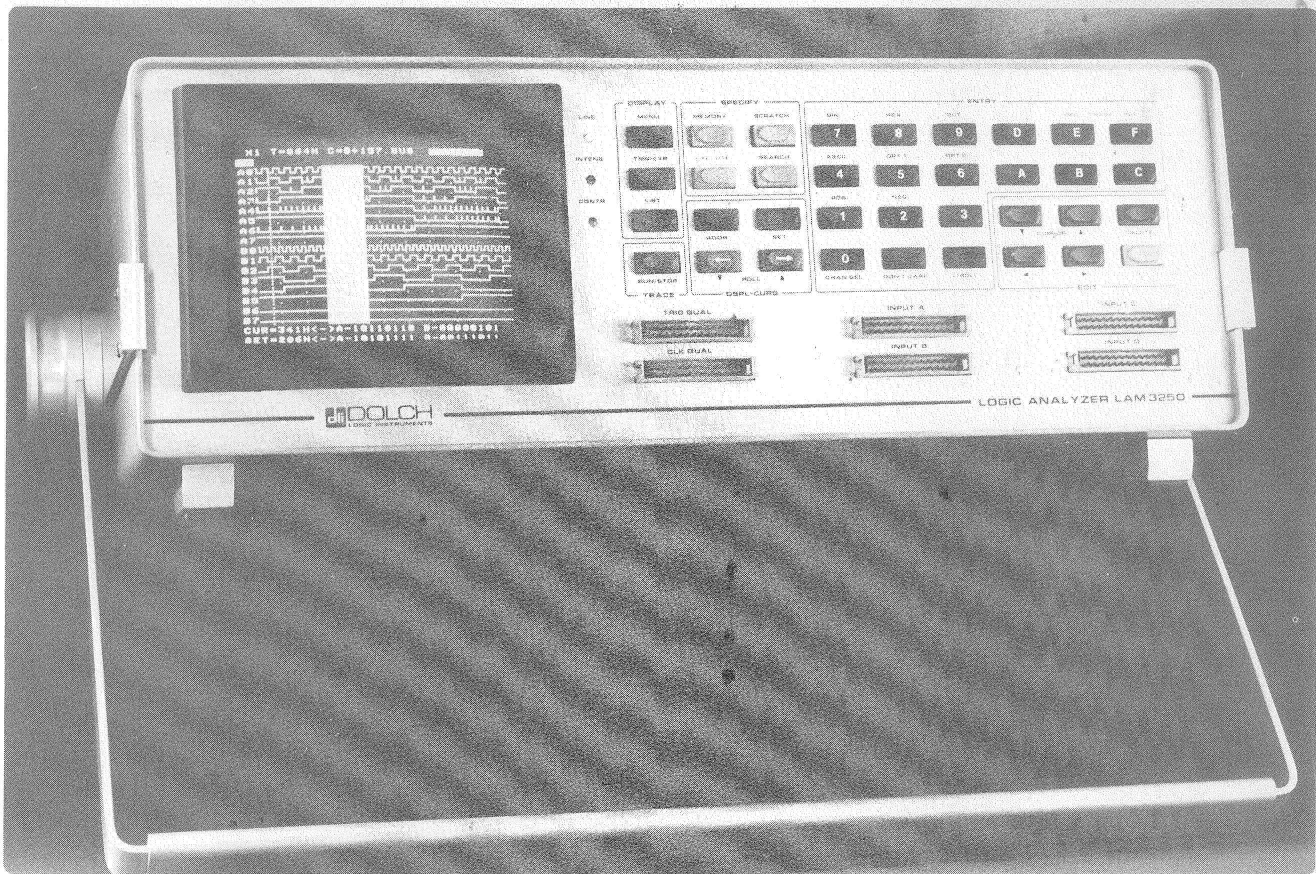


INSTRUCTION MANUAL

LAM 3250

DOLCH
LOGIC INSTRUMENTS GMBH

GmbH · Justus-v.-Liebig-Str. 19, D-6057 Dietzenbach / West Germany, Tel. (0 60 74) 20 66 · Telex 4 191 550 dli d
Inc. · 230 Devcon Drive, San Jose, CA 95112 / USA, Tel. (408) 9985730 - (800) 5387506 · Telex (910) 338-2023

TABLE OF CONTENTS

DECEMBER 1980 (from rev. 3.B)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

SECTION 1: GENERAL

1.1 INTRODUCTION

Logic analyzers have quickly become the most important tool available to the digital equipment specialist. Whether you use it to develop new systems or trouble shoot old systems, you will soon find it to be truly indispensible. The LAM 3250 is a third-generation product which brings together features and performance unavailable elsewhere.

To utilize these features, you must take the time to both learn what they are and understand how to call the programs. The time invested in a thorough reading of this manual will yield an immediate return. The LAM 3250 has many modes of operation, configurations, and features which will help you solve even the most subtle software or hardware problem. We hope that you will find the material presented below informative and easy to understand. Like our products, we are continually refining our manuals and solicit your comments. Continue reading for the details on how the LAM 3250 will help you solve your logic analysis tasks with speed and ease.

1.2 GENERAL

The LAM 3250 is a 32 channel logic analyzer. For convenience, each input port takes 8 inputs, and there are six input ports on the front panel. Clock, clock qualifiers, and trigger qualifiers enter through front panel ports. Internally, the analyzer is divided into two memory blocks, 16 bits wide and 1000 bits (words) deep, and each memory block can be clocked independently with external or internal clocks.

These two memory blocks can be organized in two ways. "Menus" are used to display the various choices you have and guide you in the set up procedure. The TRACE menu is used to set up the desired configuration.

A logic analyzer may be thought of as a memory through which the 32 channels of data are streaming. Triggering the analyzer means the opposite to triggering an oscilloscope, since when we trigger, we stop the stream - literally freezing time - so that we may then examine the interval of time before and after the trigger.

A one-to-four-level sequence must be satisfied by the input data prior to triggering the logic analyzer. To aid you with the choices, a Trigger Menu is available.

After we have captured the time around the trigger event (or after it, if desired) we then call upon the powerful compare and search features found in the COMPARE Menu. To allow the most sophisticated searching of data to be done, a Reference Memory is used. Troubleshooting intermittents is simple with the "baby sitting" features found in both the Trigger Menu and the Compare Menu.

In the timing mode, a cursor with powerful features is available.

No state of the art logic analyzer would be complete without data communication and control ports, so users of IEEE bus and RS-232 need not worry. Personality probes and disassembler firmware are available for many popular microprocessors.

We suggest that you read the next section briefly, since some of the terminology may be new for you and make specifications and features temporarily meaningless. Review them again after you have read Sections 4 and 5.

1.3 SPECIFICATIONS

1.3.1 SIGNAL INPUTS

Number:	48; including 32 data, 2 external clocks, 6 clock qualifiers, and 8 trigger qualifiers.
Impedance:	50 k, 5 pF at the probe tip.
Threshold:	Input channels A, B, C & D; clock 8 qualifiers may be separately assigned to one of the following four references: - TTL (Preset to +1.4 volts) - V1 & V2, each programmable from -9.9 volts to +9.9 volts in 0.1 volt increments. - ECL (Preset to -1.3 volts)
Maximum Voltage:	± 50 volts continuous; ± 250 volts transient.

1.3.2 SAMPLING

Internal Clock:	User programmable from 50 MHz (20 ns) to 2 Hz (500 ms). NOTE: 50 MHz ONLY AVAILABLE IN 16 BIT MODE.
External Clock:	One of two independent external clock sources can be user programmed and assigned to each input group with positive or negative edge active.
External Clock Frequency:	In 16 bit mode, DC to 50 MHz. In 32 bit mode; DC to 25 MHz.
Set Up Time:	Data must be present 5 ns before active edge of clock selected.
Hold Time:	Data must be present 2 ns after active edge of clock selected.
Qualifiers:	Each external clock can be conditioned by three true-when-high or true-when-low qualifiers. This performs a clock gating function.

Data Skew: Channel to channel, 2 ns typical.

Latch Mode: Whenever an even number of threshold transitions occur between two successive clock intervals, an input latch stores the state opposite that stored at the previous clock interval, thus detecting and recording "Glitches".

Minimum Detectable Glitch: 5 ns with 250 millivolts threshold overdrive.

1.3.3 TRIGGERING

Sequential Trigger Event Levels: Four sequential trigger event levels may be specified to complete the sequential trigger process. A "then" or "then not" algorhythm may be specified for each trigger event level.

Word Size: Each sequential trigger word may be user specified up to 40 bits wide (32 data + 8 qualifiers).

Code Selection: Each trigger word may be user specified in binary, hexadecimal or octal code, positive or negative logic.

Pass Counters: Each sequential trigger event level has an independent user programmable event counter ranging from 1 to 255 counts.

During the trigger process, real time pass counting is displayed by trigger monitor.

Restart Trigger: The fourth trigger event level may be set to perform a "restart" function.

Recording Delay: After the sequential trigger process, a trigger delay from 0 - 5000 in 32 channel mode or 0 - 6000 in 16 channel mode counts of internal or external clock may be selected before the recording is stopped.

Trigger Output: Two rear panel BNC connectors (A&B) provide a TTL signal. A is active high with every detected trigger word. B is active high after a sequential trigger process is completed.

1.3.4 SOURCE AND REFERENCE MEMORIES

Size:	32 bits by 1000 words recording (source) and 32 bits by 1000 words reference memory.
Organization:	Two blocks of 16 channels each with two different recording patterns.
Simultaneous Clock:	*) Each of the two 16 channel recording blocks may be independently assigned an internal or one of two external clock sources.

1.3.5 SCRATCH

A scratch register (with 3 months battery backup) provides a means of storing up to 6 different configurations of each basic operating mode for quick access to commonly used setup procedures.

1.3.6 COMPARE FUNCTIONS

Halt if:	Each time a trigger sequence (and delay) is completed, the unit arms itself and acquires new data in source memory which is compared to reference memory. Further recording is stopped if conditions previously specified, (R≠S, R=S) are met. The RS 232 (V 24) interface is activated dumping non-compare data during the "Halt if" mode. The output data includes the contents of the cycle and event counters.
Count if:	Each time a trigger sequence (and delay) is completed, the unit arms itself and acquires new data in source memory which is compared to reference memory. Each recording action increments a 5 digit cycle counter. An event counter (0 to 9999) is incremented whenever conditions are met which agree with those previously specified (R≠S, R=S).
Search:	Searches and compares reference and source memories and relocates the cursor to the next compare or non-compare location.
Compare Limits:	Any portion of the source memory may be compared to any portion of the reference memory. When the selected condition occurs (R=S; R≠S), this location and the following 19 locations are displayed.

*) A&B und C&D können bei INT - Clock nur mit gleicher Frequenz getaktet (eingelesen) werden! 17.12. 85 [illegible]

Compare Skew: Operates in conjunction with "Compare Limits". Checks if source and reference data matches within a selected skew range. Any skew from ± 0 to ± 9 can be assigned.

1.3.7 DISPLAY FORMATS

Menus: Three menus showing all recording, trigger and compare operations, may be displayed.

Timing Diagram: Sixteen channels of timing data from pods A and B or C and D may be displayed. Horizontal expansion of X1, X10, or X20 may be selected. Channels may be repositioned or blanked as desired. Cursor and cursor-set markers permit direct time measurement and display. Binary cursor and cursor-set location data is displayed.

Data List: User programmable selection of binary, hexadecimal, octal, ASCII or two optional codes. Positive or negative logic may be assigned to each input group.

1.3.8 MISCELLANEOUS:

Instrument Size:

	H	W	D
cm	15	46	52
inch	5.9	18.11	20.47

Weight: 16 kg

Power: 115 or 220/240 volts, (± 10%) 47-63 Hz; 150 VA.

NOTE: FACTORY SET VOLTAGE.

Temperature Range: 0 to 50 degrees centigrade ambient temperature.

SECTION 2: INSTALLATION

2.1 INITIAL INSPECTION

Upon receipt, inspect the shipping container for damage and check the accessories supplied with the instrument against the accessories list. The unit is supplied with the following accessories:

Quantity	Description
6	ALP 80 Active Logic Probe
1	Power Cord
1	Operating Manual
6	Packages of 10 Each multi-color Probe Clips and Leads

Perform a preliminary check-out procedure on the instrument in accordance with the instructions which follow. If the instrument is damaged, any accessories are not found, or the unit does not perform in accordance with the check-out procedure, notify your distributor immediately.

