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1. Introduction

The LA-ASA Analog Signal Adapter (analog probe) makes it possible to record and analyze analog signals. It can be connected to logic analyzers of the series LAxxA/LA2xxA, KSAxxA, KSAxx, LAxx/LA2xx and KLAXx/KLA2xx. An analyzer operating in conjunction with the analog probe is based on the same principle as a digital memory scope: analog/digital conversion of the analog input signal (100MHz/6 bit in the analog probe) with storage of the results in the analyzer recording memory.

The Analog Signal Adapter occupies 16 channels of the basic analyzer device. With several adapters, up to 4 analog signals can be recorded simultaneously, depending on the number of channels of the basic device. In this case, one of these adapters, functioning as the "master," supplies the recording clock for the LA and the scan clock for the other analog signal adapters ("slaves"). These operate synchronously with the master.

Since in logic analyzer applications it is chiefly the relatively fast events that must be captured, much importance has been attached to a high scan rate. In order to make the best possible use of the A/D transformer, signals asymmetrical to the 0 Volt line can be inserted in the middle of the working range of the A/D transformer by using offset settings.

To trigger on certain levels or threshold transits of the analog signal, two comparators are integrated into the analog signal adapter, which supply, in reference to the value assigned to them, information on whether the input signal is currently over or under the threshold voltage at that point.* By means of sequential polling of the comparator outputs, a signal sequence as a succession of threshold transitions can be set as a trigger condition. In addition, the time distances between the threshold transits can be polled with "BEFORE...", "BETWEEN..." etc. Triggering on analog signal recording can of course also proceed indirectly on the other digital channels, or vice versa: these can be triggered starting from the analog signal. Sequential polling of analog level and digital data (alternately) can be implemented via free master clock assignment to the individual trigger levels.

The recorded analog signal is displayed in graphics on the screen. Various types of magnification, time as well as amplitude axis, can be selected. In the vertical direction, movable segments of the amplitude flow can be displayed. Using the cursor, amplitude, sample number and distances to the other markers S and T can be selected for each point of the signal flow.

*)Triggering on certain analog signal levels via searching for the digitalized value (6-bit word) with the analyzer's own triggering is only possible under certain conditions, since this value can be skipped at the output of the analog probe when the input signal runs through this voltage value too abruptly.

1.1. The Features at a Glance

- o 100 MHz scan rate, 6-bit resolution
- o programmable input voltage range and offset
- o 2 programmable thresholds
- o triggering on a preset signal flow
- o maximum of 2 ... 4 analog channels simultaneously, depending on the number of channels in the analyzer
- o menu-driven programming for all parameters
- o compatible with all logic analyzers of the series L_{Axx}/LA_{2xx}, L_{AxxA}/LA_{2xxA}, KL_{Axx}/KLA_{2xx}, KS_{Axx} and KS_{AxxA}

1.2. Specifications

Scan rate:	100 MHz ... 500 kHz in steps of 1-2-5
Resolution:	6 bits
Analog bandwidth:	50 MHz at -3dB
Input impedance:	1 MOhm / 15 pF (BNC connector)
Input voltage ranges:	+/- 1, 2, 5 and 10 Volt (more voltage ranges via input attenuator)
Offset settings:	Range +/- 2.0, 4.0, 9.9 and 9.8 Volt, resolution of 20, 40, 100 and 200mV, depending on input voltage range
Threshold settings:	2 digital larger/smaller comparators. Range +/- 0.93, 1.86, 4.65, 9.3 Volt, resolution 30, 60, 150 and 300mV, depending on input voltage range. Recognition of current signal level (over/under current threshold) via comparator outputs.
Triggering:	On any signal flow via search of a corresponding sequence of comparator output conditions. With the settings "BETWEEN...", "BEFORE..." etc. the time interval of the threshold transits can also be evaluated.

Memory size /
time window: **At 100Mhz:**
 Time window = 10 ns x memory size of the LA
 x 2 (for LAXxA/LA2xxA with optional memory
 size of 8 bits/channel: time window = 10 ns
 x 8192 x 2 = 160.384us)
 For all other scan rates:
 Time window = scan rate x memory size

Assignment to LA
inputs: 1 sample = 6 data bits + 2 comparator output
 bits. Parallel recording of two samples in
 succession at each of 16 inputs: Connect
 Probe 1 and Probe 2 to input (or Probes 3/4,
 5/6, 7/8), clock to Probe J or Probe K.

