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K450B LOGIC ANALYZER

USER'S MANUAL

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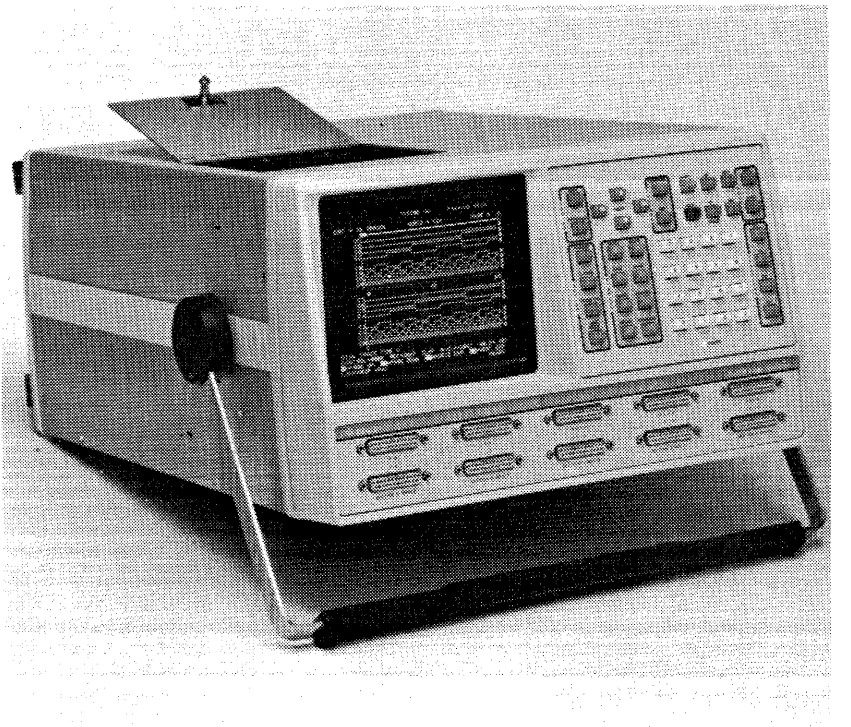

K450B Logic Analyzer with Single Disk Storage System

WARNING

This equipment has not been tested to show compliance with new FCC Rules 47 CFR Part 15) designed to limit interference to radio and TV reception. Operation of this equipment in a residential area is likely to cause unacceptable interference to radio communication requiring the operator to take whatever steps are necessary to correct the interference.

The following procedures may help alleviate the Radio or Television Interference problems:

1. Reorient the antenna of the receiver receiving the Interference.

2. Relocate the equipment causing the interference with respect to the receiver (move or change relative position).

3. Reconnect the equipment causing the interference into a different outlet so the receiver and the equipment are connected to different branch circuits.

4. Remove the equipment from the power source.

NOTE:

The user may find the following booklet prepared by the FCC helpful: "How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402. Stock Number 004-000-00345-4.

PREFACE

This manual describes the capabilities, functions and operation of the K450B Logic Analyzer. Procedures are provided for using display screens to define and set up test conditions for trace, recording the trace data, and interpreting the results.

The material in this manual reflects the K450B software and firmware level, valid for January,1989. This information is up-to-date at the time of publication, but is subject to change without notice.

Copies of this and other BIOMATION Corporation publications may be obtained from the BIOMATION sales office or distributor serving your locality.

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Chapter 1

INTRODUCTION

GENERAL DESCRIPTION

The Gould/Biomation Model K450B Logic Analyzer (Figure 1-1) is a precision, high-performance test and development instrument. The K450B monitors and records digital input logic signals generated by the user's external target system. The K450B provides 80 input channels at 100MHz, 40 input channels at 200MHz, and 20 input channels at 400MHz. The 400MHz capability requires the use of an optional 400MHz Probe described in Appendix C. The optional 100 MHz State Probe is described in Appendix E.

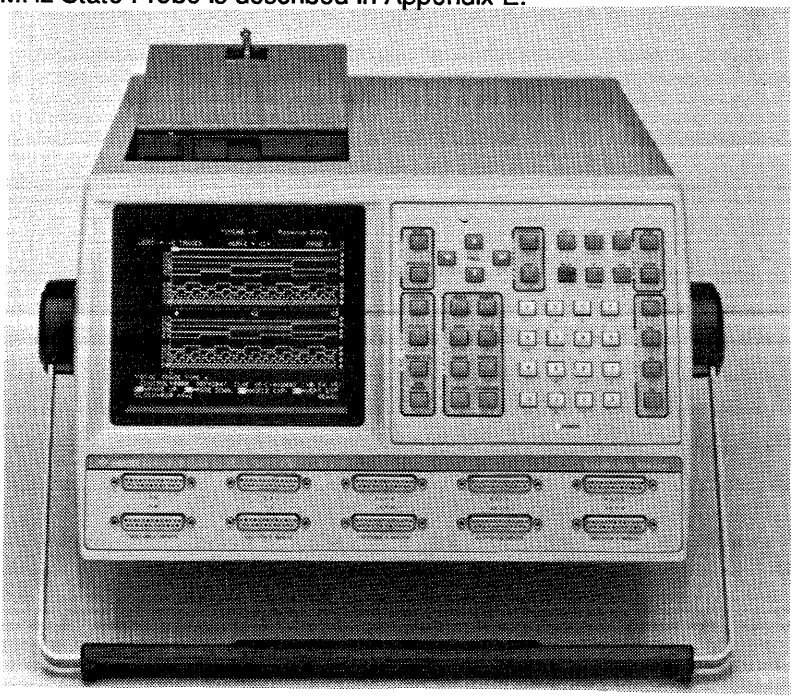


Figure 1-1. K450B Logic Analyzer

The K450B provides 10 ns resolution at 100 MHz, 5 ns resolution at 200 MHz, and 2.5 ns resolution at 400MHz. The K450B also provides sophisticated trigger schemes, a versatile clock scheme, and a variety of data options. The user can rapidly examine and record addresses, data and control signals of ECL based systems, gate arrays, bit-slice processors and other high-speed microprocessors.

FEATURES

Software Control

The K450B control logic performs measurements on the input signals to correlate data/timing characteristics, accomplish comparisons, and capture data samples; the results are then recorded in memory. The measurement operations are screen-driven by resident firmware which is controlled by manipulating various keys on the Keyboard Panel. The screens allow the user to set up test conditions, capture the results of binary logic states via trace control for data-domain analysis and display pulse-train waveforms for time-domain analysis. The display screen presents the results of analysis for examination or modification by the user.

The user-friendly control firmware generates the screens for selecting acquisition parameters and allows direct control over the acquisition process; furthermore, the control firmware displays and interprets the acquired data, and informs the user of current system status. Because the control firmware of the K450B is simple to use and versatile, the instrument is suitable for a variety of uses including laboratory software and hardware development, test engineering, and field-services testing.

Trace Control*

The K450B offers the user a screen-guided Trace Control* that is simple to use, and powerful. Trace levels can be rapidly set up using either the Auto Setup* feature or display menus and front panel keys. The flexibility of Trace Control is enhanced by a selection of commands that allow the user to select information to record.

Data may be displayed in hexadecimal, octal, binary, ASCII, and EBCDIC format, or a user specified format.

Auto Setup*

The Auto Setup* feature identifies all active inputs and configures the Logic Analyzer to record and display circuit activity. Pressing the SHIFT key then the CLOCK key executes the Auto Setup, reducing setup time and simplifying operation.

---

*Trace Control, *Auto Setup , Trademark pending Gould Inc.

External Interface

The K450B may interface to the user's system via rear panel connectors that provide IEEE-488 (GPIB)or RS-232-C communication linkages. The I/O Setup Screen allows the user to set up parameters and initiate transfer operations.

The GPIB interface allows parallel transfer to setups and data between the K450B and the user's system. The communications parameters are programmable by the user to set up the following communication modes for the GPIB link.

Talk Only Mode	Transmit data and commands to a user's system.
Listen Only Mode	Receive data and commands from a user's system.
Talk and Listen Mode	Perform interactive two-way dialogue between the K450B and a user's system.

The RS-232-C interface allows serial transfer of setups and data between the K450B and a user's device, such as printer, personal computer, or terminal. The I/O Setup Screen allows the user to specify conditions, such as baud rate, protocol, or word length, that are used to control the I/O communication.

FRONT PANEL PROBE CONNECTORS AND KEYBOARD

Front Panel Probe Connectors

The front panel probe connectors (Figure 1-1) A (7-0) through E (7-0), and A (F-8) through E (F-8), accept external data and clock inputs. The number and configuration of input connectors available to the user is dependent on the Expansion option installed in a given unit. The Power Up screen indicates which connectors are active. The probes are electrically interchangeable, but are labeled A0-EF for the convenience of the user.

Description of Keyboard Functions

Various keys on the keyboard interact with displayed information to provide a choice for the type of function that is selected.

Select Field: Any blinking field is selected by the cursor as the active field. Positioning the cursor for active field indication is controlled by the use of **FIELD** Keys.

Data Entry When a field is active, scroll forward or backward through the various choices using the **NEXT** or **PREVIOUS** keys.

Primary/Secondary Key Functions Primary key functions of a key are indicated by black lettering. Secondary functions are indicated by blue lettering. Pressing a single key will initiate the labeled primary function.

To use the secondary functions , first press the **SHIFT** key and then the secondary function key. Press the **SHIFT** key for each depression of a secondary function key. Do not hold the **SHIFT** key while requesting the secondary function.

Help Functions: Press the **HELP** key from any screen.

Don't Cares:

When the **X/SPACE** key is depressed, the K450B decides if a Don't-Care, (X) is appropriate in the active field and if so, inserts the Don't-Care.

Inserting Spaces:

Insert spaces by pressing **SHIFT** and then the **X** key. A **SHIFT/X** is never interpreted as a Don't-Care. Pressing the **X/SPACE** key in a non-pattern definition field deletes and replaces the character in the active field with a blank space without affecting adjacent characters.

Edit Mode:

The Edit mode is entered and exited by pressing the **EDIT** key, which allows the user to perform editing functions in the **Data Timing and Graph Display** screens. In the **Trace Control Set Up** screen, use the **EDIT** key to select a binary presentation of the Pattern Definitions.

KEY GROUPS

The keyboard is arranged in the following functional key groups, which are described in subsequent paragraphs:

Setup and Display Key Group

Field Key Group

Data Entry Key Group

Special Purpose Key Group

Record Key Group

Control and Reference Key Group

Edit Key Group

Setup and Display Key Group

The setup and Display Key (Figure 1-2) perform the following functions:

Setup display **Format** for thresholds, polarity and channel groups

Select internal or external **Clocks** for setup

Set a trigger/**Trace.control** sequence

Choose **Arm** repetitive rearm or single-shot

Reset K450B to its **Default** value

Display recorded information as state **Data, Timing** diagram or **Graph**

Select Normal **(A)** or Compare/Reference **(B)** memory displays and transfer **A** memory to **B** memory

Either **Search** for a given data pattern in the data screen or compare **A** memory data to **B** memory data.

Allows for either manual or **Auto Setup** of test conditions for controlling logic analyzer operation.

Allows review of current setup parameters via **Quik Setup** window.

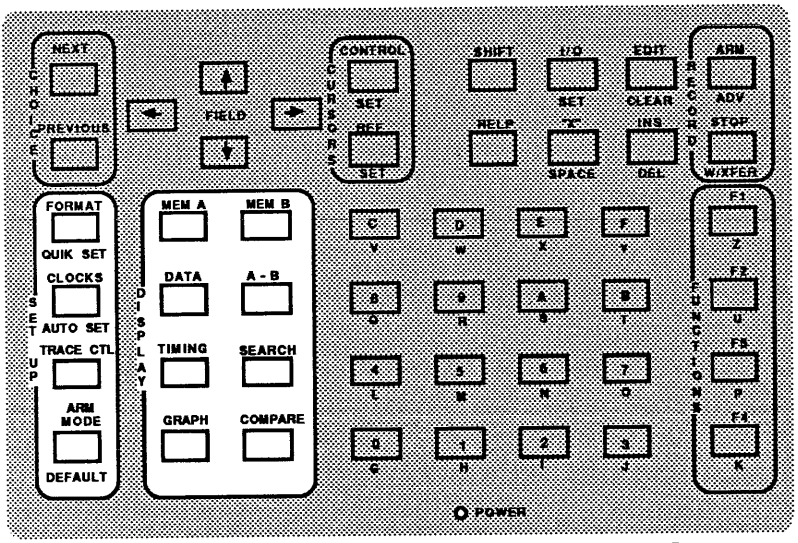


Figure 1-2. Setup and Display Key Group

Field Key Group

The **Field** keys (Figure 1-3) manually move the cursor and shift active fields on the display.

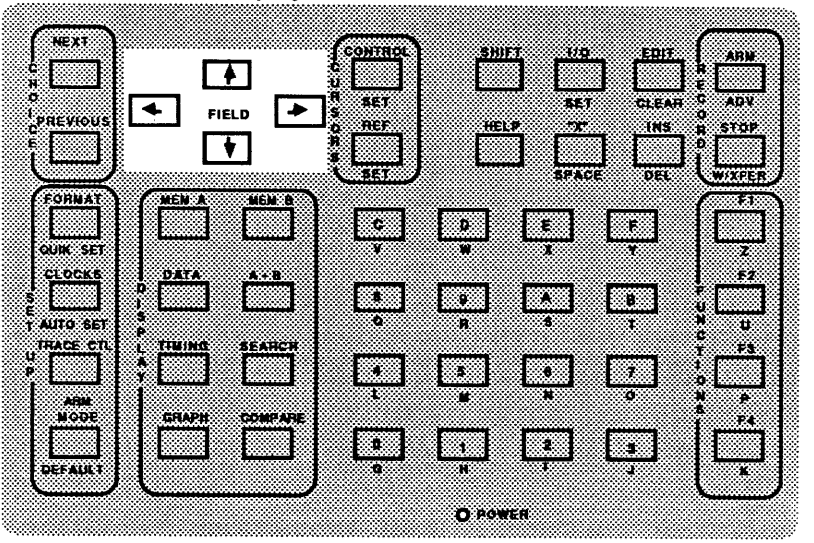


Figure 1-3. Field Key Group

Data Entry and Quick Key Group

The **Data Entry** keys ·Figure 1-4) manually enter alphanumeric information into the various displays. Each of these keys provide a choice for data entry. Pressing the **SHIFT** key first, and then the secondary letter, allows the entry of alphabetic characters located below the key.

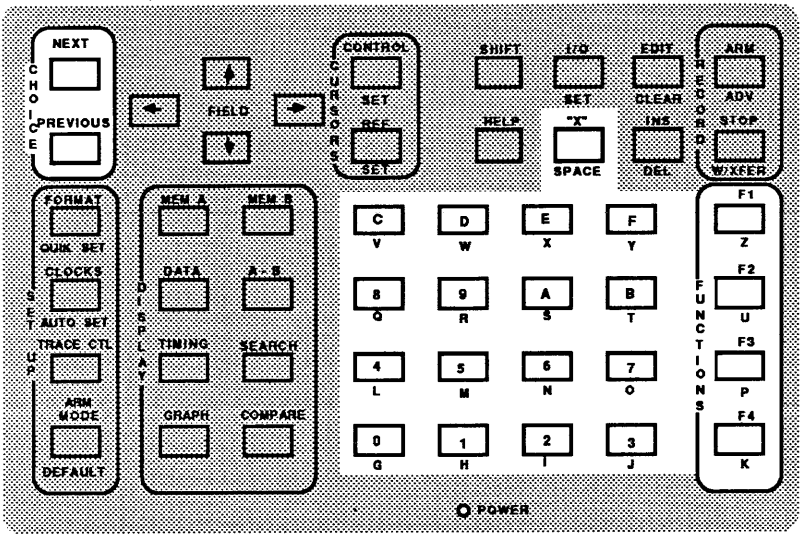


Figure 1-4. Data Entry Key Group

Many of the display fields (such as the Data Format field of the Format Screen) have multiple choices of data or information. When the field is active, the user may scroll forward or backward through the choices using the NEXT or PREVIOUS keys, respectively. Rapid selection of choices is facilitated by use of "Quick-Keys". Choices are assigned alphanumeric values, and the user may rapidly advance to another choice by pressing the alphanumeric key with the value which corresponds to the Quick-Key value. When Quick-Keys are used to make entries, the active field generally shifts to an adjacent field: if the NEXT/PREV keys are used, the active field does not reposition. As the various fields of each display are discussed in this text, the corresponding Quick Key value is shown adjacent to the choice description.

Special Purpose Key Group

The **Special Purpose** Key Group (Figure 1-5) includes the **Shift, I/O, Cancel, Help** and **Function** keys. The **Shift** key allows the user to shift the keyboard functions of dual purpose key to their secondary functions, select the **Help** displays, and access external interface. The **Help** function provides the user with access to 7-line prompt messages. The **Cancel** key cancels the currently active data transmission commands. The **I/O** key accesses the I/O Function Menu. The **FUNCTION** Keys change their purpose depending on the screen selected.

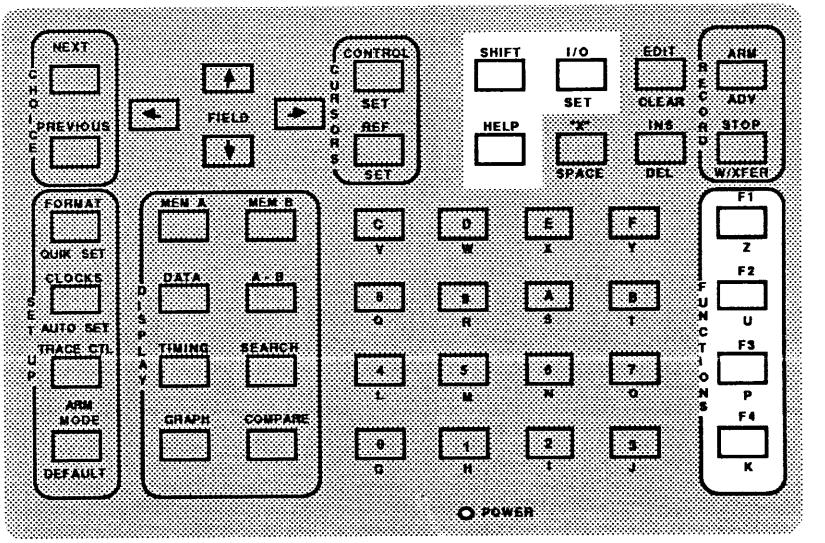


Figure 1-5. Special Purpose Key Group

Record Key Group

The **ARM** key (Figure 1-6) initiates sampling. The **SHIFT/ADV** Key will advance manually and ignore a given trace level to move to the next level. The **STOP** Key will manually abort the recording (which is useful if trigger words are not found). The **SHIFT/XFER** function will stop the recording, but still transfer data that has been captured.

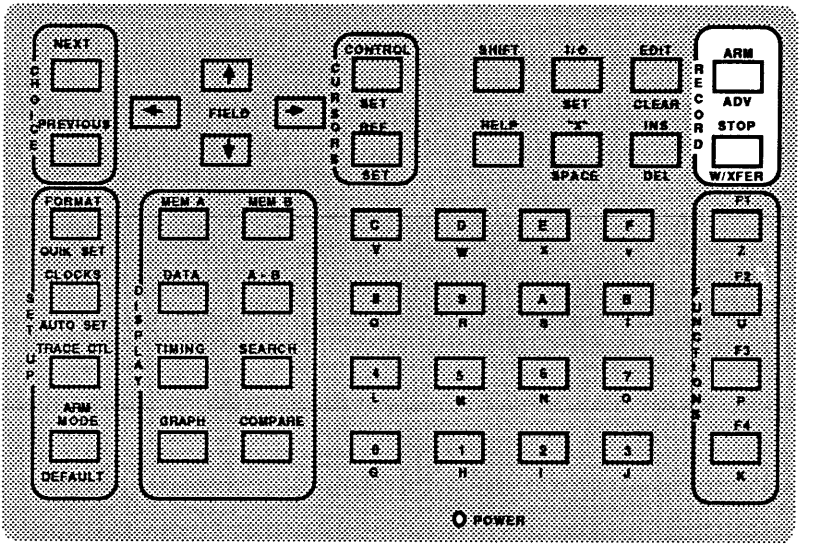


Figure 1-6. Record Key Group

Control and Reference Key Group

The **Control** and **Reference** keys (Figure 1-7) selects either the Control or Reference cursor which are in Data displays for locating specific items on the screen. The **Field** keys move the cursor associated with the **Control/Reference** key which was last pressed. The **Shift/Control** or **Shift/Reference** keys allow setting a cursor to a user defined value.

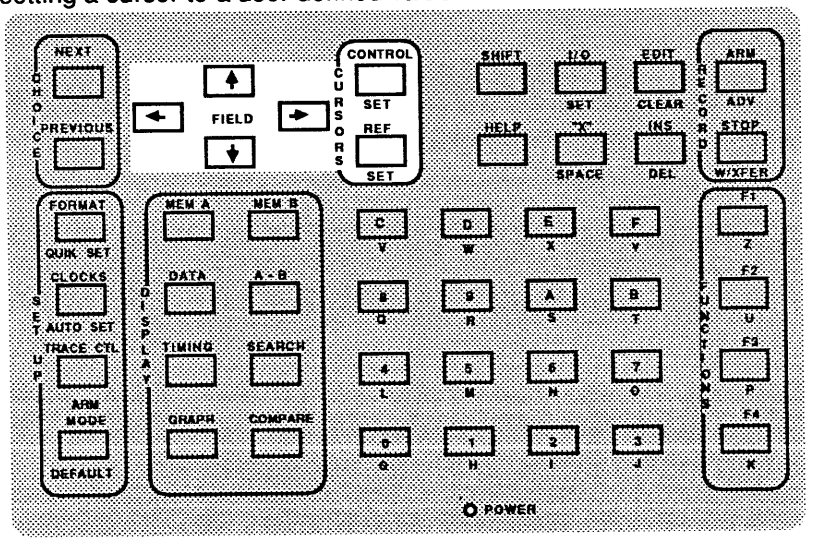


Figure 1-7. Control and Reference Key Group

Edit Key Group

The Edit/Clear, Insert/Delete Keys (Figure 1-8) perform the following functions:

The **Edit** Key selects the Edit Mode for editing Format, Trace Control Patterns, Display Data and Timing Data.

The **Clear** Key deletes column information in the Format screen.

The **Insert** Key is used to insert a blank column in certain displays.

The **Delete** Key is used to remove a column.

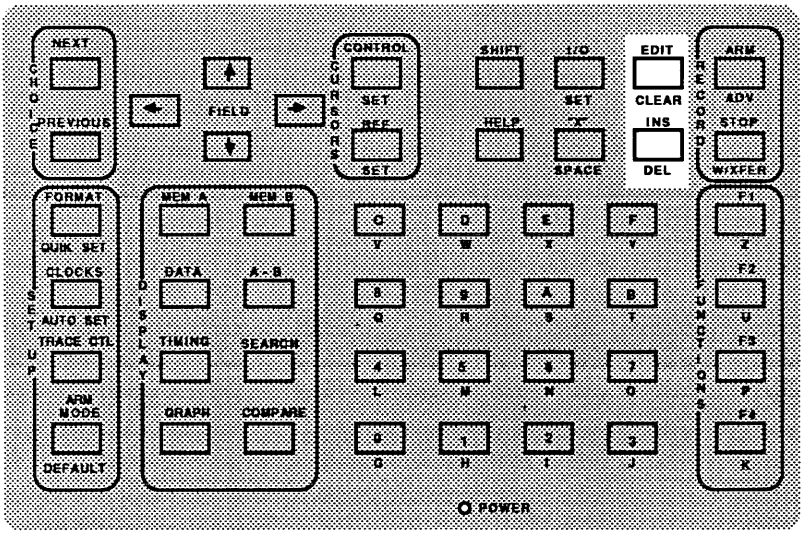


Figure 1-8. Edit Key Group

REAR-PANEL CONNECTORS AND SWITCHES

Figure 1-9 presents an overall view of the K450B rear panel. Components on the rear panel are categorized into three groups: Power Input, Interface, and Signal Output.

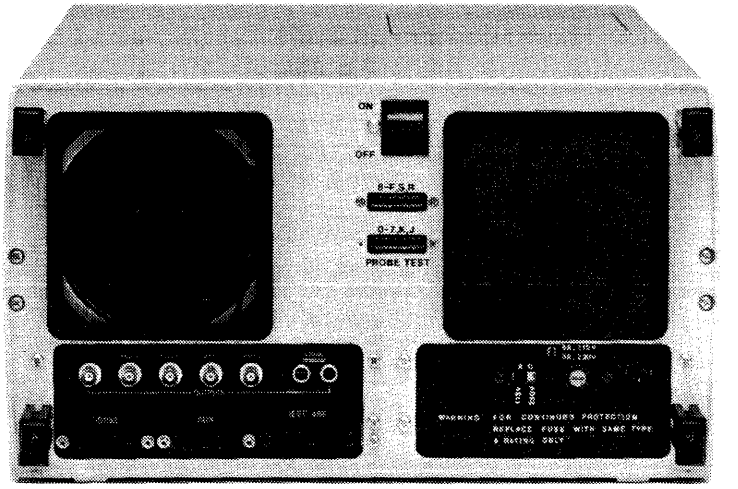


Figure 1-9. K450B Rear Panel

Power Input Group

Voltage Select: This two-position switch selects 115/230 VAC range of the unit to match the incoming AC Line voltage.

Fuses for Rated Voltage: Standard fuse holder. Fuse rating must be selected to match the incoming AC Line voltage.

VOLTAGE RANGE	FUSE
90 VAC to 135 VAC	3AG, 8 Amp
180 VAC to 270 VAC	3AG, 4 Amp

AC IN: Standard AC male, connector for power input.

AC Power ON/OFF Switch and Indicator: The AC Power switch is a double-pole single-throw pole paddle switch. The switch is in the OFF position when the paddle is down and the ON position when the paddle is up. When the unit is on, the POWER indicator on the keypanel is illuminated, indicating the presence of both AC voltage and -5 VDC.

Interface Group

IEEE-488 Port: The IEEE-488 port is of standard configuration with full Talker/Listener capabilities. This port is configured through the I/O Set Up Screen.

RS-232-C Port: The RS-232-C port is a seven-wire subset with standard pin-outs. The port is factory configured as DTE . Instructions on reconfiguring the ports as DCE may be obtained from the Gould Inc., Customer Service office listed in Chapter 6 (see Assistance).

Auxiliary Port Provides an extra RS-232-C port for external connections.

external connections.

Signal Output Group

VIDEO, BNC connector:	Display Video Out; composite video level is at a horizontal frequency of 19.230KHz
CLOCK BNC connector:	Internal Clock Out; ECL active low corresponds to the internal clock
GET, BNC connector:	Group Execute Trigger Pulse; TTL Output for IEEE-488 Command
TRACE BNC connector:	Trace/Record Out; TTL high output when trace is enabled
Two LEMO connectors:	Accessory Power Out, +5V and -5.2V @ 300 mA
Probe Test Sockets:	These sockets generate a known ring counter and clocking signals. The Probe Test pattern generator produces two clock signals, in addition to eight data signals, per test socket. The first clock signal is an external J clock input for the lower-order bits (7-0) probe of each section or an R enable input for the high-order bits (F-8) probe of each section. The second clock signal is an external K clock input for the low-order probe of each section or an S enable input for the high-order probe of each section. The clock and data signals, output by the probe test sockets, have a zero to minus 5 voltage.

Chapter 2

GETTING STARTED

GENERAL DESCRIPTION

Perform the following steps to get a working introduction to the K450B Logic Analyzer:

Power Off Turn the power off at the K450B.

Connect Probe A0 Connect one end of the probe cable to the K450B front panel socket labeled SECTION A INPUTS J,K, (7-0)

Power On Turn on the power at the K450B. When the diagnostic tests are completed, the ***Configuration screen*** (Figure 2-1) is displayed. This display indicates which hardware and software version options are installed, and which probes are active/inactive. In addition, the configuration screen allows the user to set the logic analyzer to a factory Default (F1), cycle on power up diagnostics (F2), change the Date/Time/CRT Brightness (F3) and Reset Memory A to all zeros (F4).

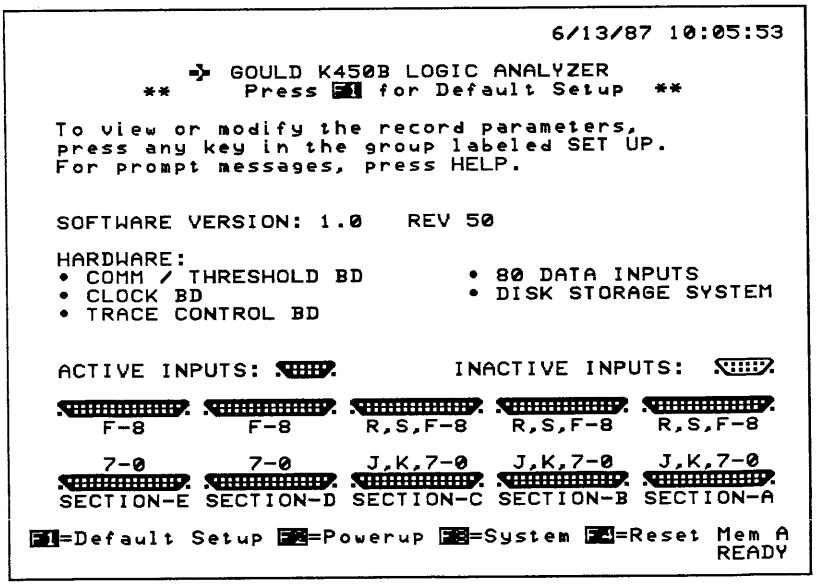


Figure 2-1. Configuration Screen

Test Probe A 0 (lower)

Connect the probe end of cable to the lower of the two rear panel sockets labeled PROBE TEST, label side up.

Press F1 (Defaults)

Press the **F1** key (it is gray, on the right of the K450B) to select the factory Default Setup parameters. These parameters are:

Clock:	20 ns.
Format:	Hex (High to low)
Threshold:	TTL
Polarity:	True
Trigger:	Center
Arm Mode:	Single Shot

Press SHIFT Then FORMAT Enter the ***Quik Setup Window*** to look at the current setup of the K450B.

Review Setup Compare the Default Parameters with the ***Quik Setup Window*** of the K450B. Inputs are grouped in probe sections, a check indicates an active input and an underline indicates an inactive input. A series of dashes (— —) for a probe section threshold indicates either no probe is attached, or that Auto Setup was unable to assign a threshold to that probe.

Note If the user does not want to continue with this section, exit by pressing the **SHIFT** and then the **FORMAT** key.

QUIK SETUP

The ***Quik Setup Window*** (Figure 2-2) shows the K450B's current setup. Enter this window from most any screen (using SHIFT/FORMAT Keys) and review or modify the current K450B major setup conditions.

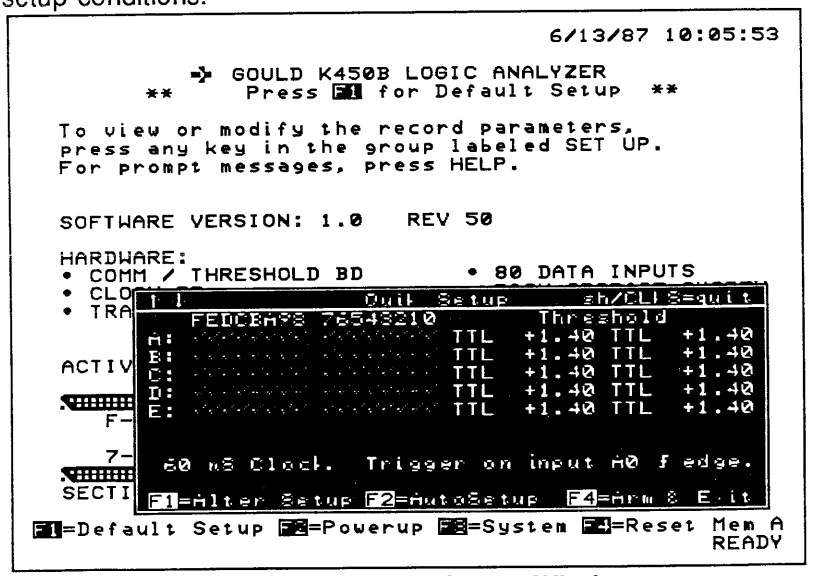


Figure 2-2. Quik Setup Window

Connect Probes

If you started this procedure at the beginning, Probe A is already connected (J,K (7-0)) to the probe test. If not, connect any number of probes or channels to the K450B Logic Analyzer and the unit under test. **Do not mix TTL, ECL or variable threshold signals on the same probe section.**

Initiate Auto Setup

If the K450B is displaying the ***Quik Setup Window*** , press the **F2** key. If the ***Quik Setup Window*** is not currently displayed, press the **SHIFT** and then the **CLOCK** keys, to initiate Auto Setup.

Watch...

The K450B Auto Setup Initialization message window is displayed The K450B ***Auto Setup screen*** takes a series of recordings and performs the following operations:

Determines which probes are installed.

Identifies probes with inputs attached to the circuit.

Determines the threshold for each probe.

Wait while it...

Configures the ***Format screen*** in binary or hex format.

Eliminates unused channels on the ***Format*** and ***Timing screens.***

Selects a trigger input and adjusts the internal clock to display activity on that input.

Selects ***Trace Control screen*** parameters to trigger on the rising edge of the trigger input and fills the display.

Takes a final recording and displays the results on the ***Timing screen.***

Cancel ?

The **F4** key may be pressed any time during the Auto Setup sequence to cancel the Auto Setup function and return to the previous setup.

Note Setup The ***Auto Setup screen*** (Figure 2-3) shows the setup to capture data from the active inputs. Compare the current setup with the default setup at the front of the getting started section.

AUTO SETUP

The K450B ***Auto Setup screen*** identifies all active inputs, configures the K450B Logic Analyzer to record, and then displays the timing relationships of the active circuit. This reduces setup time and simplifies operation. Pressing the **SHIFT** key and then the **CLOCK** key executes the K450B ***Auto Setup screen*** (Figure 2-3).

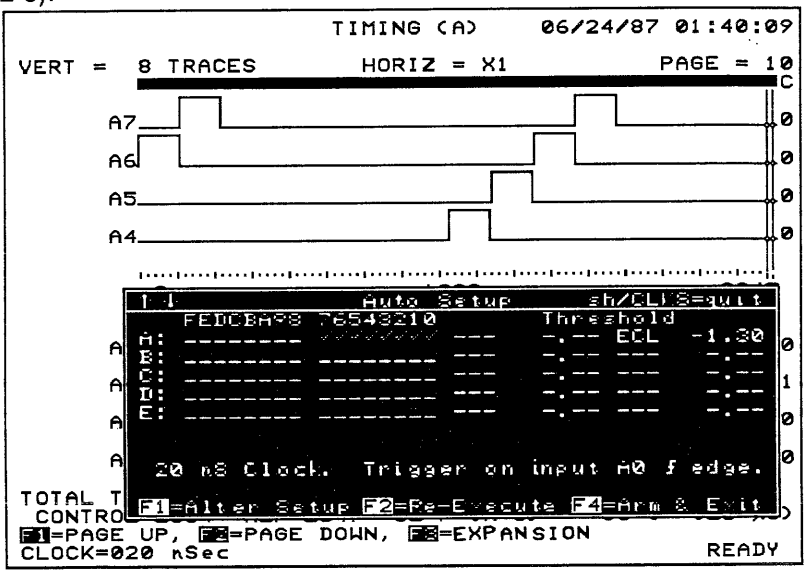


Figure 2-3. Auto Setup Screen

View Timing

Only active inputs are shown on the ***Timing screen***. If less than 16 inputs are active, a vertical expansion of 4 or 8 is used for better viewing. The ***Auto Setup screen*** displays the timing data and shows the setup parameters that generated the timing data.

View More Timing

Press the **UP** and **DOWN** field keys to move the window to the top and bottom of the ***Timing screen***.

Make Changes

Press the **F1** key to manually alter the Auto Setup results by entering the ***Alter Setup Window***.

Trigger On A0

Press the **DOWN FIELD** key four times to select trigger input.

Press the **F1** key to start editing.

Press **A** then **0** to trigger on channel A0.

Press the **F4** key to save the changes.

20 ns Clock

Press the **Field** key to select the clock rate.

Press the **F1** key to edit the clock rate.

Press the **PREVIOUS** key to select 20 ns, or enter this value directly and then press the **F4** key.

ALTER SETUP

The ***Alter Setup window*** (Figure 2-4) changes the active inputs, clock rates, thresholds, trigger input, or trigger rising/falling edge. Changes are made by using the **FIELD** keys to highlight an option, pressing the **F1** key to select the option. Use combinations of the **FIELD** keys, and press F1 to Edit. Use the **NEXT/PREV** and **DATA** keys to change setup information. Save all changes by pressing the **F4** key. Press the **F4** key a second time to arm and exit.

