OPERATOR MANUAL

Fluke 900 PC Software 900-903

FLUKE®

900 PC SOFTWARE

CONTROL AND DEVELOPMENT PACKAGE FOR THE FLUKE 900

OPERATOR MANUAL

Revision 3.1

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Table of Contents

1 900 PC SOFTWARE PACKAGE

1.1 HOW TO USE THIS DOCUMENTATION

This manual assumes some familiarity on the part of the user with the testing concepts and approach of the Fluke 900. Section 2 of the Fluke 900 Operator Manual on technical principles and Appendix I on applications are recommended as minimum reading for a user of 900 PC Software. The reader is referred to the index of the Fluke 900 Operator Manual for advice on when to use a feature.

900 PC Software controls almost all of the functions of a standalone Fluke 900 as well as offering some expanded capabilities. It operates with a hierarchy of screens and windows that are summarized by the menu tree shown in Section 3.1 on Package Operation. Each screen listed corresponds to a subsection in Section 3. Much of the information presented is available through an on-line Help utility by pressing F1

The first time user will find a quick introduction to the basic functions of 900 PC Software in Section 2, Getting Started.

1.2 GENERAL DESCRIPTION

The 900 PC Software software package is intended to bring the power and ease of use of a Personal Computer to the operation of the FLUKE 900 Dynamic Troubleshooter. Most functions that can be executed from the keyboard of the Fluke 900 can be done from the a PC in a way that takes advantage of the PC's full screen and keyboard. The main features of this package are:

1. Tactile keyboard control of Fluke 900 including use of function keys, menus and context-sensitive Help.

2. Full screen color display of test parameters and results using windows and popup boxes.

3. Unlimited Test Sequence storage to disk and ability to transfer to tester system RAM or cartridge.

4. Structured database-type environment for Sequence programming that is more flexible, powerful and easy to use than the Fluke 900 standalone unit. Some aspects of this are:

   - Copying, moving and editing during Sequence creation are easier.
   - Subsequences within Sequences are allowed for structured testing.
   - Most test parameters are immediately visible or accessible through one window.

- Documenting a Sequence is easier using fields for author, title, revision and description plus programmers comments for each line.
- Configurable options include color palette, PC port and coordination with other software instrument packages.

The basic concepts of 900 PC Software are as follows:
The opening screen contains setup and file utility functions. These may be considered "housekeeping" tasks that permit the user to maintain and transfer files and configure hardware ports, paths, and colors. All testing and development of Sequences is done from the RUN pulldown menu. Within RUN are found all the capabilities present in the Fluke 900's Manual, Sequence and Develop modes. One effect of this is that to perform an immediate test on a single IC, you must run a newly created Sequence that consists of one device, since there is no Manual mode. The equivalent of Sequence and Develop modes on the Fluke 900 is achieved on the PC by setting the mode parameter to "run only" or "develop". The mode parameter is found under the Header menu of the Seq Flow window.

All device library information is assumed to be resident in the Fluke 900. Even if LIBRARY files are resident on the PC disk, they must first be downloaded, using the Copy menu option, to the Fluke 900 (System RAM or a Cartridge) before they are usable in a Sequence. The process of creating a LIBRARY file of desired devices for download to the Fluke 900 is performed using the 900

Library Utility. This is a standalone package that may be used on its own or accessed from within 900 PC Software using the Library option under the Files menu.

The test parameters found in the local menu of the Fluke 900 are regrouped on a single TEST screen in 900 PC Software into three categories: IC Definition, Initialization and Performance Envelope. They reflect the three basic steps that occur when testing a device with Dynamic Reference Comparison. Another window, Stimulus, contains the Reset parameter.

Two minor changes to the standalone Fluke 900 parameters are that Reset and Pin Definition are each split into separate parts to reflect their use in two different functions. Reset pulse attributes such as polarity and duration are found in the Stimulus window and Reset Offset is found in the Initialization window. PinDef condition checks (High, Low, Active) are found in the Definition window and pin ignore is found in the Performance Envelope window.

A Sequence that is run from a PC is in a database format that permits flexible manipulation and editing. In this configuration, the Fluke 900 is operating in Manual mode under remote control of the PC and its LCD display is inactive. For standalone operation of such a PC Sequence on the Fluke 900, the Sequence database must be compiled into the two file types ".seq" and ".loc" that normally run on the Fluke 900 in its Sequence mode. The Compile Utility is found under the Files menu.

1.3 SYSTEM REQUIREMENTS

1.3.1 HARDWARE REQUIREMENTS

The basic hardware must include a minimum of:

- IBM XT or AT computer or compatible machine
- Hard disk drive
- 640 K of RAM memory
- RS232 serial communications port
- Screen Monitor with any of the following adapters:
  Monochrome MDA
  Hercules Graphics
  Color CGA
  Color EGA
  Color VGA

- Fluke 900 Dynamic Troubleshooter with any board revision level, but with system firmware 5.00 or higher

1.3.2 SOFTWARE REQUIREMENTS

This package will run under DOS version 3.2 or higher and is intended to run from a subdirectory on hard disk. It is recommended that all background TSR (Terminate and Stay Resident) programs be removed from memory before running this software to avoid interference. 900 PC Software requires at least 540 K of free memory to run.

1.4 INSTALLATION

STEP 1
INSTALL FLOPPY DISKETTES ONTO HARD DISK

Bring up the DOS prompt at A:
Insert floppy Disk 1 into drive A and type:

install

A prompt window appears for you to specify the directory and drive letter that the package will be installed in. Default is C:\900PCS but you may change the specification and press F10 to accept. Note that, if a directory does not exist, it will be created for you automatically.

A prompt window also appears for you to confirm whether a demonstration Sequence will be copied into a subdirectory. The default subdirectory is FILES but you may specify it differently. If it does not yet exist, it will be created automatically.

If you followed the procedure outlined above and installed this package on disk in the root directory, you should have the following contents of the directory \900PCS :

900PCS.EXE
D900.EXE
S900.EXE
FITE.HELP
MESSAGE.TXT
FILES <DIR>

STEP 2
OPTIONAL LIBRARY UTILITY, PATH, RAM DRIVE

At this time, you may also wish to install the Library Utility as a subdirectory (ie. \900PCS\LIBLOAD\). It may, however, reside anywhere on your disk and its path can be defined when it is accessed from the FILES menu of 900 PC Software. See Appendix IV of the tester Operator Manual for instructions on installing the Library Utility.

It is advisable to include the 900 PC Software executable file (900PCS) in your computer's path so you can run the program even when it is not in your current working directory (ie. PATH= C:\900PCS;...).

The package operational response may be speeded up by defining RAM in the PC as a virtual disk drive (designator E:). For example, with 1 Megabyte of PC RAM, 640 K is used for the program and 384 K is available for a virtual drive. To enable this, add the following command to the config.sys file of your PC:

DEVICE=C:\DOS\RAMDRIVE.SYS 384 512/E

Note that this assumes DOS is resident in a directory called DOS on C drive.

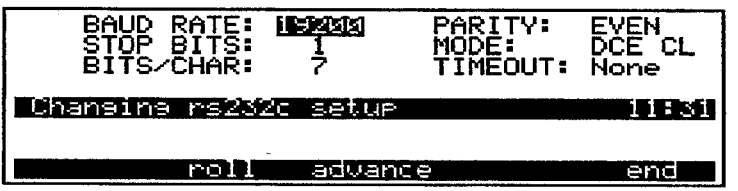
STEP 3
CONNECT AND CONFIGURE PC AND TESTER

Connect a "straight through" RS232 interface cable from the back of the tester to the serial com port of your PC. The cable should have data wires 2,3,7 connected as well as status wires 4,5,6,8,20.

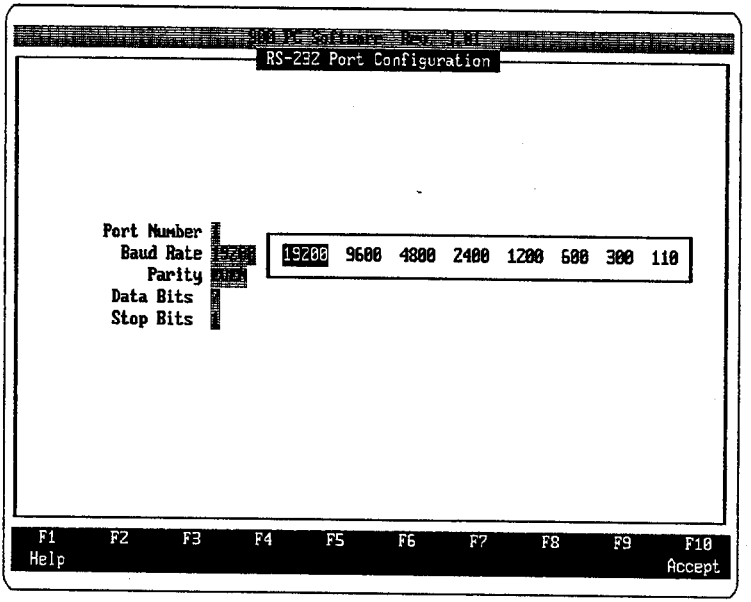
Type 900PCS at the DOS prompt on your computer and the main screen will appear as described in the Section 3.2 .

Factory default settings for 900 PC Software and the tester are the same. You may verify that baud rate, parity, data bits and stop bits are set to the same for the tester and the PC by actions described in Section 1.6.2 of the Fluke 900 Operators Manual and Section 3.5 of these instructions.

You may want to change the baud rate to 19200 for maximum data transfer speed between PC and tester. In this case, the SYSTEM, RS232 screen on the tester appears as follows:



The RS232 screen from the Setup menu of 900 PC Software appears as follows:



1.4.1 TROUBLE GUIDE

Symptom: When first running a Sequence or doing anything that requires communication to the tester, an error message appears: "Timeout Occured".
Possible Cause and Solution:

- Tester and PC do not have the same baud rate, parity setting.
- Tester RS232 port is not set to DCE CL.
- Tester is not showing its main power-up screen.
- PC port setting is incorrect (ie. Port 1 or Port 2).
- RS232 cable is not connected.

Symptom: When first communicating to the tester, an error message appears such as "Cannot set 8250 " or any message other than "Timeout Occured".
Possible Cause and Solution:

- Garbled initialization file. The user should erase the file named 900PCS.INI and restart the 900 PC Software package.

Symptom: When first running 900 PC Software, the message "Not enough memory to run program" appears.

- The PC requires 640 K of RAM memory configured.
- Background programs and TSRs must be removed so that there is at least 540 K of free RAM space to use for this package.

2 GETTING STARTED

This section outlines the typical process of creating a Test Sequence, compiling it into a form that runs on the standalone tester and copying it to the tester. Refer to Section 3 on Package Operation for details on how to perform any specific function involved in this process. In particular, Section 3.1 provides a diagram of the complete menu structure of 900 PC Software.

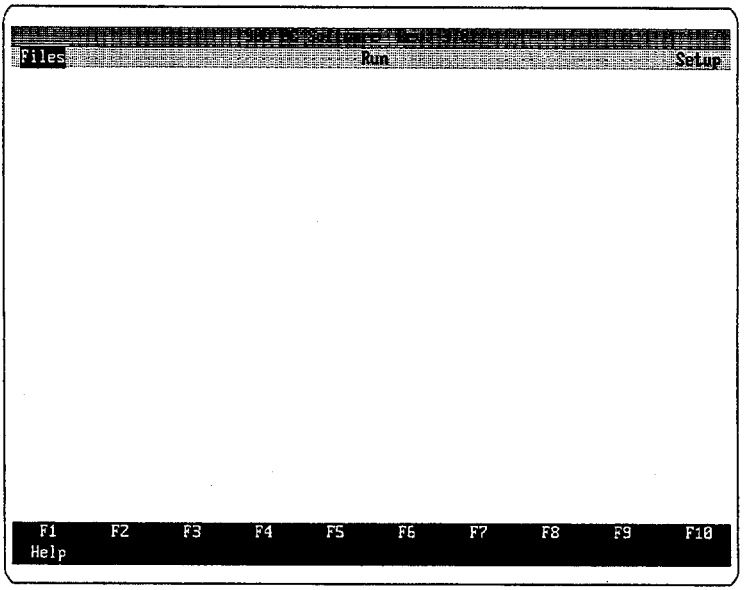
2.1 STARTING THE PACKAGE

Follow the installation procedure described previously to connect up the tester to the PC and install 900 PC Software.The tester should be sitting in its main power up screen and be connected to the UUT in the same way required for Sequence development with the standalone tester.

From the DOS prompt, after power up of your PC, type:
cd 900pcs Enter

This makes 900PCS\FILES the working directory.

Type 900PCS Enter to start the 900 PC Software package.The opening screen is refered to as the "Main Screen".



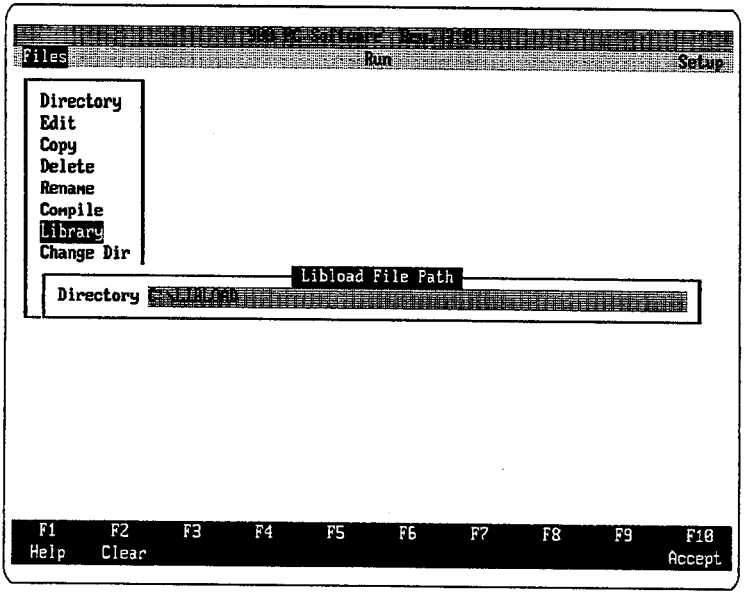
The Sequence that will be developed in the following example is to be stored on the Files subdirectory, which was created automatically when you installed the package. Make this the Working Directory by selecting the Change Dir option under the Files menu. Enter the following path: C:\900PCS\FILES (This assumes you installed the package on C drive).

2.2 LIBRARY PREPARATION

Simulation and Shadow patterns must be resident in the tester before a test Sequence is created, so the first step is

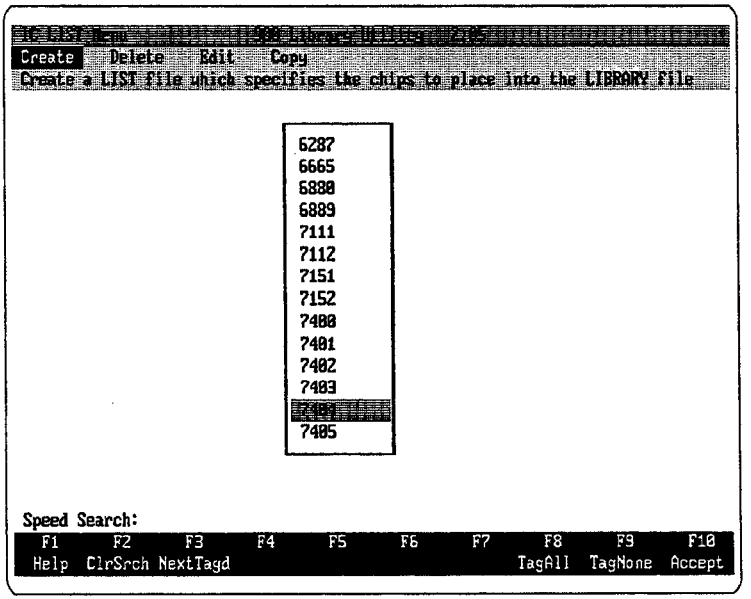
to download a library file to the tester. If actual devices are to be used as RDs in the tester's ZIF socket instead of simulated devices, this step may be omitted.

Move the cursor to the Library option in the Files menu and press Enter. Note that the Library Utility is a separate software package that is included with the tester and must be installed separately. If the path for the 900 Library Utility has not been previously defined, a dialog box will appear for you to enter it.



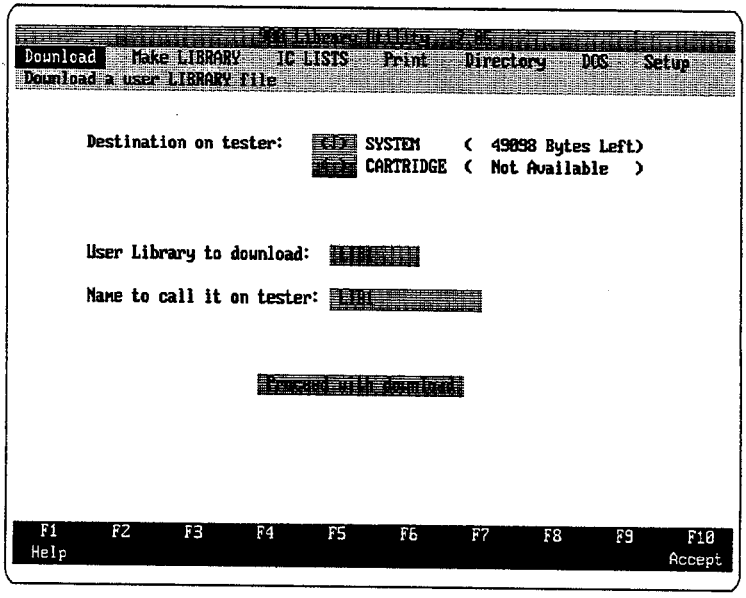
When using the Library Utiltiy, you may press F1(Help) at any time for assistance in any of the following procedures.

Move the Cursor Bar to the IC Lists Top Menu option and press Enter. Select the Create option and specify the name LIB1 in the Dialog Box. A scrolling list of ICs appears that includes all devices in the master library file. For our example, tag a few ICs by moving the Cursor Bar successively to 7400, 7404, 74244 and pressing Enter. Note that you may move the Cursor Bar by typing in device numbers or with up/down arrow keys and page up/down keys. Press F10 to accept and Y to confirm this IC List.



Press Esc and select Make Library with the Cursor Bar. Tag the name LIB1 with Enter and press F10 to accept, Y to confirm.

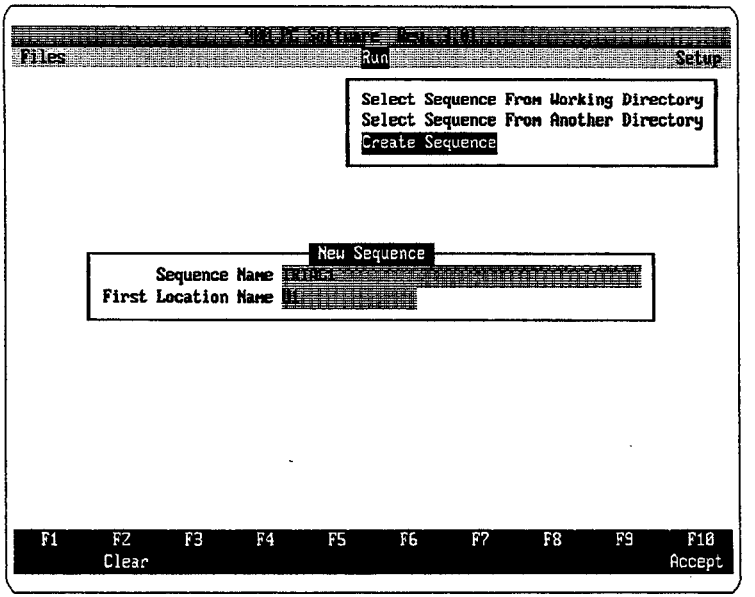
Now select the Download option of the Top Menu. (Note that , if you have a communication problem at this point, you should check the RS232 setting under the Setup option of the Top Menu. This is separate from the setting of RS232 in 900 PC Software, but they should both be set to the same configuration). Choose the tester System or Cartridge memory as the destination and press [Enter] on the User Library field. Press [Enter] again with the Cursor Bar postioned over LIB1, then [F10] to accept.



After completion of the file downloading operation, press [Esc] twice and Y to confirm exit of the Library Utility.

