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ROHDE&SCHWARZ

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Compact Logic Analyzer LAC 64

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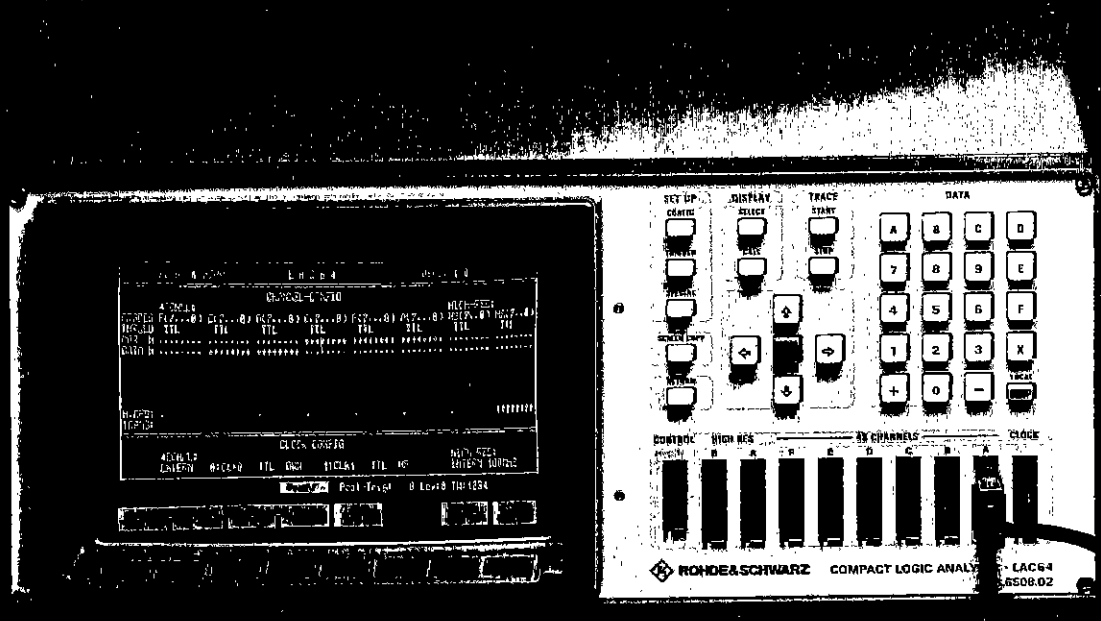
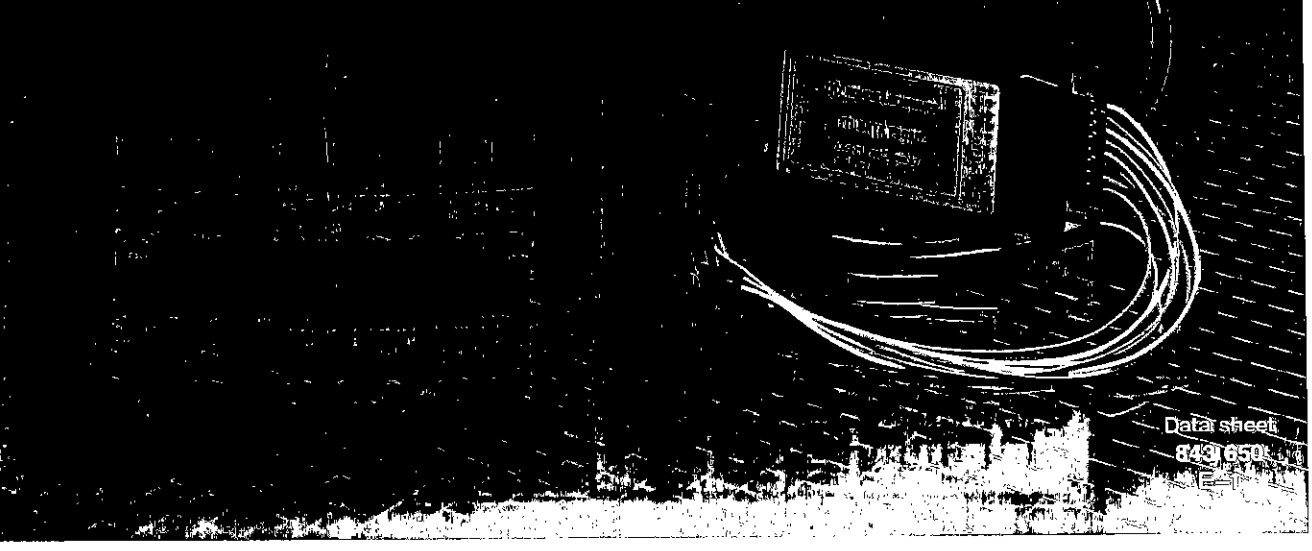
- Transitional recording
- Time measurement with 20 ns resolution
- High-impedance probes





Data sheet
843.6508.02
E-1

LAC 64

The **Compact Logic Analyzer LAC 64** is a versatile tool for measurements on

- microprocessors
- software
- digital logic circuits

The LAC 64 features a large memory depth of 4000/8000/16000 words and has a future-oriented sampling frequency of 50/100/200 MHz.

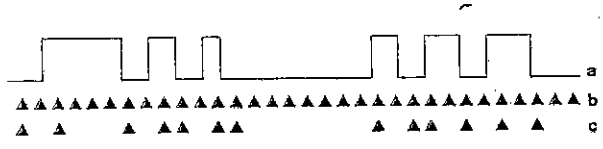
New method for combined 50-MHz logic-state and 200-MHz timing analysis

For high-speed signal analysis and glitch capture, the LAC 64 is fitted with 8 high-resolution channels allowing analysis with a resolution of 5 ns. The number of channels is doubled if a resolution of 10 ns is sufficient for the measurement task in hand. The high-resolution channels are triggered by the 50-MHz analyzer and analyze the vicinity of the trigger point of the 50-MHz analyzer. These channels can be connected in groups of eight via an electronic crossbar switch to the probe inputs of the 50-MHz analyzer, but may also be connected via separate probe inputs. The high-resolution channels can be used as a magnifier for 50-MHz analysis thus permitting specific signals to be collected with a higher time resolution.

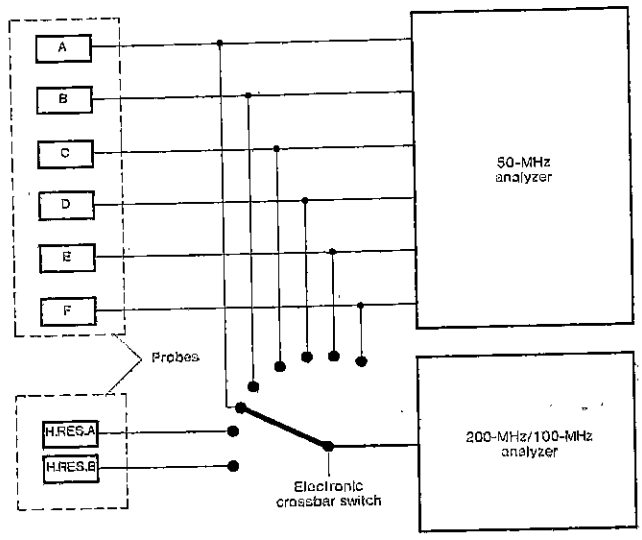
In the case of simultaneous logic-state and timing analyses, the LAC 64 does not require two probes to be connected to the same test point. This facilitates connection and at the same time prevents additional loading of the device under test by the input impedance of the second probe. Moreover, the chore of changing connections is dispensed with if the measurement is to be performed at different test points with high time resolution.

No problems with memory capacity – transitional recording with a resolution of 20 ns for up to 390 hours

The LAC 64 records 48 channels with a sampling frequency of 50 MHz. The large memory depth of 4000 words can be effectively used thanks to the transitional recording method implemented in the LAC 64. In this mode, write operations to the memory of the logic analyzer are performed only if the new data word to be recorded differs from the previous one. The interval between the individual data words is also stored, this timing information being furnished by a tracking clock with a resolution of 20 ns. This permits a correct timing representation of the data stream to be obtained. This method is particularly helpful when analyzing pulse packets in which short pulses alternate with long breaks. To allow accurate collection of the pulse packet, a high sampling frequency is required;



Reduction of memory space required due to transitional recording
a Data pattern at analyzer input
b 32 samples without transitional recording
c 13 samples with transitional recording



An electronic crossbar switch permits simultaneous 50-MHz and 200-MHz analysis using only one probe

during the breaks, this would however fill the memory with a large number of equal data words. At the beginning of the next pulse packet the memory would already be full so that the second pulse packet could no longer be analyzed. Transitional recording does not exhibit this disadvantage since recording takes place only if the data change.

Probes

Thin cables of great flexibility connect the LAC 64 probes to the logic analyzer. The disadvantages due to the use of rigid flat cables, ie abrupt separation from the device under test and tedious connection, are thus avoided. Two types of probe are available as extras: TTL probes (TTL Data Probe LAC-Z1 for eight channels and TTL Clock Probe LAC-Z2 for the two clock channels) and universal probes with adjustable switching threshold (Data Probe LAC-Z3 and Clock Probe LAC-Z4). Thanks to the high input impedance of the probes (1 MΩ ‖ 4 pF for both LAC-Z3 and LAC-Z4), the device under test is only slightly loaded.

Microprocessor analysis

Due to the combination of 48 channels at a sampling frequency of 50 MHz and the 16/8 high-resolution channels in conjunction with a multitude of probes for 8- and 16-bit microprocessors available as extras, the LAC 64 is a powerful tool for analyzing software which directly controls hardware. While the 50-MHz channels and the microprocessor probe are used to monitor program execution, the high-resolution channels simultaneously analyze the hardware operations. In this way it is possible to check whether a specific peripheral circuit correctly responds to a defined microprocessor instruction or whether the signals driving a component have the correct timing.

Efficient triggering with 50 MHz – recording only data of real interest

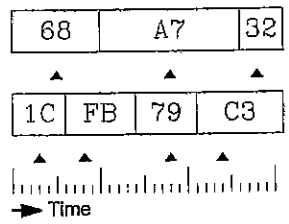
The powerful multilevel trigger facility of the LAC 64 features all the characteristics which distinguish a state-of-the-art logic analyzer: Depending on the trigger word, it is possible on each level to disable and enable storage of the input data to make sure that only data of interest are recorded. Each trigger level is divided into **sublevels** on which decision trees can be created according to the IF-THEN-ELSE principle by simply inserting further trigger words. On each sublevel, different operations such as start or stop of data transfer to the analyzer's memory, jumping to a different trigger level or start of triggering can be performed. The trigger words can be associated with counters which are able to count time intervals and clocks as well as trigger words.

Analysis of bus systems using multi-clock inputs

The two clock inputs are fitted with a special input circuit which ensures that no data are lost even if active clock signal edges occur simultaneously at the two clock inputs. Thus simultaneous monitoring of two asynchronous buses is possible; this is for instance necessary if the data streams at a FIFO input and output are to be analyzed.

Time-measurement facility

With each data word, the LAC 64 stores – with a resolution of 20 ns – timing information which corresponds to the time interval between successive data words. This time information is displayed at the righthand edge of the screen in the logic-state diagram and permits measurement of program execution times. In the timing display, this time-measurement facility is used to produce a linear time display even with an irregular external clock or selective recording.

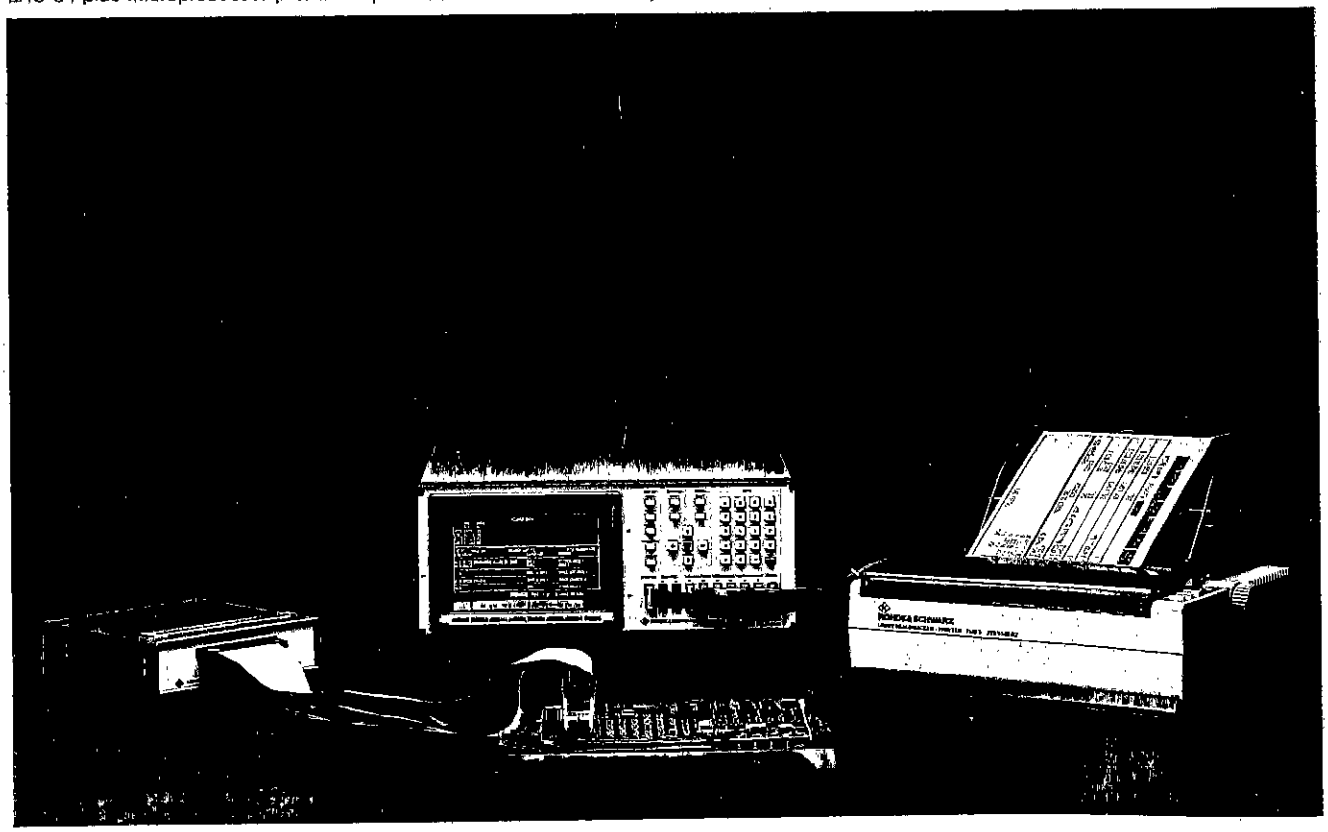


Stored data

DATA1	DATA0	Clock	Time
68H	1CH	CLK0	3ms
68H	1CH	CLK1	5ms
68H	FBH	CLK0	8ms
A7H	79H	CLK0	18ms
A7H	79H	CLK1	18ms
A7H	C3H	CLK0	24ms
32H	C3H	CLK1	28ms

No data loss when analyzing asynchronous buses

LAC 64 plus microprocessor probe – a powerful tool for software analysis



Split screen – clear result display for rapid error recognition

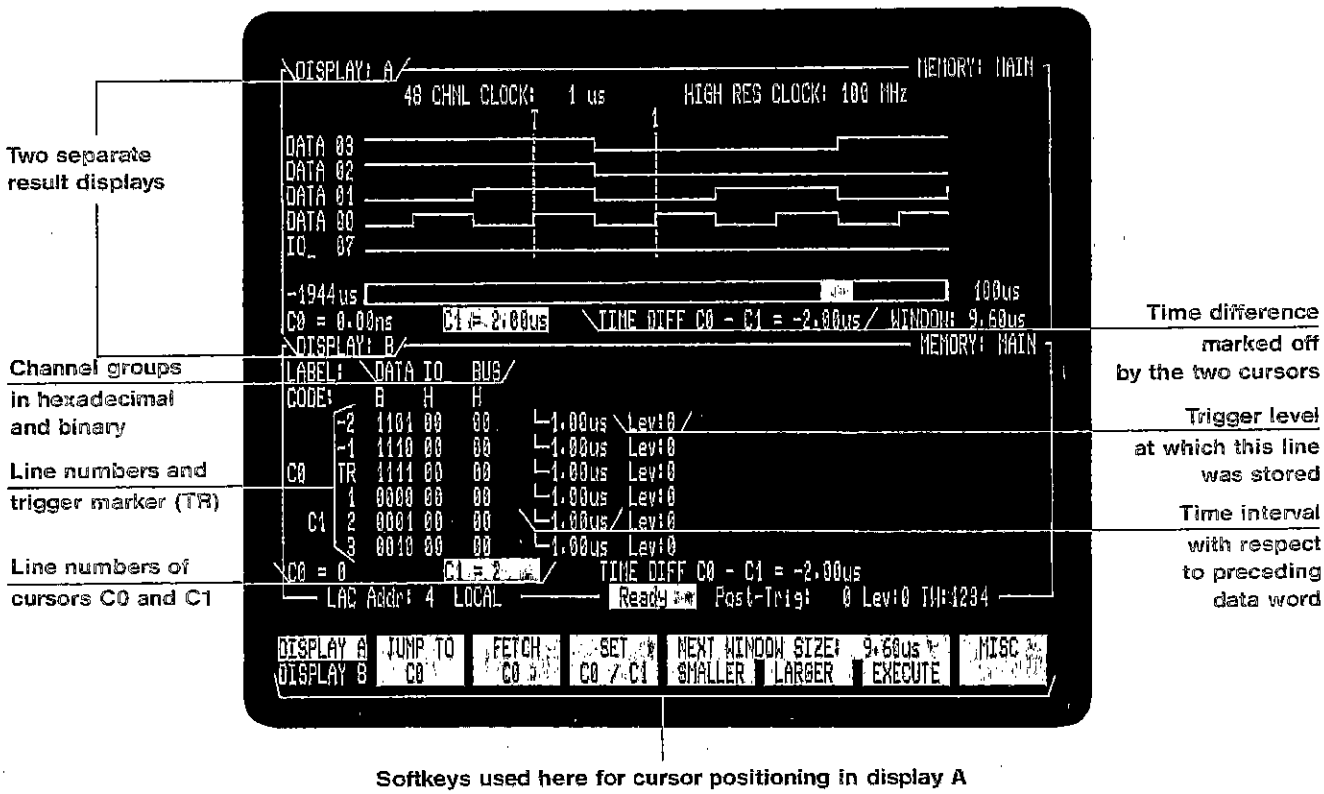
On the LAC 64, the results are displayed in clear and neat form. Powerful search and compare commands facilitate evaluation. The split-screen function makes for great operating convenience. In this mode, the screen is divided; any two types of result display are possible in the upper and in the lower screen half. The cursors of the two displays can be coupled with each other so that the time relation of the two displays is clearly visible. When analyzing microprocessor circuits, it is, for instance, possible to represent the activities of the processor in disassembled form in one half whereas in the other half the effects of program execution on the hardware can be checked with the high-resolution channels using the timing diagram.

Mode and reference memories

The battery-supported mode memory ensures that up to eight device setups can be saved after switching the LAC 64 off. The complete test result can be stored in the reference memory for comparison with subsequent measurements.

Logging of test results

At the push of a button, test results and conditions can be printed out via the IEC/IEEE-bus, RS-232-C or 8-bit parallel interface. It is possible to obtain a screen copy or a list of results.



Two separate result displays

Channel groups in hexadecimal and binary

Line numbers and trigger marker (TR)

Line numbers of cursors C0 and C1

Time difference marked off by the two cursors

Trigger level at which this line was stored

Time interval with respect to preceding data word

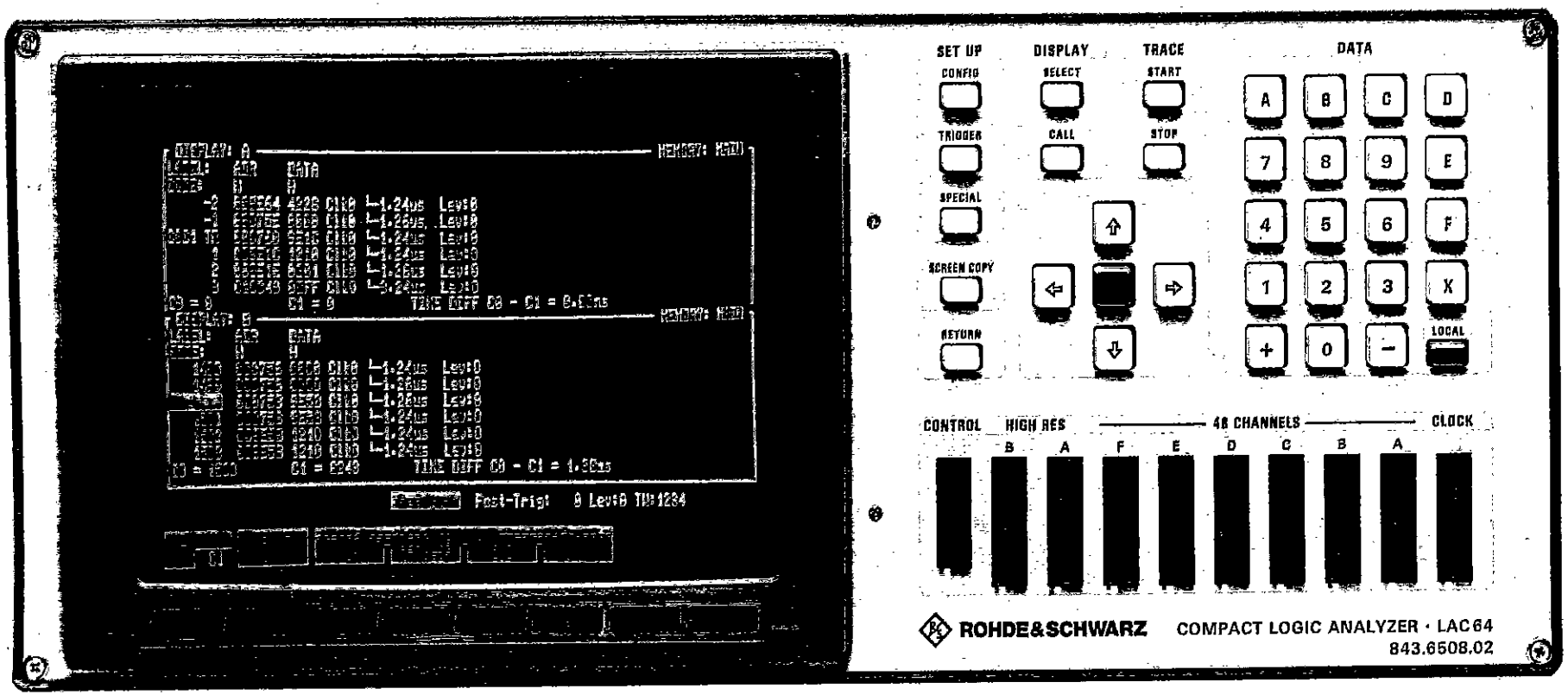
Softkeys used here for cursor positioning in display A

Split-screen result display

Hardkeys are used to call up menus for result display and to enter operating parameters. **Softkeys** – below the screen – are for menu entries. The labelling depends on the mode selected.

The firmware of the LAC 64 resides in an easy-to-exchange EPROM pack; the Analyzer is **ready for operation on power up.**

User prompting reduces the number of settings and panel controls so that simple tasks can be solved immediately and complex problems require only a brief period of familiarization. Operator errors are therefore prevented.



2 Introduction into Use of the LAC64

2.1 Principle of the Logic Analyzer

A logic analyzer is a measuring instrument that permits to display events in digital circuits. It is connected to the circuits to be tested via special probes. The logic levels on the adapted test points are evaluated during the measurement at points in time determined by the user and stored in the logic analyzer as bit patterns. These points in time can be defined to be equidistant by a clock obtained from the analyzer itself (internal clock) or by a clock obtained from the circuit under test (external clock).

The measurement sequence is controlled by a programmable trigger unit. This trigger unit starts the data transfer into the analyzer memory and determines the occurrence of the trigger event which initiates the final phase of the measurement. When the measurement has been completed, the stored bit patterns are evaluated by the logic analyzer and displayed on the screen.

2.2 Hardware Structure of the LAC64

The LAC64 is a powerful logic analyzer for general-purpose applications. It features 48 channels with a maximum sampling rate of 50 MHz and is additionally equipped with magnifying channels which permit asynchronous recording with 200/100 MHz on 8 or 16 channels, respectively. Comprehensive trigger facilities permit the user to locate complex faults in logic circuits or to monitor the function of these circuits. The logic analyzer consists of the following units:

- Probes for adaptation to the test item
- A threshold circuit that can be set to threshold values between -9.9 V and +9.9 V
- A trigger circuit that can be programmed by the user such as to start recording of the incoming data upon occurrence of particular external events. Four trigger levels can be defined. Each trigger level permits parallel monitoring of the occurrence of 4 independent trigger words and subsequent jumping to a further trigger level.
- A magnifying function which, upon triggering of the 48-channel analyzer, permits to record the logic states with a high resolution on 8 or 16 channels, respectively.
- A data memory which stores the data to be measured. The recording procedure is controlled by the trigger circuit.
- A microprocessor which serves to program the trigger unit, control the measurement as well as evaluate the data memory after termination of the measurement.
- A monitor for display of the recorded data.

2.3 Particular Features of the Logic Analyzer

The logic analyzer exhibits the following features:

- When using the external clock, two clock inputs are available. One of the clock signals is used to record the data independently of each other. Even with very short time intervals between the external clock signals, there are no losses of data. For this reason, it is even possible to perform measurements on modules with interfaces via which noncorrelated accesses are performed (e.g. FIFOs).

- The magnifying channels of the logic analyzer can be switched to all 48 channels of the instrument or used independently. It is thus possible to evaluate test points with high trigger intelligence using the 48-channel analyzer as well as to record with the high resolution of the magnifying function without the need for connecting probes to test points twice.

- For analysis of microprocessor circuits, a number of microprocessor probes are available.

- In the definition of trigger sequences, absolute time windows can also be defined; it is for example possible to specify conditions such as "Trigger when 300 ms have elapsed and a logic 1 subsequently appears on channel xx".

- In addition, it is possible to program as the counter criterion for the definition of time spans not only absolute times, but also external clocks ("Trigger when 300 external clocks at clock input 0 have elapsed and a logic 1 subsequently appears on channel xx"), the presence of external states ("...when pattern y has been applied for 300 clocks) or even the appearance of external states ("...when pattern y has appeared and disappeard 300 times").

2.4 Operation and Setting of the Logic Analyzer

2.4.1 Hardkeys and Softkeys

For setting and operation of the logic analyzer, input fields that are combined in several input menus are edited. In order to perform a setting, the user has to first call the menu that includes the desired setting by pressing a hardkey (key on control panel). Then the user is taken to the desired input field via the cursor keys or the softkeys labelled in accordance with the menu and the input field. To set a number in this input field, the numerical keypad is used. The definition of the posttrigger counter is an example of such an input field. There are also input fields where no input but a selection is to be made, e.g. the code in which a channel group is to be displayed (binary, decimal, hexadecimal,etc.). In this case, these possible notations are also offered via softkeys which are labelled accordingly when the input field is selected.

The softkey-aided operation offers the advantage that the user may only avail of those keys which are currently suitable. Thus, faulty operations are avoided and the operation is clarified, for otherwise a great number of hardkeys would be required due to the manifold input facilities of the logic analyzer.

2.4.2 Global Settings

For global settings, the following two menus are used:

- IN-OUT configuration (see section 4.7)

  In this menu, the interfaces of the logic analyzer are configured which are used to record measurement results or to enable remote control of the logic analyzer from an external controller. Available interfaces are an IEC625 interface, an RS232 interface and a CENTRONICS interface, the latter being used only for printing and not for remote control. With the IEC625 interface, the instrument address is set. The baud rate, parity bit, XON/XOFF protocol and the number of stop bits are to be set with the RS232 interface.

- SPECIAL MENU (see section 6)

  The SPECIAL MENU includes the management of eight complete instrument setups that can be predefined in the instrument (e.g. storing and loading of these setups), selection of the disassemblers and setting of parameters of the microprocessor probe. Furthermore, this menu permits to select measurement results for documentation purposes.

2.4.3 Settings for Adapting the Test Item

In these settings, the user specifies the kind of digital signals to be recorded and the channels to be selected for the following measurement.

Threshold values (see section 4.1)

Depending on the logic family used in the test item, the data to be recorded feature different logic levels. In order to match the logic analyzer to these levels, the threshold voltage of the probes can be set to different switching thresholds such as TTL, ECL or voltages between -9.9 V and +9.9 V in steps of 100 mV. The eight channels of a probe are always jointly programmed to the same threshold value. The two external clock channels can be set separately. During recording, the analyzer recognizes all levels above the set threshold voltage as logic 1 and all levels below as logic 0.

Channel configuration (see section 4.2)

The configuration menu permits the user to select individual channels or channel groups from the total of analyzer channels according to his specific measuring task, assign names to the channel groups and define the format (hexadecimal, binary, octal, ASCII or decimal) in which the channels are to be displayed in the definition of trigger words. At the same time, this specification is used as the output format for the STATE display. Channels not defined by the user in the configuration menu can also be suppressed. They appear neither in the specification of the trigger patterns nor in the display of the measurement results. This serves to make operation more convenient for the user.

Clock definition (see section 4.5)

The collection clock for the analyzer can be obtained from two different sources:

- An internal clock generator provides a clock that can be programmed in a 1-2-5 sequence. The data are always transferred in equidistant time intervals determined by this clock.

  Example: Measurement of pulse durations by sampling with a multiple of the internal clock frequency.

- The external clock is directly obtained from the test item via the clock probe.

  Example: Analysis of the states of a synchronous circuit, e.g. of a counter or a shift register, using the clock which operates the synchronous circuit. This procedure is also used in the analysis of microprocessors where the signals READ or WRITE are used as a clock.

2.4.4 Settings for Performing the Measurement

These settings are used to determine the data patterns to be selected from the applied data stream for storage and later evaluation as well as the the measurement sequence.

TRANSITIONAL RECORDING (see section 4.6)

When setting the logic analyzer , it is of great importance to clearly define the criteria for data reduction. As the memory of the analyzer is of limited capacity, the user must ensure that only relevant data are recorded in the memory. TRANSITIONAL RECORDING permits to reduce the amount of data without impeding data evaluation. In this operating mode, data are only recorded when changes in level have occurred. This serves to prevent identical data from being written into the analyzer memory several times in succession, causing the memory to be unnecessarily filled. This feature is not available for the magnifying channels.

TIME STAMP (see section 4.6.3)

In particular when operating with external clock, i.e. when using a clock signal provided by the test item itself, there is no strict connection between the number of transferred data words and the time that has elapsed during data transfer. This is also the case if the data collection is stopped and restarted upon occurrence of another condition. So as to nevertheless obtain information on the time elapsed between the data collections, the logic analyzer is equipped with a 48-bit counter the counter status of which is stored together with the data (TIME STAMP ON). The timing can then exactly be reconstructed when evaluating the data, as there is a time information for each data word stored. In this operating mode, the 48-channel analyzer can record a maximum of 2045 data words, with TIME STAMP OFF a maximum of 4990 data words. The magnifying function does not include a TIME STAMP facility, because the collection is always made with an internal clock of 100 MHz or 200 MHz, which is why the time intervals between the data words succeeding each other in the memory are always 10 ns or 5 ns, respectively.

Trigger setting

Two settings are to be performed:

- *Definition of trigger word* (see section 5.1)

  A maximum of 4 trigger words can be defined. A trigger word is a data pattern which, upon its occurrence, causes the analyzer to respond. These data patterns can be specified in different data formats (hexadecimal, binary, etc.). Furthermore, individual channels can be defined as "don't care", which means that they are irrelevant to the recognition of the data pattern.

- Trigger sequence (see section 5.2)

  The trigger sequence determines the responses to be made to the occurrence or non-occurrence of the trigger words mentioned above. The trigger sequence may comprise a maximum of four steps (levels) which can be executed in succession or in any order. Possible analyzer responses are:

  → TRACE ON: Start of recording
  → TRACE OFF: Interruption of recording
  → STORE: Storage of the currently applied data word
  → GOTO x: Jump to level x
  → TRIGGER: Initiation of the final phase of the measurement

Explanation of the TRIGGER command:
The logic analyzer cyclically writes the incoming data into the memory as long as TRACE ON or STORE is active. Basically, this procedure is not limited in time. Thus, in defining the trigger sequence, the user has to specify a sequence of conditions following the occurrence of which the analyzer completes the measurement. This command is the TRIGGER command which produces the following effect:

A user-adjustable posttrigger counter is started which is decremented with each storage following the occurrence of the trigger event. As soon as this counter has run down, the analyzer terminates the collection and starts evaluating the stored data. By presetting the posttrigger counter, the user can determine whether the data before the occurrence of the trigger sequence (set posttrigger counter to 0) or those following the trigger sequence (set posttrigger counter to the memory depth of the analyzer) are to be stored. In each trigger level, parallel monitoring of a maximum of 4 different trigger conditions is possible. This permits to define sequences, such as "Start the collection when trigger word 0 occurs but trigger when trigger word 1 occurs". Two further preadjustable counters are available which can be used for defining the trigger sequence. The response of the analyzer indicated in a trigger level can be determined by the status of these counters: The analyzer is to respond only when the counter has run down or when the counter has not run down yet, e.g. "Trigger when trigger word 0 occurs after the counter has run down." The counter criterion for these counters may then be either the time (AFTER 500 ms...), the occurrence of external clocks (AFTER 500 CLOCKS CLK0...), a combination of external clocks and applied trigger words (AFTER 1000 CLKS CLK0 WITH TRG01...) or the occurrence of trigger words (AFTER 100 OCCUR OF TRG1...). Occurrence is understood to mean that the trigger word actually has to disappear and reappear again.

2.4.5 Performing the Measurement (See Section 7.1)

After adapting the test item and performing the settings described before, data acquisition is started by pressing the START key. The monitor display appears which informs the user on the current state of the measurement. The measurement is terminated either by pressing the STOP key or after the posttrigger counter has run down (as described above). The logic analyzer then starts evaluating the stored data.

2.4.6 Evaluation of Measurement Results (See Section 7)

For evaluating the measurement, the user can choose between different types of display in the DISPLAY SELECT menu: These are the STATE display and the TIMING display. Changing between these two types of display is performed in two steps:

- In the DISPLAY SELECT menu, the type of display to be used is selected;
- In the DISPLAY CALL menu, the preselected type of display is displayed on the screen.

STATE DISPLAY

In this type of display, the data words stored by the logic analyzer are displayed in the form of a list. This list is arranged according to the channel group configuration and displays the data words in the code (hexadecimal, decimal, etc.) specified with this configuration. The lines of this list are numbered, line 0 corresponding to the point in time at which the trigger word occurred. When using an external clock, the external clock signal (clock 0 or clock 1) that has caused the storage is indicated. With the TIME STAMP option switched on, the last line indicates for each data word the time interval between its collection and the collection of the preceding data word.

TIMING DISPLAY

The representation of data in a TIMING display is similar to a multichannel oscillogram. The timing display differs from an oscillogram in that the logic analyzer displays only defined levels (HIGH and LOW) at the points in time determined by the sampling clock. By selecting a suitable magnification, either the complete memory contents of the logic analyzer or any memory sections can be displayed on a monitor. This type of display is preferably used for hardware measurements.

3 Putting into Operation

3.1 Legend to Front and Rear Views

a) Front view

1

SET UP SPECIAL

Call-up of SPECIAL menu

2

SET UP TRIGGER

Call-up of TRIGGER menu

3

SET UP CONFIG

Call-up of CONFIG menu

4

DISPLAY SELECT

Call-up of DISPLAY SELECT menu

5

DISPLAY CALL

Call-up of DISPLAY CALL menu

6

TRACE START

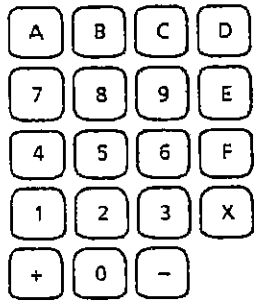
Start of recording

7

TRACE STOP

Stop of recording

8



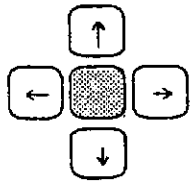
Keypad to enter signs and hexadecimal numbers

9

LOCAL

LOCAL function for IEC625

10



Cursor function

11

CLOCK

Connector for CLOCK probe

12

– 48 CHANNELS –
F A

Connector for DATA probes for the 48-CHNL-analyzer

13

HIGH-RES
B A

Connector for DATA probes for the HIGH RESOLUTION analyzer

14

CONTROL — Connection of control cable for probes LAS-Z17 and LAS-Z22

15

RETURN  — Changing to the next higher softkey menu or termination of a data entry

16

SCREEN COPY  — Generation of a screen copy via the currently active LIST channel

17

8 softkeys with software-controlled, mode-dependent function

18

Display of SETUP menus and DISPLAY menus including softkeys

b) Rear view

20

EPROM disk with operating firmware of the LAC 64

21

IEC-bus connector, female

22

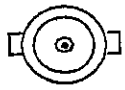
PARALLEL PRINTER — Connector for printer

