

Distributed By:  
Signal Test, Inc  
1529 Santiago Ridge Way  
San Diego, CA 92154  
Tel. 1-619-575-1577 USA  
www.SignalTestInc.com  
Sales@SignalTestInc.com



# Embedded Systems Design Series

## Digital Logic Trainers

### DL-030 Microprocessor Design Trainer



With the DL-030 Embedded Systems Design Trainer you will:

Learn general FPGA design, prototyping and testing

Have a fully functioning microprocessor or microcontroller in minutes

Third in its series of embedded systems design trainers, Global Specialties' DL-030 teaches students the advanced concepts of embedded systems control via designing and implementing microprocessors/microcontrollers on an FPGA.

The Embedded Systems Design Trainer is specifically engineered with classroom/lab learning in mind. Written by an instructor, the Student Trainer Lab Manual serves as a supplementary textbook covering essential microprocessor design topics such as data path and control unit design. With 11 hands-on labs, students will gain a solid understanding of advanced embedded systems design in an FPGA environment.

Global Specialties has created the perfect classroom tool by putting together everything you need to implement custom designed microprocessor circuits in one complete and easy-to-use trainer. Using system-on-a-programmable-chip (SOPC) framework, every aspect of the DL-030 is designed for students to get right to the business of learning embedded systems control designs.

Utilizing the DL-030 and Altera Quartus® II software, one can carry out general FPGA design, prototyping and testing, or you can continue with the Nios® II embedded design suite to successfully implement a fully functioning microprocessor or microcontroller in minutes.

#### Features:

- 137-page professionally written lab manual by university professor, Enoch Hwang, PhD with 11 hands-on labs correlated to any textbook for microprocessor design training.
- iPad version of manual available on iTunes
- Works with any Windows XP or higher system (32-bit only)
- Sturdy blow molded carrying case makes the entire lab lightweight and portable.
- 16 LED's
- 3, 7-segment displays
- 16 slide switches and 3 push-button switches
- Expandable breadboard allows the system to grow as students' knowledge increases.
- 4 each, regulated 5V power (Vcc) and ground (GND) points
- 8 input/output connection sockets
- 2-year warranty on all parts and workmanship



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## Digital Logic Trainers

DL-030

### Specifications

<i>Model DL-030</i>	
<b>FPGA</b>	Altera Cyclone®III EP3C16F256C8N 16k LE
<b>Microprocessor</b>	Altera Nios® II embedded processor
<b>Logic Indicators</b>	16 independent LED's
<b>Seven-Segment Displays</b>	Three sets of independent 7- segment displays
<b>Slide Switch</b>	16, debounced
<b>Push Button Switch</b>	3, debounced
<b>Clock</b>	16 MHz
<b>I/O</b>	8-pin general purpose
<b>Bread Board</b>	27 tie point
<b>Tie Points</b>	4-input 5Vcc 4-input GND
<b>Machined Pin Connecting Wires</b>	100 pcs
<b>USB Interface</b>	USB extension cable
<b>Physical Dimensions (H x W x D)</b>	3.5 x 13.5 x 8.5" (8.9 x 34.3 x 21.6 mm)
<b>Weight</b>	3.4 lbs (1.54 kg)
<b>Training Manual with Hands-On Exercises</b>	137 page manual 11 hands-on labs
<b>System Requirements</b>	Windows XP or higher (32-bit only) 256 MB Ram 800 MHz CPU Approximately 5 GB free hard-disk space Internet Access
<b>Software CD</b>	Quartus® II Design Software ModelSim®-Altera VHDL and Verilog HDL Simulation Tool SOPC Builder® MegaCore® IP Library Nios® II Embedded Design Suite DSP Builder

### Training Manual

- Chapter 1:** Microprocessor Design Trainer  
Microprocessor Design Trainer  
Hardware  
System Requirements  
Quartus II Development Software  
Installation  
Driver Installation  
Testing the Microprocessor Design  
Trainer Board
- Chapter 2:** Microprocessor Circuits  
Datapath  
Control Unit
- Chapter 3:** Datapath Design  
Register Transfer Level  
Problem Specification  
Selecting Registers  
Selecting Functional Units  
Data Transfer Methods  
Generating Status Signals  
Control Words  
Examples of Datapath Design
- Chapter 4:** Control Unit Design  
The State Diagram  
Examples of Control Unit Design
- Chapter 5:** Microprocessor Design  
Examples of Microprocessor Design
- Chapter 6:** Labs  
Quartus II Development Software  
Implementing a Circuit in Hardware  
Counting from 1 to 10  
Countdown from Input n  
Count and Sum  
Greatest Common Divisor  
Summing Input Numbers  
Finding the Largest Number  
Hi-Lo Number Guessing Game  
The EC-1 General Purpose  
Microprocessor  
The EC-2 General Purpose  
Microprocessor

Appendix A: FPGA Pin Mapping

## Microprocessor DesignTrainer



WARRANTY



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