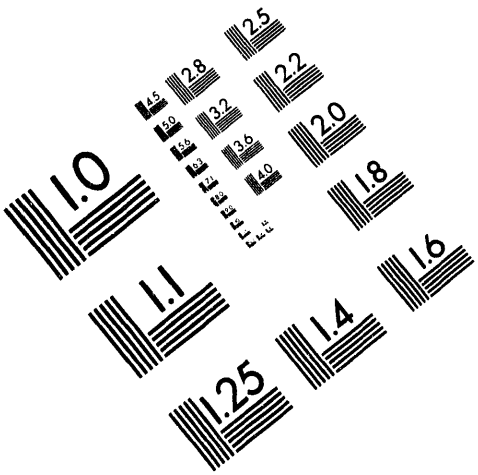

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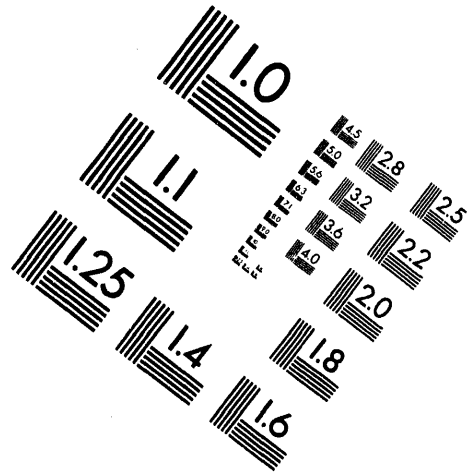

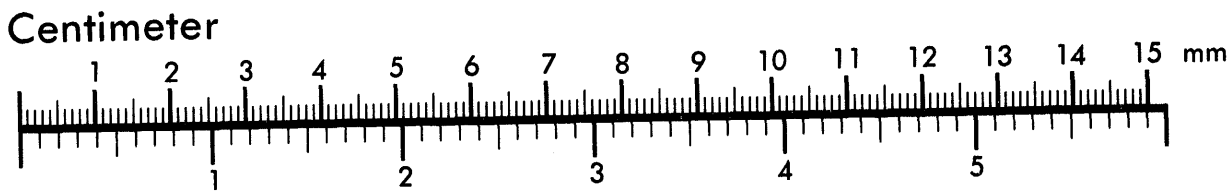

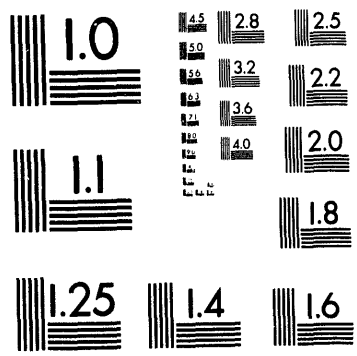

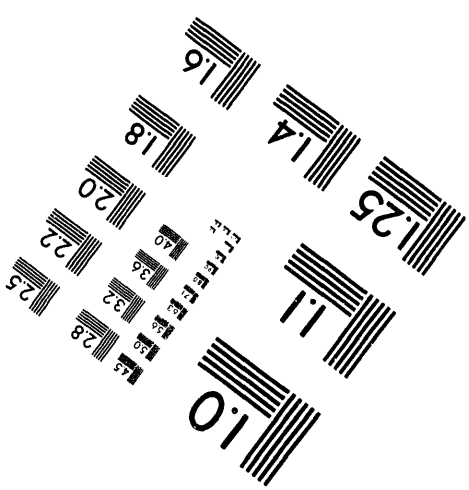

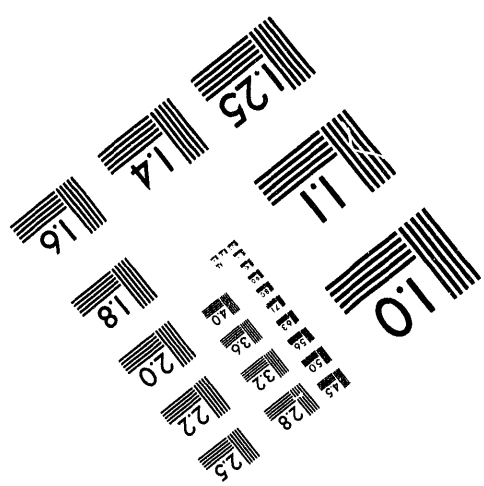

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Vol. 7

Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) Version 5.0

Fault Tree, Event Tree, and Piping & Instrumentation Diagram (FEP) Editors Reference Manual

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ABSTRACT

The Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) refers to a set of several microcomputer programs that were developed to create and analyze probabilistic risk assessments (PRAs), primarily for nuclear power plants. The Fault Tree, Event Tree, and Piping & Instrumentation Diagram (FEP) editors allow the user to graphically build and edit fault trees, event trees, and piping & instrumentation diagrams (P&IDs). The software is designed to enable the independent use of the graphical-based editors found in the Integrated Reliability and Risk Assessment System (IRRAS). FEP is comprised of three separate editors (Fault Tree, Event Tree, and Piping & Instrumentation Diagram) and a utility module. This reference manual provides a screen-by-screen guide of the entire FEP System.

FIN L1429 - SAPHIRE Maintenance and User Support

Documents in NUREG/CR-6116 Report, Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) Version 5.0

Volume 1 - Technical Reference Manual

Volume 2 - Integrated Reliability and Risk Analysis System (IRRAS) Reference Manual

Volume 3 - Integrated Reliability and Risk Analysis System (IRRAS) Tutorial Manual

Volume 4 - Systems Analysis and Risk Assessment (SARA) System Reference Manual

Volume 5 - Systems Analysis and Risk Assessment (SARA) System Tutorial Manual

Volume 6 - Graphical Evaluation Module (GEM) Reference Manual

Volume 7 - Fault Tree, Event Tree, and Piping & Instrumentation Diagram (FEP) Editors Reference Manual

Volume 8 - Models and Results Database (MAR-D) Reference Manual

Volume 9 - Validation and Verification (V&V) Manual

Volume 10 - Data Loading Manual

Previous Reports in the Series

M. K. McKay, N. L. Skinner, S. T. Wood, *Fault Tree, Event Tree, and Piping & Instrumentation Diagram (FEP) Editors, Version 4.0, Reference Manual*, NUREG/CR-5866, EGG-2625, May 1992.

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EXECUTIVE SUMMARY

The Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) refers to a set of several microcomputer programs that were developed to create and analyze probabilistic risk assessments (PRAs), primarily for nuclear power plants. The Fault Tree, Event Tree, and Piping & Instrumentation Diagram (FEP) editors allow the user to graphically build and edit fault trees, event trees, and piping & instrumentation diagrams (P&IDs). The Event Tree and Fault Tree editors are also available through IRRAS; however, the P&ID editor is available only through FEP. The system contains easy-to-use editing features. A unique menu feature called "tear-off menus" is available. This feature allows the user to pick up and move any of the pop-up menus, making it possible to place menus in convenient locations on the drawing surface.

The three editors (fault tree, event tree, and piping & instrumentation diagram) are programmed and displayed to the user in the same fashion. When the user invokes an editor, the primary editing commands are displayed in the left column on the screen and the remaining area of the screen is the drawing surface. Many of the commands shown in this column invoke other pop-up menus. All of these commands are invoked by highlighting the command and pressing the Enter key, or the left mouse button. Although a standard keyboard can be used, a mouse makes FEP an easier and faster system to use than the usual "arrow" keys.

FOREWORD

The U.S. Nuclear Regulatory Commission has developed a powerful suite of personal computer programs for the performance of probabilistic risk assessments (PRAs). This suite of programs, known as the Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE), allows an analyst to perform many of the functions necessary to create, quantify, and evaluate the risk associated with a facility or process being analyzed. These programs include software to define the database structure, to create, analyze, and quantify the data, and to display results and perform sensitivity analyses. The programs included in this suite are as follows: Models And Results Database (MAR-D) software, Integrated Reliability and Risk Analysis System (IRRAS) software, System Analysis and Risk Assessment (SARA) software, and Fault tree, Event tree, and P&ID (FEP) graphical editor software. Each of these programs performs a specific function in taking a PRA from the conceptual state all the way to publication.

MAR-D is a program that is used primarily for PRA data loading. This program defines a common relational database structure that is used by the entire suite of programs. This structure allows all of the software to access and manipulate data created by other software in the system without performing a lengthy conversion. Therefore, data created by IRRAS is immediately available to SARA for sensitivity analysis. The MAR-D program also provides the facilities for loading and unloading of PRA data from the relational database structure used to store the data. A simple ASCII data format is used for interchange with other PRA software not included in NRC's suite of programs. This feature allows for compatibility with previously developed software systems and allows for maximum data interchange. Elements of this software are included with both IRRAS and SARA to allow these programs to load and unload data in the MAR-D format. Normally, the entire MAR-D software is used only by those performing a data loading function and is not required by the end user. Documentation for MAR-D Version 5.0 is available as NUREG/CR-6116, Volume 8. It should be noted that whenever the MAR-D database structure is changed, it necessitates changes in the remaining codes (i.e., IRRAS, SARA, and FEP). Therefore, the code version numbers are changed in unison. Each version set must be used together to maintain compatibility.

IRRAS is a program developed for the purpose of performing those functions necessary to create and analyze a complete PRA. This program includes functions to allow the user to create event trees and fault trees, to define accident sequences and basic event failure data, to solve system and accident sequence fault trees, to quantify cut sets, and to perform uncertainty analysis on the results. Also included in this program are features to allow the analyst to generate reports and displays that can be used to document the results of an analysis. Because this software is a very detailed technical tool, the user of this program should be familiar with PRA concepts and the methods used to perform these analyses. Although IRRAS has been designed to be user friendly and

makes the process of performing a PRA easier, the complexity of this type of analysis requires a user with a more detailed understanding of PRA concepts than is required by other tools in this suite. The IRRAS 5.0 reference manual and tutorial are available as NUREG/CR-6116, Volumes 2 and 3, respectively. In addition, a technical document that provides information on the principles and algorithms used in the construction and operation of IRRAS and SARA is available as NUREG/CR-6116, Volume 1.

SARA is a program that allows the user to review the results of a PRA and to perform limited sensitivity analyses on these results. It is limited primarily to the extent that changes in the plant model can be accommodated by using the cut set editor. If other than simple changes are being simulated, then IRRAS should be used so that new cut sets can be accurately generated. This tool is intended to be used by a less technically-oriented user and does not require the level of understanding of PRA concepts required by IRRAS. With this program a user can review the information generated by a PRA analyst and compare the results to those generated by making limited modifications to the data in the PRA. Also included in this program is the ability to graphically display the information stored in the MAR-D database. This information includes event trees, fault trees, P&IDs and uncertainty distributions. The user of this program can gain a better understanding of the results of a PRA without getting into the details of the construction and analysis work behind the PRA. The SARA reference manual and tutorial are available as NUREG/CR-6116, Volumes 4 and 5, respectively.

FEP is a program developed to provide a common access to the suite of graphical tools developed for performing risk assessment. These tools include the graphical fault tree, event tree, and P&ID editors. The fault tree and event tree editors are available through IRRAS; however, the P&ID editor is only accessible through FEP. The fault tree editor allows the user to construct and modify graphical fault trees. The event tree editor allows the analyst to construct and modify graphical event trees. The P&ID editor allows the user to construct and modify plant drawings. These drawings can then be used to document the modeling used in a PRA. These editors are an integral part of a PRA. With the FEP tool, the user need not be concerned with the complexity of the IRRAS program if the need is only to generate one of these graphical displays. The FEP Reference Manual is available as NUREG/CR-6116, Volume 7.

SAPHIRE Version 5.0

Volume 7—Fault Tree, Event Tree, and Piping & Instrumentation Diagram (FEP) Editors Reference Manual

1. INTRODUCTION

The Fault Tree, Event Tree, and Piping & Instrumentation Diagram (FEP) editors allow the user to graphically build and edit fault trees, event trees, and piping & instrumentation diagrams (P&IDs). The software is designed to enable the use of graphical-based editors found in the Integrated Reliability and Risk Assessment System (IRRAS). FEP is made up of three separate editors (Fault Tree, Event Tree, and Piping & Instrumentation Diagrams) and a utility module. This manual provides a screen-by-screen walkthrough of the entire FEP system.

1.1 Hardware Requirements

The FEP 5.0 system requires the following hardware configuration:

- IBM PC or compatible computer
- 3MB of free fixed disk space
- 640KB of system RAM
- Enhanced Graphics Adapter (EGA) video adapter and monitor.

The following items are not required, but are strongly recommended:

- Math co-processor
- Mouse
- VGA video adapter and monitor.

If an enhanced graphics adapter is used, it must have the memory expansion option to extend the standard 4 colors to 16. This option is an upgrade to the IBM EGA board, but is usually standard on boards manufactured by other vendors.

The recommended configuration consists of all of the above. However, an IBM-AT or better would provide superior performance. A mouse will make operation of FEP much easier. The keyboard can serve as the graphics input device but is not nearly as user-friendly as the mouse.

1.2 Installation Procedures

To install the system on your hard drive, perform the following steps.

1. Insert disk #1, and type

   x:install and press **<Enter>**

   where x is the drive containing the installation diskette(s).

   Figure 1 appears. On this screen, fill out the following information:

   Source drive - Enter the drive containing the installation diskettes.

   Destination Drive - Enter the drive where the FEP files will be installed.

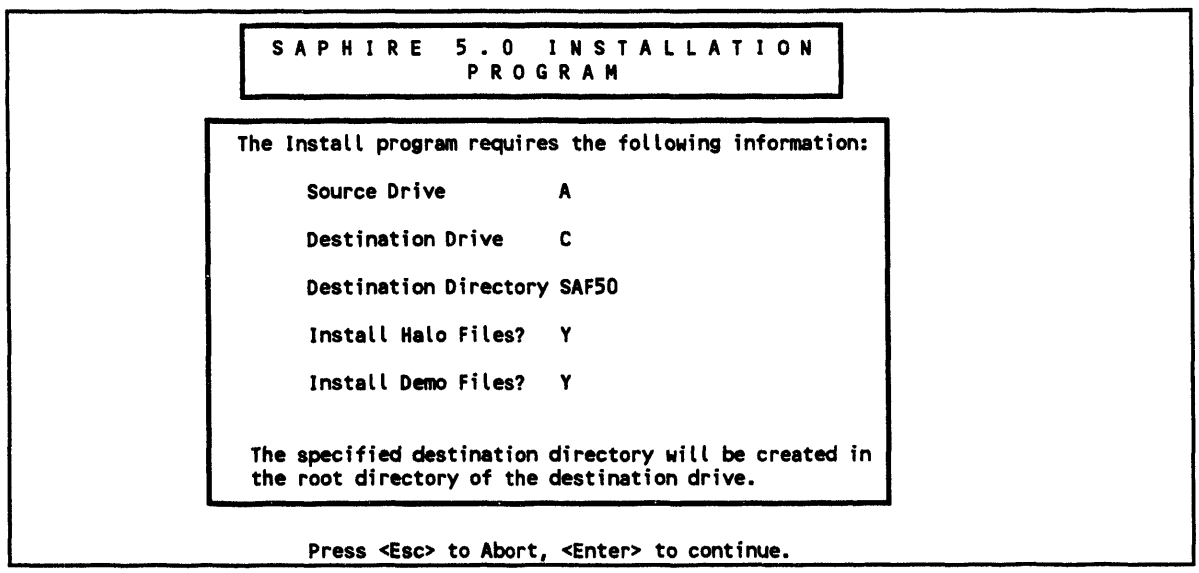


Figure 1. Installation screen.

Destination Directory - Enter the directory name where the FEP program files will be written. The specified destination directory will be created in the root directory of the destination drive.

Install HALO Files - Enter a **<Y>** to install HALO files; otherwise enter an **<N>**. These files are required by the graphical displays generated by FEP.

Install Demo Files - Enter a **<Y>** to load the demonstration database. The DEMO database contains sample data.

When complete, press **<Enter>** to continue.

3. The program files on the installation diskette(s) are compressed. The installation procedure de-compresses these files and copies them onto the hard drive. The de-compression process is indicated by the listing of files being "exploded" or "inflated". These terms are used by the de-compression software to indicate the process used when the files were compressed.

4. When complete, a prompt will appear asking you to insert the next diskette (e.g., DISK #002). Insert the disk and press <Enter> to continue to start the de-compression process for this diskette.

5. Repeat Steps 1 - 4 until all installation disks have been loaded.

6. When complete, you will be returned to the destination directory.

NOTE: If you are loading FEP from a network, you will not be loading diskettes; however, the process is the same.

After the installation is completed, you need to locate and modify your CONFIG.SYS file. This file is in the root directory. If you do not have a file by this name, you must create one. In either case, the following parameters must be included in the file, if not already present.

```
FILES=35
BUFFERS=15
DEVICE=ANSI.SYS
```

The device driver ANSI.SYS must also be copied from the DOS directory to the root directory if it is not already there.

The installation procedure will create a batch procedure, FEP.BAT, for executing FEP 5.0 in the \SAF50 directory. This procedure may be used directly or adapted to meet your specific needs. If you choose not to modify the procedure, the following format is used to execute FEP 5.0. Type:

```
CD\SAF50
FEP
```

This completes the installation of the FEP software. You must now ensure that the proper graphics input device is hooked up and ready for use. When this is done, the FEP system is ready for use.

When executing FEP for the first time, three screens will appear that allow you to define various program constants. Some of the parameters will not be important at this time. However, be sure to set the constants for the type of video (monitor type). Two parameters must be set; one for the video mode (EGA, VGA, VGA+, etc.) and one for the vendor name. These screens will not appear again until you invoke the Define Constants option from the Utility menu.

Refer to Section 7.2, Define Constants, for a complete discussion on defining constants for your configuration.

1.3 Other Modes of Operations

Each of the three graphical editors (fault tree, event tree, and P&ID) can be invoked directly without going through the FEP menu structure. By supplying a command line parameter to the FEP program, you can invoke a particular editor. For example:

C:\SAF50>**fep FTE <Enter>**

tells the FEP software to invoke the Fault Tree Editor. The other two editors can be invoked this same way. The parameter for the Event Tree Editor is **ETE** and for the P&ID Editor the parameter is **PID**.

To execute the graphical editors, the FEP software makes a call to the appropriate software. In other words, the editors can be run 'stand-alone'. If this is to be done, you must ensure that all necessary files are found in the appropriate directories. Before execution of an edito., the FEP program will set up the default constants and tell the editor where the ancillary files are kept. When an editor is run stand-alone, these important files should be placed in the default directory. The following defines which files pertain to each editor. File types are denoted by their three character extension names.

Fault Tree	Event Tree	P&ID
DLS	ETG	PID, STB

DLS, ETG, and PID files are created by the editors. DLS files are the display lists created by the Fault Tree Editor. These files are in a binary format. The PID files, created by the P&ID editor, follow suit to the DLS files. The ETG files are ASCII files. The STB file is a symbol table definition kept in binary form. This file is documented further in the P&ID section of this manual (Section 6). The graphic device driver files are always kept in the \HALO88 directory. These files should be placed in a default directory on the default drive, if the editors are to be run stand-alone.

To execute each editor stand-alone, simply type one of the following commands

FTE
ETE
PIDE

from the drive and directory where these files are found.

1.4 Invoking FEP

As mentioned earlier, to invoke FEP type **FEP** at the C:\SAF50 prompt. When you invoke this option, a disclaimer screen will be displayed for a few seconds followed by the main menu (see Figure 2). Each menu option is discussed in the following sections.

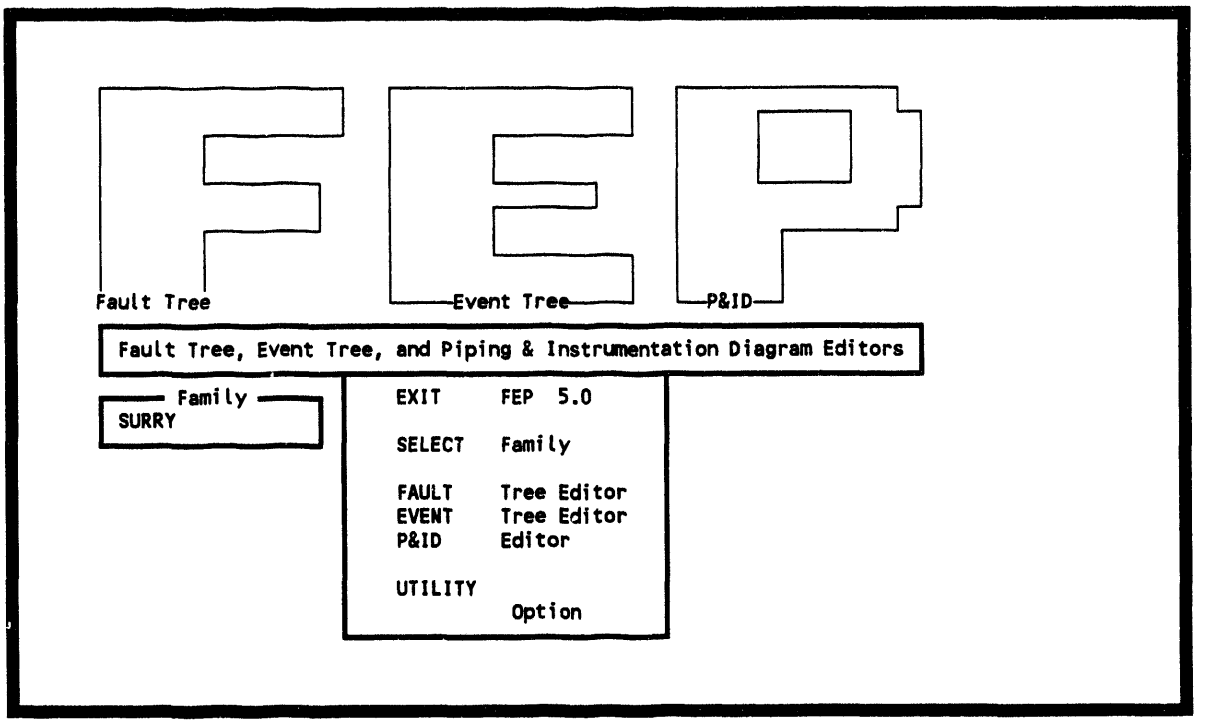


Figure 2. FEP main menu.

1.5 Menu Item Selection

After an editor has been invoked and the menu has been drawn, a cursor will be placed next to the menu. Cursor movement is controlled using a mouse (recommended method) or using the keyboard. To move the cursor simply move the mouse. To select an option on a menu, press the select (left) button. To cancel, press the cancel (right) button. To move the cursor with the keyboard use the cursor/arrow keys; to select use the Enter/Carriage Return or the Ins keys; and to cancel use the Backspace, Esc, or Del keys. The cursor may also be moved in a diagonal direction by using the Home, PgUp, End, and PgDn keys. The select button can be used as an Enter button for input prompts. This is useful when the default is acceptable, and the user simply presses the select button and does not have to move to the keyboard.

To pick any command from the menu the user simply moves the cursor over the command and presses the select button.

2. EXIT

The EXIT option is highlighted when you first enter FEP. To exit FEP and return to the DOS prompt, press <Enter>. Upon returning to the FEP main menu after invoking one of the editors or utility option, you must highlight EXIT, or enter <EX> in the option field, and press <Enter> to exit FEP and return to the DOS prompt.

3. SELECT FAMILY

This option allows you to select the family data set you wish to work with and provides the capability of copying raw (MAR-D) data files or database files into a specific family. A family is a group of models, such as those for a single plant, unit, or facility. When the family is successfully selected, the name is shown in the upper left corner of the screen.

The current directory is the current family unless you select another family. FEP retains the last family you selected when you exited the program so when you enter FEP again the last family selected is the current family. The Select Family screen (Figure 3) lists all families currently available. The select family function provides four options: Exit, Select, Family Copy, and Copy. In addition, three function keys are available:

<Esc> Exits the Select Family module and returns you to the FEP main menu.

<F1> Displays on-line help messages.

<F5> Allows you to locate a specified family. When you press <F5> a blank line will appear on the screen. Enter all or part of the family name you wish to locate and press <Enter>. This feature will place the highlight on the located name. If the requested name is not found, then the next name in alphabetical order will be highlighted. This feature is especially useful when there are several screens of families to display.

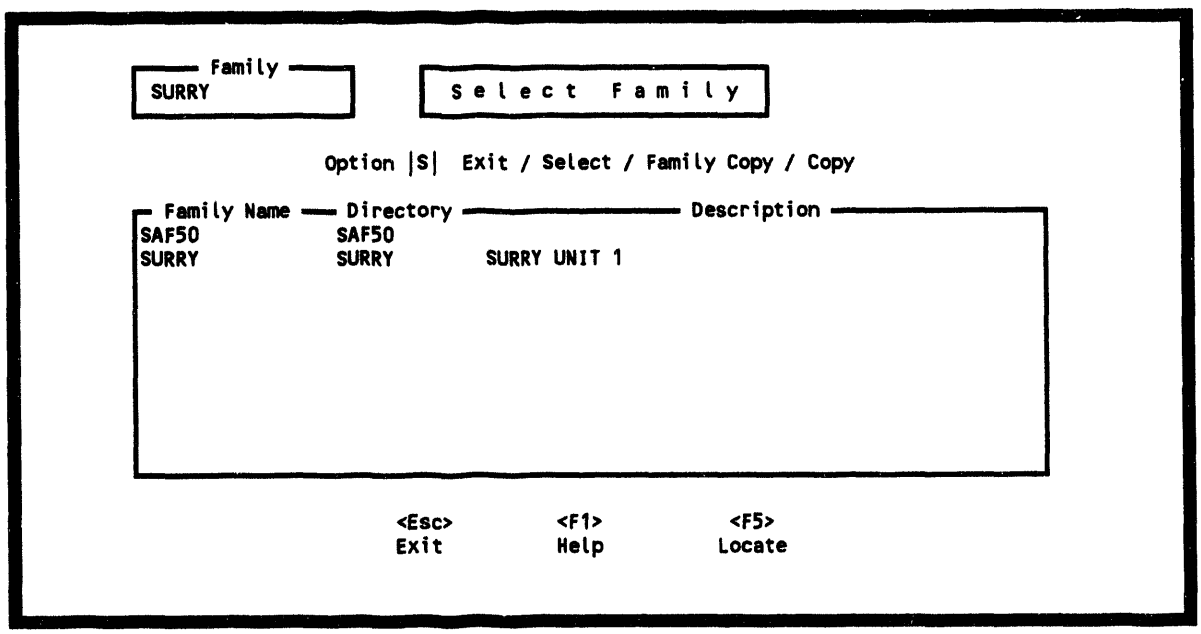


Figure 3. Select family menu.

3.1 Exit

Typing <E> in the option field and pressing <Enter>, or pressing <Esc> will return you to the FEP main menu.

3.2 Select

This option is used to select the family data files that will be accessed during subsequent FEP functions. To invoke the option, type <S> in the option field, highlight a family, and press <Enter>. If a family is not highlighted, the message **Position the cursor over the family to select** will be displayed. When a family is highlighted and selected, you will be returned to the FEP main menu where the selected family name will appear at the left of the menu. If for any reason the family cannot be selected, the message **Unable to select desired family** appears, the previously selected family will be retained, and you will be given another chance to select a family. If the highlighted family's data version does not match the current software version, the version update screen appears (Figure 4), and you will be asked if you want to rebuild the data. To select the family, the data must be rebuilt, so enter a <Y> to rebuild, and then select the desired family. If you type <N>, that family's data will not be rebuilt, that family will not be selected, the former selected family will be retained, and the message **Unable to select desired family** appears.

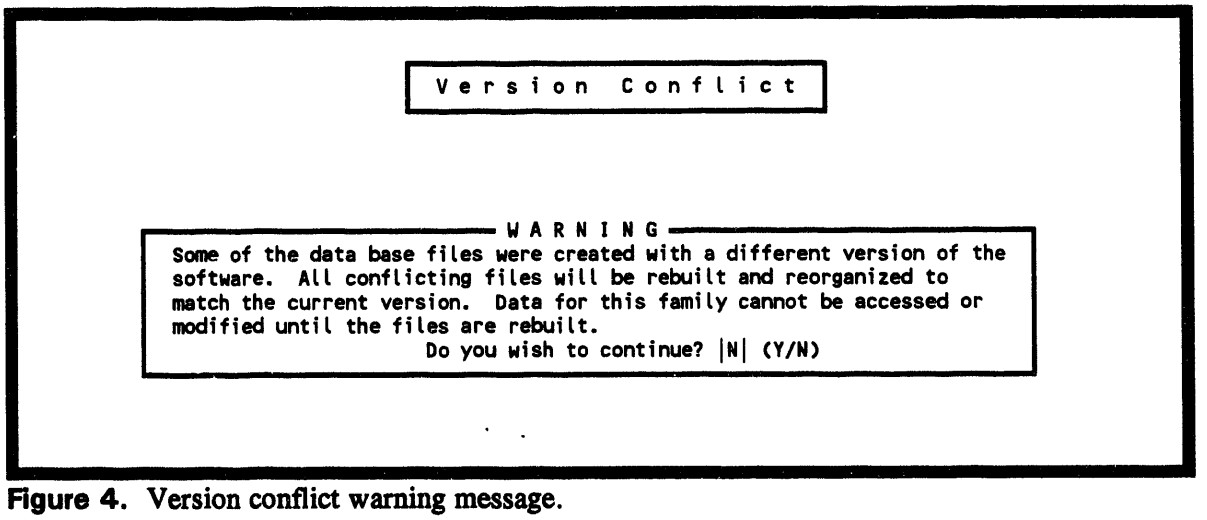


Figure 4. Version conflict warning message.

3.3 Family Copy

This option provides the means of copying database files between families. If a family contains data that the user needs, this option allows them to copy all the data into a new family. Then the user can modify any of the data in the new family while keeping the original family data preserved. The family you are copying to should be empty. This option will overwrite all existing files. To invoke this option, type <F> in the option field, highlight a family, and press <Enter>. If no family has been highlighted, the message **Position the cursor over the family to copy from** appears at the bottom of the screen. If this message appears, highlight a family and press <Enter>. The message **Position the cursor over the family to copy to** will then appear. Again, highlight a family and press <Enter>. All family database files will be copied from the first family highlighted to the second family highlighted. When the files are copied, the message **Family successfully copied** appears.

3.4 Copy

This option provides the means of copying any file (raw data and/or a MAR-D file) into any family. If the user has a need for data that was generated using another application, this option provides the mechanism to copy such data into a family. To invoke this option, type <C> in the option field, highlight the family to copy to, and press <Enter>. If no family is highlighted, the message **Position the cursor over the family to copy to** is displayed at the bottom of the screen. If this message appears, highlight a family and press <Enter>. A new screen, File Copy (shown in Figure 5), requesting the path and file name of the source data being copied into the selected family is displayed. Specify the entire path of the data to be copied and press <Enter> (e.g., A:*.* or D:\RAWDATA\DEMO*.*). A confirmation message **File(s) successfully copied** is displayed when the files have been copied.

Entering an invalid path, a nonexistent file name, or pressing <Enter> without specifying a path results in the data not being located, and displays an error message **Unable to locate requested file(s)**. To return to the Select Family screen without copying a file, press <Esc>. The message **Copy attempt terminated at users's request** appears and the Select Family screen is redisplayed.

If you want to copy to a family that does not yet exist, you must first add the family using IRRAS or MAR-D. To add a family, see the Modify Database option for MAR-D or IRRAS. After you have added the family, you may return to FEP, invoke the Select Family option and copy your database into the new family.

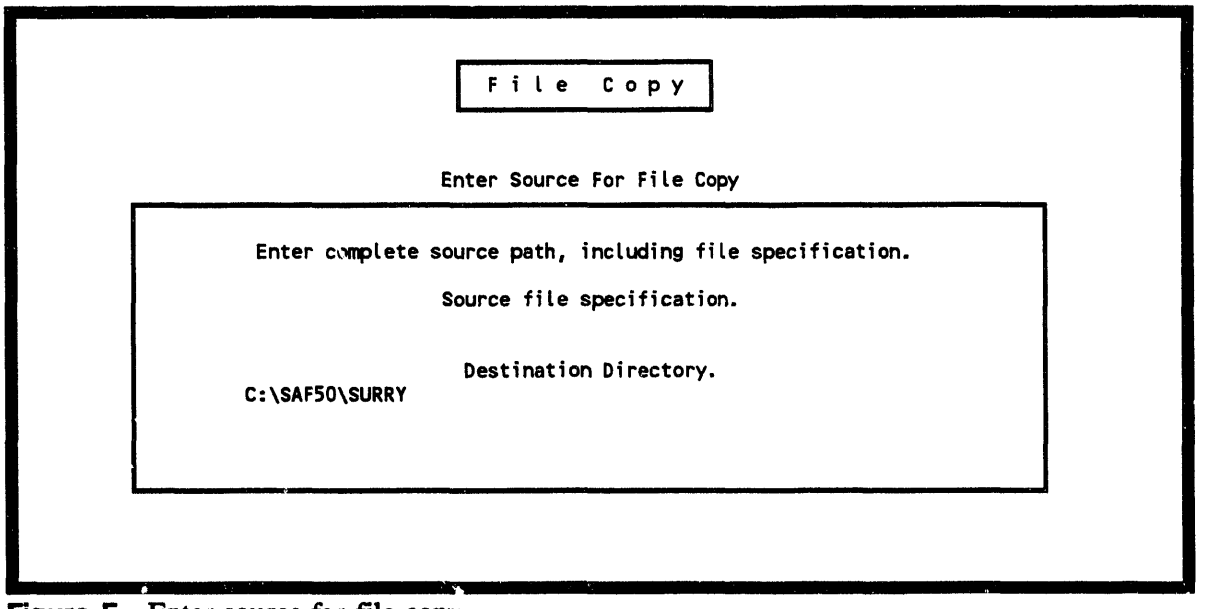


Figure 5. Enter source for file copy.

4. FAULT TREE EDITOR

The Fault Tree Editor is available through FEP and through IRRAS. The Fault Tree Editor allows you to construct the actual fault tree diagram. You may start building from scratch or from an existing file to generate or modify logic. To invoke the Fault Tree Editor you may select it from the FEP main menu or supply a command line parameter to the FEP program. To invoke the Fault Tree Editor using a command line parameter, type:

C:\SAF50>**fep FTE <Enter>**

When the Fault Tree Editor is invoked, Figure 6 will be displayed. The editing commands are shown in the left column, while the rest of the screen is the drawing surface. The editing commands shown in upper-case letters (except EXIT and SHOW) have additional pop-up menus associated with them. The cursor is used to position pop-up menus, draw lines, place drawing symbols, and select menu options.

To invoke any of the editing commands (using a mouse), position the cursor over the desired editing command on the active menu. The active menu is the last menu you pulled up or moved. When the editing command box is highlighted (a white line outlines the box), press the left mouse button. The command is now invoked. Each editing command is described in the following paragraphs.

4.1 EXIT

This option terminates the editing session and returns you to the previous screen. To invoke this option, position the cursor over the EXIT box and press the left mouse button or <Enter>.

4.2 Move

The move command ("tear-off" menu), which is represented by ←→, allows you to position the editing command menu anywhere on the screen. When you invoke this command, a white line surrounds the entire editing menu. Drag the cursor to position the outline at the new location and press the left mouse button or <Enter>. The menu will be displayed at the new location.

4.3 SHOW

This command clears the screen and re-displays the currently defined diagram.

4.4 BILD

This command allows you to generate drawing symbols. When you invoke this command, an additional pop-up menu is displayed (Figure 7). This submenu contains all the constructs needed to create fault tree models. These constructs are

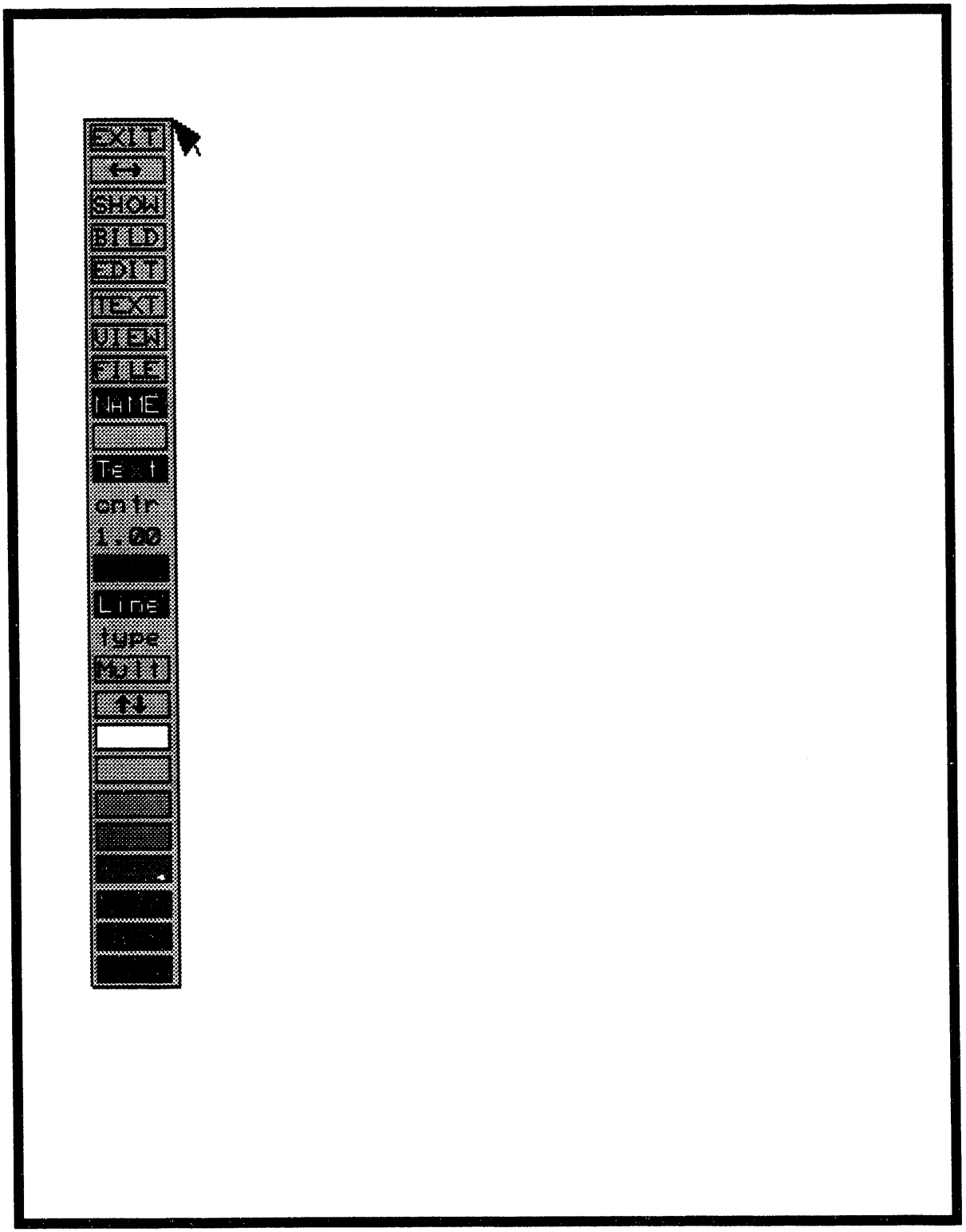


Figure 6. Editing commands for the BILD option.

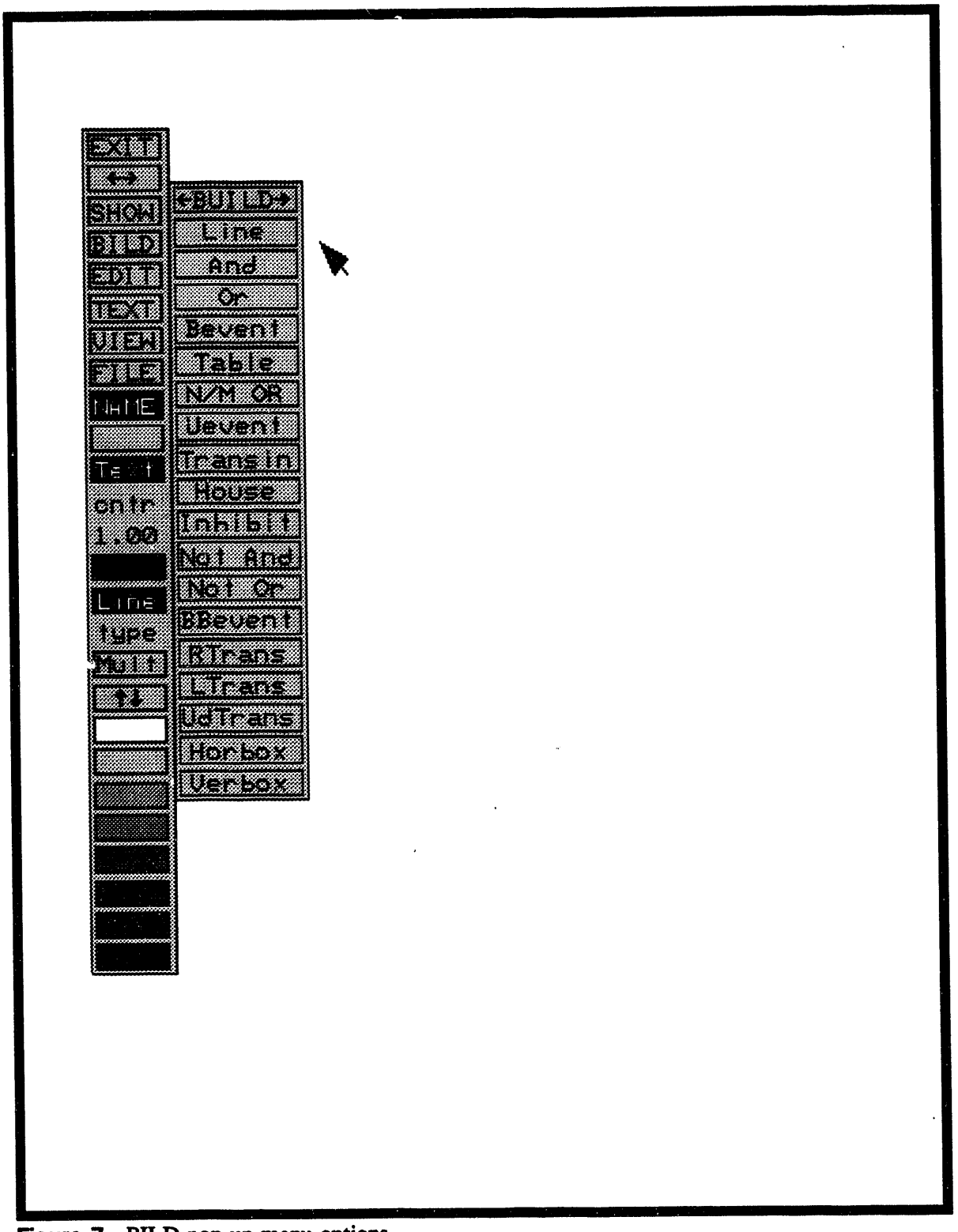


Figure 7. BILD pop-up menu options.