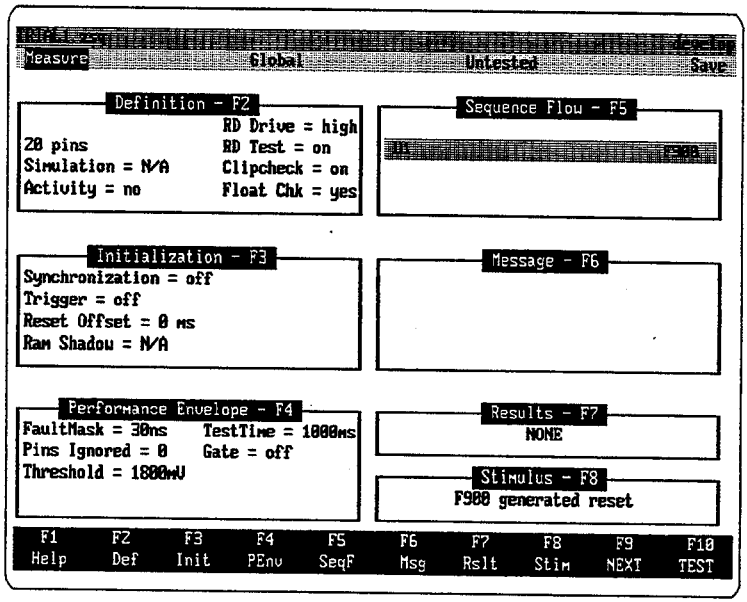
2.3 NAMING THE SEQUENCE

Select "Create Sequence" from the Run menu of the main screen. Enter a Sequence name (TRIAL1 in this example) and the location of the first device (U1 in this example) into the Dialog Box that pops up.



Press F10 to accept these entries.

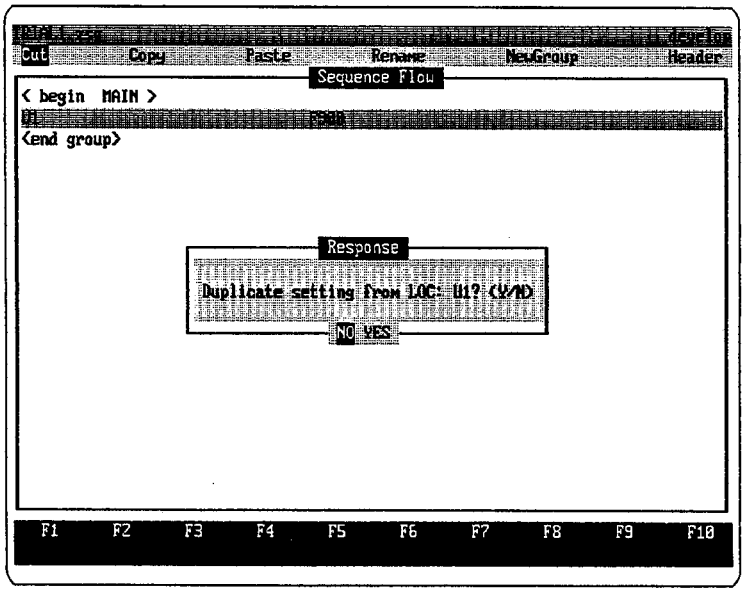
The main Test screen appears with U1 highlighted in the Sequence Flow window and default parameters in the other windows.



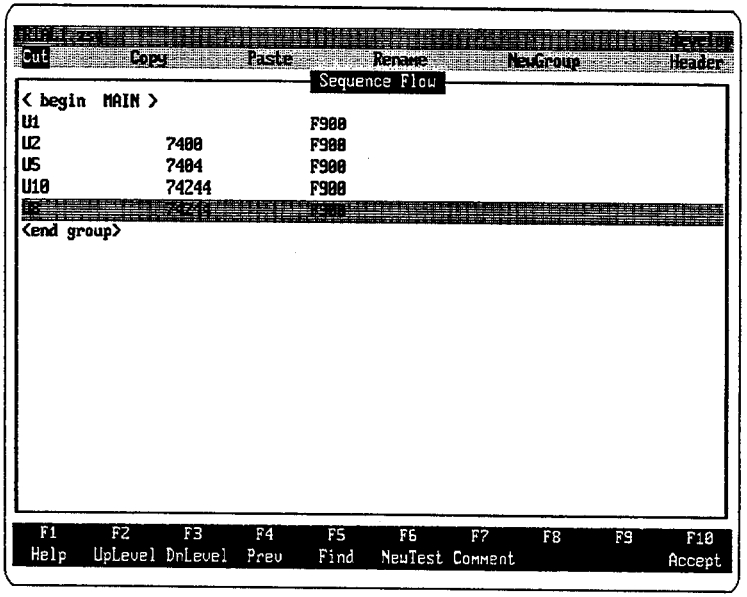
2.4 CREATING THE LOCATION LIST

Select the full Sequence Flow window by pressing F5. The previously defined locations (U1 in our example) appear as a list down the left side of the screen. U1 is considered the "current location" because this was the position of the Highlight Bar when you selected the full Sequence Flow Window. Additional locations may be added below the highlight bar by pressing F6 (New Test). For example, enter U2 into the Dialog Box that appears after pressing F6.

Note that a Dialog Box appears as follows:



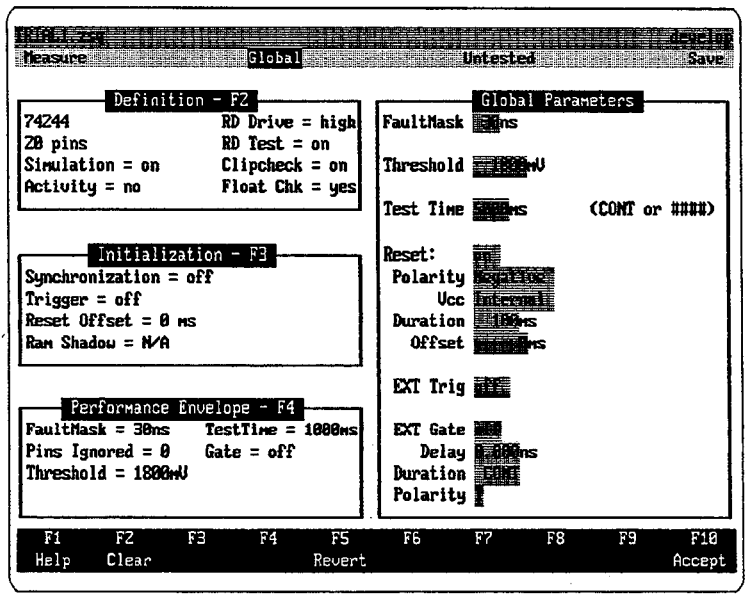
You can choose to duplicate the device information from U1. Press N for no and enter 7400. Repeat the procedure using F6 for U5 (a 7404), U10 (a 74244), and U8 (a 74244).



The highlight bar may be moved up and down this device list using the cursor control arrow keys. Move the bar to U1 at the top of the list and press F10 to return to the Test screen. Note that the highlight bar in the small Sequence Flow window is pointing to the same location highlighted in the full Seq Flow window.

2.5 DEFINING GLOBAL PARAMETERS

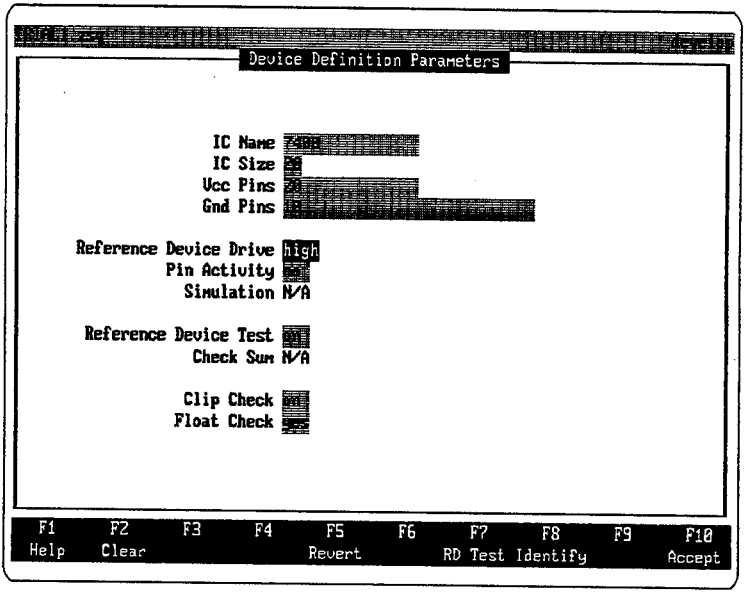
Global parameters are those that apply to all devices in a Sequence. They may be thought of as board level test parameters, such as the type of reset pulse or the Test Time. Select the Global option with the Cursor Bar in the Top Menu of the Test Screen.



Move the cursor to the Test Time field and enter a new value of 5000. Press F10 to accept the setting.

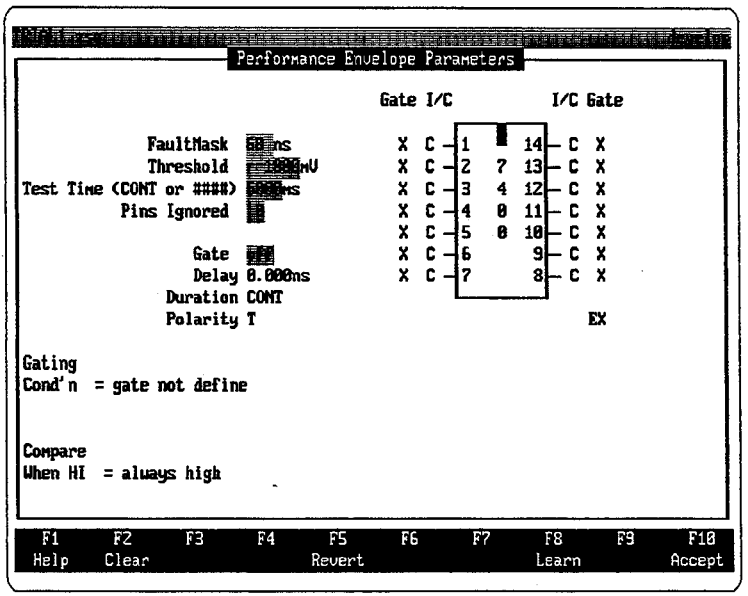
2.6 DEFINING DEVICE PARAMETERS

With the highlight bar positioned at U1 in the Test screen, press F2 to bring up the Device Definition window. Enter 7400 in the field and press F10 to accept the entire window.



The next step would normally be to verify that our test for U1 passes on a good board. If not, you would change the parameters until it does. This is the normal procedure for setting up a Sequence, even on a standalone tester. Assume that U1 passes and proceed to the next test by pressing F9 (NEXT). Note that the highlight bar moves to U2.

Let us assume, for U2, that a Fault Mask parameter change is needed to obtain a passing test result. Press F4 to enter the Performance Envelope window. The cursor will be positioned in the first field. Enter 60 as the value. Note that on an actual board, F8 (Learn) is available to help establish the correct Fault Mask. Accept the entire window with F10.



The development of an actual board Sequence involves repeating the preceding steps for every location in the Sequence Flow list.

2.7 REORDERING THE TESTS

Changing the order of tests is done from the Sequence Flow window. F5 enters this window from the Test screen and the up/down arrow keys move the highlight bar. Note that the left/right arrows move the Top Menu Cursor between various editing functions. We will use the Cut and Paste functions to make U10 the last location on the list.

Position the highlight bar on U10. Position the Top Menu Cursor on Cut and press Enter to start the cut, then F10 to accept the cut. U10 has now been removed from the list and placed in the Paste Buffer. Move the highlight bar to U8, the last location on the list. Move the Top Menu Cursor to Paste and press Enter. The revised list should now appear as:

U1
U2
U5
U8
U10

Accept this list and return to the Test screen by pressing F10.

2.8 ADDING OPERATOR PROMPTS

Scrolling through the Sequence Flow list may be done from the Test screen using the up/down arrow keys and the Page Up/Page Down keys. Once the highlight bar in the small Sequence Flow window is positioned on a desired device, pressing F10 will accept it and update the test parameters. Note that moving to another location using arrow keys requires accepting the final position, while moving with F9 (NEXT) does not. The location selected in the Test screen is the "current location".

Operator prompts may be added for each location by pressing F6 (Msg) to enter text into the Message window. F10 must be pressed to accept the text message.

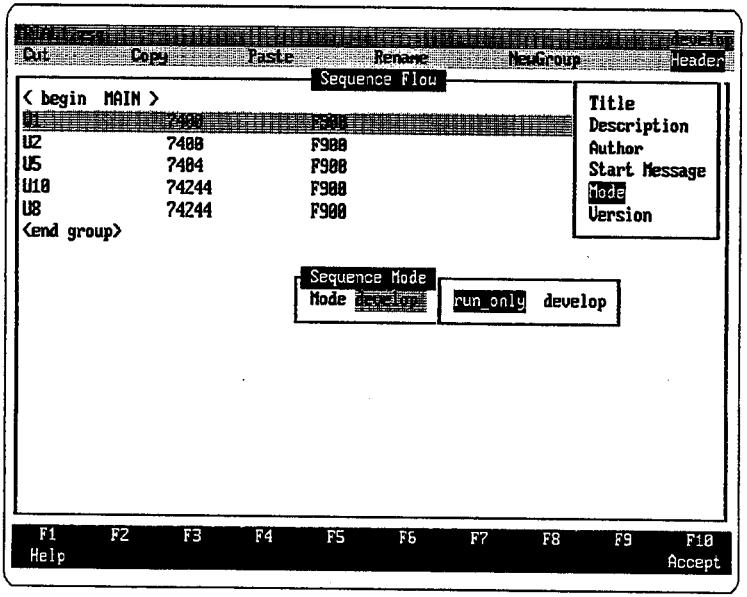
2.9 DOCUMENTING THE SEQUENCE

Sequence documenting is done from the Sequence Flow window accessed by F5. Programmer's comments may be added beside each location. For our example, move the highlight bar to U1, press F7 (Comment) and press Enter to bring up a Dialog Box for a location comment. Enter "Reset Circuit" and this will appear beside U1. Location comments appear on the same line as the U#s; Sequence comments appear between U#s.

The Header option on the Top Menu Cursor has menu options for Title, Description, Author, and a Start Message

operator prompt. Position the Top Cursor on the Header option and press Enter to permit entry of information for these purposes.

The Mode option of the Header menu is used at the completion of Sequence development to lock out further changes. After selecting this option, position cursor to "run only" and press Enter.



You are prompted to enter a password and confirm the setting. Further revisions can not be made to this Sequence unless you change the Mode back to "develop". This requires you to re-enter the original password.

Press Esc several times to exit the Header menu, the Sequence Flow window and the TRIAL1 Sequence. Press Y in response to the confirming messages to exit Sequence Flow Window, leave Sequence and save Sequence.

2.10 RUNNING THE SEQUENCE

The sample Sequence created above may be run from the Main screen by choosing the Current Sequence option or by choosing "Working Directory" from the menu and selecting the name TRIAL1.

The Sequence may also be run from a cartridge (or volatile tester System RAM) on a standalone tester after the following procedure:

1. Select Compile in the Files menu. Choose "Working Directory File" and the filename "TRIAL1.ZSQ" . The new files TRIAL1.SEQ and TRIAL1.LOC and their tester-executable versions TRIAL1.SE@ and TRIAL1.LO@ will be created in the same directory as TRIAL1.ZSQ

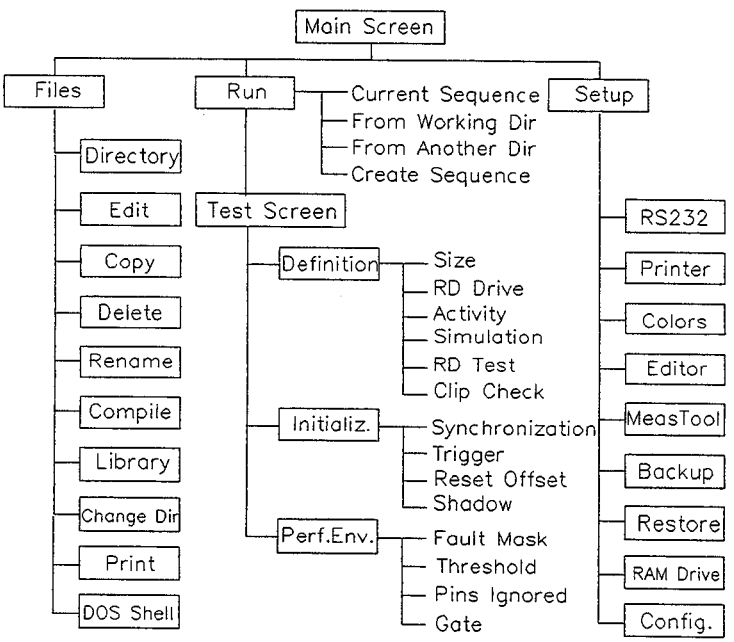
2. Copy the SE@ and LO@ files from the working directory to the tester (typically the cartridge). Note that they are downloaded to the tester as TRIAL1.seq and TRIAL1.loc .

3. The tester may now be disconnected from the PC and the Sequence run from cartridge.

3 PACKAGE OPERATION

Operation of this package is through pulldown menus and function keys that produce popup windows and boxes. The Esc key is used to exit windows and modes as well as the package itself. A popup box appears when trying to exit the package and it requires the user to confirm. Similar reminders to save changes also appear before exiting certain modes.

3.1 SCREEN MENU HIERARCHY

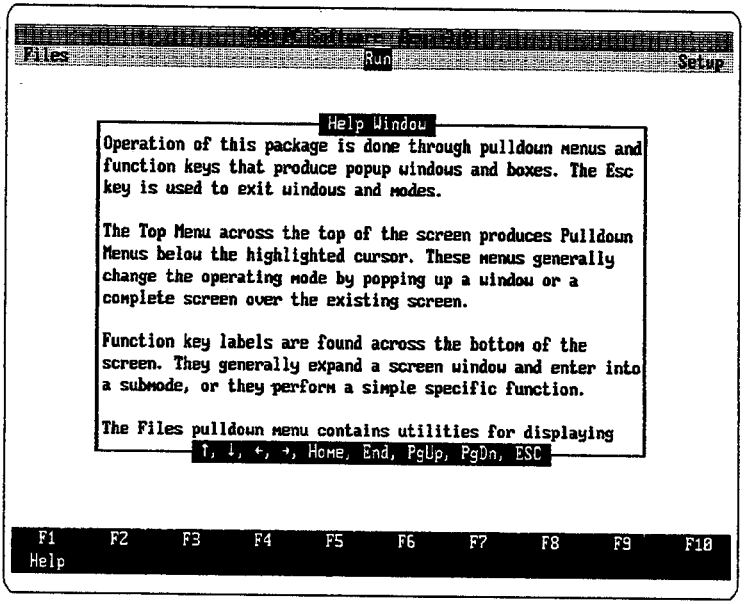


3.2 STARTING THE PACKAGE

900 PC Software installs itself in the directory 900PCS. Point to this directory by entering "cd 900pcs".

Enter "900pcs" at the DOS prompt and the main screen appears.

3.3 MAIN SCREEN



This screen shows the on line Help Utility available any time by pressing F1 (Help). Pressing Esc removes Help.

The Top Menu across the top of the screen produces Pulldown Menus below the highlighted cursor. These menus generally change the operating mode by popping up a window or a complete screen over the existing screen.

Function key labels are found across the bottom of the screen. They generally expand a screen window and enter into a submode, or they perform a simple specific function.

The Files pulldown menu contains utilities for managing files on disk such as Directory, Delete, Rename, Print. The Edit option invokes your own editor as specified in the Setup menu to make changes to text files. The Compile option produces versions of PC-generated Sequences that may be downloaded to a standalone tester. It also utilizes the compiler resident in the tester to convert tester compatible source files (.LOC, .SEQ, .LIB extensions) to executable versions for a standalone tester (.loc, .seq, .lib extensions). The Copy option is used for copying files within the PC and to/from the tester. The Library option invokes the Library Utility described in Appendix IV of the tester Operator Manual. The Change DIR option changes the working directory for the purposes of the Run menu.

