

K450 LOGIC ANALYZER

USER'S MANUAL



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K450 LOGIC ANALYZER



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K450 Logic Analyzer with Dual 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 K450 Logic Analyzer. Procedures are provided for a user to record and examine address, data and control signals of 8 and 16-bit microprocessors, ECL based systems, gate arrays, bit-slice processors and other high speed microprocessors.

A Glossary is included in Appendix A of this manual. The Glossary describes unique hardware and software terms associated with operation of the K450.

The material in this manual reflects the Control Firmware level valid on November 1985, and is up-to-date at the time of publication, but is subject to change without notice.

Copies of this publication and other Gould Inc., Design and Test Systems Division publications may be obtained from the Gould Inc., Design and Test Systems Division sales office or distributor serving your locality.

REFERENCE DOCUMENTS

The following manuals can be used as reference material in association with the K450 Logic Analyzer:

K450 Service Manual,
Publication Number 0121-0005-10 (Available April, 1986)

K450 Disk Storage System Manual,
Publication Number 0120-0095-10

ASSISTANCE

If you require assistance on this product, please call Gould Inc., Design and Test Systems Division Customer Service on the toll-free, hot-line number listed below:

Nationwide (800) 538-9320/9321

California (800) 662-9231

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INTRODUCTION

GENERAL DESCRIPTION

The Gould/Biomation Model K450 Logic Analyzer (Figure 1-1) is a precision, high-performance test and development instrument. The K450 monitors and records digital input logic signals generated by the user's external target system. The K450 may be configured to accept the following data inputs:

- 16, or 32, or 48 Inputs @ 100 MHz Sections A, B and C.
- 8, or 16, or 24 Inputs @ 200 MHz Sections A, B and C.

Additionally, the K450 accepts the following external clock inputs:

- 2 Sample and 2 Latch clocks, Section A only
- 6 Sample and 2 Latch clocks, Sections A and B
- 6 Sample and 6 Latch clocks, Sections A, B and C

The K450 provides either 10-ns resolution at 100 MHz or 5-ns resolution at 200 MHz on all input channels. The K450 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.

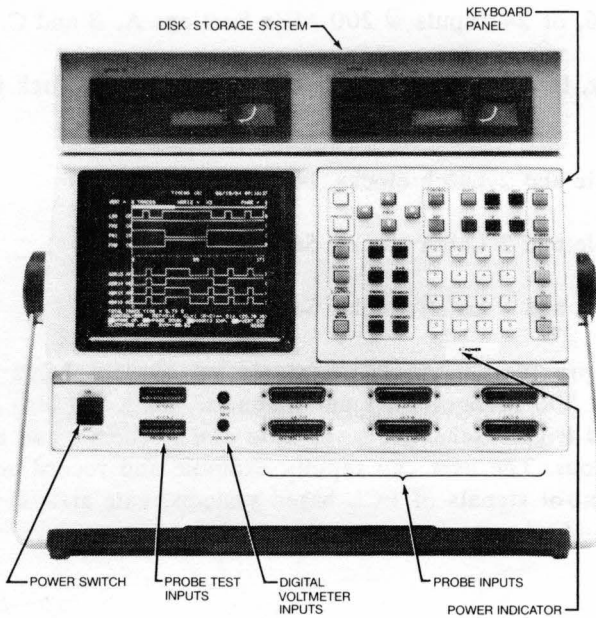


Figure 1-1. K450-D Logic Analyzer Controls and Indicators

FEATURES

Software Control

The K450 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 are 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 K450 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-service testing.

The K450 offers the user a screen-guided Trace Control* that is simple to use, and powerful. Trace levels can be rapidly set up using the 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.

K450 Auto Setup

The K450 Auto Setup feature 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 K450 Auto Setup, reducing setup time and simplifying operation.

*Gould Inc., Trademark pending

External Interface

The K450 may interface to the user's system via rear panel connectors that provide 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 of setups and data between the K450 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 K450 and a user's system |

The RS-232-C interface allows serial transfer of setups and data between the K450 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.

Reconfigurable Hardware and Software

The user can purchase a K450 unit in a minimum configuration (Section A only), which provides the following:

- 16 Data Inputs @ 100 MHz (Bits F-0) via Section A or
- 8 Data Inputs @ 200 Mhz (Bits 7-0) via Section A

This configuration can be modified later at the user's site to meet increased demands by adding additional inputs via Input Sections B and C as follows:

Addition of Section B provides a total of:

32 Data inputs @ 100 MHz (Bits F-0) via Sections A and B or
16 Data Inputs @ 200 MHz (Bits 7-0) via Sections A and B

Addition of Section C provides a total of:

48 Data Inputs @ 100 MHz (Bits F-0) via Sections A,B, and C or
24 Data Inputs @ 200 MHz (Bits 7-0) via Sections A,B, and C

A Disk Storage System (DSS) Option is available, which contains a dual, 5 1/4" disk drive system. The DSS option is available as a factory-installed unit or may be added by the user at a later time to provide the following capabilities.

- Save data automatically on two disks while the user is not operating the system
- Save setup conditions on the disk and recall at a later time
- Save acquired data and setup menus for later retrieval
- Load Diagnostic Software for troubleshooting K450 equipment operation
- Load Optional Disassemblers that translate binary instructions and data into a mnemonic format for various microprocessors.

Trace Control

The trace control functions of the K450 are menu driven and are programmable in an English-like language. Sixteen levels of trace control are available. Each level can be programmed to selectively trace, advance to the next level, jump to any level or stop the recording based on a match or non-match of independent patterns and the status of the delay counter. In conjunction with delay, this control scheme permits the user to locate and store several specific subroutines within a large program.

Tolerance Comparison Analysis

The K450 contains a memory that allows the user to enter Don't-Care states in the Data, Timing, or Arm Mode displays. When the compare function is enabled, comparisons are not made in those areas designated as Don't-Cares; consequently, the user is able to compensate minute timing deviations among the same type of boards.

K450 HARDWARE CONFIGURATION

Figure 1-2 is a simplified block diagram illustrating the major subassemblies of the K450. These subassemblies consist of printed circuit boards that interact with the Microprocessor Unit (MPU) board to control K450 circuit functions. The functions of the following printed circuit boards are described in subsequent paragraphs:

- Threshold/GPIB/RS-232 Board
- Clock Board
- MPU Board
- Display Board
- Data Board
- Control Board

Threshold/GPIB/RS-232 Board

The Threshold/GPIB/RS-232 Board provides the fixed and variable threshold voltages for the probe pods. This board also contains an Analog-to-Digital Converter used for the Digital Voltmeter (DVM) and power supply check during power-up diagnostics.

The Threshold/GPIB/RS-232 Board supports the following I/O functions:

- Two RS-232 ports (one port is labeled AUX)
- One IEEE-488 Talker/Listener port
- DVM inputs

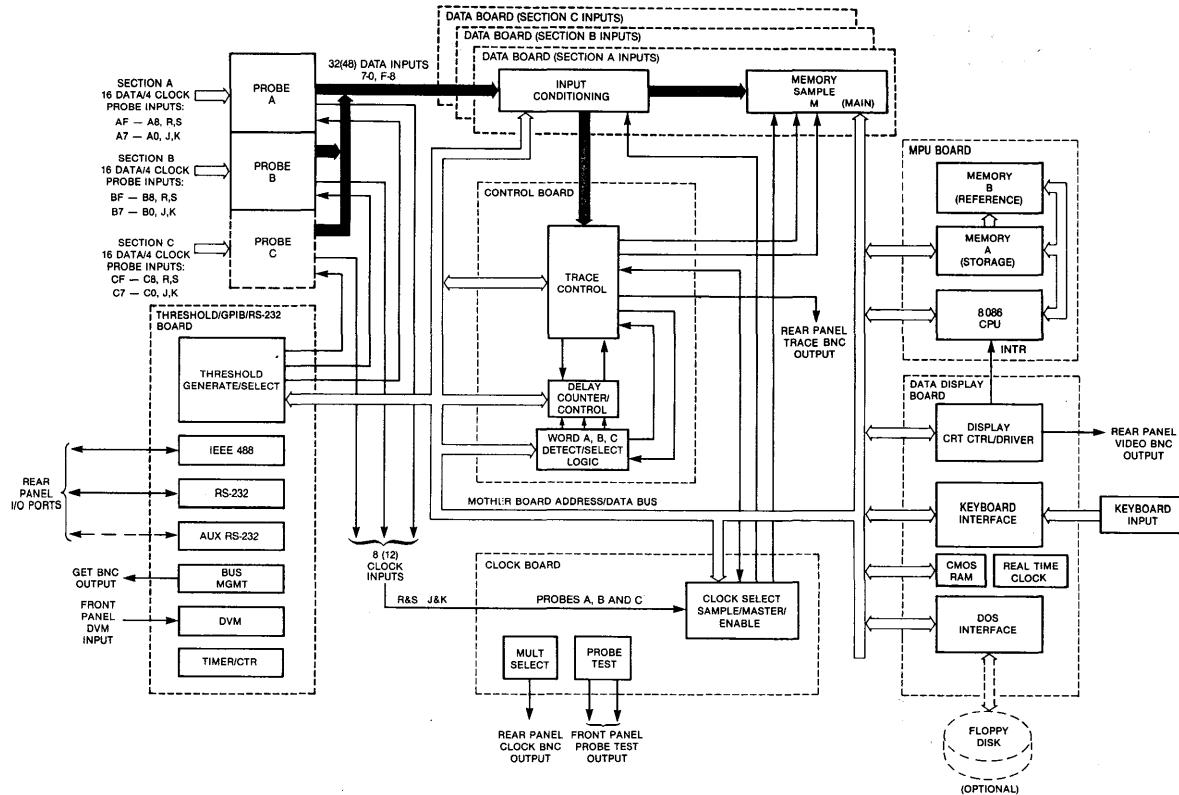


Figure 1-2. K450 Simplified Block Diagram

Various parameters such as communications source, parity, and baud rate are selected from the I/O screen using the K450 keypad.

Clock Board

The Clock Board generates all internal timing, selects between the internal and external clocks, and combines all external clocks. The minimum configuration provides four external clocks which consist of two Sample clocks (AJ, AK) and two Latch clocks (AR, AS). The 32-input system provides eight external clocks which consist of six Sample clocks, AJ, AK, BJ, BK, BR and BS, and two Latch clocks, AR and AS. The 48-input system provides a total of 12 external clocks which consist of six Sample clocks, AJ, AK, BJ, BK, CJ and CK, and six Latch clocks, AR, AS, BR, BS, CR, and CS.

The Clock Board also contains the level memory, which indicates the active program level for a given recording. In addition, this board retains the probe self-test ring counter; this counter is a psuedo ECL signal generator which is connected to the front panel for testing probes and the unit operation.

MPU Board

The MPU Board contains memories A and B, an 8086 CPU and the operating system firmware. Memories A and B are each 2,048 samples deep and 48 bits wide. This board provides control functions for the following:

- Display
- Display Setups
- Memory Transfers
- Keyboard
- Memory Functions
- Memory Compares

Display Board

The Display Board contains keyboard detection circuitry, CRT scanning and high-voltage drive circuitry for the bit mapped display, and interface circuitry for the DSS option. This board provides output to the VIDEO BNC connector located on the back panel. This board also has CMOS RAMS to save setups at power down and contains a real-time clock that allows the K450 to log the current time and date of each recording.

Data Boards

Up to three Data Boards provide interface from the probes to the Control Board. In addition to sample-mode data input, these boards provide latch/demultiplexing of data by byte, latch mode and glitch capture circuitry.

The high-speed memory on each Data Board is 2,048 samples deep by 16 bits wide and samples data at clocks speeds up to 200 MHz. Data are stored in memory on instruction from trace control.

The K450 minimum configuration with 16-inputs employs one Data Board (Input Section A only). This board accepts 16 data inputs and 4 clock inputs. The expansion options employ additional Data Boards for input sections B and C. Each Data Board provides 16 additional data inputs and 4 clock inputs to increase the total input capacity to 48 data inputs and 12 clock inputs.

Control Board

The Control Board contains high-speed logic to enable the board to recognize trace control commands. Present on this board is a sixteen-state counter for control of internal functions, such as delay. The board also provides word recognition circuitry. The delay function on this board contains an independent counter that advances on each clock pulse. This counter resets on each level change, including a jump to the same level. The delay command may be modified to function only if the parameter occurs when the counter is less than, equal to, greater than, less than or equal to, greater than or equal to, or not equal to the full count.

The Control Board also provides output to the TRACE BNC Connector located on the back panel.

SPECIFICATIONS

The following is a summary of the physical, environmental, and operating characteristics of the K450.

K450-Unit Configurations

- **016 Unit:** Provides inputs for 16 data signals @ 100 MHz (8 data signals @ 200 MHz) and 4 clocks via input Section A.
- **032 Unit:** Provides inputs for 32 data signals @ 100 MHz (16 data signals @ 200 MHz) and 8 clocks via input Sections A and B.
- **048 Unit:** Provides inputs for 48 data signals @ 100 MHz (24 data signals at 200 MHz) and 12 clocks via Input Sections A, B, and C.
- **Expansion Option:** Each data board provides probe inputs for 16 add-on data signals at 100 MHz (8 data signals @ 200 MHz) and 4 additional clocks via input Section B or C.
- **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.

Power Requirements

- Input Frequency:** 50 or 60 Hz
- Input Voltage:** 90 to 135 VAC or 180 to 270 VAC
- Input Power:** 500 Watts without DSS option or 550 Watts with DSS option

Fuses for Rated
Voltage:

VOLTAGE RANGE

FUSE

90 VAC to 135 VAC 3AG, 8 Amp

180 VAC to 270 VAC 3AG, 4 Amp

Physical Dimensions and Weight

Height: 8.6 inches (21.8 CM) without DSS, 12 inches
(30.1 Cm) with DSS

Width: 17.5 inches (44.5 CM)

Depth: 24.7 inches (62.7 CM) including handle

Weight: 45 lbs. (20 kg) without probes or DSS

55 lbs. (25 kg) without probes

Environmental Limits

Ambient Temperatures: OPERATING, 39 to 115 Deg.F (4 to
46 Deg.C)
STORAGE, -8 to 117 Deg.F (-20 to
50 Deg.C)

Relative Humidity: OPERATING, 20% to 80%
STORAGE, 1% to 95%

Max Wet Bulb: OPERATING, 78 Deg.F (25 Deg.C)
STORAGE, No condensation

Probes

Loading Characteristics:

Signal Inputs

Input resistance: 1 megohm referenced to threshold

Input capacitance: $\leq 6\text{pF}$ ($\leq 15\text{ pF}$ with flying leads)

NOTE: Input resistance may approach 500K ohms at voltages
exceeding ± 15 volts from threshold.

Maximum input without damage: ± 50 volts, peak

Common mode range: ± 0.5 volt maximum between probe and unit probed

Ground Input: Input resistance is 91K ohms referenced to chassis

Probe Transfer Characteristics:

Bandwidth to 90% volts out: \Rightarrow 100 MHz

Minimum swing for output: Threshold ± 0.20 V maximum

Threshold variance: ± 15 MV maximum, between input signals;
 ± 30 MV maximum, any two probes

Input compensation: Even to 20% overcompensated

Thresholds: Thresholds are independently selectable for each probe:

TTL, +1.4 volts

ECL, -1.3 volts

VAR A and VAR B

NOTE: 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

Data Inputs

16, 32, or 48 (@100 MHz); or 8, 16, 24 (@ 200 MHz) data inputs configured in one two or three input sections, A, B and C, respectively. Each section contains two input groups that accept 16 signals (one group for lower Bits 7-0 at 100 or 200 MHz, the other group for upper Bits F-8 at 100 MHz).

Input Modes: Sample Mode
Latch and Demultiplex Mode
Glitch Mode

Input Frequency: DC to 100 MHz (data)
DC to 50 MHz (clocks)

Clocks

The 16-input configuration provides 2 Sample (edge-sensitive) clocks and 2 Latch Enable (level sensitive) clocks for a total of 4 external clocks.

The 32-input configuration provides 6 Sample (edge-sensitive) clocks and 2 Latch Enable (level-sensitive) clocks for a total of 8 external clocks.

The 48-input configuration provides 6 Sample (edge-sensitive) clocks and 6 Latch Enable (level-sensitive) clocks for a total of 12 external clocks.

Internal: Internal clock is selectable from 20 ns (50 MHz) to 100 ms (10 Hz) in decades of time which is divided by units of 1 to 10 (i.e., 100 ns, 1 us, 10 us and 1 us, 2 us, 3 us,... 10 us). One internal clock may be programmed per recording. This clock is edge sensitive.

A 10 ns (100 MHz) or 5 ns (200 MHz) clock is available to the sample/store sections in addition to the external clock. This clock is edge sensitive.

External: Six external clock inputs which may be combined to form three Sample clocks, three Latch Enable clocks, and one Master (M) clock. These clocks are edge sensitive.

Sample clock: One sample clock may be specified for each input section (A, B, or C) to hold data for the master clock, or move trace data into memory (effective for internal, external, 200 MHz, and 100 MHz clocks). This clock is edge sensitive.

Latch clock: A special case of Sample Mode which is used to temporarily hold (by latch) the first byte of multiplexed data. When the latch clock goes false, data are held in the input latched until the latch clock returns true. The master clock then moves the sample into the pipeline (effective for external clocks only). This clock is edge sensitive.

M-Clock: The master clock is used to shift samples into memory and the trace control logic (effective for internal or external clocks). This clock is edge sensitive.

External Clock Specification

Frequency: DC to 50 MHz

Pulse Width: 8 ns Minimum

Clock Skew: 7 ns Maximum between any two clock combinations

Latch Clocks Setup: 13 ns Minimum before Sample Clocks

Clock Frequency Measurement: The K450 automatically measures the external clock frequency from 100 Hz to 50 MHz with 0.1% accuracy

Data Setup and Hold Time

Data must be present 12 ns (maximum) before, and stable until, the clock active edge. Typical setup time is 8 ns.

Data may change zero ns after the clock active edge

Minimum detectable pulse width is one clock period +5 ns

DVM Input

Range: ± 20 VDC Maximum

Resolution: 20 mv

Input Impedance: 20k ohms

Accuracy: $\pm 0.5\%$

Signal Outputs

VIDEO, BNC connector: 1 Vp-p into 75 ohms composite video output is compatible with RS-170

CLOCK, BNC connector: ECL active low corresponds to the internal clock

GET, BNC connector: Group execute trigger pulse output for the IEEE-488 Command - TTL

TRACE BNC connector: TTL high output when trace is enabled

Two LEMO connectors: +5V and -5.2V @ 300 mA

Memory

The K450 contains main memory M, storage memory A, and reference memory B. Memory M is organized as 2,048 by 20, 36 or 52 bits. Four bits of each word are used to store the level at which data were recorded. The CPU reads data from M into A or from A into B. Both A and B are a part of the CPU memory.

The operating system accommodates up to 512K bytes of RAM and 256k bytes of ROM under the control of the 16-bit, 8086 CPU.

Trace Control

Trace control employs 16 trace levels that are defined by user inputs via the display screen and keyboard. Four commands are decoded for each of the sixteen levels. The four commands are TRACE, STOP, JUMP, and ADVANCE. Control begins at level zero.

A delay counter may be programmed from 1 to 65,535 clocks or events to begin tracing after specified condition occurs. The rear panel BNC output for TRACE is at a TTL level that goes high while the K450 is tracing.

Interface

One RS-232-C Serial I/O Port configured as Data Terminal Equipment (DTE) six-wire system

One Auxiliary Serial I/O Port for RS-232-C (reserved for K450 options)

One IEEE-488 Bus Interface, Parallel Port with Talker/Listener configuration selectable by the user via software control

Timer: A 24-hour, time and date clock is backed up by a 2.9 V battery

Back Up Memory: A 2k x 16 CMOS memory with battery backup saves the setup of recording parameters if power is interrupted or when the unit is turned off.

Audible Tone Signal

A beeper which indicates keystroke errors can be enabled or disabled by the user via a menu display.

PHYSICAL DESCRIPTIONS

GENERAL

This chapter presents illustrations and descriptions of the functions of the controls, switches and connectors located on the front and rear panels of the K450.

K450 FRONT PANEL CONNECTORS AND SWITCHES

Figure 3-1 presents an overall view of the K450 front panel. The components of the front panel are categorized to simplify their description.

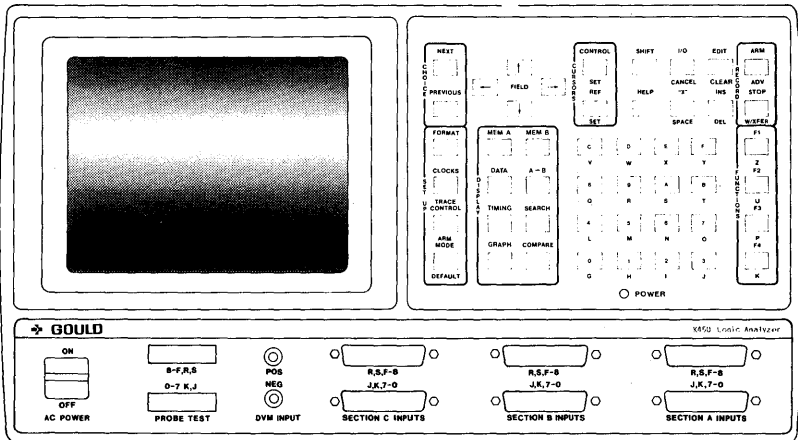


Figure 3-1. K450 Front Panel

Display Screen

The K450 employs a built-in, 8-inch diagonal raster scan CRT for display of all indicators, screens and data.

AC Power ON/OFF Switch and Indicator

The AC Power switch is a double-pole, single-throw 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.

Front Panel Connectors

The front panel connectors, A(7-0) through C(7-0), and A(F-8) through C(F-8), accept external data and clock inputs to the K450. The number and configuration of input connectors available to the user is dependent on the Expansion option installed in a given unit. Refer to the descriptions of the K450 Configurations in the specifications of Chapter 2.

Input Modes

1. Demultiplex

When Demultiplex is selected in Advanced Clocking mode, inputs are made to data channels (7-0) only. Data are internally shorted from input A(7-0) to channel A(F-8), respectively, due to the Latch Clock. Either one, two, or three sections may be in demultiplex mode.

2. Latch

When Latch is selected, those eight inputs are held by the external latch clock in a temporary register located in front of the sample register.

3. Glitch

When Glitch is selected, any pulse at least 5 nanoseconds wide and 0.250 V across threshold is latched and held to appear as a change of state at the next sample clock. A Glitch is defined as any even number of threshold transitions of an input signal between sample clocks.

4. Sample

When Sample is selected, the user may specify Internal or External clock, with each group of 16 inputs capable of being clocked independently.

Data present at the input are stored at the active transition of the user specified clock. Once data have been stored in the sample flip-flops, data are sent to the trace control board, and to memory for storage, if desired.

5. Store

When Sample is used, data are moved into memory at the Master Clock rate if the Trace Condition is enabled. When Store Mode is selected, data are moved into memory at the Section Store Clock rate if the Trace Condition is enabled. The use of either differing Store clocks for each section, or a combination of Store and Sample Clocks, can result in split-timing. Split-timing occurs whenever more than one clock rate is used for moving data into memory.

For example, Sections A and B are master clocked externally at 1 Mhz; Section C is store clocked internally at 100 Mhz. If trace is enabled for 2 master clocks, Sections A and B have 2 samples recorded; Section C has approximately 200 samples recorded, resulting in split Data and Timing Screens.

Keypanel

Figures 3-2 through 3-8 present detailed views of the major key groups. Brief descriptions of these key groups are provided. Detailed descriptions of the key functions are available in Chapter 4.