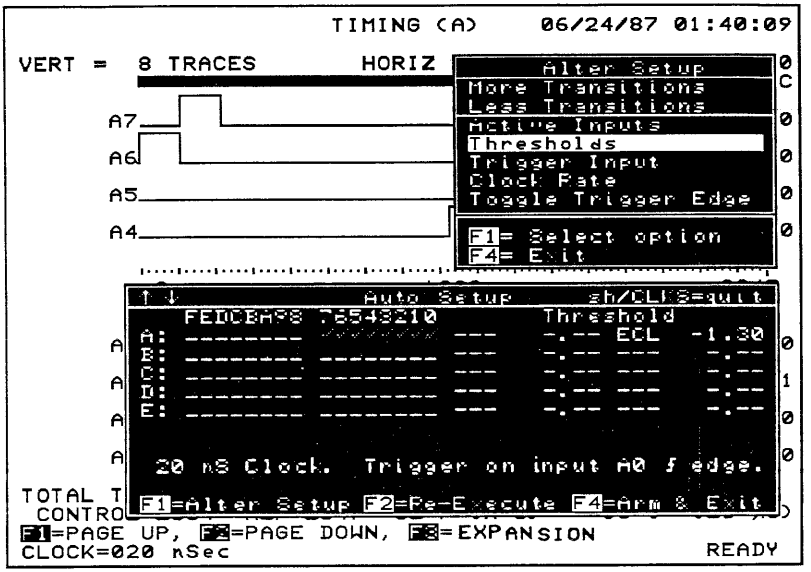


Figure 2-4. Alter Setup Window

Exit - Press F4 Press the **F4** key to ARM the K450B and exit the ***Auto Setup screen*** to the ***Timing screen.*** To exit without recording, press the **SHIFT** key, then the **CLOCK** or **FORMAT** keys.

The Timing Screen now shows a detailed timing diagram!

TRACE CONTROL TO PRECISE TIMING DIAGRAM

This section introduces trace control as the user continues to work with the Probe Test signals and several standard screens.

Press TRACE CONTROL Press the **TRACE CONTROL** key to enter the ***Trace Control screen.***

Setup The ***Trace Control screen*** should have the setup shown below if all previous steps have been followed.

0: TRACE UNTIL SAMPLE = A0 is 0

1: TRACE UNTIL SAMPLE = A0 is 1

2: TRACE FOR 2046 CLOCKS

3: STOP

Pattern Definitions:
A0 is 0 X
A0 is 1 X

Explanation

Level 1	(Step 0):	Start recording everything and when a sample (labeled "A0 is 0") has a low (0) for input channel A0 then move on to the next step.
Level 2	(Step 1):	Keep recording everything and when a sample (labeled "A0 is 1") has a high(1) for input channel A0 then move on to the next step.
Level 3	(Step 2):	Keep recording everything, but count each sample from here on and when 2046 samples have been taken move on to the next step.
	(Step 3):	Stop

Note

The K450B has a *memory that is 2048 samples* long. Early recorded samples are replaced by the most recent, keeping the last recorded 2048 for display.

In the above example the user performs the following by starting at the last recording step:

Count 2046 samples after A0 is 1
Count 1 Sample when A0 is 1

Count a sample where A0 is 0 (2048 samples number 2047 to 0).

It is likely that a number of samples before A0 is 0 were overwritten.

Center at 1024

Use the **FIELD** and **DATA** keys to change the 2046 clocks to 1024 (1/2 the memory). Look at what happens between the time the K450B is ARMed and it finds the trigger sequence.

Press ARM MODE

Press the **ARM MODE** key (lower left not ARM in upper right).

Select AUTO REARM

Press the **NEXT** key to automatically rearm the K450B. This allows the K450B to continuously update the display.

Press TIMING Press the **TIMING** key to watch the automatically updated ***Timing screen***.

Press ARM Press the **ARM** key (ARM in upper right) to start the recording sequence.

Note The *K450B flushes the record memory with lows (0)* before each pass.

Check Status The status of the K450B is displayed in the lower right corner of the screen. Three status states are:

BUSY	Flush the memory and ARM K450B
EOR	End Of Recording set up display
READY	Finished, updated and ready again

Watch... The A0 channel shows a positive going pulse at the center of the screen, but *extra samples* in front of the pulse will come and go depending on when the ARM cycle starts relative to the signal being recorded.

Press STOP Pressing the **STOP** key is not necessary ,but the screen is more responsive if the unit is not trying to continuously update the timing display.

Eliminate Extra Samples Press the **TRACE CONTROL** key and use the **FIELD** and **NEXT/PREVIOUS** keys to create the following screen:

0: WAIT UNTIL SAMPLE = A0 is 0

1. TRACE IF... SAMPLE = A0 is 1

   ADVANCE IF SAMPLE = A0 is 1

2: TRACE FOR 1024 CLOCKS

3: STOP

Pattern Definitions:

A0 is 0	X☒
A0 is 1	X☒

Explanation

	Step 0:	Wait without recording anything and when a sample (labeled "A0 is 0") has a low (0) for input channel A0 then move on to the next step.
	Step 1:	record only when a sample (labeled " A0 is 1") has a high(1) for input channel A0, also move on to the next step.
	Step 2:	Record everything, but count each sample from here on and when 1024 samples have been taken move on to the next step.
	Step 3:	Stop
TIMING/ARM	Press the **TIMING** and **ARM** keys for a clean display.	
Press STOP	Press the **STOP** key to freeze the display.	
Enter TRACE Pattern	Press the **TRACE CONTROL** and **F1** keys to enter the Pattern definition field. Press the **RIGHT FIELD** key to move from the label field into the pattern field.	
EDIT TRIGGER Pattern Bit 3	Press the **RIGHT FIELD** key to move to the least significant hex digit, the one on the right. Press the EDIT key and note that the hex character is expanded binary, downward with the most significant bit on top.	
Pattern 1XXX	Press the **FIELD**, **1**, and **Don't Care (X)** keys to select channel 3 high as the trigger signal of interest. Press the **EDIT** key to leave the Edit mode.	
TIMING/ARM	Press **TIMING** and **ARM** keys for a display triggered on channel 3.	
Press STOP	Press the **STOP** key to freeze the display.	

EXPLORING THE TIMING DISPLAY

This section explains cursor movement and timing relationships.

CONTROL Cursor — Press the **CONTROL Cursor** key to select the cursor. Press the **FIELD** keys to move this cursor

Cursor at 1022 — Use the **FIELD** keys to move this cursor and read the C value at the bottom of the screen until it is 1022. The right column of the display has a readout of the signal levels at the current cursor position and a C to indicate that the **CONTROL Cursor** is active.

REF Cursor — Press the **REFERENCE Cursor** key to select the cursor. Press the **FIELD** keys to move this cursor .

Set Cursor at 1070 — Press the **SHIFT**, **REFERENCE** and **DATA** keys 1,0,7,0 to set this cursor and read the R value at the bottom of the screen is 1070. Press the **REFERENCE** key again to leave Edit mode. The right column of the display contains a readout of the signal levels at the current cursor position and a R to indicate that the **REFERENCE** Cursor is active.

Get Pulse Width — Move the **REFERENCE** and **CONTROL** cursors to position them on edges. Read the difference R-C at the bottom of the screen in number of samples and time in nanoseconds.

Horizontal Expand -F3 — Press the **F3** soft key and watch the display expand 12x with the **CONTROL** Cursor at the very leftmost sample. Press it several more times and note the 24x and 48x modes as well as the intensified bar at the top of the screen. The bar represents the portion of the entire memory currently being displayed. *Leave at 1x* for the next section.

COMPARE A RECORDING WITH A REFERENCE RECORDING

This section explains how to use the Reference memory (B) to check a recording relative to a previous recording.

Press A->B Press the **A->B** key to move the Current recording (A) to the Reference (B) memory.

Press ARM Press the **ARM** key to view the current recording and enter AUTO REARM mode.

Press COMPARE Press the **COMPARE** key to view the current recording and the Reference (dotted line) recording. A line near the bottom of the display indicates the first sample number that does not exactly match.

Move Probe To Top TEST Move the probe from the lower rear test socket to the upper test socket. There now is a difference between the current and the Reference (dotted) recording.

STOP Stop the rearm cycle

Note It is possible to Edit the B Memory, including don't cares on a bit by bit ,sample by sample basis, put tolerances of ± N samples on each edge, save to disk on compare results and other compare and search items described in chapter 3.

SYNCHRONOUS SAMPLING USING AN EXTERNAL CLOCK

This section describes the External Clock, Thresholds, and Formats.

View DATA Enter the ***Data screen*** by pressing the **DATA** key . The information displayed is redundant since the sample rate is approximately 50 times as fast as the test signals are changing .

FORMAT Enter the ***Format screen*** by pressing the **FORMAT** key . Threshold information is on this screen.

ECL-Clocks Enter the Threshold Section by pressing the **F1** key and then press the **FIELD** keys and the **NEXT** key to change the Clocks to ECL -1.30 Threshold. The test clocks and data signals are 0 to -5 volt signals so -1.3 is a good threshold for both.

CLOCKS - EXTERNAL AJ

Enter the Clock screen with the **CLOCK** key. Press the **FIELD** keys to move to internal and the **NEXT** key to toggle to external. Verify that AJ is the only entry in the equation. If other clock information exists use the **FIELD** keys and **NEXT** key to select:

(__*__*AJ)+(__+__+__).

ARM

Start the recording cycle with External Clocks.

View DATA

Enter the ***Data screen*** by pressing the **DATA** key . The information displayed is compressed since the sample rate is exactly as fast as the test signals are changing . The Hex format is not ideal for viewing this signal stream.

FORMAT

Enter the ***Format screen*** by pressing the **FORMAT** key . This screen must be modified in order to display the data in a binary Radix.

Specify Binary

Enter the Section field by pressing the **DOWN** key. Clear the Section field by pressing the **SHIFT** and then the **EDIT** keys.

Enter eight channels by pressing the following keys:

A, 7, RIGHT FIELD
A, 6, RIGHT FIELD
. . .
. . .
. . .
A, 0, RIGHT FIELD

View DATA

Press the ***Data screen***. The binary format makes it easy to check the walking 1 pattern. Search the data for a condition where all the signals are 0.

EDIT

Press the **EDIT** key. Press the **FIELD** and **0**, keys to enter a search word of 0 00000000. Press the **EDIT** key again to leave the Edit mode.

SEARCH

Press the **SEARCH** key and the K450B flags occurrences of the Search pattern and summarizes them on the status line.

USING THE DISK STORAGE SYSTEM

The Disk Storage System (DSS) consists of a single 5 1/4-inch floppy disk (Drive A) installed in the top cover of the logic analyzer. The system uses dual-sided, double-density floppy diskettes and a Disk Operating System (DOS) with CPM-86 compatible format.

The DSS provides 328K bytes of storage capacity which furnishes space for approximately 40 setup files, or 10 data files, or 5 combined setup and data files. A maximum of 64 filenames can be stored in any disk directory including the system file. Perform the following steps:

OPEN DOOR Press down on the front edge of the disk access door to release door latch.

INSERT DISK (SYSTEM) Gently insert the system floppy diskette into the drive with disk slot toward the rear of unit and the label up. Lock the disk in place with drive latch handle. To avoid damage to the diskette, always remove diskette from drive prior to turning the logic analyzer On or Off.

PRESS I/O then 1 Press the **I/O** key. The I/O menu appears at the bottom of the screen. Press the **1** key.

LOADING Observe the red LED on the disk drive illuminates approximately 5 seconds while software is loaded into the logic analyzer RAM.

The following messages are briefly displayed at the bottom of the screen during the loading:

```
K450B DOS BOOT, Version X.X
BOOT COMPLETE
K450B DOS Loader, Version X.X
```

SAVE Cycle through the command choices using the **NEXT/PREVIOUS** keys to select the **SAVE** command or press the corresponding quick key to make the selection. **Quick** key choices are:

Key	Description	Key	Description
0	Save	6	Unlock
1	Recall	7	Directory
2	Delete	8	Format
3	Copy	9	Reboot
4	Rename	A	Sysgen

Edit Option Setup M Press the **RIGHT FIELD** key to move the cursor to the option field. Press the **EDIT** key to select Edit Mode. Use the **NEXT/PREVIOUS** keys to scroll through options until Setup M is displayed.

Drive A: Press the **RIGHT FIELD** key to move the cursor to the Disk Drive select and leave it on A . Dual disk systems have drive B .

Label MINE Press the **RIGHT FIELD** key to move the cursor to the File label field and enter:

SHIFT 5	(M)
SHIFT 2	(I)
SHIFT 6	(N)
E	(E)
SHIFT X	( )
SHIFT X	( )

Version -01 Press the **RIGHT FIELD** key to move the cursor to the Version field and enter 0 1 .

Execute F4 Press the **F4** key to save the current machine setup to Drive A in a file called MINE version 01 which has the extension SM to allow easy recall that this file contains Setup M.

File extensions are:

SM (0)	Setup M	Current Machine setup and timing-display labels
SA (1)	Setup A	Memory A setup and timing-display labels
SB (2)	Setup B	Reference memory B setup and timing-display labels
MA (3)	Memory A	Last recorded data and active trace level for each sample
MB (4)	Memory B	Memory B and Don't Care memory recorded data and active trace level for each sample
BA (5)	MA & SA	Memory A setup and recorded data
BB (6)	MB & SB	Memory B setup and recorded data
xxx (7)	Utility	Currently loaded disassembler or other executable file. A valid executable file must be in memory

Default Setup Press the **SHIFT, ARM MODE, F1** key sequence as necessary to destroy the current setup and load in the Factory Set Default Values

Press TRACE CONTROL Press the **TRACE CONTROL** key to view the current machine default setup.

Recall MINE Press the **I/O** and **1** key to return to the Disk Operating System. Use the **Next** key to scroll to RECALL. Move right and down to scroll to Setup M which is MINE -01.SM. Press **F4** to execute.

Press TRACE CONTROL Press the **TRACE CTL** key to view the current machine setup.

This concludes Getting Started. See Chapter 3 for additional information on using all display screens and options.

Chapter 3

OPERATION

INTRODUCTION

This chapter describes the operation of the various screens in the K450B Logic Analyzer.

OVERVIEW OF SCREEN APPLICATONS

The K450B is divided into Setup and Display screens. The ***Setup screens*** include the following:

Screen	Description
Format	Data format, thresholds and polarity selections.
Clocks	Clock and input mode selections
Trace Control	Trace Control setup selections.
Arm Mode	Arm Cycle control and Auto Compare selections.
Date	Set Date and Time, Error beep.
I/O	D09, GPIB and RS-232-C selections.
Review	Displays the current Trace Control setup low-level language format.

Display screens review recorded data and include the following:

Screen	Description
Data	Displays acquired data in data format selected on ***Format screen.***
Timing	Displays data waveforms..
Graph	Displays graph of acquired data versus sample number.
Configuration	Displays hardware configuration of K450B.

CONFIGURATION SCREEN

Upon powering up the K450B, the control firmware performs a short series of diagnostic tests on the microprocessor RAM and ROM, the keyboard, the CMOS RAM and system voltages. When the diagnostic tests are successfully completed, the ***Configuration screen*** (Figure 3-1) is displayed. This screen contains a message indicating successful completion of the diagnostics, a list of all options installed in the unit, the current software version number and several common display elements. If a failure is detected by the diagnostic, an error message is displayed and testing halted. Press the **NEXT** key to override the error condition and continue testing.

The configuration screen may also be entered from any screen by pressing the **SHIFT** then **ARM MODE** keys.

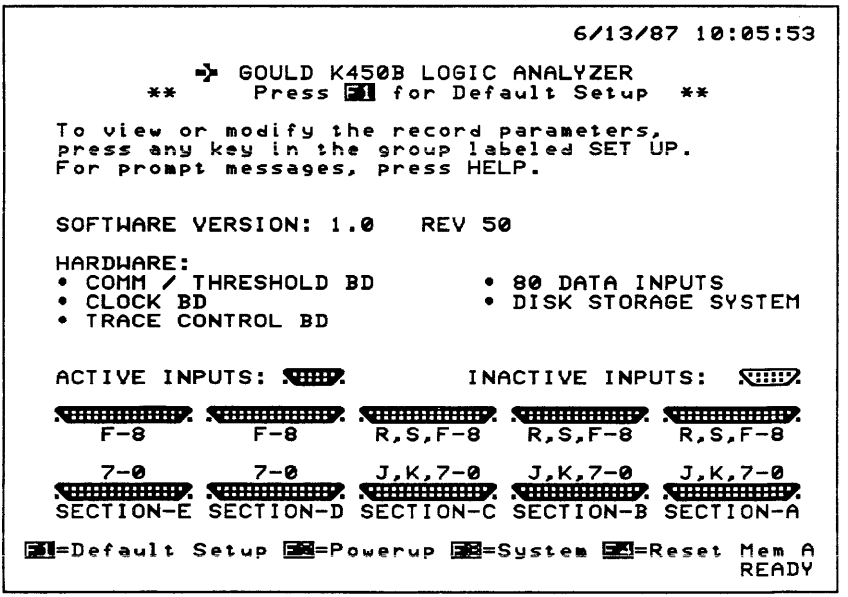


Figure 3-1. Configuration Screen

The ***Configuration screen*** allows the user to perform the following functions:

Key	Description
F1	Selects the default setup and display values. This resets the system to a known state. The current Date, Time and I/O configuration are not affected.
F2	Perform power-up diagnostic tests as if the power had been turned off and then on again.
F3	Displays the ***Date/Time Setup screen.***
F4	Sets Memory A to all zeros. Level A data are set to all F's. The Date and Time stamp indicates Reset Data. **S** Performs the identical action as the **F1** key except the I/O configuration is also set to a known state.

DATE AND TIME SETUP DISPLAY

The ***Date/Time Setup screen*** (Figure 3-2) is only accessed from the ***Configuration screen*** by pressing the **F3** key.

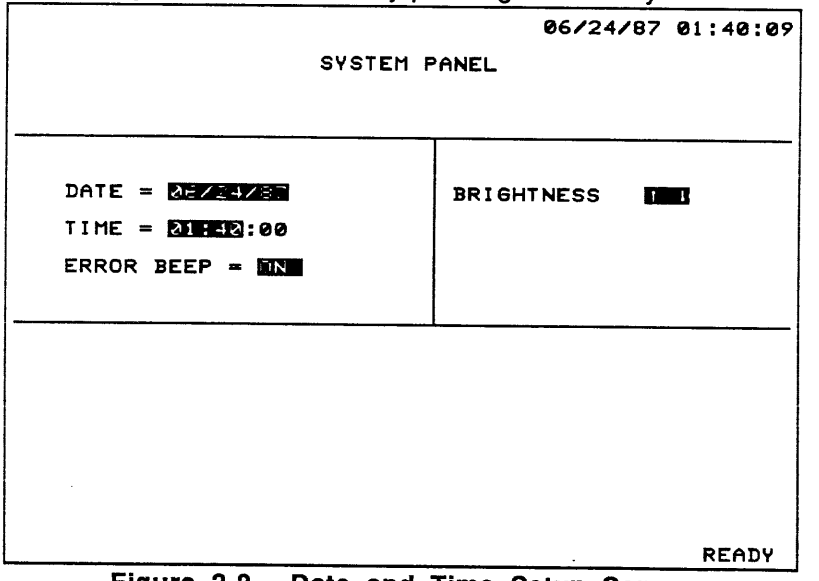


Figure 3-2. Date and Time Setup Screen

When the screen is first entered, the current date and time are set in the Date and Time fields, located in the upper-left portion of the screen. The blinking cursor appears in the leftmost position of the Date field.

The date displayed is altered using the numeric keys. The new date is evaluated when either the user leaves the date field or the last digit of the date field is entered. If the new date is valid, the system clock is set with the new date.

The current time is altered using the numeric keys. The digits representing seconds do not appear in reverse video and cannot be altered. The new time is evaluated when the user leaves the time field or the last digit of the time field is entered. If the new time is valid, the system clock is set with the new time and the seconds are set to zero. The Error Beep field allows the user to either disable (0) or enable (1) the Beep tone when errors occur.

The brightness of the display may be increased or decreased by holding the up or down **FIELD** keys while the BRIGHTNESS field is active.

SETUP OPERATION

Setup Memories

Three setup memories,M, A, and B, are associated with the Format, Clocks, Trace Control, and Arm Mode Screens. Setup Memory M contains the setup parameters used during the next acquisition cycle as shown below . Setup memory A contains the setup parameters used during the most recent acquisition cycle. Setup memory B is a user-selected copy of Setup memory A, which may be used as a reference.

Acquisition Cycle Parameters

SETUP M (selected by user)	take an -------> acquisition	SETUP A and DATA A	press -------> A -->B key	SETUP B and DATA B

Data Memories

Two Data Memories, A and B, are associated with the Data, Timing and Graph Screens. These memories contain the data acquired using Setup parameters from Setup A and Setup B.

AUTO SETUP FEATURE

The Auto Setup is a feature that identifies all active inputs and configures the Logic Analyzer to record and display circuit activity. Pressing the SHIFT key and then the CLOCK key executes the Auto Setup (Figure 3-3), reducing setup time and simplifying operation.

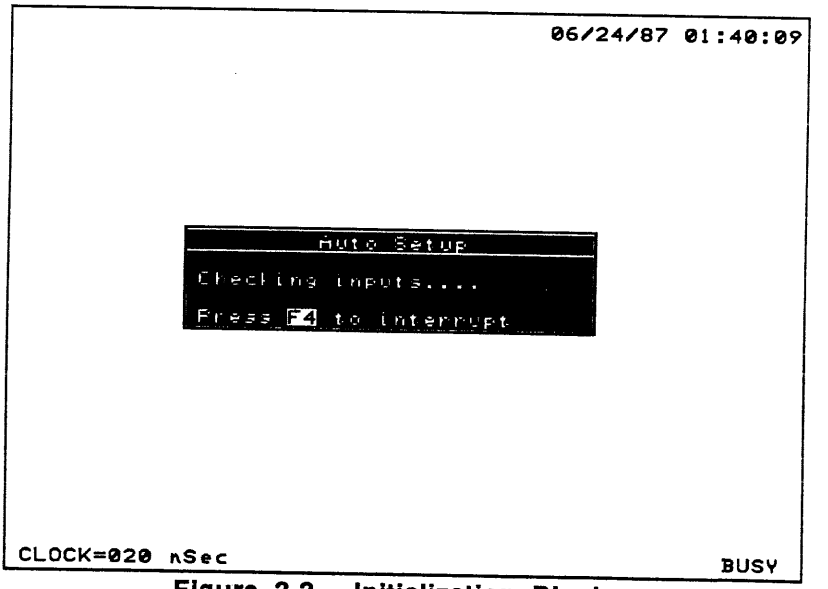


Figure 3-3. Initialization Display

AUTO SETUP EXECUTION

To execute the Auto Setup, perform the following steps:

1. Connect any number of probes or channels to the Logic Analyzer and the unit under test. Each probe is connected only to signals of the same threshold. Do not mix TTL, ECL, or variable threshold signals on the same probe.

2. Press the SHIFT key and then the CLOCK key on the front panel. The Auto Setup Initialization message window is displayed (See Figure 3-3). The Auto Setup takes a series of recordings and performs the following operations:

   -Determines which probes are installed. Identifies probes with inputs attached to the circuit.

   -Determines the threshold for each probe.

   -Configures the Format screen in binary or hexadecimal format. Eliminates unused channels on the Format and Timing.

   -Selects a trigger input and adjusts the internal clock to display activity on that input.

   -Selects Trace Control screen parameters to trigger on the rising edge of the trigger input and fill the display. Takes a final recording and displays the results on the Timing screen.

   -Only active inputs are shown on the Timing screen. If less than 16 inputs are active, a vertical expansion of 4 or 8 is used for better viewing.

   -Shows the results of the Auto Setup in a display window, super-imposed on the Timing screen.

NOTE: The F4 key may be pressed any time during the Auto Setup sequence to cancel the Auto Setup function.

3. Press the F1 key to manually alter the Auto Setup results and (or)press the F2 key to re-execute the Auto Setup function.

4. Press the F4 key to ARM the Logic Analyzer and exit to the Timing screen. To exit without recording, press the SHIFT key, then the format or clock key.

AUTO SETUP WINDOW

After the Auto Setup determination sequence, the Auto Setup Window (Figure 3-4) shows the results of the determination. Inputs are grouped in probe sections, a check indicates an active input and an underline indicates an inactive input. A series of dashes (- - - - - - -) for a probe section threshold indicates either no probe is attached or that Auto Setup was unable to assign a threshold to that probe.

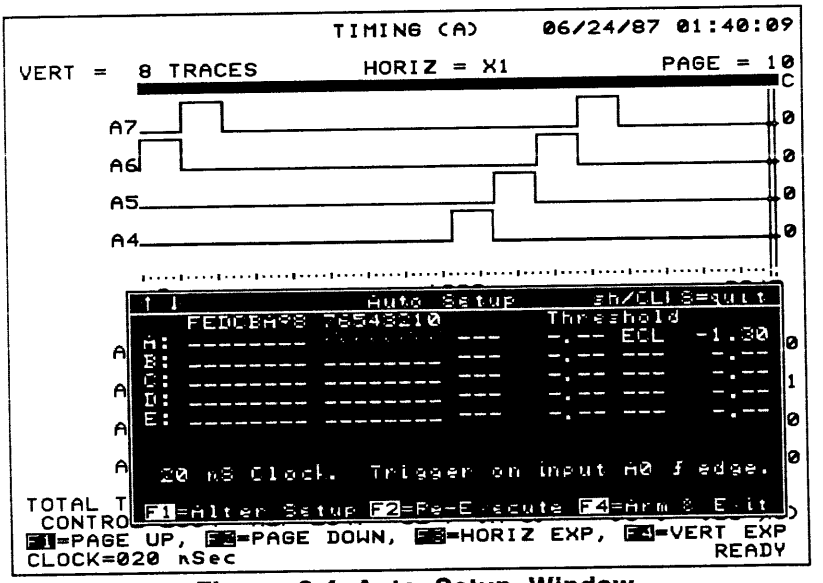


Figure 3-4 Auto Setup Window

ALTER SETUP WINDOW

The Alter Setup Window (figure 3-5) allows the user to change the number of transactions displayed, as well as five other setup parameters.

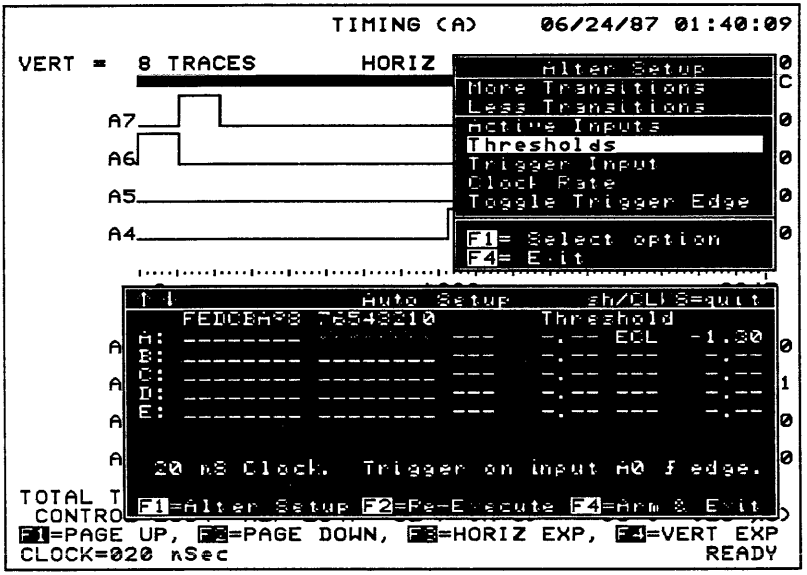


Figure 3-5 Alter Setup Window

The Alter Setup Window (Figure 3-6) changes the active inputs, clock rates, thresholds, trigger input, or trigger rising/falling edge. Changes are made by using the CURSOR ARROW keys to highlight an option, pressing the F1 key to select the option, and then using combinations of the CURSOR ARROW keys. NEXT/PREV keys and the F1 to F4 keys.

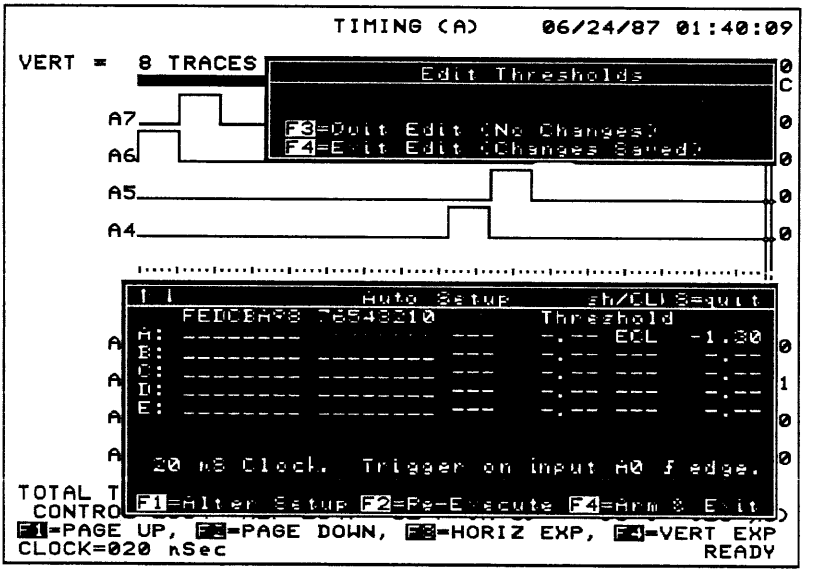


Figure 3-6 Edit Threshold Window

QUIK SETUP WINDOW

The Quik Setup Screen (Figure 3-7) displays the current parameters for the Logic Analyzer and allows for easy alterations via the Alter Setup Window

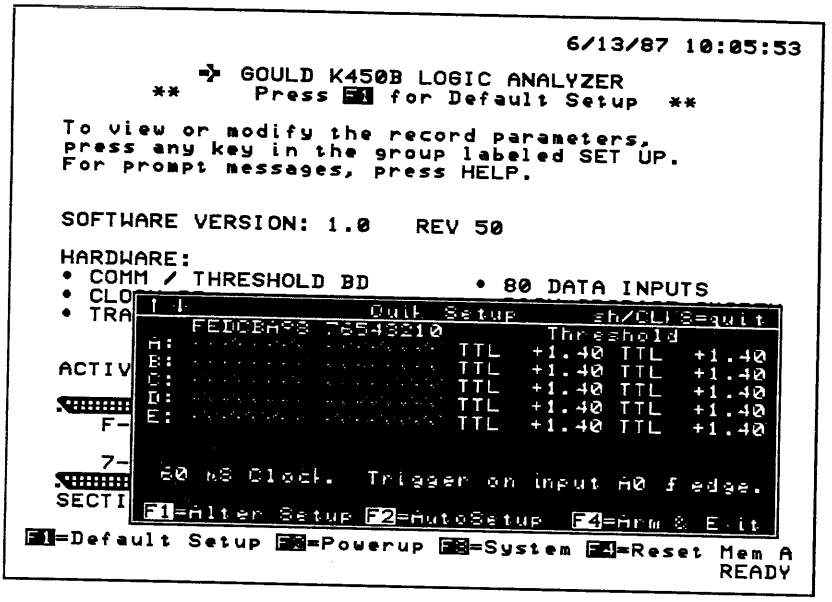


Figure 3-7 Quik Setup Screen

The Quik Setup Window duplicates the Auto Setup Window, eliminates routines, retrieves and displays the current status of the Logic Analyzer. Press the SHIFT key and then the FORMAT key to display the Quik Setup Window.

The Quik Setup Window displays the current setup of the K450B Logic Analyzer in the same form as the Auto Setup Window, without executing the Auto Setup determination phase. The user may then alter the setup for a specific situation using the same procedures as described for the alter setup window.

NOTE:

The Auto Setup and Quik Setup Windows force the clock setup of the Logic Analyzer to STANDARD INTERNAL mode. The arm mode is also forced to AFTER ONE PASS, STOP.

Both utilities are aborted without changing prior Logic Analyzer setup by pressing the SHIFT key and then the Clock Key, when the Auto or Quik Setup Window is displayed. Prior setup data is restored if the F4 key is pressed to interrupt the Auto Setup determination sequence.

FORMAT SET UP

The ***Format Set Up screen*** (Figure 3-8) allows the user to specify the display format used in the ***Data Display screen***.

The ***Format Set Up screen*** also allows the user to assign Bus Input Groupings that can be displayed in Bus Format on the ***Timing Display screen***. See Appendix D, Bus Timing Display Feature.

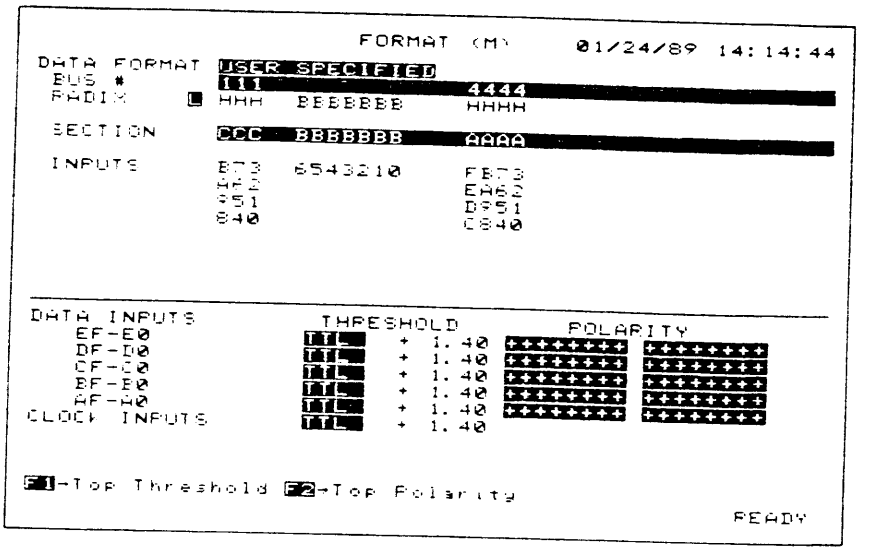


Figure 3-8. Format Screen

Data Format Fields

The ***Format Set Up screen*** is used to specify the display format in the ***Data Display screen***, set the order of channels in the ***Graph Display screen*** and set the radix used for the patterns in the ***Trace Control Set Up screen***. The ***Format screen*** is accessed by pressing the **FORMAT Set Up** key. The field adjacent to the words Data Format is the active field. pressing the **NEXT** or **PREV** keys, to scroll through the format choices. The user may also make choices using the quick-keys as listed below.

Key	Description
0	Hexadecimal - Fixed format
1	Octal - Fixed format
2	Binary - Fixed Format Displays 32 inputs but may be scrolled right/left to view all inputs
3	User Specified (Binary, Hexadecimal, Octal, ASCII, EBCDIC): 40 Entries Long Total
4	Disassembler (Accessory)

For Hexadecimal, Octal, and Binary formats, the available inputs are grouped into columns according to the format selected. In Hexadecimal format, columns are represented by four inputs. in Binary format, each column is represented by one input, in Octal format, columns are represented by a combination of one input and five groups of three inputs.

When any of the fixed formats is selected, the Trace level in which each data sample occurred is shown in the ***Data Display screen*** as denoted by the L to the right of the Radix label. If a fixed format is specified, unused inputs are automatically purged if the 200 MHz clock rate is selected.

When User Specified format is selected, the user can select the format for the ***Data screen*** by specifying the Level Display choice, and the Section and Inputs used for each column.The User Specified format can be loaded with one of the fixed formats by moving the active cursor to the Data Format field, selecting the desired fixed format, and pressing key **F4**. If a disassembler is loaded, the User Specified format can be loaded following this same procedure. Once the Fixed Format is loaded, the User Specified Format is selected and the display modified.

Radix and Level Displays

The Radix Character definitions are as follows:

Table 3-1. Radix Definitions

# Input Chars	Radix Line Char	Data Display Radix
0		
1	B	BINARY
2	Q	BASE FOUR
3	O	OCTAL
4	H	HEX
5	X	Base 32, values 0-15 are displayed as 0-F 16-31 are displayed as G-V
6	A	ASCII 6
7	A	ASCII 7
8	E	EBCDIC

The Level Display field, immediately adjacent to the Radix label, allows the user to specify if the Trace level in which each data sample occurred is shown in the ***Data Display screen.*** The quick-key selections in the Level Display are as follows:

Key	Description
0	No
1	Yes.

Section and Inputs Fields

The Section and Inputs fields allow the user to specify, on an individual basis, the inputs to be used for each column of the ***Data Display screen.*** When User Specified format is selected, the entire Section line appears in reverse video. The Inputs field does not appear in reverse video, although all selections in the Inputs field can be altered.

Section Field

When the Section field is selected, the user may select the desired input section for each column by using the following keys: NEXT, PREV, A, B, C, D, E and SPACE (to specify a blank column). These characters, A through E for 80-input configurations, A and B for 32-input configurations, etc., correspond to the input connector pairs (section) of the connector panel. Each column of data in the ***Data Display screen*** can only use inputs from a section of 16 inputs; for example, A (F-0). Pressing the **SHIFT**, **CLEAR**, **DELETE** and **INSERT** keys while in the Section field results in the following conditions:

Key	Description
SHIFT CLEAR	Deletes all columns below and to the right of the cursor.
SHIFT DEL(ETE)	Deletes the column the cursor is on.
INS (ERT)	Inserts a blank column at the cursor.
X	Removes the contents of a column but not the column itself.