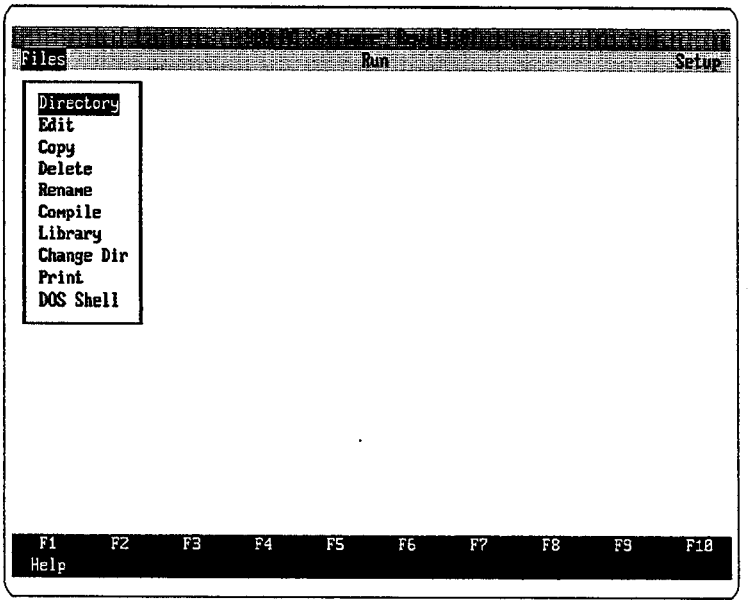
The Run pulldown menu permits the loading of an existing board test Sequence from disk or the creation of a new Sequence.

The Setup pulldown menu permits option setting for the PC serial port, printer page format, screen color template,

path definition for editors and other software packages, and specifying backup copies of Sequences and restoring them during their creation.

3.4 FILES MENU

To execute the following file utilities, move the cursor with the up/down arrows, press Enter and specify the desired disk and path in the Dialog Box.



Directory -
Lists the files resident on PC disk, cartridge inserted into the tester or present in the tester's volatile system RAM.

Edit -
Prompts for a file resident on PC disk, tester cartridge or tester system RAM and invokes the editor defined in the Setup menu. Edlin is the default editor.

Copy -
Transfers files between tester cartridge, tester system RAM and PC. Specify the source and destination with the cursor.

Delete -
Removes files from PC, or tester system RAM and cartridge. Highlight the filename with the cursor and press [Enter].

Rename -
Permits changing the name of PC-resident and tester-resident
files.

Compile -
This utility will convert a Sequence file that is compatible with the 900 PC Software database (file with extension .ZSQ) into files that are compatible with the standalone tester (files with extensions .SEQ and .LOC). When the utility is performed on tester-compatible files (extensions .SEQ, .LOC and .LIB), executable versions with extensions .SE@, .LO@, .LI@ are produced. Note that these files are put into the same PC directory or tester medium as their source file versions.

Library -
This is the Library Utility described in Appendix IV of the tester Operator Manual. It is used to create downloadable LIBRARY files of standard and simulated devices. When you first invoke this utility from 900 PC Software, you will be prompted to enter the path where it was installed. Thereafter, the utility automatically starts when selected from the Files menu.

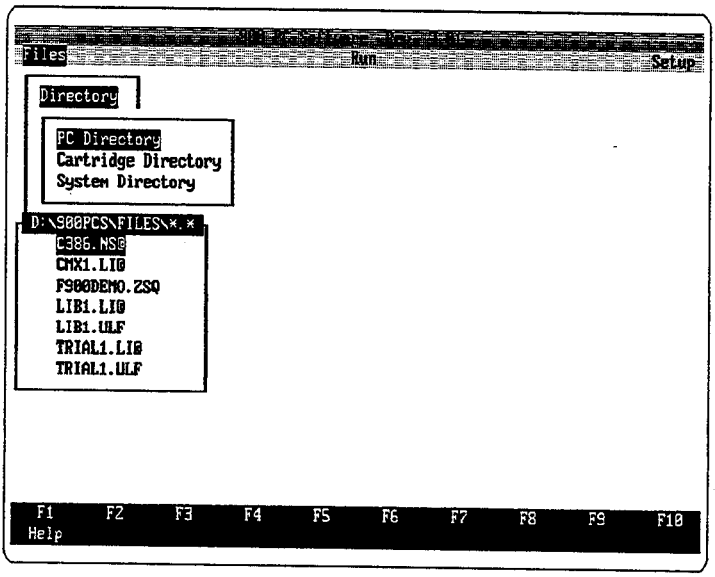
Change DIR -
This changes the working directory to any one that you specify. When running a Sequence, it is backed up in the working directory. Therefore, to restore a Sequence (using Restore under the Setup menu), you must be running it from the working directory, not "another directory".

Print -
Directs a specified file to the PC printer port. Specify the type of file with the Highlight Bar and its name in the Dialog Box. Note that Sequence means a listing of the database file on the PC, not the tester version .SEQ file.

DOS Shell -
Brings up the DOS prompt and permits DOS commands.The 900 PC Software package frees up all memory except 10K. Type EXIT to return to 900 PC Software.

3.4.1 DIRECTORY

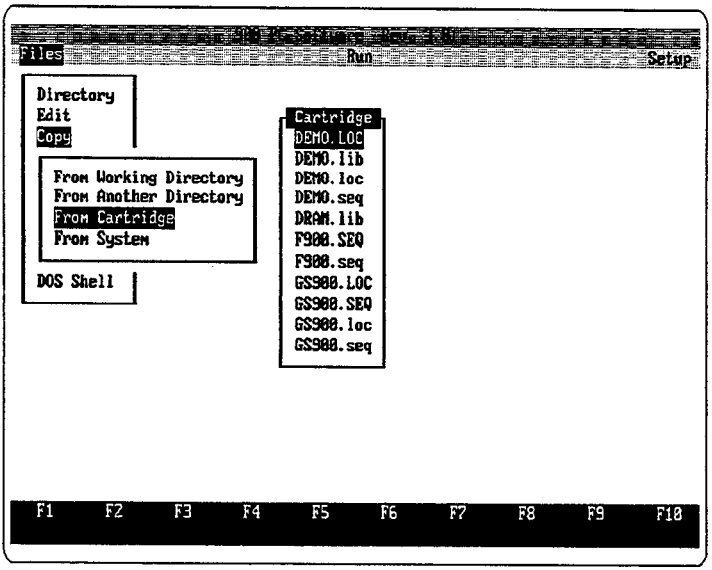
The following screen shows the popup boxes present when checking the directory of files on disk. A highlighted cursor serves to scroll the list of files through the Menu Box using up/down arrows. Note that subdirectories are not indicated, only files.



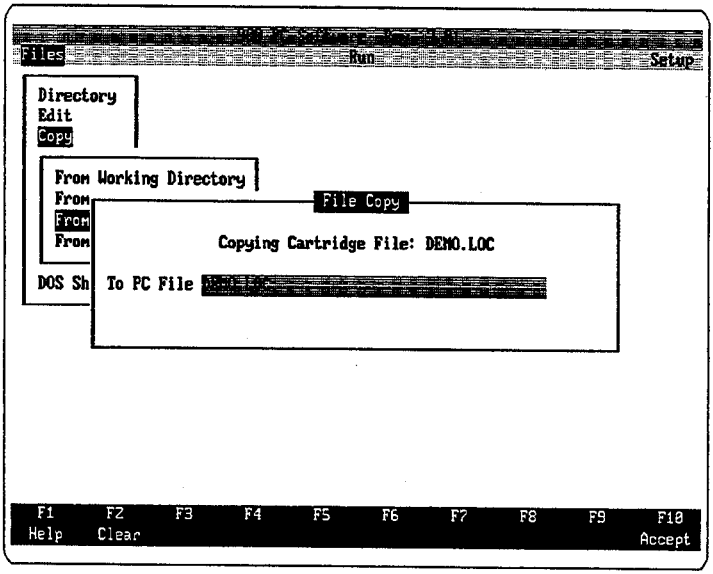
3.4.2 COPY

The Copy utility is used to duplicate files on disk and also to transfer them between PC and tester. Note that you will not be prompted if a file already exists and it will be copied over if so specified. The source file is specified by

first selecting where it is located (working PC directory, other PC directory or tester). A list of files is presented as shown below.



Highlight the choice and press Enter. The destination for copying is specified in a Dialog Box as shown on the next page.



Note about filename conventions:

Sequence source files that are resident on the tester have the filename extensions SEQ, LOC, LIB. The executable versions of these source files have the extensions seq, loc, lib. When copying an executable file from the tester to PC, its extension is modified to be SE@, LO@ or LI@ since the PC does not recognize lowercase filenames. When one of these files is copied back down to the tester, its name extension is automatically converted back into the tester executable form (ie. FILE.SE@ becomes FILE.seq).

3.4.3 COMPILE

The Compile utility is used to convert files from one format to another according to the following table (note filename extensions shown in parantheses):

File Type	Converts to
Sequence on PC database (ZSQ)	Tester source file(SEQ,LOC) and tester executable files (SE@,LO@) on PC
Tester source files resident in PC (SEQ,LOC,LIB)	Tester executable files resident in PC (SE@, LO@, LI@)
Tester source files resident in tester (SEQ,LOC,LIB)	Tester executable files resident in tester (seq,loc,lib)

Note that, when creating a Sequence in the 900PC Software database that is to be compiled and downloaded for standalone tester operation, you must conform to certain syntax conventions that apply to the tester. These restrictions do not apply to Sequences intended for operation within 900 PC Software. For example:

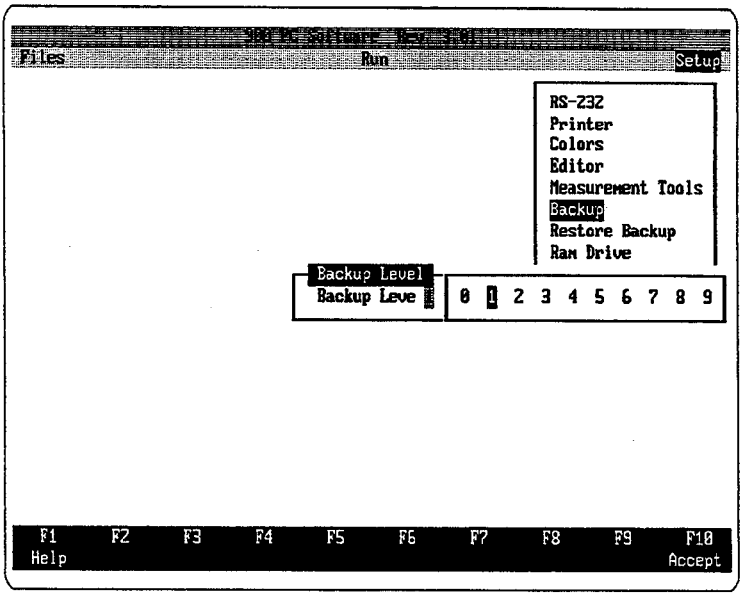
- Filenames must begin with alpha characters
- No spaces are allowed in file or location names
- Location names may not have shifted characters (from the tester keyboard) or a dash, but may have an underline. eg.: U37_A is

allowed, U37(A) and U37-A are not).
- Operator messages that are longer than 2 lines on the PC are extended to an extra dummy chip on the tester.
- Quotation marks cannot be used in operator messages
- Start Message information from 900 PC Software appears as nonexecutable comments in the SEQ file and does not appear on the tester display.

In general, if you cannot successfully compile a ZSQ file into SE@ and LO@ versions but it does produce SEQ and LOC file versions, investigate the syntax restrictions of the tester compiler. The line numbers of the compile errors appear and the files may be viewed with an editor. Another way to do this is to copy the SEQ file to the tester system RAM and then do a manual compile from the tester keyboard to locate the exact line with a problem.

3.5 SETUP MENU

Setup defines various option and configuration settings. Shown below is the popup Menu Box that appears when the Backup option is selected.



Each option is described below:

RS232 -
Permits setting of communications port. Up and down arrows select an active parameter and left/right arrows position the Highlight Bar on the desired setting. Press [Enter] to confirm each setting and [F10] to accept the entire configuration.

Printer -
Permits page formatting for file printouts. Up/down arrows select an edit field for numeric entry. Enter confirms each setting, F10 accepts the entire configuration and F5 restores the configuration to the settings that were present before changes.

Colors -
Permits the user to choose different colors for various windows and parts of the screen. See section 2.3.1 for more explanation.

Editor -
Permits the user to define the path and name of the editor to be used in the Files menu.

Measurement Tools -
Permits the user to define the path and menu name of instrument programs found in the measure pulldown menu. Up to three such definitions may be specified.

Backup -
Permits 0 to 9 backup copies of a Sequence to be retained during development. A maximum of 3 is recommended to conserve disk space. Note that the copies are stored in the Working Directory (as specified by the Change Dir option of the Files menu). It is recommended, therefore, that a Sequence is always developed in the "Working Directory" rather than "Another Directory". In this way, the backup copies are easily available.

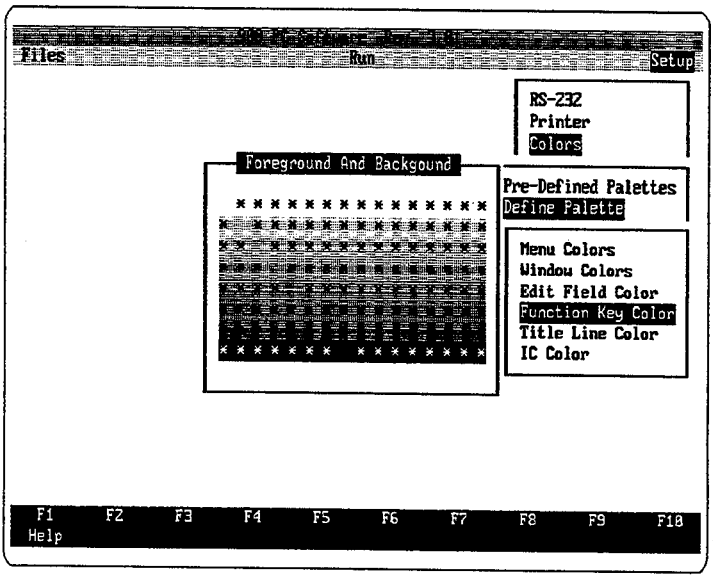
Restore Backup -
Permits one of the backup copies of a Sequence to replace the current version. Therefore, any changes made since the last Save procedure are discarded.

RAM Drive -
Permits the user to specify a portion of extended RAM in the PC to be used in the execution of the 900 PC Software. This will speed up the operational response of the package. To enable RAM Drive, enter the virtual drive letter (eg. E) in the field of the Dialog Box. A blank field will diable this feature. See the installation procedure in Section 1.4 on how to define the RAM space as a drive letter in the PC config.sys file.

Configuration -
Tester hardware and firmware revision levels are listed.

3.5.1 COLORS

The Menu Boxes permit the user to choose colors for various parts of the screen by moving the cursor to the desired color (foreground and background) and pressing Enter.



Two palettes are predefined. The terminology used is as follows:

Menu -
A horizontal (eg. Top menu) or vertical (eg. pulldown) list of selections with a highlight cursor. Choices menu is the horizontal menu of choices for some parameters.

Window -
The entire screen has a background and may have areas within it called windows (eg. Definition, Results, Stimulus, etc.). A window may fill the entire screen when selected.

Box -
Machine status messages and error messages will appear in boxes in the center of the screen to provide operator information.

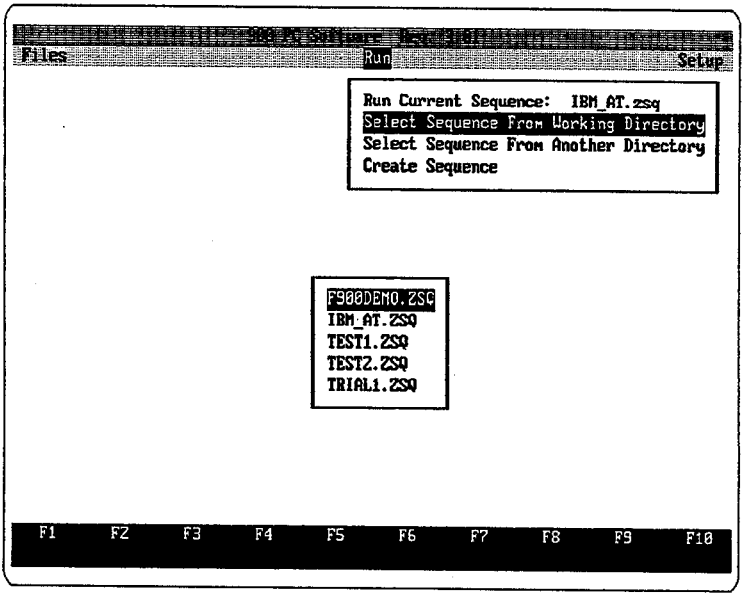
Field -
The current values for each parameter in a window. The active field is highlighted, the passive ones are not.

Function Key Line -
The labels across the bottom of the screen.

Title Line -
The top line of the screen.

3.6 RUN MENU

To load and run a Sequence file from the PC disk, pulldown the Run menu,move the cursor and press Enter on one of the selections in the pulldown menu. Note that the Working Directory can be changed from the Change Dir option of the Files menu.



The Run Current Sequence option is only shown if a Sequence has already been run. It is considered to be currently loaded and may be re-run by positioning the cursor and pressing Enter. The popup Menu Box shows the available Sequences for the other options:

Working Directory -
The directory that was current when 900PC Software was started or that has since been changed through the Change Dir option of the files menu.

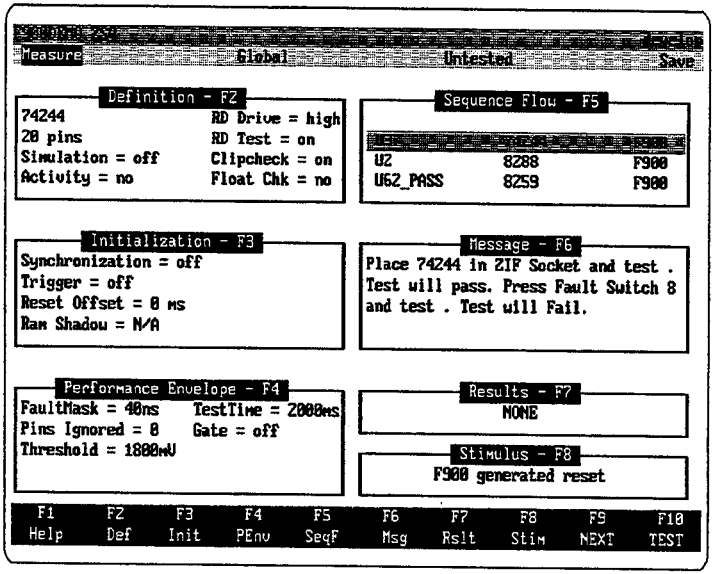
Another Directory -
A disk and directory path that you must specify in a Dialog Box.
(eg. A:\FILES)

The Create Sequence option prompts the user to enter a new Sequence name and the first IC location into a Dialog Box. The initial Test screen then appears.

Note that, unlike the standalone tester, there is no Manual Mode to test devices outside of a Sequence. It is a simple matter, however, to create a dummy Sequence consisting of a single device. The Test screen then operates like Manual Mode and you may change the device and any parameters over and over.

3.6.1 TEST SCREEN

This is the main testing screen and is used both for running and developing Test Sequences. Each window has an associated Function Key which permits changing of the parameters in that window. The Highlight Bar in the Sequence Flow window indicates the location of the current IC to be tested.



Each location has a set of parameter windows that define its test. The initial parameter values are retrieved from a device library as default values and they may be changed individually. Certain parameters, furthermore, may be given modified default values for all devices in a Sequence. These are Global parameters and are accessed from the Global option of the Top Menu Bar. They include: Fault Mask, Threshold, Test Time, Reset, External Trigger and External Gate.

F10 (TEST) initiates the test cycle on the tester. Test results are provided to the PC when a failure occurs or the Test Time expires. Note that if Test Time is set to continuous or the tester is waiting for a Trigger that is

not occuring, the user can terminate the test in two ways. [Esc] aborts the test; pressing the TEST key on the tester stops the test and provides the test results to the PC.