23

RS 232 C — RS 232 C connector

24

VIDEO  — Video output

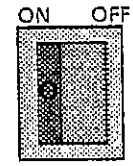


25

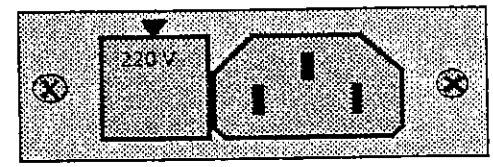
 — Setting of screen intensity

26

POWER — Power switch



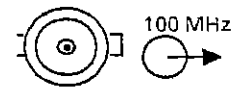
27



F1:
100/120/230/240 V
DIN 41571 T 4.0D/250 V

AC supply socket, fuse holder and AC supply voltage selector

28



Clock output, 100 MHz, ECL level

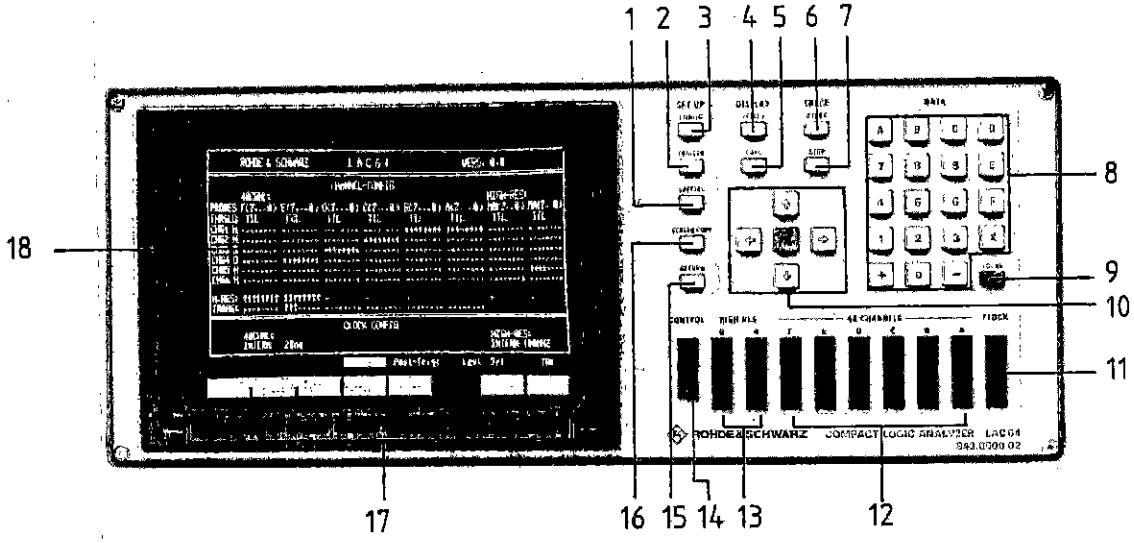


Bild 2-1 Frontansicht
Fig. 2-1 Front view

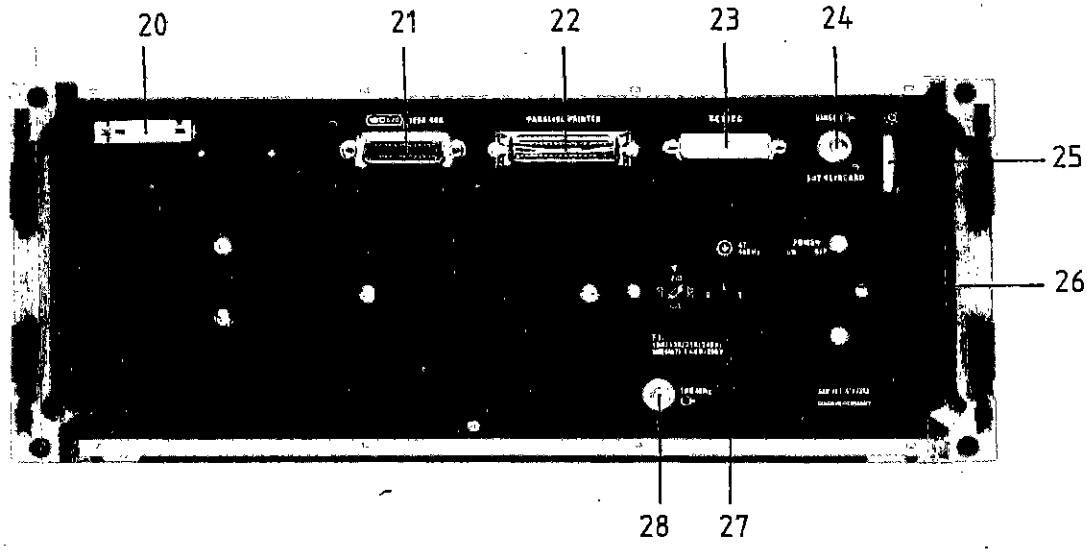
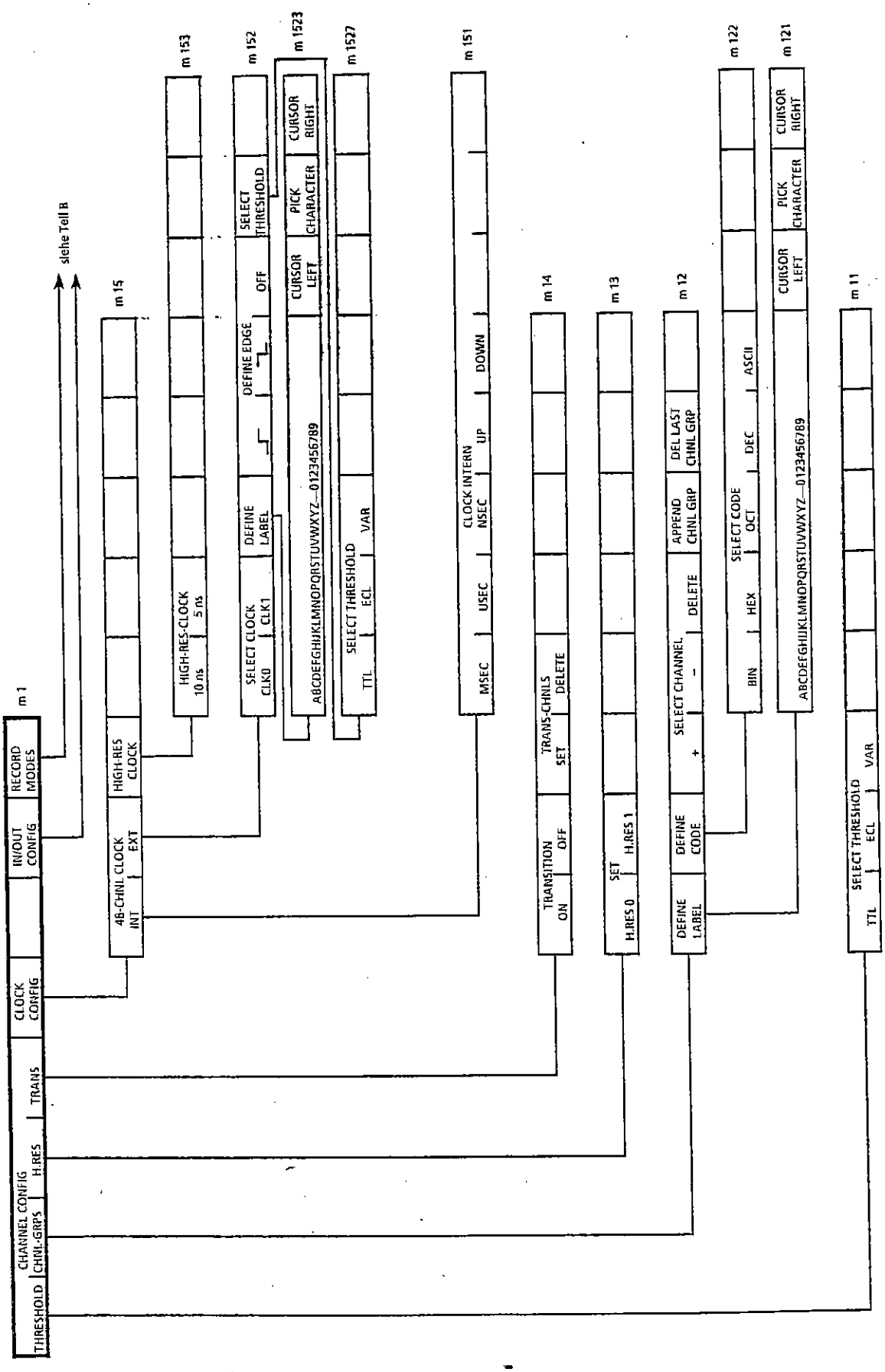
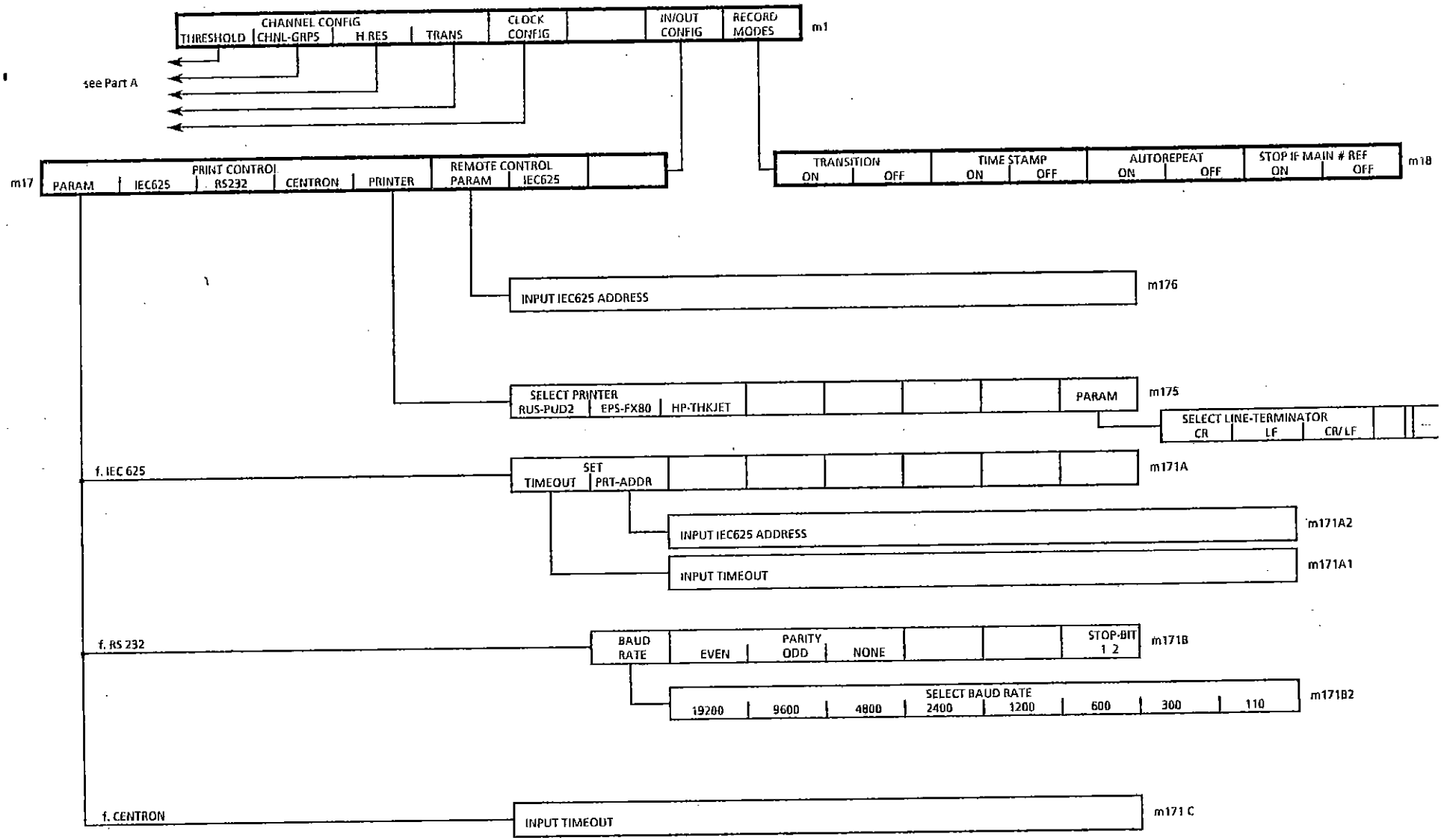


Bild 2-2 Rückansicht
Fig. 2-2 Rear view

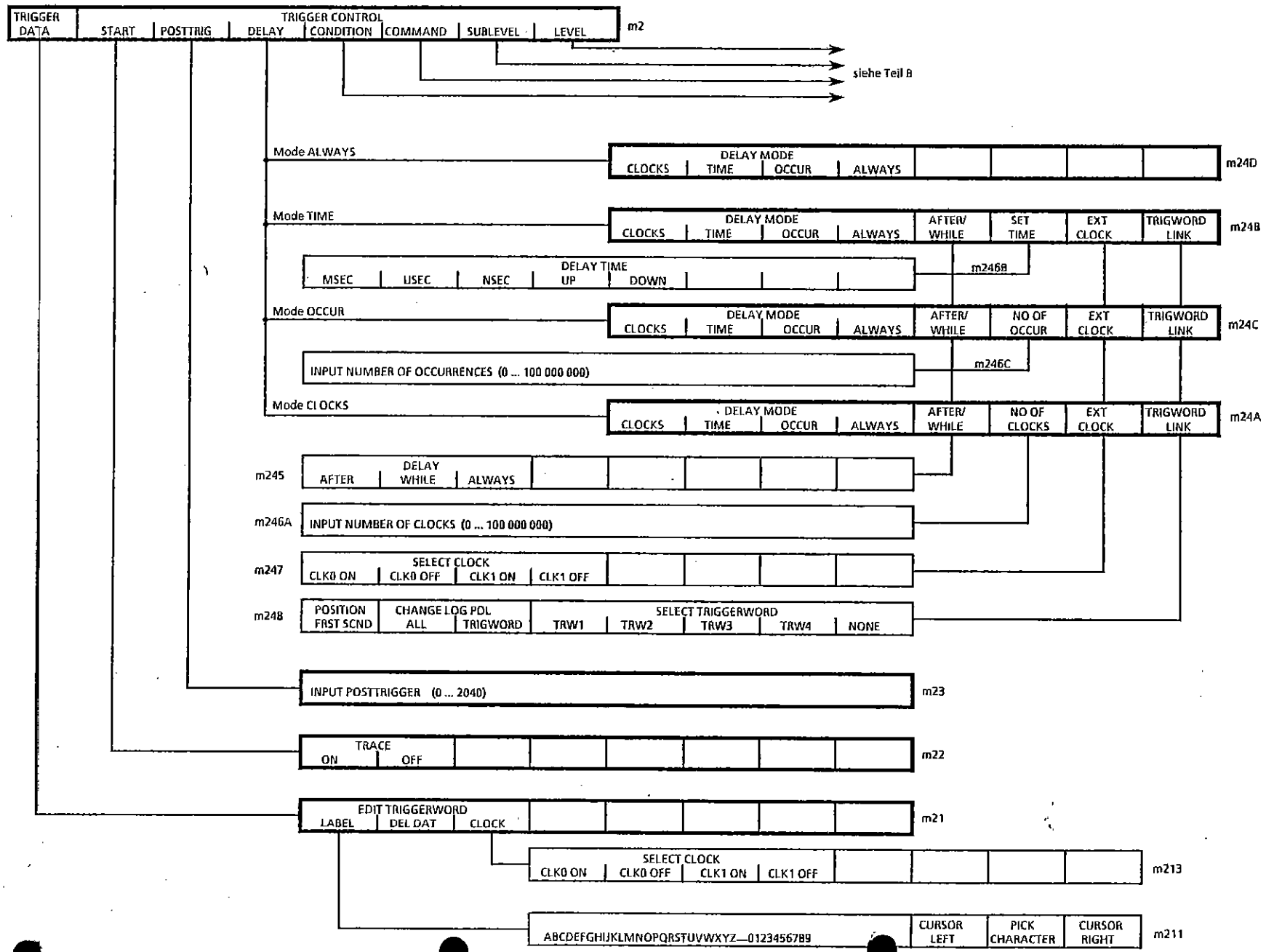
Tree Diagram of the CONFIGURATION Menu, Part A



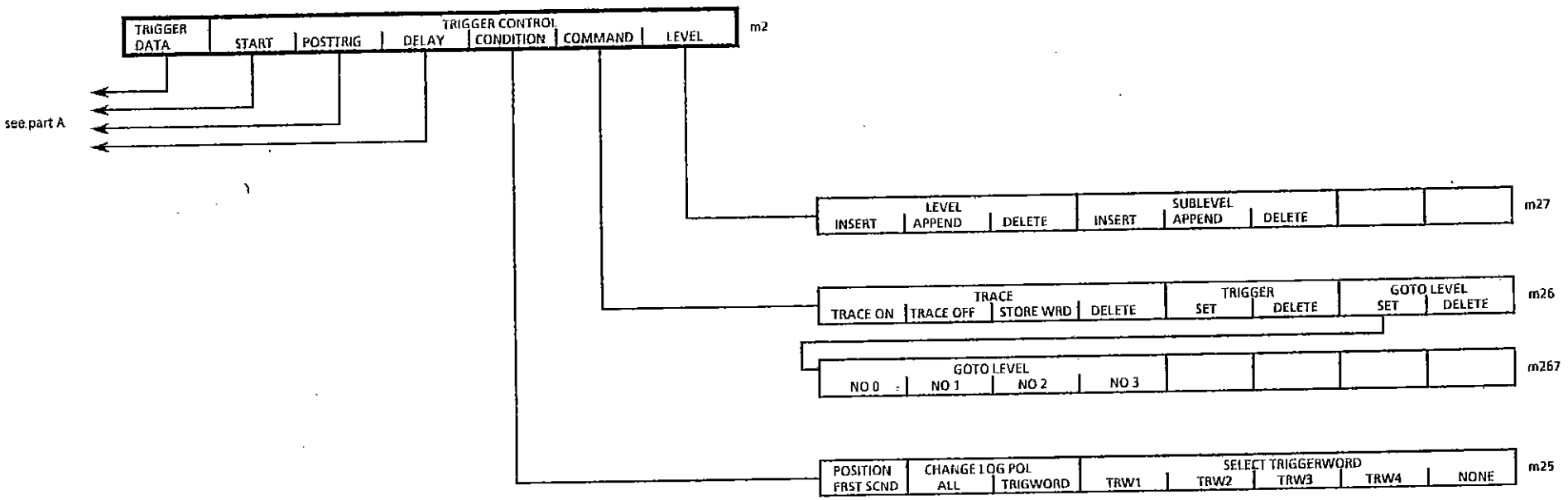
Tree Diagram of the CONFIGURATION Menu, Part B



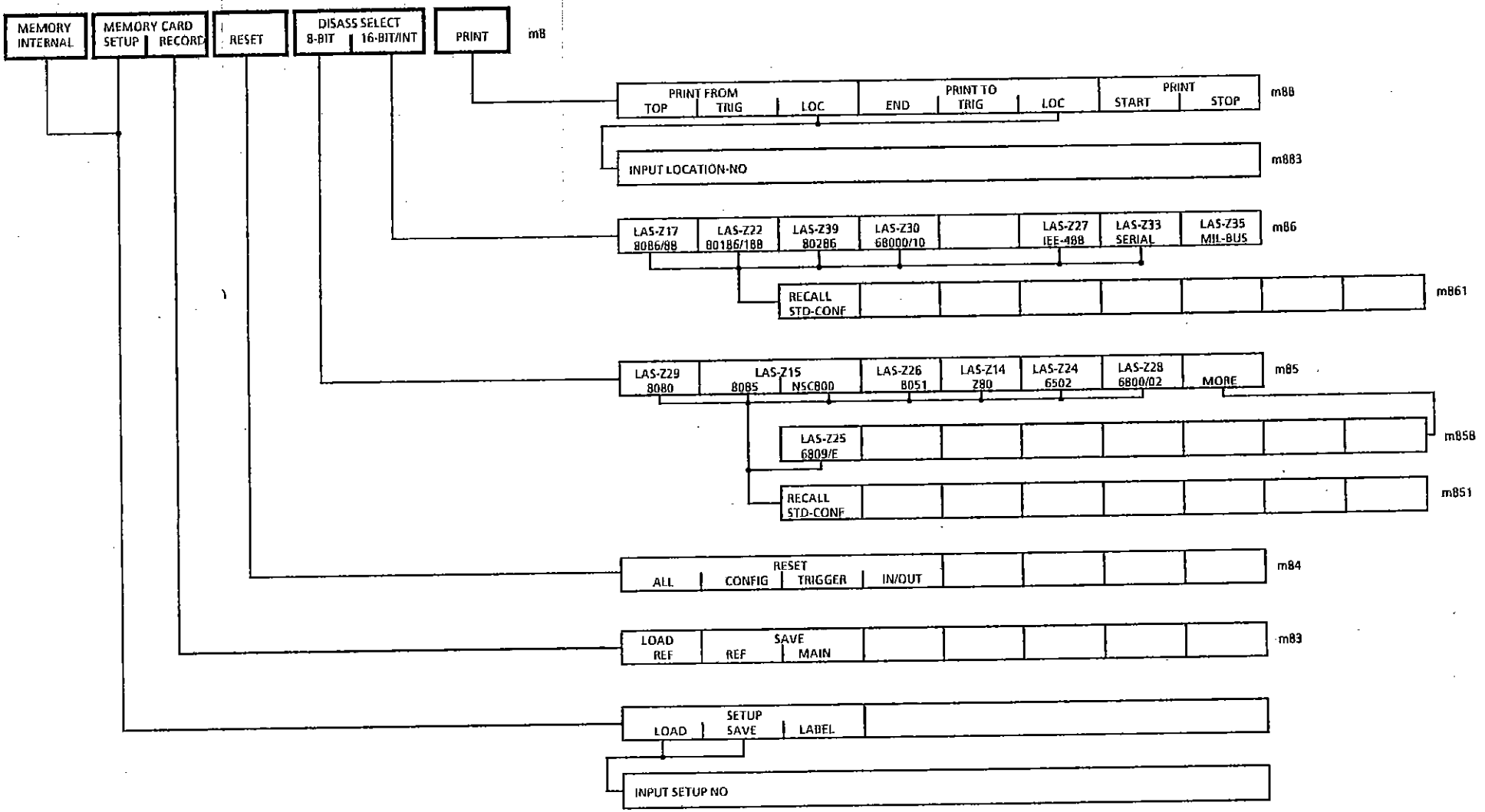
Tree Diagram of the TRIGGER Menu, Part A



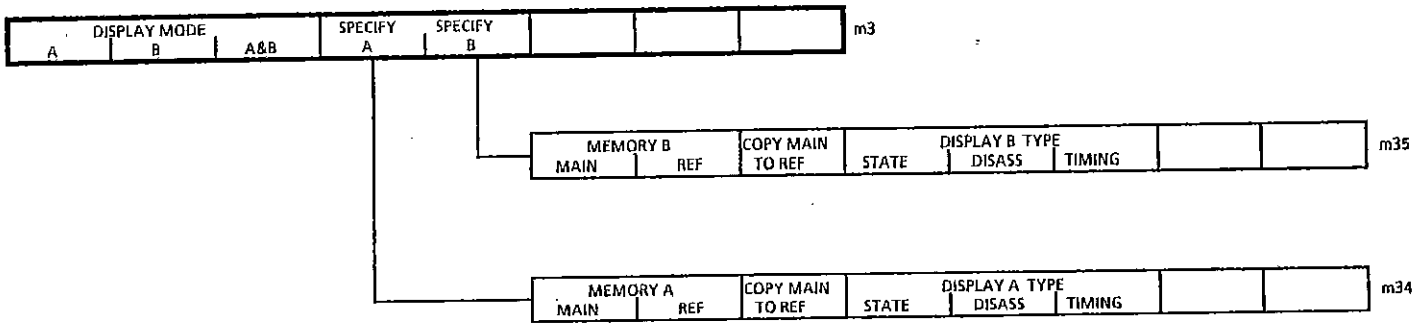
Tree Diagram of the TRIGGER Menu, Part B



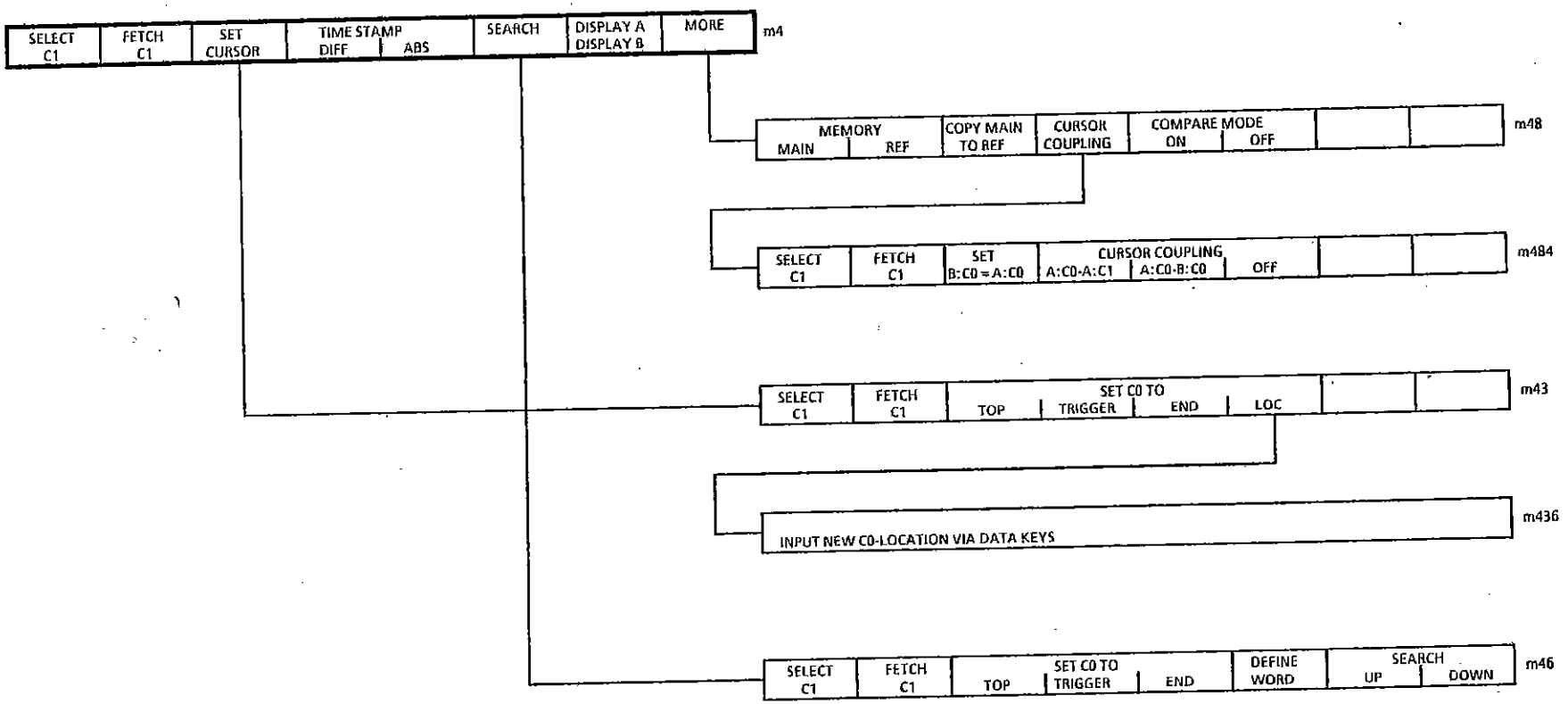
Tree Diagram of the SPECIAL Menu



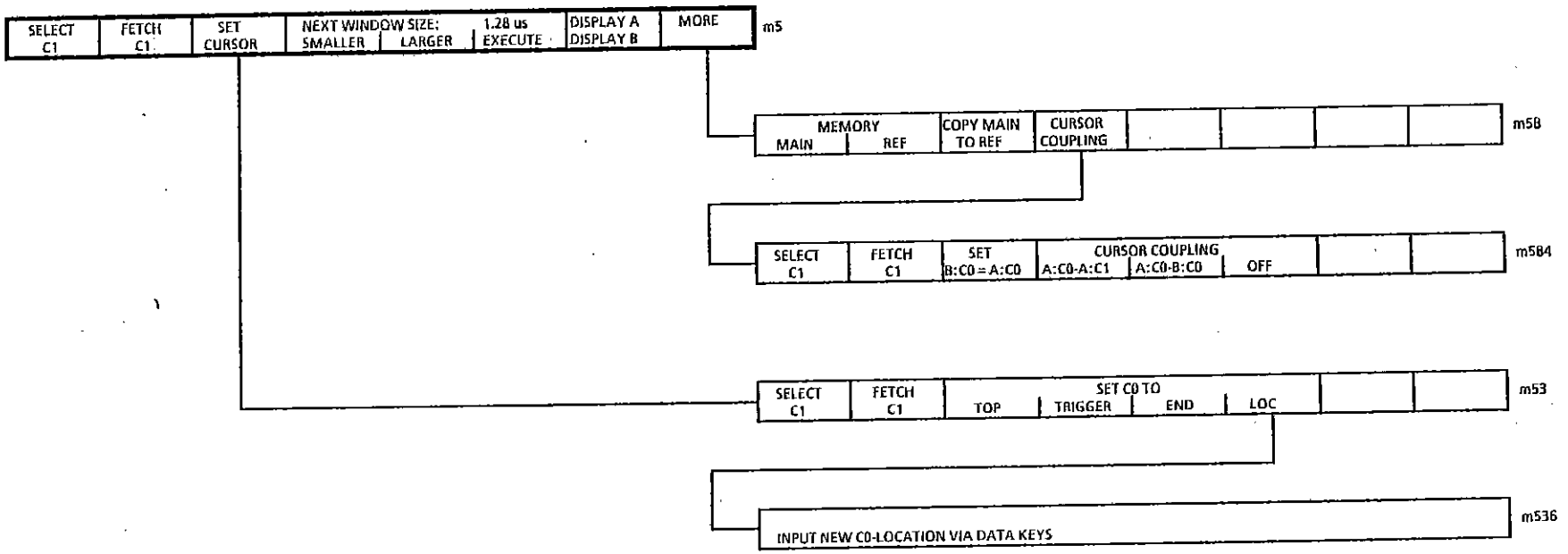
DISPLAY SELECT Menu



Tree Diagram DISPLAY CALL, STATE Display



Tree Diagram DISPLAY CALL, TIMING Display



3.3 Preparations for Use

3.3.1 Adjusting the AC Supply Voltage

The logic analyzer is designed for AC supply voltages of 100 V, 120 V, 220 V and 240 V. It is factory-set for operation from 220 V. To adjust a different AC supply voltage, remove the fuse holder ***28*** on the rear panel of the instrument, and replace with the arrow pointing to the desired AC supply voltage.

Note: Prior to putting the instrument into operation, make sure that the correct AC supply voltage is selected. This can be checked on the rear panel of the instrument (Fig. 3-2, item 28).

3.3.2 Exchanging the Fuse

To exchange the fuse, remove the fuse holder ***28***, insert the appropriate fuse and replace the fuse holder such that the arrow points to the desired AC supply voltage.

For all AC supply voltages, a fuse T4.0D is required.

3.3.3 Ventilation

For better cooling, the instrument is equipped with a blower which is located on the right side of the instrument. The required cooling air is sucked in through the air holes on the right side of the instrument. Therefore make sure not to cover the air holes, in particular at high ambient temperatures. Otherwise, the temperature inside the instrument will increase so that a higher failure rate has to be expected.

3.3.4 Connecting the Probes

The test items are connected to the logic analyzer via appropriate probes. The connectors for the probes are located on the front panel to the right of the screen. The control connector ***14*** is used for controlling microprocessor probes.

3.3.5 Switching on the Instrument

After connecting the power cable to connector ***28***, the instrument can be switched on using switch ***27*** on the rear of the instrument. After the CRT has warmed up and the self test has been carried out, the system is immediately ready for operation, which is indicated by the appearance of the configuration menu.

3.3.6 Self Test

Immediately upon switch-on of the instrument, a self test is effected. In the course of three steps, the program code (ROM test), the collection memory of the 48-channel analyzer (RAM test) and recording mode control (ASIC test) are checked. Each test is terminated by a respective screen message.

3.3.7 Brightness of the Screen

The brightness of the screen can be varied using the knurled knob ***25*** on the rear of the instrument.

3.3.8 Video Output

A video signal is available at the BNC connector ***24*** on the rear panel of the instrument, enabling an external output for the screen display of the instrument. This output can be used both for driving an external VDU with a larger screen or for connecting a hardcopy unit furnishing a printout of the display.

3.3.9 Adapting to the Test Item

The probes of the logic analyzer come with uniform adapters. These adapters can be exchanged. The individual connecting wires can be exchanged as well. The external ends of the connecting wires are provided with push-on sleeves which can be plugged onto wrap pins. The connecting wires can also be fitted with Miniclips IGA-Z8. Individual adapters are available under the designation IGA-Z3.

3.3.10 IEC-bus Connector

The IEC-bus connector permits the logic analyzer to be remote-controlled by a controller as well as to drive IEC-bus-compatible printers. It is recommended to use the R&S printer PUD2 with the IEC-bus option. The printer can directly be connected to the instrument via the IEC-bus cable PCK. Setting of the operating parameters is described in section 8.1.

3.3.11 RS232 Connector

The RS232 connector enables the logic analyzer to drive printers equipped with this interface. It is recommended to use the R&S printer PUD2 with the RS232 option. Setting of the operating parameters is described in section 3.

3.3.12 Parallel Printer (Centronics Connector)

The PARALLEL PRINTER connector ***22*** enables the logic analyzer to drive printers equipped with this interface. It is recommended to use the R&S printer PUD2 with the CENTRONICS option. Setting of the operating parameters is described in Section 4.7.

4 Instrument Configuration

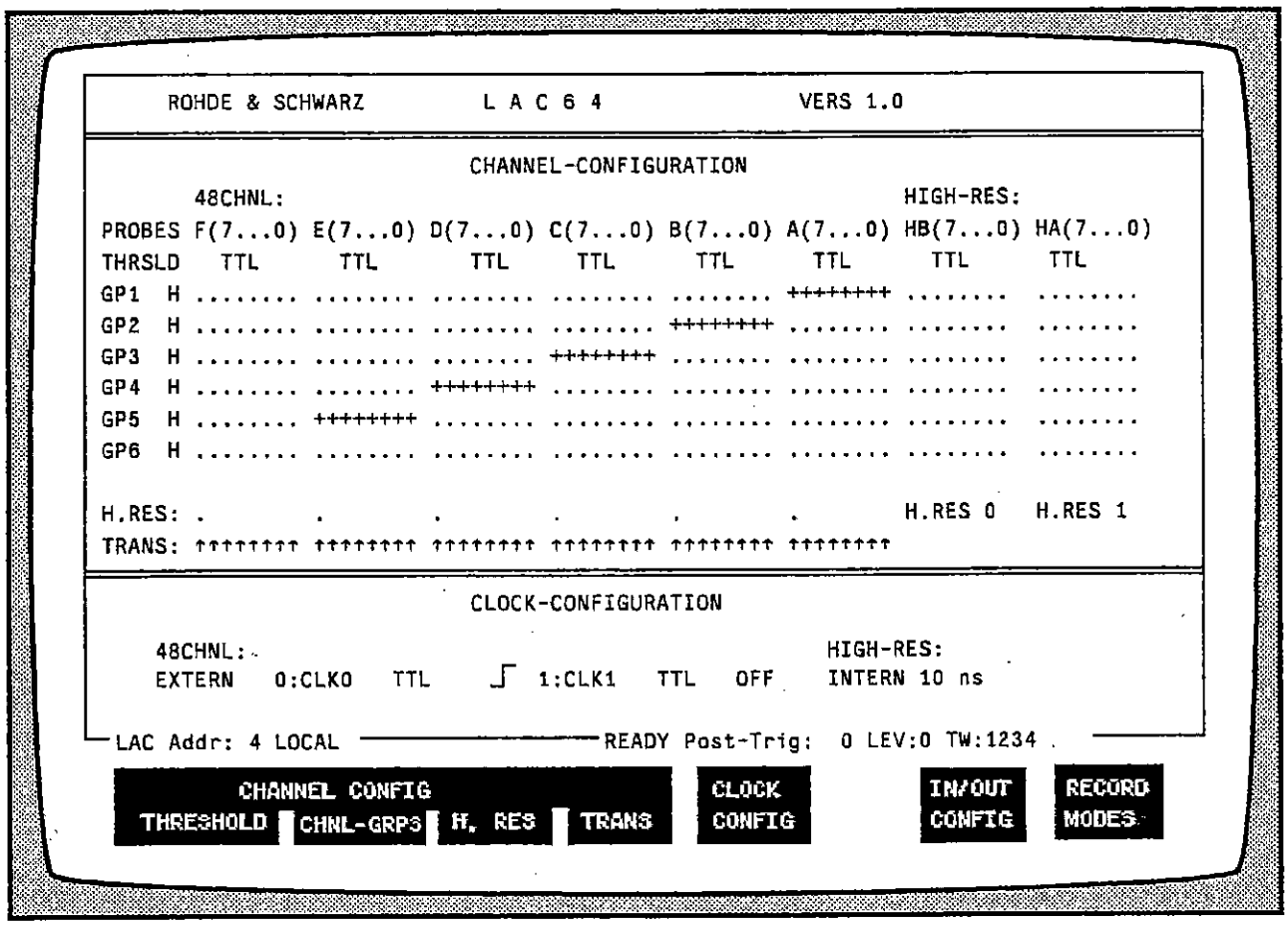


Fig. 4-1 Configuration menu

The basic instrument setting is performed in the configuration menu which is called up using the CONFIG key (see Fig. 3-1, item 3).

The configuration of the logic analyzer comprises all settings required for adapting the test channels of the logic analyzer to the test item. These are:

- Determination of the threshold voltages at the inputs of the DATA probes (see section 4.1)
- Flexible combination of test channels in channel groups, i.e. the channel configuration (see section 4.2)
- Selection of test channels with high resolution (see section 4.3)
- Selection of test channels using the TRANSITIONAL RECORDING mode (see section 4.4)
- Determination of the collection clock (see section 4.5)
- Selection of the mode of recording (RECORD MODES, see section 4.6).
- Definition of the IN-OUT configuration for printing and remote control (see section 4.7)

Notes on the screen configuration:

The configuration menu is composed of 3 successively arranged fields on the screen:

- POWER UP field
- CHANNEL CONFIGURATION field
- CLOCK CONFIGURATION field.

The POWER UP field contains the version number of the installed software. It is indicated in this field because the configuration menu does not only appear when pressing the CONFIG key but also when switching on the logic analyzer.

The CHANNEL CONFIGURATION field contains the input fields for the threshold voltages of the probes, the arrangement into channel groups of the 48-channel and high resolution analyzer and the transitional recording configuration.

The CLOCK CONFIGURATION field specifies the collection clocks for the 48-channel and high resolution analyzer.

The following monitor information is displayed in the lower section of the menu screen:

Address and status of IEC625 interface and status information of the recording process.

4.1. Setting the Threshold Voltages of the DATA and CLOCK Probes

4.1.1 Introduction

The threshold voltage of the DATA and CLOCK probes determines whether the signal applied to the probe input is recognized as logic HIGH or LOW. The signal is recorded as a HIGH signal if its voltage is greater than the threshold voltage and as a LOW signal if the voltage is smaller.

The threshold voltages are set in the configuration menu. This menu is called up using the CONFIG key (see Fig. 3-1, item 3).

- *Threshold voltages of the DATA probes*

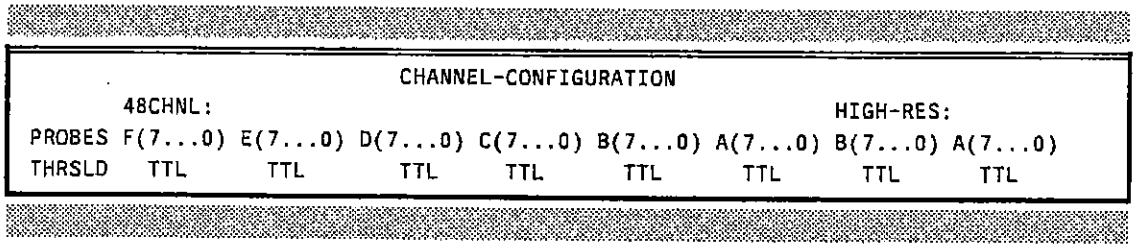


Fig. 4-2 Input fields for the threshold voltages of the DATA probes

The third line of the CHANNEL-CONFIGURATION field in the CONFIGURATION menu successively lists the DATA probes of the logic analyzer. The designations correspond to those of the probe connectors on the bottom right of the front panel.

The probes 48CHNL: F to 48CHNL: A belong to the 48-channel analyzer, the probes HIGH-RES:HB and HIGH-RES:HA belong to the high resolution analyzer.

The probe designations are followed by (*7...0*). This serves to indicate that probe channel No. 7 is represented by the column on the extreme left in the channel group field associated with each probe (the field with the characters ., +, - below the THRSLD display). Toward the right, channel 7 is followed by channel 6, 5, etc. and finally channel 0 on the extreme right of the channel group field.

The line below starting with THRSLD contains the input fields for the threshold voltages of the DATA probe in question.

- *Threshold voltages of the CLOCK probe*

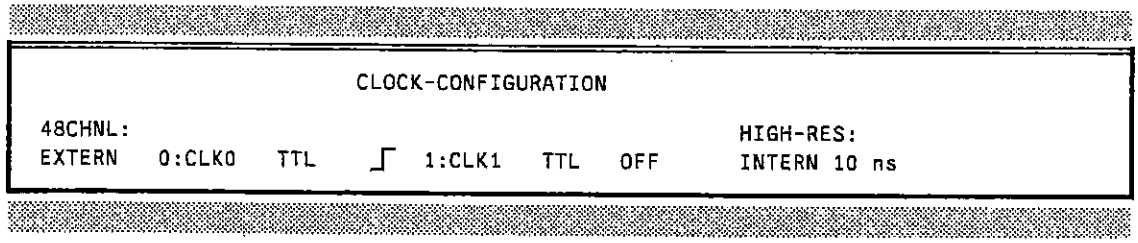


Fig. 4-3 Input fields for the threshold voltages of the CLOCK probe

The threshold voltages of the CLOCK probe can only be specified if the clock is switched to EXTERN (see section 4.6). The third line of the CLOCK-CONFIGURATION field in the CONFIGURATION menu then provides 2 input fields in which the threshold voltage of the two external clock inputs CLK0 and CLK1 can be specified. In Fig. 4-3 TTLs are set for CLK0 and CLK1.

The threshold voltage of the input comparators can be individually set for the DATA probe and the CLOCK probe of the logic analyzer. It is then identical for all channels of the probe in question. The threshold voltage can be selected between -9.9 V and +9.9 V with a resolution of 100 mV.

To simplify the operation, two values are directly offered via softkeys: +1.4 V for TTL and -1.3 V for ECL applications.

4.1.2 Setting the Threshold Voltage of the DATA Probe

The threshold voltage of the input comparators of the DATA probes is set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key (see Fig. 3-1, item 3).
  The CONFIGURATION select menu is called up.

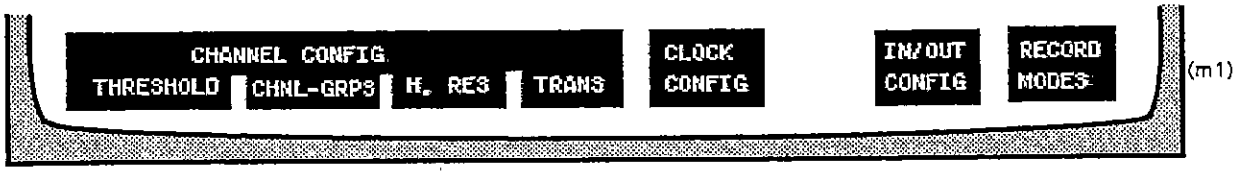


Fig. 4-4

- Press the softkey CHANNEL CONFIG THRESHOLD.
  The THRESHOLD select menu (m11) is called up.

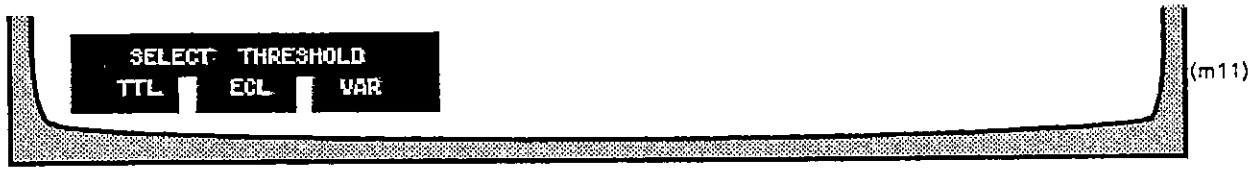


Fig. 4-5

The cursor appears in the input field THRSLD of probe F. It can be shifted to the input fields of the other probes using the cursor keys ← and →.

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
SELECT THRESHOLD TTL	The threshold voltage of the DATA probe denoted by the cursor is set to +1.4 V.
SELECT THRESHOLD ECL	The threshold voltage of the DATA probe denoted by the cursor is set to -1.3 V.
SELECT THRESHOLD VAR	Call-up of the variable THRESHOLD entry. The required threshold voltage can be set on the front panel of the logic analyzer using the numeric keypad. The entry is terminated by pressing the RETURN key.

To return to the CONFIGURATION select menu (m1), the RETURN key is pressed several times (see Fig. 3-1, item 16).

4.1.3 Setting the Threshold Voltage of the CLOCK Probe

The threshold voltage of the input comparators of the CLOCK probe is set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key (see Fig. 3-1, item 3).
  The CONFIGURATION select menu (m1) is called up.

Fig. 4-6

- Press the softkey CLOCK-CONFIG.
  The CLOCK-CONFIGURATION select menu (m15) is called up.

Fig. 4-7

- Press the softkey 48 CHNL-CLOCK EXT.
  The CLOCK-EXT setting menu (m152) is called up.

Fig. 4-8

- Press the softkey SELECT THRESHOLD.
  The CLOCK-EXT-THRESHOLD setting menu (m1527) is called up.

Fig. 4-9

The cursor appears in the field for setting the threshold voltage of the external clock input CLK0. Using the cursor keys ← and →, it can be shifted to the other input fields.

By pressing the respective softkey, the following settings can be performed:

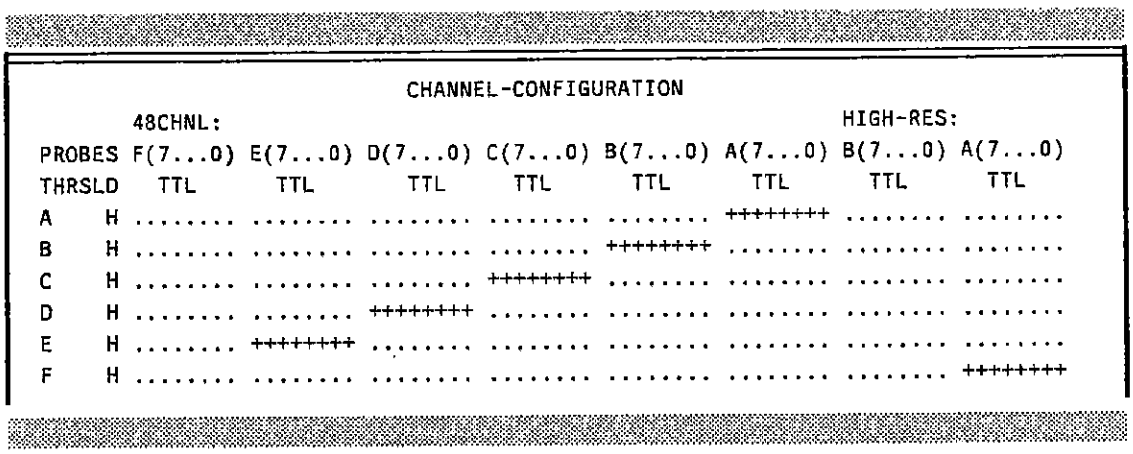
Softkey	Action
SELECT THRESHOLD TTL	The threshold voltage of the CLOCK probe denoted by the cursor is set to + 1.4 V.
SELECT THRESHOLD ECL	The threshold voltage of the CLOCK probe denoted by the cursor is set to -1.3 V.
SELECT THRESHOLD VAR	Call-up of the variable THRESHOLD entry. The required threshold voltage can be set using the numeric keypad on the front panel of the logic analyzer. The entry is terminated by pressing the RETURN key.

