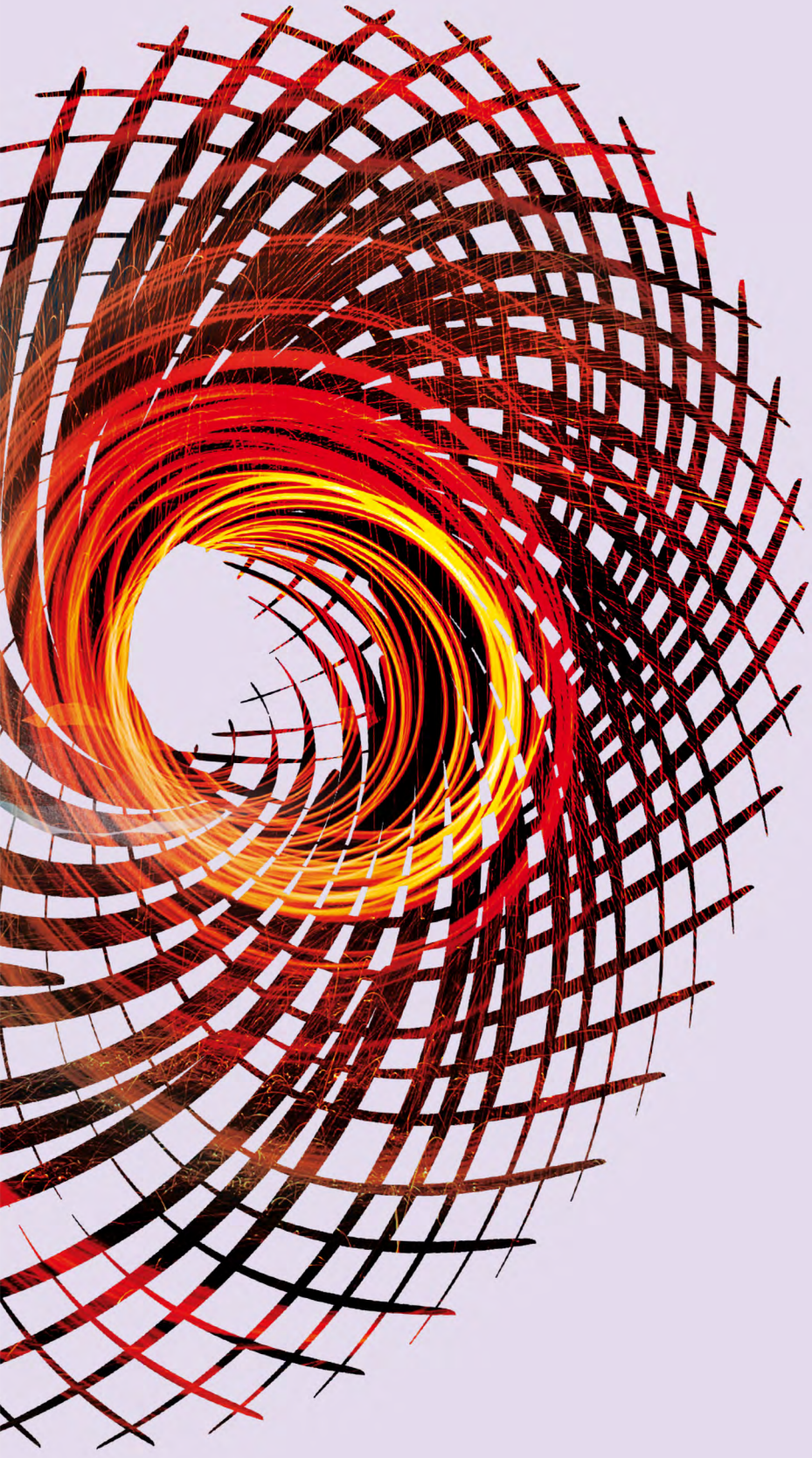
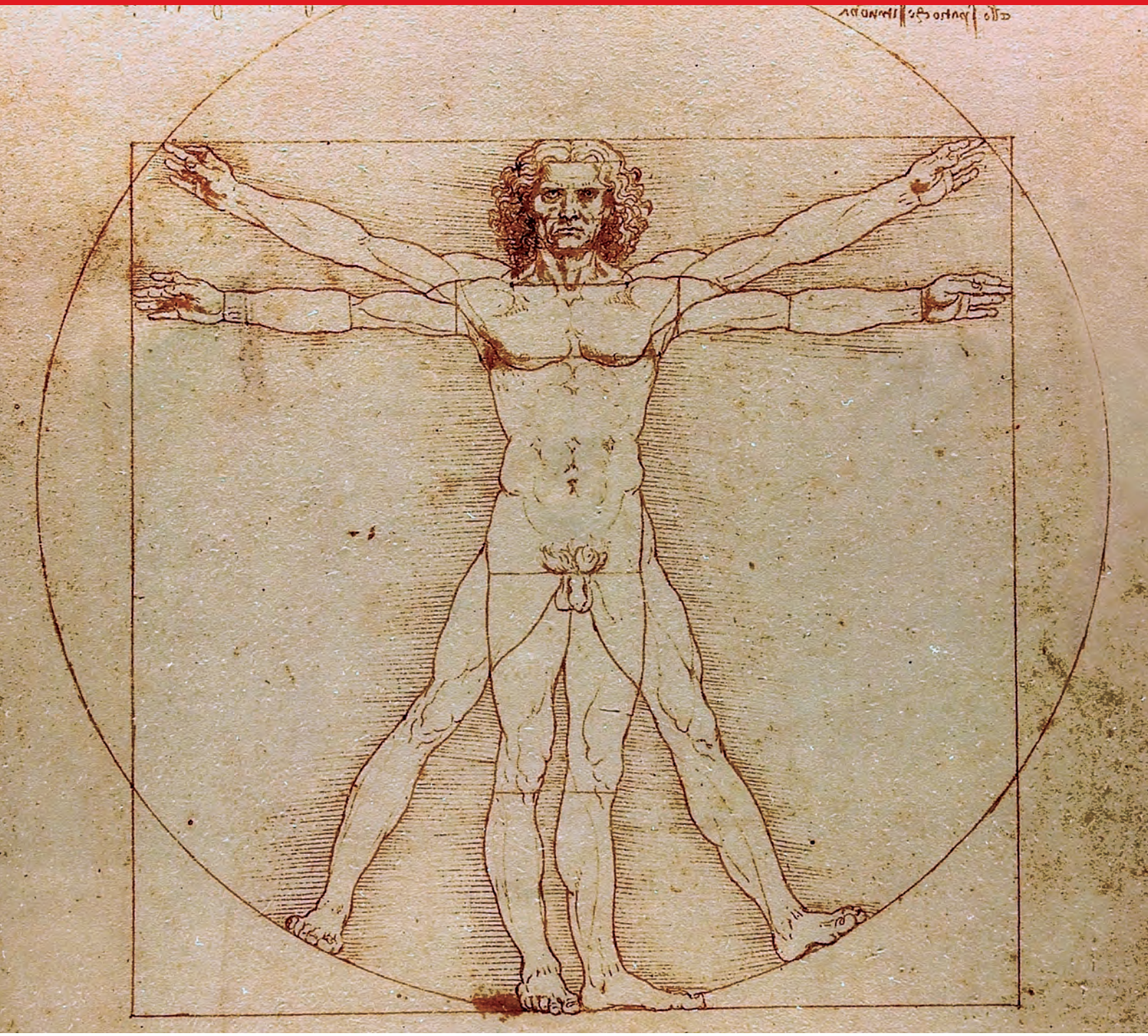
CAEN 2019 Product Catalog



40 YEARS OF INNOVATION
1979-2019

Electronic Instrumentation

CAEN **Electronic Instrumentation**



Leonardo da Vinci (1452-1519), Vitruvian Man - Gallerie dell'Accademia, Venice - 2019 Celebration

2019 Product Catalog


40
YEARS OF INNOVATION
1979-2019

Source: http://brunelleschi.imss.fi.it/stampa_leonardo/images/uomo_vitruviano_accademia_v.jpg

We are proud of the high quality of our products.

ISO 9001

ISO 9001:2015 approved quality system ensures all our internal processes.

From R&D to the registration of the incoming purchase orders, through:
- Resource Planning
- Scheduling
- Production

Our quality system is responsible for the proper functioning of all our internal processes and is subject to regularly unannounced audits, carried out by the National Standards Authority.

From the initial product design and its development stages, till the delivery of the production batches, we follow documented procedures that cover every aspect of our business. The auditing of our procedures by an independent third party guaranties that our business runs smoothly and efficiently.

The quality of CAEN S.p.A. products is constantly monitored by the application of the UNI EN ISO 9001:2015 standard. CAEN S.p.A. is ISO 9001 certified since 1998.

ISO9001:2015
certified Company

CSQ IQNet
ISO 9001:2015
cert. n. 9105.CAEN

Authorised
research laboratory
of the MIUR

CAEN New Management Team

Dear Friends,

It is with great honor that we accept the responsibility to carry on the CAEN legacy. We welcome this responsibility of leading CAEN, and in doing so we will be guided by the principles of passion, commitment, loyalty, and responsibility. CAEN is our lifeblood, our past, present, and future. We live in a challenging and unpredictable world, but change brings opportunity... the opportunity to design electronics utilizing the most modern technologies available. This process will allow us to evolve with the needs of our customers, delivering powerful instrumentation capable of supporting the most amazing scientific advances and discoveries. We are honored to have the opportunity to serve you and are committed to being your best and foremost partner on this journey though innovation, science, and discovery.

With infinite gratitude,

Jacopo Givoletti
President

CAEN Executive Board

Jacopo Givoletti
President

Franco Vivaldi
Vice President

Massimo Morichi
Vice President

Claudio Raffo
Vice President

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info@caentechnologies.com
www.caentechnologies.com

CAEN Electronic Instrumentation

Products:

Modular Pulse Processing Electronics

Waveform Digitizers

Digital Spectroscopy

Electronics for SiPM

Power Supplies

Digital Detector Emulators

Educational Kits

Applications:

High Energy Physics

Astrophysics

Neutrino Physics

Dark Matter Investigation

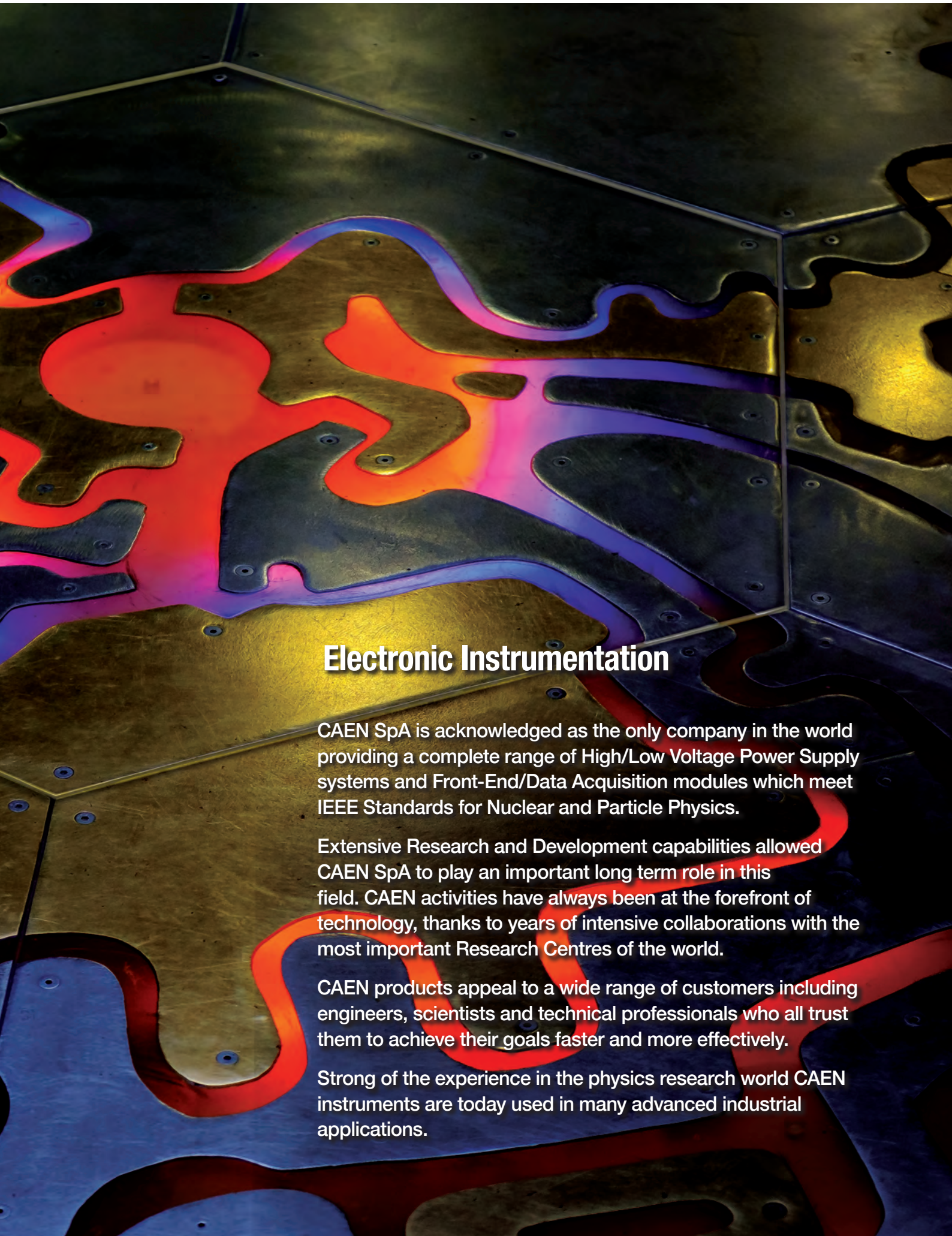
Nuclear Physics

Material Science

Medical Applications

Homeland Security

Industrial Applications



Electronic Instrumentation

CAEN SpA is acknowledged as the only company in the world providing a complete range of High/Low Voltage Power Supply systems and Front-End/Data Acquisition modules which meet IEEE Standards for Nuclear and Particle Physics.

