen Units - The position of the text label is independent of the plot. The label will remain at a fixed position and size, and is not affected by other modifications to the plot.

Instead of adding a text label to the plot, a box or circle can be created by entering a value of 2 or 3, respectively. A box or circle on the plot is treated by NTIGS as a label. The default input value is 0.

JUSTIFY 0-CENTER, 1-LEFT SET - Determines how each line of the text label will be aligned or justified. If a value of 0 is selected, the center of each line of text will be aligned. However, if a value of 1 is selected, the left edge of each line of text will be aligned. The default value is 0. This input is not used when a box or circle is being added to the plot.

COLOR (0-8) (LINE SIZE) - The colors available represent the line thickness for a box and circle. The larger the selected color number, the thicker the line(s) will be when the plot is printed. On the screen, all of the lines will appear to have the same thickness. For text labels, this input defines the thickness or boldness of each character in the label. The default value is 1.

The procedure for selecting, changing, and accepting one of the input values in the red **LABEL SIZE/UNITS/JUST./COLOR** box is the same as the procedure described in Section 3.2.6 for the values in the red **LINE CHAR.** box when the "F" command is selected.

After the proper input values have been entered and accepted, a light purple box will be displayed along the top of the screen with the words **ENTER TITLE - 3 BLANKS CAUSE NEW LINE** inside. When a box or circle is being added to the plot, this step does not play a role, and the return key should be pressed. However, if a text label is being added to the plot, the characters should be typed in at this time. Three or more consecutive blanks between characters will be interpreted by the program as the beginning of a new line. The characters will be

displayed in the purple box as they are typed in. The lines of text will be aligned according to the **JUSTIFY** (justify) option previously selected. Once the return key has been pressed, the crosshairs will reappear the screen.

Next, if a text label is being added to the plot, the two slope points should be selected from left to right across the plot in order to avoid printing the label upside down (see Section 3.3.2 for further details). However, if a box is being added to the plot, the upper right corner of the box must now be selected. Finally, if a circle is being added to the plot, the radius of the circle must be defined by selecting a point on the plot that is the desired distance away from the center. After these procedures have been followed, a text label, box, or circle will be displayed on the plot.

3.3.8 Q (Quit Label Mode)

The "Q" command is used to quit or exit the LABEL MODE and return the user to the LINE-POINT MODE.

3.3.9 S (Label Size)

The "S" command is used to change or modify the characteristics of an existing label or arrow on the plot. This command is very similar to the "N" command in the LABEL MODE. Both commands utilize the same options. The main difference between the two commands is in how they are used. The "N" command is used to create new text labels, boxes, and circles on the plot, while the "S" command is used to later modify them.

First, the "L" command in the LABEL MODE must be used to locate the label on the plot that will be modified. After the "S" command has been selected, the same red **LABEL SIZE/UNITS/JUST./COLOR** box described for the "N" command in the LABEL MODE will be displayed in the upper left corner of the screen. The options listed inside this box are also the same as those listed for the "N" command. The current value assigned to each option will be stated for the selected label. The same procedure described in Section 3.3.7 for the "N" command is used to select, change, and accept the input values listed in the red box.

The "S" command can be used to modify an existing arrow on the plot. The tail of the arrow must first be located using the "L" command. After the "S" command has been selected, the default values assigned to the arrow will be displayed on the screen. The character size value determines the size of the arrow's head. If a justify value of 1 is selected, the head of the arrow will appear solid. Otherwise, the head of the arrow will not be filled in. The color (line thickness) of the arrow can be changed by selecting a new value. The same color-value combinations listed for the "F" command in the LINE-POINT MODE are also used for this command. The units input value of the arrow should not be changed.

The "S" command cannot be used to change a label from one form to another. In other words, the user cannot change a box into a circle, a circle into a box, or a text label into either a box or a circle. If a text label is being modified, only the character size, the selection of real or

screen units, the alignment of each line of text, the color (thickness) of the characters, or a combination of these may be changed. Since the light purple box described for the “N” command in Section 3.3.7 will not be displayed on the screen, the characters in the text label cannot be changed. In order to change the text of a label, the user would have to remove the old label from the plot and then create a new one in its place. If a box or circle is being modified, only the color (thickness) of the line(s) may be changed.

After the appropriate changes to the label have been made, the program will automatically replace the old label with the new one. Since the location and orientation of the label on the plot will not change, no additional steps are required. In addition, the “S” command will not change the overall size of a box or circle on the plot.