Input Field

When the Input field is selected, the user may select the desired inputs for the specified section by using the **FIELD** keys and **NEXT**, **PREV**, **0-F**, and **SPACE** (to enter a blank). Up to eight inputs may be specified for each nonblank Section column.

When the user enters the desired section character into the section line, the active field relocates to the uppermost of eight vertical character fields. The order of bits is determined by the relative position of the input in its column. The uppermost input is the most significant bit, and the lowermost input is the least significant bit. Starting with a blank input column, as an entry between F and 0 is made in a field, the active field drops to the next input character location. Simultaneously, the radix character directly above changes to reflect the number of inputs in use in this column.

When inserting entries into an input lines column, blanks may be entered anywhere in the column, but the radix adjusts to the number of actual characters present in the column. When all desired entries in a column are completed, use of the right or left arrows of the field keys moves the active field to an adjacent column and up to the section line.

Threshold Field

The lower half of the Format screen is dedicated to the selection of thresholds for clock inputs and each section of sixteen inputs, (i.e. by probe pairs) as well as the polarity for each data input.

The choices available for the Threshold field are as follows:

Key	Description
0	TTL
1	ECL
2	VARA - variable
3	VARB - variable

The adjacent sign and threshold voltage values of +1.4 for TTL and -1.3 for ECL are fixed values. When VARA or VARB is selected, note that the sign and voltage values themselves become fields. For an active sign field, selections available are +, quick-key (1), and -, quick-key (0). For an active voltage field, numeric keyboard entries from 000 to 999 may be made giving an effective range of -9.99V to +9.99V. The keyboard entries appear as they are made, in the voltage field, shifting from right to left in a manner similar to that in a common hand-held calculator. Any change in polarity or voltage values causes a like change in all polarity or voltage fields for the same threshold, VARA or VARB. Thresholds are updated to the probe only when the **ARM** key is pressed.

Polarity Field

To the right of the threshold values are the selection fields for assigning the data display polarity for each individual input. The Quick-Key values are as follows:

Key	Description
1	+
0	-

If an input is specified as negative, the value specified is inverted prior to presentation in the ***Data Display screen***, the ***Graph Display screen*** and the value column at the right end of the ***Timing Display screen***. The ***Timing Display screen*** traces always show a signal more positive than threshold as a high and a signal more negative as a low regardless of the polarity selected. Trace control patterns always follow the timing to indicate below threshold = 0 regardless of polarity. This condition is also true of Trace Pattern Definitions.

The polarity values are associated with M, A and B data memories. Once a recording has been made, the polarity values cannot be changed. If the polarity differs in memory A and memory B, the data is compared according to its polarity, but the timing diagram presents the above and below threshold condition as it was recorded.

It is possible to have identical timing diagrams in memory A and B and still have a total miscomparison, because one recording occurs with a + and the other with a - polarity.

CLOCKS SET UP

Upon accessing the ***Clock Setup screen*** (Figure 3-9), the Clock Mode field is active and the following choices are available:

Key	Description
0	Standard
1	Advanced

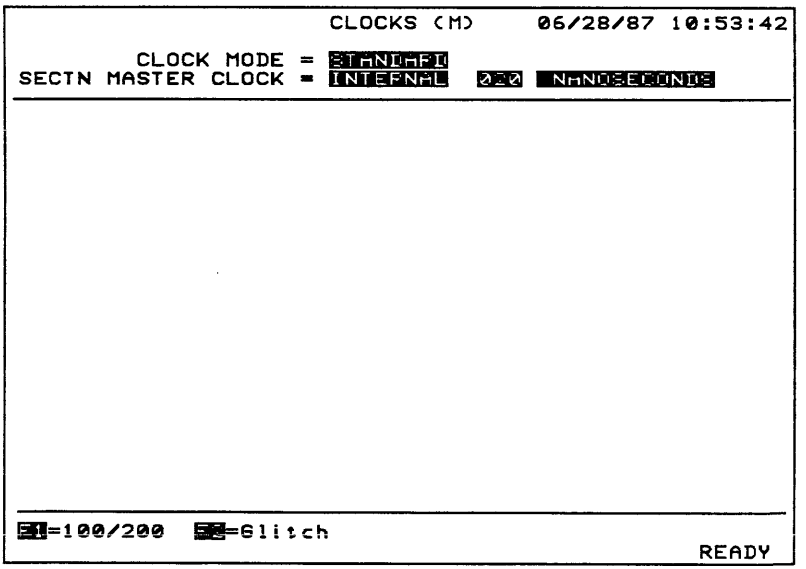


Figure 3-9. Clock Set Up Screen

Clock Mode Field

If Standard mode is selected, all inputs are sampled at the Master Clock rate. In Advanced mode, different clocking schemes can be selected for each section of inputs.

Master Clock Fields

In the Master Clock field, the clock source may be selected as follows.

Key	Description
0	Internal
1	External

Internal Master Clock

If Internal is selected (Figure 3-10), the Clock Interval and Time Unit may be specified. Valid internal clock periods range from 20 ns to 100 milliseconds, in a one through ten sequence. The 100 and 200MHz (10ns and 5ns) recording periods are discussed in Advanced Clocking.

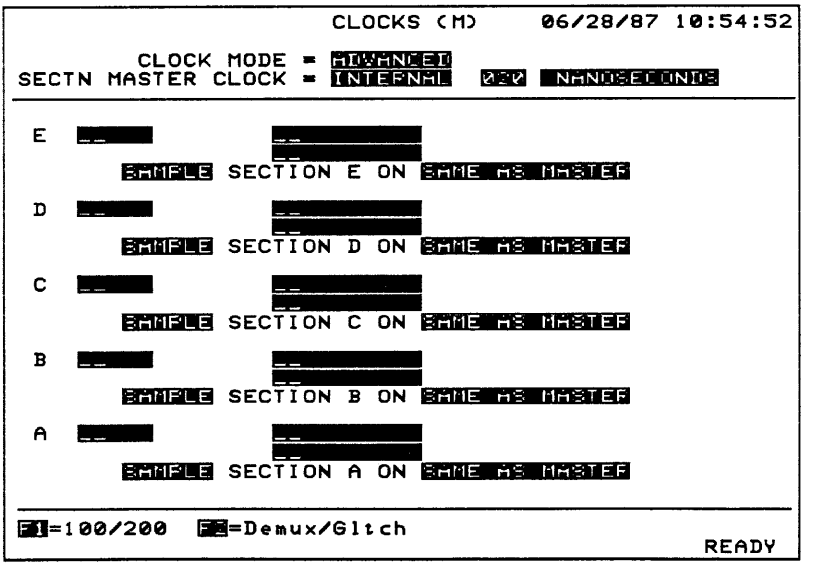


Figure 3-10. Clock Screen With Internal Master Clock

The Clock Interval value can be entered using any combination of the 0 through 9 keys and the **NEXT/PREV** keys. When the **NEXT/PREV** keys are used, the Clock Interval value either increments or decrements in the following sequence:

1, 2, . . ., 8, 9,
10, 20, . . ., 80, 90,
100, 200, . . ., 800, 900

The **NEXT/PREV** keys only increment or decrement through valid clock period values. The following unit choices are:

Key	Description
0	milliseconds
1	microseconds
2	ns

External Master Clock

For 48-80 input systems, the logical expressions formed by the six input fields allow the user to AND the J clock inputs in one group, OR the K clock inputs in another group, and then OR the two groups. For 32-input systems, the CJ and CK inputs are substituted with BR and BS inputs, respectively. When any of the six fields are active, the selections are as follows:

Key	Description
0	No clock input
1	Clock input, not inverted
2	Clock input, inverted

Master Clock Measurements

If the Master clock source is External and the unit is not armed when the screen is first entered, the Master Clock frequency is measured and displayed at the bottom of the screen. With the External Clock connected, and proper thresholds assigned, press the CLOCKS key to measure the Master Clock frequency.

Figure 3-11 is an example that shows the concept of setting up the Logic Analyzer to clock in data only on the trailing edge of three different control signals . This situation is commonly found in microprocessor applications. The objective is to capture data from the microprocessor data bus on the trailing edge of either the READ, WRITE OR INTERRUPT ACKNOWLEDGE control signals. This figure shows a BOOLEAN 'AND' condition of two TRUE and one inverted signal to create the desired rising edges necessary to clock the logic analyzer.

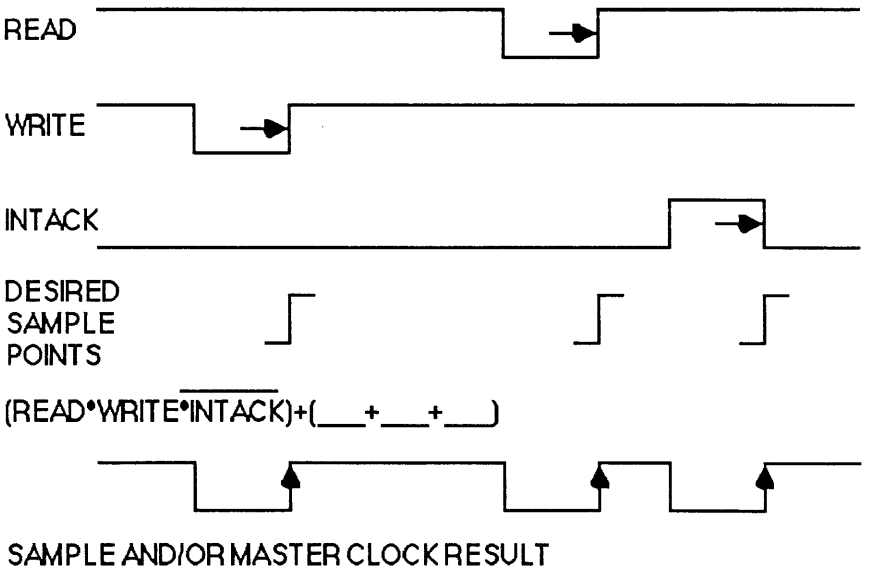


Figure 3-11 External Clock from Control Signals for a Data Bus

ADVANCED CLOCK MODE

If Advanced mode is selected, the clocking scheme for each section is specified. The active fields for each section are the Demux field, the Latch/Glitch field, the Latch Clock expression, the Store/Sample choice and the Sample Clock Expression/Period.

Two External clock inputs may be combined to form one sample clock and one Master (M) clock for 16-input systems. Four External clock inputs may be combined to form two sample clocks and one Master (M) clock for 32-input systems and 6 external clocks form three sample clocks and one Master (M) clock for 48 to 80 input systems.

Figure 3-12 shows the function of the clocks and demultiplex (Demux) in the logic analyzer. The K450B may be used to separate two time sequenced signals. This is particularly helpful when the target is a microprocessor which shares the same signal lines for address and data. The K450B is set up in the Demux Mode, which disables the upper 8 channels of each section and connects the lower 8 channels. A latch Clock is programmed to hold the address (e.g. sections A and B channels 8-F) Then the sample clock loads the held address and the data (through a transparent latch) into the sample register. The Master Clock then moves the address/data word into the Trace Control logic for recognition and possible recording.

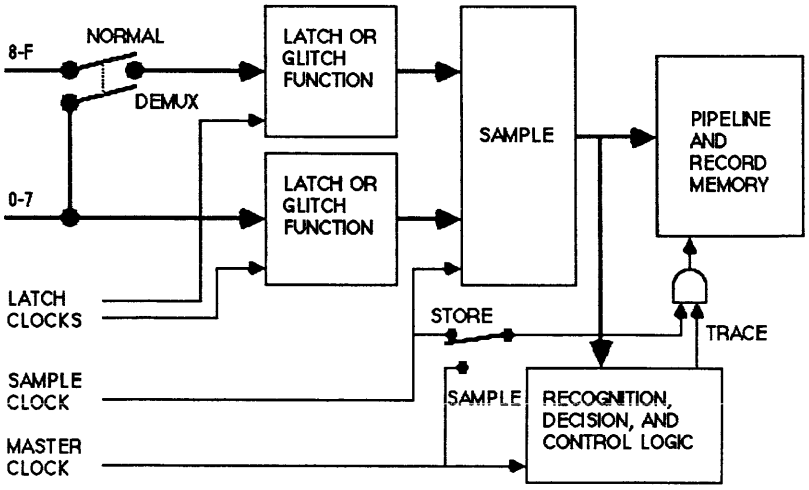


Figure 3-12. Function of Demultiplex Clocking in Advanced Mode

In the Demux field (left side), the user may select whether or not the inputs of a section are demultiplexed using the following keys:

Key	Description
0	No Demux (Inputs 7-0 and F-8 are independent.)
1	Demux (Inputs 7-0 are internally also connected to F-8.)

In the Latch/Glitch field, the following choices are available:

Key	Description
0	No latch or glitch capture
1	Latch
2	Glitch capture

If Latch is selected for either the F-8 or 7-0 inputs of a section, the Latch clock expression appears to the right of the Latch/Glitch field. The expression may appear on the first or second line of the Section, depending on which inputs have Latch selected. Note that only one expression appears for each section, corresponding to one Latch clock per sections A and D, B and E, and C.

If Glitch is selected, any pulse crossing threshold, 250mV for 5 ns or more between samples, is held as a change of state in the Latch. This even number of threshold crossings between samples is detected as a change of state at the first sample clock after the pulse.

Latch Clock

For 48-80 input systems, the logical expressions formed by the six input fields allow the user to AND the R clock inputs in one group, OR the S clock inputs in another group, and then OR the two groups. For 16 and 32-input systems, the expression has only the AR and AS inputs ORed together.

When any of the fields are active, the selections are as follows:

Key	Description
0	No clock input
1	Clock input, not inverted
2	Clock input, inverted

Sample/Store

The inputs for each section can be stored at either the Master Clock rate or Section Store Clock rate when Trace is enabled by selecting the following:

Key	Description
0	Sample
1	Store

In all cases, patterns are compared and trace decisions made at the Master Clock rate. Store moves the data into memory while trace is true at the store rate. Sample moves the sample taken just before the Master Clock into memory. The user may select to have the section inputs Stored/Sampled as follows:

Key	Description
0	INT (Internal)
1	EXT (External)
2	10 nanoseconds
3	Same as Master Clock
4	5 nanoseconds

If Internal is selected, the Internal Clock period fields appear to the right of the Sample Clock Source field. The Internal Clock period may be altered following the same procedure described in the Master Clock section. Whenever the Internal Clock period is changed, all other places where the clock is displayed on the screen are also changed simultaneously.

If External is selected, (Figure 3-13) the Clock expression may be selected following the same procedure described in the Master Clock Section. Note that sections A and D, D and E or C can have a unique sample clock.

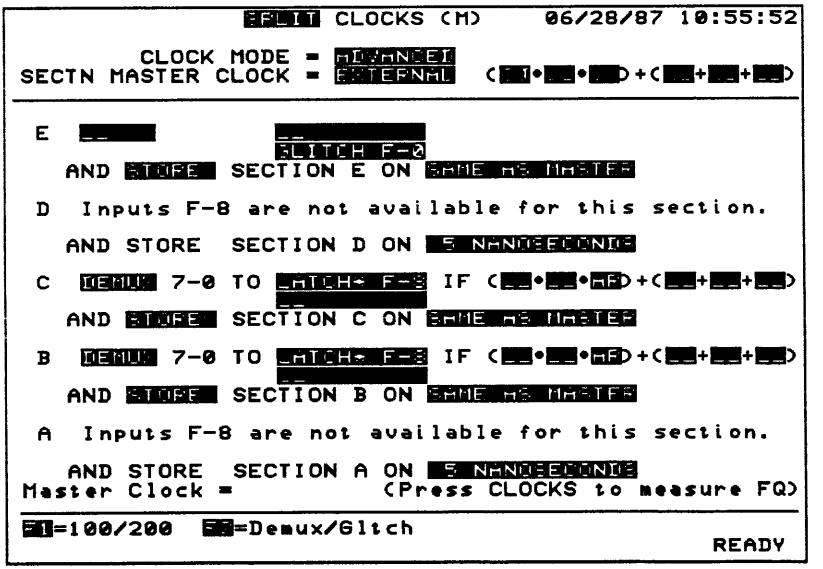


Figure 3-13. External Master Clock Screen

The user may select to record one or more sections at 200 MHZ specifying 5 ns for the section rate. When 5 ns is specified, the sample option as well as the Demux/Latch/Glitch fields for the section are not selectable. These fields therefore do not appear on the display and are replaced by the following message:

Inputs F-8 are not available for this section

Through use of keys FI through F4, the user can select 100 MHz clocking, set the Demux and Latch/Glitch fields for all sections, copy Section C selections to Section B, and copy Section B selections to Section A. The keys are:

Key	Description
F1	Changes the Clocks setup alternately to 100 MHz or 200 MHz clocking. The screen is redisplayed with the new settings.
F2	Pressing F2 in Standard Clock Mode changes the Clock Mode to Advanced, selects Glitch with no Demux for all inputs, and samples all sections at the Master Clock rate. The screen is redisplayed with the new settings.

Pressing F2 in Advanced Clock mode alters the Demux and Latch/Glitch fields for all sections. These fields can be changes with successive depressions of key F2 as follows:

Key	DEMUX	LATCH/GLITCH
1st Press	___	___ Glitch F-0
2nd Press	___	___ ___
3rd Press	Demux 7-0 to	Latch * F-8 ___7-0

Split-Timing

Split-Timing occurs whenever more than one clock rate is used for moving data into memory. The word SPLIT is briefly displayed in reverse video to the left of the CLOCKS header to inform the user that this condition is selected. Similarly, the SPLIT message appears on the associated Data, Timing and Graph display screens.

It is recommended that each section be viewed separately when split timing is used. State and timing information may be captured simultaneously, however time correlation must be reconstructed.

TRACE SET UP

When the ***Trace Set Up screen*** is accessed from an initialized state, the screen appears as shown in Figure 3-14. The large number of field choice combinations are presented in Table 3-1.

TRACE LEVELS

The K450B has sixteen levels of trace control, each of which can conditionally Trace, Stop the Recording, Advance to the Next Level or Jump to Another Level. These actions can be specified to occur always, never, when sample equals pattern or when sample does not equal pattern. The conditions can also be set to occur only before, on or after (or any combination of these actions) the time-out of the delay counter occurs. The delay counter is cleared whenever the level is entered and may be set to count either clocks (clock delay) or numbers of occurrences of a data pattern (known as events delay).

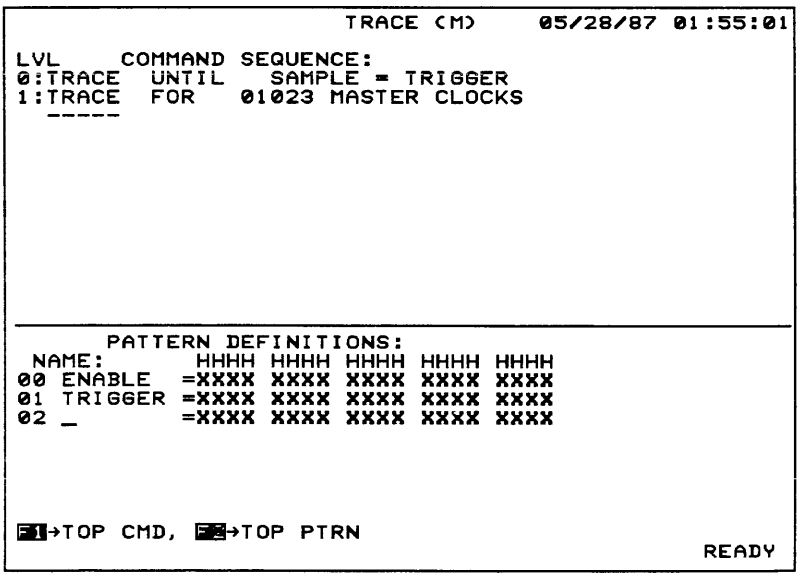


Figure 3-14. Trace Control Set Up Screen

The K450B trace control is set up from a split-screen display. The upper half of the screen allows the user to set up the trace control using high-level English-like commands. Each command is translated on entry into a low-level hardware setup, which may involve more than one hardware function. The lower half of the screen is used for defining labeled data patterns. For example, when a trace control command line specifies that an action is to be performed under conditions that the incoming data matches or fails to match a given pattern, it refers to the data pattern by label.

Set Up Trace

Thirteen lines of trace control and eight lines of pattern definitions can be displayed at one time. If more room is required, either half of the screen can be scrolled. When the active field is moved to the edge of a screen half that has more lines waiting off screen, that screen half scrolls to reveal these lines individually.

Where possible, the user is prevented from entering illegal command sequences. NEXT and PREV keys automatically skip over any choices that result in an illegal setup.

The INSERT key can be used to insert command lines. The command lines inserted are all null commands, which appear as - - - - -. The NEXT or PREV keys are used to select the desired command. The DELETE or X (Don't Care) key removes commands. If the removal of one command line results in an illegal sequence, the command lines which follow are deleted until a legal sequence is obtained. All of the deleted command lines may be restored by depressing the F3 key. Depression of any key other than F3 causes the deleted lines to be lost.

When the active field is a numeric field, the entire field blinks. The PREV or NEXT keys can be used to decrement or increment the number, or the decimal keys can be used to key in a new number.

When the active field is the pattern-name field, pressing NEXT or PREV keys select the next or previous defined name. The user may select the pattern via quick-keys, but must key in two decimal digits corresponding to the desired pattern number as shown in the pattern definitions portion of the screen.

The two main commands are WAIT And TRACE. Either is followed by a condition which specifies when to proceed to the next action. WAIT causes the instrument to wait for a given condition without recording any data.

TRACE causes the instrument to record while waiting for a condition. Table 3-1 lists the various choices available to set up the command sequences. Command format is shown in table 3-2.

Table 3-1 Trace Control Command Descriptions

Command	Description
------	Blank command line
WAIT FOR	No tracing, wait for specified delay, then advance to next level.
WAIT UNTIL	No tracing, wait until condition, then advance to next level.
WAIT - - -	No tracing, no advance selected.
TRACE FOR	Trace all, advance to next level after specified delay.
TRACE UNTIL	Trace all, advance to next level when condition true.
TRACE IF	Trace only when condition is true, no advance selected.
TRACE - - -	Trace all, no advance is selected.
OR UNTIL	Provides an alternate advance condition by setting up a Jump to the following level. When used at level F, wraps around to level 0, whereas the normal advance condition stops.
OR GO TO level IF	Attaches a Jump condition to the preceding WAIT or TRACE. If the condition is met, the K450B jumps to level 'n' on the following master clock. If the Jump condition occurs simultaneously with an advance condition, the jump takes priority.

Table 3-1 (Cont'd)

Command	Description
OR STOP IF	Attaches a Stop condition to the preceding WAIT or TRACE command. If the condition is met, the K450B stops on the following master clock. The Stop condition takes priority over either the Jump or Advance conditions.
ADVANCE IF	Available only on the line immediately following WAIT ___, TRACE ___, or TRACE IF, specifying the Advance condition to be attached to this command.
SET DELAY	Sets up the delay count and mode for the level that follows. Delay count can be from 1 to 65535. Delay modes are CLOCKS, where the counter is incremented once on every master clock, and COUNTS OF SAMPLE=, where the counter is incremented once for each sample that matches the selected pattern. Whenever a level is entered, the delay counter is reset to zero. After each delay pattern or clock, the delay counter is incremented by one. If advance on a pattern is used with delay by patterns, the two patterns must match, since the same hardware is used internally.
GO TO level	No tracing, jump immediately to selected level.
STOP	No tracing, stop immediately.

Table 3-2 Trace Control Command Format

(0)___		
(1)WAIT	(0) FOR	(delay expression)
	(1)UNTIL	(condition)
	(2)----	
(2)TRACE	(0)FOR	(delay expression)
	(1)UNTIL	(condition)
	(3)IF....	(condition)
	(2)----	
(3)OR UNTIL		(condition)
(4)OR GO TO (level) IF....		(condition)
(5)OR STOP IF		(condition)
(6)ADVANCE IF....		(condition)
(7)SET DELAY TO		(delay expression)
(8)GO TO (level)		
(9)STOP		

Table 3-2 (con't)

Parameter Definitions

(delay expression)	1 to 66535	(0) CLOCKS (1) COUNTS OF SAMPLE = (pattern)	
(condition)	If set-delay not used:	SAMPLE (0)	= (pattern)
		(1)	≠
	If set-delay used:	SAMPLE	= (pattern)(0)___
			≠
		SAMPLE	= (pattern)(1) AND COUNT (relationship) delay
			≠
		COUNT	(relationship) delay
(pattern)	1 to 8 character pattern name which may contain parenthetically enclosed character fill positions in which substitute values may be entered		
(relationship)	(0) =, (1)>, (2)>=, (3) ≠, (4) =<,(5)<		
(level)	level number value between 0 and 15 (0-F Hex)		

Setting Up Trace Level

Each Trace Level may have up to five command lines, not including blank lines.

The first line is optional and is used to select the delay value and delay type for the Trace Level (SET DELAY). This line must be included if any of the following commands within the level use the COUNT (relationship) delay condition.

The second line specifies the primary command for the level, which may be TRACE, WAIT, GO TO, or STOP.

The third through fifth lines may be included only if the primary command is TRACE or WAIT. Each of these lines begins with a secondary command (ADVANCE IF, OR UNITL, OR STOP IF, OR GO TO level IF). The secondary following commands may appear in any order with the exception of the ADVANCE IF command, which must appear on the line immediately following a WAIT, TRACE or TRACE IF command. The use of OR UNTIL and OR GO TO level IF is mutually exclusive within a level. Any or all of the secondary commands may be omitted:

line 1	SET DELAY TO . . .	(optional)
line 2	TRACE, WAIT, GO TO, STOP	(select one)
line 3	ADVANCE IF, OR STOP IF, OR UNTIL, OR GO TO level IF	(all optional)

Pattern Definitions

The operator may define up to 50 data patterns, eight of which may be displayed at one time in the pattern definition half of the screen. Each definition line consists, from left to right, of a system-supplied two-digit number, the user-supplied name of one to eight ASCII characters, and the pattern value. See Figure 3-15. Note that patterns always assume positive logic regardless of the polarity setting.

A new pattern is defined by moving the active field down to the numbered but undefined line after the last currently defined pattern. When the operator enters in a name for the pattern, the actual value of the symbol is all Don't -Cares. The active field can be moved to any column of the pattern. Pressing a hexadecimal digit key appropriate for the radix in use enters that value: pressing the X/SPACE key enters a Don't Care. Pressing the PREVIOUS or NEXT key rolls the column through its legal values.

Pressing the INS (Insert) key causes the definition currently in the active field to be moved down one position and given the next higher number. The operator can then enter a new pattern name on this line and define a pattern for it.

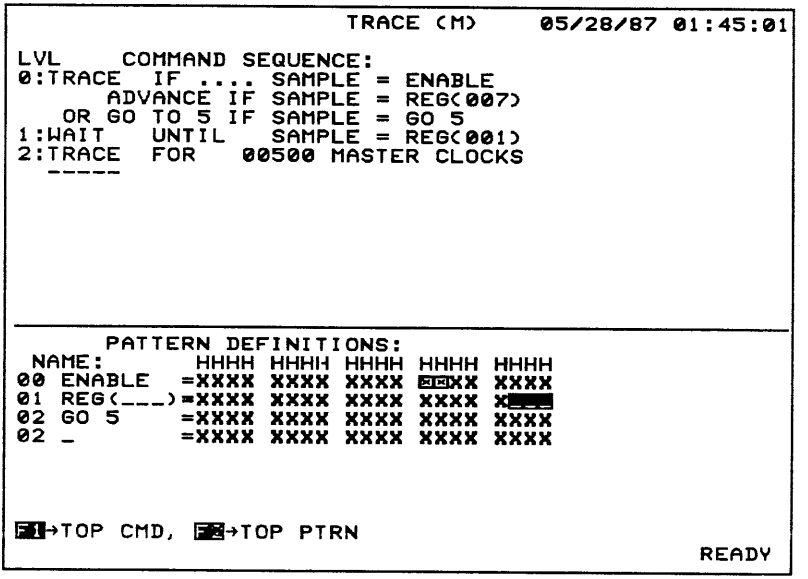


Figure 3-15. Trace Control Setup Screen

Pressing the DEL (Delete) key removes the definition in the active field if that definition is not being referenced by an acquisition control line. If it is being referenced, an error message is displayed on line 2. An accidently deleted pattern may be restored by pressing the F3 key.

If the name of a pattern is changed, the name will also be changed in all referencing trace control lines, so that these control lines will continue to reference that pattern.

Bit by Bit Editing in a Non-Binary Pattern

Pressing the EDIT key while the active field is on a pattern definition line causes this one pattern to be displayed in a two-dimensional binary representation that is a duplicate of the column definitions in the Format Screen. This allows the pattern to be edited on a bit-by-bit basis and makes possible embedded Don't-Cares. Pressing the EDIT key again returns the screen to its standard display mode. If some, but not all, bits of a pattern definition column were changed to Don't-Cares in the Edit mode, then when the pattern definitions are viewed in the non-edit mode, the character for that column is displayed as a small X with a box around it. If all bits for that column are Don't-Cares, the character displayed in the non-edit mode for that column is a large X.

Patterns with Fill-In Values

When the active field is over a pattern value column, the F4 key can be used to enter a fill-in value in that column. This displays a reverse video underscore at this column and causes the last three characters of the pattern's name field to be replaced with (_). Up to five fill-in columns may be defined for each pattern, in which case the last seven characters of the name are replaced with (_ _ _ _ _). The purpose of this is to allow the user to enter different values into these columns each time the pattern is used. When the pattern is selected in the command half of the screen, its name is followed by parentheses surrounding one to five Don't-Care characters. The user may replace the Don't-Cares with actual values, which are substituted into the pattern at the designated columns.

If the user assigns a value to a pattern definition that has not been assigned a name, the K450B automatically names the pattern. The patterns are named by their location in the sequence of patterns (for example:PO6).

In the Trace Set UP Screen, the function choices are as follows:

F1	Moves the active field to the uppermost command line
F2	Moves the active field to the uppermost pattern definitions
F3	Reverses a deletion, providing no intervening keyboard entries have been made
F4	Enters fill-in values into pattern definitions

REVIEW TRACE SETUP PARAMETER

The user can review a completed trace control setup, on a level by level basis by accessing the ***Trace Control Parameter Setup Review screen***, Figure 3-16.

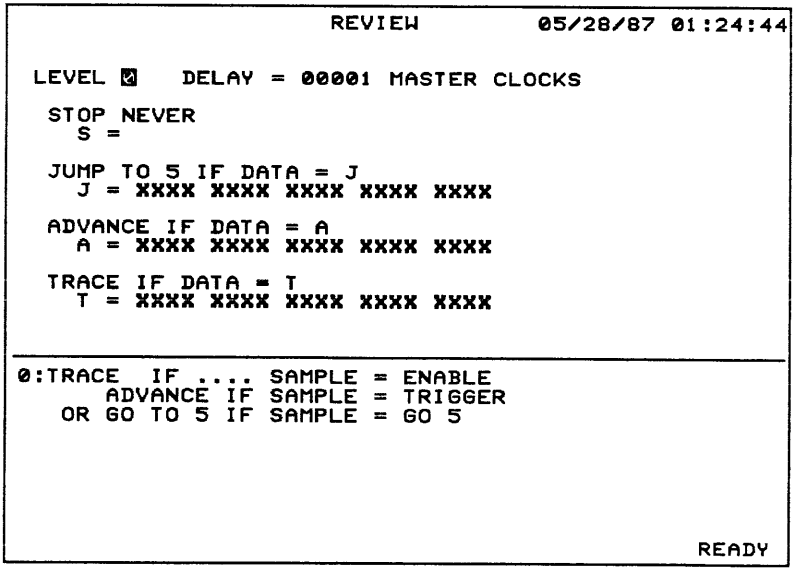


Figure 3-16. Trace Control Parameter Setup Review

This screen is selected by pressing the **SHIFT** key and then the **TRACE CONTROL** key. The screen generally appears as shown in Figure 3-16 with the Level field active. This field is the only alterable field in the display and allows the user to select specific individual trace levels for review. Selection is made via the NEXT/PREV key or the numeric keys.The trace setup for a level is evaluated and presented on the basis of four commands as follows:

Stop

Jump

Advance

Trace

The condition and pattern are presented for each command. If the trace command is set up to act on a given pattern and then later changed to Trace Always, the Trace Control Parameter Setup Review Screen displays a Trace Always Command and the original condition pattern. The Trace Control Command lines, which represent the corresponding setup or the Trace Setup Screen, are displayed at the bottom of the screen.

ARM AND RECORDING SETUP

The ***Arm Mode screen*** (Figure 3-17) is accessed by pressing the **ARM MODE key**. When the ***Arm Mode Setup screen*** is selected, the active field is the Arm Mode field.

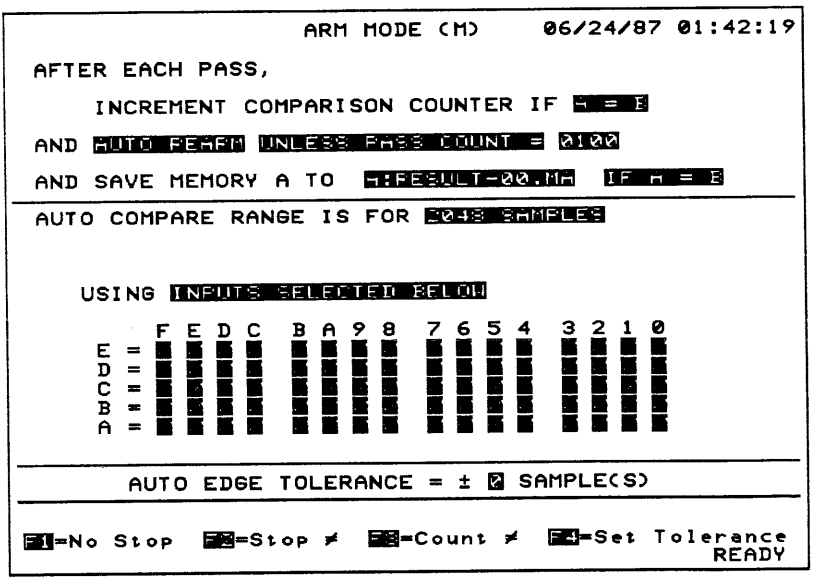


Figure 3-17. Arm Mode Screen

STOP/AUTO REARM SELECT

The user can use the following selections to either STOP the system at the end of one pass (Single Arm), or continue to rearm indefinitely until the STOP Rearm condition is true (Conditional Rearm).

Key	Description
0	STOP (no rearm)
1	AUTO REARM

When AUTO REARM is selected, the F1,F2 and F3 keys set the STOP Rearm condition and Comparison Count fields for frequently-used applications as follows:

KEY	FUNCTION
F1 = No Stop	Auto Rearm
F2 = Stop ≠	Auto Rearm Unless A ≠ B
F3 = Count ≠	Increment Comparison Counter if A ≠ B and Auto Rearm

Auto Rearm Comparison Count

When AUTO REARM is selected in the Arm Mode field, the user may select to have the data captured at the end of each pass compared with the data in memory B. The Comparison Count is incremented each time the comparison is true. The available comparison choices are as follows:

0 ---(not used)
1 INCREMENT COMPARISON COUNTER IF A = B
2 INCREMENT COMPARISON COUNTER IF A ≠ B

Auto Rearm Conditioning

When AUTO REARM is selected, pressing the STOP key and/or setting a STOP Rearm condition stops the system from rearming. The STOP Rearm conditions are displayed to the immediate right of the Arm Mode field. Up to two conditions may be selected with the following choices:

0 NEVER STOP
1 UNLESS PASS COUNT =
2 UNLESS A= B
3 UNLESS A ≠ B

If - - - is selected, no other fields appear to the right of - - -. If UNLESS PASS COUNT = is selected, the user can move the cursor to the right to set the Pass Counter Limit. If UNLESS A = B or UNLESS A ≠ B is selected, the user can move the cursor to the right and select a Pass Limit Option using the following selections:

0 (no pass limit)
1 OR PASS COUNT =
2 AND PASS COUNT >=

If the Pass Count is included in the STOP Rearm condition, the user can move the cursor to the right to set the Pass Counter Limit.

Pass Counter Limit

The user can specify a count limit of 1 through 9999 passes. The Pass Counter is set to 0 when the ARM key is pressed. At the end of each pass, the Pass Counter is incremented by one.

Auto Save Conditions

The Auto Save function is available only if the AUTO REARM is selected and the disk is installed. The Auto Save function saves recorded data to disk at the end of each recording.
Select one of the following Auto Save conditions by pressing one of the following quick-keys:

0 - - - (never)
1 IF A = B
2 IF A ≠ B
4 ALWAYS

Auto Save File Name

Three fields are associated with the file name. The first field specifies which drive Memory A data should be written to as follows:

0 drive A
1 drive B (If Dual Disk Option is installed

The second field selects the file name. This field is six characters in length and is entered using any alpha-numeric keys and the X/SPACE key. The file name may not begin with a space and no spaces may be embedded between non-space characters.