Extensive Research and Development capabilities allowed CAEN SpA to play an important long term role in this field. CAEN activities have always been at the forefront of technology, thanks to years of intensive collaborations with the most important Research Centres of the world.

CAEN products appeal to a wide range of customers including engineers, scientists and technical professionals who all trust them to achieve their goals faster and more effectively.

Strong of the experience in the physics research world CAEN instruments are today used in many advanced industrial applications.

CAEN GROUP

The CAEN Group is a cluster of core High-Tech Companies. By excellence Know-how we power Innovation.

CAEN SyS
Systems and Spectroscopy Solutions

CAEN SyS develops radiation detection instruments and solutions with added value and operational benefit for our customers, enhancing safety and security through nuclear measurements in the following Areas: Nuclear Safety, Nuclear Security, Laboratories, Customization.

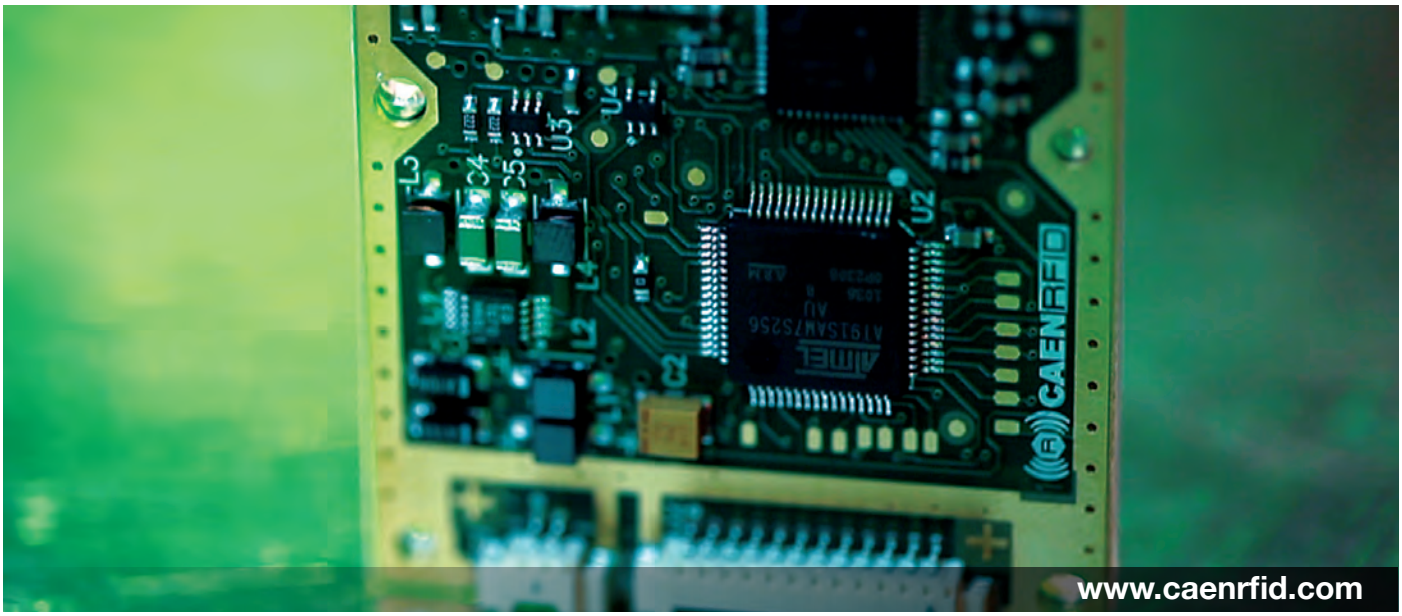
CAENels
Gear For Science

CAEN ELS is a leading company in the design of Power Supplies and state-of-the-art complete Electronic systems for the Particle Accelerator Community and high-end Industrial applications.

CAEN GROUP

CAENRFID
THE ART OF IDENTIFICATION

CAEN RFID is today a leading supplier of UHF RFID readers and tags. It has been among the first European companies to design and manufacture UHF RFID readers.

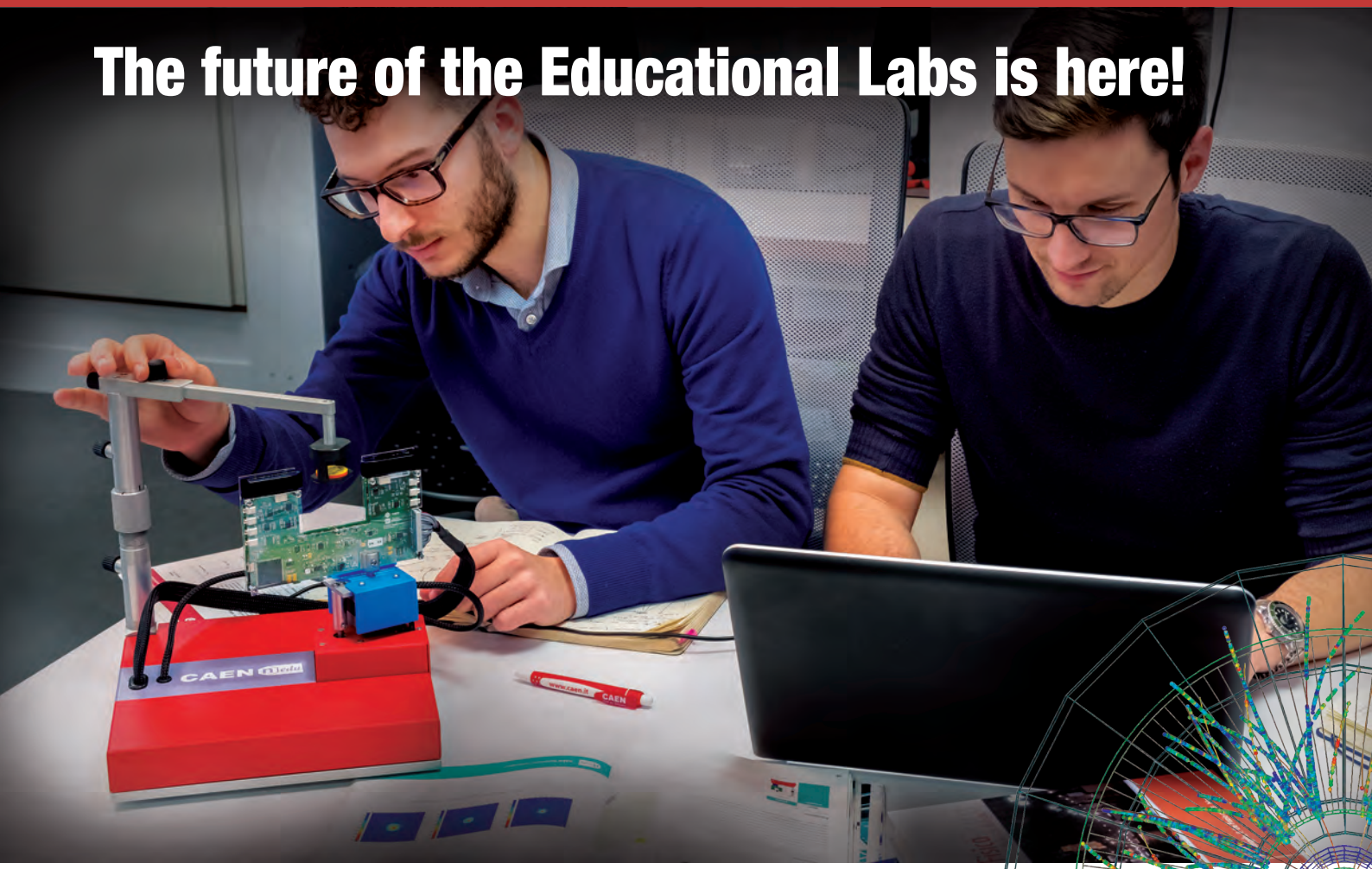


CAENqs
build security awareness

CAEN qS designs, organizes and implements “state of the art” solutions for Information Security and assists organizations in managing and controlling the critical infrastructures for protection at the highest possible standard.

CAEN n edu Educational Tools

The future of the Educational Labs is here!



Cristina Mattone
Educational Products Manager

CAEN brings the experience acquired in more than 35 years of collaboration with the High Energy & Nuclear Physics community into the University educational laboratories.

Thanks to the most advanced instrumentation developed by CAEN for the major experiments worldwide, together with the teaching experience at the University of Insubria, a series of experiments covering several applications have been carried out and are presented in detailed Educational Notes.

The goal is to inspire students and guide them towards the analysis and comprehension of different physics phenomena with a series of experiments based on state-of-the-art technologies, instruments and methods.

Be part of the project: develop your own experience and send an email to ***educational@caen.it***

CAEN realized different modular Educational Kits. The setups are all based on Silicon Photomultipliers (SiPM) state of-the-art sensor of light with single photon sensitivity and unprecedented photon number capability.

The kits are configured to perform a wide range of experiments, covering Nuclear and Particle Physics fields: from the radioactive decays (β and γ) to the cosmic rays, from the light quanta to the advanced statistics and from the nuclear imaging to the emulation of the radioactive processes..

All kits are provided with a User-friendly Control Software, including tools dedicated to the Statistical Analysis.

Educational Handbook

Free download

www.caen.it/educational

Table of Contents

This Catalog represents the state-of-the-art of CAEN's products offering at the date of printing. To check the updated list of all our products, please visit our web site (www.caen.it). Nevertheless, the products appearing either on the Catalog or on our web site do not represent all our expertise, as almost 20% of CAEN production is custom designed.

If you don't find the Product you need in our Catalog, or if you are starting a new experiment and require a completely new design, feel free to contact us. CAEN will help you at any stage of your project.

Legend

COMING SOON colour green = Indicates a Coming Soon Product. *

NEW colour red = Indicates a New Product.

* The specifications description is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions.

General Use

Indicates that Windows OS is supported. Windows® is a registered trademark of Microsoft Corporation in the United States and other countries.

Indicates that Android™ OS is supported. Android is a trademark of Google Inc.

Indicates that LabVIEW™ is supported. LabVIEW™ is a trademark of National Instruments. Neither CAEN, nor any software programs or other goods or services offered by CAEN, are affiliated with, endorsed by, or sponsored by National Instruments.

Indicates that Linux OS is supported.

Indicates that the Product is available for free download

Indicates that a Firmware trial version is available for free download.

Indicates that the App is available on Google Play™. Google Play and the Google Play logo are trademarks of Google Inc.

Indicates that MacOS® is supported. MacOS® is a trademark of Apple Inc.

Power Supply Control Software

Indicates that the Product is supported by CAEN OPC Server.

Indicates that the Product is supported by CAEN HV Wrapper library.

Indicates that the Product can be controlled by CAEN HiVoCS web based software.