The keys are arranged in the following functional groups, which are described in subsequent paragraphs:

- Setup and Display key Group
- Control and Reference key Group
- Cursor Control key Group
- Edit key Group
- Record key Group
- Data Entry key Group
- Special Purpose key Group

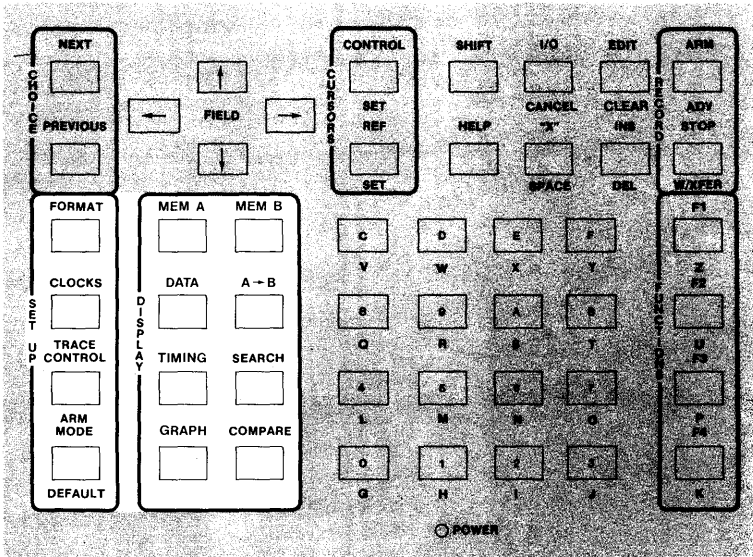


Figure 3-2. Setup and Display Key Group

Screen Setup and Display Key Group

Figure 3-2 illustrates the Screen Setup and Display Key Group. When the setup screens are initially accessed, the M memory parameter setups are displayed. These keys select the different displays needed to setup new M memory parameters and compare current M memory parameters with previous parameters. Additionally, these keys perform the following:

- To Display data
- Select A or B memory displays
- Transfer A memory data to B memory
- Either search for a given channel configuration or compare A memory data to B memory data
- Reset the K450 to its default state

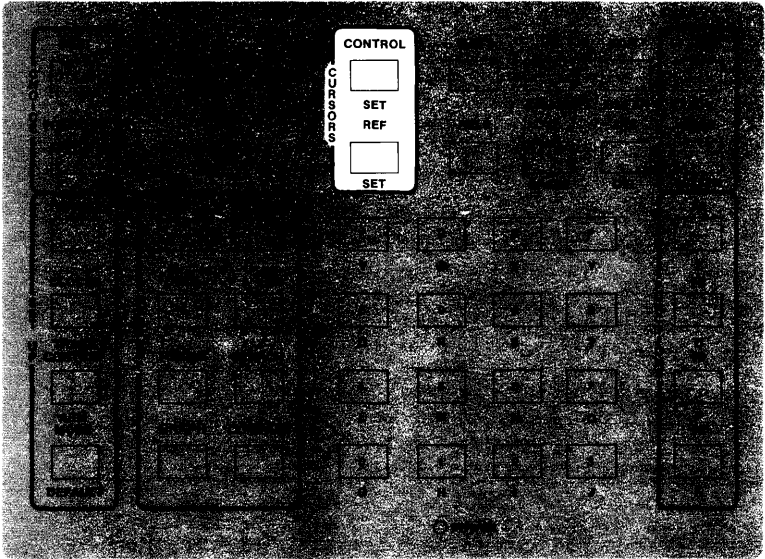


Figure 3-3. Control and Reference Key Group

Control and Reference Key Group

The Control and Reference keys (Figure 3-3) set the Control and Reference values for cursor movement, which are used on the Data displays for locating specific items on the screen.

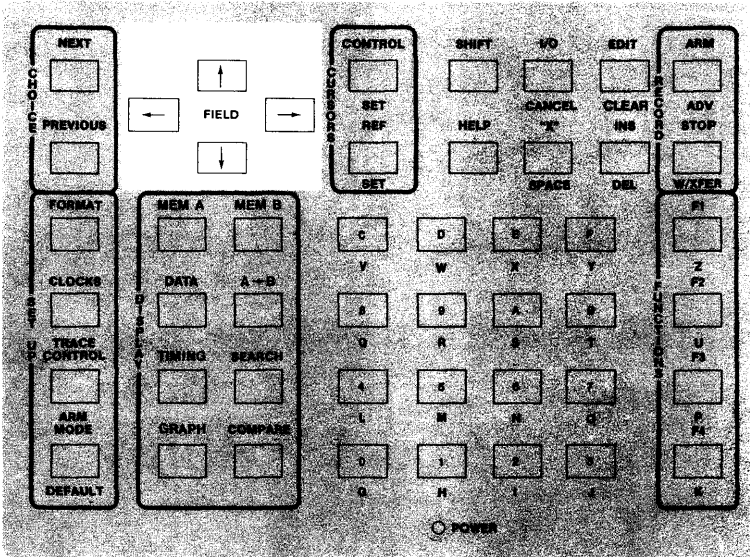


Figure 3-4. Cursor Control Key Group

Cursor Control Key Group

The Cursor Control keys (Figure 3-4) manually move the cursor and shift active fields on the display. If the cursor is flashing, depressing the SHIFT key and right-arrow key suppresses the flashing for most displays. Flashing is restored by depressing any key.

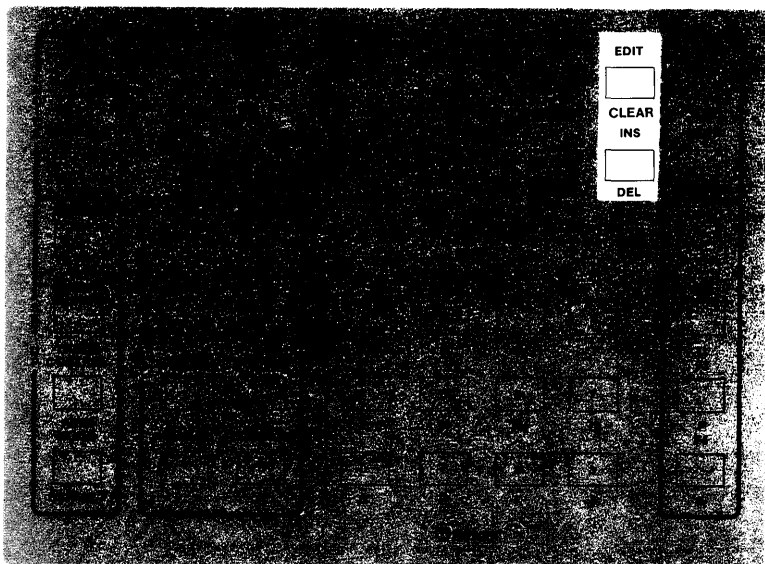


Figure 3-5. Edit Key Group

Edit Key Group

The Edit keys (Figure 3-5) place the Data Screen in a mode to change the search word or level or alter the B memory data.

These keys also place the Timing Screen in a mode for resequencing of traces, changing trace data in B memory, and entering labels for specific fields.

Keys of this group are used to insert and delete column information in certain displays. When in the Graph Screen, these keys alter vertical expansion of data.

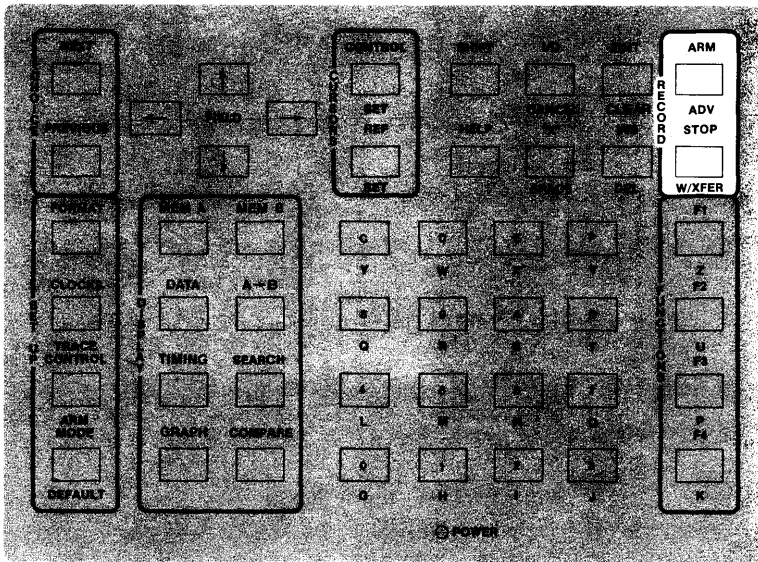


Figure 3-6. Record Key Group

Record Key Group

The Record keys (Figure 3-6) initiate a recording cycle, manually move to the next level of trace prerequisites, stop a recording, and manually transfer memory M to memory A.

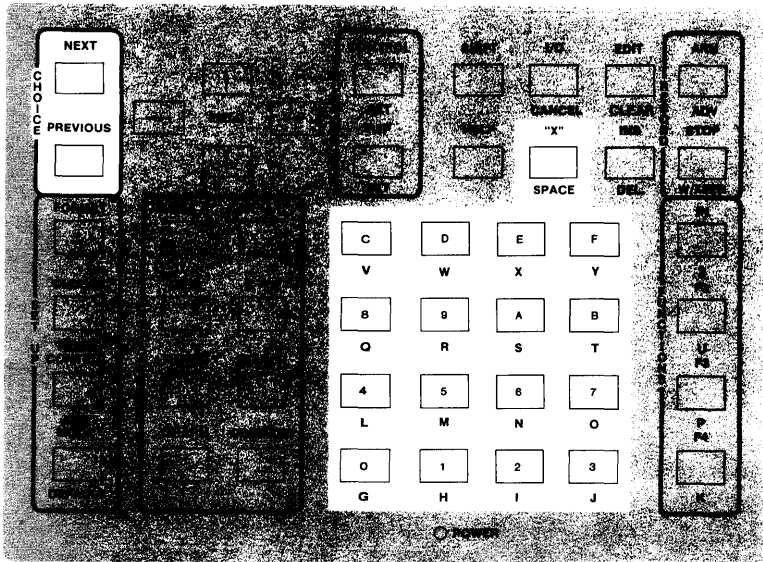


Figure 3-7. Data Entry Key Group

Data Entry Key Group

The Data Entry keys (Figure 3-7) allow the user to enter alphanumeric information manually into the various displays. Note that some of the alpha keys are located in the shifted positions of the Special Purpose Function Keys.

In addition to alphanumeric entries, this key group also enables the user to select the next and previous field values and insert spaces or Don't-Care values into certain displays.

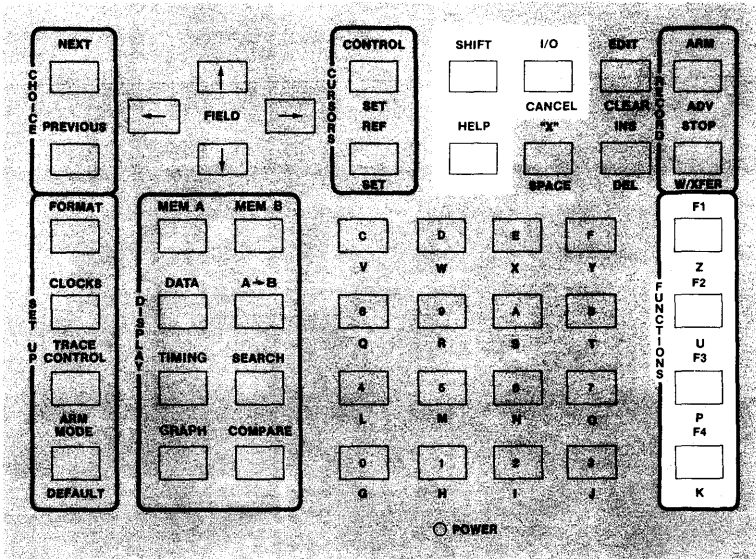


Figure 3-8. Special Purpose Key Group

Special Purpose Key Group

The Special Purpose key Group (Figure 3-8) includes the Shift, I/O, Cancel, Help and Function keys, which change their purpose depending on the screen selected. The Shift key allows the user to shift the keyboard functions of dual purpose keys 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 Send and Print commands. The I/O key accesses the I/O Function Menu.

REAR-PANEL CONNECTORS AND SWITCHES

Figure 3-9 presents an overall view of the K450 rear panel. The components of the rear panel are categorized into three groups: interface, power input and signal input. The arrangement of the interface connectors may vary on some models of the K450.

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. Table 3-1 lists the connector pin-descriptions for the IEEE-488.

Table 3-1. K450 IEEE-488 Connector Pin-Descriptions

PIN NUMBER	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

Table 3-1. (Cont'd.)

PIN NUMBER	SYMBOL	DESCRIPTION
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

RS-232-C Ports: The RS-232-C ports are seven-wire subsets with standard pin-outs. The ports are factory configured as DTE. Instructions on reconfiguring the ports as DCE may be obtained from the Gould Inc., Customer Service office listed in the Preface. Table 3-2 lists the pin-designations for the K450 RS-232-C ports.

Table 3-2. K450 RS-232-C Port Pin-Descriptions

PIN NUMBER	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	Data Terminal Ready
6	CC	Data Set Ready	Request to Send
7	AB	Ground	Ground
20	CD	Data Terminal Ready	Clear to Send

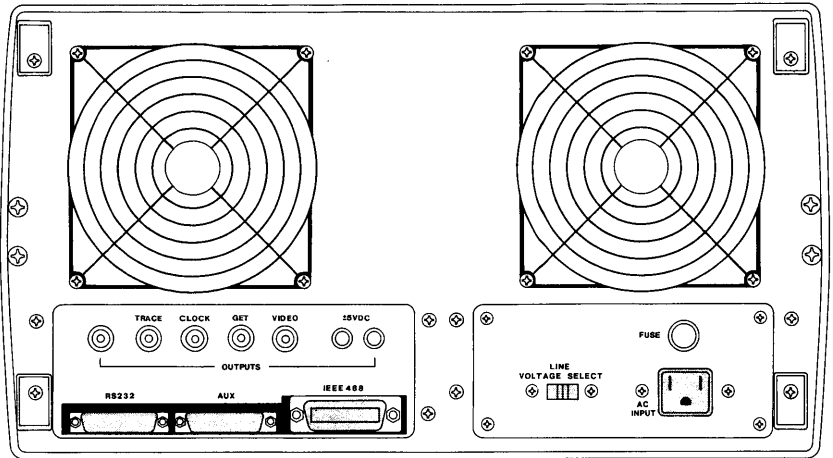


Figure 3-9. K450 Rear Panel

Power Input Group

Voltage Select: This two-position switch selects the voltage 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.

Signal Output Group

VIDEO, BNC connector:	1 Vp-p into 75 ohms composite video output is compatible with RS-170
CLOCK, BNC connector:	ECL active low corresponds to the internal clock
GET, BNC connector:	Group execute trigger pulse output for the IEEE-488 Command - TTL
TRACE BNC connector:	TTL high output when trace is enabled
Two LEMO connectors:	+5V and -5.2V @ mA

Chapter 4

OPERATION

GENERAL

This chapter describes the operating procedures for the Gould K450 Logic Analyzer and guides the user in setting up the equipment and operating the keyboard to perform analysis. Various techniques can be employed to locate and identify malfunctions in the user's target hardware. The best approach for applying K450 capabilities depends upon the user's familiarity with basic techniques for analyzing digital circuit functions and making full use of the K450 instrument resources. The instrument's resources are sophisticated analysis tools in the form of CRT screen displays that set up test actions, perform measurements, track and control input signal characteristics, record test data and display the results upon demand.

A detailed description of each display screen and field within the display is provided to guide the user in selecting and interpreting the display contents. The methods by which various keys can be used to reconfigure and alter these displays are also explained. The functions of certain keys and selected display elements are common to all displays. These keys and display elements are explained at the beginning of this chapter.

The displays in this chapter are shown in reverse video (black on white).

USER AIDS

The K450 firmware generates HELP messages that provide instructions for understanding a specific operation. The associated help message for a given display can be accessed at any time by depressing the HELP key. The message appears at the upper or lower portion of the current display, depending on the location of the active field.

ORGANIZATION OF DISPLAYS

The organization of K450 displays is shown in the menu-tree diagram of Figure 4-1. These displays are arranged in four functional categories as follows:

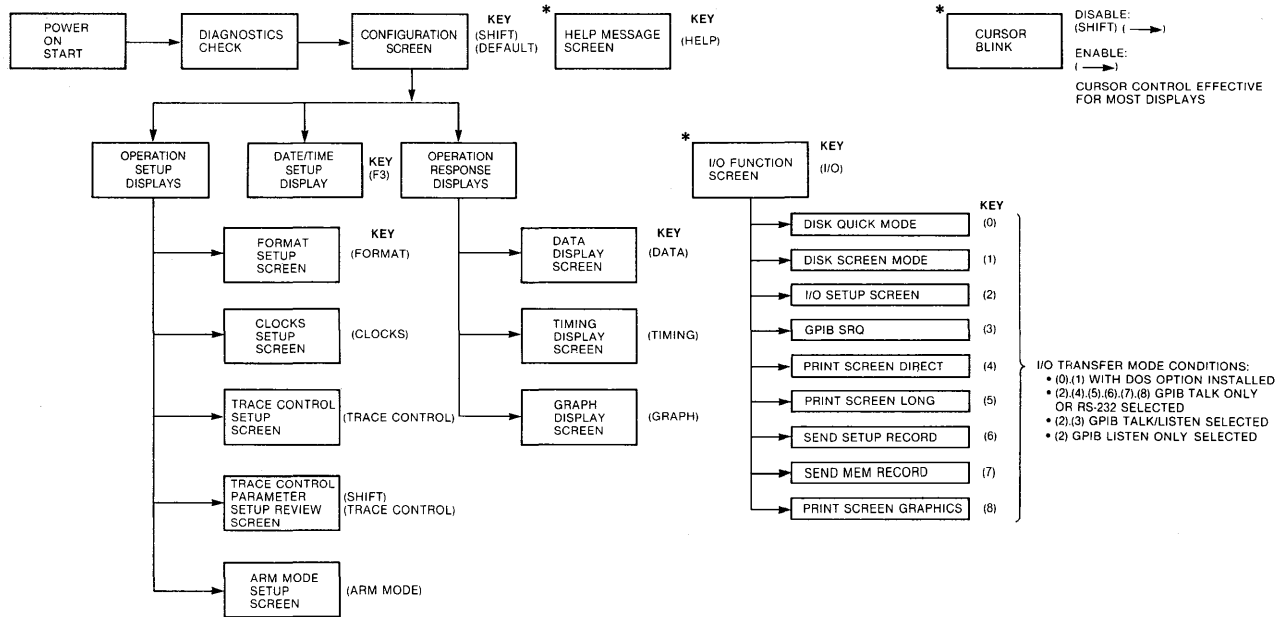
- Date and Time Setup
- Operation Setup
- Operation Response
- I/O Function

The K450 probes must be connected to the user's external equipment to supply input signals that are sampled by the K450 internal logic and displayed on the screen. The various display categories are used to set up test conditions, display the analysis results, and effect I/O transfers to the user's external equipment.

The entry point at the top of the diagram (Figure 4-1) begins with the Power Switch. Turning on AC power initializes the instrument, causing it to perform a diagnostic self-test of internal circuit functions and to display the Configuration Screen after the diagnostic is completed. The Configuration Screen presents the hardware configuration of the K450 by indicating the number of input channels available to the user. The Configuration Screen may also be accessed at any time by depressing the SHIFT and DEFAULT keys. Note that the key(s) associated with accessing a particular display is shown enclosed in parenthesis adjacent to the display block.

The first display category consists of the Date and Time Setup screen display. This display can be accessed by depressing the F3 key only when the Power Up Default Screen is present. The Date and Time Setup operations allow the user to set parameters for the Real Time clock which consists of the Date (month, day, year) and Time (hour, minutes). The user can also enable or disable the Error Beep by choosing the ON or OFF condition for the tone.

The second display category consists of the Operation Setup screens which define various test parameters used by the instrument to collect input data and clock signals.



NOTE: *

HELP MESSAGE
 USER'S GUIDE
 I/O FUNCTION
 CURSOR BLINK

THESE DISPLAY SCREENS
 MAY BE ACCESSED ANYTIME
 BY DEPRESSING THE
 SPECIFIED KEY(S)

Figure 4-1. Organization of Displays

The third display category consists of the Data Display screens which present data, timing and graph information that result from the analysis operation.

The fourth display category consists of I/O Functions. This display allows the user to perform various types of I/O transfers between the K450 unit and other equipment connected in the system via the RS-232-C and GPIB interface link. The I/O display can be accessed at any time without disrupting data displayed in other screens.

Help Messages can be accessed at any time by depressing the HELP key. This display provides information to the user on equipment functions and operating capabilities. Likewise, the blinking of the cursor can be disabled by depressing the SHIFT and right- arrow keys, or enabled by depressing the right-arrow key.

GETTING STARTED

The following procedure provides a step-by-step guide to introduce a new user to operate the various key functions and displays. This procedure also may be used to verify that the K450 and probes function properly. Included in this section is a brief discussion of the Probe Test. Any time during this procedure, depressing the HELP key provides the legal choices for the current active field.

Probe Test

The two clock and eight sample inputs of each probe can be quickly tested for correct detection of signal inputs by using the built-in 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. Figure 4-2 shows the clock and data patterns output by the upper probe test sockets.

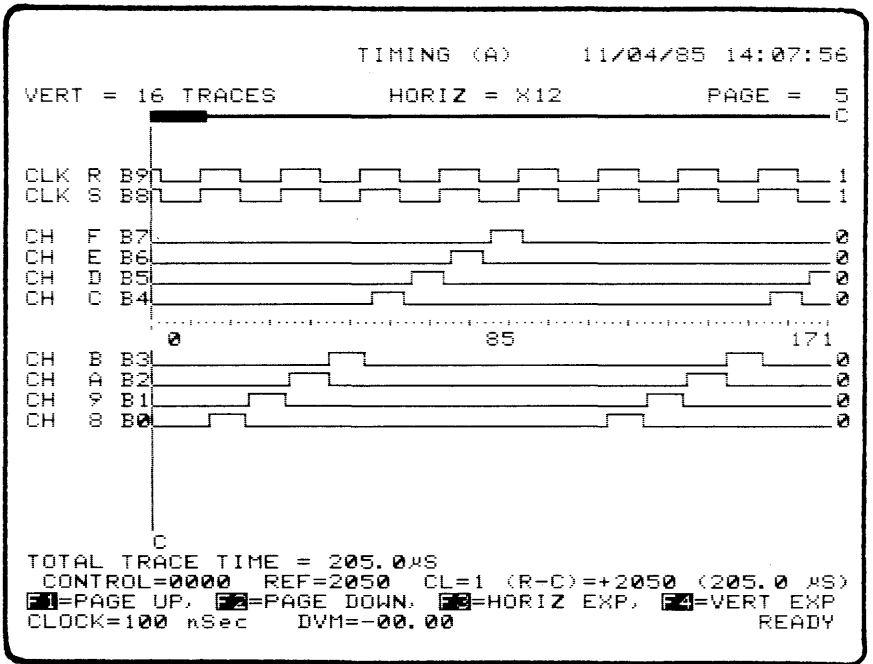


Figure 4-2. Probe Test Display

1. Connecting the Probes

- a. Verify AC power is off.
- b. Connect one end of the probe cable to the front panel socket labeled SECTION A INPUTS J,K,(7-0).

2. Configuration Display

- a. Turn on AC power; observe that the power indicator illuminates.
- b. Observe the system responds by displaying the messages for the start up diagnostics. These messages indicate the power-on test sequence is being executed. When the diagnostic tests are completed, the Configuration Screen is displayed. This display indicates which hardware options are installed; it also describes how to use various Function keys and access the HELP facility.
- c. Connect the other end of the probe cable to the lower front panel socket labeled PROBE TEST.

3. Default Setup

- a. Depress key F1 to select the Default Setup Parameters.
- b. Observe the following message is displayed near the top of the screen, informing the user that the factory default parameters are loaded into the unit:

Default Setup M and Display values locked in . . .

4. Format Screen

- a. Depress the FORMAT key. Observe the Format Screen is displayed with the Data Format field active and all polarity values set to positive. Depress the down-arrow key twice. Next, alternately depress the SHIFT and DEL keys. Depress each key three, nine or 12 times, respectively, for a 16, 32 or 48 input system configuration. This action deletes all but two columns in the field, thereby eliminating unwanted channels.
- b. Depress key F1 to move the active field to the top of the threshold location of the screen. Select ECL voltage level for each value by depressing numeric key 1. Note the active field immediately advances to the next threshold location after each value is entered. Use the NEXT/PREV keys to scroll through the choices, leaving the field at ECL before continuing this procedure.

5. Clocks Screen

- a. Depress the CLOCKS key. The Clock Screen is displayed with the Clock Mode field active.
- b. Use the down-arrow key to move the cursor to the Master Clock = field which contains the Time Unit and Clock Interval sections.
- c. Use the right-arrow key to move the cursor to the right so the cursor is located in the Decimal Clock Interval field.
- d. Use the numeric keys to directly enter 100 for the Clock Interval field; verify the Time Unit field is set to nanoseconds.

6. Trace Screen

- a. Depress the TRACE CONTROL key. The Trace Screen is displayed with the first command active.
- b. Depress the SHIFT and DEL keys to delete the first level instruction command; the level 0 command is replaced by the level 1 command.
- c. Move the active cursor to the Delay Count field by depressing the right-arrow key twice.
- d. Directly enter a value of 2051 for clocks using the numeric keys.

7. Arm Mode Screen

- a. Depress the ARM MODE key. Note that the K450 is set to perform one recording and then stop. The Arm Mode Screen is displayed as shown below in Figure 4-3.

```
ARM MODE (M)      10/11/85 09:13:46
AFTER ONE PASS.

STOP

-----
AUTO COMPARE RANGE IS FOR 2048 SAMPLES

USING INPUTS DEFINED ON FORMAT SCREEN

-----
AUTO EDGE TOLERANCE = ± 2 SAMPLE(S)
EDGE TOLERANCE IS ASSOCIATED WITH MEMORY B AND IS
SET ON EACH A→B DATA TRANSFER OR BY PRESSING F4

-----
DVM=-00.00      F4=Set Tolerance
                  READY
```

Figure 4-3. Arm Mode Screen Display

8. Initiating a Recording

- a. To initiate a recording, depress the ARM key. (The user should ensure that the ARM key, and not the ARM MODE key, is depressed.)
- b. Observe the Hardware Acquisition Status, which is located in the lower right portion of the screen. This status indicates a recording has occurred with the following status condition:

READY	Ready for an Arm signal.
BUSY	Set up internally for a recording.
EOR	End of recording activity.

