LabSmith LC880

Programmable Experiment Controller

- Complete toolkit for timing and triggering laboratory experiments
- Eight channels of agile digital delays, timers and clocks
- Easy to use Windows- or LabView-based programming and operation
- Sophisticated logic, gating and filtering
- 10 ns resolution and 100 ps accuracy
- Field-updatable software and firmware

Controlling and synchronizing experimental equipment can be tedious. Researchers are regularly forced to build controls from scratch or to piece together systems from costly but limited tools on the market. For every hour of true research, a hundred hours are lost to tracking faulty cables, taming noisy signals, adjusting quirky timing and other aggravating chores.

LabSmith designed the LC880 to coordinate, integrate and synchronize complicated physical experiments, simply, reliably and affordably. Featuring eight timing channels with programmable trigger logic, unique timing modes and 10 ns resolution, the LC880 outperforms a rack full of delays, gates, timers, filters and cables – all for the price of a single delay generator.

Innovative Software, Unique Controller

The LC880 consists of both ground-breaking software and a programmable hardware controller. Trigger™ experiment design software makes it easy to create sophisticated control schemes from a PC, with a built-in compiler that can accept C-style assignments and operations.

The LC880 hardware controller can function as part of a computer-based control system using Trigger or LabView,™ or it can operate in stand-alone mode. With the LC880 linked to your computer, you'll quickly program, refine and expand experiments. Using stand-alone mode, you can store and recall up to 64 complete settings, then trigger and monitor an experiment from the LC880's front panel. You'll have the flexibility to design experiments offline, then to embed the controller in your test environment for "set and forget" operation.

A Rack Full of Timing in a Single Box

With a single LC880 you can synchronize cameras, lasers, shutters, choppers, solenoids, igniters, etc. Each of the eight logic channels can operate as a clock, delayed trigger, counter, and more, all with 10 ns resolution and programmable trigger logic.

What's more, the LC880 brings you functions that are simply not available elsewhere. "Dynamic delay triggering" lets you reliably capture elusive phenomena, basing its delay on a real-time measurement. This unique mode lets you control uncertain timing situations, such as synchronizing a flash lamp to a passing projectile, or timing the spark in a cyclic combustion system. Another mode, false-trigger suppression, helps control noisy signals and prevents unwanted triggering in sub-optimal environments. You can even employ safety interlocks and switches to toggle between operating modes (free-run, single-shot, calibration), all without jumper cables or external logic.

A Wealth of Applications, the Price of a Single Delay

The LC880 is field-proven daily in gas dynamics, fluid flow, and material science experiments at national research facilities and major universities worldwide. In applications from gas dynamics to fracture mechanics, the LC880 is earning its place among function generators, oscilloscopes and power supplies as an indispensable lab tool.

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LabSmith LC880: Experime

Capability Beyond the Digital Delay Generator

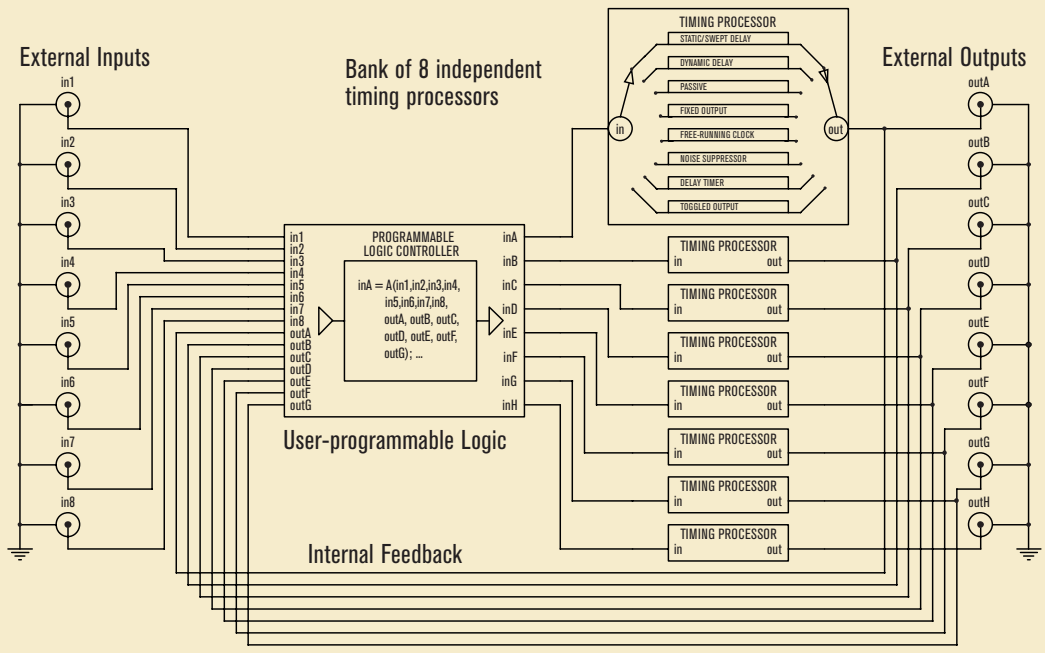
Delay generators with simple gating functions have been available for years. The LC880 surpasses those systems by leaps and bounds. The system integrates a unique programmable-logic front end to an array of intelligent timing processors. External inputs and outputs feed a parallel logic processor, with throughput time < 11 ns. Software-programmable feedback between channels permits the simple implementation of sophisticated controls.