←BUILD→	Allows you to move the BUILD pop-up menu to a new location on the screen. When you invoke this command, a white outline box appears. Drag the cursor to position the outline to the desired location and press the left mouse button or <Enter>. The BUILD pop-up menu will be re-displayed at the new location.
Line	Allows you to draw lines. When you invoke this option, you will be prompted with **Enter points for line**. The cursor will change from an arrow to a cross hair. Position the cross hair at the point where you want the line to begin, press the left mouse button or <Enter>. The cross hair will now change into a small dot. Drag the cursor in the direction you want the line to follow. When satisfied with the length and direction of the line, press the left mouse button or <Enter>. If the multipick option is turned on (see Section 4.16), the prompt **Enter points for next line** will appear. You may draw another line or press the right mouse button to terminate line mode. When you terminate line mode, the cross hair will return. Press the right mouse button to return to the normal cursor mode (arrow).
And	Generates the "And" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another And symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate And symbol generation.
Or	Generates the "Or" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another Or symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Or symbol generation.
Bevent	Generates the "Bevent" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another Bevent symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Bevent symbol generation.
Table	Generates the "Table" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another Table symbol will appear automatically. You can

position this symbol to the desired location or press the right mouse button to terminate Table symbol generation.

N/M OR

Generates the "N/M OR" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. The prompt **Enter N (out of) M values** will appear at the bottom of the screen. Enter the required values (e.g. 2 5) and press <Enter>. If the multipick option is turned on (see Section 4.16), another N/M OR symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate N/M OR symbol generation.

Uevent

Generates the "Uevent" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another Uevent symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Uevent symbol generation.

Transin

Generates the "Transin" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another Transin symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Transin symbol generation.

House

Generates the "House" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another House symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate House symbol generation.

Inhibit

Generates the "Inhibit" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another Inhibit symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Inhibit symbol generation.

Not And	Generates the "Not And" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another Not And symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Not And symbol generation.
Not Or	Generates the "Not Or" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another Not Or symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Not Or symbol generation.
BBevent	Generates the "BBevent" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another BBevent symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate BBevent symbol generation.
RTrans	Generates the "RTrans" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another RTrans symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate RTrans symbol generation.
LTrans	Generates the "LTrans" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another LTrans symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate LTrans symbol generation.
UdTrans	Generates the "UdTrans" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another UdTrans symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate UdTrans symbol generation.
Horbox	Generates the "Horbox" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another Horbox symbol will appear automatically. You

can position this symbol to the desired location or press the right mouse button to terminate Horbox symbol generation.

Verbox — Generates the "Verbox" symbol. Move the symbol to the desired screen location and press the left mouse button or the <Enter> key. If the multipick option is turned on (see Section 4.16), another Verbox symbol will appear automatically. You can position this symbol to the desired location or press the right mouse button to terminate Verbox symbol generation.

4.5 EDIT

This option allows you to modify fault tree diagrams. In addition to modifying the actual diagram, you may use this option to load existing diagrams and modify various attributes of the drawing. When you invoke the EDIT option, a pop-up menu (Figure 8) will be displayed. The first box, ←EDIT→, is used to position the pop-up menu to a new location on the screen. The remaining editing options are described in the following paragraphs.

4.5.1 ATTRIBUTES

This option allows you to specify the actual attributes of the symbols and text used in the fault tree diagram. Attributes include text size, line type, fill, font size, etc. Changing the attributes does not affect the global (default) values. Only the specific objects selected while in the given mode (e.g., Fill Col, Line Col, etc.) will be affected. When you invoke this option an additional pop-up menu is displayed as shown in Figure 9. The following attributes may be modified:

Fill Col - This attribute allows you to change the color for the drawing symbols. When you pick this option, the message **Pick a new color from the color bar** will be displayed at the bottom of the screen. To select a color, position the cursor over the desired color and press the left mouse button. (**NOTE:** The ↑↓ (color) option is active at this time. This option will display the additional color selections available.) Next, you will be prompted to **Pick shapes to be modified**. The cursor will change to a cross hair. Box the shapes to be changed by marking opposite corners. To box the symbols, position the cursor on the symbols to change and press the left mouse button. The cross hair is replaced with a small white dot. Drag the cursor over the shapes to be changed. An outline box appears. When the box surrounds the desired shapes completely, press the left mouse button. The box will disappear and the selected symbols will change to the new color. If no shapes change color, then the selected box was not large enough to include any shapes. If the multipick option is turned on (see Section 4.16), you will be prompted to **Pick next shapes to be modified**. At this point you may select more shapes or press the right mouse button to terminate this process.

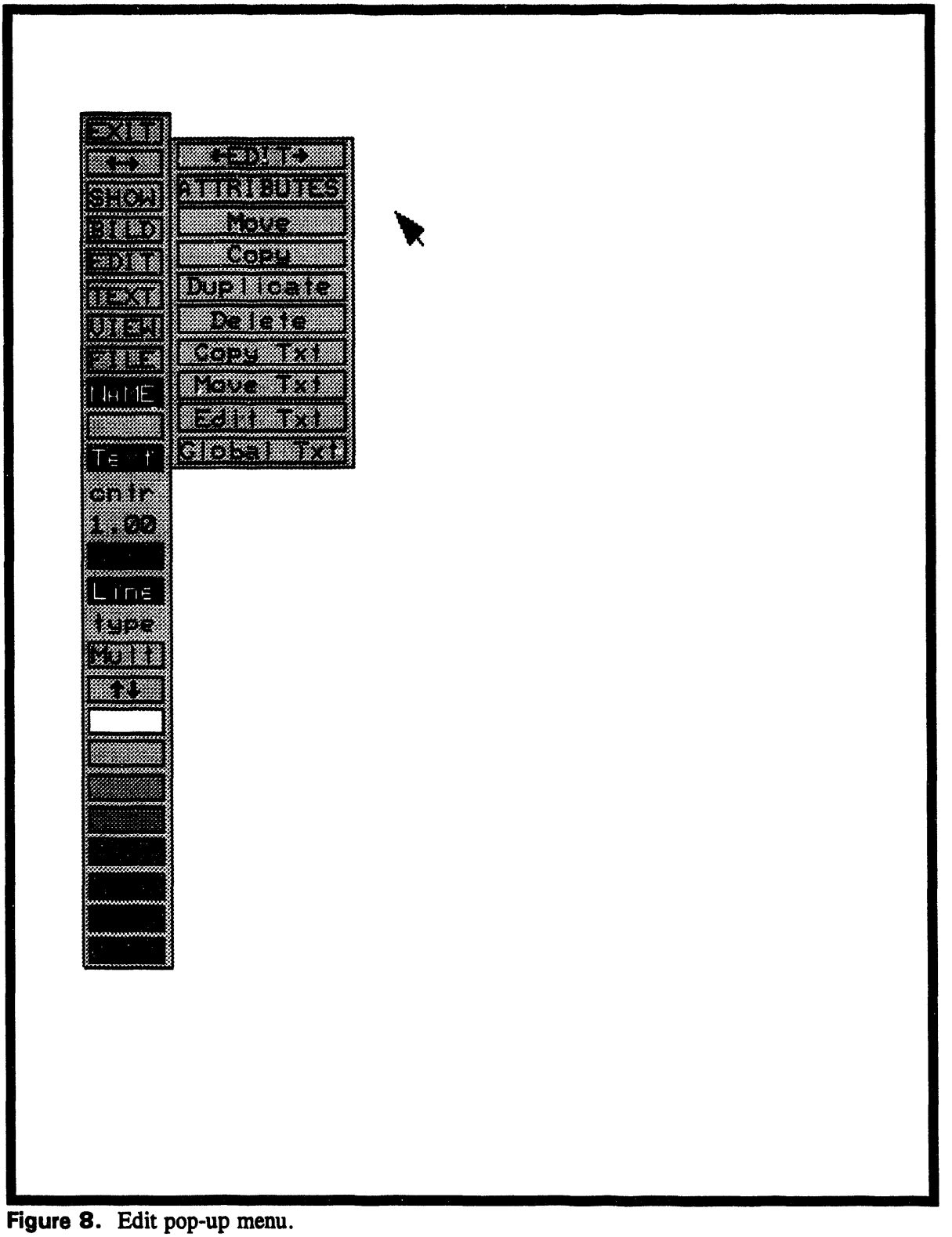


Figure 8. Edit pop-up menu.

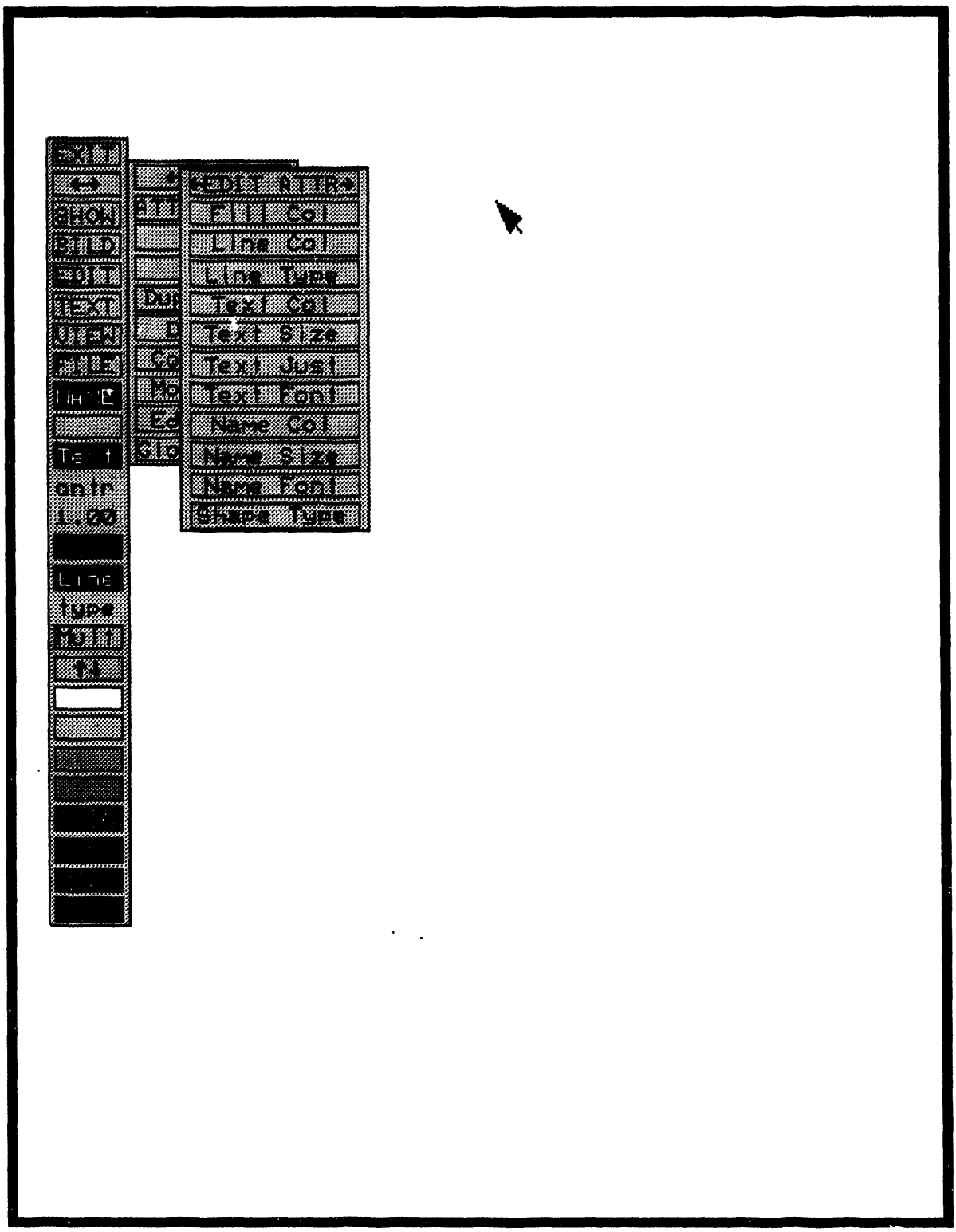


Figure 9. Attributes pop-up menu.

Line Col - This attribute allows you to change the color of the lines in the current diagram. Again, you will be prompted to **Pick a new color from the color bar**. To select a color, position the cursor over the desired color box and press the left mouse button. (**NOTE:** The ↑ ↓ (color) option is active at this time. This option will display the additional color selections available.) Next, you will be prompted to **Pick the line(s) to be modified**. The cursor will change from an arrow to a cross hair. Box the lines to be changed by marking opposite corners. To box the lines, position the cursor on the lines whose color you wish to change and press the left mouse button. The cross hair is replaced by a small white dot. Drag the cursor through the lines to be modified. A box appears surrounding the chosen lines. When the box completely surrounds the chosen lines, press the left mouse button. The box will disappear and the selected line(s) will change to the new color. If the multipick option is turned on (see Section 4.16), you will be prompted to **Pick next line(s) to be modified**. At this point, you may choose additional lines to change, or press the right mouse button to terminate the process.

Line Type - This attribute allows you to select the line type. When you select this option, a small window appears displaying the three available line types (solid, broken, or dotted line). You will be prompted to **Pick line type**. The cursor will change to a cross hair. Position the cross hair over the desired line type, and press the left mouse button. Next, you will be prompted to **Pick line(s) to be modified**. Box the lines to be changed by marking the opposite corners of the region. Choose the lines to be modified by positioning the cursor over the lines to be modified and pressing the left mouse button. Again, the cursor changes to a small dot. Drag the cursor over the lines to be modified. An outline box will appear. When the box completely surrounds the lines to be modified, press the left mouse button. The box will disappear and the selected lines will change to the new line type. If the multipick option is turned on (see Section 4.16), you will be prompted to **Pick next line(s) to be modified**. At this point, you may select more lines or press the right mouse button to terminate the process. Upon termination, the normal cursor will return.

Text Col This attribute option allows you to change the color of the text in your fault tree diagram. When you invoke this option, you will be prompted to **Pick a new color from the color bar**. Position the cursor over the desired color and press the left mouse button. (**NOTE:** The ↑ ↓ (color) option is active at this time. This option will display the additional color selections available.) Next, you will be prompted to **Pick text to be modified**. The cursor will change from an arrow to a cross hair. Box the text to be changed by marking the opposite corners of the text area. To box the area, position the cursor over the text to be changed and

press the left mouse button. A small dot will appear. Drag the cursor over the text until the outline box surrounds all the desired text. Press the left mouse button. All selected text will change to the new color. If the multipick option is turned on (see Section 4.16), you will be prompted to **Pick next text to be modified**. At this point you can select more text or press the right mouse button to terminate the process. The color change will only affect the selected text.

Text Size - This attribute option allows you to specify the height of the text in your diagram. When you invoke this option, you will be prompted to **Enter text size**. Text sizes are indicated by a number between 0.01 and 66.00, with 66 being the full 66 lines from the top to the bottom of the screen. This roughly corresponds to the 66 lines on a full sheet of regular paper. For the purpose of writing text in gate blocks, a text size of about 0.5 is appropriate. The size looks too small on the screen, but it is a good size for sending to a laserjet printer. Larger text sizes will be necessary for printers with lower resolution. Next, you will be prompted to **Pick text to be modified**. Position the cursor on the text to be resized and press the left mouse button. A small dot will appear. Drag the cursor over the text to be resized. When the outline box completely surrounds the text to be modified, press the left mouse button. The box will disappear and the selected text will be displayed in the new text size. If the multipick option is turned on (see Section 4.16), you will be prompted to **Pick next text to be modified**. At this point you can select more text, or press the right mouse button to terminate the process. This new text size will only affect the selected text.

Text Just - This attribute allows you to justify selected portions of the text in your diagram. When you invoke this option, you will be prompted to **Pick text to be modified**. Position the cross hair over the text to be justified and press the left mouse button. A small dot will appear. Drag the cursor over the text to be justified. When the outline box completely surrounds the desired text, press the left mouse button. The outline box will disappear and the selected text will be justified (see Section 4.11 for a complete discussion on setting the justification). If the multipick option is turned on (see Section 4.16), you will be prompted to **Pick next text to be modified**. At this point you may select additional text to be justified or press the right mouse button to terminate the process. Only the selected text will be justified. The remaining text will be unchanged.

Text Font This attribute option allows you to select the font type for selected text. When you select this option an additional pop-up menu will be displayed (Figure 10). Select the desired font type by positioning the cursor over the font and pressing the left mouse button. You must select a font (or cancel) in order to continue. Next, you will be prompted to **Pick text to be modified**. Position the cursor over the text to be changed and

press the left mouse button. A small dot will appear. Drag the cursor over the text to be modified. When the box completely surrounds the text to be modified, press the left mouse button. The selected text will be displayed in the new font size. If the multipick option is turned on (see Section 4.16), you will be prompted to **Pick next text to be modified**. At this point you may select more text, or press the right mouse button to terminate the process. Only the selected text will carry the new font type. The remaining text (unselected) will remain unchanged.

Name Col - This attribute option allows you to change the color of the default or given name of the symbol/shape. When you select this option, you will be prompted to **Pick a new color from the color bar**. Position the cursor over the desired color and press the left mouse button. (**NOTE:** The ↑ ↓ (color) option is active at this time. This option will display the additional color selections available.) Next, you will be asked to **Pick shapes to be modified**. Position the cross hair over the shapes to be changed and press the left mouse button. A small dot will appear. Drag the cursor over the shapes to be modified. You must be sure to place the box completely around the shape and not just the name. When the box surrounds the desired shapes, press the left mouse button. The selected symbol name(s) will change to the new color. If the multipick option is turned on (see Section 4.16), you will be prompted to **Pick next shapes to be modified**. At this point you may select additional shapes or press the right mouse button to terminate the process.

Name Size - This attribute option allows you to specify the height of the shape name in your diagram. When you invoke this option, you will be prompted to **Enter text size**. Text sizes are indicated by a number between 0.01 and 66.00, with 66 being the full 66 lines from the top to the bottom of the screen. This roughly corresponds to the 66 lines on a full sheet of regular paper. For the purpose of writing text in gate blocks, a text size of about 0.5 is appropriate. The size looks too small on the screen, but it is a good size for sending to a laserjet printer. Larger text sizes will be necessary for printers with lower resolution. Next, you will be prompted to **Pick shapes to be modified**. Position the cursor on the shape to be modified and press the left mouse button. A small dot will appear. Drag the cursor over the text to be changed. When the box surrounds the shapes to be modified, press the left mouse button. If the multipick option is turned on (see Section 4.16), you will be prompted to **Pick next shapes to be modified**. At this point you can select more shapes, or press the right mouse button to terminate the process. This new text size will only affect the selected shapes.

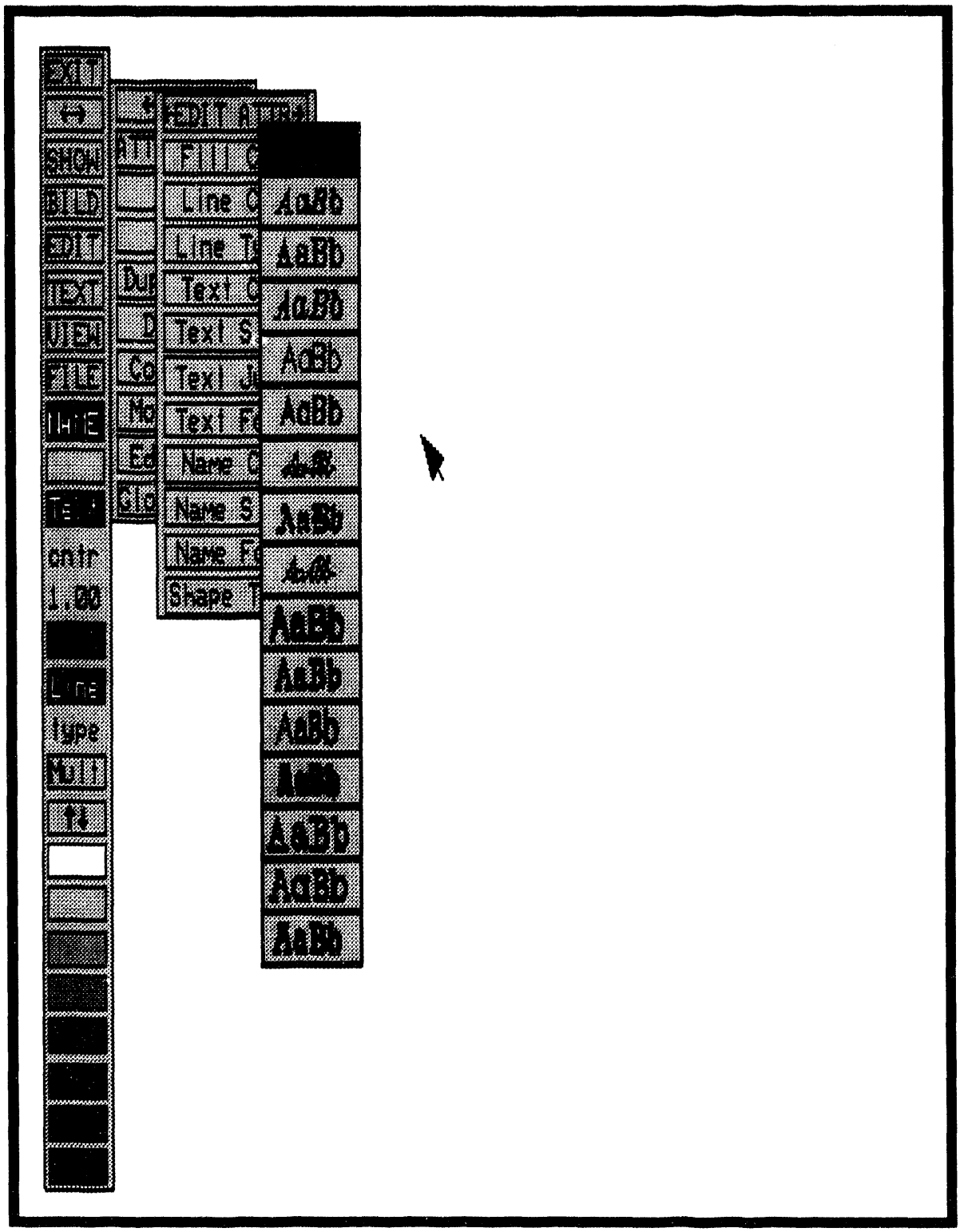


Figure 10. Font selection screen.

Name Font

This attribute option allows you to select the font type the shape name will have in your diagram. When you select this option an additional pop-up menu will be displayed (Figure 10). Select the desired font type by positioning the cursor over the font and pressing the left mouse button. Next, you will be prompted to **Pick shapes to be modified.** Position the cursor over the shapes to be changed and press the left mouse button. A small dot will appear. Drag the cursor over the text to be modified. When the box surrounds the shapes to be modified, press the left mouse button. If the multipick option is turned on (see Section 4.16), you will be prompted to **Pick next shapes to be modified.** At this point you may select more shapes, or press the right mouse button to terminate the process. Only the selected shapes will carry the new font type. The remaining shapes (unselected) will be unchanged.

Shape Type

This attribute allows you to change an existing symbol in the current diagram to another symbol. When you select this option an additional pop-up menu will be displayed showing a menu similar to the build pop-up menu shown in Figure 7. You will be prompted to **Select the new shape type, or <cancel> to quit.** On this menu, you must select the desired shape. This is the symbol with which you are replacing the existing symbol. Highlight the desired symbol and press the left mouse button on the <Enter> key. You will be prompted with **Select shapes to be changed to new type.** Position the cursor over the shape to be changed to the new shape and press the left mouse button or the <Enter> key. A small dot appears. Drag the cursor over the shape(s) to be changed. When the box completely surrounds the desired shape(s), press the left mouse button. The box will disappear and the symbols will be changed to the new symbols. If the multipick option is turned on (see Section 4.16), you will be prompted to **Select next shape(s) to be changed or <cancel> to reselect type.** At this point you may select more shapes to change, or press the right mouse button to select a new replacement symbol.

4.5.2 Move

This editing option allows you to move a portion of the diagram to a new location. When you invoke this option, you will be prompted to **Box region to be moved - press CANCEL to quit.** Position the cross hair over the region to be moved and press the left mouse button. A small dot will appear. Drag the cursor over the region until the box completely surrounds the region to be moved, and press the left mouse button. Next, you will be prompted to **Pick reference point - press CANCEL to reselect.** The reference point is used to give you some indication of the position of the object being moved relative to the box. Position the cross hair at the location where you want the selected region to be moved. Next, you will be prompted to **Position Box at new location - press CANCEL to reselect.** Use the cursor to move the box to the exact position where you want the box to appear. When you are satisfied with the new position press the right mouse button. The selected region will be moved to this

new location. If the multipick option is turned on (see Section 4.16), you will be returned to the **Position box at new location ...** prompt. At this point you may select a new location to move the selected symbols or press the right mouse button to return to the "box region" prompt. At this point you may select another region to move or press the right mouse button to terminate the process.

4.5.3 Copy

This editing option allows you to copy a portion of the diagram and move it to a new location. This option does not create an exact copy, but rather copies the structure of the objects. When you invoke this option, you will be prompted to **Box region to be copied - press CANCEL to quit.** To box the region to be copied, mark the opposite corners of the region. Position the cross hair on the region to be copied and press the left mouse button. A small dot will appear. Drag the cursor over the region to be copied until the box completely surrounds the region. Press the left mouse button. You will be prompted to **Pick reference point - press CANCEL to reselect.** Position the cursor at the location you want the region to be copied to and press the left mouse button. The selected region will be copied and displayed at the chosen location. If the multipick option is turned on (see Section 4.16), you will be returned to the **Position Box at new location -press CANCEL to reselect** prompt. At this point you can copy the selected region to another location on the diagram, or press the right mouse button to terminate the process. If the process is terminated, you will be returned to the "box region" prompt. You may select another region to copy or press the right mouse button to terminate the process.

4.5.4 Duplicate

This editing option allows you to duplicate a portion of the fault tree diagram. This option makes an **exact** copy. Duplicate replicates the structure, logic, and even the names used. When you invoke this option, you will be prompted to **Box region to be duplicated -press CANCEL to quit**. To box the region to be duplicated, mark the opposite corners of the region. Position the cross hair at the area to be duplicated and press the left mouse button. A small dot appears. Drag the cursor over the area to be duplicated until the outline box completely surrounds the desired area. When complete, press the left mouse button. The box will disappear and you will be prompted to **Pick reference point - press CANCEL to reselect.** Position the cursor at the desired point and press the left mouse button. An outline box the size of the selected area will appear. You will be prompted to **Position Box at new location - press CANCEL to reselect.** Position the cursor at the desired location and press the left mouse button. The selected area will be duplicated (an exact copy) and displayed at the new location. If the multipick option is turned on (see Section 4.16), another outline box will appear and you will be prompted to **Position Box at new location - press CANCEL to reselect.** At this point, you can duplicate the region again, or press the right mouse button to terminate the process. You will be returned to the **Box region to be duplicated** prompt. You may select another region to be duplicated or press the right mouse button to cancel the process.

4.5.5 Delete

This editing option allows you to delete any portion of the displayed fault tree diagram. When you invoke this option, you will be prompted to **Pick region to be deleted**. Position the cursor at the place you want to delete and press the left mouse button. A small dot will appear. Drag the cursor over the area to be deleted until the outline box completely surrounds the area. Press the left mouse button. Next, you will be prompted **Delete region? Left = delete, Right = cancel**. If the boxed area is the area you want to delete, press the left mouse button. If it is not the desired region, press the right mouse button. If the multipick option is turned on (see Section 4.16), you will be prompted to **Pick next region to be deleted**. At this point you may select another region to delete, or press the right mouse button to terminate the process.

4.5.6 Copy Txt

This option allows you to copy text from one area of the diagram to another. When you invoke this option, you will be prompted to **Pick text to be copied - press CANCEL to quit.** Position the cross hair on the text to be copied. A small dot will appear. Drag the cursor over the text until the outline box completely surrounds the entire text. Press the left mouse button. Next, you will be prompted to **Pick reference point - press CANCEL to reselect.** The reference point is used to give you some indication of the position of the object being moved relative to the box. Position the cursor at the desired point and press the left mouse button. You will be prompted to **Position Box at new location - press CANCEL to reselect.** The selected text will now be displayed at the new location. (The text still remains at its original location). If the multipick option is turned on (see Section 4.16), you will be prompted to **Position Box at new location**. At this point you may copy the text to yet another location or press the right mouse button to terminate the process. You will be returned to the **Pick text to be copied - press CANCEL to quit** prompt. You may select another piece of text to copy or press the right mouse button to terminate the copy process.

4.5.7 Move Txt

This editing option allows you to move text from one area of the diagram to another. When you invoke this option, you will be prompted to **Pick text to be moved - press CANCEL to quit.** To mark the text to be moved, box the opposite corners of the text region. Position the cross hair at the start of the text to be moved, and press the left mouse button. A small dot will appear. Drag the cursor over the text to be moved until the outline box completely surrounds the desired text. Press the left mouse button. Next, you will be prompted to **Pick reference point - press CANCEL to reselect**. The reference point is used to give you some indication of the position of the object being moved relative to the box. Position the cursor at the desired location and press the left mouse button. You will be prompted to **Position Box at new location - press CANCEL to reselect.** Move the cursor until the box is positioned at the point where you want to move the text. Press the left mouse button again. The text will be moved to the new location. If the multipick option is turned on (see Section 4.16), the box will appear again and you will be prompted to **Position Box at new location - press CANCEL to reselect.** At this point you can move the same text to yet another location or press the right mouse button to terminate the process. If you choose to terminate, you will be returned to the **Pick text to be moved**

prompt. You may choose more text to move or press the right mouse button to cancel the move text option. **NOTE:** When you move text, the selected text will be removed from its original position.

4.5.8 Edit Txt

This editing option allows you to edit text. When you invoke this option, you will be prompted to **Box text to be edited**. To box the text to be edited, mark the opposite corners of the text region. Position the cursor at the text to be modified and press the left mouse button. A small dot will appear. Drag the cursor over the text to be modified until the outline box surrounds all the desired text. Press the left mouse button. A large window will appear displaying the selected text in a readable format. The text is displayed one line at a time. To edit the text, simply type over the existing text. You may use the <Ins> and <Del> keys to add and delete characters as necessary. In addition, you may use the backspace and end keys. Backspace moves all characters from the right of the cursor to the left one space. The End key positions the cursor at the end of the current line. When complete, press <Esc> and the next line of text will appear. When complete, you will be prompted to **Box text to be edited** (if the multipick option is turned on - see Section 4.16). At this point you can select additional text to modify or press the right mouse button to terminate the process.

4.5.9 Global Txt

This editing option allows you to replace a specified word or group of words with a new word(s) at each and every occurrence in the fault tree diagram. When you invoke this option, you will be prompted to **Enter search string:**. Enter the word or phrase to be replaced (up to 42 characters are allowed for one search) and press <Enter>. Next, you will be prompted to **Enter replacement string:**. Enter the replacement word or phrase (again, up to 42 characters are allowed) and press <Enter>. Every occurrence will be replaced. When complete, the normal cursor (arrow) will return. **NOTE:** All occurrences of the strings will be replaced. For example, if you have a string in a text area you wish to change and that string also happens to be part of a NAME, both instances will be replaced with the new string.

4.6 TEXT

The TEXT command allows you to create titles, labels, descriptions, and names for your fault tree diagram. When you invoke this option, Figure 11 will be displayed. Each of the text submenu options is described in the following paragraphs.

The first option shown, ←TEXT→, is used to move the options menu to a new location. Position the cursor on the ←TEXT→ box and press the left mouse button. An outline box will appear. Position the box to the desired location and press the left mouse button. To remove the text suboptions menu, position the cursor anywhere in the text suboptions column and press the right mouse button.

The remaining TEXT suboptions are discussed in the following paragraphs.

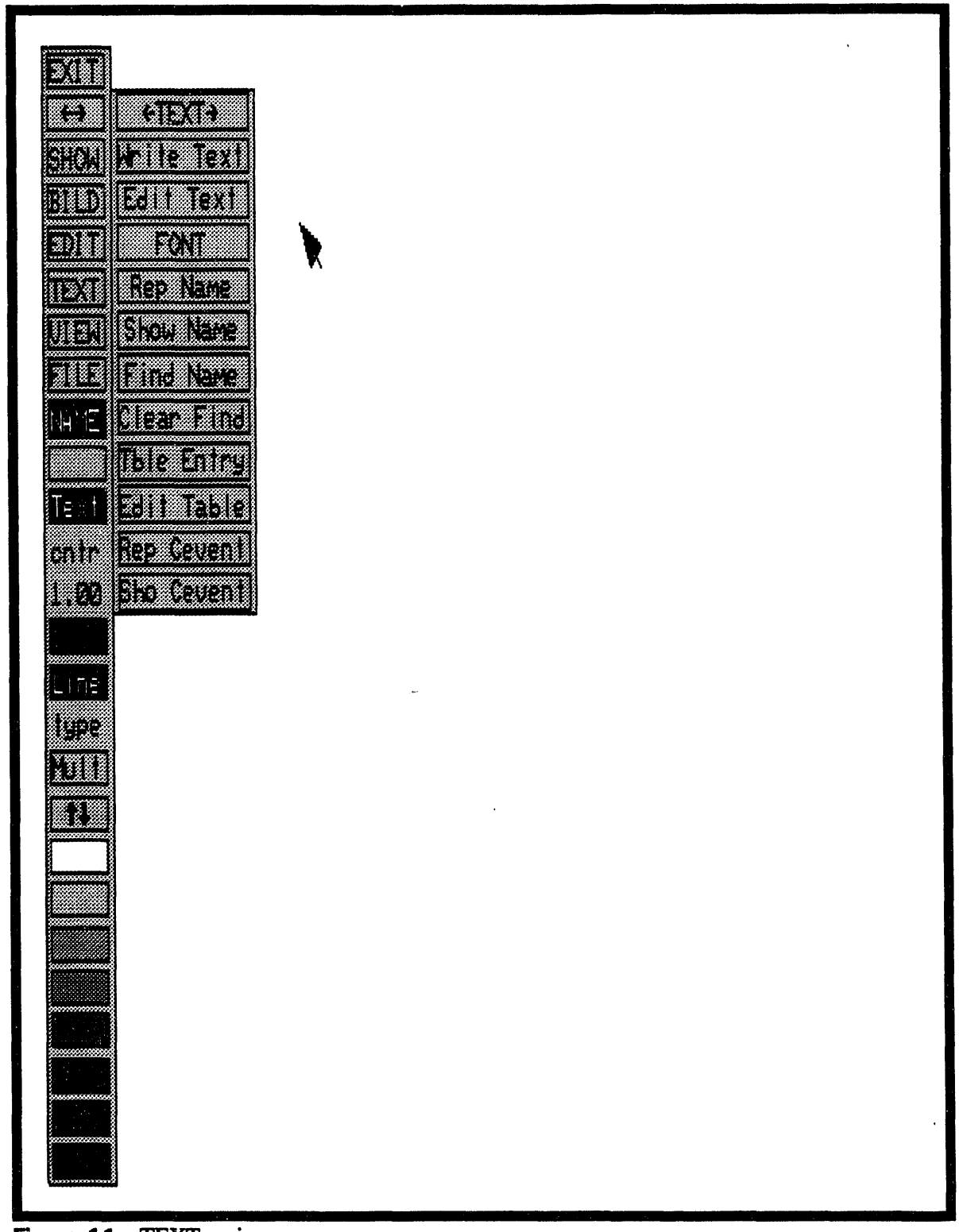


Figure 11. TEXT main menu.

4.6.1 Write Text

This text suboption allows you to add text anywhere on the fault tree diagram. When you invoke this option, you will be prompted to **Pick location for text**. Position the cursor where you want to write text and press the left mouse button. A window will appear. This window can hold up to 10 lines of text. Type in the new text as you want it to appear on the diagram. When finished, press <Esc>. When you return to the diagram, the newly added text will be included. If the multipick option is turned on (see Section 4.16), you will be prompted to **Pick next location for text.** At this point, you can choose another location to add text, or press the right mouse button to terminate the process.

4.6.2 Edit Text

This text suboption allows you to edit any of the text appearing on the diagram. When you invoke this option, you will be prompted to **Box text to be edited.** Position the cross hair at the beginning of the text you wish to modify and press the left mouse button. A small dot will appear. Drag your cursor over the text until the outline surrounds the text you wish to modify. When the text is surrounded, press the left mouse button. A window will appear displaying the first line of the selected text. To modify the text, simply type over the existing text. Use the <Ins> and <Del> keys to add and delete characters as necessary. In addition, you may use the Backspace and End keys. Backspace moves all characters from the right of the cursor to the left one space. The End key positions the cursor at the end of the current line. When complete, press <Esc>. If the multipick option is turned on (see Section 4.16), you will be returned to the **Box text to be edited** prompt. At this point, you may box more text to edit or press the right mouse button to terminate the process.

4.6.3 FONT

This text suboption allows you to change the FONT type of the text. When you invoke this option, Figure 12 will be displayed. To select a font, position the cursor on the desired font and press the left mouse button. The font is now selected. New text will now appear in the new font style. This option updates the global font default. **NOTE:** The currently selected font is shown in a different color.

4.6.4 Rep Name

This text suboption allows you to name or replace a name. When you invoke this option you will be prompted to **Pick shape to be named.** Position the cursor on the shape to be renamed and press the left mouse button. The prompt **Enter new name or CR for =>** will be displayed. Enter a new label and press <Enter>. The shape(s) will be renamed. If the multipick option is turned on (see Section 4.16), you will be returned to the **Pick next shape to be named** prompt. At this point you may choose another shape to label or press the right mouse button to terminate the process.

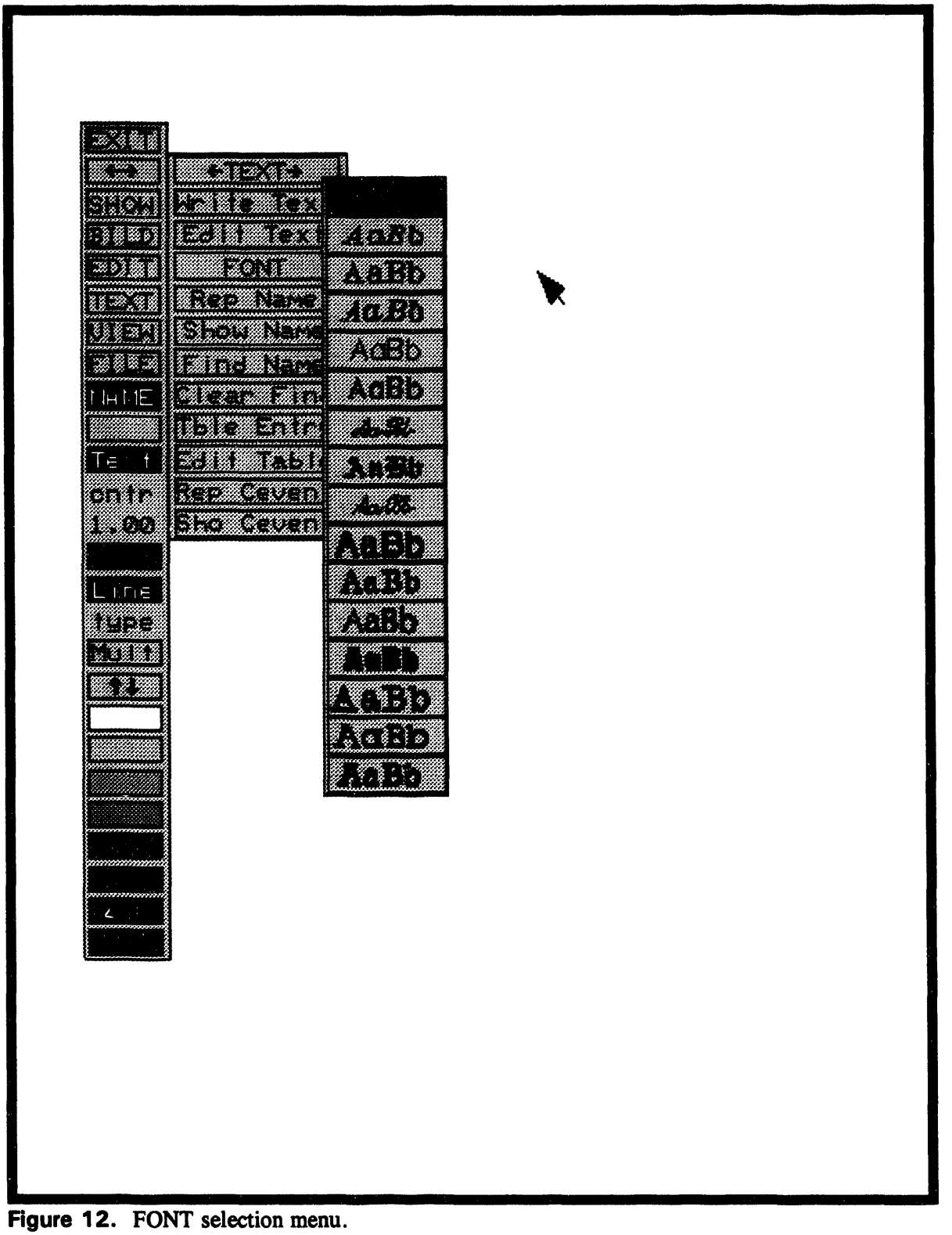


Figure 12. FONT selection menu.

4.6.5 Show Name

This text suboption allows you to display (in readable characters) a shape name. When you invoke this option, you will be prompted to **Pick the shape**. Position the cross hair on the desired shape and press the left mouse button. The name for the selected shape will be displayed at the bottom of the screen. If the multipick option is turned on (see Section 4.16), the cross hair returns and you may select another shape or press the right mouse button to terminate the process.

4.6.6 Find Name

This text suboption allows you to locate a specific shape name on your diagram. When you invoke this option, you will be prompted with **Enter name >**. Enter the shape name you wish to locate and press <Enter>. A broken dotted line will outline the shape containing the specified label. This outline will appear until you invoke the Clear Find option.

4.6.7 Clear Find

To invoke this option, position the cursor over the Clear Find menu option, and press the left mouse button. All highlight outlines will be cleared from the screen.

4.6.8 Tble Entry

This option allows you to add entries to an existing table. When you invoke this option, you will be prompted to **Pick Table**. Position the cross hair over the table to be modified and press the left mouse button. You will be prompted to **Enter name (terminate with CR) >**. Enter the new table entry and press <Enter>. If the multipick option is turned on, you will be prompted with **Next name (terminate with CR) >**. At this point you may enter another table entry or press the <Enter> key to terminate the process. Upon pressing <Enter> you will be returned to the **Pick Next Table** prompt. At this point, you may mark another table symbol for entry or press the right mouse button to terminate the process.

4.6.9 Edit Table

This option allows you to edit individual table entries. When you invoke this option, you will be prompted to **Pick gate, event, or tab**. Position the cross hair on the desired gate, event, or table and press the left mouse button. A window will appear displaying the names. You are prompted to **Pick the name to modify,-use "@" in 1st col to delete.** Position the cursor over the name to modify and press the left mouse button. You will be prompted to enter a new name. Enter the name and press <Enter>. To cancel or terminate this process, press the right mouse button.