A recording occurs quickly; if necessary, depress the ARM key again to take a recording. If a recording fails to occur, the Acquisition Status continuously displays READY on the screen.

9. Data Screen

- a. Depress the DATA key.
- b. Observe the Data Screen is displayed in a format identical to that specified by the Format Screen. The date and time of the recording appear in the upper-right corner of the screen. All level indicators are at level 0 because this level was selected for the recording.
- c. To move the Control cursor, depress the CONTROL key. The up and down arrow keys are used to move in vertical direction. Similarly, to move the Reference cursor, depress the REF key and use the up and down arrow keys. (For additional information on cursor movement, refer to the Data Screen description in this chapter.)
- d. Depress keys F1 and F2 to scroll through the data page by page. Note the cursor movement is only in the vertical direction for this particular screen.

10. Timing Screen

- a. Depress the TIMING key.
- b. Depress key F1 repeatedly until the A0-A7 input traces are displayed (Figure 4-4).
- c. The cursors are moved following the same procedure described for the Data Screen (step. c), except the cursors move in the horizontal direction using the left and right arrow keys. (For additional information on cursor movement, refer to the Timing Screen description in this chapter.)
- d. Use keys F3 and F4 to select the desired combination of horizontal and vertical displacement. Note the cursor movement is only in the horizontal direction for this particular screen.

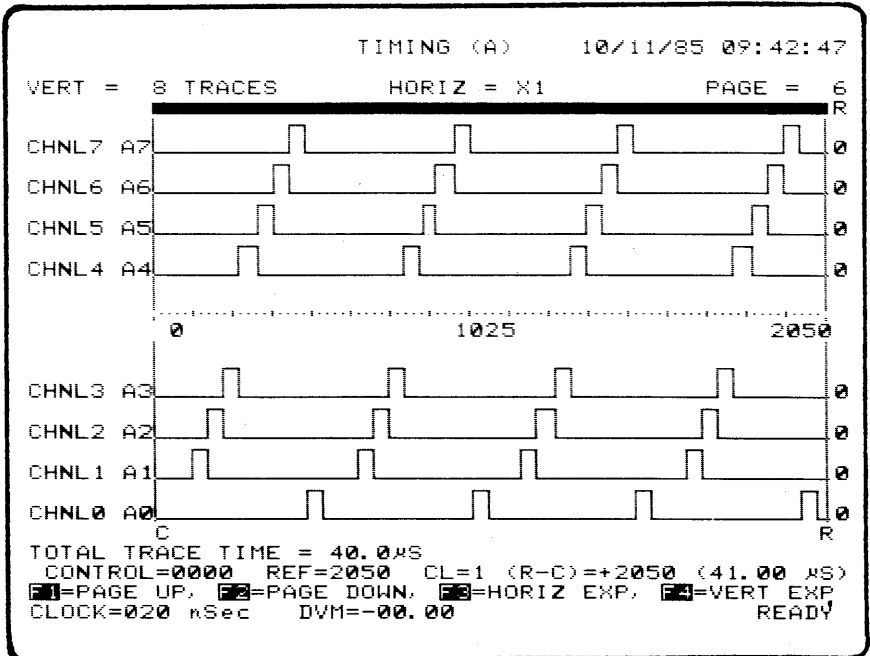


Figure 4-4. Timing Screen Display

OVERVIEW OF SCREEN APPLICATIONS

The various screens allow the user to set up conditions for running the analysis and reviewing the analysis results. The Setup screens are used to select operating parameters. Display screens are used to review the results of recorded data and the K450 hardware.

The Setup screens include the following:

SCREEN	DISPLAY CONTENT
Format	Data format, thresholds and polarity selections
Clocks	Clocks and input mode selections
Trace Control	Trace Control high level setup selections
Arm Mode	Arm Cycle control and Auto Compare selections
Date	Set Current Date and Time, Error beep
I/O	GPIB and RS-232-C selections
Review	Displays the current Trace Control setup in low-level language format

The Display screens include the following:

SCREEN	DISPLAY CONTENT
Data	Displays acquired data in data format selected on Format Screen
Timing	Displays waveforms for acquired data
Graph	Displays graph of acquired data versus sample number
Configuration	Displays hardware configuration of K450

Three setup memories, M, A, and B, are associated with the Format, Clocks, Trace Control, and Arm Mode Screens. These Setup memories contain parameters which are used to set up the hardware for an acquisition cycle as shown in Figure 4-5. Setup memory M contains the setup parameters used during the next acquisition cycle. 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.

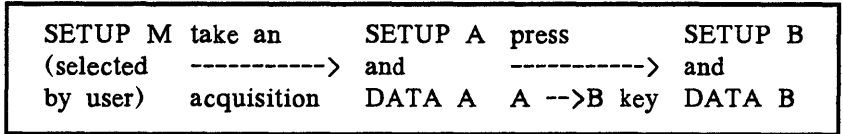


Figure 4-5. Setup Parameters for Acquisition Cycle

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.

When a time base of 200 Mhz is selected, all sample data recorded in memory A is zeroed for inputs F-8. The level data is duplicated for every two samples.

On occasion, input sections may be assigned a combination of 100 MHz and 200 MHz, resulting in a mixed time base. In this case, sample data from 0 through 2047 is zeroed. The level data is recorded with the first 2048 samples appearing on the screen as question marks (?), followed by the remaining samples (2048 through 4095) as read from level memory.

Parameter Evaluation and Adjustment

Under certain conditions, the K450 evaluates and adjusts parameters, if required, to the selected time base.

The Compare limits are evaluated if the unit is armed, Auto Compare is selected, and the maximum number for the recording equals that of Memory B. If the Compare limits conflict with the selected clock rate values, the Compare limits are automatically changed. If Auto Compare is not selected, the Compare limits are not altered; however, the Compare limits are evaluated for adjustment if the Compare Mode is active with no sample depth conflict.

When any of the Display screens (Data, Timing and Graph) are first entered, the Control and Reference values are evaluated and adjusted, if necessary, to equal rather than exceed the total number of samples. An adjustment is also performed when the Data, Timing and Graph Screens are updated due to the following:

- File recall from Disk
- Completion of a recording
- Mem A, Mem B and A-->B key action occurs

Screen Format

Each screen is 29 rows by 52 columns. The screen name is centered at the top of the display on line 1. The name is followed by a memory indicator in parentheses for all screens except the Configuration, Date, Review, and I/O screens. The memory indicator may be M, A, or B. When either no memory indicator is present or the memory indicator is M, the current date and time are displayed in the upper-right portion of the screen. If the memory indicator is A or B, and the data represents recorded data or setups, the date and time of the A or B recording is displayed; otherwise, the label of either Power Up Data or Reset Data is displayed in place of the data and time. When the K450 is powered up, Setup A and B are copies of Setup M. Memory A and B data are set to a prespecified pattern. The label Reset Data results from depression of F4 when the Configuration Screen is displayed. Line 2 is reserved for Error and Warning Messages, which appear in reverse video when either an invalid value is keyed in or to caution the user when necessary.

Line 28 displays the action which occurs if one of the Function keys is depressed.

Line 29 is reserved for information pertaining to the Master Clock used for recording, the DVM reading, the Comparison Count, the Pass Count, and the current hardware status, as shown in the following diagram:

```

+.....1.....2.....3.....4.....5...+
  CLOCK=020 nSec   DVM=00.01   C/P=0000/0000   READY
  CLOCK=EXTERNAL                                     PASS=0001   LVL F
                                                         BUSY
                                                         CLOCK?
                                                         EOR
  
```

The first Status Line field is included only when the Data, Timing or Graph Screen is displayed. The field is labeled with CLOCK= and indicates the Master or Store Clock used for the recording. If A is the memory indicator at the top of the screen, the field represents the Clock used for Memory A data. The Clock for Memory B data is displayed when B appears at the top of the screen. If all sections are stored at 200 MHz (5 nanoseconds selected) or 100 MHz (10 nanoseconds selected), the clock value displayed is 5 or 10 nanoseconds, respectively. If the Master Clock source is Internal, the Internal clock period is displayed; likewise, if the Master Clock source is External, EXTERNAL is displayed.

The second Status line field is labeled with DVM= and indicates the DVM reading taken at the end of the A or B recording when A or B appears at the top of the screen as the memory indicator. When M is the memory indicator, or no memory indicator is displayed, the DVM field indicates the current DVM reading and is updated once per second.

The third Status line field indicates the Comparison Count and Pass Count, if appropriate, for the A or B recording when A or B appears at the top of the screen as the memory indicator. When M is the memory indicator or no memory indicator is displayed, the field indicates the current count, if appropriate. This field is displayed for all screens only if AUTO REARM is selected in the Arm Mode Screen. The field values are presented as follows:

1. If INCREMENT COMPARISON COUNT is selected in the Arm Mode Screen, the label is C/P= followed by the values of the Comparison Count (4 digits) and the Pass Count (4 digits).
2. If INCREMENT COMPARISON COUNT is not selected, the label PASS= is displayed followed by the value of the Pass Count.

The last Status line field is displayed for all screens and represents the current hardware status as follows:

READY	The unit is ready to accept an Arm Signal.
BUSY	The hardware is being prepared for a record cycle.

CLOCK? The unit is awaiting a clock to start a recording.

LVL 0 through Indicates the trace control level selected for
LVL F current operations.

EOR The recording cycle is complete and the
 information acquired is being stored. If Rearm is
 selected in the Arm Mode Screen, the conditions
 for Rearming are evaluated while this status is
 displayed.

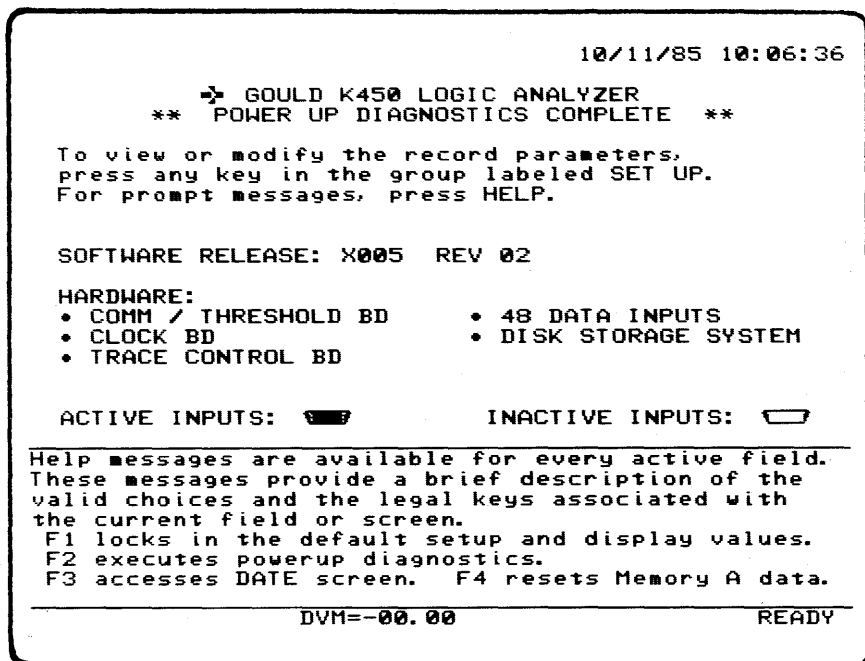


Figure 4-6. Configuration Screen

DESCRIPTIONS OF DISPLAYS

Configuration Screen

Upon powering up the K450, 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 4-6) 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. Depress the NEXT key to override the error condition and continue testing. The Configuration Screen allows the user to operate keys that perform the following functions:

<u>KEY</u>	<u>FUNCTION</u>
F1	Selects the default setup and display values. This allows the user to reset the system to a known state (the values set by the manufacturer; refer to Appendix C). 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 and Time Screen.
F4	Sets Memory A data to all zeros. Level a data are set to all F's. The Data 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

10/11/85 10:08:53

DATE = 10/11/85

ERROR BEEP = ON

TIME = 10:25:00

DVM=-00.00

READY

Figure 4-7. Date and Time Setup Screen

Date and Time Setup Display

The Date and Time Setup Screen (Figure 4-7) is only accessed from the Configuration Screen by depressing the F3 key. 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.

COMMON KEY FUNCTIONS

Selecting Input Fields

When selecting a Set Up screen, such as Format (Figure 4-8), several display elements are highlighted by reverse video.

These elements are referred to as input fields, and information may be entered into them or the information within may be altered. Note that one of these fields is further highlighted by blinking reverse video. The blinking reverse video indicates this field is selected for immediate character entry or alteration. Any field with blinking reverse video will henceforth be referred to as the ACTIVE field. Positioning of the active field indication is controlled by use of the FIELD keys. The right and left arrow keys allow the user to reposition the active field laterally along the current character line. When the active field reaches the last available field in this character line, it wraps around to the first available field at the opposite end of the line. The up and down arrow keys permit the user to move the active field vertically through those character lines containing fields. A wraparound is performed at the uppermost or lowermost fields. The FIELD keys also perform other functions in specific displays. These functions are discussed in the descriptions of the individual display operation.

Entering Data

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 with a single depression of 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 Quick-Key values of each choice are given in parenthesis; for example, (8).

Primary/Secondary Function Keys

Many of the keys on the keypad serve a dual function. The primary function of the keys is printed either directly on the keybutton or immediately above the keybutton in black lettering. The secondary function of dual-function keys is printed directly below the keybutton in blue lettering. To use the secondary functions, first depress the SHIFT key and then the desired secondary function key. Ordinarily, the user must depress the SHIFT key for each depression of a secondary function key; however, to repeat shifted function without using the SHIFT key, keep the function key depressed.

```

                                FORMAT (M)      10/11/85 10:10:43
DATA FORMAT HEX
RADIX      L HHHH HHHH HHHH
SECTION    CCCC BBBB AAAA
INPUTS     FB73 FB73 FB73
           EA62 EA62 EA62
           D951 D951 D951
           C840 C840 C840

-----
DATA INPUTS      THRESHOLD      POLARITY
CF-C8           [---] + 1.40     [---] [---]
C7-C0           [---] + 1.40     [---] [---]
BF-B8           [---] + 1.40     [---] [---]
B7-B0           [---] + 1.40     [---] [---]
AF-A8           [---] + 1.40     [---] [---]
A7-A0           [---] + 1.40     [---] [---]
CLOCK INPUTS    [---] + 1.40     [---] [---]

[1]→Top Threshold  [2]→Top Polarity  [3]=Set User Format
                                DVM=-00.00                                READY
  
```

Figure 4-8. Typical Screen Display

Help Function

A Help function is available in the K450. The user may access Help messages (Figure 4-9) by depressing the HELP key from any screen. Eight lines of information are presented in either the upper or lower half of the screen, depending on the location of the active field. The information provided is pertinent to the active field. The Help Screen also provides quick-key choices.

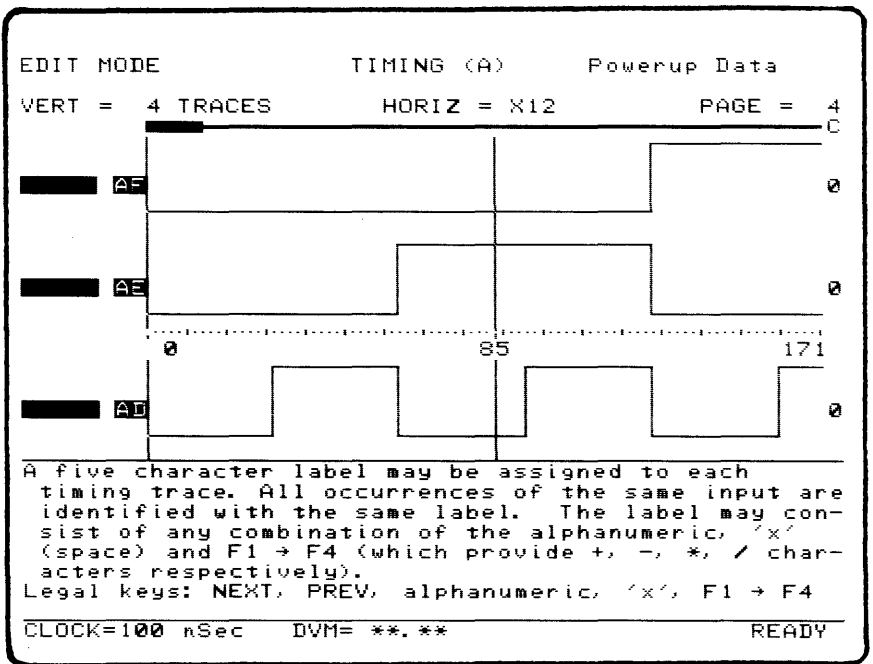


Figure 4-9. Typical Screen Display with Help Message

Don't-Care Memory

The K450 contains a tolerance comparison analysis memory (Don't-Care memory), which allows the user to designate sample data to be omitted in a comparison.

The Don't-Care memory content is initialized to contain predefined limits (all Do-Cares); as a result, all of the sample data are included in a comparison. Generally, when the X/SPACE key is depressed, the control firmware decides if a Don't-Care, X, is appropriate in the active field and if so, inserts the Don't-Care. If an X is not appropriate, a space is placed in the field.

Inserting Spaces

When editing pattern definition fields, memory B data columns, search values and certain fields relative to the disk system, either an X or a space is appropriate and must be determined by the user. In these cases, it is necessary to insert spaces by depressing SHIFT/X. A SHIFT/X is never interpreted as a Don't-Care.

In many cases, the active field consists of a single character. When a space is appropriate in the active field, depressing the the X/SPACE

key deletes and replaces the character in the active field with a blank space without affecting adjacent characters.

To use the X/SPACE functions in the Data and Timing Display Screens, in which comparisons are performed, the user must be in Edit mode. The Edit mode is entered by depressing 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.

Insert/Delete

The Insert and Delete key, INS/DEL, is used in the Format Set Up Screen to either insert additional columns into the display or delete existing columns from the display. As additional columns are inserted, the entire columnar information initially presented on the screen is shifted right. Note that information shifted off the screen cannot be returned. When using DEL in this screen, columnar information is deleted, and the remaining information is shifted left. For most numeric fields represented by two or more digits, depressing the SHIFT and CLEAR keys causes the field value to be set to the minimum legal value.

The INS/DEL key serves a function similar to the above when in the Edit mode of the Timing Display Screen. Entire lines may be inserted or deleted and the lines below shift down or up, respectively. More than 60 insertions in the inputs display causes information to become lost.

FORMAT SET UP SCREEN

The Format Set Up Screen allows the user to specify the display format used in the Data Display Screen. Due to the close relationship of the probe connections to the Format Screen, a discussion of the probes is necessary prior to discussing the Format Set Up Screen.

Figure 4-10 illustrates a typical connecting arrangement consisting of the D-connector, cable, probe case, probe tip, probe connectors with flying leads, and the grabbers which attach to various IC pins or wire-wrap post on a PCB.

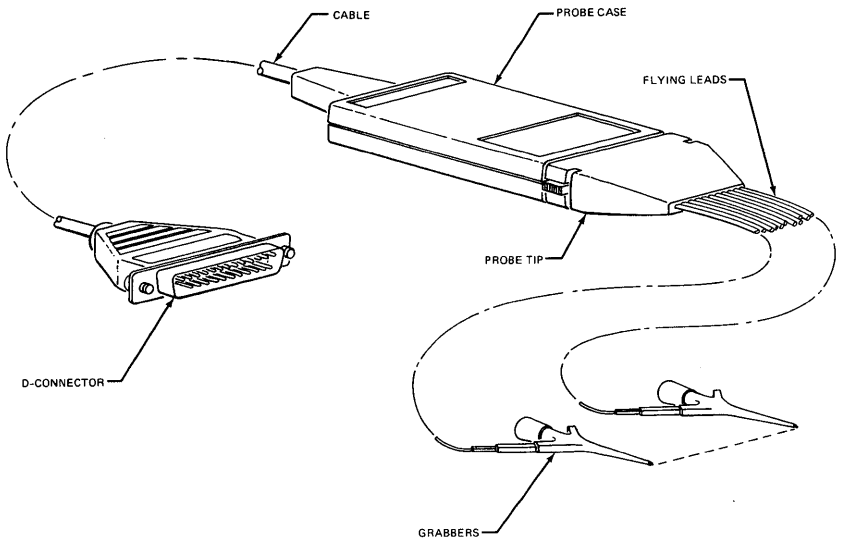


Figure 4-10. Typical K450 Probe

The probe assembly D-connector is labeled to indicate where it is attached to the K450 front panel D-connectors. Additional identification of the probe assembly consists of a label on the probe case which identifies the probe and the attached color coded input lines. Note the individual input lines on the probe connector with flying leads are further alphanumerically identified at their tips, where the grabbers attach. The input line identifiers used on the probe case label are directly associated with the section and input identifiers used in the Format Screen, Figure 4-11. The probes are electrically interchangeable.

DATA FORMAT **USER SPECIFIED**

RADIX HHHH HHHH HHHH

SECTION **CCCC BBBB AAAA**

INPUTS FB73 FB73 FB73
EA62 EA62 EA62
D951 D951 D951
C840 C840 C840

DATA INPUTS	THRESHOLD	POLARITY	
CF-C8	TTL + 1.40	----	----
C7-C0	TTL + 1.40	----	----
BF-B8	TTL + 1.40	----	----
B7-B0	TTL + 1.40	----	----
AF-A8	TTL + 1.40	----	----
A7-A0	TTL + 1.40	----	----
CLOCK INPUTS	TTL + 1.40	++++	++++

→ Top Threshold → Top Polarity
DVM=-00.00 READY

Figure 4-11. Format Screen with User Specified Selected

DATA FORMAT **BINARY**

RADIX L BBBBBBBBBBBBBBBBBBBBBBBBBBB

SECTION CCCCCCCCBBBBBBBBBAAAAAAAAA

INPUTS 765432107654321076543210

DATA INPUTS	THRESHOLD	POLARITY	
CF-C8	TTL + 1.40	++++	++++
C7-C0	TTL + 1.40	++++	++++
BF-B8	TTL + 1.40	++++	++++
B7-B0	TTL + 1.40	++++	++++
AF-A8	TTL + 1.40	++++	++++
A7-A0	TTL + 1.40	++++	++++
CLOCK INPUTS	TTL + 1.40	++++	++++

→ Top Threshold → Top Polarity = Set User Format
DVM=-00.00 READY

Figure 4-12. Format Screen with Binary Selected

Format Field

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 depressing the FORMAT Set Up key. The field adjacent to the words Data Format is the active field. Depressing the NEXT or PREV keys, to scroll through the format choices. The user may also make choices using the quick-keys as listed below.

- (0) Hexadecimal - Fixed format
- (1) Octal - Fixed format
- (2) Binary - Fixed Format, Inputs C7-A0 (48-input systems) Inputs BF-A0 (32-input systems), Inputs AF-A0 (16-input system
- (3) User Specified (Binary, Hexadecimal, Octal, ASCII, EBCDIC)
- (4) Disassembler

Fixed Formats

The predefined choices for the Section and Inputs fields are as follows:

- (0) Hexadecimal
- (1) Octal
- (2) Binary
- (4) Disassembler

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, (Figure 4-12); in Octal format, columns are represented by a combination of one input and 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.

User Specified Format

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 depressing 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 may be selected and the display modified accordingly.

Level Display Field

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 follow:

- (0) No
- (1) Yes.

Section and Inputs Field

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, (B for for 32 and 42-input systems only) C, and SPACE (to specify a blank column). These characters, A through C for 48-input configurations, A through B for 32-input configurations, and A only for 16-input configurations, 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). Depressing the SHIFT, CLEAR, DELETE and INSERT keys while in the Section field results in the following conditions:

SHIFT CLEAR Deletes all columns below and to the right of the cursor.

DELETE Deletes the column below the cursor.

INSERT Inserts a blank column at the cursor.

Input Field

When the Input field is selected, the user may select the desired inputs for the specified section by using the keys for NEXT, PREV, O-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. The radix character definitions are provided in Table 4-1.

Table 4-1. Radix Definitions

NUMBER OF INPUT CHARACTERS	RADIX LINE CHARACTER	DATA DISPLAY SCREEN RADIX
0		
1	B	BINARY
2	Q	BASE FOUR
3	0	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

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 Fields

The lower half of the Format Screen is dedicated to the selection of thresholds for clock inputs and each group of eight inputs, (i.e. by each probe) as well as the polarity for each data input. As the user moves the active field down from the last character line of the inputs, the field adjacent to the input group identifier, AF-A8 for 16-input systems, BF-B8 for 32-input systems and CF-C8 for 48-input system, becomes the active field.