The third field selects the file version number. This is a two-digit field with legal values ranging from 00 through 99. The version number is entered directly using the numeric keys. After the file is saved, the version number is automatically incremented by one for the next save.

Auto Compare

The Auto Compare fields are used under the following conditions:

1. When a comparison count evaluation is performed.

2. An A to B evaluation is performed for the STOP Rearm condition

3. The Compare Mode is used in the Display Screen.

For the first two conditions, only the selections active at the time the recording is initiated are used. The current Setup M values are used for the Compare mode.

The Auto Compare range values are determined by the selected time rate. For 200MHz, the total samples amount is 4098 (numbered 0 through 4095, P-1, P-2 and P-3); otherwise, the total samples amount is 2051 (numbered 0 through 2047, P-1, P-2 and P-3). The samples used in the comparison are as follows:

0 SAMPLES(S) BETWEEN CURSOR
1 SAMPLE(S) SELECTED BELOW
2 ALL SAMPLES

If SAMPLES BETWEEN CURSORS is selected, the Control and Reference values are on the next two lines.

If SAMPLES SELECTED BELOW is selected, the user can fill in the MEM-A and MEM-B starting numbers and the total number of samples to be compared.

The user can select which inputs are used in the comparison as follows:

0	INPUTS DEFINED ON FORMAT SCREEN
1	INPUTS SELECTED BELOW

When the user is in the AUTO COMPARE INPUTS select field with INPUTS SELECTED BELOW displayed, the selected inputs can be set to the inputs defined on the Format Screen by pressing the F1 key. The user can then omit or select inputs as required.

Auto Edge Tolerance

The Auto Edge Tolerance fields in the lower portion of the screen allow the user to specify Don't-Cares for a given number of samples on each side of a transition. The Don't Cares are associated with data memory B and are visible when viewing the memory B Data Display and Timing Display Screens.

The tolerance is entered by making the desired value field active and entering a value of 0 to 9. A zero value represents all Do-Cares. The value is then transferred to the B memory on the next A to B data transfer or upon pressing the F4 key.

Don't Care Compare Editing

See the section "EDITING" for instructions on bit-by-bit editing of the reference memory.

Recording Control

When the Setup Parameters are selected in the Format, Clocks, Trace and Arm Mode Screens, the Record keys are used to initiate, stop and force and Advance condition for recording.

Start Recording Cycle

The user may initiate a data recording by pressing the ARM key. The message BUSY is displayed in the lower right hand corner of the screen while the hardware is prepared for the recording. If a recording is in progress when the ARM key is pressed, the first recording is stopped immediately and the new recording is initiated.

When a recording is initiated, the Comparison Count and Pass Count are each set to zero. Both Counters are updated at the end of each record cycle.

The unit will not arm if both the following conditions are present:

1. Auto Compare is selected (the Rearm, Save and Compare field are active).

2. Setup M clock screen and setup B clock screen indicate the maximum number of samples differ.

In this circumstance, the following message is displayed on line two of the display:

CANNOT ARM -TOTAL SAMPLES DIFFER FOR A/B COMPARE

Cancel Recording Operation

During the process of a recording, the user may stop the recording by pressing the STOP key. This action terminates the recording process without recording any data in memory A.

Stop Recording and Transfer Trace to Memory

Pressing the STOP W/XFR Key (SHIFT/STOP) stops the recording and causes any traced data to be transferred to Memory A.

Advance A Level

If an advance condition is not found while the unit is recording, the user can force an advance by pressing the ADV key (SHIFT/ARM).

End of Recording

At the end of each recording, the message EOR appears in the lower-right portion of the screen. While EOR is displayed, the following processing occurs:

1. Pass Count and Comparison Count are incremented, if required. The date and time reading are recorded.

2. The Setup record parameters saved at the beginning of the recording are copied to Setup A.

3. The recorded data is copied to Data A

4. If AUTO REARM is selected and the STOP Rearm condition is not true, the next recording is started.

   If Auto Save is selected and the Save Condition is met, the recorded data, including Level Data, Pass Count, Comparison Count, Date and Time are saved to the specified file. As one diskette becomes full, an attempt is made to save files to the other diskette. If one file already exists, a hardware failure occurs, or if there is no space left on the diskettes, no file is saved and the appropriate message is displayed. After the file is saved, the version number is incremented by one for the next save.

DISPLAY RESULTS

Data Display Screen

The ***Data Display screen***, Figure 3-18, is accessed by pressing the **DATA** key. This screen displays the recorded data interpreted as numeric or ASCII values. The format of the data for the ***Data Display screen*** is selected in the ***Format Set Up screen***.

The C and R characters at the left of sample numbers indicate the position of Control and Reference cursors. The F1 and F2 keys are used to scroll the data up and down respectively.

The F3 key allows the user to toggle the Symbolic Display Feature on and off for the ***Data Display screen*** as follows:

F3 = PATT on -- *Symbolic Labels replace the equivalent Numeric data patterns on the ***Data Display screen.***

F3 = PATT off -- No *Symbolic Labels appear on the ***Data Display screen.***

*(Symbolic Labels are defined on the ***Trace Control screen.***)

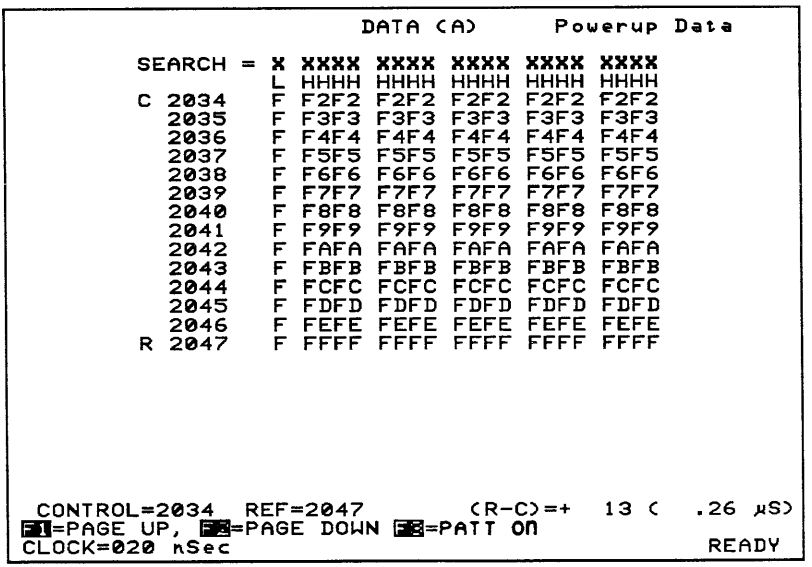


Figure 3-18. Data Display screen

The user can display Memory A data, which represents the data taken during the last recording, or Memory B, which has data placed there for a reference. The user can alternately select these two screens by pressing either the Mem A or Mem B keys. When the K450B is initialized, the A and B memories are filled with a data test pattern. The user may copy data from Memory A to Memory B by pressing the A---> B key.

Search Function

Search is used to locate a level or pattern among the recorded samples. To alter the Search selection, press the **EDIT** key. The Search word immediately changes to reverse video and the active field appears in the left-most column. Next, while in the Search word field, press the **F1** key to specify the choice of standard (one sample) or sequential (four-sample sequence) search values.

The Hexadecimal, **NEXT**, **PREV** and **X** keys enter a search value. Edit mode is exited by pressing the **EDIT** key a second time. Pressing the **SEARCH** key causes the K450 to search the entire Memory buffer (4096 samples for 200 MHz, 2048 samples for any other selected time base) for all samples that match the selected search value. Any samples currently on the screen that match the search value are tagged with an asterisk.

In the case of sequential search words, the sampled data is compared to the first search word. If a match occurs, the next next data sample is compared to the second search word. If a match occurs again, the following data sample is compared to the third search word. If this final match occurs, the first data sample is flagged with an asterisk.

A summary line appears near the bottom of the screen, showing the total number of matching samples and the sample numbers of the first and last match. The **NEXT** or **PREV** keys move the C tag to the start of the next or previous block of matching samples.

When in edit mode with Memory B selected, the active field is moved down from the search word field into the recorded data display. In this field, the hexadecimal keys are used to enter new values into the B Memory. Pressing the **X** key enters a value of Don't-Care. Attempting to move the blinking cursor past the lowermost sample in the first column causes the data to scroll up one position. This scrolling may cause the control (C) tag to be moved off the screen. This is the only case in which the C tag is removed. Leaving edit mode with the screen scrolled in this manner causes the screen to be regenerated to its original position.

Memory Compare Functions

The contents of memory A can be compared with the contents of memory B by pressing the **COMPARE** key. Any samples not identical (except for Don't-Care bits) are tagged with a not-equals sign. A summary line is displayed near the bottom of the screen, showing the total number of samples not equal, and the first and last not equal samples. These items are displayed in the same places where the search information is displayed. therefore, search and compare are mutually exclusive. Requesting either function causes the other function to be disabled if it was active. The **NEXT** or **PREV** keys may be used to move the C tag to the start of the next or previous block of not equal samples.

If the Compare mode is selected and the total number of samples differs for the A and B memories, all samples are tagged with the not-equals sign and the Compare summary line is as follows:

```
COMPARE '≠' = TOTAL SAMPLES FOR MEM A AND B DIFFER
```

If a skewed comparison is selected in the ***Arm Mode Set Up screen***, the samples tagged differ in data memories A and B. For example, the ***Arm Mode Set Up screen*** is set up with the following conditions:

```
MEMA STARTING AT 0003

MEMB STARTING AT 0005

FOR 0100 SAMPLE(S)
```

In this case, samples 3 through 103 in data memory A are compared with samples 5 through 105 in data memory B. If sample 3 in A does not match sample 5 in B, but all others match, then the ***Data Display screen*** tags sample 3 when viewing memory A and sample 5 when viewing memory B.

A total of 21 to 84 samples are displayed on the screen depending on the number of inputs available on the unit and the radix selected in the ***Format Set Up screen***. Reading from left to right, each sample line is displayed with a space for the Control (C) or Reference (R) tag followed by a four-digit sample number.

Following the sample number, a space is reserved for tags generated by the search (*) or compare (≠) functions. To the right of this space there is an available space for an optional one-digit level number character followed by up to 40 characters displayed in character row four.

Cursor Movement

The ***Data Display screen*** Control (C) and Reference (R) tags and the respective ***Timing Display*** screen cursor and reference vertical lines are interactive. For a change made to one in a given screen, there is an equal change to its counterpart in another screen. When the ***Data Display screen*** is selected, the first data line displayed is the C tag. The following samples lines appear underneath this one, forming a column of samples. Each column consists of 21 samples, and up to three columns may be displayed.

To manually move the C or R tag, the desired tag is selected by pressing the **CONTROL** or **REF** key, respectively. The tag can then be moved up or down using the **UP FIELD** or **DOWN FIELD** keys. When the C tag is moved, it always remains in the leftmost column of samples.

When the C tag is at the bottom of the data column and an attempt is made to move the tag further down, the data samples scroll up while the C tag remains stationary. Similarly, an attempt to move the C tag up when the tag is at the uppermost sample line causes the samples to scroll down.

The R tag may be moved to any position on or off screen. When moving the R tag in areas off screen, monitor the R tag location via the REF ≡ display element in character line 27 of the screen.

The C tag may also be moved by pressing the **F1** or **F2** keys. These keys cause the C tag to move up or down by 21 Samples, completely regenerating the display. When viewing the data, pressing the **NEXT** or **PREV** key moves the C tag to the next or previous level transition, except when the Search or Compare function is active.

The C tag is set by pressing the **SHIFT** and **CONTROL** keys. The desired position value is controlled via the **0** through **9** keys. Pressing the **CONTROL** key again enters the value. If the new position of the C tag is still in the leftmost column of samples, only the C tag is moved. Otherwise, the screen is regenerated with the C tag at the uppermost sample line. The R tag is similarly set by pressing the **SHIFT** key and the **REF** key, but the screen is never regenerated.

Timing Display Screen

The ***Timing Display screen***, Figure 3-19, is accessed by pressing the **TIMING** key. This screen presents recorded data. Up to 16 inputs are presented as idealized oscilloscope traces. The most recently recorded data are located on the right side of the screen. Data recorded earlier are located on the left.

The ***Timing screen*** consists of a header on character line one, a display of current expansion settings on character line three, up to 16 timing traces and a control and reference location readout on character line 27. Once the ***Timing screen*** has been accessed, the user may press the **EDIT** key and assign five-character labels to the left edges of all traces. These labels are initialized to all blanks and are separated from the two-character input identifiers by a blank. The user may enter a five-character name in the specific field, possibly the mnemonic of the signal being displayed for this trace.

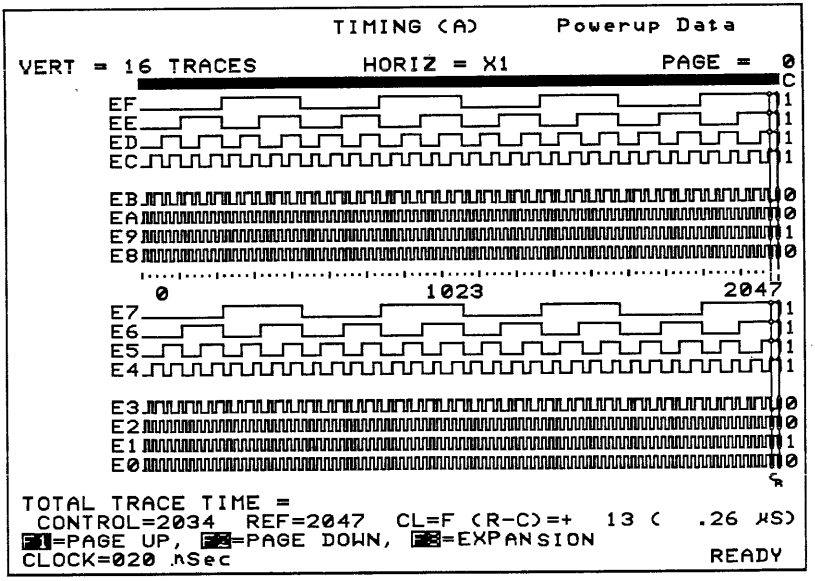


Figure 3-19. Timing Display Screen

This label remains attached to the trace input regardless of any future input sequence changes. The two-character input identifiers consist of a section character (E through A) followed by the input line number (F-0). Next is the trace itself, which occupies 43 character columns.

To the right of the trace is a readout of the value of the trace under the cursor or reference tag, whichever was moved last. This readout takes into account the selected polarity of the input, while the timing trace always displays a value more positive than threshold as high and a value more negative as low, regardless of the selected polarity.

HORIZONTAL / VERTICAL EXPANSION

The Timing Display screen is manipulated by three soft keys, **F1**, **F2** and **F3**. The **F1** and **F2** keys are used to control the Page Up / Page Down function.

The **F3** key allows the user to invoke the Horizontal / Vertical Expansion mode. When **F3** is pressed, the cursor moves to the Vertical Expansion field at the upper left side of the screen.

Press the right or left arrow **FIELD** key to select the Vertical or Horizontal Expansion mode.

Use the **NEXT** and **PREVIOUS** keys to select the choice of expansion factor. Vertical choices are 4, 8 and 16 Traces. Horizontal choices are X1, X12, X24 and X48 magnitude. The description of expansion factors are presented below.

Horizontal Timing Expansion

The traces are displayed in one of four possible horizontal expansions: X1, X12, X24 and X48. In X1 size, the recorded data is compressed by a factor of either 12 (2K) or 24 (4K) so that all samples fit on the screen. In compressed mode, each point on the screen is generated by looking at the next three samples. If any one of these samples differs from the last point displayed, the next point displayed is the opposite of the last point. This condition assures that single sample glitches are always displayed. Since a twelve-to-one compression is referred to as X1 size, a one-to-one display of the data must be called X12. Expansion by two is also provided and is labeled X24. In all expansions except X1, not all data fits on the screen. When the ***Timing Display screen*** is first accessed, the traces are presented in a X1 mode. Pressing the **F3** key selects the various expansion modes in order of their magnitude with a rollover from the X48 to X1 modes.

The selected time base determines the compression factor for recorded data as follows:

HORIZONTAL EXPANSION	COMPRESSION EXPANSION FACTOR (2K)	COMPRESSION EXPANSION FACTOR (4K)
X1	12 sample/point	24 sample/point
X12	1 points/sample	2 sample/point
X24	2 points/sample	1 point/sample
X48	4 points/sample	2 point/sample

When in the X1 expansion mode, the entire character line four is illuminated. This illuminated stripe represents the 4099 (200 Mhz) or 2051 (other selected time base) word recording buffer.

When expansion mode X24 or X48 is selected, the illuminated stripe narrows in width, and when the cursor is moved in one of these expanded modes, the remaining portion of the illuminated stripe moves. The narrowed illuminated stripe represents the portion of the recording buffer being viewed in the expanded modes. The position along character line four of the narrowed illuminated stripe represents the location within the buffer of the portion being viewed.

Vertical Timing Expansion

There are also three possible vertical expansions that can be used. v16, v8, v4, in which sixteen, eight or four traces are displayed at once.

In the ***Timing Display screen,*** there is an input sequence table with 60 entries. This table is divided up into pages of four traces each. The page displayed is changed using the **Page Up** or **Page Down**, **F1** and **F2** keys. To display the last page, press the **V** key. to advance upward to next group of pages, press the **U** key. Press **SHIFT/F1** to select Page 0.The height of each trace is determined by the vertical expansion as follows:

TRACES	# OF PGS ON SCREEN
16	4
8	2
4	1

Selection of the different vertical expansion modes is made using the **F3** and **NEXT/PREVIOUS** keys in a manner similar to selecting the horizontal expansion mode.

Bus Timing Display Feature

Input bus groupings defined on the ***Format Set Up screen*** are displayed in a Bus Format on the ***Timing screen***. See Appendix D, Bus Timing Display Feature, for a description of the display characteristics.

Graph Display Screen

The K450B ***Graph Display screen*** (Figure 3-20), plots the recorded data samples as a graph, with position on the y-axis determined by the value of the recorded sample and position on the x-axis determined by the sample number. The screen is entered by pressing the **GRAPH** key.

The Graph Display is useful for examining A/D or D/A (Analog digital) conversions, program memory utilization, counter operation and many other applications where a value can be plotted against time.

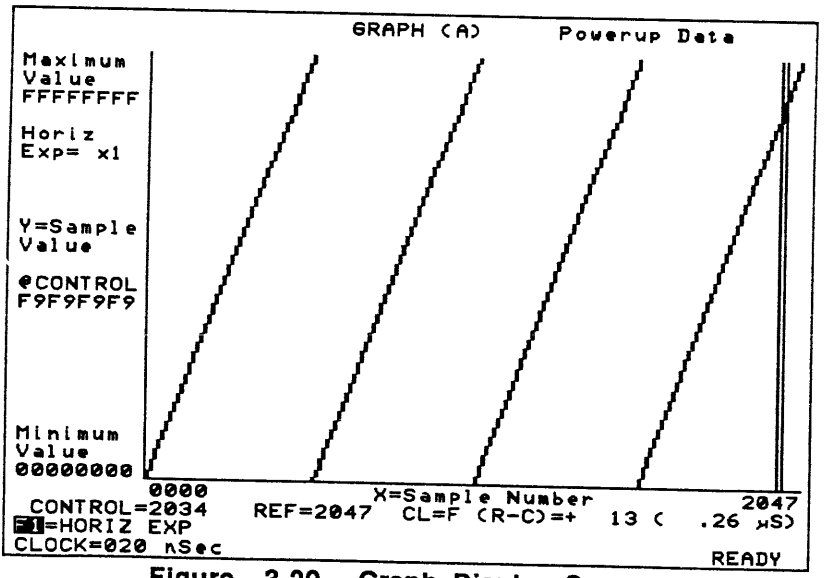


Figure 3-20. Graph Display Screen

Upon selecting the ***Graph Display screen***, press the **EDIT** key. The upper and lower limit values become fields. The leftmost character of the upper limit field is the active field. By using the right and left arrows and the hex keypad, edit the upper limit to a new value. Press the **DOWN FIELD** key to make the leftmost character of the lower limit field the active field. The editing procedure for the lower limit is the same as that for the upper limit. The limits are always displayed in hexadecimal to conserve room on the screen. When the new limits have been entered, press the **EDIT** key again to restore the limit fields to normal video and cause the graph to be regenerated using the new limits.

Upon selecting this screen, the currently selected Memory (A or B) is plotted. For each point to be plotted, the sample at that point is converted to a 32-bit value by reordering the first 32 bits of the sequence of inputs selected in the ***Format Set Up screen***.

With less than 32 inputs selected, all bits are included in the value and the number of characters required for the range and their values are adjusted. Once a 32-bit value is obtained, it is compared against the upper and lower limits selected in the ***Graph Display screen***. If out of range, a point is plotted at either the topmost or lowermost scanline. If in range, the correct position relative to the limits is determined and the point is plotted.

Only 230 scanlines are available for the graph display, so the resolution is slightly less than 8 bits. To expand the graph vertically, closer limits must be selected. Horizontally, only 172-bit positions are used. The x1 expansion displays 12 (2K) or 24 (4K) samples on each column. The x12 expansion displays either one sample (2K) or two (4K) samples on each column, so only 172 samples are shown. In x24, only 86 samples are displayed. Horizontal expansion is selected via the **F1** key.

When the ***Graph Display screen*** is selected, the Control (C) tag is visible on the screen. To manually move the C or Reference R) tag, the desired tag is selected by pressing the **CONTROL** or **REF** key. The tag is moved left or right using the **LEFT/RIGHT FIELD** keys.

When the C tag is at the rightmost sample display and an attempt is made to move the tag further right, the data samples scroll left while the C tag remains stationary. Similarly, an attempt to move the C tag left when the tag is at the leftmost sample causes the samples to scroll right. The R tag may be moved to any position on or off screen. When moving the R tag off screen, the user monitors the R tag location via the REF ▭ display element in character line 27 of the screen.

When viewing the data, **NEXT** or **PREVIOUS** moves the C tag to the next or previous level transition, except when the Search or Compare function is active.

The C tag may be set by first pressing the **SHIFT** key and then the **CONTROL** key. The desired position value is controlled via the 0 through 9 numeric keys. Pressing the **CONTROL** key again enters the value. If the new position of the C tag is still on the screen, only the C tag is moved. Otherwise, the screen is regenerated with the C tag at the leftmost sample. The R tag is similarly set by pressing the **SHIFT** and the **REF** keys, but the screen is not regenerated.

The CL=F display element on line 27 of the screen displays the Trace sequence level of the sample that the control cursor is currently pointing to.

EDITING AND LABELING

Format Screen/Edit Mode

The ***Format Set Up screen*** is used to specify the display format in the ***Data Display screen***, set the order of channels in the ***Graph Display screen*** and set the radix used for the patterns in the ***Trace Control Set Up screen***. The ***Format Set Up screen*** is accessed by pressing the **FORMAT** key. The field adjacent to the words Data Format is the active field. Press the **NEXT** or **PREV** keys, to scroll through the format choices. The user may also make choices using the quick-keys as listed below.

Key	Description
0	Hexadecimal - Fixed format
1	Octal - Fixed format
2	Binary - Fixed Format
3	User Specified (Binary, Hex, Octal, ASCII, EBCDIC)
4	Disassembler

Trace Control Patterns/Edit Mode

The operator may define up to 50 data patterns, eight of which may be displayed at one time in the pattern definition half of the screen. Each definition line consists, from left to right, of a system-supplied two-digit number, the user-supplied name of one to eight ASCII characters, and the pattern value.

A new pattern is defined by moving the active field down to the numbered but undefined line after the last currently defined pattern. When the operator enters in a name for the pattern, the actual value of the symbol is all Don't- Cares. The active field can be moved to any column of the pattern. Pressing a hexadecimal digit appropriate for the radix in use enters that value.

Pressing the **X/SPACE** key enters a Don't-Care, (Figure 3-21). Pressing the **PREVIOUS** or **NEXT** keys rolls the column through its legal values.

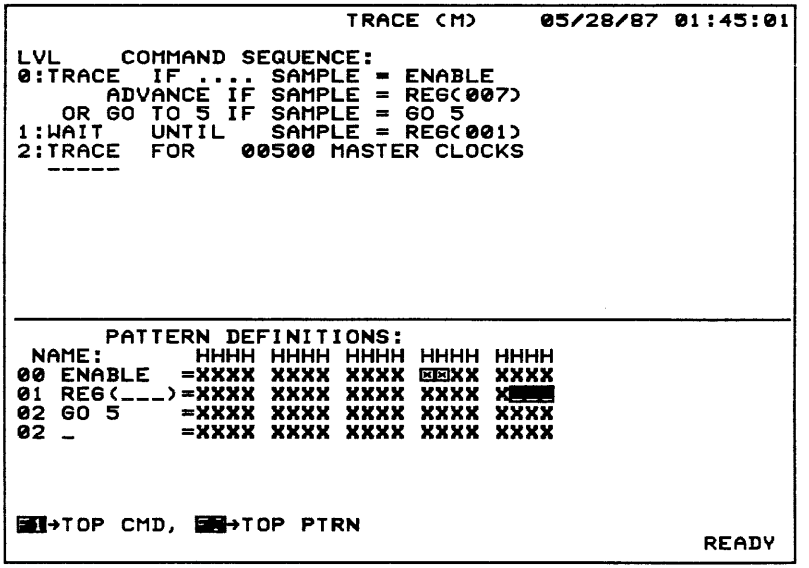


Figure 3-21. Trace Control

Pressing the **EDIT** key while the active field is on a pattern definition line causes this one pattern to be displayed in a two-dimensional binary representation that is a duplicate of the column definitions in the Format screen. This allows the pattern to be edited on a bit-by-bit basis and makes possible embedded Don't-Cares. Pressing the **EDIT** key again returns the screen to its standard display mode. If some, but not all, bits of a pattern definition column were changed to Don't-Cares in the Edit mode, then when the pattern definitions are viewed in the non-edit mode, the character for that column is displayed as a small X with a box around it. If all bits for that column are Don't-Cares, the character displayed in the non-edit mode for that column is a large X.

Pressing the **INS** key causes the definition currently in the active field to be moved down one position and given the next higher number. The operator can then enter a new pattern name on this line and define a pattern for it.

Pressing the **DEL** key removes the definition in the active field if that definition is not being referenced by an acquisition control line. If it is being referenced, an error message is displayed on line 2. An accidentally deleted pattern may be restored by pressing the **F3** key.

If the name of a pattern is changed, the name will also be changed in all referencing trace control lines, so that these control lines will continue to reference that pattern.

When the active field is over a pattern value column, the **F4** key can be used to enter a fill-in value in that column. This displays a reverse video underscore at this column and causes the last three characters of the pattern's name field to be replaced with (_). Up to five fill-in columns may be defined for each pattern, in which case the last seven characters of the name are replaced with (_ _ _ _ _). The purpose of this is to allow the user to enter different values into these columns each time the pattern is used. When the pattern is selected in the command half of the screen, its name is followed by parentheses surrounding one to five Don't-Care characters. The user may replace these Don't-Cares with actual values, which are substituted into the pattern at the designated columns.
If the user assigns a value to a pattern definition that has not been assigned a name, the K450B automatically names the pattern. The patterns are named by their location in the sequence of patterns (for example: P06).

Character line 28 of the screen presents definitions of keys **F1** through **F4**. These keys change functions depending on the screen being viewed. In the ***Trace Set Up screen***, the choices are as follows:

Key	Description
F 1	Moves the active field to the uppermost line
F2	Moves the active field to the uppermost pattern definition
F3	Reverses a deletion, providing no intervening keyboard entries have been made
F 4	Enters fill-in values into pattern definitions

Data Display Screen Edit Mode

The ***Data Display screen*** is accessed by pressing the DATA Key. The user may edit a search word, sequence of words, or the entire Compare/Reference (B) memory. This screen selects a value that performs a comparison-search of the collected data sample. The selected value may consist of either a single search word or three sequential search words that are displayed at the upper-left areas of the screen opposite the SEARCH = field (See Figure 3-22). To alter the Search selection, press the **EDIT** key. The Search word changes to reverse video and the active field appears in the left-most column. While in the Search word field, press the **F1** key to specify the choice of search values. Use the **FIELD** and **DATA** entry keys to edit the Compare and Reference (B) memory. See the Timing Edit section for more discussion of editing the reference memory.

```
EDIT MODE                    DATA (A)      Powerup Data

          SEARCH = X XXXX XXXX XXXX XXXX XXXX
                   L HHHH HHHH HHHH HHHH HHHH
          C 0000   F 0000 0000 0000 0000 0000
            0001   F 0101 0101 0101 0101 0101
            0002   F 0202 0202 0202 0202 0202
            0003   F 0303 0303 0303 0303 0303
            0004   F 0404 0404 0404 0404 0404
            0005   F 0505 0505 0505 0505 0505
            0006   F 0606 0606 0606 0606 0606
            0007   F 0707 0707 0707 0707 0707
            0008   F 0808 0808 0808 0808 0808
            0009   F 0909 0909 0909 0909 0909
            0010   F 0A0A 0A0A 0A0A 0A0A 0A0A
            0011   F 0B0B 0B0B 0B0B 0B0B 0B0B
            0012   F 0C0C 0C0C 0C0C 0C0C 0C0C
            0013   F 0D0D 0D0D 0D0D 0D0D 0D0D
            0014   F 0E0E 0E0E 0E0E 0E0E 0E0E
            0015   F 0F0F 0F0F 0F0F 0F0F 0F0F
            0016   F 1010 1010 1010 1010 1010
            0017   F 1111 1111 1111 1111 1111
            0018   F 1212 1212 1212 1212 1212
            0019   F 1313 1313 1313 1313 1313
            0020   F 1414 1414 1414 1414 1414

  CONTROL=0000  REF=2047        (R-C)=+2047
F1=Standard/Seq search      EDIT=leave edit mode
CLOCK=EXTERNAL                              READY
```

Figure 3-22. Data Display Screen in Edit Mode

Timing Display screen Edit Mode

The ***Timing Display Screen*** has an edit mode used for the following functions:

Changing Trace Labels

Resequencing Traces
Altering the Data in the B memory.

Edit mode is entered by pressing the **EDIT** key. In edit mode, the trace labels and input IDs are displayed in reverse video. The active field appears at the upper input ID.

Inputs are resequenced by moving the active field to input ID fields and entering in new input numbers, using the hex characters A-E followed by 0-F. When the first character is entered, the trace area is cleared. The active field cannot be moved until the second digit is entered. The **NEXT** or **PREVIOUS** keys may also be used to change inputs. The **SPACE** key may be used to remove inputs from the screen. Input labels are set by moving the active field to the desired column. The characters Space, 0-9 and A-F may be entered directly from the Hexadecimal pad. Hexadecimal pad entry causes the active field to move right one position. The other characters, G-Z, are entered via **SHIFT** Hex pad keys.

Keys **F1** through **F4** enter the following characters:

Key	Description
F1	+
F2	-
F3	*
F4	/

If in memory B (memory select can be changed while in Edit mode), the active field can be moved into the trace area and used as an editing cursor. In this field, the active field becomes narrow and slightly taller than one trace. The number of the sample under the editing cursor is displayed at the bottom of the screen. The right and left arrow keys can be used to move the cursor to any desired position. Data values of 0 or 1 can be entered in directly. Don't-Cares can also be entered in, using the **X** key. These Don't-Cares appear as cross-hatched areas.

If the editing cursor is moved past the right edge of the screen, the data on the screen is shifted so that the editing cursor remains on the screen and the C cursor is moved to stay at the left edge. When edit mode is exited or memory A is selected, the screen stays in its current position.

When the Compare function is active and Memory A is selected, Memory B data is simultaneously displayed using dotted lines. This condition allows the user to quickly verify where mismatches occur. Similarly, memory A is displayed using dotted lines when the Compare function is active with memory B selected.

Total Trace Time

If the Compare and Search functions are not active, the Total Trace Time for the recording is displayed just above the Control and Reference readouts. The Total Trace time represents the total time the trace function was active during the recording. This value is less than or equal to the actual elapsed recording time depending on the Trace Control Setup used.

I/O FUNCTION SELECTIONS

This section describes the operation of the ***Input/Output Screen*** and its associated functions. Pressing the I/O Key accesses the I/O Function menu as shown in Figure 3-23.

The number of choices available depends on the Logic Analyzer configuraton and the I/O mode in which it is operating.

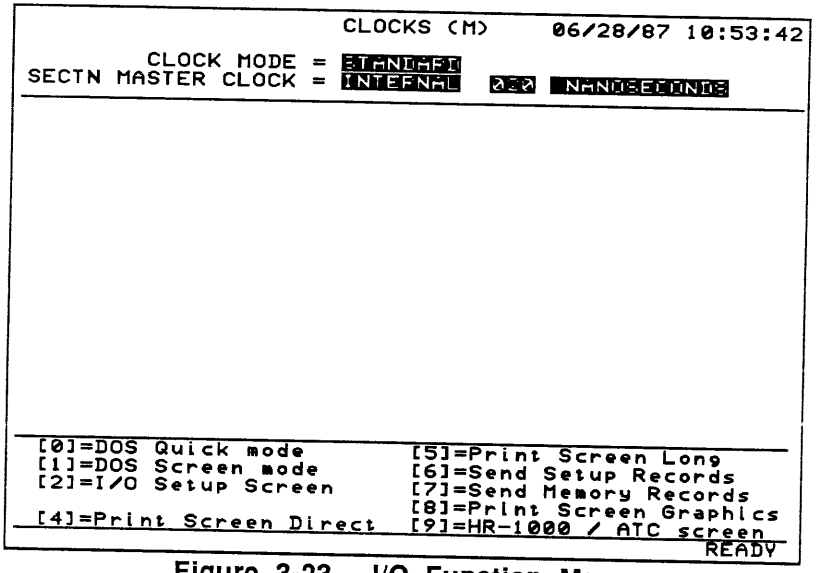


Figure 3-23. I/O Function Menu

I/O Screen Quick Key Functions

Nine quick-keys choices allow interaction with the peripheral equipment attached to the logic analyzer for the following functions:

Key	Description	
0	Disk Quick Mode	Allows keyboard inputs for disk operations while viewing any other screens.
1	Disk Screen Mode	Selects the full screen Disk Operating System mode.
2	I/O Setup Screen	Selects ***I/O Setup screen*** for configuring the I/O ports.
3	GPIB-SRQ	Sets the GPIB-SRQ line to active.
4	Print Screen Direct	Sends the screen text presently displayed to the active port.
5	Print Screen Long	Sends all pages of the currently displayed screen to the active port.
6	Send Setup Records	Sends all setup records for the currently active memory (M, A, or B).
7	Send Memory Records	Sends memory records. If the currently active memory is A or M, memory A records are sent. If the active memory is B, memory B records are sent.
8	Print Graphics	Sends the exact bit mapped graphics display to a dot matrix printer.

I/O SETUP SCREEN:

The ***I/O Setup screen*** (Figure 3-24) allows the user to select and view parameters used for the communications port. This screen is accessed by pressing the I/O Key.

The screen is divided into four areas as follows:

Upper Left Area	-For use in configuring GPIB port.
Upper Right Area	-For use in configuring the RS232C
Middle Area	-Active port selection.
Middle Lower Area	-Commands and Messages

When the I/O Setup Screen is first accessed, the GPIB Mode = field is active. Note that in the following descriptions of the I/O Setup Screen the available selections are only accessible when given field is active.

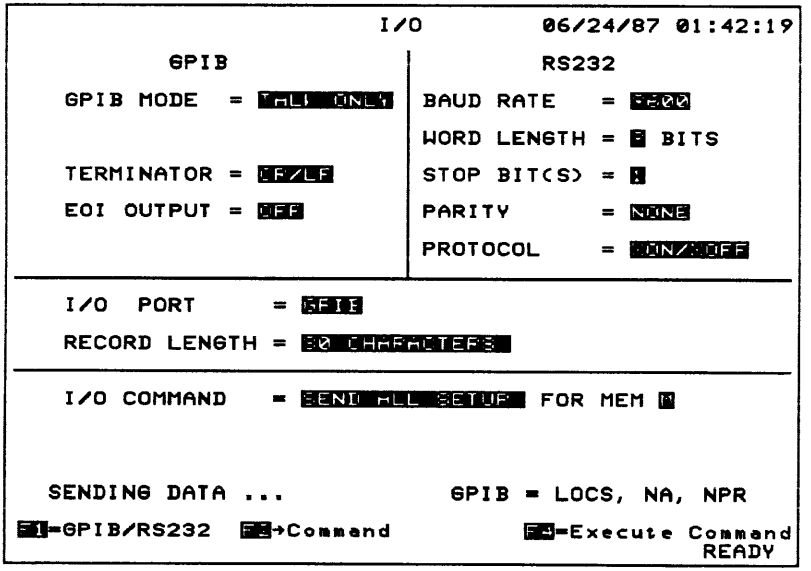


Figure 3-24. I/O Setup Screen

The I/O commands are selectable under the following conditions:

The I/O port choice is RS-232-C

The I/O port choice is GPIB. The GPIB mode is TALK ONLY.