4.6.10 Rep Cevent

This option allows you to rename or change the name (label) given to the event part of an inhibit gate. When you select this option you will be prompted to **Pick INHIBIT gate.**

4.6.11 Sho Cevent

This option allows you to view the Cevent name associated with the inhibit gate. When you invoke this option, you will be prompted to **Pick the INHIBIT gate.**

4.7 VIEW

This option allows you to change the position and size of the displayed diagram. You may move the drawing up, down, right, left, zoom in, zoom out, or restore the drawing to its original size and/or position. You may also use a toggling method to display/not display names and text, and display a grid. When you select this option, Figure 13 will be displayed.

The first box, ←VIEW→, is used to move the VIEW menu to a new location on the screen. To invoke this option, position the cursor on the ←VIEW→ box and press the left mouse button. An outline box will appear. Move the outline to the desired location on the screen and press the left mouse button. In addition, you can remove the VIEW option box by positioning the cursor on any command in the VIEW menu and pressing the right mouse button or pressing the <Esc> key. The VIEW submenu consists of the following options:

- Page ↑: Invoking this option allows you to shift the figure up one page (previous page). To invoke this option, position the cursor in the Page ↑ box and press the left mouse button or <Enter>. The diagram's previous page will be displayed and the message **View changed** will appear at the bottom of the screen. This message will remain on the screen until the view option is terminated.

- Page ↓: Invoking this option allows you to shift the figure down one page (next page). To invoke this option, position the cursor in the Page ↓ box and press the left mouse button or <Enter>. The diagram's next page will be displayed and the message **View changed** will appear at the bottom of the screen. This message will remain on the screen until the view option is terminated.

- Page ←: Invoking this option allows you to shift the figure to the left one page (one screen). To invoke this option, position the cursor in the Page ← box and press the left mouse button or <Enter>. The diagram will shift to the left one screen at a time and the message **View changed** will appear at the bottom of the screen. This message will remain on the screen until the view option is terminated.

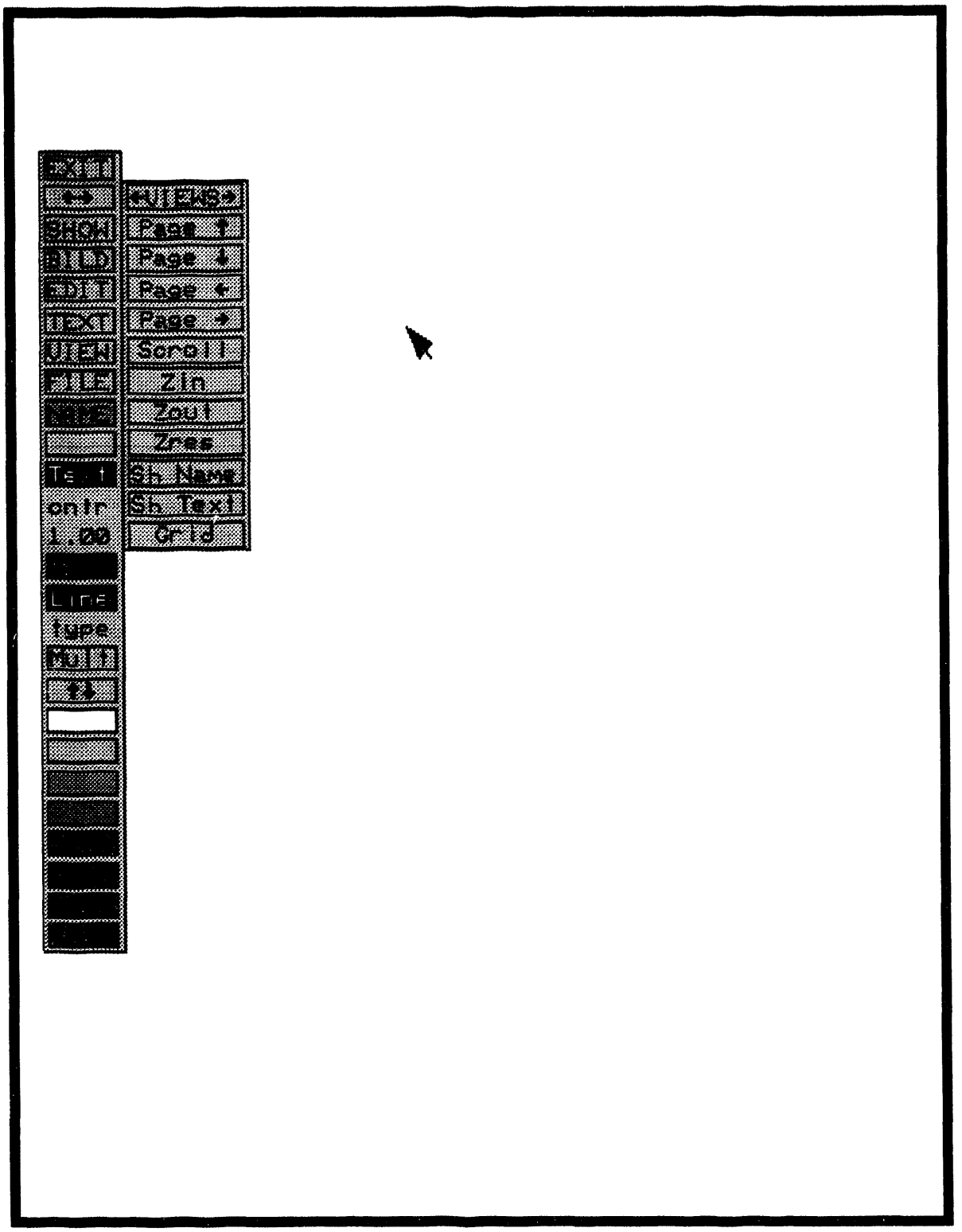


Figure 13. VIEW main menu.

- Page → : Invoking this option allows you to shift the figure to the right one page (one screen). To invoke this option, position the cursor in the Page → box and press the left mouse button or <Enter>. The diagram will shift to the right one screen at a time and the message **View changed** will appear at the bottom of the screen. This message will remain on the screen until the view option is terminated.

- Scroll: Invoking this option allows you to move the diagram to another location on the screen. To invoke this option, position the cursor in the Scroll box and press the left mouse button. A white outline box appears, with a cross hair placed in the center of the outline. Position the cursor at the desired location and press the left mouse button. The cross hair serves as a reference point for placing the drawing. The reference point (+) is used to give you some indication of the position of the object being moved relative to the screen.

- Zoom in: Invoking this option allows you to fill the screen with a small portion of the original display (magnifies the selected portion of the screen). To invoke this option, position the cursor in the Zin (zoom in) box and press the left mouse button or <Enter>. The message **Pick two corners of box** will be displayed. Move the cursor to the start of the portion of the diagram to be enlarged and press the left mouse button. A small dot appears. Drag the cursor across the desired area until it is completely surrounded by the outline box. Press the left mouse button. The portion of the original display enclosed by the box will now fill the entire screen. The display can be restored to its original size by invoking the Zres (zoom restore) option.

- Zoom out: Invoking this option allows you to shrink the displayed diagram by approximately 50%. To invoke this option, position the cursor in the Zout (zoom out) box and press the left mouse button or <Enter>. The entire display will be reduced. To restore the display to its original size, invoke the Zres option.

- Zoom Restore: This option restores any display created by Zin (zoom in), page up, page down, page left, page right, or Zout (zoom out) to the original display size or to the last saved file. To invoke this option, position the cursor in the Zres box and press the left mouse button or <Enter>.

- Sh Name: This option allows you to toggle the setting to display or not display names. Sh Name displays all the names in your diagram. No Name does not display any of the names in your diagram.

- Sh Text: This option allows you to toggle the text setting from Sh Text to No Text. Sh Text displays all defined text. No Text does not display the text.

- GRID: This option displays a grid behind your diagram to allow you to line up symbols and text. This is a toggle switch. To turn the grid on position the cursor in the GRID option box and press the left mouse button or <Enter>. To turn the grid off, repeat the same steps.

4.8 FILE

This option allows you to perform various file maintenance utilities including loading, saving, merging files, and printing hard copies of your diagrams. When you invoke this option, Figure 14 will be displayed. Each FILE option is discussed in the following paragraphs.

The first box, ←FILE→, is used to move the FILE menu to a new location on the screen. To invoke this option, position the cursor on the ←FILE→ box and press the left mouse button. An outline box will appear. Move the outline to the new location on the screen and press the left mouse button. The menu will be placed at the new location. In addition, you can remove the FILE menu box by positioning the cursor on any command in the FILE menu and pressing the right mouse button or pressing the <Esc> key.

4.8.1 Load

This FILE suboption allows you to load any fault tree file (graphics) with the extension ".DLS" onto the screen. When you invoke this option, you will be prompted to **Enter file name >**. Enter the name of the file you wish to load and press <Enter>. The diagram will appear on the screen. If you do not remember your file name, use the LIST suboption to display all existing files in the current directory.

4.8.2 Save

This FILE suboption allows you to save all changes made to the diagram. When you invoke this option you will be prompted to **Enter file name or CR for File ...>**. The default file name will consist of the currently displayed diagram and an extension of .DLS. Enter a new file name if desired, or press <Enter> to save the diagram under the default name. If the default file name already exists (i.e., you have saved your diagram previously), the message **File already exists. Do you wish to replace? Y/N>** will be displayed. If you wish to write the changes over the existing file, type a Y and press <Enter>; otherwise, enter an N.

4.8.3 Logic

This FILE suboption allows you to save the logic of the diagram. When you invoke this option, you are prompted to **Enter file name or CR for file XXX >**, where XXX is the file name of the currently displayed diagram. Enter the new file name and press <Enter>. When complete, the message **Logic saved** will be displayed at the bottom of the screen.

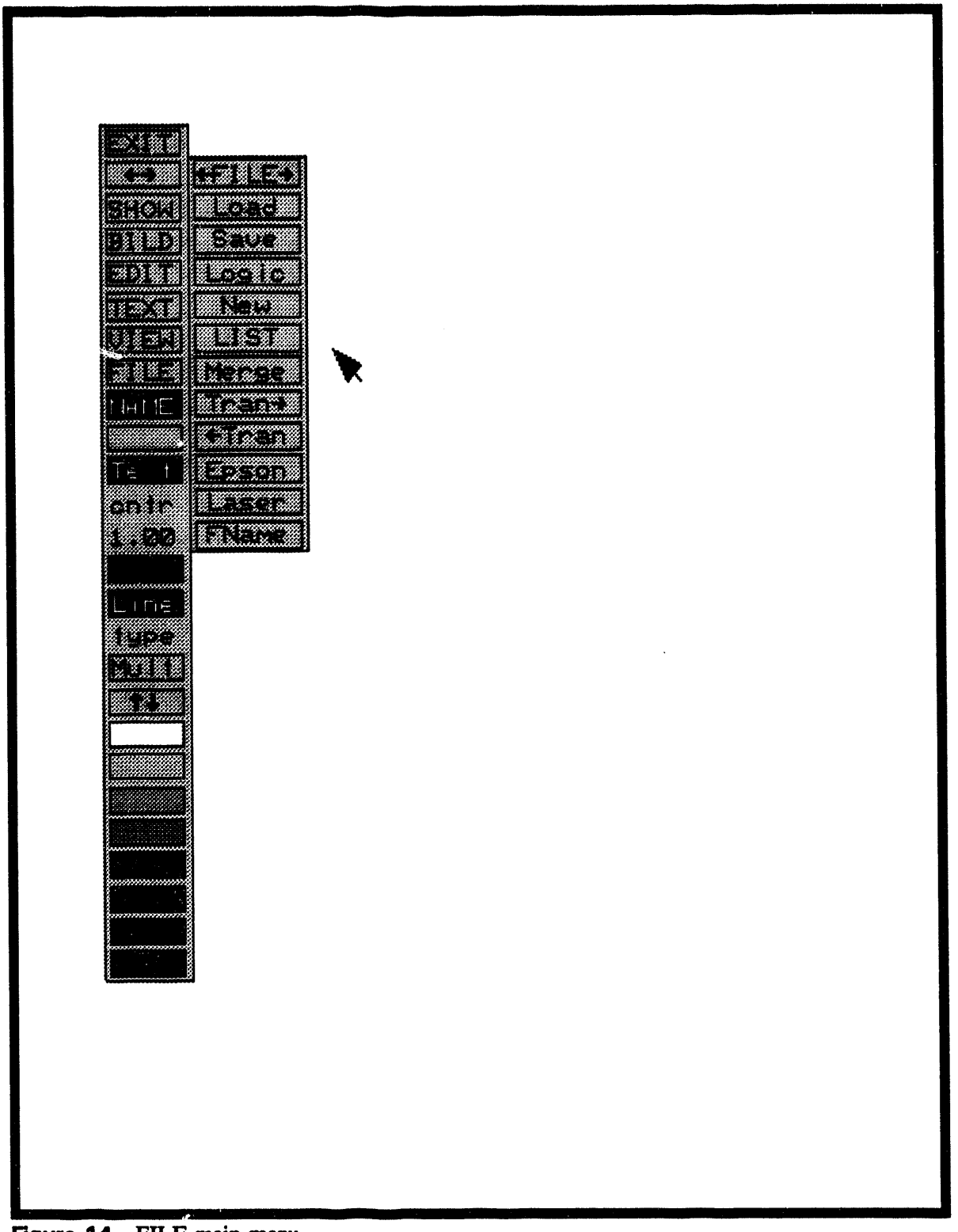


Figure 14. FILE main menu.

4.8.4 New

This FILE suboption allows you to essentially cancel your current editing session. All changes made since the last save will not be applied. When you invoke this option, the screen will be cleared and you will be returned to Figure 6.

4.8.5 LIST

This FILE suboption displays the list of files currently residing in the default directory. When you invoke this option, a pop-up menu will be displayed showing all the files contained in the current directory. You will be prompted to **Pick the file to load**. Position the cursor over the file to load and press the left mouse button or <Enter>. The file will be loaded and displayed on the screen.

4.8.6 Merge

This FILE suboption allows you to merge the contents of two files into a single file. When you invoke this option, a pop-up menu will be displayed showing all the files contained in the current directory. You will be prompted to **Pick the file to load**. Position the cursor over the file to merge into the currently displayed diagram and press the left mouse button or <Enter>. Next, you will be prompted to **Pick location for the top center of merged file**. Position the cross hair at the desired location and press the left mouse button or <Enter>. The screen will be cleared and then reshown with the merged files displayed.

4.8.7 Tran→

This FILE suboption allows you to view the drawing defined in the file given in the transfer name.

4.8.8 ←Tran

This FILE suboption allows you to view the drawing that define(s) the transfer logic. Transfers allow you to create fault trees consisting of many pages.

4.8.9 Epson

This option formats the diagram for an Epson printer and sends it to the local Epson printer.

4.8.10 Laser

This option formats the diagrams for a laser printer and sends it to the local laser printer to be printed.

4.8.11 FName

This option displays the current file name of the diagram being displayed. When you invoke this option, the file name will be displayed at the bottom of the screen.

4.9 NAME

This option allows you to change the defaults for the name symbols. When you invoke this option, Figure 15 will be displayed. Each option is described below.

- Name Col: This option allows you to change the color of the name. When you invoke this option, you will be prompted to **Pick a new color from the color bar**. Position the cursor on the desired color and press the left mouse button. (**NOTE:** The ↑ ↓ (color) option is active at this time. This option will display the additional color selections available.) The NAME box will change to the new default color.

- Name Size: This option allows you to change the text size of the name. When you invoke this option, you will be prompted to **Enter text size >**. As mentioned earlier, text sizes are indicated by a number between 0.01 and 66.00, with 66 being the full 66 lines from the top to the bottom of the screen. This roughly corresponds to the 66 lines on a full sheet of regular paper. Enter the desired text size and press <Enter>.

- Dflt Gate: This option allows you to assign a default name to the gate. When you invoke this option you will be prompted to **Enter gate default name >**. Enter the name (up to 11 characters are allowed) and press <Enter>.

- Dflt Event: This option allows you to assign a default name for an event. When you invoke this option you will be prompted to **Enter event default name >**. Enter the desired name (up to 11 characters are allowed) and press <Enter>.

4.10 Text

This option allows you to set a default color for the text in your diagram. To invoke this option position the cursor over the Text box and press the left mouse button. You will be prompted to **Pick a new color from the color bar**. Position the cursor on the desired color box and press the left mouse button. (**NOTE:** The ↑ ↓ (color) option is active at this time. This option will display the additional color selections available.) All text will now be displayed in this color. If the diagram already exists, only the new text will be displayed in the new color. You must return to the ATTRIBUTES option to

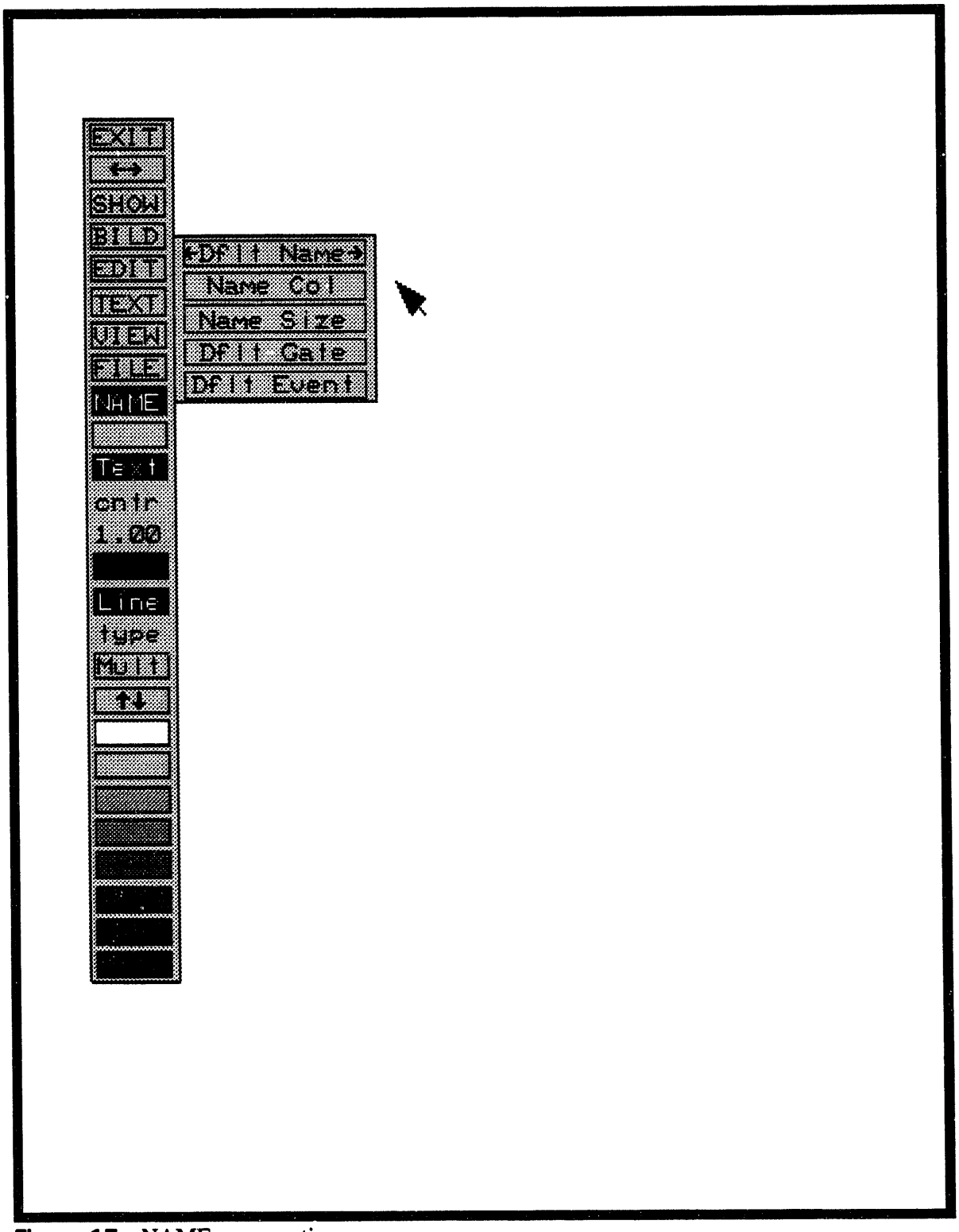


Figure 15. NAME menu options.

change the existing text color (if desired).

4.11 cntr/left/right

This option allows you to set the justification for your diagrams. Justification is where the text will be placed offset from the placement point. This works as a toggle switch. To change justification, position the cursor over the cntr (default) box and press the left mouse button or the <Enter> key. You will see the box change from cntr to rght (right). Press the left mouse button or <Enter> key again, and the box will change from rght to left.

Left justification means the text will be anchored at the left bottom corner, or the text will flow to the right of where it was placed. Center justification means the text will be centered about the placement point. Right justification means the text will be placed to the left of the placement point. Set the toggle for the desired justification.

4.12 Text Size (0.50)

This option allows you to set a default text size for your diagrams. The default value is .5. Text size ranges from .001 to 9.0. For the purpose of writing text in gate blocks, a text size of about 0.5 is appropriate. The size looks too small on the screen, but it is a good size for sending to a laser printer. **REMEMBER**, here you are setting the default text size. You may always change the text size for specific text by invoking the ATTRIBUTES option, under the EDIT command.

4.13 Fill

This option allows you to select a color for the drawing symbols. When you invoke this option you will be prompted to **Pick a new color from the color bar**. Position the cursor over the desired color and press the left mouse button. (**NOTE:** The ↑ ↓ (color) option is active at this time. This option will display the additional colors available.) The Fill box will change to the newly selected color. All drawing symbols created in your new diagram will be displayed in this selected color. If you modify an existing drawing, the symbol colors won't change. To change the color of existing symbols you must invoke the ATTRIBUTES suboption from the EDIT option.

4.14 Line

This option allows you to select a color for the lines that connect the text and symbols in the diagram. When you invoke this option you will be prompted to **Pick a new color from the color bar**. Position the cursor over the desired color and press the left mouse button. (**NOTE:** The ↑ ↓ (color) option is active at this time. This option will display the additional color selections available.) The Line box will change to the selected color. All lines generated in your new diagram will be this selected color. Again, if you are modifying an existing drawing the lines won't change to this color. To change existing

lines to the new color you must invoke the ATTRIBUTES suboption for the EDIT option.

4.15 type

This option allows you to set a default line type for your diagrams. When you invoke this option, a small window appears displaying the three line types (solid, broken, and dotted). To select a line type, position the cross hair over the desired line type and press the left mouse button. All lines drawn in your new diagram will be of this type. If you have an existing drawing that you are modifying, remember - the existing lines do not change. To change existing lines you must access the ATTRIBUTES suboption under the EDIT option.

4.16 Mult

This option allows you to toggle between multiple pick and single pick. The multipick option allows you to continue with a given process until terminated. For example, when creating an "AND" gate, the symbol will reappear after each placement until you cancel the process by pressing the right mouse button. If single pick (sngl) is turned on, the user must return to the menu and select "AND" again after each placement.

4.17 Scroll Color Bar (↑ ↓)

This option allows you to scroll the color bar to display the additional color selections available. Position the cursor on the color bar scroll box (up and down arrow) and press the left mouse button or <Enter> key. The next series of available colors will be displayed.

5. EVENT TREE EDITOR

The Event Tree Editor is available through FEP and IRRAS. The Event Tree Editor allows you to construct or edit an event tree diagram. You may start building the diagram from scratch or from an existing file to generate or modify logic. To invoke the Event Tree Editor you may select it from the FEP main menu or supply a command line parameter to the FEP program. To invoke the Event Tree Editor using a command line parameter, type:

C:\SAF50>**fep ETE <Enter>**

When the Event Tree Editor is invoked, Figure 16 is displayed. The editing commands are shown in the left column, while the rest of the screen is the drawing surface. The commands shown in all upper-case letters (excluding EXIT) have additional pop-up menus associated with them. The cursor is used to position pop-up menus and select menu options.

To invoke any of the editing commands (using a mouse), position the cursor over the desired editing command on the active menu. The active menu is the last menu you pulled up or moved. When the editing command box is highlighted (a white line outlines the box), press the left mouse button. The command is now invoked. Each editing command is described in the following paragraphs.

5.1 EXIT

This option terminates the editing session and returns you to the FEP main menu. To invoke this option, position the cursor over the EXIT box and press the left mouse button or <Enter>.

5.2 Move (←→)

The move command ("tear-off" menu), which is represented by ←→, allows you to position the editing command menu anywhere on the screen. When you invoke this command, a white outline surrounds the entire editing column. Drag the cursor to position the outline at the desired location and press the left mouse button or <Enter>. The menu will be displayed at the new location.

5.3 Show

This command clears the screen and re-displays the currently defined diagram.

5.4 EDIT

This command allows you to make changes to the event tree. When you invoke this option, an additional pop-up menu is displayed (Figure 17). As shown, six options are available: EDIT, Add, Del, Copy, Pass, and Page.

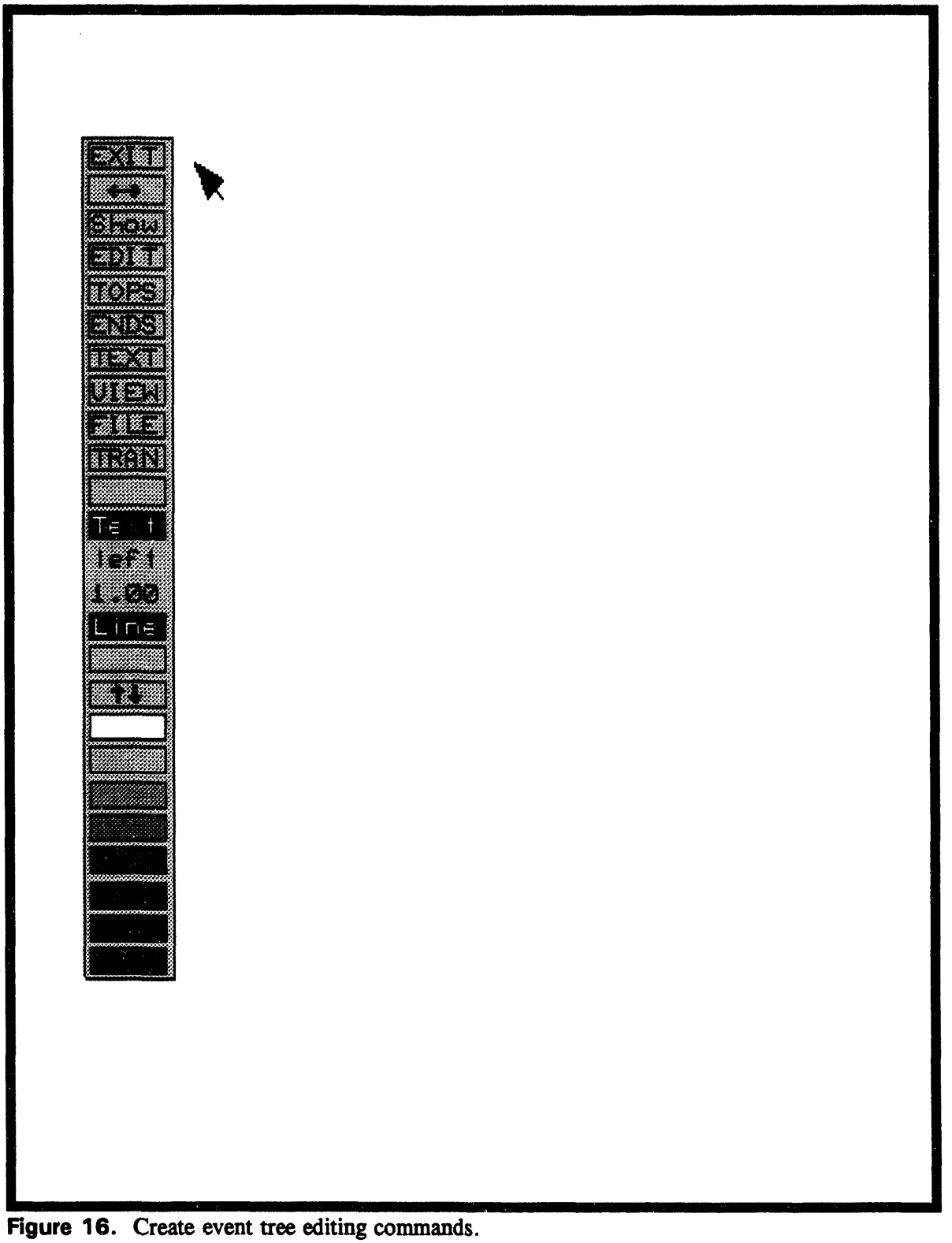


Figure 16. Create event tree editing commands.

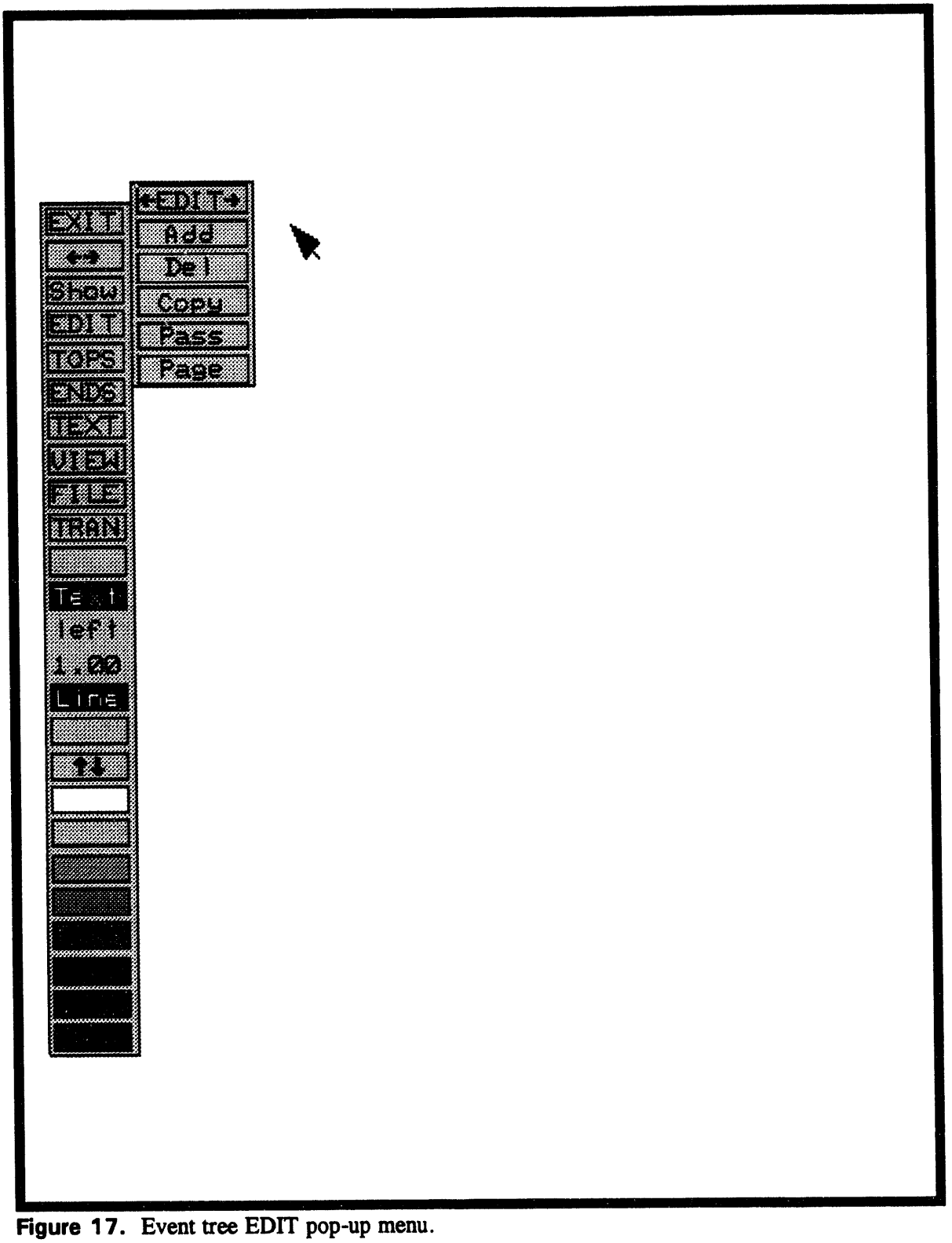


Figure 17. Event tree EDIT pop-up menu.

5.4.1 ←EDIT→

This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←EDIT→ box and press the left mouse button. An outline will appear. Move the outline to the new location on the screen and press the left mouse button. The menu will be moved to the new location.

5.4.2 Add

This option allows you to add a branch to the event tree. When you invoke this option, you will be prompted to **Pick the intersecting point of the new branch.** The cursor will change from a filled cursor arrow to an 'empty' cursor arrow. Position the cursor over the place where the new branch is to be added and press the left mouse button. A small box will appear. Next, you will be prompted to **Pick the vertical position of the new branch.** The vertical position determines whether the new branch will be added above or below the existing branch. Position the cursor to the desired vertical position and press the left mouse button. The diagram is redrawn with the new branch added. The prompt to **Pick the intersecting point of the new branch** will return. At this point you can select another location to add a branch or press the right mouse button to terminate the add process.

5.4.3 Del

This option allows you to delete branches from the tree. When you invoke this option, you will be prompted to **Pick the branch to be deleted**. Position the cursor on the branch to be deleted and press the left mouse button. The selected branch will be highlighted and the message **Delete highlighted branch? Left = YES, Right = NO** will be displayed. If the highlighted branch should be deleted, press the left mouse button; if not, press the right mouse button. If you responded yes, the diagram will be redrawn to reflect the deletion. In either case, the prompt **Pick the branch to be deleted** will return. At this point you may select another branch to delete, or press the right mouse button to terminate the deletion process.

5.4.4 Copy

This option allows you to copy existing branches of the tree to new locations. When you invoke this option, you will be prompted to **Pick beginning of the branch to copy**. Position the cursor at the start of the branch to be copied and press the left mouse button. Next, you will be prompted to **Pick copy location**. There are three ways to use the copy command. In each case you select the existing branch to be copied. Then, you may either place the cursor over the start of a pass, at the start of a branch and replace the existing branch, or place the cursor at the start of a branch and add the copied logic to the branch. Depending on the copying method you use, you will be prompted with **Replace = left button, Add = Right button**. If this branch is a replacement for an existing branch, press the left mouse button. If this branch is an addition, press the right mouse button. If this branch is an addition, you will be prompted to **Pick vertical location of the start of new sub-tree**. Pick the new location and press the left mouse button.

5.4.5 Pass

This option allows you to change a branch to a pass. When you invoke this option you will be prompted to **Pick the branch th is to be made a pass**. Position the cursor on the branch to be converted and press the left mouse button. The entire branch is highlighted and you will be prompted with **Make highlight branch a pass? Left = YES, Right = NO**. If this is the branch you wish to change into a pass press the left mouse button; otherwise, press the right mouse button. If you respond yes, the branch is converted to a pass. If you respond no, the process is terminated. In either case, the prompt **Pick the branch that is to be made a pass** will return. At this point you may select another branch, or press the right mouse button to terminate this procedure.

5.4.6 Page

This option allows you to separate a large drawing into separate pages. When you invoke this option, you will be prompted to **Pick beginning of the branch to page**. Position the cursor at the branch where the new page is to start and press the left mouse button. The message **Create Transfer Here? [N]** will appear. If this is the point where the page should appear, press Y; otherwise enter an "N."

When you highlight a section of the drawing and enter a "Y" to transfer, the block will be moved to the next page and a transfer will be created automatically by the system. If you respond "N" to the transfer the diagram will not be broken up and a transfer will not be created. In either case, the prompt **Pick beginning of the next branch to page** will appear. At this point, you may select another location to page or press the right mouse button to terminate the paging process.

5.5 TOPS

This option allows you to make changes to the top events. When you invoke this option, an additional pop-up menu will be displayed (Figure 18). As shown, the following options are available: TOPS, Add, Del, Edit, Name?, Width, Size, FONT, and DESC.

5.5.1 ←TOPS→

This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←TOPS→ box and press the left mouse button. An outline will appear. Move the outline to the new location and press the left mouse button. The menu will be moved to the new location.

5.5.2 Add

This option allows you to add a new event. For example, an event tree might have the existing events 1, 2, 3, and 4. A new event is needed between events 2 and 3. You select this event and will be prompted to **Pick the event that will follow the new event**. The cursor will change from an arrow to a cross hair. Position the cross hair at the desired event (in this example, we would pick event 3) and press the left mouse button. The prompt **Enter new event name:** will be displayed. Enter the event

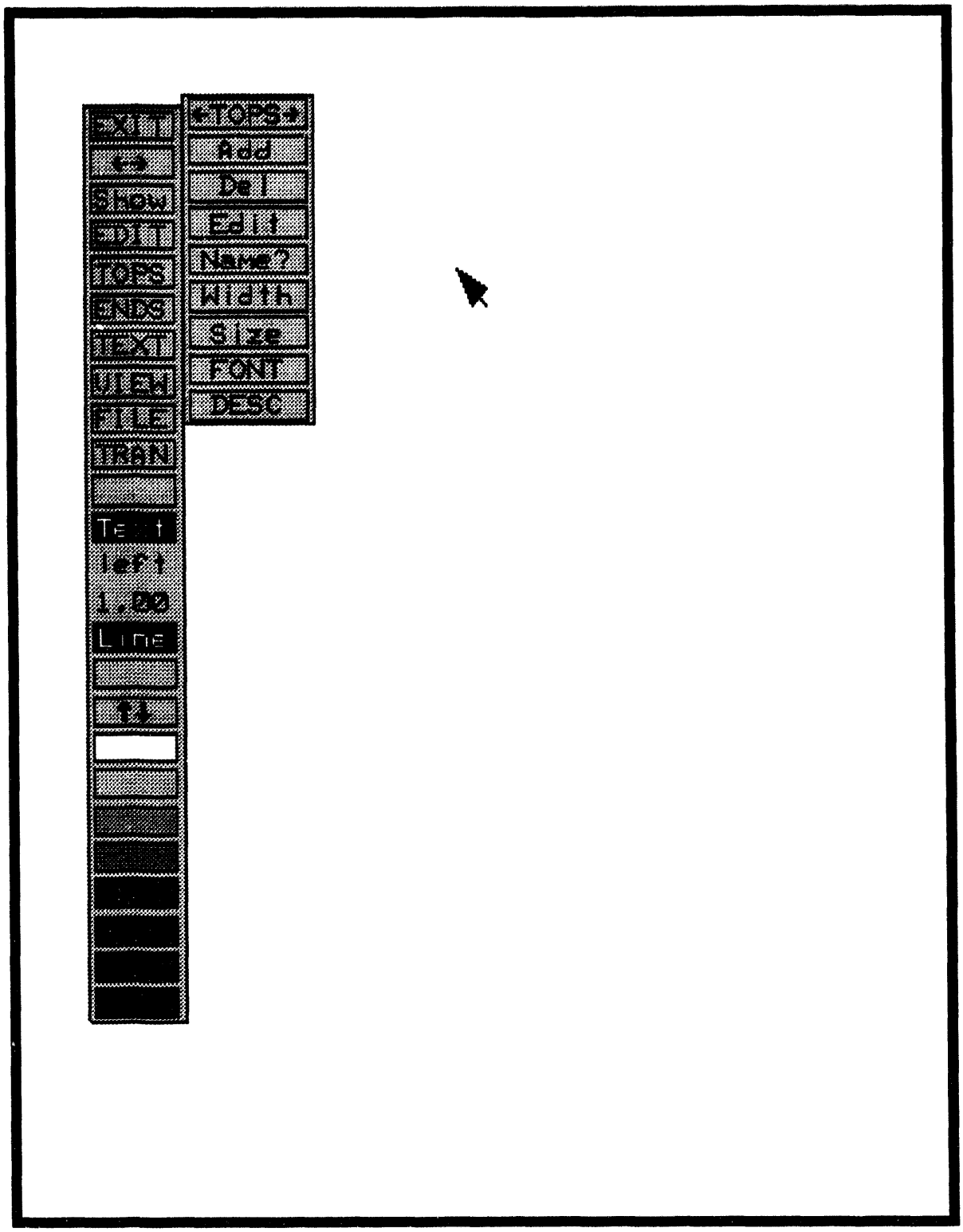


Figure 18. TOPS pop-up menu.

name (up to 16 characters are allowed) and press <Enter>. The diagram will be redrawn and displayed showing the newly added event and the event list will be updated.

5.5.3 Del

This option allows you to delete an event. To delete an event all branch points that logically fall below the event must be converted to passes. When you invoke this option you will be prompted to **Pick the event that is to be deleted**. The cursor will change from an arrow to a cross hair. Position the cursor on the event to be deleted and press the left mouse button. If the branch points have not been converted to passes, the message **The event picked is currently being used in the tree** will be displayed. If you want to delete the event you must go back and convert the branch points using the PASS option under the EDIT command. When the deletion is successful, the tree will be updated and redisplayed.

5.5.4 Edit

This option allows you to change an event name. When you invoke this option you will be prompted to **Pick the event name to be edited**. The cursor changes from an arrow to a cross hair. Position the cursor on the event in the diagram or the event name displayed at the top to be renamed and press the left mouse button. The prompt **Enter new event name for xxx:** will be displayed. Enter the new name (up to 16 characters are allowed) and press <Enter>. The event name will be changed at the top of the diagram.

5.5.5 Name?

To conserve space on the diagram, a limited number (default is 5) of characters of the event name are displayed on the diagram. Use this option to display the complete event name (all 16 characters). When you invoke this option you will be prompted to **Pick an event name.** The cursor will change from an arrow to a cross hair. Position the cursor on the desired event name at the top of the diagram and press the left mouse button. The entire event name will be displayed on the prompt line at the bottom of the screen. The cross hair will remain so you may select additional event names to display or press the right mouse button to terminate the process.

5.5.6 Width

This option allows you to change the displayed width of the event names. When you invoke this option, you will be prompted to **Enter top width size <old size>**. Enter the new top width size and press <Enter>. You may enter a value greater than 1 (default is 5). If you press <Enter> without entering a value, the width does not change. If the width is changed, the tree will be redisplayed with the new width.

5.5.7 Size

This option allows you to change the text size of the event names. When you invoke this option, you will be prompted to **Enter new top name text size <old value>**. Enter the new text size and press <Enter>. You may enter a value of 0.01 to 9.00. If you press <Enter> without entering a new value, the text size does not change. If the text size is changed, the tree will be redisplayed with the new top text size.

5.5.8 FONT

This option allows you to select the font type for the event names and headers. When you select this option, an additional pop-up menu will be displayed (see Figure 19). Select the desired font type by positioning the cursor over the font and pressing the left mouse button. You must select a font (or cancel) in order to continue. If the font type is changed, the tree will be redisplayed with the new event name font type.

