DT5790

Dual Digital Aquisition System for Charge Integration and Pulse Shape Discrimination

The DT5790 is a dual digital acquisition system for charge integration and pulse shape discrimination in organic, inorganic and liquid scintillator detectors. It combines two 250 MS/s, 12-bit waveform digitizers with 2 Vpp input dynamics and adjustable DC offset, two ±4 kV, 3 mA (4 W max.) HV outputs, and low-voltage bias outputs of ±12 V and ±24 V for preamplifiers. DPP-PSD provides dual-gate charge integration, energy and PSD analysis, while oscilloscope, list and histogram modes support setup and acquisition. Coincidence, anti-coincidence and synchronization functions are included.

Overview

Product Highlights

- 2 x 250 MS/s 12-bit Waveform Digitizer
- 2 x HV bias outputs for detector driving up to ± 4 kV, 3 mA, (4 W)
- On-line Digital Pulse Processing for Charge Integration and Pulse Shape Discrimination (DPP-PSD)
- Energy and Time histograms and 2-D Scatter plots of PSD parameter
- Synchronization, coincidences & anti-coincidences capabilities
- Fully controlled by the CoMPASS Software
- USB and Optical Link communication interfaces
- Suited for detectors based on Organic, Inorganic and Liquid Scintillators
- 2 x Low Voltage bias outputs for preamps driving (± 12 V, ± 24 V)
- Oscilloscope operating mode for an easy setup and signal monitoring
- Waveform or lists of energy & time stamp (4 ns resolution) events
- Windows and Linux, 32 and 64 bit OS supported
- C/C++ and LabVIEW libraries for an easy interface to custom DAQ systems
- Firmware upgradeable

Product Description

The CAEN **Mod. DT5790** is a complete digital acquisition system for scintillators and other detectors. It is ideally suited for **Organic**, **Inorganic** and **Liquid Scintillators** coupled to photodetectors like **PMTs** and **SiPMs** whose pulses can be directly accepted by the board.

In a compact desktop form factor, the DT5790 houses:

- **2x 250 MS/s and 12-bit waveform digitizer** with single-ended analog inputs on BNC connectors. 2 Vpp of input dynamics and adjustable DC offset via a 16-bit DAC on each channel in the full range.
- **2x ±4 kV 3 mA (4 W max.) HV bias outputs** on SHV connectors for detectors driving. HV polarity NEGATIVE, POSITIVE or MIXED selectable by ordering options.
- **2x ±12 V 100 mA and ±24 V 50 mA Low Voltage bias outputs** on DB9 connectors for preamplifiers driving.

The DT5790 operates upon the **DPP-PSD** firmware, specially developed for **Charge Integration and Pulse Shape Discrimination**. DPP-PSD is based on an advanced on line **Digital Dual Gate Charge Integration** allowing an effective data analysis even at high count rate. It performs input signal baseline calculation, self-triggering and double-gate charge integration with programmable parameters, double integration of both prompt and total charge for Pulse Shape Discrimination and pedestal subtraction for energy calculation.

Thanks to the 2-input simultaneous acquisition, the DT5790 is able to manage coincidence and anti-coincidence between a pair of detectors, allowing the user, for example, to easily take advantage of background rejection or anti-Compton techniques.
The module has been designed to operate as a scalable multi-input multi-board acquisition system, offering synchronization capabilities. A CLK IN front panel connector is provided to synchronize the clocks from different boards, as well as digital I/Os can serve for trigger propagation and Start/Stop acquisition management.

Safety features allows the module to perform as a current generator and includes:

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Overview (continued)

- Over Voltage / Under Voltage alarms.
- Overcurrent / Over Temperature alarms (Kill or Ramp selectable esc modes).
- Channel Inhibit on DB9 and dedicated BNC connectors, configurable logic by panel switch.

The DT5790 houses **USB 2.0** and **Optical Link** interfaces. USB 2.0 allows data transfers up to **30 MB/s**. The Optical Link supports transfer rate of **80 MB/s** and offers Daisy-chain capability. Therefore, it is possible to connect up to 8 DT5790 boards can be connected in daisy chain to a single link of the A2818 PCI Controller or A4818 USB3-to-CONET adapter, while a maximum of 32 boards by the 4-link A3818 PCIe Controller.

Operating modes:

- Oscilloscope": makes possible to acquire waveforms, either input signals or the outputs of the internal digital filters, for monitoring and parameters tuning.
- "List": charge, PSD and time stamp are extracted from the pulses.
- "Pulse Shape Discrimination (PSD)": histogram of the total charge (16k) and 2-D scatter plot of PSD parameter are built at software level.

Software available (Windows and Linux)**:**

CAEN provides drivers for all the different types of physical communication channels, a set of C and LabView libraries (**CAENComm** and **CAENDigitizer**), demo applications and utilities:

- **CAENUpgrader**: tool that allows the user to update the firmware of the digitizers, change the PLL settings, load, when requested, the license for the pay firmware and other utilities.
- **CoMPASS**: Multiparametric DAQ Software for Physics Applications supporting CAEN digitizers, pulse processors and MCAs.