[F9] (NEXT) moves the bar to the IC below the current one and updates all the screen parameters. Page Up, Page Down and Up/down arrow keys will also scroll the bar within the Seqence Flow window to another location. Press [F10] (Accept) to update the screen parameters associated with the location in the highlight bar.

Selecting a location may also be done in the full Seq Flow window accessed by pressing [F5]. There is an expanded list and a Find key to search for a location.

The very top line of the Test screen identifies the name of the Sequence, a user-definable descriptive title in the center, and the mode (develop or run-only). The descriptive title and mode are set through the Header option of the Seq Flow window.

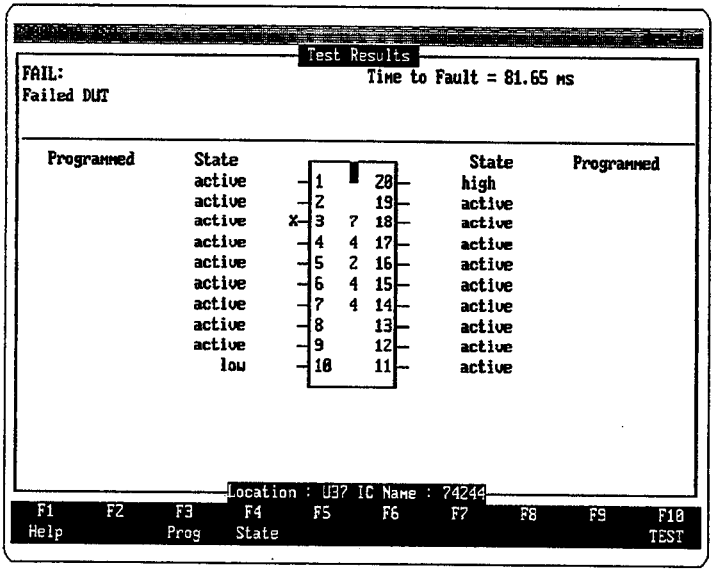
The Top Menu has:
Measure, to perform a measurement function (eg. frequency) or to shell out to another instrument package.

Global, which permits certain test parameters to be set to a constant value for the entire Sequence. This is most uaseful for board level parameters such as Test Time which typically remain the same for all devices.

Untested, which lists locations not yet tested. It is initialized each time the Sequence is restarted from the main screen.
Save, which saves the Sequence test parameters and device locations to disk. The previous version(s) are also retained as backup copies according to the setting in the Setup menu.

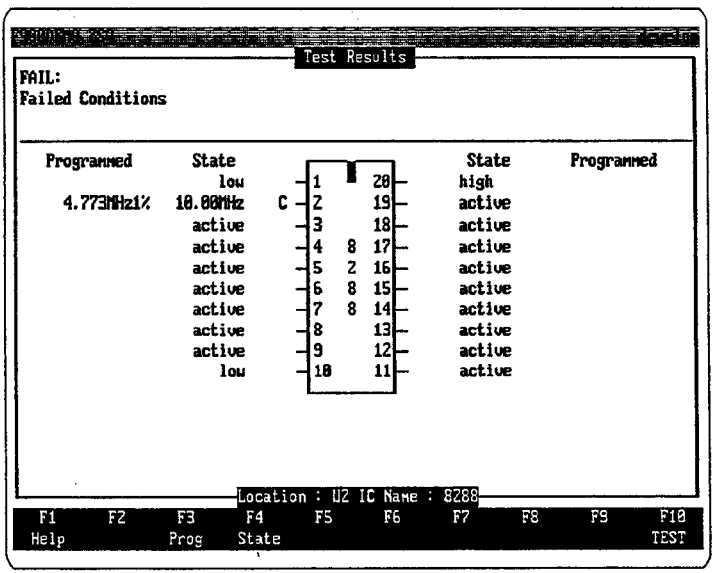
3.6.2 RESULTS SCREEN

This screen appears automatically after a FAIL test result or may be brought up with a Function Key after a PASS result.



The pins that had signals which exceeded the Fault Mask setting are marked with X. F4 (State) produces a listing of the observed activity beside each pin. The time that the fault was captured after the start of test (eg. edge of the Reset pulse) appears at the top of the screen. The state of the DUT pins at the end of test cannot be viewed using 900 PC Software. It can only be viewed using the tester's keyboard operating in nonremote mode.

Mismatches in programmed pin activity appear as the following screen:

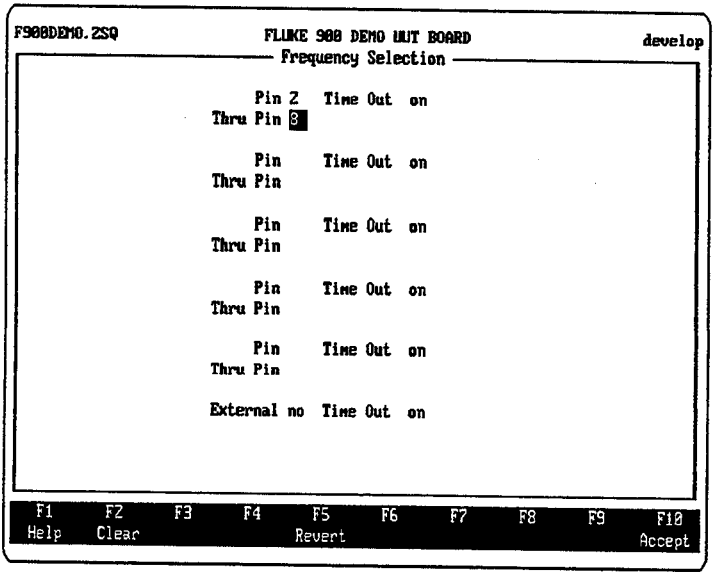


Pins which fail the specified condition activity checks are marked with C. The actual observed condition and the

preprogrammed condition will appear beside the pin(s). Press F5 to observe the actual activity on all pins. Press F4 to see the programmed activity conditions on all pins.

3.6.3 MEASURE - FREQUENCY

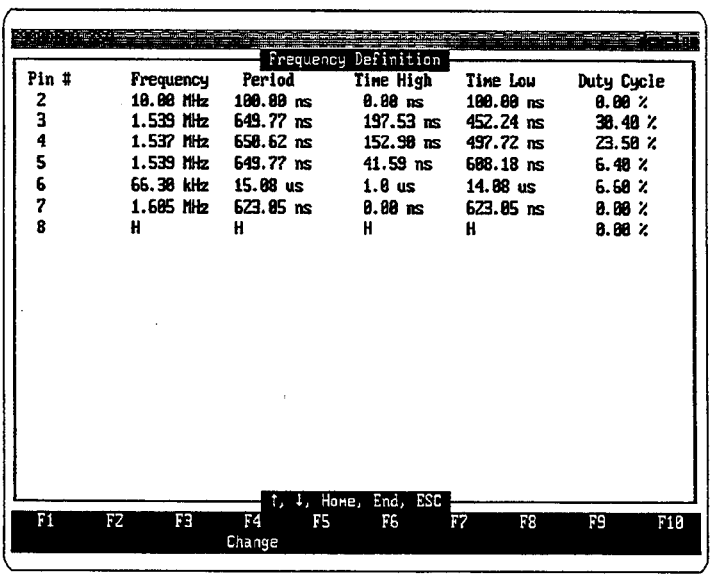
Selecting frequency from the measure window is similar to using immediate frequency on a number of pins with the standalone tester. The pulldown menu permits selection of Frequency the Frequency Window appears:



Frequency can be measured on up to 5 groups of pins (eg. 1-2, 5, 7-10, 14, 20). Time out should be set to "off" for any signal less than 100 Hz. Note that the Cntrl

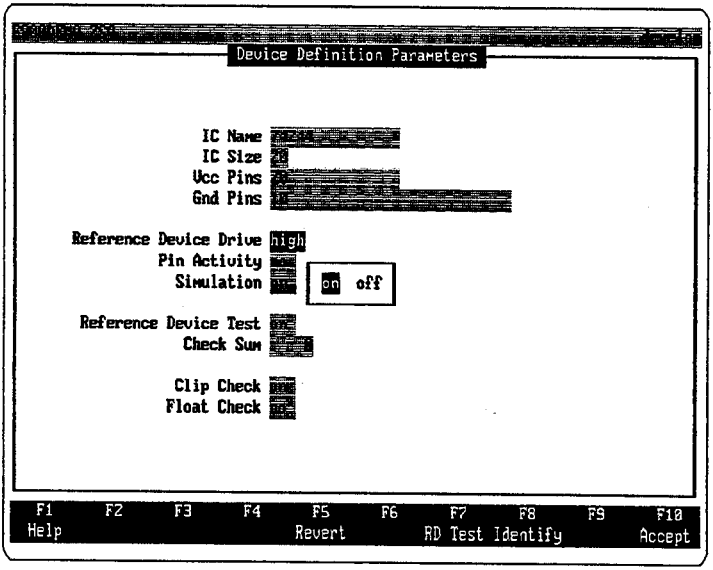
right/left arrows move the cursor between the pin column and the Time Out column. When in the Time Out column, the cursor resides in a small Choices Menu Box.

External is the EXT patch lead on the Interface Buffer. Gate and Delayed Gate are the pin conditions defined from the Performance Envelope window.
F10 (Accept) confirms the setting of the entire Frequency Dialog Box.



3.6.4 DEFINITION WINDOW

The Device Definition screen is used to specify the device under test. This is also where activity condition checks are programmed for any desired pins.



Up/down arrows select the desired parameter and left/right arrows choose a value from a Menu Box. Press [Enter] to update the value. [F10] (Accept) confirms the entire window and [F5] reverts to the setting when the window was entered.

The user will normally select a device number and all further parameters in this window are filled in from the

library (eg. Vcc pins, IC size...). A device not in the library may be specified by choosing the size of the IC followed by its Vcc and GND pins. This will clear the IC name field.

Other parameters that may be set are:

Reference Device Drive -
High for TTL, Low for certain weak devices (e.g. some EPROMs).

Pin Activity -
(Enter) alters the condition tests that verify High, Low or Active toggling signals on the DUT pins and EXT lead.

Simulation -
N/I means Simulation Option hardware is not installed in tester. N/A means simulation library is not resident in the tester cartridge or system RAM. Off means that a reference device must be in the socket. Note that Simulation files must always be resident in the tester before a Sequence is created so that the on/off indicator flag may be displayed on all simulated devices. If N/A appears for a device, you must first download the appropriate simulation file and respecify the device in order to enable it.

RD Test -
The automatic test of the Reference Device before DUT comparison test may be set to ON or OFF. Out of circuit device testing using RD Test can only be done from the tester keyboard in nonremote operation.

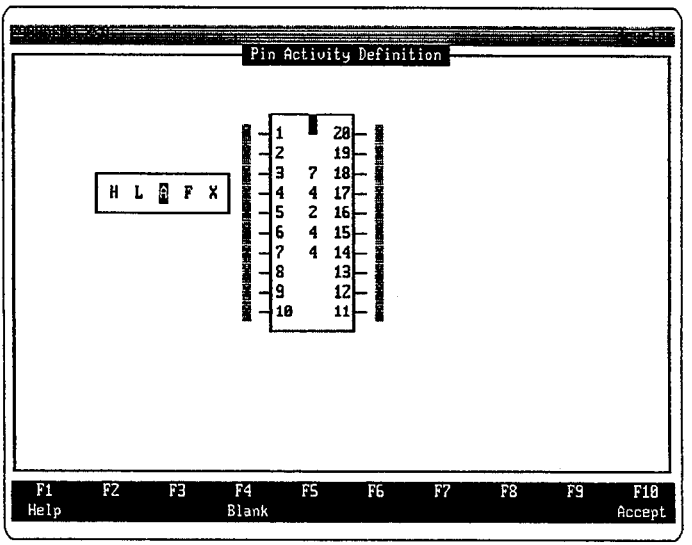
Check Sum -
this numerical value for PALs and EPROMs is obtained by placing the Reference Device in the tester socket and pressing F7 to perform RD Test.

Clip Check -
Off disables the check for clip orientation.

Float Check -
The check for floating pins during the entire Test Time may be disabled for individual pins or the entire DUT.

3.6.4.1 ACTIVITY WINDOW

Condition checks may be performed on specified pins by choosing "alter" in the Pin Activity field of the Definition window.



Pin Activity check can be set on any pins as follows:

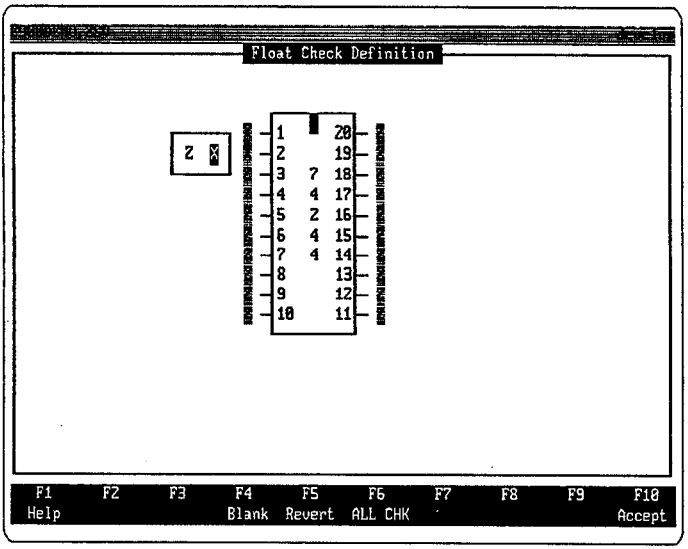
H - high during the entire test time
L - low during the entire test time
A - at least 1 transition during the test time
F - frequency measurement within a tolerance
X - don't care

Up/down arrows move the Choices Menu Box from pin to pin. Ctrl right/left arrow moves it to the other side of IC. Right/left arrows highlight a choice and Enter confirms it.

When F is chosen, a Dialog Box appears for entering the values. Enter the value, M, K or H for units and a tolerance value before pressing F10 to accept them. F10 (Accept) confirms the entire Pin Activity window. F5 reverts to the setting when the window was entered and F4 clears all settings.

3.6.4.2 FLOAT CHECK WINDOW

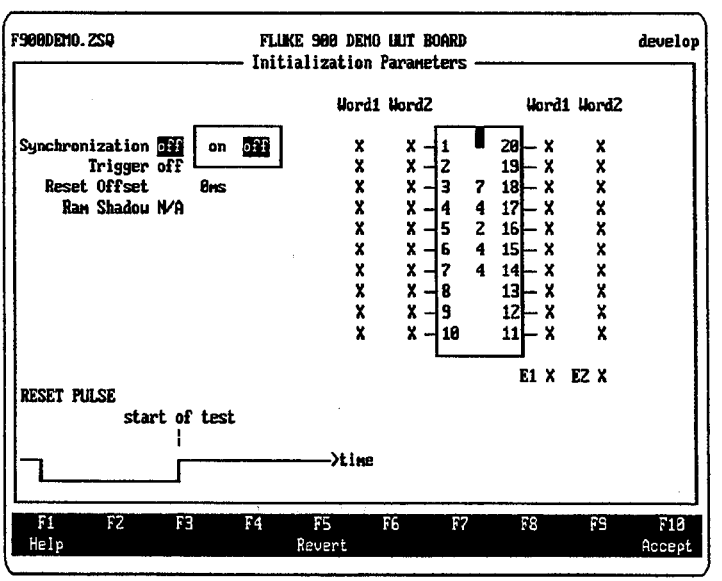
The verification for floating pins may be disabled and re-enabled by choosing "alter" in the Float Check field of the Definition Window.



Float Check can be set on any pin as follows:
Z - inactive for the entire duration of Test Time and capable of being driven high and low by the tester's Interface Buffer.
X - not checked.

Up/down arrows move the Choices Menu Box from pin to pin. Ctrl right/left arrow moves it to the other side of IC. Right/left arrows highlight a choice and Enter confirms it. F4 (Blank) sets all pins to X; F6 (ALL CHK) sets all pins to Z.

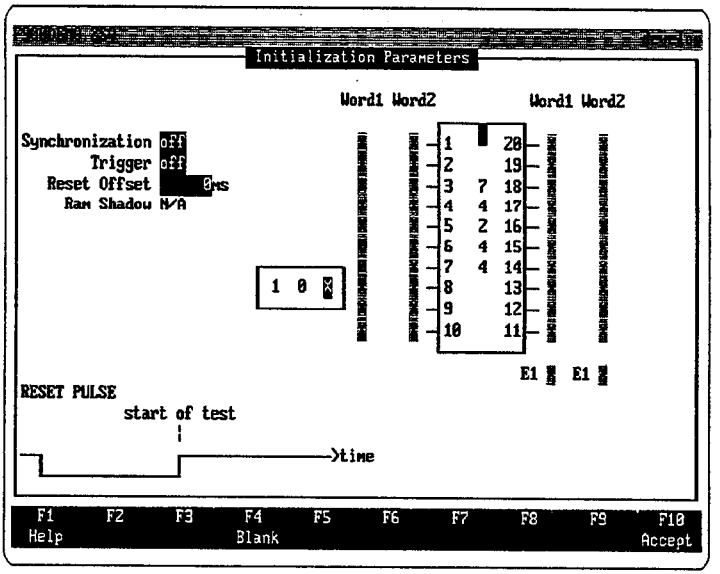
3.6.5 INITIALIZATION WINDOW



The parameters in this window ensure that RD and DUT are in the same state before comparison testing.

Synchronization -
If "on" is selected, a Sync Time value must be entered in milliseconds (3000 ms is typical). This is how long the tester will try to initialize a synchronous RD and DUT before returning a FAIL or Unable-to-Synchronize test result.

Trigger -
Choose "alter" to define two events (W1, W2) on the device pins and EXT which cause the start of comparison.



Up/down arrows move a Choices Menu Box through consecutive pins and words. Ctrl left/right arrows move the Menu Box sideways between words and pins. E1 and E2 mean words 1 and 2 of the EXT lead. Left/right arrows move the choice cursor from X (don't care) to 1 or 0 and [Enter] confirms each pin change.

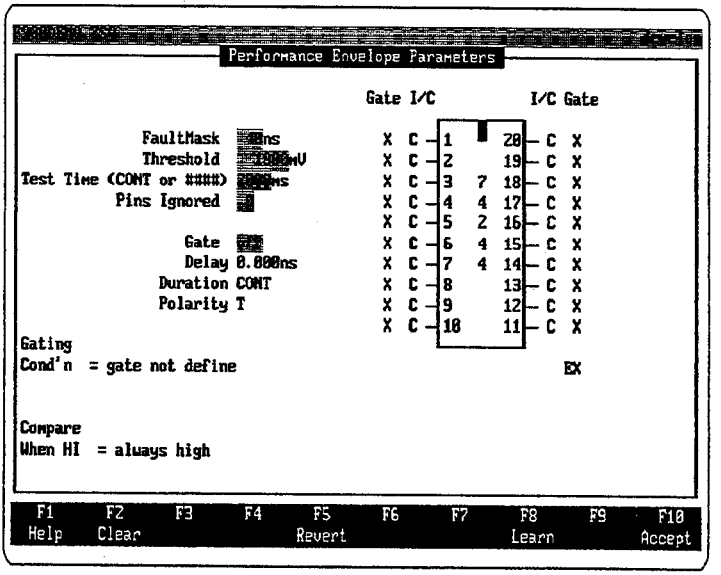
[F4] sets the entire Trigger definition to "don't care", [F5] reverts to the setting present when you first entered the initialization window. [F10] (Accept) must be pressed to confirm any new Trigger setting.

When testing with a Trigger setting, the occurence of the Trigger words starts the actual testing and produces a Pass or Fail test result. If, however, the Trigger words do not occur, the tester remains waiting for Trigger with the activity LEDs showing the DUT states. The user may press [Esc] , which returns the result: "Test Aborted". Alternatively, pressing the TEST key on the tester will terminate the test cycle and return the result: "Trigger did not occur".

Reset Offset -
A negative value (eg.-100 ms) shifts the comparison Test Time into the Reset pulse duration. This is used for testing devices in the UUT reset circuit. A positive value (eg.100 ms) delays comparison testing until some time after the trailing edge of the Reset pulse. This can be used to wait for a programmable device to be initialized by UUT activity before testing.

