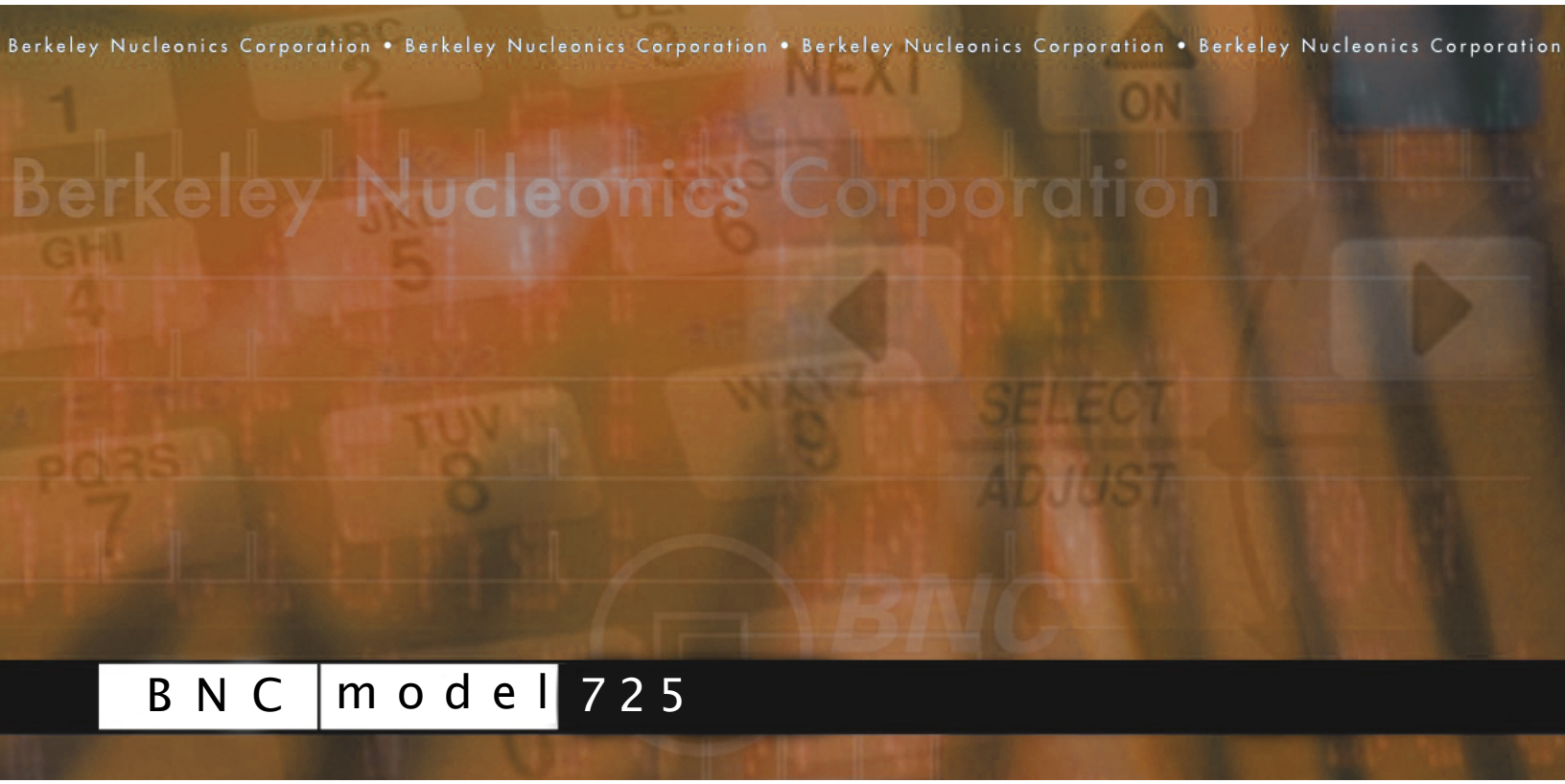
Multi-Trigger Digital Delay Generator

FAST ComTec GmbH



APPLICATIONS:

- Control and time experiments quickly and easily.
- Eliminate delays, gates, timers, filters and cables.
- Designed by experimenters for experiment control.
- Warmup, interlock, arm, sync, digital delay, trigger

BNC model 725

Overview

Researchers and system integrators, needing controls and diagnostics for their experiments and systems, are regularly forced to build from scratch or to piece together several boxes. Many hours are spent learning the idiosyncrasies of each box and how to properly couple boxes to each other. Each box has its own programming protocol. Valuable time is lost to tracking connections, taming noisy signals, adjusting timing on multiple boxes and other aggravating chores. Now one box will eliminate much of this.

The Model 725 coordinates, integrates and synchronizes complicated setups, simply, reliably and affordably. Featuring eight timing channels with programmable logic, unique timing modes and 10 ns resolution, the Model 725 outperforms a rack full of instruments, specialized boxes, filters and cables. Inputs can be logic signals, switches, transducers, interlocks, computer commands and gauges. The Model 725 can be programmed and controlled easily via Labview or Windows. It contains sophisticated logic, gating and filtering. It has eight inputs, eight outputs and eight separate timers.

A Rack Full of Timing in a Single Box

With a single Model 725 you can synchronize cameras, lasers, shutters, choppers, solenoids, igniters, etc. You can even employ safety interlocks and switches. A wide variety of operating modes facilitate operation without jumper cables or external logic.

Each of the eight logic channels can operate independently. It can function as a clock, delayed trigger, counter, and more, all with 10 ns resolution and programmable trigger logic. You may use its internal clock or your own external clock (where you can control several Model 725's from the same timebase). You may also select the timebase that a channel uses – external or internal. What's more, the Model 725 brings you functions that are simply not available elsewhere. "Dynamic delay triggering" lets you reliably capture elusive phenomena, changing its delay after 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 suppress unwanted triggering. A sweep mode allows incrementing delay with each trigger. A channel can also be triggered N times then stop or it may skip N triggers before providing outputs.

Eight timers – selectable modes for each

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 after a specified delay
- 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 (TDC) Mode: the processor measures, reports and stores the delay between successive inputs, with < 20 ns uncertainty.

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INTERNAL TIMING PROCESSORS

PROCESSOR MATRIX
Independent Timing; each timing processor operates in its own mode. Logic Statements (OR, AND, XOR, Negated, etc...) can be used to create combinations of external inputs and external outputs. The Rear Panel input and output jacks are the combinatorial logic inputs to the timing processors.

FRONT PANEL

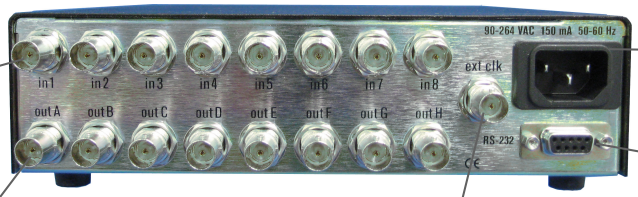
POWER BUTTON
Multi-Function (Powers Unit, Initiates a Diagnostic, Enable/Disable Indicator for Front Panel Controls)

FUNCTION BUTTONS
Pairs with a channel

CHANNEL LED
Indicates State (Disabled, Trigger Ready, Triggered)

ALL LED
Indicates Status for All Channels (responding to external input with active outputs, won't respond to external inputs with fixed outputs