In the case of physical damage, notify the shipping agent as well and keep the packaging material available for inspection by the shipper's representative. In any case, it is advisable to keep the shipping carton and packing material, for use should the need ever arise to reship the instrument.

2.2 POWER REQUIREMENTS

The instrument has been factory-wired for the voltage and frequency used in the country of destination, in one of two configurations.

a) 115 volt nominal, 50/60 Hz

b) 230 volt nominal, 50 Hz (suitable for 220 volt and 240 volt applications)

Obtain the power cord from one of the accessory bags shipped with the instrument. Attach the power cord to the instrument at the rear panel connector labeled POWER. Toggle the front panel POWER switch to off (down) and plug the power cord into a grounded power receptacle supplying the appropriate voltage and frequency. The instrument will operate properly with an input voltage fluctuation of $\pm$ 10 of nominal. Total power consumption is 150 VA.

2.3 ENVIRONMENTAL CONSIDERATIONS

The instrument will work properly under ambient temperature conditions from 0-50 degrees centigrade. However, normal procedures should be observed to ensure that the side and bottom louvers and fan intake remain unobstructed during operation. If the fan should become inoperative, it is recommended that the unit not be used until the unit has been repaired.

2.4 PRELIMINARY CHECK OUT

Unpack the instrument and accessories and prove that the LAM 3250 is configured for the power supply voltage in the country of use. In general, units that have a serial number prefix "SI" are of American manufacture and intended for use with 115 volt 60 Hz power source. If a unit is required to operate with a power source other than in the country of delivery, contact your distributor.

Connect power to the instrument and switch on (switch on rear panel). The green power/on indicator on the front panel should illuminate and after approximately 75 seconds the power up sign-on message must appear on the monitor. If at this stage the monitor remains dark, then try turning the front panel intensity control clockwise (through hole with a small screwdriver). If anything other than the sign-on message appears then hit the reset button on the rear panel. If problems persist then contact your distributor.

Included with the sign-on message is the revision number of the software in the machine in the form 'REV X.X' where X.X is the revision number; availability of any software decoding options (e.g., disassemblers) and pass/failure message for the power up self/test. See Figure 1.

NOTE:

> The failure message 'NONVOLATILE MEMORY ERROR!' does not necessarily imply a hardware failure of the machine. It may also be caused by scratch memory files which have not been loaded since manufacture or empty battery following long storage periods. Upon successful power up, push the - MENU - key and see that the FORMAT SPECIFICATION appears on the monitor.

2.5 SIGNAL CONNECTIONS

2.5.1 INPUT SIGNALS

The LAM 3250 accepts four types of inputs; data, trigger qualifiers, clock, and clock qualifier signals. These signals enter the instrument via the ALP 80 Active Logic Probe pods. The ALP 80 pods can be used interchangeably as the interface for these signals. During use, you may find it convenient to label the pods as to input function for reference purposes.

SIGN-ON MESSAGE

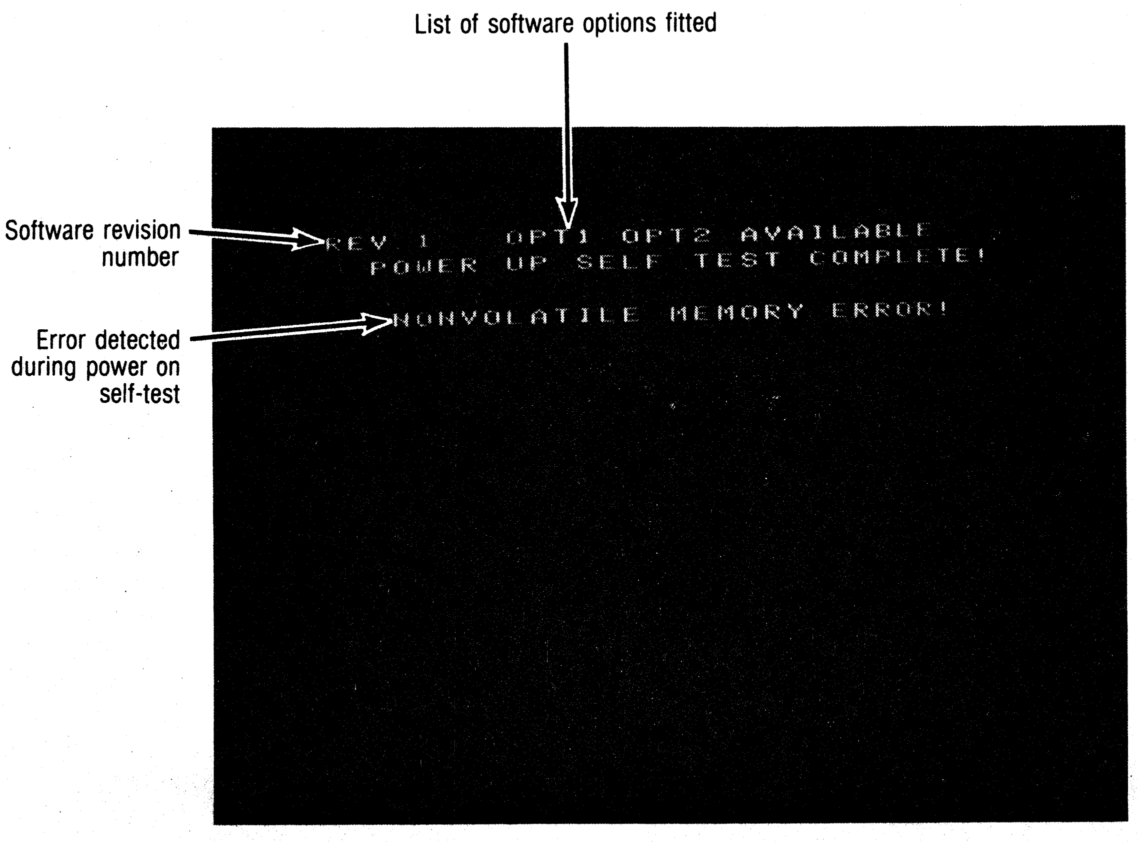


Figure 1

The input connectors and pods connectors are keyed to indicate proper mating.

CAUTION

PROPER MATING SHOULD BE VERIFIED BEFORE CONNECTION IS ATTEMPTED TO AVOID POSSIBLE EQUIPMENT DAMAGE.

2.5.1.1 Data Signals

There are five INPUT connectors on the front panel, labeled A through D and Q (= Qualifier).

The INPUT connector labels correspond to the pod assignments used in the various display formats. Pin assignments on the ALP 80 pods refer to the relative binary weights of the inputs:

"0" = LSB = 2^0 = 00000001 Binary

"7" = MSB = 2^7 = 10000000 Binary

Two ground pin locations are provided on each pod. The ground pins are labeled "$\underline{1}$".

2.5.1.2 Clock and Clock Qualifier Signals

An input connector on the front panel, labeled CLOCK/QUAL, accepts an ALP 80 pod for input of clock and clock qualifier signals. Three external clocks and three clock qualifiers can be connected. The following pin assignments apply to the ALP 80 pod when used for clock and clock qualifier inputs:

Pin	Clock and Qualifier	Pin	Clock and Qualifier
0	External Clock 1	4	External Clock 2
1	Clock 1 Q 1	5	Clock 2 Q 1
2	Clock 2 Q 2	6	Clock 2 Q 2
3	Clock 3 Q 3	7	Clock 3 Q 3

Two ground pin locations are provided, labeled "$\underline{1}$".

2.5.2 OUTPUT, CONTROL AND BUS INTERFACE SIGNALS

Output, control and bus interface signals are available at the rear panel connectors for various interfacing and control purposes. Figure 2 gives the pin designations of the RS 232/V24 connector.

Connector required for interfacing:

Miniature D type 25 Pole Plug eg. Cannon 25P

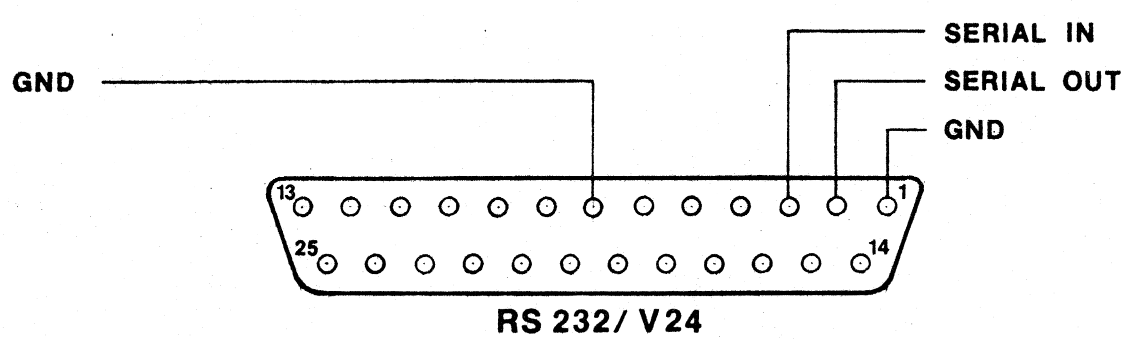


Figure 2

2.5.2.1 External Video Output

This connector is provided on European units for normal 625 line scan monitors.

2.5.2.2 Serial Communication Port

The connector labeled RS 232/V24 allows serial data to be sent and received. Data may also be written into the reference memory through a remote terminal. When used with a printing terminal, the instrument can do continuous monitoring of specified data patterns and give a print-out as soon as a fault is detected in this pattern.

2.5.2.3 IEEE - BUS Interface

The connector labeled IEEE-BUS can be used when the (IEEE 488) interface option is installed in the LAM 3250. An "-01" as the last two digits of the instrument serial number indicated that the IEEE - BUS (IEEE 488) option has been installed.

The IEEE 488 option will allow full remote programming of all keyboard selectable functions. It will allow data I/O to other IEEE 488 devices.

2.5.3 TRIGGER OUTPUTS

Two trigger outputs are available to allow further analysis of a fault in conjunction with an oscilloscope or other instrments. Trigger outputs are available at BNC connectors on the rear panel. Both trigger outputs are of TTL logic levels.

The connector labeled TRIG-OUT A provides a high to low signal transition whenever a trigger word is recognized. The connector labeled TRIG-OUT B provides a high to low signal transition after the complete sequential trigger process has been completed.

SECTION 3: DESCRIPTION OF CONTROLS AND CONNECTORS

3.1 THE FRONT PANEL CONTROLS AND CONNECTORS

(See Figure 3)

3.2 THE KEYBOARD

The LAM 3250 uses a keyboard entry system for control of setup and displays. The keys are arranged in six (6) functional groups which are described below.

3.2.1 KEY COLOR CODING

Color	Function		
RED	Recording	START/STOP	key
BLACK	Parameter	ENTRY	keys
GREEN	Edit	CURSOR	keys
BLUE	Display	CURSOR	keys
LIGHT GREY	Direct Function Execution keys. MEMORY, SCRATCH, SEARCH, EXECUTE ENTER		
DARK GREY	Display Control keys.		

3.2.2 FUNCTIONAL GROUPING

The keys are arranged into groups of specific functions which are described below:

3.2.2.1 DISPLAY Group

The keys in this group select display of menu, timing diagram, or data list on the monitor.

Pressing the - MENU - key causes display of the FORMAT SPECIFICATION. Pressing again causes display of the TRIGGER SEQUENCE and again display of the COMPARE menu.

Pressing the - TMG EXP - key causes the display of the timing diagram on the monitor in expansion X1 mode (Timing Domain display). Repeated pressing causes display in the expanded X10 and X20 mode.

The - LIST - key selects display of the data list (Data Domain display).

3.2.2.2 TRACE

The - RUN/STOP - key allows manual start and abort of a data recording.

3.2.2.3 DISPL-CURS Group

The Display Cursor group of keys allow Forward/Backward rolling of the display cursor in timing diagram and Up/Down rolling of the display in data list with the and - ROLL - keys. The position of the SET cursor (used for timing measurements) is controlled using the - SET - key and direct keyboard input of the display cursor is selected with the - LOC-entry key.

3.2.2.4 ENTRY Group

This group is used for input of many setup parameters; display control (e.g. list decoding bases); and control of storage and recall to and from the scratch memory as directed by the guiding headline message which appears on the monitor.