I/O Setup Functions Keys

The following describes the various function keys available in the ***I/O Setup Screen***:

Key	Description
F1	Switches the I/O port selection between GPIB and RS-232-C.
F2	Moves the active field immediately to the I/O command field. This choice is available only when the I/O command field is displayed
F4	When the I/O Command field is displayed, executes the following:

Command	Records Sent and I/O
Send All Setup	All Format, Clocks, Trace Control, Arm Mode for selected memory
Send All Memory	If MEM =A: MA, LA, PA If MEM =B: MB, LB, PB,MX
Send Display Parameters	WG, WL, WQ, WS, WT, WV, ZC, CC, CR
Send All Search	ZR, KT
Send Status	KT
Send String	Sends specified Output String

Process String	Process specified Input String received from the active I/O port.

GPIB INTERFACE

Table 3-3 lists the K450B GPIB interface capabilities.

Table 3-3 GPIB Interface Capabilities

Function	Signal	K450B Application
Source Handshake	(SH1)	Complete Capability
Acceptor Handshake	(AH1)	Complete Capability
Talker Function	(T5)	Basic Talker.Talk Only Unaddress if MLA
Talker Function with Address Extension	(TEO)	No Capability
Listener Function	(L3)	Basic Listener Listen Only Unaddress if MLA
Listener Function with Address Extension	(LEO)	No Capability
Service Request	(SR1)	Complete Capability
Remote Local Function	(RL1)	Complete Capabilit
Parallel Poll Function	(PP1)	Remote Configuration
Device Clear Function	(DC1)	Complete Capability
Device Trigger Function	(DT1)	Complete Capability
Controller Function	(CO)	No Capability

GPIB Interface Mode

The K450B Logic Analyzer can be configured to operate in one of the following interface modes:

Talk and Listen

Talk Only

Listen Only

Talk and Listen Mode

In this mode, the K450B Logic Analyzer accepts information from, as well as transfers information to, a controller. This mode is best suited for automatic testing of equipment. To use Talk and Listen mode, assign an address between 0 and 30 in decimal to the instrument.

The K450B Logic Analyzer processes records sent on the GPIB bus when addressed to listen. The K450B Logic Analyzer is addressed to talk. In that case, the instrument processes records and sends the necessary information back to the controller.

IFC Command

The IFC Command, sent via the IFC line, clears the K450B Logic Analyzer GPIB and sets the Talk and Listen states to idle.

Device Trigger and Device Clear Commands

The Device Trigger command, causes a pulse on the rear panel GET BNC connector. The Device Clear command, sets the Default Setup M and Display values in the K450B Logic Analyzer.

Talk Only Mode

Talk Only mode transfers information to a dedicated GPIB printer or to another K450B Logic Analyzer.

Listen Only Mode

This mode receives information from another K450B Logic Analyzer.

Termination Characters

The K450B Logic Analyzer is configured to send any of four termination strings. The four termination strings are:

CR and LF

CR&LF + EOI

CR

CR + EOI

IEEE-488 Port

The IEEE-488 port is of standard configuration with full Talker/Listener capabilities. This port is configured through the ***I/O Set Up Screen***. Table 3-4 lists the connector pin-descriptions .

Table 3-4 GPIB Port Pin-Descriptions

Pin	Symbol	Description
1	D101	Data Input Output 1
2	D102	Data Input Output 2
3	D103	Data Input Output 3
4	D104	Data Input Output 4
5	EIO	End or identify
6	DAV	Data Valid
7	NRFD	Not Ready for Data
8	NDAC	Not Data Accepted
9	IFC	Interface Clear
10	SRQ	Service Request
11	ATN	Attention
12	Shield	
13	D105	Data Input Output 5
14	D106	Data Input Output 6
15	D107	Data Input Output 7
16	D108	Data Input Output 8
17	REN	Remote Enable
18	GND	Signal Ground Return for Pin 6
19	GND	Signal Ground Return for Pin 7
20	GND	Signal Ground Return for Pin 8
21	GND	Signal Ground Return for Pin 9
22	GND	Signal Ground Return for Pin 10
23	GND	Signal Ground Return for Pin 11
24	GND	Logic Ground

GPIB STATUS BYTE

By using the 𝕂𝕋 command (refer to the Record Type index in chapter 4) or issuing a serial poll command, the user may read the GPIB Status Byte. The eight bits of the Status Byte have the following meaning:

Bit	Meaning
7	Recording in progress (armed but not stopped)
6*	SRQ - K450B Logic Analyzer requests service
5	Error in powerup diagnostics
4*	Listen Record error, rest of record ignored
3	Not used (always zero)
2*	Acquisition control error (ARM control)
1*	GPIB SRQ key depressed
0*	Recording complete

*These bits are cleared following a serial poll response and when the K450B Logic Analyzer sends a 𝕂𝕋 record.

RS-232-C INTERFACE

Two connectors on the rear panel, labeled RS-232 and AUX provide the RS-232-C interface.

This interface is provided for applications where the K450B Logic Analyzer is remotely controlled using modems and telephone lines. The RS-232-C interface can also be used to connect the K450B Logic Analyzer to a local peripheral. The interface characteristics can be selected in the ***I/O Setup screen***.

Protocols

The RTS/CTS handshake is used to synchronize two devices with different processing speeds. The K450B Logic Analyzer uses the Data Terminal Ready (DTR) signal to indicate the imminent buffer overflow. The K450B Logic Analyzer ceases transmission if the Clear To Send (CTS) signal goes false.

Many computers and peripherals use XOFF/XON (DC3/DC1, control S/control Q in ASCII table) protocol to synchronize their data exchange.When the K450B Logic Analyzer can only accept a few more characters, an XOFF character (CTRL/S) is sent to signal additional time is required to empty and process the input buffer. The XON character then indicates the K450B Logic Analyzer is ready to accept more data. If the K450B Logic Analyzer receives an XOFF character, information is not transmitted until an XON signal is received.

RS-232-C Ports

The RS-232-C ports are seven-wire subsets with standard pin-outs. The ports are factory configured as DTE. Table 3-5 lists the pin-designations for the K450B RS-232-C ports.

Table 3-5. RS-232-C Port Pin-Connections

Pin	Name	DTE Sender	DCE Receiver
2	BA	Transmit Data	Receiver
3	BB	Receive Data	Transmit Data
4	CA	Request to Send	Data Set Ready
5	CB	Clear to Send	Terminal Ready
6	CC	Data Set Ready	Request to Send
7	AB	Ground	Ground
20	CD	Data Terminal Ready	Clear to Send

Using Null Modem

To access the K450B from a remote location, simply connect the K450B to a modem or an acoustic coupler with an RS-232-C cable. The cable should have male connectors on both ends. Most computer peripherals operate as DTE, indicated by a female connector in the back of the instrument. Pins 2 and 3 wires in the cable must be interchanged in one connector to transfer signals properly. This is the purpose of the null modem. The user can arrange one of the following three configurations when a modem or acoustic coupler is not used, The following configurations can be used to connect the K450B locally with another DTE such as CRT terminal.

Null Modem Variations

The user might desire to use the simple Null Modem circuit shown in Figure 3-25. Note, however, that this circuit lacks handshake capabilities.

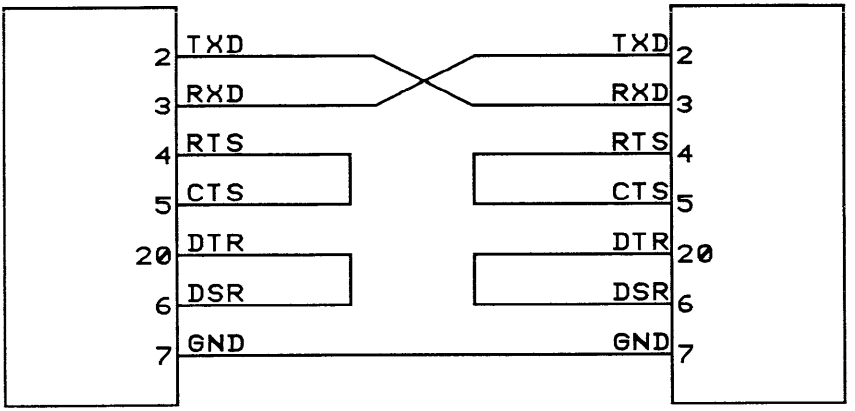


Figure 3-25 Simple Null Modem Wiring Diagram

Another alternative to implementing an easy wiring configuration is shown in Figure 3-26. This circuit allows logic handshaking by means of the DTR/DSR lines.

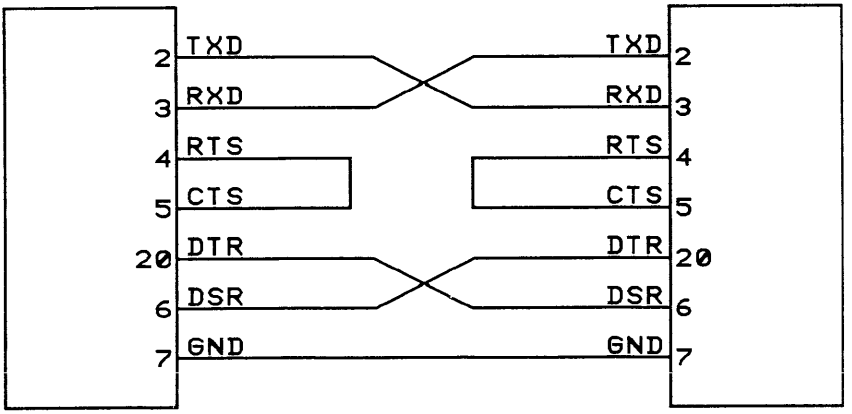


Figure 3-26. Null Modem Wiring Diagram with DTR/DSR

The interconnection shown in Figure 3-27 is a complete arrangement to interconnect the K450B to any computer using the earlier described hardware handshake capabilities.

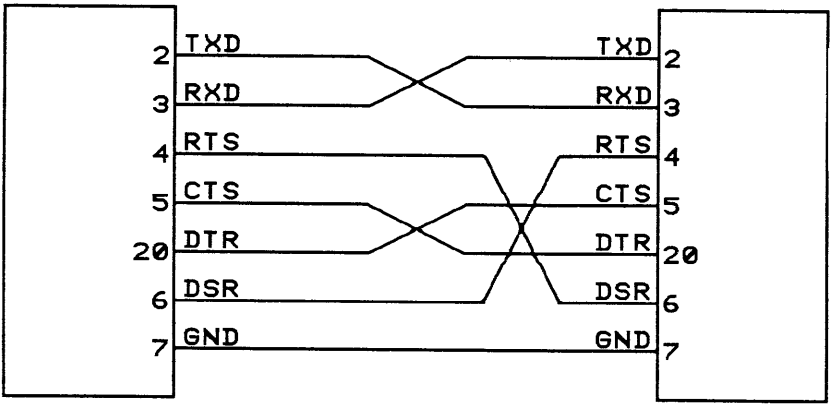


Figure 3-27. Complete Null Modem

GRAPHICS PRINTER INTERFACE

The wiring connection shown in Figure 3-28 interconnect the K450B to the Graphics Printer Accessory. The RS-232-C interface components are provided in the Graphics Printer Kit (part number A19510). The Graphics Printer may also be interfaced to the GPIB Port.

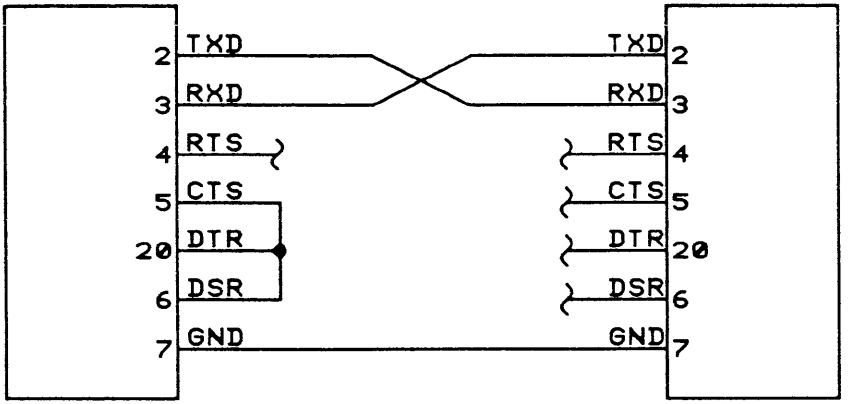


Figure 3-28. Null Modem for Graphics Printer

Print Using RS-232 Port

The following procedure presents steps for printing a graphics screen to the Graphics Printer Accessory (supplied by Gould Inc.) via the RS-232 port. Verify AC power is removed from both units prior to connecting the null modem.

1. Connect the Graphics Printer to the K450B using the null modem diagram shown in Figure 3-28.

2. Power up the K450B and Graphics Printer units. Access the I/O Set Up Screen and set the following RS-232 controls for identical conditions on both the Graphics Printer and K450B units:

Baud Rate	1,200 BPS
Word Length	8 bits
Stop Bits	1 or 2
Parity	Disable
Protocol	XON/XOFF

3. Enter the Graphics Screen and press the I/O key. A prompt appears at the bottom of the display screen which indicates the print function enabled.

4. Press Key 8 (Print Graphics) to execute the print function.

Print Using GPIB Port

The following procedure presents steps for printing a graphics screen to the Graphics Printer accessory via the IEEE-488 port. Verify AC power is removed from both units prior to connecting the cable.

1. Connect the Graphics Printer to the K450B via the GPIB Port.

2. Power up the K450B and Printer units. Access the I/O Set Up Screen and set the following controls for identical conditions on both the printer and K450B units:

GPIB Mode	Talk Only
Terminator	CR
EOI Output	OFF
I/O Port	GPIB
Record Length	80 Characters
I/O Command	Send all Setup

3. Enter the Graphics Screen and press the I/O key. A prompt appears at the bottom of the display screen which indicates the print function enabled.

4. Press Key 8 (Print Graphics) to execute the print function.

Loading the DSS Software

The Disk Storage System (DSS) Operating System software is supplied on two Diskettes, Part Numbers 0121-0470-10 and -20. Both diskettes contain the same software, except the -10 is write protected. The DSS Operating System software is loaded into the logic analyzer RAM in the following manner.

1 Turn On the logic analyzer and wait for the Power Up Screen to be displayed.

2 Press down on the front edge of the disk access door to release door latch.

3. Gently insert the system floppy diskette into the drive with disk slot toward the rear of unit and the label up. Lock the disk in place with drive latch handle.

****

CAUTION

To avoid damage to the diskette, always remove diskette from drive prior to turning the logic analyzer On or Off

****

4. Press the I/O key. The I/O menu appears at the bottom of the screen. Select the 0 (Quick Mode) or 1 (DOS Screen Mode) selection keys. Press either key. The advantage of the Quick Mode is that a major portion of the original display remains on the screen.

5. Observe the red LED on the disk drive illuminates approximately 5 seconds while software is loaded into the logic analyzer RAM. The following messages are briefly displayed at the bottom of the screen during the loading:

   K450B DOS BOOT, Version 1.0
   BOOT COMPLETE
   K450B DOS Loader, Version 1.0

6. The DSS directory and Command/Function fields are displayed as a result of pressing the 1 key. Pressing the 0 (Quick Mode) key results in displaying the Command/Function fields only.

Reboot Loading

The Reboot loading method is performed when DSS software has been previously loaded. Use the following procedure to reload DSS software into logic analyzer RAM.

1. Gently insert the system floppy diskette into the drive with disk slot toward the rear of unit and the label up. Lock the disk in place with drive latch handle.

2. Press the I/O key and then the 0 (Quick Mode) or 1 (Screen Mode) key. The disk storage system directory is displayed on the screen.

3. Press the 9 key (Quick Mode) or select the Reboot command from the Command field. Press the F4 key to execute the command.

4. The red LED on the disk drive illuminates approximately 5 seconds while software is loaded into logic analyzer RAM. The following messages are briefly displayed at the bottom of the screen during the loading.

   K450B DOS BOOT, Version 1.0
   BOOT COMPLETE
   K450B DOS Loader, Version 1.0

5. The DSS directory and the Command/Function fields are displayed as a result of pressing the 1 key. Pressing the 0 (Quick Mode) key results in displaying the Command/Function fields only.

Using DSS Software

After the DSS software has been properly loaded into the logic analyzer RAM, the user can execute any of 11 available system commands. These commands and the available options are described in detail under the SYSTEM COMMANDS in this section.. To execute a command, proceed as follows:

1. Press the I/O key, then press the 1 or 0 key. (The 1 key is used for the following example. Pressing the HELP key displays available commands.) Note the HELP screen is not available for key 0.

2. Either cycle through the command choices using the NEXT/PREVIOUS keys to select the desired command or press the corresponding quick key to make the selection. Quick key choices are as follows:

(0) - Save	(6) - Unlock
(1) - Recall	(7) - Directory
(2) - Delete	(8) - Format
(3) - Copy	(9) - Reboot
(4) - Rename	(A) - Sysgen
(5) - Lock	

3. Press the right-arrow key to move the cursor to the option field.The options for NEXT/PREVIOUS keys and quick keys are shown in Table 3-6. Press the down-arrow cursor key to scroll through all available files or to create a new file.Press the EDIT key to select Edit Mode.

4. In Edit mode, move the cursor right to edit the file and the initial version number. (Note the file type extension or suffix is normally supplied by the selection of an option field). Press the EDIT key to exit the Edit Mode

5. Press the F4 key to execute the system command. (Press the F4 key a second time if a warning message is to be ignored.)

FILE CATEGORIES

The DSS uses the following category of files:

Setup File:	Setup parameters for the clock select, data format, input mode, logic polarity and trace control specifications. This file also contains the timing display labels. Whenever a setup file is created, it always contains setup parameters for all setup menus.
Memory File:	Recorded data from the logic analyzer trace memories A or B and the active trigger levels for the recorded samples. The data from locations 0 through 2047, is stored in the data file. Additionally, total trace time, date and time of recording are stored.
Utility File:	Executable code for logic analyzer. These files are provided for disassemblers.

DOS exchanges files within the setup file category (setup file A with setup file B). Files cannot be exchanged between categories (a setup file cannot be exchanged with a data file). If illegal file changes are attempted, an error message is displayed on the message line.

File Name

Each file is assigned a unique name consisting of a file label, version number and file type designator. The file label contains six characters. The letters A through Z, numbers 0 through 9 and the SPACE (shift X) characters are used for the file label. All other characters are invalid. The file label cannot start with a space, and spaces cannot be interspersed with alphanumeric characters. Spaces are used only as fill characters following file labels of less than six contiguous alphanumeric characters.

File Version

The file version field contains two characters. Numbers 0 through 9 are the only valid characters for this field.

File Type

The file type field determines the type of file (setup, data, or execution file). The field is three characters in length. As the Save or Recall command option fields are changed, the file type option field also changes. However, when the file type option field is changed, the Save and Recall command option fields do not change. This allows the user to exchange files within a category. The character options available for the file type are listed in Table 3-6.

Table 3-6. File Type Character Options.

Name	Description	Key
SM	Setup (M) memory parameters for next recording	0
SA	Setup (A) memory parameters for last recording	1
SB	Setup (B) memory parameters for reference	2
MA	Memory A recorded data	3
MB	Memory B recorded data and Don't-Care Memory	4
BA	Both the setup parameters for memory MA & SA A and memory A recorded data	5
BB	Both the setup parameters for memory MB & SB B and memory B recorded data	6
EXE	Utility files for disassemblers, diagnostics, etc.	7
***	Wildcard used in delete, copy, lock, unlock and directory commands	8

An SA file can be transferred to an SB file and vice versa. An SA or SB file cannot be transferred to memory data or execution type files.

The number of blocks required for each file type is listed in Table 3-7.

Table 3-7. Blocks Required per File Type

File Type	Number Of Blocks
System File	13 Blocks
Setup M, A, or B File	4 Blocks
Memory A File	15 Blocks
Memory B File	29 Blocks
BA File	18 Blocks
BB File	32 Blocks
Utility File	Variable

Wildcard Character with File Name

An asterisk (*) is available for use as a wildcard character in file names. The * is entered by pressing the **X** key and can be used in the label, version, and type fields to allow flexibility to the user. When the * is used in a field, it indicates that any valid character may occupy the position(s) from the * location to the end of the field. Any character in the field to the right of of the * is ignored by the system. For example, the * can be used in a directory command as follows:

```
DIR  A:  F*ILEA-*8.SA
```

This command lists the following fields:

The label field starts with F. All other characters to the right of F (ILEA) are ignored.

All version levels are listed, the 8 is ignored.

The file type is SA

The following is a typical file listing from the directory:

```
FILEA 01.SA
FILEA  02.SA
FOO   07.SA
FINDA 05.SA
F     09.SA
```

Creating Files

When the ***I/O screen*** is initially invoked, it looks for a system disk in Drive A and creates a filename as follows:

A:FILE-01.SM

This file is called the default file and appears in the command line of both Screen Mode and Quick Mode. Whenever a filename is required by a command, the system starts with the default filename. The user may change the default name to a more suitable filename. The default filename, however, is always displayed first, even if other files are stored on the disk.

To create files from the default filename, enter the Edit mode by pressing the **EDIT** key. Enter valid characters from the keyboard (0 through 9, A through Z and space characters) in the label field.

To erase a character, replace it with a space character. Increase or decrease the version field by pressing the **F1** or **F2** key, or enter a version number directly from the keyboard.

The third field (file type) is controlled by the system. Keyboard entries are not permitted in this field. Press the **NEXT/PREVIOUS** key to select a file type.

Auto Directory

Auto Directory selects filenames in the directory of the current disk for use in the command line of the DOS. This simplifies Copy and Rename operations.

When the selection cursor is moved through the Directory filenames, the Directory scrolls when the cursor reaches the last filename on the screen. The cursor is aligned to any of the first 16 filenames via the **QUICK** keys. The **0** key corresponds to the first filename, and the **F** key corresponds to the sixteenth filename.

When the filename command field is first selected, it displays the first filename shown in the Directory. When working with the Rename and Copy commands in the non-Edit mode, the information in the two filename blocks changes as the fields are selected.

DISK STORAGE SYSTEM COMMANDS

When a command is selected, the command and default options are displayed near the bottom of the screen. Each command has options that are selected by pressing the **RIGHT FIELD**, **EDIT**, and **QUICK** keys.The **NEXT/PREVIOUS** keys also select an option. Press the **F4** key to execute the selected command. Some commands such as Format or Sysgen give a warning (such as DISK WILL BE ERASED!). This warning may be ignored by pressing the **F4** key a second time. Figure 3-29 shows the Directory with the Save command selected and default options shown at the bottom of the screen.

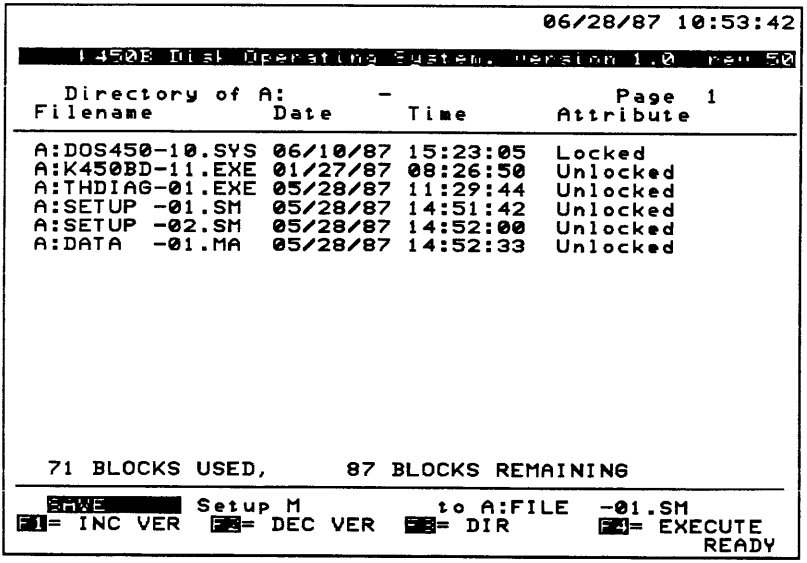


Figure 3-29. Directory Save Command Display

Save

The Save command is used to store logic analyzer information (setup parameters, recorded data, etc.) on the floppy disk. The Save command has eight options described in Table 3-8. Each command is selected in the Save option field by pressing the **QUICK**, or **NEXT/PREVIOUS** keys.

Table 3-8. Save Command Options

Option	Function	Key
Setup M	Stores memory M setup parameters and timing-display labels	0
Setup A	Stores memory A setup parameters and timing-display labels	1
Setup B	Stores reference memory B setup parameters and timing-display labels	2
Memory A	Stores memory A recorded data and active trace level for each sample	3
Memory B	Stores memory B and Don't Care memory recorded data and active trace level for each sample	4
MA & SA	Stores memory A setup parameters and recorded data	5
MB & SB	Stores memory B setup parameters and recorded data	6
Utility	Stores a currently loaded disassembler or other executable file. a valid executable file must be in memory.	7

3-30). This mode makes specific files accessible without proceeding through the Directory display. When the Quick Mode is selected, the lower portion of the screen allows the user to select a pre-recorded file via the Auto Directory Mode or Edit Mode.

Any attempt to execute a Save command which specifies a filename that already exists on the disk results in the following message displayed on line 2 of the screen:

A:(Filename), FILE ALREADY EXISTS

Press the **F4** key again to erase the previous file and execute the Save command to save the new information. The user may also change the filename for the new information and execute the Save command to store the data.

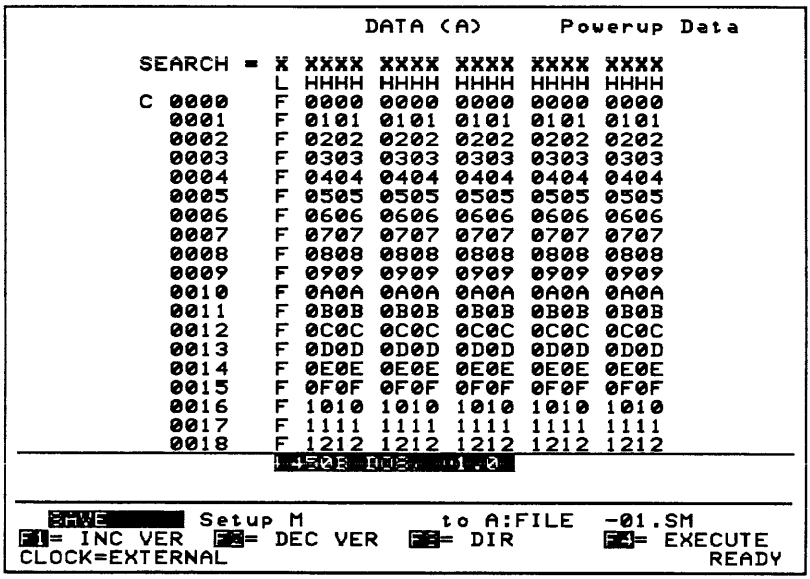


Figure 3-30.. Quick Mode Display

Recall

The Recall command loads information Files (setup parameters, setup menus, recorded data, etc.) from the disk into logic analyzer memory A or B.

Each option may be selected by pressing the **EDIT** key and then the **QUICK** key as indicated in Table 3-9.

Table 3-9. Recall Command Options

Option	Function	Key
Setup M	Loads setup parameters and timing display labels from a specified file into logic analyzer Setup M Menus	0
Setup A	Loads storage memory A setup parameters and timing-display labels from a specified file into logic analyzer Setup A.	1
Setup B	Loads reference memory B setup parameters and timing display labels from a specified file into Memory B	2
Memory A	Loads memory A recorded data and active trace level for each sample from a specified file into Memory A.	3
Memory B	Loads memory B and Don't-Care memory recorded data and active trace level for each sample from a specified file into Memory B	4
MA & SA	Loads memory A setup and recorded data from a specified file into logic analyzer Setup A Menus and Memory A	5
MB & SB	Loads memory B setup and recorded data from a specified file into Setup B Menus and Memory B	6

Utility	Loads disassembler or other executable file	7

If the user attempts to execute a Recall command that specifies a filename which does not exist on the disk, the following message appears on the screen:

A:(Filename), FILE NOT FOUND

In this case, the user must access the Directory command via the disk storage menu to determine which files are available on the disk.

Delete

The Delete command erases any specified unlocked file from the disk. This command has the options described in Table 3-10. Each option can be selected in the Delete option field by pressing the **EDIT** key and then the **QUICK** key indicated.

Table 3-10. Delete Command Options

Option	Function	Key
DELETE A:File	Selects the first file on disk to be erased	0
DELETE A:FILE	Selects the sixteenth file on disk to be erased	F

Copy

The Copy command copies directory contents from a source disk to a destination disk. The DOS software allows a single floppy disk drive to be both the source and destination device. To execute the Copy command, the destination disk must be properly formatted. Use the Format command to format a new disk. If a file already exists, the system informs the user that this file is already on disk.

The user can take any of the following actions:

1. Press the **F4** key. The old file is erased and the new information is copied from the source file.

2. Change the filename and press the **F4** key to execute the Copy command.

3. Exit the processing by reselecting the Copy command.

Copying an entire disk will require swapping the source and destination disks several times.The Copy command has the options described in Table 3-11 Each option is selected by pressing the EDIT key and then the QUICK key as indicated.The wildcard character (*) can be used with the Copy command.

Table 3-11. Copy Command Options

Option	Function	Key
COPY Filename	Copies the specified files, to filename except system file to specified files.	0
COPY SOURCE to DESTINATION	Copies all files to the destination Enter a source filename in the left filename field and a destination Filename in the right filename field. Both the source and destination locations must be A.	2

When the command line is properly configured, perform the following steps:

1. Press the **F4** key. Line 2 displays the message:

   MOUNT SOURCE DISKETTE ON A, PRESS F4

2. Press the **F4** key again. Line 2 displays the message:

   MOUNT DESTINATION DISK ON A, PRESS F4

3. Replace source diskette with destination diskette and lock in place with drive handle.

4. Press the **F4** key again.

5. If the copy is successful, line 2 displays:

   COMMAND DONE

6. If a filename already exists, the following is displayed:

   A: (filename), FILE ALREADY EXISTS

Rename

The Rename command allows the user to change the name of an existing file. This command is described in Table 3-12. The option is selected in the Rename field by pressing the **EDIT** key and then **QUICK** key .

Table 3-12. Rename Command Option

Option	Function	Key
RENAME A:FILENAME	Changes the name of a file on disk to a new name. Specify both the old and new filenames completely before executing the Rename command. If not, the following message appears on the screen:	0
ILLEGAL FILENAME	If the user attempts to execute a Rename command that specifies a filename that already exists, the following message appears on the screen: A:(Filename), FILE ALREADY EXISTS Perform the following: 1. Press the **F4** key again to erase the previous file and execute the Rename command. 2. Select another filename. 3. Select another command via the DSS menu.	

Lock

The Lock command protects a file or group of files from being either overwritten or erased. This file protection can only be removed via the Unlock command. The Lock command has the option described in Table 3-13. The option can be selected in the Lock option field by pressing the **EDIT** key and then the **QUICK** key. Press the **F4** key to execute the command. When a file is locked, the system can only read this file. The Lock command does not protect files against access via the Sysgen or Format commands. The wildcard character (*) is used with the Lock command.

Table 3-13. Lock Command Option

Option	Function	Key
LOCK A: Filename	Causes specified files on disk to be write and erase protected.	0

Unlock

The Unlock command reverses the Lock command allowing the user to overwrite or erase a file. The Unlock command has the option described in Table 3-14. The option can be selected in the Unlock option field by pressing the **EDIT** key and then the **QUICK** key. Press the **F4** key to execute the command. The wildcard character (*) is used with the Unlock command.

Table 3-14. Unlock Command Option

Option	Function	Key
UNLOCK A: Filename	Causes specified files on disk to be completely accessible to user	0

Directory

The Directory command displays all or a selection of (up to 16) filenames. File listings include filename, date and time, and the locked or unlocked attributes for each file. The command has two options described in Table 3-15.

Table 3-15. Directory Command Options

Option	Function	Key
Filename	Displays filenames in the Directory screen	0
DIR A	Displays all filenames	3

Select an option by pressing **EDIT** and then the **QUICK** key. Press **F4** key to execute the command. The wildcard character (*) is used with the Directory command.

The **PAGE UP** or **PAGE DOWN** keys access other groups of 16 filenames. Rollover occurs from the last filename to the first filename. When the Directory command is executed, the filename and file attribute is displayed. File size is included in the display when a single file is listed. A typical screen is shown in Figure 3-31.

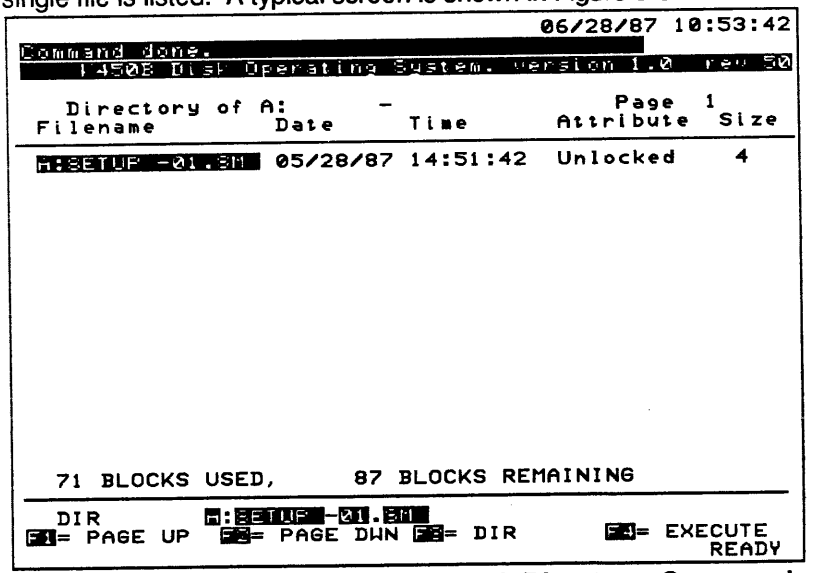


Figure 3-31. Display of Executed Directory Command

Format

Use of the Format command erases all information stored on the disk. Avoid formatting the system disk.

The Format command initializes a floppy disk to a recording format that is acceptable to the Disk Operating System. Disks must be formatted before any system commands are executed. The Format command has the option described in Table 3-16 This option can be selected in the Format option field by pressing the **QUICK** key.

Table 3-16. Format Command Option

Option	Function	Key
FORMAT A: DISKNAME	Causes floppy disk to be properly formatted	0

Select the Format command, and press the **RIGHT FIELD** key to enter the Format options field. The Edit mode is automatically selected. A six-character name may be assigned to a disk for the Format and Sysgen operations. When the **F4** key is pressed to execute the Format command, the following message appears on the screen:

```
WARNING: DISK WILL BE TOTALLY ERASED
```

Press F4 again to continue the operation.

Reboot

The Reboot command reloads DOS software, loader and programs, into the logic analyzer. The Reboot command has the option described in Table 3-17. Press the **F4** key to execute the command.

Table 3-17. . Reboot Command Option

Option	Function	Key
REBOOT A	Causes the DOS software on disk to be loaded into RAM.	0

****

CAUTION

Use of the Sysgen command erases all information stored on the disk. Avoid overwriting the system disk with Sysgen.

****

The Sysgen command copies the Disk Operating System programs from a source disk to a destination disk. To copy the DOS using Sysgen , perform the following steps:

1. Move the cursor to the right to enter the Sysgen options fields. The Edit mode is automatically selected. Select A to A and assign a disk name.

2. Press the **F4** key. Line 2 displays the message:

   MOUNT SOURCE DISKETTE ON A, PRESS F4

3. Insert the proper diskette, and press the **F4** key. Line 2 displays the message:

   MOUNT DESTINATION DISK ON A, PRESS F4

4. Insert the proper diskette, and press the **F4** key. Line 2 displays the message:

   WARNING: DISK WILL BE TOTALLY ERASED

5. Press the **F4** key again.

6. When Sysgen executes successfully, line 2 displays the message:

   COMMAND DONE
   Part No. 0121-0355-10
   May, 1987
   K450B LOGIC ANALYZER

Chapter 4

REMOTE INPUT/OUTPUT COMMANDS

INPUT/OUTPUT RECORDS

This chapter contains descriptions of each K450B Logic Analyzer Input/Output (I/O) record. Each description contains the syntax and system response for the record. Each command is presented on a separate page and a cross-reference index is provided at the end of this chapter to identify the page location for each command. The commands often cover a 96-channel data base (Input Sections A through F). The upper 16 channels (Section F) are reserved for future use.

Record Types

There are three classes of records used by the K450B for I/O operations. They are described here from the standpoint of a K450B connected to a remote controller.

RECORD TYPE	K450B ACTION
Send	Returns a value/status indicator. the remote controller.
Receive	Set a value or perform a command. Action does not return results directly.
Send / Receive	Dependent on the syntax used, the K450B will return or set a value.

The K450B terminates SEND records and acknowledges RECEIVE records with a CR/LF sequence for RS-232 mode, and with either CR/LF or CR for GPIB mode, dependent on the ***I/O Setup Screen*** selection.