The choices available for this field are as follows:

- (0) TTL
- (1) ECL
- (2) VARA - variable
- (3) VARB - variable

The adjacent polarity 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 polarity and voltage values themselves become fields. For an active polarity 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 depressed.

Polarity Fields

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

- (1) +
- (0) -

If an input is specified to be negative, the value specified is inverted prior to presentation in the Data Display, the Graph Display and the value column at the right end of the Timing Display. The Timing Display 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.

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.

CLOCKS SET UP SCREEN

Clock Mode Field

Upon accessing the Clocks Screen, the Clock Mode field is active and the following choices are available:

- (0) Standard
- (1) Advanced

If Standard mode is selected, (Figure 4-13), 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:

- (0) Internal
- (1) External

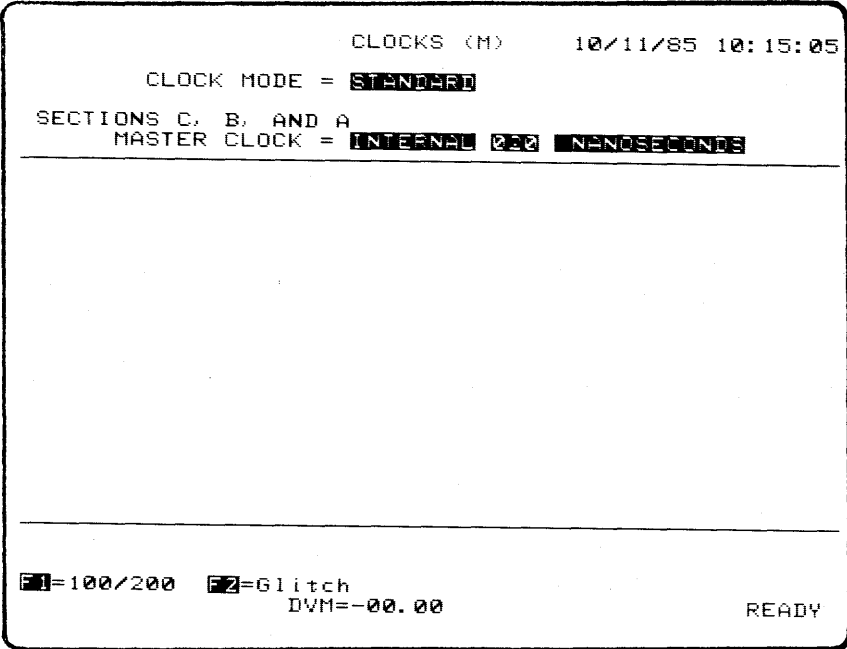


Figure 4-13. Clock Screen with Standard Clock Mode

Internal Master Clock

If Internal is selected (Figure 4-14), the Clock Interval and Time Unit may be specified. Valid internal clock periods range from 20 nanoseconds to 100 milliseconds, in a one through ten sequence.

```
CLOCKS (M)      11/04/85 13:48:00
CLOCK MODE = ADVANCED
SECTIONS C, B, AND A
MASTER CLOCK = INTERNAL 020 NANoseconds
-----
SECTION C
Inputs F-8 are not available for this section.

STORE SECTION C ON 5 NANoseconds
SECTION B
Inputs F-8 are not available for this section.

STORE SECTION B ON 5 NANoseconds
SECTION A
Inputs F-8 are not available for this section.

STORE SECTION A ON 5 NANoseconds
-----
F1=100/200  F2=Demux/Glitch  F3=Copy C+B  F4=Copy B+A
DVM=-00.00  READY
```

Figure 4-14. 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. When the time-unit field is active, the following three choices are available:

- (0) milliseconds
- (1) microseconds
- (3) nanoseconds

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

External Master Clock

For 48-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. For 16-input systems, the logical expression is formed by AJ and AK clock inputs ORed together. When any of the six fields are active, the selections are as follows:

- (0) No clock input
- (1) Clock input, not inverted
- (2) Clock input, inverted

Section Input Mode Selection

If Advanced mode is selected, the clocking scheme for each section may be 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.

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

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

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

- (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; however, note only one expression appears for each section, corresponding to one Latch clock per section.

If Glitch is selected, any pulse crossing threshold 250mV for 5 nanoseconds or a move 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-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:

- (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:

- (0) Sample
- (1) Store

Note that in all cases, patterns are compared and trace decisions made at the Master Clock rate. Store just moves the data into memory when trace is true at the store rate.

The user may select to have the section inputs Stored/Sampled as follows:

- (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 4-15) the Clock expression may be selected following the same procedure described in the Master Clock Section. Note each section can have a unique sample clock.

The user may select to record one or more sections at 200 MHz specifying 5 nanoseconds for the section rate. When 5 nanoseconds 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

```

          SPLIT CLOCKS (M)      10/11/85 10:22:27
    CLOCK MODE = ADVANCED
SECTION C. B. AND A
  MASTER CLOCK = EXTERNAL (F1.F2.F3)+(F4+F5+F6)
SECTION C
  LATCH F-8
  AND SAMPLE SECTION C ON INT 200 NANoseconds
SECTION B
  Inputs F-8 are not available for this section.
  STORE SECTION B ON 5 NANoseconds
SECTION A
  DEMUX 7-0 TO LATCH F-8 IF (F1.F2.F3)+(F4+F5+F6)
  DEMUX 7-0
  AND SAMPLE SECTION A ON EXT (F1.F2.F3)+(F4+F5+F6)
Master Clock = (Press CLOCKS to measure F0)
F1=100/200 F2=Demux/Glitch F3=Copy C+B F4=Copy B+A
          DVM=-00.00
          READY
  
```

Figure 4-15. Clock Screen with External Master Clock Selected

Through use of keys F1 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 following examples provide detailed descriptions of these keys and their associated actions:

F1 Depressing F1 changes the Clocks setup alternately to 100 MHz or 200 MHz clocking. The screen is redisplayed with the new settings.

F2 Depressing 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.

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

<u>KEY</u>	<u>OPERATION</u>	<u>DEMUX</u>	<u>LATCH/GLITCH</u>
	1st Depression	_____	Glitch F-8 Glitch 7-0
	2nd Depression	_____	_____ _____
	3rd Depression	Demux 7-0 to	Latch * F-8 _____7-0

F3 Depressing F3 in Advanced Clock Mode duplicates all Section C selections in Section B. The screen is redisplayed with the Clock Mode field active.

F4 Depressing F4 in Advanced Clock mode duplicates all Section B selections in Section A. The screen is redisplayed with the Clock Mode field active.

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.

TRACE SET UP SCREEN

When the Trace Set Up Screen is accessed from an initialized state, the screen appears as shown in Figure 4-16. The large number of field choice combinations are presented in Table 4-2.

```

                                     TRACE (M)      10/11/85 10:25:15
LVL  COMMAND SEQUENCE:
0:TRACE UNTIL SAMPLE = TRIGGER
1:TRACE FOR 01025 CLOCKS
-----

PATTERN DEFINITIONS:
NAME:  HHHH HHHH HHHH
00 ENABLE  =XXXX XXXX XXXX
01 TRIGGER =XXXX XXXX XXXX
02 -      =XXXX XXXX XXXX

F1→TOP CMD, F2→TOP PTRN
                                DVM=-00.00
                                                                READY
```

Figure 4-16. Trace Control Set Up Screen

The K450 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. These 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).

The K450 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 named 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 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 the F3 key 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, depressing NEXT or PREV keys select the next or previous defined name. The user may select the pattern via quick-keys, but he 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 4-2 lists the various condition choices available to set up the command sequences.

Table 4-2. 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 K450 jumps to level lv on the following master clock. If the Jump condition occurs simultaneously with an Advance condition, the Jump takes priority.

Table 4-2 (Cont'd.)

COMMAND	DESCRIPTION
OR STOP IF A	Attaches a Stop condition to the preceding WAIT or Trace command. If the condition is met, the K450 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 4-3. 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		

Parameter Definitions

(delay expression)	-	1 to 65535	(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 A 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 UNTIL, 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 (all optional)
UNTIL, OR GO TO level IF

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.

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. Depressing a hexadecimal digit

appropriate for the radix in use enters that value; depressing the X/SPACE key enters a Don't-Care, (Figure 4-17). PREVIOUS or NEXT rolls the column through its legal values.

```

                                     TRACE (M)      10/11/85 10:33:54
LVL   COMMAND SEQUENCE:
00:TRACE  UNTIL   SAMPLE = TRIGG(5)
1:TRACE  FOR    01025 CLOCKS
-----

PATTERN DEFINITIONS:
NAME:      HHHH HHHH HHHH
00 ENABLE  =XXXX XXXX XXXX
01 TRIGG( )=07X XXXX XXXX
02 -       =XXXX XXXX XXXX

[1]→TOP CMD, [2]→TOP PTRN, [3]=FILL-IN COL
                                     DVM=-00.00
                                     READY
```

Figure 4-17. Trace Control Setup Screen with Don't-Care Entered

Depressing 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. Depressing 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.

Depressing 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.

Depressing 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 accidentally deleted pattern may be restored by depressing 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 K450 automatically names the pattern. The patterns are named by their location in the sequence of patterns (for example: PO6).

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:

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

REVIEW SCREEN

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 4-18.

```

                                REVIEW                10/14/85 08:26:06

LEVEL  DELAY = 00001 CLOCKS
STOP NEVER
S =

JUMP TO 5 IF DATA = J
J = XXXX XXXXXXXX   XXX

ADVANCE IF DATA = A
A = XXXX XXXXXXXX   XXX

TRACE IF DATA = T
T = XXXX XXXXXXXX   XXX

-----
2:TRACE IF ... SAMPLE = ENABLE
   ADVANCE IF SAMPLE = ENABLE
   OR GO TO 5 IF SAMPLE = ENABLE

                                DVM=-00.00                READY
```

Figure 4-18. Trace Control Parameter Setup Review

This screen is selected by depressing the SHIFT key and then the TRACE CONTROL key. The screen generally appears as shown in Figure 4-18 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

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

Arm Mode Field

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 or until the STOP Rearm condition is true (Conditional Rearm).

- (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:

Comparison Count	Stop Rearm Condition
F1=No Stop (0)	(0)
F2=Stop \neq (1)	(3) UNLESS A \neq B
F3=Count \neq (2) If A \neq B	(0)

Stop Rearm Condition Fields

When AUTO REARM is selected, depressing 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) (Stop Never)
- (1) UNLESS PASS COUNT =
- (2) UNLESS A = B
- (3) UNLESS A \neq 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 \neq 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 Field

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

Auto Save Fields

The Auto Save function is available only if the AUTO REARM is selected and the dual disk option installed. The Auto Save function saves recorded data to disk at the end of each recording.

Auto Save Condition

Select one of the following Auto Save conditions by depressing one of the following quick-keys:

- (0) --- (never)
- (1) IF A = B
- (2) IF A \neq 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

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.

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 Comparison Count are incremented, if required. The date, time, and DVM 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, Time and DVM reading, 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.

Auto Compare Fields

The Auto Compare fields are used under the following conditions: when a Comparison count evaluation is performed, an A to B evaluation is performed for the STOP Rearm condition, and 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 200 MHz, 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) SAMPLE(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, as shown in Figure 4-20.

```

ARM MODE (M)      10/14/85 08:45:48
AFTER EACH PASS.
  INCREMENT COMPARISON COUNTER IF A=B
AND AUTO REARM
AND SAVE MEMORY A TO A:RESULT-00.MA IF A=B
AUTO COMPARE RANGE IS FOR SAMPLE(S) SELECTED BELOW
MEM-A STARTING AT
MEM-B STARTING AT
FOR 2047 SAMPLE(S). ( MAXIMUM = 2051
USING INPUTS DEFINED ON FORMAT SCREEN

AUTO EDGE TOLERANCE = ± 2 SAMPLE(S)
EDGE TOLERANCE IS ASSOCIATED WITH MEMORY B AND IS
SET ON EACH A+B DATA TRANSFER OR BY PRESSING

DVM=-00.00      [F3]=Set Tolerance
READY

```

Figure 4-20. Auto Compare Range Field

Auto Compare Input Fields

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

- (0) INPUTS DEFINED ON FORMAT SCREEN
- (1) INPUTS SELECTED BELOW

IF INPUTS SELECTED BELOW is selected, the choices are as follows:

- (0) omit an input from the comparison
- (1) include an input

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 depressing the F1. The user can then omit or select inputs as required.

Auto Edge Tolerance Fields

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. 0 represents all Do-Cares. The value is then transferred to the B memory on the next A to B data transfer or upon depression of the F4 key.

Arm Control

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

Arm Key

The user may initiate a data recording by depressing the ARM key. The message BUSY is displayed in the lower righthand corner of the screen while the hardware is prepared for the recording. If a recording is in progress when the ARM key is depressed, 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

ADV Key

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

Stop Key

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

Stop W/XFR

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

DATA DISPLAY SCREEN

The Data Display Screen, Figure 4-21, is accessed by depressing 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.

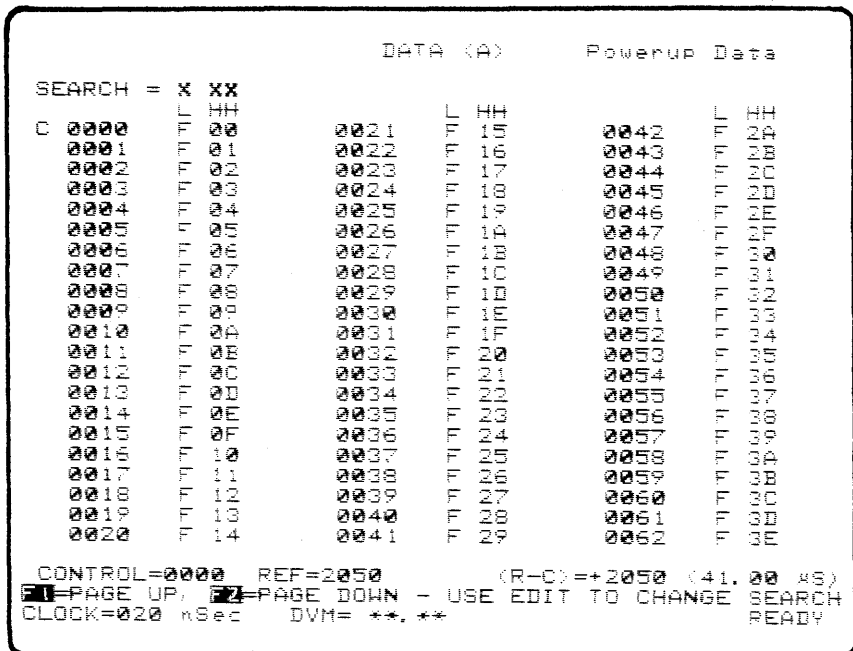


Figure 4-21. Data Display Screen

The user can display memory A data, which represents the data taken during the last recording, or memory B data, which could contain data placed there for a reference. The user can alternately select these two screens by depressing either the Mem A or Mem B keys. When the K450 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 depressing the A---> B key.

Data Display Screen - Edit Mode

The Data Display screen enables the selection of a value that is used to perform 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 4-22). To alter the Search selection, depress the EDIT key; note the Search word(s) immediately change to reverse video and the active field appears in the left-most column. Next, while in the Search word field, depress the F1 key to specify the choice of search values.

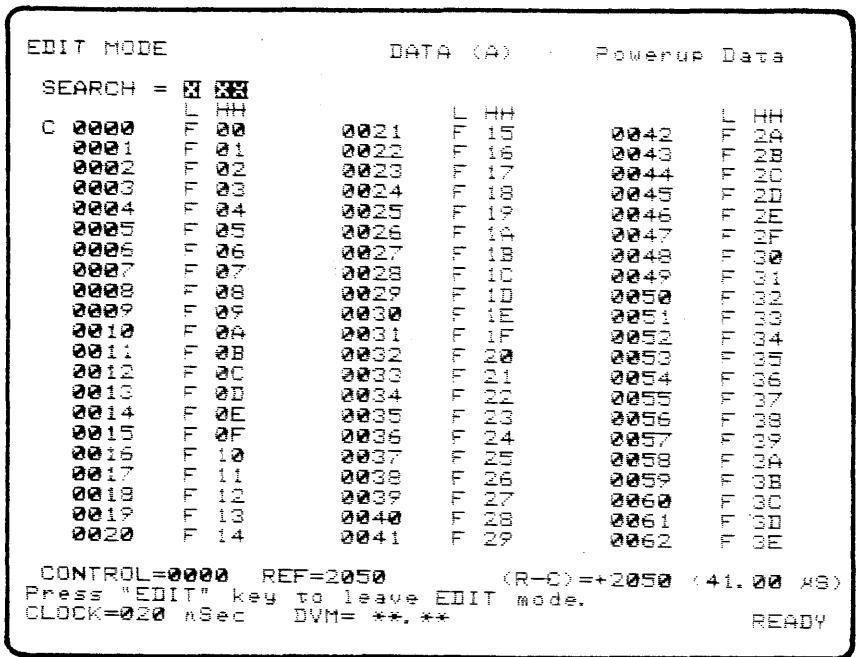


Figure 4-22. Data Display Screen in Edit Mode

Search Function: The Hexadecimal keys, NEXT, PREV and X keys select search value. Once set up, edit mode is exited by depressing the EDIT key again. Depressing 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 can be moved down from the search word field into the recorded data display. In this field, the hexadecimal keys can be used to enter new values into the B memory. Depressing 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.