3.2.2.5 EDIT Group

Movement of the edit cursor during menu programming is controlled by the cursor keys ← → ↑ and ↓. In menu displays, all programmable fields are shown in inverted video. The current cursor position is shown by blinking the field. At the top of the screen appears a guiding line which directs the user how to change the value of a parameter. There are three types of programmable field:

1. Fields enclosed in square brackets, e.g., MAN . These fields are changed by using the - ROLL - key from the ENTRY group.

2. Fields enclosed in ≠ brackets, e.g., 50NS . These fields are changed by using the - INC - and - DEC - keys from the ENTRY group.

3. Digital fields must be entered using the - ENTER - key from the EDIT group. The value for these fields may then be directly entered with keys from the ENTRY group.

   The - DELETE - key will restore the value in a field to that before any change was made.

3.2.2.6 SPECIFY Group

The keys in this group are used for controlling various memory functions:

1. - SCRATCH - is used to select the non-volatile memory for storage and recall of setup procedures.

2. - MEM-select - is used to select display of source or reference memory and data transfer from source to reference memory.

3. - SEARCH - is used to initialize a search for a compare or non compare sample between source and reference memory.

4. - EXECUTE - is used to execute procedures which have been selected in this group.

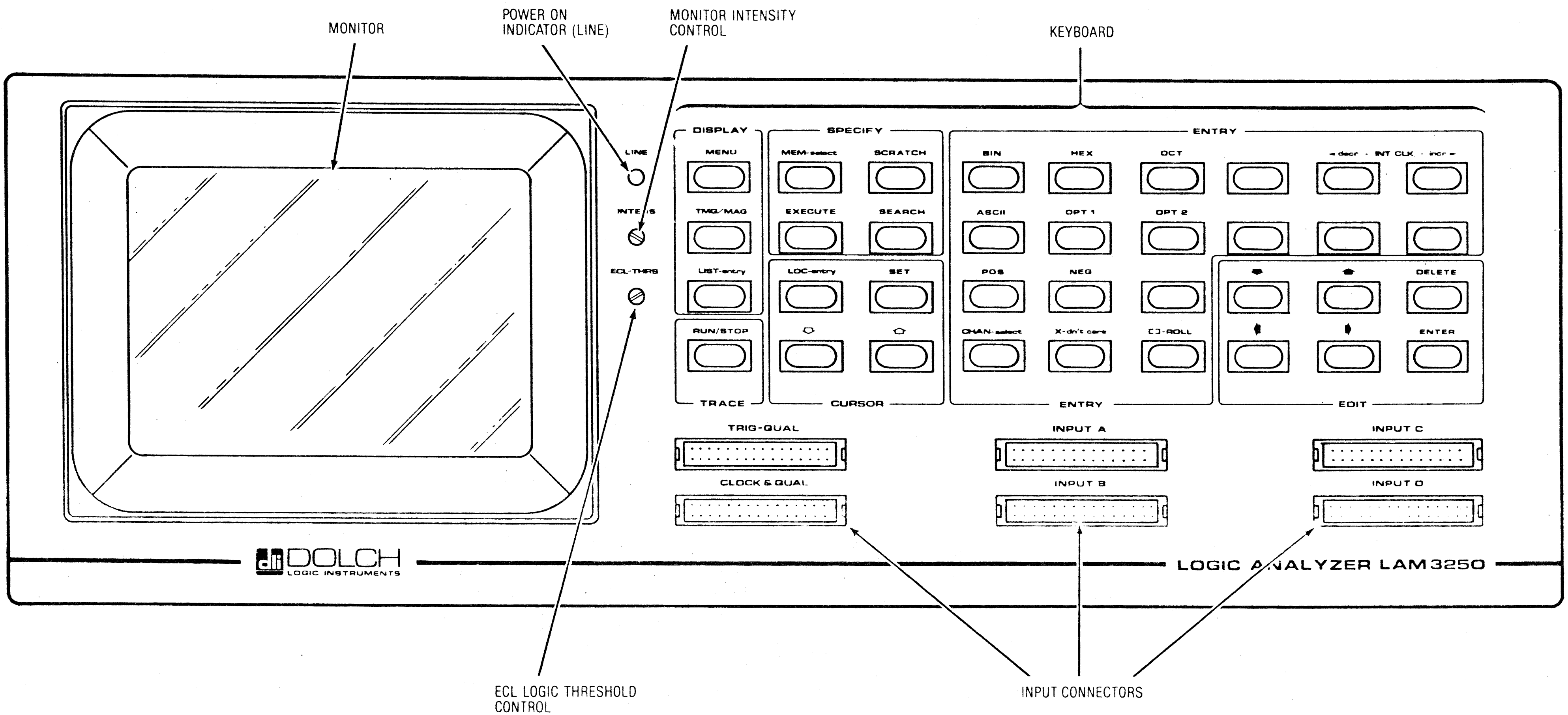

MONITOR
POWER ON
INDICATOR (LINE)
MONITOR INTENSITY
CONTROL
KEYBOARD
DISPLAY
SPECIFY
ENTRY
MENU
MEM-select
SCRATCH
BIN
HEX
OCT
◄ decr - INT CLK - incr ►
LINE
TMG/MAG
EXECUTE
SEARCH
ASCII
OPT 1
OPT 2
ECL-THRS
LIST-entry
LOC-entry
SET
POS
NEG
DELETE
RUN/STOP
CHAN-select
X-dn't care
[ ]-ROLL
ENTER
TRACE
CURSOR
ENTRY
EDIT
TRIG-QUAL
INPUT A
INPUT C
CLOCK & QUAL
INPUT B
INPUT D
DOLCH
LOGIC INSTRUMENTS
LOGIC ANALYZER LAM3250
ECL LOGIC THRESHOLD
CONTROL
INPUT CONNECTORS

Figure 3

3.3 THE REAR PANEL CONTROLS AND CONNECTORS .

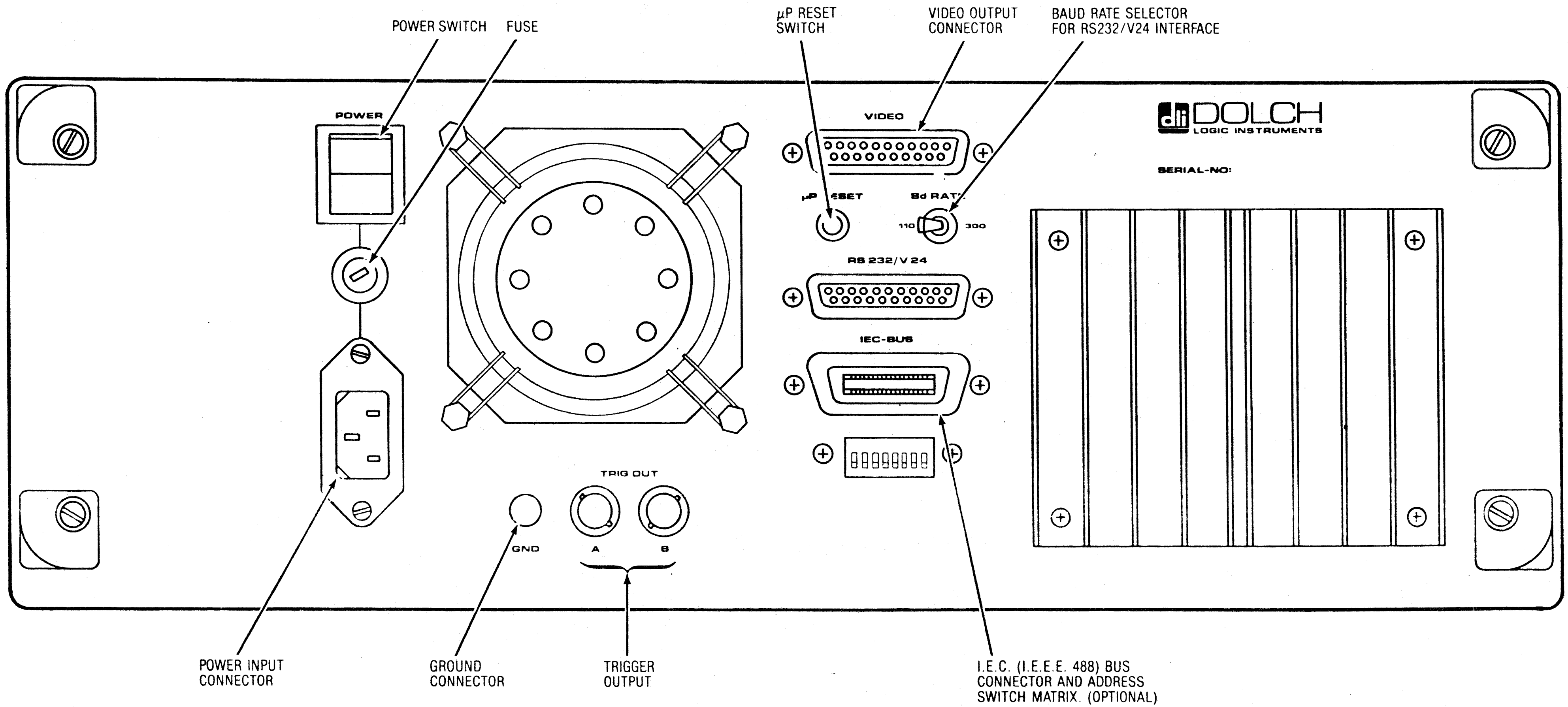


Figure 4

SECTION 4: MENU PROCESSING

4.1 INTRODUCTION

Three separate but interacting 'menus' are used to establish the data recording conditions of the LAM 3250. Menus are selected and displayed on the monitor by pressing the - [MENU] - key. Repeated pressing causes sequencially activation of the trace format specification, trigger specification, and compare specification.

Each specification or menu consists of an arrangement of parameter fields (marked in inverted video) by use of the keyboard. Prompting messages giving assistance to the operator appear in the top line on the screen.

4.2 USE OF THE EDIT KEYS

The edit cursor (marked by a blinking parameter field) is controlled by the cursor keys [←] [→] [↑] [↓] which cause it to move directly between parameters in a horizontal or vertical direction. Promptinq messages give further information about how to change the value of a selected parameter.

The - [DELETE] - key may be used to restore the original value of a parameter to what it was before it was changed, in the case of an input error.

The - [ENTER] - key is used to enter or allow direct input of the digits of a digital field. When the edit cursor is positioned over a digital field and - [ENTER] - is pressed, only the first digit of the field will blink, indicating that this digit may now be changed by input from the keyboard. Upon inputing a digit the cursor will move to the next digit except in the case of the last digit where the cursor will move to the next parameter. The horizontal cursor [←] and [→] may be used to move between digits of a parameter or away from a field.

4.3 CHANGING PARAMETERS

There are three types of parameter in the menus.

4.3.1 Roll fields which are enclosed in square brackets, e.g., [TTL] . When this type of field is addressed by the cursor it is only necessary to use the - [ROLL] - key to change its value.

4.3.2 Inc/Dec fields which are enclosed in pointed brackets, e.g., <100NS>. When this field type is addressed by the cursor then the value in the field may be increased or decreased using the - [INC] - and - [DEC] - keys.

4.3.3 Digital fields where it is necessary to press - [ENTER] - before setting up a new value directly using the digit keys 0-9 and A-F.

4.4 THE TRACE MENU (RECORDING FORMAT SPECIFICATION)

The trace menu is used to establish the analyzers' recording format. It is divided into four sections (separated by horizontal dashed lines) which are concerned with:

- Recording mode
- Logic Threshold selection
- Clock selection
- Clock and Clock Qualifier polarity selection

4.4.1 RECORDING MODE SELECTION

Using the paramater by the title 'MODE' the two logic analyzers may be configured in two ways:

- [16 BIT] which creates a 16 bit wide 2000 word deep analyzer operating up to a 50 Mhz sample rate (using input channels A and B).
- [32 BIT] which creates a 32 bit wide 1000 word deep analyzer operating up to a 25 Mhz sample rate using input channels A, B, C and D.

The parameter by the 'START' label is used to select three different operation modes.

- [MAN] where a recording is inititiated by pushing the - START/STOP - key.
- [REP] where pressing the START/STOP key initiates repeated recording cycles until the key is pushed again. In this operating mode, data may be displayed between recordings for up to 9 seconds. This display time is programmed in the field to the right of the 'START' mode parameter.
- [REM] which enables control over the extended V24/V28 interface.

