What's Logic Analyzer? Why Leaptronix LA?



Contents

- LA Principles
- When should use Logic Analyzer
- The difference between LA and Oscilloscope
- The difference between PC Base and Standalone
- Feature of the LA series
- Key point for purchase



Principles

- Block Diagram
- Feature of Probe
- Skew
- Signal Capture
- Trigger
- Storage
- Glitch



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Block Diagram



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Feature of Probe

- Multi-channel
- To limit Dynamic range
 - -Usually, the probe is resistive or capacitive.
 - -Resistive : Effect the Amplitude of input signal.
 - -Capacitive: Effect the waveform of input signal.
- Able to set threshold
 -Fixed: TTL/CMOS/ECL
 -Variable: -4V~+4V.
- Will effect or decrease bandwidth.



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Skew

• The time delay of signal transmission between two channels.



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Signal Capture

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• Structure of single signal capture



• Result of signal capture for one channel





Mode of Signal Capture

	Timing	State		
Sample	Asynchronous	Synchronous		
Clock	Internal Clock	External Clock		
BUS Analysis	Timing Analysis	State Analysis		
Data Display	Waveform	List		

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• Accuracy of Timing Analysis

-There is error of Sampling Period in Logic Analyzer





• Fast sampling Period





• Slow Sampling Period





• Intermediate Sampling Period



* The best Sampling Period : 3~5 times than target signal



Importance of Timing Analysis

- BUS Analysis
- Glitch Detection



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State Analysis

- DUT offers the CLK
- Setup time and Hold time
- The Bandwidth of LA affects synchronous speed.





• Mode of Sampling



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State

- Setup time : A specific time before the rising CLK edge.
- Hold time : A keeping time after the CLK edge.







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Importance of State Analysis

• To check what happen in Bus: Applied to MCU or products that should be measured synchronously.





• Example







Channel no: 32



	Mode of Display								
Name	Address BUS	Data BUS	Control BUS						
Display	HEX	HEX	HEX						
-0003	043D	34	2						
-0002	0431	OA	2						
-0001	0433	C8	3						
+0000	0437	1A	2						
+0001	043A	54	4						
+0002	043C	82	3						
+0003	0436	1D	3						
+0004	0431	44	4						
+0005	043E	23	2						

Check what happen in BUS



Trigger

• What is a "Trigger"?

-A Trigger is an event, when detected, allow the Logic Analyzer to fill its trace memory and complete the measurement





Trigger Mode

Pattern trigger

- Set Voltage Threshold as the Level

 $>1.5V \rightarrow High; <1.5V \rightarrow Low$

- Ch 1 \rightarrow High "Logic 1"
- Ch 2 \rightarrow Low "Logic 0"



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- Edge Trigger
 - Set Trigger Level at rising edge or falling edge.





Trigger Procedure



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• Ring Model







Storage Method

• Deeper memory and trigger timing.

-A: End of memory \rightarrow All pre-trigger

-B: Center of memory $\rightarrow \frac{1}{2}, \frac{1}{2}$

-C: Beginning of memory \rightarrow All post-trigger



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- Deeper memory
 - -Typical storage: Store every data.

-Transitional storage: Store data when it transits from High to Low or from Low to High.



• Typical Storage





• Transitional Storage



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Glitch

Cause of Glitch

- A sudden discharge from the capacitor.
- Ripple and Noise from the power supply.
- A sudden change of current.
- An interference from electromagnetic wave.



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• Glitch Waveform





• The function of Glitch detection is to find the variation of signal between LA sampling periods and record it on LA display.





• Glitch detection



XA Glitch will cause incorrect data code.



• Glitch Display



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When show use Logic Analyzer

- Verify and debug digital designs.
- Trace and correlate many digital signals synchronously.
- Detect and analyze timing violations and transients on Buses.
- Trace embedded software execution.







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Difference between Logic Analyzer and Oscilloscope

Signal parameter



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• When user would like to see more data on Oscilloscope, it will be difficult to analyze those data.

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• It takes much more time to analyze state by Oscilloscope than by Logic Analyzer.

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When to use LA	When to use Oscilloscope
Observe many digital signals synchronously	Only observe few (1~4) analog signal.
Embedded systems development	
Analyze the change of software & hardware integration.	Get accurate information about the change of voltage
Set Trigger Level and process signal analysis.	

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Difference between PC Based and stand alone

Pc Based	Stand alone				
Need to be connected to computer (share Memory and CPU)	No need to be connected to computer				
Work under Windows system, not convenient for engineer while debugging .	Work stand alone, convenient for engineer				
Not upgradeable	Upgradeable				
Low accuracy	High accuracy				
Lower price (Only main unit)	Higher price (Included CPU, Memory, Probe Pod)				

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Pc Based	Stand alone		
Can not show test result immediately.	Show test result immediately. (3~5 times faster than PC Based LA)		
Only a few brand provide glitch detection	Glitch detection		

Features of the LA series

- •External (synchronous, up to 500MHz) and internal (asynchronous, up to 200MHz) capture.
- •I2C, UART and SPI signal decode by PC.
- •32 channels.
- •Four trigger modes: Pattern, Edge, AND and OR.
- •Pre-trigger ,3 level Post trigger and continued- trigger.
- •BUS analysis and Glitch capture.

- Trigger counter and Pulse wide trigger.
- 5.6 inch TFT LCD display.
- •USB2.0 and PC-Linked function.
- •High speed Zoom in/ Zoom out.

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Function:

1. Auto-Scale:

Search 32 channels automatically and show the result on LCD display.

2. Auto-Store:

LA will memorize the relative position of every synchronous signal.

Example: Auto-Store

Waveform of stable system

Waveform of unstable system

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3.Search

While transmitting data, user can search specific data or use cursor to measure the period of data that appears repeatedly.

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4. RAM Size:

•Auto: LA set the RAM size automatically according to the sample rate.

•Manual: User can set RAM size by himself.

5. 3 Level continuous/un-continuous Trigger

Display of 3 Level un-continuous Trigger

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Display of 3 Level continuous Trigger

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7. Pulse Width Trigger

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8. Trigger Out

• Send signal to another test instrument like Oscilloscope via external trigger.

9. Glitch detection:

• The function of Glitch detection is to find the variation of signal between LA sampling periods and record it on LA display.

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Glitch detection display

10. PC Remote Control:

• Transmit data to PC for analysis and debug via USB2.0 port.

Key Point for Purchase

- Sample Rate
- State Bandwidth
- Channel
- Memory Depth
- Glitch Detect CKT

Leaptronix-Your best measurement solution