BINARY TRANSFER RECORD NOTES

If one of the Binary Transfer records is used while in GPIB mode, the EOI selection is forced active, regardless of its prior state. It is not reset after the binary transfer is complete.

Binary Transfer records only operate with ASCENDING ranges. Use of DESCENDING or FIXED ranges may result in INVALID RECORD messages and the results are undefined.

Record Syntax

K450B I/O records are sent or received entirely in ASCII, with the exception of the BINARY TRANSFER records. Each record contains one or more of the following elements:

MEMORY

A single character preceding setup record identifiers, indicating the desired K450B setup memory. Default (no character) is setup memory M. Other valid characters are 'A' (setup memory A), and 'B' (setup memory B).

RECORD

Two characters identifying the I/O record type. Always present.

RANGE

For records with a sequence of values, specifies the range of values to be sent or received. Range specifications are described later in this chapter.

DATA

Sent or received data values for the record.

The remote controller must insert an equals (=) between the RECORD or RANGE and the DATA elements of a RECEIVE record. The remote controller must terminate all records with a carriage return (CR). The K450B ignores linefeeds (LF) sent by the remote controller.

RANGE/DATA VALUES FOR 400MHz INPUT

The optional 400MHz Probe (described in Appendix C) must be installed to enable software to acknowledge the channels selected for 400MHz (2.5 ns) input. Appendix C also describes each command associated with the 400MHz Probe input.

The parameters for Range and Data identify the sampling rate (400MHz), Time Base (2.5 nanoseconds), and Memory Depth (8192 samples). The user must specify the applicable value for Range and Data choices when the command is issued.

Listed below are the various symbols used in the syntax.

Symbol	Description
,	Entries separated by comma for Data choice field (*, L, G), indicate selections.
{}	Braces, which must not be entered, indicate required entries.
( )	Parenthesis enclosing an index must be included where specified.
NA	Not Applicable. The field is not required.
<A/B>	Memories A or B can be selected for setup data by prefixing the letter A or B.If omitted, Memory M is used. A superscript numeral outside an entry enclosed in braces indicates the amount of times the selected entry must be sent.The total amount of entries consists of a combination of desired entries.

INVALID RECORDS

The K450B Logic Analyzer's response to invalid records or data depends on which communication port, RS-232-C or GPIB, is active.

RS-232-C Invalid Record Processing

When RS-232-C is active and the K450B Logic Analyzer receives an invalid record type or data, the K450B Logic Analyzer sends the following Invalid Record (IR) message:

end-of-line IR=*** INVALID RECORD *** end-of-line

The K450B Logic Analyzer then discards the remaining portion of the received record and scans the input until an end-of-line message is received. If the K450B Logic Analyzer receives the IR record, it sends an end-of-line message. When a data record is received and processed, the K450B Logic Analyzer responds with an end-of-line message if the data is valid. Otherwise, the Invalid Record is sent. The K450B Logic Analyzer accepts either CR or CR/LF as the end-of-line message.

If the K450B Logic Analyzer receives an end-of-text character (Ctrl/C, 03H), it cancels the command processing and waits for a new record identifier.The maximum record length selected on the ***I/O Setup screen*** is 80 characters. This capability is useful when the output is sent to a printer or CRT. The K450B Logic Analyzer batches all received records and processes them sequentially.

GPIB Invalid Record Processing

When GPIB is active and the K450B Logic Analyzer receives an invalid record type or data, it performs the following functions:

> The K450B Logic Analyzer sets bit 4 (listen error record) in the GPIB status byte and then sends an SRQ-message to the controller.
>
> The K450B Logic Analyzer discards the remainder of the received record and scans the input until an end-of-line message is received.

If the K450B Logic Analyzer receives an Invalid Record, it accepts and ignores the record. When a data record has been received and processed, the K450B Logic Analyzer does not respond if the data is valid. Otherwise, bit 4 is set in the GPIB status byte and a SRQ-message is sent to the controller. The K450B Logic Analyzer accepts any number of end-of-line messages. The K450B Logic Analyzer accepts either CR or CR/LF as the end-of-line message. The K450B Logic Analyzer sends the end-of-line message selected on the ***I/O Setup screen*** (either CR or CR/LF).

If the K450B Logic Analyzer receives an end-of-text character (Ctrl-C, 03H), it cancels the command processing and waits for a new record-identifier. The maximum record length selected on the ***I/O Setup screen*** is 80 characters or unlimited. This capability is useful when the output is sent to a printer or CRT. The K450B Logic Analyzer batches all received records and processes them sequentially.

RANGE SPECIFICATIONS

The following presents the range specifications for input/output array-record types. The Range Index field lists both the minimum and maximum index value for the record. The data values listed for Array records indicate the selection(s) required for each element of the array (e.g., if the range is (0-3), data must be entered four times) except when a colon separator is used in the range index.

The brackets below indicate required entries:

1. ({index})

   Record includes only one array value.

   Example: (0) (5) (456)

2. ({Lower} - {upper})

   Record includes all values in the range in ascending order.

   Example: (0-2) (5-123) (500-514)

3. ({upper} - {lower})

   Record includes all values in the range in descending order.

   Example: (2-0) (123-5) (514-500)

4. ({lower} /)

   Input Records: Values included start from the specified lower limit in ascending order.

   Request Records: Requests all values starting from the specified lower limit to the absolute upper limit.

   Example: (2/) (123/) (500/)

5. ({ upper})

   Input Records: Values included start from the specified upper limit in descending order.

   Request Records: Requests all values starting from the specified upper limit to the absolute lower limit.

   Example: (2) (123) (500)

6. (-)

   Input Records: Values included start from the absolute lower limit in ascending order.

Request Records: Requests all values starting from the absolute lower limit to the absolute upper limit.

7. ({lower} : {upper})

Input Records: Only one array value is included. All array elements in the range are set to that value.

Example: (2:0) (123:5) (514:500)

8. (:)

Input Record: Only one array value is included. All array elements are set to that value. When the communication port is GPIB, the FIXED format range specifications (1,2,3) are processed slightly faster than the VARIABLE format range specifications.

CLOCK DEMUX (CD)

Syntax

MEMORY	RECORD	RANGE		DATA	
<A/B>	{CD}	{(0-5)}	{=}	{*,D} {*,L,G} { *,L,G}	{EOL}

Record Type: Send / Receive

The selected range specifies the clock section or sections to be sent/received. Range value is from 0 (section A) to 5 (section F). The first data choice specifies NO DEMUX (*), or DEMUX (D) for that clock section. The second and third data choices specify Latch or Glitch mode for inputs 7-0 and F-8 respectively, of that section. The selections are neither Latch nor Glitch (*), Latch mode (L), or Glitch mode (G).

Example: CD(5)=*LG

CLOCK LATCH EXPRESSION (CL)

Syntax

MEMORY	RECORD	RANGE		DATA		
<A/B>	{CL}	{(0-2)}	{=}	{*,H,L}	6	{EOL}

Record Type: Send / Receive

The selected range specifies the clock sections to be sent/received. The K450B supports three latch clock expressions, with each expression operating on two clock sections. Range values are: 0 (section A and D), 1 (section B and E), and 2 (section C and F). The data consists of 6 characters per range entry, specifying the state of each clock input in the Latch Clock expression. Each character must specify INACTIVE (*), ACTIVE HIGH (H), or ACTIVE LOW (L). The order of clock inputs is as follows: **CR, BR, AR, CS, BS, AS**. All inputs must be specified, regardless of the number physically present in the K450B.

Note that the Latch Clock expression will be sent or received by the K450B even if the Latch mode has not been selected using the **CD** record command.

Example: CL(2)=H**LL*

CLOCKS MODE (CM)

Syntax

MEMORY	RECORD	RANGE		DATA
<A/B>	{CM}	NA	{=}	{S, A} 6 {I, E {H, L, *} {EOL}

Record Type: Send/Recieve

The first data choice specifies the Clock Mode. S selects Standard and A selects Advanced. The second data choice specifies the Master Clock Source. I selects Internal and E selects External.
If External (E) is selected, the third data choice must be included to specify the Master Clock Expression. *, H, and L must be selected in any combination of six. * selects not used for inputs, H selects Active High and L selects Active Low.

These six selections represent the following Clock Inputs: CJ, BJ, AJ, CK, BK and AK for 48-input systems, configured for more than 32 channels, and BR, BJ, AJ, BS, BK and AK for 32-input systems.

Example: CM=AE**L***

Syntax

MEMORY	RECORD	RANGE	DATA
<A/B>	{CS}	{(0-5)} {=}	{S, R} 6 {EOL} {I, E {H, L, *} H, M, 2}

Record Type: Send/Recieve

The selected index must be in the range of 0 through 5 and specifies the Clock Section values. 0 selects A, 1 selects B, 2 selects C, 3 selects D, 4 selects E and 5 selects F. The first data choice specifies the Clock Section Mode. S selects Sample and R selects Store. The second data choice specifies the Sample/Store Clock Source. I selects Internal, E selects External, H selects 10 Nanoseconds, M selects the same value as the Master Clock, and 2 selects five ns.

If External (E) is selected for the Sample/Store Clock Source, the third data choice is included. H, L and * must be selected in any combination of six to specify the Sample/Store Clock Expression for the Clock Section. * selects not used for the input, H selects Active High and L selects Active Low.

These six selections represent the following Clock Inputs: CJ, BJ, AJ, CK, BK and AK for 48 input systems, configured for more than 32 channels and BR, BJ, AJ, BS, BK and AK for 32 input systems.

Example: CS(0)=SEHHH***

INTERNAL CLOCK PERIOD (CI)

Syntax

MEMORY	RECORD	RANGE		DATA	
<A/B>	{CI}	NA	{=}	{001-900} {M, U, N}	{EOL}

Record Type: Send/Recieve

The first data choice must be selected from a range of 001 through 900 and specifies a value for the Time Interval field. The valid clock periods are 020 ns to 100 milliseconds in a one through ten sequence.The second data choice specifies the Time Unit. M selects milliseconds, U selects microseconds and N selects nanoseconds. The cursor remains in the field following execution of the selection.

Example: CI=100N

SEND ALL CLOCKS RECORDS (C-)

Syntax

MEMORY	RECORD	RANGE	DATA	
<A/B>	{C-}	NA	NA	{EOL}

Record Type:Send

The K450B responds by sending the following output records:

CM, CI, CD, CS

Example: C-

CONTROL CURSOR POSITION (CC)

Syntax

MEMORY	RECORD	RANGE		DATA	
<A/B>	{CC}	NA	{=}	{0000-4095}	{EOL}

Record Type: Send/Receive

The data choice consists of four numeric characters forming a value in the range of 0000 through 4095 (for 200 Mhz) or 0000 through 2047 (for any other selected time base). The selected value specifies the Control Cursor position.

Example: CC=0098

REFERENCE CURSOR POSITION (CR)

Syntax

MEMORY	RECORD	RANGE		DATA	
<A/B>	{CR}	NA	{=}	{0000-4095}	{EOL}

Record Type: Send/Receive

The data choice consists of four numeric characters forming a value in the range of 0000 through 4095 (for 200 Mhz) or 0000 through 2047 (for any other selected time base). The selected value specifies the Reference Cursor position Although the Reference Cursor value is more closely associated with the Display Records, it is included in this section as it directly affects an Arm Mode Screen selection. Specifically, the Auto Compare range choice between Cursors is dependent on the Reference Cursor value.

Example: CR=1049

DATA AND CLOCK THRESHOLDS (FT)

Syntax

MEMORY	RECORD	RANGE		DATA	
<A/B>	{FT}	{(0-6)}	{= }	{T, E, A, B}	{EOL}

Record Type: Send/Receive

The index selected must be in a range of 0 through 6 and specifies the Input Group as follows:

0	Clocks
1	AF-A0
2	BF-B0
3	CF-C0
4	DF-D0
5	EE-E0
6	FF-F0

The inputs are presented on the screen with AF-A0 located on the bottom and FF-E0 on top of the Data Inputs Column. The data choice specifies the threshold assigned to the input group. T selects TTL, E selects ECL, A selects VARA, and B selects VARB.

Example: FT(0-4)=AETTT

DATA FORMAT COLUMN DEFINITIONS (FD)

Syntax

MEMORY	RECORD	RANGE		DATA
<A/B>	{FD}	{(0-39)}	{=}	{0-8} {EOL} {A0, A1, A2,..EE, EF}

Record Type: Send/Receive

The selected index must be in a range of 0 through 39 and specifies the desired Data Format Column(s). Up to 40 columns may be defined by the user. The first data choice for each index specifies the radix for the column as follows:

0	Blank Column	3	Octal	6	ASCII6
1	Binary	4	Hex	7	ASCII7
2	Quad	5	X	8.	EBCDIC

The first data choice also specifies the number of character pairs to follow, which select the Inputs. The second data choice selects the character pair(s). Each character pair consists of an Alpha character in the range of A through E, which specifies the Section, followed by a Hex character in the range of 0 through F, which specifies the Input number.

If Memory M is selected, this record type represents the Data Format Column Definitions for the User Specified Mode. However, all blanks within columns are purged. If either Memory A or B is selected, this record type represents the Data Format Column Definitions used when the A or B acquisition was initiated.

Example: FD(0-3)1B004AFAEDAC4ABAAA9A8

DATA FORMAT LEVEL SELECT (FL)

Syntax

MEMORY	RECORD	RANGE		DATA	
<A/B>	{FL}	NA	{=}	{T, F}	{EOL}

Record Type: Send/Receive

When Memory M is selected, either T or F can be selected to display the Level Memory on or off, respectively, when in User Specified Mode. When T is selected, an L, representing Level, appears in the Level Memory Field, which is located adjacent to the Radix field on the screen. When F is selected, the Level Memory is blank. If either Memory A or B is selected, this record indicates the Data Format Level Select used when the A or B acquisition was initiated.

Example: FL=T

DATA FORMAT MODE (FF)

Syntax

MEMORY	RECORD	RANGE		DATA	
<A/B>	{FF}	NA	{=}	{0-4}	{EOL}

Record Type: Send/Receive

The data choice is a numeric character in the range of 0 through 4 and specifies the Data Format Mode as follows:

0	Hex
1	Octal
2	Binary
3	User Specified
4	Disassembler

Example : FF=3

DATA POLARITY FIELD (FP)

Syntax

MEMORY	RECORD	RANGE		DATA	
<A/B>	{FP}	{(0-95)}	{=}	{+, -}	{EOL}

Record Type: Send/Receive

The selected index must in the range of 0 through 95, with 0 corresponding to Input A0 and 95 corresponding to Input FF. The data choice is either + or - and specifies the polarity assigned to the selected Input to be positive or negative.

Example: FP(0-1)=-+

VARIABLE THRESHOLD A (FA)

Syntax

MEMORY	RECORD	RANGE		DATA
<A/B>	{FA}	NA	{=}	{+, -} {000-999} {EOL}

Record Type: Send/Receive

The first data choice is either + or - and specifies the polarity of the threshold to be either positive or negative. The second data choice specifies the voltage.

Example: FA=+500

VARIABLE THRESHOLD B (FB)

Syntax

MEMORY	RECORD	RANGE		DATA
<A/B>	{FB}	NA	{=}	{+, -} {000-999} {EOL}

Record Type: Send/Receive

The first data choice is either + or - and specifies the polarity of the threshold to be either positive or negative. The second data choice specifies the voltage. Three numeric characters forming a value in the range of 000 through 999 are selected to identify a threshold in 10mV steps.

Example: FB=-750 (Represents -7.50 Volts)

SEND ALL FORMAT RECORDS (F-)

Syntax

MEMORY	RECORD	RANGE	DATA	
<A/B>	{F-}	NA	NA	{EOL}

Record Type: Send

The K450B responds by sending the following output records:

FF, FL, FD, FT, FA, FB, FP

Example: F-

TRACE CONTROL COMMAND (TC)

Syntax

MEMORY	RECORD	RANGE	DATA
<A/B>	{TC}	{(0-79)}	{=}{ASCII STRING}{EOL}

Record Type: Send/Receive

The selected index must be in the range of 0 through 79. This index specifies the line number of the Trace Control. The data choice is an ASCII string consisting of 23 characters selected as presented in Table 4-1. Definitions for entries are provided following the table.

Table 4-1. Trace Control Command Entries

ASCII CHAR.	FUNCTION	COMMAND ENTRY	
1	COMMAND		*W T U G S A D J H
2	COMMAND EXTENSION	If command = W or T If command = G or J otherwise	* F U I (0...F) *
3	CONDITION SELECT	If W,T,U,G,S,A otherwise	S C A *
4	PATTERN	If W,T,U,G,S,A otherwise	E N *
5,6	PATTERN SELECT	Number of valid pattern	(00...49)
7-16	PATTERN FILL-IN DIGIT	Must be five character pairs, each representing the ASCII encoded decimal value of a fill-in character	00-FF
17	DELAY RELATION	If character 2 is C or A otherwise	>=<G=L *
18-22	DELAY		(00001 through 65535)
23	DELAY	If WF TF OR TD otherwise	(C or S) *

ENTRY DEFINITIONS:

ASCII #	ENTRY	DEFINITION
1st	*	Null
	W	WAIT
	T	TRACE
	U	OR UNTIL
	G	OR GO TO
	S	OR STOP
	A	ADVANCE
	D	SET DELAY
	J	GO TO
	H	STOP
2nd	*	Don't Care - Blank
	F	FOR
	U	UNTIL
	I	IF
	(0...F)	Target Level
3rd	S	Sample Pattern
	C	Count
	A	Sample and Count
	*	Don't-Care
4th	E	When equal
	N	When not equal
	*	Don't-Care
5th and 6th	00..49	Pattern Number
7th - 16th	00-FF	(7,8) 5th Fill-In Character (9,10) 4th Fill-In Character (11,12) 3rd Fill-In Character (13,14) 2nd Fill-In Character (15,16) 1st Fill-In Character

17th	>	Count greater than delay
	=	Count equal to delay
	<	Count less than delay
	G	Count greater than/equal to delay
	x	Count not equal to delay
	L	Count less than/equal to delay
	*	Don't-Care
18th - 22nd	(00001.65535)	delay count
23rd	C	Clocks
	S	Counts of Sample = pattern

Example: TC(0-1)=TUSEO1FFFFFFFF05=
00512CTFSEOOFFFFFFFFFF=OO25OC

Syntax

MEMORY	RECORD	RANGE	DATA		
<A/B>	{TP}	{(0-49)}	{=}	{0-5}	{EOL} FIRST VALUE {00-39}

Record Type: Send/Receive

The selected index must be in the range of 0 through 49 and specifies the Pattern Line number.The first data choice is a numeric character in the range of 0 through 5 and specifies the number of fill-in columns for the selected pattern. Note that selecting zero clears any set parameters.

The second data choice consists of a numeric character pair in the range of 00 through 39 and specifies the column fill-in (s). The number of pairs must coincide with the numeric character specified for the first data choice.

Example: TP(0-2)=0212130

TRACE CONTROL PATTERN NAME (TN)

Syntax

MEMORY	RECORD	RANGE		DATA	
<A/B>	{TN}	{(0-49)}	=	{ASCII CHAR}	{EOL}

Record Type: Send/Receive

The selected index must be in the range of 0 through 49 and specifies the sequentially numbered Pattern Definition Line number.The data choice consists of any combination of eight ASCII alpha characters, numeric symbols and spaces, which specify the pattern name.

Example: TN(0-2)=ENABLE TRIGGER

TRACE CONTROL PATTERN VALUE (TV)

Syntax

MEMORY	RECORD	RANGE		DATA	
<A/B>	{TV}	{(0-49)}	{=}	{*, 1, 0}	{EOL}

Record Type: Send/Receive

The selected index must be in the range of 0 through 49 and specifies the Pattern Definition Line number, presented on the screen from top to bottom, beginning with 0. The first data choice consists of any combination of 96 asterisks, zeros or ones, which specify Don't-Care, 0 or 1 for each of the 48 Inputs. The first character selected corresponds to Input FF and the last corresponds to Input A0.

Example: (Hex Data Format selected)

```
TV(0)=000000000001000000000000001000000101010101010100000000000000000000000000000100100100000100010010
```

SEND ALL TRACE CONTROL RECORDS (T-)

Syntax

MEMORY	RECORD	RANGE	DATA	
<A/B>	{T-}	NA	NA	{EOL}

Record Type: Send

The K450B responds by sending the following output records:

TC, TN, TP, TV

Example: T-

ARM MODE (RM)

Syntax

MEMORY	RECORD	RANGE		DATA
<A/B>	{RM}	NA	{=}	{S, R} {EOL} {*, L, E, N} {*, P, L} {0000-9999}

Record Type: Send/Receive

The first data choice specifies the Arm Mode. S selects Stop and R selects Auto Rearm. The second data choice is only included if Auto Rearm (R) is selected and represents the first Rearm condition. * selects Unconditional Rearm, L selects Unless Pass Count =, E selects Unless A = B, and N selects unless A = B. The third data choice is only included if either Unless A = B (E) or Unless A = B (N) is selected and specifies the second Rearm condition. * selects No Additional Condition, L selects Or Pass Count =, and P selects And Pass Count >=. The fourth data choice is only included if Or Pass Count = (L) or And Pass Count >= (P) is selected. Four numeric characters, each in the range of 0 through 9 are selected to specify the Pass Limit value.

Example: RM=RL0100

AUTO COMPARE INPUTS (RI)

Syntax

MEMORY	RECORD	RANGE		DATA	
<A/B>	{RI}	NA	{=}	F, S {0, 1}	{EOL}

Record Type: Send/Receive

The first data choice specifies the Auto Compare Input Select Mode. F selects Inputs Defined On Format Screen and S selects Inputs Selected Below. The second data choice is only included if Inputs Selected Below (S) is selected. This choice consists of two numeric characters, 0 and 1, which specify Don't Care and Care, for the Data Inputs. A total of 96 characters are required to select each of the possible 96 Inputs. The first character corresponds to A0 and the 96 character corresponds to FF.

Example:

```
RI=S000000001111111111111111111111111111111111111111
```

AUTO COMPARE RANGE (RR)

Syntax

MEMORY	RECORD	RANGE	DATA
<A/B>	{RR}	NA {=}	{F S {0000-4095} {EOL} {0000-4095} {0001-4096} A}

Record Type: Send/Receive

The first data choice specifies the Auto Compare Range Mode. F selects Sample(s) Between Cursors, S selects Sample(s) Selected Below, and A selects 4096 Samples (for 200 MHz) or 2048 Samples (for any other selected time base).

The next three data choices are included if the first data choice is Sample(s) Selected Below (S). For 200 MHz, the second and third data choices consist of four numeric characters in the range of 0001 through 4095. The fourth data choice consists of four numeric characters in the range of 0001 through 4096. For any other selected time base, the second and third data choices consist of four numeric characters in the range of 0000 through 2047. The third data choice consists of four numeric characters in the range of 0001 through 2048. These characters specify the Mem-A Start, Mem-B Start and the total number of samples to be compared,which appears as "For specified number of Samples "on screen.

Example Entry: RR=S000040000005

AUTO EDGE TOLERANCE (RE)

Syntax

MEMORY	RECORD	RANGE	DATA	
<A/B>	{RE}	NA {=}	{0-9}	{EOL}

Record Type : Send/Receive

The data choice has a numeric character in the range of 0 through 9 and specifies the Auto Edge Tolerance selection. This value is used to set the Don't-Care memory during the next A-->B transfer.

Example: RE=0

AUTO SAVE (RS)

Syntax

MEMORY	RECORD	RANGE	DATA
<A/B>	{RS}	{NA} {= }	{*, E, N, A} {EOL} {A, B} {File Name} {00-99}

Record Type: Send/Receive

The first data choice specifies the Auto Save condition. * selects No Auto Save, E selects Save if A = B, N selects Save if A = B and A selects Save Always. If the first data choice is Save if A = B (E), Save if A = B (N), or Save Always (A), the next three data choices must be included. The second data choice specifies either Drive A (A) or Drive B (B).

The third data choice consists of six alphanumeric characters which specify the file name for the save. Spaces may be included but not imbedded between the alphanumeric characters. The characters appear from left to right in the Save field. The fourth choice consists of a numeric character pair in the range of 00 through 99 and indicates the starting version number for the file name.

The file name for the save and its starting version number is entered using both the Alpha and 0 through 9 numeric keys.

Example: RS=NARESULT00

COMPARISON COUNT MODE (RC)

Syntax

MEMORY	RECORD	RANGE		DATA	
<A/B>	{RC}	NA	{=}	{*, E, N}	{EOL}

Record Type: Send/Receive

The data choice specifies the Comparison Count. * selects Not Used, E selects If A = B and N selects If A = B.

Example: RC=N

SEND ALL ARM MODE RECORDS (R-)

Syntax

MEMORY	RECORD	RANGE	DATA	
<A/B>	{R-}	NA	NA	{EOL}

Record Type: Send

The K450B responds by sending the following output records:

RM, RC, RR, RI, RE, RS, CC, CR

Example: R-

SEARCH/COMPARE FIRST/LAST/TOTAL (ZT)

Syntax

MEMORY	RECORD	RANGE		DATA	
NA	{ZT}	NA	{=}	{0000-4096} {0000-4095} {0000-4095}	{EOL}

Record Type: Send

The first data choice is a number in the range of 0000 through 4096 (for 200 MHz) or 0000 through 2048 (for any other selected time base. The second and third data choices are values in the range of 0000 through 4095 (for 200 MHz) or 0000 through 2047 (for any other selected time base).

If Search is active, the first data choice specifies the total number of samples matching the Search Word/Level. The second data choice specifies the number of the first sample matching the Search Word/Level. The third data choice specifies the number of the last sample matching the Search Word/Level.

If Compare is active, the first data choice specifies the total number of sample mismatches. The second data choice specifies the number of the first sample mismatch. The third data choice specifies the number of the last sample mismatch. The second and third data choices are only included if the first data choice is other than 0.

Example Entry: ZT=399900014052

SEARCH/COMPARE SELECT (ZC)

Syntax

MEMORY	RECORD	RANGE		DATA
NA	{ZC}	NA	{=}	{0, 1, 2} {EOL}

Record Type: Send/Receive

The data choice specifies the Search/Compare Mode. 0 selects Not Active, 1 selects Search Active, 2 selects Compare Active.

Example: ZC=1

SEARCH RESULTS (ZR)

Syntax

MEMORY	RECORD	RANGE	DATA
NA	{ZR}	{(0-4095)} {=}	{0, 1} {EOL}

Record Type: Send

The selected index is in a range of 0 through 4095 (for 200 MHz) or 0 through 2047 (for any other selected time base) and specifies the sample number. The data choice is either 0 or 1. If Search is active, 0 indicates the sample did not match the Search word. One indicates a match. If Compare is active, 0 specifies no mismatch. One specifies a mismatch. Search results may be output but not accepted by the K450B as false information could be presented in such a case.

Example: Entry and Screen Display:

SEND SEARCH/COMPARE RESULTS (Z-)

Syntax

MEMORY	RECORD	RANGE	DATA
NA	{Z-}	NA	NA {EOL}

Record Type: Send

The K450B responds by sending the Search/Compare Results (ZR) and the Search/Compare First/Last/Total (ZT) records.
Example: Z-

ACQUISITION CONTROL (QQ)

Syntax

MEMORY	RECORD	RANGE		DATA
NA	{QQ}	NA	{=}	{A, D, S, X} {EOL}

Record Type: Receive

The data choice consists of one alphanumeric character, A, D, S or X.

Example: QQ=A

CLEAR DISPLAY (DC)

Syntax

MEMORY	RECORD	RANGE	DATA
NA	{DC}	NA	NA {EOL}

Record Type: Receive

When this record is received, the K450B screen is blanked except for the status data displayed on the top and bottom lines. This record enables the user to display messages on the screen using record type DT.

Example: DC

DEVICE CLEAR (KK)

Syntax

MEMORY	RECORD	RANGE	DATA
NA	{KK}	NA	NA {EOL}

Record Type: Receive

When this record is received, the Default Setup M and display values are loaded into RAM.

Example: KK

DISPLAY TEXT (DT)

Syntax

MEMORY	RECORD	RANGE		DATA	
NA	{DT}	NA	{=}	{02-28} {01-52} {01-52} {text}	{EOL}

Record Type: Receive

This record enables the user to display text on the K450B screen.The first data choice consists of a numeric character pair in the range of 02 through 28, which specifies the row at which data is displayed.The second and third data choices both consist of a numeric pair in the range of 01 through 52 and specify the starting column at which text is displayed and the number of text characters. The fourth data choice specifies the text to be displayed, using alphanumeric characters.

Example: DT=03341150 MHZ MODE

PRINT SCREEN DIRECT (PD)

Syntax

MEMORY	RECORD	RANGE	DATA	
NA	{PD}	NA	NA	{EOL}

Record Type: Receive

When this record is received, the K450B sends an exact copy of the current text on screen.This data stream is intended for a printer and is not accepted by another K450B.

Example: PD

PRINT SCREEN LONG (PL)

Syntax

MEMORY	RECORD	RANGE	DATA
NA	{PL}	NA	NA {EOL}

Record Type: Receive

Sending PL followed by pressing the **RETURN** key prints out ***Trace Control*** and ***DOS Directory screens*** in their full length and entirety. ***Data screens*** are printed out from the cursor to end of memory. the ***Timing screen*** is printed out in Graphics Mode, from the currently displayed screen to the last screen containing a valid input.When in other screens, sending PL returns a copy of the screen.This data stream is intended for a printer and will not be accepted by another K450B.

Example: PL

GRAPH EXPANSION, LABELS (WG)

Syntax

RECORD	MEMORY	RANGE	DATA
			8 8
NA	{WG}	NA {=}	{0,1,2,3}
			{Hex Char}
			{Hex Char} {EOL}

Record Type: Send/Receive

The first data choice specifies the Graph Expansion. Zero selects x1, 1 selects x12, 2 selects x24, and 3 selects x96. The second and third data choices both have eight characters in the Hex range of 0 through F and select the upper and lower graph limit.

Example: WG=EFFFFFFF00000000

SEARCH LEVEL (WV)

Syntax

RECORD	MEMORY	RANGE		DATA
NA	{WV}	NA	{=}	{*, Hex Char} {EOL}

Record Type: Send/Receive

The data choice specifies the Search Level value. An asterisk selects Don't-Care. A value is specified in the Hex range of 0 through F.

Example: WV=*

SEARCH SELECT (WD)

Syntax

RECORD	MEMORY	RANGE	DATA
NA	{WD}	NA	{=} {0, 1}

Record Type: Send/Receive

The index specifies a single search word (0) or three sequential search words (1). The search word(s) appear in the upper-left corner of the ***Data Display screen*** opposite the SEARCH = field.

Example: WD=1

SEARCH VALUE (WS)

Syntax

RECORD	MEMORY	RANGE	DATA	
{NA}	{WS}	{(0-95)}	{=} {*, 1, 0}	{EOL}

Record Type: Send/Receive

The selected index is in the range of 0 through 95 and specifies the Data Input number, with 0 corresponding to A0 and 95 corresponding to FF on the screen. The data choice is either a 0, 1 or an asterisk for Don't-Care.The Search Value is in the ***Data Display screen*** on line 3.

Example:

```
WS(095)=0100000101000001010000010100000101000001010000
01010000000
```

SEQUENTIAL SEARCH LEVELS (WY)

Syntax

RECORD	MEMORY	RANGE		DATA	
NA	{WY}	{(0-2)}	{=}	{*, HEX CHAR}	{EOL}

Record Type: Send/Receive

The selected index is in the range of 0 through 2 and corresponds to the first, second and third sequential search word. The data choice is an asterisk for Don't Care or any Hexadecimal value.

Example: WY(0)=*

SEQUENTIAL SEARCH VALUE (WX)

Syntax

RECORD	MEMORY	RANGE		DATA	
NA	{WX}	{(0-287)}	{=}	{*, 1, 0}	{EOL}

Record Type: Send/Receive

The selected index is in the range of 0 through 287 and specifies the sequential search word value as follows: 0 through 95 indicates the first word. 96 through 191 indicates the second word. 192 through 287 indicates the third word. For each value, the lowest and highest input number corresponds to data inputs A0 through FF on the screen. The data choices are 0,1 or an asterisk for Don't-Care value.

Example: WX(0-5)=1011*0

TIMING EXPANSION (WT)

Syntax

RECORD	MEMORY	RANGE		DATA
NA	{WT}	{NA}	{=}	{0, 1, 2, 3} {EOL} {0, 1, 2} {00, 01, 02, ..., 14}

Record Type: Send/Receive

The first data choice specifies the ***Timing screen*** horizontal expansion. 0 selects x1, 1 selects x12, 2 selects x24 and 3 selects x96. The second data choice specifies the ***Timing screen*** vertical expansion. 0 selects 16 traces, 1 selects 8 traces and 2 selects 4 traces. The third data choice is a numeric pair in the range of 0 through 14 and specifies the page number. The maximum legal value for the page number depends on the vertical expansion, selected as follows:

4	Traces Page 14
8	Traces Page 13
16	Traces - Page 11

Example: WT=1214

TIMING LABELS (WL)

Syntax

RECORD	MEMORY	RANGE		DATA	
				5	
NA	{WL}	{(0-95)}	{=}	{ASCII}	{EOL}

Record Type: Send/Receive

The selected index is in the range of 0 through 95. This index specifies the input number, with 0 corresponding to the A0 input and 95 corresponding to the FF input. Five ASCII characters are selected for each input to specify the Timing Trace label. In the ***Timing Display screen***, the Timing labels appear in the leftmost columns, followed by the input indentifiers (A0-FF) and the Timing traces.

Example: WL(44-95)=ADDR3ADDR2ADDR1ADDR0

TIMING SEQUENCE (WQ)

Syntax

RECORD	MEMORY	RANGE	DATA
NA	{WQ}	{(0-95)} {=}	{A0, A1, ... CE, CF} {EOL}

Record Type: Send/Receive

The selected index is in the range of 0 through 95. This index specifies the traces, with 0 corresponding to the top trace on page 0 and 95 corresponding to the bottom trace on the last page.The data choice consists of a data pair in the range of A0 through CF and specifies the input selected by the indexed trace.

Example: WQ(0-7)=CFCECDCCCBCAC9C8

SEND ALL DISPLAY RECORDS (W-)

RECORD	MEMORY	RANGE	DATA	
NA	{W-}	NA	NA	{EOL}

Record Type: Send

The K450B responds by sending the following display records:

WD, WV, WS, WT, WQ, WL, WG, WX, WY, ZC, CC, CR

Example: W-

DON'T-CARE DATA (MX)

Syntax

RECORD	MEMORY	RANGE		DATA	
NA	{MX}	{(0-4095)}	{=}	{HEX CHAR}	{EOL}

Record Type: Send/Receive

The Don't-Care Memory is related to Memory B sample data and selects either do not include Don't Care (0), or include Don't Care (1), bits when Compare is active. The selected index is in a range of 0 through 4095 (200 MHz) or 0 through 2047 (any other selected time base) and specifies the sample number. Each sample is specified by twelve Hex characters in the range of 0 through F. The first Hex character selects the FF-FC inputs and the last Hex character selects the A3 through A0 inputs.

Example: MX(0)=000FFFF0FFFFFFFFFFFFFFFF

LEVEL DATA (LA/LB)

Syntax

RECORD	MEMORY	RANGE	DATA
NA	{LA/LB}	{(0-4095)} {=}	{HEX CHAR} {EOL}

Record Type: Send/Receive

LA selects Memory A level data. LB selects Memory B level data.The selected index must be in the range of 0 through 4095 (200 MHz) or 0 though 2047 and specifies the sample number.The data choice is a Hex character in the range of 0 through F and specifies the Trace Control level active at the time the sample was recorded.

Example: LB(0-3)=012F

SAMPLE DATA (MA/MB)

Syntax

RECORD	MEMORY	RANGE	DATA
NA	{MA/MB}	{(0-4095)} {=} {HEX CHAR}	{EOL}

Record Type: Send/Receive

MA selects Memory A data. MB selects Memory B data. The selected index is in the range of 0 through 4095 (200 MHZ) or 0 though 2047 (any other selected time base) and selects the sample number.

Each sample is represented by twelve Hex characters in the range of 0 through F. For each sample, the first Hex character corresponds to the CF-CC inputs and the last character corresponds to the A3-A0 inputs.

Example: MA(0-1)=000000000000101010101010

Syntax

RECORD	MEMORY	RANGE		DATA
NA	{PA/PB}	NA	{=}	{0000-9999} {EOL} {0000-9999} 31 {ASCII CHAR}

Record Type: Send

When this record type is received, the K450B responds by sending 39 characters, which represent the Pass Count, Comparison Count, Total Trace Time, Date and Time taken at the end of the recording for Memory A (PA) or Memory B (PB). The first four characters specify the Pass Count and the next four characters specify the Comparison Count. Both are represented in a range of 0000 through 9999. Next, follows a string of 31 ASCII characters. The first ten ASCII characters specify the Total Trace Time, followed by eight characters, which specify the Date and the next eight characters specify the Time.