To return to the CONFIGURATION select menu (m1), the RETURN key is pressed several times (see Fig. 3-1, item 16).

4.2 Arrangement of Channels in Channel Groups

4.2.1 Introduction

The channel configuration provides a clear arrangement of the total of 64 channels of the logic analyzer:



```
                          CHANNEL-CONFIGURATION
        48CHNL:                                                    HIGH-RES:
PROBES F(7...0) E(7...0) D(7...0) C(7...0) B(7...0) A(7...0) B(7...0) A(7...0)
THRSLD   TTL      TTL      TTL      TTL      TTL      TTL      TTL      TTL
A    H ........ ........ ........ ........ ........ ++++++++ ........ ........
B    H ........ ........ ........ ........ ++++++++ ........ ........ ........
C    H ........ ........ ........ ++++++++ ........ ........ ........ ........
D    H ........ ........ ++++++++ ........ ........ ........ ........ ........
E    H ........ ++++++++ ........ ........ ........ ........ ........ ........
F    H ........ ........ ........ ........ ........ ........ ........ ++++++++
```

Fig. 4-10

The channels of the 48-channel or high resolution analyzer can be combined in channel groups. Each channel group is assigned a name (label) and a display code. With this code and this name, the trigger words will then be displayed in the TRIGGER menu and the recorded data in the DISPLAY menu.

Each channel is represented by a vertical line of dots ("...") in the central part of the CHANNEL CONFIGURATION menu. If a plus or a minus sign is entered in this line, this channel is part of the channel group which is arranged in the horizontal direction, i.e. in the associated line.

By entering plus or minus signs in this field, any channels of the logic analyzer can be optionally combined in channel groups. The two signs determine the channel group and also indicate whether the respective channel group is treated with positive (+) or negative (-) logic in the TRIGGER menu and in the DISPLAY menus.

The channel configuration is set in the CONFIGURATION menu. This menu can be directly called up via the CONFIG key (see Fig. 3-1, item 3).

The name of a channel group (label) can consist of up to 4 ASCII characters. All alphanumeric characters as well as "_" and space are available and can be optionally combined in any way . The name is entered via a softkey menu.

The display codes available are hexadecimal (H), binary (B), octal (O), decimal (D) and ASCII (A).

The indication of polarity of the signs entered in the channel groups (+ and -) is always identical for all channels of a channel group.

In the list of channel groups, new channel groups can be added at any place or unwanted groups deleted. A maximum of 20 channel groups is possible.

Note: The channels of the 48-channel analyzer cannot be combined with the channels of the high resolution analyzer in common channel groups!

Entries in the channel group field of the 48-channel analyzer refer to both analyzers: An H.RES channel group (H.RES0 oder H.RES1) entered further down in line H.RES indicates that this channel is recorded by both analyzers (with different clock rates). This is considered in the display by particular markings.

Entries in the HIGH-RES channel group field ensure an exclusive high resolution recording of this channel group via the probe inputs HIGH RES B and A of the logic analyzer. For any such recording it is moreover necessary that the channel groups of the high resolution analyzer (H.RES0 or H.RES1) are specified further down (vertically seen) in line H.RES (see section 4.3).

4.2.2 Entering the Channel Group Data

The channel group data are set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key (see Fig. 3-1, item 3).
  The CONFIGURATION select menu (m1) is called up.

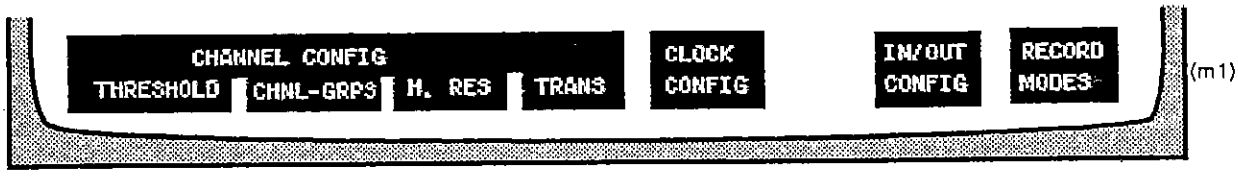


Fig.4-11

- Press the softkey CHANNEL CONFIG CHNL-GRPS.
  The 48-CHNL configuration setting menu (m11) is called up.

Fig.4-12

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
SELECT CHANNEL +	A + (plus) sign is entered in the configuration field at the current cursor location. In the event that this channel has been assigned to a different channel group, the entry is deleted. The complete channel group is switched to positive polarity.
SELECT CHANNEL −	As SELECT CHANNEL +, except that the − (minus) sign is used and the channel group is switched to negative polarity.
SELECT CHANNEL DELETE	An entry of + (plus) or - (minus) sign present at the current cursor location is deleted.
INSERT CHNL GRP	A new channel group is inserted directly ahead of the current cursor location.
APPEND CHNL GRP	A new channel group is appended directly following the current cursor location.
DELETE CHNL GRP	The channel group present at the current cursor location is deleted.

By pressing the RETURN key (see Fig. 3-1, item 16), the CONFIGURATION select menu can again be return-ed to.

4.2.3 Entering Labels for the Channel Groups

The labels of the channel groups are entered in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key (see Fig. 3-1, item 3).
  The CONFIG select menu is called up.

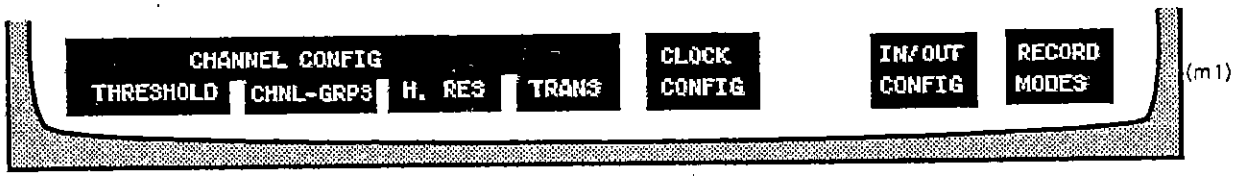


Fig. 4-13

- Press the softkey CHANNEL CONFIG CHNL-GRPS.
  The 48-CHNL-configuration setting menu (m11) is called up.

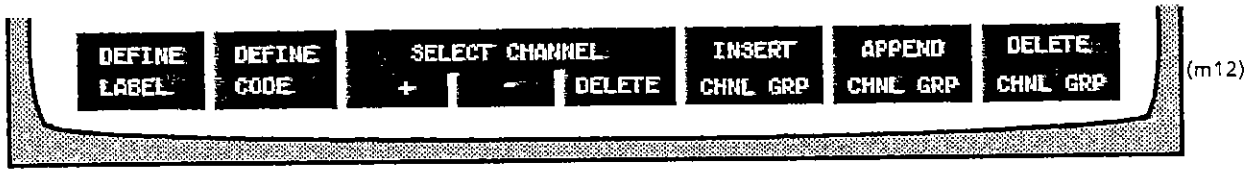


Fig. 4-14

▸ Press the softkey DEFINE LABEL.
The LABEL input menu (m11) is called up.

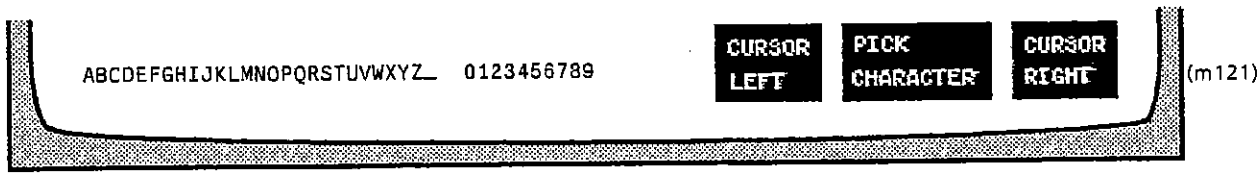


Fig. 4-15

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
CURSOR LEFT	Cursor in the ASCII select line moves one position to the left
PICK CHARACTER	The ASCII character denoted by the cursor is included in the label
CURSOR RIGHT	Cursor in the ASCII select line moves one position to the right

To return to the CONFIG select menu (m1), the RETURN key (see Fig. 3-1, item 16) is pressed several times.

4.2.4 Setting the Channel Group Display Code

The channel group display codes are set in the CONFIGURATION menu. Proceed as follows:

▸ Press the CONFIG key (see Fig. 3-1, item 3).
The CONFIGURATION select menu is called up.

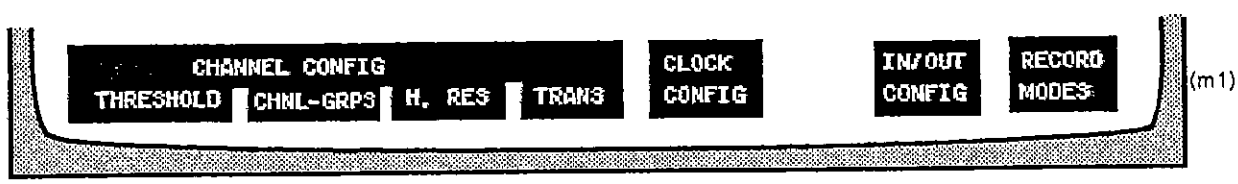


Fig. 4-16

▸ Press the softkey CHANNEL CONFIG CHNL-GRPS.
The 48-CHNL configuration setting menu (m11) is called up.

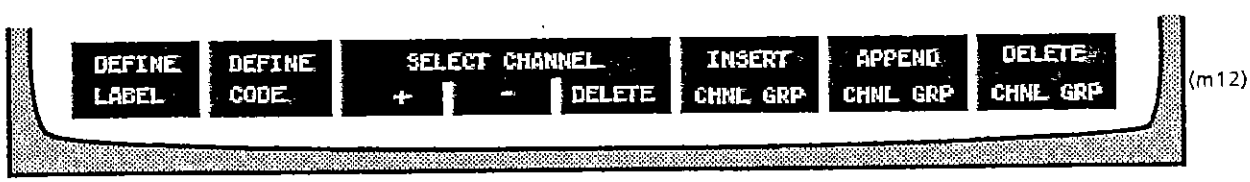


Fig. 4-17

- Press the softkey DEFINE CODE.
  The display CODE input menu (m112) is called up.

Fig. 4-18

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
SELECT CODE BIN	The channel group denoted by the current cursor location is assigned the new display code "binary".
SELECT CODE HEX	The channel group denoted by the current cursor location is assigned the new display code "hexadecimal".
SELECT CODE OCT	The channel group denoted by the current cursor location is assigned the new display code "octal".
SELECT CODE DEC	The channel group denoted by the current cursor location is assigned the new display code "decimal".
SELECT CODE ASCII	The channel group denoted by the current cursor location is assigned the new display code "ASCII".

By pressing the RETURN key (see Fig. 3-1, item 16), the CONFIGURATION select menu (m1) can again be returned to.

4.3 Configuration of the High Resolution Analyzer

4.3.1 Introduction

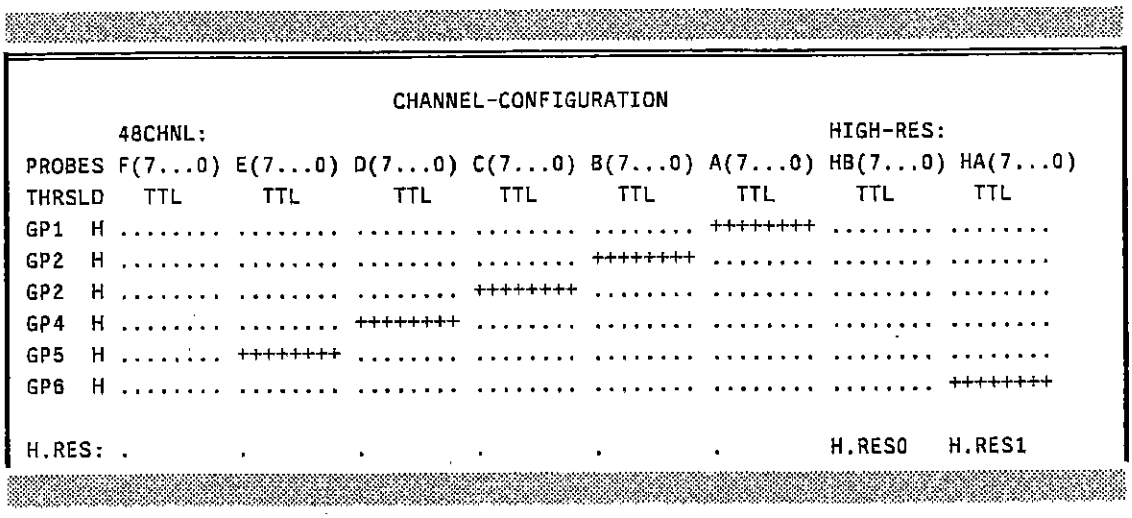


Fig. 4-19

In addition to the 48-channel analyzer, the logic analyzer also contains the high resolution analyzer. This can be conceived of as a magnifier that allows to observe the time period before and after the trigger event with a high resolution of up to 5 ns. This analyzer always uses an internal clock.

With regard to the trigger point, the high resolution analyzer is linked with the 48-channel analyzer. As soon as the latter detects a trigger event, both analyzers are started. In the DISPLAY menu, this trigger point functioning as synchronization point will then enable a time-correlated display of both collections made with different clock rates. If no trigger event occurs, the high resolution analyzer is not started, which is why no high resolution display is possible.

The high resolution analyzer is set in the CONFIGURATION menu. This menu can be called up using the CONFIG key (see Fig. 3-1, item 3).

The high resolution analyzer features two basic settings: 16 channels with a clock rate of 100 MHz or 8 channels with 200 MHz. An internal clock is always used.

The high resolution channels can either be superimposed on the 48 channels of the 48-channel analyzer in 1 or 2 blocks of 8 channels each (H.RES0 und H.RES1) or form their own channel groups.

If they are to be superimposed on the channels of the 48-channel analyzer as a "magnifier", the H.RES blocks in the H.RES line must be positioned below the respective channels of the 48-channel analyzer. It needs be noted that these channels form part of the channel groups of the 48-channel analyzer (see section 4.2.1).

If the high resolution channels are to form their own channel groups, the H.RES blocks in the H.RES line must be positioned below the respective channels of the high resolution analyzer. It needs be noted that these channels form part of the channel groups of the high resolution analyzer (see section 4.2.1).

Note: The channels of the 48-channel analyzer cannot be combined with those of the high resolution analyzer in common channel groups!

4.3.2 Setting the Configuration of the High Resolution Analyzer with a Clock Rate of 10 ns

The configuration of the high resolution analyzer with a clock rate of 10 ns is set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key.
  The CONFIGURATION select menu (m1) is called up.

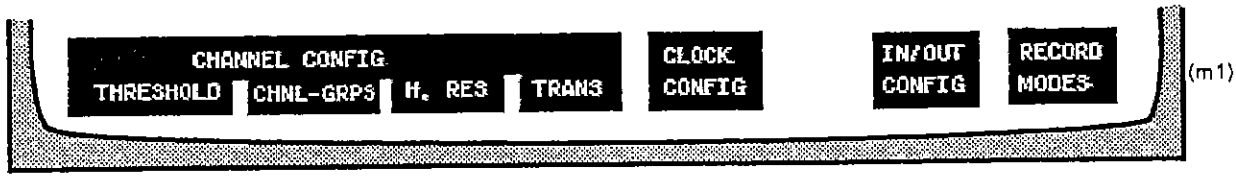


Fig. 4-20

- Press the softkey CHANNEL CONFIG H. RES.
  The HIGH-RES setting menu is called up:

Fig. 4-21

The cursor appears at the beginning of the input line in the menu and can be shifted to the selected channels using the cursor keys.

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
SET H.RES0	The H.RES0 block of the high resolution analyzer is assigned to the probe denoted by the cursor location.
SET H.RES1	The H.RES1 block of the high resolution analyzer is assigned to the probe denoted by the cursor location.

By pressing the RETURN key (see Fig. 3-1, item 16), the CONFIGURATION select menu (m1) can again be returned to.

Note: The channels of the 48-channel analyzer cannot be combined with those of the high resolution analyzer in common channel groups!

4.3.3 Setting the Configuration of the High Resolution Analyzer with a Clock Rate of 5 ns

The configuration of the high resolution analyzer with a clock rate of 10 ns is set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key.
  The CONFIGURATION select menu (m1) is called up.

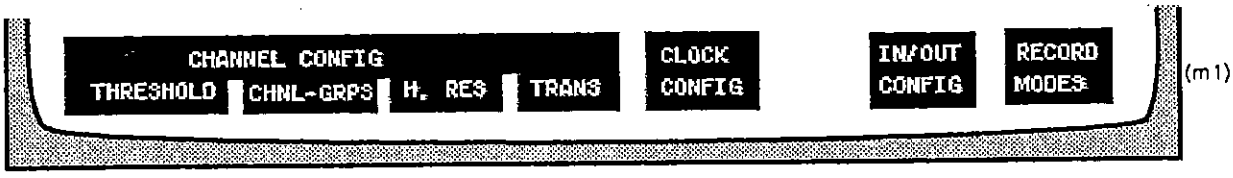


Fig. 4-22

- Press the softkey CHANNEL CONFIG H. RES.
  The HIGH-RES setting menu is called up:

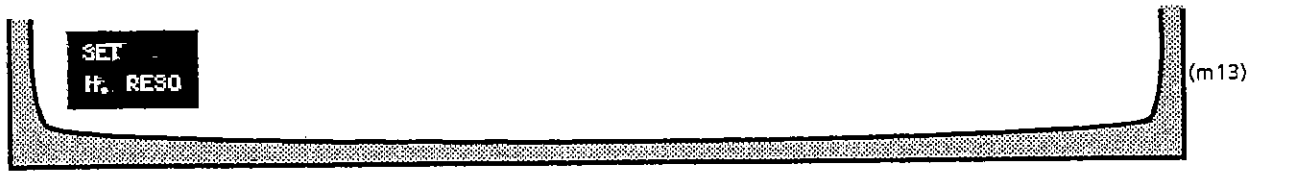


Fig. 4-23

The cursor appears at the beginning of the input line in the menu and can be shifted to the selected channels using the cursor keys.

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
SET H.RESO	The H.RESO block of the high resolution analyzer is assigned to the probe denoted by the cursor location.

By pressing the RETURN key (see Fig. 3-1, item 16), the CONFIGURATION select menu (m1) can again be returned to.

4.4 Configuration of the TRANSITIONAL RECORDING Mode

4.4.1 Introduction

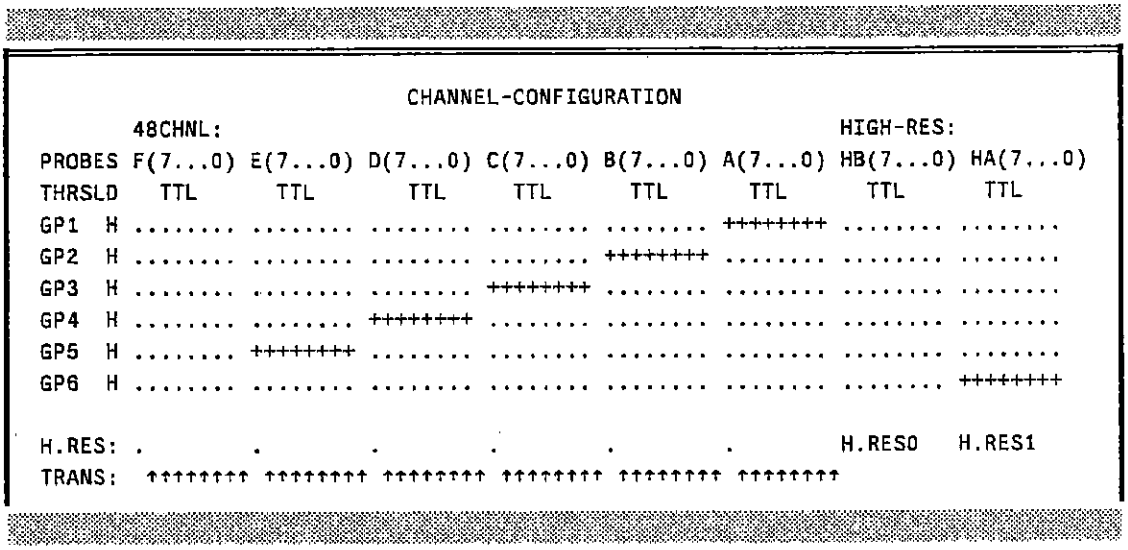


Fig. 4-24

The TRANSITIONAL RECORDING mode checks with each clock whether there has been a change in the logic levels of the channels since the last recording. If this is not the case, the current status of the signal is not transferred into the memory. If, however, the level of at least one channel has changed, the new status of all channels and the time elapsed since the last collection are recorded in the memory. Storage of this time permits a time-linear display of the measurement results in the DISPLAY menus.

The purpose of this type of recording is to prevent signals that do not change over a longer period of time from unnecessarily occupying storage space in the memory.

The 48 channels of the 48-channel analyzer can be individually set to the TRANSITIONAL RECORDING mode in the bottom line of the CHANNEL-CONFIG field in the CONFIGURATION menu which starts with the name TRANS. The channels of the high resolution analyzer are operated in normal mode only.

A channel operating in the TRANSITIONAL RECORDING mode is marked by an arrow (↑) at the respective place in the TRANS setting line. Channels of this kind are also marked in the display of the recorded data in the DISPLAY menus.

The current TRANSITIONAL RECORDING configuration can be switched on and off as a whole. For this purpose, a corresponding switching facility is provided in theTRANSITIONAL RECORDING menu (m14) (see section 4.4.2) and in the RECORD MODE menu (m18). The RECORD MODE menu is called up in the CONFIGURATION menu (m1) (see section 4.6).

4.4.2 Setting the Configuration for TRANSITIONAL RECORDING

The TRANSITIONAL RECORDING mode is set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key.
  The CONFIGURATION select menu (m1) is called up.

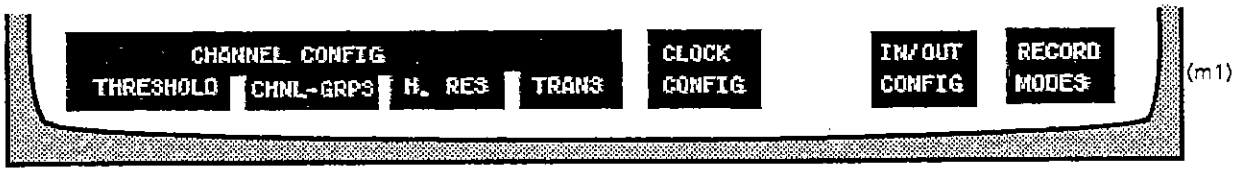


Fig. 4-25

- Press the softkey CHANNEL CONFIG TRANS.
  The TRANSITIONAL RECORDING setting menu (m13) is called up.

Fig. 4-26

With the TRANSITIONAL RECORDING mode switched on, the cursor appears at the beginning of the input line TRANS, when the TRANSITIONAL RECORDING menu (m14) has been called. The cursor can then be shifted to the required channel using the cursor keys.

By pressing the respective softkey, the following settings can be performed:

Softkey	Aktion
TRANSITION ON	This softkey switches on the TRANSITIONAL-RECORDING mode.
TRANSITION OFF	This softkey switches off the TRANSITIONAL-RECORDING mode.
TRANS-CHNLS SET	The channel denoted by the cursor location is set to theTRANSITIONAL-RECORDING mode and marked by an arrow.
TRANS-CHNLS DELETE	The TRANSITIONAL RECORDING mode is cancelled for the channel denoted by the cursor location. The arrow is deleted.

Note: The softkeys TRANS-CHNLS SET and TRANS-CHNLS DELETE are only displayed, when the TRANSITIONAL RECORDING mode is switched on. This applies also for the arrows and the cursor in the input line TRANS.

The softkeys TRANSITION ON and TRANSITION OFF are also displayed in the RECORD MODE menu (m18) (s. section 4.6).

By pressing the return key, the CONFIGURATION select menu can again be returned to.

4.5 Setting the CLOCK

4.5.1 Introduction

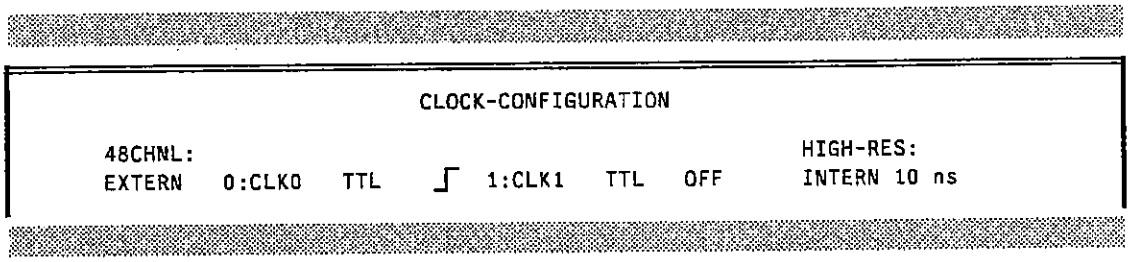


Fig. 4-27

A logic analyzer measures the logic level at the DATA probe inputs at defined points in time (i.e. clocks) and stores the measurement results in the internal data memory. The clock can be internally generated or also externally applied to the CLOCK probe (see Fig. 3-1, item 11).

In the operating mode CLOCK INTERN, the clock is generated by an internal oscillator. It delivers a periodic clock signal that can be set to occur at particular time intervals.

In the operating mode CLOCK EXTERN, the clock is obtained from an external source, e.g. from the test item itself. For this purpose, the two CLOCK-EXT inputs of the CLOCK probe of the logic analyzer are used.

The clock is set in the CONFIGURATION menu. This menu can be called up using the CONFIG key.

Note: With TRANSITIONAL RECORDING mode active, the measured data are not as a rule generally stored with each clock but only if they have changed since the last storage.

The following settings are possible:

- ***48-channel analyzer CLOCK INTERN:***
  The setting range for the internal clock of the 48-channel analyzer covers 20 ns to 500 ms. It can be set to 20 ns, 40 ns, 60 ns, 80 ns, 100 ns and, starting at 100 ns, the clock rate can be set in steps of 1 ns. The units ns, µs and ms can be directly set.

- ***48-channel analyzer CLOCK EXTERN:***
  The logic analyzer provides two external clock inputs via the CLOCK probe. It can be selected for each clock input whether a rising or a falling edge is to be used. Besides, each input can also be disabled.

  As with the DATA probes, the threshold value of the input comparators can be set in 100-mV steps from -9.9 V to +9.9 V for each CLOCK probe. The two clock channels can be assigned a name (label) consisting of a maximum of 4 characters.

- ***High-resolution analyzer:***
  The high resolution analyzer always uses an internal clock. Clock rates of 10 ns and 5 ns can be selected.

4.5.2 Setting the Internal Clock of the 48-channel Analyzer

The internal clock of the 48-channel analyzer is set in the CONFIGURATION menu which is directly called up using the CONFIG key on the front panel of the logic analyzer. Proceed as follows:

- Press the CONFIG key.
  The CONFIGURATION select menu (m1) is called up.

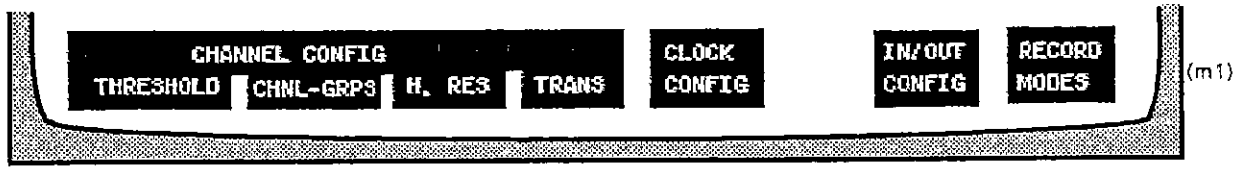


Fig. 4-28

- Press the softkey CLOCK CONFIG.
  The CLOCK select menu is called up.

Fig. 4-29

- Press the softkey 48-CHNL-CLOCK INT.
  The CLOCK INTERN setting menu for the 48-channel analyzer is called up.

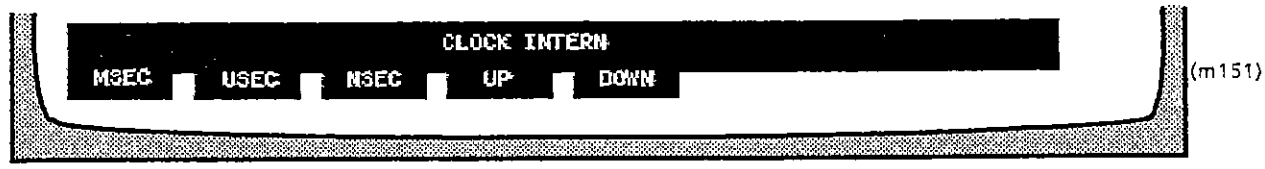


Fig. 4-30

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
MSEC	The unit becomes milliseconds .
USEC	The unit becomes microseconds.
NSEC	The unit becomes nanoseconds.
UP	The clock rate changes in ascending sequence.
DOWN	The clock rate changes in descending sequence.

The following numerical values can be selected:

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 200, 300, 400, 500, 600, 700, 800, 900.

Note: The entries are restricted by the range limits of the internal clock (20 ns or 500 ms).

To return to the CONFIG select menu (m1), the RETURN key (see Fig. 3-1, item 16) is pressed several times.

4.5.3 Setting the External Clock of the 48-channel Analyzer

The external clock of the 48-channel analyzer is set in the CONFIGURATION menu. This menu can be directly called up using the CONFIG key on the front panel of the logic analyzer. Proceed as follows:

- Press the CONFIG key.
  The CONFIGURATION select menu (m1) is called up.

Fig. 4-31

▸ Press the softkey CLOCK CONFIG.
The CLOCK select menu is called up.

Fig. 4-32

▸ Press the softkey 48-CHNL-CLOCK EXT.
The CLOCK EXTERN setting menu for the 48-channel analyzer (m152) is called up.

Fig. 4-33

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
SELECT CLOCK CLK0	The first CLOCK-EXTERN channel is currently activated.
SELECT CLOCK CLK1	The second CLOCK-EXTERN channel is currently activated.
DEFINE LABEL	Call-up of the input menu for the label name of the currently activated CLOCK-EXTERN channel. The label name may comprise a maximum of 4 ASCII characters. The entry is made via a LABEL input menu (m1523) as described for the channel group labels in section 4.2.3
DEFINE EDGE ⌐	The active edge for the currently activated CLOCK-EXTERN channel is set to "rising".
DEFINE EDGE ⌙	The active edge for the currently activated CLOCK-EXTERN channel is set to "falling".
DEFINE EDGE OFF	Switching off of the CLOCK-EXT channel. Via key ⌐ or ⌙ the channel is activated again.
SELECT THRESHOLD	Call-up of the CLOCK-EXT-THRESHOLD setting (m1527) for the currently active CLOCK-EXTERN channel (see section 4.1.3).

To return to the CONFIGURATION select menu (m1), the RETURN key (see Fig. 3-1, item 16) is pressed several times.

4.5.4 Setting the Clock of the High Resolution Analyzer

The clock of the high resolution analyzer is set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key.
  The CONFIGURATION select menu (m1) is called up.

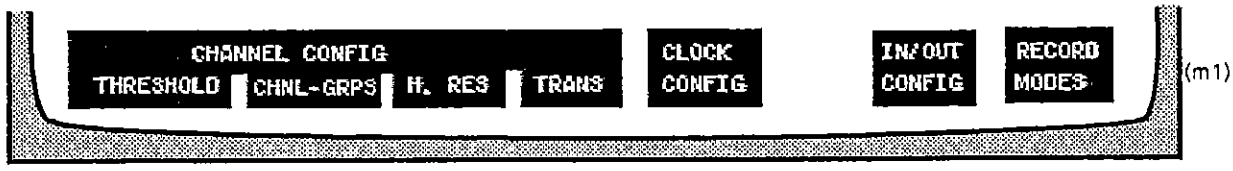


Fig. 4-34

All settings referring to the clock are indicated in the lower third section of the CONFIGURATION menu, the CLOCK CONFIG field.

- Press the softkey CLOCK CONFIG.
  The CLOCK select menu is called up.

Fig. 4-35

- Press the softkey HIGH-RES-CLOCK.
  The CLOCK-INTERN setting menu for the high resolution analyzer (m153) is called up.

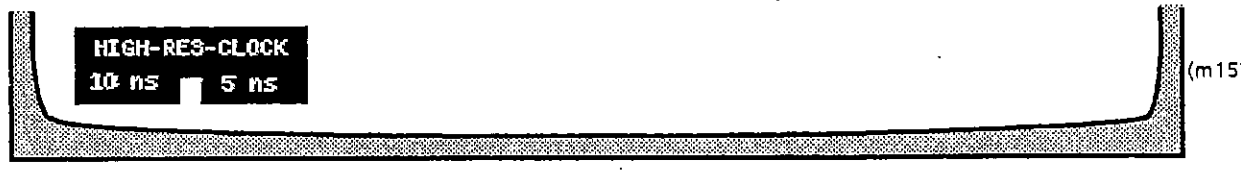


Fig. 4-36

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
HIGH-RES-CLOCK 10 ns	The clock of the high resolution analyzer is set to 10 ns, internal.
HIGH-RES-CLOCK 5 ns	The clock of the high resolution analyzer is set to 5 ns, internal.

If a clock rate of 5 ns is selected, the high resolution analyzer can only be assigned one probe in the HIGH-RES menu.

To return to the CONFIG select menu (m1), the RETURN key (see fig. 3-1, item 16) is pressed several times.

4.6 Configuration of the RECORD MODE

4.6.1 Introduction

- **Transitional Recording on/off**
  The TRANSITIONAL RECORDING mode is switched on or off as a whole.

- **Recording with TIME STAMP on/off**
  This determines whether the next collection is to be made with or without the time being measured from clock to clock (TIME STAMP). As the TIME STAMP information is recorded in the memory together with the measured data, the maximum number of data words in the memory is affected.

- **Autorepeat Mode**
  The AUTOREPEAT mode permits to define whether the logic analyzer is to stop after recording or to automatically restart.

4.6.2 Activating and Deactivating the TRANSITIONAL RECORDING Mode

The TRANSITIONAL RECORDING mode is set in the CONFIGURATION menu. Proceed as follows:

▸ Press the CONFIG key.
The CONFIGURATION select menu (m1) is called up.

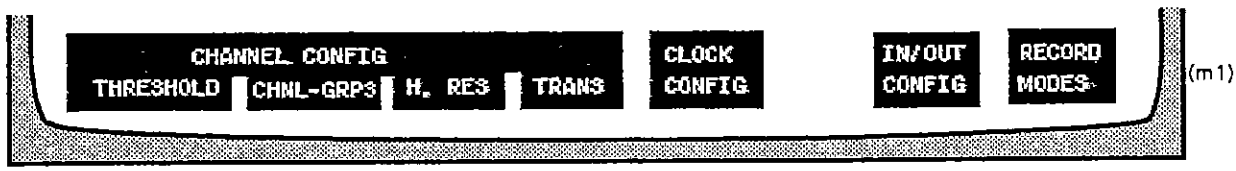


Fig. 4-37

▸ Press the softkey RECORD MODES.
The RECORD MODE setting menu is called up.

Fig. 4-38

By pressing the respective softkey, the TRANSITIONAL RECORDING mode can be switched on and off:

Softkey	Action
TRANSITION ON	TRANSITIONAL RECORDING mode is switched on.
TRANSITION OFF	TRANSITIONAL RECORDING mode is switched off.

By pressing the RETURN key (see Fig. 3-1, item 16), the CONFIGURATION select menu (m1) can be returned to.

4.6.3 Activating and Deactivating TIME STAMP Measurement

The TIME STAMP measurement is set in the CONFIGURATION select menu. Proceed as follows:

- Press the CONFIG key.
  The CONFIGURATION select menu (m1) is called up.

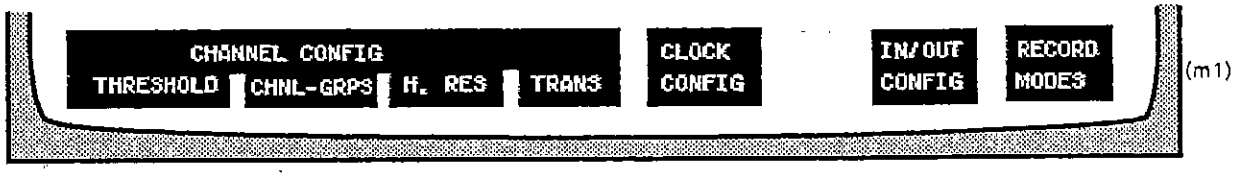


Fig. 4-39

- Press the softkey RECORD MODES.
  The RECORD-MODE setting menu is called up.

Fig. 4-40

By pressing the respective softkey, the TIME STAMP is switched on and off:

Softkey	Action
TIME STAMP ON	TIME-STAMP measurement is switched on.
TIME STAMP OFF	TIME STAMP measurement is switched off.

By pressing the RETURN key (see Fig. 3-1, item 16), the CONFIGURATION select menu (m1) can again be returned to.

4.6.4 Settings for the AUTOREPEAT Mode

The AUTOREPEAT mode is set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key.
  The CONFIG select menu (m1) is called up.

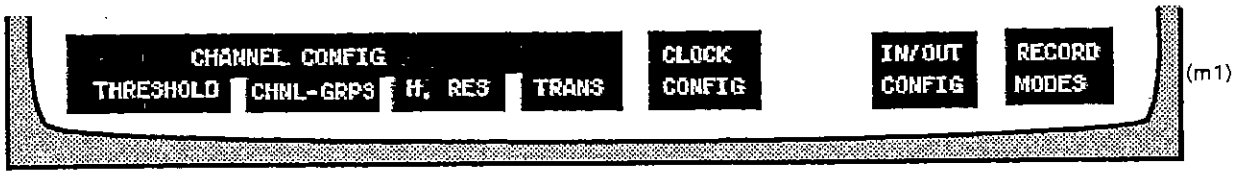


Fig. 4-41

- Press the softkey RECORD MODES.
  The RECORD-MODE setting menu is called up.

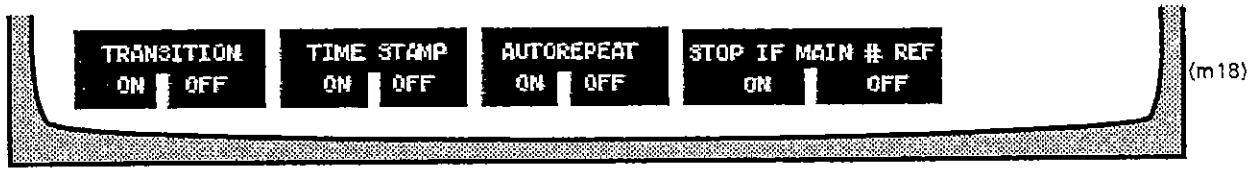


Fig. 4-42

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
AUTOREPEAT ON	AUTOREPEAT mode is switched on. This means that on completion of a data collection the LAC64 automatically restarts recording. See also the key function STOP IF MAIN # REF in this menu.
AUTOREPEAT OFF	AUTOREPEAT mode is generally switched off.
STOP IF MAIN # REF ON	The following series of automatic recordings is interrupted if the recordings have different values in the MAIN and the REF memory. (This softkey is output only if the AUTOREPEAT mode is switched to ON.) See also Section 7.4.7
STOP IF MAIN # REF OFF	The series of automatic recordings is not interrupted if the recordings have different values in the MAIN and REF memory. (This softkey is output only if the AUTOREPEAT mode is switched to ON.)

By pressing the RETURN key (see Fig. 3-1, item 16), the CONFIGURATION select menu (m1) can again be returned to.

4.7 Setting the Parameters for Printing and Remote Control

4.7.1 Introduction

This configuration is used to determine all parameters required for printing of menus, recorded data, etc, and remote control of the logic analyzer. Note that only presettings are made here; printing is actually started in the SPECIAL menu (see section 6), remote control is initiated from an external controller (see section 8, Remote Control).

The IN-OUT configuration is set in the CONFIGURATION menu which is directly called up via the CONFIG key.

Print parameters (Print control):
The logic analyzer permits to output hardcopies via 3 different interfaces:

- IEC625
- RS232
- CENTRONICS

Always one of these interfaces is currently activated. Interface parameters can only be defined for the currently active interface, but are retained in the background when another one has been activated.

Interface	Parameter	Setting
IEC625	TIMEOUT	Selectable timeout for printing
	PRINTER ADDRESS	Listener address of the printer attached.
RS232	BAUDRATE PARITY STOP BIT	Baud rate of data transfer. Selectable from 110 to 19200 bauds. Parity bit, can be set to EVEN, ODD, NONE. Stop bit. Can be set to 1 or 2 bits.
CENTRONICS	TIMEOUT	Selectable timeout for printing

So as to facilitate printing, the logic analyzer supports two types of printers, Rohde&Schwarz printer PUD2 and the printer of the EPSON EPS-FX80 type.

Remote control parameters:
The logic analyzer permits remote control via the IEC625 interfaces. The settings selected are always retained in the background when the interface is no longer active.

Interface	Parameter	Setting
IEC625	IEC625 ADDRESS	Listener address of the logic analyzer

Note: The IEC625 interface can be used ***either*** for printing ***or*** remote control.

4.7.2 Setting the Parameters for the RS232 Interface

The parameters for the RS232 interface are set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key.
  The CONFIGURATION select menu (m1) is called up.

Fig. 4-43

- Press the softkey IN/OUT CONFIG.
  The IN/OUT configuration menu (m17) is called up.

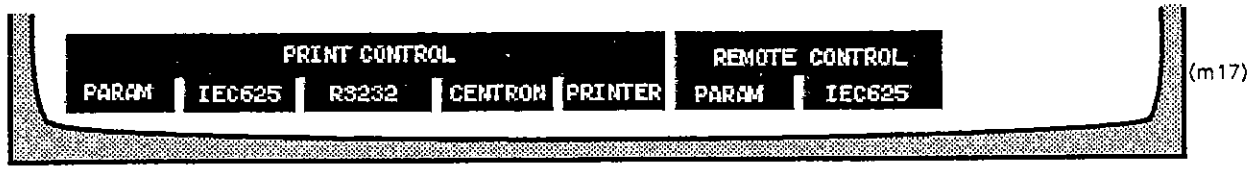


Fig. 4-44

- Press the softkey PRINT CONTROL RS232.
- Press the softkey PRINT CONTROL PARAM.
  The PRINT CONTROL PARAMETER menu (171b) for the RS232 interface is called up.

Fig. 4-45

By pressing the respective softkey, the following settings can be performed or the BAUD RATE menu selected:

Softkey	Action
BAUD RATE	Call-up of BAUD RATE menu (m171b2)
PARITY EVEN	Parity bit is set to EVEN
PARITY ODD	Parity bit is set to ODD
PARITY NONE	Parity bit is ignored
STOP-BIT 1 2	1 or 2 stop bits are provided

By pressing the RETURN key several times (see Fig. 3-1, item 16), the CONFIGURATION select menu (m1) can again be returned to.