RAM Shadow -
"on" and "off" enable and disable the use of this feature which ignores comparison testing of RAM locations that have not been first written. N/I means the Simulation Option hardware is not installed. N/A means the Shadow Pattern for the selected RAM device is not available and must first be downloaded to the tester as a library file. As with Simulation parameter, the Shadow pattern file must be resident in the tester before a RAM device is defined as a location in the Sequence. Only this way will the choices on/off appear.

3.6.6 PERFORMANCE ENVELOPE



Performance Envelope parameters affect the comparison testing of RD and DUT.

Up/down arrows move between parameters. Value changes must be confirmed by pressing [Enter]. [F2] clears out a numeric field, [F5] reverts the Performance Envelope setting to what it was when the window was entered. [F10] confirms any changes made to the entire screen. The parameters are:

Fault Mask -
The tolerance of comparison (1 to 9999 ms in 1 ms steps).

Threshold -
The DUT transition level between logic 0 and 1 set on the Interface Buffer. Values are 0 to 5000 in 100 mvolt steps.

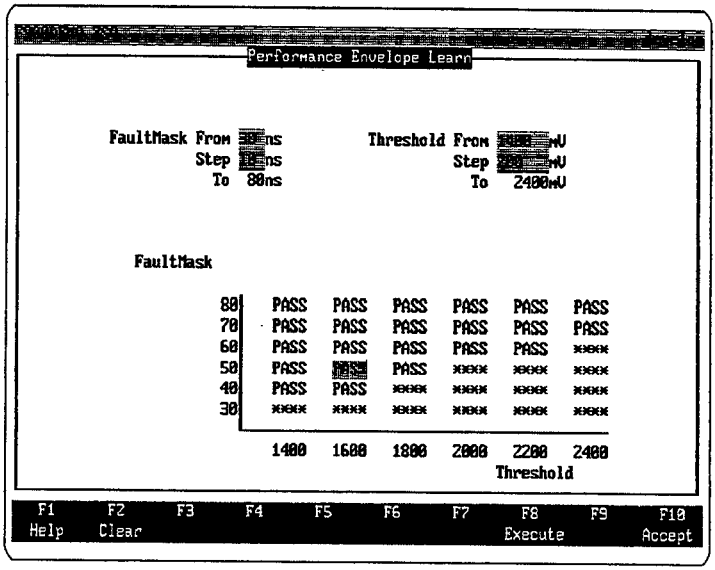
Test Time -
The duration of comparison. Values range from 1 to 9999 milliseconds in ms steps. The letter C specifies continuous test.

Pins Ignored -
This is used to disable or re-enable comparison on selected pins. Choose alter to change the setting. Move the Nenu Box to the desired pin(s) with up/down arrows. Ctrl left/right arrows move the box to the opposite side of the IC. Left/right arrows highlight I (ignore) or C (compare) and [Enter] confirms the choice.

F4 changes all pins to compare, F5 reverts to the setting when the window was first entered and F10 (Accept) confirms the setting for the entire IC. If a setting was changed and Esc is pressed, you are asked to confirm the update.

Gate -
Choose "alter" to define a time segment of comparison within Test Time.

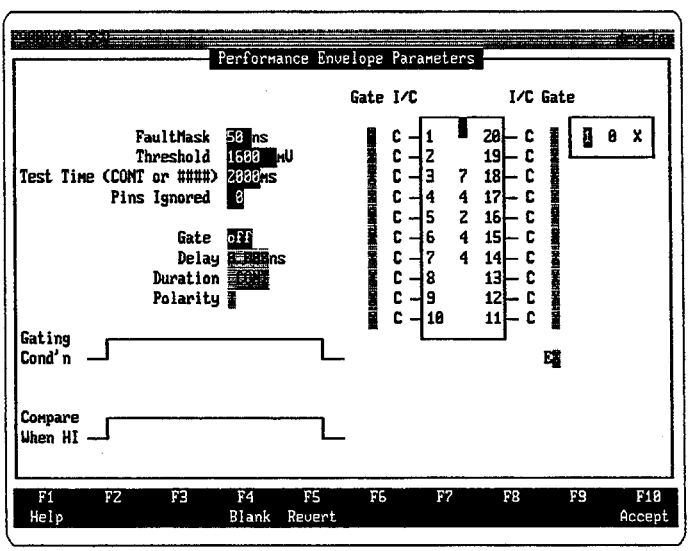
F8 (Learn) will perform a repeated test for a range of Fault Mask and Threshold values and report the passing and failing combinations.



The starting value and step size of the parameters may be entered in the top fields. F8 will re-execute the Learn function. F10 will accept the recommended values shown in reverse highlighting.

3.6.6.1 GATE

Gate defines a time of comparison within Test Time based on the state of the pins and the EXT lead along with its parameters Delay, Duration and Polarity (if the tester has the Simulation Option installed).



Enter a value for Delay and Duration or press Enter a few times to make a Choices Menu Box appear beside

the IC pins. Up/down and Ctrl left/right arrows position the Menu Box at each pin. Left/right arrows select logic 0, 1 or don't care for each pin. Press [Enter] to confirm changes in each setting. Ctrl left/right arrows also move the highlight box to the Delay, Duration and Polarity fields when the Menu Box is on an adjacent pin.

Testers which have the Simulation Option hardware installed permit values to be set for Delay, Duration and Polarity. After the gate condition occurs, comparison is delayed for a time, then enabled for a duration. Polarity may be set (T)True or (I)Inverted to define a condition of comparison or a condition of ignoring.
Values and units of the two settings can span the following ranges:

40 ns	10 us
80 ns	20 us
120 ns	30 us
.	.
600 ns	150 us

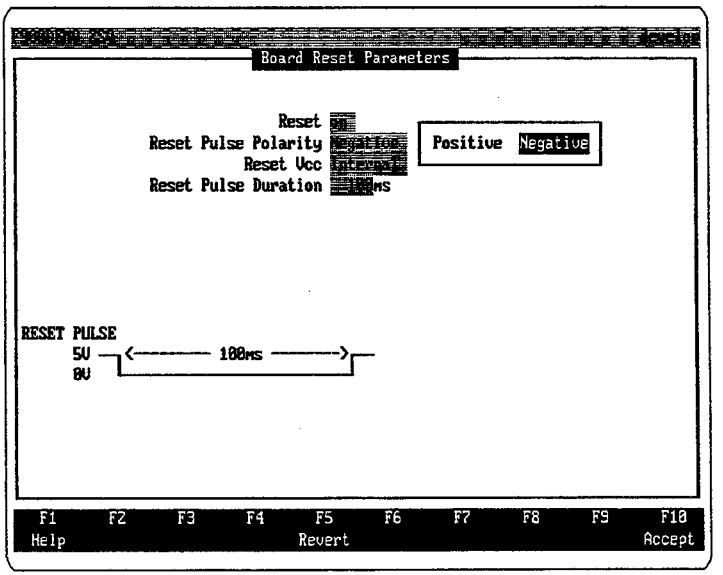
[F4] changes the Gate setting to "don't care", [F5] reverts to the setting when the window was first entered and [F10] confirms the entire Gate setting.

3.6.7 STIMULUS WINDOW

The options that may be selected using the cursor are:

User Generated -
The tester reset lead is always tristated and has no effect on the UUT. This is for test setups where the UUT cannot be rest or looping diagnostics are being used.

Tester Generated Reset -
This will pulse the tester's Reset lead before comparison testing. Use arrows to move the Choices Menu Box, highlight a choice and confirm with (Enter).



Polarity -
For a negative pulse, the lead is driven high for 10 ms, low for the pulse duration and back high for 10 ms. The reverse occurs for a positive pulse.

Reset Vcc -
Internal drive will sink/source 50 mA at 0.8/4.2 V. External drive will operate from a voltage supplied on the VCC patch lead up to 15 V.

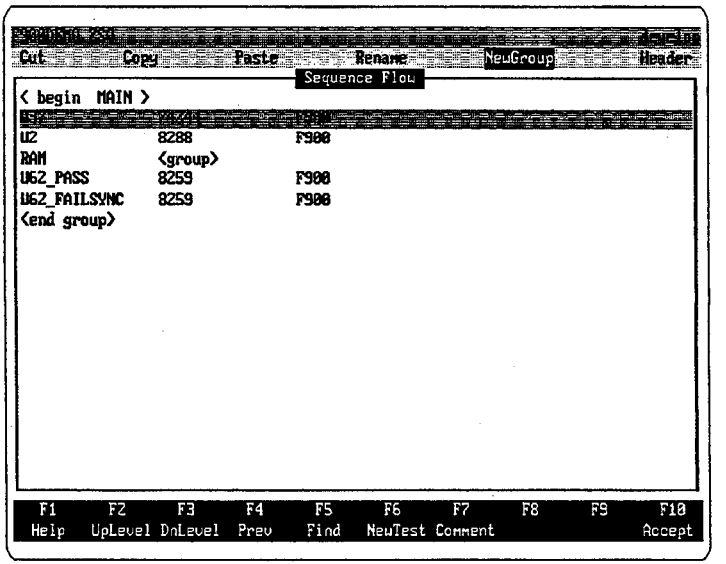
Duration -
The width of the pulse, 10 to 32760 ms in 1 ms steps.

3.6.8 MESSAGE WINDOW

An operator prompt may be added that is 4 lines of 37 characters. The message will wrap to the next line when entered but may split words in the middle. Press F10 (Accept) to confirm the entry.

3.6.9 SEQUENCE FLOW WINDOW

The Sequence Flow window is a programming window used to define the order and structure of testing.



A list may be created down the left side of the screen showing individual tests in the order they are to be executed. When the full window is entered by pressing F5 in the Test screen, a highlight pointer indicates the current device which has test parameters loaded in the Test Screen. Each line shows the device type and has space for a programmer's comment.

Terminology used:

Location -
device topological position (U#), also known as an individual test.

Group -
a series of locations given a group name, also known as a level in the program structure.

Each location is uniquely defined by its name. If there are multiple U2 locations listed in the Sequence, for example, they all will have the same set of parameters and a change to one will change the others. If you want to duplicate a location and make a parameter change to the duplicate without affecting the original, do the following:

> Make the original location (eg. U2) the current one using the pointer bar in the small Sequence Flow window of the Test screen.
> Go into the full Seq Flow window using F5.
> Position the cursor bar at the desired position for the new device.
> Press F6 to add a new location with a unique name (eg. U2A).
> Respond Yes to the prompt for duplicating the setting for the current location.
> Return to the Test screen and make any desired parameter modifications.

Eighteen location and group names may appear on a single screen and the arrow keys scroll the list to accomodate Sequences of any length. The Sequence structure permits a grouping of locations by function to assist in fault isolation. The board can be divided into groups and subgroups by function, each of which can

have its own location list. Note that the list of locations that appears in the Sequence Flow Window of the Test Screen is a single "run list" of all locations.

As an example, the following is a typical structured Sequence and run list:

Main Sequence			Run List
U1			U1
<RESET>	RESET		U4
.	Group		U5
.	U4		U7
.	U5		U37
.	U7		U38
.			U39
<BUS>---	BUS		U80
U57	Group		U81
U58	U37		U57
U59	U38		U58
	U39		U59
	<DMA>--	DMA Group	
		U80	
		U81	

To change the currently selected location in the TEST screen, move the Highlight Bar in the Seq Flow Window with the up/down arrows to the desired location and press F10 (Accept).

The function keys within the Seq Flow Window are:

F2/F3 (Up/Down Level) -
The main Sequence may have groups which are accessed by highlighting a group name and pressing F3 (Down Level). F2 (Up Level) returns back. The structure will allow levels within levels.

F4 (Previous) -
This is used to select a location that was previously tested. A Dialog Box appears with an ordered list of locations that have been selected previously in the TEST screen. You may move the cursor to a desired location and press Enter. The TEST screen will then appear to retest this location.

F5 (Find) -
This is used to position the highlight pointer on a specified location. Enter the location into the Dialog Box. If it exists, The Highlight Bar moves and you are asked to Accept, Cancel (restore the pointer to its previous location), or choose the Next occurence of the specified location. The main Sequence and all groups are searched in consecutive order.

F6 (New Test) -
This is used to add a new location below the Highlight Bar. Press F6 and enter the location name into the Dialog Box.
NOTE: a dialog box will prompt you to continue if you try to add a location that is already specified in the

Sequence. This Dialog Box also appears for any location that is present in the Paste Buffer. This means that, if you cut a location out of a Sequence and try to add another location of the same name, a Dialog Box appears since it is present in the Paste Buffer. Press Yes to continue to redefine this location.

F7 (Comment) -
This key is used to enter a programmer's comment beside the location with the Highlight Bar. A location comment appears beside the highlighted location. A Sequence comment is inserted below the highlighted location.

3.6.9.1 SEQUENCE EDITING

The top line menu has a number of editing functions that may be executed by moving the Top Menu Cursor with arrows and pressing Enter.

Cut -
Move menu cursor to Cut, press Enter, then move the Highlight Bar to mark text for removal and press Enter again. The cut locations now fill the Paste Buffer.

Copy -
Move Menu Cursor to Copy, press Enter, then mark text with highlight. Press Enter to put a copy in the Pasting Buffer.

Paste -
Position the highlight pointer to the location

immediately before the desired copy pasting location. Move menu cursor to Paste and press Enter.

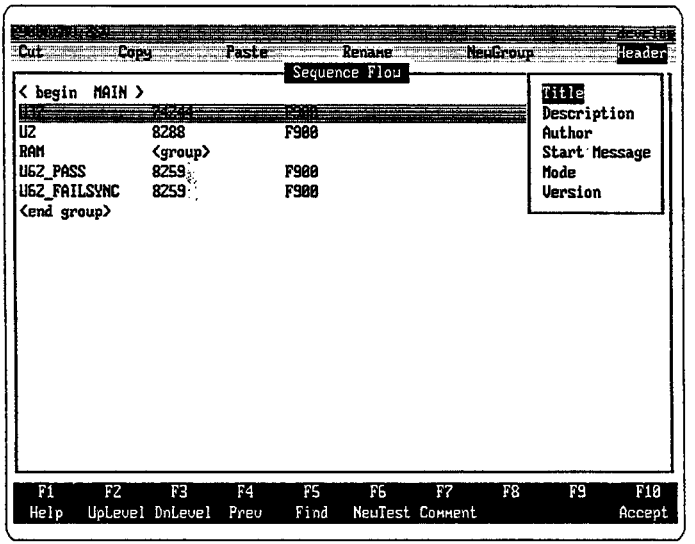
Rename -
A pulldown menu appears for you to select location or group name. Press Enter. Now enter the old and new names in the Dialog Box that appears. The old name will be changed wherever it appears in the Sequence.

New Group -
Position Highlight Bar to the location immediately before the desired group location. Move Top Menu Bar to NewGroup, press Enter and type a name into the Dialog Box.

Header -
The Header menu options are used to document a Sequence and to change from "development mode" to "run only mode" and back.

3.6.9.2 SEQUENCE DOCUMENTATION

The Header option pulls down the menu shown on the next page.



Title -
A Dialog Box appears, permitting entry of a descriptive title which will appear in the center of the top line in the TEST screen.

Description -
A full screen window appears permitting entry of text describing the board under test or the Sequence. Since this is not normally viewed by a test operator, this description is suited to programmer's information.

Author -
A Dialog Box appears for entry of the Sequence programmer's name.

Start Message -
A full screen window appears permitting entry of test instructions for the operator. This information will appear as the first screen when running the Sequence. Note that this information will not appear on the tester display if you compile the Sequence for execution on a standalone tester.

Mode -
A box pops up with an associated choices menu. The user may move the cursor and accept a change in mode. "Run only" means that parameter changes are temporary and are not saved. "Develop" menas that all parameter changes are saved on disk. When changing from Develop to Run you are prompted to enter a password. This same password is required to change back to Develop.

Version -
A Dialog Box appears with an edit field showing the Sequence version and the date and time it was saved. The version is in the form: X.YYY . The user typically enters a number for X and YYY is automatically incremented each time the Sequence is saved.

APPENDIX IV

LIBRARY UTILITY AND LISTING FOR THE FLUKE 900

OVERVIEW OF LIBRARY UTILITY

This PC based utility allows the user to create LIBRARY files that can then be downloaded into the tester system RAM (48K) or a Data Cartridge (32 or 64K). This procedure consists of three steps:

- Creating or editing an IC LIST of desired devices
- Converting the LIST into a LIBRARY file
- Downloading the LIBRARY file to the tester

The first two steps may be done on a PC without a tester.

The utility comes equipped with a Master LIBRARY file containing data of several hundred devices. This Master LIBRARY will be updated on a regular basis by the factory, and new releases will be mailed automatically to users. Please make sure that you fill in the registration card to ensure prompt delivery of your copy of upcoming releases.

The amount of data that a file contains will vary depending on whether SIMULATION data or SHADOW RAM data is to be included and the level of data compression selected. A typical simulated chip will have 2 K of data. The utility optimizes and compresses the data patterns to conserve storage as it creates a LIBRARY from an IC LIST.

In the event that the file size exceeds a specified limit (to a maximum of 64K), a WARNING message is given. In addition, if the file size exceeds 64K, the operation will be aborted and the LIBRARY file will not be saved.

The utility has a context-sensitive online HELP feature. Both cursor and mouse operation are supported.

HARDWARE CONFIGURATION

PERSONAL COMPUTER

The Library Utility will operate on any PC XT/AT/286/386 with the following hardware configuration:

1. The PC must be equipped with a Hard Drive, and a Floppy Disk Drive (360K or 1.2M, 5 1/4" format). The Utility will occupy approximately 1 megabyte of hard disk space. It requires a further 1 Mbyte of free hard disk space to use for temporary working files.

2. A minimum of 640K RAM. The Utility will require 500K of free memory to run.

   In the event that there is insufficient memory to operate due to memory resident programs and TSRs, the utility will refuse to load and will abort operations. In such an event the system "autoexec.bat" file will need to be modified so that it will not invoke these programs, and the PC will have to be re-booted.
   (eg. use the <Ctrl><Alt><Del> keys)

3. An RS232C serial port is required to communicate with the tester for downloading the library files.The serial port should be set to the standard configuration shown on the next page:

COM1:	Port address = 3F8
	Interrupt = #4
COM2:	Port address = 2F8
	Interrupt = #3

If the port address or interrupt is nonstandard, the Library Utility will NOT communicate properly with the tester.
All communication parameters, such as whether to use COM1 or COM2, baud rate, etc., can be set from the SETUP menu.

4. Color or Monochrome monitor. Monochrome monitors must support the intensity character attribute since high intensity is used by the Library Utility to select options and chips from a list. Some older monitors do not support this attribute.

5. DOS 3.30 or later version.

TESTER

In order for the tester to communicate successfully with the PC, it has to have the same settings for Baud Rate, Parity, etc. These parameters can be modified on the tester from the <system> level <rs232c> menu.

Note: 1. The MODE option must set to <DCE CL> and a straight through cable used to hook the tester to the PC.

2. The tester has to be in the "Power-Up" screen level in order to allow the PC to control it.

SOFTWARE INSTALLATION

The Library Utility comes on a number of disks. Installing the program will copy all the necessary files onto your hard disk, and create a directory called LIBLOAD (unless you specify otherwise). Normally this will be on drive C (C:\LIBLOAD), but you may define a different path during the installation procedure.

Insert Disk 1, type A:INSTALL at the DOS prompt and follow the instructions that appear on the screen.

If for any reason INSTALL fails, you may simply copy the files from the floppy disks to the desired DIRECTORY on your hard drive and then type the following DOS command:
>COPY /B F900LIB.1+F900LIB.2+F900LIB.3 F900LIB.LI!

This command recombines the library files into a single file. The F900LIB.1, F900LIB.2 and F900LIB.3 files may then be deleted.