Indicates that the Product is supported by a LabVIEW™ Instrument Driver.

Indicates that the Product can be controlled by CAEN ZEUS software

Indicates that the Product can be controlled by CAEN GECO2020 software.

Indicates that the Product is supported by an EPICS Input Output Controller.

Firmware for Digitizers and V2495/DT5495

Indicates that the Digitizer can run Waveform Recording firmware.

Indicates that the Digitizer can run Digital Pulse Processing for Pulse Height Analysis (DPP-PHA) firmware.

Indicates that the Digitizer can run Digital Pulse Processing for Pulse Shape Discrimination (DPP-PSD) firmware.

Indicates that the Digitizer can run Digital Pulse Processing for Charge to Digital Conversion (DPP-QDC) firmware.

Indicates that the Digitizer can run Digital Pulse Processing for Zero Length Encoding (DPP-ZLEplus) firmware.

Indicates that the Digitizer can run Digital Pulse Processing for Dynamic Acquisition Window (DPP-DAW) firmware.

Indicates that the Product can run CAEN FW 2495SC 16 Channel, 200 MHz Multievent latching scaler firmware.

Indicates that the Product can run SCI-5550 firmware.

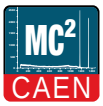
Legend (continued)

Software for Digitizers, Digital Detector Emulators and Digital Spectroscopy Devices

Indicates that the Product can be controlled by CAENScope software.

Indicates that the Product can be controlled by CAEN WaveDump software.

Indicates that the Product can be controlled by CAEN CoMPASS software.



Indicates that the Product can be controlled by CAEN MC²Analyzer software.

Indicates that the Product can be controlled by CAEN GammaTOUCH software.

Indicates that the Product can be controlled by CAEN Detector Emulator Control Center.

Indicates that Hexagon Software design Kit is available for the product.

Indicates that the Product can be controlled by CAEN Gamma Quantus software.

Indicates that the Product is supported by CAEN Upgrader software.

Indicates that the Product is supported by CAEN VME Demos software.

Indicates that the Product can be controlled by CAEN DPP-PSD Control software.

Indicates that the Product can be controlled by CAEN DPP-QDC demo software.

Indicates that the Product can be controlled by CAEN DPP-ZLEplus demo software.

Indicates that the Product can be controlled by CAEN DPP-DAW demo software.

Indicates that the Product can be controlled by CAEN SCI 5550 Readout Software.

Indicates that the Product can be controlled by CAEN WaveCatcher software.

Indicates that the Product can be controlled by CAEN SCI-Compiler software.


40
YEARS OF INNOVATION
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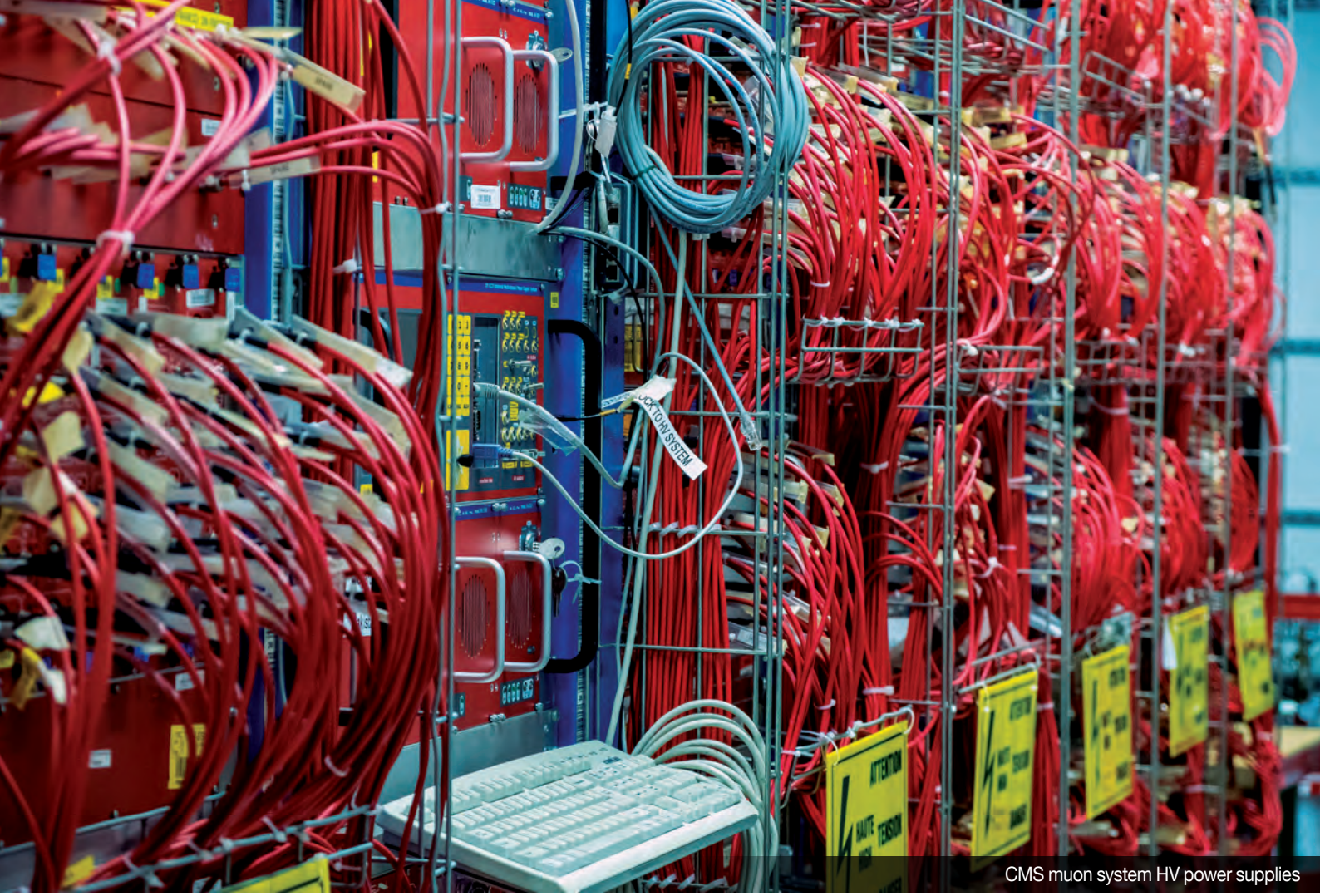
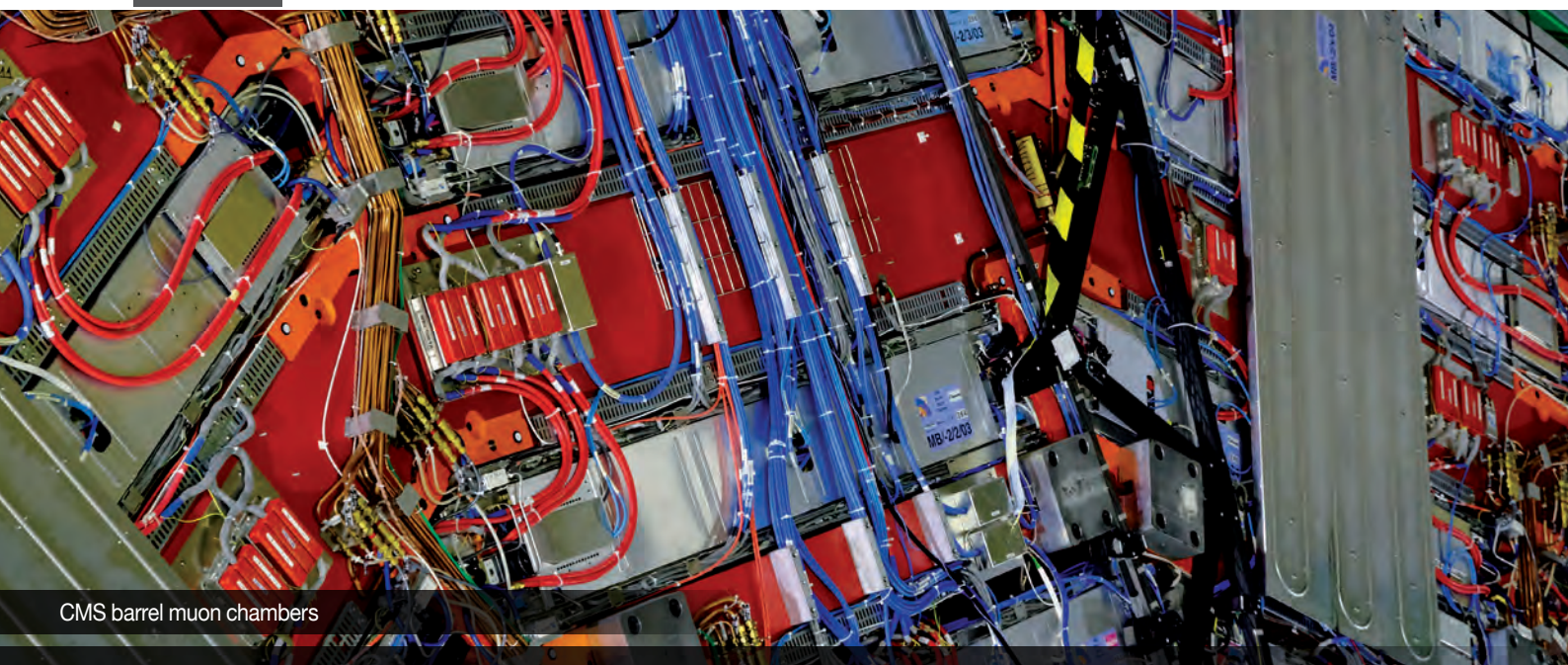


CMS muon system HV power supplies

POWER SUPPLIES



CMS barrel muon chambers

Introduction to High and Low Voltage Power Supplies

High and low voltages are expression difficult to define in an univocal way. In the research community and in the electrical and electrotechnical industry the meaning of high and low voltage may be quite different depending on the considered application.

In the United States 2014 National Electrical Code (NEC), high voltage is defined as any voltage over 1000 V (article 490.2), while the International Electrotechnical Commission and its national counterparts (IET, IEEE, VDE, etc.) defines High and Low Voltages as follows:

	AC	DC
High Voltage (HV)	> 1000 V	> 1500 V
Low Voltage (LV)	50 – 1000 V	120 – 1500 V
Extra Low Voltage (ELV)	< 50 V	< 120 V
Safety ELV (SELV)	25 V	60 V

In the scientific community and in related industrial activities the difference between low and high voltage is almost always related to the specific application. When talking about particle detectors, “high voltage” is used to create an electric field that allows to amplify the signal produced by the particle when interacting with the detector material.

Therefore, the same “high voltage” expression might mean the 6 kV needed to power a Germanium detector, the 3 kV for a photomultiplier as well as the few hundred volts for providing the reverse bias to a silicon detector. In a similar way, “low voltage” is used to power the analog and digital electronics integrated in the detectors or for other similar applications.

A power supply is an electronic device that supplies electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to another and, as a result, power supplies are sometimes referred to as electric power converters. Power supplies are categorized in various ways, including by functional features, are packaged in different ways and classified accordingly and can be broadly divided into linear and switching types.

All CAEN power supplies are the results of 35 years of experience side by side with the research community. All of them features:

- Modularity
- High reliability
- Mechanic solidness
- High performance
- Hardware and software protection against failures like over currents, over/under voltage, shorts
- Remote and local control
- Dedicated control software

Introduction to Power Supplies working principles

A voltage regulator is an electrical component designed to automatically maintain a constant voltage level. It can be made by a simple “feed-forward” design or may include negative feedback control loops. It may use an electromechanical mechanism, or electronic components.

Depending on the design, it may be used to regulate one or more AC or DC voltages. A simple voltage regulator can be made from a resistor in series with a diode (or series of diodes). Due to the logarithmic shape of diode V-I curves, the voltage across the diode changes only slightly due to changes in current drawn or changes in the input. When precise voltage control and efficiency are not important, this design may work fine.

Feedback voltage regulators operate by comparing the actual output voltage to some fixed reference voltage. Any difference is amplified and used to control the regulation element in such a way as to reduce the voltage error. This forms a negative feedback control loop; increasing the open-loop gain tends to increase regulation accuracy but reduce the stability.

