CAEN
Tools for Discovery

725 - 730 Digitizer Families
16/8 Channel 14-bit 250-500 MS/s Digitizer

The perfect mix of sampling rate, resolution and channel density for the maximum flexibility

Today with the NEW DAW and ZLEplus DPPs!

Features

- **Resolution: 14-bit**
- **Sampling rate:**
  - 500 MS/s (730 family)
  - 250 MS/s (725 family)
- **Analog input on MCX coax. connectors**
- **VME64/VME64X (16/8 ch.), NIM (8 ch.) and Desktop (8 ch.) modules**
- **0.5 or 2 V$_{pp}$ input dynamic range with programmable DC offset adjustment**
- **Algorithms for Digital Pulse Processing and effective zero-suppression**
- **VME64/VME64X, USB and Optical Link communication interfaces**
- **Multi-board synchronization features**
- **16 programmable LVDS I/Os**
- **Daisy chain capability**
- **Demo software tools, DPP Control Software, CAEN Compass and MC^{2}Analyzer Software, C and LabVIEW libraries**

Applications

- Nuclear and Particle Physics
- Dark Matter and Astroparticle Physics
- Fast Neutron Spectroscopy
- Fusion Plasma Diagnostic
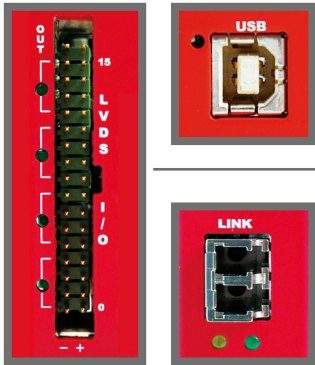- Environmental Monitoring
- Homeland Security

Overview

725 and 730 are two families of CAEN Waveform Digitizer able to perform basic waveform recording and run online advanced algorithms for digital pulse processing: charge integration and pulse shape discrimination with constant fraction timing (DPP-PSD), pulse height analysis (DPP-PHA), zero-length encoding (DPP-ZLEplus), and dynamic acquisition window (DPP-DAW). The wide selection of DPP algorithms supported by the two families makes the 730 and 725 a "must-have" for any kind of nuclear physics application.

Data is read by a Flash ADC, 14-bit resolution and 500 MS/s (x730) or 250 MS/s (x725) sampling rate, which is well suited for mid-fast signals as the ones coming from liquid or inorganic scintillators coupled to PMTs or Silicon Photomultipliers, but also for high precision detectors as Silicon or HPGe coupled with charged sensitive preamplifiers. In this case the sampling rate can be

reduced using the decimation feature. The acquisition can be channel independent and it is possible to make coincidence/anti-coincidence logic among different channels and external veto/gating. Multiple boards can be synchronized to build up complex systems. The data stream is written in a circular memory buffer with independent read/write access, which reduces the dead-time of the acquisition process. In case of DPP mode, data can be saved in time-stamped list mode to support higher input rates by improving the throughput performances. Piled-up events can be rejected or saved for offline analysis.

730 and 725 families come in three form factors: VME (16 or 8 input channels), NIM (8 input channels) and Desktop (8 input channels). The communication to and from the board is provided through the following interfaces: USB (DT and NIM form factors), VMEbus (VME form factor), and Optical Link (all form factors).

USB
An USB 2.0 link is provided in NIM and Desktop form factors for an easy data readout.

Digital I/O
Digital I/Os are provided in VME boards that can be used for individual trigger propagation to external trigger logic. This feature makes VME form factor ideal to scale up the acquisition channels where a global trigger generation is mandatory.

Optical Link
An Optical link is provided in any form factor for high performance data readout through CAEN proprietary daisy-chainable CONET communication protocol.