Setting the baud rate

- Press the BAUD RATE softkey.
  The BAUD RATE menu (m171b2) is called up.

Fig. 4-46

The baud rate can now be set to the appropriate value.

To return to the CONFIGURATION select menu (m1), press the RETURN key (see Fig. 3-1, item 16) several times.

4.7.3 Setting the Parameters for the IEC625 Interface

The parameters for the IEC625 interface are set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key.
  The CONFIGURATION select menu (m1) is called up.

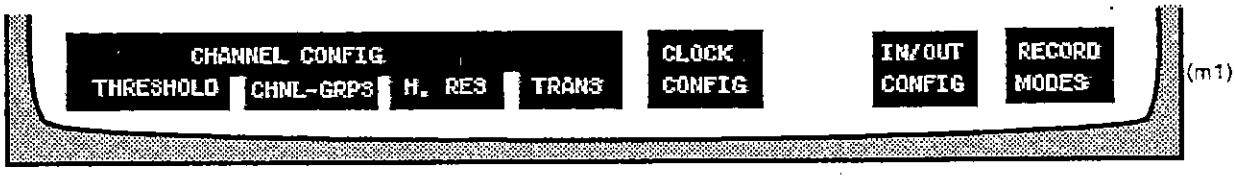


Fig. 4-45

- Press the softkey IN/OUT CONFIG.
  The IN/OUT configuration menu (m17) is called up.

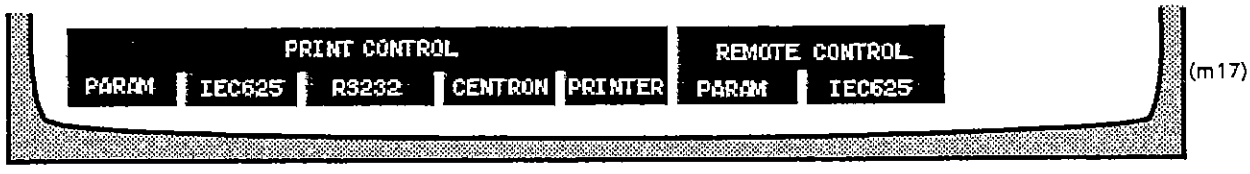


Fig. 4-46

Setting the print parameter for IEC625

- Press the softkey PRINT CONTROL IEC625.
- Press the softkey PRINT CONTROL PARAM.
  The PRINT CONTROL PARAMETER menu for the IEC625 interface (m171a) is called up.

Fig. 4-47

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
SET TIMEOUT	Call-up of the timeout entry
SET PRT-ADDR	Call-up of the printer address entry

Note: The TIMEOUT specification is carried out in 100-ms steps.

Note: The IEC625 interface can be used ***either*** for printing ***or*** for remote control.

To return to the IN/OUT configuration menu (m17), the RETURN key is pressed (see Fig. 3-1, item 16).

Setting the IEC625 Address

- Press the softkey REMOTE CONTROL IEC625.
- Press the softkey REMOTE CONTROL PARAM.

The listener address can now be input.

Note: The IEC625 interface can be used ***either*** for printing ***or*** for remote control.

By pressing the RETURN key several times (s. Fig. 3-1, item 16) the CONFIGURATION select menu (m1) can again be returned to.

4.7.4 Setting the Timeout for the CENTRONICS Interface

The timeout for the CENTRONICS interface is set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key.
  The CONFIGURATION select menu (m1) is called up.

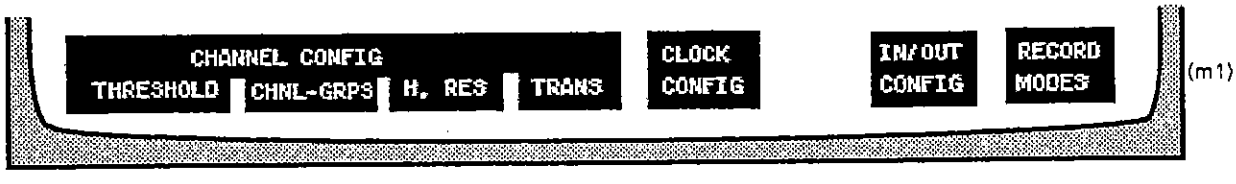


Fig. 4-50

- Press the softkey IN/OUT CONFIG.
  The IN/OUT configuration menu (m17) is called up.

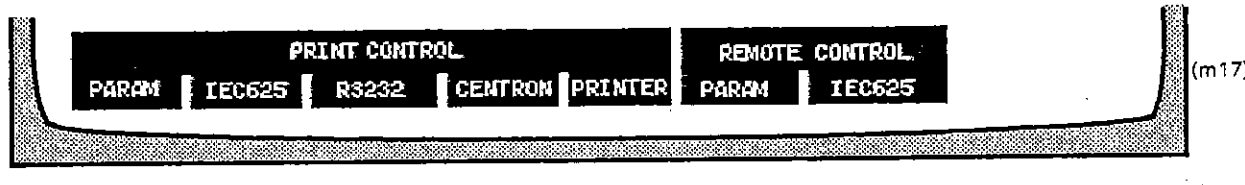


Fig. 4-51

- Press the softkey PRINT CONTROL CENTRON.
- Press the softkey PRINT CONTROL PARAM.

The Timeout value for the CENTRONICS interface can now be input.

Note: The TIMEOUT specification is carried out in 100-ms steps.

4.7.5 Interface Selection for Printing and Remote Control

The interface for printing and REMOTE CONTROL is set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key.
  The CONFIGURATION select menu (m1) is called up.

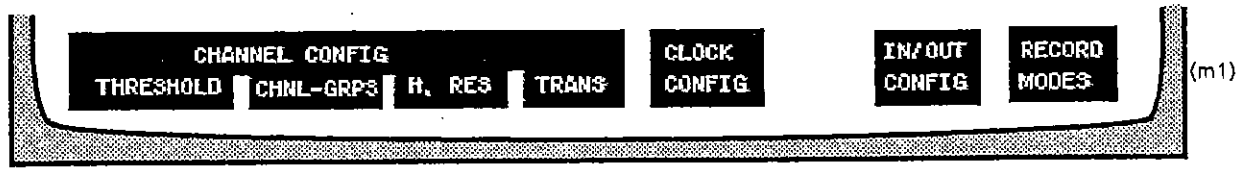


Fig. 4-53

- Press the softkey IN/OUT CONFIG.
  The IN/OUT configuration menu (m17) is called up.

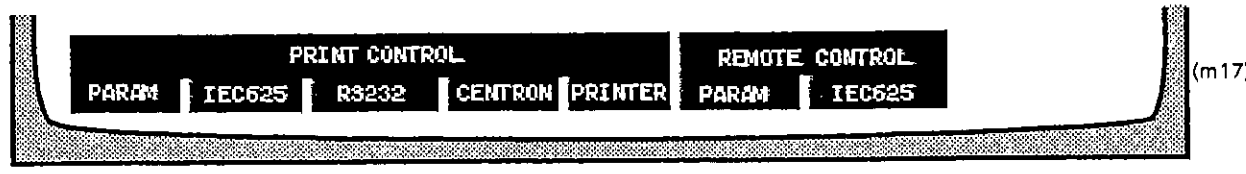


Fig. 4-54

By pressing the respective softkey, the required interface can be selected:

Softkey	Action
PRINT CONTROL IEC625	The IEC625 interface is the currently active interface for printing.
PRINT CONTROL RS232	The RS232 interface is the currently active interface for printing.
PRINT CONTROL CENTRON	The CENTRONICS interface is the currently active interface for printing.
REMOTE CONTROL IEC625	The IEC625 interface is the currently active interface for REMOTE CONTROL.

Note: The IEC625 interface can be used *either* for printing *or* for REMOTE CONTROL.

To return to the CONFIGURATION select menu (m1), the RETURN KEY (see Fig. 3-1, item 16) is pressed several times.

4.7.6 Selection of Printer and Terminator (LINE Terminator)

The printer is set in the CONFIGURATION menu. Proceed as follows:

- Press the CONFIG key.
  The CONFIGURATION select menu (m1) is called up.

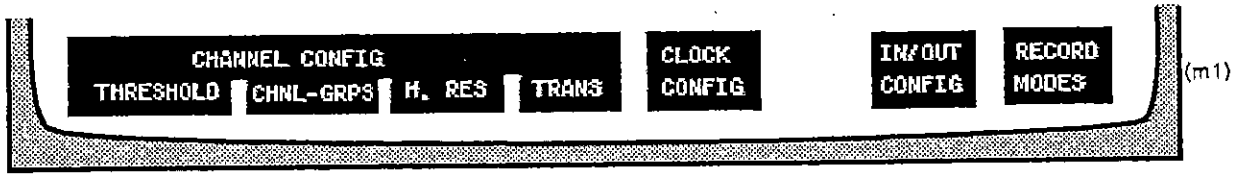


Fig. 4-55

- Press the softkey IN/OUT CONFIG.
  The IN/OUT configuration menu (m17) is called up.

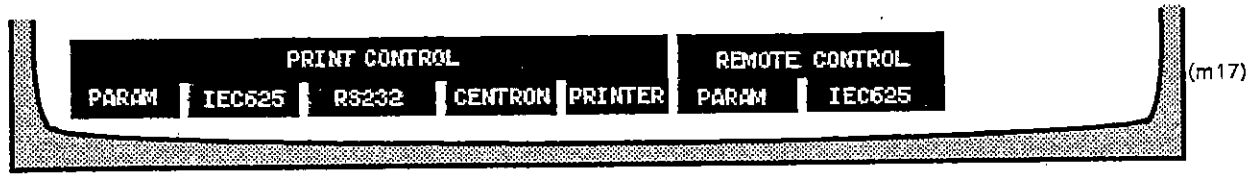


Fig. 4-56

- Press the softkey PRINT CONTROL PRINTER.
  The printer select menu (m175) is called up.

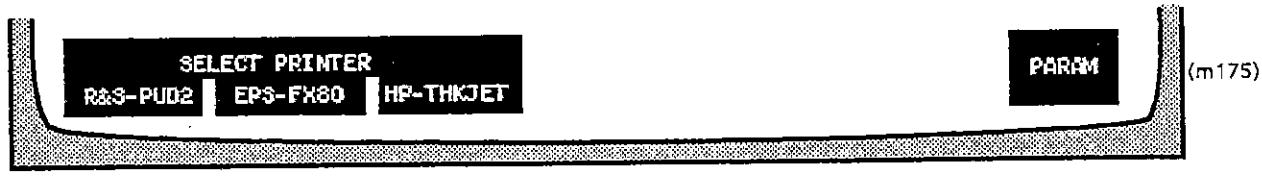


Fig. 4-57

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
SELECT PRINTER R&S PUD2	In print the control characters are automatically adapted for Rohde&Schwarz printer PUD2.
SELECT PRINTER EPS-FX80	In print the control characters are automatically adapted for printer of type EPSON-FX80.
SELECT PRINTER HP-THKJET	In print the control characters are automatically adapted for printer of type HP-THINKJET.
PARAM	Call-up of the terminator setting menu (m1758)

By pressing the RETURN key (see Fig. 3-1, item 16), the CONFIGURATION select menu (m1) can again be returned to.

4.8 Selection of Disassembler

4.8.1 Introduction

All settings concerning the selection of a disassembler are performed in the SPECIAL MENU which is called up using the SPECIAL key.

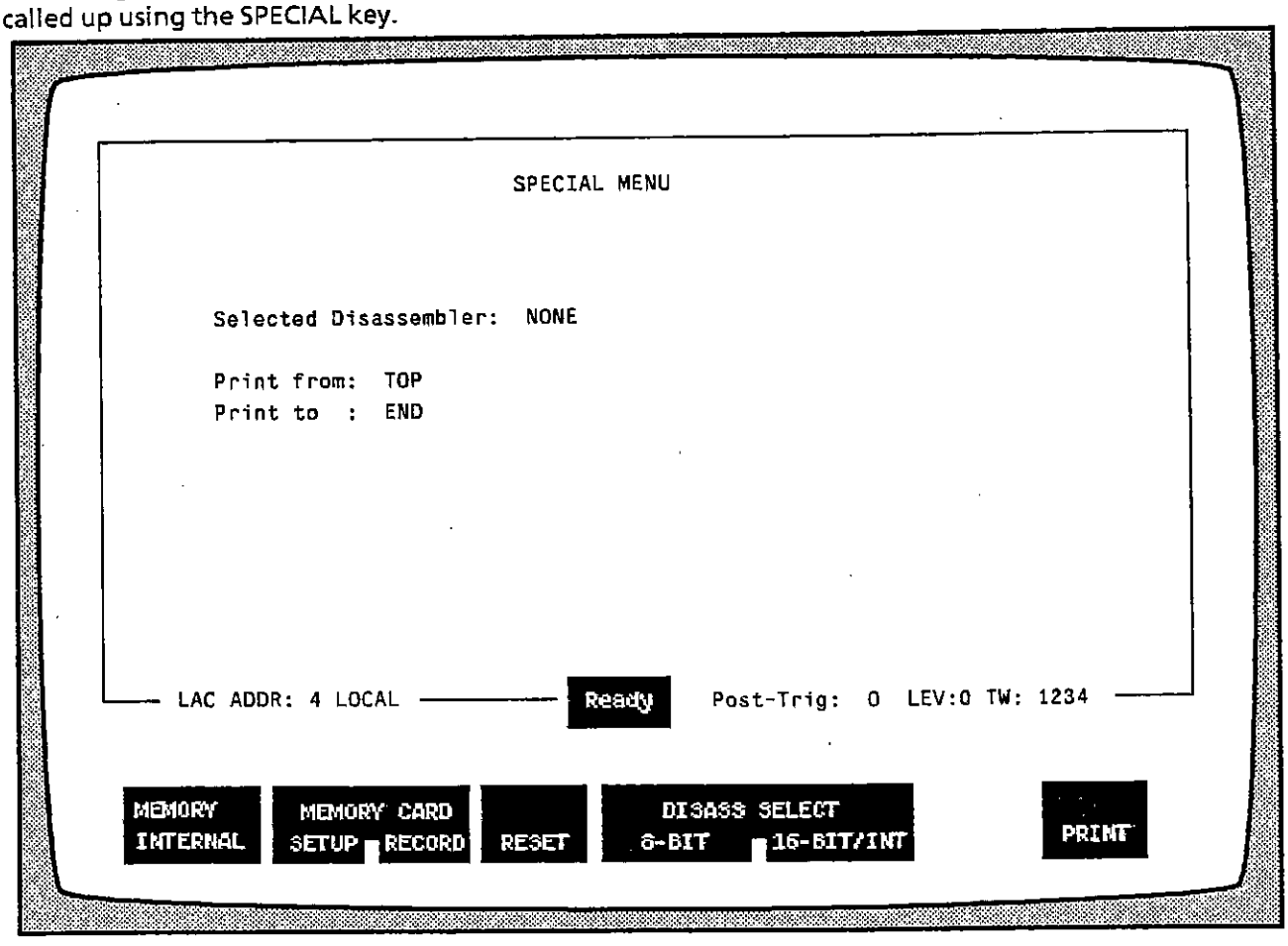


Fig. 4-58 SPECIAL MENU

All settings are exclusively made with the aid of softkey menus. The upper part of the screen merely gives an overview informing on the current state of the setting parameters.

If a microprocessor data stream is recorded with a R&S microprocessor probe, the data flow can be displayed in disassembled form. The programs required are included in the logic analyzer and need only be called up.

The following microprocessors are supported:

• 8-bit processors:	8080	(LAS-Z29)
	8085	(LAS-Z15)
	NSC800	(")
	8031/51	(LAS-Z26)
	Z80	(LAS-Z14)
	6502	(LAS-Z24)
	6800/02	(LAS-Z28)
	6809/E	(LAS-Z25)
• 16-bit processors:	8086/88	(LAS-Z17)
	80186/88	(LAS-Z22)
	80286	(LZ-39)
	68000/10	(LAS-Z30)
• Interfaces:	SERIAL	(LAS-Z33)
	IEEE 488	(LAS-Z27)
	MIL-BUS	(LAS-Z35)

4.8.2 Selection of Disassembler for 8-bit Processors

▸ Press the SPECIAL key (see Fig. 3-1, item 1).
The SPECIAL select menu is called up.

Fig. 4-59

▸ Press the softkey DISASS SELECT 8-BIT.
The first select menu for the 8-bit processor disassembler (m84) is called up.

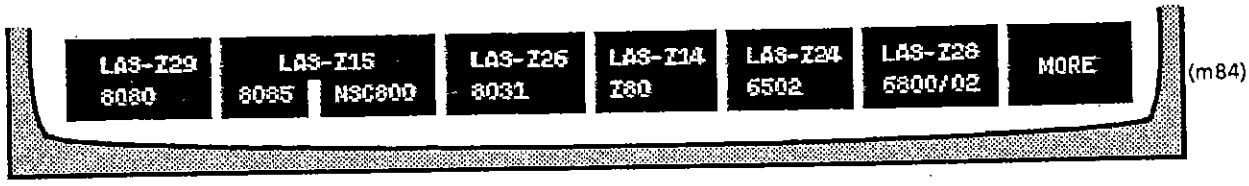


Fig. 4-60

By pressing the respective softkey, the following disassemblers or the following menus can be selected:

Softkey	Action
LAS-Z29 8080	Call-up of the disassembler software of the disassember probe LAS-Z29.
LAS-Z15 8085	Call-up of the disassembler software of the disassember probe LAS-Z15 (for 8085).
LAS-Z15 NSC 800	Call-up of the disassembler software of the disassember probe LAS-Z15 (for NSC 800).
LAS-Z26 8051	Call-up of the disassembler software of the disassember probe LAS-Z26.
LAS-Z14 Z80	Call-up of the disassembler software of the disassember probe LAS-Z14.
LAS-Z24 6502	Call-up of the disassembler software of the disassember probe LAS-Z24.
LAS-Z28 6800/02	Call-up of the disassembler software of the disassember probe LAS-Z28.
MORE	Call-up of the second select menu for the 8-bit processor disassembler (m848).

To return to the SPECIAL select menu (m8), the RETURN key is pressed.

▸ Press the MORE softkey.
The second select menu for the 8-bit processor disassembler (m848) is called up.

Fig. 4-61

By pressing the softkey LAS-Z25 6809, the disassembler software of the disassembler probe LAS-Z25 is called up.

Following the disassembler selection in menus m84 and m848, a further menu is read out which is used to call up an instrument setting in accordance with the present processor type:

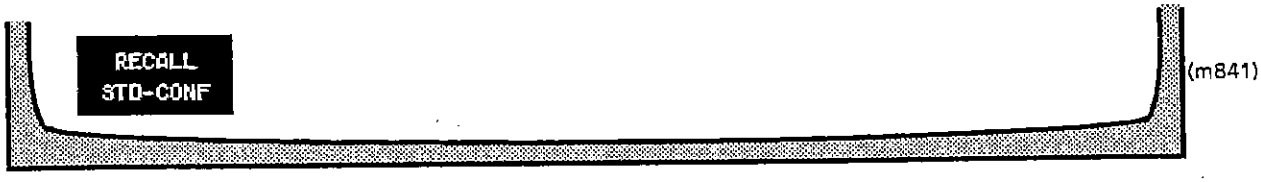


Fig. 4-62

Press the RECALL STD-CONF softkey to select an instrument setting suitable for the currently used processor type.

Note: This instrument setting is valid for all configuration and trigger settings in the CONFIGURATION and TRIGGER menus.

By pressing the RETURN key several times, the SPECIAL select menu (m8) can again be returned to.

4.8.3 Selection of Disassembler for 16-bit Processors

- Press the SPECIAL key (see Fig. 3-1, item 1).
  The SPECIAL select menu is called up.

Fig. 4-63

- Press the softkey DISASS SELECT 16-BIT/INT.
  The select menu for the 16-bit processor disassembler (m85) is called up.

Fig. 4-64

By pressing the respective softkey, the following menus can be called up:

Softkey	Action
LAS-Z17 8086/88	Call-up of the disassembler software of the disassembler probe LAS-Z17.
LAS-Z22 80186/188	Call-up of the disassembler software of the disassembler probe LAS-Z22.
LZ-39 80286	Call-up of the disassembler software of the disassembler probe LZ-39.
LAS-Z30 68000/10	Call-up of the disassembler software of the disassembler probe LAS-Z30.

By pressing the RETURN key, the SPECIAL select menu (m8) can again be returned to.

4.8.4 Selection of Disassembler for Interfaces

Following the disassembler selection in menu m85, a further menu is read out which is used to call up an instrument setting in accordance with the present processor type:

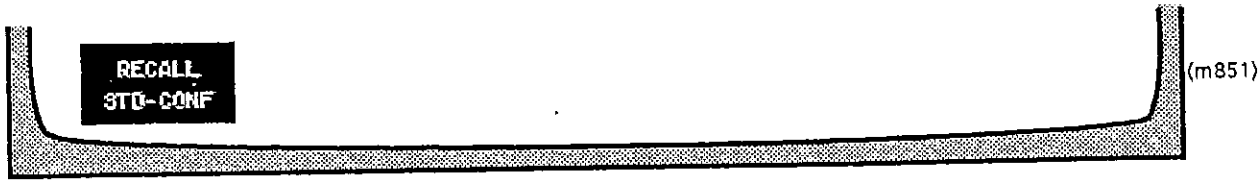


Fig. 4-65

Press the LOAD STD-CONF softkey to select an instrument setting suitable for the currently used processor type.

Note: This instrument setting is valid for all configuration and trigger settings in the CONFIGURATION and TRIGGER menus.

By pressing the RETURN key several times, the SPECIAL select menu (m8) can again be returned to.

- Press the SPECIAL key (see Fig. 3-1, item 1).
  The SPECIAL select menu is called up.

Fig. 4-66

- Press the softkey DISASS SELECT 16 BIT/INT.
  The SPECIAL select menu for interfaces (m86) is called up.

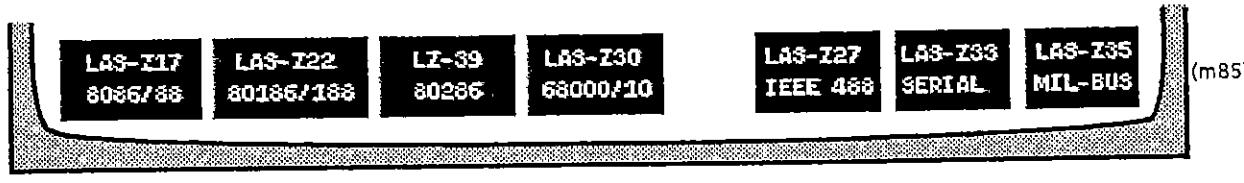


Fig. 4-67

By pressing the respective softkey, the following menus can be called up:

Softkey	Action
LAS-Z27 IEEE488	Call-up of the disassembler software of the disassembler probe LAS-Z27.
LAS-Z33 SERIAL	Call-up of the disassembler software of the disassembler probe LAS-Z33.
LAS-Z35 MIL-BUS	Call-up of the disassembler software of the disassembler probe LAS-Z35.

By pressing the RETURN key, the SPECIAL select menu (m8) can again be returned to.

Following the disassembler selection in menu m86, a further menu is read out which is used to call up an instrument setting in accordance with the present processor type:

Fig. 4-68

Press the LOAD STD-CONF softkey to select an instrument setting suitable for the currently used processor type.

Note: This instrument setting is valid for all configuration and trigger settings in the CONFIGURATION and TRIGGER menus.

By pressing the RETURN key several times, the SPECIAL select menu (m8) can again be returned to.

5 Definitions for Trigger Words and Trigger Conditions

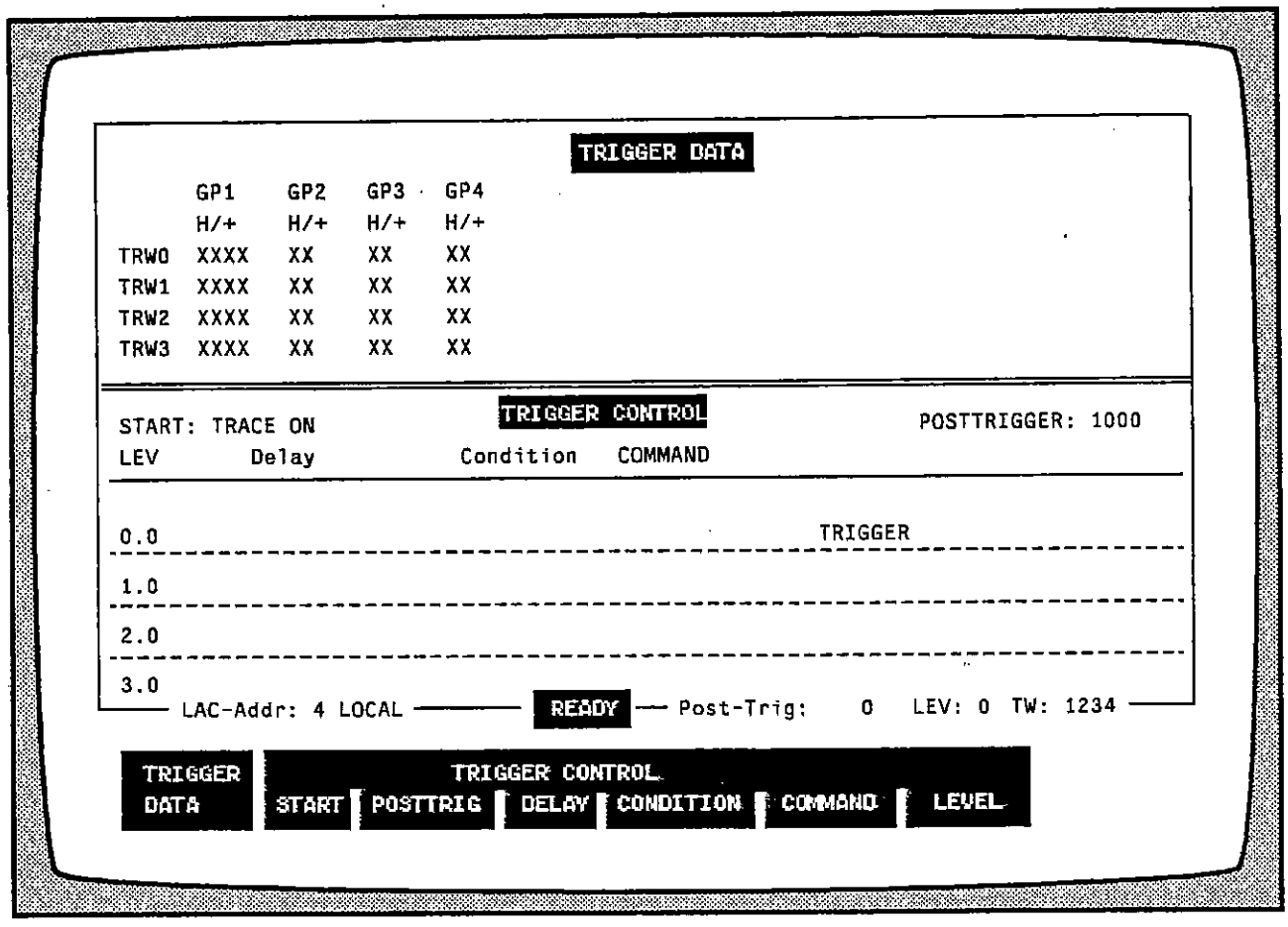


Fig. 5-1 TRIGGER menu

The TRIGGER menu is called up using the TRIGGER key (see Fig. 3-1, item 2).
The TRIGGER menu permits to perform settings concerning the measurement sequence. These are:

- definition of trigger words (in the menu field TRIGGER DATA, see section 5.1),
- specification of the start condition (in the menu field TRIGGER CONTROL, see section 5.2.2),
- specification of the posttrigger (in the menu field TRIGGER CONTROL, see section 5.2.3),
- specification of the trigger control sequence (in the menu field TRIGGER CONTROL, see sections 5.2.4 and following).

With the suitable start condition, the logic analyzer following actuation of the START key continuously reads the incoming data into its memory, the older data being overwritten. This process continues until the so-called trigger event occurs.

The trigger event is the final element of a sequence of logically linked individual events. An important event may be the occurrence of particular data words in the measured data. These data words can be detected in the data stream through corresponding use of trigger words (specified in the upper part of the TRIGGER menu, the TRIGGER DATA menu).

This sequence is programmed in the bottom part of the TRIGGER menu, the TRIGGER CONTROL menu. This menu features four fields (LEV) where "program lines" can be entered in a predetermined way. These lines first allow to specify a delay (DELAY); further to the right, a condition (CONDITION) can be entered on which the commands listed under COMMAND can be performed.

One of these commands is GOTO n where n = 0 to 3. It permits to jump to the beginning of another field. This is how the trigger control sequence is produced. TRIGGER is another command. Upon occurrence of this command in the trigger control sequence, the trigger event has been reached.

The data word recorded at this point in time is stored at a location in the memory determined by the POSTTRIGGER setting. When the memory is completely filled, recording is stopped and the measured data can be evaluated in the DISPLAY menus.

5.1 Entering the Trigger Words

5.1.1 Introduction

The trigger facility continuously compares the applied measured data of the 48-channel analyzer with the set trigger word. Each of its 48 individual elements is assigned to a particular channel of the 48-channel analyzer and may assume the logic values 0, 1 and X (don't care).

With each collection clock during the measurement, the trigger words are compared element by element with the current measured data of the 48 channels of the 48-channel analyzer, the comparison being always successful with the X elements, irrespective of whether the logic level of the measured data is 0 or 1.

If a correspondence between trigger word and measured data is found and if this trigger word is entered at the current position in the trigger control sequence (in the bottom part of the TRIGGER menu, the TRIGGER CONTROL menu), the sequence can be shifted further by one element (see the example given in section 5.2.1).

In order to improve clarity, the elements of a trigger word are combined in groups in the same way as the channels are combined and arranged in channel groups in the CONFIGURATION menu. Each trigger word group is then assigned the name of the channel group and is displayed with the respective polarity and in the respective display code.

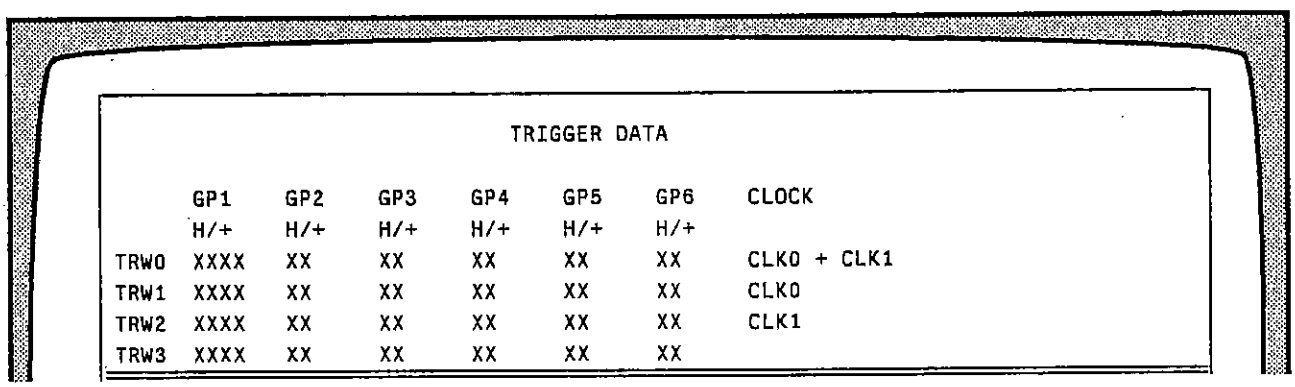


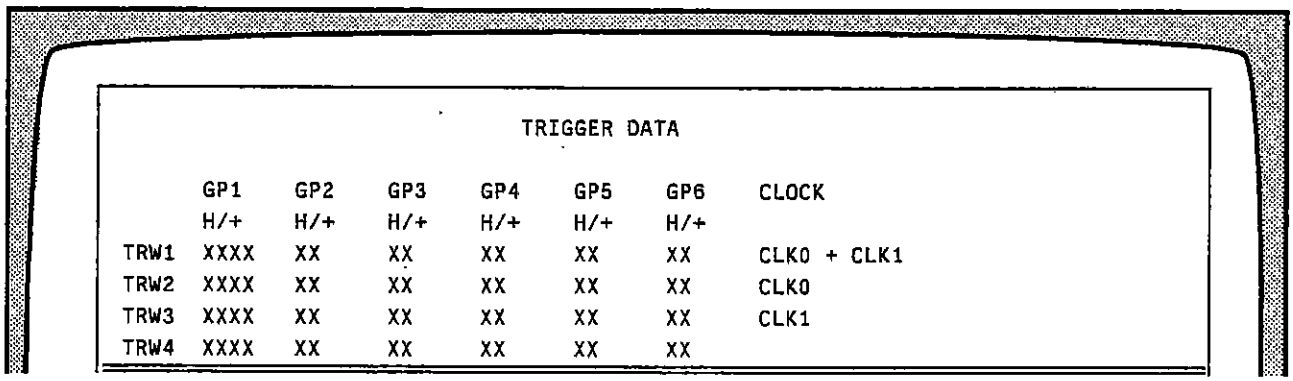
Fig. 5-2

This means that, with 1 position in the trigger word, 4 channels are covered with octal coding and 3 channels with decimal coding. If the polarity of the channel group is set to negative (-), this means that the instrument will use the logically inverted value for this trigger word group.

Each trigger word has its own name under which it can be used as an element in the trigger control sequence in the TRIGGER CONTROL menu.

The trigger words of the logic analyzer are set in the upper half of the TRIGGER menu, i.e. in the field TRIGGER DATA. The TRIGGER menu is called up using the TRIGGER key.

Four trigger words independent of each other are available.



TRIGGER DATA

	GP1	GP2	GP3	GP4	GP5	GP6	CLOCK
	H/+	H/+	H/+	H/+	H/+	H/+	
TRW1	XXXX	XX	XX	XX	XX	XX	CLK0 + CLK1
TRW2	XXXX	XX	XX	XX	XX	XX	CLK0
TRW3	XXXX	XX	XX	XX	XX	XX	CLK1
TRW4	XXXX	XX	XX	XX	XX	XX	

Fig. 5-3

In each trigger word, a logic value can be entered for each bit independently of the other trigger words: 0 or 1 with binary, 0 to F with hexadecimal display code, or an X (X means that the logic value is not specified for this channel). The display code for the channel groups specified in the CONFIGURATION menu is of great importance to the trigger words, because, with most codes, several channels are covered with one trigger word input element. (Thus, a hexadecimal 4 in the trigger word specifies 0100 for 4 channels). If channels are to be assigned 0, 1 or X individually, the display code BIN has to be selected for this channel group).

Note: If a position cannot be displayed in the trigger word (e.g. if "0X10" is present in the instrument and the display code is to be hexadecimal), an exclamation mark will appear instead (!).

Trigger word clocks:

The trigger words can be logically linked with one or both external clock inputs if the clock is switched to EXTERN. This means that a recorded word will only be detected as a trigger word in the collection if this word has been recorded with at least one of the external clock inputs specified. Both trigger word clocks are specified by the names assigned to them in the CONFIGURATION menu.

Trigger word labels:

Each of the 4 trigger words can be assigned its own name under which it can be called up as an element in the trigger control sequence in the TRIGGER CONTROL menu (see TRW1 to TRW4 in Fig. 5-3). The name may comprise a maximum of 4 ASCII characters.

5.1.2 Entering the Trigger Word Data

The trigger word data are set in the TRIGGER menu. Proceed as follows:

- Press the TRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

Fig. 5-4

- Press the softkey TRIGGER DATA.
  The TRIGGER DATA menu (m21) is called up.

Fig. 5-5

The cursor appears in the first TRIGGER DATA input field and can be shifted to any other of the TRIGGER DATA input fields using the cursor keys (see Fig. 3-1, item 10).

The trigger word required is entered at the position denoted by the cursor location via the input field (at the front panel). The possible setting ranges depend on the channel group display codes set in the CONFIGURATION menu (see section 4.2.4).

The part of the respective trigger word denoted by the cursor location and belonging to a channel group can be deleted by pressing the DEL DATA softkey.

5.1.3 Entering the Trigger Word Labels

The trigger word labels are set in the TRIGGER menu. Proceed as follows:

- Press theTRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

Fig. 5-6

- Press the softkey TRIGGER DATA.
  The TRIGGER DATA menu (m21) is called up.

Fig. 5-7

- Press the softkey EDIT TRIGGERWORD LABEL.
  The LABEL input menu (m211) is called up.

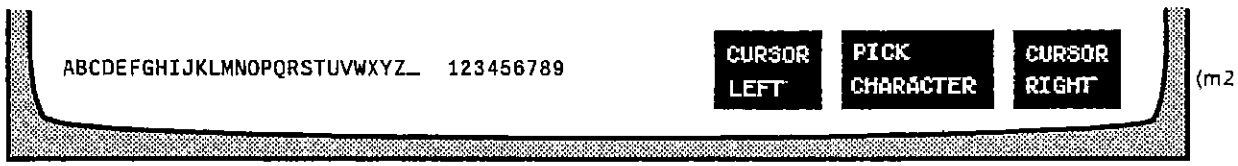


Fig. 5-8

The cursor appears in the label field of the first trigger word and can be shifted to any other of the trigger label input fields using the cursor keys (see Fig. 3-1, item 10).

By pressing the respective softkey, the following settings can be performed (see section 5.1.1):

Softkey	Action
CURSOR LEFT	Cursor in the ASCII select line moves one position to the left.
PICK CHARACTER	The ASCII character denoted by the cursor location is included in the label.
CURSOR RIGHT	Cursor in the ASCII select line moves one position to the right.

5.1.4 Entering the Trigger Word Clocks

The trigger word clocks are set in the TRIGGER menu. Proceed as follows:

- Press the TRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

Fig. 5-9

- Press the softkey TRIGGER DATA.
  The TRIGGER DATA menu (m21) is called up.

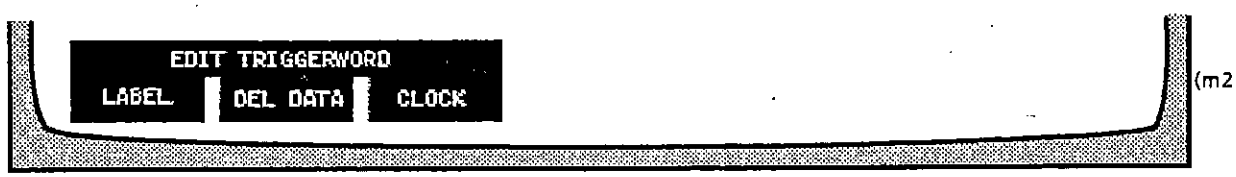


Fig. 5-10

- Press the softkey EDIT TRIGGERWORD CLOCK.
  The TRIGGER CLOCK SELECT menu (m213) is called uup.

Fig. 5-11

The cursor appears in the CLOCK field of the first trigger word and can be shifted to any other of the trigger clock input fields using the cursor keys (see Fig. 3-1, item 10).

By pressing the respective softkey, the following settings can be performed (see section 5.1.1):

Softkey	Action
SELECT CLOCK CLK0 ON	With external clock generation the trigger word data are assigned the clock input CLK0.
SELECT CLOCK CLK0 OFF	CLK0 is not assigned to the trigger word data.
SELECT CLOCK CLK1 ON	With external clock generation the trigger word data are assigned the clock input CLK1.
SELECT CLOCK CLK1 OFF	CLK1 is not assigned to the trigger word data.

5.2 Setting the Trigger Control Sequence (TRIGGER CONTROL)

5.2.1 Introduction

The trigger control sequence of the logic analyzer is set in the TRIGGER CONTROL field of the TRIGGER menu. The TRIGGER menu is called up using the TRIGGER key.

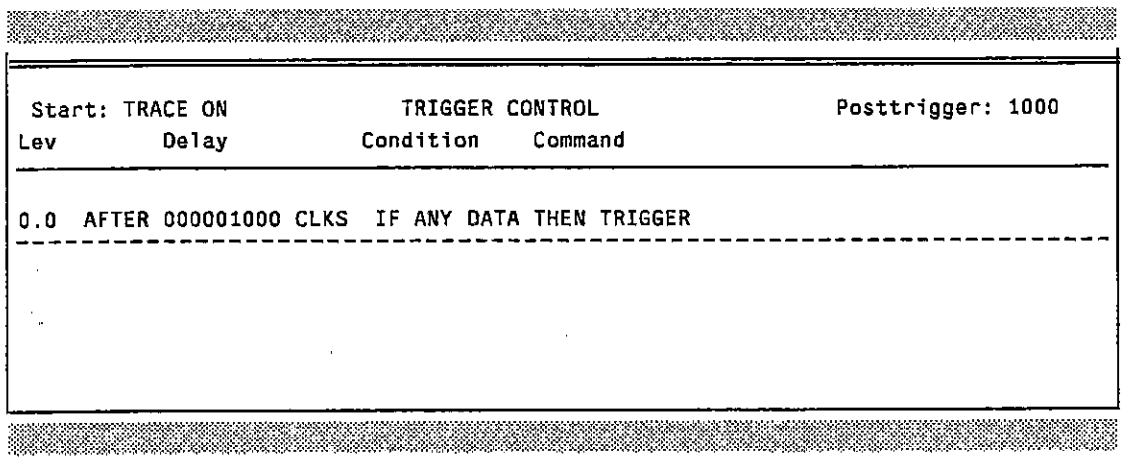


Fig. 5.12 TRIGGER CONTROL menu

Trigger event and trigger control sequence:

Trigger words and trigger control sequence are used for exact recording of the trigger event. The trigger event is the final element in a sequence of logically linked observations in the data stream of the test item and, together with the posttrigger setting, determines the end of data recording (see also section 5.1).
The type and composition of the trigger control sequence can be programmed in this menu:

In each of the four levels (LEV), program lines can be defined from the left to the right. Each of the lines is arranged identically: If, following a particular delay (DELAY), a particular condition is fulfilled (CONDITION), particular commands (COMMAND) will be executed.

The delay can be set in many ways (see " Range of possible DELAY settings").

The trigger words become relevant in the definition of the condition (CONDITION): If a trigger word entered in the CONDITION field complies with a recorded data word of the test item, this will be detected and the commands listed further to the right under COMMAND will be executed.

The GOTO command permits to jump from the end of one level to the beginning of another one. Thus, trigger levels are linked, producing the trigger control sequences.

Each level consists of a maximum of 4 sublevels. This serves the following purpose:

If a level is currently active in the trigger control sequence, its sublevels are operated parallel to one another. The sublevel where the delay has elapsed first and the conditions have been fulfilled has its commands executed first and exclusively. However, in the event that several sublevels are simultaneously entitled to have their commands executed, this is done from the top to the bottom, which means that the sublevel with the lowest line number is considered first.