There will also be a trade-off between stability and the speed of the response to changes. If the output voltage is too low, the regulation element acts in order to produce a higher output voltage–by dropping less of the input voltage (for linear series regulators and buck switching regulators), or to draw input current for longer periods (boost-type switching regulators); if the output voltage is too high, the regulation element will normally be commanded to produce a lower voltage. However, many regulators have over-current protection, so

ALICE Time of Flight LV/HV power supply systems - experimental cavern

that they will entirely stop sourcing current (or limit the current in some way) if the output current is too high. Some regulators may also shut down if the input voltage is outside a given range.

"Voltage regulator" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

Linear Power Supplies

In electronics, a linear regulator is a system used to maintain a steady voltage. The resistance of the regulator varies in accordance with the load resulting in a constant output voltage. The regulating device is made to act like a variable resistor, continuously adjusting a voltage divider network to maintain a constant output voltage, and continually dissipating the difference between the input and regulated voltages as waste heat. Since the regulated voltage of a linear regulator must always be lower than input voltage, efficiency is limited and the input voltage must be high enough to always allow the active device to drop some voltage.

Linear regulators may place the regulating device in parallel with the load (shunt regulator) or may place the regulating device between the source and the regulated load (a series regulator). Simple linear regulators may only contain a Zener diode and a series resistor; more complicated regulators include separate stages of voltage reference, error amplifier and power pass element.

"Linear regulator" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

Switching Power Supplies

A switched-mode power supply is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, it transfers power from a source to a load, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. Ideally, a switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time. This higher power conversion efficiency is an important advantage of a switched-mode power supply.

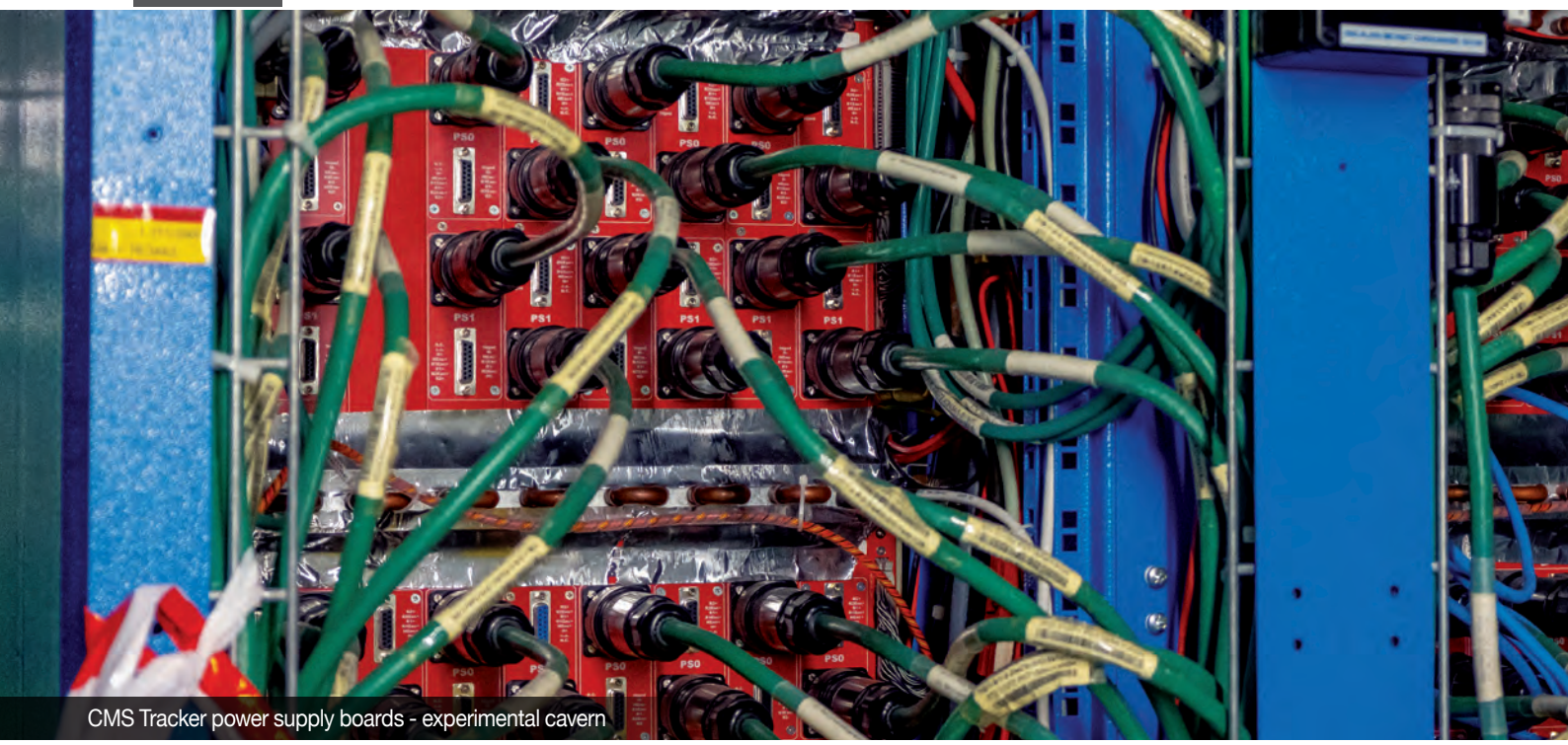
Moreover they also may be substantially smaller and lighter than a linear supply due to the smaller transformer size and weight. Switching regulators are used as replacements for linear regulators when higher efficiency, smaller size or lighter weight are required. They are, however, more complicated; their switching currents can cause electrical noise problems if not carefully suppressed, and simple designs may have a poor power factor.

"Switched-mode power supply" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

Linear and Switching Power Supplies: a comparison

It's not trivial to choose the proper power supply for a specific application. In many cases the final decision is a compromise between the advantages and the drawbacks of the two technologies. In the following, we perform a quick comparison between Linear and Switching power supplies:

- Size and Weight
  - Linear Power Supplies: Heatsinks for high power linear regulators and large transformers due to low operating frequency are large and add size and weight
  - Switching Power Supplies: Smaller transformer due to higher operating frequency. Size and weight of adequate RF shielding may be significant.
  - Linear Power Supplies: any voltage available, if a transformer is used; if transformerless, limited to what can be achieved with a voltage doubler. If unregulated, voltage varies significantly with load.
  - Switching Power Supplies: any voltage available, limited only by transistor breakdown voltages in many circuits. Voltage varies little with load.
- Efficiency, heat and power dissipation:
  - Linear Power Supplies: if regulated, the efficiency largely depends on voltage difference between input and output; output voltage is regulated by dissipating excess power as heat resulting in a typical efficiency of 30-40%. If unregulated, transformer iron and copper losses may be the only significant sources of inefficiency.


CMS Tracker power supply boards - experimental cavern

- Switching Power Supplies: output is regulated using duty cycle control; the transistors are switched fully on or fully off, so very little resistive losses between input and the load. The only heat generated is in the non-ideal aspects of the components and quiescent current in the control circuitry.

• Radio frequency Interference
- Linear Power Supplies: mild high-frequency interference may be generated by AC rectifier diodes under heavy current loading, while most other supply types produce no high-frequency interference.
- Switching Power Supplies: EMI/RFI produced due to the current being switched on and off sharply. Therefore, EMI filters and RF shielding are needed to reduce the disruptive interference.
- Linear Power Supplies: Unregulated power supplies may have a little AC ripple superimposed upon the DC component at twice mains frequency (100–120 Hz).
- Switching Power Supplies: Noisier due to the switching frequency. An unfiltered output may cause glitches in digital circuits or noise in analog circuits.

• Noise at the input terminals
- Linear Power Supplies: causes harmonic distortion to the input AC, but relatively little or no high frequency noise.
- Switching Power Supplies: very low cost power supplies may couple electrical switching noise back onto the mains power line, causing interference with any electronic equipment connected to the same phase. Non power-factor-corrected SMPSs also cause harmonic distortion.

• Power Factor
- Linear Power Supplies: Low for a regulated supply because current is drawn from the mains at the peaks of the voltage sinusoid, unless a choke-input or resistor-input circuit follows the rectifier.
- Switching Power Supplies: ranging from very low to medium since a simple SMPS without PFC draws current spikes at the peaks of the AC sinusoid.

"Switched-mode power supply" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

Providing power over Long Distances: the Voltage Drop Issue

Voltage drop describes how the supplied energy of a voltage source is reduced as electric current moves through the passive elements of an electrical circuit. Voltage drops across internal resistances of the source, across conductors, across contacts, and across connectors are undesired because supplied energy is dissipated and lost. If the voltage drop is too high the operation of the electrical equipment involved could be compromised. In electronic design and power transmission, various techniques are employed to compensate for the effect of voltage drop on long circuits or where voltage levels must be accurately maintained.

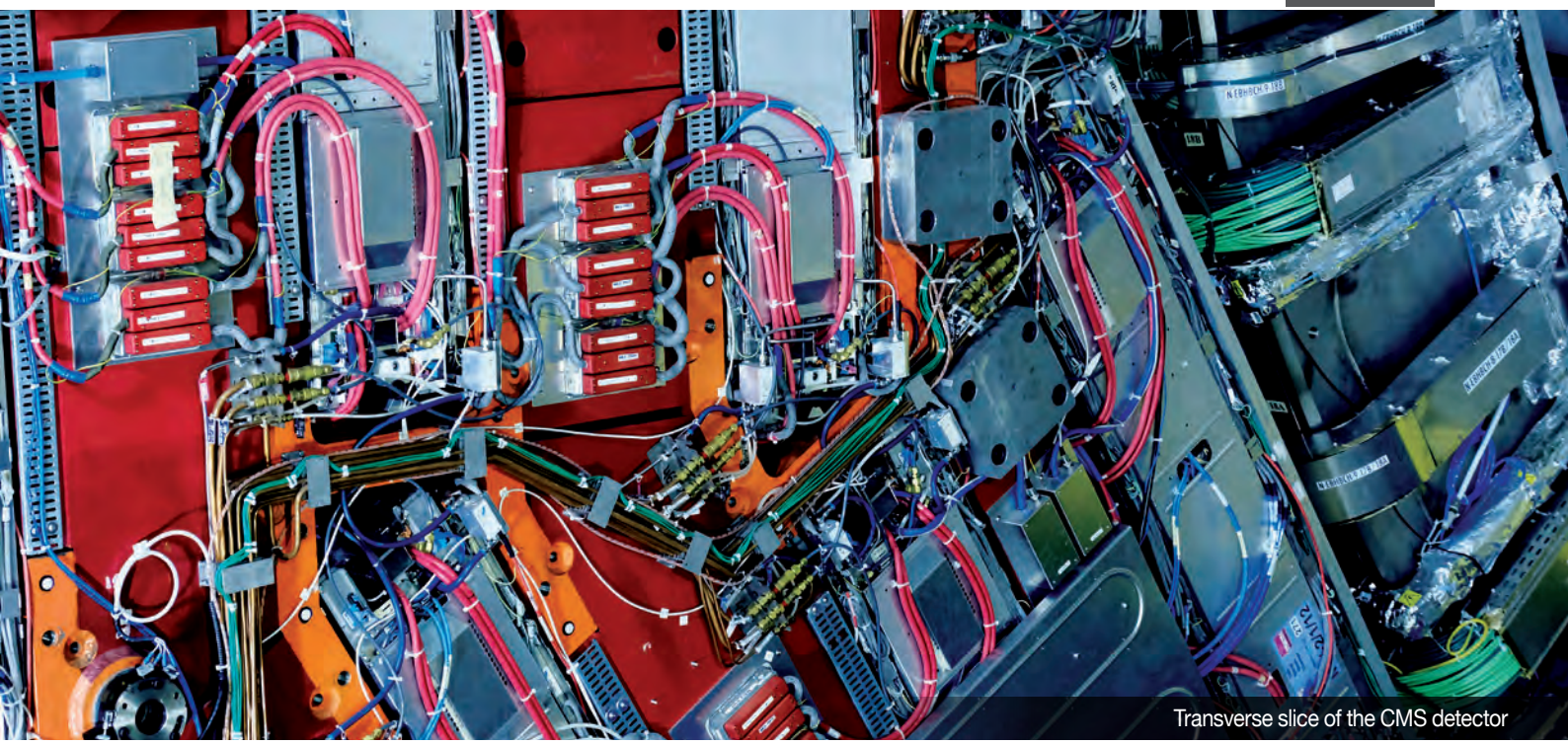
The simplest way to reduce voltage drop is to increase the diameter of the conductor between the source and the load, which lowers the overall resistance but with the but the drawbacks of higher costs and larger cable capacitance. In power distribution systems, a given amount of power can be transmitted with less voltage drop if a higher voltage is used.