Model Compare

Model	No. Of Channels	Resolution (bits)	Max Sampling Rate (MS/s)	Bandwidth (MHz)	Board Memory Samples/ch	Package
DT5725	8	14	250	125	640 k - 5.12 M	Desktop
DT5730	8	14	500	250	640 k - 5.12 M	Desktop
N6725	8	14	250	125	640 k - 5.12 M	1U - NIM
N6730	8	14	500	250	640 k - 5.12 M	1U - NIM
V1725	8 / 16	14	250	125	640 k - 5.12 M	6U - VME64
V1730	8 / 16	14	500	250	640 k - 5.12 M	6U - VME64
VX1725	8 / 16	14	250	125	640 k - 5.12 M	6U - VME64X
VX1730	8 / 16	14	500	250	640 k - 5.12 M	6U - VME64X

Firmware / Software

x730 - x725 digitizers are provided with FPGAs that can run Digital Pulse Processing firmware for Physics Applications.

DPP-PHA - Pulse Height Analysis

Free downloadable DPP-PHA Trial version

725 and 730 digitizers running DPP-PHA firmware become multichannel data acquisition systems for nuclear physics or other applications requiring radiation detection. The digitizers accept signals directly from Charge Sensitive Preamplifiers or photomultiplier and implement a digital replacement of Shaping Amplifier and Peak Sensing ADC (Multi-Channel Analyzer).

Some typical applications:

• Gamma ray spectroscopy with Germanium and Silicon Detectors
• Readout of PMTs with slow scintillators (for instance NaI)
• Applications that require a moderate timing resolution to make coincidences

Available software:

MC²Analyzer
Software with basic analysis tools and complete acquisition / control capabilities for CAEN Digital MCAs and Digitizers running Pulse Height Analysis. It allows to manage multiple boards, to set the relevant DPP-PHA parameters, to collect the spectra and perform mathematical analysis, like energy calibration, peak search, background subtraction, peak fitting, etc..

CoMPASS
Multiparametric DAQ Software for Physics Applications

DPP-PSD - Pulse Shape Discrimination

Free downloadable DPP-PSD Trial version

725 and 730 digitizers running DPP-PSD firmware become multichannel data acquisition systems for nuclear physics or other applications requiring radiation detection. The digitizers accept signals directly from the detector and implement a digital replacement of Dual Gate QDC, Discriminator and Gate Generator.

Some typical applications:

• Readout of PMTs coupled to organic liquid scintillators (e.g. BC501-A)

• Applications that require a moderate timing resolution to perform coincidences

• Gamma-Neutron discrimination (dual gate integration)

Available software:

CoMPASS

CAEN Multi-PArameter Spectroscopy Software (CoMPASS) is the new software from CAEN able to implement a Multi-parametric DAQ for Physics Applications, where the detectors can be connected directly to the digitizers inputs and the software acquires energy, timing, and PSD spectra.

It features a User-friendly GUI when different CAEN digitizer models with DPP firmwares are detected. The software harmonizes the data in a unique format both for synchronous and asynchronous acquisitions of disomogeneous CAEN boards. The resulting data can be plotted and saved thanks to the CERN Root interface.

DPP-ZLEplus - Zero Length Encoding

Free downloadable DPP-ZLEplus Trial version

The Zero Length Encoding (DPP-ZLEplus) allows the user to transfer the digitized waveforms in compressed mode, performing an enhanced Zero Suppression algorithm on the input signals.

The DPP-ZLEplus identifies and saves those samples where the distance from the baseline is larger than a programmable threshold, while discarding samples not fulfilling this requirement. The acquisition window, triggered by a global trigger, is completely scanned, but only the relevant data is saved. The event data size can be therefore quite small compared with the data produced by the ADCs in the same window.

Some typical applications:

• Readout of a large number of detectors following a global trigger

• Application requiring an effective data reduction Gamma-Neutron discrimination (dual gate integration)

Available software:

DPP-ZLEplus

DPP-ZLEplus Control Software is an open source software which can configure the setup, start/stop the acquisition and manage the data readout: the waveforms elaborated by the ZLEplus algorithm are plotted using Gnuplot or saved to output text files. The user can make an entire acquisition through this software, as well customize the readout program thanks to the C source files and the provided VS project.