NOTE

Selecting the [REM] mode will disable the IEEE control option (if fitted).

4.4.2 LOGIC THRESHOLD SELECTION

In this section the logic input threshold for the input pods A; B; C & D; and the trigger qualifier and clock pods.

RECORDING FORMAT SPECIFICATION

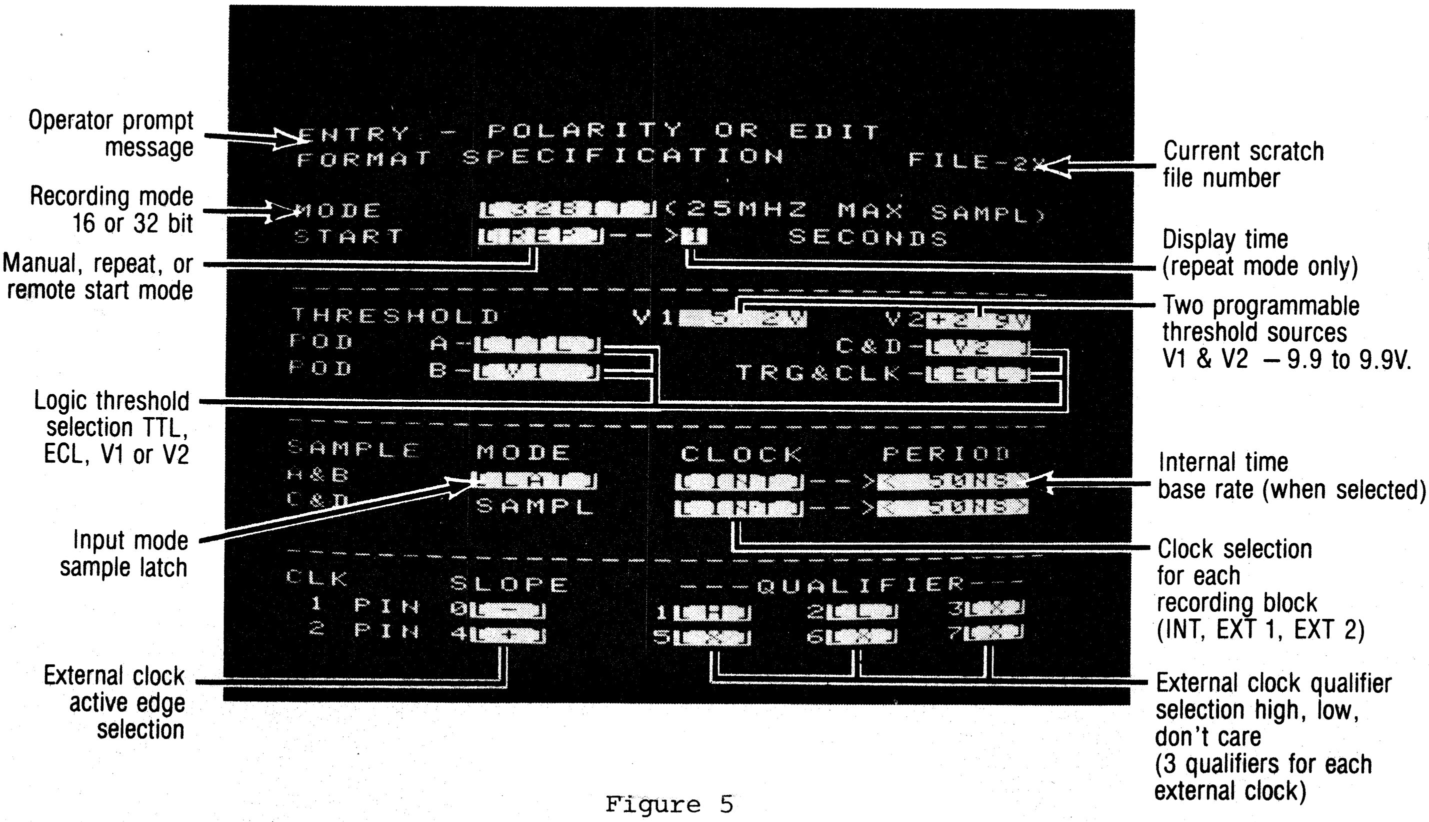


Figure 5

The threshold may be individually selected from:

- [TTL] +1.4 volt T^2L Logic Level
- [ECL] -1.3 volt ECL Logic Level
- [V1] -9.9 to +9.9 volt internal programmable voltage source
- [V2] -9.9 to +9.9 volt second internal programmable voltage source.

The two internal programmable voltage sources V1 and V2 may be programmed from -9.9V to +9.9V in 100mV steps.

4.4.3 CLOCK SELECTION

In this section the sample clock source for the input channel groups A & B and C & D may be assigned to

- Internal clocks [INT]
- External clock 1 [CK1]
- External clock 2 [CK2]

In the case in which the internal clock is selected, its rate may also be chosen in this section from 5~~2~~00mS to 20nS (50nS limit in 32 BIT mode).

For the input channel groups A & B the normal sample mode of operation may be selected [SAM], or the latch [LAT] mode, which enables the input glitch detector (see special applications).

4.4.4 CLOCK AND QUALIFIER POLARITY SELECTION

In this section, the polarity ([+] or [-]) of the two external clocks may be selected and the active level for each of the three qualifiers for each clock [H] , [L] , [X] .

4.5 TRIGGER SPECIFICATION (TRIGGER MENU)

The trigger menu provides the means of specifying the desired trigger conditions for a data recording. In order to control the four-level sequential trigger structure, it is also divided into five sections (i.e., one section/level and a final section for control of the trigger delay clocks). In each trigger level the following parameters are programmable:

1. The function for the level.
2. The event counter for the level.
3. The trigger word at this level.

TRIGGER MENU

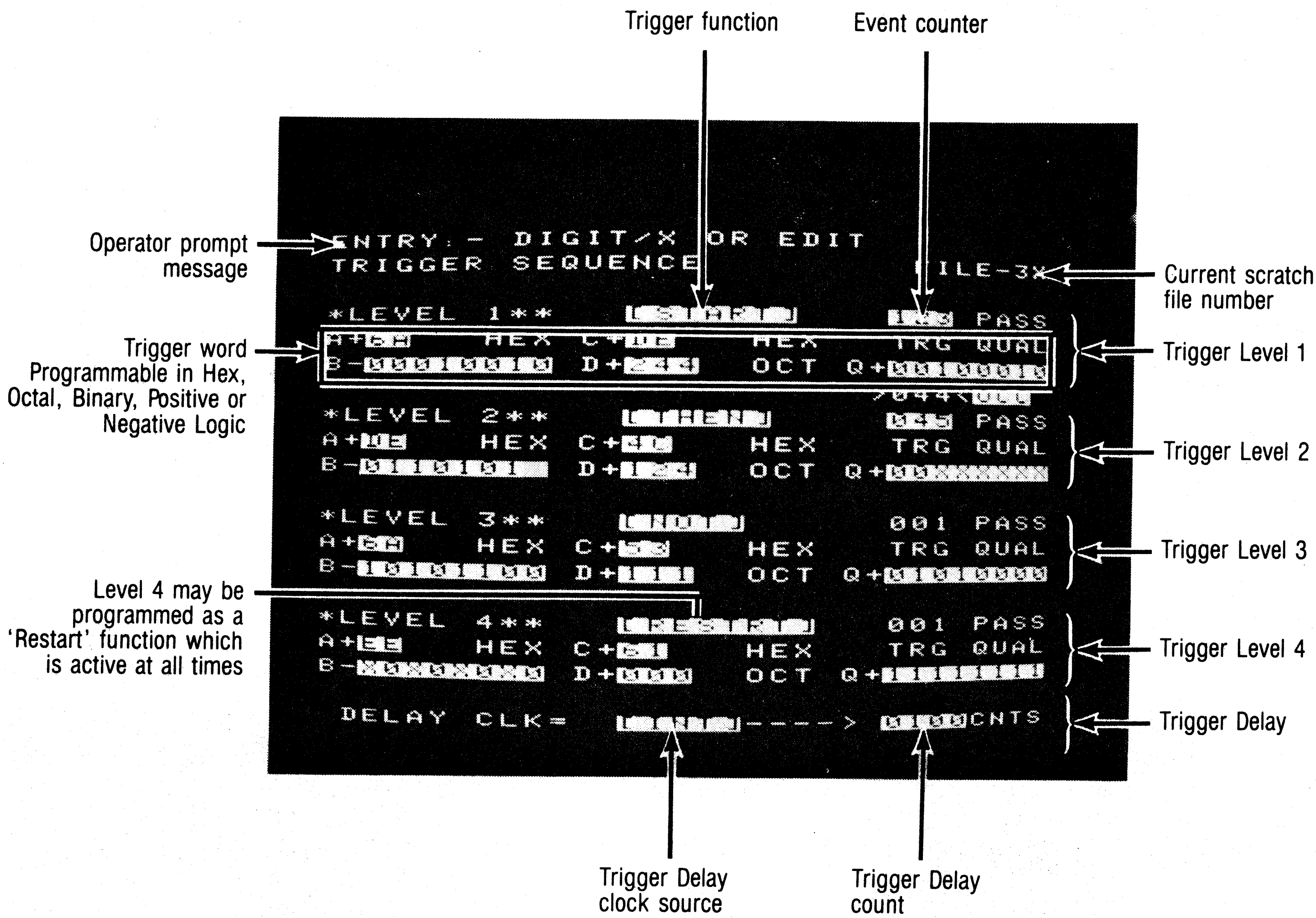


Figure 6

4.5.1 TRIGGER FUNCTION

The trigger function which may be specified in Level 1 is either 'FREE RUN' or 'START'. In 'FREE RUN' mode all other information programmed into the trigger menu is unused. Upon pressing the TRACE START button, the analyzer memory will be filled (1000 or 2000 samples) with data from the input channels and made available for display. When the 'START' function is specified in Level 1, then the trigger word specified in this level must be seen the number of times specified by the pass counter before proceeding to the next trigger level. In trigger levels 2, 3, and 4, the functions 'THEN', 'THEN NOT', and 'OFF' may be specified. The 'OFF' function programmed as trigger function causes this level to be ignored for trigger purposes. The 'THEN' function causes the trigger structure to wait for the appearance of a specified trigger word the number of times specified by the pass counter before proceeding to the next trigger level. The 'THEN NOT' function (abbreviated 'NOT' on the monitor) means that when a specified trigger word does not appear on the next event following the previous trigger level, then the trigger structure will proceed to the next trigger level, otherwise the trigger structure will be completely re-initialized. In trigger level 4, a further function may be selected - the 'RESTART' function. When a trigger word specified as a 'RESTART' function occurs at any time during the trigger procedure then the entire trigger structure will be restarted from Level 1.

4.5.2 EVENT (PASS) COUNTER

The event counter (1 to 255) specifies how often a trigger word must occur at a trigger level before proceeding to the next trigger level. The pass counter in trigger levels 2 to 4 is only programmable when a 'THEN' function is selected. Otherwise it is set to 001 and not accessible with the EDIT CURSOR.

4.5.3 TRIGGER WORD

The boolean trigger word to be sought at each trigger level is the logical AND of the word specified for pods A, B, C, D and Q. The Q or Qualifier pod is a group of 8 input channels which are not recorded by the analyzer being only available to extend the trigger word. The trigger word for each pod may be displayed and programmed in Hexadecimal, Octal or Binary bases - Positive or Negative logic levels. In order to change the display base for a trigger word, it is only necessary to select it with the EDIT CURSOR and enter the desired base or polarity using the 'ENTRY' keys. After pressing the - ENTER - key, the trigger word itself may be entered digit for digit using the 'ENTRY' keys.

4.5.4 TRIGGER CLOCK

A clock source which is used for recording in analyzer blocks A&B or C&D must be chosen for trigger clock. This is the clock to which the trigger structure will be synchronized and be used as trigger delay clock. The trigger delay counter is used to select the amount of pre-trigger and post-trigger data which is to be captured by the logic analyzer. The normal trigger point (with zero trigger delay) sits at the end of memory.