Compare Functions: The contents of memory A can be compared with the contents of memory B by depressing 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
```

Note that 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 13 in data memory A are compared with samples 5 through 15 in data memory B. If sample 3 in memory A does not match sample 5 in memory 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 (\neq) 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.

Control and Reference Tags: 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 sample 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 depressing the CONTROL or REF key, respectively. The tag can then be moved up or down using the up-arrow or down-arrow 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, the user can 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 depressing the Page Up (F1) or Page Down (F2), function keys. These keys cause the C tag to move up or down by 21 Samples, completely regenerating the display. When viewing the data, depressing 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 depressing the SHIFT and the CONTROL keys. The desired position value is controlled via the 0 through 9 keys. Depressing 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 depressing the SHIFT key and the REF key, but the screen is never regenerated.

TIMING DISPLAY SCREEN

The Timing Display Screen, Figure 4-23, is accessed by depressing 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.

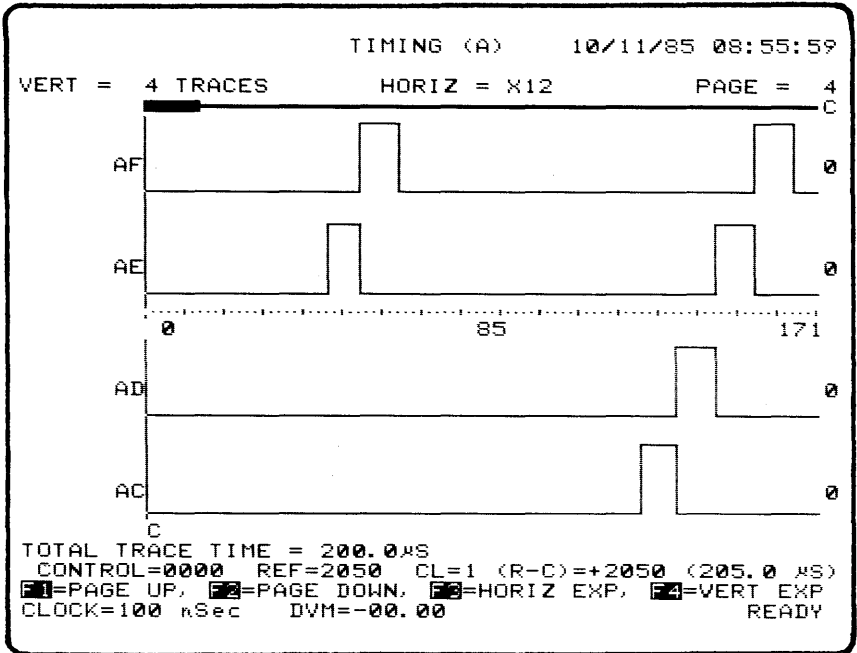


Figure 4-23. Timing Display Screen

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 depress 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. 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 (C 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 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. Successive depressions of the F3 key select 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:

<u>HORIZONTAL EXPANSION</u>	<u>COMPRESSION EXPANSION FACTOR (2K)</u>	<u>COMPRESSION EXPANSION FACTOR (4K)</u>
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 Expansions: There are also three possible vertical expansions that can be used; v16, v8, v4, in which sixteen, eight or four traces, respectively, 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 being displayed can be changed using the Page Up or Page Down keys, F1 and F2 keys, respectively. To display the last page, depress the V key; to advance upward to next group of pages, depress the U key. Depress SHIFT/F1 keys to select Page 0.

The height of each trace is determined by the vertical expansion as follows:

<u>TRACES</u>	<u>NUMBER OF PAGES ON SCREEN</u>
16	4
8	2
4	1

Selection of the different vertical expansion modes is made using the F4 key in a manner similar to selecting the horizontal expansion mode.

Timing Display Screen - Edit Mode

The Timing Screen has an edit mode used for the following functions: Changing Trace Labels, Resequencing Traces and Altering the Data in the B memory. Edit mode is entered by depressing the EDIT key. In edit mode, the trace labels and input IDs are displayed in reverse video. The active field appears at the topmost 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-C 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. Note that removing inputs will not increase vertical expansion.

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 shifted Hex pad keys. Keys F1 through F4 enter the following characters:

- 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 directly. Don't-Cares can also be entered, 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.

The Control (C) and Reference (R) tags on the Data Screen and the respective vertical cursor and reference lines on the Timing Screen are interdependent. A change made to one in a given screen, results in an equal change to its counterpart in the other screen. When the Timing Screen is selected, the C tag is visible on the screen.

To manually move the C or R tag, the desired tag is selected by depressing the CONTROL or REF key, respectively. The tag can then be moved left or right using the left or right arrow keys. When the C tag is at the rightmost portion of the Timing 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 in areas off screen, the user can monitor the R tag location via the REF = display element in character line 27 of the screen.

When viewing the data, depressing 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 may be set by first depressing the SHIFT key and then the CONTROL key. The desired position value is controlled via the 0 through 9 numeric keys. Depressing 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 depressing the SHIFT key and the REF key, but the screen is never regenerated.

GRAPH DISPLAY SCREEN

The K450 Graph Display Screen (Figure 4-24), 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 depressing the GRAPH key.

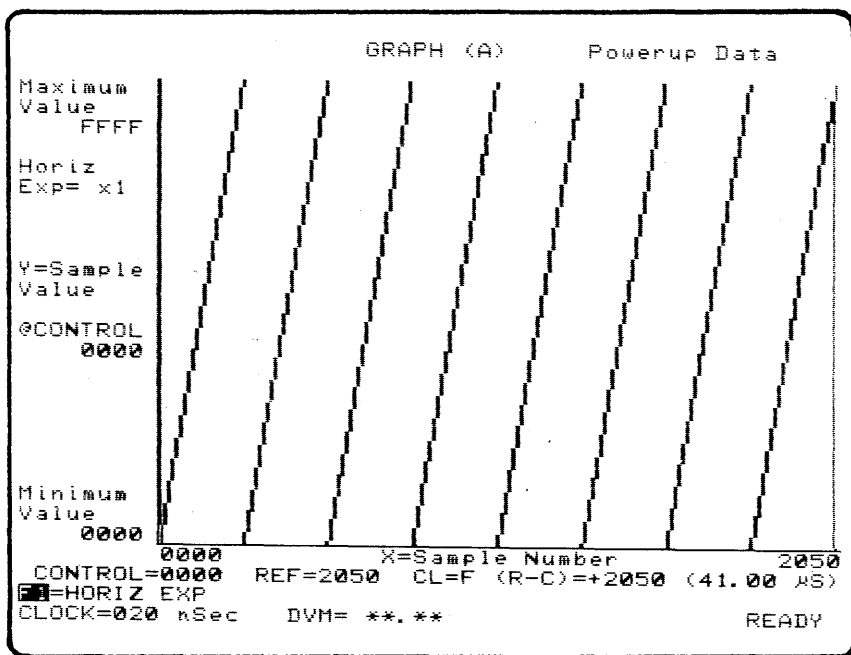


Figure 4-24. Graph Display Screen

Upon selecting the Graph Display Screen, the user may depress 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, the user may edit the upper limit to a new value. The user can then depress the down-arrow 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 CRT. When the new limits have been entered, depressing the EDIT key again restores the limit fields to normal video and causes 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 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 depressing the CONTROL or REF key, respectively. The tag can then be moved left or right using the left and right arrow 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 can monitor the R tag location via the REF = display element in character line 27 of the screen.

When viewing the data, depressing the NEXT or PREVIOUS key 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 depressing the SHIFT key and then the CONTROL key. The desired position value is controlled via the 0 through 9 numeric keys. Depressing 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 depressing the SHIFT key and the REF key, but the screen is never regenerated.

K450 AUTO SETUP

The K450 Auto Setup is a feature that identifies all active inputs and configures the K450 Logic Analyzer to record and display circuit activity. Pressing the SHIFT key and then the CLOCK key executes the K450 Auto Setup (Figure 4-25), reducing setup time and simplifying operation.

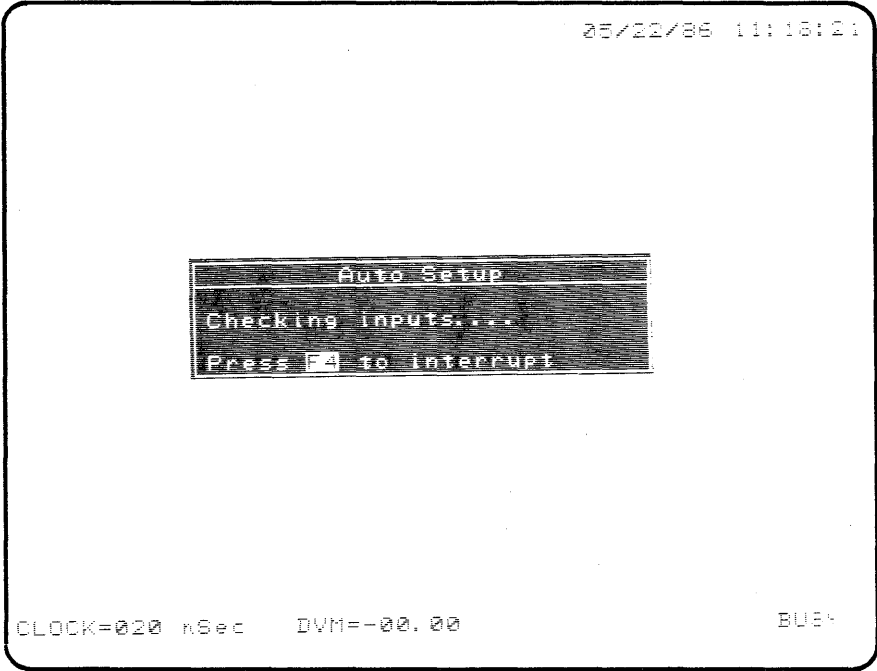


Figure 4-25. Initialization Display

AUTO SETUP EXECUTION

To execute the K450 Auto Setup, perform the following steps:

1. Connect any number of probes or channels to the K450 Logic Analyzer and the unit under test. Each probe is connected only to signals of the same threshold. Do not mix the TTL, ECL or variable threshold signals on the same probe.
2. Press the SHIFT key and then the CLOCK key on the K450 front panel. The K450 Auto Setup Initialization message window is displayed (See Figure 4-25). The K450 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 hex 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.

The F4 key is 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 K450 and exit to the Timing screen. To exit without recording, press the SHIFT key, then the FORMAT or CLOCK keys.

AUTO SETUP WINDOW

After the K450 Auto Setup determination sequence, the Auto Setup Window (Figure 4-26) 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.

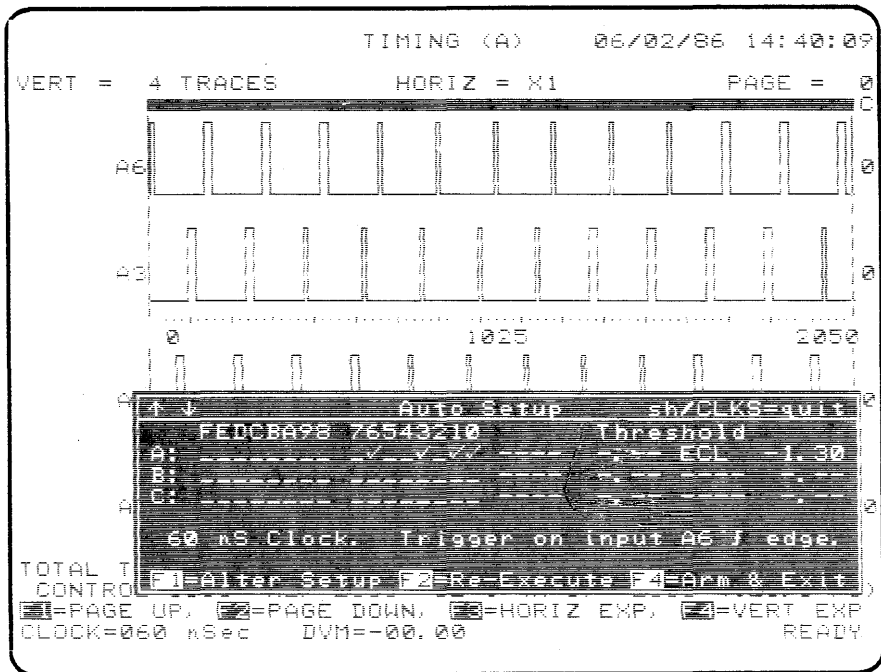


Figure 4-26. Auto Setup Window

ALTER SETUP WINDOW

The Alter Setup Window (Figure 4-27) allows the user to change the number of transactions displayed, as well as five other setup parameters.

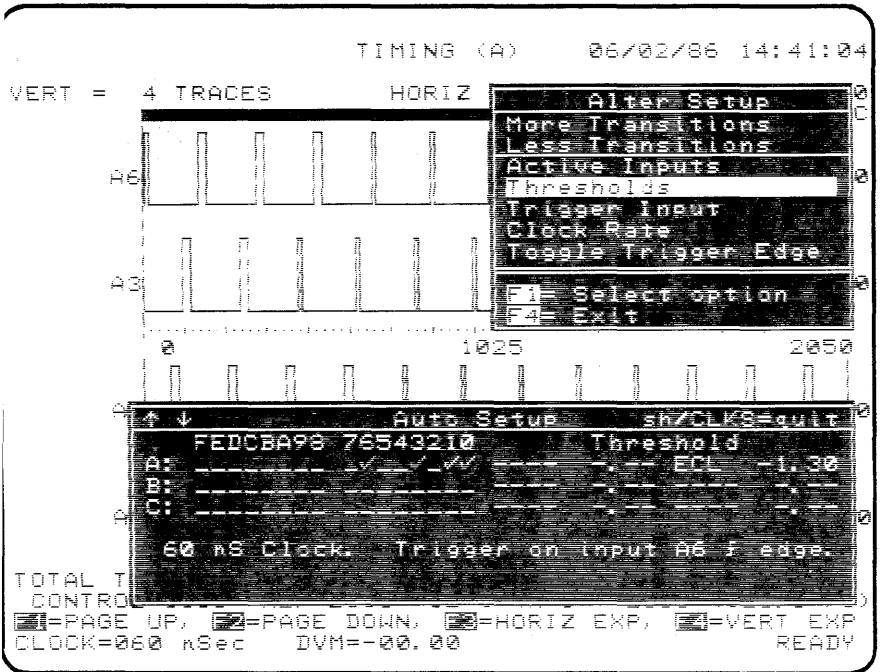


Figure 4-27. Alter Setup Window

The Quik Setup Window duplicates the Auto Setup Window, eliminates routines, gets 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 K450 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 K450 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.

Chapter 5

INPUT/OUTPUT OPERATIONS

I/O SCREEN FUNCTION SELECTIONS

This chapter provides information concerning the Input/Output (I/O) Screen and its associated functions, including descriptions of the various Record Types. Depression of the I/O key accesses the I/O Function menu, as shown in Figure 5-1

I/O Screen Quick Key Functions

Nine quick-key choices allow interaction with peripheral equipment attached to the K450 as follows:

<u>QUICK KEY</u>	<u>I/O FUNCTION</u>
(0) Disk Quick Mode	-Allows keyboard inputs for disk operations while viewing setup or display 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	-Causes the K450 to set the GPIB-SRQ line active.
(4) Print Screen Direct	-Causes the K450 to send the visible portion of the screen presently displayed to host or terminal.
(5) Print Screen Long*	-Causes the K450 to send all information for a given screen to the host or terminal. (*See note which follows.)

I/O Screen Quick Key Functions (Cont'd.)

<u>QUICK KEY</u>	<u>I/O FUNCTION</u>
(6) Send Setup Records	-Causes the K450 to send all setup records for the currently active memory (M, A, or B).
(7) Send Memory Records	-Causes the K450 to send 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 Screen Graphics	-Causes the K450 to send the exact bit mapped graphics display to an Epson FX-80**, or equivalent printer. Graphics mode is valid for any screen, but is especially useful for printing timing charts and other graphic screens.

*If Print Screen Long is selected with the Timing Screen displayed, the K450 automatically defaults to the Print Screen Graphics Mode (quick-key 8). The screen contents are printed from the currently displayed screen to the last screen containing a valid input. The Horizontal Expansion, Control and Reference values are not changed during this process. Also, the Status messages on the top and bottom of the screen are only printed at the beginning and end of each print-out.

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```

                                CLOCKS (M)      10/14/85 09:06:54
                                CLOCK MODE = STANDARD
SECTIONS C, B, AND A
                                MASTER CLOCK = INTERNAL 100 NANoseconds
-----
[0]=DISK QUICK MODE           [5]=PRINT SCREEN LONG
[1]=DISK SCREEN MODE         [6]=SEND SETUP RECORDS
[2]=I/O SETUP SCREEN         [7]=SEND MEMORY RECORDS
[3]=PRINT SCREEN GRAPHICS
[4]=PRINT SCREEN DIRECT
                                DVM=--00.00
                                READY

```

Figure 5-1. I/O Function Menu

Note that the number of choices available depends on the configuration of the K450 and the I/O mode in which it is operating.

The I/O Setup Screen (Figure 5-2) allows the user to select and view parameters used for the communications port. This screen is accessed by depressing the I/O key and the numeric key 2.

I/O		10/30/85 13:50:51	
GPIB		RS232	
GPIB MODE =	LSTN ONLY	BAUD RATE =	9600
TERMINATOR =	CR/LF	WORD LENGTH =	8 BITS
EOL OUTPUT =	OFF	STOP BIT(S) =	1
		PARITY =	NONE
		PROTOCOL =	XON/XOFF
<hr/>			
I/O PORT =	RS232		
RECORD LENGTH =	80 CHARS.		
<hr/>			
I/O COMMAND =	SEND ALL SETUP	FOR MEM	M
<hr/>			
F1 =GPIB/RS232	F2 →Command DVM=-00.00	F4 =Execute Command	READY

Figure 5-2. I/O Setup Screen

The screen is divided into three areas as follows:

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

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 the given field is active.

Mode = Field

The following quick-key choices are available in the GPIB mode of operation:

- (0) TALK ONLY
- (1) LSTN ONLY
- (2) TALK/LSTN

GPIB Address = Field

The user can directly assign a two-digit GPIB address to the K450 using legal decimal values of 00 through 30. The GPIB address is selectable only when the GPIB mode is TALK/LSTN.

Terminator = Field

The user can define the end-of-line delimiter as follows:

- (0) CR/LF
- (1) CR

EOI Output = Field

The user can select to enable or disable the End or Identify GPIB line as follows:

- (0) Disable
- (1) Enable

When enabled, the EOI line is forced true as the last data byte of each record is sent.

Baud Rate = Field

The user can set the RS-232-C communications rate using the following baud rate choices:

- (0) 110
- (1) 150
- (2) 300
- (3) 600
- (4) 1200
- (5) 1800
- (6) 2400
- (7) 4800
- (8) 9600

Word Length = Field

The user may select a word length as follows:

- (0) Seven Bits
- (1) Eight Bits

Stop Bit(s) = Field

The user may select stop bits as follows:

- (0) One Stop Bit
- (1) Two Stop Bits

Parity = Field

The parity choices are as follows:

- (0) None
- (1) Even
- (2) Odd

Protocol = Field

The protocol choices are as follows:

- (0) XON/XOFF
- (1) RTS/CTS

I/O Port = Field

The user can specify the communication port as follows:

- (0) RS-232-C port
- (1) GPIB port

When the GPIB port is chosen and TALK ONLY mode is not selected, the only other field available in this section of the display is Character Length =. If the RS-232-C port or GPIB TALK ONLY mode is chosen, a third field, Command =, appears.

Record Length

The user can specify record lengths to be sent from the K450 as follows:

- (0) 80 characters
- (1) an unlimited number of characters

Command = Field

Information to be sent from the K450 is specified as follows:

- (0) Send all Setup
- (1) Send all Memory
- (2) Send all Display Parameters
- (3) Send all Search
- (4) Send Status
- (5) Send String
- (6) Process Input String

The I/O command field is only selectable under the following conditions:

1. The I/O port choice is RS-232-C
2. The I/O port choice is GPIB and the GPIB mode is TALK ONLY.

Output String = Field

This field is available only when the Send String command is selected. Up to 25 characters may be specified using the alphanumeric, SPACE, F1 (=), F2 (\$), F3 (___), CONTROL (""), REF (""), and EDIT (+) keys. SHIFT CLEAR causes the character at the cursor as well as all characters to the right of the cursor to appear as underline (___) characters. When F4 is depressed with the Send String command selected, all characters up to the first underline (___) character in the Output String field are sent with the appropriate terminator appended. This feature is useful for remotely controlling one K450 from another K450.

Input String = Field

This field is available only when the Process Input String command is selected in the I/O command field. Up to 25 characters may be entered using the alphanumeric, CONTROL, REF, EDIT, F1, F2 and F3 keys. Entering SHIFT CLEAR causes the character at the cursor as well as all characters to the right of the cursor to be set to the underline () character. When F4 is depressed, the input string up to the first underline () character is processed with an appended terminator as if received through the current I/O port.

Status Display

When data is output from the K450, SENDING DATA appears at the bottom of the screen. As data is received by the K450, RECEIVING DATA ... appears at the bottom of the screen.

When the GPIB port is used, the GPIB status appears in the lower-right corner of the screen labeled GPIB =. The three status indicators relate to Remote/Local, Talker/Listener, and Service Request state of the K450 GPIB interface as follows:

STATUS	DESCRIPTION
Remote/Local	LOCS (local mode) REMS (remote mode) RWLS (remote with local lockout)
LWLS	(local with local lockout)
Talker/Listener	NA (neither active) TA (talker addressed) LA (listener addressed)
Service Request	NPR (no request) SRQ (service requested)

These messages can be useful when first attempting connection to the K450. For example, if SENDING DATA appears on the screen but the receiving device does not detect any input, the cable may not be connected; in the case of the RS-232-C, CTS may not be active.

I/O Screen Function Keys

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

<u>FUNCTION KEY</u>	<u>APPLICATION</u>
F1	The user can quickly switch the I/O port selection between GPIB and RS-232-C using the F1 key. When F1 is depressed, the I/O port selection is changed and the active field becomes the topmost setup field for the newly selected I/O port.
F2	This choice is available only when the I/O command field is displayed and allows the user to move the active field immediately to the I/O command field.
F4	When the I/O Command field is displayed, depressing F4 causes the appropriate records to be sent or action taken as follows:

<u>COMMAND</u>	<u>RECORDS SENT</u>
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	Specified Output String
Process Input String	Input String processed as described above

EXTERNAL INTERFACE

The K450 can communicate with a variety of other instruments, computers, and peripherals. This section contains the specific information needed to operate the K450 over two interfaces: the IEEE STD 488-1978 and EIA-RS-232-C. The IEEE STD 488-1978 is an 8-bit parallel interface, commonly referred to as the General Purpose Instrumentation Bus (GPIB). The EIA-RS-232-C is an asynchronous bit serial interface.

The specific mechanical, electrical, and functional characteristics and standards of the GPIB and RS-232-C are explained in detail in the following references.

GPIB Reference Documents

1. IEEE Standard Digital Interface for Programmable Instrumentation (IEEE STD 488-1978).
Osborne/McGraw-Hill.
2. Pet and the IEEE-488 Bus. E./ Fisher & C. Jensen.
Osborne/McGraw-Hill, 1980.
3. Articles in Microcomputing, July, 1980; Electronic Test, April, 1981.
4. "IEEE-488": Its impact on the Design, Building and Programming of Automatic Test and Measurement Systems" by David W. Ricci, Hewlett-Packard. Presented at ELECTRO '80, Session 3: IEEE-488 User Fundamentals, May 13-15, 1980, Boston, MA.

RS-232-C Reference Documents

1. EIA Standard, Interface between DTE and DCE, RS-232-C.
2. EIA, Application Notes for RS-232-C Standard (Bulletins 9 & 12).
3. CCITT Series V Recommendations.
4. Data sheets and application notes of various Data Communication chips.

5. Digital, Technical Aspects of Data Communication, J. McNamara.
6. Data Communication Handbook, A. Weissberger.

GPIB INTERFACE DESCRIPTION

The K450 GPIB Interface is an implementation of the IEEE 488-1978 published November 30, 1978, under the title "IEEE Standard Digital Interface for Programmable Instrumentation". This implementation supports the capabilities and electrical interface as defined by that standard. Table 5-1 lists the K450 GPIB interface capabilities.

Table 5-1. GPIB Interface Capabilities

FUNCTION	SIGNAL	K450 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 Capability
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 Connection

A female connector labeled IEEE 488 is provided on the rear connector panel of the K450. Connect one end of the GPIB cable to this connector and the other end to a controller or another K450. The instrument can be operated locally or from a remote station.

GPIB Interface Modes Description

The first field in the GPIB interface section of the I/O Setup Screen is designed for interface mode selection. The K450 can be configured to operate in one of the following three interface modes:

1. Talk and Listen
2. Talk Only
3. Listen Only

Talk and Listen Mode: In this mode, the K450 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 K450 processes records sent on the GPIB bus when addressed to listen. The K450 can also be 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 K450 GPIB and sets the Talk and Listen states to idle.

Device Trigger and Device Clear Commands: The Device Trigger command, a multiwire message, causes a pulse on the rear panel GET BNC connector. The Device Clear command, a multiwire message, causes the Default Setup M and Display values to be set in the K450. The K450 is disarmed.

Talk Only Mode: The foremost application of Talk Only mode is the transfer of information to a dedicated GPIB printer to provide hard copies of setup screens, timing diagrams, or memory.

Talk Only mode is also used to transfer setups and/or contents of memory A or B to another K450.

Listen Only Mode: Similar to Talk Only mode, Listen Only mode has limited use; it is used to receive information from another K450. This condition permits users to remotely change the K450 talk/listen mode since it always receives and processes records in Listen Only; for example, the user can change the instrument to Talk and Listen mode.

Termination Characters

Because the K450 can be configured to send any of four termination strings, the unit has flexibility to adapt to any controller. For example, some controllers must receive Carriage Return only. Others may require both Carriage Return and Line Feed to terminate a record. The four termination strings are as follow:

1. CR and LF
2. CR&LF + EOI
3. CR
4. CR + EOI

GPIB Status Byte

By using the KT command (refer to the Record Type index in this chapter) 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:

<u>BIT</u>	<u>MEANING</u>
7	Recording in progress (armed but not stopped)
6*	SRQ - K450 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 K450 sends a KT record.

RS-232-C INTERFACE DESCRIPTION

This interface is provided for applications where the K450 is remotely controlled using modems and telephone lines. The RS-232-C interface can also be used to connect the K450 to a local peripheral. The interface characteristics can be selected in the I/O Setup Screen. The K450 is configured as a Data Terminal Equipment (DTE).

Protocols

The modem control lines are used to control an asynchronous modem. The RTS/CTS handshake is used to synchronize two devices with different processing speeds. This feature protects the internal buffer from overflowing with received characters. The K450 uses the Data Terminal Ready (DTR) signal to indicate the imminent buffer overflow; thus data should not be sent until this signal is released. The K450 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. The K450 has implemented this software protocol. When the K450 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 K450 is ready to accept more data. If the K450 receives an XOFF character, information is not transmitted until an XON signal is received.

RS-232-C Interface Connection

One female connector labeled RS-232-C is provided on the rear connector panel of the K450. To access the K450 from a remote location, simply connect the K450 to a modem or an acoustic coupler with an RS-232-C cable. The cable should have male connectors on both ends. The instrument can also be connected to various computers and computer peripherals. 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 have to be interchanged in one connector to transfer signals properly. This is essentially an implementation 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 K450 locally with another DTE such as a CRT terminal.

Null Modem Variations

The user might desire to use the simple Null Modem circuit shown in Figure 5-3. Note, however, that this circuit lacks handshake capabilities.

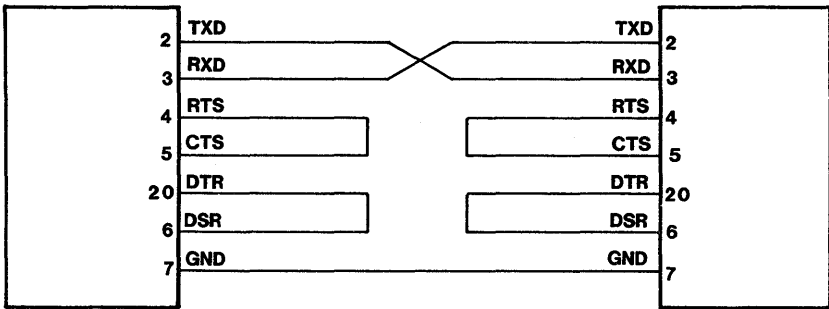


Figure 5-3. Simple Null Modem Wiring Diagram

Another alternative to implementing an easy wiring configuration is shown in Figure 5-4. This circuit allows logic handshaking by means of the DTR/DSR lines.

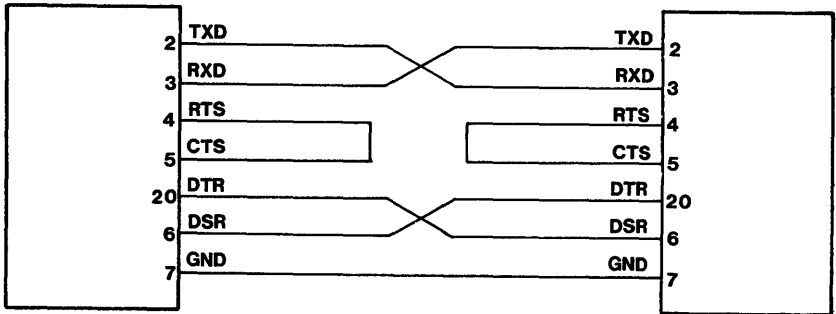


Figure 5-4. Null Modem Wiring Diagram with DTR/DSR

The interconnection shown in Figure 5-5 is a complete arrangement to interconnect the K450 to any computer using the earlier described hardware handshake capabilities.

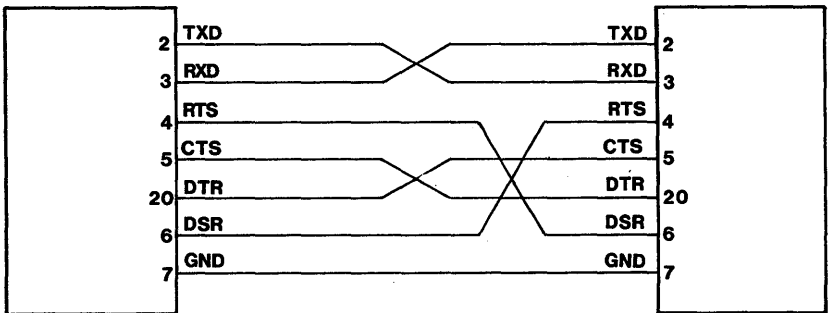


Figure 5-5. Complete Null Modem

The wiring connections shown in Figure 5-6, interconnect the K450 to the Graphics Printer Accessory. The RS-232-C interface components are provided in the Graphics Printer Kit (part number A19510).

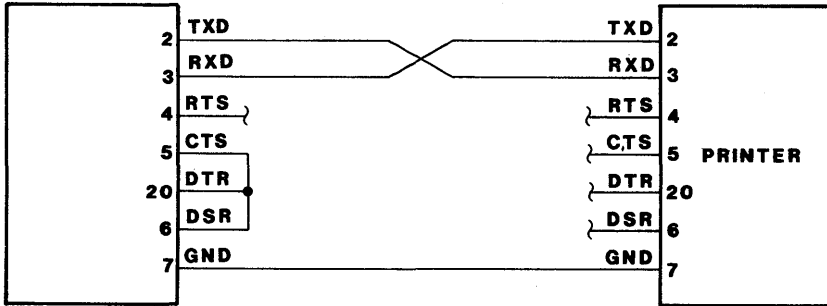


Figure 5-6. Null Modem for Graphics Printer

Example Use of Graphics Printer

The following procedure presents steps for printing a graphics screen to the Graphics Printer accessory via the RS-232 port. Verify AC power is removed from both units prior to connecting the modem.

1. Connect the Graphics Printer to the K450, using the null modem diagram shown in Figure 5-6.
2. Power up the K450 and Printer units. Access the I/O Set Up Screen and set the following RS-232 controls for identical conditions on both the printer and K450 units:

Baud Rate	9,600 BPS
Word Length	8 bits
Stop Bits	1 or 2
Parity	Disable
Protocol	XON/XOFF

3. Enter the Graphics Screen and depress the I/O key. A prompt appears at the bottom of the display screen which indicates the print function is enabled.
4. Depress Key 8 (Print Graphics) to execute the print function.