NOTE: DO NOT interchange the order of F900LIB.1, F900LIB.2 and F900LIB.3

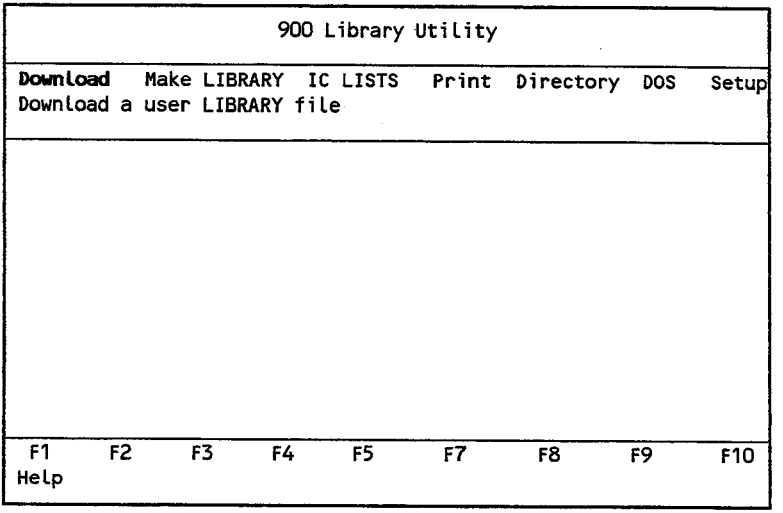
The installation procedure also creates a subdirectory called FILES under the directory LIBLOAD. This is where data files will be stored under control of the package Setup option called Path (it is set to .\FILES by default). If you start this package from a current directory other than LIBLOAD, you must also change the Path option setting to fully specify where the FILES subdirectory is located.
(ie. C:\XXX\LIBLOAD\FILES)

MENU STRUCTURE

To invoke the Library Utility, enter the following commands after the DOS prompt:

> cd c:\libload
> libload

The system will then put up the following screen, after successful boot-up of the package.



The Top Menu cursor selects the different options. It can be moved around by the arrow keys, space bar, TAB key or mouse. The Enter key selects the highlighted option. Pressing the first character of an option will also select that option. The Esc key returns to a previous screen or aborts a function.

As the cursor is moved, a brief explanation of the highlighted option is displayed on the line below it. In addition, the F1 key provides a detailed context-sensitive HELP facility at all levels of the package.

Any operation that will change data or destroy a stored file causes a confirming message to appear. A cursor is positioned over the "no change" option. To proceed with the change, reposition the cursor and press Enter, or press Y for yes or N for no.

The Library Utility will create downloadable LIBRARY files from user created IC LISTS, as well as printable files for documentation purposes.
The files have the following extensions when viewed with the DOS **directory** command:

.ULF -User created IC LIST file
.LI@ -Downloadable Library file created by "Make Library"
.LST - List file of the IC's in a downloadable file
.REP -A report file on the last Make LIBRARY session

It is recommended that the user organize the library files in subdirectories which can be selected via the Path option in the Setup menu. During installation the default path will be set to a subdirectory called "FILES".

The Top Menu options and their options are:

Download

Make LIBRARY

IC LISTS: Create, Delete, Edit, Copy

Print: User LIBRARY, Main LIBRARY

Directory

DOS

Setup: Path, RS232, LIB Options, Setup, Screen

MENU DESCRIPTIONS

DOWNLOAD

The Download option sends user selected files to the tester. The files can be sent to the Cartridge or the System RAM. The Utility will query the tester on the amount of space available in System Memory and on the cartridge. If the file to be downloaded requires more space than available in the medium selected, the operation will be aborted.

```
                        900 Library Utility

Download  Make LIBRARY  IC LISTS  Print  Directory  DOS  Setup
Download a user LIBRARY file

     Destination on tester:  ( )  SYSTEM      ( 49098 Bytes Left)
                             (/)  CARTRIDGE   ( 13335 Bytes Left)

     User Library to download:  FILE_1

     Name to call it on tester: FILE_1

                          Proceed with download

 F1      F2    F3    F4    F5    F7    F8    F9    F10
Help                                              Accept
```

When the tester System RAM is empty, up to 48K bytes can be downloaded to it. Data cartridges hold up to 32K or 64K.

When the "User Library to download" field is selected, the system will list the available library files in a pop-up window. Once the desired file is tagged, the system will automatically assign the same name to the file as it is downloaded into the tester. The user, however, can modify the name to any other. Valid tester file names consist of Alphanumeric characters and the underscore "_" symbol, and the file name must begin with an upper case alpha character. (Note: The tester does not accept filenames with the dash "-" symbol).

Once all the parameters have been properly selected, the user can commence the download operation by selecting the "Proceed with download" field or by pressing F10 (Accept).

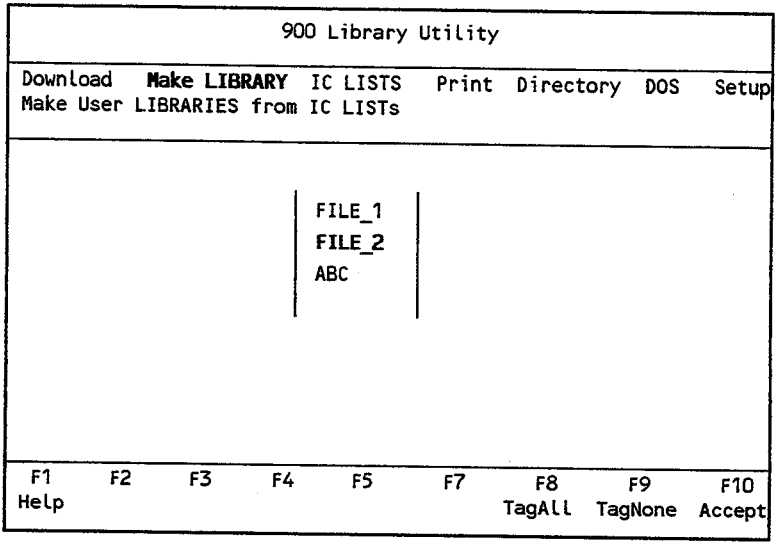
When running a sequence on the tester, it is recommended that the .seq and .loc files be resident in :SYST and that the library files be on the data cartridge (:CART). This will allow the maximum number of devices to be resident in the tester (ie. 64 K cartridge).

Libraries resident in System RAM and the Cartridges have priority over those resident in the system ROM. System ROM libraries do not include SIMULATION or SHADOW RAM patterns. Refer to the list of devices at the end of this appendix. STD designates a standard unsimulated device.

Tester firmware levels 5.05 and earlier do not permit downloading of a single file larger than 32 K. See Setup, LIBRARY Options for additional information.

MAKE LIBRARY

The Make LIBRARY option creates downloadable library files from valid user generated IC LISTs. The utility will display, in a pop-up window, all available IC LIST files in the user directory defined by the Path command in the Setup menu.



One or more files can be tagged using the Enter key, F8 will tag all the files and F9 will untag all the files. Once all desired files are tagged, the F10 key accepts the entire list.

The amount of time it will take to create the file will vary from a few minutes up to several hours, based on the number of chips in each file, whether Simulation and Shadow RAM data is to be included, and the compression level selected. Another major factor will be the speed of the PC itself (e.g a 12 MHz PC/AT will run typically 10 times faster than a PC/XT).

The type of data to be included in the library file, as well as the maximum desired size of a file are determined by the LIBRARY Options command in the Setup menu. The system will ask the user to confirm if the data to be included in the file is correct before commencing the LIBRARY creation.

The utility will attempt to minimize the file size by utilizing data compression techniques. The user can select the type of compression to be performed through the Setup menu (Maximum compression is the default).

If the program calculates that the LIBRARY file size is likely to exceed the maximum defined by LIBRARY options, it will request confirmation from the user prior to proceeding. If the file size overflows the 64K limit, the operation will be aborted.

The utility cannot determine if all the data can fit until the compression algorithm is calculated. Since this can be a time consuming activity, it is advisable to operate within a reasonable limit following these guidelines:

1. The uncompressed data for a Chip with Simulation and/or Shadow RAM will occupy 2.5K Bytes. After optimization this can be reduced to typically 1.5K bytes with maximum compression, and 2K with minimum compression.
2. A chip without Simulation or Shadow data will typically require 250 bytes.

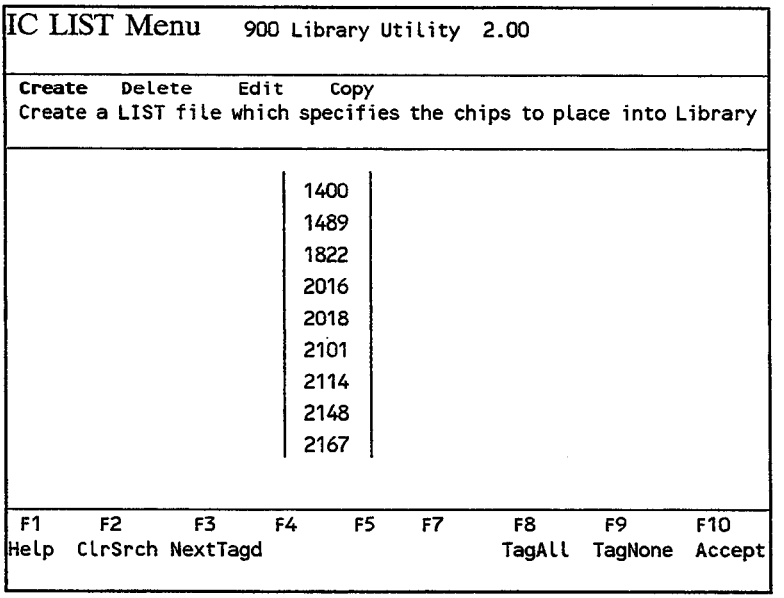
3. Equivalent chips require approximately 20 bytes.

A 64K data cartridge can typically hold up to 40 chips with Simulation Data, and all their associated equivalents.The PRINT option will give a full listing of all the chips in the created library file.

The results of the Make LIBRARY procedure are logged to a file with the name LIBLOAD.REP. If several LISTs were tagged to make LIBRARIES in a batch, the LIBLOAD.REP file contains the size and completion confirmation for each individual LIST. This file is temporary, and the data in it will be overwritten by the next Make LIBRARY command.

IC LISTS

This menu allows the user to Create, Delete, Edit or Copy IC LISTs. The LISTs are generated from the master library database that is included in the utility.



The speed search mode is activated by keyboard entry of the chip number. Entering <7><4> will cause the cursor to move to the first chip in the list with the number "74". The cursor control keys scroll up and down the LIST.

The Enter key will tag/untag the IC at the cursor position, and <F8> and <F9> will tag/untag all ICs in the LIST. The F3 key will position the cursor to the next tagged IC.

The recommended procedure is:

Step 1: Select Create, tag the desired devices from the master LIST and accept the LIST with F10.

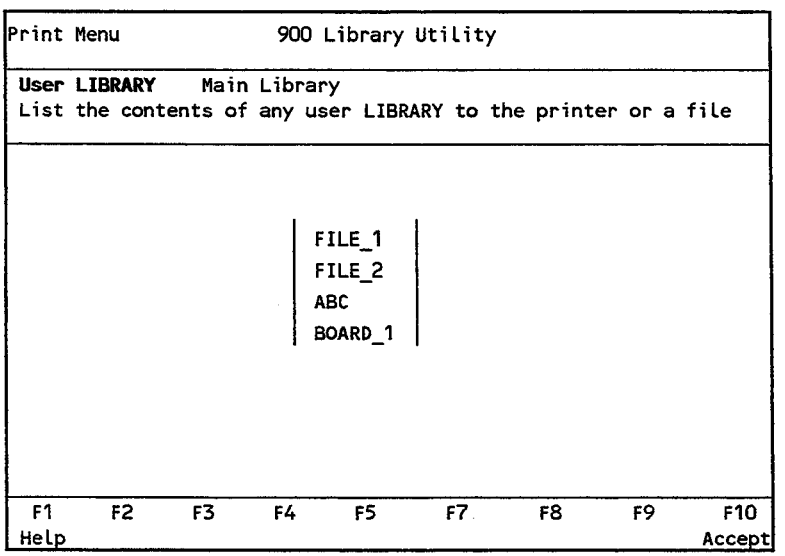
Step 2: Revise or continue creating an existing LIST by selecting Edit and proceeding to tag/untag devices before accepting the final LIST with F10. To avoid losing your LIST inadvertently, Copy it first to a new name before editing. After you complete the Edit, you may Delete the copy.

Step 3: Execute a "Make LIBRARY" procedure to create a downloadable file from a LIST.

PRINT

The Print command can be used to print the chips in user created LIBRARY files or the Main LIBRARY. The output can be directed to the default on-line DOS printer LPT1 or LPT2, or to a list file with the same name as the library file with an .LST extension.

Note: In order to avoid confusion, do not assign the PRN device to COM1 if the tester is attached to it.



DIRECTORY

The Directory menu option displays the user downloadable LIBRARY files and the user generated IC LISTs resident in the sub-directory specified by the Setup/Path option.

```
                        900 Library Utility

Download   Make LIBRARY   IC LISTS   Print   Directory   DOS   Setup


  User Libraries     Size on 900     Time          Date
  ------------------------------------------------------
  FILE_1                7505         20:56:16      09/01/90
  FILE_2               32000         10:14:37      09/02/90

  User LISTS                         Time          Date
  ------------------------------------------------------
  FILE_1                             19:03:10      09/01/90
  FILE_2                             09:30:15      09/02/90


 F1      F2    F3    F4    F5    F7    F8    F9    F10
Help
```

The file size displayed adjacent to the LIBRARY file name is the actual amount of space the file will occupy in the tester memory when downloaded. This is different from the size of the file displayed by the DOS directory command, which will typically be three times larger.

DOS

This allows the user to shell out to DOS while leaving the Library Utility loaded in memory. Most DOS commands can be executed if they do not exceed the available free memory space.

In order to return to the Library Utility the following command should be entered at the DOS prompt:

> exit

SETUP

The Setup menu option allows the user to perform the following tasks:

1. Path: Defines the subdirectory where the user generated files will be saved.

2. RS232: Defines the parameters for the communication port, and its location in the PC (i.e. COM1 or COM2). For proper communication, both the PC and the tester have the same settings for the RS232C port, and the tester has to be set to DCE CL mode.

3. LIBRARY Options:

Defines the data to be included into the library file for the user generated IC LISTs. Four options are available:

(a) Include SIMULATION data (on by default)
(b) Include Shadow Data (default)

(c) Include CMOS out-of-circuit test patterns. Only testers with the CMOS out-of-circuit option installed should enable this function. (on by default)

(d) Define the level of data compression (Maximum by default)

In addition, the user can define the maximum library file size in 8K increments (i.e. 8k, 16K,..., 64K). The largest allowable size is 64K. For testers with firmware revision 5.05 or less, this should be set to 32 Kbytes. If you attempt to download a file that is larger than 32 K to such a tester, the download will not proceed and a warning message will appear. You may recreate the LIBRARY file as two smaller files and download them separately.

4. Info: Displays revision information about the Library Utility package and its subprograms and files. For example, Library Utility 2.05 consists of the executable Libload program version 2.05 and the Library Data files version 2.05 .

5. Screen: Defines the color of the screen from three pre-defined color palettes. This feature is only for color monitors.

The user can also define the number of lines to be displayed on the screen, 25 or 43, if an EGA or a VGA graphic adaptor is present.

LIBRARY LISTING

LIBRARY DEVICES SUPPORTED: Feb. 1,1992
(575 Devices supported, 359 Simulated, 53 RAM Shadows)

CSM - CHECKSUM GENERATED
DNLD- DOWNLOADABLE LIBRARY
PAT - RD TEST PATTERN EXISTS
PRC - RD PRESENCE CHECK
RDT - REFERENCE DEVICE TEST
ROM - STANDARD LIB FIRMWARE #.## AND UP
SHAD- SHADOW RAM PATTERN
SIM - RD SIMULATION LIBRARY
STD - STANDARD LIBRARY (NOT SIMULATED)
SYNC- SYNCHRONIZATION USING STIME

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
1489	14	QUAD EIA RECEIVER	PAT	NO	6.00	SIM
2509	20	QUAD 2-PORT REG	PAT	YES	4.00	SIM
2522	20	8 BIT SER/PAR REG	PAT	YES	4.00	SIM
2523	20	8 BIT REG/COMM I/O PIN	PAT	YES	4.00	STD
252538	20	1 OF 8 DEMUX TS	PAT	NO	4.00	SIM
252539	20	1 OF 4 DEMUX TS	PAT	NO	5.00	STD
252548	20	1 OF 8 DEMUX WITH ACK	PAT	NO	4.00	SIM
25381	20	4 BIT ALU	PAT	NO	4.00	STD
2902	16	LOOK AHEAD CARRY GEN	PAT	NO		SIM
2918	16	QUAD D REGISTER	PAT	YES		SIM
2919	20	QUAD REGISTER	PAT	YES		SIM
2923	16	8 INPUT MUX TS	PAT	NO	4.00	SIM
2947	20	OCT BIDIR TRANSCEIVER	PAT	NO	4.00	SIM
2965	20	4 BIT INV BUF/LINE DRVR	PAT	NO	4.00	SIM
2966	20	4 BIT NONINV LINE DRVR	PAT	NO	4.00	SIM
29803	16	16 WAY BRANCH CNTRL	PAT	NO		SIM
29806	24	6 BIT SELECT DECODER	PAT	NO		SIM
29818	24	PIPELINE REGISTER	PAT	YES		SIM
29821	24	BUS TRANSCEIVER	PAT	NO		SIM
29826	24	8 BIT INV BUS REG	PAT	YES		SIM
29827	24	10 BIT BUFFER	PAT	NO		SIM
29828	24	10 BIT INV BUFFER	PAT	NO		SIM
29833	24	PARITY BUS TRANSCVER	PAT	NO		SIM
29843	24	9 BIT BUS INT LATCH	PAT	YES		SIM
29861	24	10 BIT BUS TRANSCVR	PAT	NO		SIM
29863	24	9 BIT TRANSCIEVER	PAT	NO		SIM

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
4000	14	3-IN NOR & INV	PAT	NO	1.17C	SIM
4001	14	2-IN NOR	PAT	NO	1.17C	SIM
4002	14	4 IN NOR	PAT	NO	1.17C	SIM
4006	14	18 BIT SHIFT REG	PAT	YES	1.17C	SIM
4008	16	4 BIT FULL ADDER	PAT	NO	1.17C	SIM
4009	16	HEX INVERTER	PAT	NO		SIM
4010	16	HEX BUFFER	PAT	NO		SIM
4011	14	2-IN NAND	PAT	NO	1.17C	SIM
4012	14	4-IN NAND	PAT	NO	1.17C	SIM
4013	14	D FLIP FLOP	PAT	YES	1.17C	SIM
4014	16	8 BIT SHIFT REG	PAT	YES	1.17C	SIM
4015	16	4 BIT SHIFT REG	PAT	YES	1.17C	SIM
4017	16	JOHNSON DEC COUNTER	PAT	YES	1.17C	SIM
4019	16	QUAD 2-IN MULTIPLEX	PAT	NO		SIM
4021	16	8 BIT SHIFT REG	PAT	YES	1.17C	SIM
4023	14	3-IN NAND	PAT	NO	1.17C	SIM
4024	14	7 STAGE BIN COUNTER	PAT	YES		SIM
4025	14	3-IN NOR	PAT	NO	1.17C	SIM
4027	16	JK FLIP FLOP	PAT	YES	1.17C	SIM
4028	16	BCD TO DEC DECODER	PAT	NO	1.17C	SIM
4029	16	BIN/D UP/DN COUNTER	PAT	YES	1.17C	SIM
4030	14	2-INP XOR	PAT	NO	1.17C	SIM
4032	16	SERIAL ADDER	PAT	YES	1.17C	SIM
4041	14	QUAD TRUE/CMPL BUFFR	PAT	NO	1.17C	SIM
4042	16	4 BIT TRANS LATCH	PAT	YES	1.17C	SIM
4043	16	QUAD NOR RS LATCH	PAT	YES	1.17C	SIM
4048	16	PROG 8-IN GATE	PAT	NO	1.17C	SIM
4049	16	INV BUFFER	PAT	NO	1.17C	SIM
4050	16	BUFFER	PAT	NO	1.17C	SIM
4054	16	4 SEG DISPALY DRVR	PAT	NO		SIM
4056	16	BCD TO 7 SEG DECODER	PAT	NO		SIM
4063	16	4 BIT MAGN COMPARATR	PAT	NO		SIM
4068	14	8-IN NAND	PAT	NO	1.17C	SIM
4069	14	INVERTER	PAT	NO	1.17C	SIM
4070	14	2-IN XOR	PAT	NO	1.17C	SIM
4071	14	2-IN NOR	PAT	NO	1.17C	SIM
4072	14	4-IN OR	PAT	NO	1.17C	SIM
4073	14	3-IN AND	PAT	NO	1.17C	SIM
4075	14	3-IN OR	PAT	NO	1.17C	SIM
4076	16	4 BIT D REG TS	PAT	YES	1.17C	SIM
4077	14	2-IN XNOR	PAT	NO	1.17C	SIM
4078	14	8-IN NOR	PAT	NO	1.17C	SIM

