Logic Analysis Fundamentals

User's Guide

**Computer-Based
Training Course**

i

ii

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iii
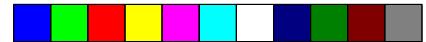
Conventions

The following conventions are used throughout this manual:

- **Bold** is used to emphasize important information in the text or to highlight text to be entered from your computer's keyboard.

- *Italics* are used for titles that refer to the course and its modules, to indicate selections to be made, or for emphasis.

- **<Keystroke>** indicates a key or combination of keys to be pressed.

iv

Table of Contents

v

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1

Logic Analysis Fundamentals Computer-Based Training

- **Course Objectives**

- **The Logic Analysis Fundamentals Program**

- **Hardware/Software Requirements**
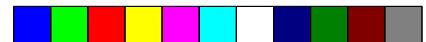
Purpose of this Course

This course is designed for those who have a basic knowledge of electronic theory and circuits and wish to learn about logic analysis. When you have completed this course, you will have a basic knowledge of the measurement techniques as well as the theory, technology and terminology of logic analysis.

The Logic Analysis Fundamentals Program

The program needs to be downloaded from www.educatorscorner.com.

Hardware/Software Requirements

To use *Logic Analysis Fundamentals,* you will need a
Vectra computer or an IBM PC/AT compatible computer equipped
with the following:

- DOS 3.1 or higher

- Windows 3.0 or higher

- 2 MB of RAM

- A hard disk with 5.0 MB of available space

- One 1.44 MB diskette drive

- A Microsoft-compatible mouse

- VGA or higher resolution monitor. When using SVGA,
  the program will occupy only a portion of the screen.

- A processor running at 100 MHz is recommended for optimum
  performance.

  The program will run satisfactorily on slower processors, but
  will take more time to complete.

1-3
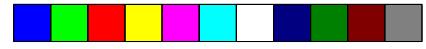
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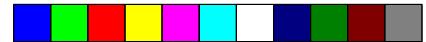
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Getting Started

- **Setup and Installation**

- **Starting the Program**
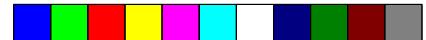
Setup and Installation

Follow these steps to setup and install Logic Analysis Fundamentals.

1. Save the file LAF.exe to your computer.

2. Double-click on LAF.exe to unpack.

3. Choose the current file destination or change the folder name to another temporary directory. Note: these files will not be deleted during installation.

4. Click the unzip button.

5. Go to the destination folder you selected and open up the Set Up folder.

6. Then open up the Disk 1 folder.

7. Look for the setup.exe file and click on it to begin installation.

8. The set up and installation will start up.

9. Follow the step by step instructions for installation.

Starting the Program

Click on the Start button; go to Programs and look for Logic Analysis Fundamentals *and open your new program.*

You can go back and delete the setup files unpacked in the temporary folder.
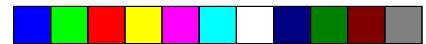
3

Troubleshooting

- **Installation**

- **During the Program**

Installation

Below are error messages which could appear while you install or use *Logic Analysis Fundamentals,* along with their causes and solutions.

The target location must be different from the source
Try another disk as the target.

The disk drive is an invalid disk
The disk can't hold the program.
Try a different disk drive.

There is not enough space
There is not enough room on the hard drive for the program.
You will need to clear enough room for the program.

Unable to create specified path
You may have typed in the wrong path.
Retype the path.

Unable to copy, compress, or delete file
The file is missing or corrupted on the disk.
You may need a new copy if installing.

During the Program

There is not enough memory...
You may not have enough RAM.

H
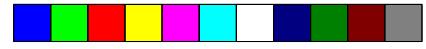
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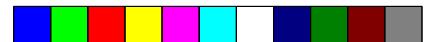
4