5.5.9 DESC

This option allows you to edit event description text and set various attributes of the descriptions including text size, font type, and number of lines of description to display. When you invoke this option, an additional pop-up menu will be displayed (see Figure 20).

5.5.9.1 ←DESC→. This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←DESC→ box and press the left mouse button. An outline will appear. Move the outline to the new location and press the left mouse button. The menu will be moved to the new location.

5.2.5.9.2 Edit. This option allows you to edit or add any event name descriptions contained in the displayed diagram. When you select this option, you will be prompted to **Pick the event description to be edited**. To select the event description to edit, move the cursor over the event or event description and press the left mouse button. A window will appear displaying the selected description and the prompt **Edit Description - Press <Esc> when done** will appear. If no description exists, enter a description. To modify the description, simply type over the existing description. Use the <Ins> and <Del> keys to add and delete characters as necessary. In addition, you may use the Backspace and End keys. The Backspace key deletes the character to the left of the cursor and moves the rest of the characters to the left one space. The End key positions the cursor at the end of the current line. When complete, press <Esc>. You will be prompted to **Pick the event description to be edited**. At this point you may select another description to edit or press the right mouse button to terminate the process.

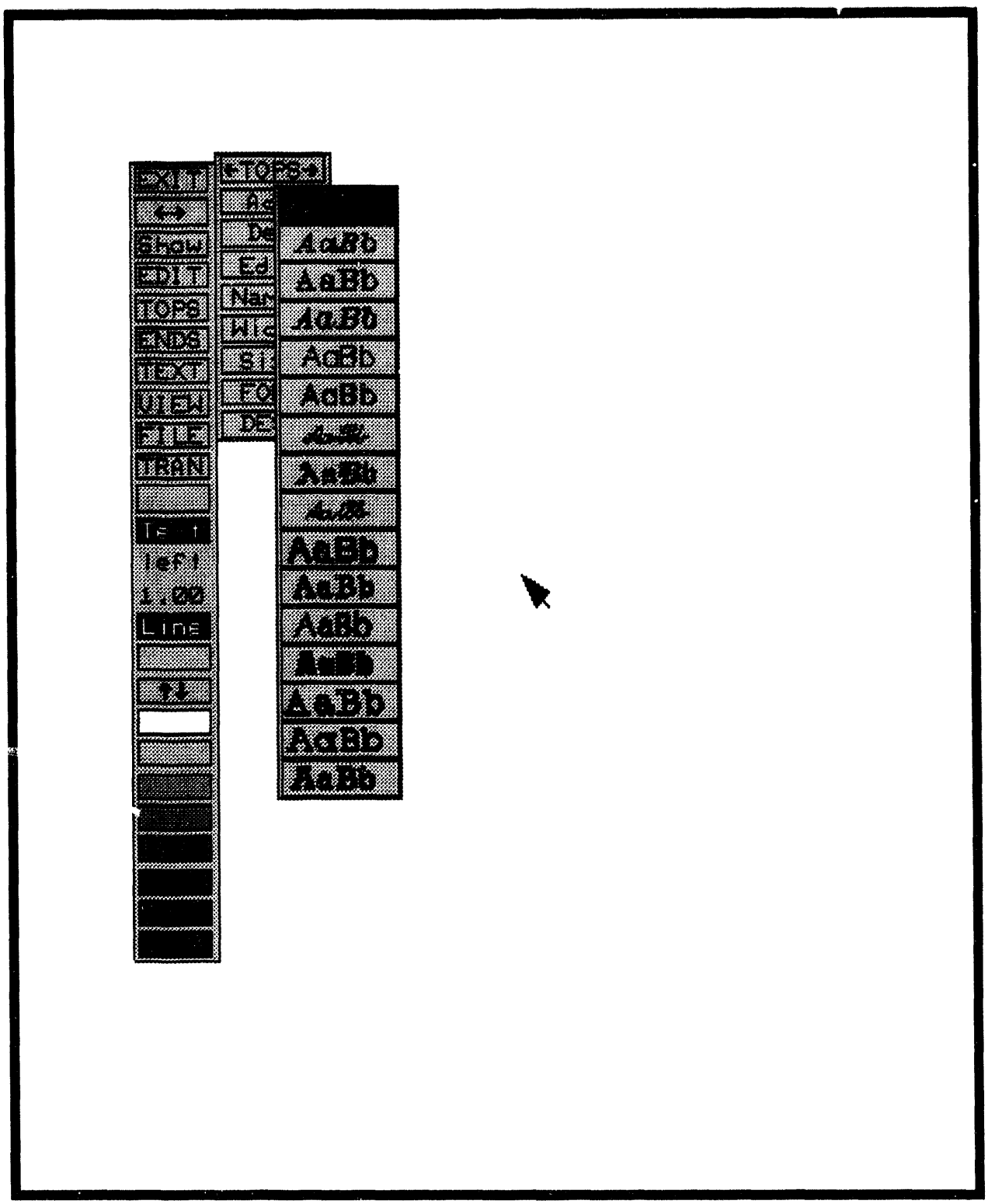


Figure 19. Font type menu for event names and headers.

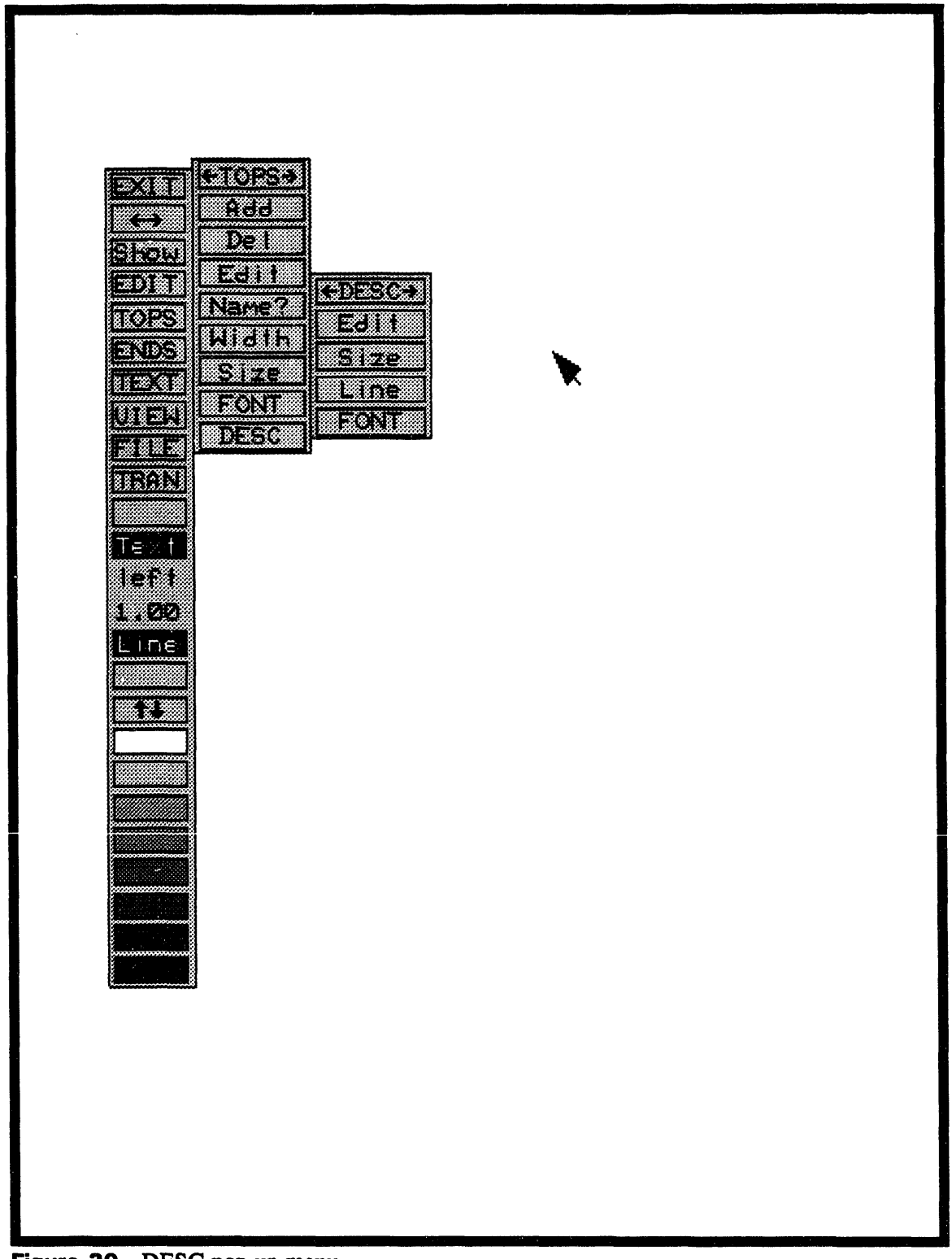


Figure 20. DESC pop-up menu.

5.5.9.3 Size. This option allows you to specify the height of the event descriptions in your diagram. The prompt **Enter new top description text size: <old size>** will be displayed. At this prompt, enter the desired text size and press <Enter>. You may enter a value of 0.01 to 9.0. The event descriptions will be displayed in the new size.

5.5.9.4 Line. This option allows you to specify the number of lines in event descriptions. When you invoke this option, you will be prompted to **Enter new top description line count: <old count>**. At this prompt, enter the desired line count and press <Enter>. You may enter a value of 0 or greater. The event descriptions will be displayed with the new line count.

5.5.9.5 FONT. This option allows you to select the font type for the event descriptions. When you select this option, an additional pop-up menu will be displayed (see Figure 21). Select the desired font type by positioning the cursor over the font and pressing the left mouse button. You must select a font (or cancel) to continue. If the font type is changed, the event descriptions will be redisplayed.

5.6 ENDS

At the end of each sequence is a unique number and some textual information. This information includes the sequence name, end state name, and two other fields used for user defined information. You may provide a sequence name or the software will use defaults of A, B, C, etc. (See Generating Sequence Logic section for a discussion of using numbers instead of names.) When a branch (sequence) is added, the names or "ends" are given defaults. Each default equates to a blank screen. Also, a display option is given to each end. This allows you to turn on or off the information. Usually you will have the text turned off while building your event tree. Each list or column of information has a header. The header may be placed at any horizontal location. Display information is associated with each header. Individual sequences and/or column information may be turned off or on. Sequence and header information, along with the display and placement attributes, are modified through the ENDS command. When you invoke this command, an additional pop-up menu is displayed (Figure 22). As shown, the following options are available: ENDS, End States, Edit Header, Place Header, Edit Height, Edit Size, and FONT.

5.6.1 ←ENDS→

This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←ENDS→ box and press the left mouse button. An outline will appear. Move the outline to the new location and press the left mouse button. The menu will be moved to the new location.

5.6.2 End States

This option allows you to display information about the end state. When you invoke this option you will be prompted to **Pick the leaf corresponding to the desired endstate information.** The cursor is placed on the tree at the end of the sequences. The cursor will only move in the vertical direction allowing you to pick only leaf branches. Position the cursor at the desired end state and press the left mouse button. A window will appear displaying the sequence names, end state names, frequencies, and

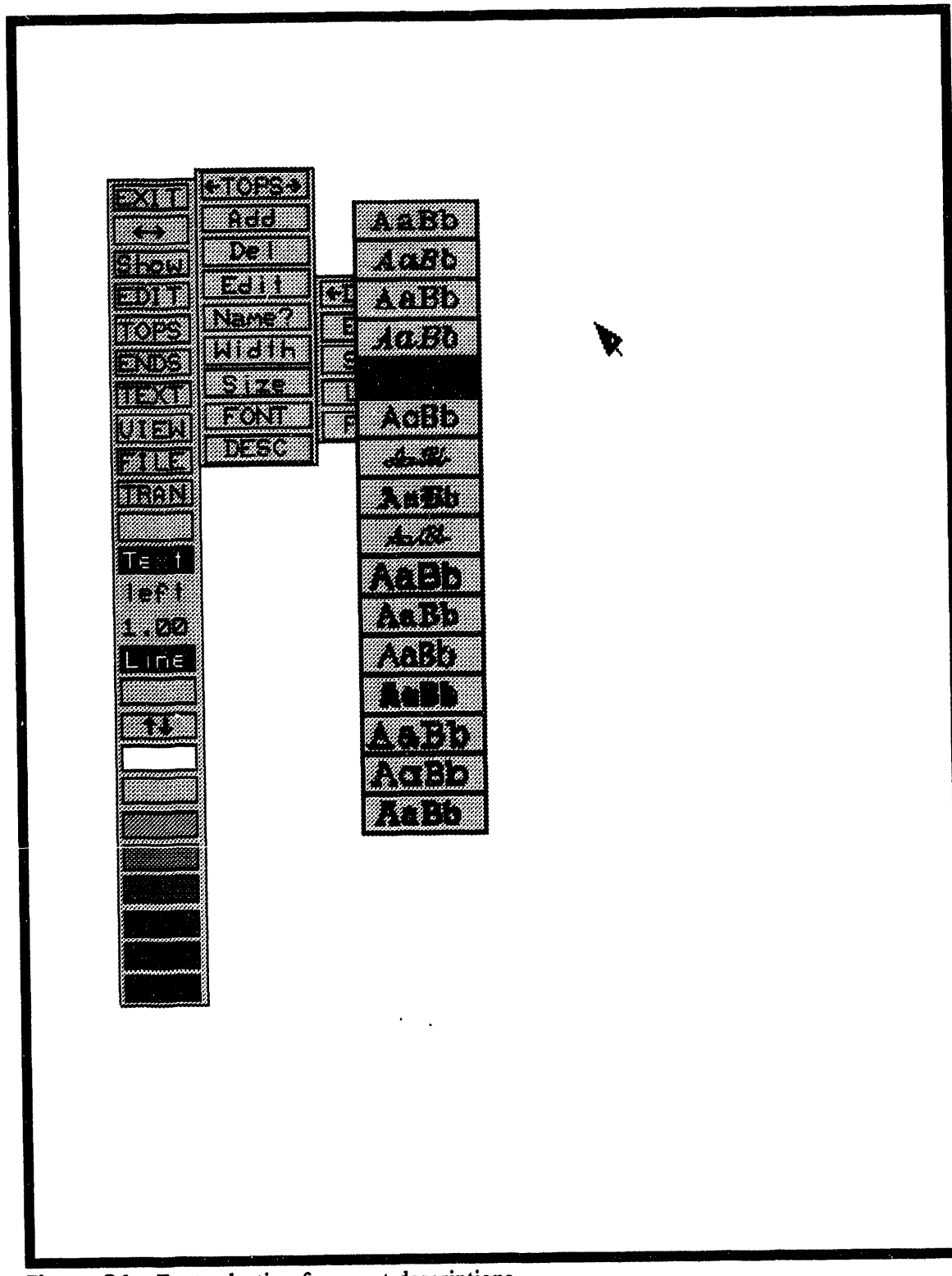


Figure 21. Font selection for event descriptions.

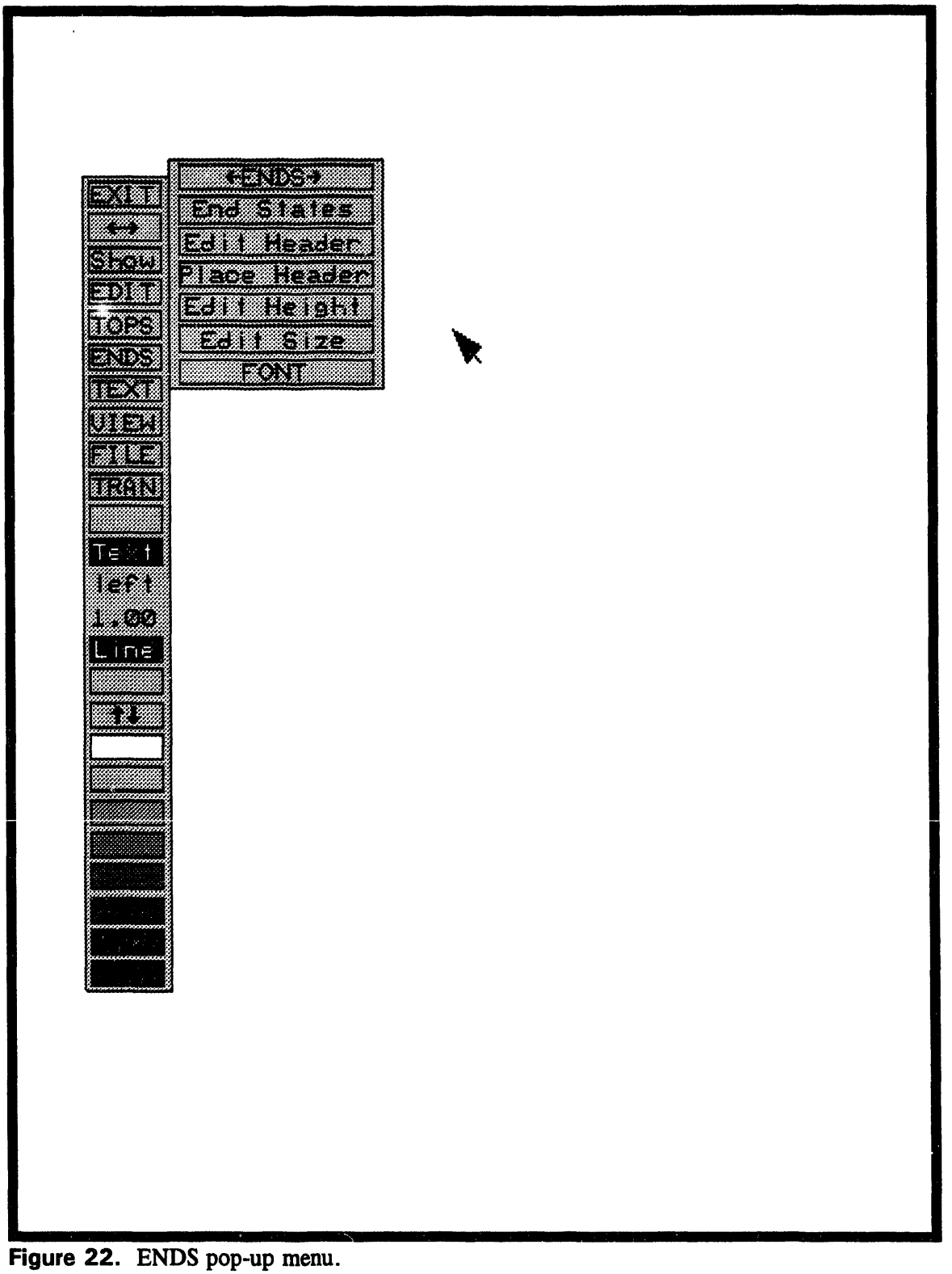


Figure 22. ENDS pop-up menu.

the data contained in the two user-defined fields for the selected end state. Next, you will be prompted to **Pick the box to be edited**. Position the cross hair over the box to be edited and press the left mouse button. If you choose to edit the sequence names, end state names, or frequency values you will be prompted to **Enter Text:**. Enter the desired text and press <Enter>. If a name already exists, it will be overwritten with the new name you entered.

The two remaining fields are toggle switches. The toggles allow you to specify whether or not to display the item.

FEP provides four columns of information for the user to add additional information about each sequence in an event tree. FEP requires that the first column be the sequence name, the second must be the end state, the third is used to store the sequence frequency, and the fourth is user defined. The column names and positions may be changed by the user, but the information stored in each column must be as explained above.

To terminate this process, press the right mouse button. The window will disappear and you will be returned to the **Pick the leaf corresponding to the desired endstate information** prompt. At this point, you may select another end state or press the right mouse button to terminate the process.

5.6.3 Edit Header

This option allows you to edit header information. When you invoke this option, a window appears. This window contains sequence names, end state names, frequencies, and two user-defined fields contained in the header. Next, you will be prompted to **Pick the box to be edited**. Position the cross hair over the box to be edited and press the left mouse button. If you selected to edit sequence names, end state names, or frequency values you will be prompted to **Enter text:**. Enter the desired text and press <Enter>. If the box contained data, it will be replaced by the text you just entered. To terminate this process, press the right mouse button.

5.6.4 Place Header

This option allows you to move a header to another location on the screen. When you invoke this option you will be prompted to **Pick the header that is to be relocated.** Position the cross hair on the header contained in the listing on the right side of the screen or on the title to the left of the status/tops line at the top of the screen to be moved and press the left mouse button. You will be prompted to **Pick the placement point for the header**. Position the cursor on the desired location and press the left mouse button. The headers will be moved to the new location. The prompt **Pick the header that is to be relocated** will return. At this point, you may select another header to relocate or press the right mouse button to terminate the process.

5.6.5 Edit Height

This option allows you to specify the height or distance between branches (nodes) of the diagram. When you invoke this option, you will be prompted to **Enter new node height <old height> >**. At this prompt, enter the desired node height and press <Enter>. You may enter a value greater than 0.0.

The tree will be redisplayed with the new node height.

5.6.6 Edit Size

This option allows you to specify the height of the end state text in your diagram. When you invoke this option, you will be prompted to **Enter new end state text size: <old value>**. At this prompt, enter the desired text size and press <Enter>. You may enter a value of 0.01 to 9.0. The tree will be displayed with the new end state text size.

5.6.7 FONT

This option allows you to select the font type for the end state text. When you select this option, an additional pop-up menu will be displayed (see Figure 23). Select the desired font type by positioning the cursor over the font and pressing the left mouse button. You must select a font (or cancel) in order to continue.

5.7 TEXT

This option allows you to add text to the diagram at any location, in any size and color. When you invoke this command, an additional pop-up menu is displayed (Figure 24). As shown, seven options are available: TEXT, FONT, Write, Move, Copy, Erase, and EDIT.

5.7.1 ←TEXT→

This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←TEXT→ box and press the left mouse button. An outline will appear. Move the outline to the new location and press the left mouse button. The menu will be moved to the new location.

5.7.2 FONT

This option allows you to select the font type for the text. When you select this option an additional pop-up menu will be displayed (Figure 25). Select the desired font by positioning the cursor over the font and pressing the left mouse button. You must select a font (or cancel) in order to continue. All new text will be displayed in the selected font. Remember, you are changing the default font type using this option. No existing text will be changed to this new font type. To change existing text, select the TEXT option, the EDIT suboption, and invoke the FONT command. You may then mark existing text to be changed to the default font.

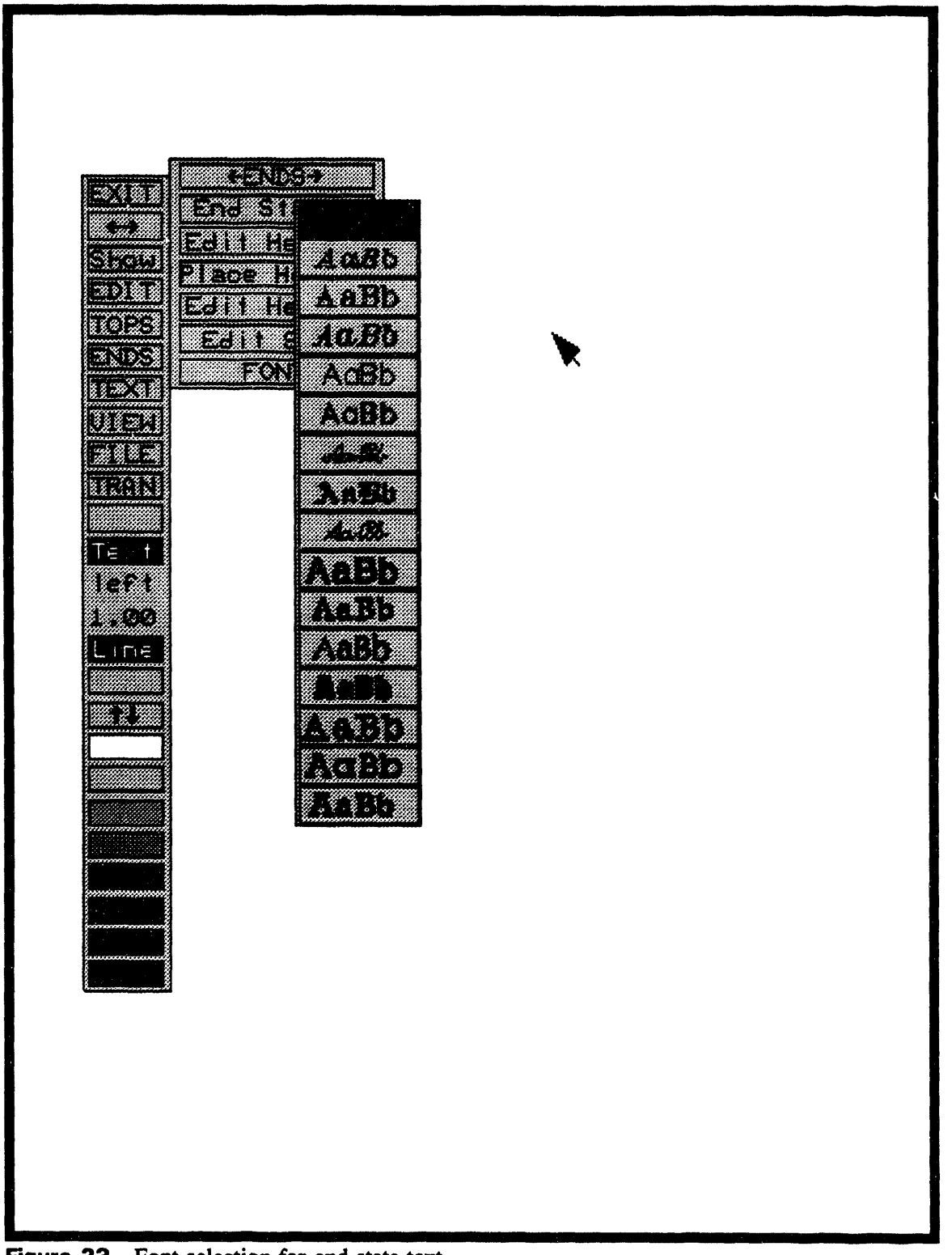


Figure 23. Font selection for end state text.

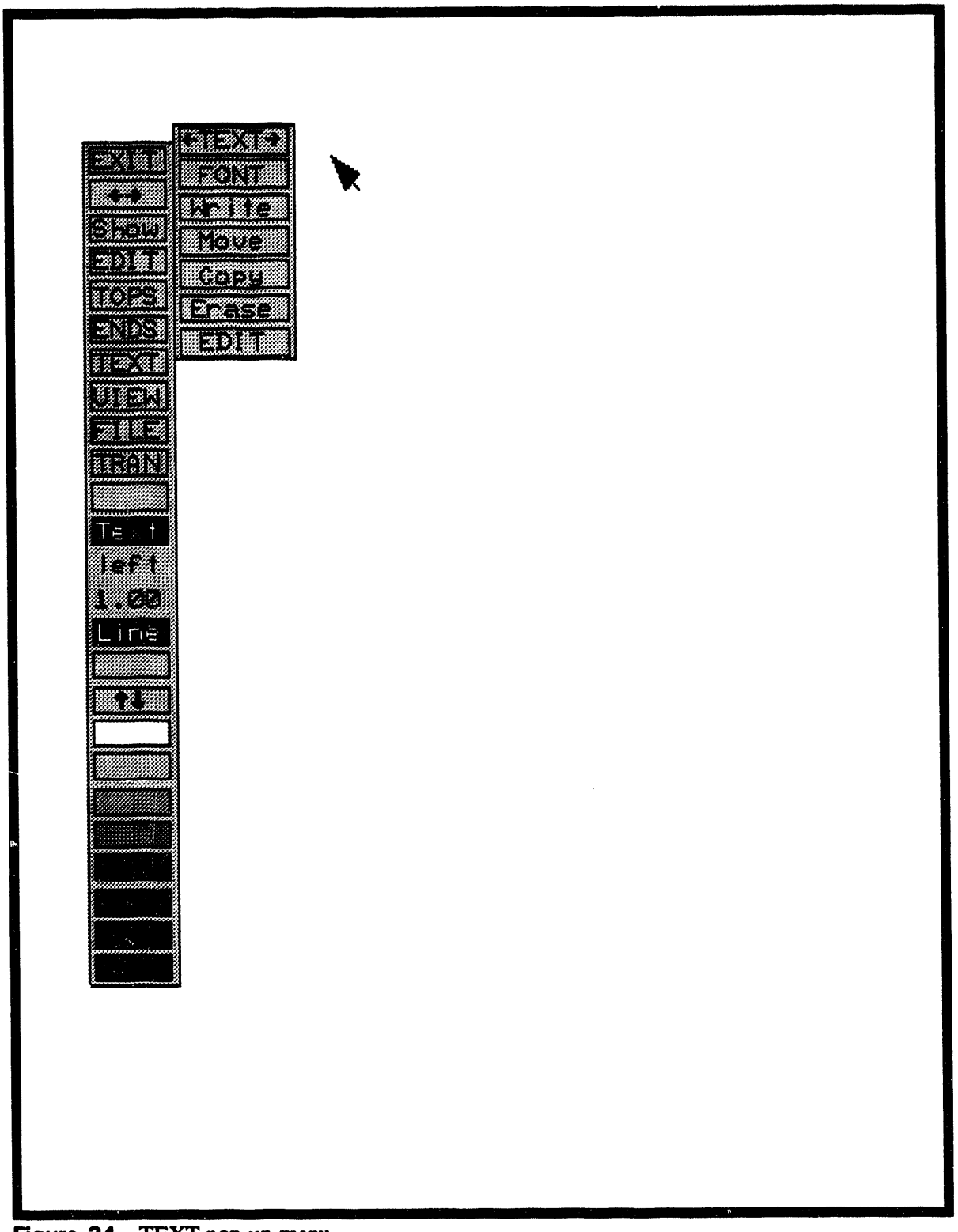


Figure 24. TEXT pop-up menu.

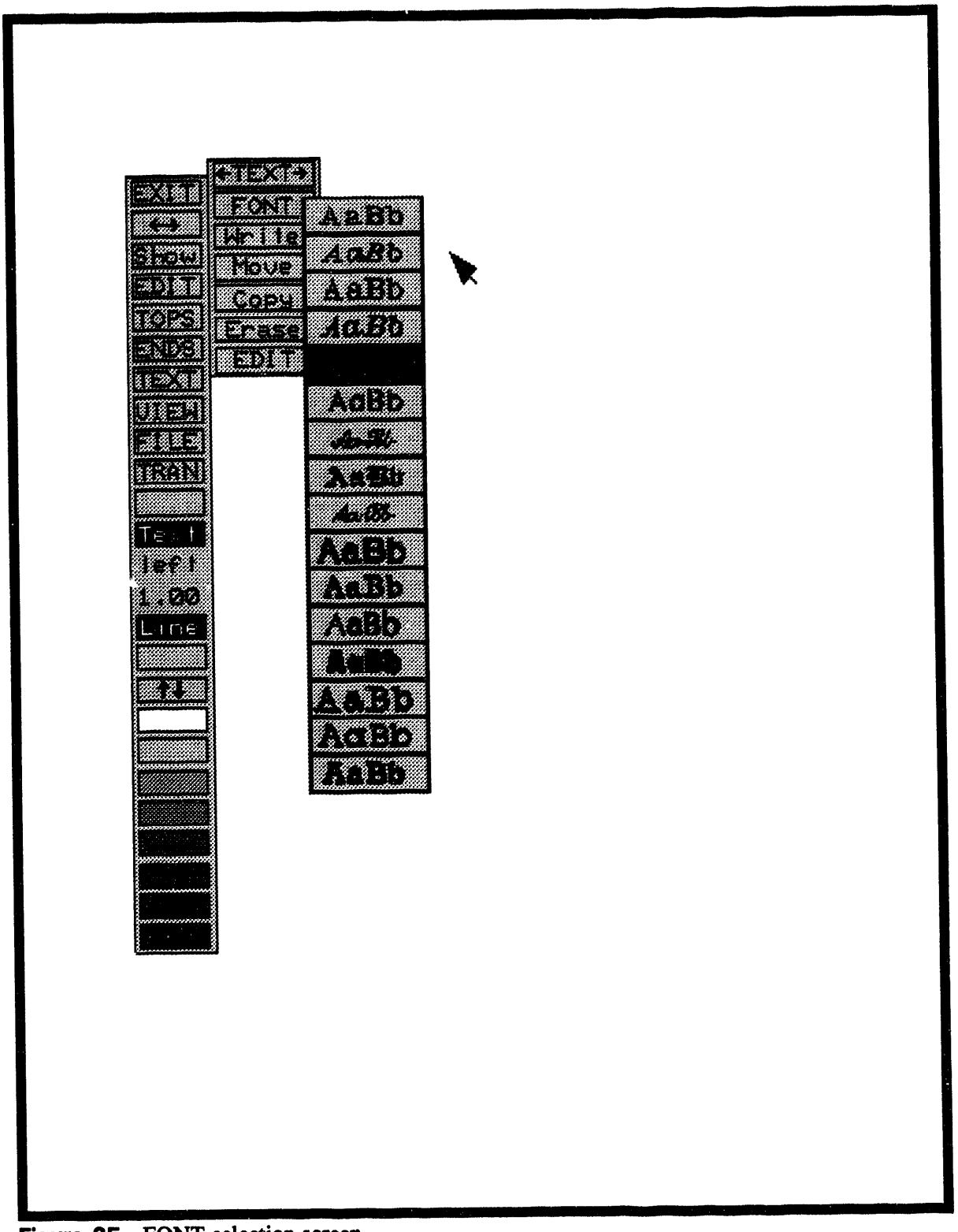


Figure 25. FONT selection screen.

5.7.3 Write

This option allows you to write text at any location on the screen. When you invoke this option you will be prompted to **Pick text placement location.** Position the cursor at the desired location and press the left mouse button. A window will appear in the top left corner of the screen. Enter the desired text. When complete, press <Esc>. If the show text option is turned on (See VIEW option), the newly added text will be displayed on the screen. Next, you will be prompted to **Pick next text placement location:**. At this point you may select another location to write text or press the right mouse button to terminate the process.

5.7.4 Move

This option allows you to move the selected text to a new location on the screen. When you invoke this option you will be prompted to **Pick region to be moved - press CANCEL to quit**. You select the region by marking the opposite corners of the text to be moved. Position the cross hair at the text you want to move and press the left mouse button. A small dot appears. Drag the cursor across the desired text until the box totally surrounds the text. Press the left mouse button again. The message **Pick reference point - press CANCEL to quit** will be displayed. The reference point is used to give you some indication of the position of the text being moved relative to the box. Position the cross hair at the location where you want the selected text to be moved to. Next, you will be prompted to **Pick placement point - press CANCEL to reselect**. Use the mouse to move the box to the exact position where you want the box to appear. When you are satisfied with the new position press the left mouse button. The selected text will be moved to the new location. The prompt **Pick placement point - press CANCEL to reselect** will be displayed again. At this point you may select another location to move the text, or press the right mouse button or <Esc> key to terminate the process.

5.7.5 Copy

This option allows you to copy the selected text to a new location on the screen. When you invoke this option you will be prompted to **Pick region to be copied - press CANCEL to quit**. You select the region by marking the opposite corners of the text to be copied. Position the cross hair at the text you want to copy and press the left mouse button. A small dot appears. Drag the cursor across the desired text until the box totally surrounds the text. Press the left mouse button again. The message **Pick reference point - press CANCEL to quit** will be displayed. The reference point is used to give you some indication of the position of the object being copied relative to the box. Position the cross hair at the location where you want the selected region to be copied to. Next, you will be prompted to **Pick placement point - press CANCEL to reselect**. Use the mouse to move the box to the exact position where you want the text to appear. When you are satisfied with the new position press the left mouse button. The selected text will be moved to the new location. The prompt **Pick placement point - press CANCEL to reselect** will be displayed again. At this point you may select another location to copy the text to, or press the right mouse button or <Esc> key to terminate the process.

5.7.6 Erase

This option allows you to delete selected text. When you invoke this option you will be prompted to **Pick region to be deleted**. You select the region by marking the opposite corners of the text to be deleted. Position the cross hair at the text you want to move and press the left mouse button. A small dot appears. Drag the cursor across the desired text until the box totally surrounds the text. Press the left mouse button again. The message **Delete this region? left = YES, Right = NO** will be displayed. If this is the text to be deleted, press the left mouse button; otherwise press the right button. Next, you will be prompted to **Pick next region to be deleted**. At this point you may select more text to delete or press the right mouse button or <Esc> key to terminate the process.

NOTE: If the text is not deleted, check the size of the outline box used to mark the region. It must be large enough to encompass all the text desired; otherwise, no text will be deleted.

5.7.7 EDIT

This option allows you to edit text and set various attributes of the text including color, size, font, and justification. When you invoke this option, an additional pop-up menu will be displayed (Figure 26).

5.7.7.1 ←EDIT TXT→. This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←EDIT TXT→ box and press the left mouse button. An outline will appear. Move the outline to the new location and press the left mouse button. The menu will be moved to the new location.

5.7.7.2 Text. This option allows you to edit any of the text contained in the displayed diagram. When you select this option you will be prompted to **Box text to be edited**. You select the text to be edited by boxing the opposite corners of the text region. Position the cross hair at the beginning of the text you wish to modify and press the left mouse button. A small dot will appear. Drag the cursor over the text until the outline surrounds the text you wish to modify. When the text is completely surrounded, press the left mouse button. A window will appear displaying the selected text. To modify the text, simply type over the existing text. Use the <Ins> and <Del> keys to add and delete characters as necessary. In addition, you may use the Backspace and End keys. The Backspace key deletes the character to the left of the cursor and moves the rest of the characters to the left one space. The End key positions the cursor at the end of the current line. When complete, press <Esc>. You will be prompted to **Pick next text to be edited**. At this point you may select additional text to edit or press the right mouse button to terminate the process.

5.7.7.3 Color. This option allows you to change the color of selected text in your event tree diagram. When you invoke this option you will be prompted to **Box the text to be changed**. Position the cursor at the beginning of the text you wish to change and press the left mouse button. A small dot will appear. Drag the cursor over the text until the outline box surrounds all the desired text. Press the left mouse button. Next, you will be prompted to **Pick the new text color from the color bar**. To select a color, position the cursor over the desired color and press the left mouse button. The text will immediately change to the new color. The prompt **Box next region to be changed** will be displayed.

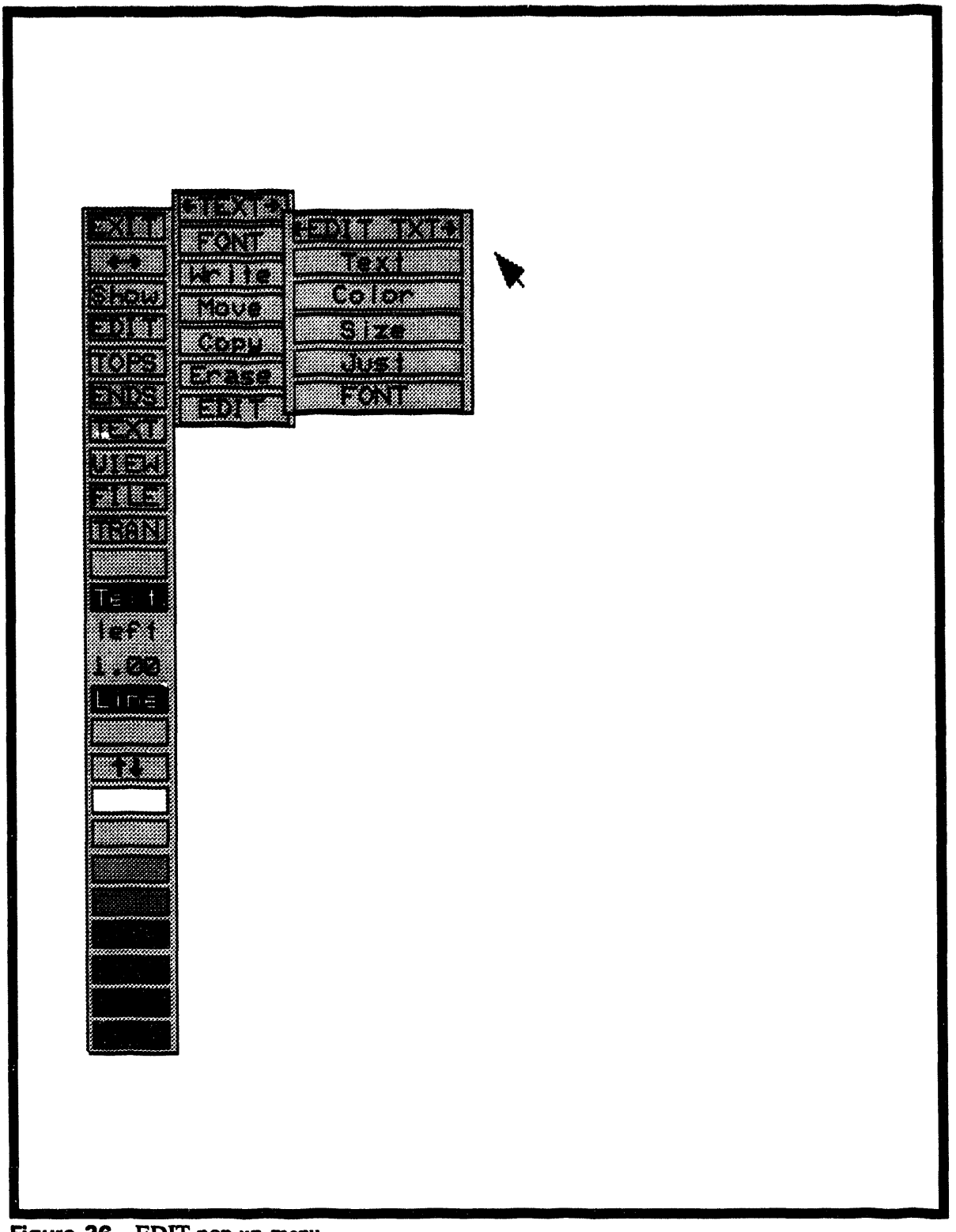


Figure 26. EDIT pop up menu.

At this point you may select more text to change or press the right mouse button to terminate the process.

5.7.7.4 Size. This option allows you to specify the height of selected text in your diagram. When you invoke this option, you will be prompted to **Box the text to be changed**. Position the cross hair at the beginning of the text you wish to change and press the left mouse button. A small dot will appear. Drag the cursor over the text until the outline surrounds all the desired text. When all the desired text is surrounded, press the left mouse button. Next, the prompt **Enter the new text size >** will be displayed. At this prompt enter the desired text size and press <Enter>. You may enter a value of .001 to 9.0. The selected text will be displayed in the new size. Next, you will be prompted to **Box next region to be changed**. At this point you may select more text to be changed or press the right mouse button to terminate this process.

5.7.7.5 Just. This option allows you to justify selected portions of the text in your diagram. Justification is where the text will be placed offset from the placement point. When you invoke this option you will be prompted to **Box the text to be changed**. Position the cursor at the beginning of the text to be changed and press the left mouse button. A small dot will appear. Drag the cursor over the text until the outline completely surrounds it. When the desired text is completely surrounded press the left mouse button. You will be prompted to **Enter text justification -('L'=Left, 'R'=Right, 'C'=Center) >**. Enter the desired justification and press <Enter>. The prompt **Box next region to be changed** will be displayed. At this point you may select additional text to modify or press the right mouse button to terminate this process. See Section 5.12 for a compete discussion on setting the justification.