More sophisticated techniques use active elements to compensate for the undesired voltage drop. In many cases the use of long cables cannot be avoided in particular when the power supplies have to be installed away from hostile environments or the space constraints become critical. In these conditions then main challenge is providing a stable low voltage levels at the load (as low as 1.5 - 2 V) over long distances, even hundred of meters without increasing the cable sections too much because the voltage drop along the cables could be considerably higher than the voltage required by the load.

Many parameters have to be taken into account when estimating if a setup is suitable in terms of stability and performances for the particular application. Among them the distance to cover, the cable capacitance and resistance, the voltage regulation time, voltage and current levels to be kept and so on.

CAEN has a deep experience in successfully providing long distance power supply and features its low voltage units with reliable solutions based on sense wires which allows a full compensation of the voltage drops along tens of meters cables. Some CAEN power supplies features the so called "Line Drop Recovery" (LDR) technology which allows through a digital control to avoid the use of the sense wires.

"Switched-mode power supply" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.



Transverse slice of the CMS detector

Power Supplies for Hostile Environment

In many specific application operating the power supplies close to the detector, even in a hostile environment, is much more convenient if not mandatory. This of course requires that the power supply is able to work inside the hostile conditions for a sufficient long time keeping the performances at the required level and with an high degree of reliability. Standard power supplies cannot work in magnetic field or radioactive environment, so for application that needs to be hosted inside such conditions special solution for the magnetic sensitive parts inside the power box and/or radiation tolerant solution have to be implemented. The CAEN EASY System is the answer to such a challenging request.

Low Voltage Power Supplies

Power Supplies for Analog and Digital Front End Electronics

In modern physics experiments, every particle detector is equipped with built-in electronics in which, thanks to the always more effective miniaturization, more and more components are integrated. The main goal is to have a preprocessing of the detector signal as soon as possible in order to reduce the noise contamination and have a faster data processing. This complex electronics needs stable low voltages for analog and digital circuits. However the geometry, space constraints and often hostile environmental conditions lead to the use of cables whose length may range from centimeters to several hundreds of meters.

CAEN, thanks to its longstanding experience, provides suitable solution to all low voltage installation needs: constant voltage over long distances, magnetic and radiation tolerance capabilities for power supplies that must operate very close to detectors, multichannel HV/LV integrated systems, high power devices.

Low Voltage Power Supply Requirements	
Typical Voltage	1.5 – 60 V
Typical Current	1 – 200 A
Polarity	Positive or Negative

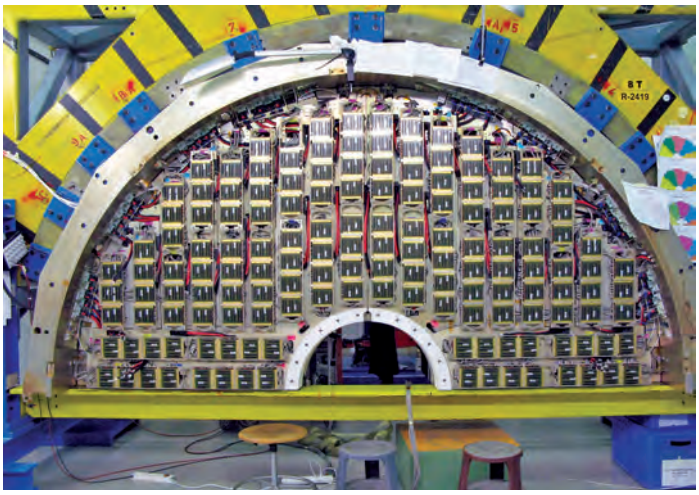


Figure A: Front end electronics for the MRPCs of the ALICE TOF. © 2006-2016 CERN

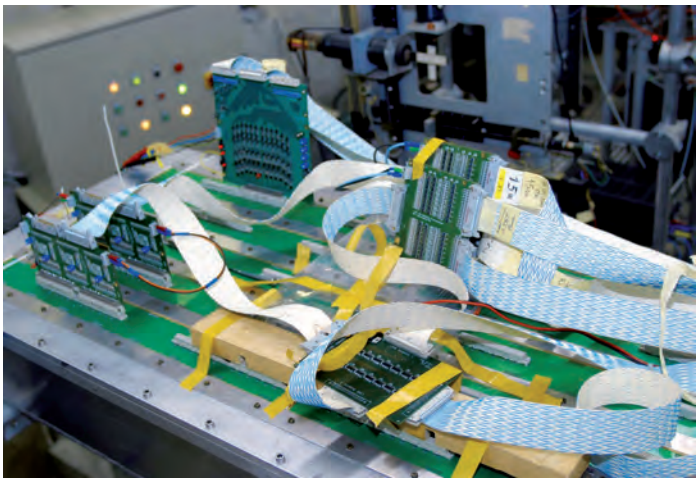


Figure B: CMS ECAL Endcap DEE 4 - Optical fibres and electronics © 2008 CERN, for the benefit of the CMS Collaboration

CMS Tracker service power supplies

Power Supplies for Particle Detectors

Photomultipliers

Photomultiplier tubes are extremely sensitive detectors of light in the ultraviolet, visible, and near-infrared ranges of the electromagnetic spectrum. These detectors multiply the current produced by incident light by as much as 100 million times, in multiple dynode stages, enabling individual photons to be detected when the incident flux of light is very low.

Photomultipliers are typically constructed with an evacuated glass housing, containing a photocathode, several dynodes, and an anode. Incident photons strike the photocathode material, which is usually a thin vapor-deposited conducting layer on the inside of the entry window of the device. Electrons are ejected from the surface as a consequence of the photoelectric effect. These electrons are directed by the focusing electrode toward the electron multiplier, where electrons are multiplied by the process of secondary emission. The necessary distribution of voltage along the series of dynodes is created by a voltage divider chain.

Photomultiplier tubes typically utilize 1000 to 3000 volts to accelerate electrons within the chain of dynodes. Negative high-voltage supplies (with the positive terminal grounded) are often preferred. While powered, photomultipliers must be shielded from ambient light to prevent their destruction through overexcitation. If used in a location with strong magnetic fields photomultipliers are usually magnetically shielded by a layer of soft iron or mu-metal. The combination of high gain, low noise, high frequency response or, equivalently, ultra-fast response, and large area of collection has maintained photomultipliers an essential place in nuclear and particle physics, astronomy and medical diagnostics.

"Photomultiplier" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

PMTs Power Supply Requirements	
Typical Voltage	1 – 3 kV
Typical Current	0.1 to 3 mA
Polarity	Positive or Negative

Photodiodes

A photodiode is a semiconductor device that converts light into current. The current is generated when photons are absorbed in the photodiode. When a photon of sufficient energy strikes the diode, it creates an electron-hole pair. This mechanism is also known as the inner photoelectric effect. If the absorption occurs in the junction's depletion region, or one diffusion length away from it, these carriers are swept from the junction by the built-in electric field of the depletion region. Thus holes move toward the anode, and electrons toward the cathode, and a photocurrent is produced.

The total current through the photodiode is the sum of the dark

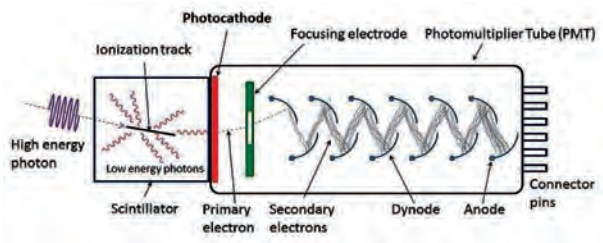


Figure 1: Schematic view of a scintillation detector coupled with a photomultiplier

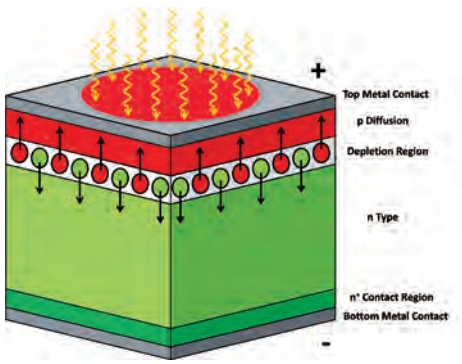
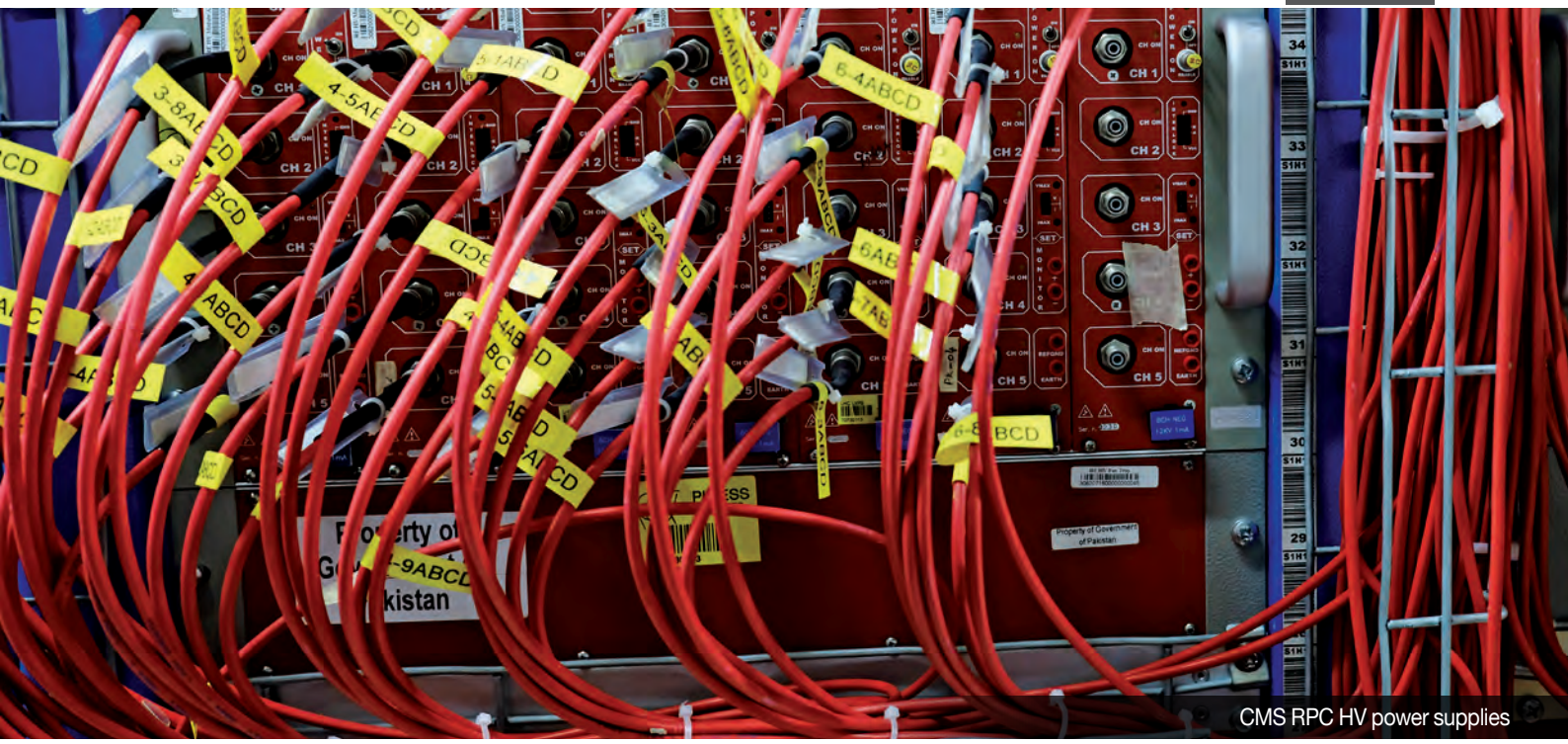


Figure 2: Schematic view of a photodiode working principle



CMS RPC HV power supplies

current (current that is generated in the absence of light) and the photocurrent, so the dark current must be minimized to maximize the sensitivity of the device. When used in zero bias, the flow of photocurrent out of the device is restricted and a voltage builds up. When reverse biased, the depletion layer is widen and the reaction volume expanded.