Number of analog
channels Depending on number of channels of the LA
 being used: 16 digital channels can be
 connected to one LA-ASA analog probe -->
 maximum of 4 analog channels to an LA64.
 Synchronized scanning with a master clock.

Display: Graphic display of analog signal flows.
 Voltage range (y axis) and time window (x
 axis) can be selected and moved horizontally
 and/or vertically. Cursor with selection of
 sample number, voltage value etc.

(subject to change)

1.3. Nomenclature

LA-ASA analog signal adapter, 100 MHz / 6 bit, 1 analog
 channel. With software for LAXx/LA2xx or
 KLAXx/KLA2xx.

LA-ASA-A Analog signal adapter, 100 MHz / 6 bit, 1 analog
 channel. With software for LAXxA/LA2xxA.

KSA-ASA Analog signal adapter, 100 MHz / 6 bit, 1 analog
 channel. With software for KSAXx connected to a
 KONTRON KDS or KPDS development system.

KSA-ASA-A Analog signal adapter, 100 MHz / 6 bit, 1 analog
 channel. With software for KSAXxA connected to a
 KONTRON KDS or KPDS development system.

KPA-ASA-A Analog signal adapter, 100 MHz / 6 bit, 1 analog
 channel. With software for KSAXx at a KPI
 interface card (for use with an IBM PC/XT/AT).

2. User Guide

2.1. Connections to the Analog Probe

The signal input of the analog probe is implemented as a BNC connector. If the analog signal to be analyzed has an amplitude of more than +/- 10 Vss, an input attenuator probe like the one used for oscilloscopes should be connected.

The analog probe is connected to the analyzer via three probes, whose plugs are designated PROBE J, PROBE 1 and PROBE 2. The connection procedures for various modes of operation are described in Section 2.2.

If two or more analog probes are working with an analyzer simultaneously, the master supplies the scan clock via the clock outputs to the slaves at their clock inputs. See Section 2.2.2. for a description of this mode.

Fig. 1: Connections to the Analog Signal Adapter (Analog Probe)

2.2. Connecting the Analog Probe to the Analyzer/ Settings in the Configuration Menu

2.2.1. Connecting One Analog Probe

The plugs of the three connector cables to the logic analyzer are designated PROBE 1, PROBE 2, and PROBE J (Fig. 1). The three cables can be connected to the three inputs with the same labels on the LA or KSA back wall. However, all the following methods of connection are possible:

```
plug PROBE 1 --> input PROBE 1
plug PROBE 2 --> input PROBE 2
plug PROBE J --> input PROBE J
```

or

```
plug PROBE 1 --> input PROBE 3
plug PROBE 2 --> input PROBE 4
plug PROBE J --> input PROBE J
```

or

```
plug PROBE 1 --> input PROBE 5
plug PROBE 2 --> input PROBE 6
plug PROBE J --> input PROBE K
```

or

```
plug PROBE 1 --> input PROBE 7
plug PROBE 2 --> input PROBE 8
plug PROBE J --> input PROBE K
```

The logic analyzer should be turned off when you connect the cables. All three connector cables must always be connected to the logic analyzer!

If an analog probe is connected to the analyzer, this is recognized when the software is loaded, and is announced in the Configuration Menu, as well as in the table temporarily displayed upon booting, which gives information on the hardware configuration of the analyzer.

When the <Menu Std> key is pressed, a special Analog Probe Menu appears after the Configuration Menu. Display of the analog signal itself is called up by pressing the <F5> key.

Immediately after the software is loaded, the default setting of external clock with positive edge (e.g. +J0) and the setting of its threshold with ECL automatically appears in the Configuration Menu. If clock rates of <50 MHz are set in the Analog Probe menu, clock qualifier bits are also set in the Configuration Menu.

2.2.2. Connecting Several Analog Probes

In accordance with the connection methods described in the preceding section, several analog probes can be connected simultaneously, i.e. 2 analog probes to a 32-channel basic device, 4 analog probes to a 64-channel basic device.