Using the Program

- **Screen Layout**

- **Navigating**

- **Math Reference Tool**

- **Glossary**

- **Hotwords**

- **Printing**

- **Exiting**
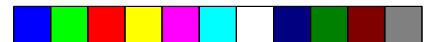
Screen Layout

A typical screen is organized like this:
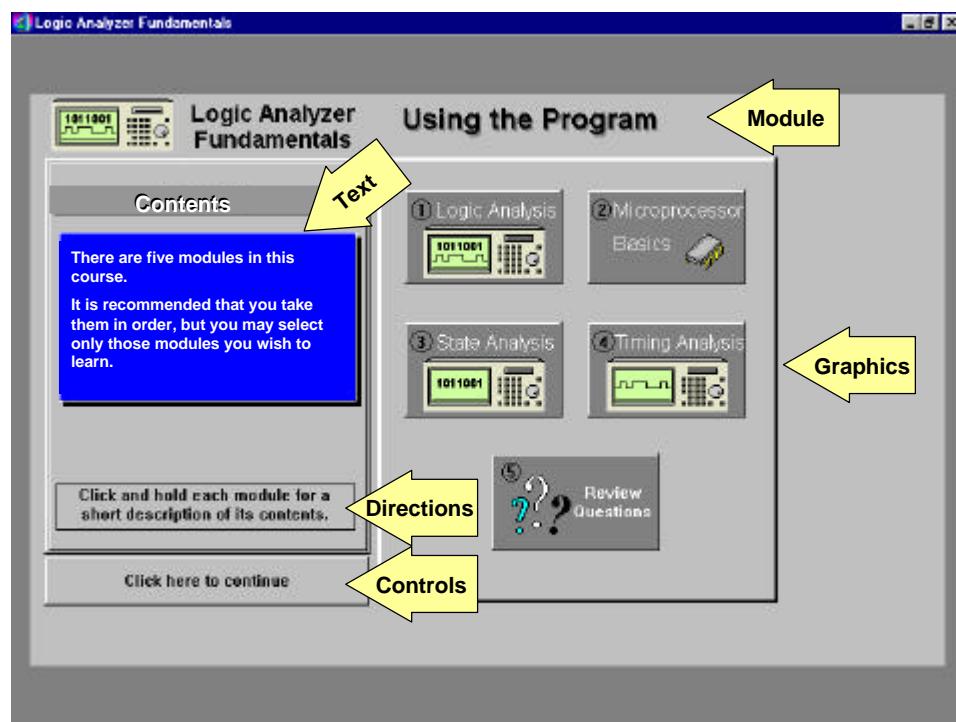
Text
Provides instruction,
description, or questions.

Module
Tells you which module you're
currently working with.

Directions
Shows you where to click.

Controls
Provides navigation
through the course.

Topic
A short description of
each page

Graphics
Illustrates the meaning
of the text.
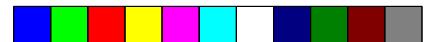
Navigating

These five controls are used to navigate through *Logic Analysis Fundamentals.* They are grouped together in a row on the lower left hand part of the screens.

Control your course by pressing these buttons:
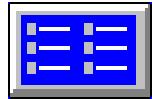
Returns you to the main menu.

Returns you to the previous screen.

Takes you to math reference tool.

Advances you to the next screen.
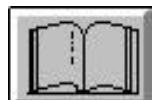
Takes you to the glossary.

Returning

The glossary and math reference tool buttons will take you to those parts of the course for review or reference. You can return from these sections to the exact location you left at any time by clicking on the **Return** button.

4-3
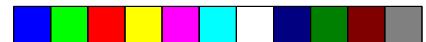
Math Reference Tool

The math reference tool provides additional information about the mathematical information and descriptions presented in the material. The math reference tool is not always active. When it is active, click on the math button to reference more material.

Glossary

The glossary alphabetically lists and defines all the technical logic analyzer terms presented in the course. Each screen in the glossary covers listings under letters of the alphabet (the first screen covers A-B, the second C-D, and so on except for the last, which covers W-X-Y-Z).

A column of tabs which you can click to select any letter you want is provided on the right side of each glossary screen.

Scroll the glossary page up and down to run through all the listings for the letter pair selected.

To move to the listings for the next or previous screen, you can also click the page-ahead or page-back arrow at the bottom of the screen.

Clicking on the **Return** button will place you exactly where you were in the course before you entered the glossary.

4-4
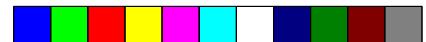
Hotwords

Technical terms concerning logic analysis may be hotwords. Clicking on a hotword will display a short definition of the term. The cursor will change from an arrow to a pointing hand when positioned on a hotword. The hotword will also be underlined in the text. (The glossary normally contains more information.)

Printing

To print a screen, press **Ctrl**-**P** and select **Print**.

Exiting

You can exit the program from any screen by selecting the system menu box from the upper left corner and selecting **<u>C</u>lose** from the menu.

You can also exit by using the **<ALT>** + **<F4>** combination.

4-5
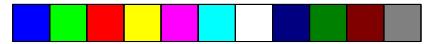
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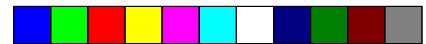
H

5

Course Contents

- **Module Descriptions**

Module Descriptions

The course provides basic understanding of the terminology and functions of logic analysis.

There are five modules (not counting Using the Program, which describes how to use the course). We recommend that you take them all in order, but you may also choose to take only the specific modules you want to learn.

Module 1 **Logic Analysis**
introduces logic analysis basics.

Module 2 **Microprocessor Basics**
explains microprocessor operations, busses, and the peripheral interface.

Module 3 **State Analysis**
explores the use of the logic analyzer as a state analyzer.

Module 4 **Timing Analysis**
demonstrates the logic analyzer as a timing analyzer and introduces glitch detection.

Module 5 **Review and Quiz**
asks questions to check your understanding of the material.
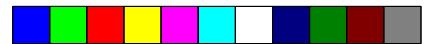
6

Appendix

- **Glossary of Logic Analysis Terms**

Glossary of Logic Analysis Terms

A

Acquisition buffer
Data storage for logic analysis measurements.

Address bus
The address bus is used to specify a memory or I/O element for data exchange.

Analyze and display
Analyze the stored data and display the results.