"Photodiode" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

Photodiodes Power Supply Requirements	
Typical Voltage	5 V to 100 V
Typical Current	1 µA to 10 mA
Polarity	Positive or Negative

Avalanche Photodiodes

An avalanche photodiode (APD) is a highly sensitive semiconductor electronic device that exploits the photoelectric effect to convert light to electricity. APDs can be thought of as photodetectors that provide a built-in first stage of gain through avalanche multiplication. From a functional standpoint, they can be regarded as the semiconductor analog to photomultipliers. By applying a high reverse bias voltage (typically 100-200 V in silicon), APDs show an internal current gain effect (around 100) due to impact ionization (avalanche effect).

However, some silicon APDs employ alternative doping and beveling techniques compared to traditional APDs that allow greater voltage to be applied (> 1500 V) before breakdown is reached and hence a greater operating gain (> 1000). In general, the higher the reverse voltage the higher the gain. If very high gain is needed (10^5 to 10^6), certain APDs (single-photon avalanche diodes) can be operated with a reverse voltage above the APD's breakdown voltage. In this case, the APD needs to have its signal current limited and quickly diminished.

Active and passive current quenching techniques have been used for this purpose. APDs that operate in this high-gain regime are in Geiger mode. This mode is particularly useful for single photon detection provided that the dark count event rate is sufficiently low.

"Avalanche Photodiode" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

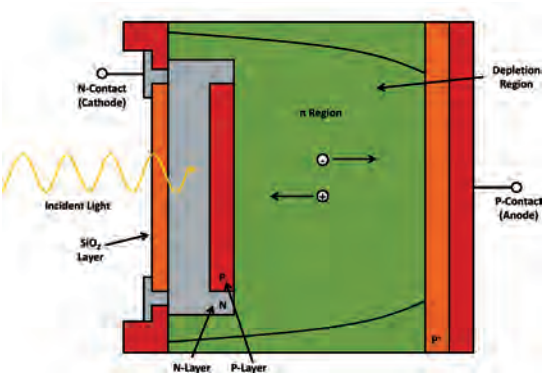


Figure 3: Schematic view of the APD working principle

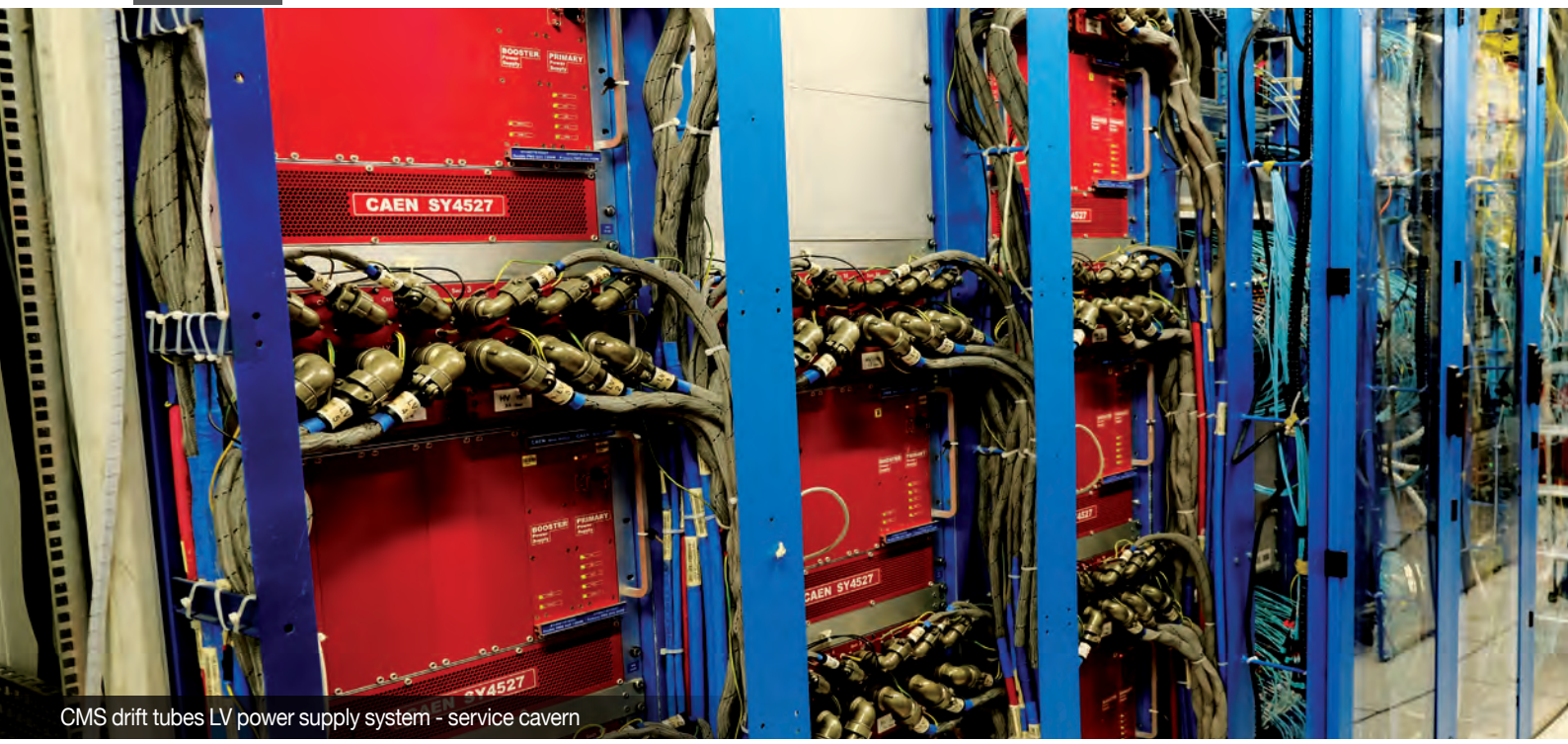
APDs Power Supply Requirements	
Typical Voltage	50 – 2000 V
Typical Current (Anode)	1 – 10 mA
Polarity	Positive or Negative

Silicon photomultipliers

Silicon photomultipliers are silicon single photon sensitive devices built from an avalanche photodiode (APD) array on common silicon substrate. The dimension of each single APD can vary from 20 to 100 µm and their density can be up to 1000 per square millimeter. Every APD in SiPM operates in Geiger-mode and is coupled with the others by a polysilicon quenching resistor.

Although the device works in digital/switching mode, the SiPM is an analog device because all the microcells are read in parallel making it possible to generate signals within a dynamic range from a single photon to 1000 photons per single square millimeter area device. The supply voltage depends on APD technology used, and typically varies between 20 V and 100 V, thus being from 15 to 75 times lower than the voltage required for a traditional photomultiplier tubes (PMTs) operation.

Photo detection efficiency ranges from 20-50% depending on device and wavelength, being similar to a traditional PMT. The gain is also



CMS drift tubes LV power supply system - service cavern

similar to a PMT being approximately 10^6 while the G/V dependence is linear and does not follow a power law like in the case of PMTs. The signal parameters are practically independent of external magnetic fields and the small dimensions permits extremely compact, light and robust mechanical design.

"Silicon Photomultiplier" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

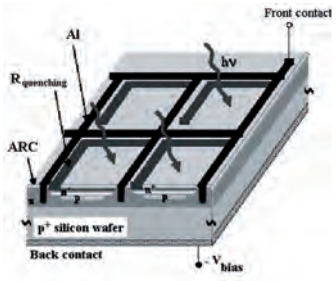


Figure 4: Schematic view of the Silicon

Silicon PMs Power Supply Requirements	
Typical Voltage	25 V to 70 V
Typical Current (Anode)	10 to 30 mA
Typical Voltage (electronics)	5 V
Typical Current (electronics)	40 to 100 mA
Polarity	Positive or Negative

Silicon Strips, Drift and Pixel Detectors

Semiconductor detectors are also a very useful tool to detect charged particles. In semiconductor detectors, ionizing radiation is measured by the number of charge carriers set free in the detector material which is arranged between two electrodes, by the radiation. Ionizing radiation produces free electrons and holes. The number of electron-hole pairs is proportional to the energy of the radiation to the semiconductor. As a result, a number of electrons are transferred from the valence band to the conduction band, and an equal number of holes are created in the valence band. Under the

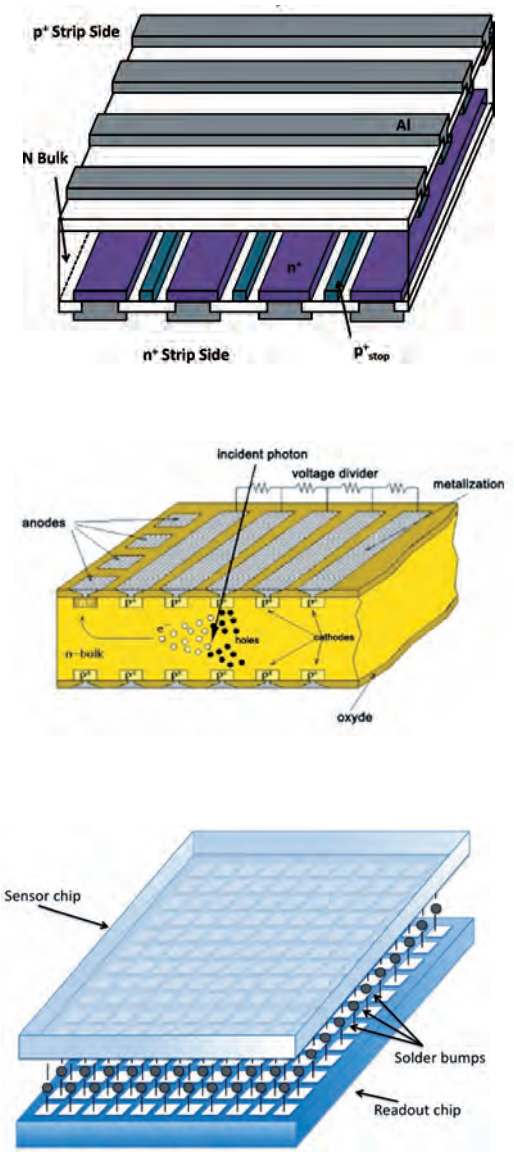
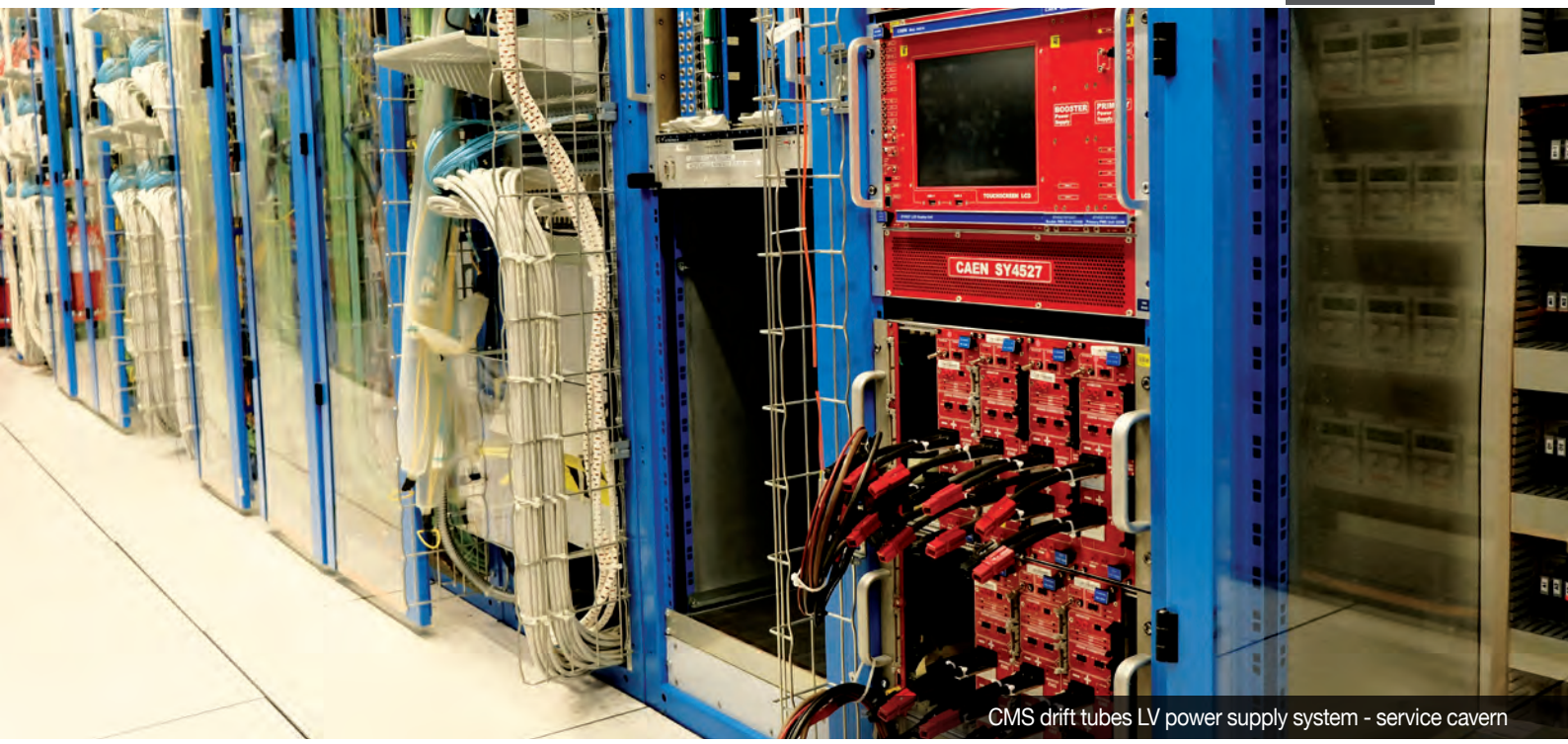


Figure 5: Schematic view of a Silicon Strip (top), Drift (middle) and Pixel (bottom) sensor and working principle



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influence of an electric field, electrons and holes travel to the electrodes, where they result in a pulse that can be measured in an outer circuit. The holes travel in the opposite direction and can also be measured. Most silicon particle detectors work, in principle, by doping narrow (usually around 100 micrometers wide) strips of silicon to turn them into diodes, which are then reverse biased.