Please note that only one of these analog probes, as the master, supplies the scan clock for the rest of the analog probes (slaves) and the recording clock for the analyzer!

This has the following consequences for the method of connection and the settings required in the Configuration Menu:

1. The analog probes are to be connected with their connector cables PROBE 1 and PROBE 2 to inputs PROBE n (n=successive numbers). For example, if analog probe 1 is connected to inputs PROBE 1 and PROBE 2, then analog probe 2 must be connected to inputs PROBE 3 and PROBE 4. (This does not apply to a 32-channel basic device, such as the LA32A!)
2. The analog probe that is connected to the analyzer probe inputs with the lowest probe numbers functions as the master. Your connector cable designated PROBE J should be connected to input PROBE J if this analog probe is connected to PROBE 1/2 or PROBE 3/4, or to input PROBE if it is connected to PROBE 5/6.
3. In the Configuration Menu:
 - a) an ARRANGEMENT must be used in which all clock default fields (CLOCK INPUT line) belonging to the analog probes that are connected are ORed, which is shown as an O or OR displayed between them.
 - b) the clock input belonging to the master analog probe must be set to +J0 or +J1 or +K0 or +K1. The INPUT CLOCK fields of the slave analog probes should be set to OFF.
4. The connector cables of the rest of the analog probes (slaves) designated as PROBE J are not to be connected to the analyzer!
5. The clock input of the slave analog probes is to be connected to one of the three clock outputs of the master analog probe (see also Fig. 1).
For this, use the connector cables included in the package (mini BNC plugs at each end, one cable per analog probe).

Perfect operation with several analog probes is guaranteed only when all of these instructions have been followed!!

2.3. ANALOG PROBE CONFIGURATION Menu

Regardless of whether one or several analog probes is connected, parameter input fields appear for each of these analog probes in a separate column in this menu. Only the clock rate needs to be set once, since several analog probes always function in master/slave mode (see Section 2.2.2.1). Which analog probe functions as master and which as slave, or the LA probe inputs they are connected to, is shown at the head of the parameter column or in the line reading "Probes connected to..."

2.3.1. Input Range

Possible settings are +/- 1V, +/- 2V, +/- 5V and +/- 10V. If the level of the input signal exceeds the +/- 10V range, an oscilloscope input attenuator should be connected in front. If the input signal is asymmetrical to the 0 V line, we recommend setting an offset:

2.3.2. Offset

The offset should be input with a positive sign if the middle signal level > 0 V, and with a negative sign when it is < 0 V. "Middle signal level" here is the midpoint between the maximum and minimum current value of the signal.

The size of the offset should be set as close as possible to this middle signal level. This applies especially when the entire signal amplitude (point to point) equals or is only a little under one of the possible input range settings. This type of offset setting guarantees that a range which does not exceed the input voltage range can be selected that makes the best possible use of the available resolution.

The range and resolution of the offset that you can set depend on the input range selected (see also Specifications, Section 1.2.). If too large a value is entered, the range is automatically corrected; if unavailable intermediate values are entered, they are rounded down to the next smaller (absolute) values.

2.3.3. Upper Trigger Level / Lower Trigger Level

The setting for these thresholds is used for triggering (see Section 2.5.) on certain signal levels, threshold transits, as well as (for sequential polling) for triggering on certain signal flows:

The two threshold voltages entered here are used as comparison levels for two ECL comparators integrated into the analog probe. With this level, each sample of the analog input signal is compared to "larger than" and "smaller than." Depending on the thresholds that were set, the two high-order bits of analog probe outputs PROBE 1 and PROBE 2 indicate whether the input signal for the current sample is over or under the current threshold:

bit 7 = "1" -> signal is over the Upper Trigger Level
bit 7 = "0" -> signal is under the Upper Trigger Level

bit 6 = "1" -> signal is over the Lower Trigger Level
bit 6 = "0" -> signal is under the Lower Trigger Level

Fig. 2: Distribution of input voltage ranges into three ranges and condition of bit 7 and bit 6 of PROBE 1 and PROBE 2 for signal levels in these ranges.