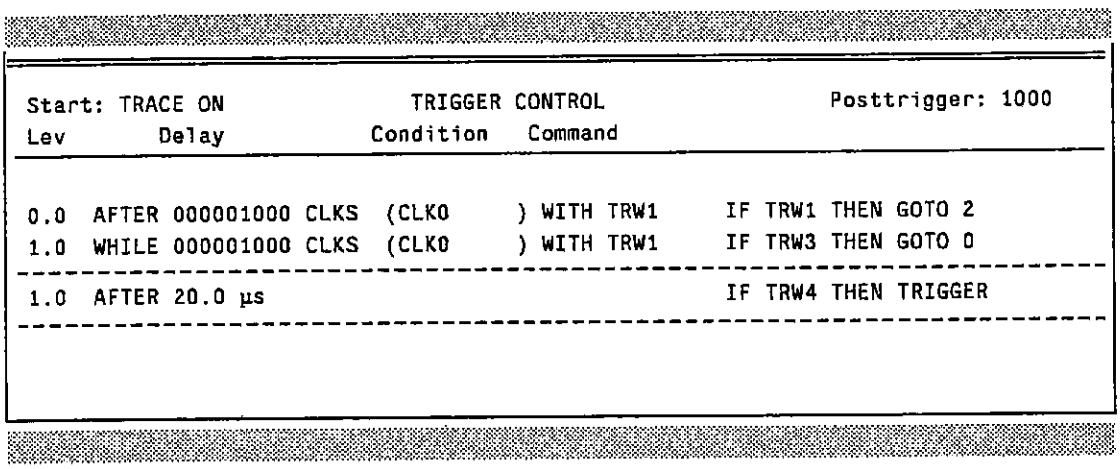


Fig. 5-13 Example of a trigger control sequence

Start condition:

The input field START: permits to specify the way in which the logic analyzer is to record data after the START key has been pressed.

Either the logic analyzer immediately starts recording, continuously filling the memory with the incoming data (START: TRACE ON), or it waits until one of the commands TRACE ON or STORE is reached in the trigger control sequence in the COMMAND section (START:TRACE OFF).

Posttrigger:

Upon occurrence of the trigger event in the trigger control sequence, the logic analyzer continues recording for as many clocks as specified in the POSTTRIGGER field. It is thus possible to place the trigger event to any location in the memory and thus attach more importance to the events before or after the trigger event. Posttrigger can be set in a range from 0 to 2040.

Range of possible DELAY settings

Each level of the trigger control sequence begins with the input field DELAY. Three different modes are available:

- delay of n clocks (CLKS),
- delay of absolute time (TIME) and
- delay of events (OCCURRENCE).

Note: DELAY specifications can be assigned for max. two of the four levels of the trigger control sequence.

AFTER, WHILE: This entry determines whether the condition entered in the CONDITION field is to be fulfilled after expiration of the delay (AFTER) or within the delay period (WHILE) . AFTER and WHILE can be used in each sublevel and for each of the 3 delay modes. If ALWAYS has been entered for a sublevel, no delay is specified for this respective sublevel.

CLKS: In this delay mode, a finite number of clocks is delayed; depending on the configuration, either internal or external clock is used. With external clock, the two clock inputs can be individually selected. If both inputs are activated, the event of one or both clocks is taken as clock occurrence. Setting range: 1 to 100×10^6 clocks.

```
 Start: TRACE ON              TRIGGER CONTROL                Posttrigger: 1000
Lev        Delay           Condition   Command

0.0   AFTER 000001000 CLKS  IF ANY DATA THEN TRIGGER
```

Fig. 5.14 Example of internal clock

```
 Start: TRACE ON              TRIGGER CONTROL                Posttrigger: 1000
Lev Delay                             Condition   Command

0.0   AFTER 000001000 CLKS  (CLK0+CLK1) IF ANY DATA THEN TRIGGER
```

Fig. 5-15 Example of external clock

In addition, a WITH condition can be added in which one or two trigger words are to be inserted (they can be logically inverted individually or together and are ANDed). If this WITH condition is included in the specification of the delay, the delay clocks will continue to be counted only if the WITH specification simultaneously complies with the recorded data.

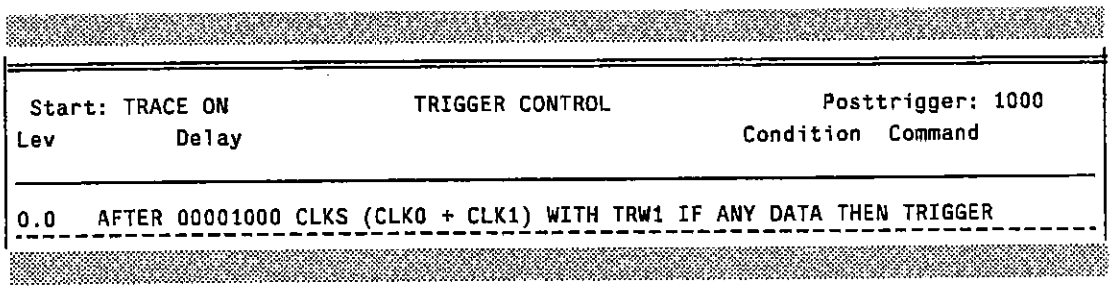


Fig. 5-16

Note: The CLCKS mode is only provided simultaneously for all sublevels of a trigger control sequence level but will then be valid for all those sublevels with an AFTER or WHILE entry. The trigger words are called up or deleted under the names assigned to them in the TRIGGER DATA menu.

TIME: An absolute time is delayed in this delay mode irrespective of whether the logic analyzer uses internal or external clock for recording. The selectable range extends from 20 ns to 500 ns.

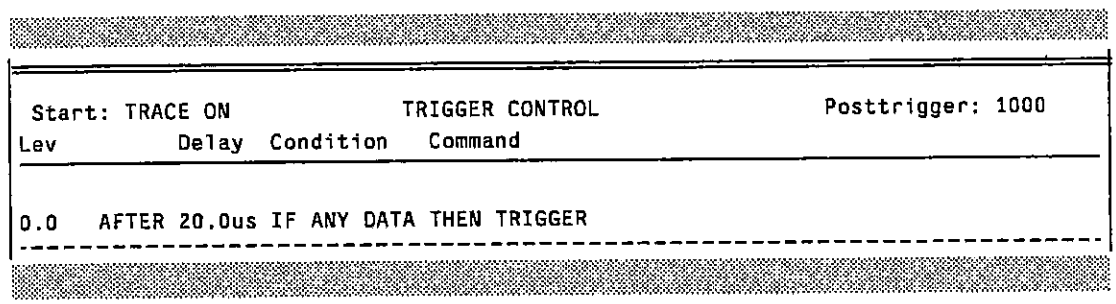


Fig. 5-17

In addition, a WITH condition can be added in which one or two trigger words are to be inserted (they can be logically inverted individually or together and are ANDed). If this WITH condition is included in the specification of the delay, the delay clocks will continue to be measured only if the WITH specification simultaneously complies with the recorded data.

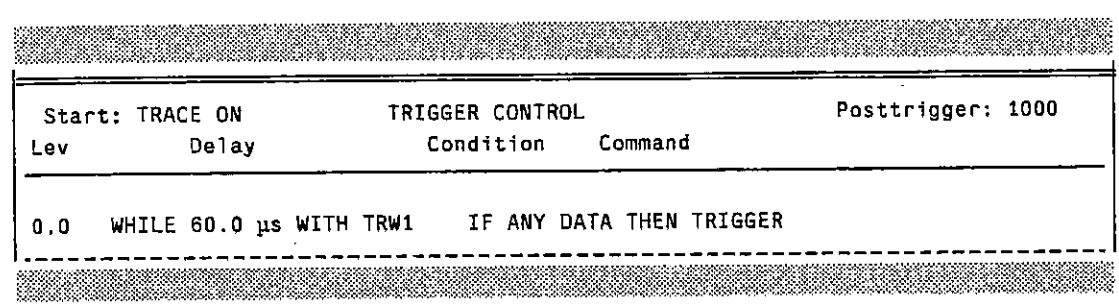


Fig. 5-18

Note: The TIME mode is only provided simultaneously for all sublevels of a trigger control sequence level, but will then be valid for all those sublevels with an AFTER or WHILE entry . The WITH condition can be used with internal clock only. The trigger words are called up or deleted under the names assigned to them in the TRIGGER DATA menu.

OCCURRENCE: In this delay mode, the occurrence of a number of events is waited for. It is again of no concern whether the logic analyzer uses internal or external clock for recording. With external clock, it is additionally possible to individually select the two clock inputs. If both inputs are activated, the event of one or both clocks is taken as clock occurrence. One or two trigger words serve as events. They can be logically inverted either individually or together and are ORed.
Setting range: 1 to 100×10^6 occurrences.

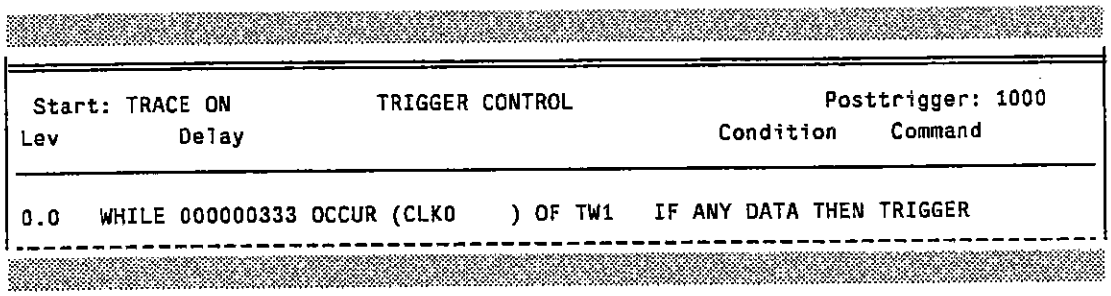


Fig. 5-19

Note: The OCCURRENCE mode is only provided simultaneously for all sublevels of a trigger control sequence level and is valid for all those sublevels with an AFTER or WHILE entry. The trigger words are called up or deleted under the names assigned to them in the TRIGGER DATA menu.

Range of possible CONDITION settings:

In this field, a condition is formulated on which the commands of the COMMAND field are executed (considering the DELAY specification). This condition consists of one or two trigger words which can be logically inverted either individually or together and are ANDed.
The trigger words are called up or deleted under the names assigned to them in the TRIGGER DATA menu.

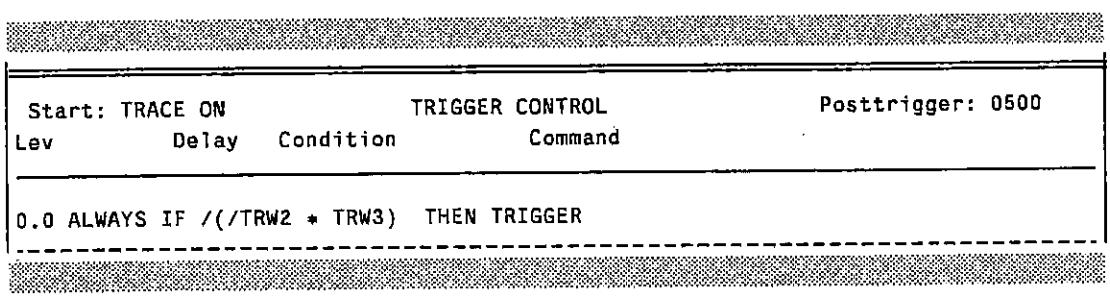
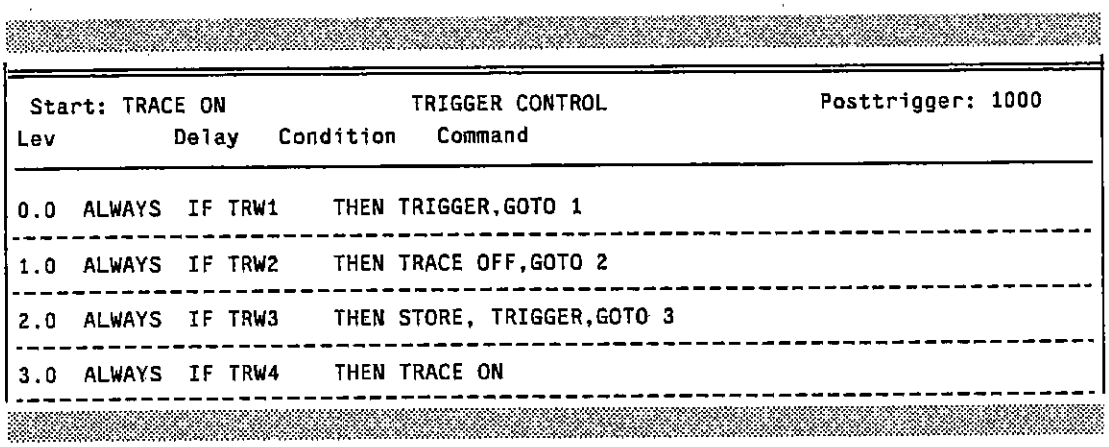


Fig. 5-20

Note: CONDITION entries are possible for all sublevels.

Range of possible COMMAND settings:

In this field, all commands are entered which will be executed when the settings of the DELAY and CONDITION field are fulfilled in a trigger level.



Start: TRACE ON		TRIGGER CONTROL	Posttrigger: 1000
Lev	Delay	Condition	Command
0.0	ALWAYS	IF TRW1	THEN TRIGGER,GOTO 1
1.0	ALWAYS	IF TRW2	THEN TRACE OFF,GOTO 2
2.0	ALWAYS	IF TRW3	THEN STORE, TRIGGER,GOTO 3
3.0	ALWAYS	IF TRW4	THEN TRACE ON

Fig. 5-21

The following commands are available:

GOTO n: Jump to the trigger control sequence level n (0 to 3). This command can be used to optionally link the individual levels in any way. A jump upon GOTO to the current line causes processing of this sequence level to be restarted. The DELAY is also restarted in this level.

TRIGGER: This command indicates that the trigger event has now occurred. The data word recorded at this point in time is stored in the memory under the name TRIGGER. Recording is stopped when the posttrigger counter has run down.

TRACE OFF: The current data collection of the logic analyzer is stopped. However, this does not affect the trigger control sequence.

TRACE ON: If the data collection has been stopped by TRACE OFF, it can be resumed using this command.

STORE: The data word applied to the logic analyzer at this point in time is recorded. Thus, selective data recording is possible in conjunction with the TRACE OFF command and corresponding DELAY and CONDITION specifications.

The individual commands can be optionally combined at will in each sublevel (exception: only one of the commands TRACE ON / TRACE OFF / STORE can be active at a time).

5.2.2 Setting the Trigger Control Start Condition

The trigger control start condition is set in the TRIGGER menu. Proceed as follows:

- Press the TRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

Fig. 5-22

- Press the softkey TRIGGER CONTROL START.
  The TRIGGER CONTROL START input menu (m22) is called up.

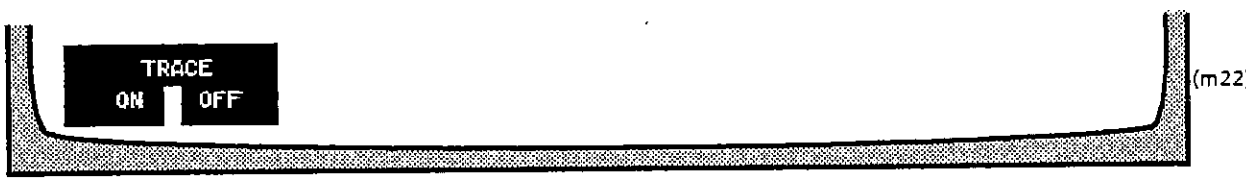


Fig. 5-23

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
TRACE ON	Entry of TRACE ON in the trigger control start condition
TRACE OFF	Entry of TRACE OFF in the trigger control start condition

To return to the TRIGGER select menu, the RETURN key is pressed.

5.2.3 Setting the Trigger Control Posttrigger

The trigger control posttrigger is set in the TRIGGER menu. Proceed as follows:

- Press the TRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

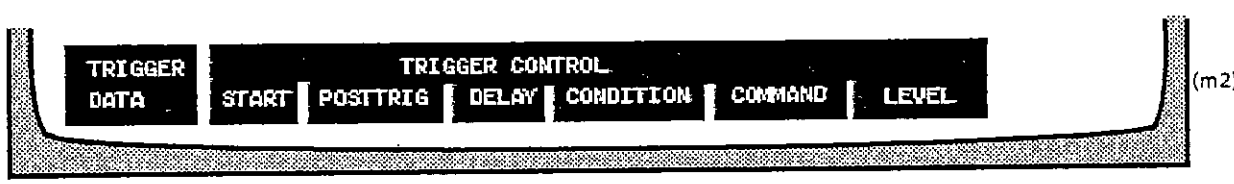


Fig. 5-24

- Press the softkey TRIGGER CONTROL POSTTRIG.
  The POSTTRIGGER input menu is called up.

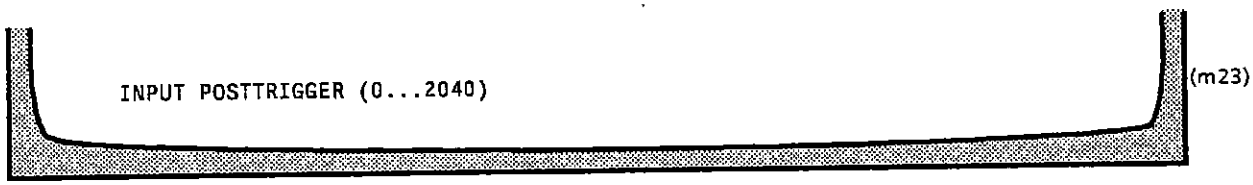


Fig. 5-25

The required posttrigger value can now be entered via keys 0 to 9 on the front panel keyboard. The data entry is terminated by pressing the RETURN key (see Fig. 3-1, item 15).

5.2.4 Setting the Trigger Control Delay Mode CLKS

The trigger control delay mode CLKS is set in the TRIGGER menu. Proceed as follows:

- Press the TRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

Fig. 5-26

- Press the softkey TRIGGER CONTROL DELAY.
  The TRIGGER CONTROL DELAY select menu (m24) is called up.

Fig. 5-27

Note: The labelling of the 4 softkeys on the right depends on the DELAY mode set. Fig. 5-27 shows the DELAY MODE CLOCKS.

- Press the softkey DELAY MODE CLOCKS.
  The CLOCKS delay mode is set.

Entering further parameters:

a) *Entering the AFTER/WHILE condition*

- Press the softkey AFTER/WHILE in the DELAY select menu (m24).
  The AFTER/WHILE select menu is called up.

Fig. 5-28

By pressing the respective softkey, the following settings can be performed or menus called up:

Softkey	Action
DELAY AFTER	Entry of AFTER at the beginning of the DELAY field in the currently active sublevel
DELAY WHILE	Entry of WHILE at the beginning of the DELAY field in the currently active sublevel
DELAY ALWAYS	The delay specification for the currently active sublevel is deleted.

Note: The AFTER/WHILE condition can be individually specified for each sublevel. The respective input fields are reached via the cursor keys.

To return to the DELAY select menu (m24), the RETURN key is pressed.

b) *Entering the DELAY time*

- Press the softkey NO OF CLOCKS in the DELAY select menu (m24).
  The input menu for the required number of external clocks is called up.

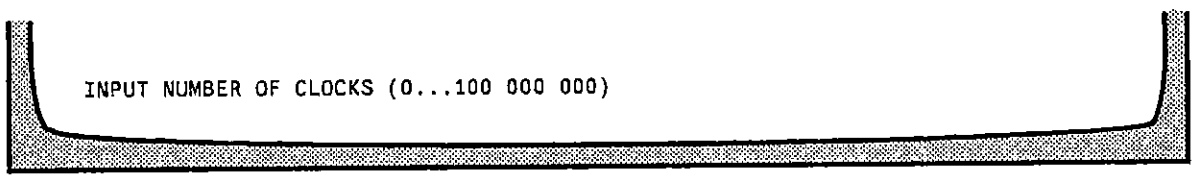


Fig. 5-29

The required number of external clocks can now be entered via keys 0 to 9 on the front panel keyboard. The data entry is terminated by pressing the RETURN key (see Fig. 3-1, item 15).

c) Entering the EXTERNAL CLOCK in the DELAY condition
(possible only if the clock is set to CLOCK EXTERN in the CONFIGURATION menu).

▸ Press the softkey EXT CLOCK in the DELAY select menu.
The CLK EXT SELECT menu for the DELAY field (m247) is called up.

Fig. 5-30

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
SELECT CLOCK CLK0 ON . . . SELECT CLOCK CLK1 OFF	By switching on and off, the delay specification can optionally be assigned one or both external clocks. (In the softkey texts, the clock labels specified in the CONFIG menu are indicated). The two clocks are ORed.

To return to the DELAY select menu (m24), the RETURN key is pressed (see Fig. 3-1, item 15).

d) Entering the WITH condition (TRIGWORD LINK)

▸ Press the softkey TRIGWORD LINK in the DELAY select menu (m24).
The SELECT TRIGWORD LINK menu for the DELAY field (m248) is called up.

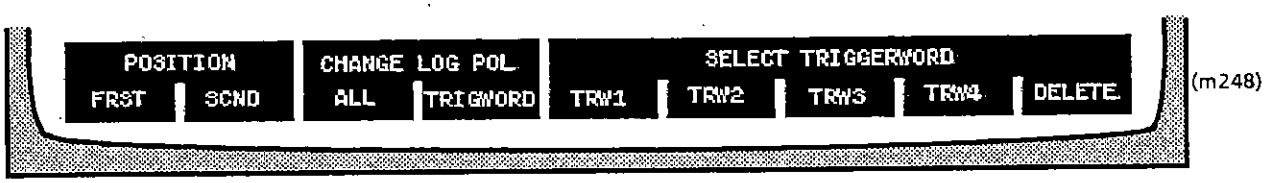


Fig. 5-31

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
POSITION FRST SCND	This switch is used to determine whether the adjacent softkeys of this menu are to refer to the first or second of the two possible positions in the WITH input field.
CHANGE LOG ALL	Inversion of the logic polarity of the combination of both trigger words in the WITH input field. The forward slash corresponds to a logic inversion.
CHANGE LOG POL TRIGWORD	Inversion of the logic polarity of the first or second trigger word in the WITH input field. The forward slash corresponds to a logic inversion.
SELECT TRIGGERWORD TRW1 to TRW4	The respective trigger word is inserted at the first or second position in the WITH input field. (The trigger word names specified in the TRIGGER menu are indicated in the softkey texts).
SELECT TRIGGERWORD DELETE	Clear the first or second trigger word in the WITH input field.

Note: The two trigger word entries in the WITH condition are ORed.

To return to the DELAY select menu (m24), the RETURN key is pressed (see Fig. 3-1, item 15).

5.2.5 Setting the Trigger Control Delay Mode TIME

The trigger control delay mode TIME is set in the TRIGGER menu. Proceed as follows:

- Press the TRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

Fig. 5-32

- Press the softkey TRIGGER CONTROL DELAY.
  The TRIGGER CONTROL DELAY select menu (m24) is called up.

Fig. 5-33

Note: The labelling of the 4 softkeys on the right depends on the DELAY mode set. Fig. 5-33 shows the DELAY MODE TIME.

- Press the softkey DELAY MODE TIME.
  The delay mode TIME is set.

Setting further parameters:

a) Entering the AFTER/WHILE condition

- Press the softkey AFTER/WHILE in the DELAY select menu (m24).
  The AFTER/WHILE select menu is called up.

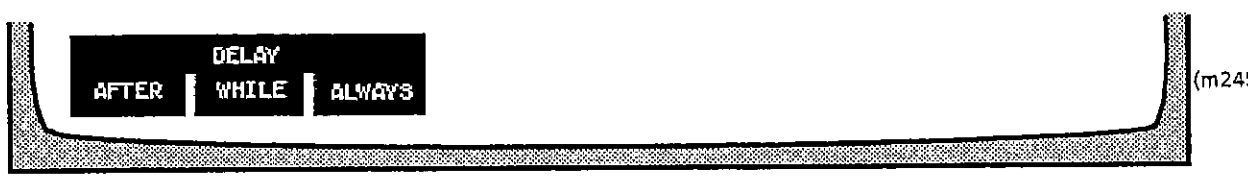


Fig. 5-34

By pressing the respective softkey, the following settings can be performed or menus called up:

Softkey	Action
DELAY WHILE	Entry of WHILE at the beginning of the DELAY field in the currently active sublevel
DELAY AFTER	Entry of AFTER at the beginning of the DELAY field in the currently active sublevel
DELAY ALWAYS	The delay specification for the currently active sublevel is deleted.

Note: The AFTER/WHILE condition can be individually specified for each sublevel. The respective input fields are reached via the cursor keys.

To return to the DELAY select menu (m24), the RETURN key is pressed (see Fig. 3-1, item 15).

b) Entering the DELAY time

- Press the softkey SET TIME in the DELAY select menu (m24).
  The input menu for the delay time required (m246B) is called up.

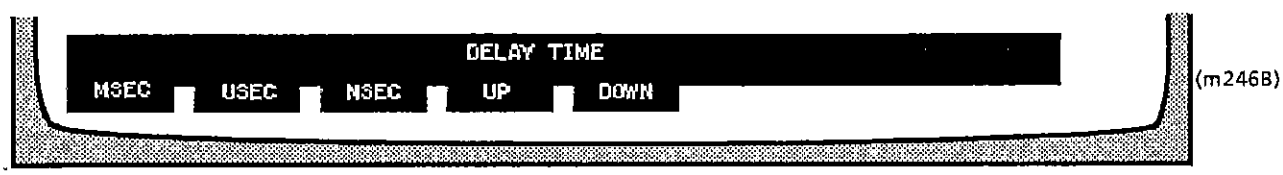


Fig. 5-35

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
MSEC	The unit becomes msec (milliseconds)
USEC	The unit becomes usec (mikroseconds)
NSEC	The unit becomes nsec (nanoseconds)
UP	Change of delay in ascending sequence.
DOWN	Change of delay in descending sequence.

The following numeric values can be selected:

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 200, 300, 400, 500, 600, 700, 800, 900

To return to the DELAY select menu (m24), the RETURN key is pressed.

5.2.6 Setting the Trigger Control Delay Mode OCCURRENCES

The trigger control delay mode OCCURRENCES is set in the TRIGGER menu. Proceed as follows:

- Press the TRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

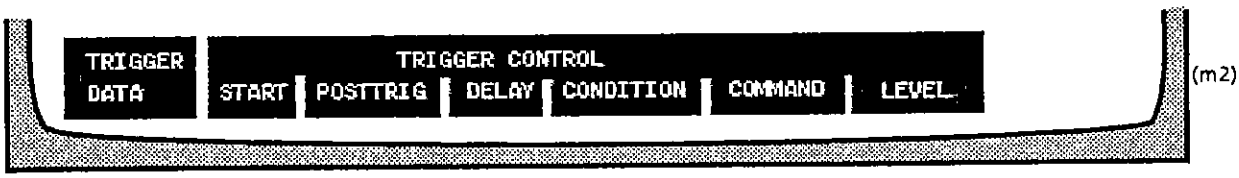


Fig. 5-38

- Press the softkey TRIGGER CONTROL DELAY.
  The TRIGGER CONTROL DELAY select menu (m24) is called up.

Fig. 5-39

Note: The labelling of the 4 softkeys on the right depends on the DELAY mode set. Fig. 5-39 shows the DELAY MODE OCCUR.

- Press the softkey DELAY MODE OCCUR.
  The delay mode OCCURRENCES is set.

Entering further parameters

a) Entering the AFTER/WHILE condition

- Press the softkey AFTER/WHILE in the DELAY select menu (m24).
  The AFTER/WHILE select menu is called up.

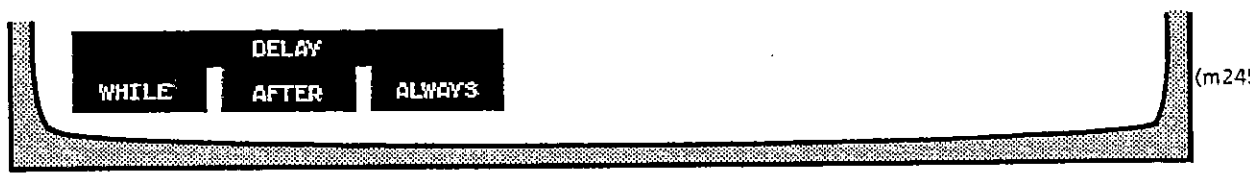


Fig. 5-40

By pressing the respective softkey, the following settings can be performed or menus called up:

Softkey	Action
DELAY WHILE	Entry of WHILE at the beginning of the DELAY field in the currently active sublevel
DELAY AFTER	Entry of AFTER at the beginning of the DELAY field in the currently active sublevel
DELAY ALWAYS	The delay specification for the currently active sublevel is deleted.

Note: The AFTER/WHILE condition can be individually specified for each sublevel. The respective input fields are reached via the cursor keys.

To return to the DELAY select menu (m24), the RETURN key is pressed (see Fig. 3-1, item 15).

b) Entering the DELAY time

▸ Press the softkey NO OF OCCUR.
The input menu for the required number of occurrences is called up.

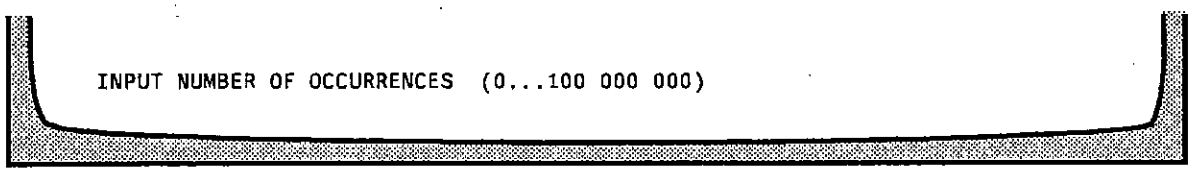


Fig. 5-41

The required number of occurrences can now be entered via keys 0 to 9 on the front panel keyboard. The data entry is terminated by pressing the RETURN key (see Fig. 3-1, item 15).

c) Entering the EXTERNAL CLOCK in the DELAY condition
(possible only if the clock is set to CLOCK EXTERN in the CONFIGURATION menu).

▸ Press the softkey EXT CLOCK in the DELAY select menu.
The CLK EXT SELECT menu for the DELAY field (m247) is called up.

Fig. 5-42

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
SELECT CLOCK CLK0 ON . . . SELECT CLOCK CLK1 OFF	By switching on and off, the delay specification can optionally be assigned one or both external clocks. (In the softkey texts, the clock labels specified in the CONFIG menu are indicated). The two clocks are ORed.

To return to the DELAY select menu (m24), the RETURN key is pressed (see Fig. 3-1, item 15).

d) Entering the WITH condition (TRIGWORD LINK)

▸ Press the softkey TRIGWORD LINK in the DELAY select menu (m24).
The SELECT TRIGWORD LINK menu for the DELAY field (m248) is called up.

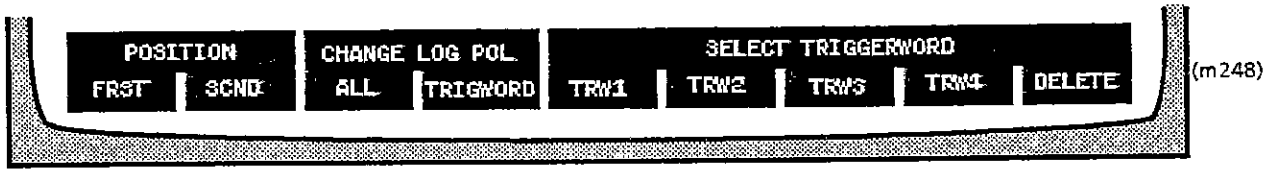


Fig. 5-43

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
POSITION FRST SCND	This switch is used to determine whether the adjacent softkeys of this menu are to refer to the first or second of the two possible positions in the WITH input field.
CHANGE LOG ALL	Inversion of the logic polarity of the combination of both trigger words in the WITH input field. The forward slash corresponds to a logic inversion.
CHANGE LOG POL TRIGWORD	Inversion of the logic polarity of the first or second trigger word in the WITH input field. The forward slash corresponds to a logic inversion.
SELECT TRIGGERWORD TRG1 to TRG4	The respective trigger word is inserted at the first or second position in the WITH input field. (The trigger word names specified in the TRIGGER menu are indicated in the softkey texts).
SELECT TRIGGERWORD DELETE	Clear the first or second trigger word in the WITH input field.

Note: The two trigger word entries in the WITH condition are ORed.

To return to the DELAY select menu (m24), the RETURN key is pressed.

5.2.7 Deleting Trigger Control Delay Settings

A setting in the DELAY field of the TRIGGER CONTROL menu is deleted as follows:

- Press the TRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

Fig. 5-44

- Press the softkey TRIGGER CONTROL DELAY.
  The TRIGGER CONTROL DELAY select menu (m24) is called up.

Fig. 5-45

Select the trigger control level required using the cursor keys.

Note: Fig. 5-45 shows the DELAY MODE CLOCKS for external clock.

- Press the softkey DELAY MODE ALWAYS.
  The DELAY setting of this trigger control level is deleted.

To return to the TRIGGER select menu, the RETURN key is selected.

5.2.8 Setting the Trigger Control CONDITION

The trigger control condition is set in the TRIGGER menu. Proceed as follows:

- Press the TRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

Fig. 5-46

- Press the softkey TRIGGER CONTROL CONDITION.
  The TRIGGER CONTROL CONDITION input menu (m25) is called up.

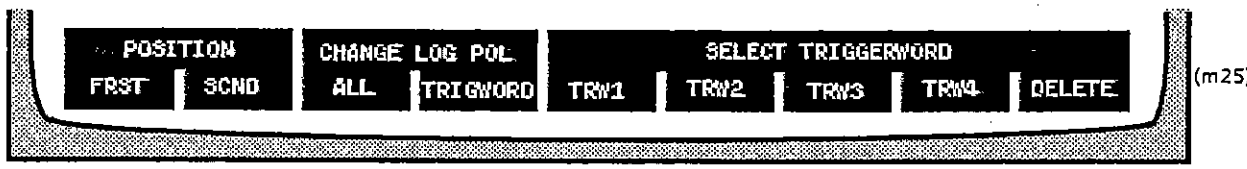


Fig. 5-47

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
POSITION FRST SCND	This switch is used to determine whether the adjacent softkeys of this menu are to refer to the first or second of the two possible positions in the CONDITION input field.
CHANGE LOG POL CONDITION	Using this softkey, the logic polarity of the CONDITION is inverted as a whole. The forward slash corresponds to a logic inversion.
CHANGE LOG POL TRIGWORD	Inversion of the logic polarity of the first or second trigger word in the CONDITION input field. The forward slash corresponds to a logic inversion.
SELECT TRIGGERWORD TRW1 to TRW4	The respective trigger word is inserted at the first or second position in the CONDITION input field. (The trigger word names specified in the TRIGGER menu are indicated in the softkey texts).

Note: The two trigger word entries in the TRIGGER CONTROL condition are ANDed.

To return to the TRIGGER select menu (m24), the RETURN key is pressed (see Fig. 3-1, item 15).

5.2.9 Setting the Trigger Control COMMAND

The trigger control commands are set in the TRIGGER menu. Proceed as follows:

- Press the TRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

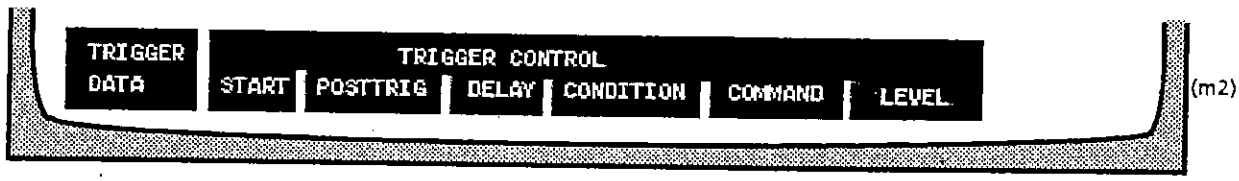


Fig. 5-48

- Press the softkey TRIGGER CONTROL COMMAND.
  The trigger control command input menu (m26) is called up.

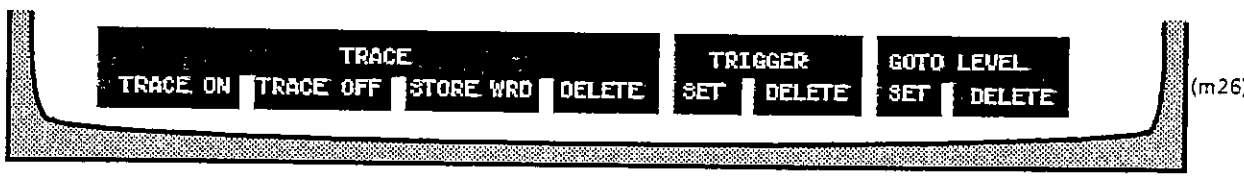


Fig. 5-49

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
TRACE TRACE ON	The TRACE command TRACE ON is entered in the COMMAND field of the currently active sublevel.
TRACE TRACE OFF	The TRACE command TRACE OFF is entered in the COMMAND field of the currently active sublevel.
TRACE STORE WRD	The TRACE command STORE is entered in the COMMAND field of the currently active sublevel.
TRACE DELETE	A TRACE command in the currently active suvblevel is deleted.
TRIGGER SET	The command TRIGGER is entered in the COMMAND field of the currently active sub-level.
TRIGGER DELETE	A TRIGGER command in the currently active sublevel is deleted.
GOTO LEVEL SET	Entry of the number of the trigger control level to be operated next.
GOTO LEVEL DELETE	A current GOTO command is deleted.

To return to the trigger select menu (m2), the RETURN key is pressed.

5.2.10 Setting the Number of Trigger Control Levels

The number of trigger control levels is set in the TRIGGER menu. Proceed as follows:

- Press the TRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

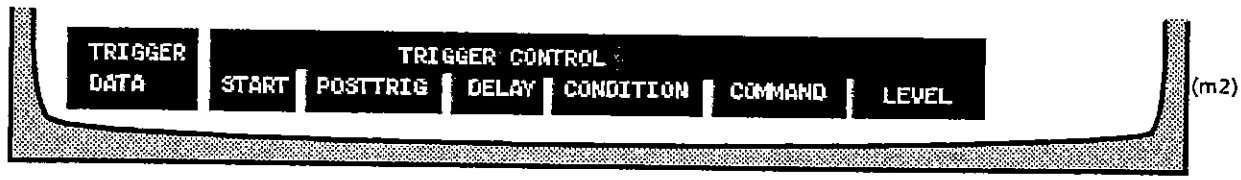


Fig. 5-50

- Press the softkey TRIGGER CONTROL LEVEL.
  The TRIGGER CONTROL LEVEL input menu (m27) is called up.

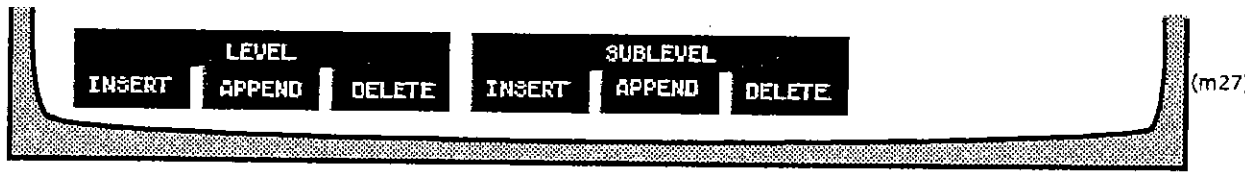


Fig. 5-51

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
LEVEL INSERT	A new level is inserted preceding the level denoted by the current cursor location.
LEVEL APPEND	A new level is appended following the level denoted by the current cursor location.
LEVEL DELETE	The level denoted by the current cursor location is deleted.

Note: A maximum of four levels is possible.

To return to the TRIGGER select menu, the RETURN key is pressed (see Fig. 3-1, item 15).

5.2.11 Setting the Number of Trigger Control Sublevels

The number of trigger control sublevels is set in the TRIGGER menu. Proceed as follows:

- Press the TRIGGER key (see Fig. 3-1, item 2).
  The TRIGGER select menu is called up.

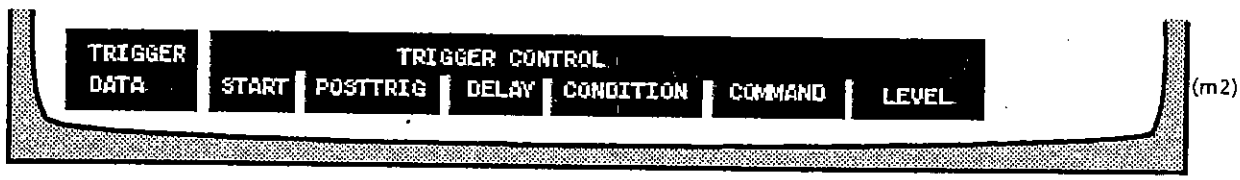


Fig. 5-52

- Press the softkey TRIGGER CONTROL LEVEL.
  The TRIGGER CONTROL LEVEL input menu (m27) is called up.

Fig. 5-53

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
SUBLEVEL INSERT	A new sublevel is inserted preceding the sublevel denoted by the current cursor location.
SUBLEVEL APPEND	A new sublevel is appended following the sublevel denoted by the current cursor location.
SUBLEVEL DELETE	The sublevel denoted by the current cursor location is deleted.

Note: For each level, a maximum of four sublevels is possible.

To return to the TRIGGER select menu, the RETURN key is pressed (see Fig. 3-1, item 15).

6 Loading and Saving of Complete Instrument Setups and Recordings; Printing of Recorded Data and Setting Menus

6.1 Introduction

All settings concerning the loading and saving of complete instrument setups or recordings as well as the printing of recorded data or setting menus are performed in the SPECIAL MENU. This menu is called up using the SPECIAL key (Fig. 3-1, item 1).