DPP-DAW - Dynamic Acquisition Window

COMING SOON

The DPP-DAW firmware allows the user to acquire data from each channel independently and to adapt the acquisition window to the real pulse duration (over-threshold). Samples are identified when their distance from the baseline is larger than a programmable threshold. After the minimum record length is reached, the DPP-DAW firmware acquires the input samples until they return below the threshold level for a programmable number of samples. The acquisition can be vetoed/gated with an external signal on TRG-IN front panel connector.

The DPP-DAW firmware has many advantages, like the possibility to acquire each channel independently and the possibility to adjust the record length to each event individually. This ensure an optimization of the data transfer, since only the "relevant" samples are transmitted, while channels with no data are not transferred at all.

Available software:

DPP-DAW

DPP-DAW Control Software is an open source software which can configure the setup, start/stop the acquisition and manage the data readout: the waveforms elaborated by the DAW algorithm are plotted using Gnuplot or saved to output text files. The user can make an entire acquisition through this software, as well customize the readout program thanks to the C source files and the provided VS project.

Some typical applications:

• Neutrino experiment

• Large number of detectors

• Drift chambers, TPC, Cherenkov detectors

• Application requiring an effective data reduction

Waveform Recording Firmware

Free downloadable

The default firmware for Waveform Recording takes advantage of the flash ADC technology of the digitizer to convert and retrieve the analog input into digital waveform samples, preserving the information required by the experimental activities and the applications of nuclear techniques.

Each channel of the digitizer is able to implement a digital discriminator that generates a trigger when a certain condition is met; in the basic implementation, this is just a programmable threshold which is continuously compared to the digitized input.

The waveform digitizer therefore provides time information and digitized signal waveforms through fast communication interfaces, allowing the user to operate post-processing data analysis.

Available software:

CAEN WaveDump

WaveDump is a basic console application, with no graphics, supporting digitizers running Waveform Recording Firmware. It allows the user to program a single board (according to a text configuration file containing a list of parameters and instructions), to start/stop the acquisition, read the data, display the readout and trigger rate, apply some post-processing (e.g. FFT and amplitude histogram), save data to a file and also plot the waveforms using Gnuplot.

Starting with this demo is strongly recommended to all those users willing to write the software on their own. Source files and the VS project are included for developers.

CAENScope

CAENScope is a user friendly software interface to specifically control CAEN digitizer running Waveform Recoding Firmware. The software interface presents different sections to easily manage the digitizer configuration and plot the waveforms. Once connected, the program retrieves the digitizer information. Different parameters can be set for the channels, the trigger and the trace visualization (up to 12 traces can be simultaneously plotted). Signals are recordable to files in two different formats: Binary (SQLite db) and Text (XML).

All CAEN Control Software are available for free download on the web site.