That is after a trigger is detected then data recording is terminated, capturing a complete memory full of pre-trigger data. Using the trigger delay counter, a post-trigger delay may be introduced so that post-trigger data may be captured and examined. For example, in 32 bit mode (set in FORMAT SPECIFICATION) a memory of 1000 words of data is available. A trigger delay of 400 will enable the user to see 600 samples of pre-trigger data + 400 samples of post-trigger data (= 1000).

4.6 COMPARE MENU

The compare menu provides the means of controlling the compare processor which method of letting the LAM 3250 'baby sit' or digital system, capturing intermittent failures or statistical information. The compare process allows repeated data recordings from a system under test (S.U.T.) to be compared with known good reference data and either stop or count on failures or non-failures. For the compare process, two "windows" or sections are defined in both the source and reference data, which one to be compared together. (See Figure 7)

4.6.1

When the compare process is started (with TRACE START while in compare menu) data recordings will be made and source data compares with reference data only inside these "windows." The compare menu allows the user to specify which input pods are to be included during the compare process, the start address and width of the windows in both source (SRC) and reference (REF) memories.

4.6.2 COMPARE FUNCTION

The following compare functions may be specified:

1. COUNT IF R = S

   When started indicates the total number of recording cycles made and the total number of successful compares.

2. COUNT IF R<>S

   When started indicates the total number of recording cycles made and the total number of unsuccessful compares.

3. HALT IF R = S

   When started halts the first time a successful comparison is made.

4. HALT IF R<>S

   When started halts the first time an unsuccessful comparison is made.

COMPARE

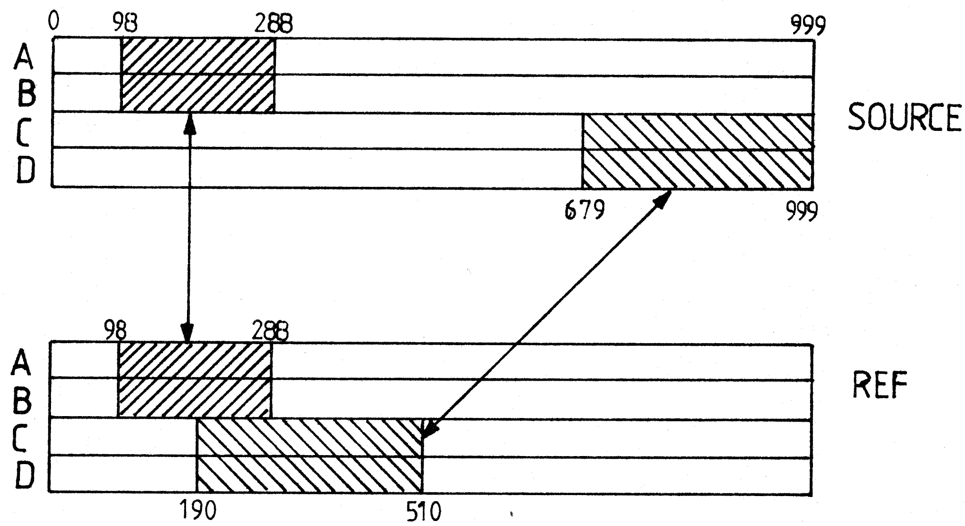


Figure 7

COMPARE MENU

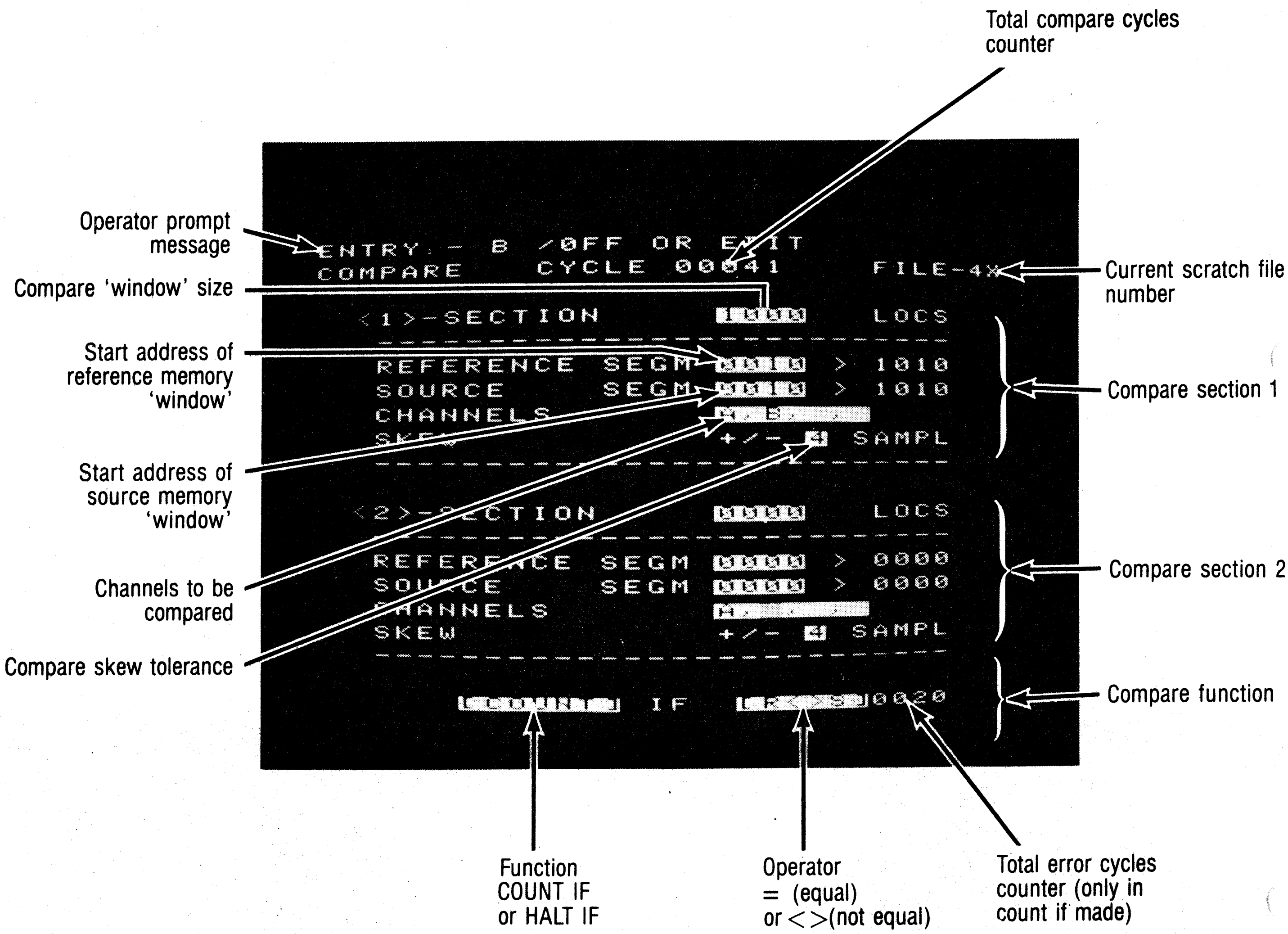


Figure 8

4.6.3 SKEW

When a data source is perfectly stable but an asynchronous recording method is used -- (INTERNAL CLOCK) a 'jitter' of ± 1 sample is always possible. The 'SKEW' parameter allows the user to specify an acceptable source data to reference data SKEW or 'jitter' from ± 0 to ± 9 data samples. This feature may be especially useful when controlling data which is derived from a magnetic recording medium where due to head alignment problems, transport speed variations, bit 'push apart' effects in the medium, a certain amount of data 'jitter' is always present.

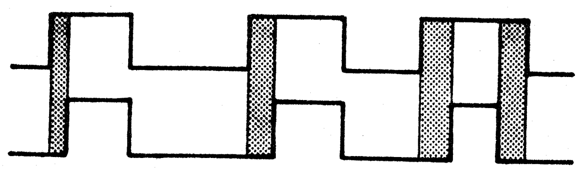


Figure 9

SECTION 5:

5. SCRATCH TABLE

Hitting the specify - SCRATCH - key causes display of the Scratch Memory Table. This table provides the means of accessing the non-volatile store for saving and recalling various setup procedures. This memory provides a means of storing up to 6 different setups for the trace format specification, trigger specification, compare specification, timing diagram configuration, data list display configuration, search mode configuration, and finally all states together.

5.1 SCRATCH STORE

In order to store a setup procedure in scratch memory, one must first use the EDIT CURSOR to select the store function and machine setup to be stored. The file number (1-6) in which the setup is to be saved is then entered using the ENTRY keys and - EXECUTE - pressed. The file number will then be automatically incremented. NOTE that storing all states to file X will overwrite the file X for each setup procedure.

5.2 SCRATCH RECALL

The EDIT CURSOR is used to select the RECALL function and setup state required. The file number to recall is then entered using the ENTRY keys and - EXECUTE - pressed. The setup procedure which has been recalled is now displayed on the monitor.

SCRATCH MEMORY CONTROL

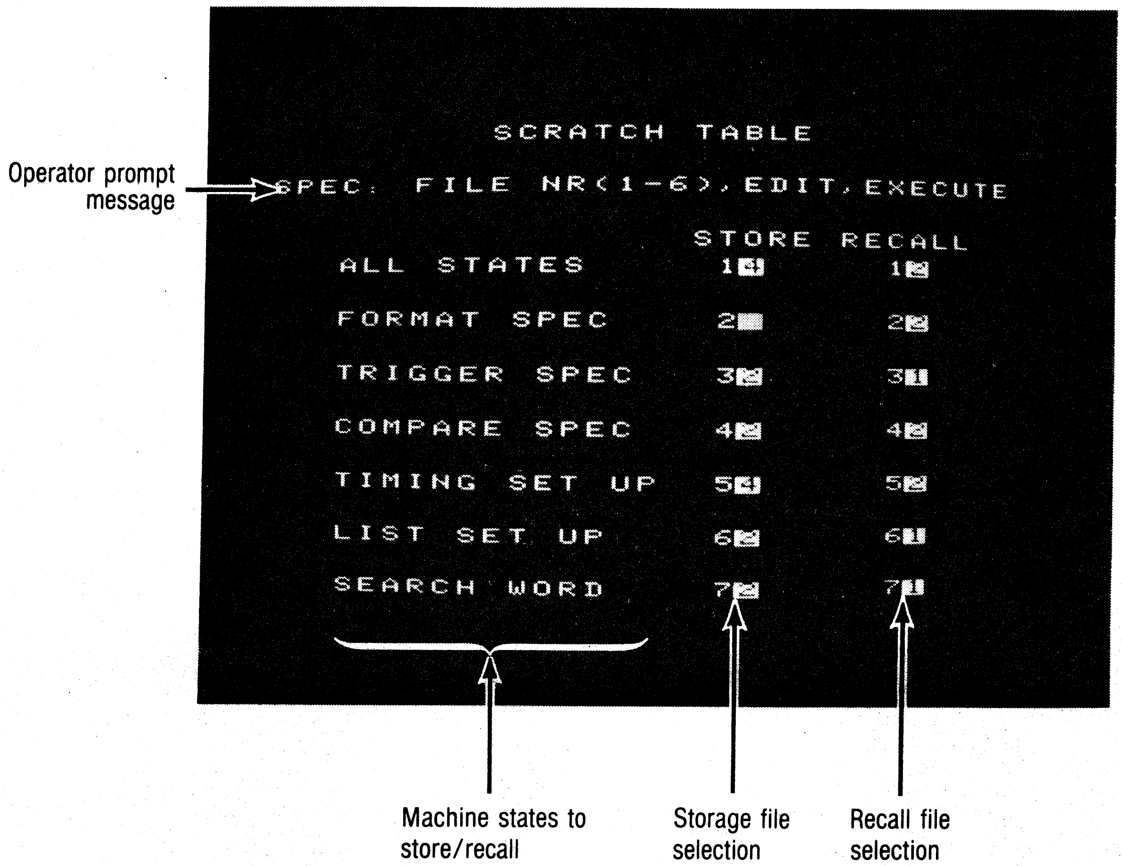


Figure 10

SECTION 6: TIMING DIAGRAM

6.1

A timing diagram is an effective way of displaying for analysis data related to hardware timing. The magnification facilities (X10 and X20) enable detailed examination of timing and phase relationship between signals. Selection of the timing diagram is made by pressing the DISPLAY - [TMG/MAG] - key; repeated pressing of this key selects X10, X20 or X1 expansion. The timing diagram is available for channels A & B following a recording in 16 channel X2K mode or for channels A & B or C & D in 32 channel X1K mode. All address information displayed upon the screen (cursor, trigger, etc.) is represented in decimal base and binary data at the cursor position is shown extra.