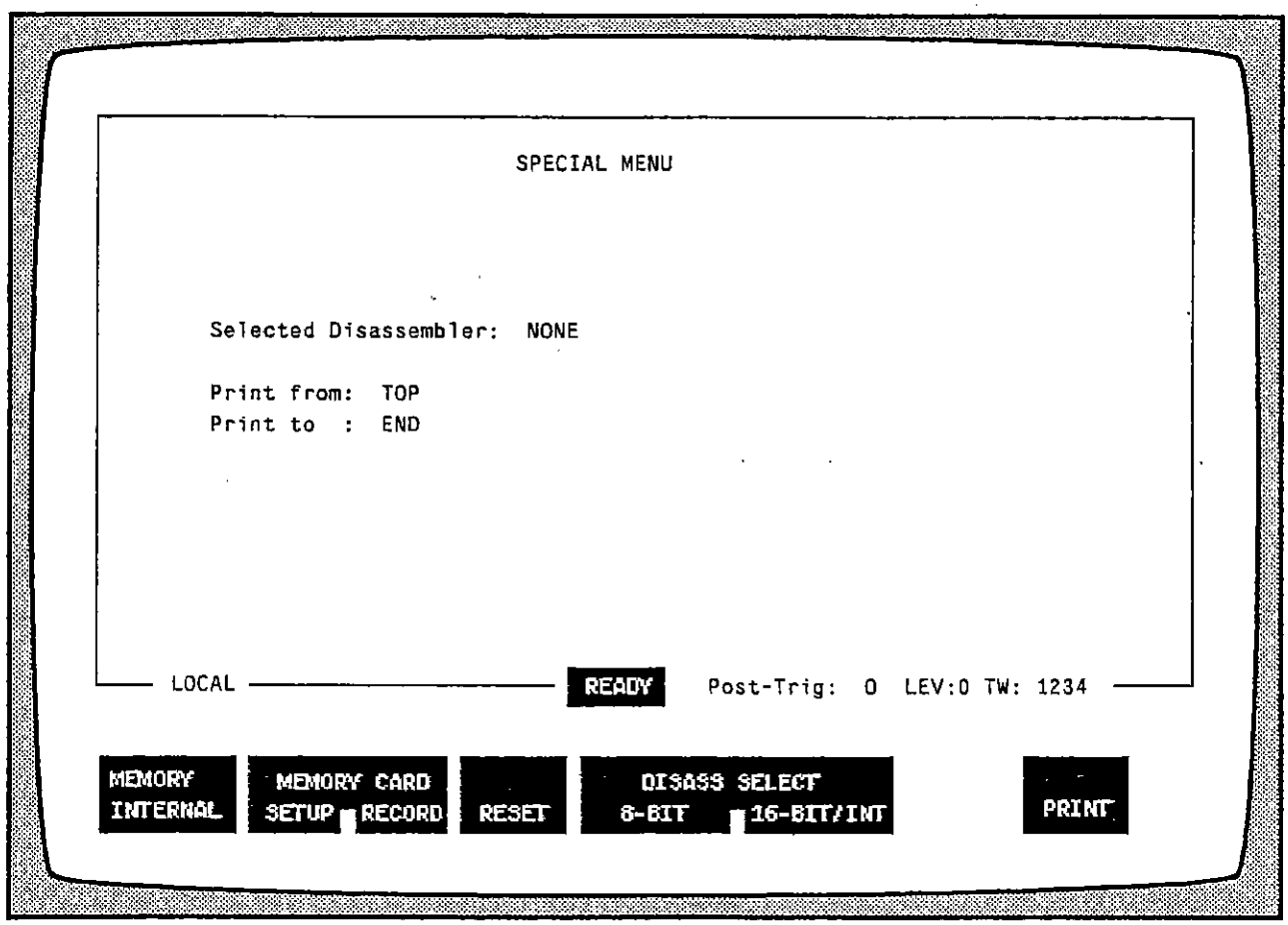


Fig. 6-1 SPECIAL MENU

All settings are effected with the aid of softkey menus. The upper part of the screen contains an overview of the current state of the setting parameters.

Loading and saving of complete instrument setups from/on the CMOS-RAM

The logic analyzer permits to save a total of 8 complete instrument setups in the CMOS-RAM of the LAC64 with battery back-up and recall them again. This includes all settings of the CONFIGURATION, TRIGGER and SPECIAL menus.

Loading and saving of complete instrument setups from/on the MEMORY card

Starting from series 860 792/001, the logic analyzer is capable of saving a total of 20 complete instrument setups on the MEMORY card and recalling them again. This includes all settings of the CONFIGURATION, TRIGGER and SPECIAL menus.

Loading and saving of recordings from/on the MEMORY card

Starting from series 860 792/001, the LAC64 features the capability of saving a recording from the MAIN or the REF memory on a MEMORY card. These recordings are then loaded again in the REF memory.

Printing of recorded data and setting menus

The recorded data of the 48-channel analyzer and the high resolution analyzer can be printed out

- from the beginning, from a particular line or from the trigger event, and
- up to the end or a particular line
- up to the trigger event
- from the trigger event.

The required interface to the printer with the respective operating parameters is specified in the CONFIGURATION menu (see section 4.7).

The recorded data as well as the setting menus can, however, also be printed via actuation of the SCREEN COPY key (see Fig. 3-1, item 16). In this case, the current screen contents is transferred to the printer.

Reset of instrument settings

It is possible for a number of instrument settings to be reset to standard values. Differentiation is made between:

- Resetting of configuration data
  (data set in the CONFIGURATION menu, with the exception of IN/OUT data)

- Resetting of trigger data
  (Data set in the TRIGGER menu)

- Resetting of interface data
  (IN/OUT data of the CONFIG menu)

- Resetting of all data set in the CONFIGURATION and TRIGGER menus.

6.2 Printing of Recorded Data

- Press the SPECIAL key (see Fig. 3-1, item 1).
  The SPECIAL select menu is called up.

Fig. 6-2

- Press the softkey PRINT.
  The PRINT menu (m88) is called up.

Fig. 6-3

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
PRINT FROM TOP	Printing is started at the beginning of recording.
PRINT FROM TRIG	Printing is started upon occurrence of the trigger event.
PRINT TROM LOC	Printing is started from the line to be entered now.
PRINT TO END	Printing is stopped at the end of recording.
PRINT OT TRIG	Printing is stopped upon occurrence of the trigger event.
PRINT TO LOC	Printing is stopped at the line to be entered now.

To return to the SPECIAL menu (m8), the RETURN key is pressed.

- Press the softkey PRINT START (in PRINT menu (m88)).
  Printing is carried out via the currently acitve interface for printing (as to setting refer to section 4.7). Printing can be interrupted by pressing the softkey PRINT STOP.

Note: Recorded data can also be printed using the SCREEN COPY key (s. Fig. 3-1, item 16). Pressing this key causes the current screen display to be output on a printer.

6.3 Printing of Setting Menus

The printing of setting menus such as the CONFIGURATION or the TRIGGER menu is effected as follows:

- The menu to be printed is displayed on the screen (e.g. by pressing the CONFIG key or the TRIGGER key, respectively).
- The screen contents is printed out using the SCREEN COPY key (see Fig. 3-1, item 16).

Printing is carried out via the currently active interface for printing (as for setting, refer to section 4.7).

6.4 Loading of Complete Instrument Setups

6.4.1 Loading of Complete Instrument Setups from the CMOS-RAM

▸ Press the SPECIAL key (see Fig. 3-1, item 1).
The SPECIAL select menu is called up.

Fig. 6-4

▸ Press the softkey MEMORY INTERNAL.
The MEMORY INTERNAL select menu is called up.

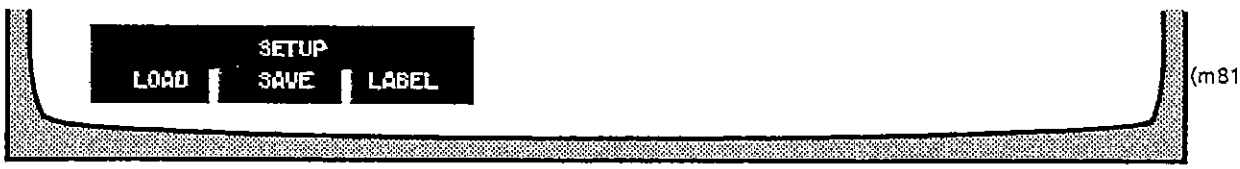


Fig. 6-5

▸ Press the softkey SETUP LOAD.

A number between 1 and 8 can then be entered. On actuation of the RETURN key, the setup from the internal CMOS-RAM with the entered number is loaded.

If no setup is to be loaded, number 0 is entered.

6.4.2 Loading of Complete Instrument Setups from the MEMORY Card
(only for instruments starting from series 860 792/001)

- Press the SPECIAL key (see Fig. 3-1, item 1).
  The SPECIAL select menu is called up.

Fig. 6-6

- Press the softkey MEMORY CARD SETUP.
  The MEMORY CARD SETUP select menu is called up.

Fig. 6-7

- Press the softkey SETUP LOAD.
  The MEMORY CARD SETUP LOAD menu is called up.

  A number between 1 and 20 can then be entered. On actuation of the RETURN key, the setup from the MEMORY card inserted on the control panel field with the entered number is loaded into the LAC64.

  If no setup is to be loaded, number 0 is entered.

  Note: To have a complete instrument setup loaded into the LAC64 from a MEMORY card, a complete instrument setup must have been stored before on this card under the same number.

6.5 Saving of Complete Instrument Setups

6.5.1 Saving of Complete Instrument Setups in the CMOS-RAM

- Press the SPECIAL key (see Fig. 3-1, item 1).
  The SPECIAL select menu is called up.

Fig. 6-8

- Press the softkey MEMORY INTERNAL.
  The MEMORY INTERNAL select menu is called up.

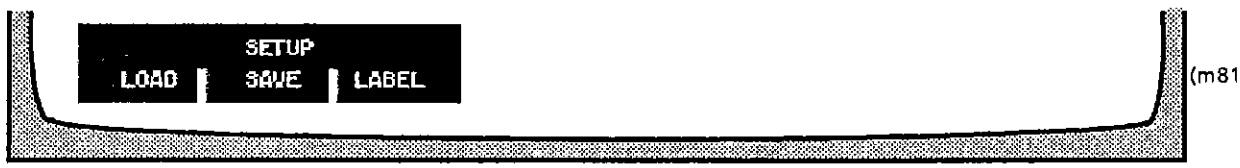


Fig. 6-9

- Presss the softkey SETUP SAVE.

  A number between 1 and 8 can then be entered. On actuation of the RETURN key, the setup from the internal CMOS-RAM with the entered number is loaded.

  If no setup is to be loaded, 0 is entered.

6.5.2 Saving of Complete Instrument Setups on the MEMORY Card

(only for instruments starting from series 860 792/001)

- Press the SPECIAL key (see Fig. 3-1, item 1).
  The SPECIAL select menu is called up.

Fig. 6-10

- Press the softkey MEMORY CARD SETUP.
  The MEMORY CARD SETUP menu is called up.

Fig. 6-11

- Press the softkey SETUP SAVE.
  The MEMORY CARD SETUP SAVE menu is called up.

  A number between 1 and 20 can then be entered. On actuation of the RETURN key, the setup from the MEMORY card inserted on the control panel field with the entered number is loaded into the LAC64.

  If no setup is to be loaded, number 0 is entered.

6.6 Reset of Instrument Settings

- Press the SPECIAL key (see Fig. 3-1,item 1).
  The SPECIAL select menu is called up.

Fig. 6-12

- Press the softkey RESET.
  Das SETUP RESET mehu (m83) is called up.

Fig. 6-13

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
RESET ALL	Resetting of all data set in the CONFIGURATION and TRIGGER menus
RESET CONFIG	Resetting of all data set in the CONFIGURATION menu (with the exception of the IN/OUT interface data)
RESET TRIGGER	Resetting of all data set in the TRIGGER menu
RESET IN/OUT	Resetting of all interface data (IN/OUT data set in the CONFIGURATION menu)

To return to the SPECIAL select menu, the RETURN key is pressed.

6.7 Entering of Labels for Complete Instrument Setups

6.7.1 Entering of Labels for Complete Instrument Setups in the CMOS RAM

To obtain a better overview, a label consisting of four characters can be assigned to each of the eight complete instrument setups stored in the internal CMOS RAM of the LAC64.
Proceed as follows:

- Press the SPECIAL key (see Fig. 3-1, item 1).
  The SPECIAL select menu is called up.

Fig. 6-14

- Press the softkey MEMORY INTERNAL.
  The MEMORY INTERNAL select menu is called up.

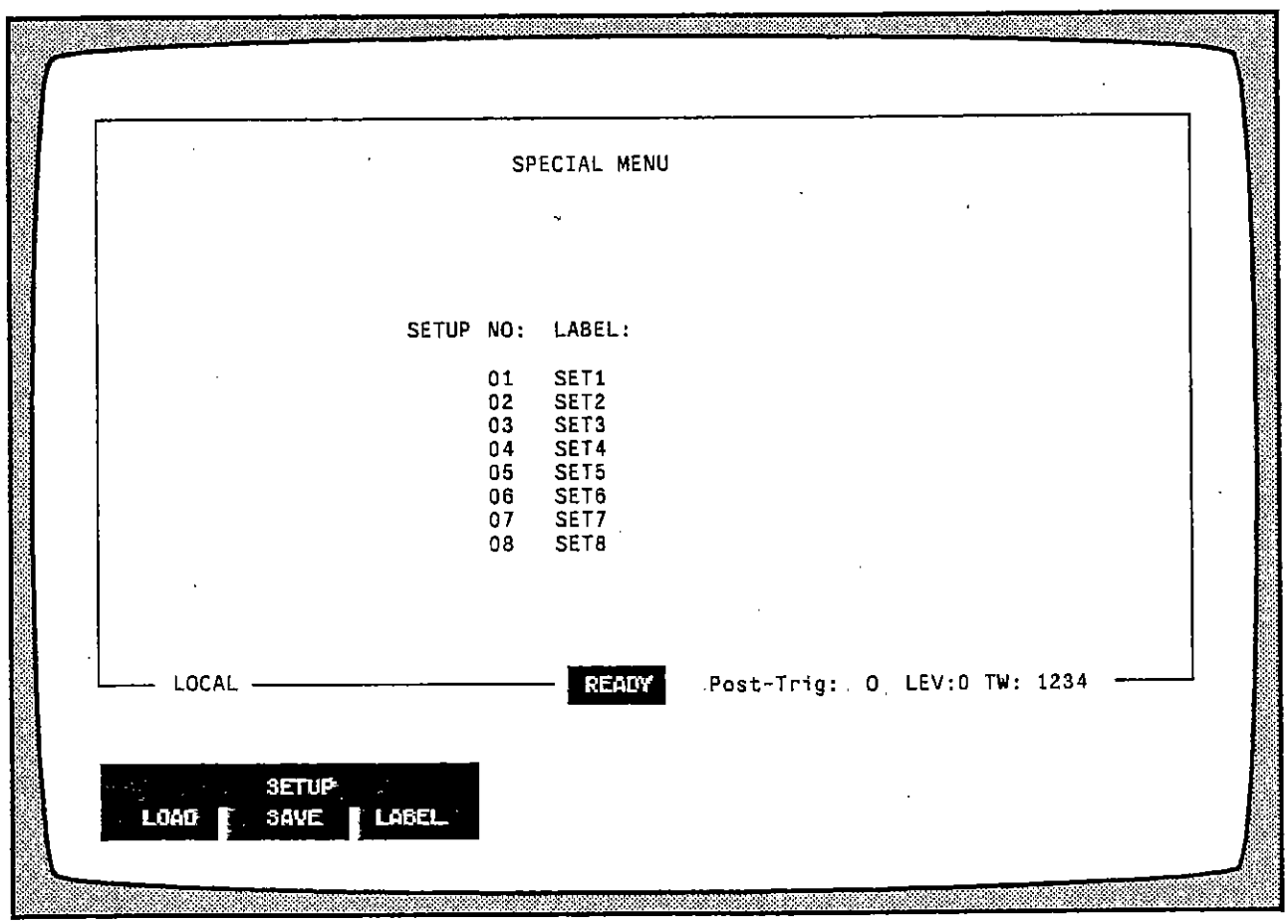


Fig. 6-15

▸ Press the softkey SETUP LABEL.
The SETUP input menu is called up.

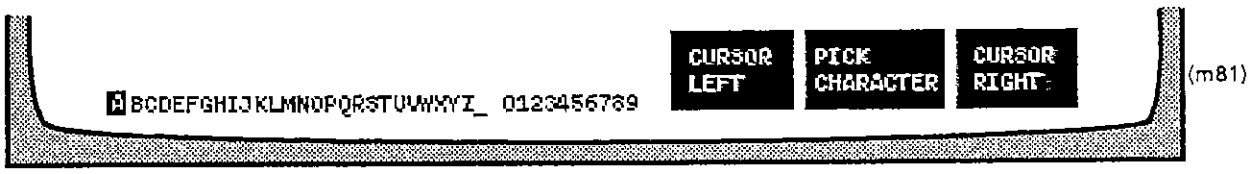


Fig. 6-16

The required label can be selected using key ↑ or ↓ on the LAC64 keypad.

The softkeys CURSOR LEFT or CURSOR RIGHT can then be used to select the required letter from the alphabetical line and have it included in the label name by pressing the softkey PICK CHARACTER.

By pressing the RETURN key, the SPECIAL select menu can again be returned to.

6.7.2 Entering of Labels for Complete Instrument Setups on the MEMORY Card

(only for instruments starting from series 860 792/001)

To obtain a better overview, a label consisting of four characters can be assigned to each of the 20 complete instrument setups stored on the MEMORY card of the LAC64.
Proceed as follows:

▸ Press the SPECIAL key (see Fig. 3-1, item 1).
The SPECIAL select menu is called up.

Fig. 6-17

▸ Press the softkey MEMORY CARD SETUP.
The MEMORY CARD SETUP select menu is called up.

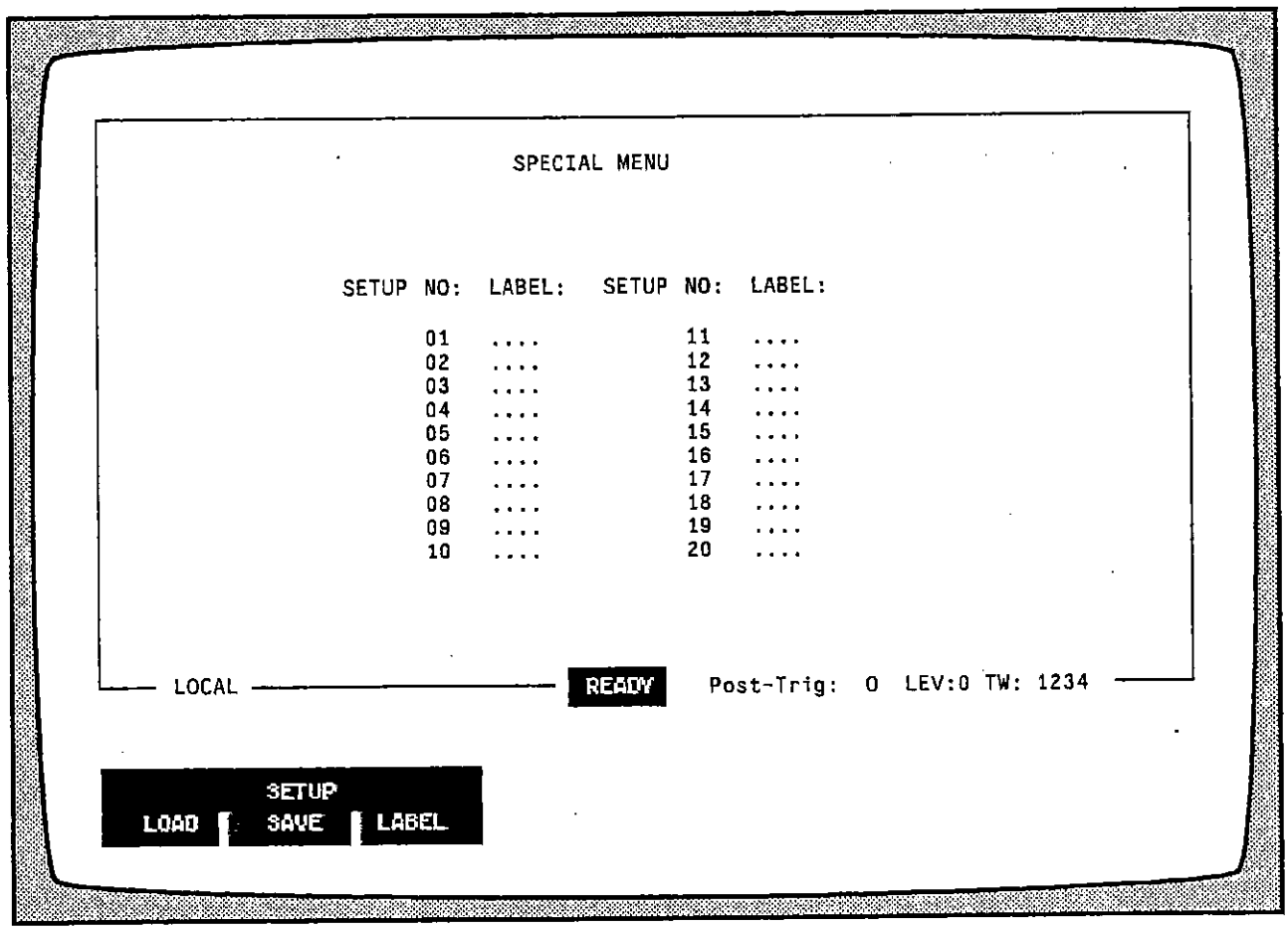


Fig. 6-18

- Press the softkey SETUP SAVE.
  The LABEL input menu is called up.

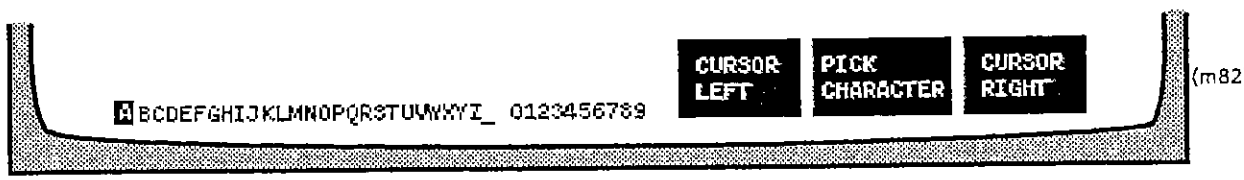


Fig. 6-19

The required label can be selected using keys ↑ ↓ ← or → on the LAC64 keypad.

The softkeys CURSOR LEFT or CURSOR RIGHT can then be used to select the required letter from the alphabetical line and have it included in the label name by pressing the softkey PICK CHARACTER.

By pressing the RETURN key, the SPECIAL select menu can again be returned to.

6.8 Loading of Data Collections from the MEMORY Card

(only for instruments starting from series 860 792/001)

A complete data recording can be stored on the MEMORY card (see section 6.9), which can again be loaded back into the REF memory.
Proceed as follows:

- Press the SPECIAL key (see Fig. 3-1, item 1).
  The SPECIAL select menu is called up.

Fig. 6-20

- Press the softkey MEMORY CARD RECORD.
  The MEMORY CARD RECORD select menu is called up.

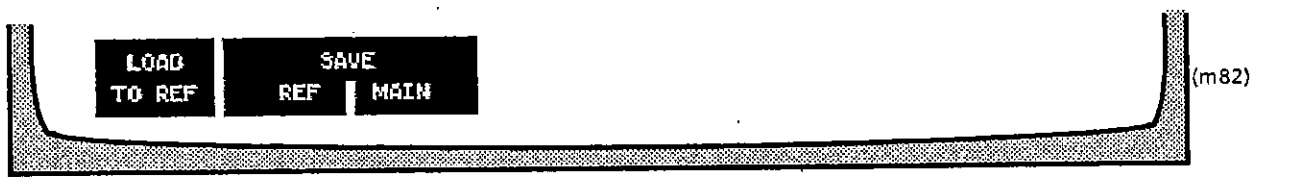


Fig. 6-21

On actuation of softkey LOAD TO REF, a data collection stored on the MEMORY card is loaded into the REF memory of the LAC64.

By pressing the RETURN key, the SPECIAL select menu can again be returned to.

6.9 Saving of Data Collections on the MEMORY Card

A complete data recording can be stored on the MEMORY card either from the MAIN memory or the REF memory.
Proceed as follows:

- Press the SPECIAL key (see Fig. 3-1, item 1).
  The SPECIAL select menu is called up.

Fig. 6-22

- Press the softkey MEMORY CARD RECORD.
  The MEMORY CARD RECORD select menu is called up.

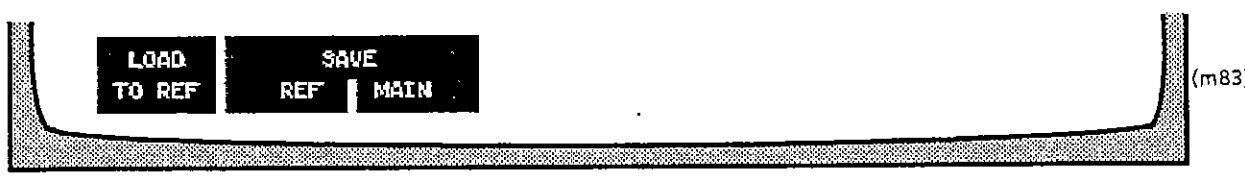


Fig. 6-23

By pressing the respective softkey, a recording is stored on the MEMORY card:

Softkey	Action
SAVE REF	Saving of recordings in the REF memory on the MEMORY card
SAVE MAIN	Saving of recordings in the MAIN memory on the MEMORY card

To return to the SPECIAL select menu, the RETURN key is pressed.

7 Recording and Display of Test Data

7.1 Start of Recording

Once the logic analyzer has been suitably set via the CONFIGURATION and TRIGGER setting menus in view of the test tasks to be performed, the data collection is initiated as follows:

- Press the START key.

  The current status of recording is read out on the screen in the monitor line (line prior to the softkey line).

  STARTED: The logic analyzer has started recording and is awaiting the trigger event.

  TRIGGERED: The trigger event has been found and the collection memory is being filled, depending on the posttrigger setting.

  BUSY: Recording is terminated and the logic analyzer unit gets ready for display of the recorded data.

  READY: Recording is terminated and the test result is displayed on the screen.

  POSTTRIG: Current state of the posttrigger counter

  LEV: Current level in the trigger control sequence

  TW: Display whether a trigger word has been discovered in the data stream. (Figures 1 to 4 refer to the 4 trigger words which, in case of successful search, are read out in inverse display.

  Note: Recording of data may be interrupted at any time using the STOP key.

  To repeat a measurement, the AUTOREPEAT mode is used. In this operating mode, the logic analyzer displays the currently measured data on the screen after recording has been terminated, and automatically restarts. The AUTOREPEAT mode is set in the CONFIGURATION menu (see section 4.6.4).

  During recording, new entries can be made at any time in the setting menus, which, however, will only be considered for the next measurement.

7.2 Selection of the Type of Display "DISPLAY SELECT"

7.2.1 Introduction

The recorded data can be displayed and interpreted on the screen. The following menus are provided for this purpose:

- DISPLAY SELECT menu
  In this menu, the type of display of the recorded data is determined (see section 7.2.2).
- DISPLAY CALL menu
  In this menu, the recorded data are displayed on the screen as specified in the DISPLAY SELECT menu (see sections 7.3, 7.4 and 7.5).

The DISPLAY SELECT menu is called up using the DISPLAY SELECT key (see fig. 3-1, item 4).

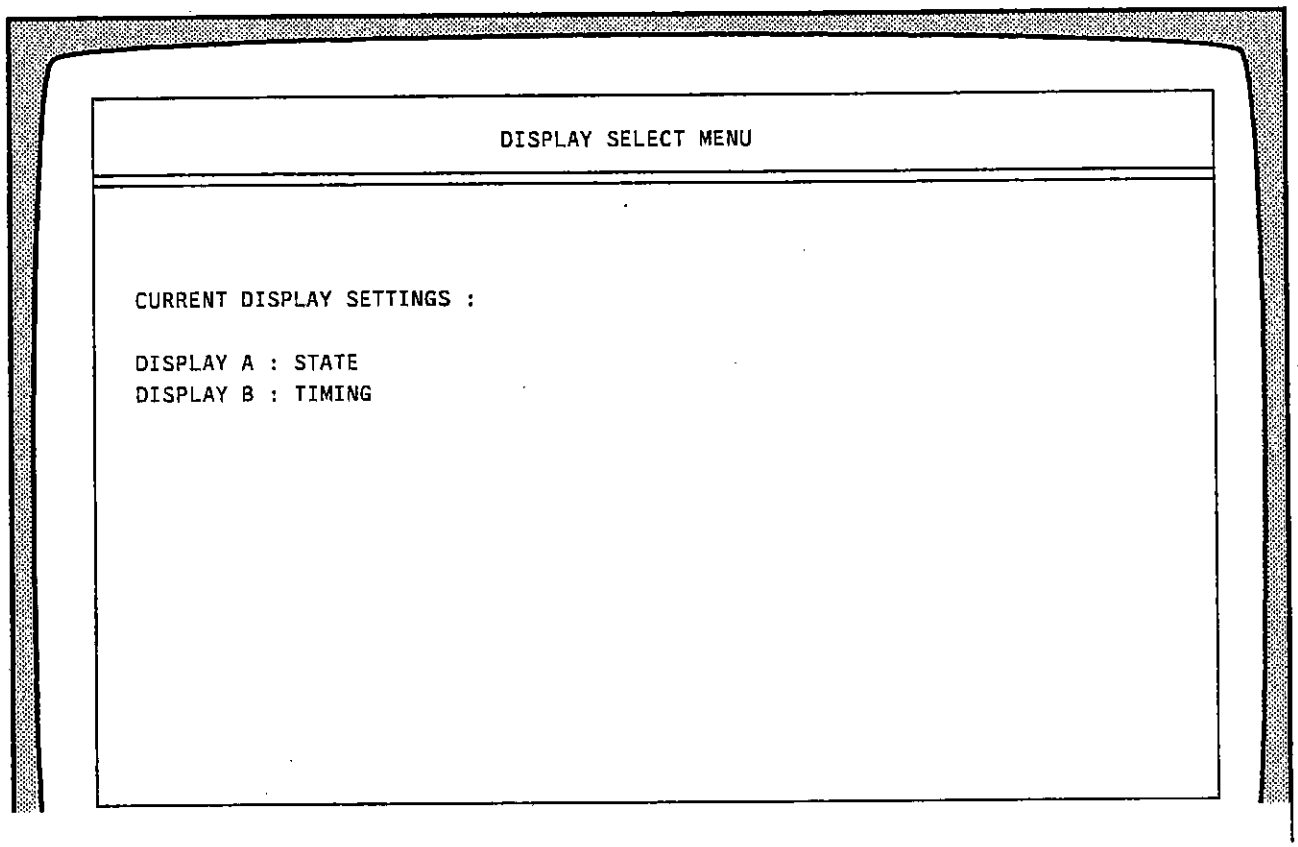


Fig. 7-1

The following parameters are set in the DISPLAY SELECT menu:

Display mode:

In the DISPLAY CALL menu, the recorded data are displayed in sections (as if seen through "windows") on the screen. Two such windows, DISPLAY A and DISPLAY B, can be determined, which are output on the screen either individually (DISPLAY MODE A or DISPLAY MODE B, resp.) or together (DISPLAY MODE A&B). As to the setting of the modes, see section 7.2.2.

Types of display used in display modes A and B

It is possible to define for each of the two displays A and B in which manner the recorded data are to be displayed:

STATE: The recorded data are successively displayed clock by clock. The time axis is vertically directed toward the bottom (see fig. 7-4). The display format is specified in the CONFIGURATION menu (section 7.3.1).

DISASS: The recorded data are generally displayed in the same manner as in the STATE mode. In addition, also the disassembler text specified for each processor type is indicated. As to the selection of the processor type, refer to section 4.8.

TIMING: The recorded data are graphically displayed channel by channel in a way corresponding to the time axis of the electric signals. The time axis is horizontally directed toward the right (see fig. 7-10 and section 7.3.2). The display format is specified in the CONFIGURATION menu.

The selection of the types of display used in the respective display modes is described in section 7.2.3.

Note: In the CONFIGURATION menu, the channels can be assigned both to the 48 channel analyzer and to the high resolution analyzer (see section 4). The high resolution channels are displayed in the TIMING display only.

7.2.2 Selection of Display Mode

To select whether the recorded data are to be displayed in the DISPLAY CALL menu in both DISPLAYS A and B or just in one of them, i.e. optionally either DISPLAY A or B, the DISPLAY SELECT menu is used.

Proceed as follows:

- Press the key DISPLAY SELECT.
  The DISPLAY SELECT menu (m3) is called up.

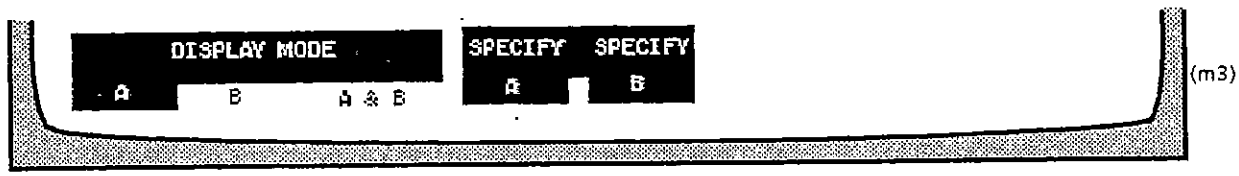


Fig. 7-2

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
DISPLAY MODE A	The recorded data are displayed in the DISPLAY CALL menu in display A only.
DISPLAY MODE B	The recorded data are displayed in the DISPLAY CALL menu in display B only.
DISPLAY MODE A&B	The recorded data are displayed in the DISPLAY CALL menu in both displays A and B.

7.2.3 Selection of the Type of Display Used in the Display Modes

The type of data display to be used for the two display modes DISPLAY A and DISPLAY B is set in the DISPLAY SELECT menu.

Proceed as follows:

- Press the DISPLAY SELECT key.
  The DISPLAY SELECT menu (m3) is called up.

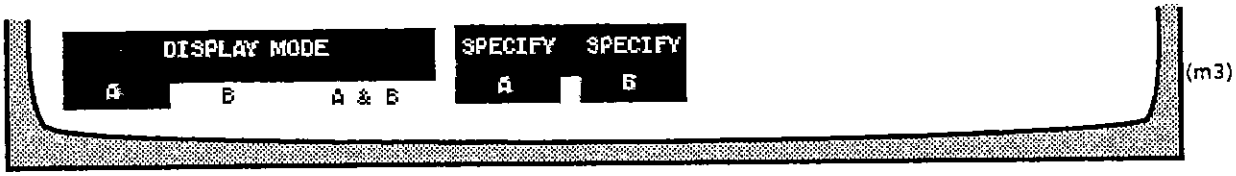


Fig. 7-3

Now press either the softkey SPECIFY A or SPECIFY B. One of the two submenus DISPLAY SELECT SPECIFY is then displayed. Fig. 7-4 shows the submenu for display A.

The submenu for display B corresponds to that of display A

Fig. 7-4

Softkey	Action
DISPLAY A TYPE STATE	Display A is assigned the display type STATE.
DISPLAY A TYPE DISASS	Display A is assigned the display type DISASSEMBLER.
DISPLAY A TYPE TIMING	Display A is assigned the display type TIMING.

Hinweis: The softkey DISPLAY A TYPE DISASS appears only if a disassembler was loaded in advance (see section 4.8).

7.3 Call-up of Data Display (DISPLAY CALL)

The data display is called up using the DISPLAY CALL key (see Fig. 3-1, item 5). The recorded data are displayed on the screen as specified in the DISPLAY SELECT menu (see section 7.2), either in DISPLAY A or DISPLAY B or in both displays, using the display types STATE, DISASS or TIMING.

7.3.1 STATE Display

In the STATE display, the recorded data are displayed clock by clock in successive order in the form of a list. The time axis is vertically directed toward the bottom (see Fig. 7-4). The display format is specified in the CONFIGURATION menu .

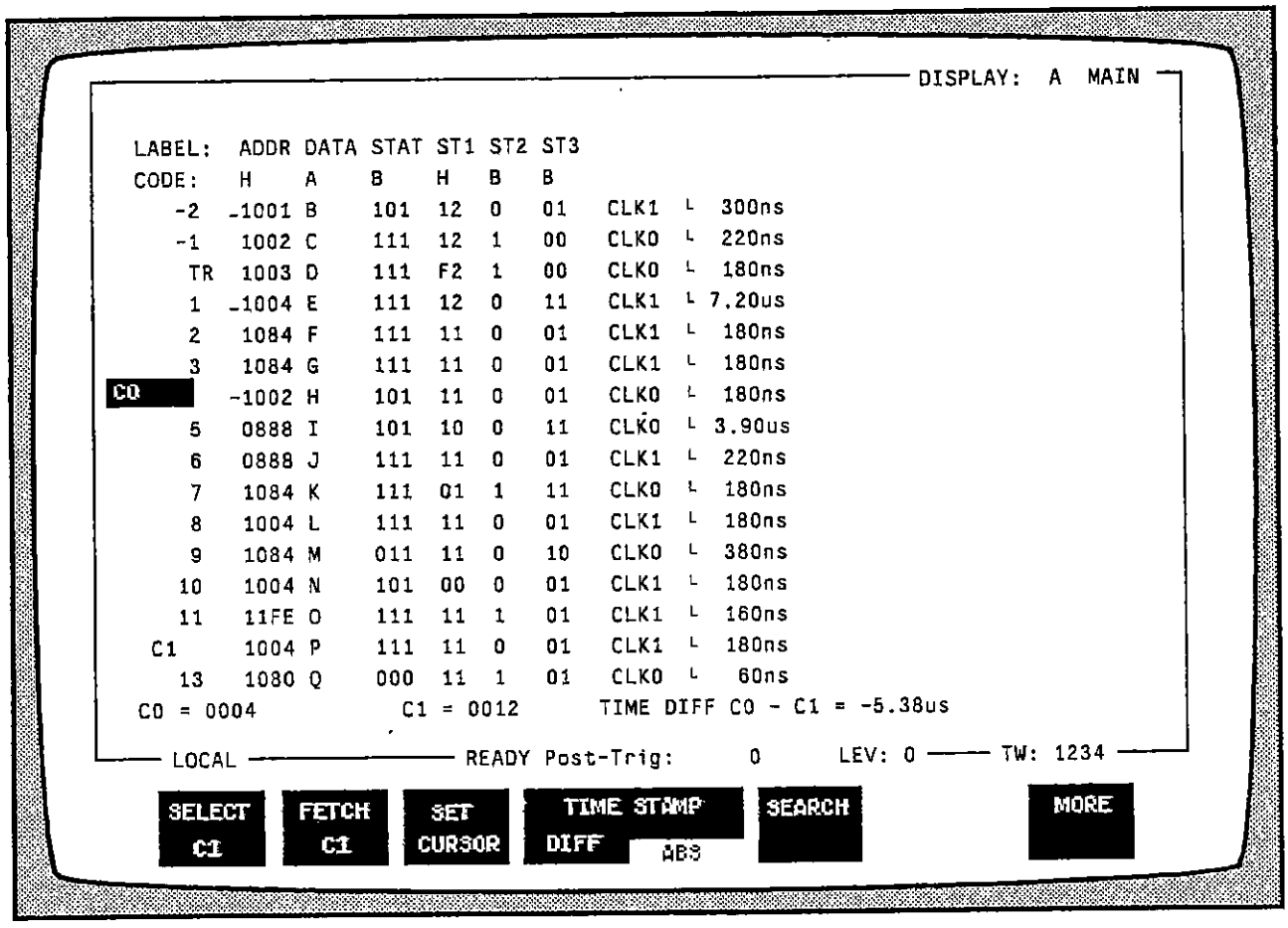


Fig. 7-5: Collection in the STATE display

Explanation of Fig. 7-5:

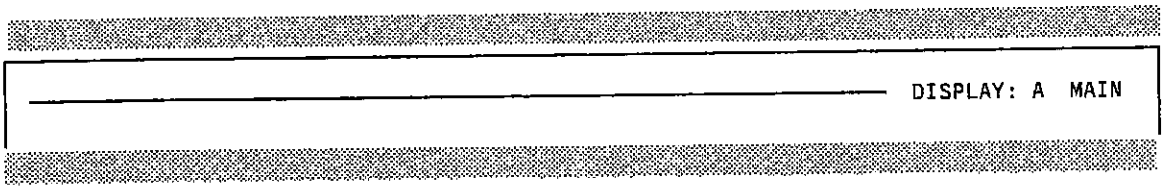


Fig. 7-5 a

The upper edge of the STATE display indicates which of the two available windows (DISPLAY: A or DISPLAY B) is displayed and whether the recorded data of the main (MAIN) or the reference (REF) memory are used. The windows and the data memory are selected in the DISPLAY SELECT menu (see section 7.2.2 and 7.4.3).

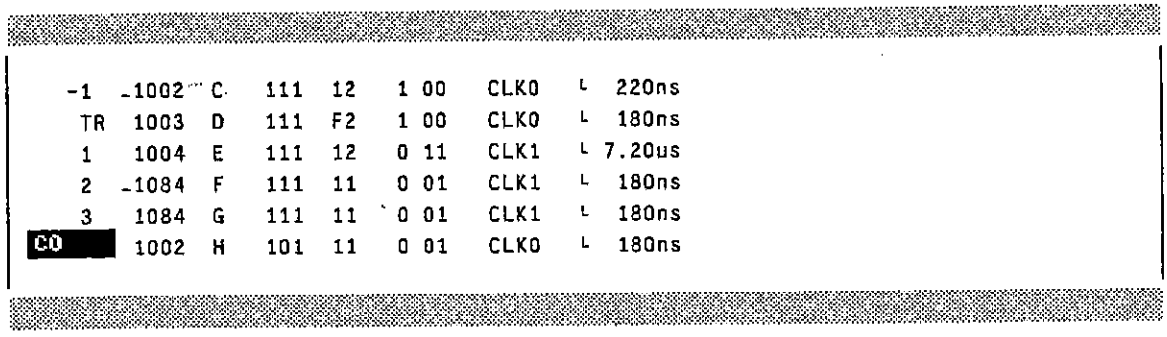


Fig. 7-6

Only a section of the recorded data is displayed on the screen. This section can be vertically shifted using the cursor keys ↑ and ↓ or set to a particular location in the collection using the softkey menu.

The first column to the left shows a numbering of the recorded words in successive order. The trigger event is always to be found at location 0 (see marker TR). The recorded words preceding the trigger event are negative, the following words are positive.

This column also indicates the current locations of the two state cursors C0 and C1 (see markers C0 and C1).

On the lower screen edge, the two cursors C0 and C1 are again indicated with their line numbers and the time difference between them (if the operating mode TIME STAMP is set in the CONFIGURATION menu).

If correspondingly specified in the TRIGGER menu, recording is possible in a selective way, i.e. not all data words coming from the test item but only the selected ones are transferred into the memory. The suppressed data words are marked by a horizontal line before the first data word (see fig. 7-6, line TR and 3).

The recorded data are displayed further to the right, starting from the second column. They are arranged in groups and coded as specified in the CONFIGURATION menu.

If external clock is used for recording, the clock input (CLK0 or CLK1) used to record the respective data word is indicated in a separate column.

If TIME STAMP mode is switched to ON in the softkey menu RECORD MODES (m18) (in the CONFIGURATION menu), a column is added in the STATE display in which the time differences between the clocks are indicated. Note that the time entered in a data word line is the time interval between the preceding collection clock and the collection clock of the data word in question, if TIME STAMP DIFF has been specified (s. section 7.4.5). In the display TIME STAMP ABS the time is indicated upon trigger (line 0).