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
4081	14	2-IN AND	PAT	NO	1.17C	SIM
4096	14	JK M-S FLIPFLOP	PAT	YES		SIM
4099	16	8 BIT ADDR LATCH	PAT	YES	1.17C	STD
40000	14	QUAD 2-IN NAND	PAT	NO	2.06	SIM
40004	14	HEX INVERTER	PAT	NO		SIM
40010	14	TRIPLE 3-IN NAND	PAT	NO		SIM
40074	14	DUAL D FLIP FLOP	PAT	YES		SIM
40104	16	4 BIT BIDIR REGISTER	PAT	YES	1.17C	SIM
40138	16	3 TO 8 DEMULTIPLEXER	PAT	NO		SIM
40139	16	DUAL 2 TO 4 DEMUX	PAT	NO		SIM
40160	16	BCD COUNTER	PAT	YES		SIM
40161	16	BINARY COUNTER	PAT	YES		SIM
40162	16	BCD COUNTER	PAT	YES		SIM
40163	16	BINARY COUNTER	PAT	YES		SIM
40174	16	HEX D FLIP FLOP	PAT	YES		SIM
40175	16	QUAD D FLIP FLOP	PAT	YES		SIM
40192	16	BCD UP/DWN COUNTER	PAT	YES		SIM
4501	16	4-IN NAND, 2-IN NOR	PAT	NO	1.17C	SIM
4502	16	STROBED INV BUFFER	PAT	NO	1.17C	SIM
4503	16	HEX TS BUFFER	PAT	NO	1.17C	SIM
4506	16	AND OR INV GATE	PAT	NO	1.17C	SIM
4508	24	4 BIT LATCH	PAT	YES	1.17C	SIM
4511	16	BCD TO 7 SEG LATCH	PAT	NO		SIM
4512	16	8 CHAN DATA SELECTER	PAT	NO	1.17C	SIM
4514	24	1 OF 16 DECODER	PAT	NO		SIM
4516	16	BIN UP/DN COUNTER	PAT	YES	1.17C	SIM
4518	16	BCD COUNTER	PAT	YES	1.17C	SIM
4519	16	4 BIT AND/OR SEL	PAT	NO	1.17C	SIM
4520	16	BIN COUNTER	PAT	YES	1.17C	SIM
4530	16	MAJORITY 5 GATE	PAT	NO	1.17C	SIM
4531	16	12 BIT PARITY TREE	PAT	NO	1.17C	SIM
4532	16	8 BIT PRIORITY ENCODE	PAT	NO	1.17C	SIM
4539	16	DUAL 4 CHAN DEMUX	PAT	NO	1.17C	SIM
4554	16	2 BY 2 MULTIPLIER	PAT	NO	1.17C	SIM
4555	16	1-4 DEMUX, ACTIVE HI	PAT	NO	1.17C	SIM
4556	16	1-4 DEMUX, ACTIVE LOW	PAT	NO	1.17C	SIM
4572	16	INV NOR/NAND	PAT	NO	1.17C	SIM
4581	24	ALU FUNCTION GEN	PAT	NO	1.17C	SIM
4585	16	4 BIT MAGN COMPARE	PAT	NO	1.17C	SIM
4598	18	8 BIT ADDR LATCH	PAT	YES	1.17C	SIM
4724	16	8 BIT ADDR LATCH	PAT	YES	1.17C	SIM
6880	16	QUAD BUS TRNSCVR INV	PAT	NO	4.00	STD

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
6889	16	QUAD TRANSCVR NONINV	PAT	NO	4.00	STD
7400	14	QUAD 2-IN NAND	PAT	NO	4.00	SIM
7401	14	QUAD 2-IN NAND OC	PAT	NO	4.00	SIM
74H01	14	QUAD 2-IN NAND OC	PAT	NO	4.00	SIM
7402	14	QUAD 2-IN NOR	PAT	NO	4.00	SIM
7403	14	QUAD 2-IN NAND	PAT	NO	4.00	SIM
7404	14	HEX INVERTER	PAT	NO	4.00	SIM
7405	14	HEX INVERTER OC	PAT	NO	4.00	SIM
7407	14	HEX BUFFER OC	PAT	NO	4.00	SIM
7408	14	QUAD 2-IN AND	PAT	NO	4.00	SIM
7409	14	QUAD 2-IN AND OC	PAT	NO	4.00	SIM
7410	14	TRIPLE 3-IN NAND	PAT	NO	4.00	SIM
7411	14	TRIPLE 3-IN AND	PAT	NO	4.00	SIM
7412	14	TRIP 3-IN NAND OC	PAT	NO	4.00	SIM
7413	14	DUAL 4-IN NAND ST	PAT	NO	4.00	SIM
7414	14	HEX INVERTER ST	PAT	NO	4.00	SIM
7415	14	3-IN AND OC	PAT	NO	6.00	SIM
7416	14	HEX INVERTER OC	PAT	NO	4.00	SIM
7417	14	HEX BUFFER OC	PAT	NO	4.00	SIM
7418	14	DUAL 4-IN NAND	PAT	NO	4.00	SIM
7420	14	DUAL 4-IN NAND	PAT	NO	4.00	SIM
7421	14	DUAL 4-IN AND	PAT	NO	4.00	SIM
7422	14	DUAL 4-IN NAND OC	PAT	NO	6.00	STD
7424	14	QUAD 2-IN NAND	PAT	NO	4.00	SIM
7425	14	DUAL 4-IN NOR,STROBE	PAT	YES	4.00	SIM
7426	14	QUAD 2-IN NAND OC	PAT	NO	4.00	SIM
7427	14	TRIPLE 3-IN NOR	PAT	NO	4.00	SIM
7428	14	QUAD 2-IN NOR	PAT	NO	4.00	SIM
7430	14	8-IN NAND	PAT	NO	4.00	SIM
7432	14	QUAD 2-IN OR	PAT	NO	4.00	SIM
7433	14	QUAD 2-IN NOR OC	PAT	NO	6.00	STD
7434	14	HEX BUFFER	PAT	NO	6.00	SIM
7437	14	QUAD 2-IN NAND	PAT	NO	4.00	SIM
7438	14	2-IN NAND OC	PAT	NO	4.00	SIM
7439	14	QUAD 2-IN NAND OC	PAT	NO	6.00	STD
7440	14	DUAL 4-IN NAND	PAT	NO	4.00	SIM
7442	16	1 OF 10 DEMUX	PAT	NO	4.00	SIM
7443	16	4 TO 10 DECODER	PAT	NO	6.00	STD
7444	16	4 TO 10 DECODER	PAT	NO	6.00	STD
7445	16	BCD TO DEC. /DRV	PAT	NO	6.00	STD
7446	16	BCD TO SEVEN SEG.	PAT	NO	6.00	STD

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
7448	16	BCD TO SEVEN SEG.	PAT	NO	6.00	STD
7449	16	BCD TO SEVEN SEG. OC	PAT	NO	6.00	STD
7451	14	DUAL AND OR INV	PAT	NO	4.00	SIM
74L51	14	DUAL AND OR INV	PAT	NO	4.00	SIM
74LS51	14	AND OR INV	PAT	NO	4.00	SIM
74LS54	14	4-WIDE AND-OR-INV	PAT		5.00	SIM
7464	14	4-2-3-2 IN AND OR	PAT	NO	4.00	SIM
7470	14	AND GATED JK FF	PAT	YES	6.00	STD
7472	14	AND GATED JK FF	PAT	YES	6.00	STD
7473	14	JK-FF WITH CLEAR	PAT	YES	4.00	SIM
7373A	14	JK-FF WITH CLEAR	PAT	YES	4.00	SIM
7474	14	DUAL D FF	PAT	YES	4.00	SIM
7475	16	4 BIT BISTBL LATCH	PAT	YES	6.00	SIM
7476	16	DUAL JK FF	PAT	YES	6.00	SIM
7477	14	4 BIT LATCH	PAT	YES	6.00	SIM
7478	14	DUAL JK FF	PAT	YES	6.00	SIM
7480	14	GATED FULL ADDER	PAT	YES	6.00	STD
7483	16	4-BIT ADDER, CARRY	PAT	NO	4.00	SIM
7485	16	4-BIT MAGNITUDE COMP	PAT	NO	4.00	SIM
7486	14	2-INP XOR	PAT	NO	4.00	SIM
7490	14	DECADE COUNTER	PAT	YES	4.00	SIM
7491	14	8-BIT SHIFT REG	PAT	YES	4.00	SIM
7492	14	DIV BY TWELVE COUNT	PAT	YES	4.00	SIM
7493	14	BINARY COUNTER	PAT	YES	4.00	SIM
7494	16	4-BIT SHIFT REG	PAT	YES	4.00	SIM
7495	14	4-BIT PAR SHIFT REG	PAT	YES	4.00	SIM
7496	16	5-BIT SHIFT REG	PAT	YES	6.00	STD
7497	16	6-BIT RATE MULTIPL.	PAT	YES	6.00	STD
74100	24	8-BIT LATCH	PAT	YES	6.00	STD
74106	16	DUAL JK FF NEG. EDGE	PAT	YES	6.00	STD
74107	14	JK-NEG EDGE FF	PAT	YES	4.00	SIM
74109	16	JK-FF WITH PRE, CLR	PAT	YES	4.00	SIM
74111	16	DUAL JK FF	PAT	YES	6.00	STD
74112	16	JK-NEG FF	PAT	YES	4.00	SIM
74113	14	DUAL JK FF NEG. EDGE	PAT	YES	6.00	STD
74114	14	JK-NEG EDGE FF	PAT	YES	4.00	SIM
74116	24	DUAL 4-BIT LATCH	PAT	YES	5.00	SIM
74125	14	BUF/SEPARATE TS CONTR	PAT	NO	4.00	SIM
74126	14	BUF/SEPARATE TS CONTR	PAT	NO	4.00	SIM
74128	14	2-IN NOR LINE DRIVR	PAT	NO	4.00	SIM
74131	16	3 TO 8 DEMUX	PAT	NO	6.00	STD
74132	14	2-IN NAND SCHMITT	PAT	NO	4.00	STD

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
74133	16	13-INPUT NAND	PAT	NO	4.00	SIM
74134	16	12-INPUT NAND TS	PAT	NO	4.00	SIM
74135	16	QUAD EX OR/NOR	PAT	NO	4.00	SIM
74136	14	QUAD XOR OC	PAT	NO	6.00	STD
74137	16	3 TO 8 DEMUX LATCH	PAT	YES	6.00	STD
74138	16	3-8 DEMUX	PAT	NO	4.00	SIM
74139	16	2-4 DEMUX	PAT	NO	4.00	SIM
74140	14	4-IN NAND LINE DVR	PAT	NO	4.00	SIM
74147	16	10-4 PRIORITY ENCODER	PAT	NO	4.00	SIM
74148	16	10-4 PRIORITY ENCODER	PAT	NO	4.00	SIM
74150	24	1 OF 16 SEL/MUX	PAT	NO	4.00	SIM
74151	16	1 OF 8 SEL/MUX	PAT	NO	4.00	SIM
74153	16	4 TO 1 SEL/MUX	PAT	NO	4.00	SIM
74154	24	4 OF 16 DEMUX	PAT	NO	4.00	SIM
74155	16	2 TO 4 DEMUX	PAT	NO	4.00	SIM
74156	16	2 TO 4 DEMUX OC	PAT	NO	4.00	SIM
74157	16	2 TO 1 MUX	PAT	NO	4.00	SIM
74158	16	2 TO 1 MUX INV	PAT	NO	4.00	SIM
74159	24	4 OF 16 DEMUX OC	PAT	NO	4.00	SIM
74160	16	4-BIT SYNC DEC COUNT	PAT	YES	4.00	SIM
74161	16	4-BIT COUNT/ASYN CLR	PAT	YES	4.00	SIM
74162	16	4-BIT SYNC DEC COUNT	PAT	YES	4.00	SIM
74163	16	4-BIT BIN COUNTER	PAT	YES	4.00	SIM
74164	14	8-BIT P-OUT SHIFT REG	PAT	YES	4.00	SIM
74165	16	8-BIT SHIFT REG	PAT	YES	4.00	SIM
74166	16	8-BIT SHIFT REG	PAT	YES	4.00	SIM
74167	16	DECADE RATE MULTIP	PAT	YES	6.00	STD
74168	16	4-BIT U/D DEC COUNT	PAT	YES	4.00	SIM
74169	16	4-BIT BIN SYN COUNT	PAT	YES	4.00	SIM
74170	16	4x4 REGISTER FILE	PAT	YES		SIM
74173	16	4-BIT D TYPE REG TS	PAT	YES	4.00	SIM
74174	16	HEX D-FF	PAT	YES	4.00	SIM
74175	16	QUAD D-FF	PAT	YES	4.00	SIM
74176	14	PRESET COUNTER	PAT	YES	6.00	STD
74177	14	PRS. BINARY COUNTER	PAT	YES	6.00	STD
74178	14	4-BIT SHIFT REG	PAT	YES	6.00	STD
74179	14	4-BIT SHIFT REG	PAT	YES	6.00	STD
74180	14	9-BIT PAR GEN/CHECK	PAT	NO	4.00	SIM
74181	24	ALU/FUNC GEN	PAT	NO	4.00	SIM
74182	16	LOOK AHEAD CARRY GEN	PAT	NO	4.00	SIM
74183	14	DUAL CRY/SAVE ADDER	PAT	NO	6.00	STD
74184	16	BCD TO BIN CONVERT.	PAT	NO	6.00	SIM

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
74185	16	BIN TO BCD CONVERT.	PAT	NO	6.00	SIM
74190	16	SYNC U/D DEC COUNT	PAT	YES	4.00	SIM
74191	16	SYNC U/D BIN COUNT	PAT	YES	4.00	SIM
74192	16	SYNC U/D DEC COUNT	PAT	YES	4.00	SIM
74193	16	SYNC U/D BIN COUNT	PAT	YES	4.00	SIM
74194	16	4-BIT L/R SHIFT REG	PAT	YES	4.00	SIM
74195	16	4-BIT PAR SHIFT REG	PAT	YES	4.00	SIM
74196	14	DEC/BIN CNTR/LATCH	PAT	YES	6.00	STD
74197	14	BIN CNTR/LATCH	PAT	YES	6.00	STD
74198	24	8-BIT BI/SHIFT REG.	PAT	YES	6.00	STD
74199	24	8-BIT BI/SHIFT REG.	PAT	YES	6.00	STD
74230	20	OCTAL BUFFER/LINE DR	PAT	NO	6.00	STD
74237	16	3 TO 8 DECODER	PAT	NO	6.00	SIM
74238	16	3 TO 8 DECODER	PAT	NO	6.00	SIM
74240	20	4-BIT BUFFER	PAT	NO	4.00	SIM
74241	20	4-BIT BUFFER	PAT	NO	4.00	SIM
74242	14	QUAD INV BUS TRNCVR	PAT	NO	4.00	SIM
74243	14	QUAD NONIN TRNCVR	PAT	NO	4.00	SIM
74244	20	4-BIT BUFFER	PAT	NO	4.00	SIM
74245	20	8-BIT TRANSCEIVER	PAT	NO	4.00	SIM
74248	16	BCD TO 7 SEG DECODER	PAT	NO	6.00	SIM
74251	16	8 TO 1 MUX TS	PAT	NO	4.00	SIM
74253	16	DUAL 4 TO 1 MUX TS	PAT	NO	4.00	SIM
74256	16	DUAL 4 BIT ADDRESS LAT	PAT	YES	6.00	SIM
74257	16	2 TO 1 MUX TS	PAT	NO	4.00	SIM
74258	16	2 TO 1 MUX TS	PAT	NO	4.00	SIM
74259	16	8-BIT ADDR LATCHES	PAT	YES	4.00	SIM
74260	14	5-INPUT NOR	PAT	NO	4.00	SIM
74265	16	COMPL OUT ELEMENTS	PAT	NO	4.00	SIM
74266	14	2-INPUT XOR OC	PAT	NO	4.00	SIM
74273	20	D-FF, COMM CLR & CLK	PAT	YES	4.00	SIM
74276	20	DUAL JK FF	PAT	YES	6.00	STD
74278	14	4-BIT PRIORITY REG.	PAT	YES	6.00	STD
74279	16	QUAD SR LATCH	PAT	NO	6.00	STD
74280	14	9-BIT PARITY GEN	PAT	NO	4.00	SIM
74287	16	PROM 256x4	CSM	NO	4.00	STD
74289	16	64 BIT RAM	PAT	YES	6.00	STD
74290	14	DECADE COUNTER	PAT	YES	6.00	SIM
74293	14	4-BIT BIN COUNTER	PAT	YES	6.00	SIM
74295	14	4-BIT BI/SHIFT REG.	PAT	YES	6.00	SIM
74298	16	QUAD 2-IN MUX	PAT	YES	4.00	SIM
74299	20	8-BIT SHIFT REG, 3-ST	PAT	YES	4.00	SIM

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
74322	20	8-BIT SER/PAR REG	PAT	YES	4.00	SIM
74323	20	8-BIT SHIFT/STORE REG	PAT	YES	4.00	SIM
74348	16	8 TO 3 DECODER	PAT	NO	6.00	SIM
74350	16	3-STATE 4-BIT SHIFTER	PAT	NO	6.00	SIM
74352	16	DUAL 4-IN MUX	PAT	NO	4.00	SIM
74353	16	DUAL 4-IN MUX TS	PAT	NO	4.00	SIM
74354	20	8 TO 1 MUX/REG	PAT	YES	4.00	SIM
74356	20	8 TO 1 MUX/REG	PAT	YES	4.00	SIM
74365	16	6-BIT BUFFER	PAT	NO	4.00	SIM
74366	16	6-BIT INV BUF	PAT	NO	4.00	SIM
74367	16	4+2-BIT TS BUF	PAT	NO	4.00	SIM
74368	16	4+2-BIT INV 3 ST BUF	PAT	NO	4.00	SIM
74373	20	8-BIT D LATCH TS	PAT	YES	4.00	SIM
74374	20	8-BIT D-FF TS	PAT	YES	4.00	SIM
74375	16	4-BIT LATCH	PAT	YES	6.00	SIM
74376	16	QUAD JK FF	PAT	YES	6.00	SIM
74377	20	OCTAL D FF WITH EN	PAT	YES	4.00	SIM
74378	16	D FF WITH ENABLE	PAT	YES	4.00	SIM
74379	16	QUAD D FF WITH EN	PAT	YES	4.00	SIM
74LS381	20	4-BIT ALU	PAT	NO	4.00	SIM
74386	14	QUAD 2 INPUT XOR	PAT	NO	6.00	SIM
74390	16	4-BIT DECADE COUNTER	PAT	YES	4.00	SIM
74393	16	4-BIT BIN COUNTER	PAT	YES	4.00	SIM
74395	16	4-BIT SHIFT REG TS	PAT	YES	4.00	SIM
74398	20	QUAD 2-PORTS REG	PAT	YES	4.00	SIM
74399	16	QUAD 2-PORTS REG	PAT	YES	4.00	SIM
74412	24	MULTIMODE BUF LATCH	PAT	YES	4.00	SIM
74425	14	BUS BUFFERS INV TS	PAT	NO	4.00	SIM
74426	14	BUS BUFFERS TS	PAT	NO	4.00	SIM
74450	24	16 TO 1 MUX	PAT	NO		SIM
74461	24	OCTAL COUNTER	PAT	YES		SIM
74465	20	OCTAL BUFFER	PAT	NO	6.00	SIM
74490	16	DUAL DECADE COUNTER	PAT	YES	6.00	STD
74521	20	8-BIT IDENTITY COMP	PAT	NO	4.00	SIM
74533	20	OCT D TYPE LATCH TS	PAT	YES	4.00	SIM
74534	20	OCT D TYPE FF TS	PAT	YES	4.00	SIM
74537	20	1 OF 10 DEMUX TS	PAT	NO	4.00	SIM
74538	20	1 OF 8 DEMUX TS	PAT	NO	4.00	SIM
74539	20	1 OR 4 DEMUX TS	PAT	NO	4.00	SIM
74540	20	OCT INV BUF LINE DR	PAT	NO	4.00	SIM
74541	20	OCT NINV BUF LINE DR	PAT	NO	4.00	SIM
74543	24	OCTAL REGIST. TRANS	PAT	YES	6.00	SIM