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Technical Specifications

Mechanical

Dimensions : 154 W x 50 H x 164 L mm³ (without connectors) 154 W x 50 H x 194 L mm³ (including connectors)
Weight: 950 g

Analog Input

Input Features
- BNC connector
- Single-ended, DC coupled
- Input range: 2 Vpp
- Impedance: 50 Ω
- Positive and negative signals accepted
- Bandwidth: DC to 125 MHz
- Programmable DC offset adjustment on each input in the full scale range

Number of Inputs
2

ADC

Resolution: 12 bits
Sampling Rate: 250 MS/s simultaneously on each channel

Digital Signal Processing

- Input baseline calculation and subtraction
- Manual trigger threshold adjustment
- Dual gate charge integration
- Pile-up detection and rejection
- Online PSD calculation
- Configurable PSD threshold for Neutron Gamma discrimination
- Time Stamp: 4 ns resolution, 32 bit

Preamplifier Power Supply

Preamp Features
- DB9 connector
- ± 12 V, 100 mA output
- ± 24 V, 50 mA output
- Output voltage tolerance: 2%
- Voltage ripple < 5 mVpp

Extra Features
- Aux. analog input: 0 ÷ 10 V
- Ext. input for detector's temperature readout

Preamp Outputs
2

High Voltage Power Supply

HV Features
- SHV connector
- 4 kV Vset, 3 mA Iset (4 W power limited)
- HV polarity configurable by ordering option
- Vset, Vmon resolution: 0.1 V
- Iset, Imon resolution: 0.05 µA
- User configurable Ramp-Up/Ramp-Down rates independently for each channel: 1÷ 500 V/s range in steps of 1 V/s
- User configurable HV parameters independently for each channel

HV Outputs: 2

Voltage Ripple
- 3 mVpp (Typ.), 5 mVpp (Max.) @ 1 kV/500 µA
- 3 mVpp (Typ.), 5 mVpp (Max.) @ 2 kV/1 mA
- 10 mVpp (Typ.), 15 mVpp (Max.) @ 4 kV/1 mA

Operating Modes

- Pulse Shape Discrimination (PSD): histogram of Total Charge (16k) and 2-D Scatter Plot of PSD parameter (built at SW level)
- List Mode: Total Charge, Prompt Charge and Time Stamp for each event
- Oscilloscope mode: input and internal filters waveforms

Trigger Modes

- Uncorrelated: each channel operates independently (basing on channel self-trigger)
- Correlated: coincidences & anticoincidences among channels AND/OR an external trigger (TRG IN)
- External: channels are triggered by external trigger only (TRG IN)

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Technical Specifications (continued)

Front Panel Digital I/Os	**CLK-IN (AMP Modu II)** AC coupled differential Input Clock: LVDS, ECL, PECL, LVPECL, CML (single ended NIM/TTL available by orderable cable); Jitter<100 ppm requested; can be used as external clock reference for single board or to synchronize the clocks of multiple boards, provided through a Fan In. **TRG-IN (LEMO)** External trigger Input: NIM/TTL, Zin = 50 Ω can be used either to force the event acquisition from all the board channels, or to GATE/VETO the individual channel self-triggers, or in coincidence/anticoincidence with the self-triggers, or to propagate the common trigger in multi-board synchronization (in combination with GPO) **GPO (LEMO)** General Purpose Output: NIM/TTL, Zin = 50 Ω can be used to propagate the global trigger in multi-board synchronization (in combination with TRG IN), as output register or Run ON/OFF status **GPI (LEMO)** General Purpose Input: NIM/TTL, Zin = 50 Ω can be used as SYNC/START in multi-board synchronization or Run ON/OFF control
Communication Interface	**Optical Link:** CAEN CONET proprietary protocol Up to 80 MB/s transfer rate Daisy-chain capability: it is possible to connect up to 8 or 32 ADC modules to a single Optical Link Controller (A2818 or A3838 respectively) **USB:** USB2.0 compliant, Up to 30 MB/s transfer rate
Firmware	Firmware upgradeable via USB/Optical Link
Software	• Controlled by the CoMPASS Software • For developers: general purpose C libraries with demo samples available
Power Requirements	**Operating Supply Voltage** +12 VDC ± 10% **Consumptions (@ +12 VDC)** 3.2 A(*) Typ. (± 10% tolerance) The module is powered by external AC/DC stabilized power supply included in the kit (12 VDC, 45 W) (*) *measured with maximum current charge on preamp outputs and 1kV/1mA (1W) charge on HV outputs*
Environmental	**Operating Conditions** • 0 – 50°C Temperature range • EMC compliant

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Ordering Information

ORDERING CODE	DESCRIPTION
WDT5790XMAAA	DT5790M – Dual Digital Pulse Analyzer – 1HVPS +4kV, 1HVPS -4kV, (3mA 4W), 2LVPS ±12V/100mA ±24V/50mA
WDT5790XNAAA	DT5790N – Dual Digital Pulse Analyzer – 2 HVPS -4kV/3mA (4W), 2 LVPS ±12V/100mA, ±24V/50mA
WDT5790XPAAA	DT5790P – Dual Digital Pulse Analyzer – 2 HVPS +4kV/3mA (4W), 2 LVPS ±12V/100mA, ±24V/50mA

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

Accessories

A317 — Cable assembly for Clock distribution 3-pin AMPMODU IV female terminations – 18 cm / 25cm

A318 — Adapter for Clock signal FISCHER S101A004 male to 3-pin AMPMODU IV female – 10 cm

DT4700 — Clock Generator and FAN-OUT

Software & Control Tools

CAEN Toolbox — Multi-Functional Software Suite for the Upgrade of Front-end Boards, Bridges and Power Supplies

CAENDigitizer Library — Library of functions for CAEN Digitizers high level management

COMPASS — Multiparametric DAQ Software for Physics Applications

Firmware

DPP-PSD — Digital Pulse Processing for Charge Integration and Pulse Shape Discrimination

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