INTERFACING TWO K450s

Two K450's easily interface to each other; however, if one unit is a 32-input system and the other a 48-input system, the user must set up the 32-unit remotely from the 48-input unit in order to ensure proper duplication. The communications link may be RS-232-C or GPIB.

INPUT/OUTPUT RECORDS

This section presents the K450 Record Types. Each Record Type description explains the syntax, procedures and system response.

It is strongly recommended that the user become familiar with Chapter 4 (Operation) prior to attempting remote operation of the K450.

Record Types

The following three types of GPIB/RS-232-C records can be used when operating the K450:

- **Request Record** - Requests the instrument to return an output record.
- **Input/Output** - If sent to a K450 (input), an input/output record commands the instrument to set a parameter to a particular value. If sent back from the K450 (output), an input/output record indicates the value of the parameter. The input/output records are complimentary and can both be performed for one operation.
- **Command** - Instructs the instrument to perform some action; a command record can only be sent, with no response from the K450.

The general format for these record types is as follows:

1. INPUT/OUTPUT

<memory indicator> <record identifier> <range> = <data>
<end of line>

2. REQUEST

<memory indicator> <record identifier> <range>
<end of line>

All records are represented by ASCII characters and begin with a two-character record identifier. However, for all input/output records and request records used for setup screen parameters, the two-character record identifier may be preceded by a Memory Indicator, either A or B. If the Memory Indicator is absent, the memory defaults to Memory M. Input/output records may be divided into scalar records, in which single values are sent, and array records, in which one or more values may be sent. For data array records, the record identifier must be followed by a range specification, which consists of parenthesis containing the range. Scalar Data identifiers may not be followed by parenthesis.

GPIB records sent by the K450 are terminated by a carriage return, linefeed (CR/LF), or carriage return (CR), depending upon the GPIB terminator selection on the I/O Setup Screen. RS-232-C records sent by the K450 are always terminated by a CR/LF. Records received by the K450 must end with a CR; linefeeds are ignored.

In response to most request records, the K450 sends output records with the same record identifier as the request record, as shown in the following example:

(Request record sent to the K450) CM<end-of-line>

(Response from K450) CM=SI<end-of-line>

(Request record sent to K450) FT(0-2)<end of line>

(Response from K450) FT(0-2)=TTT<end-of-line>

Conventions for Record Syntax

The format for each record type is listed under the headings of MEMORY SELECT, RECORD ID, RANGE INDEX, and DATA. For input/output records, an = must be inserted between the RANGE INDEX and DATA fields. All records must end with an end-of-line (EOL) terminator.

Listed below is a description of the various symbols used in the syntax.

- , - Entries separated by comma for Data choice field (e.g. *, 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 can consist of a combination of desired entries.

Quick-key Choices

Where applicable, the various quick-key choices associated with a given record type are provided. The user should note that these quick-key choices are not used in remote operation of the K450 and are presented only to inform the user of available choices for direct interfacing with the instrument.

Record Categories

The Record Types are alphabetically ordered by function name, rather than the actual record names; however, an index is provided in front of the record types, providing the record identifiers in alphabetical order and the corresponding page number on which the record appears.

INVALID RECORDS

The K450'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 K450 receives an invalid record type or data, the K450 sends the following Invalid Record (IR) message:

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

The K450 then discards the remaining portion of the received record and scans the input until an end-of-line message is received. If the K450 itself receives the IR record, it sends an end-of-line message. When a data record is received and processed, the K450 responds with an end-of-line message if data is valid; otherwise, the Invalid Record is sent. The K450 accepts and ignores any number of end-of-line messages and accepts either CR or CR/LF as the end-of-line message. The K450, however, always sends CR/LF as the end-of-line message. If the K450 receives an end-of-text character (Ctrl-C, 03H), it immediately cancels the command processing and waits for a new record identifier.

The maximum record length can be selected on the I/O Setup Screen to be either 80 characters or unlimited. This capability is useful when the output is sent to a printer or CRT. The K450 batches all received records and processes them sequentially.

GPIB Invalid Record Processing

When GPIB is active and the K450 receives an invalid record type or data, it performs the following functions:

- a) The K450 sets bit 4 (listen error record) in the GPIB status byte and then sends an SRQ-message to the controller.
- b) The K450 discards the remainder of the received record and scans the input until an end-of-line message is received.

If the K450 itself receives an Invalid Record, it accepts and ignores the record (i.e., no response is set back). When a data record has been received and processed, the K450 does not respond if data are

valid; otherwise, bit 4 is set in the GPIB status byte and a SRQ-message is sent to the controller. The K450 accepts any number of end-of-line messages. The K450 accepts either CR or CR/LF as the end-of-line message. The K450, however, always sends the end-of-line message selected on the I/O Setup Screen (either CR or CR/LF).

If the K450 receives an end-of-text character (Ctrl-C, 03H), it immediately cancels the command processing and waits for a new record-identifier. The maximum record length can be selected on the I/O Setup Screen to be either 80 characters or unlimited. This capability is useful when the output is sent to a printer or CRT. The K450 batches all received records and processes them sequentially.

RANGE SPECIFICATIONS

The following data entry examples present the range specifications for input/output array-record types. Note 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.

NOTE: When the communication port is GPIB, the FIXED format range specifications (1,2,3) are processed slightly faster than the VARIABLE format range specifications.

INDEX OF K450 COMMAND SET

<u>COMMAND MNEMONIC</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
C-	Send All Clocks Records	5-35
CC	Control Cursor Position	5-62
CD	Clocks Demux	5-29
CI	Internal Clock Period	5-34
CM	Clocks Mode	5-31
CR	Reference Cursor Position	5-63
CS	Clock/Sample Store	5-32
DC	Clear Display	5-70
DS	Display Screen	5-96
DT	Display Text	5-72
F-	Send All Format Records	5-44
FA	Variable Threshold A	5-42
FB	Variable Threshold B	5-43
FD	Data Format Column Definitions	5-37
FF	Data Format Mode	5-40
FL	Data Format Level Select	5-39
FP	Data Polarity Field	5-41
FT	Data and Clock Thresholds	5-36
KC	K450 Configuration	5-94

INDEX OF K450 COMMAND SET (Cont'd.)

<u>COMMAND MNEMONIC</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
KF	Current Master Clock Frequency	5-93
KK	Device Clear	5-71
KT	Current K450 Status	5-95
LA	Level Data A	5-86
LB	Level Data B	5-86
MA	Sample Data A	5-87
MB	Sample Data B	5-87
MX	Don't-Care Data	5-85
PA	Sample Data Parameters A	5-88
PB	Sample Data Parameters B	5-88
PD	Print Screen Direct	5-73
PL	Print Screen Long	5-74
QA	Send All Memory A Records	5-89
QB	Send All Memory B Records	5-89
QQ	Acquisition Control	5-69
R-	Send All Arm Mode Records	5-64
RC	Comparison Count Mode	5-61
RE	Auto Edge Tolerance	5-58
RI	Auto Compare Inputs	5-55

INDEX OF K450 COMMAND SET (Cont'd.)

<u>COMMAND MNEMONIC</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
RM	Arm Mode	5-53
RR	Auto Compare Range	5-56
RS	Auto Save	5-59
SD	Current Date and Time	5-91
SE	Beep Select	5-90
SV	Current DVM Reading	5-92
T-	Send All Trace Control Records	5-52
TC	Trace Control Command	5-45
TN	Trace Control Pattern Name	5-50
TP	Trace Control Parameter Field	5-49
TV	Trace Control Pattern Value Field	5-51
W-	Send All Display Records	5-84
WD	Search Select	5-77
WG	Graph Expansion, Labels	5-75
WL	Timing Labels	5-82
WQ	Timing Sequence	5-83
WS	Search Value	5-78
WT	Timing Expansion	5-81
WV	Search Level	5-76
WX	Sequential Search Value	5-80

INDEX OF K450 COMMAND SET (Cont'd.)

<u>COMMAND MNEMONIC</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
WY	Sequential Search Levels	5-79
Z-	Send All Search/Compare Results	5-68
ZC	Search/Compare Select	5-66
ZR	Search/Compare Results	5-67
ZT	Search/Compare First/Last/Total	5-65
--	Send All Arm Mode, Clocks, Format and Trace Records	5-98
\$+	Normal Mode Keystrokes	5-97
\$-	Shifted Keystrokes	5-97

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
<A/B>	{CD}	{{0-2}	{=}	{*,D} {EOL}
				{*, L, G}
				{*, L, G} 6
				If L, {H, L, *}

Record Type - Input/Output/Request: Array

The selected index must be in a range of 0 through 2 and specifies the Clock Section; 0 selects Section A, 1 selects Section B and 2 selects Section C.

The first data choice specifies either no Demux (*) or Demux (D) for the Clock Section.

The second and third data choices specify the Latch/Glitch mode for the 7-0 and F-8 inputs, respectively. * selects no Latch/Glitch, L selects Latch Mode and G selects Glitch Mode.

If Latch Mode (L) is selected, the fourth data choice is included. H, L and * are selected in any combination of six to specify the Latch Clock Expression for the Clock Section; H selects Active High, L selects Active Low and * selects not used.

For 48 input systems, these six selections for the fourth data choice represent the following Clock Inputs, presented from left to right on the screen: CR, BR, AR, CS, BS and A\$. For 32 and 16 input systems, values for CR, BR, CS and BS must be included; however, these values cannot be viewed on the screen and are not used for recordings.

CLOCK DEMUX(CD) (Cont'd.)

Quick-key choices are available to select the following conditions:

Demux Select	Latch/Glitch Mode	Clock Inputs
(0) No Demux	(0) No Latch/Glitch	(0) Clock Input Not Used
(1) Demux	(1) Latch Mode	(1) Active High
	(2) Glitch Mode	(2) Active Low

Note the cursor advances to the adjacent field immediately after the selection is entered.

Example Entry: CD(2)=D*L**H***

SYNTAX

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

Record Type - Input/Output/Request: Scalar

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, presented from left to right on the screen: CJ, BJ, AJ, CK, BK and AK for 48-input systems, and BR, BJ, AJ, BS, BK and AK for 32-input systems. For 16-input systems, values must be included for all six inputs; however, only the third (AJ) and sixth (AK) inputs are displayed on screen and used for operations.

Quick-key Choices are available to select the following conditions:

Clock Mode	Master Clock Source	Clock Inputs
(0) Standard	(0) Internal	(0) Clock Input Not Used
(1) Advanced	(1) External	(1) Active High

Note the cursor immediately advances to the adjacent field after the selection is entered.

Example Entry: CM=AE**L***

CLOCK/SAMPLE STORE (CS)

SYNTAX

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

Record Type - Input/Output/Request: Array

The selected index must be in the range of 0 through 2 and specifies the Clock Section values; 0 selects A, 1 selects B and 2 selects C.

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 nanoseconds.

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, represented from left to right on the screen: CJ, BJ, AJ, CK, BK and AK for 48 input systems, and BR, BJ, AJ, BS, BK and AK for 32 input systems. For 16-input systems, values must be included for all six inputs; however, only the third (AJ) and sixth (AK) inputs are displayed on screen and used for operations.

CLOCK/SAMPLE STORE (CS) (Cont'd.)

Quick-key choices are available to select the following conditions:

Sample/Store	Sample/Store	Clock Source	Clock Inputs
(0) Sample	(0)	Internal	(0) Clock Input Not Used
(1) Store	(1)	External	(1) Active High
	(2)	10 Nanoseconds	(2) Active Low
	(3)	Same as Master Clock	

Note the cursor immediately advances to the adjacent field after the selection is entered.

Example Entry: CS(0)=SEHHH***

INTERNAL CLOCK PERIOD (CI)

SYNTAX

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

Record Type - Input/Output/Request: Scalar

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 range from 020 nanoseconds through 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.

Quick-keys are available to select the following conditions for the Time Unit:

- (0) Milliseconds
- (1) Microseconds
- (2) Nanoseconds

Note the cursor remains in the field following execution of the selection. Valid values for the Clock Interval can be directly entered using the 0 through 9 numeric keys.

Example Entry: CI=100N

SEND ALL CLOCKS RECORDS (C-)

SYNTAX

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

Record Type - Request

The K450 responds by sending the following output records:

CM, CI, CD, CS

Example Entry: C-

DATA AND CLOCK THRESHOLDS (FT)

SYNTAX

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

Record Type - Input/Output/Request: Array

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

- (0) Clocks
- (1) A7-A0
- (2) AF-A8
- (3) B7-B0
- (4) BF-B8
- (5) C7-C0
- (6) CF-C8

The inputs are presented on the screen with A7-A0 located on the bottom and CF-C8 on the 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.

Quick-keys are available to select the following conditions for the threshold type:

- (0) TTL
- (1) ECL
- (2) VARA
- (3) VARB

The cursor moves in a vertical direction to the next adjacent field after the selection is entered.

Example Entry: FT(0-4)=AETTT

DATA FORMAT COLUMN DEFINITIONS (FD)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>		<u>DATA</u>		
<A/B>	{FD}	{{0-39}}	{=}	{0-8}	First Value	{EOL}
				{A0, A1, A2, . . . CE, CF}		

Record Type - Input/Output/Request: Array

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 C, which specifies the Section, followed by a Hex character in the range of 0 through F, which specifies the Input number.

Quick-keys are available to select the following conditions for the Data Input(s):

- (0-F) Selects Input Number
- (A-C) Selects Section for Input Column
- (C is only valid with 48 input systems.)

DATA FORMAT COLUMN DEFINITIONS (FD) (Cont'd.)

NOTE: 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 Entry: FD(0-3)1B004AFAEDAC4ABAAA9A8

DATA FORMAT LEVEL SELECT (FL)

SYNTAX

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

Record Type - Input/Output/Request: Scalar

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.

Quick-keys are available to select the following conditions for the Level Memory:

- (0) Level not included in Display
- (1) Include level in Display

The cursor remains in the Level Field after the selection is entered.

Example Entry: FL=T

DATA FORMAT MODE (FF)

SYNTAX

MEMORY RECORD RANGE DATA

<A/B> {FF} NA {=} {0-4} {EOL}

Record Type - Input/Output/Request: Scalar

The data choice is a numeric character in the range of 0 through 5 and specifies the Data Format Mode as follows:

- (0) Hex
- (1) Octal
- (2) Binary
- (3) User Specified
- (4) Disassembler

These choices can also be directly entered using the corresponding numeric keys. The cursor remains in the Data Format Mode field after the selection is entered.

Example Entry: FF=3

SYNTAX

MEMORY RECORD RANGE DATA

<A/B> {FP} {(0-47)} {=} {+, -} {EOL}

Record Type - Input/Output/Request: Array

The selected index must in the range of 0 through 47, with 0 corresponding to Input A0 and 47 corresponding to Input CF. The Inputs are presented on the screen with A0 located in the lower-right and CF in the upperleft of the Data Polarity columns.

The data choice is either + or - and specifies the polarity assigned to the selected Input to be positive or negative, respectively.

Quick-key choices are available to assign the Data Polarity as follows:

- (0) Negative
- (1) Positive

Note the cursor movement is left to right. To move the cursor to the right, use the left-arrow key.

Example Entry: FP(0-1)--+

VARIABLE THRESHOLD A (FA)

SYNTAX

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

Record Type - Input/Output/Request: Scalar

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

The second data choice specifies the voltage; three numeric characters forming a value in the range of 000 through 999 are selected. The numeric characters are presented on the screen with the first character as a whole number and the following characters as decimal values.

Quick-keys are available to select the following conditions for the polarity:

- (0) Negative
- (1) Positive

The cursor remains on the input selected for alteration.

The voltage value can be entered directly using the 0 through 9 numeric keys.

Example Entry: FA=+500

SYNTAX

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

Record Type - Input/Output/Request: Scalar

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

The second data choice specifies the voltage; three numeric characters forming a value in the range of 000 through 999 are selected. The numeric characters are presented on the screen with the first character as a whole number and the following two characters as decimal values.

Quick-keys are available to select the following conditions for the polarity:

- (0) Negative
- (1) Positive

The cursor remains on the input selected for alteration.

The voltage value can be directly entered using the 0 through 9 numeric keys.

Example Entry: FB=-750

SEND ALL FORMAT RECORDS (F-)

SYNTAX

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

Record Type - Request

The K450 responds by sending the following output records:

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

Example Entry: F-

TRACE CONTROL COMMAND (TC)

SYNTAX

MEMORY RECORD RANGE DATA

<A/B> {TC} {{0-79}} {=}{ASCII STRING} {EOL}

Record Type - Input/Output/Request: Array

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 5-2. Definitions for entries are provided following the table.

Table 5-2. Trace Control Command Entries

ASCII CHAR. ENTRY	FUNCTION	COMMAND SELECTION	ENTRY SELECTIONS
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 command is W,T,U,G,S,A otherwise	S C A *
4	PATTERN	If command is W,T,U,G,S,A otherwise	E N *
5,6	PATTERN SELECT	Must be number of valid pattern	(00...49)

TRACE CONTROL COMMAND (TC) (Cont'd.)

Table 5-2 (Cont'd.)

ASCII CHAR. ENTRY	FUNCTION	COMMAND SELECTION	ENTRY SELECTIONS
7-16	PATTERN FILL-IN DIGIT	Must be five character pairs, each representing 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 command is WF TF OR TD otherwise	(C or S) *

ENTRY DEFINITIONS:

ASCII CHARACTER ENTRY #

1st	ENTRY	DEFINITION
	*	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

TRACE CONTROL COMMAND (TC) (Cont'd.)

ASCII CHARACTER ENTRY # (Cont'd.)

2nd	ENTRY	DEFINITION
	*	Don't Care - Blank
	F	FOR
	U	UNTIL
	I	IF
	(0...F)	Target Level
3rd	ENTRY	DEFINITION
	S	Sample Pattern
	C	Count
	A	Sample and Count
	*	Don't-Care
4th	ENTRY	DEFINITION
	E	When equal
	N	When not equal
	*	Don't-Care
5th and 6th	ENTRY	DEFINITION
	00..49	Pattern Number
7th - 16th (See NOTE)	ENTRY	DEFINITION
	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

TRACE CONTROL COMMAND (TC) (Cont'd.)

ASCII CHARACTER ENTRY # (Cont'd.)

17th	ENTRY	DEFINITION
	>	Count greater than delay
	=	Count equal to delay
	<	Count less than delay
	G	Count greater than or equal to delay
	≠	Count not equal to delay
	L	Count less than or equal to delay
	*	Don't-Care

18th - 22nd	ENTRY	DEFINITION
	(00001...65535)	delay count

23rd	ENTRY	DEFINITION
	C	Clocks
	S	Counts of Sample = pattern

NOTE: The actual value displayed on the screen depends on the format (or radix) selected for each fill-in column. For a binary radix in which only one input is used, the fill-in character is represented only by the least significant bit of the fill-in value. For a hex radix (four inputs), the four least significant bits are used. For ASCII-7, the true value is represented by the seven least significant bits of the fill-in value.

Example:

```
TC(0-1) =TUSEO1FFFFFFFFF05=00512CTFSEOOFFFFFFFFF
=00250C
```

TRACE CONTROL PARAMETER FIELD (TP)

SYNTAX

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

Record Type - Input/Output/Request: Array

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.

The columns are presented from left to right on the screen, with 0 corresponding to the column immediately to the right of the = pattern field and 39 corresponding to the rightmost column.

Example Entry: TP(0-2)=0212130

TRACE CONTROL PATTERN NAME (TN)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
<A/B>	{TN}	{(0-49)}	{=} {ASCII CHAR}	⁸ {EOL}

Record Type - Input/Output/Request: Array

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 Entry: TN(0-2)=ENABLE TRIGGER

TRACE CONTROL PATTERN VALUE FIELD (TV)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
<A/B>	{TV}	{(0-49)}	{=} {*, 1, 0}	⁴⁸ {EOL}

Record Type - Input/Output/Request: Array

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 48 asterisks, zeros or ones, which specify Don't-Care, 0 or 1, respectively, for each of the 48 Inputs. The first character selected corresponds to Input CF and the last character corresponds to Input A0.

Example Entry and Screen Display: (Hex Data Format selected)

TV(0)=00000000000100000000000001000000101010101010101

SEND ALL TRACE CONTROL RECORDS (T-)

SYNTAX

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

Record Type - Request

The K450 responds by sending the following output records:

TC, TN, TP, TV

Example Entry: T-

SYNTAX

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

Record Type - Input/Output/Request: Scalar

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. These values appear from left to right on the screen.

Quick-keys are available to select the conditions presented below. Note the cursor remains in the field selected for alteration.

Arm Mode

- (0) STOP After One Pass
- (1) Auto Rearm

ARM MODE (RM) (Cont'd.)

First Rearm Condition

- (0) ____ (Stop Never)
- (1) Unless Pass Count =
- (2) Unless $A = B$
- (3) Unless $A \neq B$

Second Rearm Condition

- (0) ____ (No Pass Limit)
- (1) Or Pass Count =
- (2) And Pass Count \geq

The Pass Limit value can be directly entered using the 0 through 9 numeric keys.

Example Entry: RM=RL0100

AUTO COMPARE RANGE (RR)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>
<A/B>	{RR}	NA	{=} {F S {0000-4098} {0000-4098} {0001-4099} A}
			{EOL}

Record Type - Input/Output/Request: Scalar

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 4098. The fourth data choice consists of four numeric characters in the range of 0001 through 4099. For any other selected time base, the second and third data choices consist of four numeric characters in the range of 0000 through 2050. The third data choice consists of four numeric characters in the range of 0001 through 2051. These characters specify the Mem-A Start, Mem-B Start and the total number of samples to be compared, which appears as And For____ Samples on screen.

These fields are presented on the screen with Mem-A at the topmost position on the screen, followed by Mem-B and For____Samples. Note the total number of samples may not exceed the value of 4099 (for 200 Mhz) or 2051 (for any other time base) minus the greater of the Mem-A and Mem-B starting samples numbers.

Quick-keys are available to select the conditions listed below for the Auto Compare Range. Note the cursor remains in the field after the selection is entered.

AUTO COMPARE RANGE (RR) (Cont'd.)

- (0) Sample(s) Between Cursors
- (1) Sample(s) Selected Below
- (2) 4096 Samples (200 Mhz), or 2048 Samples (other time base)

The values for Mem-A, Mem-B, and Auto Compare Total may be directly entered using the 0 through 9 numeric keys.

Example Entry: RR=S000040000005

AUTO EDGE TOLERANCE (RE)

SYNTAX

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

Record Type - Input/Output/Request: Scalar

The data choice consists of 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.

The Auto Edge Tolerance field is located in the lower portion of the screen.

The Auto Edge Tolerance can be directly entered using numeric keys 0 through 9. The cursor remains in the field after the selection is entered.

Example Entry: RE=0

SYNTAX

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

Record Type - Input/Output/Request: Scalar

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.

Quick-keys are available to select the following conditions:

Auto Save

- (0) Not Used
- (1) Increment if A = B
- (2) Increment if A = B
- (3) _____

Auto Save Drive

- (0) Drive A
- (1) Drive B

AUTO SAVE (RS) (Cont'd.)

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

Example Entry: RS=NARESULT00

SYNTAX

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

Record Type - Input/Output/Request: Scalar

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

Quick-key choices are available to select these conditions for the Comparison Count:

- (0) Not Used
- (1) If A = B
- (2) If A \neq B

The cursor remains in the field after the selection is entered.

Example Entry: RC=N

CONTROL CURSOR POSITION (CC)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
<A/B>	{CC}	NA	{=} {0000-4098}	{EOL}

Record Type - Input/Output/Request: Scalar

The data choice consists of four numeric characters forming a value in the range of 0000 through 4098 (for 200 Mhz) or 0000 through 2050 (for any other selected time base). The selected value specifies the Control Cursor position.

NOTE: Although the Control 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 upon the value of the Control Cursor.

Example Entry: CC=0098

REFERENCE CURSOR POSITION (CR)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
<A/B>	{CR}	NA	{=}	{0000-098} {EOL}

Record Type - Input/Output/Request: Scalar

The data choice consists of four numeric characters forming a value in the range of 0000 through 4098 (for 200 Mhz) or 0000 through 2050 (for any other selected time base). The selected value specifies the Reference Cursor position.

NOTE: 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 Entry: CR=2049

SEND ALL ARM MODE RECORDS (R-)

SYNTAX

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

Record Type - Request

The K450 responds by sending the following output records:

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

Example Entry: R-

SEARCH/COMPARE FIRST/LAST/TOTAL (ZT)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{ZT}	NA	{=} {0000-099} {0000-4098} {0000-4098}	{EOL}

Record Type - Output/Request: Scalar

The first data choice forms a numeric value in the range of 0000 through 4099 (for 200 MHz) or 0000 through 2051 (for any other selected time base. The second and third data choices each form a numeric value in the range of 0000 through 4098 (for 200 MHz) or 0000 through 2050 (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.