By searching for bit combinations 10, 00 or 01 (bit 7, bit 6) in the triggering, a current value for the signal level is implicitly searched which lies over the upper threshold, between the two thresholds or below the lower threshold.

The range and resolution of the Upper Trigger Level and Lower Trigger Level that can be set depend on the input Range set (see also Specifications, Section 1.2.). If too large a value is entered, it is automatically corrected; if unavailable intermediate values are entered, they are rounded down to the next smaller (absolute) values.

2.3.4. Sample Rate

Scan rates can be set from 500 kHz .. 100 MHz in steps of 1-2-5.

If several analog probes are connected, they function in master-slave mode (see Section 2.2.2.). Therefore only one common sample rate should be set.

For sample rates < 50 MHz, a clock qualifier is automatically set in the Configuration Menu on which the recording clock of the analyzers is "subdivided." The analog probe supplies the corresponding qualifier signals.

The analyzer recording clock at sample rates 100 MHz and 50 MHz is identical in both cases (50 MHz); in the case of 50 MHz only every other recorded sample is evaluated in software (see Section 2.4.). Please note that when the scan rate is reduced from 100 MHz to 50 MHz the time window that is captured is not enlarged. This is only the case when the scan rate is reduced further!

2.4. Interpreting Data in the Data List

2.4.1. Sample Order at 100MHz Scan Rate

Since the clock rate for recording with external clocks cannot exceed 50 MHz, at a scan rate of 100 MHz the analog probe must transfer two successive samples together to the analyzer. The required recording clock for the analyzer is thus reduced to 50 MHz.

An advantage of this type of recording is that fact that the time window that can be captured is doubled:

time window at 100 MHz = 2 x memory size x 10 ns

For a basic device with a memory depth of 2K bits/channel, this results in a time window of 40.96 us, at 4K bits/channel it is 81.82 us, and at 8K bits/channel 163.84 us.

Every two successive samples are read via PROBE 1 and PROBE 2. The first sample (in time) of this sample pair appears on PROBE 1, the second on PROBE 2.

2.4.2. Sample Order at <100MHz Scan Rate

If 50 MHz is set as the sample rate in the Configuration Menu, only every other sample of the analog probe is evaluated by software during graphic display of the analog signal. This refers to all data read via PROBE 1. There are no changes in clock setting and recording mode compared to the 100 MHz sample rate.

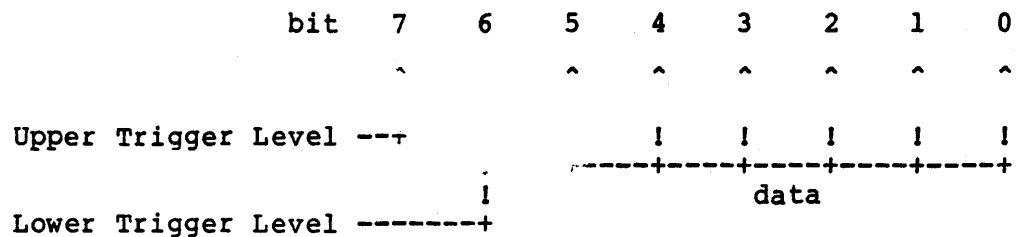
For scan rates of < 50 MHz, clock qualifier bits are automatically set that subdivide the recording rate for the logic analyzer appropriately. For these scan rates also, only the data read over PROBE 1 are evaluated.

For all scan rates from 500 kHz to 50 MHz inclusive, the following is the time window that can be captured directly from memory:

time window at 50 MHz and less = memory size x scan rate

2.4.3. Channel Assignment of Data and Comparator Bits

Each sample read into the analyzer basically consists of the actual data (6 bits, output of A/D transformer) and the level information referenced to the Upper Trigger Level or Lower Trigger Level (2 bits, outputs of the comparators).



data = 00 DEC -> negative input signal in the range selected
data = 63 DEC => positive input signal in the range selected

bit 7 = "1" -> signal is over the Upper Trigger Level
bit 7 = "0" -> signal is under the Upper Trigger Level

bit 6 = "1" -> signal is over the Lower Trigger Level
bit 6 = "0" -> signal is under the Lower Trigger Level

(see also Fig. 2 in Section 2.3.3.1)

As described in Section 2.4.1., at a scan rate of 100 MHz two successive samples are read into the analyzer together. The above assignment of data and trigger level bits there fore also applies to samples read via PROBE 1 as for PROBE 2.