Example: PA=001000105.0uS 10/29/85 11:03:23

SEND ALL MEMORY RECORDS (QA/QB)

Syntax

RECORD	MEMORY	RANGE	DATA	
NA	{QA/QB}	NA	NA	{EOL}

Record Type: Send

The K450B responds by sending the following memory records:

For QA: PA, MA, LA

For QB: PB, MB, MX, LB

Example: QA

Syntax

MEMORY	RECORD	RANGE		DATA	
NA	{SE}	NA	{=}	{0, 1}	{EOL}

Record Type: Send/Receive

The data choice specifies the error beep tone to be either enabled (1) or disabled (0).

Example: SE=1

CURRENT DATE AND TIME (SD)

Syntax

MEMORY	RECORD	RANGE	DATA
NA	{SD}	NA {=} {01-02} {/} {01-31} {/} {00-99} {00-23} {:} {00-59} {:} {00-59} {EOL}	

Record Type: Send/Receive

The first five data choices specify the current date by month, day and year. The choices consist of numeric character pairs, followed by back slashes, within the following ranges: 01 through 12 for the month (/), 01 through 31 for the day (/), and 00 through 99 for the year. Additional error checking is performed for months with fewer than 31 days and for leap years.

The next five choices specify the current time based on a twenty-four hour clock in hours, minutes and seconds. The choices consist of numeric character pairs, followed by colons, in the following ranges: 00 through 23 for hours (:), 00 through 59 for minutes (:), and 00 through 59 for seconds.

Although a numeric pair other than 00 may be specified for the seconds of an input record, 00 is used to program the system clock. For output records, the seconds are accurate.

Example: SD=09/19/8510:10:47:26

CURRENT MASTER CLK FREQUENCY (KF)

Syntax

MEMORY	RECORD	RANGE		DATA
{NA}	{KF}	NA	{=}	{ALPHANUMERIC CHARACTER} {EOL}

Record Type: Send

When this record is requested, the K450B responds with an alphanumeric string consisting of ten characters, including spaces. The K450B's response depends on the Master Clock mode selected and the current record status. If Clock Mode is Internal, Internal Clock Period is returned. If Clock Mode is External and the unit is not Armed, the Clock Period is measured and its value returned. If Clock Mode is External and the unit is Armed, the message returned is, UNIT ARMED.

Example: KF=UNIT ARMED

Syntax

MEMORY	RECORD	RANGE		DATA
NA	{KC}	NA	{=}	{K450B}
{EOL}				
				{Software Version}
				{0, 1, 2}
				{0, 1}

Record Type: Send

When this record is received, the K450B responds with a string of ten characters, separated into five fields by slashes (/). The first field indicates the device type, K450B. The second and third fields present the the software version number and revision number. The fourth field specifies the number of data boards installed. The fifth field lists the current options installed. The first indicator lists the number of options and is followed by a four character description of each option, separated by commas.

Example: KC=K450B/v1.2x/r50/80ch/1;DISK

CURRENT K450B STATUS (KT)

Syntax

MEMORY	RECORD	RANGE		DATA
NA	{KT}	NA	=	{0, 1} {EOL} {READY, BUSY, CLOCK?, EOR, LVL 0 - LVL F}

Record Type: Send

When this record is received, the K450B responds by sending a string of fourteen characters. The first eight characters are the binary representation of the eight Status Byte bits, with the first character representing the most significant bit and the eighth character representing the least significant bit. The ninth character indicates the current record status as follows:

0	READY
1	BUSY
2	CLOCK?
3	EOR
4	LVL 0 - LVL F

The last five characters indicate the current record status.

Example: KT=110100012CLOCK?

DISPLAY SCREEN (DS)

Syntax

MEMORY	RECORD	RANGE	DATA
NA	{DS}	NA {=}	{A,C,D,F,G,I,O,R,S,T,W,X} {EOL}

Record Type: Send/Receive

The data choice specifies the current screen as follows:

A	Arm Mode
C	Clocks
D	Data
F	Format
G	Graph
I	I/O
O	Disk Operating System
R	Trace Control Review
S	Date
T	Timing
X	Trace Control
W	Configuration

Example: DS=I

KEYSTROKE RECORDS ($-, $+)

Syntax

MEMORY	RECORD	RANGE	DATA
NA	{$-/$+}	NA {=}	{01-48} {EOL}

Record Type: Receive

This record enables the user to simulate key entry via the front panel.Sending either $+= or $-= specifies normal or shifted, front panel keys. Each key, represented by a numeric character pair, must be in the range of 01 through 48.

The keys are defined as follows:

Key	Description	Key	Description
01	NEXT	25	SHIFT
02	PREV	26	HELP
03	FORMAT	27	D
04	CLOCKS	28	9
05	TRACE	29	5
06	ARM MODE	30	1
07	UP	31	I/O
08	LEFT	32	X/SPACE
09	MEM A	33	E
10	DATA	34	A
11	TIMING	35	6
12	GRAPH	36	2
13	RIGHT	37	EDIT
14	DOWN	38	INS
15	MEM B	39	F
16	DATA	40	B
17	SEARCH	41	7
18	COMPARE	42	3
19	CONTROL	43	ARM
20	REF	44	STOP
21	C	45	F1
22	8	46	F2
23	4	47	F3
24	0	48	F4

Example: $+=05

SEND ALL SETUP RECORDS (--)

Syntax

MEMORY	RECORD	RANGE	DATA	
<A/B>	{--}	NA	NA	{EOL}

Record Type: Send

The K450B responds by sending the following output records:

CM	CD	CI	CS				
FD	FF	FL	FP	FT	FA	FB	
RC	RE	RI	RM	RR	RS	CC	CR
TC	TN	TP	TV				

Example: --

BINARY TRANSFER SAMPLE DATA (XA/XB)

Syntax

MEMORY	RECORD	RANGE		DATA	
NA	{XA/XB}	{(0-4095)}	{=}	binary data	{EOL}

Record Type: Send / Receive

XA selects memory A data, **XB** selects memory B data. Range selects one or more of a possible 4096 memory samples, each 12 bytes wide. A sample begins with inputs A0-A7 in byte 0, and ends with inputs F8-FF in byte 11.

Note that the DATA element of this record is in BINARY format, not displayable directly on most terminals. The benefit of this method is an approximately double rate of transfer versus standard ASCII, which requires 2 characters to represent one byte of memory.

BINARY TRANSFER CONTROL-C DISABLE (XC)

Syntax

MEMORY	RECORD	RANGE	DATA	
NA	{XC}	NA {=}	{0,1}	{EOL}

Record Type: Send / Receive

Sets (1), clears (0), or returns the Control-C Disable flag. Since the K450B must be capable of receiving the Control-C as a data value (03) instead of a cancel command, the remote controller must send a RECEIVE record with a value of 1 (disable) prior to sending the **XA, XB, XX, XL,** or **XM** RECEIVE records.

Note that it is not necessary to use this command when a SEND request record has been issued by the remote controller, because the Control-C data only affects the K450B in RECEIVE mode.

The remote controller should delay approximately 500 milliseconds following this command before sending one of the binary transfer requests to allow time for the K450B communications buffer to empty.

The use of any I/O commands other than **XA, XB, XC, XL, XM,** or **XX** causes the K450B to automatically clear the Control-C Disable flag, to avoid accidentally leaving the flag enabled.

Example: **XC=1** (Disables Control-C checking)
XC=0 (Enables Control-C checking)

BINARY TRANSFER LEVEL DATA (XL/XM)

Syntax

MEMORY	RECORD	RANGE		DATA	
NA	{XL/XM}	{(0-4095)}	{=}	binary data	{EOL}

Record Type: Send / Receive

XL selects Level memory A, **XM** selects level memory B. Range selects the level number for one or more of a possible 4096 memory samples. Each level returned is a byte in the range 0 - F, and specifies the Trace Control level active at the time the sample was recorded.

Note that the DATA element of this record is in BINARY format, not displayable directly on most terminals. The benefit of this method is an approximately double rate of transfer versus standard ASCII, which requires 2 characters to represent one byte of memory.

BINARY TRANSFER DON'T-CARE DATA (XX)

Syntax

MEMORY	RECORD	RANGE		DATA	
NA	{XX}	{(0-4095)}	{=}	binary data	{EOL}

Record Type: Send / Receive

The DON'T-CARE memory is a one for one mask of sample memory B and enables or disables comparisons between memory A and memory B. A one (1) in a bit position enables the comparison of the corresponding bits in memories A and B, while a zero (0) disables the comparison. Range selects one or more of a possible 4096 memory samples, each 12 bytes wide. A sample begins with inputs A0-A7 in byte 0, and ends with inputs F8-FF in byte 11.

Note that the DATA element of this record is in BINARY format, not displayable directly on most terminals. The benefit of this method is an approximately double rate of transfer versus standard ASCII, which requires 2 characters to represent one byte of memory.

INDEX BY COMMAND

Chapter 5

SPECIFICATIONS

K450B INPUT CONFIGURATIONS

Model #	Description
132:	Provides inputs for 32 data signals @ 100 MHz (16 data signals @ 200 MHz) and 8 clocks via input Section A /B and a single 5 1/4 " floppy disk.
164:	Provides inputs for 64 data signals @ 100 MHz (32 data signals @ 200 MHz) and 12 clocks via input Sections A/B and C/D.
180:	Provides inputs for 80 data signals @ 100 MHz (40 data signals @200 MHz) and 12 clocks via Input Sections A/B, C/D and E.
Expansion Option:	Each data board has probe inputs for 16 or 32 add-on data signals @ 100 MHz (8 or 16 data signals @ 200 MHz) via input Section C/D (32) or E (16).
DSS Option:	Disk Storage System provides two 5 1/4" floppy disk drives mounted in an add-on assembly unit which provides 312K bytes of storage per disk. This replaces the single disk drive.

POWER REQUIREMENTS

Input Frequency:	50 or 60 Hz
Input Volts:	90 to 135 Vac or 180 to 270 Vac
Input Power:	500 Watts without DSS option or 550 Watts with DSS option
Fuses/Rated Voltage:	Voltage Range Fuse
	90 Vac to 135 Vac 3AG, 6 Amp
	180 Vac to 270 Vac 3AG, 3 Amp

ENVIRONMENTAL LIMITS

Ambient Temp:	39 to 115 Deg.F (4 to 46 Deg.C) OPERATING-8 to 117 Deg.F (-20 to 50 Deg.C) STORAGE
Relative Humidity:	20% to 80% OPERATING 1% to 95% STORAGE
Max Wet Bulb:	78 Deg.F (25 Deg.C) OPERATING No condensation STORAGE

SIGNAL OUTPUTS

Video, BNC :	One Vp-p into 75 ohms composite video output is available with 60 Hz vertical, 19.2 KHz horizontal (416 x 290 pixel) refresh.
Clock, BNC:	ECL active low corresponds to the internal clock
Get,BNC:	Group execute trigger pulse output, TTL, for IEEE-488.
Trace BNC:	TTL high output when trace is enabled
Lemo:	+5V and -5.2V @ 300 mA Auxillary Power

INTERFACES

One RS-232-C port configured as Data Terminal Equipment . One Auxiliary Serial I/O Port for RS-232.

One IEEE-488 Bus Interface, Parallel Port.

FEATURES

CLOCK:	A 24-hour, time and date clock is backed up by a 2.9 V battery
BACK UP MEMORY:	Saves the setup of recording parameters if power is interrupted or when the unit is turned off.

PROBE LOADING

Input Resistance:	1 megohm referenced to threshold
Input Capacitance:	<= 6pF (<= 15 pF with flying leads) Input resistance may approach 500K ohms at voltages exceeding +15 volts from threshold.
Max Input:	+50 volts, peak

PROBE BANDWIDTH

Bandwidth To 90% V Out:	= >100 MHz
Min Swing For Output:	Threshold ± 0.20 V maximum
Threshold Variance:	+15 MV maximum, between input signals +30 MV maximum, any two probes
Input Comp:	Even to 20% overcompensated
Thresholds:	Thresholds are independently selectable for each section and the clock group TTL, +1.4 volts ECL, -1.3 volts VAR A and VAR B Variable thresholds may be set from -9.99 to +9.99 volts in 0.01 volt Increments. Accuracy of all threshold voltages is 30mV.
Polarity:	+ or - is selectable for each signal

Chapter 6

CUSTOMER SERVICE AND REFERENCE INFORMATION

INTRODUCTION

This chapter provides customer service and reference information.

CUSTOMER SERVICE

This section provides customer service information

Warranty

The Gould Inc., Design and Test Systems Division equipment is warranted against defects in materials and workmanship for a period of one year from date of shipment. Any floppy disk or hard disk drives attached to or contain within this equipment is warranted for 90 days from date of shipment. Gould Inc., Design and Test Systems Division will repair or replace products that prove to be defective during the warranty period.

Warranty service must be performed at a Gould Inc., Design and Test Systems Division authorized service facility. The customer must call Gould's Customer Service department at the toll free number listed in this section of the manual and obtain a Return Authorization number prior to returning the unit for service. If the unit fails within 30 days of the shipment date, Gould Inc., will pay for all shipping charges related to the repair of the unit. Units under warranty, but beyond the 30 day shipment period should be sent to Gould Inc., prepaid and Gould Inc., will return the unit prepaid. The customer must pay all shipping charges for units out of warranty. Misuse of , abuse of or tampering with this unit will, at the discretion of Gould Inc., will cause this warranty to be null and void.

Inspection

Remove the Unit from its shipping container and inspect for any damage that might have occurred during shipping. Refer to the shipping papers to verify that all items listed were received. Do not operate if the unit is damaged or incomplete. File a claim with the shipping firm. Notify Gould Inc., Design and Test Systems Division, Customer Service Department. Gould will repair or replace the unit without waiting for settlement of the claim against he carrier.

Assistance

For assistance with this product, call Gould Inc., Design and Test Systems Division, Customer Service on the nationwide toll-free hot-line number: (800)538-9320

Appendix A

BASICS OF K450B TRACE CONTROL™

INTRODUCTION

Trace Control™ is a powerful data qualifying feature developed by Gould engineers to precisely control capturing of information by logic analyzers. Trace Control™ runs on a easily learned command language, letting the K450B Logic Analyzer users specify exactly which samples to save and which to ignore.

CAUSE AND EFFECT RELATIONSHIPS

An engineer debugging a digital circuit is like a detective looking for clues. The mystery is why the code is not executing properly. Finding the clues means examining many cause and effect relationships. Engineers need logic analyzers that:

- Turn on and off the trace (acquisition) memory based on software activities
- Trap intermittent failures while skipping proper execution

COMMAND STRUCTURE PARALLELS PROGRAM FLOW

The K450B Logic Analyzer's Trace Control™ is structured to operate like a program flows: advancing to the next instruction, jumping to another set of instructions, stopping at the end of the program, and looping on prescribed routines. These utilities follow the flow, making decisions based on what the code is actually doing.

HIGH LEVEL LANGUAGE

Trace Control™ is specified via a structured high level command language. The commands are executed based on conditions. The conditions determine if and when any given command is executed. Up to sixteen levels of Trace Control™ can be used to set up the K450B with each level allowing up to five command lines.

TRACE CONTROL COMMANDS

Commands: Commands are executed when conditions are met.	
TRACE:	Data is saved in acquisition memory.
WAIT:	Data is not saved in acquisition memory; Trace Control™ waits for a condition or a counter then advances to the next level.
ADVANCE:	Trace Control™ advances to the next level; acquisition status is not affected.
GO TO :	Trace Control™ jumps to the selected level; acquisition status is not affected.
STOP:	Freezes acquisition memory; displays results.

TRACE CONTROL CONDITIONS

Conditions:
For each command specified, a condition is also specified that will determine whether or not the command will be executed. Several types of conditions are available.

Sample:	SAMPLE = WORD ≠ WORD Up to 50 user specified pattern definitions may be programmed to be used with commands. Example: TRACE IF SAMPLE = BREAK3 (where BREAK3 is a user-defined pattern definition).
Delay:	COUNT = ____ CLOCKS or ≠ PATTERNS > < ≥ ≤ On each of the 16 levels, a unique delay may be defined using the "set delay..." statement. The delay count is set to zero every time the level is entered. Each master clock increments the delay count, or if a delay by patterns is selected, then the specified pattern increments the delay count. Examples: • TRACE UNTIL COUNT = 35 CLOCKS. • SET DELAY TO 48 COUNTS OF SAMPLE = FREEZE TRACE UNTIL COUNT = 48 (where FREEZE is a user-defined pattern).
Compound Conditions:	Sample and delay conditions are logically ANDed; both must be true simultaneously. Example: SET DELAY TO 21 CLOCKS. TRACE IF SAMPLE = PITCH 1 AND COUNT ≥ 21.

Command/Condition Matrix

TRACES CONTROL™ COMMANDS		TRACES DATA	ADVANCES TO NEXT LEVEL	JUMPS TO SELECTED LEVEL	STOPS RECORDING M ⟶ A TRANSFER
TRACE (DETERMINES MEMORY CONTENT)	FOR	ALWAYS (IF IN THIS LEVEL)	DELAY CONDITION		ALL CONDITIONS (IF NOT FOLLOWED BY ANOTHER LEVEL)
	UNTIL		ALL CONDITIONS		
	IF	ALL CONDITIONS			
WAIT	FOR		DELAY CONDITIONS		
	UNTIL		ALL CONDITIONS		
UNTIL			ALL CONDITIONS		ALL CONDITIONS (IF NOT FOLLOWED BY ANOTHER LEVEL)
STOP	IF				ALL CONDITIONS
GO TO (LEVEL)	IF			ALL CONDITIONS	
ADVANCE	IF		ALL CONDITIONS		

- Trace and Wait are mutually exclusive
- Wait or Trace are logically ORed with Until, Stop, Go To (level), and Advance

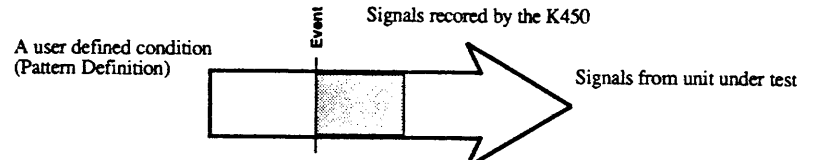
- All Conditions infers any one of the following:
  - Sample Conditions
  - Delay Conditions
  - Compound Conditions

EXPLANATION OF EXAMPLES

Description

RECORD AFTER AN EVENT
(Post Trigger)

Commonly used description



Solid line indicates the event was recoreded

Dashed line indicates the event location, but is not recoreded

Purpose: To record an event and capture sequential data following the event.

Data Stored: The K450 Trace Control level 0 waits until it sees the predefined event, stores one clock sample of the event, and then advances to level 1. Level 1 stores the specified number of clock samples of following data and advances to the next level. Since no level exists the Trace Control goes to a default STOP command.

Command Sequence: a high level command language structured to operate like programs flow. Examples display a typical illustration of how it is used.

Trace Control Screen:

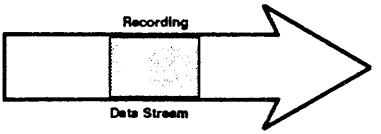
```
                    LVL  COMMAND SEQUENCE:
0:TRACE IF... SAMPLE = EVENT
 ADVANCE IF SAMPLE = EVENT
1:TRACE FOR 02047 CLOCKS
                    ----


                    PATTERN DEFINITIONS:
NAME:                    HH HH
00 EVENT                 =00 8F
01 -                           =XX XX
```

Pattern Definitions: user defined labels and conditions to be used with the Command Sequence. (Ex. EVENT is a user defined label and set of conditions)

Note: The event will appear at the start of the timing display since the command sequence is programmed to fill all the memory. By changing the number of clocks the event can be moved around on the display.

Auto Setup™

CONFIGURES, RECORDS, AND DISPLAYS DATA (Auto Trigger)



Purpose: To record a sequential data sample window.

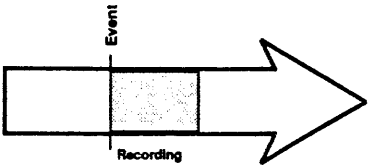
Benefit: Sets up the logic analyzer automatically and samples data from the system under test.

Procedure:
1. Press the **Shift** key.
2. Press the **Auto Setup** key.

Data Stored: The K450 Auto Setup configures input channels, thresholds, internal clock, Trace Control™, and then records data and stops when the memory is full.

Setup #1

RECORD AFTER AN EVENT (Post Trigger)



Purpose: To record an event and capture sequential data following the event.

Data Stored: The K450 Trace Control level 0 waits until it sees the pre-defined event, stores one clock sample of the event, and then advances to level 1. Level 1 stores the specified number of clock samples of following data and advances to the next level. Since no level exists the Trace Control goes to a default STOP command.

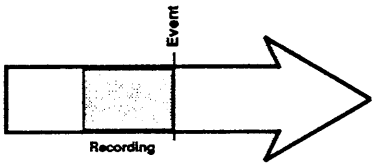
Trace Control Screen:

```
                    LVL  COMMAND SEQUENCE:
0:TRACE IF... SAMPLE = EVENT
 ADVANCE IF SAMPLE = EVENT
1:TRACE FOR 02047 CLOCKS
                    ----


                    PATTERN DEFINITIONS:
NAME:                    HH HH
00 EVENT                 =00 8F
01 -                     =XX XX
```

Note: The event will appear at the start of the timing display since the command sequence is programmed to fill all the memory. By changing the number of clocks the event can be moved around on the display.

Setup #2

RECORD IMMEDIATELY BEFORE AN EVENT (Pre-trigger)



Purpose: To record sequential data before an event and record the event.

Data Stored: The K450 Trace Control level 0 stores 2048 samples of data and then advances to level 1. Level 1 stores every thing it sees until the event occurs and stores one sample of the event and then advances control to the next level. Since there is no level defined, a blank line is defaulted to a STOP commmand.

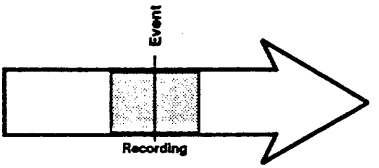
Trace Control Screen:

```
LVL  COMMAND SEQUENCE:
0:TRACE  FOR  02048 CLOCKS
1:TRACE  UNTIL  SAMPLE = EVENT
         ----

         PATTERN DEFINITIONS:
NAME:          HH HH
00 EVENT       =00 8F
01 -           =XX XX
```

Note: The event will be displayed in the last memory location. To insure the capture of the first occurrence of an EVENT after a reset, delete level 0 (the display memory may not always fill up if the event is found before 2048 samples are taken).

Setup #3

RECORD AROUND AN EVENT (Center Trigger)



Purpose: To record sequential data before an event, record the event, and then record sequential data following the event.

Data Stored: The K450 Trace Control level 0 stores 1023 samples and then advances to level 1. Level 1 stores data until SAMPLE = EVENT, stores the event and then advances to Level 2. Level 2 stores the next 1023 samples and advances to the blank line (default STOP).

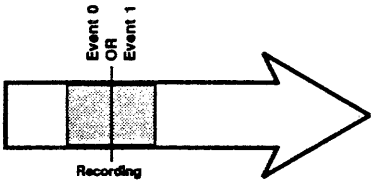
Trace Control Screen:

```
LVL      COMMAND SEQUENCE:
0:TRACE  FOR  01023 CLOCKS
1:TRACE  UNTIL  SAMPLE = EVENT
2:TRACE  FOR  01023 CLOCKS


         PATTERN DEFINITIONS:
NAME:          HH HH
00 EVENT       =00 8F
01 -           =XX XX
```

Note: The positioning of the event can be changed by the clocks in the trace control command sequence. By changing the clocks, different portions of the data stream can quickly be examined. To insure the capture of the first occurrence of an EVENT after a reset, delete level 0.

Setup #4

RECORD AROUND EITHER OF TWO EVENTS (OR Trigger)



Purpose: To record sequential data before an event, record the occurrence of one of two possible events, and then record sequential data following the event.

Benefit: Gives the ability to follow program branches, take alternative paths, and make decisions in real time.

Data Stored: The K450 Trace Control level 0 stores data until SAMPLE = EVENT 0 or until SAMPLE = EVENT 1, stores the event found and then advances to level 1. Level 1 stores the next 1023 samples and advances to level 2. Level 2 stops the data recording.

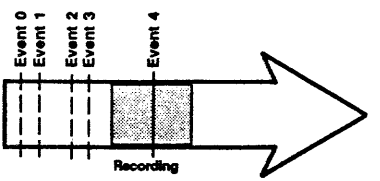
Trace Control Screen:

```
LVL COMMAND SEQUENCE:
0:TRACE  UNTIL  SAMPLE = EVENT 0
        OR UNTIL          SAMPLE = EVENT 1
1:TRACE  FOR  01023 CLOCKS
2:STOP
      ----
PATTERN DEFINITIONS:
NAME              HH HH
00 EVENT 0        =00 8F
01 EVENT 1        =90 BD
02 -              =XX XX
```

Note: The positioning of the event can be changed by the clocks in the trace control command sequence. In this example the event found will be first stored in memory location 1024. The display memory may not always fill up if the event is found before 1023 samples are taken.

Setup #5

RECORD AROUND THE Nth EVENT IN A SEQUENCE OF EVENTS (Sequential Trigger)



Purpose: To wait for a series of events to occur, record sequential data before an event, record the event, and then record sequential data following the event.

Benefit: To precisely define an area inside a multi-nested subroutine or to follow a complex program path.

Data Stored: The K450 Trace Control level 0/1/2/3 waits until SAMPLE = EVENT 0/1/2/3 and then advances to the next level. Level 4 stores samples until SAMPLE = EVENT 4 and then advances to level 5. Level 5 stores the next 1023 samples and advances to the blank line (default STOP)

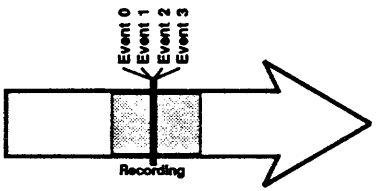
Trace Control Screen:

```
LVL COMMAND SEQUENCE:
0:WAIT  UNTIL  SAMPLE = EVENT 0
1:WAIT  UNTIL  SAMPLE = EVENT 1
2:WAIT  UNTIL  SAMPLE = EVENT 2
3:WAIT  UNTIL  SAMPLE = EVENT 3
4:TRACE  UNTIL  SAMPLE = EVENT 4
5:TRACE  FOR  01023 CLOCKS

        PATTERN DEFINITIONS:
NAME              HH HH
00 EVENT 0        =00 8F
01 EVENT 1        =01 31
02 EVENT 2        =02 9B
03 EVENT 3        =FE 7B
04 EVENT 4        =01 AB
```

Note: Up to sixteen levels can be programmed. The positioning of the event can be changed by the clocks in the trace control command sequence. In this example you may not always fill the memory before the event.

Setup #6

RECORD AROUND A CONSECUTIVE SERIES OF EVENTS (Consecutive Trigger)



Purpose: To record sequential data before a sequential series of events, record the series of events, and then record sequential data after the events.

Benefit: Trigger on multibyte instructions.

Data Stored: The K450 Trace Control level 0 stores data until SAMPLE = EVENT 0 and then advances to level 1. Level 1/2/3 stores EVENT 1/2/3 if it occurs as the next data sample and then advances to level 1/2/3, or if not, level 1/2/3 goes to level 0. Level 4 stores the next 1023 samples of data.

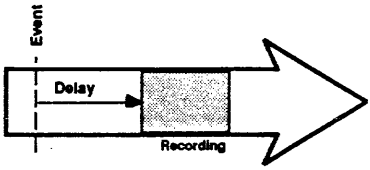
Trace Control Screen:

```
LVL COMMAND SEQUENCE:
0:TRACE  UNTIL  SAMPLE = EVENT 0
1:TRACE ___
        ADVANCE IF SAMPLE = EVENT 1
    OR GO TO 0 IF SAMPLE ≠ EVENT 1
2:TRACE ___
        ADVANCE IF SAMPLE = EVENT 2
    OR GO TO 0 IF SAMPLE ≠ EVENT 2
3:TRACE ___
        ADVANCE IF SAMPLE = EVENT 3
    OR GO TO 0 IF SAMPLE ≠ EVENT 3
4:TRACE  FOR  01023 CLOCKS
        PATTERN DEFINITIONS:
NAME            HH HH
00 EVENT 0      =00 8F
01 EVENT 1      =01 31
02 EVENT 2      =02 9B
03 EVENT 3      =03 8D
04 EVENT 4      =04 FE
```

Note: The display memory may not always fill up if the event is found before 1023 samples are taken.

Setup #7

RECORD LONG AFTER AN EVENT (Clock Delay)



Purpose: To record a window of sequential data at a pre-determined location after an event.

Benefit: Trigger on a known event and look at data at a prescribed time after the event.

Data Stored: The K450 Trace Control waits until SAMPLE = EVENT and then advances to level 1. Level 1 waits for 10000 clocks and then advances to level 2. Level 2 stores the next 2048 samples of data and then advances to the blank line (default STOP).

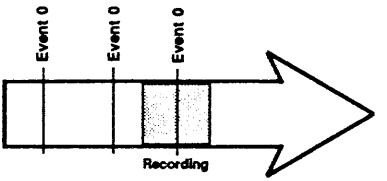
Trace Control Screen:

```
LVL  COMMAND SEQUENCE:
0:WAIT  UNTIL  SAMPLE = EVENT
1:WAIT  FOR   10000 CLOCKS
2:TRACE  FOR  02048 CLOCKS


        PATTERN DEFINITIONS:
NAME:           HH HH
00 EVENT        =00 8F
01 -            =XX XX
```

Note: By changing the number of delay clocks in level 1 you can alter the window of captured data. Use the DELAY value like the delay trigger control on an oscilloscope.

Setup #8

RECORD AROUND THE Nth OCCURRENCE OF AN EVENT (Event Delay)



Purpose: To record the occurrence of an event a predetermined number of times and record sequential data around the last occurrence of the event.

Data Stored: The K450 Trace Control level 0 sets a counter for 3 COUNTS OF SAMPLE = EVENT 0, the next line of level one stores data until count = 3 and then advances to level 1. Level 1 stores sequential data for the next 1023 clocks and advances to the blank line (default STOP).

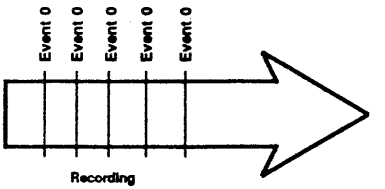
Trace Control Screen:

```
LVL  COMMAND SEQUENCE:
0:SET DELAY TO 00003 COUNTS OF
                              SAMPLE = EVENT 0
      TRACE UNTIL COUNT = 00003
1:TRACE FOR 01023 CLOCKS
      ----


      PATTERN DEFINITIONS:
NAME:          HH HH
00 EVENT 0     =00 8F
01 -           =XX XX
```

Note: To change the number of events looked for, simply change the delay counter in level 0. The display memory may not always fill up if the event is found before 1023 samples are taken.

Setup #9

RECORD OCCURRENCES OF A SINGLE EVENT (Selective Recording)



Purpose: To record the occurrence of one type of event and one type only.

Benefit: This example is useful if you wish to examine data associated with a particular address over a period of time.

Data Stored: The K450 Trace Control level 0 sets a counter to 2048 COUNTS OF SAMPLE = EVENT 0, traces every occurrence of Event 0 until the counter has reached 2048, and then advances to level 1. Level 1 stops the command sequence.

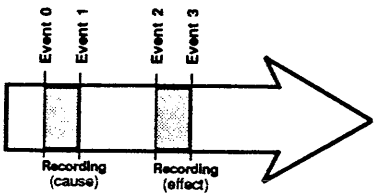
Trace Control Screen:

```
LVL  COMMAND SEQUENCE:
0:SET DELAY TO 02048 COUNTS OF
                              SAMPLE = EVENT 0
      TRACE IF . . . SAMPLE = EVENT 0 ___
      ADVANCE IF SAMPLE = EVENT 0
                              AND COUNT = 02048
1:STOP

      PATTERN DEFINITIONS:
NAME:          HH HH
00 EVENT 0     =00 8F
01 -           =XX XX
```

Note: To change the number of times you wish to record a particular event, change the delay counter.

Setup #10

RECORD BETWEEN EVENTS (Windows)



Purpose: To record an event followed by sequential data until a second defined event occurs. Wait until a third event occurs, record the event followed by sequential data until a forth event occurs and record the forth event.

Benefit: Captures cause and effect relationships in code execution, although they may be separated by megabytes.

Data Stored: The K450 Trace Control level 0 waits until it sees SAMPLE = EVENT 0 stores the event and advances to level 1. Level 1 stores all preceding data until SAMPLE = EVENT 1 stores the event and then advances to level 2. Level 2 waits until SAMPLE = EVENT 2 store the event and advances to level 3. Level 3 stores all preceding data until SAMPLE = EVENT 3, stores the event and advances to the blank line (default STOP).

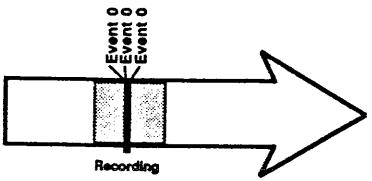
Trace Control Screen:

```
LVL  COMMAND SEQUENCE:
0:TRACE IF.... SAMPLE = EVENT 0
        ADVANCE IF SAMPLE = EVENT 0
1:TRACE UNTIL SAMPLE = EVENT 1
2:TRACE IF.... SAMPLE = EVENT 2
        ADVANCE IF SAMPLE = EVENT 2
3:TRACE UNTIL SAMPLE = EVENT 3
     PATTERN DEFINITIONS
NAME:          HH HH
00 EVENT 0     =00 8F
01 EVENT 1     =64 BD
02 EVENT 2     =9B 3A
03 EVENT 3     =FF 5C
```

Note: Setup one window by deleteing Level 2 & 3. Also a good example for capturing subroutines.

Setup #11

RECORD AROUND THE Nth CONSECUTIVE OCCURENCE OF AN EVENT (Filter)



Purpose: To record sequential data before an event, record the event only if it is present a predetermined number of clocks, and then record data immediately following the event.

Benefit: When making asynchronous recording, triggering on noise or glitches is undesirable. A filtered trigger on stable inputs assures examination of the same section of code for each recording.

Data Stored: The K450 Trace Control level 0 stores 1023 samples and then advances to level 1. Level 1 sets a counter to 3 COUNTS OF SAMPLE = EVENT 0, traces until an occurrence of EVENT 0, traces until the counter has reached 3 counts of EVENT 0, or resets the counter if a consecutive sample does not equal EVENT 0. If the counter condition is satisfied, level 1 advances control to level 2. Level 2 stores the next 1023 samples of data and then advances to the next level. Level 3 stops the command sequence.

Trace Control Screen:

```
LVL  COMMAND SEQUENCE:
0:TRACE FOR 01023 CLOCKS
1:SET DELAY TO 00003 COUNTS OF
SAMPLE = EVENT 0
TRACE UNTIL SAMPLE = EVENT 0 AND
                          COUNT = 00003
     OR GO TO 1 IF SAMPLE ≠ EVENT 0
2:TRACE FOR 01023 CLOCKS
3:STOP
     PATTERN DEFINITIONS:
NAME:          HH HH
00 EVENT 0     =XX 8F
01 EVENT 1     =XX E0
```

Note: Change the filter by changing the number of delay counts.

Appendix B

K450B ERROR MESSAGES

This Appendix provides a listing of Error and Warning messages generated by the K450B. Any additional explanation of the messages are enclosed in parenthesis. The error messages are grouped in the following categories:

General Messages

Arm Mode Screen

Clocks Screen

Format Screen

Trace Control Screen

I/O Related Functions

Disk Related Operations

When an error condition occurs, the beep tone sounds if enabled. In most cases, a message is displayed on line 2 of the screen with a brief description of the problem.

GENERAL MESSAGES

Illegal key - Press HELP for more information

Illegal quick mode key - Press HELP for legal keys

Illegal value - Press HELP for legal values

Cannot alter Memory A or B Setup
These values may be changed only when the M indicator is displayed for this screen.

AC POWER INTERRUPTION. Press NEXT to Restart.
This message is displayed when a power interruption occurs. The K450B assumes the worst case exists (e.g. machine setup lost) and will reset when the NEXT key is pressed.

GENERAL MESSAGES (Cont'd.)

Unassigned Interrupt, near x x x x : x x x x, Press NEXT to continue

This message is displayed when the K450B CPU processes an unused interrupt. This error can result from one of the following conditions:

- If a power brown-out occurs that is insufficient to trigger the AC Power Interruption

- If a component on the CPU is faulty

- If a programming error has triggered the interrupt

Divide Error, near x x x x : x x x x , Ignored

This Warning message is displayed when the CPU detects a Divide by Zero or a Divide Overflow. This is only a warning and processing will continue (although data integrity is undetermined). Divide errors are extremely unlikely, but can occur for the same reasons listed for Unasigned Interrupt Errors

NOTE: If either of the last two messages appear (i.e., Unassigned Interrupt or Divide Error), Follow the procedure listed below:

1. Note the address (x x x x : x x x x) indicated in the error message.

2. Note the K450B Setup and Recorded Data that was present at the time the error occurred.

3. List the Key sequence that caused the error, if possible.

4. If the problem is repeated, call Gould Inc., DTD Customer Service and provide this information.

ARM MODE SCREEN

SET TOLERANCE

This message is displayed when the F4 key is pressed and indicates the Don't - Care memory is being altered with the selcted Auto Edge tolerance value.