Arithmetic logic unit (ALU)
The ALU or arithmetic logic unit contains the shift registers, accumulators and control activity to perform arithmetic and logic operations.

Asynchronous
Asynchronous activity refers to logic signals that are not referenced to other timing signals and therefore cannot be predicted.

B

Bus
Transfer media for either data, address, or control information.

C

Comparator
A converter circuit which compares the measured voltage with a reference value and provides a voltage output corresponding to either logic "1" or logic "0".

6-2
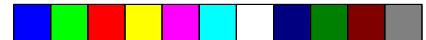
Glossary of Logic Analysis Terms

Capturing and storing data
Capture the digital wave forms and store them as data.

Clock signal
The clock signal provides timing information to convert voltage
levels to digital data.

Control bus
The control bus contains lines for command and timing.

Control unit
The control unit receives and decodes the next program instruction.

D

Data bus
The data bus provides a data path between the microprocessor
and memory or I/O.

Decoder
A decoder decodes the address and selects the appropriate
memory or I/O element.

Digital circuit wave forms
A wave form which produces data continuously.

Display buffer
The measurement data is transferred to the display buffer for
examination by the user.

Device under test (DUT)
Can be any device which emits a series of electronic signals.
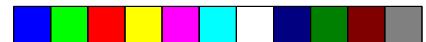
Glossary of Logic Analysis Terms

E-F

No entries for these letters

G

Glitch
A glitch is an unwanted threshold transition due to crosstalk or circuit noise which causes an incorrect logic transition.

Glossary button
Pressing the glossary button takes you to the glossary.

H

Handshake protocol
A sequence for data transfer between two devices.

Hotwords
Hotwords are underlined in text. The cursor changes to a hand when it touches a hotword.

I

Internal bus
The internal bus handles the communication media between the data, control, and address busses.

Interrupt request
The interrupt request is a signal to stop or pause the current process.

6-4

Glossary of Logic Analysis Terms

Inverse-assembler
Inverse-assembler capabilities allow logic analyzers to display the actual assembly language code executed by the micro-processor system.

J-K

No entries for these letters

L

Latch circuit
The latch circuit combines a digital voltage level with a sampling clock signal to produce a data bit.

Logic analysis
Logic analysis is the process of measuring and evaluating digital circuit wave forms.

Logic Analyzer
A Logic Analyzer measures and analyzes digital circuit wave forms from a device under test or DUT.

Logic state
A state of either "on" or "off", 1 or 0, respectively.

Logic threshold
A reference level by which digital wave forms are measured.

M

Main menu button
Pressing the main menu button returns you to the main menu.
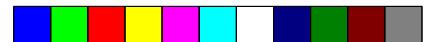
Glossary of Logic Analysis Terms

Math reference tool
The math reference tool provides additional information and
explanation about the material.

Math reference tool button
Pressing the math reference tool button gives more math information.

Measurement channel
A complete measurement will consist of some combination
of channel inputs displayed by the logic analyzer.

Memory buffer
A storage container used after each sample comparison which
assigns a logic value of either "1" or "0".

Microprocessor
The microprocessor system, or microcomputer, contains all
the elements needed to run a program and communicate with
peripheral devices.

N

Next button
Pressing the "next" button takes you to the next page.

O

No entry for this letter

6-6

Glossary of Logic Analysis Terms

P

Peripheral Interface Adapter
The Peripheral Interface Adapter (PIA) manages communication
between the microcomputer and peripheral devices such as
printers, disk drives, monitors, and keyboards.

Previous button
Pressing the "previous" button returns you to the previous page.

Probe
A device for reading electronic signals from a device and transmitting
the signals to the logic analyzer.

Q

No entries for this letter

R

RAM
Random Access Memory

Read
Data input from a device.

Reference level
The reference level may be adjusted to correspond to TTL, ECL,
or other types of logic systems.

Register
The register section contains specialized and general purpose
registers necessary for executing software program instructions.

6-7
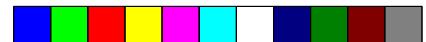
Glossary of Logic Analysis Terms

Reset
A signal sent to the microprocessor to coordinate the timing
of the clock signal.

ROM
Read Only Memory

S

State analysis
State analysis is measuring and displaying logic states or
conditions occurring on a device under test.

Status signals
Status signals indicate the state of the device, whether it is ready
or not ready for data transfer.

Synchronous
Synchronous activity refers to logic signals that are referenced
to other timing signals and are predictable.

Synchronizing signal
A signal sent to the microprocessor to coordinate the timing
of the clock signal.

T

Timing analysis
Timing analysis of measurements provides timing information
about logic states and their transitions.

6-8
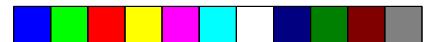
Glossary of Logic Analysis Terms

Timing relationship
Measurements of a number of input channels are measured
with an accuracy determined by the resolution of the sample
clock period.

Trigger event
A trigger event is a specific and pre-programmed data sequence.

U-V

No entries for these letters

W

Write
Data output to a buffer, display screen, or storage media.

X-Y-Z

No entries for these letters

H

Blank