DT5781

Dual/Quad Digital Multi Channel Analyzer - Desktop

4	16 K	DC
Inputs	Channels	Coupling

The DT5781 is a compact desktop digital multi-channel analyzer with four independent 16k MCAs; a two-channel DT5781A version is also available. Designed for high-resolution nuclear spectroscopy with HPGe, silicon, PMT and crystal detectors, it integrates 100 MS/s, 14-bit waveform digitizers with selectable input range, adjustable DC offset and digital fine gain. FPGA-based DPP-PHA firmware provides pulse-height, timing and waveform data, with PHA, list and oscilloscope modes. Two independent inputs support coincidence and anticoincidence measurements. USB 2.0 and Optical Link interfaces enable scalable multi-board operation.

Overview

Product Highlights

- Dual or Quad Independent 16k Digital MCA
- Fully controlled by the CoMPASS Software
- Features DPP-PHA firmware for energy and time stamp calculation
- Counting Rate up to 1 MCps
- Drivers, libraries and API for Windows and Linux 32/64-bit
- Suited for high resolution digital nuclear Spectroscopy
- Selectable Input Dynamic Range and adjustable Digital Fine Gain
- Digital oscilloscope function for an easy setup and signal monitoring
- USB and Optical Link communication interfaces

Product Description

AT A GLANCE	
Inputs	**4**
Channels	**16 K**
No. of LV Preamp. Outputs	**0**
Coupling	**DC**
Package	**Desktop**
No. of HV Outputs	**0**

The CAEN **Mod.DT5781** is a compact desktop system integrating **4 Independent 16k Digital MCA** for **digital nuclear Spectroscopy**. A version with **2 independent 16k MCA** is also available (**DT5781A**). It is ideally suited for high energy resolution semiconductor detectors, like HPGe and Silicon, connected to a Charge Sensitive Preamplifier (CSP) but it can also properly work directly connected to a PMT with inorganic scintillators (NaI, CsI) and other types of crystal, provided that the pulse shape is exponential and the decay time is long enough (typ. > 200 ns).

The module houses **4x (or 2x) 100 MS/s 14-bit waveform digitizer (based on 724 series)** on single-ended inputs with BNC connectors, featuring 4-step software configurable input range and adjustable DC offset via a 16-bit DAC on each input in the full range.

The DT5781 is equipped with a FPGA featuring the real-time Digital Pulse Processing for Pulse Height Analysis (DPP-PHA firmware) making the module a spectroscopy acquisition system providing energy (i.e. pulse height) and timing information as well as portions of the waveform and other traces for the fine tuning of the PHA settings.

Thanks to its two independent inputs of simultaneous acquisition, the DT5781 is able to manage coincidences and anticoincidences 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.

The DT5781 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 8/32 MCA modules to a single Optical Link Controller (Mod. A5818/A4818).

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Operating modes:

- “Pulse Height Analysis (PHA)”: pulse height histogram (1k-2k-4k-8k-16k) built at software level.
- “List mode”: pulse height and time stamp for each event.
- “Oscilloscope” mode: input and internal filters waveforms.

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, CAENDigitizer, CAENDPP), demo applications and utilities:

- CAEN Toolbox: GUI-based utility allowing users to update the firmware of digitizers, modify PLL settings, load licenses for paid firmware (when required), and access other useful features.
- CoMPASS: Multiparametric DAQ Software for Physics Applications designer for CAEN Digitizers running Pulse Shape Discrimination and Pulse Height Analysis, CAEN Pulse processors and MCAs.

Technical Specifications

Mechanical

Dimensions

- 154 W x 50 H x 164 L mm³ (without connectors)
- 154 W x 50 H x 183 L mm³ (including connectors)

Weight

- 800 g (DT5781 version)

Analog Input

Input Features

- BNC connector
- Single-ended, DC coupled
- Impedance: 1 kΩ
- Positive and negative signals accepted
- Programmable 4-step analog coarse gain (x1, x3, x10, x33) corresponding to 10 Vpp-3 Vpp-1 Vpp-0.3 Vpp
- Bandwidth: DC to 5 MHz
- Programmable DC offset adjustment on each input in the full scale range

Number of Inputs

- 4 inputs: DT5781
- 2 inputs: DT5781A

ADC

- **Resolution:** 14 bits
- **Sampling rate:** 100 MS/s simultaneously on each channel

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Digital Signal Processing

- Trapezoidal filter for the energy calculation with adjustable rise time in the range 0 – 10 µs and flat top in the range 0 – 5 µs
- Manual and automated trigger threshold adjustment
- Manual and automated Pole-Zero cancellation; decay time up to 6.5 ms
- Digital decimation in steps of 2-4-8 allows to extend the time parameters range
- Digital fine gain from x1 to x10 in steps of 0.01
- Pile-up rejection and Live Time correction
- Baseline restorer with programmable averaging
- Trigger and Timing filter based on integrative-derivative component
- Time Stamp: 10 ns resolution, 31 bit and rollover tracking event
- Adjustable moving average low pass filter to reduce the high frequency noise

Operating Modes

- Pulse Height Analysis (PHA): pulse height histogram (1k-2k-4k-8k-16k) built at software level
- List mode: pulse height and time stamp for each event
- Oscilloscope mode: input and internal filters waveforms

Trigger Modes

- Uncorrelated: each channel operates independently (based on channel self-trigger)
- Correlated: coincidence/anticoincidence among channels and/or an external trigger (TRG-IN)
- External: channels are triggered by external trigger only (TRG-IN)

Front Panel Digital I/O

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.

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 to force the event acquisition from all the channels of the board, to gate/veto the individual channel triggers, or to propagate the common trigger in multi-board synchronization (in combination with GPO).

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Technical Specifications (continued)

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 (A4818 or A5818 respectively)

USB

USB 2.0 compliant Up to 30 MB/s transfer rate

Firmware

- Firmware can be upgraded via USB/Optical Link

Software

- Fully controlled by CoMPASS Software
- For developers: general purpose C libraries with demo samples available

Power Requirements

- **Operating Supply:** Voltage +12 VDC ± 10%
- **Consumptions (@ +12 VDC):** 1.75 A (Typ.) for DT5781 (± 10% tolerance) 1.15 A (Typ.) for DT5781A (± 10% tolerance)

The module is powered by external AC/DC stabilized power supply included in the kit (12 VDC, 45 W)

Environmental

Operational Conditions
0 – 50°C Temperature Range – EMC compliant

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Ordering Information

ORDERING CODE	DESCRIPTION
WDT5781AXAAA	DT5781A – Dual Digital MCA
WDT5781XAAAA	DT5781 – Quad Digital MCA

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

A386 — AC coupler BNC female to BCN male

A387 — Input Filter cable BNC female to BNC male – 25 cm

A1422 — Low-Noise Fast-Rise-Time Charge-Sensitive Preamplifiers (Boxed)

A1424 — Scintillation Preamplifier

DT4700 — Clock Generator and FAN-OUT

Related Products

A4818 — USB 3.0 to CONET2 Adapter

A5818 — CONET2 Controller based on PCI Express Gen 3 interface

Software & Control Tools

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

CAENDPP Library — High level library for CAEN Digitizers running DPP firmware

COMPASS — Multiparametric DAQ Software for Physics Applications

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