3.3.10 V (Vertical Label Move)

The “V” command is used to move an existing label to a new location and position it vertically on the plot. Using this command, only one point is required to position the label. Since the label will be positioned vertically on the plot, the two points used to define the slope of the label are not required (see Section 3.3.6 for further details).

First, the label should be located using the “L” command in the LABEL MODE. The crosshairs are then moved to the desired new location of the label, and the “V” command is selected. The label will then be repositioned vertically at the new location on the plot. If the V key is continuously held down, the label will move with the crosshairs. The label will continue to move across the screen until the user releases the V key. The “L” command must be used each time the user wishes to move a different label.

In order to move a box or circle, the user must first locate the lower left corner of the box or the center of the circle using the “L” command. After the “V” has been selected, this selected point will be moved to the new location of the crosshairs. The same box or circle will then be repositioned on the plot according to this point.

4.0 SUMMARY COMMANDS AND EXAMPLES

For a summary of the commands and examples, refer to appendices A, B, and C.

**APPENDIX A
INTERACTIVE COMMANDS SUMMARY**

LINE-POINT MODE

<u>Command</u>	<u>Description</u>
A	Add a new point to a line after an existing point on that line
B	Add a new point to a line before an existing point on that line
C	Locate or identify the nearest data point to the crosshairs
D	Delete the data point that is closest to the crosshairs
E	End or terminate the editing of the current plot in the LINE-POINT MODE
F	Format or change the characteristics of one or all of the lines on the plot
G	Specify the type of grid , if any, to be drawn on the plot
K	Remove or " kill " an entire line on the plot that belongs to the point closest to the crosshairs
L	Enter the LABEL MODE from the LINE-POINT MODE
M	Move a data point on an existing line to a new location on the plot
N	Create a new line on the plot, beginning at the location indicated by the crosshairs
P	Redraw the plot on the screen in the current scale or list all of the lines on the plot
R	Rescale a plot to its original size after a Zoom command
S	Show the coordinate values at the crosshairs position relative to the origin of the plot that is currently displayed on the screen
V	Add a new point to an existing line by entering the exact coordinate values of the point into the program
W	Rescale the X-axis and Y-axis values of the plot while maintaining the same grid characteristics
Z	Zoom in on a particular region of a plot based on the location of the crosshairs

LABEL MODE

<u>Command</u>	<u>Description</u>
A	Place an arrow on the plot
C	Copy (duplicate) an existing label to a new location on the plot
D	Delete the label that is the closest to the crosshairs
H	Move an existing label to a new location and position it horizontally on the plot
L	Locate the nearest label or arrow on the plot to the crosshairs
M	Move an existing label or arrow to a new location on the plot
N	Add a new label to the plot
Q	Quit or exit the LABEL MODE and return the system to the LINE-POINT MODE
S	Change or modify the characteristics of an existing label or arrow on the plot
V	Move a selected label to a new location and position it vertically on the plot

APPENDIX B LINE-POINT MODE EXAMPLES

The following examples summarize the basic use of various NTIGS interactive commands in the LINE-POINT MODE. The <m> symbol indicates that a selection using the mouse button is required. The <cr> symbol denotes that a carriage return is required.

1. REDRAW PLOT OR LIST LINES

The following steps demonstrate how to redraw the plot or list all of the lines on the plot:

- Option No. 1: Redraw Plot
 - Move crosshairs to any location above plot
 - Select "P" command

- Option No. 2: List Lines on the Plot
 - Move crosshairs to the immediate left of plot
 - Select "P" command

2. ADD A POINT TO A LINE

The following steps demonstrate how to add a point to an existing line on a plot:

- Option No. 1: Add a point after an existing point on a line
 - Move crosshairs to line and estimate location of existing point
 - Select "C" command
 - Move crosshairs to desired location of new data point
 - Select "A" command
 - Select "P" command to redraw plot

- Option No. 2: Add a point before an existing point on a line
 - Move crosshairs to line and estimate location of existing point
 - Select "C" command
 - Move crosshairs to desired location of new data point
 - Select "B" command
 - Select "P" command to redraw plot

- Option No. 3: Add a point to an existing line by entering the exact coordinate values of the point
 - Move crosshairs to line and estimate location of existing point
 - Select “C” command
 - Select “V” command
 - Move crosshairs to X VALUE row in red box, select current value <m>, and enter a new X-axis coordinate value, <cr>
 - Move crosshairs to Y VALUE row in red box, select current value <m>, and enter a new Y-axis coordinate value, <cr>
 - Accept values <m>
 - Select either “A” or “B”
 - Select “P” command to redraw plot