5.7.7.6 FONT. This option allows you to select the font type for selected text. When you select this option an additional pop-up menu will be displayed (Figure 27). Select the desired font type by positioning the cursor over the font and pressing the left mouse button. You must select a font (or cancel) in order to continue. Next, you will be prompted to **Box the text to be changed**. Position the cursor over the text to be changed and press the left mouse button. A small dot will appear. Drag the cursor over the text to be modified. When the box completely surrounds the desired text, press the left mouse button. The selected text will be displayed in the new font type. Next, you will be prompted to **Box next region to be changed**. At this point you may select more text or press the right mouse button to terminate the process.

5.8 VIEW

This option allows you to change the position and size of the displayed diagram. You may move the drawing up, down, right, left, zoom in, zoom out, or restore the drawing to its original size and/or position. You may also toggle to display/not display text and turn on and off the grid. When you select this option, Figure 28 will be displayed. The VIEW submenu consists of the following options:

- Page ↑: Invoking this option allows you to shift the diagram up one page (previous page). To invoke this option, position the cursor in the Page ↑ box and press the left mouse button <Enter>. The diagram's previous page will be displayed. If no previous page exist, only the header information will appear.

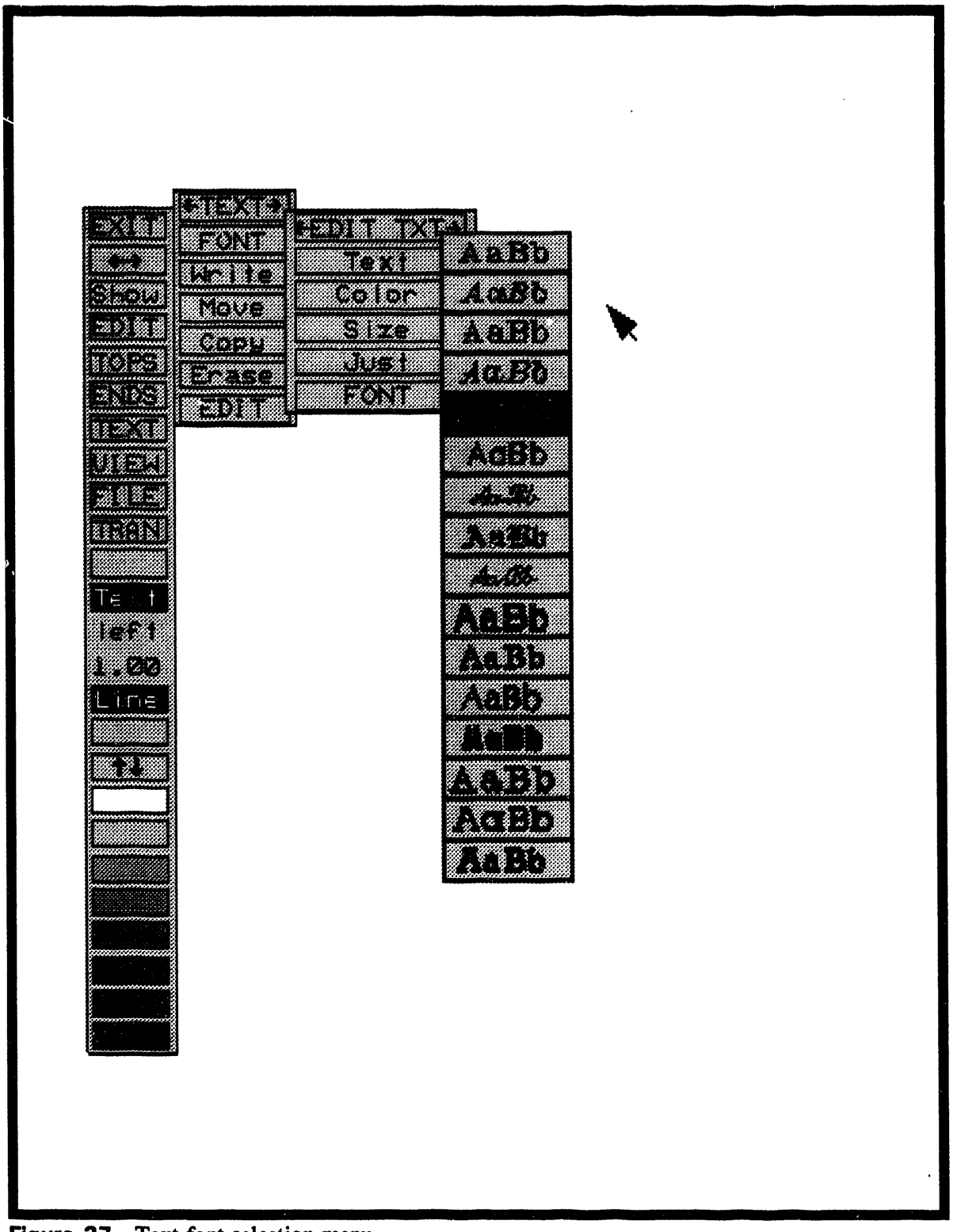


Figure 27. Text font selection menu.

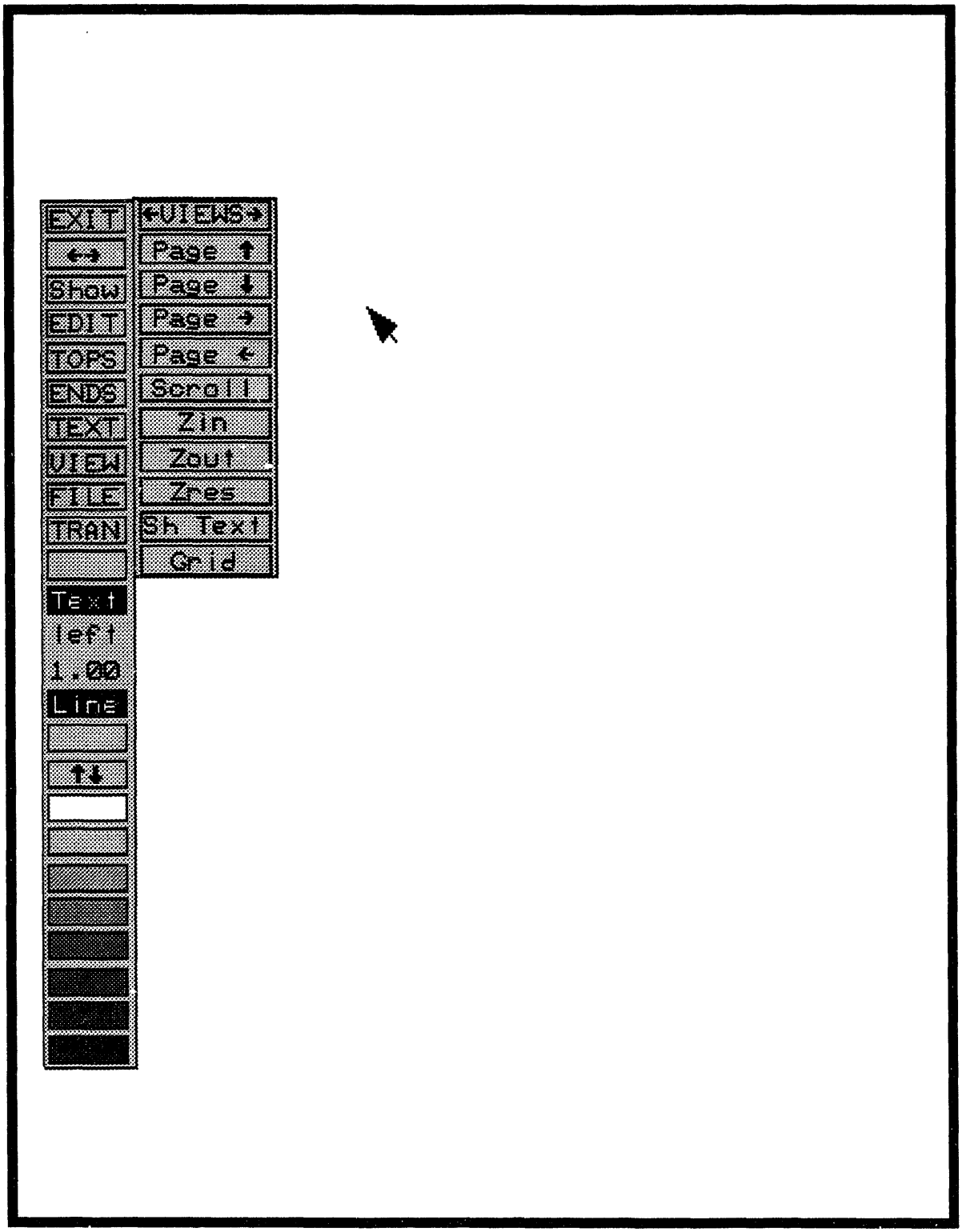


Figure 28. VIEW pop-up menu.

- Page ↓: Invoking this option allows you to shift the diagram down one page (next page). To invoke this option, position the cursor in the Page ↓ box and press the left mouse button or <Enter>. The diagram's next page will be displayed. If no next page exist, only the header information will appear.

- Page →: Invoking this option allows you to shift the diagram to the right one page (one screen). To invoke this option, position the cursor in the Page → box and press <Enter>. The diagram will shift to the right one screen. If no figure exists on this new screen, only the header information will appear.

- Page ←: Invoking this option allows you to shift the diagram to the left one page (one screen). To invoke this option, position the cursor in the Page ← box and press <Enter>. The diagram will shift to the left one screen. If no figure exists on this new screen, only the header information will appear.

- Scroll: Invoking this option allows you to move the diagram to another location on the screen, To invoke this option, position the cursor in the Scroll box and press the left mouse button. A white outline box appears, with a cross hair placed in the center of the outline. Position the cursor at the desired location and press the left mouse button. The cross hair serves as a reference point for placing the drawing. The reference point (+) is used to give you some indication of the position of the object being moved relative to the screen.

- Zoom in: Invoking this option allows you to fill the screen with a small portion of the original display (magnifies the selected portion of the screen). To invoke this option, position the cursor in the Zin (zoom in) box and press the left mouse button or <Enter>. The message **Pick first corner** will be displayed. Move the cursor at the start of the diagram to be enlarged and press the left mouse button. A small dot appears. Next, you will be prompted to **Pick next corner**. Drag the cursor across the desired area until it is completely surrounded by the outline box. Press the left mouse button. The portion of the original display enclosed by the box will now fill the entire screen. The display can be restored to its original size by invoking the Zres (zoom restore) option.

- Zoom out: Invoking this option allows you to shrink the screen by approximately 50%. To invoke this option, position the cursor in the Zout (zoom out) box and press the left mouse button or <Enter>. The entire display will be reduced, while the drawing space is increased. To restore the display to its original size, invoke the Zres option.

- Zoom Restore: This option restores any display created by zoom in or zoom out to the original display size or to the last saved file. To invoke this option, position the cursor in the Zres box and press the left mouse button or <Enter>.

- Sh Text: This option allows you to toggle the display the text setting from Sh Text to No Text. Sh Text displays all defined text. No Text does not display the text.

- Grid: This option displays a grid behind your diagram to allow you to line up symbols and text. This is a toggle switch. To turn the grid on, position the cursor in the Grid option box and press the left mouse button or <Enter>. To turn the grid off, repeat the same steps.

5.9 FILE

This option allows you to perform various file manipulation functions including loading, saving, listing and creating event tree files. When you invoke this option, an additional pop-up menu will be displayed (Figure 29). Each of these pop-up commands is discussed in the following paragraphs.

5.9.1 ←FILE→

This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←FILE→ box and press the left mouse button. An outline will appear. Move the outline to the new location and press the left mouse button. The menu will be moved to the new location.

5.9.2 Load

This is one of the options that can be used to load a file. When you invoke this option, you will be prompted to **Enter file name >**. At this prompt, enter the file name and press <Enter>. You must know the name of the file before initiating this option. The LIST command also allows you to load a file, but in addition it will display a list of available files.

5.9.3 Save

This option allows you to save the current file. When you invoke this command you will be prompted to **Enter file name or CR for file *current file name***. At this point you may enter a new file name or choose the default file name provided by pressing <Enter>. The file is then written to disk. If you enter a new file name, do not provide an extension. The extension ".ETG" is provided by MAR-D.

5.9.4 New

This option allows you to create a new event tree (file). When this command is invoked you will be prompted to **Enter Initiating Event or Top Name**. Enter the event or name and press <Enter>. You will then be asked **Is this an Initiating Event**. Respond with a Y or N. You will then be prompted to **Enter Event Name #1**. Enter an event name and press <Enter>. This prompt will repeat (with the event number increasing each time) until you press <Enter> without entering a name. The newly created event tree will then be displayed on the screen. The default form of an event tree will contain a success/fail branch at the first event and a don't care or pass extending through the ending event.

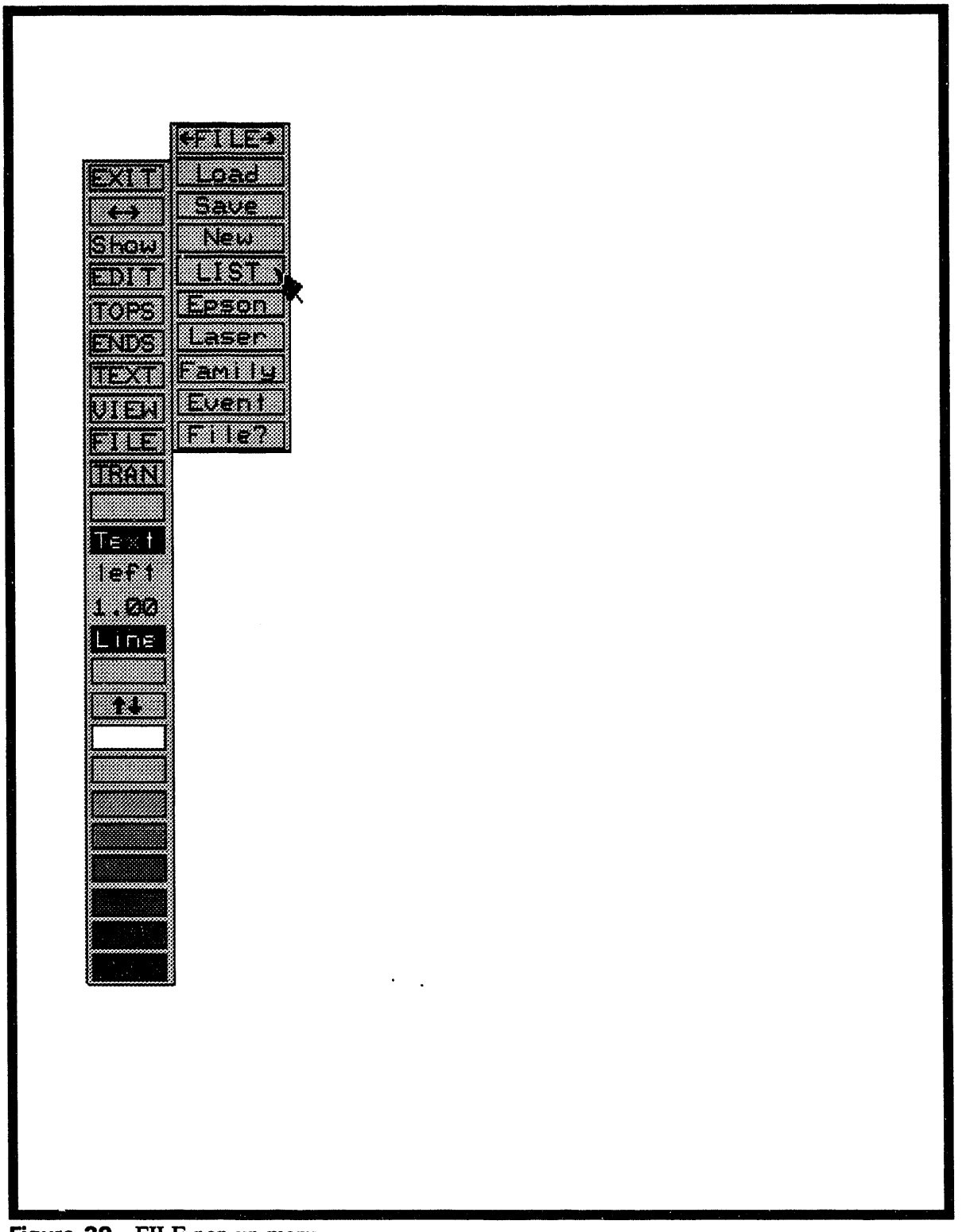


Figure 29. FILE pop-up menu.

5.9.5 LIST

This is one of the two options used to load an event tree diagram. When you invoke this option, an additional pop-up menu will be displayed listing the files available. You will be prompted to **Pick the file to load**. To select a file to be loaded, position the cursor on the desired file name and press the left mouse button. The selected diagram will be displayed on the screen. You may now proceed with other editing functions.

5.9.6 Epson

This option formats the current diagram for an Epson printer and sends it to the attached local Epson printer.

5.9.7 Laser

This option formats the current diagram for a laser printer and sends it to the local laser printer to be printed.

5.9.8 Family

This option allows you to view and change the name of the family corresponding to the current diagram. The default family name is provided. When you invoke this option you will be prompted to **Type in the New Name or <Return> for *family name*>**. Enter a new file name if desired, or press <Enter> to accept the default family.

5.9.9 Event

This option allows you to view and change the event tree file name. The current file name for the event tree is provided. When you invoke this option, you will be prompted to **Type in the New Name or <Return> for *current file name* >**. Enter a new file name and press <Enter> or leave blank and press <Enter> to keep the current file name.

5.9.10 File?

This option allows you to view the current file name. When this option is invoked the current file name is displayed at the bottom left corner of the screen. If no file name is assigned to the current diagram, the default file name of **NONAME.ETG** will be displayed.

5.10 TRAN

This option allows you to add, delete, and modify transfer file names as well as transfer to and from files that are added as transfers. When you invoke this option, an additional pop-up menu will be displayed (Figure 30). Each pop-up option is discussed in the following paragraphs.

5.10.1 Add

The add option allows you to place a transfer file name in the diagram. This transfer file name can then be selected and you can transfer back and forth between the two event tree diagrams or any number of diagrams (files) that are included in the transfer list. When you invoke this option you will be prompted to **Pick the leaf where the transfer is to be placed**. The cursor will move vertically along the end of the event branches. Position the cursor on the desired transfer point and press the left mouse button. The prompt **Enter transfer file name** will be displayed. Enter the appropriate file name and press <Enter>. A "T" is placed after the selected sequence number and the entered file name is placed in the corresponding end state slot. The prompt **Pick the leaf where the transfer is to be placed** will return. At this point you may select another transfer point or press the right mouse button to terminate the process.

5.10.2 Delete

This option allows you to delete transfer file names from the diagram. When you invoke this option you will be prompted to **Pick the leaf corresponding to the transfer to be deleted**. Position the cursor on the leaf branch where a transfer has been previously added and press the left mouse button. The "T" will be deleted and the corresponding sequence name will be removed from the transfer list. You will be returned to the previous prompt. At this point you may select another transfer point to delete or press the right mouse button to terminate the process.

5.10.3 Modify

This option allows you to change the transfer file name. When you invoke this option you will be prompted to **Pick the leaf corresponding to the transfer to be edited**. Position the cursor on the transfer leaf and press the left mouse button. The prompt **Type in the New Name or <Return> for *current transfer file name* >**. Enter the new transfer file name or press <Enter> to retain the existing file name.

5.10.4 Tran→

This option allows you to work with multiple files simultaneously. When you invoke this option you will be prompted to **Pick the leaf corresponding to the desired transfer file name**. The selected file is then loaded into the system. This option will allow you to transfer back and forth to various files.

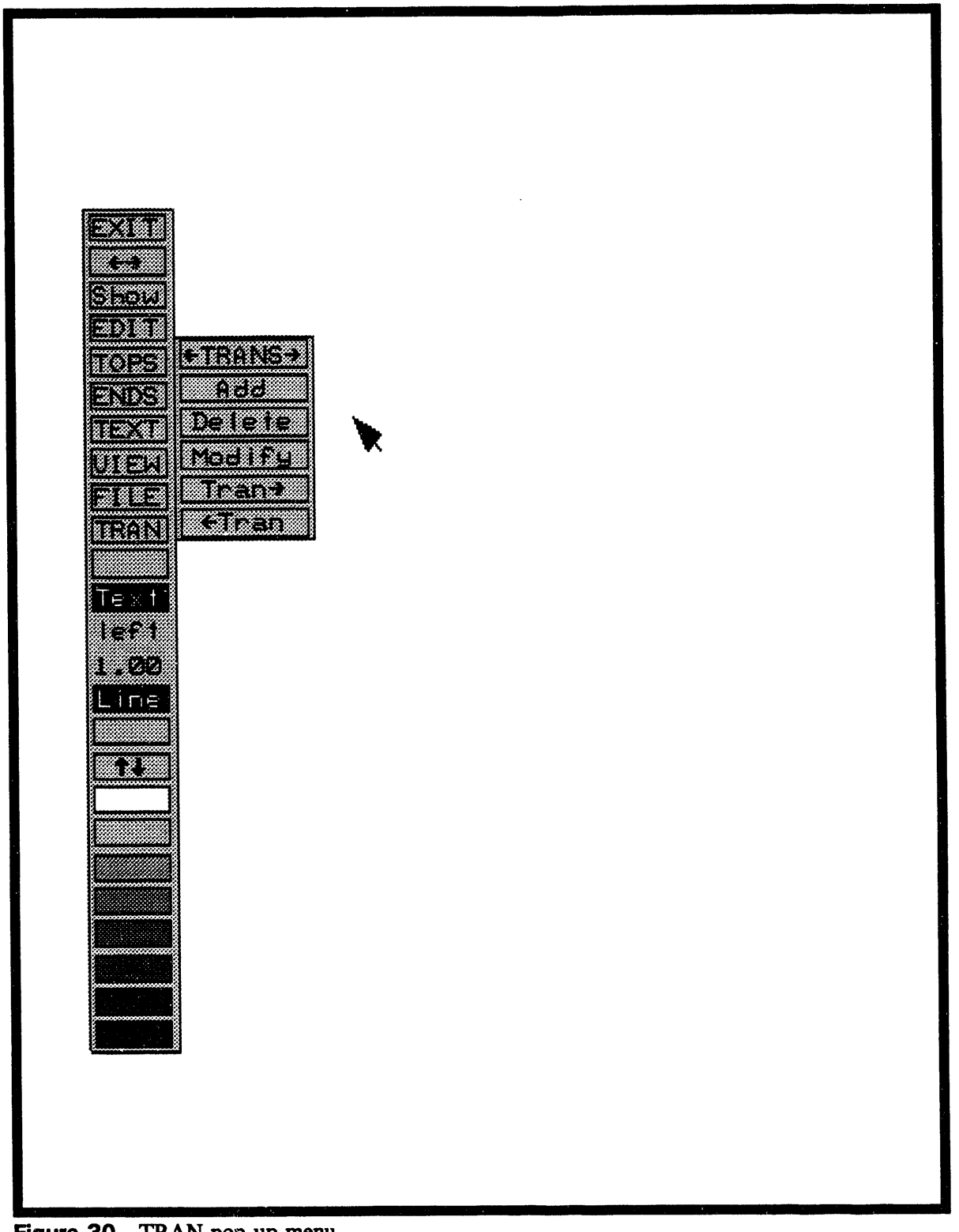


Figure 30. TRAN pop-up menu.

5.10.5 ←Tran

After a transfer to another file has been made, you use this option to return to the previous file. When you invoke this option you will be prompted to **Pick the file to transfer to**. A pop-up window will appear showing you a list of available transfer files. Select a file by positioning the cursor on the desired file and pressing left mouse button. If no files exist, the message **No transfer files** will be displayed.

5.11 Text

This option allows you to set a default color for the text in your diagram. To invoke this option, position the cursor over the Text box and press the left mouse button. You will be prompted to **Pick a new color from the color bar**. Position the cursor on the desired color and press the left mouse button. (**NOTE:** The ↑↓ is active. Use this option to display additional color selections.) The Text box will change to the selected color. All text created in your diagram from now on will be displayed in this new color. Any existing text in your diagram will retain the old color. To change the color of the existing text, you must invoke the TEXT option and select the EDIT suboption and invoke the Color command (see Section 5.7.7.3).

5.12 cntr/left/rght

This option allows you to set the justification for your diagram. Justification is where the text will be placed offset from the placement point. This works as a toggle switch. To change justification, position the cursor over the cntr (left or rght) box and press the left mouse button. You will see the box change from cntr to rght (right). Press the left mouse button again and the box will change from rght to left.

Left justification means the text will be anchored at the left bottom corner, or the text will flow to the right of where it was placed. Center justification means the text will be centered about the placement point. Right justification means the text will be placed to the left of the placement point. Set the toggle switch for the desired justification.

5.13 Text Size

This option allows you to set a default text size for your diagrams. Text sizes range from .001 to 9.0. For the purpose of writing general text in event trees, a text size of about 0.5 is appropriate. The size looks too small on the screen, but it is a good size for sending to a laser printer. When you invoke this option you are prompted to **Enter new text size >**. Enter the desired size and press <Enter>. The Text Size box will reflect the current default setting. Remember, here you are setting the default text sizes. You may always change the text size for selected text by invoking the TEXT option, selecting the EDIT suboption, and invoking the Size command (see Section 5.7.7.4).

5.14 Line

This option allows you to select a color for the lines in your diagram. When you invoke this option you will be prompted to **Pick a new color from the color bar**. Position the cursor over the desired color and press the left mouse button. The Line box will change to reflect the newly selected color. (Remember, you may use the color feature (↑ ↓) to display additional colors). All new lines generated in your diagram will be this default color.

5.15 ↑ ↓ (Color)

This option allows you to scroll the color bar to display the additional color selections available. Position the cursor on the scroll box (↑ ↓) and press the left mouse button or <Enter> key. The next series of colors will be displayed.

NOTE: When you try to exit the Create Event Trees option without saving your changes, you will be prompted with **ARE YOU SURE? Enter "Y" to Quit anyway**. At this point you may enter a <Y> to quit without saving or press <Enter> to terminate the exit procedure.

6. P&ID EDITOR

The Piping and Instrumentation Diagram (P&ID) Editor is available only through FEP. The P&ID Editor allows you to quickly create and edit flow diagrams. In addition, you have the ability to construct and define any symbol desired. The user constructed symbols are displayed in the menus as they will appear and can be selected directly from the menus. To invoke the P&ID Editor you may select it from the FEP main menu or supply a command line parameter to the FEP program. To invoke the P&ID Editor using a command line parameter, type:

C:\SAF50>**fep PID <Enter>**

After invoking this Editor, the screen will clear and Figure 31 will be displayed. To invoke any of the editing commands (using a mouse), position the cursor over the desired editing command on the active menu. The active menu is the last menu you pulled up or moved. When the editing command box is highlighted (a white line outlines the box), press the left mouse button. The command is now invoked. Each editing command is described in the following paragraphs.

6.1 EXIT

This option terminates the editing session and returns you to the FEP Main Menu. To invoke this option, position the cursor over the EXIT box and press the left mouse button or <Enter>.

6.2 Move (⟷)

The "tear off" or "move" command, which is represented by ⟷, allows you to position the editing command menu anywhere on the screen. When you invoke this command, a white outline surrounds the entire editing column. Drag the cursor to position the outline at the desired location and press the left mouse button or <Enter>. The menu will be displayed at the new location.

6.3 Show

This command clears the screen and re-displays the currently defined diagram.

6.4 EDIT

This command allows you to make changes to the diagram. When you invoke this option, an additional pop-up menu is displayed (Figure 32, Figure 54). Each of these editing commands is described in the following paragraphs.

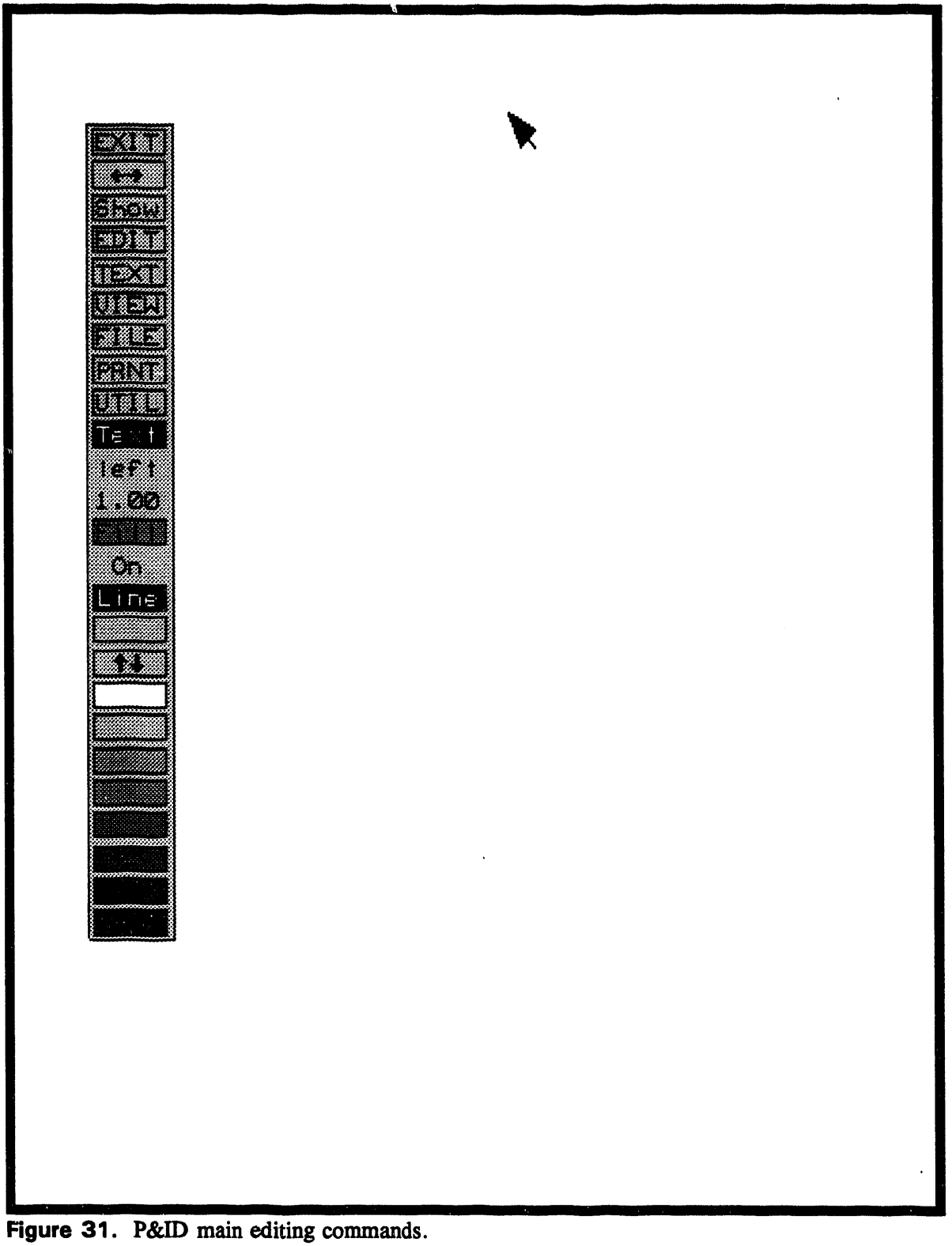


Figure 31. P&ID main editing commands.

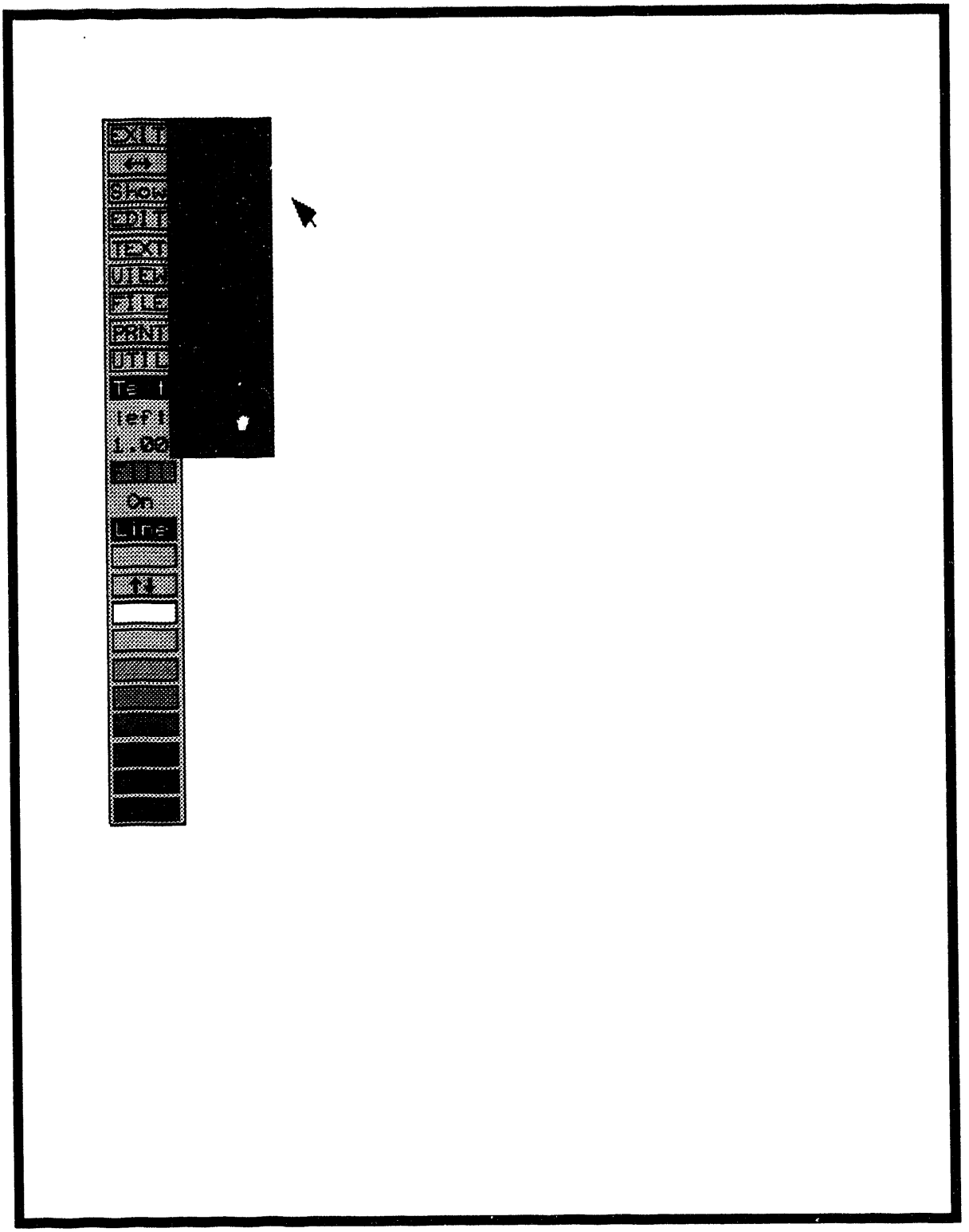


Figure 32. EDIT commands.

6.4.1 ←EDIT→

This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←EDIT→ box and press the left mouse button. An outline will appear. Move the outline to the new location on the screen and press the left mouse button. The menu will be moved to the new location.

6.4.2 Delete

This option allows you to delete a specified portion of the displayed diagram. When you invoke this option, you will be prompted to **Pick region to be deleted**. Position the cursor at the place you want to delete and press the left mouse button. A small dot will appear. Drag the cursor over the area to be deleted until the outline box completely surrounds the area. Press the left mouse button. It is important to note that only those items that are completely within the boundaries of the box will be deleted, except the lines. To delete lines the box must only intersect with the lines. Upon pressing <Enter>, a menu will appear in the center of the screen and you will be prompted to **Select type of deletion - CANCEL to terminate**. This menu allows you to selectively delete classes of items within the box. They are: lines, text, symbols, or all. For example selecting "Lines" will delete all lines within or intersecting with, the box. All other items are left alone. Selecting "All" will delete all items. The cancel button (i.e., the right mouse button or the <Esc> key) will terminate the operation.

After the operation is complete the prompt, **Pick next region to be deleted** is given. A new box may be drawn around any items to be deleted or the delete command may be exited by pressing the right mouse button.

6.4.3 Copy

This option allows you to copy the selected portion of the diagram to a new location on the screen. When you invoke this option you will be prompted to **Pick region to be copied - cancel to quit**. You select the region by marking the opposite corners of the region to be copied. Position the cross hair at the area you wish to copy and press the left mouse button. A small dot appears. Drag the cursor across the desired region until the box totally surrounds the desired region. Press the left mouse button. The message **Pick reference point - cancel to quit** will be displayed. The reference point is used to give you some indication of the position of the object being copied relative to the box. Position the cross hair at the location where you want the selected region to be copied to and press the left mouse button. Next, you will be prompted to **Pick placement point - cancel to reselect** will be displayed again. Use the mouse to move the box to the exact position where you want the selected region to appear. When you are satisfied with the new position, press the left mouse button. The selected region will be copied to the new location. After completion of the copy, the prompt **Pick reference point - cancel to reselect** will return. At this point you may select another location to copy the region, or press the right mouse button or <Esc> key to terminate the process.

6.4.4 Move

This option allows you to move the selected portion of the diagram to a new location on the screen. When you invoke this option, you will be prompted to **Pick region to be moved - cancel to quit**. Select the region by marking the opposite corners of the region to be moved. Position the cross hair at the area you wish to move and press the left mouse button. A small dot appears. Drag the cursor across the desired region until the box totally surrounds the desired region. Press the left mouse button. The message **Pick reference point - cancel to quit** will be displayed. The reference point is used to give you some indication of the position of the object being copied relative to the box. Position the cross hair at the location where you want the selected region to be moved to and press the left mouse button. Next, you will be prompted to **Pick placement point - cancel to reselect** will be displayed again. Use the mouse to move the box to the exact position where you want the selected region to appear. When you are satisfied with the new position, press the left mouse button. The selected region will be copied to the new location. After completion of the move, the prompt **Pick reference point - cancel to reselect** will return. At this point, you may select another location to move the region, or press the right mouse button or <Esc> key to terminate the process.

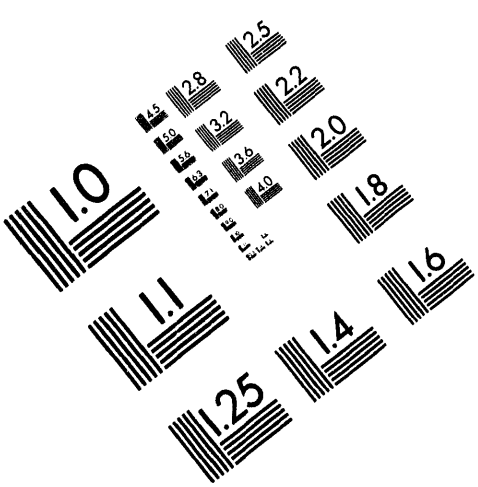
6.4.5 Scale

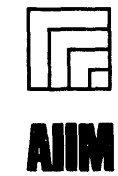
This option allows you to select items within the drawing and change their size. When you invoke this option, you will be prompted to **Box Symbols to scale**. You select the symbols to scale by marking the opposite corners of the region to be scaled. Position the cross hair at the area you wish to scale and press the left mouse button. A small dot appears. Drag the cursor across the desired region until the box totally surrounds the desired region. Press the left mouse button. You will be prompted to **Select edge/corner to expand - corners give even scale**. Position the cursor at the desired corner/edge and press the left mouse button. The prompt **Place edge** will be displayed. Position the cursor at the desired edge and press the left mouse button. Move the mouse to enlarge/reduce the scaling factor. The scaling factor is displayed at the bottom left corner of the screen and is updated as you move the mouse. When the desired scaling factor is reached, press the left mouse button or <Enter>. The symbol will be displayed in it new size. The prompt **Select edge/corner to expand - corners give even scale** will be displayed again. At this point, you may select a new region to scale or press the right mouse button to terminate the process.

Using scale, you can draw an entire diagram, label it, and then scale it to the size of the output page. Items may be scaled in any direction, to any size.

6.4.6 Rotate

This option allows you to rotate or spin any symbol or line. Rotate has two forms of use. The first (default) form rotates the item(s) about the center. The second rotates the item(s) about a user-specified point. When you invoke this option, you will be prompted to **Pick Symbol to rotate**. You select the symbols to rotate by marking the opposite corners of the region to be rotated. Position the cross hair at the symbol you wish to rotate and press the left mouse button. A small dot appears. Drag the cursor across the desired symbol until the box totally surrounds the desired symbol. Press the left mouse button. A small window appears containing the following options:





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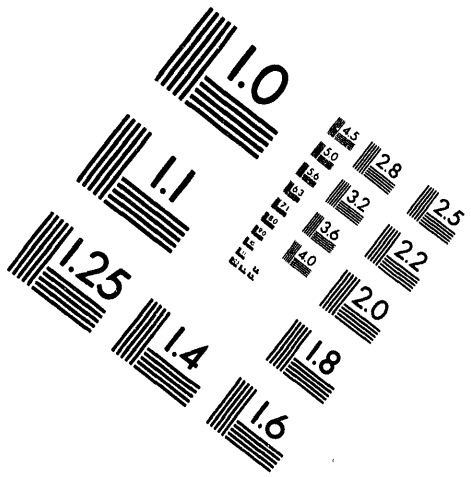

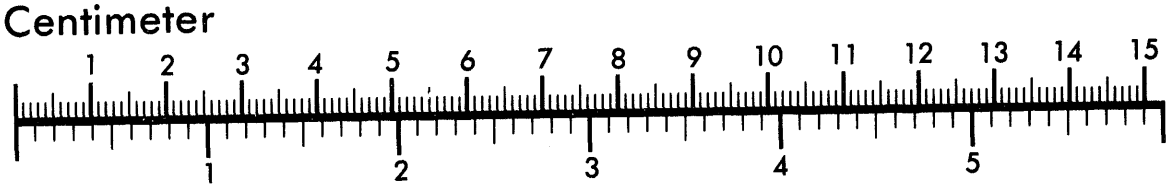

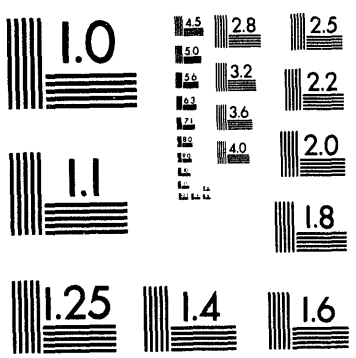

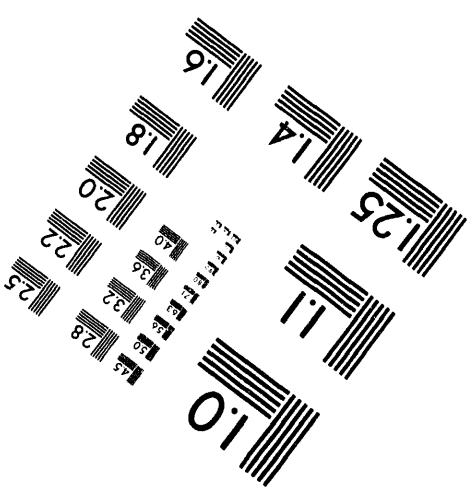

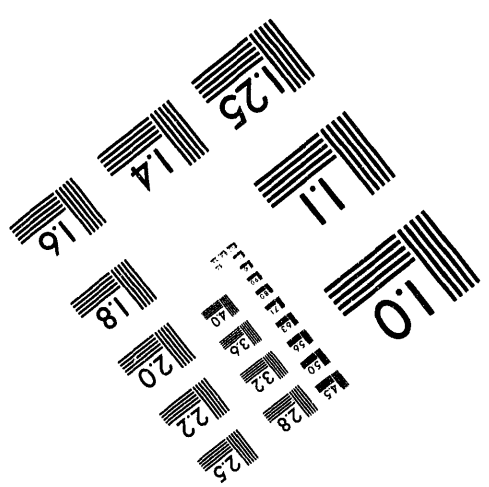

2 of 2

CANCEL	Terminates the current process and returns you to the **Pick next Symbol to rotate** prompt.
OK	Accepts the current rotation value displayed in the window.
Angle	Allows you to input the rotation value. You may enter a value from 0 to 360. This value will become the default value.
Left Window	This symbol (which looks like an analog clock without numbers) can also be used to change the rotation value. Position the cursor in the box at the approximate angle you wish to rotate the symbol and press the left mouse button. The amount of the rotation is displayed in the Angle window. When satisfied with the rotation value, position the cursor on the OK window and press the left mouse button. The selected symbol will be rotated to the specified angle.