At scan rates below 100 MHz, only the data read via PROBE 1 are evaluated (see Section 2.4.2.).

2.5. Triggering

2.5.1. Triggering on the Analog Signal

2.5.1.1. Trigger Words Used

Depending on the slope of an analog signal during transit through certain threshold voltages, during the signal's A/D conversion the digitalized value that corresponds exactly to this threshold voltage is frequently skipped over; therefore there should be no triggering on the data bits (bits 0 ... 5). Otherwise there is the risk that the analog input signal might have traversed this level, but the fact was not recognized in the triggering!

Normally only bit 6 and bit 7 are used in triggering; the search is for when the Upper Trigger Level (bit 7) or Lower Trigger Level (bit 6) is exceeded or not met.

The corresponding trigger words should be defined in the Trigger Word Menu as follows:

In this example, the analog probe is connected to analyzer inputs PROBE 1, PROBE 2 and PROBE J.

With trigger word LOW, input levels below the Lower Trigger Level are searched; with trigger word HIGH, levels above the Upper Trigger Level are searched; with trigger word MED, values between these two thresholds are searched.

In groups A and B, two successive samples are checked (see Section 2.4.1.) during this. If threshold transits are recognized immediately, even if only one sample transits the Trigger Level, then Group A and B must be polled individually with different trigger words, as described below in Section 2.5.1.3.:

If only samples evaluated in the analog display are to be triggered on., at scan rates of 500 kHz ... 50 MHz only the words LOW 1, MED 1, and HIGH1 can be used (see also Section 2.4.1. and 2.4.2.).

2.5.1.2. Using the Trigger Filter

With the words LOW, MED and HIGH as defined in the previous section, levels are searched that are between two successive 10 ns samples (groups A and B). This corresponds functionally to trigger filter = 02. When the trigger filter is explicitly input at = 02, a level is searched that extends over 4 samples (at 10 ns) etc.

This applies to a scan rate of 100 MHz. At 50 MHz and slower, only the samples on probe 1 are evaluated. If trigger words LOW 1, MED 1 and HIGH1 are used a trigger filter = n is set, this means that the level is searched at n successive samples of the sample rate selected.

Basically the following is valid: To avoid triggering on outliers of short duration, at 100 MHz the words LOW, MED and HIGH are used; for all other scan rates, a trigger filter > 01 should be set when LOW 1, MED 1 and HIGH1 are used.

2.5.1.3. Triggering on Rising or Falling Edges

In order to trigger on a signal transit through the Upper Trigger Level or the Lower Trigger Level, it is not sufficient to search the condition LOW, MED, HIGH etc.; on the contrary, the first appearance must be recognized. If rising and falling edges are to be differentiated, then the previous level condition must be polled first in sequential triggering:

a) rising edge through the Lower Trigger Level

TRIGGER FILTER 01 ON ALL LEVELS
NORMAL RECORDING FOR ALL LEVELS

- 1> IF LOW IS TRUE 00001 TIMES ANYTIME WITH C2 THEN GOTO 2
NO SECOND TRIGGERWORD
- 2> IF MED GOES TRUE 00001 TIMES ANYTIME WITH C2 THEN TRIGGER
NO SECOND TRIGGERWORD

For logic analyzers of the series L_{Axx}/LA_{2xx}, KL_{Axx}/KLA_{2xx} and KS_{Axx}, the trigger setting "GOES ..." is not available. "IS TRUE" is used instead at level 2.

For scan rates of 500 kHz ... 50 MHz, LOW 1 (instead of LOW) or MED 1 (instead of MED) can be used, but do not have to be.