Agile Processor, Clever Timing

The LC880 logic processor is engineered for fast data throughput (11 ns) and minimal throughput spread (~1 ns). External cabling and hard-wired logic simply can't match the logic processor's speed. The eight digital timing processors may be independently programmed to operate in any of the following modes:

- Delayed-Pulse Mode: a pulse of specified duration (8 µs to 1370 s) after a specified delay (50 ns to 1370 s).
- Dynamically Delayed Pulse Mode*: the processor measures the delay between successive inputs, calculates an output-pulse delay, then supplies an output pulse after the calculated delay, with < 20 ns uncertainty.
- Toggled Output Mode: the channel toggles output with each trigger signal.
- Noise-Suppression Mode*: the processor supplies an output pulse only after its input has remained high for a definable duration. This unique timing mode guards against false triggers by noise glitches.
- Fixed Mode: output is either high or low, regardless of input.
- Passive Mode: output is equal to its input, or the inverse of its input.
- Clock Mode: a repetitive pulse train with specified high- and low-state durations up to a frequency of 780 kHz.
- Timer Mode: the processor measures, reports and stores the delay between successive inputs, with < 20 ns uncertainty.

*Unique to the LC880



LC880 architecture: 8 inputs, timing channels, and outputs with trigger signal logic and routing.

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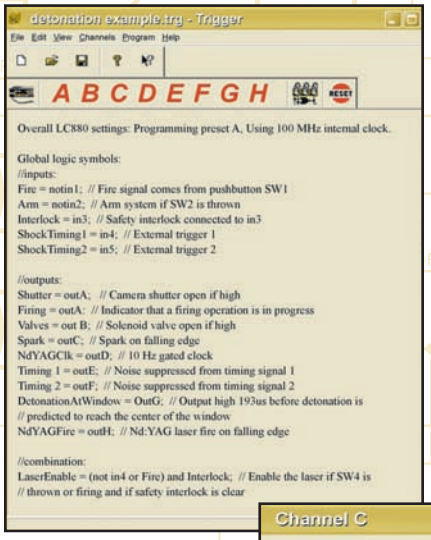
Applications

- Gas Dynamics
- Fluid Flow
- Material Science
- MEMS/BioMEMS
- Fracture Mechanics
- Photonics
- Life Sciences

Simplified Programming

Trigger software makes it easy to start creating sophisticated control schemes. The Windows® user interface lets you program each experiment, channel by channel. You can set all logic using C-style syntax for quick composition. Onboard diagnostics and debugging, and extensive Help files, tutorials and sample files will help you get started quickly. LabView drivers are available for easy integration with other lab equipment.



Programming in Trigger: Sample file in which an LC880 controls a camera shutter, two solenoid valves, a spark plug, and a Nd:YAG laser for a detonation experiment.

Examples from the Field

Two examples will help to illustrate the extent of the LC880's capabilities.

In a two-pulse experiment, two lasers were fired in rapid succession to illuminate and capture successive snapshots of a high speed fluid flow. The LC880 handled all aspects of the experiment, from warming up the lasers to precisely timing the nano-second-scale pulses. Using the LC880's onboard logic, the experimenters implemented special "alignment" and "calibration" modes for preparing the experiment and "laser ready" interlocks for safety.