NOTE: Text is rotated by entering the exact amount in the Angle window. Orientation is always horizontal.

When complete, the prompt **Pick next Symbol to rotate** will reappear. At this point, you may select another symbol to rotate or press the right mouse button to terminate the rotate option.

6.4.7 ←Flip→ and ↑Flip↓

This option allows you to invert a symbol. For example, a given symbol may be defined in a particular drawing as having one input and one output. The input is on the left side of the symbol and the output on the right. This defines the flow or direction of the symbol as left to right. However, the logic or drawing may dictate that the flow is going in a right to left direction. Connecting the symbols in this manner may yield incorrect logic in the drawing. Therefore, the symbol may be flipped to invert the direction of flow through the symbols. The "←Flip→" command inverts a symbol horizontally; the "↓↑Flip" command inverts a symbol vertically.

When you invoke either flip symbol you will be prompted to **Box Symbols to flip**. You select the symbol to flip by marking the opposite corners of the symbol to be flipped. Position the cross hair at the area you wish to flip and press the left mouse button. A small dot appears. Drag the cursor across the desired region until the box totally surrounds the desired symbol. Press the left mouse button. The symbol will be flipped in the specified direction and the prompt **Box next symbol to flip** will be displayed. At this point you may continue to flip symbols or press the right mouse button to terminate the process.

6.4.8 Adjust

This command allows you to line up symbols. After a rotation or scale a symbol may no longer be lined up according to its snap point. To adjust a symbol or symbols, select the command and box the symbols in the same fashion as the Flip command.

6.4.9 Symbls

The "SYMBLS" command is used to select the proper symbol and place it in your drawing. When you invoke this command, the symbols submenu is displayed (Figure 33, Figure 55). As shown, this submenu contains a graphic representation of each symbol in the current symbol file. If the current file is incorrect or the required symbol needs to be created refer to Section 7.6 for information on how to modify the symbol file. The symbol submenu is capable of displaying only six symbols at one time. However, there may be many more symbols contained within the current symbol file. It is possible to view each symbol in the file by selecting one of the arrows ("◄" or "►") in the upper left, and upper right corners of the symbol menu. This will page or scroll though the entire list of symbols. It is also possible to select a page of symbols directly without scrolling through one page at a time. The symbol submenu provides a status bar that displays the currently selected page. The status bar is divided into segments, which presents six symbols at a time. To display a specific page, you select a specific segment. This function is only useful when you know which page contains the desired symbol.

When the symbol that is to be placed into the drawing is displayed in the menu, place the cursor in the appropriate box and select it. The cursor now takes on the shape of the selected symbol and may be moved to anyplace on the screen. When the cursor is over the location of the desired placement point, select it. This will place the symbol down in the drawing. You may continue placing the same symbol into the drawing each time a placement point is selected. To get a new symbol, press the right mouse button (cancel) and select a new symbol from the symbol menu. To exit the symbol command, press the right mouse button again. Press the right mouse button again to remove the symbol submenu from the screen.

6.4.10 Line

Lines are symbols that are used to link other symbols together, such as a pipe connecting two valves. When the "Line" command is selected in the edit menu, a submenu called the "Line" menu is displayed (see Figure 34). You may then pick the desired line type to be used from this menu. When this is done the prompt **Enter points in order of direction of flow** is given. Position the cursor at the desired start point and press the left mouse button. A small dot appears and you are asked to **Enter next point**. Drag the cursor to the desired location and length and press the left mouse button. An additional line may be added to the first by simply selecting one additional point. To start a new line, press the cancel button and the original prompt **Enter points in order of direction of flow** appears. To pick a new line type or to exit the line command, press the cancel button again. When this is done, the line menu remains on the screen.

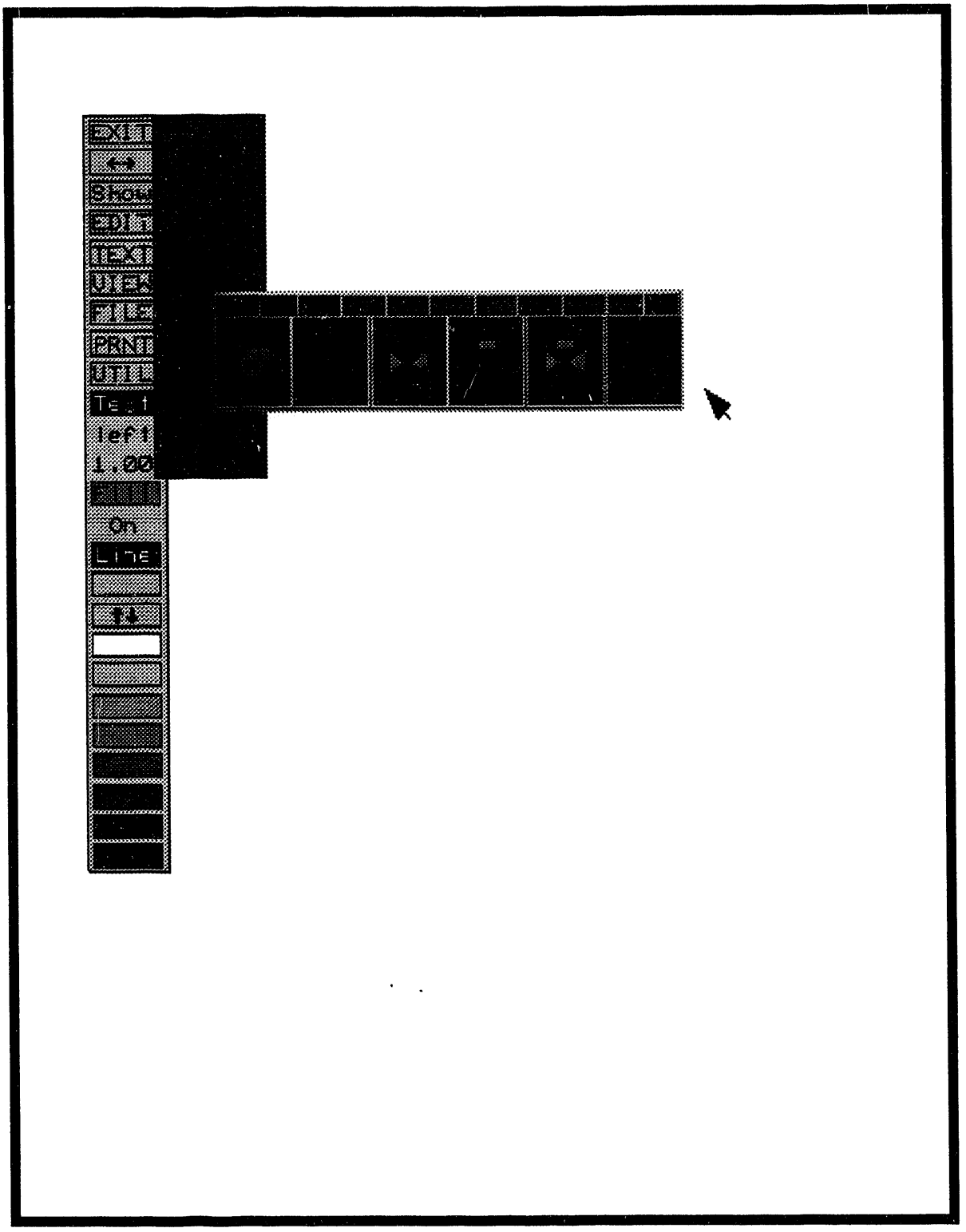

Figure 33. Symbols menu.

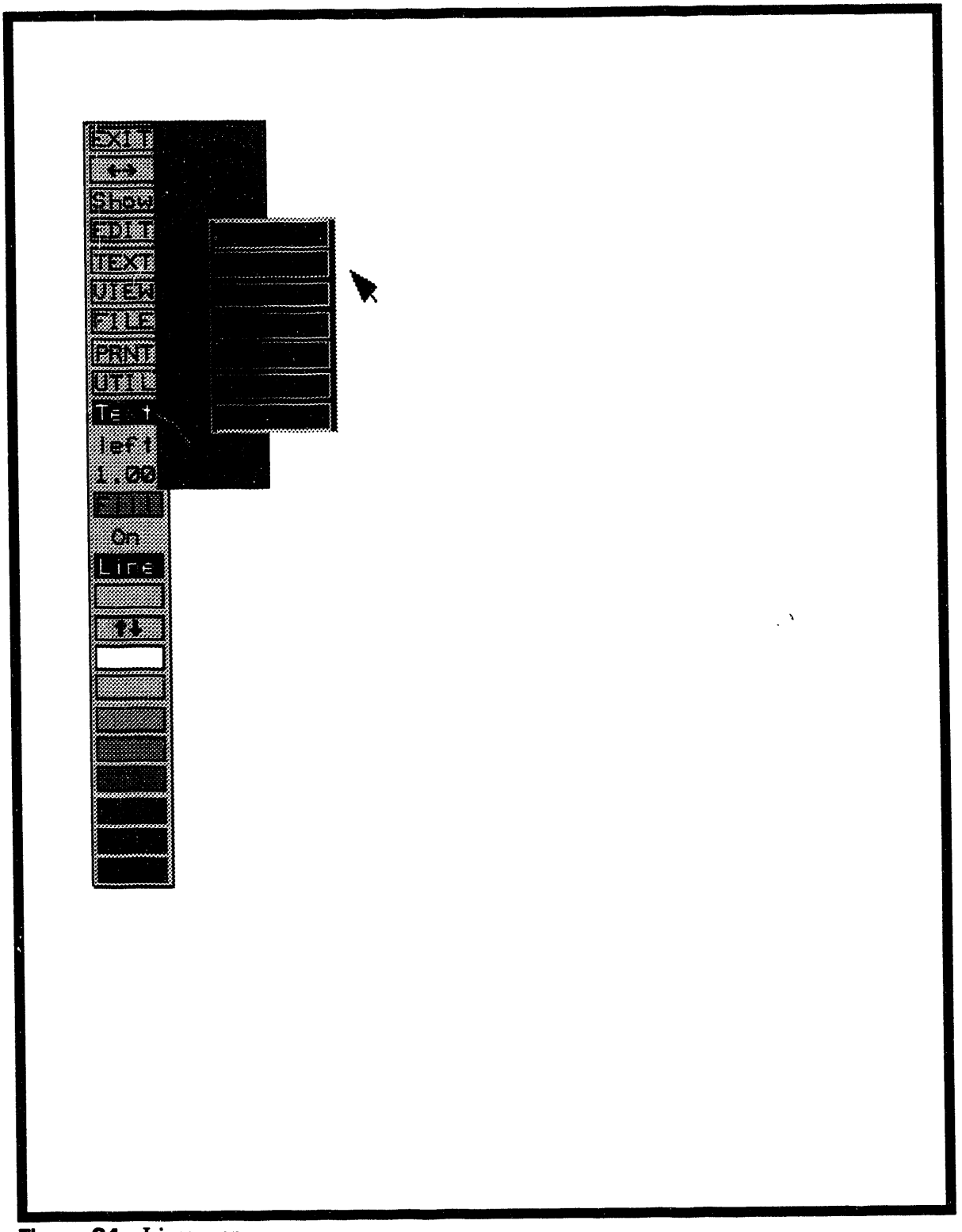

Figure 34. Lines menu.

The Line menu contains a command called "Ortho", for orthogonal line function. This command is a toggle that switches the ortho function on or off (Y or N). The line function will automatically connect the symbols together (output to input if defined). The orthogonal line function will draw lines in at only right angles; thus, if a symbols output does not line up with the next symbols input a line adjustment is automatically made. If ortho is off, then a diagonal line is drawn instead.

With the orthogonal line function, if you try to connect two symbols in which the flow is incorrect a message is given which states that the flow may be incorrect and asks you to verify.

6.4.11 ATTRIB

This command allows you to make changes to symbols that have already been placed in a drawing. When you invoke this command, another submenu (Figure 35) will be displayed. As shown, the following options are available:

Fill col This command allows you to change the fill color for specific symbols. When you invoke this option, you will be prompted to **Pick a new color from the color bar**. Position the cursor on the desired color and press the left mouse button. (Remember, activate the color bar (↑ ↓) to display additional color selections.) The prompt **Box the symbols to be changed** will be displayed. To box the symbols, you mark the opposite corners of the symbols to be changed. Position the cross hair at the area you wish to change and press the left mouse button. A small dot appears. Drag the cursor across the desired symbols until the box totally surrounds the desired region. Press the left mouse button. The symbol will change to the specified fill color and the prompt **Box the symbols to be changed** will be displayed. At this point, you may select additional symbols to change or press the right mouse button to terminate the process. Remember, this does not change the default fill color. This command allows you to change the color of existing symbols only.

Name col Same as Fill Col above, except you are changing the color of the name.

Name This command allows you to change the name of a specified symbol. When you invoke this option, you will be prompted to **Box the symbols to be changed**. To box the symbol, you mark the opposite corners of the symbol to be changed. Position the cross hair at the area you wish to change and press the left mouse button. A small dot appears. Drag the cursor across the desired symbol until the box totally surrounds the desired region. Press the left mouse button. You will be prompted to **Enter new symbol name:**. Type in the new symbol name from the keyboard and press <Enter>. Symbol names must be unique and can be up to 16 characters long. Once the new name has been entered the screen is updated to reflect the change. The prompt **Box next symbols to be changed** will be displayed. At this point, you may continue to box symbols and change names, or press the right mouse button to terminate the process.

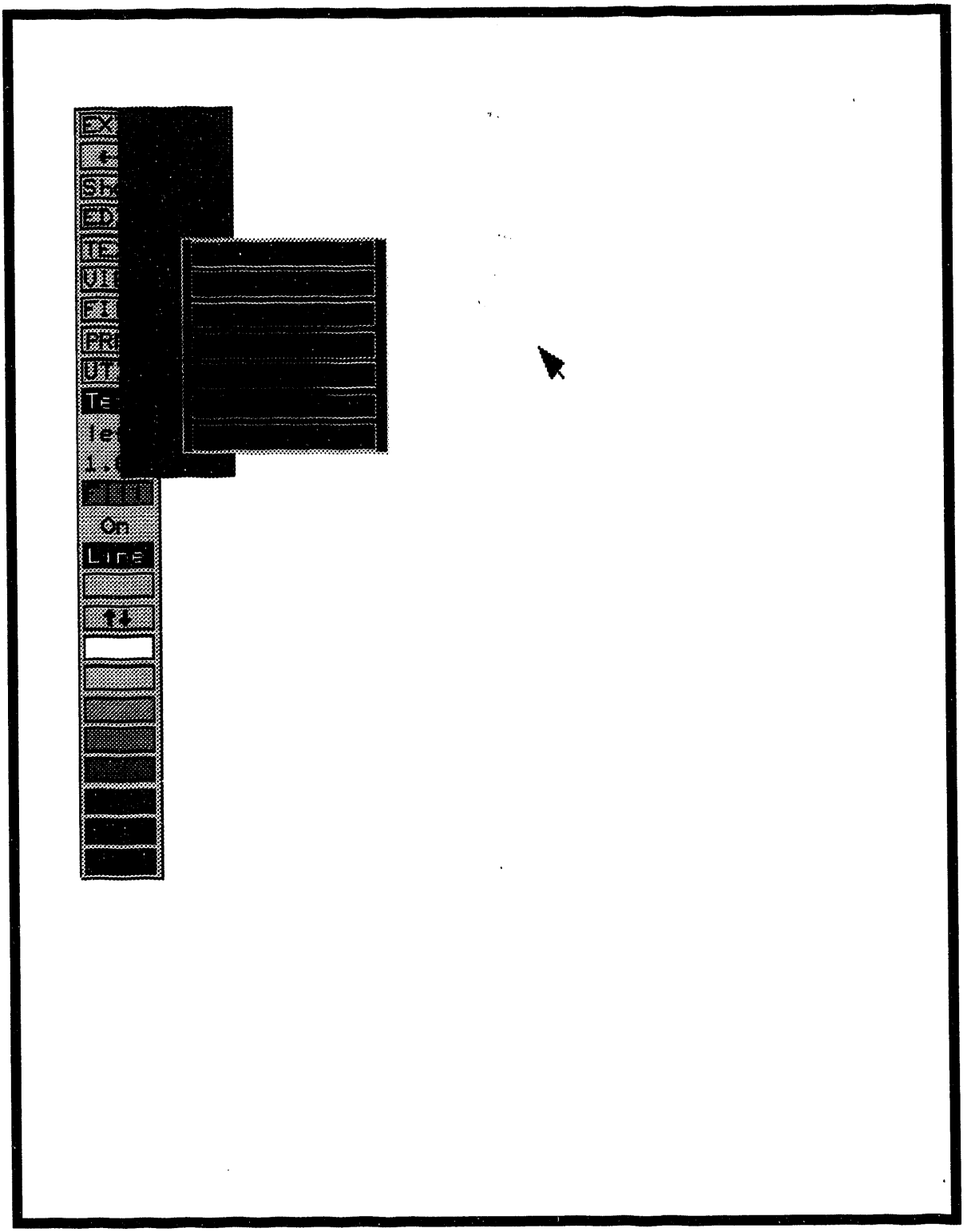

Figure 35. Symbol attributes submenu.

Name size This command allows you to change the size the name is displayed or printed in. When you invoke this option you will be prompted to **Enter new text size >**. Text sizes are indicated by a number between 0.01 and 66.00, with 66 being the full 66 lines from the top to the bottom of the screen. Negative numbers are not valid. Enter the desired text size and press <Enter>. You will be prompted to **Box the symbols to be changed**. To box the symbol, you mark the opposite corners of the symbol to be changed. Position the cross hair at the area you wish to change and press the left mouse button. A small dot appears. Drag the cursor across the desired symbol until the box totally surrounds the desired region. Press the left mouse button. The change will be applied to the drawing and the prompt **Box next symbols to be changed** will be displayed. At this point, you may continue the process, or press the right mouse button to terminate the process.

Name FONT This command allows you to change the font for a specified name. When you invoke this option, the font submenu will be displayed. Select the font by positioning the cursor over the desired font on the submenu and pressing the left mouse button. You will be prompted to **Box the symbols to be changed**. To box the symbols, you mark the opposite corners of the symbols to be changed. Position the cross hair at the area you wish to change and press the left mouse button. A small dot appears. Drag the cursor across the desired symbol until the box totally surrounds the desired region. Press the left mouse button. The drawing will be updated to reflect the change and you will be returned to the **Box symbols to be changed** prompt. You can continue this process, or press the right mouse button to terminate this process.

Line Col Same as Fil col, except you are changing the color of the line(s).

6.5 TEXT

This option allows you to add or manipulate the text in your drawing. When you invoke this option, Figure 36 will be displayed. Each text command is discussed in the following paragraphs.

6.5.1 ←TEXT→

This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←TEXT→ box and press the left mouse button. An outline will appear. Move the outline to the new location on the screen and press the left mouse button. The menu will be moved to the new location.

6.5.2 Font

The font command allows you to select the default font for the text. Selection is done in the same manner as explained above in the Edit - Name Font section.

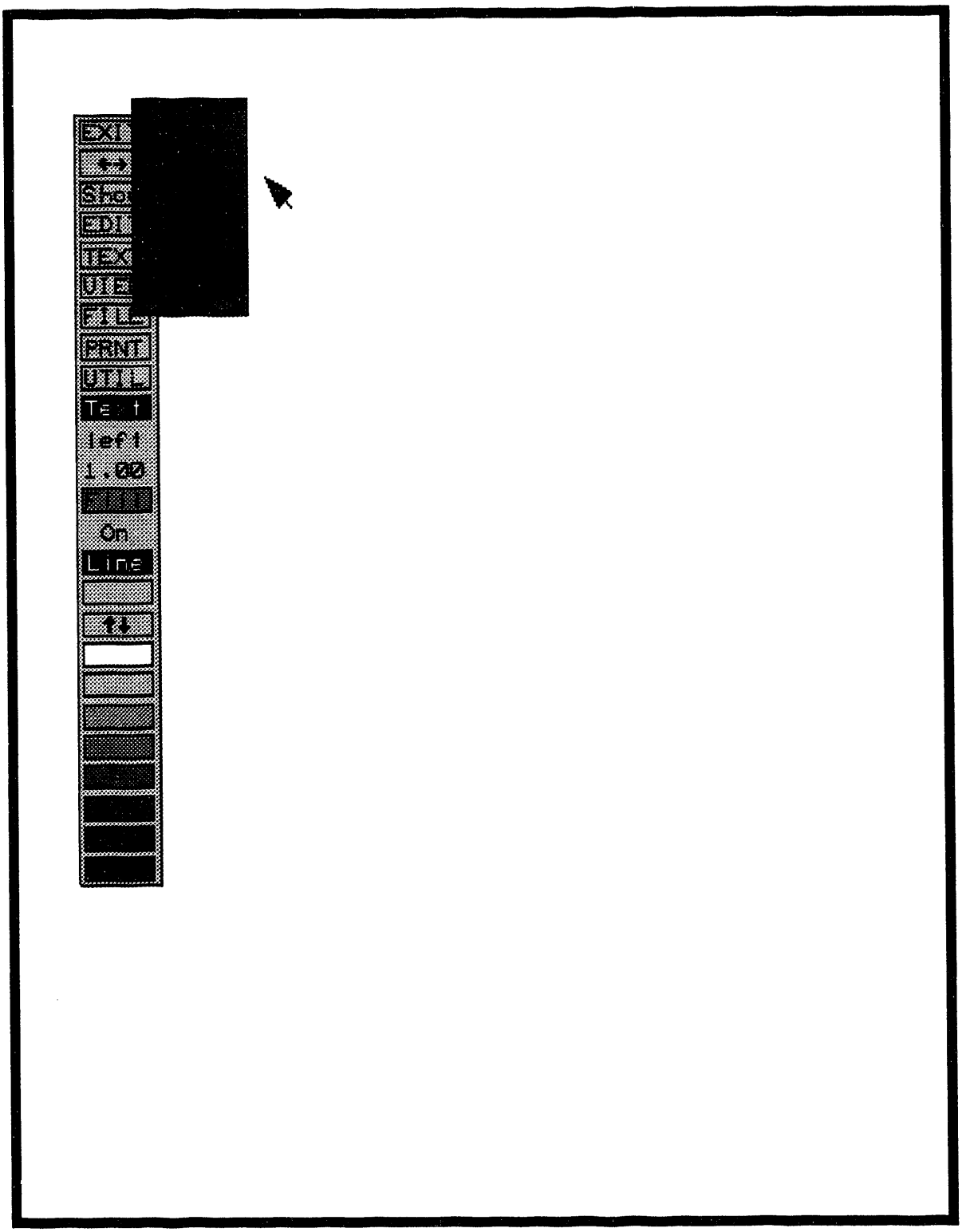

Figure 36. Text menu.

6.5.3 Write

The "WRITE" command allows you to place text at any location on the screen. When you invoke this command you will be prompted to **Pick text placement location**. Position the cross hair on the screen where you want the new text to be placed and press the left mouse button. A window will appear in the upper left corner of the screen. You may enter up to 10 lines of text with 60 characters each. Enter the desired text and when complete press the <Esc> key. The following is a description of the keys that can be used in the window editor:

<↑, ↓, →, ←>:	Moves the direction indicated within the window.
<Enter>:	Positions the cursor at the beginning of the next line.
<Backspace>:	Moves all the characters, from the cursor to the line's end, to the left one space.
<Del>:	Deletes the character at the cursor position, then moves all the characters to the line's end left one space.
<End>:	Positions the cursor at the line's end.
<Ins>:	Turns on the insert mode.
<Esc>:	Exits the window editor.

6.5.4 Copy

Allows you to copy any text and place it at any location in the diagram. When you invoke this option you will be prompted to **Pick region to be copied - cancel to quit**. Position the cross hair at the text you want to copy and press the left mouse button. A small dot appears. Drag the mouse until the box completely surrounds the text to be copied. Press the left mouse button. Next, you will be prompted to **Pick reference point - cancel to quit**. The reference point is used to give you some indication of the position of the text being moved relative to the box. Position the cursor at the desired point and press the left mouse button. You will be prompted to **Pick placement point - cancel to reselect**. Position the cursor at the desired placement point and press the left mouse button. The selected text will be displayed at the new placement point. (The text still remains at its original location). The prompt **Pick placement point - cancel to reselect** will return. At this point, you may select another placement point to copy the selected text, or press the right mouse button to terminate the process.

6.5.5 Move

This command operates the same as the COPY command, except the selected text is moved rather than copied.

6.5.6 Erase

This command allows you to delete selected text. When you invoke this option you will be prompted to **Pick region to be deleted**. To select the text to be deleted you mark the opposite ends of the text. Position the cross hair at the text to be deleted and press the left mouse button. A small dot appears. Drag the cursor across the text until the box completely surrounds the text to be deleted. Press the left mouse button. The text will be deleted and the prompt **Pick next region to be deleted** will be displayed. At this point you may select more text to delete or press the right mouse button to terminate the process. **NOTE:** If the text was not deleted, the box was not large enough.

6.5.7 Edit

This command allows you to alter existing text by changing the size, color, context, and justification. When you invoke this option, the Edit submenu will be displayed (Figure 37).

The following options are available:

←EDIT→ This option allows you to move the pop-up menu to a new location on the screen. To invoke this option, position the cursor on the ←EDIT→ box and press the left mouse button. An outline will appear. Move the outline to the new location on the screen and press the left mouse button. The menu will be moved to the new location.

Text This option allows you to edit any text displayed on the screen. When you invoke this option, you will be prompted to **Pick the text to be changed**. To select the text to be changed you mark the opposite ends of the text. Position the cross hair at the text to be changed and press the left mouse button. A small dot appears. Drag the cursor across the text until the box completely surrounds the text to be changed. Press the left mouse button. A window appears displaying the selected text. Change the text as desired and press <Esc> when complete. The cursor movements used in this window are described in Section 6.5.3, the WRITE command.

Colr This command allows you to change the color of the specified text. When you invoke this option you will be prompted to **Pick a new color from the color bar**. Select the desired color and press the left mouse button. Next, you will be prompted to **Pick the text to be changed**. To select the text to be changed you mark the opposite ends of the text. Position the cross hair at the text to be changed and press the left mouse button. A small dot appears. Drag the cursor across the text until the box completely surrounds the text to be changed. Press the left mouse button. The selected text will change to the new color and the prompt **Pick the text to be changed** will be displayed. At this point, you may select more text to change to the new color, or press the right mouse button to terminate the process.

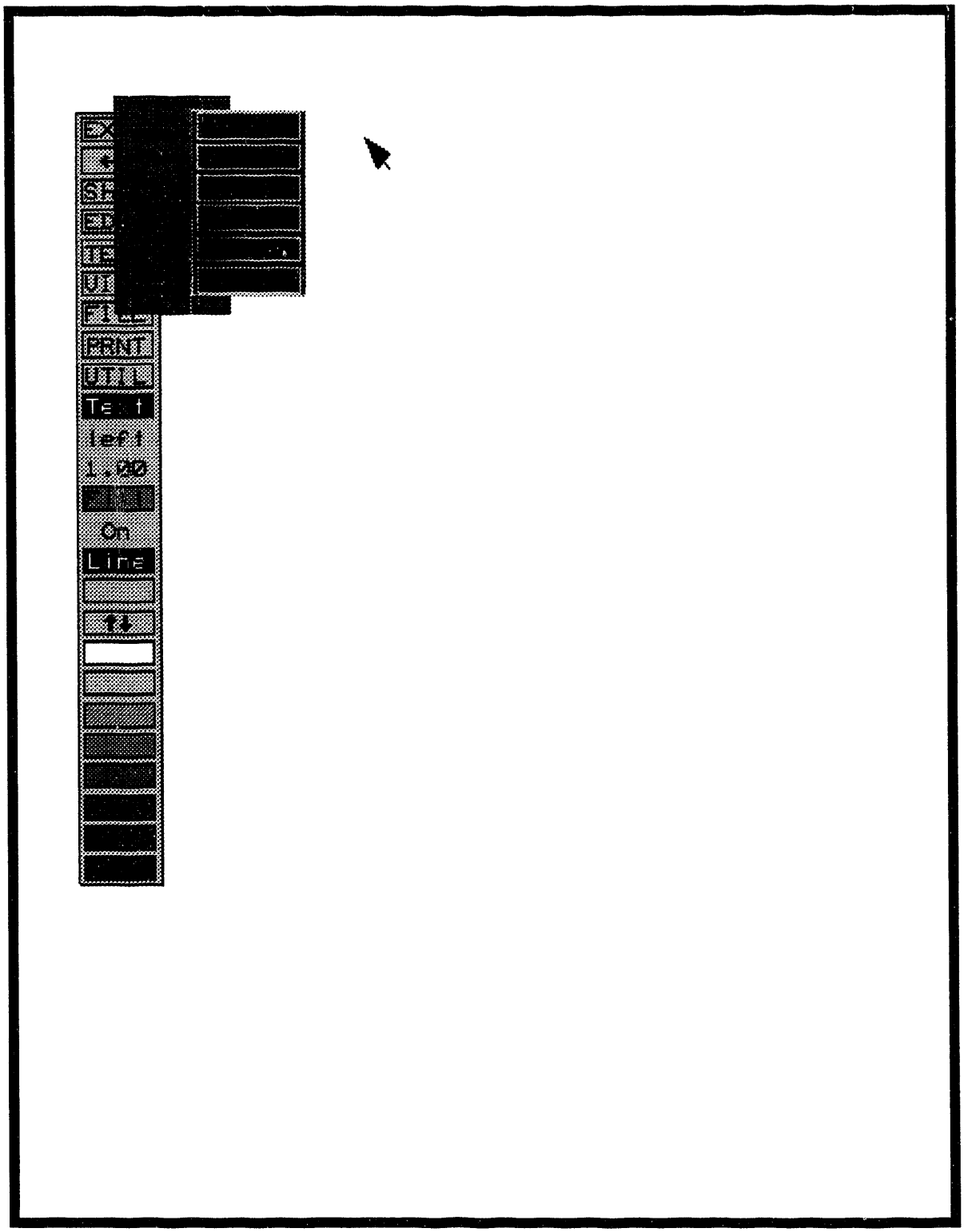

Figure 37. Text-edit submenu.

Size

This command allows you to change the size of the specified text. When you invoke this option you will be prompted to **Enter new text size >**. Enter the desired text size (1 - 66) and press the left mouse button. Next, you will be prompted to **Pick the text to be changed**. To select the text to be changed you mark the opposite ends of the text. Position the cross hair at the text to be changed and press the left mouse button. A small dot appears. Drag the cursor across the text until the box completely surrounds the text to be changed. Press the left mouse button. The selected text will change to the size and the prompt **Pick text to be changed - Press cancel to quit** will be displayed. At this point you may select more text to change to the new size or press the right mouse button to terminate the process.
NOTE: Remember, if the text does not change your box was not large enough.

Just

This command allows you to justify selected portions of the text in your diagram. When you invoke this command, the prompt **Enter text justification - ('L'=Left, 'R'=Right, 'C'=Center)** will be displayed. Enter the type of justification (L, R, or C). Next, you will be prompted to **Pick the text to be changed**. To select the text to be justified you mark the opposite ends of the text. Position the cross hair at the text to be justified and press the left mouse button. A small dot appears. Drag the cursor across the text until the box completely surrounds the text to be justified. Press the left mouse button. The selected text will be justified and the prompt **Pick text to be changed - Press cancel to quit** will be displayed. At this point you may select more text to justify, or press the right mouse button to terminate the process.

FONT

This command allows you to change the font of the specified text. When you invoke this option, the font submenu will be displayed. Select the font by positioning the cursor over the desired font and pressing the left mouse button. Next, you will be prompted to **Pick the text to be changed**. To select the text to be changed you mark the opposite ends of the text. Position the cross hair at the text to be changed and press the left mouse button. A small dot appears. Drag the cursor across the text until the box completely surrounds the text to be changed. Press the left mouse button. The selected text will change to the new font and the prompt **Pick text to be changed - Press cancel to quit** will be displayed. At this point you may select more text to change or press the right mouse button to terminate the process.
NOTE: Remember, if the text does not change your box was not large enough.

6.6 VIEW

This option allows you to change the position and size of the displayed diagram. You may move the drawing up, down, right, left, zoom in, zoom out, restore the drawing to its original size, or restore to the view previous to the last view change. When you select this option, Figure 38 will be displayed.

The first box, ←VIEW→, is used to move the VIEW menu to a new location on the screen. To invoke this option, position the cursor on the ←VIEW→ box and press the left mouse button. An outline box will appear. Move the outline to the desired location of the screen and press the left mouse button. In addition, you can remove the VIEW option box by positioning the cursor on the any command in the VIEW menu and pressing the right mouse button or pressing the <Esc> key. The VIEW submenu consists of the following options:

- Page ↑: Invoking this option allows you to shift the figure up one page (previous page). To invoke this option, position the cursor in the Page ↑ box and press the left mouse button or <Enter>. The diagram's previous page will be displayed and the message **View changed** will appear at the bottom of the screen. This message will remain on the screen until the view option is terminated.

- Page ↓: Invoking this option allows you to shift the figure down one page (next page). To invoke this option, position the cursor in the Page ↓ box and press the left mouse button or <Enter>. The diagram's next page will be displayed and the message **View changed** will appear at the bottom of the screen. This message will remain on the screen until the view option is terminated.

- Page ←: Invoking this option allows you to shift the figure to the left one page (one screen). To invoke this option, position the cursor in the Page ← box and press the left mouse button or <Enter>. The diagram will shift to the left one screen at a time and the message **View changed** will appear at the bottom of the screen. This message will remain on the screen until the view option is terminated.

- Page →: Invoking this option allows you to shift the figure to the right one page (one screen). To invoke this option, position the cursor in the Page → box and press the left mouse button or <Enter>. The diagram will shift to the left one screen at a time and the message **View changed** will appear at the bottom of the screen. This message will remain on the screen until the view option is terminated.

- Scroll: Invoking this option allows you to move the diagram to another location on the screen. To invoke this option, position the cursor in the Scroll box and press the left mouse button. A white outline box appears, with a cross hair placed in the center of the outline. Position the cursor at the desired location and press the left mouse button. The cross hair serves as a reference point for placing the drawing. The reference point (+) is used to give you some indication of the position of the object being moves relative to the screen.

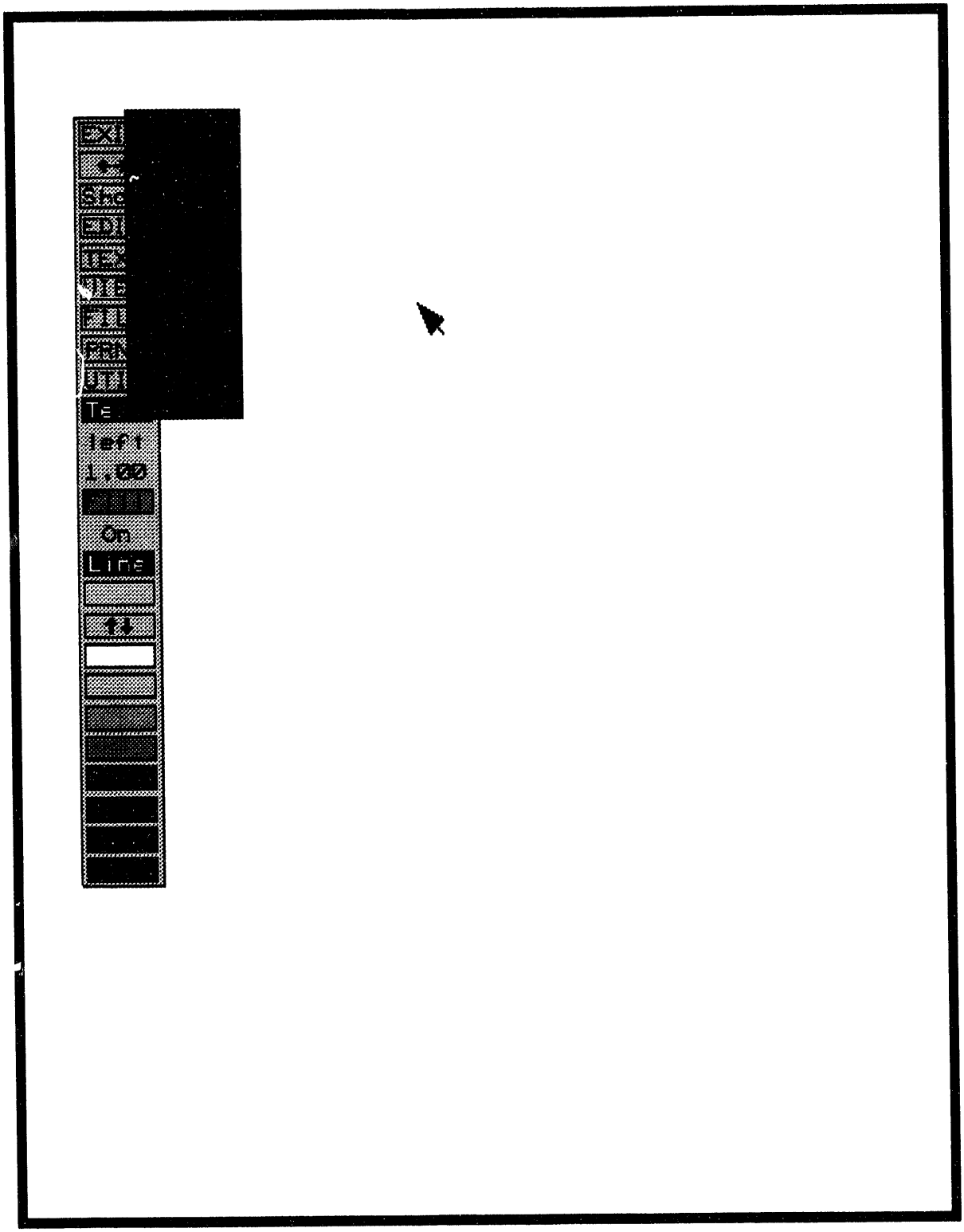

Figure 38. View menu.

- Zoom in: Invoking this option allows you to fill the screen with a small portion of the original display (magnifies the selected portion of the screen). To invoke this option, position the cursor in the Zin (zoom in) box and press the left mouse button or <Enter>. The message **Pick first corner** will be displayed. Move the cursor at the start of the diagram to be enlarged and press the left mouse button. A small dot appears. Drag the cursor across the desired area until it is completely surrounded by the outline box. Press the left mouse button. The portion of the original display enclosed by the box will now fill the entire screen. The display can be restored to its original size by invoking the Zres (zoom restore) option.

- Zoom out: Invoking this option allows you to shrink the screen by approximately 50%. To invoke this option, position the cursor in the Zout (zoom out) box and press the left mouse button or <Enter>. The entire display will be reduced. To restore the display to its original size, invoke the Zres option.

- Zoom Restore: This option restores any display created by Zin (zoom in) or Zout (zoom out) to the original display size or to the last saved file. To invoke this option, position the cursor in the Zres box and press the left mouse button or <Enter>.

- Zoom Previous: This option restores the display to the view previous to the last view change.

6.7 FILE

This option allows you to load and save drawings and to perform various file manipulations. When you invoke this option, Figure 39 will be displayed. Each command is discussed in the following paragraphs.

The first box, ←FILE→, is used to move the FILE menu to a new location on the screen. To invoke this option, position the cursor on the ←FILE→ box and press the left mouse button. An outline box will appear. Move the outline to the desired location on the screen and press the left mouse button. In addition, you can remove the FILE options box by positioning the cursor on any command in the FILE menu and pressing the right mouse button or pressing the <Esc> key.

6.7.1 Save

This option allows you to save all changes made to the diagram. When you invoke this option you will be prompted to **Enter file name or CR for file *current file name*.PID >**. To accept the default name press <Enter>, or you may enter a new file name. A file name consists of up to eight characters. A three character extension of .PID will be supplied by the system. If the default file name already exists (i.e., you have saved your diagram previously), the message **File already exists! Replace file? <Y/N>** will be displayed. If you wish to write the changes over the existing file, type a <Y> and press <Enter>; otherwise, enter an <N>.