REAR PANEL



INPUT CONNECTORS
Eight BNC Channel Input Jacks

POWER IN
An internally-fused jack for a standard 100-250VAC IEC power cord

OUTPUT CONNECTORS
Eight BNC Channel Output Jacks

CLOCK SOURCE
A BNC input jack for an external clock source

COMMUNICATIONS
A 9-Pin RS-232 jack to connect to the COM port of your PC

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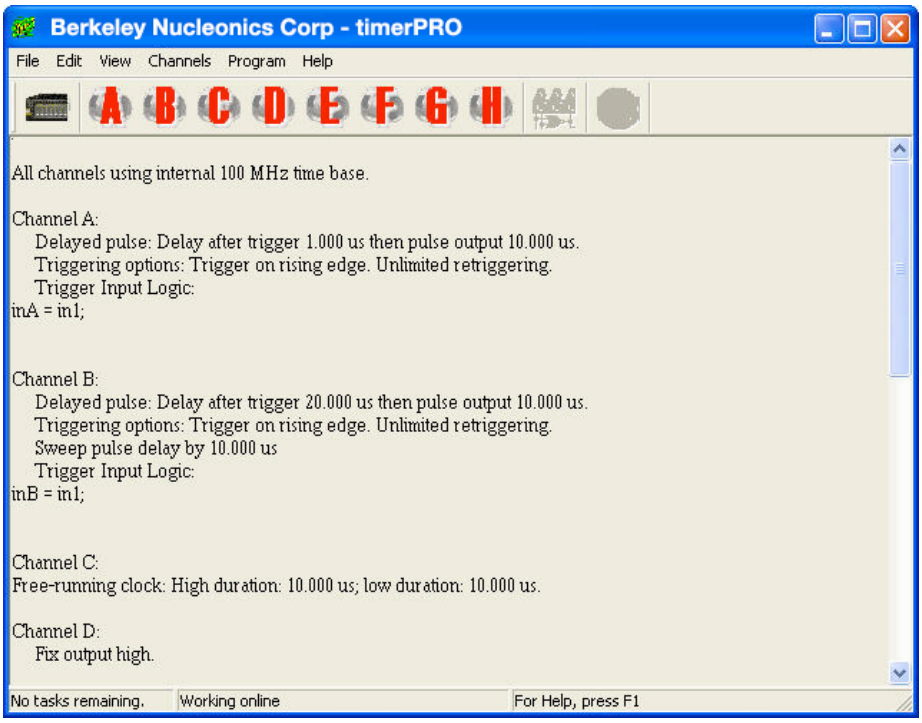
The Model 725's logic is engineered for fast data throughput (11 ns) and minimal throughput spread (~1 ns). It would be difficult to match this performance with external cabling and hard-wired logic.

Innovative Software, Unique Controller

The Model 725 hardware controller can operate in stand-alone mode or via computer control. The computer control system uses its own user-friendly software, timerPRO, or LabView,™ both tested and proven in many experiments. timerPRO makes it easy to create sophisticated control schemes from your PC. With the Model 725 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 Model 725'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. The firmware in the Model 725 is field upgradeable, allowing access to new timing modes and capabilities as they become available.

timerPRO's GUI - The Windows User Interface opening window.



timerPRO displays each Channel's properties – its clock source, the timing mode, its output configuration and its input logic configuration.

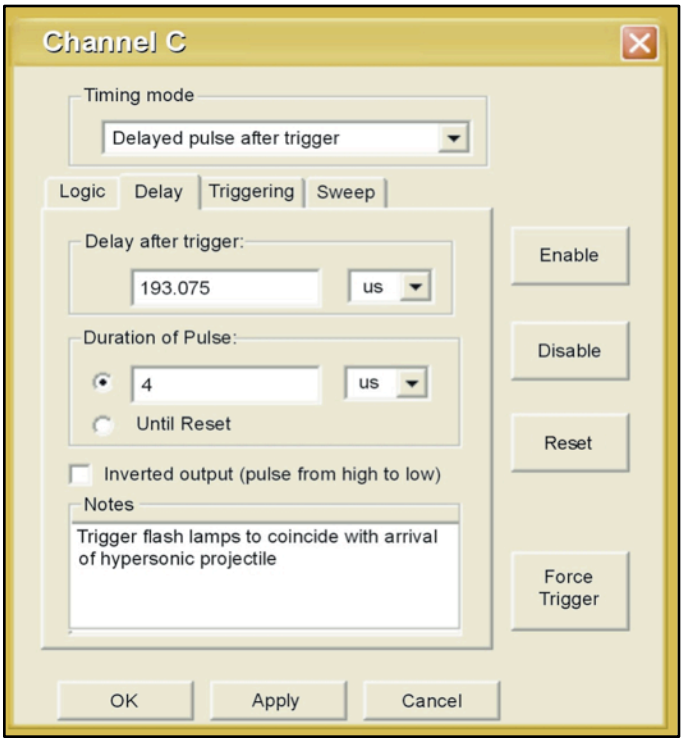
A controller that also provides Digital Delays