Ordering Option

Code	Description	Form Factor
WDT5725SXAAA	DT5725S - 8 Ch. 14 bit 250 MS/s Digitizer: 640kS/ch, CE30, SE	Desktop
WDT5725SBXAA	DT5725SB - 8 Ch. 14 bit 250 MS/s Digitizer: 5.12MS/ch, CE30, SE	Desktop
WN672S5XAAAA	N6725S - 8 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	NIM
WN6725SBXAAA	N6725SB - 8 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	NIM
WV1725SXAAAA	V1725S - 16 Ch. 14 bit 250 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64
WV1725SBXAAA	V1725SB - 16 Ch. 14 bit 250 MS/s Digitizer: 5.12MS/ch, CE30, SE	6U-VME64
WV1725SCXAAA	V1725SC - 8 Ch. 14 bit 250 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64
WV1725SDXAAA	V1725SD - 8 Ch. 14 bit 250 MS/s Digitizer: 5.12MS/ch, CE30, SE	6U-VME64
WVX1725SXAAA	VX1725S - 16 Ch. 14 bit 250 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64X
WVX1725SBXAA	VX1725SB - 16 Ch. 14 bit 250 MS/s Digitizer: 5.12MSch, CE30, SE	6U-VME64X
WVX1725SCXAA	VX1725SC - 8 Ch. 14 bit 250 MS/s Digitizer: 640kS/c, CE30, SE	6U-VME64X
WVX1725SDXAA	VX1725SD - 8 Ch. 14 bit 250 MS/s Digitizer: 5.12MS/ch, CE30, SE	6U-VME64X
WFWDPPTFAA25	DPP-PHA - Digital Pulse Processing for Pulse Height Analysis (16 ch x725)	6U-VME64 VME64X
WFWDPPTFAD25	DPP-PHA - Digital Pulse Processing for Pulse Height Analysis for (8ch x 725)	ALL
WFWDPPNGAA25	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (16 ch x725)	6U-VME64 VME64X
WFWDPPNGAD25	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (8ch x725)	ALL
WFWDPPTWAA25	DPP-DAW - Digital Pulse Processing with Dynamic Acquisition Windows (16ch x725)	6U-VME64 VME64X
WFWDPPTWAD25	DPP-DAW - Digital Pulse Processing with Dynamic Acquisition Windows (8ch x725)	ALL
WFWDPPZLAA25	DPP-ZLEplus - Digital Pulse Processing Zero Length Encoding for (16ch x725)	6U-VME64 VME64X
WFWDPPZLAD25	DPP-ZLEplus - Digital Pulse Processing Zero Length Encoding for (8ch x725)	ALL
WFWDPPS2501A	DPP-SUP - Super Licence for 16ch x 725 Digital Pulse Processing	6U-VME64 VME64X
WFWDPPS2501D	DPP-SUP - Super Licence for 8ch x 725 Digital Pulse Processing	ALL

Code	Description	Form Factor
WDT5730SXAAA	DT5730S - 8 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	Desktop
WDT5730SBXAA	DT5730SB - 8 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	Desktop
WN6730SXAAAA	N6730S - 8 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	NIM
WN6730SBXAAA	N6730SB - 8 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	NIM
WV1730SXAAAA	V1730S - 16 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64
WV1730SBXAAA	V1730SB - 16 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	6U-VME64
WV1730SCXAAA	V1730SC - 8 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64
WV1730SDXAAA	V1730SD - 8 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	6U-VME64
WVX1730SXAAA	VX1730S - 16 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64X
WVX1730SBXAA	VX1730SB - 16 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	6U-VME64X
WVX1730SCXAA	VX1730SC - 8 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64X
WVX1730SDXAA	VX1730SD - 8 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	6U-VME64X
WFWDPPTFAA30	DPP-PHA - Digital Pulse Processing for Pulse Height Analysis (16 ch x730)	6U-VME64 VME64X
WFWDPPNGAA30	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (16ch x730)	6U-VME64 VME64X
WFWDPPTFAD30	DPP-PHA - Digital Pulse Processing for Pulse Height Analysis for (8ch x 730)	ALL
WFWDPPNGAD30	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (8ch x730)	ALL
WFWDPPDWAA30	DPP-DAW - Digital Pulse Processing with Dynamic Acquisition Windows (16ch x730)	6U-VME64 VME64X
WFWDPPDWAD30	DPP-DAW - Digital Pulse Processing with Dynamic Acquisition Windows (8ch x730)	ALL
WFWDPPZLAA30	DPP-ZLEplus - Digital Pulse Processing Zero Length Encoding for (16ch x730)	6U-VME64 VME64X
WFWDPPZLAD30	DPP-ZLEplus - Digital Pulse Processing Zero Length Encoding for (8ch x730)	ALL
WFWDPPS3001A	DPP-SUP - Super Licence for 16ch x 730 Digital Pulse Processing	6U-VME64 VME64X
WFWDPPS3001D	DPP-SUP - Super Licence for 8ch x 730 Digital Pulse Processing	ALL

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