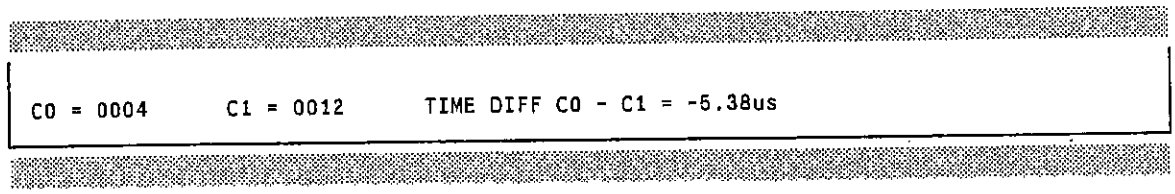


Fig. 7-7

Notes:

Output of data using 2 displays

If it has been selected in the DISPLAY SELECT menu that the recorded data are to be read out using the two displays, the screen is horizontally divided into windows DISPLAY A and DISPLAY B in the DISPLAY CALL menu. A softkey line is again available which can be assigned to the upper or lower window (see section 7.4.1).

Cursors C0, C1

Two cursors are provided in the STATE and DISASSEMBLER menu which can be freely shifted within the collection. One of the two cursors is always active, determining the section of the data collection currently visible on the screen (see DISPLAY CALL softkey menu) (see section 7.4.2).

MEMORY MAIN-REF

Each collection is filed in the main memory (MAIN) first. It can then be completely copied to a second data memory, the reference memory (REF). The MAIN or REF data can optionally be displayed on the screen (see sections 7.4.3 and 7.4.4).

HIGH-RESOLUTION collections

In the case of channels which are assigned both to the 48-channel analyzer and the high resolution analyzer, the collections of the 48-channel analyzer are always represented in the STATE display.

Memory depth

The 48-channel analyzer records a maximum of 2042 data words in the operating mode TIME STAMP ON (see section 4.6.3) and a maximum of 4990 data words in the TIME STAMP OFF mode. With the high resolution analyzer, which invariably uses internal clock only, recording is always effected within a time period of 81.9 µs.

7.3.2 TIMING Display

In the TIMING display, the recorded data are graphically displayed along their linear time axis for each channel separately. The time axis is horizontally directed toward the right.

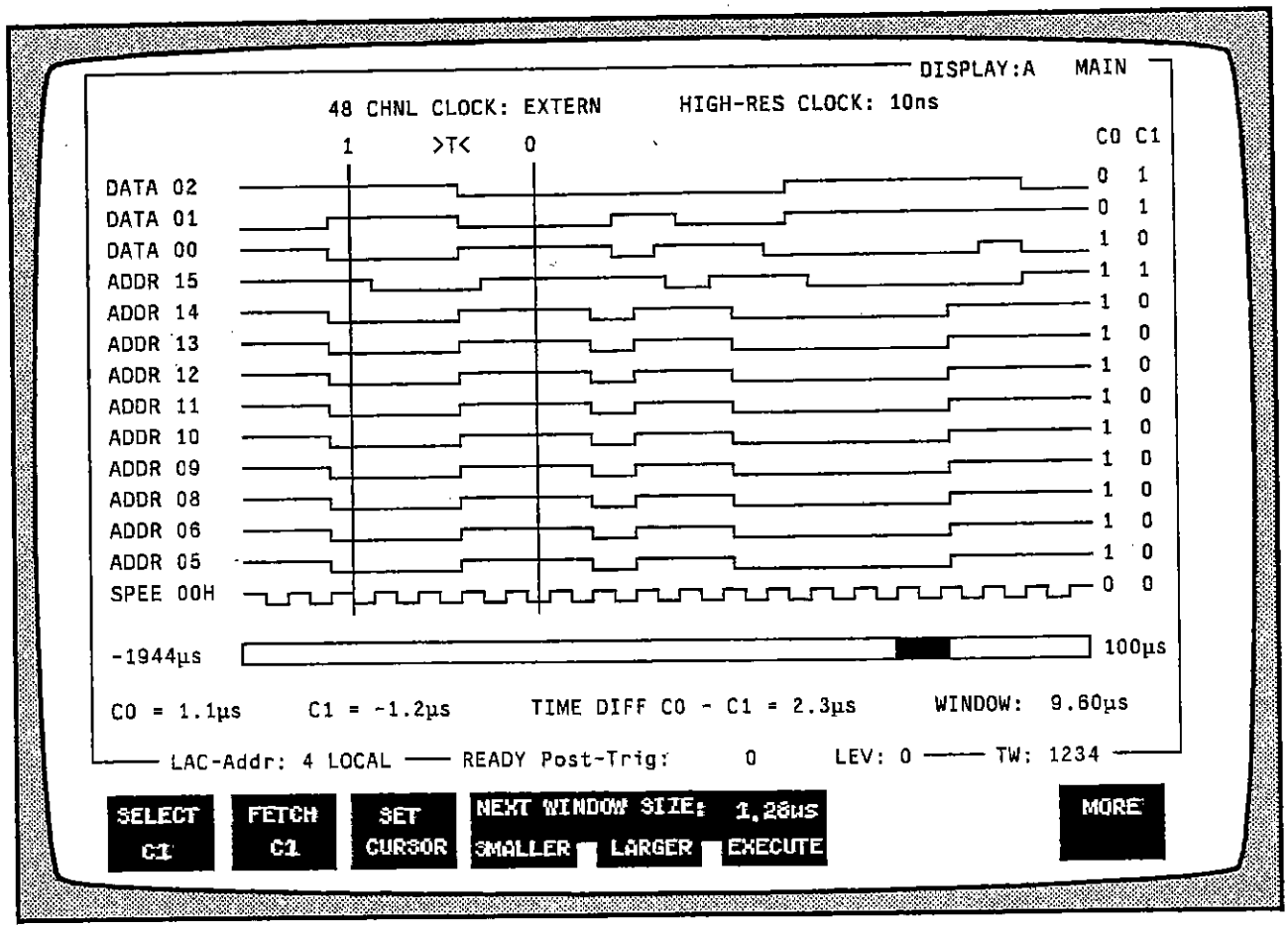


Fig. 7-8 Timing display

Explanation of Fig. 7-8:

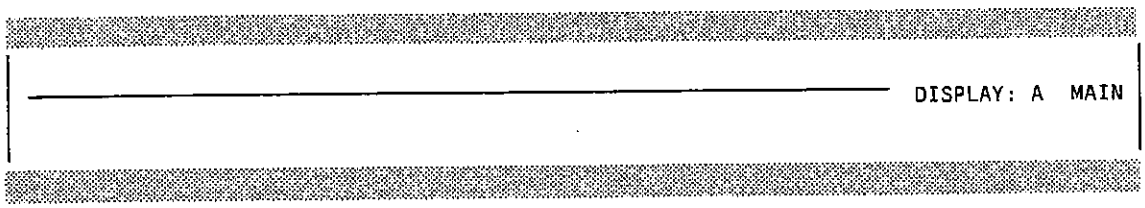


Fig. 7-9
The upper edge of the TIMING display indicates which of the two available windows (DISPLAY: A or DISPLAY:B) is currently displayed and whether the recorded data from the main (MAIN) or the reference memory (REF) are displayed.

The windows are selected in the DISPLAY SELECT menu (see section 7.2), the data memory is selected in the MORE softkey menu (see section 7.5.5).

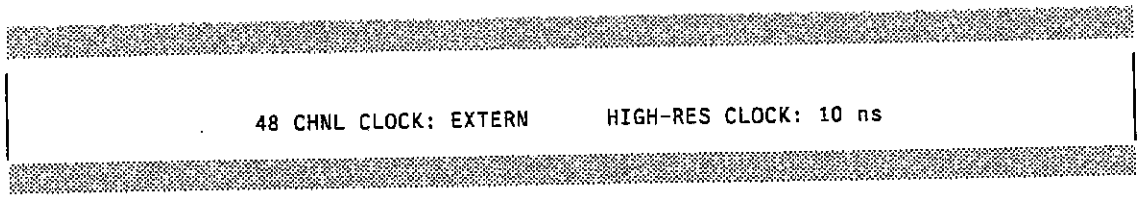


Fig. 7-10

This menu line indicates the clock with which the current collections for the 48-channel analyzer (on the left) and the high resolution analyzer (on the right) were obtained. The clock is specified in the CONFIGURATION menu before starting the collection.

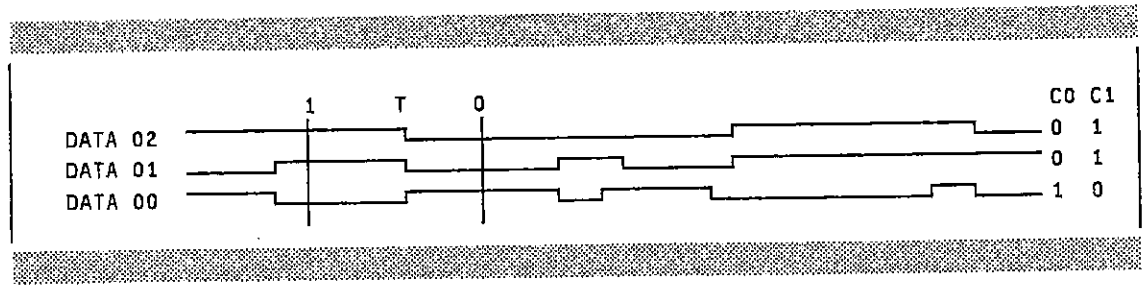


Fig. 7-11

This is the central part of the TIMING display. The data are displayed in a manner corresponding to the time axis of the electric signals. Each channel is assigned a line. The lines are arranged in the same way as the channel groups have been selected in the CONFIGURATION menu and consist of three parts each:

- On the left-hand screen edge, the name (label) of this channel specified in the CONFIGURATION menu is read out. Successive numbers are appended for the invidual channels. Names associated with channel groups of the high-resolution analyzer are characterized by the additional designation H. These channels are displayed at high resolution in a window of ± 40 µs at occurence of the trigger event (marked by a bright background).

- In the central part, the recorded data are graphically displayed with their logic states. The time axis is directed toward the right. The analysis is facilitated by a few optical aids:

  → The location of the trigger event is marked in the collection by a T.

  → Two TIMING cursors are available (these are the two vertical lines designated by 0 and 1 which vertically extend over all channels). They can be shifted to any locations in the collection and are used to measure time intervals and to select an interesting section of the complete collection. This section can then be displayed covering the entire screen. One of the two cursors is the active one, i.e. it responds to the cursor keys ← and →.

  Note: If, with a small magnification, the logic transitions (from 0 to 1 or from 1 to 0) become so close that the resolution of the screen is no longer sufficient for display, the signal edge will be represented by a thicker line at the respective place on the screen.

- Two binary data words are displayed on the right-hand edge of the TIMING display in the vertical direction. The values correspond to the logic levels present at the current locations of the two cursors.

- The trigger event is indicated by ">T<" above the recorded data, the two cursors by "0" or "1". The acitve cursor is inverted.

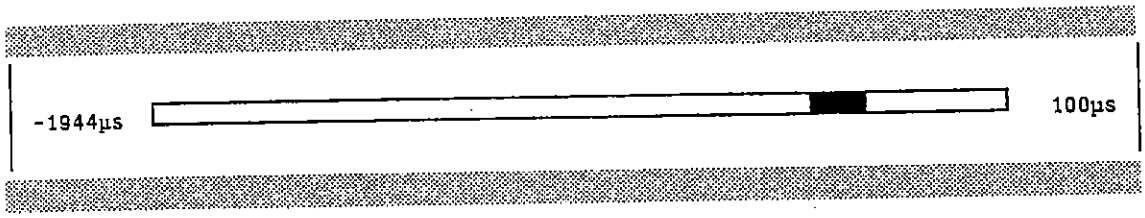


Fig. 7-12

- The graphics following the recording data indicates where the recording data currently displayed on the screen (i.e. WINDOW) are situated in the complete memory.

  Additionally, to the left and right-hand side, also the intervals from the first collection clock to the trigger event and from the trigger event to the last collection clock are indicated.

  If one of the two cursors or the trigger event is located beyond the visible screen, it is indicated in the graphics above by "0", "1" or "T".

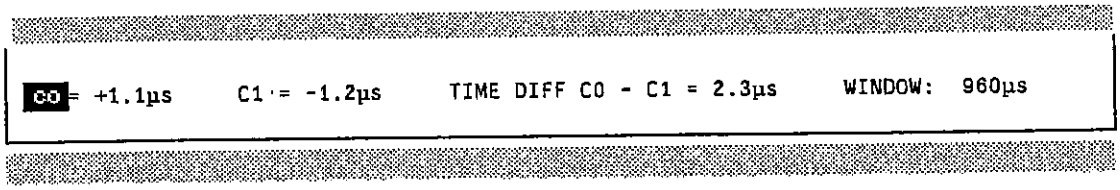


Fig. 7-13

The bottom line of the TIMING menu indicates the locations of the two timing cursors in the collection. With TIME STAMP switched ON, the time distance of the two cursors and the size of the window is added.

The bottom right corner shows the time covered by the displayed WINDOW.

Only a section of the collection can be displayed on the screen. However, this section can be shifted over the complete memory content using the cursor keys →, ←, ↑ and ↓:

Using the cursor keys ↑ and ↓, other channels can be displayed in the window; using the cursor keys → and ←, the displayed window can be shifted to the beginning or the end of the collection if the magnification of the display is greater than 1.

The magnification set in the DISPLAY CALL menu determines the size of the window which is then extended over the complete width of the screen.

Notes:

Selection of the DISPLAY mode

If it has been selected in the DISPLAY SELECT menu that the recorded data are to be read out in two displays, the screen is horizontally divided into the windows DISPLAY: A and DISPLAY: B. A softkey line is again available which can optionally be assigned either to the upper or the lower window (see section 7.5.1).

Shifting the TIMING cursors

Each of the two timing cursors can individually be shifted over the TIMING display by means of the cursor keys ← and →, depending on which cursor is currently active. In addition, they can be directly set to the beginning of the collection, to the trigger event, to the end of the collection or to a particular collection clock (see section 7.5.2).

Size of the window

The window displayed on the screen can be magnified or reduced in steps. This is always done using the factor 2, i.e. when reducing the size of the window, the number of collection clocks displayed is halved with each step, if TIME STAMP is OFF or the window displayed with TIME STAMP is ON (see section 7.5.3).

Switchover between main memory and reference memory (MAIN / REF)

The content of the timing display can be switched from the main memory to the reference memory at any time. Note that, at the time of the collection, each of the two memories accepts setting data from the CONFIGURATION and TRIGGER menus and retains them (e.g. clock setting) (see section 7.5.4).

Copying from the main memory to the reference memory (COPY MAIN TO REF)

The complete content of the main memory (MAIN) is copied to the reference memory (REF) with all the data accepted from the CONFIGURATION and TRIGGER menus at the time of the collection (e.g. clock setting) (see section 7.5.5).

High resolution collections

High resolution collections always cover a time period of 81.8 µs which is symetrically arranged around the trigger point determined by the 48 channel analyzer.

In the TIMING display, all channels which have been assigned to the high resolution analyzer are in this time period displayed with high resolution. For better clarity, this range is additionally specified on the screen using inverse display.

In the case of channels which have been assigned both to the 48-channel and to the high resolution analyzer, the collections of the high resolution analyzer are always represented in TIME display.

Memory depth

The 48-channel analyzer records a maximum of 2042 data words in the operating mode TIME STAMP ON (see section 4.6.3) and a maximum of 4990 data words in the TIME STAMP OFF mode. With the high resolution analyzer, which invariably uses internal clock only, recording is always effected within a time period of 81.9

Cursor-Coupling

There are several possibilities of coupling two of the four cursors (cursors C0 and C1 on displays A and B).

- Coupling the two cursors of the same display
  This possibility should be selected e.g., if the two cursors in a TIMING display are to define a constant window for time measuring purposes.

- Coupling the active cursor with the corresponding cursor of the other display
  This type of coupling allows for scrolling 2 corresponding parts in both displays (A and B) at a time, e.g. in a disassembler listing. It is also possible in a TIMING display with assigned STATE display to position the cursor in both displays at the same events. (see section 7.6.1).

7.4 Entries for STATE and DISASS Displays

7.4.1 Selection of the Display Window Assigned to the Softkey Line

If the display mode with two display windows (MODE A&B) has been selected in the DISPLAY SELECT menu (see section 7.2.2), the softkey line available can optionally be assigned either to DISPLAY A or DISPLAY B.

- Press the key DISPLAY CALL (see Fig. 3-1, item 5).
  The STATE menu (m4) is called up.

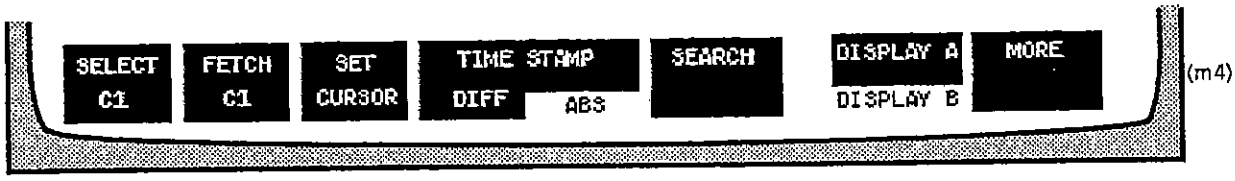


Fig. 7-14

By pressing the respective softkey, the following setting can be performed:

Softkey	Action
DISPLAY A DISPLAY B	Changing to the other display window. This softkey appears only if a data display in two windows has been specified in the DISPLAY SELECT menu (A&B).

Note: For easy operation this softkey also appears in the menu (m484), where the cursor coupling is defined (see section 7.6.1).

7.4.2 Setting the Cursor Location

- The STATE or DISASS display is set in the DISPLAY SELECT menu for the currently activated display (A or B) (see section 7.2.3).

- Press the DISPLAY CALL key (see Fig. 3-1, item 6).
  The STATE menu (m4) is called up (with C0 being the active cursor)

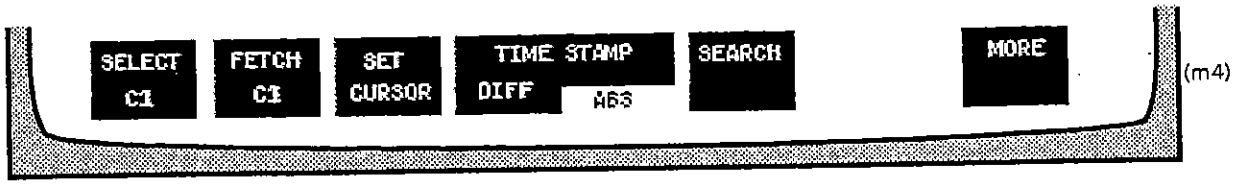


Fig. 7-15

By pressing the respective softkey, the following settings can be performed or menus called up:

Softkey	Action
SELECT C1	Cursor C1 is now the active cursor and can be shifted using the cursor keys ↑ and ↓ (at the front panel).
FETCH C1	Cursor C1 is set to the current location of cursors C0.
SET C0/C1	Call-up of the SET CURSOR menu (m43)

Remark.: The softkeys SELECT C1 and FETCH C1 also appear in menu m43, thus ensuring high operating ease.

- Press the softkey SET CURSOR.
  The SET CURSOR menu (m44) is called up (with C0 being the active cursor in this example).

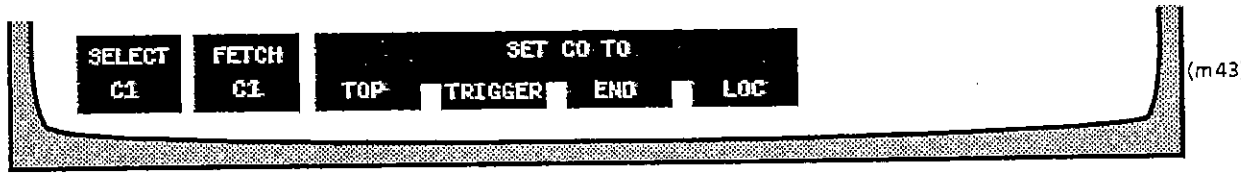


Fig. 7-16

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
SELECT C1	Cursor C1 becomes the current cursor. It can be moved using the cursor keys ↑ or ↓ (at the front panel).
FETCH C1 (C0)	Cursor C1 is set to the current location of cursors C0.
SET C0 (1) TOP	Jump of cursor C0 (or C1) and the data display to the beginning of the collection.
SET C0 (1) TRIGGER	Jump of cursor C0 (or C1) and the data display to the trigger event in the collection.
SET C0 (1) END	Jump of cursor C0 (or C1) and the data display to the end of the collection.
SET C0 (1) 0..N	Entry of the line number in the collection to which the cursor C0 (or C1) is to refer.

To return to the DISPLAY SELECT menu, the RETURN key is pressed.

7.4.3 Selection of the MAIN or REF Memory

- Press the key DISPLAY SELECT (see Fig. 3-1, item 6).
  The DISPLAY SELECT menu (m3) is called up.

Fig. 7-17

- Select the SPECIFY function for the display required (A or B). (Fig. 7-18 shows display A by way of example).

Fig. 7-18

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
MEMORY A MAIN	Select the MAIN memory for display A.
MEMORY A REF	Select the reference (REF) memory for display A.

Note: To simplify the operation these softkeys appear once again in menu MORE of the STATE display.

To return to the DISPLAY SELECT menu, the RETURN key is pressed.

7.4.4 Copying of Data from the MAIN Memory to the REF Memory

- Press the DISPLAY SELECT key.
  The DISPLAY SELECT menu (m3) is called up.

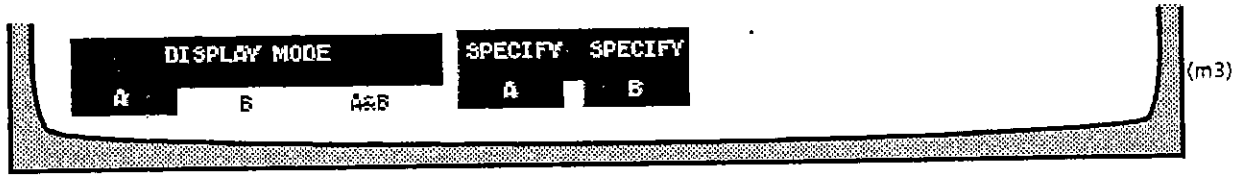


Fig. 7-19

- Select the SPECIFY function for the display required (A or B). (Fig. 7-20 shows display A by way of example).

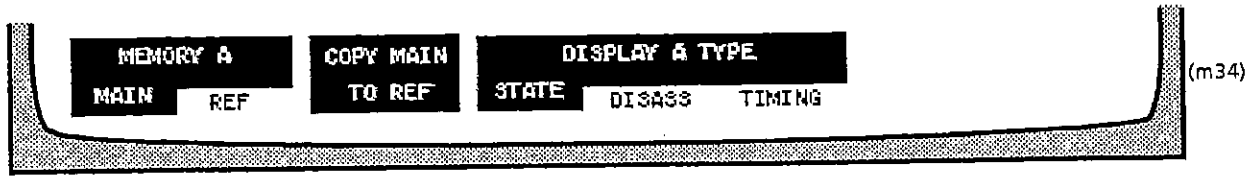


Fig. 7-20

By pressing the respective softkey, the following setting can be performed:

Softkey	Action
COPY MAIN TO REF	Copying of the recorded data from the main memory to the reference REF memory.

Note: This function can also be selected in menu m48 (MORE menu of the STATE display)

To return to the STATE menu, the RETURN key is pressed.

7.4.5 Defining Absolute or Differential Time Display

If TIME STAMP is ON, i.e. a time was recorded with each recording line, the time in the STATE display can be preselected to be displayed either

- as the difference between the current line and the preceding line
  or
- absolutely, i.e. referred to the trigger event in line 0.

▸ Press DISPLAY CALL to display the STATE menu (m4).

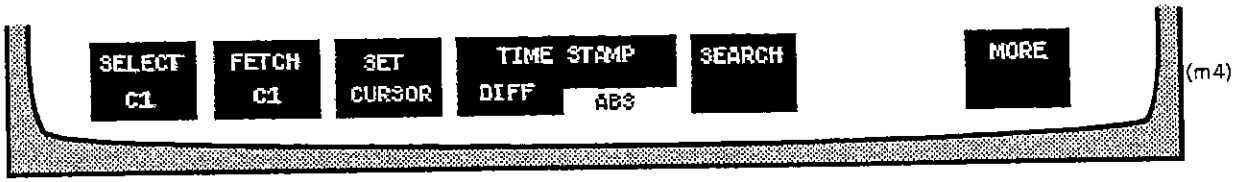


Fig. 7-21

By pressing the respective softkeys the following settings can be performed:

Softkey	Action
TIME STAMP DIFF	Differential time display, i.e. the difference between the current line and the preceding line is displayed.
TIME STAMP ABS	Absolute time display, i.e. related to the trigger event (line 0).

7.4.6 Searching for Data in the Collection (SEARCH WORD)

If the recorded data are displayed on the LAC64 screen in the STATE or DISASS display type, a data word can be specified, which is then searched for in the data collection either upward or downward starting from the current cursor location.

- First set the STATE or DISASS type of display if not yet activated (cf. section 7.2).
- Press the DISPLAY CALL key. The STATE or DISASS menu is called up.

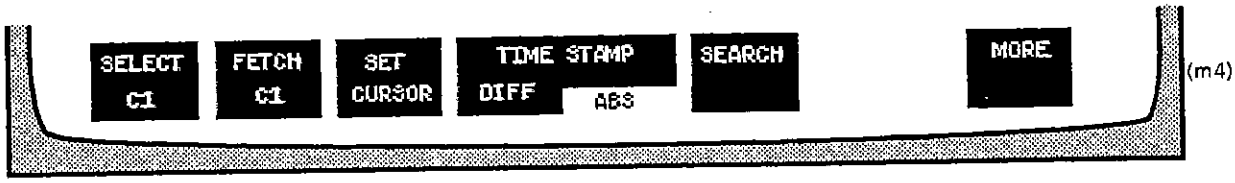


Fig. 7-21a

- Press the SEARCH key. The SEARCH WORD menu is called up.

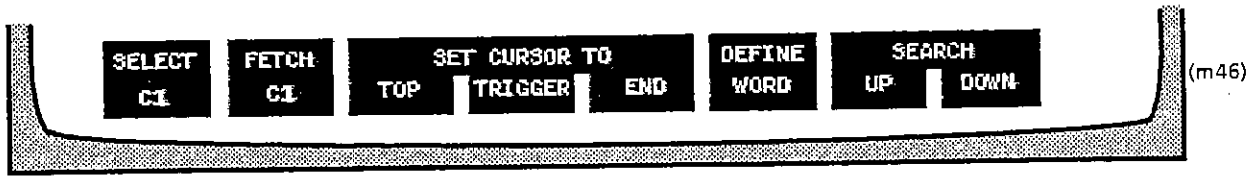


Fig. 7-21b

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
DEFINE WORD	Defining of the search word at the bottom of the data display. The input format is identical with the display format of the recorded data.
SEARCH UP	The data word entered with DEFINE WORD is searched for starting from the current cursor location in upward direction.
SEARCH DOWN	The data word entered with DEFINE WORD is searched for starting from the current cursor location in downward direction.

By pressing the RETURN key (see Fig. 3-1, item 16), the STATE or DISASS menu can again be returned to.

7.4.7 Comparing Recorded Data in the MAIN Memory and the REF Memory (COMPARE MODE)

If the recorded data are displayed on the LAC64 screen in the STATE or DISASS display type, differences between the recordings in the MAIN memory and those in the REF memory can be optically set off on the screen. The COMPARE MODE function is activated for this purpose:

- First set the STATE or DISASS type of display if not yet activated (cf. section 7.2).
- Press the DISPLAY CALL key. The STATE or DISASS menu is called up.

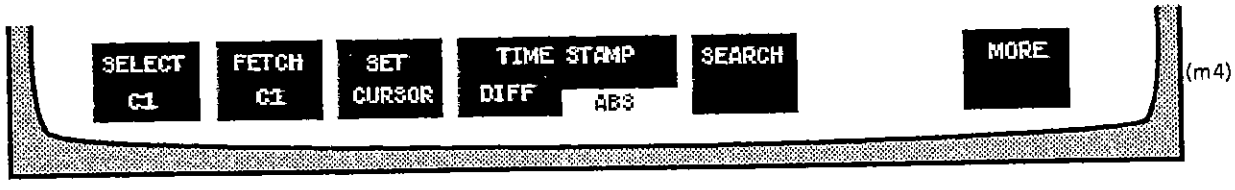


Fig. 7-21c

- Press the MORE key. The MORE menu for the STATE display is called up.

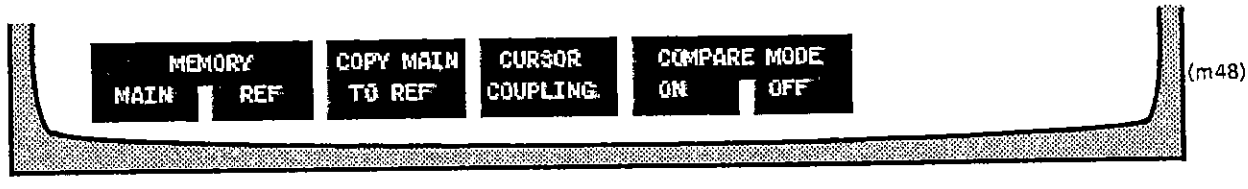


Fig. 7-21d

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
COMPARE MODE ON	COMPARE MODE is activated. Each data line showing differences in the recorded data in the MAIN and the REF memory are highlighted on the screen.
COMPARE MODE OFF	COMPARE MODE is deactivated.

By pressing the RETURN key (see Fig. 3-1, item 16), the STATE or DISASS menu can again be returned to.

Note: The COMPARE MODE function can be used in combination with the AUTOREPEAT function to have recordings repeated until differences between the recorded data in the MAIN memory and the REF memory occur (cf. section 4.6.4).

7.5 Entries for TIMING Display

7.5.1 Selection of the Display Window Assigned to the Softkey Line

If the display mode with two display windows (MODE A&B) has been selected in the DISPLAY SELECT menu (see section 7.2.2), the softkey line available can optionally be assigned either to DISPLAY A or DISPLAY B.

- Press the key DISPLAY CALL (see Fig. 3-1, item 5).
  The DISPLAY CALL menu for TIMING display (m5) is called up.

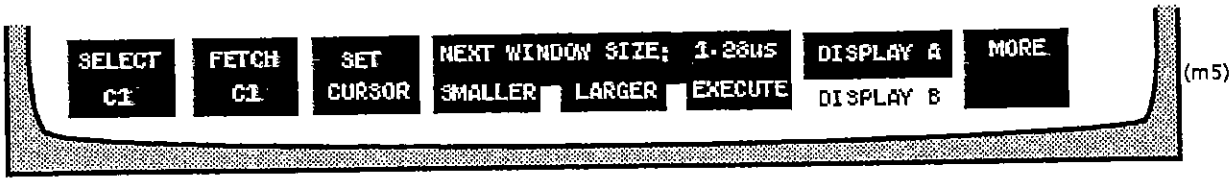


Fig. 7-22

By pressing the respective softkeys, the following setting can be performed:

Softkey	Action
DISPLAY A DISPLAY B	Changing to the other display window specified in the DISPLAY SELECT menu (DISPLAY A or DISPLAY B).

Note: These two softkeys are provided only if a data display using 2 display sections has been specified.

7.5.2 Setting the Cursor Location

- The TIMING display is set in the DISPLAY SELECT menu for the currently activated display (A or B) (see section 7.2.3).
- Press the key DISPLAY CALL (see Fig. 3-1, item 5).
  The DISPLAY CALL menu for TIMING display (m5) is called up.
  Cursor C0 is the active cursor in this example.

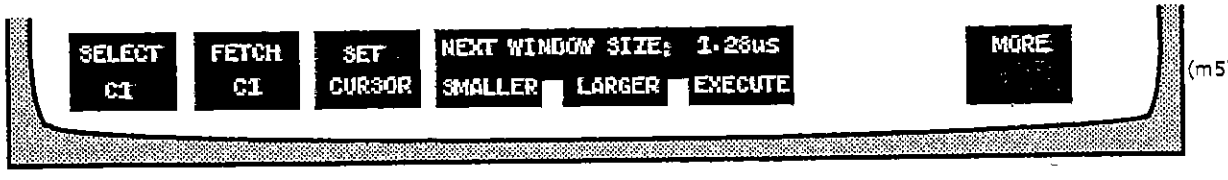


Fig. 7-23

By pressing the respective softkey, the following settings can be selected:

Softkey	Action
SELECT C1	Cursor C1 or C0 is now the active cursor and can be shifted using the cursor keys ← and → (at the front panel).
FETCH C1	Cursor C1 is set to the current location of cursors C0.
SET	Call-up of the CURSOR LOCATION menu (m54)

Note: For easy operation the softkeys SELECT C1 and FETCH C1 are displayed once again in the SET CURSOR menu (m54).

▸ Press the softkey SET CURSOR.
The SET CURSOR menu (m54) is called up.

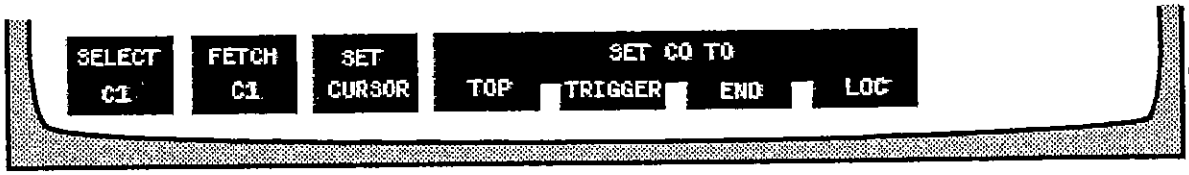


Bild 7-24

By pressing the respective softkey, the cursor can be shifted as follows:

Softkey	Action
SELECT C1	C1 becomes the current cursor and can be shifted using the cursor keys ← and → (at the front panel).
FETCH C1	Cursor C1 is set to the current location of cursors C0.
SET C0 TO TOP	Jump of cursor C0 (or C1) and the data display to the beginning of the collection.
SET C0 TO TRIGGER	Jump of cursor C0 and the data display to the trigger event in the collection.
SET C0 TO END	Jump of cursor C0 and the data display to the end of the collection.

To return to the DISPLAY CALL menu, the RETURN key is pressed.

7.5.3 Modification of the Currently Displayed Window

- The TIMING display is set in the DISPLAY SELECT menu (see section 7.2.3)

- Press the key DISPLAY CALL (see Fig. 3-1, item 5).
  The DISPLAY CALL menu for TIMING display (m5) is called up.

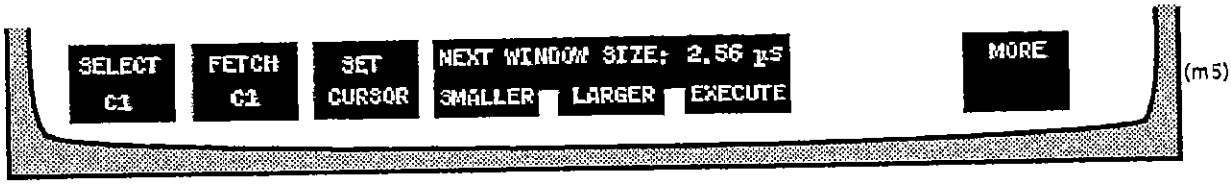


Fig. 7-25

By pressing the respective softkey, the following types of display can be selected:

Softkey	Action
NEXT WINDOW SIZE: 2.56 µs SMALLER	Presetting of reduction in size of the current window. The active timing cursor is assumed to be the middle of the new window. By pressing the key again, the new window is halved again.
NEXT WINDOW SIZE: 2.56 µs LARGER	Presetting of doubling in size of the current window. The active timing cursor is assumed to be the middle of the new window. By pressing the key again, the new window is further doubled in size.
NEXT WINDOW SIZE: 2.56 µs EXECUTE	Modification of the current window according to the presettings made by means of the two above softkeys.

To return to the DISPLAY CALL menu, the RETURN key is pressed.

7.5.4 Selection of the MAIN or REF Memory

▸ Press the DISPLAY SELECT key (see Fig. 3-1, item 5).
The DISPLAY SELECT menu for TIMING display (m5) is called up. .

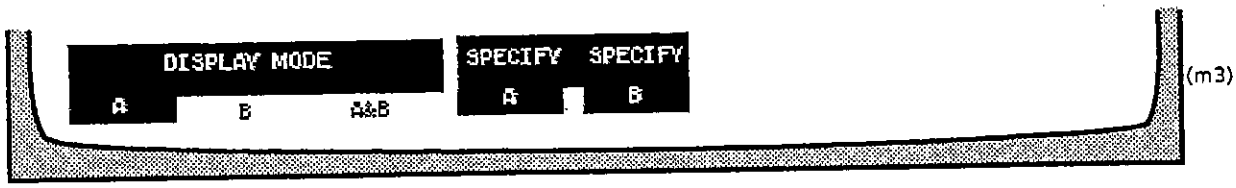


Fig. 7-26

Select the SPECIFIY funtion for the display required (A or B). (Fig. 7-26 shows display A by way of example).

Fig. 7-27

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
MEMORY A MAIN	Select the main memory for display A.
MEMORY A REF	Select the reference memory for display A.

These softkeys are also available in the MORE menu for the TIMING display (m58).

To return to the DISPLAY SELECT menu, the RETURN key is pressed.

7.5.5 Copying of Data from the MAIN Memory to the REF memory

- Press the DISPLAY SELECT key (see Fig. 3-1, item 5).
  The DISPLAY SELECT menu for TIMING display (m3) is called up.

Fig. 7-28

- Select the SPECIFIY function for the display required (A or B) (for display A in the example below).

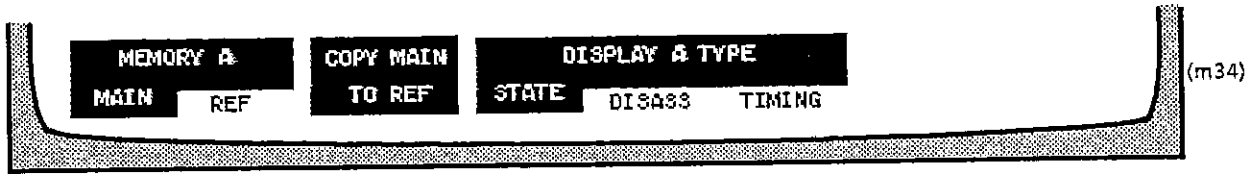


Fig. 7-29

By pressing the respective softkey, the following settings can be performed:

Softkey	Action
COPY MAIN TO REF	Copying of the recorded data from the main memory to the reference memory.

This softkey also appears int the MORE menu for the TIMING display (m58).

To return to the DISPLAY CALL menu, the RETURN key is pressed.

7.6 Entries for all Data Displays

7.6.1 Cursor Coupling

The entry is performed in the same way for all data displays. Operation of the STATE display with cursor C0 being active is described by way of example.

- Press the DISPLAY CALL key.
  The STATE menu (m4) is called up.

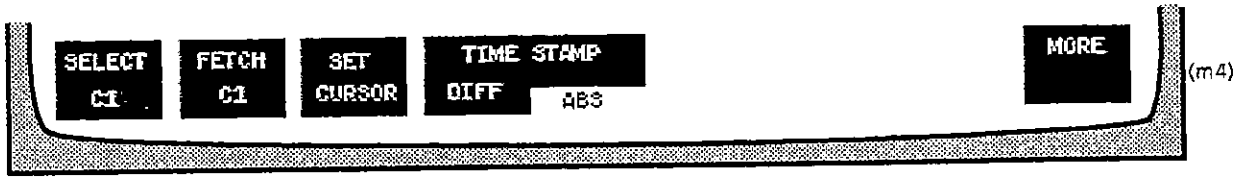


Fig. 7-30

- Press the softkey MORE.
  The MORE menu for the STATE display (m48) is displayed.

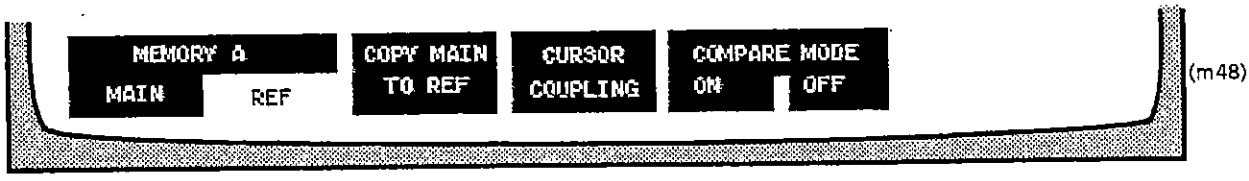


Fig. 7-31

- Press the softkey CURSOR COUPLING.
  The CURSOR COUPLING menu for the STATE display (m484) is called up.

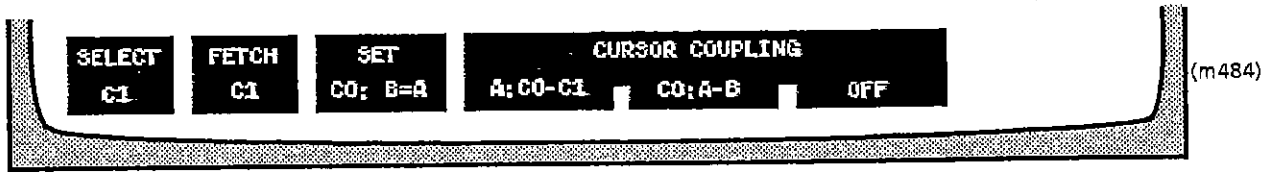


Fig. 7-32

By pressing the following softkeys the following coupling functions for the softkeys can be set:

Softkey	Action
SET C0:B-A	This softkey is displayed only if display mode A&B is selected. On actuation of this softkey, the cursor C0 in the non-active display B is set to the same point as cursor C0 in the active display A. The two cursors are not coupled.
CURSOR COUPLING A:C0-C1	The two cursors of the active display A are coupled. Actuating one of the two cursors then automatically effects both cursors. If display A is a STATE or a DISASSEMBLER display the space between the two cursor lines is constant, if it is a TIMING display, however the time interval between the cursor movements is constant.
CURSOR COUPLING C0:A-B	The active cursor (here C0) of the active display (e.g. DISP A) is coupled to the corresponding cursor of the inactive display (i.e. cursor C0 in display B). If both displays are STATE or DISASS displays, the coupling is performed with constant space between the cursor lines, if not, the cursors move with constant time distance.
CURSOR COUPLING OFF	The coupling of the active cursor is cancelled.

Note: It is possible to couple the cursors C0 and C1 of one display independently of each other with the cursors C0 and C1 of the other display, or to cancel coupling. In Fig. 7-30, C0 is the active cursor. Correspondingly, the coupling of C0: A - B can be switched on or off. If the other cursor is selected (via SELECT C1), the softkey labelling is modified to C1: A - B and the softkey functions are connected with C1.

If cursors are coupled in one display, they can no longer be coupled with those in the other display.