3. MOVE A POINT ON A LINE

The following steps demonstrate how to move a point on an existing line on a plot:

- Move crosshairs to line and estimate location of existing point to be moved
- Select “C” command
- Move crosshairs to desired new location of data point
- Select “M” command
- Select “P” command to redraw plot

4. REMOVE A POINT ON A LINE

The following steps demonstrate how to remove a point from an existing line on a plot:

- Move crosshairs to line and estimate location of existing point to be deleted
- Select “C” command
- Select “D” command
- Select “P” command to redraw plot

5. SHOW COORDINATE VALUES

The following steps demonstrate how to list the coordinate values at the current location of the crosshairs:

- Move crosshairs to desired location on plot
- Select “S” command

6. ADD A LINE

The following steps demonstrate how to add a new line to a plot:

- Move crosshairs to desired starting point of new line
- Select "N" command
- Optional - Move crosshairs to **COLOR** row in red box, select current value <m>, and enter a new color value, <cr>
- Optional - Move crosshairs to **DASH MODE** row in red box, select current value <m>, and enter a new dash mode value, <cr>
- Optional - Move crosshairs to **TYPE** row in red box, select current values <m>, and enter two new type values, <cr>
- Accept values <m>
- Select either "A," "B," or "V" command to add another data point to the line; Repeat this step until all of the desired data points have been located on the plot
- Select "P" command to redraw plot

7. MODIFY FORMAT OF LINE(S)

The following steps demonstrate how to modify the format of one or all of the lines on a plot:

- Option No. 1: Modify all lines
 - Move crosshairs to any location in plot area
 - Select "F" command
- Option No. 2: Modify one line
 - Move crosshairs to the immediate left of the plot
 - Select "P" command
 - Move crosshairs to row containing desired line
 - Select "F" command
- Optional - Move crosshairs to **COLOR** row in red box, select current value <m>, and enter a new color value, <cr>
- Optional - Move crosshairs to **DASH TYPE** row in red box, select current value <m>, and enter a new dash type value, <cr>
- Optional - Move crosshairs to **MODE** row in red box, select current values <m>, and enter two new mode values, <cr>
- Accept values <m>
- Select "P" command to redraw plot

8. REMOVE A LINE

The following steps demonstrate how to remove or delete a line from a plot:

- Move crosshairs to line and estimate location of data point
- Select “C” command
- Select “K” command
- Select “K” command again
- Select “P” command to redraw plot

9. MODIFY GRID

The following steps demonstrate how to modify the grid of a plot:

- Select “G” command
- Optional - Move crosshairs to **# OF X MAJOR TICKS** row in red box, select current value <m>, and enter a new X-axis major ticks value, <cr>
- Optional - Move crosshairs to **# OF Y MAJOR TICKS** row in red box, select current value <m>, and enter a new Y-axis major ticks value, <cr>
- Optional - Move crosshairs to **# OF X MINOR TICKS** row in red box, select current value <m>, and enter a new X-axis minor ticks value, <cr>
- Optional - Move crosshairs to **# OF Y MINOR TICKS** row in red box, select current value <m>, and enter a new Y-axis minor ticks value, <cr>
- Optional - Move crosshairs to **X GRID FLAG** row in red box, select current value <m>, and enter a new X-axis grid flag value, <cr>
- Optional - Move crosshairs to **Y GRID FLAG** row in red box, select current value <m>, and enter a new Y-axis grid flag value, <cr>
- Optional - Move crosshairs to **PLOT CELL SIZE** row in red box, select current value <m>, and enter a new cell size value, <cr>
- Optional - Move crosshairs to **X AXIS LOCATION** row in red box, select current value <m>, and enter a new X-axis location value, <cr>
- Optional - Move crosshairs to **Y AXIS LOCATION** row in red box, select current value <m>, and enter a new Y-axis location value, <cr>
- Optional - Move crosshairs to **ORIENT** row in red box, select current value <m>, and enter a new orientation value, <cr>
- Optional - Move crosshairs to **AXIS LABEL SIZE** row in red box, select current value <m>, and enter a new label size value, <cr>
- Optional - Move crosshairs to **X LABEL SKIP FACTOR** row in red box, select current value <m>, and enter a new X-axis label skip factor value, <cr>
- Optional - Move crosshairs to **Y LABEL SKIP FACTOR** row in red box, select current value <m>, and enter a new Y-axis label skip factor value, <cr>
- Accept values <m>
- Select “P” command to redraw plot

