DT5800

Desktop Digital Detector Emulator

2	125 MHz	10 Mcps / 5 Mcps (Poisson)
Channels	D/A Sample rate	Maximum Rate

CAEN DT5800 is a dual-channel desktop digital detector emulator operating as a pulser, detector emulator or arbitrary waveform generator. It emulates energy spectra, time distributions, custom signal shapes, pile-up, noise, interference and baseline drift, with multiple shapes per channel for pulse shape discrimination. Its 12 ps/step programmable delay generator supports correlated signals on the two outputs. Outputs reach 2 V (4 V in high Z) at up to 10 Mcps, or 5 Mcps in Poisson mode. It provides 1M points of RAM per channel and USB 2.0 communication.

Overview

Product Highlights

- 2 Channels
- Energy spectrum emulation
- Custom signal shape emulation
- Noise and periodic interference emulation
- 12 ps/step programmable delay generator
- Multiple shape on the same channel for testing of pulse shape discrimination
- Nuclide Database
- Windows Software
- Pulser/Emulator/Function Generator operating modes
- Time distribution emulation
- Pile-up emulation
- Baseline drift
- Correlated signals generation on the two output channels
- Continuous and pulsed reset pre-amplifier emulation
- USB interface

Product Description

AT A GLANCE	
Channels	**2**
D/A Sample rate	**125 MHz**
Maximum Rate	**10 Mcps / 5 Mcps (Poisson)**
Multiple shapes on a single channel	**Yes (2 different)**
Minimum rising time (fast mode)	**8 ns**
Form Factor	**Desktop**

The CAEN **Mod.DT5800** is a **Dual Channel Detector Emulator**, an instrument for emulating in real time signals from generic setups for radiation detection, which can be operated as Desktop units. It shares the same functionalities as the NDT6800 and can operate in three modes: Pulser Mode, Emulation Mode and Waveform Generator Mode.

The output generated by the device can go up to 2 V (4 V in case of high Z) and the maximum pulse rate is 10 Mcps (5 Mcps in Poisson statistics mode). In the detector emulator operating mode, the system is able to emulate with high accuracy a radiation detection system from the detector output to its related front-end electronics. The user can program different emulation parameters like signal shape distributions, energy spectra, time distribution, as well as noise characterization and baseline drift.

Thanks to the 12 ps/step delay generator they are particularly suited for timing application. Moreover, the multiple shapes capability can be used for pulse shape discrimination applications. The two channels can be correlated either with the same or different statistical distributions.

Operating modes:

- **PULSER**

Classic pulser operation. The system allows to set the signal amplitude, the signal rate, and to choose between constant and Poisson distributed rate.

- **DETECTOR EMULATOR**

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Overview (continued)

In the detector emulator operating mode, the system is able to emulate with high accuracy a radiation detection system from the detector output to its related front-end electronics. The user must provide: the signal shape distribution, the required energy spectrum, the time distribution, the noise characterization, and the baseline drift.
The signal shape can be generated either by using the system internal database, or using recorded shapes from the experimental setup. The same is true for the energy spectrum. It is possible to create several emission lines through the tool itself, or to import a file in the format of **CVS/ANSI N42.42**, or to use the internal database electronics. The user can choose a Poisson or any arbitrary time distributions. It is also possible to emulate white noise, 1/f noise, random walk, as well as interferences. The characterization of the baseline drift can be also added.

- **CORRELATED EVENT GENERATOR**

The instrument allows to generate correlated events with fixed time shift (time steps of 12 ps). The two signals can have either the same or different statistical distributions. Furthermore, it is possible to generate a subset of events according to a fixed energy spectrum, being statistical uncorrelated from the background events.

- **ARBITRARY WAVEFORM GENERATOR**

The instrument comes with 1M points of RAM memory per channel to store and then reproduce the events from pre-defined functions.
The Desktop Digital Detector Emulator is available in dual channel (**DT5800D**) version **and allows the event correlation.**

USB 2.0 communication interface. Software tool compliant with Windows OS. Shape and spectrum files import from any Digital Pulse Processors, Digitizers, and oscilloscopes. Model shape generation (with no noise) from input waveforms.
Programmable digital outputs: Trigger in, Trigger out, and Gate.

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Technical Specifications

Energy emulation features

- Single line (65535 selectable levels)
- Spectrum emulation (16384 bins with 14 bit resolution)
- ± 4 V output range
- 16 bit D/A converter

Time emulation features

- Costant rate emulation
- Poisson distribution
- Programmable statistical generation of events (256 bins, 8 bit resolution)
- Up to 11 MCPS, both in costant and statistical emulation
- Integrator circuit emulation without pile-up limitation
- Up to 16 pile-up events in the memory based algorithm
- Programmable dead-time and emulation of parallelizable and non-parallelizable machines
- 20 ns to 10 ms exponential decay time

Signal shape

- 4096 points to store waveforms
- Arbitrarily programmable shapes
- Shape duration from 64 ns to 26 µs (w/o interpolation) / 26 ms (interp.)
- Separated rising and falling edge interpolation
- Up to two separate shapes mixed on the same channel with indipendent statistic

Noise emulation

- White noise emulation (BW 62.5 MHz)
- 1/f noise emulation
- Random Walk (baseline drift)
- Interference generation (e.g. possibility to record spikes from switching power supplies and inject in the output signal)
- Interference generated with fixed amplitude and frequency or randomly modulated in amplitude and injection time

Baseline

- Baseline drift programmable with arbitrary shape

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Correlated events emulation

- Three operation modes:
  1) Channel 1 (CH1) is the time shifted copy of Channel 2 (CH2) (12 ps step);
  2) CH2 has its own statistics generator (i.e. different spectrum, different noise, etc.) but is triggered by CH1 (delayed by 12 ps step);
  3) A third emulator channel (with separate statistic properties) generates correlated pulses for both CH1 and CH2. In this way, only some events of the two channels are correlated
- 12 ps step programmable delay (from 0 ps to 32 us), 18 FWHM, 60 ppm linearity
- Temperature stabilization of the delay line

Digital I/O

- 2-input and 2-output programmable
- Trigger out, analog saturation warning, machine overload sensing
- Trigger in, random number generetor control (reset / play / pause), gating, baseline reset

RNG (random number generator)

- 8 indipendent LFSRs with 64 bits generate the base for the statistical emulation
- Possibility to randomize the seeds of each RNG indipendently
- Possibility to inizialize the RNG with fixed seeds to get repetible sequences to test different processing architectures
- Generation of finite length streams of pulses to debug step-by-step the DUT

Programmable sequence

- 500 k points of memory/CH to store a sequence of pairs (energy, time of occurrence) to generate long predictable and defined sequences of pulses.

Arbitrary waveform generator

- 1 M points/CH to store any arbitrary waveform
- Function generation: sin, square, ramp, saw, pulse, sinc up to 10 MHz

Software and interfaces

- Windows based user interface managing more than one emulator
- USB 2.0 interface

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Ordering Information

ORDERING CODE	DESCRIPTION	STATUS
WDT5800DXAAA	DT5800D – Dual Channel Desktop Digital Detector Emulator with channel correlation	
WDT5800SXAAA	DT5800S – Single Channel Desktop Digital Detector Emulator	Obsolete

1. Ordering codes and descriptions are reproduced from the product record. Availability is confirmed at order entry.

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