6.2 TIME DISPLAYED

The amount of time displayed on the horizontal axis is dependent upon the recording mode selected (16 channel or 32 channel) and the sample clock rate. The full scale time is calculated by multiplying the maximum number of samples (1000 or 2000) by the sample clock period: e.g., 16 channel, x 2000 sample mode and internal timebase 20nS.

2000 x 20nS = 40μ seconds

or 16 channel x 2000 recording mode and timebase of 500 mS

2000 x 500 mS = 17 minutes

6.3 THE TRIGGER MARKER

A trigger marker will be displayed on the timing diagram at the point in the data stream where the trigger sequence and delay was completed during data measurements. The trigger marker is not available when the instrument has recorded in 'FREE RUN' MODE or when a recording is manualy stopped before occurence of a specified trigger event.

6.4 THE CURSOR

A movable "cursor" is provided with the timing diagram to simplify the measurement of timing differences and to "call-up" specific addresses. The cursor is a solid vertical line extending through all data lines. The cursor address is indicated in the lower left-hand corner of the display and is labeled CUR=. The cursor is followed by the binary coded data from channel A and B at the cursor address. The cursor can be controlled in one of two ways:

6.4.1 Step or sweep motion is achieved by pressing the - **CURSOR** - control key or keys. Note that holding the - **CURSOR** - control key pressed will accelerate the cursor movement after four cursor steps.

6.4.2 Pressing the DSPL CURS - ADDR - key allows direct entry of a four digit decimal cursor followed by the EDIT - ENTER - key.

6.5 THE CURSOR "SET" MARKER

The "set" marker is a location in the data stream which is used to retain a previous cursor address. Pressing the DSPL CURS - SET - key causes the cursor address to become the new "set" location. The relative displacement between the "set" and cursor locations is very useful for timing measurements. This displacement is indicated in terms of time in the lower left of the display as CUR/SET = 1346 u seconds. This makes it easy to measure time relations by holding any cursor position with the - **CURSOR** - SET key and moving the cursor in the data stream. A translucent "curtain" will be displayed between the cursor and the "set" point. This curtain shows the relationship between the cursor and set points at a glance.

6.6 CHANNEL SELECTION

The display of timing channels may be reordered by pressing the ENTRY - CHAN SEL - key. A blinking cursor now appears at the top right of the screen. This cursor may be placed over the channel designation for any displayed channel using the - **EDIT CURSOR** - and keys. Now the new channel selection may be directly entered using the - **ENTRY** - keys.

6.7 TIMEBASE SELECTION

In the timing diagram display mode the internal timebase rate may be directly changed using the T'BASE - INC - and - DEC - keys. The selected value is displayed at the lower right of the screen.

6.8 DISPLAY BLOCK SELECTION

Following a data recording in 32 channel mode the user may display a timing diagram from channels A + B or C + D. In order to select the channel group for display press the ENTRY CHAN-select key. The selected channel display at the upper left of the screen will start to blink. Repeated pushing of the key will than select channels A + B or C + D for display.

TIMING DIAGRAM

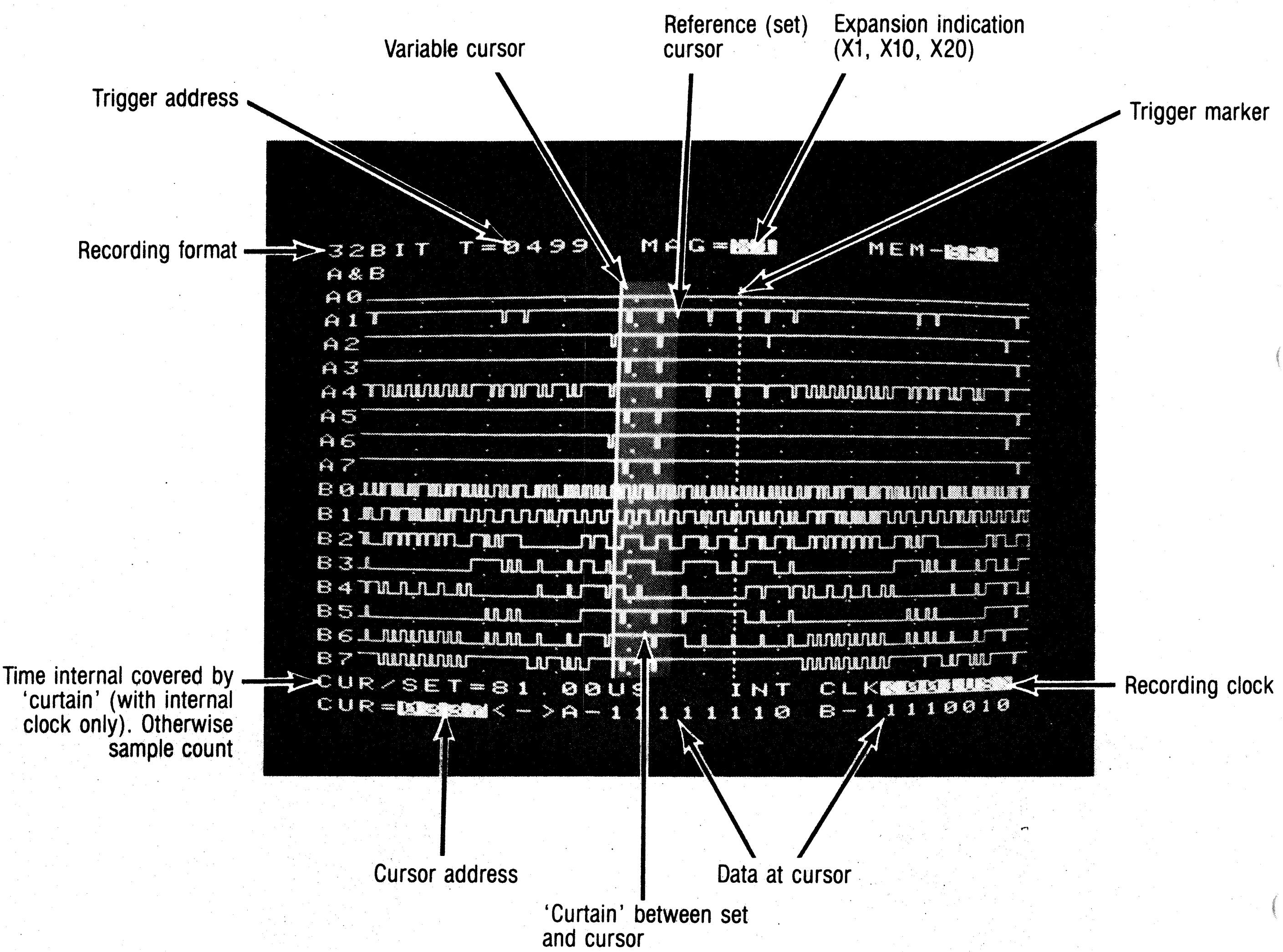


Figure 11

SECTION 7:

7. THE DATA LIST

Pushing the DISPLAY - [LIST] - key causes recorded data to be displayed. A window in the analyzers memory from 16 or 32 samples (depending upon the number of recording channels displayed) is shown on the monitor. The position of this window may be scrolled through memory by using the DSPL-CURS and keys.

7.1 CHANNEL AND DECODE SELECTION

Any combination of recording channels with various decoding bases may be displayed on the monitor simultaneously, limited only by the screen capacity. Display decoding bases available are binary, ASCII, octal, hexidecimal in positive or negative logic. In addition, up to two optional decoding modes may be fitted in the machine including disassemblers for Z80, 8080, 8085, 6800 microprocessors and for the GPIB bus. In order to display, for example, channel B in ASCII decoding negative logic, push the - [LIST] - key, - [ENTRY] - keys [B] , [ASCII] , [NEG] followed by the - **EDIT ENTER** - key. In order to remove channel A from the display, push - **ENTRY** [A] - and - **EDIT** [DELETE] - keys. When a Z80 disassembler display is required and this is fitted on option 1, then the - [OPT 1] - key will activate this. In order to return to the normal data list mode, press the - [LIST] - key.

7.2 CURSOR CONTROL

The display cursor is shown as the first as the first sample of the data 'window' displayed. The position of the data window may be controlled in two ways. The cursor value may be decremented or incremented using the DISPL-CURS and keys (which have an auto-repeat function when held), or may be directly entered by pressing the DSPL-CURS -[LOC-entry] , - **ENTRY** - of 4 decimal digits and then - **EDIT**[ENTER] - .

NOTE

When using a disassembler option the DSPL-CURS does not step from sample to sample but between instruction fetches for the microprocessor.

DATA LIST DISPLAY (1)

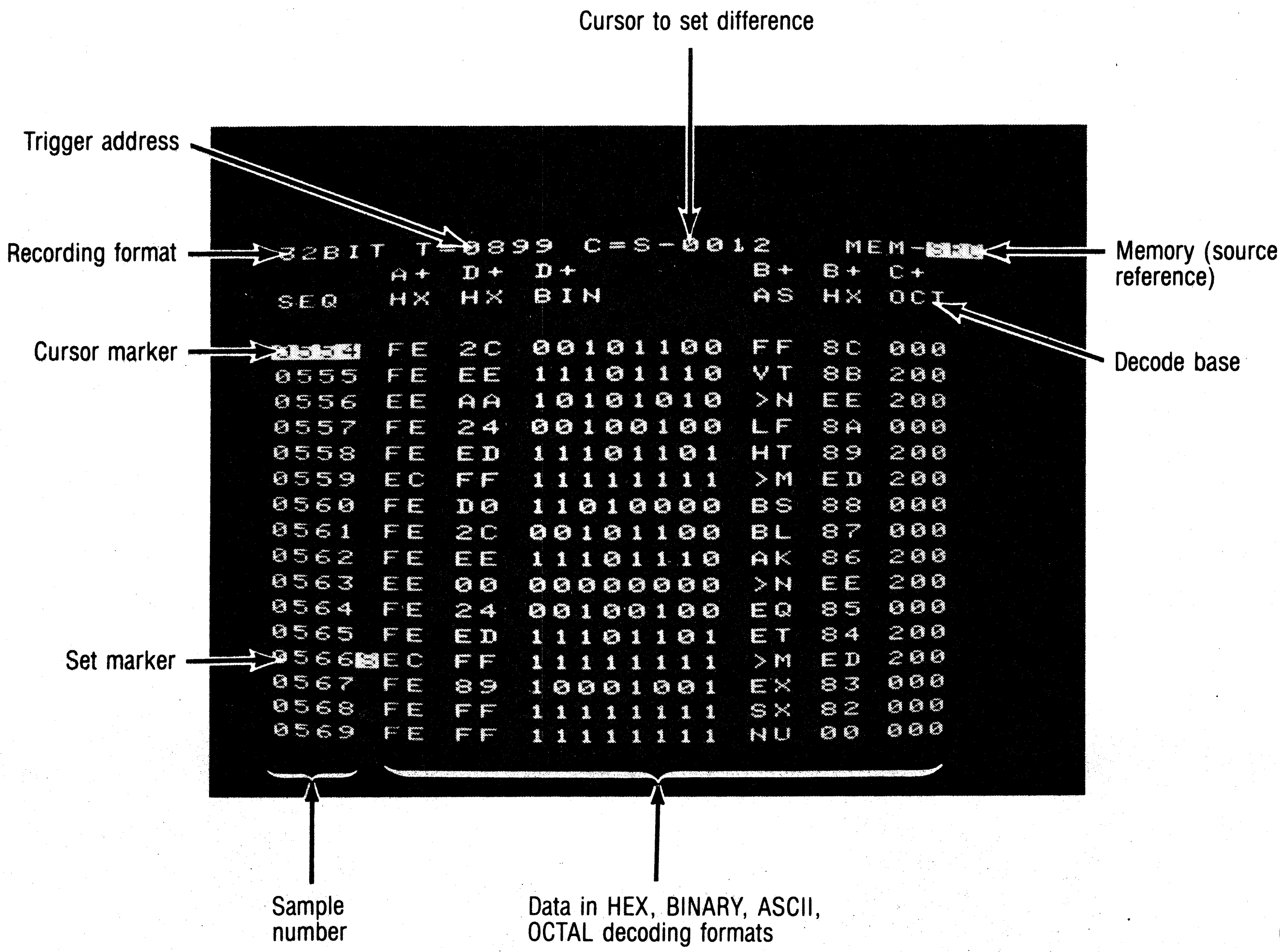
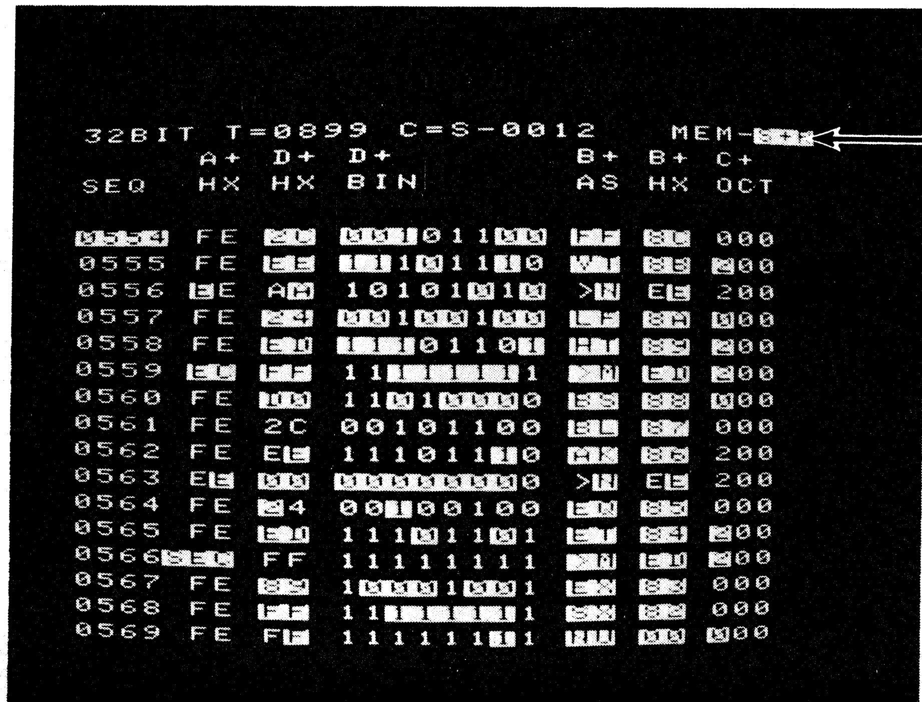