For a scan rate of 100 MHz, a threshold transit can be recognized more exactly using ORed polling of the level conditions at PROBE 1 and PROBE 2; then, of course, there may be triggering on outliers of short duration:

TRIGGER FILTER 01 ON ALL LEVELS
NORMAL RECORDING FOR ALL LEVELS

- 1> IF LOW 1 IS TRUE 00001 TIMES ANYTIME WITH C2 THEN GOTO 2
BUT IF LOW 2 IS TRUE THEN GOTO 2
- 2> IF MED 1 GOES TRUE 00001 TIMES ANYTIME WITH C2 THEN TRIGGER
BUT IF MED 2 GOES TRUE THEN TRIGGER

b) rising edge through Upper Trigger Level

According to the same principle, a rising edge is triggered on through the Upper Trigger Level:

TRIGGER FILTER 01 ON ALL LEVELS
NORMAL RECORDING FOR ALL LEVELS

- 1> IF MED IS TRUE 00001 TIMES ANYTIME WITH C2 THEN GOTO 2
NO SECOND TRIGGERWORD
- 2> IF HIGH GOES TRUE 00001 TIMES ANYTIME WITH C2 THEN TRIGGER
NO SECOND TRIGGERWORD

For logic analyzers of the series L_{Axx}/LA_{2xx}, KL_{Axx}/KLA_{2xx} and KS_{Axx}, the trigger setting "GOES ..." is not available. "IS TRUE" is used instead at level 2.

For scan rates of 500 kHz ... 50 MHz, MED 1 (instead of MED) or HIGH1 (instead of HIGH) can be used, but do not have to be.

For a scan rate of 100 MHz, a threshold transit can be recognized more exactly using ORed polling of the level conditions at PROBE 1 and PROBE 2; then, of course, there may be triggering on outliers of short duration:

TRIGGER FILTER 01 ON ALL LEVELS
NORMAL RECORDING FOR ALL LEVELS

- 1> IF MED 1 IS TRUE 00001 TIMES ANYTIME WITH C2 THEN GOTO 2
BUT IF MED 2 IS TRUE THEN GOTO 2
- 2> IF HIGH1 GOES TRUE 00001 TIMES ANYTIME WITH C2 THEN TRIGGER
BUT IF HIGH2 GOES TRUE THEN TRIGGER

c) falling edge through Lower Trigger Level

According to the same principle, a falling edge is triggered on through the Lower Trigger Level:

TRIGGER FILTER 01 ON ALL LEVELS
NORMAL RECORDING FOR ALL LEVELS

- 1> IF MED IS TRUE 00001 TIMES ANYTIME WITH C2 THEN GOTO 2
NO SECOND TRIGGERWORD
- 2> IF LOW GOES TRUE 00001 TIMES ANYTIME WITH C2 THEN TRIGGER
NO SECOND TRIGGERWORD

For logic analyzers of the series LAxx/LA2xx, KLAxx/KLA2xx and KSAxx, the trigger setting "GOES ..." is not available. "IS TRUE" is used instead at level 2.

For scan rates of 500 kHz ... 50 MHz, MED 1 (instead of MED) or LOW 1 (instead of LOW) can be used, but do not have to be.

For a scan rate of 100 MHz, a threshold transit can be recognized more exactly using ORed polling of the level conditions at PROBE 1 and PROBE 2; then, of course, there may be triggering on outliers of short duration:

TRIGGER FILTER 01 ON ALL LEVELS
NORMAL RECORDING FOR ALL LEVELS

- 1> IF MED 1 IS TRUE 00001 TIMES ANYTIME WITH C2 THEN GOTO 2
BUT IF MED 2 IS TRUE THEN GOTO 2
- 2> IF LOW 1 GOES TRUE 00001 TIMES ANYTIME WITH C2 THEN TRIGGER
BUT IF LOW 2 GOES TRUE THEN TRIGGER

d) falling edge through Lower Trigger Level

According to the same principle, a falling edge is triggered on through the Upper Trigger Level:

TRIGGER FILTER 01 ON ALL LEVELS
NORMAL RECORDING FOR ALL LEVELS

- 1> IF HIGH IS TRUE 00001 TIMES ANYTIME WITH C2 THEN GOTO 2
NO SECOND TRIGGERWORD
- 2> IF MED GOES TRUE 00001 TIMES ANYTIME WITH C2 THEN TRIGGER
NO SECOND TRIGGERWORD

For logic analyzers of the series L_{Axx}/LA_{2xx}, KL_{Axx}/KLA_{2xx} and KS_{Axx}, the trigger setting "GOES ..." is not available. "IS TRUE" is used instead at level 2.