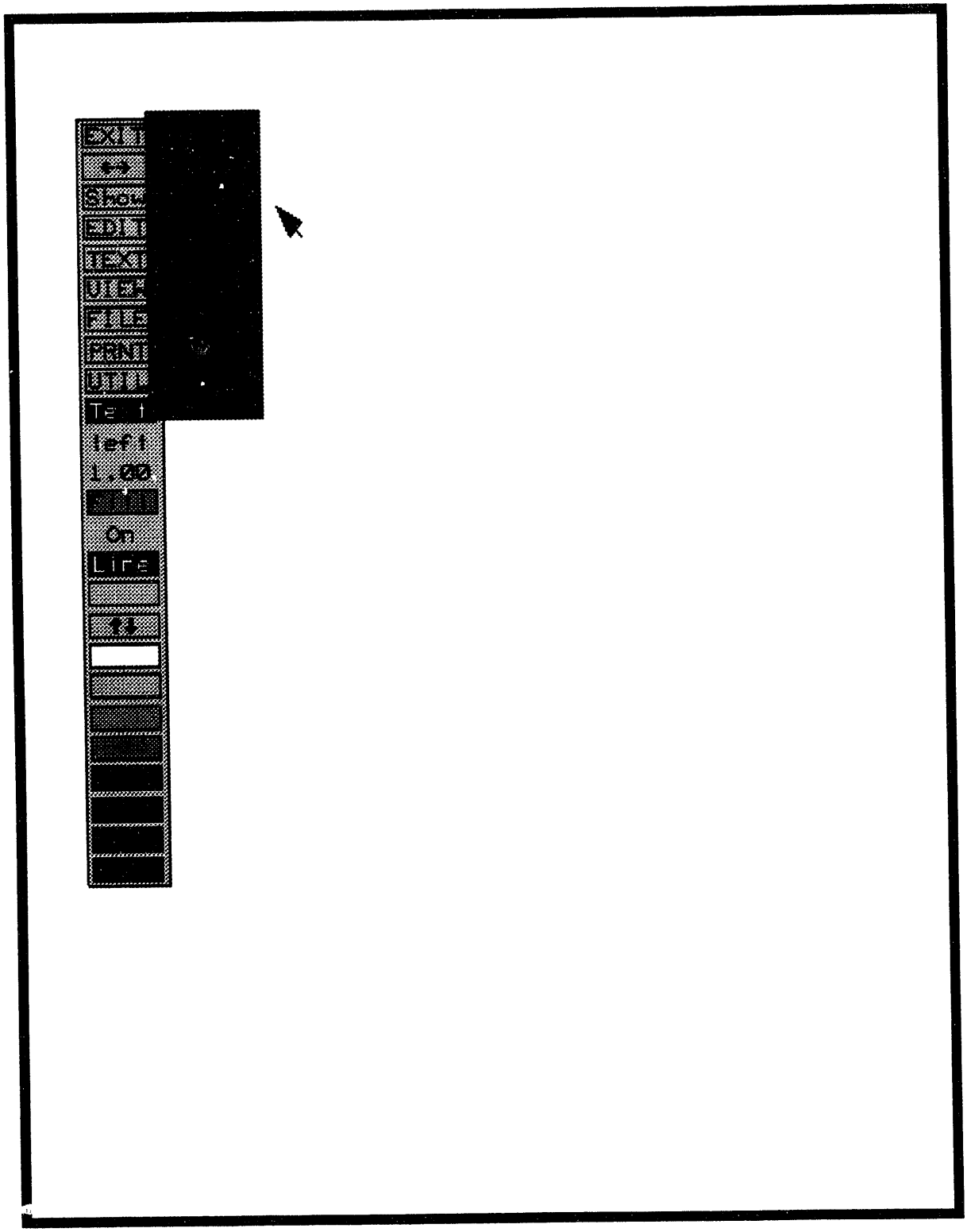

Figure 39. File menu.

6.7.2 Load

This option allows you to load any P&ID file with the extension of ".PID" onto the screen. When you invoke this option you will be prompted to **Enter file name >**. Enter the name of the file you wish to load and press <Enter>. The diagram will be loaded and displayed on the screen. If you do not remember your file name, use the List command to display all existing file names with an extension of ".PID" residing in the current directory.

6.7.3 List

This option displays a list of all files with a ".PID" extension currently residing in the default directory. When you invoke this option, a pop-up menu will be displayed showing all the files contained in the current directory. You will be prompted to **Pick the file to be loaded**. Position the cursor over the file name to load and press the left mouse button. The file will be loaded and displayed on the screen.

6.7.4 New

This option allows you to essentially cancel your current editing session. The new command will clear the screen if the current file has been saved or is unchanged. If the current file has not been saved then you are asked whether or not to discard the drawing anyway (without saving).

6.7.5 Xfer→ (Transfer)

This option allows you to work with more than one file at a time. When this option is invoked you will be prompted to **Pick transfer symbol to transfer**. Select the symbol and press the left mouse button. The program then loads this drawing onto the screen.

6.7.6 ←Xfer (Transfer Back)

After a transfer has been made, you need a way to get back to the transferring file. This is done by invoking this command, choosing a location for the transfer symbol, and supplying a file name for that transfer.

6.7.7 +Tran (Add Transfer)

To transfer, a transfer symbol must be added to the drawing. When you invoke this command, you must position the cursor at the desired transfer location and press the left mouse button. You will be prompted to **Enter Transfer file name >**. Enter a name for this transfer and press <Enter>. A filled triangle will be placed at the selected location.

6.7.8 SName

This command allows you to use a different symbol table with the editor. Because the name of the symbol table is stored with the drawing, each drawing can use a different set of symbols. When you invoke this option, the message **Symbol table name or <cr> for [defaultfile.stb]**. Press <Enter> to accept the default file name or enter a new file name and press <Enter>.

6.7.9 File?

This command displays the file name of the file currently loaded on the screen.

6.8 PRNT

This option includes several printing options. When you invoke this command, Figure 40 will be displayed. As shown, the print options include:

Epson This option sends the current file to the Epson printer. When you invoke this option, the screen will clear, the drawing will be redrawn without menus, and the Epson printer will begin to print.

Laser This option sends the current file to the laser printer. When you invoke this option, the screen will clear, the drawing will be redrawn without menus, and the Laser printer will begin to print.

PaintJ This option sends the current file to the HP Paint Jet printer. When you invoke this option, the screen will clear, the drawing will be redrawn without menus, and the Paint Jet printer will begin to print.

6.9 UTIL

The Utility option allows you to specify program defaults used when working with and displaying the drawings. When you invoke this command, Figure 41 will be displayed. As shown, the following options are available:

Skip The Skip function allows you to specify how much of a skip or jump factor to use when moving the cursor. This is used to fine tune the spacing used for the placement of symbols. For example, the first two symbols in the default symbol table are a motor driven pump and a valve. The pump has an input defined at left center of the symbol and an output at upper-center right. The valve has an input defined at left center. To connect the symbols together without a jag in the line one of the symbols must be adjusted up or down. This may prove to be difficult if the skip value is too large. A modification can be made to specify how much to jump in the x and y directions at movement.

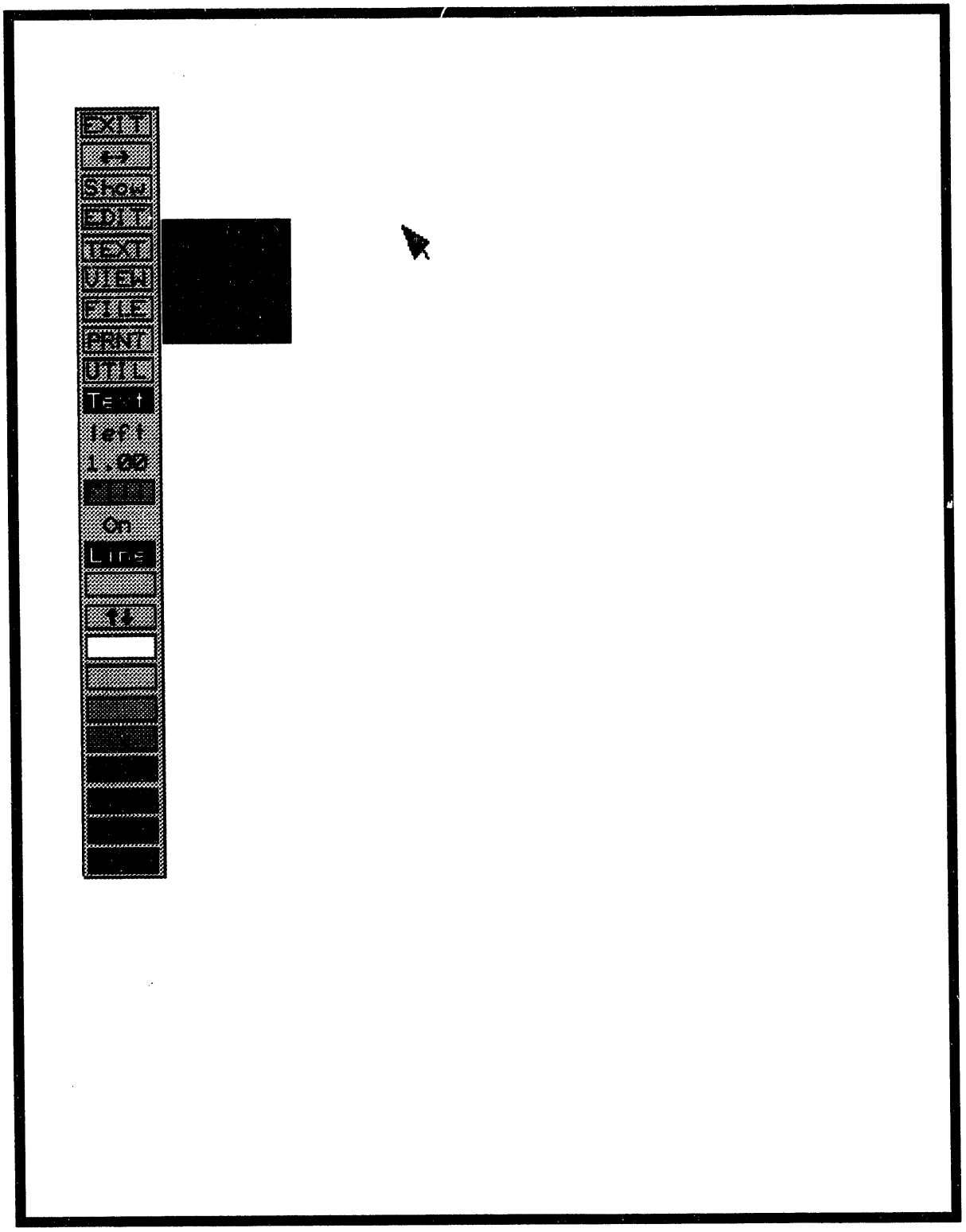

Figure 40. Print menu.

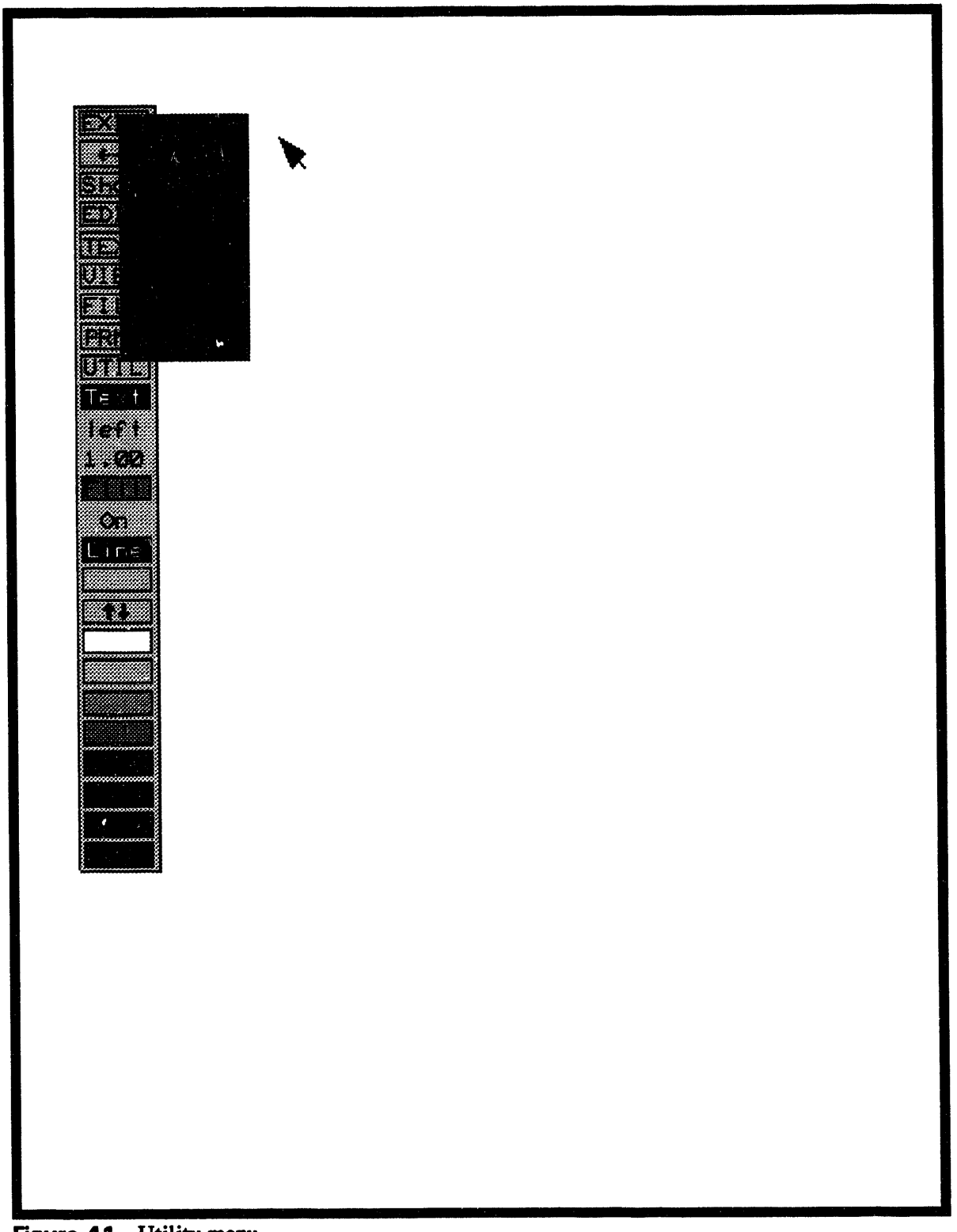

Figure 41. Utility menu.

Scale Each symbol in the symbol table is defined in a normalized grid from -1 to 1 in the x any y directions. By default each symbol when placed onto the drawing area is scaled by a factor of 2 (twice the normal size). This value may be changed with this command to fit your needs. Values may range from 0.1 to 9.9.

Rotate Rotation within the Edit menu is done in two ways: about the center of each object and about a user selected point. This option allows you to specify which method to use.

Grd Off The grid command enables you to turn on or off the grid.

Snap On The P&ID cursor movement snaps according to the skip value defined with the skip function. This command will allow you to disable the skip/jump inherent to the cursor.

Sh Name This command toggles the symbol names on and off. If the symbol names are off when a hard copy of the drawing is made, the symbol names will not be printed.

Sh Text This command gives you the ability to show all text on the screen, or to hide all text from the screen.

6.10 Text

This option allows you to set a default color for the text in your diagrams. To invoke this option, position the cursor over the Text box and press the left mouse button. You will be prompted to **Pick a new color from the color bar**. Position the cursor on the desired color box and press the left mouse button. (**NOTE:** The ↑ ↓ (color) option is active at this time. This option will display the additional color selections available.) All text will now be displayed in this color. If the diagram already exists, only the new text will be displayed in the new color. You must return to the ATTRIBUTES option to change the existing text color (if desired).

6.11 cntr/left/right

This option allows you to set the justification for your diagrams. Justification is where the text will be placed offset from the placement point. This works as a toggle switch. To change justification, position the cursor over the cntr (default) box and press the left mouse button or the <Enter> key. You will see the box change from cntr to rght (right). Press the left mouse button or <Enter> key again, and the box will change from rght to left.

Left justification means the text will be anchored at the left bottom corner, or the text will flow to the right of where it was placed. Center justification means the text will be centered about the placement point. Right justification means the text will be placed to the left of the placement point. Set the toggle for the desired justification.

6.12 Text Size

This option allows you to set a default text size for your diagrams. The default value is .5. Text size ranges from .001 to 9.0. For the purpose of writing text in gate blocks, a text size of about 0.5 is appropriate. The size looks too small on the screen, but it is large enough when printed on a laser printer. **REMEMBER,** here you are setting the default text size. You may always change the text size for special text by invoking the ATTRIBUTES option, under the EDIT command.

6.13 Fill

This option allows you to select a color for your drawing symbols. When you invoke this option you will be prompted to **Pick a new color from the color bar**. Position the cursor over the desired color and press the left mouse button. (**NOTE:** The ↑ ↓ (color) option is active at this time. This option will display the additional color selections available.) The Fill box will change to the newly selected color. All drawing symbols created in your diagram will be displayed in this selected color. If you modify an existing drawing, these symbol colors won't change. To change the color of existing symbols you must invoke the ATTRIBUTES suboption from the EDIT option.

6.14 On/Off

This option is a toggle to fill or not fill symbols when placed on the drawing. When set to On, the symbol is filled with the set color; if set to off, no fill is used.

6.15 Line

This option allows you to select a color for the lines that connect the text and symbols in the diagram. When you invoke this option you will be prompted to **Pick a new color from the color bar**. Position the cursor over the desired color and press the left mouse button. (**NOTE:** The ↑ ↓ (color) option is active at this time. This option will display the additional color selections available.) The Line box will change to the selected color. All lines generated in your diagram will be this selected color. Again, if you are modifying an existing drawing the lines won't change to this color. To change existing lines to the new color you must invoke the ATTRIBUTES suboption for the EDIT option.

7. UTILITY OPTIONS

The Utility options allow you to perform various miscellaneous functions including defining constants, rasterizing print files, extracting graphic files, converting fault trees and P&ID drawings, and setting colors for the plotter. When you invoke this option, Figure 42 will be displayed. Each option is discussed in the following paragraphs.

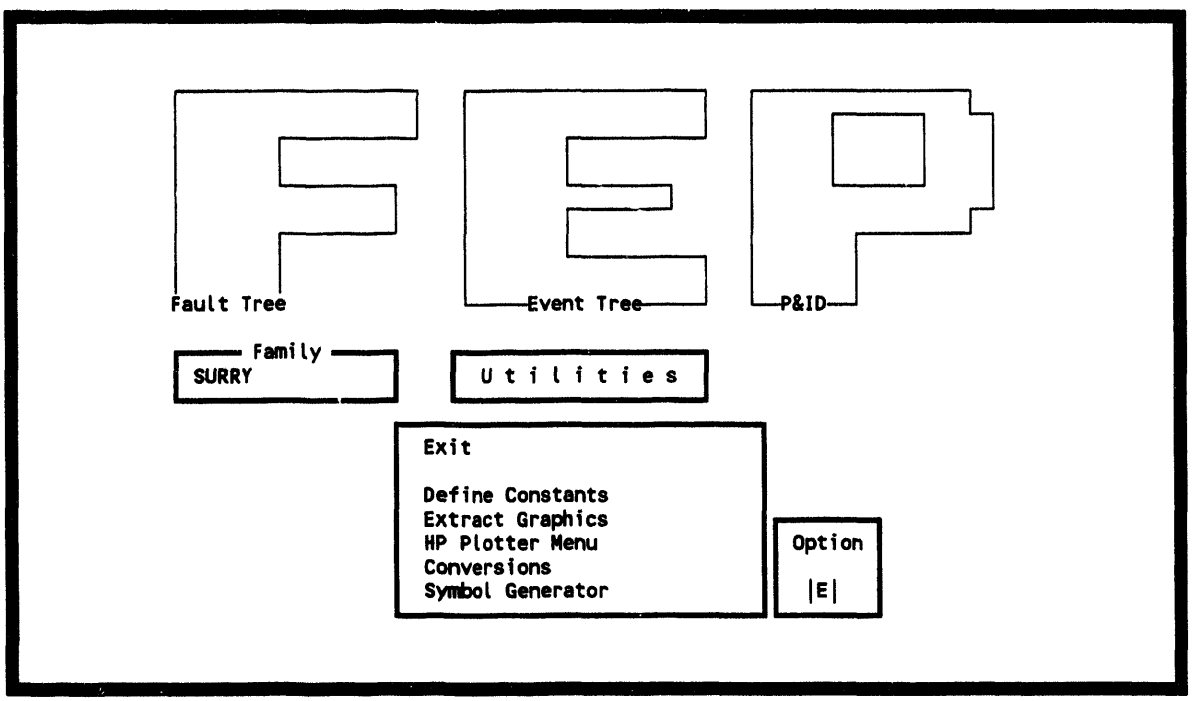

Figure 42. Utilities main menu.

7.1 Exit

This option terminates the utility options and returns you to the FEP main menu. To invoke this option, highlight Exit or type an <E> and press <Enter>, or press the <Esc> key.

7.2 Define Constants

The Define Constants <D> option allows you to define what hardware the system uses as well as specifying file locations and archive information, and defining uncertainty settings, cut set constants, and default values for the graphics editor. After choosing this option, the User Information Constants screen shown in Figure 43 is displayed. Table 1 provides a brief description of each of the fields in Figure 43.

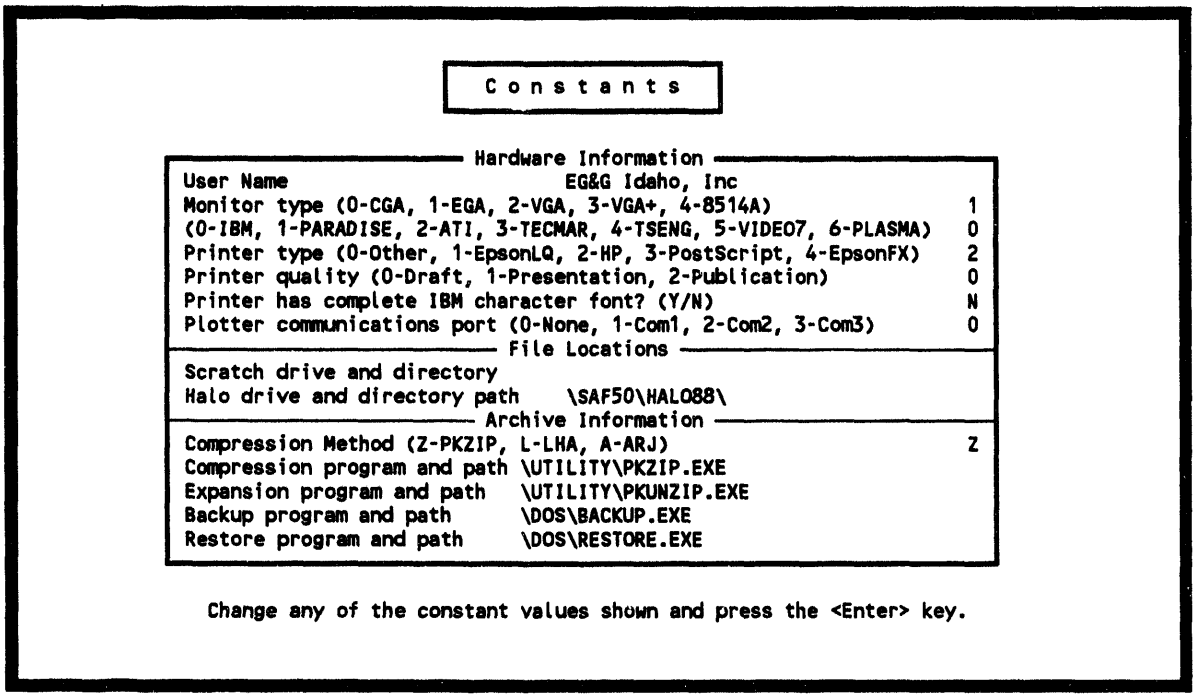

Figure 43. User information constants screen.

Table 1. User Information field descriptions for constants option.

FIELD	DESCRIPTION
User Name	36 character user identification (optional) field
Monitor type	0 - Enhanced graphics monitor 1 - DEFAULT - Standard color graphics monitor 2 - Video graphics monitor (2640 x 480) 3 - Video graphics monitor plus (800 x 600) 4 - 8514A
Card type	0 - IBM 1 - Paradise 2 - ATI 3 - TECMAR 4 - TSENG 5 - VIDEO-7 6 - PLASMA
Printer type	0 - Other 1 - Epson 2 - HP Laser (DEFAULT)
Printer Quality	0 - Draft 1 - Presentation 2 - Publication
Printer has complete IBM character font?	Y - Yes N - No (DEFAULT)
Plotter communications port	0 - No Plotter connected to port (DEFAULT). 1 - Plotter connected to Com1 port. 2 - Plotter connected to Com2 port. 3 - Plotter connected to Com3 port.
Scratch drive and directory	36 character field indicating the drive and path to the scratch directory where files will be stored (DEFAULT set to blanks)
Halo drive and directory path	36 character field indicating the drive and path to the Halo graphics that IRRAS 5.0 should use (\HALO88\)
Compression Method	The compression method (package) you will be using. 'Z' = PKZIP 'L' = LHA 'A' = ARJ
Compression program and path	40 character field indicating the drive, path, and executable used to compress files.

Table 1. (continued)

FIELD	DESCRIPTION
Expansion program and path	40 character field indicating the drive, path, and executable used for file expansion.
Backup program and path	40 character field indicating the drive, path, and executable used for backing up files.
Restore program and path Size cutoff	40 character field indicating the drive, path, and executable used for restoring files.

After setting the hardware configuration, file locations, and archive information press <Enter>. The next constants screen will appear (see Figure 44). On this screen, you supply default values and flag settings for cut set generation, transformations, uncertainty and other miscellaneous information. Table 2 provides a brief description of each of the fields in Figure 44.

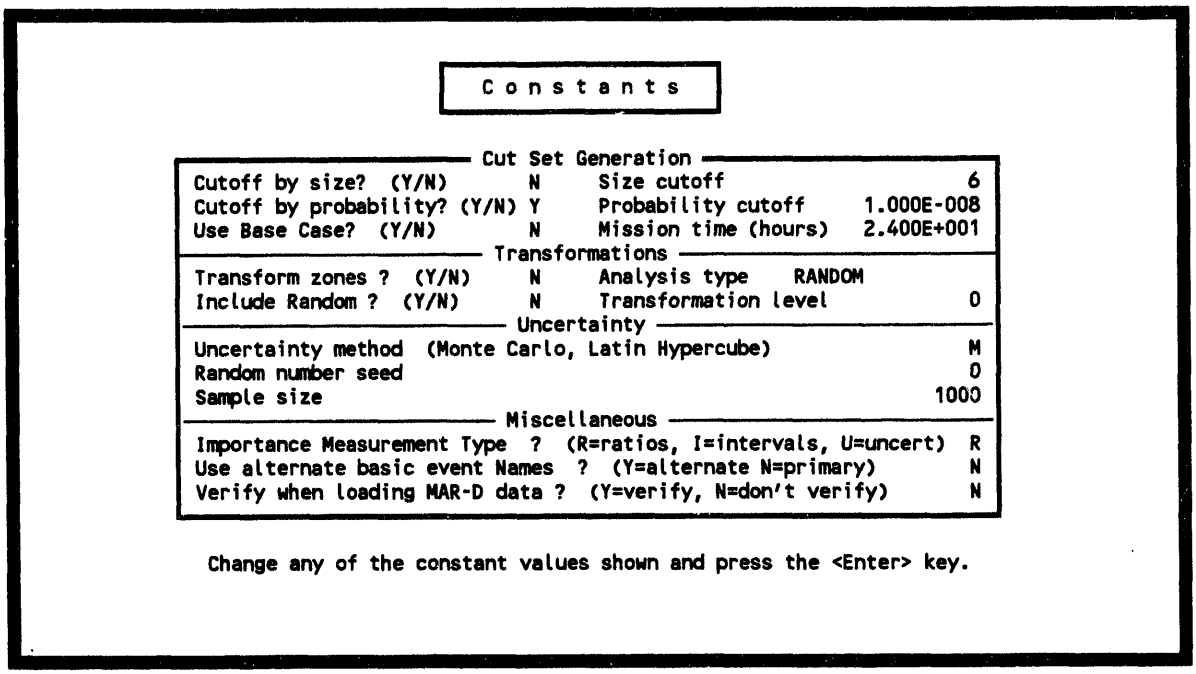

Figure 44. Set default values and flags.

Table 2. Default values and flag settings.

FIELD	DESCRIPTION
Cutoff by size?	Y - Do not generate fault tree or sequence cut sets containing more basic events than indicated in the Size cutoff field (DEFAULT). N - Generate all cut sets for the fault tree or sequence that meet the probability cutoff criteria (if in effect).
Size cutoff	The default maximum number of basic events allowed in cut set generation when size cutoff is in effect. DEFAULT = 6
Cutoff by probability?	Y - Do not generate fault tree or sequence cut sets that have a probability less than the cutoff indicated in the probability cutoff field (DEFAULT) N - Generate all cut sets that meet the size cutoff criteria (if in effect) regardless of the cut set probability.
Probability cutoff	The default minimum cut set probability allowed in cut set generation when probability cutoff is in effect. (DEFAULT = 000E-015)
Use Base Case?	Y - Uses base case values for the analysis N - Uses the alternate case values for the analysis.
Mission time (hours)	The default mission time to be used in the calculation of basic event probabilities (when appropriate). DEFAULT = 2.400E+001
Transform zones	Y - Perform zone transformation during cut set generation. N - Will not perform zone transformation during cut set generation.
Analysis Type	The type of analysis to perform. Default is RANDOM.

Table 2. (continued)

FIELD	DESCRIPTION
Include Random	When performing location transformations this flag indicates whether or not to include random failures of this event in the transformations. Y includes random failures; N does not include random failures.
Transformation level	The level of the transformations to be performed.
Uncertainty method	The uncertainty method to be used in the analysis. M - Monte Carlo L - Latin Hypercube
Random number seed	5 digit numeric field indicating the first random number in the seed to be used in the Monte Carlo calculation. 0 (default) indicates that the random number will be the current value of the real clock.
Sample size	6 digit numeric field indicating the default number of Monte Carlo samples to be run in the uncertainty analyses. Sample size may range from 1 to 999999 (DEFAULT = 1,000).
Importance Measurement	R - Ratios (DEFAULT) I - Intervals U - Uncertainty
Use alternate basic event names?	Y - Alternate name will be used. N - Primary name will be used (DEFAULT).
Verify when loading MAR-D data?	Y - File dependency will be checked. N - No file cross checking will done. (DEFAULT)

After setting the User Information constants, press <Enter>. The next screen displays the Fault Tree Graphics Constants (Figure 45). Table 3 provides a brief description of each of the fields in Figure 45.

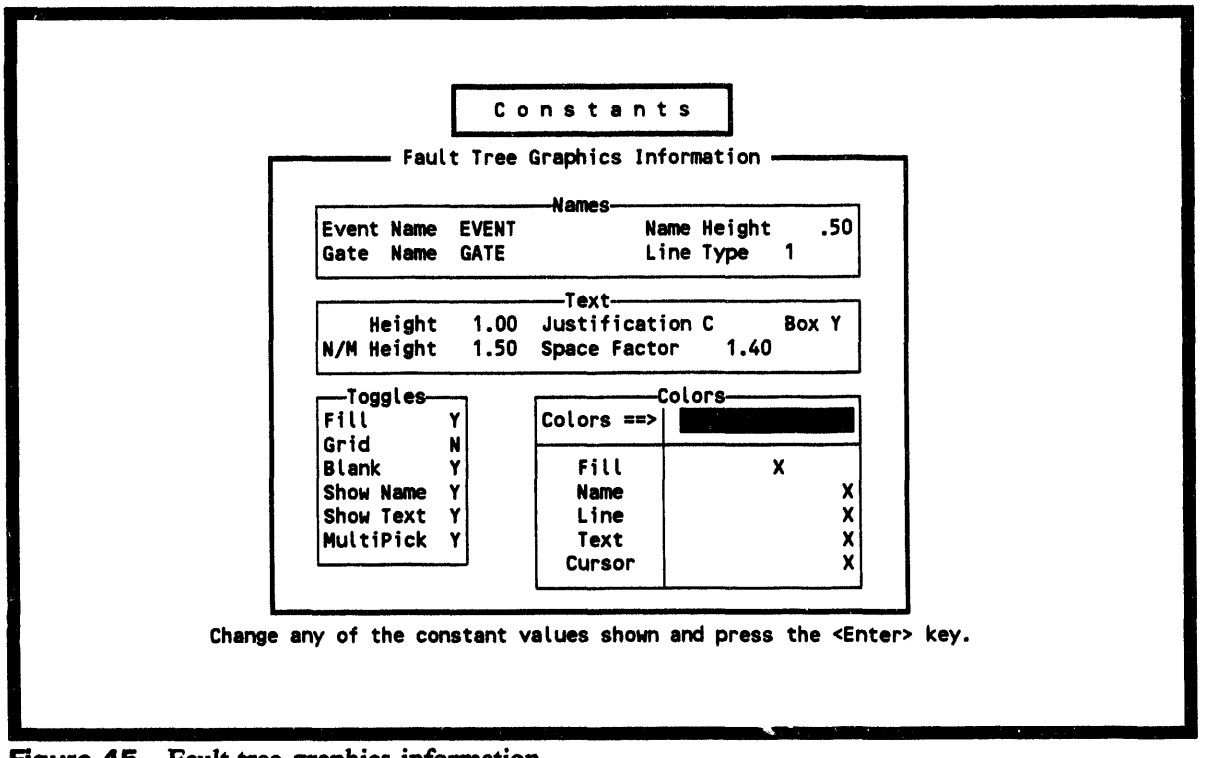

Figure 45. Fault tree graphics information.

Table 3. Fault tree graphics information field descriptions.

FIELD	DESCRIPTION
Event Name	10-character field for the fault tree basic event default name. The default name is followed by a sequential number for each separate event, e.g., EVENT1, EVENT2, etc. (DEFAULT = EVENT)
Gate Name	10-character field for the fault tree gate default name. The default name is followed by a sequential number for each separate event, e.g., GATE1, GATE2, etc. (DEFAULT = GATE)
Name Height	The height of the event and gate names. This is a number between 0.01 and 66.00, where 66.00 represents the full 66 lines from the top of the screen to the bottom. (DEFAULT = 0.50)
Line Type	1 - Solid line (DEFAULT) 2 - Dashed line. 3 - Dotted line.
Text Height	The height of the text to be written. This is a number between 0.01 and 66.00 (see Name Height). DEFAULT = .50
N/M Height	The height of the numbers on an N/M OR gate showing the N and M values. This is a number between 0.01 and 66.00. (DEFAULT = 1.50)
Justification	Text justification. L - Left justified. C - Centered (DEFAULT). R - Right justified.
Space Factor	The spacing between lines of text written consecutively. This is a number between 1.00 and 10.00. A value of 1.00 will cause the top of the following line of text to touch the bottom of the preceding line. (DEFAULT = 1.40)
Box	Y = Use boxed basic events. N = Use normal events.

Table 3. (continued)

FIELD	DESCRIPTION
Fill	Yes/No toggle turning the fill on/off for plotting. DEFAULT = No
Grid	Yes/No toggle turning a reference grid on/off. DEFAULT = No
Blank	Y - The immediate area surrounding a gate or event name will be blanked out. (DEFAULT) N - The gate and event names will be written over any lines drawn in the areas for the names.
Show Name	Yes/No toggle turning on/off the display of event and gate names when the SHOW command is used. DEFAULT = Yes
Show Text	Yes/No toggle turning on/off the display of descriptive text when the SHOW command is used. DEFAULT = Yes.
MultiPick	When building trees, multipick will generate multiple gates for each pick of a gate type. DEFAULT = Yes.
Fill Color	An X under the desired color selects the default color for filling in shapes. DEFAULT color = blue.
Name Color	An X under the desired color selects the default color for displaying names. DEFAULT color = white.
Line Color	An X under the desired color selects the default color for drawing lines. DEFAULT color = white.
Text Color	An X under the desired color selects the default color for writing text. DEFAULT color = white.
Cursor Color	An X under the desired color selects the default color for the cursor. DEFAULT color = white.

After setting the Fault Tree graphics information constants press <Enter>. The next screen displays Event Tree graphics information (Figure 46). Make any changes needed and press <Enter>. Table 4 provides a brief description of each of the fields in Figure 46.

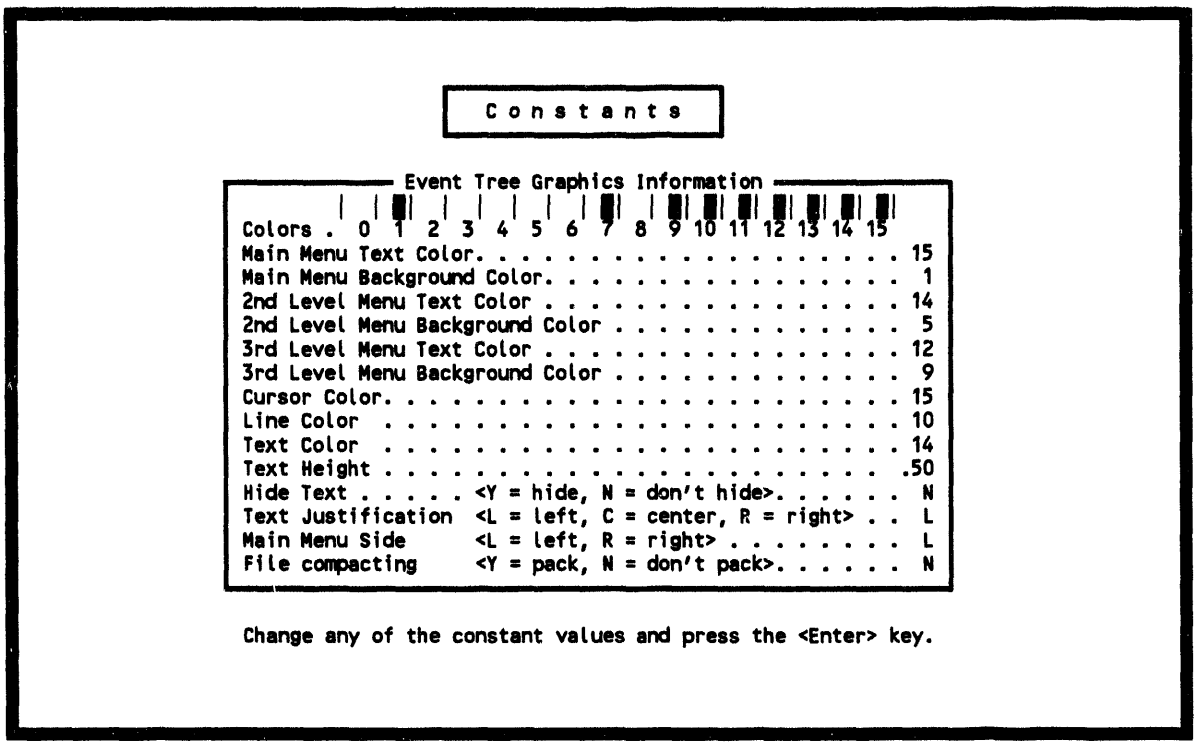

Figure 46. Event tree graphics information.

Table 4. Event tree graphics information field descriptions.

FIELD	DESCRIPTION
Colors	Colors that can be used in event tree graphics and their associated reference numbers.
Main Menu Text Color	Color of main menu's text. DEFAULT = 15 (white).
Main Menu Background Color	Background color upon which text is written. DEFAULT = 1 (blue).
2nd Level Menu Text Color	Color of text in second level menus. DEFAULT = 14 (yellow).
2nd Level Menu Background Color	Background color of second level menus upon which text is written. DEFAULT = 5 (purple).
3rd Level Menu Text Color	Color of text in third level menus. (DEFAULT = 12 (cyan).
3rd Level Menu Background Color	Background color of third level menus upon which text is written. DEFAULT = 9 (light blue).
Cursor Color	Default color of cursor. DEFAULT = 15 (white).
Line Color	Default color of lines. DEFAULT = 15 (white).
Text Color	Default color of text. DEFAULT = 14 (yellow).
Text Height	Default text height. DEFAULT = 1.00.
Hide Text	Y/N Hide text when displaying tree. DEFAULT = N.
Text Justification	L = Left (DEFAULT) C = Center R = Right.
Main Menu Side	L/R - Side of screen to place main menu. (DEFAULT = left).
File Compacting	Y/N - Compact file when leaving editor. DEFAULT = No.

7.3 EXtract Graphics

This option allows you to extract or delete fault trees, event trees, and P&IDs from the current family directory. When you invoke this option, Figure 47 will be displayed.

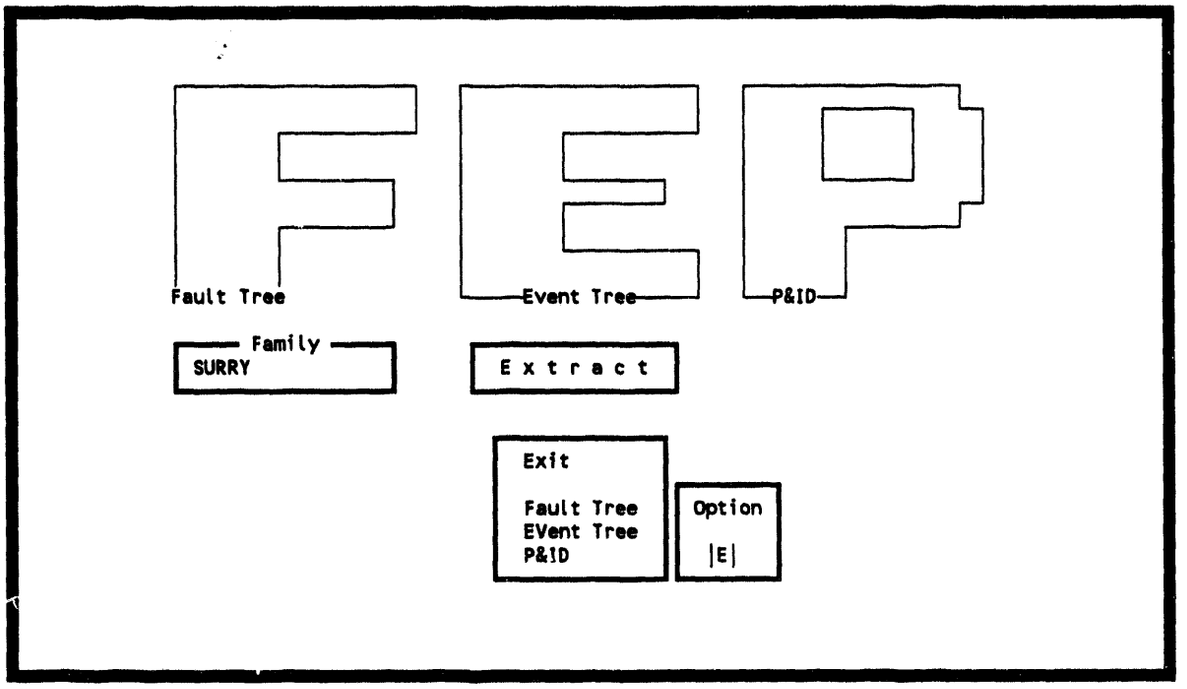

Figure 47. Extract graphics main menu.

7.3.1 Exit

This option returns you to the Utilities main menu. To invoke this option, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

7.3.2 Fault Tree

This option allows you to extract fault trees and delete extracted trees from the current family directory. When you create a fault tree diagram and save it, the .DLS file is saved in the data base as well as in a temporary .DLS file. When you delete the temporary .DLS file, the file still exists in the data base. This option allows you to extract the .DLS file from the data base. When you invoke this option, Figure 48 will be displayed. On this screen, all fault trees residing in the current directory are displayed. Three options are available: Exit, eXtract Trees, and Delete Extracted Trees.