Note 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

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{ZC}	NA	{=}	{0, 1, 2} {EOL}

Record Type - Input/Output/Request: Scalar

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

Example Entry: ZC=1

SEARCH/COMPARE RESULTS (ZR)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{ZR}	{(0-4098)} {=}	{0, 1}	{EOL}

Record Type - Output/Request: Array

The selected index is in a range of 0 through 4098 (for 200 MHz) or 0 through 2050 (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; 1 indicates a match.

If Compare is active, 0 specifies no mismatch; 1 specifies a mismatch.

NOTE: Search results may be output but not accepted by the K450 as false information could be presented in such a case.

Example Entry and Screen Display:

SEND ALL SEARCH/COMPARE RESULTS (Z-)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{Z-}	NA	NA	{EOL}

Record Type - Request

The K450 responds by sending the Search/Compare Results (ZR) and the Search/Compare First/Last/Total (ZT) records.

Example Entry: Z-

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{QQ}	NA	{=}	{A, D, S, X} {EOL}

Record Type - Command

The data choice consists of one alphanumeric character, either A, D, S or X. This selection performs the identical function to record keys on the K450 as follows:

- (A) Arm
- (D) Advance
- (S) Stop
- (X) W/xfer

Example Entry: QQ=A

CLEAR DISPLAY (DC)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{DC}	NA	NA	{EOL}

Record Type - Command

When this record is received, the K450 CRT is blanked except for the status information displayed on the topmost and lowermost lines. This record enables the user to display messages on the screen using record type DT.

Example Entry: DC

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{KK}	NA	NA	{EOL}

Record Type - Command

When this record is received, the Default Setup M and display values are loaded into RAM. This record type function is identical to the conditions which occur when the F1 key is depressed while the Configuration Screen is displayed.

Example Entry: KK

DISPLAY TEXT (DT)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{DT}	NA	{=}	{02-08} {EOL}
				{01-52}
				{01-52}
				{text}

Record Type - Command

This record enables the user to display text on the K450 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, respectively.

The fourth data choice specifies the text to be displayed, using alphanumeric characters.

Example Entry: DT=03341150 MHZ MODE

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{PD}	NA	NA	{EOL}

Record Type - Command

When this record is received, the K450 sends an exact copy of the current text on screen.

NOTE: This data stream is intended for a printer and will not be accepted by another K450.

Example Entry: PD

PRINT SCREEN LONG (PL)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{PL}	NA	NA	{EOL}

Record Type - Command

Sending PL followed by a carriage return 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.

NOTE: This data stream is intended for a printer and will not be accepted by another K450.

Example Entry: PL

GRAPH EXPANSION, LABELS (WG)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>
NA	{WG}	NA	{=} {0,1,2,3} {HEX CHAR} {HEX CHAR} {EOL}

Record Type - Input/Output/Request: Scalar

The first data choice specifies the Graph Expansion; 0 selects x1, 1 selects x12, 2 selects x24, and 3 selects x48.

The second and third data choices both consist of eight characters in the Hex range of 0 through F and select the upper and lower graph limit, respectively, of the graph.

The numeric characters are presented in reverse order on the screen.

Example Entry: WG=EEEEEEFF00000000

SEARCH LEVEL (WV)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>
NA	{WV}	NA	{=} {*, HEX CHAR} {EOL}

Record Type - Input/Output/Request: Scalar

The data choice specifies the Search Level value. An asterisk selects Don't-Care; a specific value can be specified in the Hex range of 0 through F.

Example Entry: WV=*

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{WD}	NA	{=} {0, 1}	{EOL}

Record Type - Input/Output/Request: Scalar

The selected index specifies either 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 Entry: WD=1

SEARCH VALUE (WS)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
{NA}	{WS}	{(0-47)}	{=}	{*, 1, 0} {EOL}

Record Type - Input/Output/Request: Array

The selected index must be in the range of 0 through 47 and specifies the Data Input number, with 0 corresponding to A0 and 47 corresponding to CF on the screen.

The data choice is either a 0, 1 or an asterisk for Don't-Care.

Note the Search Value appears in the Data Display Screen on line 3.

Example Entry:

```
WS(0-47)= 0100000001000000010000000100000001000000010  
          000000
```

SEQUENTIAL SEARCH LEVELS (WY)

SYNTAX

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

Record Type: Input/Output/Request: Array

The selected index must be in the range of 0 through 2 and corresponds to the first, second and third sequential search word, respectively.

The data choice is an asterisk for Don't Care or any Hexadecimal value.

Example Entry: WY(0)=*

SEQUENTIAL SEARCH VALUE (WX)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{WX}	{0-143}	{=}	{*, 1, 0} {EOL}

Record Type - Input/Output/Request: Array

The selected index must be in the range of 0 through 143 and specifies the sequential search word value as follows: 0 through 47 indicates the first word; 48 through 95 indicates the second word; 96 through 143 indicates the third word. For each value, the lowest and highest input number corresponds to data inputs A0 through AF, respectively, on the screen.

The data choices are 0,1 or an asterisk for Don't-Care value.

The sequential search word is displayed at the top of the left- most column of samples.

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

SYNTAX

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

Record Type - Input/Output/Request: Scalar

The first data choice specifies the Timing Screen Horizontal Expansion; 0 selects x1, 1 selects x12, 2 selects x24 and 3 selects x48.

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 Entry: WT=1214

TIMING LABELS (WL)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{WL}	{(0-47)}	{=} {ASCII}	⁵ {EOL}

Record Type - Input/Output/Request: Array

The selected index must be in the range of 0 through 47. This index specifies the input number, with 0 corresponding to the A0 input and 47 corresponding to the CF input.

Five ASCII characters must be 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 identifiers (A0-CF) and the Timing traces.

Example Entry: WL(44-47)=ADDR3ADDR2ADDR1ADDR0

SYNTAX

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

Record Type - Input/Output/Request: Array

The selected index must be 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 lowermost 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 Entry: WQ(0-7)=CFCECDCCCBCAC9C8

SEND ALL DISPLAY RECORDS (W-)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{W-}	NA	NA	{EOL}

Record Type - Request

The K450 responds by sending the following display records:

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

Example Entry: W-

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>
NA	{MX}	{0-4098} {=}	{HEX CHAR} ¹² {EOL}

Record Type - Input/Output/Request: Array

The Don't-Care Memory is associated with Memory B sample data and selects to either do not include (0) or include (1), bits when Compare is active.

The selected index must be in a range of 0 through 4098 (200 MHz) or 0 through 2050 (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 CF-CC inputs and the last Hex character selects the A3 through A0 inputs.

Example Entry: MX(0)=000FFFF0FFFF

LEVEL DATA (LA/LB)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{LA/LB}	{0-4098}	{=}	{HEX CHAR} {EOL}

Record Type - Input/Output/Request: Array

LA selects Memory A-level data; LB selects Memory B-level data.

The selected index must be in the range of 0 through 4098 (200 MHz) or 0 through 2050 and specifies the sample number.

The data choice must be 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 Entry: LB(0-3)=012F

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>
NA	{MA/MB}	{(0-4098)} {=}	{HEX CHAR} ¹²
			{EOL}

Record Type - Input/Output/Request: Array

MA selects Memory A data; MB selects Memory B data.

The selected index must be in the range of 0 through 4098 (200 MHZ) or 0 though 2050 (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 Entry: MA(0-1)=0000000000001010101010

SAMPLE DATA PARAMETERS (PA/PB)

SYNTAX

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

Record Type - Output/Request: Scalar

When this record type is received, the K450 responds by sending 39 characters, which represent the Pass Count, Comparison Count, Total Trace Time, Date, Time and DVM reading 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. The next eight characters specify the Time, followed by the final six characters, which specify the DVM reading.

Example Entry and Screen Display:

PA=001000105.OuS 10/29/85 11:03:23-00.00

SEND ALL MEMORY RECORDS (QA/QB)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{QA/QB}	NA	NA	{EOL}

Record Type - Request

The K450 responds by sending the following memory records:

For QA: PA, MA, LA

For QB: PB, MB, MX, LB

Example Entry: QA

SYNTAX

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

Record Type - Input/Output/Request: Scalar

The first five data choices specify the current date by month, day and year. The choices consist of numeric character pairs, followed by backslashes, 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.

NOTE: 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 Entry: SD=09/19/8510:10:47:26

CURRENT DVM READING (SV)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>
NA	{SV}	NA {=}	{+, -} {0-9} {0-9} { . } {0-9} {0-9}
			{EOL}

Record Type - Output/Request: Scalar

When this record is received, the K450 responds by sending the current DVM reading.

Example Entry and Screen Display: SV=-00.00

CURRENT MASTER CLOCK FREQUENCY (KF)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>
{NA}	{KF}	NA	{=} {ALPHANUMERIC CHARACTER} ¹⁰ {EOL}

Record Type - Output/Request: Scalar

When this record is requested, the K450 responds with an alphanumeric string consisting of ten characters, including spaces. The K450's response depends on the Master Clock mode selected and the current record status of the unit as follows:

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 Entry and Screen Display: KF=UNIT ARMED

K450 CONFIGURATION (KC)

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>
NA	{KC}	NA	{=} {K450} {Software Version} {0, 1, 2} {0, 1}
			{EOL}

Record Type - Output/Request

When this record is received, the K450 responds with a string of ten characters, separated into five fields by slashes (/).

The first field indicates the device type: K450.

The second and third fields present the the software version number and revision number, respectively.

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.

Entry Example and Screen Display:

KC=K450/vX007/RO4/32ch/2:DISK,COMM

SYNTAX

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

Record Type - Output/Request

When this record is received, the K450 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 Entry and Screen Display: KT=110100012CLOCK?

DISPLAY SCREEN (DS)

SYNTAX

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

Record Type - Input/Output/Request

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

NOTE: Selecting O only applies to those systems with the Disk Operating System installed.

Example Entry: DS=I

SYNTAX

<u>MEMORY</u>	<u>RECORD</u>	<u>RANGE</u>	<u>DATA</u>	
NA	{\$/-\$+}	NA	{=}	{01-48}
				{EOL}

Record Type - Command

This record enables the user to simulate key entry via the front panel.

Sending either \$+= or \$-= specifies normal or shifted, respectively, front panel keys. Each key, represented by a numeric character pair, must be in the range of 01 through 48. The desired key is specified as follows:

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

A SHIFT key value (25) in a \$+ record causes the key value immediately following to be shifted.

Example Entry: \$+=05

SEND ALL SETUP RECORDS (--)

SYNTAX

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

Record Type - Request

The K450 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 Entry: --

Appendix A

GLOSSARY OF TERMS

Acquisition Cycle

The cycle that a logic analyzer performs to acquire data consisting of the following steps:

1. Analyzer flushes all acquisition memory to 0 (zero).
2. Analyzer starts sampling data.
3. End of record is reached.
4. Data are transferred from acquisition memory to system.
5. CRT display is updated with new data.

This cycle may be modified somewhat in auto-arm modes.

Active Field

A field on a CRT screen that is changed by depressing one of the alphanumeric keys. The active field is identified by a blinking reverse video.

Analog

In analog systems, information is encoded as a continuous range of signal values (voltage or current); in comparison, in a digital system, information is encoded as signals that at any given time can only produce one of two states, 0 or 1.

Analog to Digital Conversion

The process of translating an analog signal into a sequence of binary digits that is representative of the analog signal level.

Arm Mode

The mode of operation of the logic analyzer when the ARM key is depressed.

- a. Single arm, in which one acquisition cycle (pass) is performed each time the ARM key is depressed.
- b. Auto Rearm, in which the analyzer continuously rearms until the STOP key is depressed.
- c. Auto Rearm with condition (also known as autostop), in which the analyzer rearms until some condition occurs.

Clock Transition

The change of state of a clock line. For each clock pulse, two transitions occur: the rising and falling edges of the pulse. In most cases, data are transferred only on one of these edges.

Data Domain Analysis

The use of the logic analyzer to view digital data decoded as symbolic values. Normally, the data are displayed as binary, octal or hexadecimal, although ASCII and EBCDIC representations can also be viewed.

Data Pattern Definitions

In the K450 Logic Analyzer, the trace control system can be programmed to act on the appearance of a given pattern in the data stream. Part of the Trace Control screen is used for entering certain pattern values and assigning them symbolic names.

Data Transition

The change of state of a data line.

Delay Counter

A 16-bit counter on the trace control board that is loaded with a preprogrammed value whenever a trace control level is entered or re-entered. On each level, the counter can be programmed to decrement either on each clock or on occurrences of the advanced pattern. Whenever a level is entered, the hardware is in the state $COUNT < DELAY$. When the counter reaches zero, the hardware is in the state $COUNT = DELAY$. Thereafter, the state is $COUNT > DELAY$.

Demultiplex

Several microprocessors use a multiplexed bus, in which data, address and status information are sent over the same set of lines at different times. To simplify use of the logic analyzer with these processors, a demultiplex mode is provided, in which data from one set of probe inputs (7-0) of each section is routed internally to the 7-0 and F-8 probe inputs of the same section.

Event

In a logic analyzer, an "event" is a series of one or more contiguous samples in which a particular condition is true, surrounded by samples in which that condition is not true.

Field

A field is a part of a display that shows one particular type of information. Usually the term refers to display items that can be altered by the operator.

Logic Analyzer

A logic analyzer is a device that records digital signals and displays recorded data.

Master Clock

The clock moves data into the trace control board and into the acquisition memory.

Occurrence

One "event" is an appearance of a given condition, for however long the condition remains true. One "occurrence" is the presence of a condition on any sample, regardless of whether it was also true on the previous sample. For example, if a condition is true for three samples in a row, this is considered three "occurrences" of that condition, but only one "event".

Pass Counter

A counter that keeps track of the number of arm cycles that have occurred since the ARM key was depressed.

Quick-Key

When setting up the K450, most fields have a fixed number of legal choices. These fields can normally be set using the NEXT or PREV keys, but can also be set by entering the hex digit associated with the desired choice. A hex digit key used in this manner is referred to as a "Quick- Key".

Radix/Radices

The radix of a number system is equal to the number of possible symbols for each digit. The binary number system has a radix of 2, since each digit is one of two possible symbols: 0 and 1. Octal has a radix of 8; hexadecimal has a radix of 16. In the K450 logic analyzer, the term generally indicates a symbolic representation system, where the choices are: Binary (1 bit), Quad (2 bits), Octal (3 bits), Hex (4 bits), X (5 bits), ASCII-6 (6 bits), ASCII-7 (7 bits), and EBCDIC (8 bits).

Recording

A recording is the data sampled during an acquisition cycle and retained when the acquisition cycle ends. If the logic analyzer samples more than its memory can store, only the most recent data is retained.

Split Timing/Clocking

Split Timing occurs whenever more than one clock rate is used for moving data into memory and is associated with the Clocks, Data, Timing and Graph Display Screens in the K450. The word "SPLIT" is briefly displayed in reverse video on the given screen to indicate this condition.

Threshold

A voltage limit above or below which a signal is recognized as a defined value, usually the binary digit of 1 or 0.

Threshold Range

A voltage range over which successive threshold measurements are made.

Time Domain Analysis

Time domain analysis displays the recorded data as idealized oscilloscope traces. This analysis is useful for viewing timing relationships among the signal lines.

Tolerance Comparison

The K450 can compare the data stored in memory A with that stored in memory B. To enhance flexibility, the K450 allows "Don't-Care" samples to be stored in memory B. These samples are simply not compared with their counterparts in memory A. This condition allows tolerances to be placed around rising and falling edges in memory B. The Arm Mode screen provides a means for generating tolerances around each edge in the memory B buffer.

Trace Command Sequence

In the K450 logic analyzer, trace control is setup through a series of simple commands. These form a sequence of commands that are performed on each acquisition cycle, subject to conditional commands present in the sequence.

Trace Control

Trace Control is a trademarked feature of Gould logic analyzers. It is a system for selectively storing events of interest while ignoring all other system activity.

Trace Level

The K450 trace control system has sixteen basic states, called levels, each of which has certain options and conditions. When each sample is traced, the trace level is stored along with the data. These levels can be viewed in the Data screen.

Appendix B

K450 ERROR MESSAGES

This Appendix provides a listing of error messages generated by the K450. 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 - Depress "HELP" for legal keys

Illegal value - Press "HELP" for legal values

Cannot alter Memory A or B Setup

Values may be changed only when the 'M' indicator is displayed for this screen.

General Messages (Cont'd.)

AC POWER INTERRUPTION. Press NEXT to Restart.

This message is displayed when a power glitch occurs.

UNASSIGNED INTERRUPT. Press NEXT to restart.

This message is displayed when an unexpected and unspecified interrupt occurs.

Arm Mode Screen

SET TOLERANCE

This message is displayed when the F4 key is depressed and indicates the Don't-Care memory is being altered with the selected 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 OCTAL

User Specified Format set to DISASSEMBLER

The appropriate message is displayed when the F4 key is depressed 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 K450 is under remote control. The user may restore control to the local front panel by depressing the F1 key.

GPIB REMOTE MODE WITH LOCKOUT

The K450 is under remote control. The local user is locked out.

Print/Send Job Aborted

If the K450 is actively sending data, depression of 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.

I/O Related Functions (Cont'd.)

Print/Send Job in progress. Press CANCEL to abort.

This warning 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 I/O key to exit

This prompt occurs when an illegal key is depressed 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 depressed. The message indicates the screen key has been recognized and will be processed immediately following completion of the disk operation.

Cannot load Disk system.

Appendix C

DEFAULT VALUES

This Appendix presents the Default screens of the K450.

When either the F1 key or the SHIFT A(S) key is depressed while the Configuration screen is displayed, some system variables are set to specified values. These variables are listed below with their corresponding default values. Illustrations of all affected screens as they appear with default values are also provided in this section.

<u>SCREEN</u>	<u>FIELD NAME</u>	<u>VALUE</u>
Arm Mode	Arm Mode	Stop
	Stop Rearm	No Stop
	Comparison Count	No Count
	Auto Compare Range Select	2048 Samples
	Start Mem-A	000
	Start Mem-B	000
	Total Compare	2051
	Input Select	Inputs defined on format screen
	Selected Inputs	All
	Auto Edge Tolerance	0

SCREEN	FIELD NAME	VALUE
Clocks	Clock Mode	Standard
	Master Clock Source	Internal
	External Master Clock	(__*__*AJ)+(____+____+____)
	Internal Clock	020 Nanoseconds
	All Sections Demux Select	Not Selected
	Latch/Glitch	Not Selected
	Latch Clock	(__*__*AR)+(____+____+____)
	Sample/Store	Store
	Section Source	10 Nanoseconds
	External Section Clock	(__*__*AJ)+(____+____+____)
Data	Control Cursor	000
	Reference Cursor	2050
	Search Level	Don't-Care
	Search Word	All Don't-Care
	Search/Compare	Neither active
Date/Time	Error Beep	ON
Format	Data Format	User Specified
	Level Select	Selected
	Section	CCCC BBBB AAAA (48)

SCREEN	FIELD NAME	VALUE
Format (Cont'd.)	Inputs	FB73 FB73 FB73 EA62 EA62 EA62 D951 D951 D951 C840 C840 C840
	Threshold	All TTL
	Polarity	All Positive (+)
	Graph	
	Minimum Value	00000000
	Maximum Value	FFFFFFFF
	Horizontal Exp	x1
I/O	 GPIB Mode	Listen On ly
	 GPIB Addr	0
	 Terminator	CR/LF
	 EOI	Off
	 I/O Port	RS232
	 Record Length	80 char
	 I/O Comm	Send setup for Mem M
	 Baud Rate	9600
	 Word Length	8 bits
	 Stop Bits	1
	 Parity	None
	 Protocol	XON/XOFF

SCREEN	FIELD NAME	VALUE
Timing	Timing Sequence	All inputs in descending order (CF, CE,..., A1, A0)
	Page	0
	Horizontal Exp	x1
	Vertical Exp	16 Traces
	Timing Labels	All Blank
Trace Control	Command Sequence	0: Trace until sample = Trigger 1: Trace for 1023 Clocks
	Pattern Definitions	00 Enable all Don't-Cares 01 Trigger all Don't-Cares 02_all Don't-Cares

```

                                ARM MODE (M)      10/11/85 09:13:46
AFTER ONE PASS.

    STOE

-----
AUTO COMPARE RANGE IS FOR 0048 SAMPLES

    USING 10000 SAMPLES DEFINED ON FORMAT SCREEN

-----
    AUTO EDGE TOLERANCE = ± 2 SAMPLE(S)
    EDGE TOLERANCE IS ASSOCIATED WITH MEMORY B AND IS
    SET ON EACH A+B DATA TRANSFER OR BY PRESSING F4

-----
                                DVM=-00.00      F4=Set Tolerance
                                                    READY

```

Figure C-1. Arm Mode Default Screen

```

                                CLOCKS (M)      10/11/85 10:15:05
    CLOCK MODE = STANDARD
SECTIONS C, B, AND A
    MASTER CLOCK = INTERNAL 000 NANoseconds

-----

F1=100/200  F2=Glitch
                                DVM=-00.00
                                                    READY

```

Figure C-2. Clocks Default Screen

				DATA (A)	Powerup Data		
SEARCH	=	X	XXXX XXXX XXXX				
			HHHH HHHH HHHH		L	HHHH HHHH HHHH	
C	0000	F	0000 0000 0000	0021	F	1515 1515 1515	
	0001	F	0101 0101 0101	0022	F	1616 1616 1616	
	0002	F	0202 0202 0202	0023	F	1717 1717 1717	
	0003	F	0303 0303 0303	0024	F	1818 1818 1818	
	0004	F	0404 0404 0404	0025	F	1919 1919 1919	
	0005	F	0505 0505 0505	0026	F	1A1A 1A1A 1A1A	
	0006	F	0606 0606 0606	0027	F	1B1B 1B1B 1B1B	
	0007	F	0707 0707 0707	0028	F	1C1C 1C1C 1C1C	
	0008	F	0808 0808 0808	0029	F	1D1D 1D1D 1D1D	
	0009	F	0909 0909 0909	0030	F	1E1E 1E1E 1E1E	
	0010	F	0A0A 0A0A 0A0A	0031	F	1F1F 1F1F 1F1F	
	0011	F	0B0B 0B0B 0B0B	0032	F	2020 2020 2020	
	0012	F	0C0C 0C0C 0C0C	0033	F	2121 2121 2121	
	0013	F	0D0D 0D0D 0D0D	0034	F	2222 2222 2222	
	0014	F	0E0E 0E0E 0E0E	0035	F	2323 2323 2323	
	0015	F	0F0F 0F0F 0F0F	0036	F	2424 2424 2424	
	0016	F	1010 1010 1010	0037	F	2525 2525 2525	
	0017	F	1111 1111 1111	0038	F	2626 2626 2626	
	0018	F	1212 1212 1212	0039	F	2727 2727 2727	
	0019	F	1313 1313 1313	0040	F	2828 2828 2828	
	0020	F	1414 1414 1414	0041	F	2929 2929 2929	

CONTROL=0000 REF=2050 (R-C)=+2050 (41.00 MS)
PAGE UP, PAGE DOWN - USE EDIT TO CHANGE SEARCH
CLOCK=020 nSec DVM= **. **
READY

Figure C-3. Data Default Screen

DATE		10/11/85 10:08:53	
DATE =	<input type="text" value="10/11/85"/>	ERROR BEEP =	<input type="checkbox"/> ON
TIME =	<input type="text" value="10:08:53"/>		
DVM=-00.00		READY	