8 Remote Control of the Logic Analyzer

Most functions of the logic analyzer can be operated via remote control as well. For this purpose, commands for the interface functions (e.g. reset of the device) as suggested by the IEEE standards as well as commands controlling the measuring functions are provided. It is thus possible to perform settings on the logic analyzer, carry out measurements and display the results.

8.1 Remote Control Interface

The logic analyzer is remote-controlled via the IEC-625-1 interface from an external controller which must also be provided with this interface. This interface is compatible with IEEE 488. It is set to the following default values when switching on the device:

Device address of the logic analyzer: 4

Terminator of the transfer: LF (ASCII character 10 decimal or 0A hexadecimal)

The following interface functions are implemented in the device:

Code	Meaning	Setting
C0	Controller	(No Capabilities)
L4	Listener	(Basic Listener, unaddress if MTA)
T5	Talker	(Basic Talker, Serial Poll, Talk Only Mode, unaddress if MLA)
DC0	Device Clear	(No Capabilities)
DT0	Device Trigger	(No Capabilities)
SR0	Service Request	(No Capabilities)
RL1	Remote/Local	(Complete Capability)

Note: The only key of the keyboard which can still be operated after recognition of a remote control command is the LOCAL key. It is used to manually enable the keyboard again and thus abort remote control mode.

Using the device address, the logic analyzer can be addressed by an external computer which always has the controller function. The logic analyzer never assumes control over the remote control interface - not even to output a screen copy to a connected printer.

The terminator is used to mark the end of data transfer both from the external controller to the logic analyzer and vice versa. The interface parameters are selected in the IN-OUT configuration which is accessible via the CONFIG menu. (For more detailed information, refer to section 4.7).

8.2 Remarks on the Command Syntax

In the syntax description, the following symbols are used:

Symbol	Meaning
x,...,y	The element x may occur at any time, followed by the element y at the end. In the description of the individual commands, an upper limit is usually indicated, limiting the frequency of occurrence of an element and thus restricting "any times".
[..]	The elements in the brackets are optional.
(x1 .. x2)	All elements lying between x1 and x2 (incl.) are valid. x1 and x2 are numbers or ASCII characters.
<LF>	Terminator LF (see above)

All characters and character strings which are not explicitly declared to be variable in the description are part of the command syntax and must always be included in the command.

Furthermore, the following items are to be observed in order to avoid errors in the processing of remote control commands:

- As a rule, each command must be terminated by a semicolon (;), which may be preceded or followed by any number of blanks.

  The same applies to the transfer of a block of a defined length; blocks of a non-defined length are not permissible.

  Example: `CONFIG; SCOPY <LF>` causes an error
  `CONFIG; SCOPY; <LF>` is the correct expression

- Commands ending with a question mark (?) are to be entered such that there is no blank bet-ween the command mnemonic and the question mark.

  Example: `*OPC?;` and not `*OPC ?;`

- Channel group names (labels) may be up to four characters long and must be enclosed in inverted commas ("or").

  The characters can be selected from the ASCII character set at will, the respective delimiter (" or ') having to be indicated twice if it is to be used within the label.

  Example: `'Name' , "S""T"` are valid lables

  Note: In the syntax description, only the inverted comma (") is to be found as a delimiter; it is, of course, equivalent to the inverted comma (').

- The command mnemonic must always be in upper case letters; lower case notation will cause a syntax error.

  In all other cases, upper case and lower case notation are irrelevant with regard to the syntax unless otherwise specified.

- Transfer of blocks exceeding the length of the IEC bus input buffer is generally permitted (e.g. to read and write to the reference memory).

  However, modifications performed on such blocks cannot be undone when an error occurs, since the old values are not stored. (Such an error would be involved for instance if the indicated block length did not comply with the actual one).

8.3 Commands for the Interface Functions (Common Commands)

The common commands serve for remote control and are subdivided into three groups:

- Device-specific commands modifying or setting the status of the logic analyzer; they also include the request for the transmission of device data or performance of a self test;
- Instruction to control the command execution;
- Commands for status check; they allow for reading the registers of the IEC bus interface and partly writing to them.

The commands indicated are all suggested in the IEEE-488 standard; they are implemented to suit the indicated requirements. Common commands are distinguished from other commands by the * character.

8.3.1 Instrument Reset

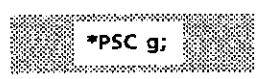
a) Overview

Three possibilities exist to set the logic analyzer to a defined status for remote control:

- Deletion of all registers when switching on the power supply or retaining of the old values (command *PSC)
- Reset of the device to the basic status in which all registers are likewise reset and the input buffer is deleted (command *CLS)
- Reset of the device to a defined initial status; however, no registers are affected and the Output Buffer maintains its contents (command *RST)

b) Commands

Setting the Power-On-clear-flag



Syntax: `*PSC g;`

g: (-32767 .. +32767);
g = 0 sets the Power-On-clear-flag to FALSE, a value other than zero sets the flag to TRUE

This flag is used to determine whether all registers on the IEC-bus interface are cleared (Power-On-clear-flag = TRUE) or not (Power-On-clear-flag = FALSE) when switching on the power supply.

Polling the Power-On-clear-flag

*PSC?;

Syntax: *PSC?;

The response consists of the ASCII character "0" (30 hexadecimal or 48 decimal) for FALSE or "1" (31 hexadecimal or 49 decimal) for TRUE as the value of the Power-On-clear-flag.

Reset of the instrument to the basic status

*CLS;

Syntax: *CLS;

The device is set to the basic status, all buffers except the Output Buffer are deleted and the registers reset.

Reset of the instrument to a defined initial status

*RST;

Syntax: *RST;

The contents of all relevant registers as well as of the Output Buffer are retained; however, the assumed status is independent of the commands reveiced so far.

8.3.1.1 Device Identification

a) Overview

Four parameters are used for the device identifier in line with the IEEE-488 standard:

- manufacturer
- model
- serial number
- firmware number, version number

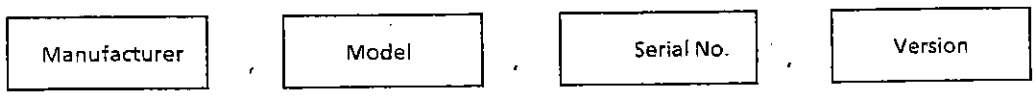
Having recognized this command, the logic analyzer outputs its specific data to the external controller.

b) Command

*IDN?;

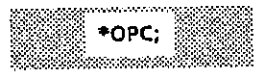
Syntax: *IDN?;

The response consists of a character string containing the data indicated above, separated by commas; if an element does not contain any value, a zero will be inserted instead.

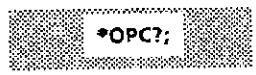


8.3.2 Controlling the Execution of an Operation

Syntax: `*OPC;`



Syntax: `*OPC?;`



The response obtained will be the ASCII character "1" (31 hexadecimal or 49 decimal) if all operations are completed.

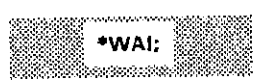
The command permits to check the execution of the commands transferred so far. The command *OPC requests the device to output a message as soon as all current operations are completed. This message can then be read using the query *OPC.

8.3.3 Enforcing the Sequential Command Execution

The *WAI common command prevents the device from executing any further commands or queries following the *WAI command until all previous operations have been completed. Thus, the *WAI command allows to force sequential command execution of overlapped commands.

The *OPC command can be used for the same purpose. With this command, however, the external controller assumes the control by way of explicite polling, while the *WAI command gives control to the addressed device as a result of the linking in command sequence.

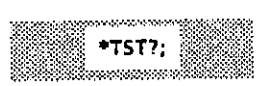
Syntax: `*WAI;`



8.3.4 Self Test

This command requests the LAC to initiate a self-test and then transmit the self test result to the external controller.

Syntax: `*TST?;`



If no error is detected during the self test, the device transmits a number the value of which is zero. A number the value of which is not zero is transmitted if the self test could not be completed or if errors occurred.

8.3.5 Register Operations

Overview:

Messages on errors or the status of command execution are summarized in several 8-bit registers. Also, there are Enable Registers to enable or disable messages.

The registers of the IEC bus interfaces can be read, mostly they can also be set. A more detailed description of the meanings of the individual registers and their contents is given with each command.

For further information refer to the IEEE-488 standard.

8.3.5.1 Reading the Status Byte Register

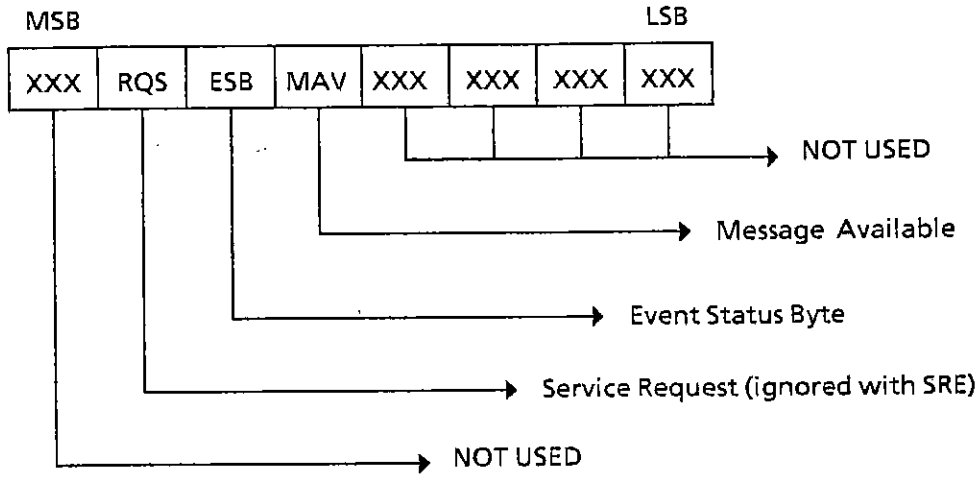
The Status Byte Register is composed of all the status summary messages. For instance, error messages or a request to the device to give out data require the respective bit to be set.

Syntax: *STB?;

*STB?;

In response, a number with a value between 0 and 255 is given, which corresponds to the bit assignment of the Status Byte Register in binary format.

Status Byte (STB),
Service Request Enable Register (SRE)



8.3.5.2 Setting and Reading the Service Request Enable Register

Service Request Enabling allows an application programmer to select which summary messages in the Status Byte Register may cause service requests. The Service Request Enable Register selects the summary messages.

The state of bit 6 is generally ignored, but should normally be set to zero, as is done in response to reading of the register.

Setting the Service Request Enable Register

Syntax: `*SRE n;`

***SRE n;**

n: (0 to 255) ;
This number n defines the new bit assignment of the Service Request Enable Register in binary format.

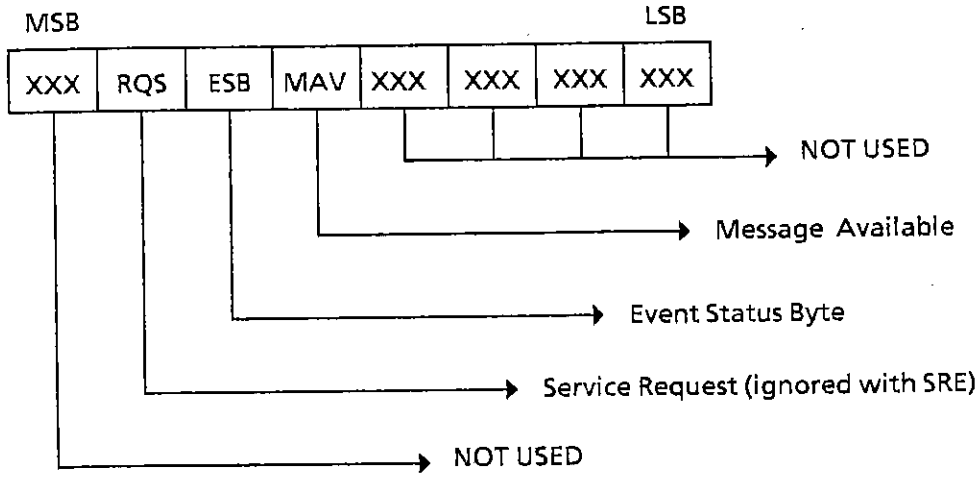
Reading the contents of the Service Request Enable Register

Syntax: `*SRE?;`

***SRE?;**

In response, a number with a value between 0 and 255 is given, which corresponds to the bit assignment of the Status Byte Register in binary format.

Status Byte (STB),
Service Request Enable Register (SRE)



8.3.5.3 Reading the Standard Event Status Register

The Standard Event Status Register summarizes all the messages (i.e. events) which may occur in the course of command execution, both with a complete result and in the case of error.

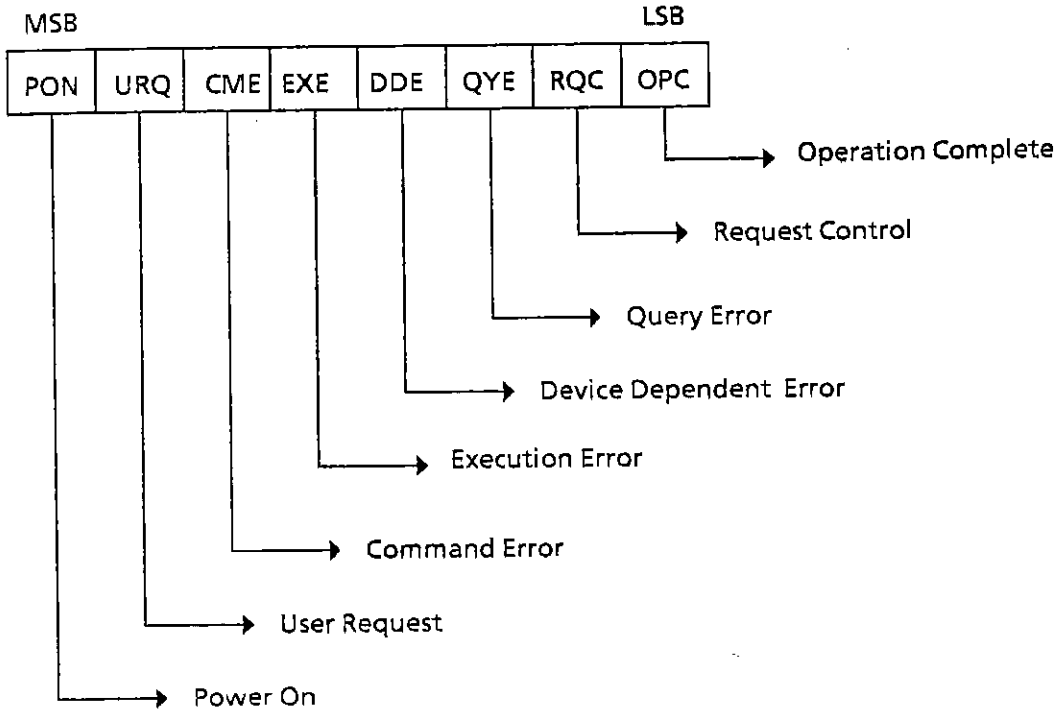
The only operation allowed is reading of the register. The Standard Event Status Register is destructively read, i.e. read and cleared.

Syntax: `*ESR?;`

`*ESR?;`

In response, a number with a value between 0 and 255 is given, which corresponds to the bit assignment of the Status Byte Register in binary format.

Event Status (Enable) Register (ESR, ESE) :



8.3.5.4 Setting and Reading the Standard Event Status Enable Register

As the Standard Event Status Register cannot be written remotely, a respective Event Enable Register has been provided so that the messages of the event bits in the Standard Event Status Register are passed on to the Status Byte Register only if the respective enable bit in the Standard Event Status Enable Register is also set.

Setting the Standard Event Status Enable Register

Syntax: `*ESE n;`

*ESE n;

n: (0 to 255) ;
This number n defines the new bit assignment of the Standard Event Status Enable Register in binary format.

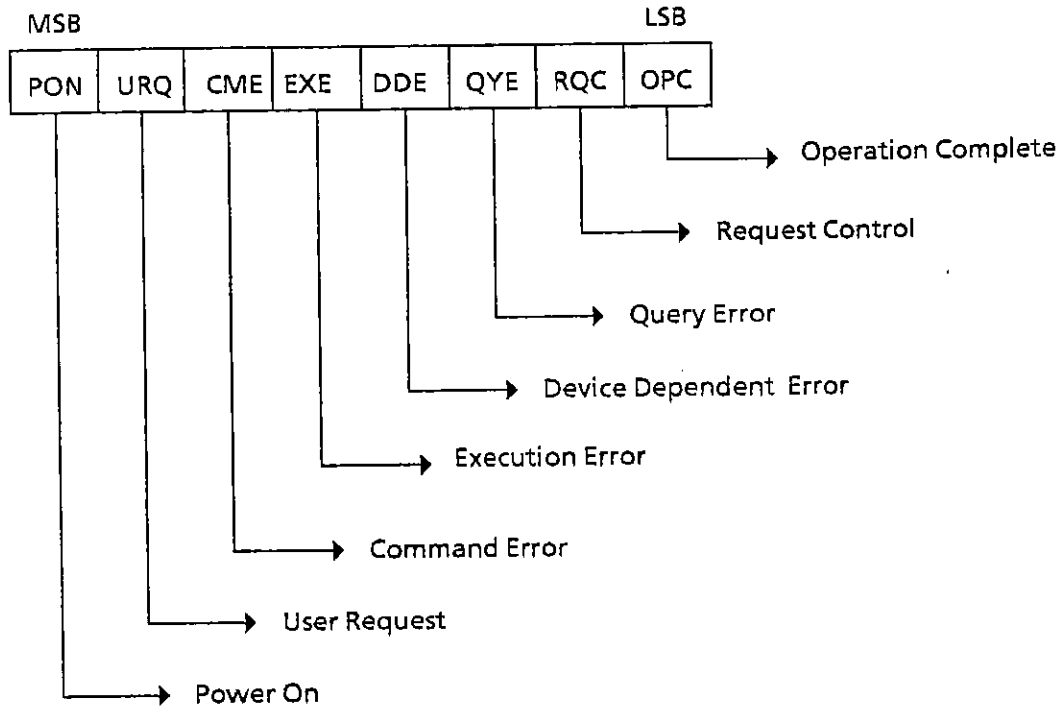
Reading the contents of the Standard Event Status Enable Register

Syntax: `*ESE?;`

*ESE?;

In response, a number with a value between 0 and 255 is given, which corresponds to the bit assignment of the Standard Event Status Enable Register in binary format.

Event Status (Enable) Register (ESR, ESE) :



8.4 Commands for Controlling the Measurement

All functions that can be performed via hardkeys and softkeys can also be released via remote control. The LOCAL key forms an exception; it cannot be addressed via remote control.

In the following section, the function of the particular keys will be just briefly outlined. For more detailed information, refer to the sections discussing the manual operation.

Note: Each of the following commands may be shortened providing they are still unambiguous!

8.4.1 Menu Selection

a) Overview

The following commands permit to call up a select menu (CONFIGURATION menu, TRIGGER menu, etc.).

Softkey menus are called up using the commands described in section 8.4.2.

b) Commands

Call up CONFIG menu
(Explanation of this menu given in section 4)

CONFIGURATION;

Syntax: `CONFIGURATION;`

Call up TRIGGER menu
(Explanation of this menu given in section 5)

TRIGGER;

Syntax: `TRIGGER;`

Call up SPECIAL menu
(Explanation of this menu given in section 6)

SPECIAL_FUNCTION;

Syntax: `SPECIAL_FUNCTION;`

Call up DISPLAY SELECT menu
(Explanation of this menu given in section 7.2)

DISPLAY:SELECT;

Syntax: `DISPLAY:SELECT;`

Call up DISPLAY CALL menu
(Explanation of this menu given in section 7.3)

DISPLAY:CALL;

Syntax: `DISPLAY:CALL;`

8.4.2 Selection of Softkey Menus and Entry of Data

a) Overview

For cursor control, entry of data and driving of softkeys, commands are provided which usually do not only contain a character but a character string.

The softkeys are remote-controlled in the common form described below, because their meanings usually vary from softkey menu to softkey menu. Remote control of the softkeys is to be performed in the same order as with manual control.

b) Commands

Softkeys

SOFTKEY n[,..,n];

Syntax: `SOFTKEY n[,..,n];`

n: (1 .. 8)

Each softkey is assigned a number. The left hand key is assigned the number 1, the right hand key the number 8.

The operation released depends on the menu currently selected.

Note: A maximum of 100 elements (n) are permissible

Example: `SOFTKEY 7,3,5,1;`

Returning from the softkey menu

RETURN;

Syntax: `RETURN;`

To return from a softkey menu to the next higher menu, press the RETURN key or, in remote-control mode, transfer the RETURN command.
(For explanations of this function, see also section 2).

Cursor control

CURSOR E zn[,..,zn];

Syntax: `CURSOR zn[,..,zn];`

z: A character of the set {u,U,d,D,l,L,r,R} for up, down, left and right
n: Number of steps in the direction z

The specification of a cursor movement always consists of a letter indicating the direction and a number specifying the number of steps to be performed in this direction.

The letter and the number must both be indicated in this case; no default values are defined.

Note: No blank is permissible between z and n.
A maximum of 4 elements zn is permissible (they are sufficient for any cursor movement).

Example: `CURSOR U7,R13;`

Numeric data

DATA z[,..,z];

Syntax: `DATA z[,..,z];`

z: A character of the set {0 to 9,a to f, A to F,x,X, + ,-} (= numeric keypad of the logic analyzer)

The range of values of these data comprises all characters present on the numeric keypad on the front panel of the logic analyzer. They do not have to be entered individually but several of them may be combined in one command.

Note: A maximum of 100 elements (z) is permissible.

Example: `DATA +,7,A,X,X;`

8.4.3 Controlling the Collection

a) Overview

The two commands START and STOP are used to start and stop the data collection of the logic analyzer. The measurement is performed with the parameters set when the START command is given (see section 4.8).

b) Command

Start the collection

START;

Syntax: `START;`

Stop the collection

STOP;

Syntax: `STOP;`

8.4.4 Requesting a Screen Copy

Syntax: HARDCOPY;

Any screen display can be output to a printer.

The screen copy is always output via the interface indicated in the IN-OUT configuration as the list channel, i.e. the printer interface.

As a result of this, the IEC bus interface cannot be used for printing the screen copy; the printer has to be connected to the Centronics or V24 interface.

8.5 Memory Operations

Overview:

Data can be read via the IEC bus both from the MAIN memory and the REF memory. Write operations are possible only on the REF memory of the LAC64 (i.e. the memory of the 48-channel analyzer and that of the high resolution analyzer).

The MAIN memory permits no write operations.

Following a respective request, all the data stored in the memory are output. Also, the complete memory contents is rewritten when new data are entered.

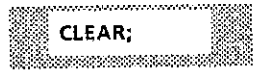
The data are always transferred in blocks containing the values in binary form. For the exact meaning of these bytes refer to section 8.5.4.

It is also possible to read the memory limits and to clear the REF memory.

8.5.1 Clearing the REF Memory

The REF memory can be explicitely cleared. This operation affects both the memory of the 48-channel analyzer and that of the high resolution analyzer.

Syntax: CLEAR;



8.5.2 Reading from the Memory

Overview:

The following commands are used for reading the memory of the LAC64 via the IEC bus. Read operations do not affect the memory contents (i.e. the contents is retained).

Reading of the current memory limits is useful in view of a better estimation of the length of the data block to be expected (and thus of the memory space required).

Refer to section 8.5.4 for more information on the format of the data block to be transmitted.

8.5.2.1 Reading the Memory Limits

Polling of the memory limits supplies the initial line and the end line of the 48-channel analyzer, as also displayed in the STATE display.

Syntax: `RECALL:RANGE:MAIN;` (MAIN memory)

RECALL:RANGE:
MAIN;

`RECALL:RANGE:REFERENCE;` (REF memory)

RECALL:RANGE:
REFERENCE;

The response consists of an ASCII string in the form of initial line, end line.

8.5.2.2 Reading the Data

Overview:

All the data stored in the MAIN or the REF memory can be read. They are transmitted in the form of a data block in binary form(cf. section 8.5.4).

Read operations do not affect the memory, i.e. its contents is retained.

Note: As the data block read is as a rule greater in size than the Output Buffer of the IEC bus interface, no further commands requiring a feedback should be sent to the LAC64 as long as not all the data in the Buffer have been read out. Otherwise, a jam might be caused if the external controller continues sending further commands even though the LAC64 can no longer accept any as its Input Buffer is already filled and thus no further commands can be processsed due to this lack of free space in the Input Buffer. On the other hand, however, the external controller no longer reads out data from the LAC64 Output Buffer as long as the transmission cannot bec completed.

Commands:

Reading the memory of the 48-channel analyzer

Syntax: `RECALL:MAIN;` (MAIN memory)

```
RECALL:MAIN;
```

`RECALL:REFERENCE;` (REF memory)

```
RECALL:
REFERENCE;
```

The response consists of a data block in binary form as outlined in section 8.5.4.

Reading the memory of the high resolution analyzer

Syntax: `RECALL:HIGH_RESOLUTION:MAIN;` (MAIN memory)

```
RECALL:HIGH_RE-
SOLUTION:MAIN;
```

`RECALL:HIGH_RESOLUTION:REFERENCE;` (REF memory)

```
RECALL:HIGH_RESO-
LUTION:REFERENCE;
```

The response consists of a data block in binary form as outlined in section 8.5.4.

8.5.3 Writing to the Memory

Overview:

The following commands are used for writing into the complete REF memory of the respective analyzer. All the data still contained in the memory are overwritten by these operations.

When processing the data block obtained, the LAC64 immediately transfers these data into the memory. As a result of this, it is no longer possible to have the old memory content restored if an error is detected at the end of the block, as the old content has not been saved.

An error of this kind may for instance arise if the indicated block length exceeds the length of the data block actually transferred.

Commands:

Writing into the complete REF memory

Syntax: `SAVE b1;` (48 channel analyzer)

```
SAVE b1;
```

`SAVE:HIGH_RESOLUTION b1;` (High resolution analyzer)

`b1;` data block in binary form

```
SAVE:HIGH_
RESOLUTION b1;
```

Note: The data block must be in accordance with the specified format as described in section 8.5.4. Reading of the memory via RECALL supplies a data block in the required format.

8.5.4 Format Structure of the Data Block

A general data format is used for reading from the LAC64 memory (section 8.5.2.2) and writing to the LAC64 memory (section 8.5.3). Fig. 8-1 gives an overview of the structure of the data block used and the setup of the individual elements.

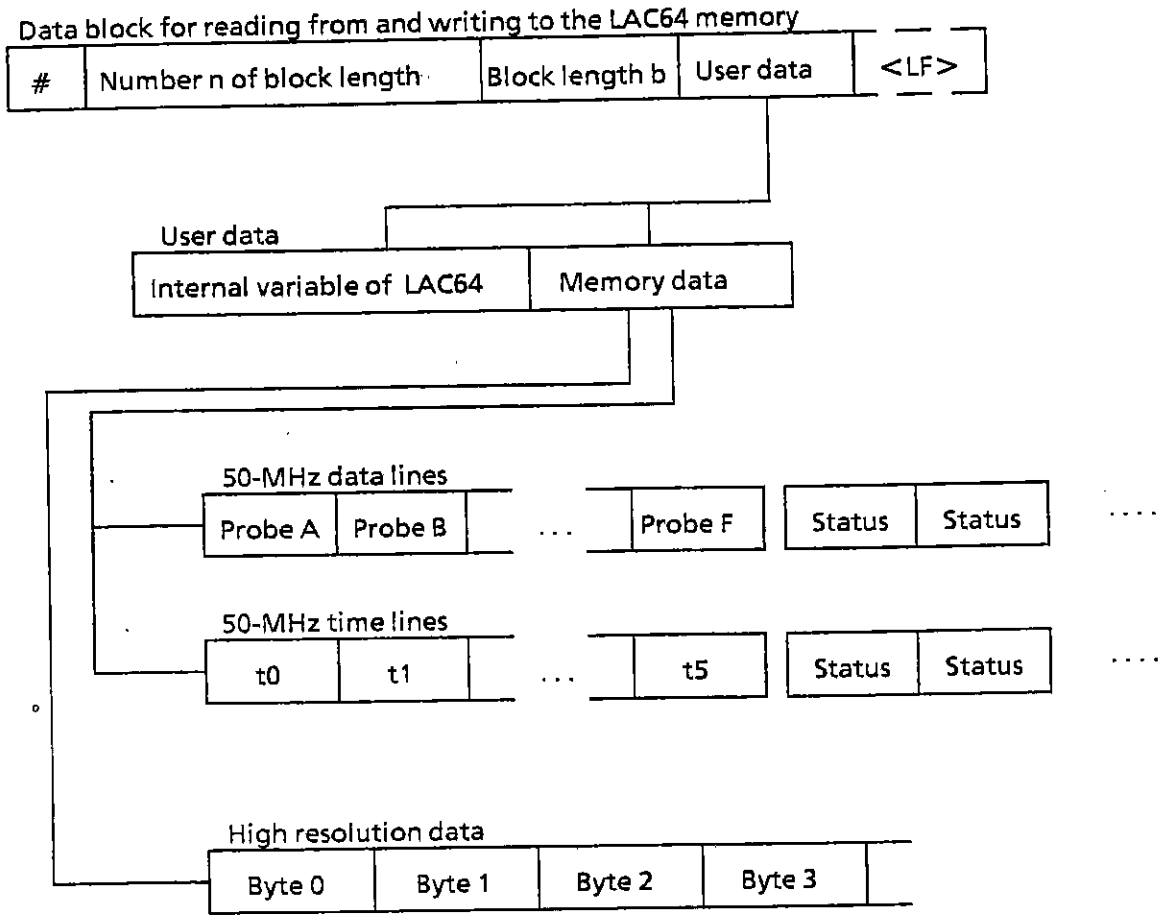


Fig. 8-1 Overview of the structure of the data block used

Detailed information on the formats of data block, user data and memory data is given in the following sections.

Format of data block:

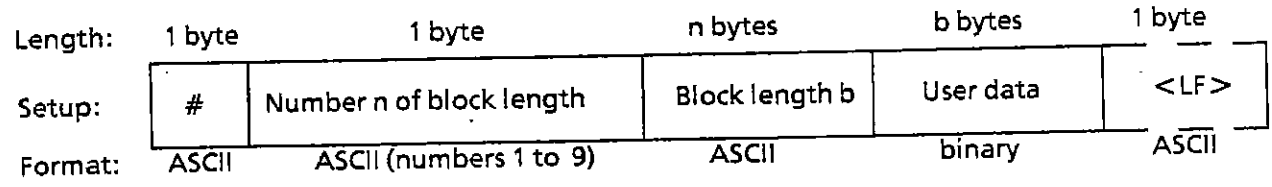


Fig. 8-2 Setup of data block

The block begins with the symbol #, followed by a (single-)digit n for the block length. This is succeeded by the length indication b for the subsequent user data.

This setup is in line with the IEEE 488.2 standard, cf. section 7.7.6.

When reading from the analyzer memory, the LAC64 additionally transmits the character <LF> and the control line signal EOI at the end of the block. EOI can be used by the controller as terminator.

Format of user data:

The user data are set up as follows:

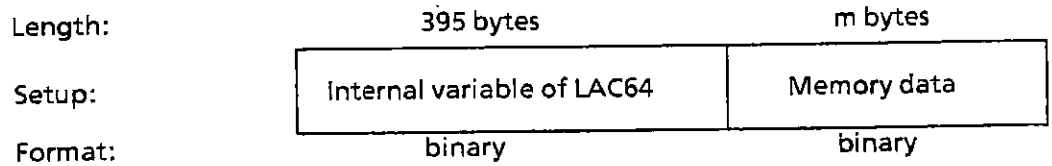


Fig. 8-3 Setup of user data

The first 395 bytes contain internal variables of the LAC64 which must not be modified. The data bytes following these 395 bytes are the actual memory data, consisting of 50-MHz data lines and 50-MHz time lines in the case of the 50-MHz memory, and of high resolution data in the case of the high resolution memory.

Format of memory data for the 50-MHz recording:

The 50-MHz recording is made up of a sequence of data lines and time lines. Both consist of 6 bytes data each and two bytes status (Fig. 8-4a, 8-4b). Data lines and time lines have different status words: with data lines bit S4 is zero, with time lines it is one (compare also Fig. 5).

The line numbers of the first (and last) data lines are obtained by reading the memory limits as specified in section 8.5.2.1.

Fig. 8-4a shows the setup of a data line. The highest-order bit corresponds to channel 7 of the respective probe.

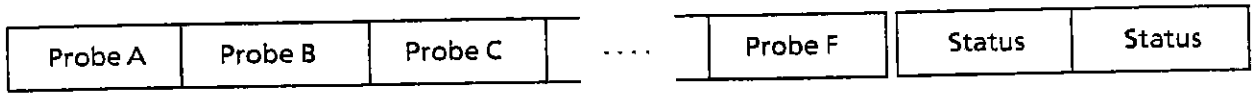


Fig. 8-4a Setup of a data line

The bytes of a time line (Fig. 4b) supply the currently active status of a 48-bit counter in the analyzer, which is increased by one every 20 ns with the LAC64 system clock.

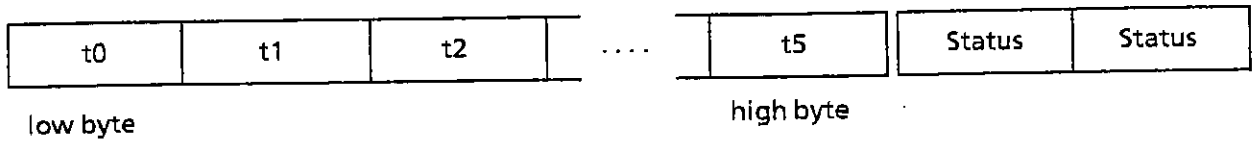


Fig. 8-4b Setup of a time line

The following applies for the assignment of data lines and time lines:

The information contained in a time line refers to the previous data line if the status bit S0 of this line is zero. The time line contains the status of the 48-bit counter increased by one (20 ns). Data lines immediately succeeding one another with S0 being zero are read with 20 ns delay (counter difference one).

If S0 in the data line before the time line is one, the time information of the time line applies to the two previous data lines. The time line then contains the status of the 48-bit counter increased by two (40 ns).

Explanatory note:

A time line, i.e. the current counter status, is included during the data recording of the analyzer following a data line if this is possible with the rate of the data to be read. Entries in the 50-MHz memory of the LAC64 can be made at a maximum speed of every 20 ns.
If new data arrive every 20 ns, they are immediately transferred into the memory in successive order. If enough time is left for insertion of a time line, it is written to the memory 20 ns after the last date, which thus results in a counter status increased by one (20 ns). The status bit S0 of the data lines is then always set to zero.

If both Clk0 and Clk1 occur with external clock in a 20-ns window, the LAC64 reads two data lines. These data lines are transferred to the memory in successive order if no further clock is given for 40 ns. The first data line in bit S0 then shows a zero, the second a one. A subsequent time line is generated after two system clocks. Therefore, it shows a counter status increased by two (40 ns).

Example:

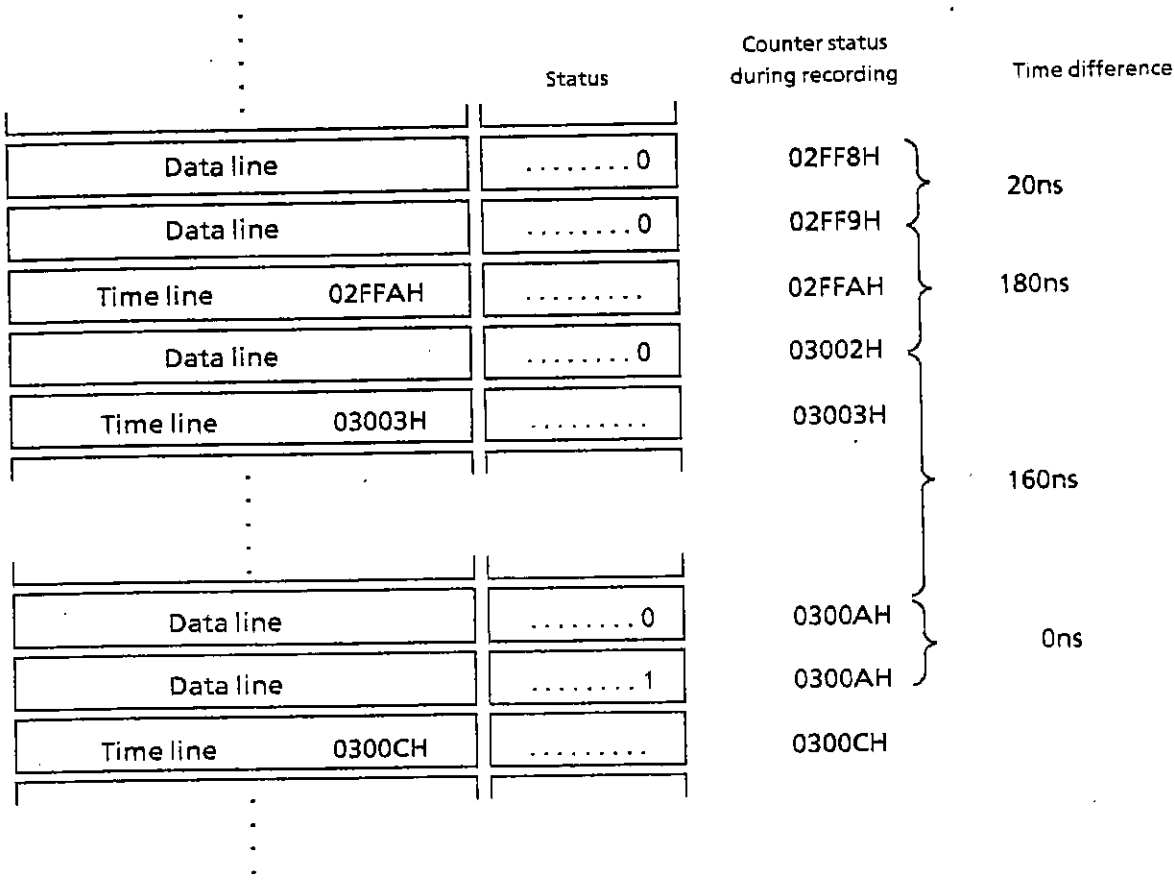


Fig. 8-5 shows the structure of a data line status word. Only bit S4 is of interest in a time line.

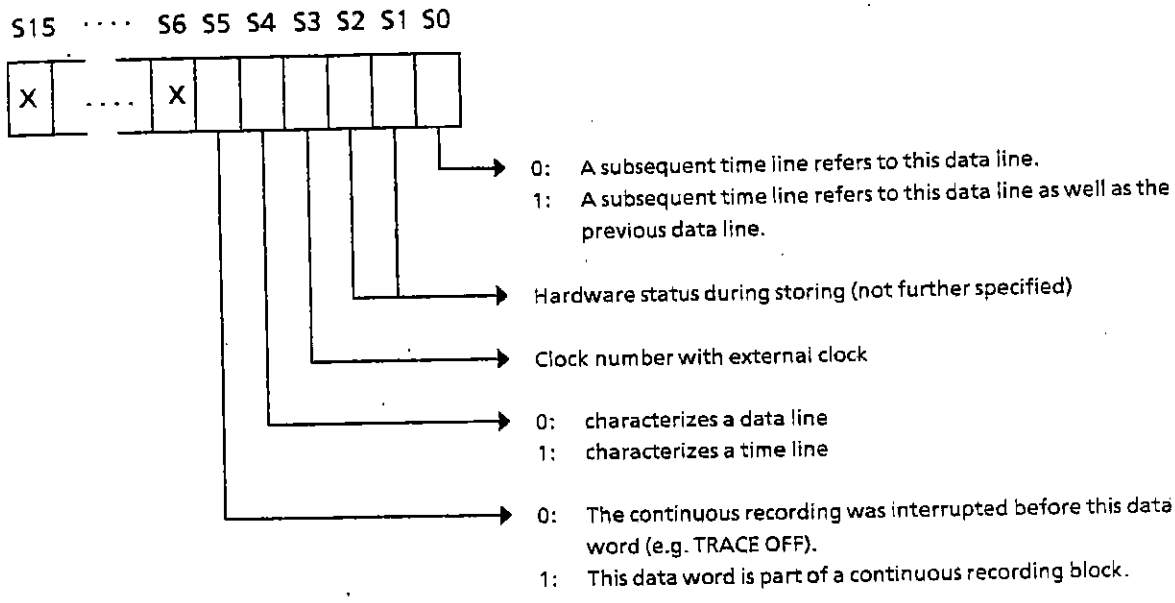


Fig. 8-5 Structure of a status word with 50-MHz data collection

Format of memory data for the high resolution recording:

The structure of the memory data (cf. Fig. 8-1) for the high resolution channels depends on whether the data collection is performed at a 200-MHz or a 100-MHz resolution.

With a 200-MHz resolution, one 8-bit high resolution group is recorded every 5 ns. The respective data bytes are contained in the memory without additional time or status information in successive order (Fig. 8-6).
The highest-order bit corresponds to channel 7 of the high resolution group.

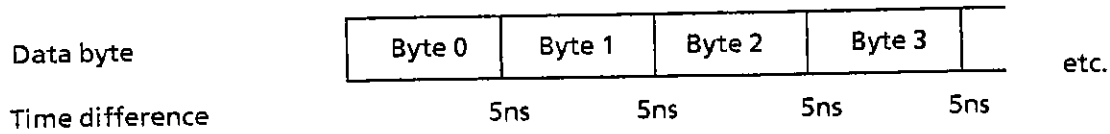


Fig. 8-6 Setup of memory data for 200-MHz recording

With a data collection at a resolution of 100 MHz, two 8-bit high resolution groups are recorded every 10 ns. This means that the memory temporarily contains two successive data bytes (Fig. 7).
The first byte contains the data of the high-order high resolution group (probe F > probe E > probe D etc.).
The highest-order bit of a data byte corresponds to channel 7 of the respective group.
There are no time lines and status bytes.

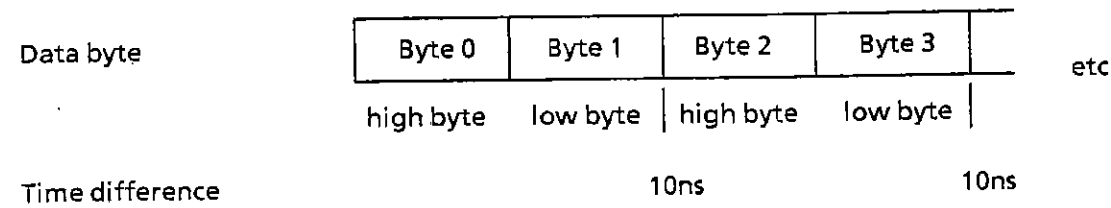


Fig. 8-7 Setup of memory data for 100-MHz recording

The high resolution data can be assigned to the 50-MHz data only if a trigger event occurred during recording. The high resolution data then cover the range of -40 680ns ... trigger ... 41 180ns.

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