7.3.2.1 Exit. This option returns you to the previous screen. To invoke this option, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

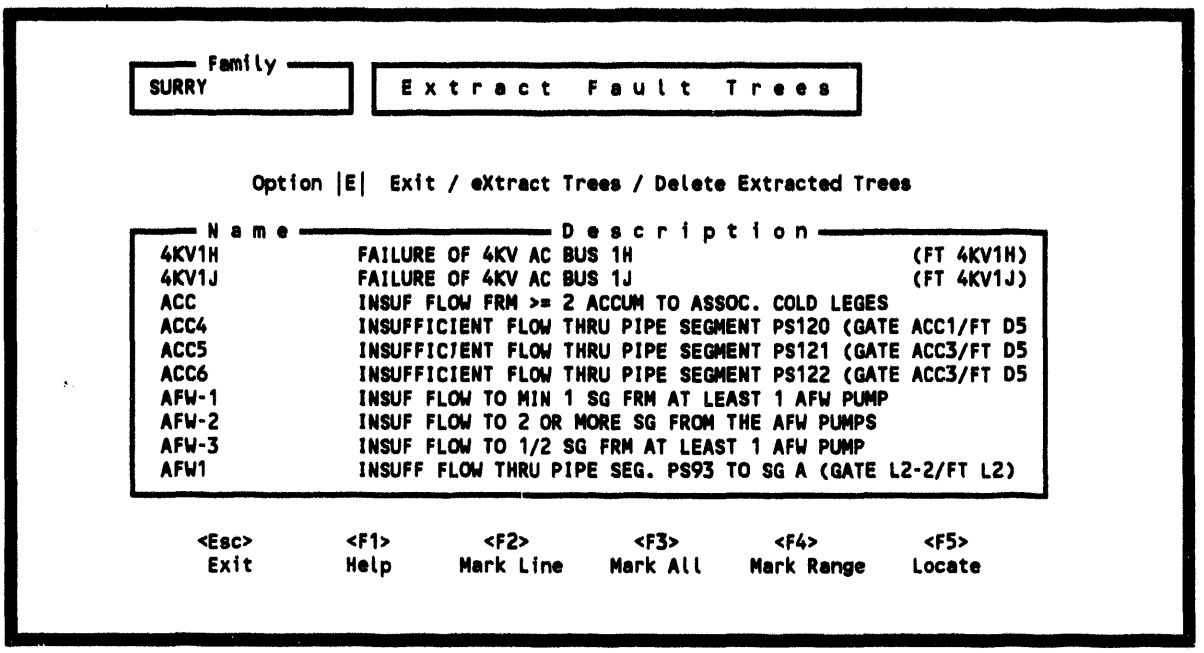

Figure 48. Select fault trees to extract.

7.3.2.2 eXtract Trees. This option allows you to remove specific trees from the current family directory. To invoke this option, enter an <X> in the option field, highlight the tree to be extracted or mark the trees to be extracted (using the function keys) and press <Enter>. A message will be displayed notifying you that the tree(s) was successfully extracted.

7.3.2.3 Delete Extracted Trees. This option allows you to delete extracted fault trees from the current family directory. To invoke this option, enter a <D> in the option field and press <Enter>. Figure 49 will be displayed. This screen lists all the fault trees in the directory for the current family. To delete a fault tree, enter a <D> in the option field, highlight the fault tree to be deleted or mark the trees to be deleted (using the function keys), and press <Enter>.

7.3.3 EVent Trees

This option allows you to extract and delete event trees from the data base. This option operates in the same manner and offers the same options as described for Fault Trees (see Section 7.3.2).

7.3.4 P&ID

This option allows you to extract and delete P&ID drawings from the data base. This option operates in the same manner and offers the same options as described for Fault Trees (see Section 7.3.2).

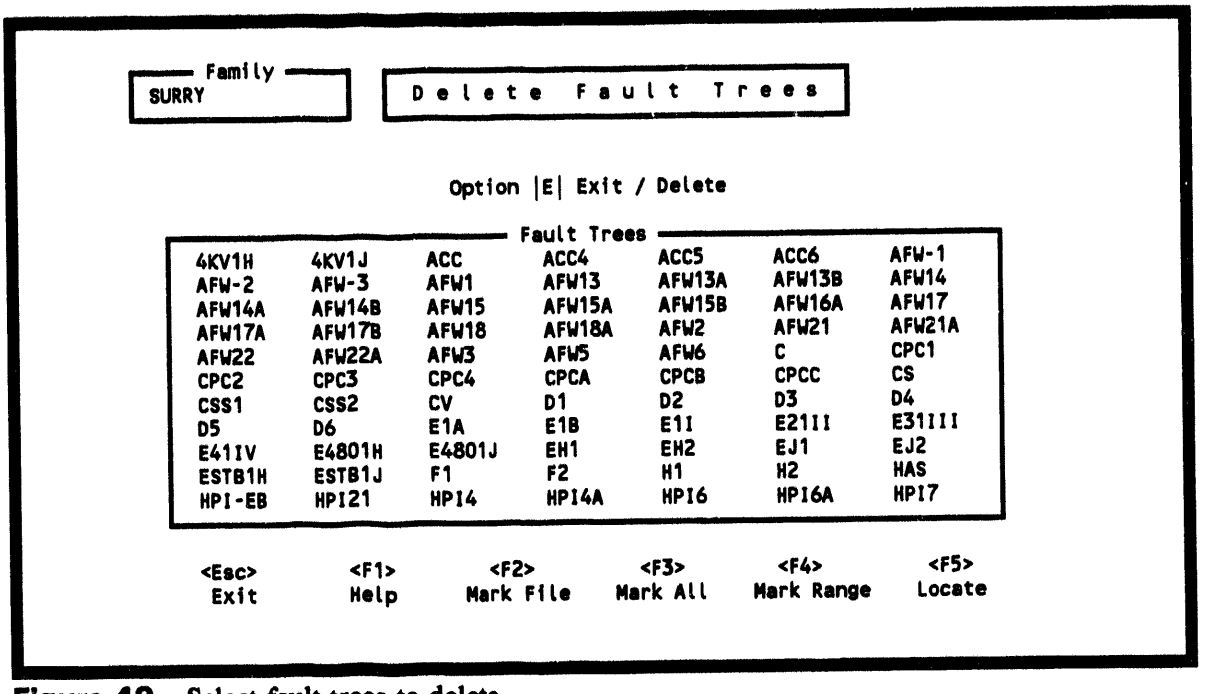

Figure 49. Select fault trees to delete.

7.4 HP Plotter Menu

The FEP System allows you to send fault tree, event tree, and P&ID drawings to the Hewlett Packard Pen Plotter HP7475. After building a drawing and selecting "HP Plotter Menu" from the Utilities main menu, FEP will save a plot file rather than sending output directly to the plotter. Because most pen plotters are very slow, FEP creates a plot file and gives you the ability to plot drawings at a more convenient time.

Once you have invoked this option from the Utility menu, the screen shown in Figure 50 is displayed. As shown, five options are available: Exit, Fault Trees, EVent Trees, P&ID Drawings, and Define Plotter Pens. Each option is discussed in the following paragraphs.

In addition, the following function keys are available from most screens.

<Esc>: Returns to the previous screen.

<F1>: Displays on-line help messages.

<F2>: Marks a file for further processing. When you mark a file, an asterisk will appear in front of the file name.

<F3>: Marks all the displayed files for further processing.

<F4>: Allows you to mark a range of files for further processing.

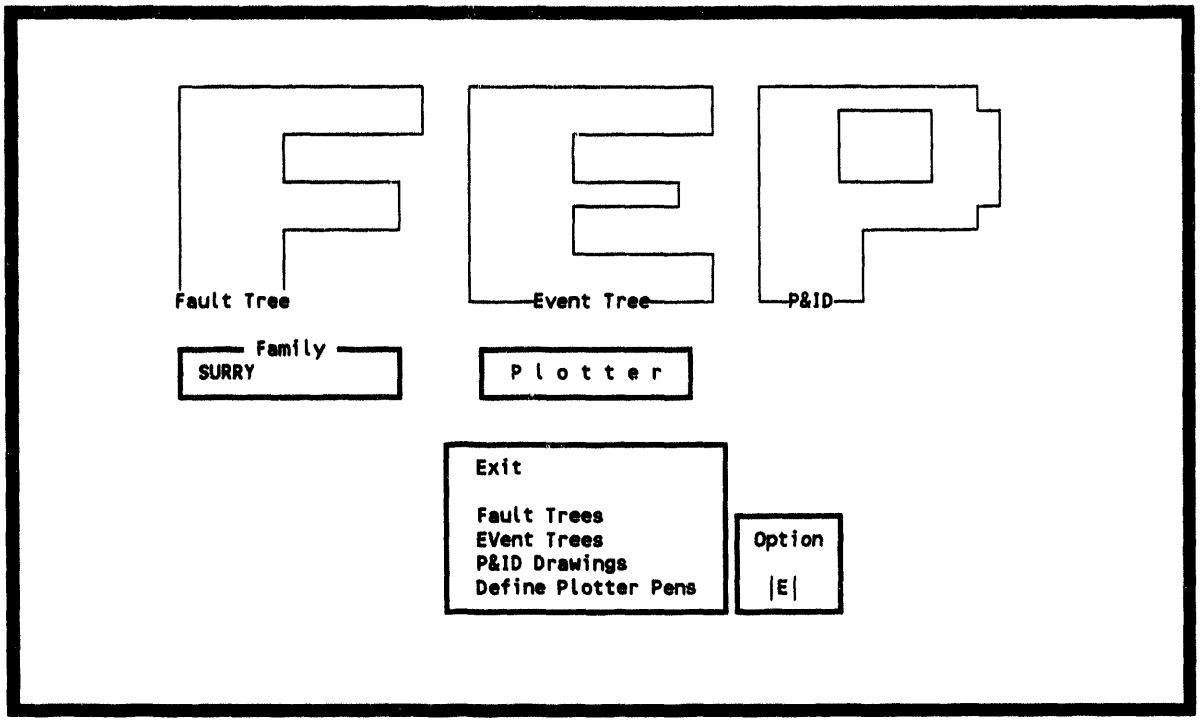

Figure 50. HP plotter menu.

<F5>: Allows you to locate a specific file for further processing. When you invoke this function, a prompt will be displayed. You must enter the file name to locate and press <Enter>. The specified file will be highlighted. If the file name does not exist, then the next name in alphabetical order will be highlighted.

7.4.1 Exit

This option returns you to the Utilities main menu. To invoke this option, highlight "Exit" or type an "E" in the option field and press <Enter>, or press the <Esc> key.

7.4.2 Fault Trees

This option allows you to plot or rasterize a fault tree drawing, or create an HPGL format for the selected fault tree. When you invoke this option, Figure 51 will be displayed. As shown, the following options are available:

Exit: Returns you to the previous menu.

Plotter: This option sends the specified file to the attached plotter. This option takes the .DLS files and sends it to the HP Pen Plotter (7475). If a plotter is not defined,

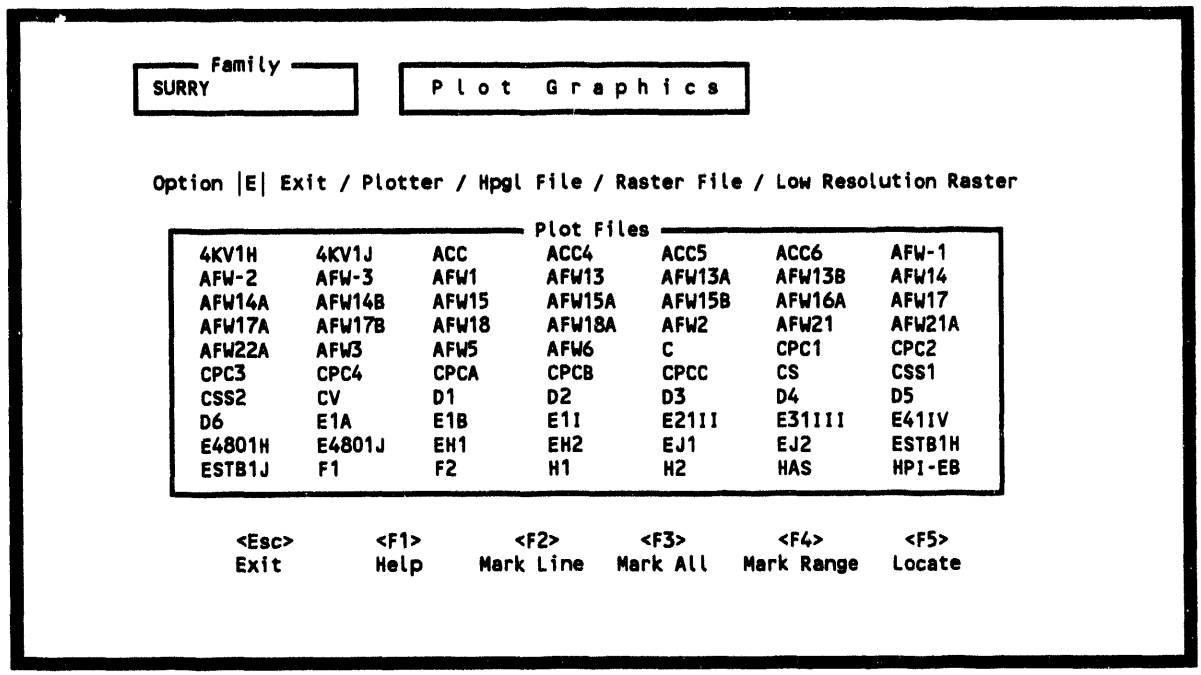

Figure 51. Fault tree diagram listing.

you will receive the message **Plotter not attached.**

HPGL File

This option creates .HPG files. An .HPG file may be printed using the batch program PLOTHPG. Once the *.HPG file is created, exit FEP and return to the SAF50\XXXXXX subdirectory. At this point, you must type the following command:

..\PLOTHPG *.HPG

where

* = wild card specification used to spool all *.HPG files contained in the specified directory. If you do not wish to print all *.HPG files, you may specify an individual file.

NOTE: PLOTHPG will only work on an HP LaserJet III or IIIP.

Raster File

This option allows you to rasterize fault tree diagrams for printing. Obtaining a "laser printed" output of a fault tree diagram is done in two steps. First, you must select the drawings to rasterize. Once the drawings have been rasterized, you must exit the program and return to the SAF50\XXXXXX subdirectory. At this point, you use the PLOTRAS batch program to send the files to the laser printer. The command to invoke this batch program is:

..\PLOTRAS *.RAS

(see the "where" list under HPGL Files)

This option rasterizes the selected fault tree to 300 dots per inch (dpi). This provides you with the highest quality of output available. To invoke this option, enter an <R> in the option field, highlight or mark the file(s) to rasterize and press <Enter>. When you invoke this option, a message will be displayed telling you that the rasterizing is being performed. A percent complete will also be displayed so you can track the progress of the rasterizing. When complete, a message will be displayed notifying you that the raster image has been created.

NOTE: PLOTRAS will work on any laser printer.

Low Resolution Raster — This option operates the same as the Raster File option described above. However, this option rasterizes the fault tree to 150 dpi.

7.4.3 EVent Trees

This option allows you to plot or rasterize an event tree drawing, or create an HPGL format for the selected event tree. This option operates in the same manner and offers the same options as described for Fault Trees (see Section 7.4.2).

7.4.4 P&ID Drawings

This option allows you to plot or rasterize a P&ID drawing, or create an HPGL format for the selected P&ID. This option operates in the same manner and offers the same options as described for Fault Trees (see Section 7.4.2).

7.4.5 Define Plotter Pens

Because the HP7475 Pen Plotter has only six pens, the P&ID Editor uses a pen color map to re-map the sixteen screen colors to the six pen colors. This color map can easily be changed by using the "Define Plotter Pens" option of the Utility menu.

After making this selection, the screen clears and the pen definitions appear as shown in Figure 52. You are prompted to select a color box shown on the screen. Using the mouse, you can place the cursor over the box and press the select button. After selecting the color box, you are prompted to enter the new pen number for the color shown.

After changing all color maps, you simply position the marker over the stop sign and press the left button, to return to the Utility Menu.

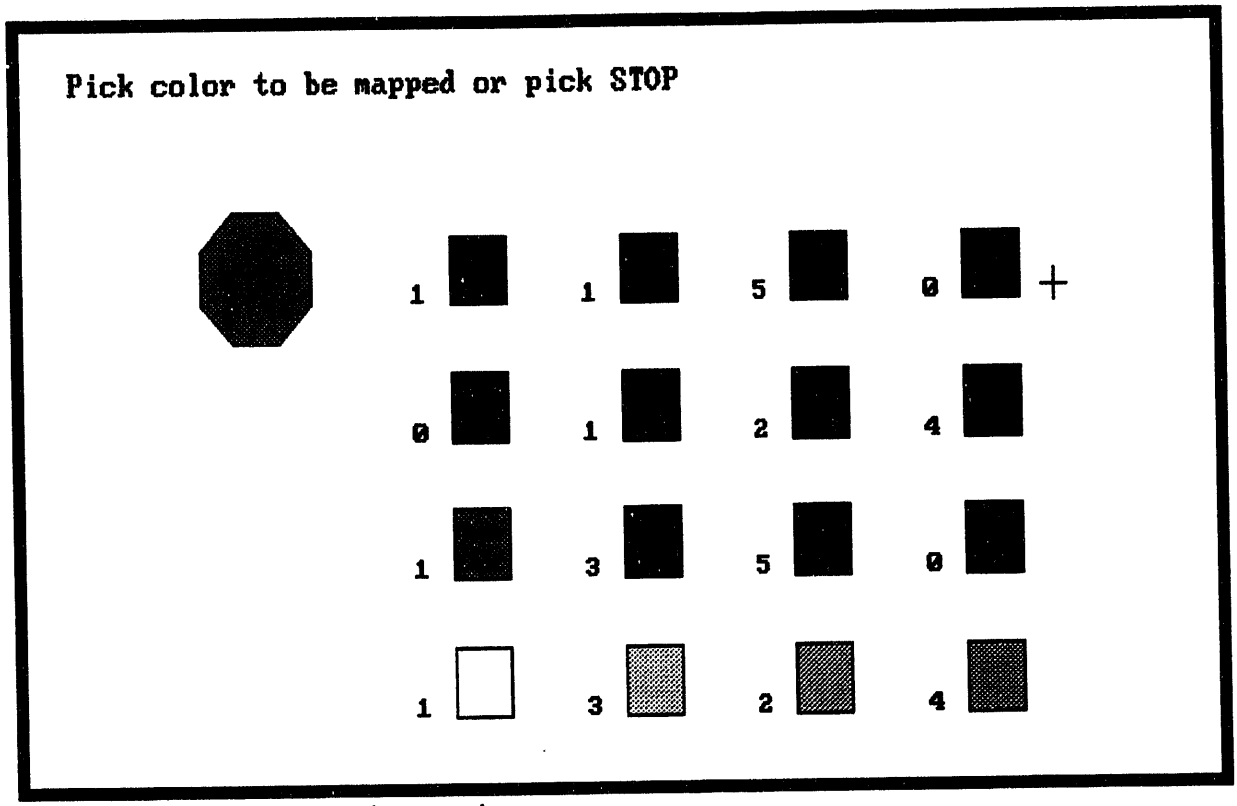

Figure 52. Redefine pen color mapping.

7.5 Conversions

This option allows you to perform three types of conversions. When you invoke this option, Figure 53 will be displayed.

7.5.1 Exit

This option returns you to the Utilities main menu. To invoke this option, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

7.5.2 Alpha to Graphics (FT)

This option allows you to convert the alphanumeric logic for a system or subsystem to a graphical format. Use this option when you define the fault tree logic with an ASCII file or use the logic editor to change the logic for a fault tree. The graphics and logic information for a fault tree are two separate entities, therefore, a conversion must be made if any changes are made to the alphanumeric logic. However, if changes are made to the graphics representation, the changes are automatically reflected in the alphanumeric logic. When you invoke this option, Figure 32, Figure 54 will be displayed. As shown, two options are available: Exit and Convert.

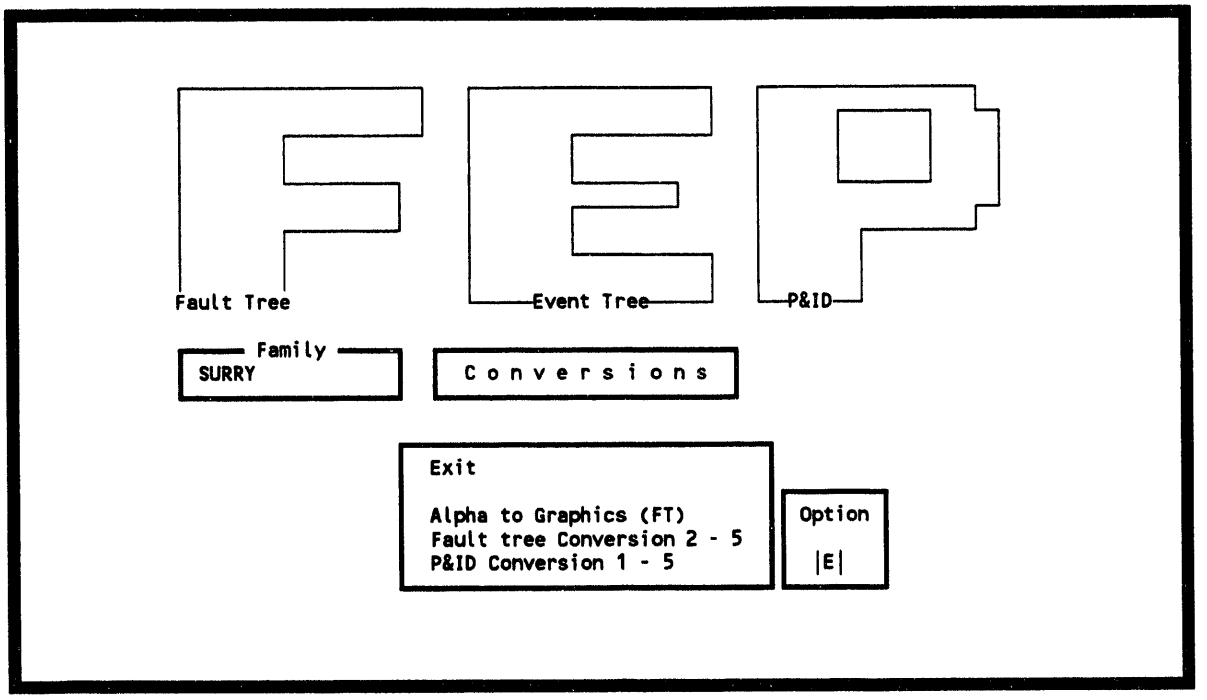

Figure 53. Conversion main menu.

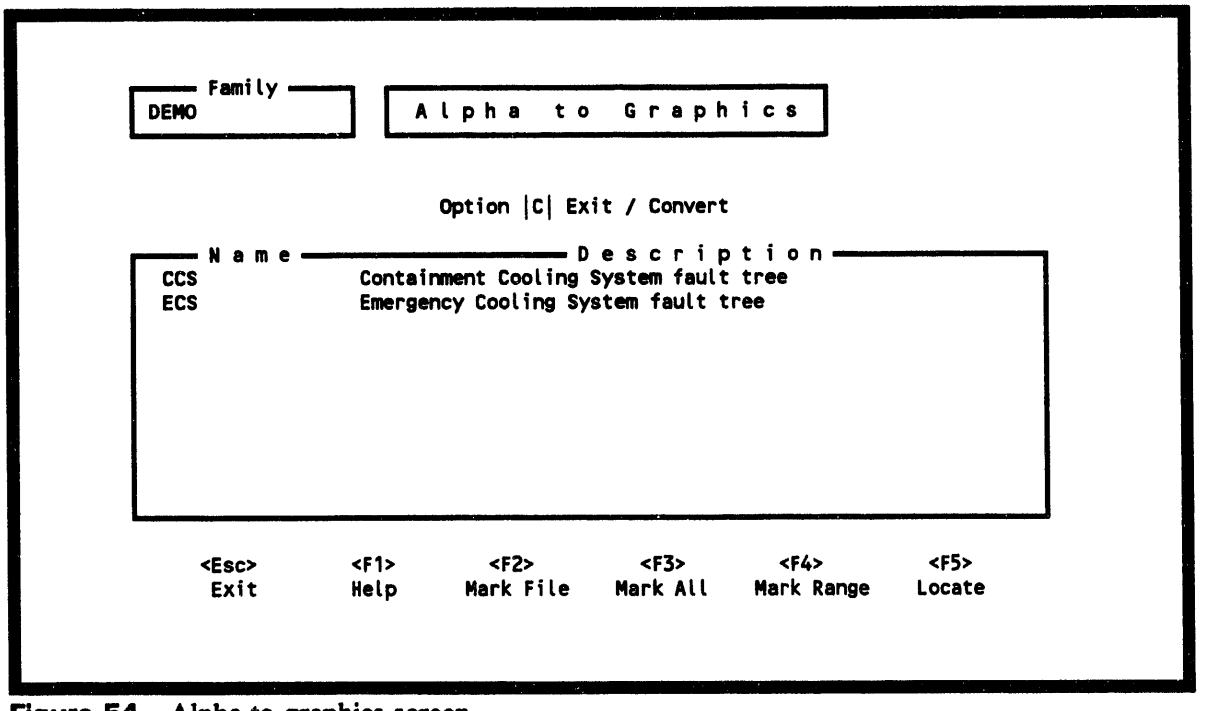

Figure 54. Alpha to graphics screen.

7.5.2.1 Exit. This option returns you to the previous screen. To invoke this option, enter an <E> in the option field and press <Enter>, or press the <Esc> key.

7.5.2.2 Convert. This option allows you to convert an alpha file(s) to a graphical format. To invoke this option, enter a <C> in the option field, highlight the file (using the arrow key) or mark the files (using the function keys) you wish to convert. A small window will appear at the top of the screen (as shown in Figure 33, Figure 55). Two prompts are displayed asking you whether you want to use tables and/or boxed events in the newly created graphic file. Enter a Y or N. Press <Enter> when complete. A message will appear notifying you that the graphics image has been created.

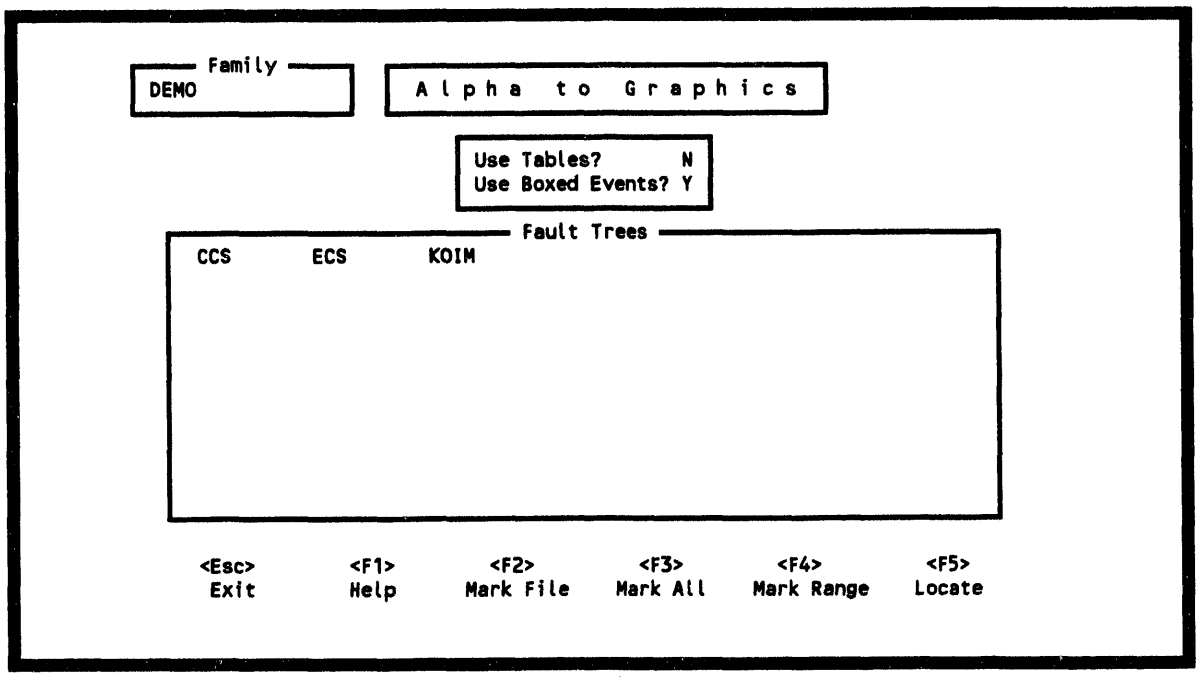

Figure 55. Set table/box toggle for conversion.

7.5.3 Fault Tree Conversion 2 - 5

This option allows you to convert fault trees that were created using Version 2.0 to Version 5.0. When you invoke this option, Figure 56 will be displayed. All fault tree files created using Version 2.0 will be displayed. As shown, the following options are available:

Exit	Returns you to the Utilities Main Menu.
Convert	Performs the actual conversion. To invoke this option, enter a <C> in the option field and highlight the file to convert. If no file is highlighted, all files may be converted.

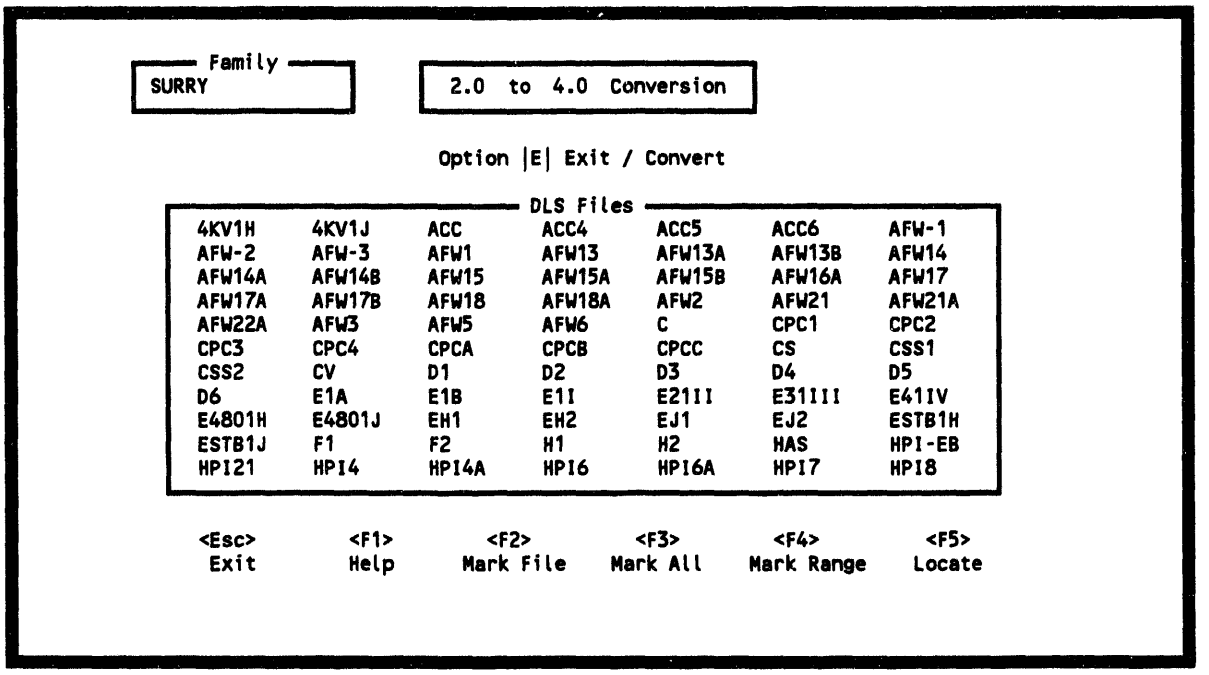

Figure 56. Fault tree conversion menu.

7.5.4 P&ID Conversion 1 - 5

This option allows you to convert P&IDs that were created using Version 1.0 to Version 5.0. When you invoke this option, Figure 57 will be displayed. All P&IDs created using Version 1.0 will be displayed. As shown, the following options are available:

Exit — Returns you to the Utilities Main Menu.

Convert — Performs the actual conversion. To invoke this option, enter a <C> in the option field and highlight the file to convert. If no file is highlighted, all files may be converted.

7.6 Symbol Generator

The symbol compiler is invoked from the FEP main menu by selecting the Utility Option, then selecting the "Symbol Generator" option. The symbol compiler is used when a change has been made to an existing symbol file or a new symbol file has been created. When the symbol generator is invoked a new screen appears and prompts for the file name of the file to be compiled (see Figure 58). The file name entered must be an ASCII file, formatted in a specific manner that will be explained later. The file provided with the P&ID software package is named SMBLFILE.GEN. When this file name is entered at the prompt the system responds with the message, **Compiling....Please Wait**. The compile time will vary depending upon the length of the file and the complexity of the symbols being compiled. A file containing 40 symbols requires approximately 20 seconds to compile. When completed the success of the compilation is displayed at the bottom of the screen. All compiled files are given the ASCII file name

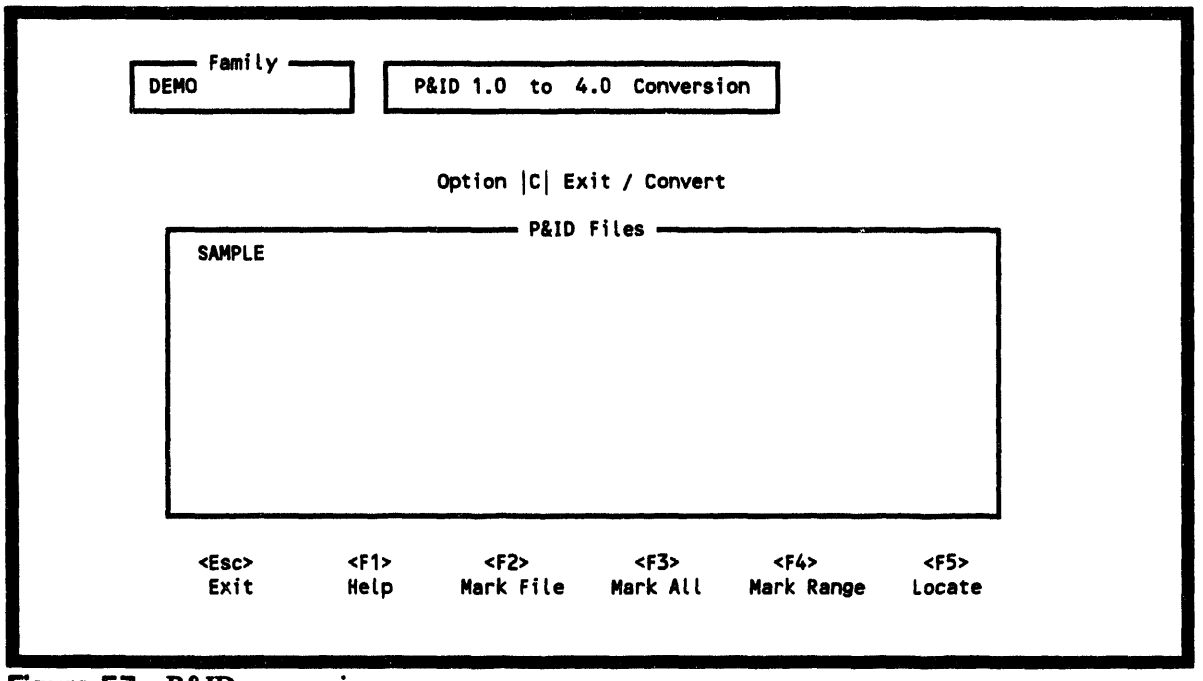

Figure 57. P&ID conversion menu.

entered by the user. However, the extension ".STB" is added to distinguish between the two files. Each time the ASCII symbol file is edited it must be re-compiled in order for the changes to be incorporated into a P&ID. It is important to note that once a symbol in a symbol file has been changed and the file has been compiled, each copy of that symbol in each drawing using the changed symbol file name will be updated to reflect the change. To avoid global changes like this, simply copy and rename the file before making any changes. This will preserve the original symbol file and avoid changes being made to earlier drawings.

7.6.1 Editing a Symbol File

Editing the symbol file becomes necessary whenever a symbol needs to be changed, added, or deleted. It is important to remember that only the ASCII symbol file may be edited. An example of such a file is the file named SMBLFILE.GEN that is provided as part of the P&ID software package. Editing a symbol file is accomplished by using any text editor. A symbol when completed may not have any X or Y value less than -1.0 or greater than 1.0. There are three essential items required to create a correct symbol: unique symbol numbers, graphic entities, and inputs and outputs. An explanation of each follows.

7.6.1.1 Symbol Numbers. Each symbol must have a unique number. Symbols do not have to be numbered in consecutive order. However, they must be in ascending (sorted) order from the top of the file to the bottom. The symbol number must be the first line of a symbol. Following the symbol number, a semicolon and a brief description of the symbol may be entered. A correct example is:

```
symbol 1  ;box.
```

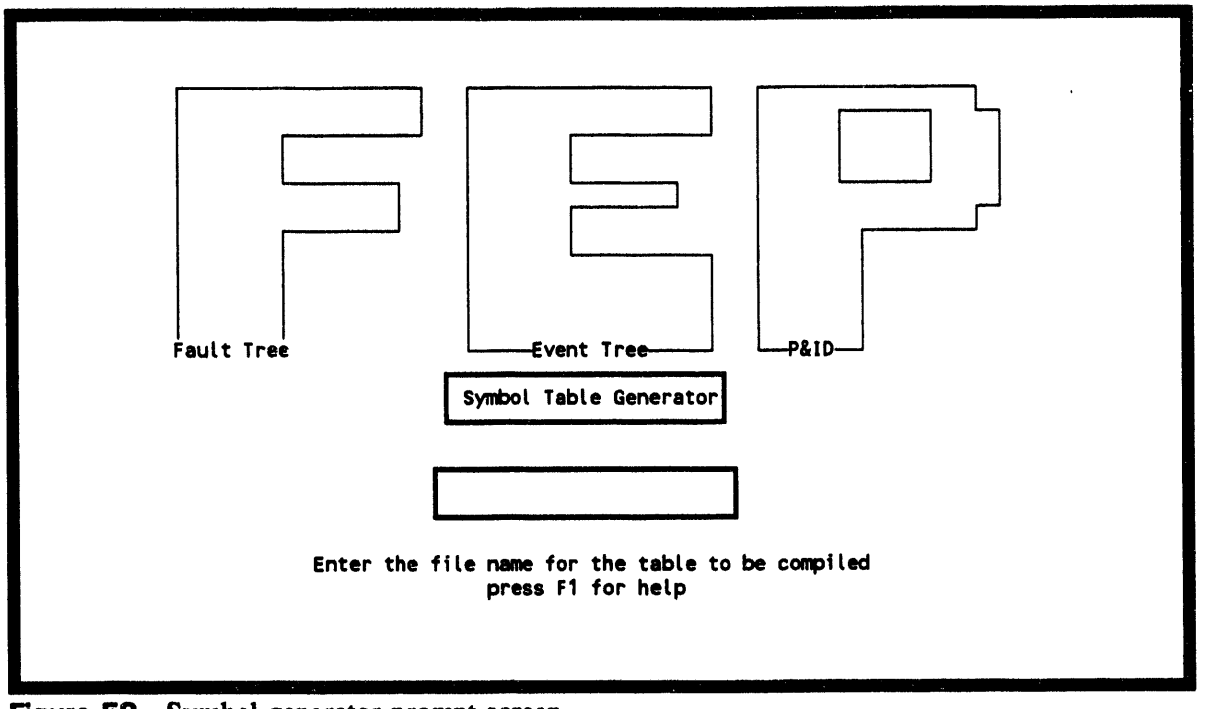

Figure 58. Symbol generator prompt screen.

7.6.1.2 Graphic Entities. Three types of entities may be used when creating a symbol: polylines, arcs, and lines. One or all types may be used in creating a symbol. The correct usage of each is briefly explained below.

Lines: Lines are used for drawing shapes that are not shaded or filled or they may be combined with arcs to create both filled and non-filled shapes. An example of how to draw an "L" shape using lines is shown below.

```
line        0.0, 1.0, 0.0, -1.0, 0.5, -1.0
```

Polylines: Polylines are best used for drawing polygon shapes. The first and last point of a polygon must be identical. An option provided with polylines enables polygons to be drawn filled or unfilled. To make a filled polygon, a "Y" is entered as the first parameter following the word polyline. This is followed by the x and y values for each point of the polygon shape. An example of how to draw a filled square shape using polyline is shown below.

```
polyline    y, 0.0, 0.0, 1.0, 0.0, 1.0, 1.0, 0.0, 1.0, 0.0, 0.0
```

Arcs: Another graphic entity used for drawing symbols is arcs. Circles and ellipses may be generated also. Arcs may also be connected to lines to create polyline shapes with curves in them that can be filled. The first parameter of an arc is the fill option. Enter a "Y" or "N" to fill or not fill the shape. Remember, to fill a shape the first and last point must be identical. The second parameter is the x and y value for the center of the arc. The third parameter is the x radius and the y radius. The fourth parameter is the starting angle of the arc in degrees. The fifth and last parameter is the number of degrees to draw the arc. To draw a complete circle a value of 360.0 would be entered. An example of how to draw a "C" shape is shown below.

```
arc         n, 0.0, 0.0, 1.0, 1.0, 45.0 270.0
```

An example of how to connect arcs and lines together to make filled shapes is shown below. The shape is a "D".

```
line        0.0, 1.0, 0.0, -1.0
c
arc         y, 0.0, 0.0, 1.0, 1.0, 270.0, 180.0
```

7.6.1.3 Inputs and Outputs. Inputs and outputs are the points which connecting symbol lines use to make contact with a symbol. The line function in the P&ID will automatically detect if an input or output is present and connect the line to that point. This feature is useful for rapid development of a diagram.

Each symbol may have as many as 256 inputs and outputs. Each input and output must be written on a separate line in the ASCII symbol file. Some symbols may have no outputs. Still others may have neither inputs or outputs. When this occurs enter "nil" for the x and y value. Each symbol must have at least one input and one output defined even if it is defined as nil. Some correct input and

output examples are listed below.

```
input     -1.0, 0.0
output    nil
input     nil
output    1.0, 0.0
output    0.0, 1.0
```

A completed symbol would look similar to the one listed below. This is a copy of the steam generator from SMBLFILE.GEN.

```
symbol  25 ;steam generator
arc     n, 0.0, 0.0, 1.0, 1.0, 53.0, 74.0
c
line    -0.6018, 0.7986, -0.6018, -0.1, -0.3009, -0.3009, -0.3009, -0.8993
c
arc     n, 0.0, -0.5, 0.5, 0.5, 233.0, 74.0
c
line    0.3009, -0.8993, 0.3009, -0.3009, 0.6018, -0.1, 0.6018, 0.7986
line    -0.6018, 0.7986, 0.6018, 0.7986
line    -0.6018, -0.1, 0.6018, -0.1
line    -0.3009, -0.3009, 0.3009, -0.3009
line    -0.3009, -0.8993, 0.3009, -0.8993
input   nil
output  nil
```

DATE
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END