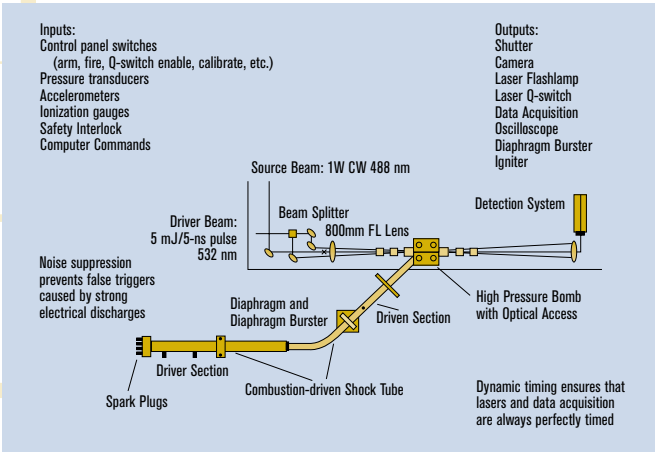
In a second example, a combustion-driven shock tube was used to study high speed gas flows. The LC880 was the heart of the experiment, taking charge of ignition, pressure sensing, detonation, laser timing, data acquisition and more. By controlling multi-million dollar experimental apparatus day in and day out, the LC880 has earned the respect and trust of renowned researchers worldwide.

Trigger timing modes can be programmed via dialog controls. Logic is programmed using C-style syntax.

Support

LabSmith is dedicated to the advancement of scientific experimentation. Our products are thoughtfully designed to enter service right out of the box and to endure years of use and abuse. Every LabSmith product comes with extensive documentation, support files, and tutorials that guide you from simple tasks through complete implementations. And we back every product with a full 1-year warranty.

In research facilities around the globe, experimentalists are shaping the future. At LabSmith, we're building products that help them achieve their goals.



The LC880 in the field: controlling an optical diagnostics experiment in a combustion driven shock tube.

LabSmith LC880: Specifications

TIMING PROCESSOR

Property	Min	Max	Typ	Notes
Trigger-pulse delay	50 ns	1370 s	–	delays over 20 s have 640 ns timing resolution
Trigger-pulse duration	7.7 µs	1370 s	–	durations over 20 s have 640 ns timing resolution
Delay resolution	10 ns	10 ns	–	
Duration resolution	10 ns	10 ns	–	
Delay jitter from asynchronous source	–	10 ns	–	
Delay jitter from internal source	–	200 ps	50 ps	
Absolute timing accuracy	–	0.01%	0.001%	0 to 50° C
Internal timing	1.5625 MHz	100 MHz	–	
External timing	1 MHz	100 MHz	–	
External trigger pulse duration	50 ns	–	–	

LOGIC PROCESSOR

Property	Min	Max	Typ
Inputs	–	–	8 external and 7 internal
Outputs	–	–	8 internal (to timing processors)
Throughput delay	–	11 ns	10 ns

ELECTRICAL CHARACTERISTICS

Property	Min	Max	Typ	Notes
Input impedance	–	–	4.7 kΩ	DC
Input capacitance	–	–	20 pF	
Output voltage levels:				TTL-compatible
Logical high	3.5 V	4.9 V	4.5 V	1 kΩ load
Logical low	0.0 V	0.2 V	0.1 V	
Output source/sink currents:				
Logical high	32 mA	–	50 mA	Short-circuit current
Logical low	64 mA	–	80 mA	Short-circuit current
Output rise time	–	–	10 ns	1 kΩ load
Input/output voltage protection	–30 V	+30 V	–	

PHYSICAL DIMENSIONS

Property	Typ	Notes
Width	208 mm (8.2")	black enamel-coated anti-RFI steel enclosure
Length	242 mm (9.5")	electrostatically shielded
Height	60 mm (2.4")	

POWER REQUIREMENTS

Property	Min	Max	Notes
Voltage	–	100–250 VAC 50–60 Hz	external male AC connector with fuse, internal cooling fan
Current	0.5A	–	internally fused DC supply

PROGRAMMING REQUIREMENTS

- Standard RS-232 interface, (e.g., external IBM PC-compatible COM port)
- 38400 baud, 1 stop bit, no parity, RTS/CTS (hardware) flow control
- Unit is supplied with cable for 9-pin D connector

SOFTWARE REQUIREMENTS

- PC-compatible computer
- Trigger software for Windows 95, NT, Me, 2000, XP or later, included
- LabView drivers available
- Other environments: Call for details

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Visit our website at www.labsmith.com for information on the LC880 and other LabSmith products. Try our Trigger software at www.labsmith.com/downloads

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