Figure C-4. Date/Time Default Screen

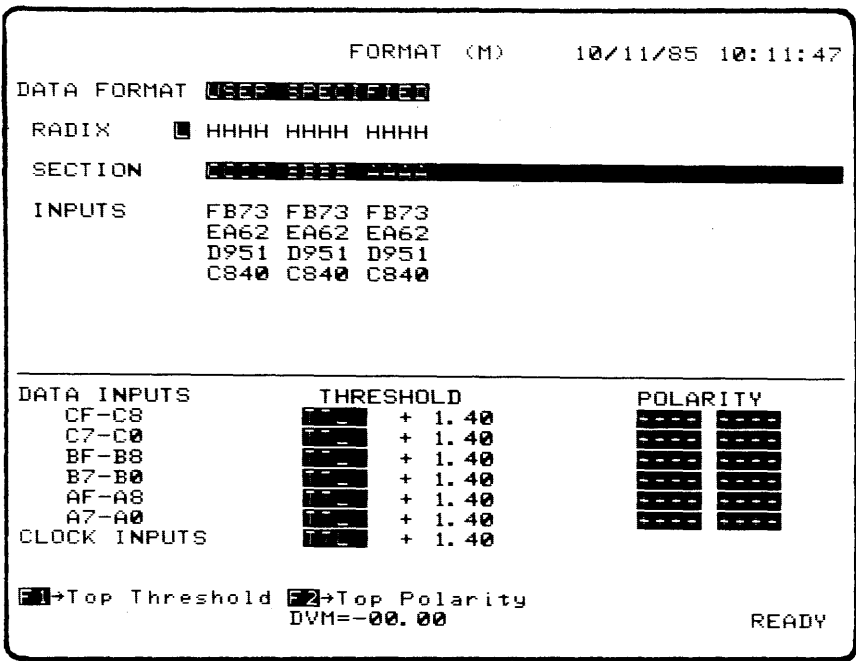


Figure C-5. Format Default Screen

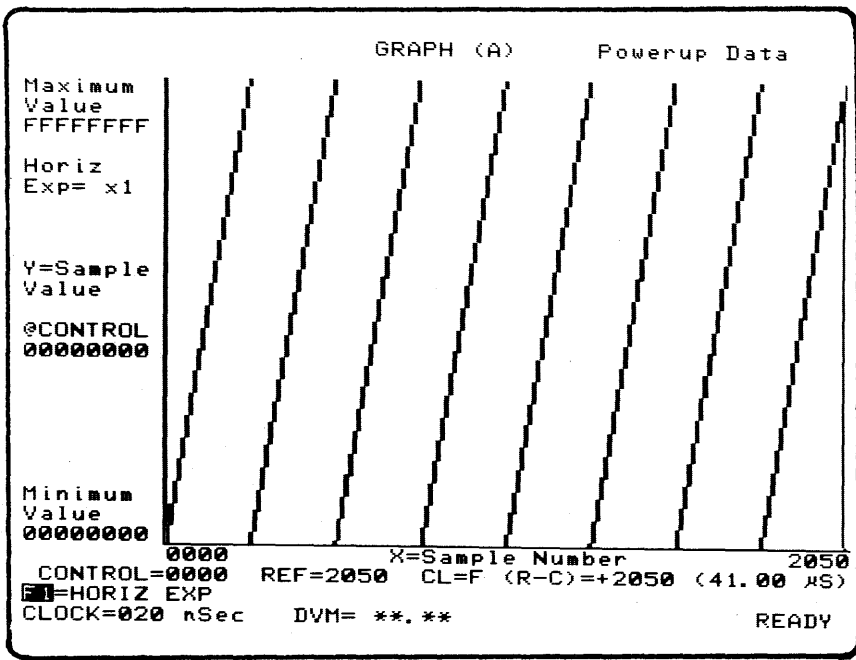


Figure C-6. Graph Default Screen

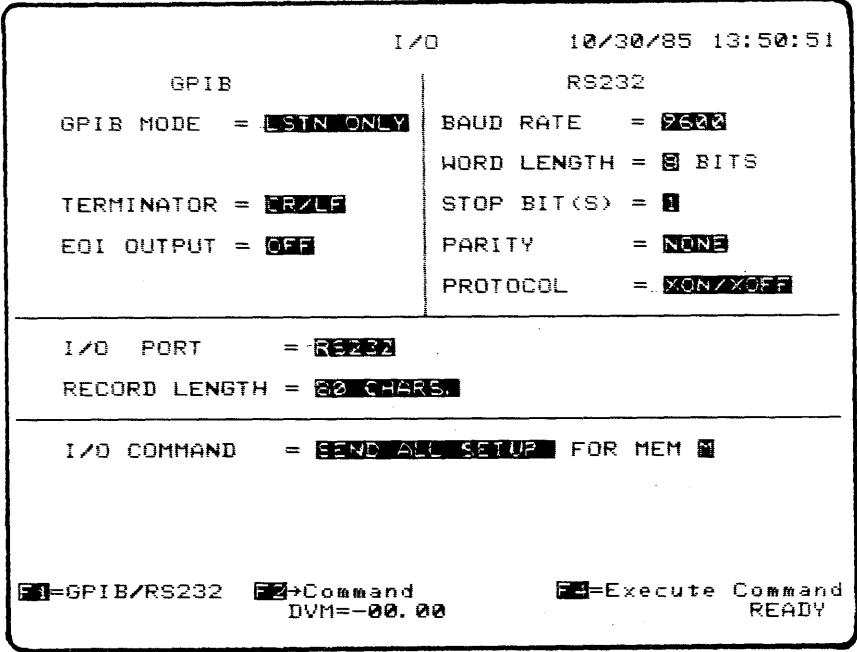


Figure C-7. I/O Default Screen

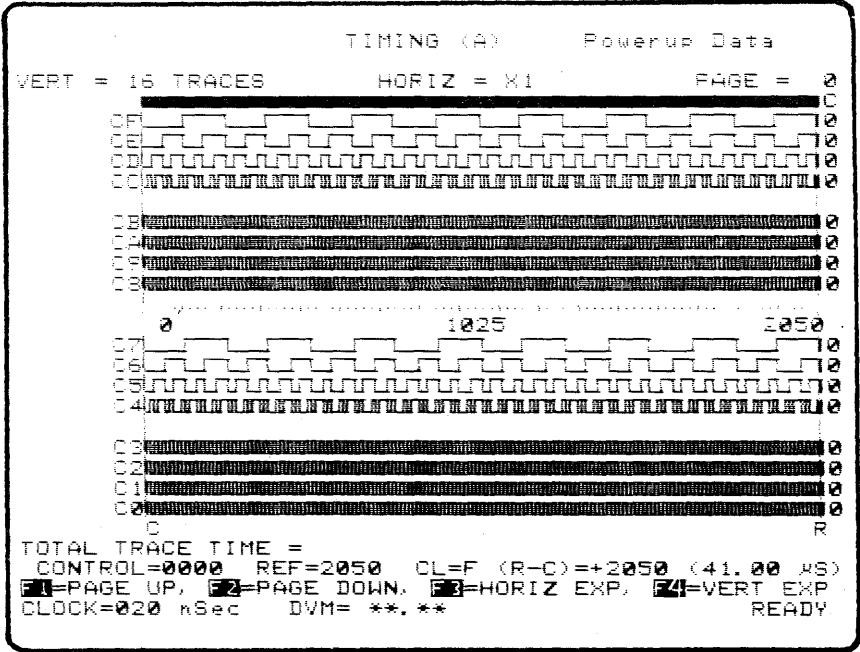


Figure C-8. Timing Default Screen

LVL COMMAND SEQUENCE:
0:TRACE UNTIL SAMPLE = TRIGGER
1:TRACE FOR 01023 CLOCKS

PATTERN DEFINITIONS:
NAME: HHHH HHHH HHHH
00 ENABLE =XXXX XXXX XXXX
01 TRIGGER =XXXX XXXX XXXX
02 =XXXX XXXX XXXX

→TOP CMD, →TOP PTRN
DVM=-00.00

READY

Figure C-9. Trace Default Screen

Part No. 0121-0355-10

December, 1986

**Gould
K450A
LOGIC ANALYZER**

**ADDENDUM TO K450 LOGIC ANALYZER
USER'S MANUAL**



GOULD
Electronics

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Chapter 1

K450A LOGIC ANALYZER DESCRIPTION

INTRODUCTION

This addendum manual describes extended features of the K450 Logic Analyzer which are incorporated in the K450A equipment configuration. This Addendum should be used with the K450 Logic Analyzer User's Manual (Publication Number 0121-0004-10).

K450A FEATURES

All operating features described in the K450 User's Manual are applicable for the K450A except for the following features listed below.

- System Panel Screen
- Stopping Data Transmission with TeleDiagnosis
- Single Disk Storage System
- Power Fuses for Rated Voltages

These features are unique for the K450A, and details of each feature are presented in subsequent paragraphs.

SYSTEM PANEL SCREEN

The System Panel Screen (Figure 1-1) is accessed only from the Power Up Screen by pressing the F3 key. This screen allows the user to set the Date and Time, enable and disable the Error Beep, and vary the Brightness of the CRT.

The procedure to set the Date and Time, and Enable/Disable the Error Beep is the same as described in Chapter 4 of the K450 User's Manual.

The System Panel Screen for the K450A includes the capability for adjusting the intensity of the CRT via software control. After accessing the System Panel Screen, Move the cursor to the BRIGHTNESS Field. Press and hold the up-arrow FIELD key to increase brightness. Press and hold the down-arrow FIELD key to decrease brightness.

11/04/86 14:26:24	
SYSTEM PANEL	
DATE = 11/24/86 TIME = 14:24:00 ERROR BEEP = ON	BRIGHTNESS ↑ ↓
DVM--00.00	READY

Figure 1-1. System Panel Screen

STOPPING DATA TRANSMISSION

The TeleDiagnosis Option allows a K450 Logic Analyzer at a local site to communicate with another K450 at a remote site via telephone lines. This operating procedure is described in the K450 TeleDiagnosis Option User's Manual Addendum (Publication Number 0121-0190-10).

If the user desires to stop the transmission while I/O transfer is in process, the CANCEL entry terminates the transmission. Pressing the SHIFT and I/O keys causes the transmission to stop. Existing conditions for stopping data transmission requires the local user to telephone the remote user that transmission/receiving operations have been terminated.

The K450A feature for the CANCEL operation also sends a Control-C (EXT) character to inform the remote K450 to stop further transmission and receiving of data. This feature eliminates the need for verbal communication between the local and remote operators.

K450A DISK STORAGE SYSTEM

The K450A Disk Storage System (DSS) is configured as a single 5 1/4-inch floppy disk drive installed on the top cover of the logic analyzer chassis. A separate chapter is provided in this Addendum to describe the DSS operating procedure (see Chapter 6).

POWER FUSES FOR RATED VOLTAGES

The K450A uses the following fuses for system power:

VOLTAGE RANGE	FUSE
90 vac to 135 vac	3AG, 6 Amps.
180 vac to 270 vac	3AG, 3 Amps.

Chapter 6

DISK STORAGE SYSTEM

GENERAL

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 system stores recorded data and the setups used to record data. The DSS is also used to load disassemblers and accessory programs. 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. It is possible to run out of directory space without filling up the disk.

The storage allocation is as follows:

Total storage capacity = 4096 bytes/track
X 80 tracks = 328K bytes.

Formatted data disk = 320K bytes (since the loader and directory files occupy 8K).

Formatted system disk = 298K bytes (since the system occupies 22K and the loader/directory occupies 8K).

User interface to the DSS is accomplished through the logic analyzer keyboard. The DSS Operating System software is designed to support both a dual (A/B) or single (A) disk-drive system. The commands used to operate the dual-disk system also apply for the single disk-drive system. The software defaults to Drive A options and treats Drive B entries as errors. The active disk is always Drive A.

When performing Copy, Format, and Sysgen operations with two diskettes and a single drive system, it is necessary to interchange the first and second diskettes with each other in response to user prompt instructions displayed on the screen.

CONTROL KEYS

The Disk Storage System is controlled by the user via the logic analyzer keyboard. The function keys, listed in Table 6-1, provide the interface for execution of disk functions.

Table 6-1. Logic Analyzer Major Function Keys

KEY	FUNCTION
LEFT ARROW	Moves the CRT cursor left
RIGHT ARROW	Moves the CRT cursor right
PREVIOUS	Selects the previous choice
NEXT	Selects the NEXT choice
I/O	Enters the I/O menu screen
HELP	Calls the Help menu
F1-F4 Soft-Keys	Function of the soft keys is dependent upon the current screen and active field being viewed. The definitions of soft keys for the current conditions are displayed at the bottom of the screen.

OPERATING PROCEDURES

The following paragraphs provide step-by-step procedures for operating the DSS.

Loading the DSS Software

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:

K450 DOS BOOT, Version 1.0
BOOT COMPLETE
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

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.

K450 DOS BOOT, Version 1.0
BOOT COMPLETE
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 the 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 of this chapter. 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
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 6-2. 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.)

Table 6-2. Edit Mode Quick-Key Options

MATCHING		
FILE TYPE	FILE (OPTION FIELD)	QUICK-KEY
SM	Setup M memory parameters for next recording	(0)
SA	Setup A memory parameters for next recording	(1)
SB	Setup B memory parameters for reference	(2)
MA	Memory A recorded data	(3)
MB	Memory B recorded data	(4)
BA (Types MA & SA combined)	Both the memory A setup parameters & memory A recorded data	(5)
BB (Types MB & SB combined)	Both the memory B setup parameters & memory B recorded data	(6)
	Utility files such as disassemblers, Diagnostics, etc.	(7)

NOTE: Refer to the two lines near bottom of screen. These two lines, command and soft key, help guide the user through the command selection and execution process. In addition, error messages are displayed at the top of the screen

SYSTEM FILES

Each DOS file is a collection of related information that is stored on a floppy disk. Numerous files can be created on the disk, each with a unique name. The DSS uses the following category of files:

1. Setup file: contains 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.
2. Memory file: contains 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, and DVM readings are stored.
3. Utility file: contains executable code for logic analyzer. These files are currently provided for disassemblers.

The above described files are stored on tracks 2 through 79 of the 5-1/4-inch diskettes. The file directory is stored on disk track 1. Every time a file is created or updated, the appropriate entries (filename, location and length) are made in the directory.

The DOS can exchange files within the setup file category (e.g. setup file A with setup file B). Files cannot be exchanged between categories (e.g. 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. This feature prevents the user from inadvertently locking up the logic analyzer by recalling illegal setups.

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 can be 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. The character options available for the file type are listed in Table 6-3.

The user should note that as the Save or Recall command option fields are changed, the file type option field also changes to coincide. However, when the file type option field is changed, the Save and Recall command option fields do not change. This dissimilarity in operation allows the user to exchange files within a category.

Table 6-3. File Type Character Options.

MATCHING		
FILE	FILE CONTENTS (OPTIONS FIELD)	QUICK-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 (Types MA & SA combined)	Both the setup parameters for memory A and memory A recorded data	(5)
BB (Types MB & SB combined)	Both the setup parameters for memory B and memory B recorded data	(6)
	Utility files such as 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 6-4.

Table 6-4. 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 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 (i.e., 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 of his choice. 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. Of the three fields in a filename, 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 soft key, or enter a version number directly from the keyboard.

The third field (file type) is controlled by the system. To avoid illegal entries, keyboard entries are not permitted in this field. To select a file type, press one of the quick keys defined in Table 6-3. Alternatively, press the NEXT/PREVIOUS key to select a file type.

AUTO DIRECTORY OPERATION

Auto Directory operation allows the user to select filenames contained in the directory of the current disk for use in the command line of the DOS. This simplifies Copy and Rename operations.

When moving the cursor from the command field, the top directory entry is in reverse video and the file appears in the command line. All files in the directory can be accessed by moving the cursor up or down.

When the selection cursor is progressively 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. Quick key (0) corresponds to the first filename, and quick key (F) corresponds to the sixteenth filename.

When the filename command field is first selected, it changes to display 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 to coincide with each other as the fields are alternately selected.

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 cursor right-arrow key, EDIT key, and the associated quick-key.

The NEXT/PREVIOUS key may also be used to select an option.

Press the F4 key to execute the selected command. Figure 6-1 shows the Directory with the Save command selected and default options shown at the bottom of the screen.

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.

```
01/28/86 14:53:26
k450 Disk Operating System, version 1.0, rev 50

Directory of A: - Page 1
Filename Date Time Attribute
-----
A: DOS450-10.SYS 11/06/85 15:23:05 Locked
A: K450D -11.EXE 01/27/86 08:26:50 Unlocked
A: THDIAG-01.EXE 01/28/86 11:29:44 Unlocked
A: SETUP -01.SM 01/28/86 14:51:41 Unlocked
A: SETUP -02.SM 01/28/86 14:52:02 Unlocked
A: DATA -01.MA 01/28/86 14:52:03 Unlocked

71 BLOCKS USED, 87 BLOCKS REMAINING

SAVE Setup M to A:FILE -01.SM
F1= INC VER F2= DEC VER F3= DIR F4= EXECUTE
DVM=-00.00 READY
```

Figure 6-1. Directory with a Selected Save Command

SAVE Command

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 6-5. Each command option, can be selected in the Save option field by pressing the quick-key indicated in the quick key column, or alternatively using the NEXT/PREVIOUS keys.

Table 6-5. Save Command Options

OPTION	FORMAT	FUNCTION	QUICK KEY (EDIT)
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)

The Save command may be selected via the Quick Mode (see Figure 6-2). This mode makes specific files accessible without proceeding through the Directory display. When the Quick Mode is selected, the lower portion of the CRT screen allows the user to select a pre-recorded file via the Auto Directory Mode or Edit Mode. The advantage of the Quick Mode is that the major portion of the original display remains on the screen.

```

                                DATA (A)      01/28/86 14:57:23

SEARCH = X XX XX
          L HH HH
C 0000   F 00 00   0021   0 10 01   0042   0 10 04
0001   0 10 00   0022   0 10 01   0043   0 10 04
0002   0 10 00   0023   0 10 01   0044   0 10 04
0003   0 10 00   0024   0 10 01   0045   0 10 04
0004   0 10 00   0025   0 10 01   0046   0 10 04
0005   0 10 00   0026   0 10 01   0047   0 10 0C
0006   0 10 00   0027   0 10 03   0048   0 10 08
0007   0 10 00   0028   0 10 02   0049   0 10 08
0008   0 10 00   0029   0 10 02   0050   0 10 08
0009   0 10 00   0030   0 10 02   0051   0 10 08
0010   0 10 00   0031   0 10 02   0052   0 10 08
0011   0 10 00   0032   0 10 02   0053   0 10 08
0012   0 10 00   0033   0 10 02   0054   0 10 08
0013   0 10 00   0034   0 10 02   0055   0 10 08
0014   0 10 00   0035   0 10 02   0056   0 10 08
0015   0 10 00   0036   0 10 02   0057   0 10 00
0016   0 10 00   0037   0 12 04   0058   0 10 10
0017   0 10 01   0038   0 10 04   0059   0 10 10
0018   0 10 01   0039   0 10 04   0060   0 10 10

                                *450 DOS, v1.0

SAVE          Setup M          to A:FILE  -01.SM
F1= INC VER  F2= DEC VER  F3= DIR      F4= EXECUTE
CLOCK=100 nSec  DVH=-00.00          READY

```

Figure 6-2. Quick Mode Display

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

In this case, the user may 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.

RECALL Command

The Recall command loads information Files (e.g., setup parameters, setup menus, recorded data, etc.) from the disk into logic analyzer memory A or B. The Recall command contains the options described in Table 6-6. Each option may be selected by pressing the EDIT key and then the quick-key as indicated in Table 6-6.

Table 6-6. Recall Command Options

OPTION	FORMAT	FUNCTION	QUICK KEY (EDIT)
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 Menus	(1)
Setup	B	Loads reference memory B setup parameters and timing display labels from a specified file into logic analyzer Memory B	(2)
Memory	A	Loads memory A recorded data and active trace level for each sample from a specified file into logic analyzer 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 logic analyzer Memory B	(4)
MA & SA		Loads memory A setup parameters and recorded data from a specified file into logic analyzer Setup A Menus and Memory A	(5)

Table 6-6. (Cont'd.)

OPTION FORMAT	FUNCTION	QUICK KEY (EDIT)
MB & SB	Loads memory B setup parameters and recorded data from a specified file into logic analyzer Setup B Menus and Memory B	(6)
Utility	Loads a currently loaded 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 Command

The Delete command erases any specified unlocked file from the disk. This command has the options described in Table 6-7. Each option can be selected in the Delete option field by pressing the EDIT key and then the quick-key indicated.

Table 6-7. Delete Command Options

OPTION FORMAT	FUNCTION	QUICK KEY (EDIT) *
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)

***NOTE:** The non-Edit Mode of Delete operation is described in section for "Auto Directory Operation"

COPY Command

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. Continue processing by pressing the F4 key. In this case, the old file is erased and the new information is copied from the source file.
2. A second choice is to change the filename and press the F4 key to execute the Copy command.
3. A third choice is to abandon the processing by reselecting the copy command.

The Copy command has the options described in Table 6-8. Each option can be selected in the Copy option field by pressing the EDIT key and then the quick-key as indicated.

NOTE: The wildcard character (*) described under the paragraph titled "Wildcard Character with Filename" can be used with the Copy command.

The non-Edit mode of operation is described in the section titled "Auto Directory Operation".

Table 6-8. Copy Command Options

OPTION FORMAT	FUNCTION	QUICK KEY (EDIT)*
COPY Filename to filename	Copies the specified files, except system file to specified files.	(0)
COPY SOURCE to DESTINATION	Copies all files, except the system file to the destination	(2)

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.

When the command line is properly configured, perform the following sequence of 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 DISKETTE 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 the message:

COMMAND DONE

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

A: (filename), FILE ALREADY EXISTS

RENAME Command

The Rename command allows the user to change the name of an existing file. This command has a single option as described in Table 6-9. The option can be selected in the Rename field by pressing the EDIT key and then quick-key (0) as indicated.

Table 6-9. Rename Command Option

OPTION FORMAT	FUNCTION	QUICK KEY (EDIT) *
RENAME A:FILENAME	Changes the name of a file on disk to a new name	(0)

***NOTE:** The non-Edit mode of operation is described in the section titled "Auto Directory Operation".

The user must specify both the old and new filenames completely before executing the Rename command. If not, the following message appears on the screen:

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

In this case, the user can 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 command

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 6-10. 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.

NOTE: The wildcard character (*) described in the paragraph titled "Wildcard Character with Filename" can be used with the Lock command.

Table 6-10. Lock Command Option

OPTION FORMAT	FUNCTION	QUICK KEY (EDIT) *
LOCK A:Filename	Causes specified files on disk to be write and erase protected	(0)

***NOTE:** The non-Edit mode of operation is described in the section titled "Auto Directory Operation".

UNLOCK Command

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 6-11. 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.

NOTE: The wildcard character (*) described in the paragraph titled "Wildcard Character with Filename" can be used with the Unlock command.

Table 6-11. Unlock Command Option

OPTION FORMAT	FUNCTION	QUICK KEY (EDIT) *
UNLOCK A:Filename	Causes specified files on disk to be completely accessible to user	(0)

***NOTE:** The non-Edit mode of operation is described in the section titled "Auto Directory Operation".

DIRectory Command

The Directory command displays all or a selection of filenames stored on the disk. File listings include the filename, date and time, and the locked or unlocked attributes for each selected file. The command has two options described in Table 6-12. Each option can be selected in the Directory option field by pressing the EDIT key and then the quick-key. Press the F4 key to execute the command.

NOTE: The wildcard character (*) described in the paragraph titled "Wildcard Character with Filename" can be used with the Directory command.

Table 6-12. Directory Command Options

OPTION FORMAT	FUNCTION	QUICK KEY (EDIT) *
Filename	Displays specified filenames in the Directory screen	(0)
DIR A	Displays all filenames on disk	(3)

***NOTES:** The non-Edit mode of operation is described in the section titled "Auto Directory Operation".

Only 16 filenames can be displayed at one time. The PAGE UP or PAGE DOWN soft keys must be used to access other groups of 16 filenames. Rollover occurs from the last filename to the first filename. These soft keys only appear with the DIR command and not the F3 DIR command.

When the Directory command is executed, the filename and file attribute (locked or unlocked) is displayed on the screen. File size is also included in the display when a single file is listed. A typical screen is shown in Figure 6-3. In addition, the number of blocks used and unused are indicated at the bottom of the screen.

```
01/28/86 14:57:23
Command done.
K450 Disk Operating System, version 1.0, rev 50

Directory of A:
Filename      Date      Time      Attribute  Size
-----
A:SETUP -01.S1 01/28/86 14:51:42 Unlocked   4

71 BLOCKS USED,      87 BLOCKS REMAINING

DIR
F1= PAGE UP  F2= PAGE DWN  F3= DIR  F4= EXECUTE
DVM=-00.00  READY
```

Figure 6-3. Display of Executed Directory Command

FORMAT Command

CAUTION

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 software. Disks must be formatted before any of the remaining system commands can be executed. The Format command has the option described in Table 6-13. This option can be selected in the Format option field by pressing the quick-key.

Table 6-13. Format Command Option

OPTION FORMAT	FUNCTION	QUICK KEY (EDIT)*
FORMAT A:DISKNAME	Causes floppy disk to be properly formatted	(0)

Select the Format command, and move the cursor right 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 soft key is pressed to execute the Format command, the following message appears on the screen:

WARNING: DISK WILL BE TOTALLY ERASED

Confirm that the floppy disk to be formatted is installed in the disk drive. Press the F4 soft key again to complete executing the format command.

REBOOT Command

The Reboot command reloads DOS software, loader and programs, into the logic analyzer RAM. The Reboot command has the option described in Table 6-14. This option can be selected in the Reboot option field by pressing the quick-key. Press the F4 key to execute the command.

Table 6-14. Reboot Command Option

OPTION	FORMAT	FUNCTION	QUICK KEY (EDIT)
REBOOT	A	Causes the DOS software on disk to be loaded into logic analyzer RAM	(0)

NOTE: Only like versions of the Disk Operating System can be rebooted. A different software version may cause the system to malfunction.

SYSGEN Command

The Sysgen command copies the Disk Operating System programs from a source disk to a destination disk.

CAUTION

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

To copy the DOS using the Sysgen command, perform the following sequence of 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, if desired.
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 DISKETTE 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

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