As charged particles pass through these strips, they cause small ionization currents that can be detected and measured. Arranging hundreds or thousands of these detectors around a collision point in a particle accelerator can yield an accurate picture of what paths particles take. Silicon detectors have a much higher resolution in tracking charged particles than older technologies such as cloud chambers or wire chambers. The drawback is that silicon detectors are much more expensive than these older technologies and require sophisticated cooling to reduce leakage currents (noise source).

They also suffer degradation over time from radiation. Three typical configurations of a silicon detector are silicon micro-strip, silicon drift and silicon pixels detectors. All of them frequently operate in high radiation environments and require a bias voltage adjustable on a wide range, typically from 0 to 500 V, with a high precision remote monitoring and controlling system for voltages and currents, in order to avoid breakdowns and guarantee a constant gain over time.

"Semiconductor detector" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

Silicon Detectors Power Supply Requirements	
Typical Voltage (bias)	50 – 500 V
Typical Current (bias)	1 mA
Typical Voltage (electronics)	2 – 5 V
Typical Current (electronics)	40 to 500 mA
Polarity	Positive or Negative

Germanium detectors

Germanium detectors are mostly used for gamma spectroscopy in nuclear physics, as well as x-ray spectroscopy. While silicon detectors cannot be thicker than a few millimeters, germanium can have a depleted, sensitive thickness of centimeters, and therefore can be used as a total absorption detector for gamma rays up to few MeV.

The major drawback of germanium detectors is that they must be cooled to liquid nitrogen temperatures to produce spectroscopic data. At higher temperatures, the electrons can easily cross the band gap in the crystal and reach the conduction band, where they are free to respond to the electric field, producing too much electrical noise to be useful as a spectrometer. Cooling to liquid nitrogen temperature (77 K) reduces thermal excitations of valence electrons so that only a gamma ray interaction can give an electron the energy necessary to cross the band gap and reach the conduction band.

"Semiconductor detector" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

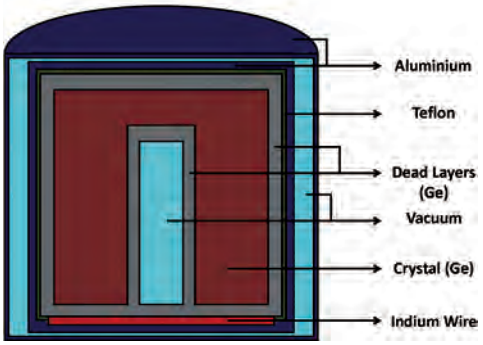
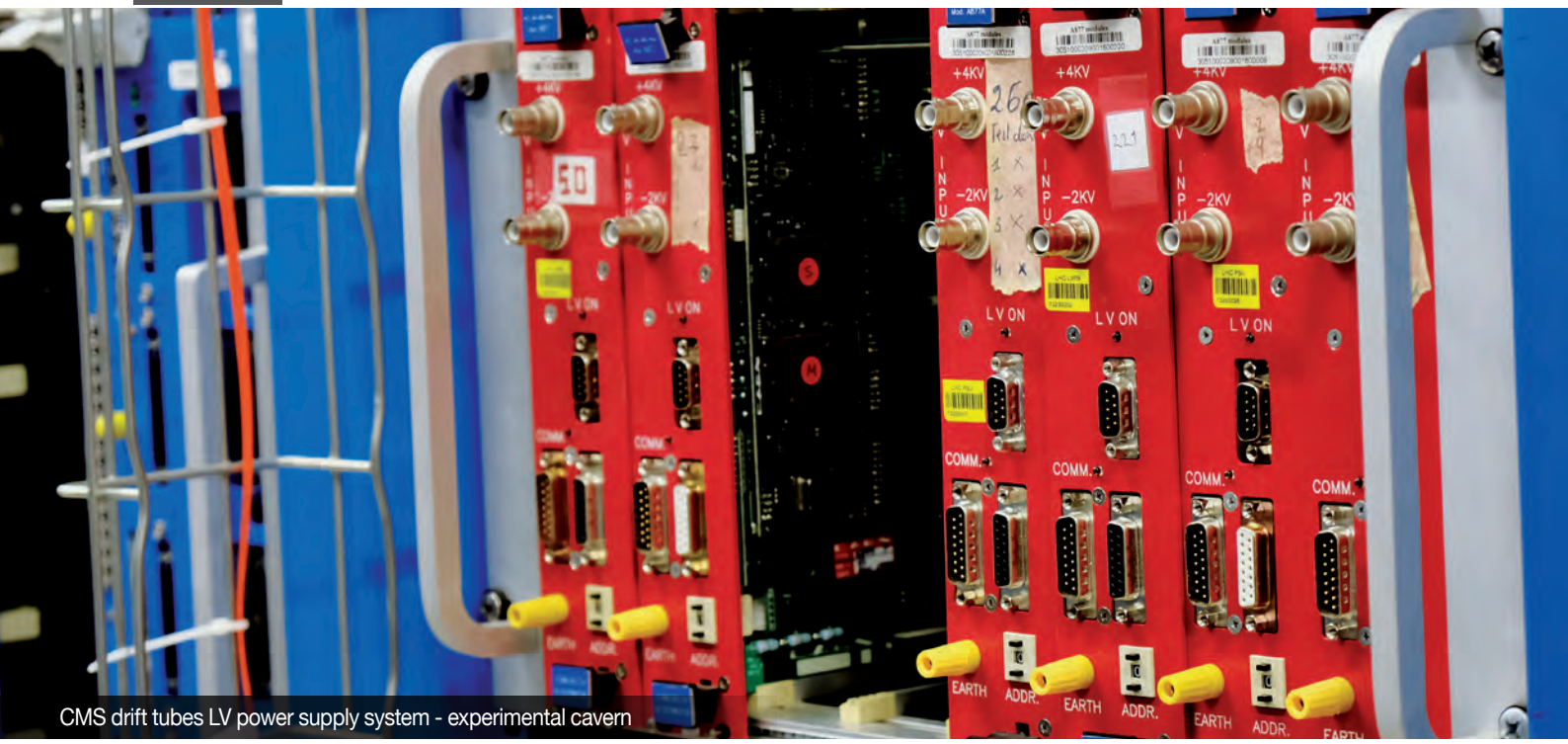


Figure 6: Schematic view of a Germanium detector

Germanium Detectors Power Supply Requirements	
Typical Voltage (bias)	Up to 4500 V
Typical Current (bias)	0.1 – 1 mA
Typical Voltage (electronics)	2 – 5 V
Typical Current (electronics)	40 to 500 mA
Polarity	Positive or Negative



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Wire Chambers

The Wire Chambers are particle detectors belonging to the family of gaseous detectors. It is composed by a wire or an array of wires kept at high voltage (anode), which run through a chamber with conductive walls held at ground potential (cathode). Alternatively, the wires may be at ground potential and the cathode held at a high negative voltage; the key point is that a uniform electric field draws extra electrons or negative ions to the anode wires with little lateral motion. The chamber is filled with carefully chosen gas, such as an argon/methane mix, such that any ionizing particle that passes through the tube will ionize surrounding gaseous atoms. The resulting ions and electrons are accelerated by the electric field across the chamber, causing a localised cascade of ionization known as a Townsend avalanche.

This allows to count the crossing particles and if chamber is used in the proportional regime to evaluate the particle energy loss. In case of a multi wire proportional chamber by computing pulses from all the wires, the particle trajectory can be found and together with the information about the energy loss, the particle identification can be performed. If one also precisely measures the timing of the current pulses of the wires and takes into account that the ions need some time to drift to the nearest wire, one can infer the distance at which the particle passed the wire.

This greatly increases the accuracy of the path reconstruction and is known as a drift chamber. If two drift chambers are used with the wires of one orthogonal to the wires of the other, both orthogonal to the beam direction, a more precise detection of the position is obtained. If an additional simple detector (like the one used in a veto counter) is used to detect, with poor or null positional resolution, the particle at a fixed distance before or after the wires, a tridimensional reconstruction can be made and the speed of the particle deducted from the difference in time of the passage of the particle in the different part of the detector. This setup gives up the detector called Time Projection Chamber (often written just TPC).

"MultiWire Proportional Chamber" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

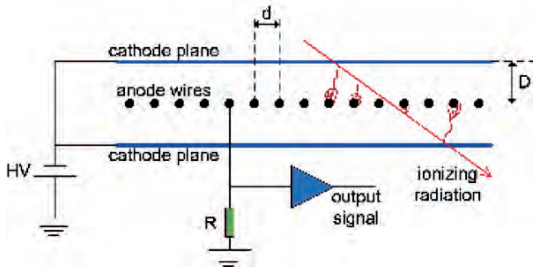


Figure 7: Schematic view of a Wire Chamber working principle

Wire Chambers Power Supply Requirements	
Typical Voltage	0.5 – 10 kV
Typical Current	less than 1 mA
Polarity	Positive (common) or Negative

MicroMegas detectors

The "Micromegas " (Micro-MEsh GAseous Structure) detector is a gaseous particle detector coming from the development of wire chamber. The Micromegas works by amplifying the charges that have been created by ionization in the gas volume, divided in two parts by a metallic micro-mesh placed between 25 µm and 150 µm from the readout electrode. The micro-

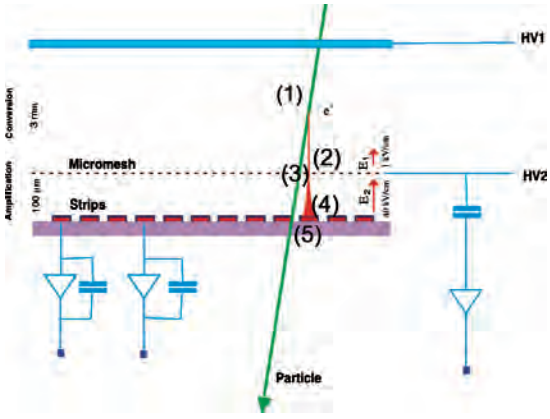


Figure 8: Schematic view of a MicroMegas working principle

mesh is the key element since it allows, at the same time a high gain of 10^4 with a fast signal of about 100 ns and a spatial resolution of about 100 µm.

"MicroMegas detector" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

MicroMegas Detectors Power Supply Requirements	
Typical Voltage (Mesh)	up to 500 V
Typical Voltage (Drift Electrode)	up to 800 V
Typical Current	nA range
Polarity	Dependent on ground configuration

Resistive Plate Chambers

Resistive Plate Chambers (RPC) are gaseous parallel-plate detectors that combine good spatial resolution with a time resolution comparable to that of scintillators. They are therefore well suited for fast space-time particle tracking applications.