For scan rates of 500 kHz ... 50 MHz, HIGH1 (instead of HIGH) or MED 1 (instead of MED) can be used, but do not have to be.

For a scan rate of 100 MHz, a threshold transit can be recognized more exactly using ORed polling of the level conditions at PROBE 1 and PROBE 2; then, of course, there may be triggering on outliers of short duration:

TRIGGER FILTER 01 ON ALL LEVELS
NORMAL RECORDING FOR ALL LEVELS

- 1> IF MED 1 IS TRUE 00001 TIMES ANYTIME WITH C2 THEN GOTO 2
BUT IF MED 2 IS TRUE THEN GOTO 2
- 2> IF HIGH1 GOES TRUE 00001 TIMES ANYTIME WITH C2 THEN TRIGGER
BUT IF HIGH2 GOES TRUE THEN TRIGGER

2.5.2. Indirect Triggering via Digital Signals

Basically, analog signals can also be recorded indirectly by triggering on digital signals simultaneously. In this case, all bits assigned to the analog probe are to be set at don't care in the trigger words.

Analog signal triggering proceeds simultaneously with the rest of the channels of the basic device ("digital signals"). However, a time assignment of analog probe data with data from the other channels is possible only if the channels either are recorded with the logic analyzer's internal clock, or if their sample time points are captured with the Time Measurement option (-TM Option) if recorded with external clocks.

2.5.3. Triggering on Analog and Digital Signals

Since the recording clock supplied by the analog probe and the recording clocks of the other channels are basically asynchronous to each other, digital and analog signals can be triggered on only sequentially or alternately:

For this, the recording clock of the digital signals should be assigned as the master clock for their trigger words in the Trigger Word Menu, while the clock supplied by the analog probe should be designated the master clock for the analog signal trigger words.

Calling up these trigger words in the Trigger Sequence Menu causes triggering alternately on analog and digital signals in different trigger levels.

2.5.4. Triggering on Several Analog Signals

Since several analog probes basically operate in master-slave mode (see Section 2.2.2.), all analog signals are recorded **synchronously**. Thus signal levels of several analog signals can be polled at the same time in the same trigger word.

2.5.5. Triggering on Several Analog Signals and Digital Signals

Here the operation should be basically the same as described in the section on Triggering on Analog and Digital Signals: Trigger words to which the common recording clock of all analog probes is assigned as the master clock allow triggering on one or more analog signals. Trigger words to which the external recording clock of digital channels is assigned allow triggering on these digital channels. Analog and digital signals can be triggered on alternately in different trigger levels this way.

2.6. Displays

2.6.1. Analog Signal Display

2.6.1.1. Calling up the Analog Signal Display

The recorded analog signals are displayed with the <F5> key. If no analog probe is connected, pressing this key has no effect.

2.6.1.2. Selecting Data to be Displayed

For the following entries, the field under discussion must be selected with the four directional keys <up>, <down>, <left> and <right>. The field selected appears in inverse video. Next the desired setting can be selected with <Roll up> and <Roll dn>.

Data from ...

SOURCE --> display source data

REFRNC --> display reference data

Probe ...

--> display recording of the analog probe ...

2.6.1.3. Time Window Displayed

An orientation scale appears in the next to last line of the screen, like the Timing Diagram:

To the left of this scale is the sample number at which the displayed portion of the analog signal begins.

To the right of this scale is the sample number at which the displayed portion of the analog signal ends.

The relative length of the bar in the scale, in relation to its entire length, shows which time segment from the entire recording is being displayed.

Note:

At a scan rate of 100 MHz, two samples per analyzer memory position are recorded and evaluated. Therefore at this scan rate the data from sample number (n) can be found at the memory position with the address (n/2)!

Magnification Switching and Moving the Time Window:

At first the bar can be selected within the orientation scale with the directional keys. Then it is displayed in inverse video.

The following modes of operation are then possible:

Upper directional keys <right> and <left>

--> Move the window to earlier or later numbers in the recording memory.