Delay generators have been available for years. They use a single trigger with a common clock to synchronize multiple events and cannot be retriggered until the completion of the longest timed event. The Model 725 uses 8 triggers and 8 timers and 8 outputs. The triggering of each of these timers is independent of the other timers. The triggers can be logical combinations of inputs and outputs – AND's, OR's, XOR's and Negated. Also the any number of timers can be triggered together to function as a traditional multi-channel digital delay generator.

Simplified Programming

Both Labview drivers and an embedded compiled software package "timerPRO" makes it easy to create 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.

See examples of a Channel Menu and a User File below. Note the Functions within each channel include: Enable/Disable inputs or outputs, Skip N triggers before channel triggers, Retrigger N times and then stop, Alert Computer upon completion of the cycle, Sweep - select the delay increment with each trigger



Tabs for Channel Settings: 1. Logic sets combinatorial logic for timers. 2. Delay selects delay, width, inverted pulse. 3. Triggering can be normal, skip N triggers, retrigger N times. 4. Sweep selects delay increment per trigger.

Some applications examples

Fluid dynamics:
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 Model 725 handled all aspects of the experiment, from warming up the lasers to precisely timing the nanosecond- scale pulses. Using the Model 725's onboard logic, the experimenters implemented special "alignment" and "calibration" modes for preparing the experiment and "laser ready" interlocks for safety.

High speed gas flow:
A combustion-driven shock tube was used to study high speed gas flows. The Model 725 was the heart of the experiment, taking charge of ignition, pressure sensing, detonation, laser timing, data acquisition and more.

Inputs: Control panel switches, pressure transducers, accelerometers, ionization gauges, safety interlock, computer commands Outputs: Shutter, Camera, Laser Flashlamp, Laser Q-Switch, Data Acquisition, Oscilloscope, Diaphragm Burster, Igniter

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TIMING PROCESSOR

PROPERTY	MIN	MAX	TYP	NOTES
Trigger-pulse delay	50 ns	1370s	_	delays over 20 s have 640 ns timing resoltuion
Trigger-pulse duration	7.7 ms	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

PHYSICAL DIMENSIONS

PROPERTY	MIN	NOTES
Width	208 mm (8.2”)	black enamel-coated anti RFI steel enclusure electrostatically shielded
Length	242 mm (9.5”)	
Height	60 mm (2.4”)	

ELECTRICAL CHARACTERISTICS

PROPERTY	MIN	MAX	TYP	NOTES
Input impedance	_	_	4.7kΩ	DC
Input capacitance	_	_	20 pF	
Output voltage levels				TTL-compatible
Logical high	3.5 V	4.9 V	4.5 V	1kΩload
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	1kΩload
input /ouput voltage protection	-30 V	+30 V	_	

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**

POWER REQUIREMENTS

PROPERTY	MIN	MAX	NOTES
VOLTAGE	_	100-250 VAC 50-60 HZ	external male AC connector with fuse, internal cooling fan internal fused DC supply
CURRENT	0.5 A	_	
Specifications Certification			CE

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