Figure 12

DATA LIST DISPLAY (2)



Source data displayed but differences to reference are displayed in inverted video.

Figure 13

OPTION Z80 DISASSEMBLER

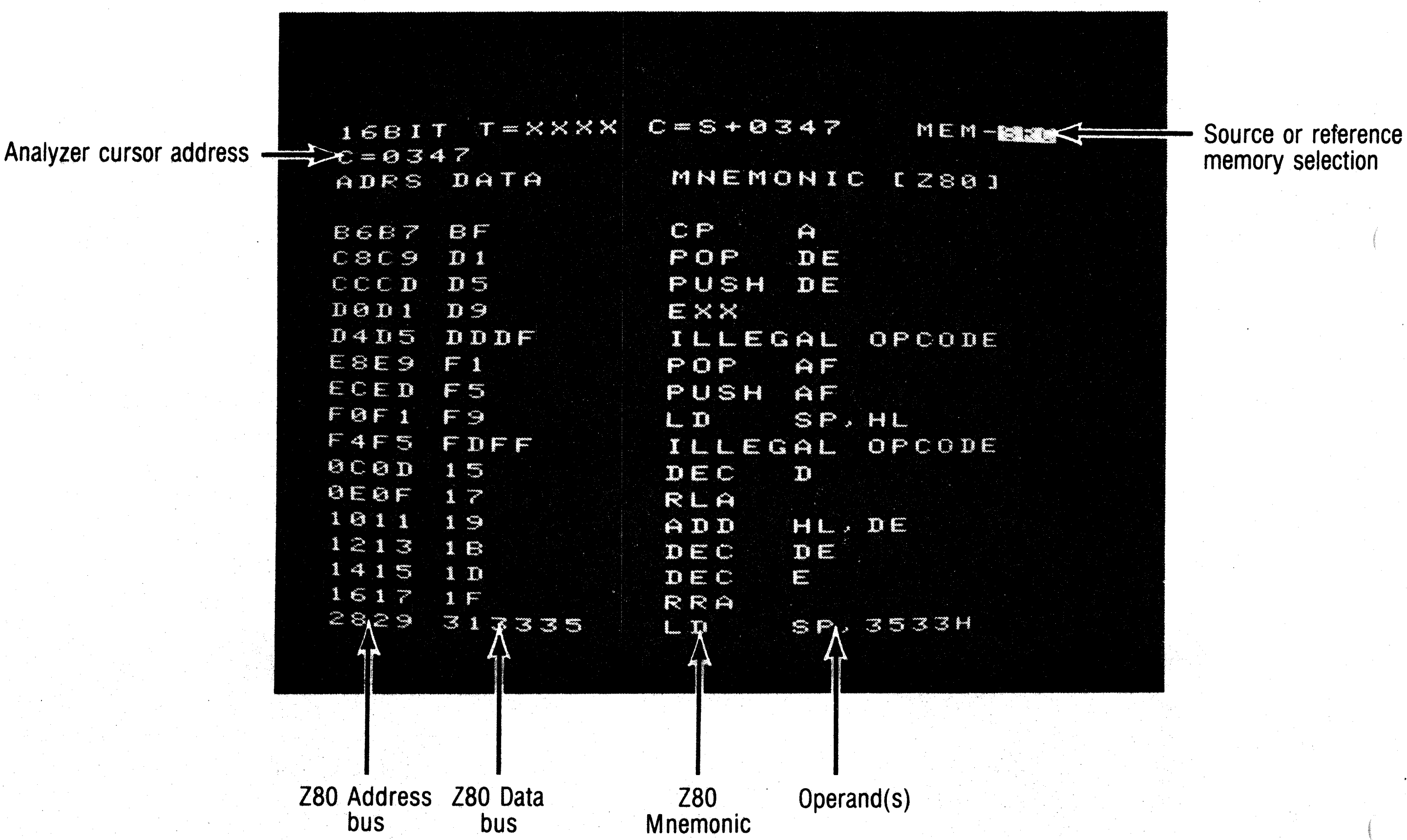


Figure 14

OPTION 8085 DISASSEMBLER

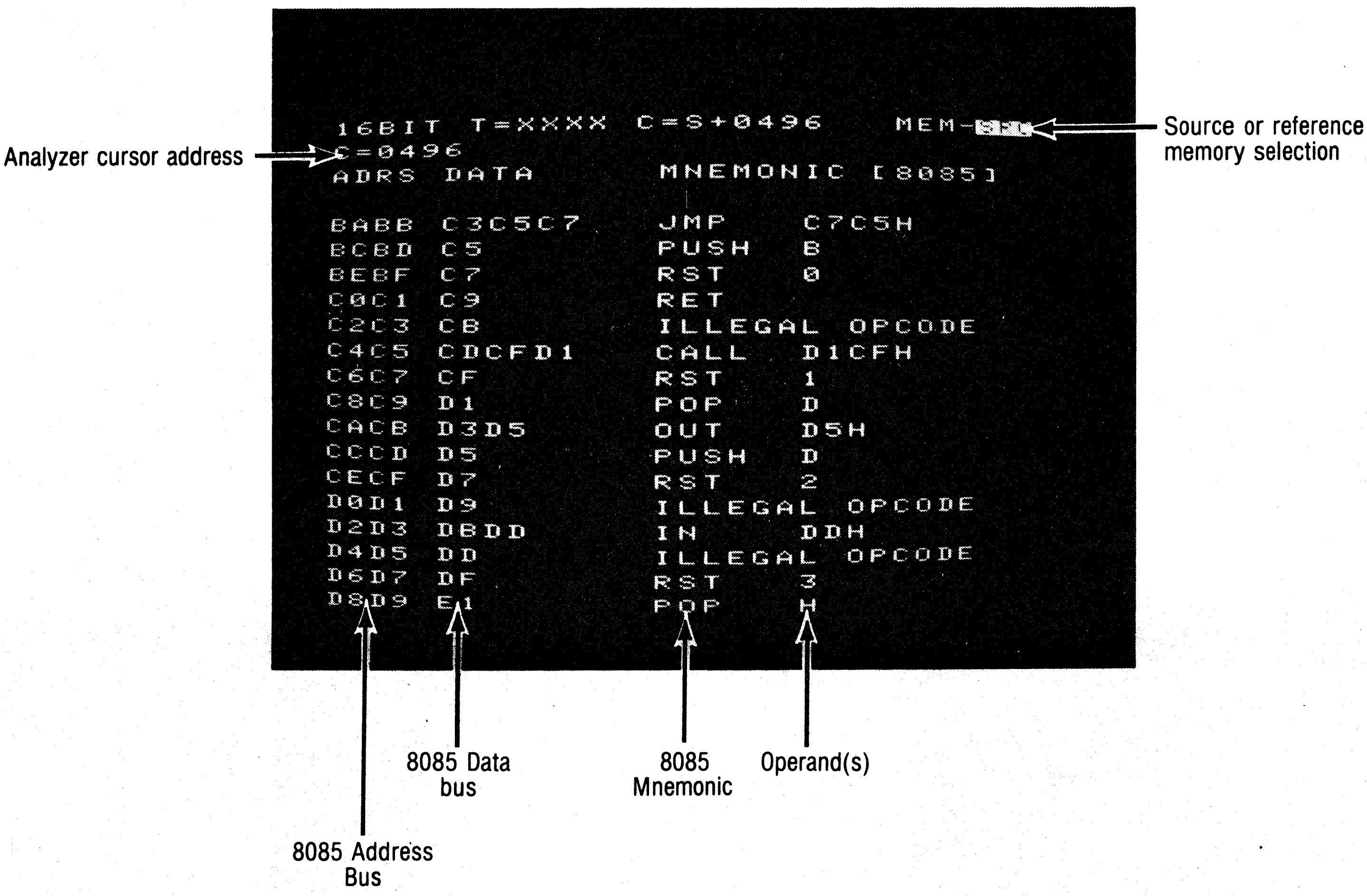


Figure 15

7.3 MEMORY CONTROL

Using the SPECIFY - [MEM-select] - key allows selection of four memory functions. The currently selected function is displayed at the upper right hand corner of the monitor, e.g., MEM-SRC. The functions available are:

- SRC: causes display of source memory, i.e., input data.
- REF: causes display of reference memory.
- S+R: causes display of source data but differences between source and reference data are marked in inverted video on the display.
- R+S: causes display of reference data but differences between reference and source are marked in inverted video on the display.
- S R: causes transfer of captured data (SRC-memory) to the reference memory.

N O T E

After selecting a memory function using the [MEM-select] key it is necessary to press the [EXECUTE] key before the specified action is carried out.

7.4 MEMORY COMPARISON (SEARCH)

Due to the limited size of the 'visible window' in memory, a search process for a non-compare between source and reference data could be rather tedious. The - [SEARCH] - key performs this function automatically. Repeated pressing of the - [SEARCH] - key selects one of three diferent search functions. The currently selected function is shown at the upper right hand corner of the monitor, e.g., SRCH - S = R

7.4.1 S<> R FUNCTION

Selecting the S<>R function and then EXECUTE will initiate a search through the entire memory for all occurences of non-compare between source and reference for the channels displayed on the screen, A display of the total non-compare points will be given and the display cursor will be adjusted by each EXECUTE to the next non-compare occurence between the previous cursor and end of memory.

7.4.2 S= R FUNCTION

The S=R function is the same as the previously described S<>R function except that a search is made for the next point of comparison between memories.

7.4.3 WORD FUNCTION

The WORD search function allows the search for a specified data word in the memory block which has been previously selected for display. Upon specifying the WORD function, an extra line appears over the data list on the screen with the title 'WORD'. A blinking cursor now indicates where the digits of a specified search word may now be entered using the - **ENTRY** - and - **EDIT** CURSOR - keys (**DELETE** is also active). Any data word for the input channels currently displayed and in the current display decode base may be entered. Upon pressing the - EXECUTE - key a search is made through the entire memory for the specified data word and the display cursor adjusted to the address where the first occurence is found. A display of the total number of occurrences of the search word in memory is also available in the form "TOTAL = 1234".