10. ZOOM AND RESCALE

The following steps demonstrate how to zoom in on a region of a plot and then rescale the plot to its original size:

- Move crosshairs to area to be enlarged
- Select "Z" command; Repeat this step to enlarge the plot even further
- Use other NTIGS commands as desired
- When finished, select "R" command to restore plot to full size

11. WINDOWS OPTION

The following steps demonstrate how the windows option can be used to rescale each axis of a plot:

- Select "W" command
- Optional - Move crosshairs to **X AXIS BEGINNING** row in red box, select current value <m>, and enter a new X-axis beginning value, <cr>
- Optional - Move crosshairs to **X AXIS DELTA** row in red box, select current value <m>, and enter a new X-axis delta value, <cr>
- Optional - Move crosshairs to **Y AXIS BEGINNING** row in red box, select current value <m>, and enter a new Y-axis beginning value, <cr>
- Optional - Move crosshairs to **Y AXIS DELTA** row in red box, select current value <m>, and enter a new Y axis delta value, <cr>
- Accept values <m>

12. ENTER LABEL MODE

The following steps demonstrate how to enter the LABEL MODE from the LINE-POINT MODE:

- Move crosshairs to any location in plot area
- Select "L" command

13. END NTIGS SESSION

The following steps demonstrate how to exit the NTIGS program with the changes made during the session being saved to the data file:

- Move crosshairs to any location in plot area
- Select "E" command

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APPENDIX C LABEL MODE EXAMPLES

The following examples summarize the basic use of various NTIGS interactive commands in the LABEL MODE. The <m> symbol indicates that a selection using the mouse button is required. The <cr> symbol denotes that a carriage return is required.

1. CREATE A TEXT LABEL

The following steps demonstrate how to add a new text label to a plot:

- Move crosshairs to desired location of text label
- Select "N" command
- Optional - Move crosshairs to **CHARACTER SIZE** row in red box, select current value <m>, and enter a new character size, <cr>
- Optional - Move crosshairs to **UNITS** row in red box, select current value <m>, and enter a new units value (0 for real, 1 for screen), <cr>
- Optional - Move crosshairs to **JUSTIFY** row in red box, select current value <m>, and enter a new alignment (justification) value (0 for center, 1 for left), <cr>
- Optional - Move crosshairs to **COLOR** row in red box, select current value <m>, and enter a new color (line size) value, <cr>
- Accept values <m>
- Type in characters for label, <cr>
- Move crosshairs to a left slope point, <m>
- Move crosshairs to a right slope point, <m>

2. CREATE AN ARROW

The following steps demonstrate how to add a new arrow, tail first, to a plot:

- Move crosshairs to desired location of arrow's tail
- Select "A" command
- Move crosshairs to desired location of bend in arrow, <m>
- Move crosshairs to desired location of tip of arrow, <m>

3. CREATE A BOX

The following steps demonstrate how to add a new box to a plot:

- Move crosshairs to desired location of lower left corner of box
- Select "N" command
- Move crosshairs to **UNITS** row in red box
- Select current value <m>
- Enter a value of 2, <cr>
- Optional - Move crosshairs to **COLOR** row in red box, select current value <m>, and enter a new color (line size) value, <cr>
- Accept values <m>
- <cr> (text characters not used)
- Move crosshairs to desired location of upper right corner of box, <m>

4. CREATE A CIRCLE

The following steps demonstrate how to add a new circle to a plot:

- Move crosshairs to desired location of center of circle
- Select "N" command
- Move crosshairs to **UNITS** row in red box
- Select current value <m>
- Enter a value of 3, <cr>
- Optional - Move crosshairs to **COLOR** row in red box, select current value <m>, and enter a new color (line size) value, <cr>
- Accept values <m>
- <cr> (text characters not used)
- Move crosshairs desired distance away from center of circle in order to define radius, <m>

5. MOVE A TEXT LABEL

The following steps demonstrate how to move an existing text label to a new location on a plot:

- Move crosshairs to text label
- Select “L” command
- Move crosshairs to desired new location of text label

- Option No. 1: Regular Move (sloped label)
 - Select “M” command
 - Move crosshairs to a left slope point, <m>
 - Move crosshairs to a right slope point, <m>