CLOCKS SCREEN

* * * Warning: Split - Timing Selected * * *

This message alerts the user that clocking has been selected. This condition results when at least one section of data is being stored at a different rate from the other sections.

FORMAT SCREEN

User Specified Format set to HEX

User Specified Format set to BINARY

User Specified Format set to DISASSEMBLER

The appropriate message is displayed when the F4 key is pressed with one of the fixed formats selected.

TRACE CONTROL SCREEN

Cannot insert new line - 80 lines already defined

Cannot insert pattern - 50 patterns already defined

Pattern cannot have more than five fill - in columns

Cannot insert line in front of ADVANCE command

The ADVANCE command must immediately follow the TRACE or WAIT command.

Cannot enter Edit Mode while on a fill - in column

Cannot delete pattern - Referenced in a Command line

I / O RELATED FUNCTIONS

Invalid Record Received. . .

IR type record received

GPIB REMOTE MODE - PRESS [F1] TO RETURN TO LOCAL

The K450B is under remote control. The user may restore control to the local front panel by pressing the F1 key.

I / O RELATED FUNCTIONS (Cont'd.)

GPIB REMOTE MODE WITH LOCKOUT

The K450B is under remote control. The local user is locked out.

Print / Send Job Aborted

If the K450B is actively sending data, pressing the CANCEL key causes this message to be displayed.

INVALID

An invalid record is received. This message is not to be confused with receipt of an IR record.

Print /Send Job in progress. Press CANCEL to abort.

This Warning message is displayed when a new request to send data is made by the local user while an operation is still in progress.

Press Hex Pad Keys for menu choice or press I / O Key to exit.

This prompt occurs if an illegal key is pressed while the I / O Function Menu is displayed.

DISK RELATED OPERATIONS

One moment please.

This message is displayed when a disk access operation is in progress and a screen key is pressed. The message indicates the screen key has been recognized and will be processed immediately following completion of the disk operation.

Cannot load Disk System.

This message is displayed when the DOS software does not load into Logic Analyzer RAM during the boot loading sequence.

Appendix C

K450B 400MHz PROBE OPERATION

INTRODUCTION

This Appendix describes operation of the 400MHz Probe which is an accessory for the K450B Logic Analyzer. This feature employs special hardware and software that allows the K450B to accept input data signals at a sampling rate of 400MHz (2.5 ns resolution) on up to 20 input channels. The captured data is stored in the K450B with a memory depth of 8192 word samples.

Hardware Description

The 400MHz Probe hardware (Figure C-1) consists of the D-Connector Probe Cable, Probe Case, and a 5-pin connector with flying leads and grabbers. The grabbers attach to various IC pins or wire wrap posts on a printed circuit board.

NOTE: This probe is used for 400MHz inputs only and must be installed at the lower connector (Bits 0-7) on the Logic Analyzer Front Panel. The software acknowledges four signals, Bits 0 through 3 as 400MHz input channels and ignores Bits 4 through 7.

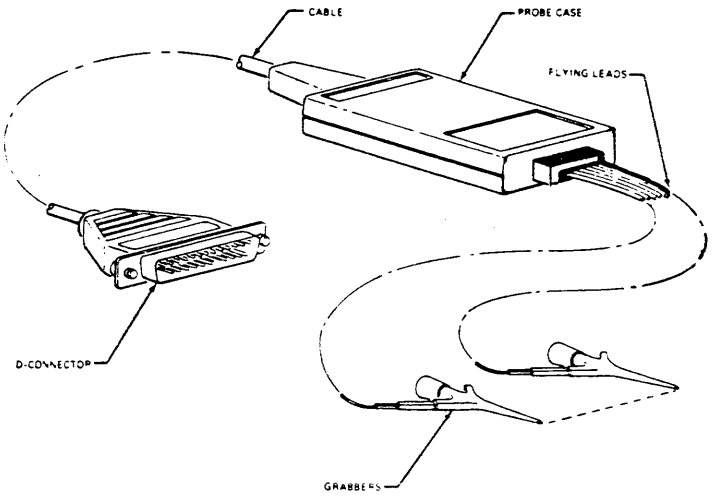


Figure C-1. K450B 400MHz Probe

Software Description

Software for the 400MHz Probe resides in 14 PROM chips installed on the K450B MPU Board. Procedures are included in this Appendix for updating these PROMs in an existing K450B unit to process inputs for 100MHz, 200MHz, and 400MHz.

INPUT CHANNEL CONFIGURATIONS

The following input channel configurations are available when the 400MHz Probe Input feature is installed:

# CHANNELS	INPUT CAPABILITY
32:	Two Input Sections, A and B accept the following signals: - 8 Clocks (6 Sample, 2 Latch) - 32 Data Signals @ 100 MHz - 16 Data Signals @ 200MHz - 8 Data Signals @ 400MHz
64:	Four Input Sections, A,B, C,and D accept the following signals: - 12 Clocks (6 Sample, 6 Latch) - 64 Data Signals @ 100MHz - 32 Data Signals @ 200MHz - 16 Data Signals @ 400MHz
80:	Five Input Sections, A,B, C,D, and E accept the following signals: - 12 Clocks (6 Sample, 6 Latch) - 80 Data Signals @ 100MHz - 40 Data Signals @ 200MHz - 20 Data Signals @ 400MHz

PROM INSTALLATION

General

The PROM Set for K450B consists of 14 chips which are installed on the K450B MPU board. Prior to beginning the installation procedure, position the carrying handle of K450B Logic Analyzer to the front of machine so that the chassis rests flat on the work surface.

WARNING

Disconnect the 115 / 230 Vac power source to K450B to avoid a shock hazard. Also, high voltage is present on the CRT Assembly and Display board components.

Procedure

1. Remove the six Phillips-head screws that secure the Top Cover / Disk Drive assembly to the K450B chassis. Carefully lift the assembly from chassis to expose the card cage. (See Figure C-2.)

2. Remove two screws that secure the card retainer bracket to top of card cage and remove bracket.

3. Remove MPU board from card cage.

4. Remove existing PROMS for K450B Main Code from MPU board.

5. Install the new K450B Main Code PROM Set on MPU board. Install 14 PROMs at the following IC socket locations shown in Figure C-3:

PROM #	COL / ROW	PROM#	COL / ROW
1 of 14	1A	2 of 14	2A
3 of 14	1B	4 of 14	2B
5 of 14	1C	6 of 14	2C
7 of 14	1D	8 of 14	2D
9 of 14	1E	10 of 14	2E
11 of 14	1F	12 of 14	2F
13 of 14	1G	14 of 14	2G

6. Reinstall the MPU board in card cage and install the card retainer bracket.

7. Reinstall the Top Cover / Disk Drive assembly on chassis using care to route cables to avoid possible inteference and binding. Secure cover with six screws.

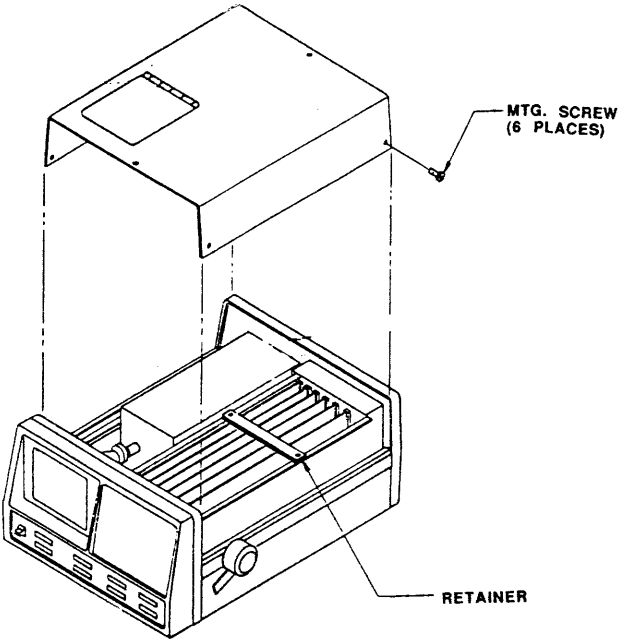


Figure C-2. Arrangement of Top Cover Assembly

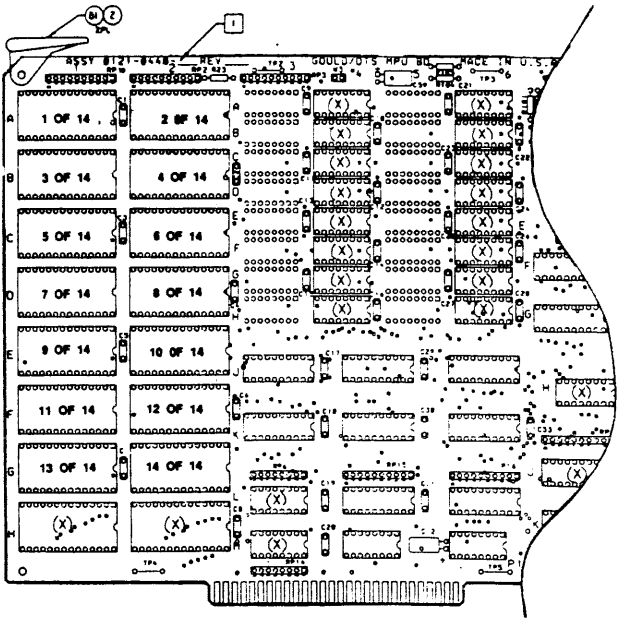


Figure C-3. Location of PROM Set on MPU Board

8. Power up the K450B and verify the ***Configuration Screen*** (Figure C-4) indicates Software Version: 1.10, Revision: C or later is present.

9. Press **F1** Key to set default parameters for this software revision level. The current Setup parameters stored in CMOS may be incompatible with the new EPROMS. This would cause a CMOS checksum error to occur the first time the system is powered up after changing the EPROMS. If this happens, clear the error by pressing the **NEXT** key, and press the **F2** Key to re-run the power up diagnostics.

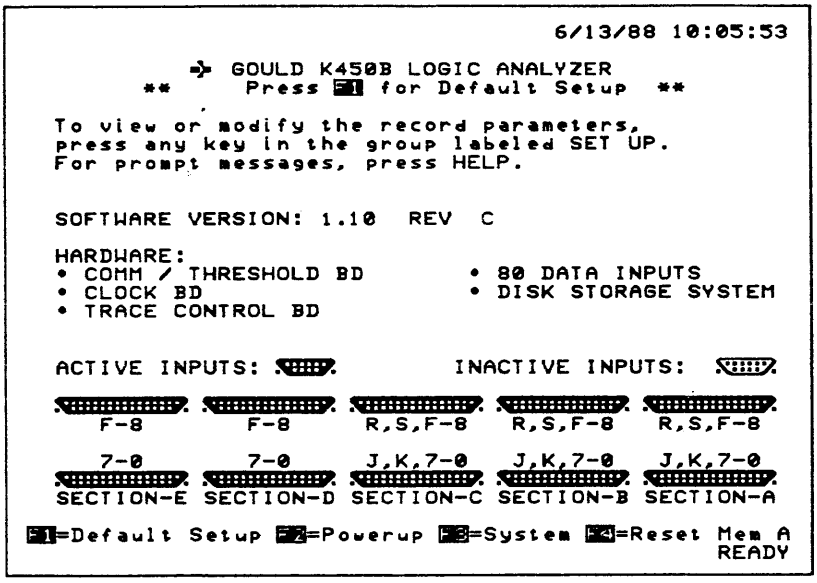


Figure C-4. Configuration Screen

INPUT SAMPLING RATES

Each of the five Input Sections, A through E accept 16 data signals. Bits 0-7 are supplied to the lower connector and Bits 8-F are supplied to the upper connector to provide 80 input channels for a fully configured K450B unit.

100MHz Inputs

All input data with a sampling rate of 100MHz, or less, can be supplied to both the lower connectors (Bits 0-7) and upper connectors (Bits 8-F) to provide 80 input channels. The captured data is stored in the word buffer with a memory depth of 2048 word samples. This is a standard feature of the K450B.

200MHz Inputs

Data inputs at a 200MHz sampling rate are supplied to eight channels at the lower input connectors only (Bits 0-7) to provide 40 input channels. The captured data is stored in the word buffer with a memory depth 4096 word samples. This is a standard feature of the K450B.

400MHz Inputs

Data inputs at a 400MHz sampling rate are supplied to four channels at the lower input connectors only (Bits 0-3) to provide 20 input channels. The captured data is stored in the word buffer with a memory depth of 8192 word samples.

When data for any Input Section is stored with the 2.5 ns clock, the data for that section is not transferred in a straight-forward manner because of the following conditions. While the Logic Analyzer operates in the 400MHz mode, it is actually operating in the the 200MHz mode. Data at the four input channels is delayed by 2.5 ns in the probe and is recorded in the channel (Bits 4-7) memory.

For display purposes, this data is manipulated to present four channels of 8192 samples; however, the I/O commands reflect the actual recorded format for eight channels of 4096 samples.

CLOCK SET UP SCREEN

The ***Clock Screen*** (Figure C-5) uses Function Key **F1** to select recording periods for 100MHz (10 ns), 200MHz (5 ns), and 400MHz (2.5 ns). Other operations of the ***Clock Screen*** remain the same as described in Chapter 3. The selection of different recording periods at specified input sections (Split Timing) may include the 400Mhz rate by specifying 2.5 ns for the specified input section(s).

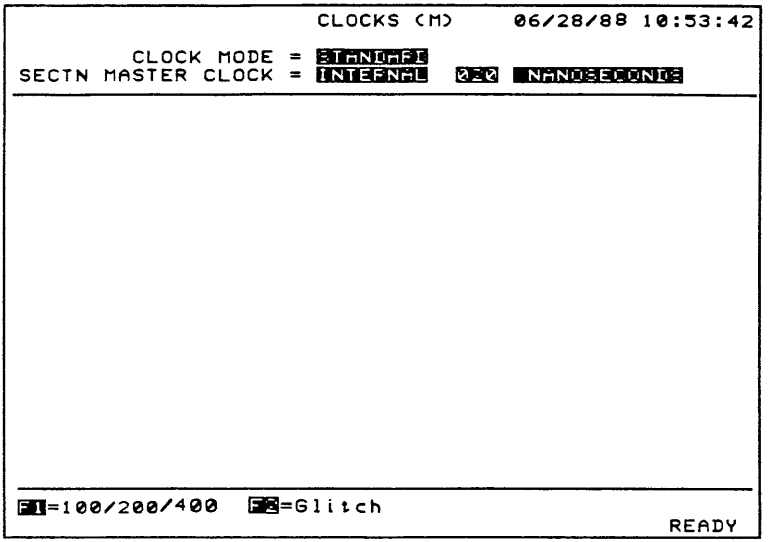


Figure C-5. Clock Screen

Auto Compare Range Values

Auto Compare range values on the ***Data Display Screen*** are determined by the selected time rate at which samples are stored. Samples used in the comparison consist of Samples Contained Between Cursor, Samples Selected Below, and All Samples. The description of these conditions is presented in Chapter 3. See description of ***Data Display Screen***.

The data in Memory A and B must be of the same length when using the Compare and Auto Compare feature. Also, the Compare functions operate more slowly when the 200MHz or 400MHz clock rate is assigned for samples.

At 100MHz sampling rate, the memory depth is 2048 (numbered 0-2047).

At 200MHz sampling rate, the memory depth is 4096. sample (numbered 0-4095).

At 400MHz sampling rate, the memory depth is 8192 (numbered 0-8191).

Search Function Range

The search function operates on the memory buffer contents when the ***Data Display Screen*** is present. Operation of the Search Function is described in Chapter 3. The Search function operates more slowly when the 200MHz or 400MHz clock rate is assigned for samples.

The following sample quantities are available when the 400MHz Probe Input firmware is installed:

100MHz	Memory Depth = 2048 Sample Count
200MHz	Memory Depth = 4096 Sample Count
400MHz	Memory Depth = 8192 Sample Count

Level Display

Level data is recorded and displayed relative to the master clock, except when full extended clocking is involved. This condition exists when all Input Sections are stored at 10ns, 5ns, or 2.5 ns, and the master clock is selected for 20 ns. In this case, the Level information recorded is multiplied by 2, 4, or 8 and is justified to the end of the record. This gives an approximation of the actual level for the data that is recorded. However, a change of Level will not be precisely aligned with the displayed data.

TRACE CONTROL SCREEN

The Trace Control pattern recognition can only occur every 20 ns with a high resolution recording. Therefore, in order to ensure recognition, a pattern must be valid at least 20 ns.

However, since sampling is totally asynchronous, the probability exists that a much shorter occurrence of the trigger pattern (which could be undesirable) may be recognized as the pattern.

TIMING DISPLAY SCREEN

The operation of Vertical and Horizontal Expansion for the ***Timing Display Screen*** is controlled by Function Keys **F3** and **F4** which operate as follows:

1. When the ***Timing Display Screen*** is first accessed, the following information is presented for the Function Keys:

   F1 = Page Up, **F2** = Page Down, **F3** = Expansion

2. Press **F3** to enter the Expansion Mode. The following choices are indicated:

   F3 = Horizontal, **F4** = Vertical

3. Pressing either Key (**F3** or **F4**) causes the screen to expand by a factor of one, and then exit from the Expansion Mode (i.e., restore Function Keys to the condition shown in Step 1).

4. Repeating Steps 2 and 3 causes the screen to step through each expansion factor, up to the maximum limit for Vertical Traces or Horizontal Magnitude. The expansion factor will wrap around when the maximum limit is reached.

GRAPH DISPLAY SCREEN

The ***Graph Display Screen*** (Figure 3-20) and its functions are not available when any Input Section is set up for the 400MHz (2.5 ns) sampling rate.

REMOTE INPUT/OUTPUT COMMANDS

The Remote Input/Output Commands described in Chapter 4 are entered using the following Syntax:

MEMORY RECORD RANGE DATA

The user is required to specify parameter values for Range and Data that identify the 400MHz Probe Input capability. The following additional values are used to identify conditions for Range and Data parameters:

CONDITION	VALUE
Sampling Rate	400MHz
Time Base	2.5 Nanoseconds
Memory Depth	8192 Samples (Range = 0-8191)

Each of the following Commands require the user to specify parameter values that recognize the 400MHz capability:

CLOCK/SAMPLE STORE (CS)

The Data Choice field now includes a new parameter value of "4" which is used to specify 2.5 ns (400MHz) for the Sample/ Store Clock Source.

CONTROL CURSOR POSITION (CC)

The Data Choice field now includes a parameter value in the range of 0000-8191 (for 400MHz) to specify the Control Cursor Position

REFERENCE CURSOR POSITION (CR)

The Data Choice field now includes a parameter value in the range of 0000-8191 (for 400MHz) to specify the Reference Cursor Position.

AUTO COMPARE RANGE (RR)

The Fourth Data Choice now includes a parameter value in the range of 0001-8192 (for 400MHz) to specify the Time Base for Auto Compare if the condition, Sample(s) Selected Below (S), was specified in the First Data Choice.

SEARCH/COMPARE FIRST/LAST/TOTAL (ZT)

The First Data Choice now includes a parameter value in the range of 0000-8191 (for 400MHz) to specify the Selected Time Base.

SEARCH RESULTS (ZR)

DON'T - CARE DATA (MX)

LEVEL DATA (LA/LB)

The Selected Index for Commands ZR, MX, and LA /LB now include a parameter value in the range of 0000-8191 (for 400MHz) to specify the Sample Number.

BINARY TRANSFER LEVEL DATA (XL/XM)

BINARY TRANSFER DON'T- CARE DATA (XX)

The number of possible Memory Samples for Commands XL/XM and XX is extended to 8192 (for 400MHz) to specify Memory Depth of the Word Buffer.

Appendix D

K450B BUS TIMING DISPLAY FEATURE

INTRODUCTION

This Appendix describes operation of the K450B Bus Timing Display Feature. This feature provides the added capability for selecting, monitoring, and recording bus activity signals generated by the user's target system hardware.

Special software is employed that allows the user to select groupings of bus inputs on the ***Format Screen*** and display results of the recorded input groupings in Bus Format on the ***Timing Screen***.

SOFTWARE DESCRIPTION

Software for the Bus Timing Feature resides in the K450B main code firmware which consists of 14 PROM chips installed on the K450B MPU Board. The software level, Version 2.10, Revision E, is displayed on the ***Configuration Screen*** when the K450B unit is powered up. This software level (or a later version) must be present in the K450B system to enable operation of the Bus Timing Feature.

K450B units which are configured with earlier software versions may be updated in the field by installing the current PROM Set for software Version 2.10, Revision E (or a later version). The procedure for installing the PROM Set in the K450B Logic Analyzer is described in Appendix C. Refer to the description of PROM Installation.

FORMAT SCREEN

Format Screen Operation

An overall description of setup requirements for the ***Format Screen*** is provided in Chapter 3. This setup information describes how the screen parameters are used to select test conditions for User Specified Format, Fixed Format, Radix Definitions, Section Inputs, Data Inputs, and variations in Threshold/Polarity limits. These settings are used by the K450B to organize the recorded results and present this information on the ***Data*** and ***Timing Screens***. Refer to Chapter 3 for overall operating details of the ***Format Screen***.

Specifying Bus Inputs on Format Screen

An additional input field, BUS #, is provided on the ***Format Screen*** which is used for entering bus information (see Figure D-1).

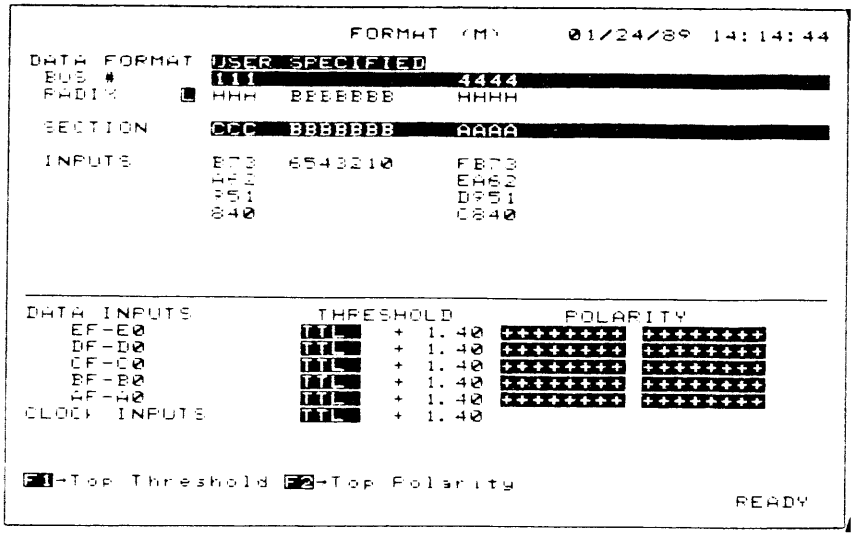


Figure D-1. Format Screen with Bus # Input Field

The BUS # Field is displayed on line 4 of the video screen when either the User Specified or Disassembler Mode is selected in the DATA FORMAT Field.

When User Specified Data Format is selected, The BUS # Field is displayed in reverse video and the contents may be changed by editing.

When Disassembler Data Format is selected, the BUS # Field is displayed in normal video and is available for display only (i.e., the content can not be altered).

The BUS # Field allows the user to specify up to 8 input groupings for display in Bus Format on the ***Timing Screen*** (see description of ***Timing Screen*** which follows).

To enter a Bus Grouping, select User Specified Data Format and move the cursor to the BUS # Field. Move the cursor until it is located directly above a column of inputs defined in the SECTION and INPUTS Fields that are to be included in the Bus Grouping. Enter a digit from 0 to 7 corresponding to the Bus Display Number. Continue to add to the Bus Grouping by moving the cursor to each column that is to be included in the grouping, and enter the Bus Display Number There is no limit to the number of inputs and columns that may be included in a single Bus Group.

Legal Keys for entering data in the BUS # Field are **0** through **7**, **NEXT**, **PREVIOUS**, and the Left and Right Arrow **FIELD** keys.

NOTE: Information contained in the BUS # Field is saved for future reference in both the CMOS Memory and Disk DOS .SM File.

TIMING SCREEN

Timing Screen Operation

The ***Timing Screen*** allows the user to view traces of recorded information on the video screen and to rearrange, label, magnify and measure the captured data. Refer to Chapter 3 for overall details of operation for the ***Timing Screen***.

Timing Screen Bus Groupings

The K450B Bus Timing Display Feature allows groupings of bus input signals to be observed on the ***Timing Screen*** (Figure D-2).

The individual bus inputs may be grouped and displayed in a Bus Format where the trace display is a bitwise OR condition for each data input. Any number of inputs may be specified in a Bus Grouping that is defined on the ***Format Screen***. The value of the least significant 32 bits of a bus, at the active Control or Reference Cursor, is displayed on the ***Timing Screen*** in hexadecimal form. The displayed value tracks the active cursor to the right while the cursor is located on the left side of the screen, and tracks to the left while the cursor is located on the right side of the screen.

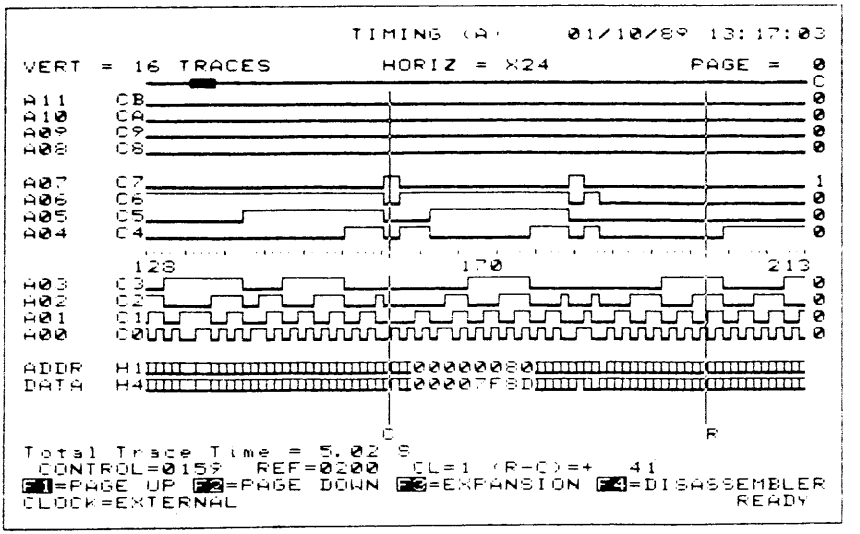


Figure D-2. Timing Screen with Bus Grouping Trace

To select a bus for display, first enter the Channel Edit Mode by pressing the **EDIT** key. Move the reverse video cursor to the desired trace location and enter the Bus Number by pressing the **SHIFT** key, followed by the **1** key (this keying sequence is equivalent to the **H** key). Next,enter a digit from 0 to 7 that corresponds to the Bus Number entered in the BUS # Field in the ***Format Screen***.

When the cursor is in the Channel Edit Field, The **NEXT** and **PREVIOUS** keys cycle through the valid inputs only. The Bus Groups must be explicitly entered as H0 through H7.

NOTE: The Bus information is saved for future reference in both the CMOS Memory and Disk DOS .SM File.

Appendix E

K450B 100 MHz STATE PROBE OPERATION

INTRODUCTION

This Appendix describes operation of the 100 MHz State Probe, an accessory for the K450B Logic Analyzer. This probe allows the K450B user to record synchronous data at rates greater than the basic 50 MHz clocking capability.

Hardware Description

The 100 MHz State Probe hardware (Figure E-1) consists of the D-Connector Probe Cable, Probe Case, and a 10-pin connector with flying leads and grabbers. The grabbers attach to various IC pins or wire-wrap posts on a printed circuit target board.

NOTE: The use of this probe precludes the use of one of the K Clock inputs. The probe must be installed at Input Sections A, B, or C at the lower connector (Bits 0-7) on the front panel of Logic Analyzer.

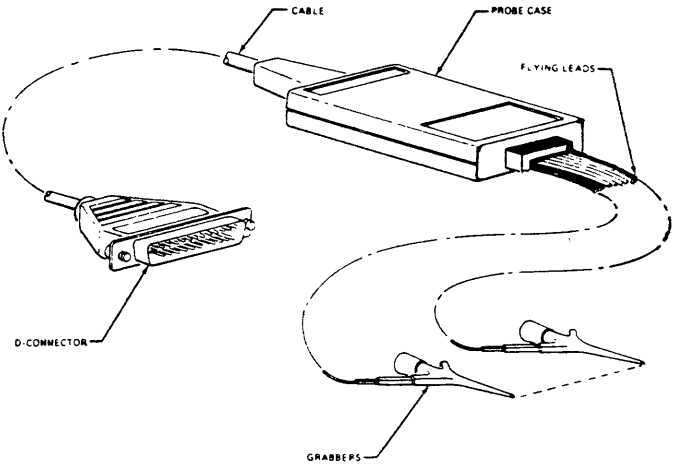


Figure E-1. K450B 100 MHz State Probe

The inputs of the 100 MHz State Probe have the same high-impedance, variable-threshold inputs as the standard (AP 1000) Data Probe that is supplied with the K450B. The accompanying flying lead set contains 10 leads.

100 MHz STATE PROBE OPERATION

The K450B has two main logical parts for controlling inputs. These parts consist of Trace Control and Main Memory as shown in Figure E-2. Trace Control contains circuitry that decides what is stored in memory. The K450B is capable of storing data into memory at the rate of 100 million samples per second across all channels. Trace Control can make decisions at clock rates up to 50 MHz.

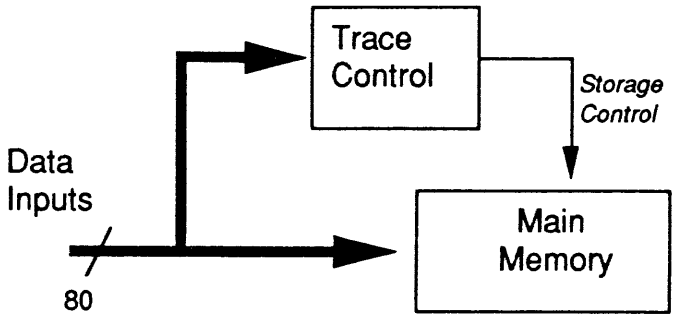


Figure E-2. K450B Input Control

If the Trace Control circuitry is clocked faster than 50 MHz, the logic analyzer operation is unpredictable. Yet, there are instances where it is desirable to record at 100 MHz, even if the data can only be triggered on at 50 MHz. This mode of operation requires two clocks, one for Main Memory and another for Trace Control as shown in Figure E-3. The K450B is capable of providing this sophisticated recording method. This feature is called split-timing clocking.

The problem with split timing is that the circuit under test may not have suitable clocks available. Although a test circuit may have a clock available at less than 50 MHz, its edges may be either too far ahead, or too far behind the true system clock, to capture valid data.

The 100 MHz State Probe provides two coordinated clock signals to operate the Logic Analyzer for this type of split-timing mode.

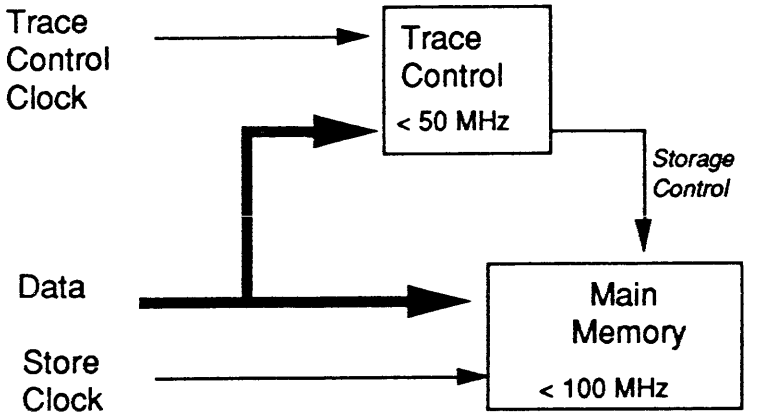


Figure E-3. K450B Clock Inputs

The probe double buffers the J Clock input signal and sends it to the J input of the Logic Analyzer and to an internal divide by 2 circuit. The output of the divide by 2 circuit is sent to the K Clock input of the Logic Analyzer (see Figure E-4). This half-speed clock signal is sent to the K input where it is used to drive the trace control circuitry.

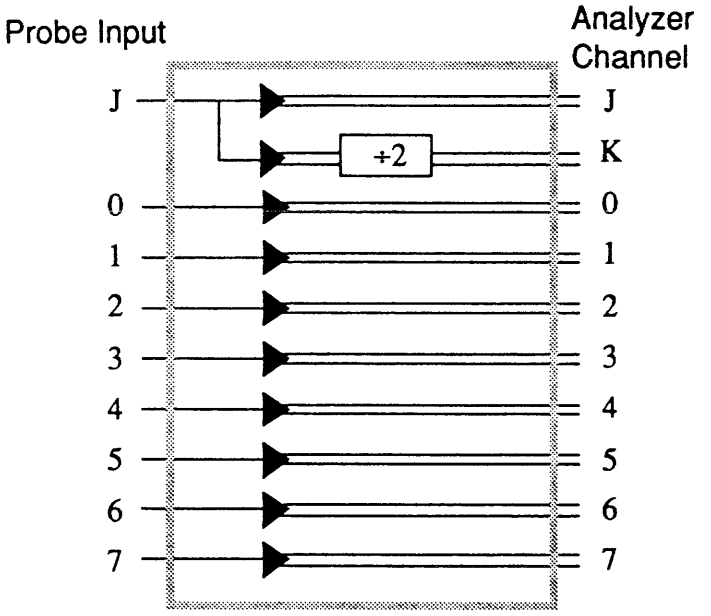


Figure E-4. 100 MHz State Probe Circuits.

The trace control circuitry, running at one-half the sampling rate, checks every other data sample against the pattern being looked for. The clocking sequence for this check is shown in Figure E-5.

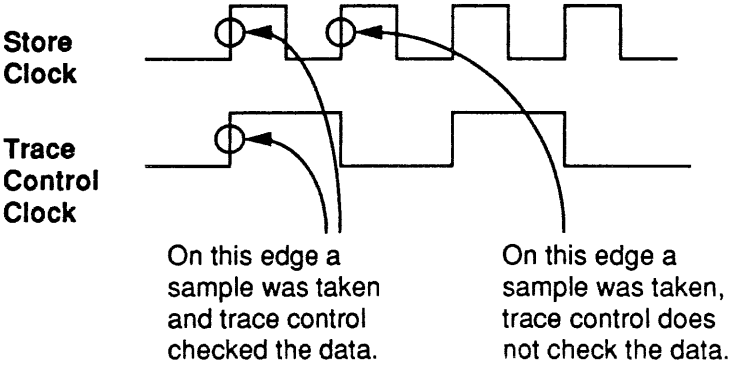


Figure E-5. K450B Clocking for Trace Control Data Check

CLOCK SCREEN SETUP

The 100 MHz State Probe takes advantage of the K450B's split-timing clocking. Therefore, Advanced Clock Mode must be selected for the Clock Screen Setup. This clock mode allows the user to specify the requirements for each input channel section.

The split-timing condition is present when more than one clock rate is used for moving data into memory. The message, SPLIT, is briefly displayed in reverse video to the left of the CLOCKS header to notify the user that clocking for split-timing is enabled. The SPLIT message also appears on the associated screens for Data, Timing, and Graph displays.

An example clock screen setup for 100 MHz State Probe operation is shown in Figure E-6. Refer to Chapter 3, Operation of Logic Analyzer Screens for specific requirements to configure the Clock Screen for Advanced Clock Mode.

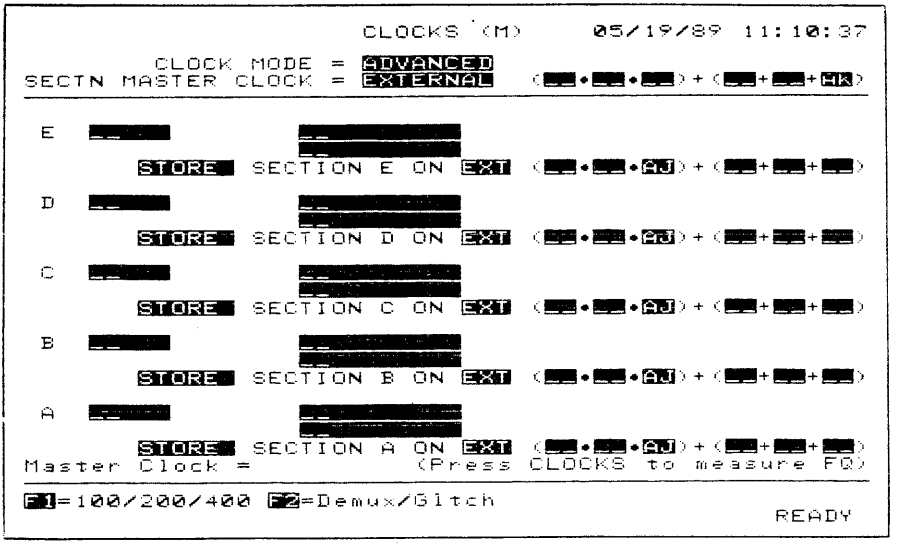


Figure E-6. Example Clock Screen Setup for Split Timing

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