This movement proceeds in levels that are fixed for that particular magnification. The time window displayed can be positioned on any sample number via moving within the Data List or by entering jumps "S HOME", as described below.

<Roll up>, <Roll dn>, keys 0 ... 6

--> magnification switching:

<Roll up> selects the next larger, <Roll dn> the next smaller time window.

Direct selection of various levels of magnification with "0" ... "6"; "0" calls up the lowest, "6" the highest level of magnification.

(Note: Depending on memory available, after entering "0" a larger time window can be selected, that is, display of the entire memory!)

Using the HOME FUNCTION in the Data List

Since the first sample displayed in the Data List (or also in the Time Diagram) is always equal to the first analog signal sample displayed, the HOME function can be used to position the analog signal display:

- key <List>
- enter the desired memory address in the S HOME field
- upper <HOME> key
- <F5> key

Now the signal display begins at the previously entered memory address S HOME. Please note that the sample number of the analog signal will agree with the memory address of the analyzer only at scan rates of 50 MHz and less. On the other hand, at the scan rate of 100 MHz:

$$\text{sample number} = \text{memory address} \times 2$$

2.6.1.4. Amplitude Window Displayed

To the left of the y axis, which is labeled with voltages, an orientation scale for the amplitude window appears vertically:

If the entire input voltage range is displayed, this scale appears as a bar.

If only a portion of the input voltage range is displayed, the bar represents, in relation to the entire length of the scale, which level segment of the entire input voltage range is displayed.

Switching Amplitude Magnification and Moving the Window Displayed:

At first the bar can be selected within the orientation scale with the directional keys. Then it is displayed in inverse video.

The following modes of operation are then possible:

<Roll up>, <Roll dn>, keys 0 ... 3

--> magnification switching:

<Roll up> selects the next larger, <Roll dn> the next smaller amplitude window.

Direct selection of various levels of magnification with "0" ... "3"; "0" calls up the lowest, "3" the highest level of magnification.

Upper directional keys <right> and <left>

--> Move the amplitude window to earlier or later numbers in the input voltage range to more positive or more negative voltages.

2.6.1.5. Cursor

The cursor line can be moved horizontally within the time window with the Cursor > and Cursor < keys: If the key is pressed quickly, the cursor is moved one sample, if the key is held down the cursor moves faster and faster.

The following appears in the lowest line of the screen:

Cur.Smpl.#:

--> sample number at cursor position

Cur.Vltgl:

--> level of input voltage at cursor position

Note:

At a scan rate of 100 MHz, two samples per analyzer memory position are recorded and evaluated. Therefore at this scan rate the data from sample number (n) can be found at the memory position with the address (n/2)!

Taking this arrangement into account, certain positions of the analog signal in the Data List can be determined by positioning the cursor, e.g. by entering S HOME in order to set the beginning of the analog signal display at this position.

In the topmost line of the screen, the following time distances are read under "time: ..."

C-T=

--> Time distance between trigger point and sample number of the cursor.

C-S=

--> Time distance between sample number of the cursor and the first (leftmost) sample of the analog signal display

T-S=

--> Time distance between the trigger point and the first (leftmost) sample of the analog signal display

2.6.1.6. Special Features of the Display

a) Interpolation between Individual Scan Points

Successive sample points are connected to each other in the analog display by **straight lines**. Since these straight lines are shown in graphics with finite resolution, they have a stepped appearance at higher magnifications. This stepped appearance should not be confused with the **amplitude levels** that originate from A/D conversion:

The individual scan points within the analog signal that is displayed can be identified by moving the cursor, since pressing the cursor quickly moves it from sample to sample.

b) Samples that Exceed the Displayed Amplitude Range by Levels

When the entire input voltage range is displayed:

Data = 00 DEC or = 63 DEC correspond to 0 or full scale of the A/D transformer. The analog input signal for these samples was outside the input voltage range selected, or was exactly on the border.

Therefore the samples are not displayed in the analog signal; the display of preceding or following samples ends or begins at the next samples whose voltage lies within the boundaries.

For amplitude-magnified display:

Only samples are displayed that lie within the displayed amplitude window in terms of level. The line that connects the samples inside and outside the windows is not shown.