- Option No. 2: Horizontal Move
 - Select “H” command

- Option No. 3: Vertical Move
 - Select “V” command

6. COPY A TEXT LABEL

The following steps demonstrate how to copy an existing text label to a new location on a plot:

- Move crosshairs to text label
- Select “L” command
- Move crosshairs to desired new location of label
- Select “C” command
- Move crosshairs to a left slope point, <m>
- Move crosshairs to a right slope point, <m>

7. MOVE OR COPY AN ARROW

The following steps demonstrate how to move or copy an existing arrow to a new location on a plot:

- Move crosshairs to arrow's tail
- Select "L" command
- Move crosshairs to desired new location of arrow's tail
- Select "M" command or "C" command
- Move crosshairs to desired location of bend in arrow, <m>
- Move crosshairs to desired location of tip of arrow, <m>

8. MOVE OR COPY A BOX

The following steps demonstrate how to move or copy an existing box to a new location on a plot:

- Move crosshairs to lower left corner of box
- Select "L" command
- Move crosshairs to desired new location of lower left corner of box
- Select "M" command or "C" command
- Move crosshairs to desired location of upper right corner of box, <m>

9. MOVE OR COPY A CIRCLE

The following steps demonstrate how to move or copy an existing circle to a new location on a plot:

- Move crosshairs to center of circle
- Select "L" command
- Move crosshairs to desired new location of center of circle
- Select "M" command or "C" command
- Move crosshairs to desired distance away from circle in order to define radius of circle, <m>

10. MODIFY A TEXT LABEL

The following steps demonstrate how to modify an existing text label on a plot:

- Move crosshairs to text label
- Select "L" command
- Select "S" command
- Optional - Move crosshairs to **CHARACTER SIZE** row in red box, select current value <m>, and enter a new character size value, <cr>
- Optional - Move crosshairs to **UNITS** row in red box, select current value <m>, and enter a new units value (0 for real, 1 for screen), <cr>
- Optional - Move crosshairs to **JUSTIFY** row in red box, select current value <m>, and enter a new alignment (justification) value (0 for center, 1 for left), <cr>
- Optional - Move crosshairs to **COLOR** row in red box, select current value <m>, and enter a new color (line size) value, <cr>
- Accept values <m>

11. MODIFY A BOX

The following steps demonstrate how to modify an existing box on a plot:

- Move crosshairs to location of lower left corner of box
- Select "L" command
- Select "S" command
- Optional - Move crosshairs to **COLOR** row in red box, select current value <m>, and enter a new color (line size) value, <cr>
- Accept values <m>

12. MODIFY A CIRCLE

The following steps demonstrate how to modify an existing circle on a plot:

- Move crosshairs to location of center of circle
- Select "L" command
- Select "S" command
- Optional - Move crosshairs to **COLOR** row in red box, select current value <m>, and enter a new color (line size) value, <cr>
- Accept values <m>

13. MODIFY AN ARROW

The following steps demonstrate how to modify an existing arrow on a plot:

- Move crosshairs to arrow's tail
- Select "L" command
- Select "S" command
- Optional - Move crosshairs to **CHARACTER SIZE** row in red box, select current value <m>, and enter a new value to change the size of the arrow's head, <cr>
- Optional - Move crosshairs to **JUSTIFY** row in red box, select current value <m>, and enter a value of 1 to make the arrow's head solid, <cr>
- Optional - Move crosshairs to **COLOR** row in red box, select current value <m>, and enter a new value to change the color (line thickness) of the arrow, <cr>
- Accept values <m>

14. REMOVE A TEXT LABEL

The following steps demonstrate how to remove or delete an existing text label from a plot:

- Move crosshairs to text label
- Select "L" command
- Select "D" command

15. REMOVE AN ARROW

The following steps demonstrate how to remove or delete an existing arrow from a plot:

- Move crosshairs to arrow's tail
- Select "L" command
- Select "D" command

16. REMOVE A BOX

The following steps demonstrate how to remove or delete an existing box from a plot:

- Move crosshairs to lower left corner of box
- Select "L" command
- Select "D" command

17. REMOVE A CIRCLE

The following steps demonstrate how to remove or delete an existing circle from a plot:

- Move crosshairs to center of circle
- Select "L" command
- Select "D" command

18. RETURN TO THE LINE-POINT MODE

The following steps demonstrate how to leave the LABEL MODE and return to the LINE-POINT MODE:

- Move crosshairs to any location above plot
- Select "Q" command

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