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
74545	20	OCT TRANS TS BIDIREC	PAT	NO	4.00	SIM
74547	20	1 OF 8 DEMUX & LATCH	PAT	YES	4.00	SIM
74548	20	1 OF 8 DEMUX WITH ACK	PAT	NO	4.00	SIM
74563	20	OCTAL D TYPE LATCH	PAT	YES	6.00	SIM
74564	20	OCT-D FF 3-ST OUT	PAT	YES	4.00	SIM
74573	20	8-BIT D-LATCH TS	PAT	YES	4.00	SIM
74574	20	8-BIT D FF TS	PAT	YES	4.00	SIM
74576	20	8-BIT D FF	PAT	YES	6.00	SIM
74577	20	8-BIT D FF	PAT	YES	6.00	SIM
74580	20	8-BIT D FF INV OUT	PAT	YES	6.00	SIM
74588	20	OCT TRANS TS BIDIREC	PAT	NO	4.00	STD
74589	16	8-BIT SHIFT REG/LATCH	PAT	YES	6.00	SIM
74595	16	8-BIT SHIFT REG/LATCH	PAT	YES	4.00	SIM
74597	16	8-BIT SHIFT REG/LATCH	PAT	YES	6.00	SIM
74620	20	OCT INV BUS TRANSC TS	PAT	NO	4.00	SIM
74621	20	OCT BUS TRANSC OC	PAT	NO	4.00	SIM
74622	20	OCT INV BUS TRANSC OC	PAT	NO	4.00	SIM
74623	20	OCT BUS TRANSC TS	PAT	NO	4.00	SIM
74638	20	OCT BUS TRANSC	PAT	NO	4.00	SIM
74639	20	OCT BUS TRANSC	PAT	NO	4.00	SIM
74640	20	OCT BUS TRANSC INV	PAT	NO	4.00	SIM
74641	20	OCT BUS TRANS INV OC	PAT	NO	4.00	SIM
74642	20	OCT BUS TRANS INV OC	PAT	NO	4.00	SIM
74643	20	BUF A-B INV,B-A NINV	PAT	NO	4.00	SIM
74644	20	BUF A-B INV,B-A N OC	PAT	NO	4.00	SIM
74645	20	OCT BUS TRANS TS	PAT	NO	4.00	SIM
74646	24	OCT TRANSCEIVER/REG	PAT	YES	4.00	SIM
74648	24	OCT TRANSCEIVER/REG	PAT	YES	4.00	SIM
74669	16	UP/DN 4-BIT COUNTER	PAT	YES	6.00	SIM
74670	16	4X4 REG WITH TS OUT	PAT	YES	4.00	SIM
74682	20	8-BIT IDENTITY COMP.	PAT	NO	6.00	SIM
74684	20	8-BIT IDENTITY COMP.	PAT	NO	6.00	STD
74688	20	8 BIT IDENTITY COMP	PAT	NO	4.00	SIM
74689	20	8 BIT IDENT COMP OC	PAT	NO	4.00	SIM
74691	20	4-BIT CNTR/OUT REG.	PAT	YES	6.00	SIM
74804	20	HEX 2 INP NAND DRIVER	PAT	NO	6.00	SIM
74808	20	HEX 2 INO AND DRIVER	PAT	NO	6.00	SIM
74832	20	HEX 2 INP OR DRIVER	PAT	NO	6.00	STD
74842	24	10 BIT BUS INTERFACE	PAT	NO		SIM
74843	24	9 BIT BUS INTERFACE	PAT	NO		SIM
74874	24	DUAL 4-BIT D FF	PAT	YES	6.00	SIM
74962	18	8 BIT SHIFT REG	PAT	YES	6.00	SIM

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
741000	14	2-IN NAND	PAT	NO	4.00	SIM
741002	14	2-IN NOR	PAT	NO	4.00	SIM
741003	14	2-IN NAND OC	PAT	NO	4.00	SIM
741004	14	HEX INVERTER	PAT	NO	4.00	SIM
741005	14	HEX INVERT OC	PAT	NO	4.00	SIM
741008	14	2-IN AND	PAT	NO	4.00	SIM
741010	14	3-IN NAND	PAT	NO	4.00	SIM
741011	14	3-IN NAND	PAT	NO	4.00	SIM
741020	14	4-IN NAND	PAT	NO	4.00	SIM
741032	14	2-IN OR	PAT	NO	4.00	SIM
741035	14	OCT BUFFER OC	PAT	NO	4.00	SIM
741181	24	ALU/FUNC GEN	PAT	NO	4.00	SIM
741240	20	4-BIT BUF LINE DR TS	PAT	NO	4.00	SIM
741241	20	4-BIT BUF TS	PAT	NO	4.00	SIM
741242	14	4-BIT BUS TRANSC TS	PAT	NO	4.00	SIM
741244	20	4-BIT BUFF/DRVR TS	PAT	NO	4.00	SIM
741245	20	OCT BUS TRANSC TS	PAT	NO	4.00	SIM
741640	20	OCT BUS TRANSC INV	PAT	NO	4.00	SIM
741645	20	OCT BUS TRSC NINV TS	PAT	NO	4.00	SIM
747266	14	QUAD EXCLUSIVE NOR	PAT	NO	6.00	SIM
75160	20	BUS TRANSCEIVER	PAT	NO	6.00	SIM
75162	22	LINE TRANSCEIVER	PAT	NO	6.00	SIM
8212	24	MULTIMODE BUF LATCH	PAT	YES	4.00	SIM
8253	24	PROG INTERNAL TIMER	NO	NO	4.00	STD
8259	28	PROG INTERRUPT CNTR	PAT	YES	4.00	STD
8286	20	OCT BUS TRANSCEIVER	PAT	NO	4.00	SIM
8287	20	8 BIT INV BUS TRASCVR	PAT	NO	6.00	SIM
8288	20	BUS CONTROLLER 86/88	PRC	NO	4.00	STD
8T09	14	QUAD BUS DRIVER	PAT	NO	6.00	SIM
8T10	16	D BUS FLIPFLOP	PAT	YES	6.00	SIM
8T13	16	LINE DRIVER	PAT	NO	6.00	SIM
8T26	16	BUS TRANSCIEVER	PAT	NO	6.00	SIM
8T28	16	QUAD 3-STATE TRSCVR	PAT	NO		SIM
8T38	16	BUS TRANSCIEVER	PAT	NO	6.00	SIM
8T96	16	HEX INV BUFFER	PAT	NO	6.00	SIM
8T97	16	HEX 3-STATE BUFFER	PAT	NO	6.00	SIM
8T98	16	HEX INV BUFFER	PAT	NO	6.00	SIM
8T127	16	QUAD 3-STATE TRSCVR	PAT	NO		SIM
8T129	16	TRANSCIEVER	PAT	NO	6.00	SIM

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
9002	14	2-IN NAND	PAT	NO	4.00	SIM
9003	14	3-IN NAND	PAT	NO	4.00	SIM
9004	14	4-IN NAND	PAT	NO	4.00	SIM
9009	14	4-IN NAND	PAT	NO	4.00	SIM
9012	14	2-IN NAND	PAT	NO	4.00	SIM
9016	14	INVERTER	PAT	NO	4.00	SIM
9024	16	J-K/FF, PRE & CLR	PAT	YES	4.00	SIM
9311	24	1 OF 16 DEMUX	PAT	NO	4.00	SIM
9334	24	1-OF 16 DEMUX	PAT	NO	4.00	SIM
9341	24	ALU/FUNCTION GEN	PAT	NO	4.00	SIM

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
DYNAMIC RAMs						
2164	16	64Kx1	PRC	NO	4.00	SHAD
2620	18	16Kx4	PRC	NO	4.00	SHAD
2800	16	256Kx1	PRC	NO	4.00	SHAD
41128	16	128Kx1		NO	4.00	
411024	18	1MBx1	PRC	NO	6.00	SHAD
41256	16	256Kx1	PRC	NO	4.00	SHAD
41416	18	16Kx4	PRC	NO	4.00	SHAD
41464	18	64Kx4	PRC	NO	6.00	SHAD
4164	16	64Kx1	PRC	NO	4.00	SHAD
4416	18	16Kx4	PRC	NO	4.00	SHAD
4464	18	64kx4	PRC	NO	6.00	SHAD
511000	18	1MBx1	PRC	NO	6.00	SHAD
514256	20	256Kx4	PRC	NO		SHAD
6256	16	256Kx1	PRC	NO	4.00	SHAD
6665	16	64Kx1	PRC	NO	4.00	SHAD
8118	16	16Kx1	PRC	NO	6.00	SHAD
81416	18	16Kx4	PRC	NO	4.00	SHAD
81256	16	256Kx1	PRC	NO	4.00	SHAD
8264	16	64Kx1	PRC	NO	4.00	SHAD
STATIC RAMs						
1400	20	16Kx1	PAT	NO	4.00	SHAD
1600	22	64Kx1	PAT	NO	6.00	SHAD
1822	22	256x4	PAT	NO	4.00	STD
2016	24	2Kx8	PAT	NO	4.00	SHAD
2018	24	2Kx8	PAT	NO	4.00	SHAD
2088	28	8Kx8	PAT	NO	4.00	SHAD
2101	22	256x4	PAT	NO	4.00	STD
2114	18	1Kx4	PAT	NO	4.00	SHAD
2147	18	4Kx1	PAT	NO	4.00	SHAD
2148	18	1Kx4	PAT	NO	4.00	SHAD
2167	20	16Kx1	PAT	NO	4.00	SHAD
2168	20	4Kx1	PAT	NO	6.00	SHAD
4016	24	2Kx8	PAT	NO	4.00	SHAD
4311	20	16Kx1	PAT	NO	4.00	STD
5047	20	1Kx4	PAT	NO	4.00	STD
5114	18	1Kx4	PAT	NO	4.00	SHAD
5257	24	256Kx1	PAT	NO	6.00	SHAD
5517	24	2Kx8	PAT	NO	4.00	SHAD

NUMBER	SIZE	FUNCTION	RDT	SYNC	ROM	DNLD
5561	22	64Kx1	PAT	NO	6.00	SHAD
5562	22	64Kx1	PAT	NO	6.00	SHAD
5564	28	8Kx8	PAT	NO	4.00	SHAD
5565	28	8Kx8	PAT	NO	4.00	SHAD
55256	28	256Kx1	PAT	NO		SHAD
6116	24	2Kx8	PAT	NO	6.00	SHAD
6147	18	4Kx1	PAT	NO	4.00	STD
6164	28	8Kx8	PAT	NO	4.00	SHAD
6168	20	4Kx1	PAT	NO	6.00	SHAD
6207	24	256Kx1	PAT	NO	6.00	SHAD
6287	22	64Kx1	PAT	NO	6.00	SHAD
7C122	22	256x4	PAT	NO	5.00	SHAD
7C187	22	64Kx1	PAT	NO	6.00	SHAD
7C197	24	256Kx1	PAT	NO	6.00	SHAD
8167	20	16Kx1	PAT	NO	4.00	SHAD
8171	22	64Kx1	PAT	NO	6.00	SHAD
8864	28	8Kx8	PAT	NO		SHAD
9044	18	4Kx1	PAT	NO	4.00	STD
9101	22	256x4	PAT	NO	4.00	STD
9111	18	256x4	PAT	NO	4.00	SHAD
9124	18	1Kx4	PAT	NO	4.00	SHAD
93415	16	1Kx1	PAT	NO	4.00	STD
93422	22	256x4	PAT	NO	4.00	SHAD
93425	16	1Kx1	PAT	NO	4.00	SHAD
9988	28	8Kx8	PAT	NO	4.00	SHAD

NUMBER	SIZE	FUNCTION	RDT SYNC	ROM	DNLD
EPROMs					
2732	24	4Kx8 EPROM	CSM NO	4.00	STD
2764	28	8Kx8 EPROM	CSM NO	4.00	STD
27128	28	16Kx8 EPROM	CSM NO	4.00	STD
27256	28	32Kx8 EPROM	CSM NO	4.00	STD
27512	28	64Kx8 EPROM	CSM NO	4.00	STD
7C225	24	512x8 EPROM	CSM NO		STD
7C235	24	1024x8 EPROM	CSM NO		STD
7C245	24	2Kx8 EPROM	CSM NO		STD
7C251	28	16Kx8 EPROM	CSM NO		STD
7C254	28	16Kx8 EPROM	CSM NO		STD
7C261	24	8Kx8 EPROM	CSM NO		STD
7C263	24	8Kx8 EPROM	CSM NO		STD
7C264	24	8Kx8 EPROM	CSM NO		STD
7C266	28	8Kx8 EPROM	CSM NO		STD
7C271	28	32Kx8 EPROM	CSM NO		STD
7C281	24	1Kx8 EPROM	CSM NO		STD
7C291	24	2Kx8 EPROM	CSM NO		STD
PROMs					
7111	16	32x8	CSM NO		STD
7112	16	32x8	CSM NO		STD
7151	20	4Kx4	CSM NO		STD
7152	20	4Kx4	CSM NO		STD
82S129	16	PROM 256x4	CSM NO	4.00	STD
TBP24S10	16	PROM 256x4	CSM NO	4.00	STD

NUMBER	SIZE	FUNCTION	RDT SYNC	ROM	DNLD

PALs

NOTE:
20 pin PLC packages are pin equivalent to DIP packages and are specified with the prefixes PAL, PLC, PLH, PLS, PLUS, GAL.
28 pin PLC packages are not pin equivalent to DIP packages. AMD standard PLC packages are supported using the prefix SPAL.

GAL16V8	20	AND D FF PAL	CSM NO	6.00	STD
GAL20V8	24	AND D FF PAL	CSM NO	6.00	STD
PAL6L16	24	AND PAL	CSM NO	6.00	STD
PAL8L14	24	AND D PAL	CSM NO	6.00	STD
PAL10H8	20	AND OR PAL	CSM NO	4.00	STD
PAL10L8	20	AND OR PAL	CSM NO	5.00	STD
PAL12H6	20	AND OR PAL	CSM NO	4.00	STD
PAL12L6	20	AND OR PAL	CSM NO	5.00	STD
PAL12L10	24	AND OR PAL	CSM NO	4.00	STD
PAL14H4	20	AND OR PAL	CSM NO	4.00	STD
PAL14L4	20	AND OR PAL	CSM NO	5.00	STD
PAL14L8	20	AND OR PAL	CSM NO	4.00	STD
PAL16H2	20	AND OR PAL	CSM NO	4.00	STD
PAL16C1	20	AND OR PAL	CSM NO	4.00	STD
PAL16L2	20	AND OR PAL	CSM NO	5.00	STD
PAL16L8	20	AND OR PAL	CSM NO	5.00	STD
PAL16L6	24	AND OR PAL	CSM NO	5.00	STD
PAL16RA8	20	AND OR D FF PAL	CSM NO	6.00	STD
PAL16R8	20	AND OR D FF PAL	CSM NO	4.00	STD
PAL16R6	20	AND OR D FF PAL	CSM NO	4.00	STD
PAL16R4	20	AND OR D FF PAL	CSM NO	4.00	STD
PAL16X4	20	AND OR XOR D FF PAL	CSM NO	4.00	STD
PAL16A4	20	AND OR XOR D FF PAL	CSM NO	4.00	STD
PAL16P8	20	AND OR/NOR PAL	CSM NO	4.00	STD
PAL16RP8	20	AND OR/NOR D FF PAL	CSM NO	4.00	STD
PAL16RP6	20	AND OR/NOR D FF PAL	CSM NO	4.00	STD
PAL16RP4	20	AND OR/NOR D FF PAL	CSM NO	4.00	STD
PAL16L6	24	AND NOR PAL	CSM NO	4.00	STD
PAL18L4	24	AND NOR PAL	CSM NO	4.00	STD
PAL20L2	24	AND NOR PAL	CSM NO	4.00	STD
PAL20C1	24	AND OR/NOR PAL	CSM NO	4.00	STD
PAL20L10	24	AND NOR PAL	CSM NO	4.00	STD
PAL20S10	24	AND OR PAL	CSM NO	5.00	STD
PAL20X10	24	AND OR XOR D FF PAL	CSM NO	4.00	STD

NUMBER	SIZE	FUNCTION	RDT SYNC	ROM	DNLD
PAL20X8	24	AND OR XOR D FF PAL	CSM NO	4.00	STD
PAL20X4	24	AND OR XOR D FF PAL	CSM NO	4.00	STD
PAL20XRP4	24	AND OR XOR D FF PAL	CSM NO		STD
PAL20XRP6	24	AND OR XOR D FF PAL	CSM NO		STD
PAL20XRP8	24	AND OR XOR D FF PAL	CSM NO		STD
PAL20L8	24	AND NOR PAL	CSM NO	4.00	STD
PAL20R8	24	AND OR D FF PAL	CSM NO	4.00	STD
PAL20R6	24	AND OR D FF PAL	CSM NO	4.00	STD
PAL20R4	24	AND OR D FF PAL	CSM NO	4.00	STD
PAL20S10	24	AND OR/NOR PAL	CSM NO	4.00	STD
PAL20RS10	24	AND OR/NOR D FF PAL	CSM NO	4.00	STD
PAL20RS8	24	AND OR/NOR D FF PAL	CSM NO	4.00	STD
PAL20RS4	24	AND OR/NOR D FF PAL	CSM NO	4.00	STD
PAL20RA10	24	AND OR/NOR D FF PAL	CSM NO	4.00	STD
PAL22P10	24	AND OR/NOR PAL	CSM NO	5.00	STD
PAL22RX8	24	AND OR D FF MUX PAL	CSM NO	6.00	STD
PAL22V10	24	AND OR D FF MUX PAL	CSM NO	4.00	STD
PAL22XP10	24	AND OR XOR PAL	CSM NO		STD
PAL23S8	20	AND D FF PAL	CSM NO	6.00	STD
PAL29M16	24	AND OR MUX D FF PAL	CSM NO	6.00	STD
PAL29MA16	24	AND OR MUX D FF PAL	CSM NO	6.00	STD
PAL32VX10	24	AND OR MUX D FF PAL	CSM NO	6.00	STD
PLC18V8	20	AND OR D FF PAL	CSM NO	6.00	STD
PLHS473	24	AND OR PAL	CSM NO	6.00	STD
PLS100	28	AND OR INV PAL	CSM NO	6.00	STD
PLS101	28	AND OR INV PAL	CSM NO	6.00	STD
PLS155	20	AND OR JK FF PAL	CSM NO	6.00	STD
PLS167	24	AND OR PAL	CSM NO	6.00	STD
PLS168	24	AND OR SR FF PAL	CSM NO	6.00	STD
PLS173	24	OR PAL	CSM NO	6.00	STD
PLS179	24	AND OR JK FF PAL	CSM NO	6.00	STD
PLUS153	20	AND OR PAL	CSM NO	6.00	STD
PLUS173	24	OR PAL	CSM NO	6.00	STD

NUMBER	SIZE	FUNCTION	RDT SYNC	ROM DNLD
SPAL20L8	28	SQUARE PKG 20L8	CSM NO	STD
SPAL20L10	28	SQUARE PKG 20L10	CSM NO	STD
SPAL20R4	28	SQUARE PKG 20R4	CSM NO	STD
SPAL20R6	28	SQUARE PKG 20R6	CSM NO	STD
SPAL20R8	28	SQUARE PKG 20R8	CSM NO	STD
SPAL20RA10	28	SQUARE PKG 20RA10	CSM NO	STD
SPAL20XRP4	28	SQUARE PKG 20XRP4	CSM NO	STD
SPAL20XRP6	28	SQUARE PKG 20XRP6	CSM NO	STD
SPAL20XRP8	28	SQUARE PKG 20XRP8	CSM NO	STD
SPAL22P10	28	SQUARE PKG 22P10	CSM NO	STD
SPAL22V10	28	SQUARE PKG 22V10	CSM NO	STD
SPAL22XP10	28	SQUARE PKG 22XP10	CSM NO	STD
SPAL29M16	28	SQUARE PKG 29M16	CSM NO	STD