7.5

USASC II DECODE REPRESENTATION (sheet 1)

note 1) b̸ = blank or space
2) parity (bit 2^7) is not used

HEX	ASC II	DISPLAY
00	NULL	NU
1	SOH	SH
2	STX	SX
3	ETX	EX
4	EOT	ET
5	ENQ	EQ
6	ACK	AK
7	BELL	BL
8	BS	BS
9	H-TAB	HT
A	LF	LF
B	V-TAB	VT
C	F-FEED	FF
D	CR	CR
E	SO	SO
F	SI	SI
10	DLE	DL
11	DC1	D1
12	DC2	D2
13	DC3	D3
14	DC4	D4
15	NAK	NK
16	SYN	SY
17	ETB	EB
18	CAN	CN
19	EM	EM
A	SUB	SB
B	ESC	EC
C	FS	FS
D	GS	GS
E	RS	RS
F	US	US
20	SP	b̸
21	!	!
22	"	"
23	#	#
24	$	$
25	%	%
26	&	&
27	`	`
28	(	(
29	)	)
A	*	*
B	+	+
C	,	,
D	-	-
E	.	.
F	/	/

HEX	ASC	DISPLAY
30	0	0
31	1	1
32	2	2
33	3	3
34	4	4
35	5	5
36	6	6
37	7	7
38	8	8
39	9	9
A	:	:
B	;	;
C	<	<
D	=	=
E	>	>
F	?	?
40	@	@
41	A	A
42	B	B
43	C	C
44	D	D
45	E	E
46	F	F
47	G	G
48	H	H
49	I	I
A	J	J
B	K	K
C	L	L
D	M	M
E	N	N
F	O	O
50	P	P
51	Q	Q
52	R	R
53	S	S
54	T	T
55	U	U
56	V	V
57	W	W
58	X	X
59	Y	Y
A	Z	Z
B	[	[
C	\	\
D	]	]
E	^	
F	–	-̣

USASC II DECODE REPRESENTATION (sheet 2)

<table>
<tr><th>HEX</th><th>ASC II</th><th>DISPLAY</th></tr>
<tr><td>60</td><td></td><td></td></tr>
<tr><td>61</td><td>a</td><td>>A</td></tr>
<tr><td>62</td><td>b</td><td>>B</td></tr>
<tr><td>63</td><td>c</td><td>>C</td></tr>
<tr><td>64</td><td>d</td><td>>D</td></tr>
<tr><td>65</td><td>e</td><td>>E</td></tr>
<tr><td>66</td><td>f</td><td>>F</td></tr>
<tr><td>67</td><td>g</td><td>>G</td></tr>
<tr><td>68</td><td>h</td><td>>H</td></tr>
<tr><td>69</td><td>i</td><td>>I</td></tr>
<tr><td>A</td><td>j</td><td>>J</td></tr>
<tr><td>B</td><td>k</td><td>>K</td></tr>
<tr><td>C</td><td>l</td><td>>L</td></tr>
<tr><td>D</td><td>m</td><td>>M</td></tr>
<tr><td>E</td><td>n</td><td>>N</td></tr>
<tr><td>F</td><td>o</td><td>>O</td></tr>
<tr><td>70</td><td>p</td><td>>P</td></tr>
<tr><td>71</td><td>q</td><td>>Q</td></tr>
<tr><td>72</td><td>r</td><td>>R</td></tr>
<tr><td>73</td><td>s</td><td>>S</td></tr>
<tr><td>74</td><td>t</td><td>>T</td></tr>
<tr><td>75</td><td>u</td><td>>U</td></tr>
<tr><td>76</td><td>v</td><td>>V</td></tr>
<tr><td>77</td><td>w</td><td>>W</td></tr>
<tr><td>78</td><td>x</td><td>>X</td></tr>
<tr><td>79</td><td>y</td><td>>Y</td></tr>
<tr><td>A</td><td>z</td><td>>Z</td></tr>
<tr><td>B</td><td>{</td><td>>E</td></tr>
<tr><td>C</td><td>|</td><td>>\</td></tr>
<tr><td>D</td><td>}</td><td>>]</td></tr>
<tr><td>E</td><td>-</td><td>>^</td></tr>
<tr><td>F</td><td>DEL</td><td>DT</td></tr>
</table>

SECTION 8: SPECIAL APPLICATIONS

8.1 "GLITCH" CATCHING

When troubleshooting in the time domain, it may be helpful to use the Latch mode. Time domain measurements imply hardware problems. Thus, by capturing asynchronous glitches on the lines, you may be able to more effectively analylize the circuitry.

The Latch mode works as a detector of glitches that are narrow enough to fall between two consecutive sample clocks. The LAM 3250 is capable of capturing glitches as narrow as 5 ns, regardless of the clock period selected. The exact duration of the glitch is not recorded, but the time relationship between the glitch and other activity in the circuit is preserved. Most of the time this information is sufficient to help you debug your timing problems.

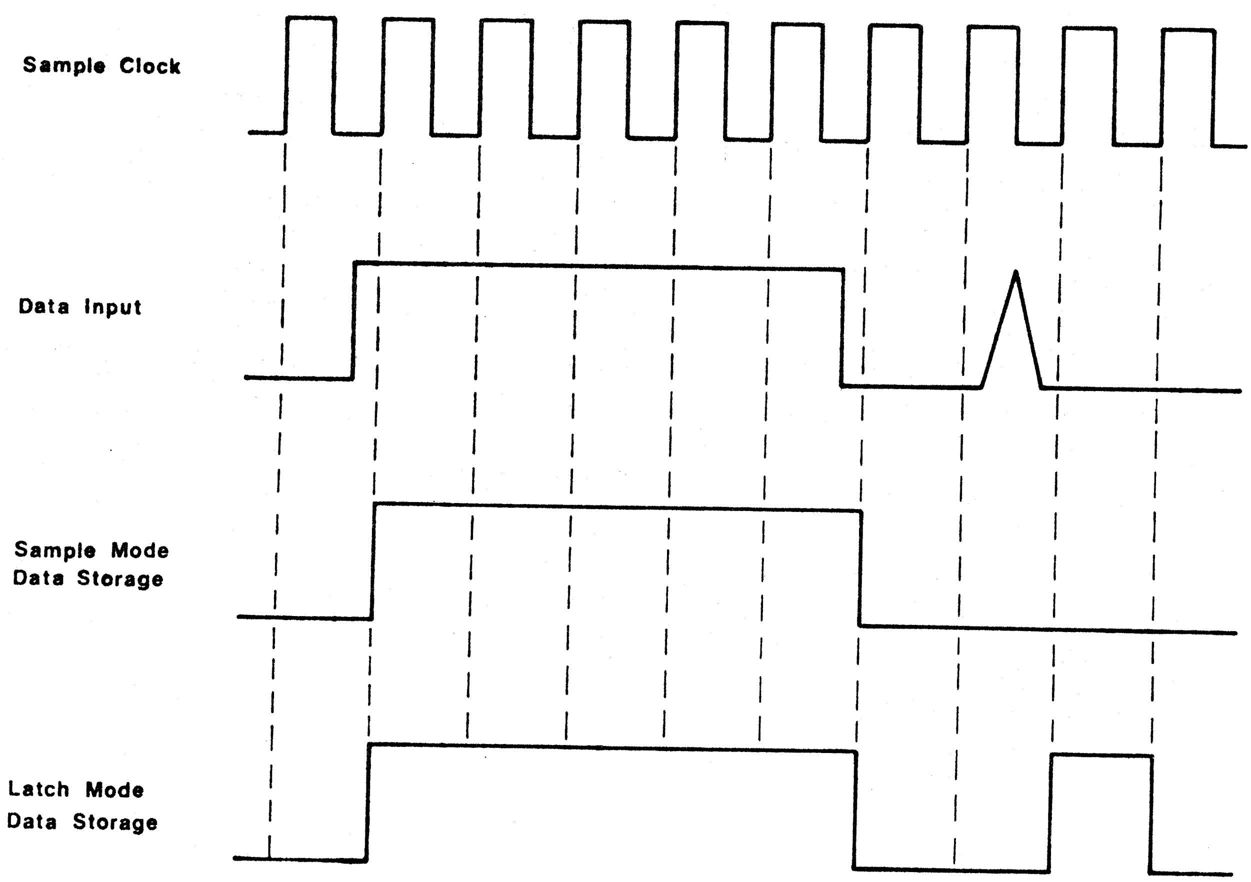


Figure 16

APPENDIX A

STANDARD SERIAL INTERFACE LAM 3250

1. GENERAL

1.1 INTRODUCTION

The serial interface provides the simplest and most universal communication between the LAM 3250 and a wide range of computers and peripherals. The interface voltages and pinouts are as laid down in IEC NORM V24/V28 (US RS232C) which provides an interface standard between a wide variety of terminals, peripherals, modems and computers.

The LAM 3250 may be controlled by a simple serial terminal (half duplex mode) to provide hard-copy of test results for documentation purposes.

1.2 INTERFACE STANDARD

The connector pinout is as follows:

PIN	SIGNAL	
7	SYSTEM GND	) INTERNALLY LINKED
1	SYSTEM GND	
2	TX DATA OUT	
3	RX DATA IN	

DATA RATE	110 or 300 baud switch selectable
START BITS	1
STOP BITS	2
DATA BITS	8 (incl. parity)
PARITY SENT	- ALWAYS RESET
RECEIVED	- IGNORED
LOGIC 0	+3 TO + 12V
1	-3 TO - 12V

No modem control signals are available.

MODE - half duplex with echo of received characters.

1.3 REMOTE ENABLE

The serial interface must be enabled by selecting the REM MODE function in the TRACE FORMAT specification.

2.1 CONTROL CHARACTERS

Return	:	Execute instruction and start transmission
/	:	rub out previous character
Space	:	Separates programming instructions
.	:	stop transmission (immediate character)
,	:	store instruction characters

2.2 When executing illegal characters, the LAM 3250 will respond with a ? followed by a CRLF and a • (period), after this is ready for receiving the next command.

3. DATA PRINTOUT

Data printout is controlled by (MP) followed by a sequence of character groups separated by single space characters which couse selecting of the data to print out.

NOTE

By printout the LAM 32.50 issues (CR) (LF) sequence to terminate a line.

3.1 L - COMMAND

The single character (L) causes printout of a line of data at the current cursor position. Executing this character with CR will print the data at the nextcursor position. A modified form of this command is described in 3.4.

3.2 PRINT SCREEN

The print screen command enables the printing of the monitor contents. It has the following format:

MP T (X) , where:

(X)=R = Trace Format

T = Trigger Specification

C = Compare Menu

L = Data List

3.3 PRINT TIMING DIAGRAM

The print timing diagram command causes printout on a hardcopy device of a section of the timing diagram. If has the format:

MP D (N1 N2 N3 N4) S X1 E X2,

where: N1 is the input channel group to be printed.

N1 = A = channel A

B = channel B

C = channel C

D = channel D

N2 is the input channel (0-7)

N3 is S for Source Data

R for Reference Data

N4 is either X for marking of Source to Reference differences or a space character.

E X A M P L E

MP D A35X S 10 E100 ,

= Print a timing diagram for channel A3, Source Data marking differences to the reference data. The S and E parameters are described in Section 3.4.

3.4 MODIFIED L - COMMAND

This command has the format:

MP L PN1N2N3 SX1 EX2

where N1 is an input pod A, B, C, or D

N2 is + for +ve logic

- for -ve logic

0 for disabled

N3 is A for ASCII

B for BINARY

0 for OCTAL

H for HEXADECIMAL

S is a start address given in X1

E is an end address given in X2

This command may be used for printing specified columns in data list (Hex or Dec.) format with selected decodings and address range.

3.5 THE CHANGE COMMAND - C

This command may be used to change the analyzers' data content. (Remote printout format). It has the format:

MP C

The analyzer prompts with a list of active pod data at the current cursor address. To change data type

P = DD

where P is a Pod (A, B, C, D)

DD is new data for the pod in hexadecimal base. Other data at the same address but from other pods may be changed by using the "space" char. after specifying DD and typing again P=DD.

NOTE : The L command allows printing over a larger area as available on the screen. A maximum of 9 columns may be printed in this mode.