An RPC consists of two parallel plates, made out of phenolic resin (bakelite) with a bulk resistivity of 10^{10} - 10^{11} Ωcm, separated by a gas gap of a few millimeters. The whole structure is made gas tight. The outer surfaces of the resistive material are coated with conductive graphite paint to form the HV and ground electrodes. The read-out is performed by means of aluminum strips separated from the graphite coating by an insulating PET film. The RPCs can be operated in streamer mode, i.e. the electric field inside the gap is kept intense enough to generate limited discharges localized near the crossing of the ionizing particle. However, the rate capability obtained in such operational conditions is limited (~100 Hz/cm^2).

A significant improvement is achieved by operating the detector in the so-called avalanche mode; the electric field across the gap (and consequently the gas amplification) is reduced and a robust signal amplification is introduced at the front-end level. The substantial reduction of the charge produced in the gap improves by more than one order of magnitude the rate capability.

CMS RPC Technical Note" http://www.nevis.columbia.edu/~chi/rpc/cms-rpc-tech-note.pdf

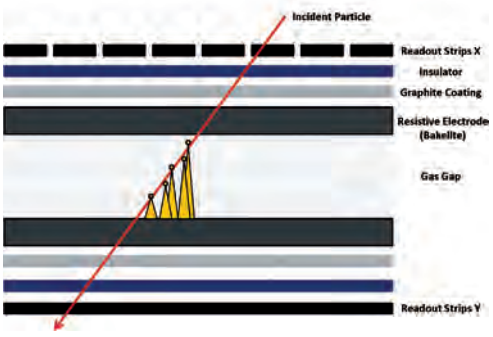


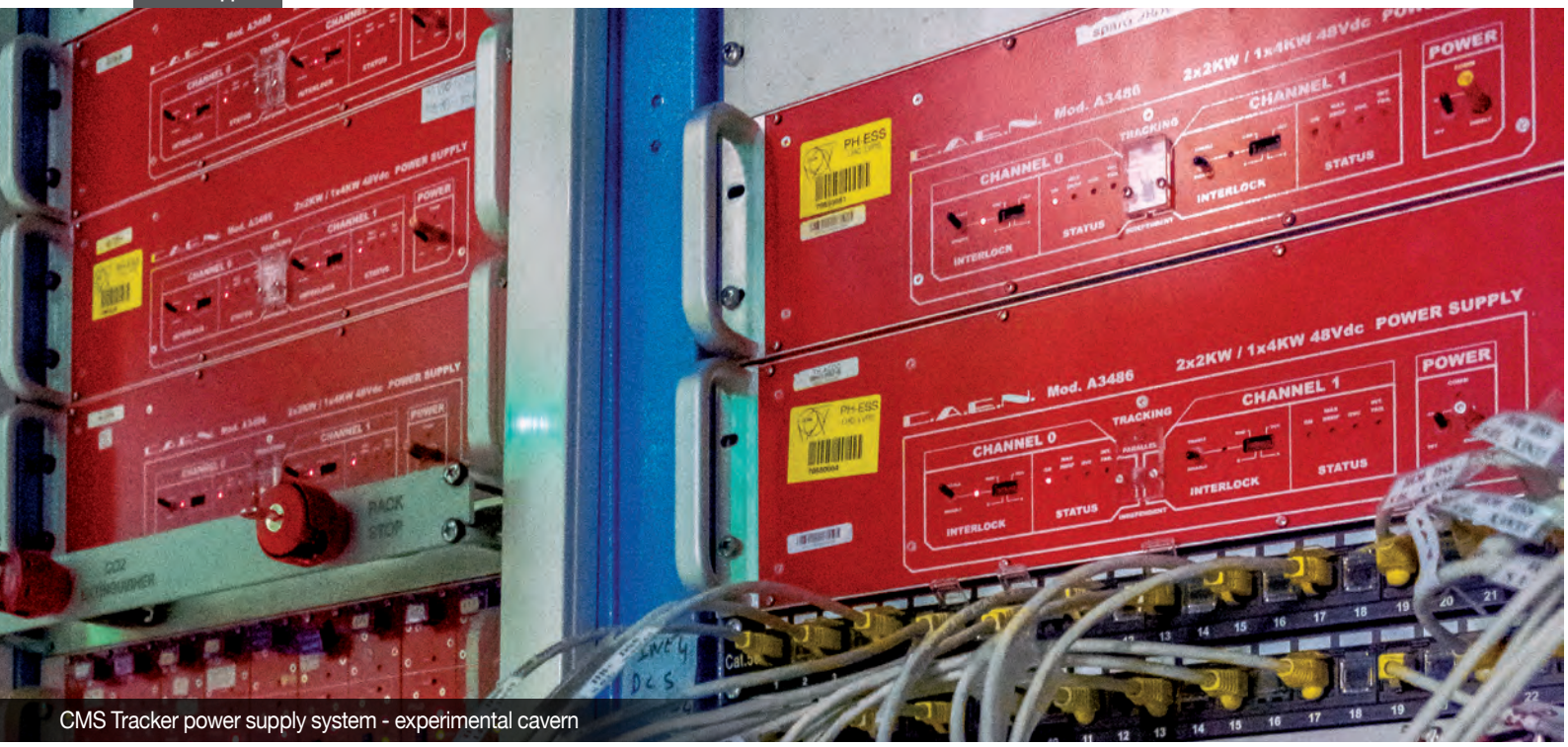
Figure 9: Schematic view of a Resistive Plate Chamber working principle

RPC Detectors Power Supply Requirements	
Typical Voltage	9 – 12 kV
Typical Current	1 µA/m^2
Polarity	Positive or Negative

Gas Electron Multipliers

A Gas Electron Multiplier (GEM) is a type of gaseous ionization detector used in nuclear and particle physics and radiation detection. All gaseous ionization detectors are able to collect the electrons released by ionizing radiation, guiding them to a region with a large electric field, and thereby initiating an electron avalanche. The avalanche is able to produce enough electrons to create a current or charge large enough to be detected by electronics. In most ionization detectors, the large field comes from a thin wire with a positive high-voltage potential; this same thin wire collect the electrons from the avalanche and guides them towards the readout electronics.

GEMs create the large electric field in small holes in a thin polymer sheet; the avalanche occurs inside of these holes. The resulting electrons are ejected from the sheet, and a separate system must be used to collect the electrons and guide them towards the readout. GEMs are one of the class of micropattern gas detectors; this class includes micromegas and other technologies.



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Typical GEMs are constructed of 50–70 micrometre thick Kapton foil clad in copper on both sides. A photolithography and acid etching process makes 30–50 micrometer diameter holes through both copper layers; a second etching process extends these holes all the way through the Kapton. The small holes can be made very regular and dimensionally stable. For operation, a voltage of 150–400 V is placed across the two copper layers, making large electric fields in the holes. Under these conditions, in the presence of appropriate gases, a single electron entering any hole will create an avalanche containing 100–1000 electrons; this is the "gain" of the GEM. Since the electrons exit the back of the GEM, a second GEM placed after the first one will provide an additional stage of amplification. Many experiments use double- or triple-GEM stacks to achieve gains of one million or more.

"Gas electron multiplier" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. 10 Aug. 2004.

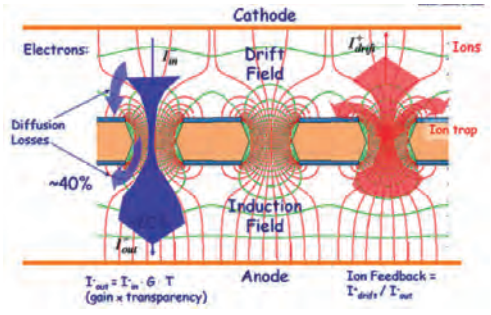

Figure 10: Schematic view of a GEM working principle

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GEM Detectors Power Supply Requirements	
Typical Voltage	300 – 500 V (GEM foils) / 500 - 700 V (Transfer gaps)
Typical Current	1 - 10 mA (GEM foils) / few µA (Transfer gaps)
Polarity	Positive or Negative

CAEN Power Supply Products

At CAEN we believe that a perfect blend of tradition and innovation constitute the foundation of our DNA. The tradition of CAEN Power Supplies was born from the needs of the research institutions, and has developed and grown through years of side-by-side collaboration with our customers. Innovations such as high-density multi-channel Power Supplies have solidified our status at the worldwide leader in detector bias. Our synergistic relationship with the research community, coupled with years of hard-earned expertise and experience, have qualified CAEN Power Supplies as a veritable standard in Physics Laboratories throughout the world.

For CAEN, innovation never sleeps. We've continued to introduce new and innovative features into our Power Supplies, features which have served to advance the standard of operation. During the LHC setup phase we were the first to design Power Supplies able to withstand harsh experimental hall conditions such as radiation and magnetic fields.

Our most recent design innovations include sophisticated touch-screen control, Wi-Fi connectivity, and single dashboard GUI control software similar to what you will find in the most advanced consumer electronics.

In recognition of our long-standing blend of tradition and innovation, the "CMS Crystal Award 2009" was awarded to CAEN for the development and production of supply systems for the CMS tracker.

CAEN offers a wide selection of power supplies in different form factors and standards. For smaller setups, NIM and VME modular solutions as well as Desktop and Rack-Mount Power Supplies are the ideal fit. For larger setups requiring high channel densities our Universal Multichannel Systems and boards (up to 48-channels per board) have been designed to offer the perfect blend of features and performance while respecting the budget.

Universal Multichannel Systems

Our Universal Multichannel Power Supply Systems are 100% internally developed and designed to install into a standard 19" relay rack. The mainframes and dedicated HV/LV boards were purposefully designed to provide peak performance in a broad spectrum of operational scenarios and for a vast number of detector types. CAEN mainframe systems are modular, making upgrade and maintenance a breeze. A single mainframe may house and provide control for up to 768 independent channels. Each mainframe may be configured with a mixture of both High Voltage boards for detector bias and Low Voltage boards to drive peripheral electronics.

Mainframes may be controlled either locally via touchscreen or remotely via Ethernet. CAEN offers several control software solutions, including a flexible and powerful GUI-based dedicated software platform (GECO2020) which allows the system administrator to define control access for individual users. Our mainframes may also be easily integrated into a user's Supervisory Control and Data Acquisition (SCADA) or Detector Control System (DCS) via CAEN's OPC Server/EPICS software, which allows the user to access, monitor, and control all system parameters and functions via Ethernet.

CAEN High Voltage boards have been tailored to provide bias to a wide range of detector types. Detector-specific HV solutions are available for PMTs, RCP, SiPM, and everything in between. These HV solutions are also available in densities ranging from 6 to 48-channels, making them the perfect fit for nearly any sized application.

This exceptional combination of power, flexibility, modularity, and reliability enable CAEN to customize the perfect HV/LV Mainframe System for any experimental conditions, from the smallest test-bench applications up to the largest international High Energy Physics experiments, and to do so in the most cost effective manner possible.

NIM High Voltage Power Supplies

The NIM (Nuclear Instrumentation Module) standard was first defined by the U.S. Atomic Energy Commission in 1968-1969. The idea was to realize a flexible and simple system based on interchangeable modular electronics for experimental Particle and Nuclear Physics. The goal was completely accomplished, since still nowadays NIM Modules are in widespread use all around the world in experimental physics, either big projects or small laboratories.

NIM High Voltage Power Supplies are the best choice for small experiments in which a really low noise feature is expected. Besides the well established generation of daisy chainable NIM power supplies, CAEN now offer a new generation of double width, self ventilated, 8 channels NIM module that provide more power per channel with excellent monitor resolution capabilities and ripple performaces.

The NIM Line includes also the NDT Power Supplies, which are hosted in a NIM module and can be plugged in NIM crates for power but have also the chance of desktop operation thanks to a mains power supply cord.

VME High Voltage Power Supplies

The VME bus (VERSA Module Eurocard) architecture was conceived in 1981 as a combination of the VERSA bus electrical specification and the EUROCARD form factor. VME was originally targeted for industrial applications, where it's durability and flexibility proved to be advantageous. However, these qualities also made VME an excellent choice for many applications, including military, medical, telecommunications, and high energy physics.

VME solutions are an integral part of CAEN's design history. CAEN VME solutions for Data Acquisition and Front End applications have been part of were first developed decades ago. These solutions have been upgraded and modernized multiple times, and were recently joined by CAEN VME programmable High Voltage Boards. Thanks to the innovative GECO2020 Control Software, and the multi-master capability of CAEN VME Bridges, it is now possible to accommodate and independently control an integrated VME DAQ/HV System.

Desktop and Rack High Voltage Power Supplies

While the standard for experimental physics Power Supplies is rooted in NIM, modern applications often require more portability and flexibility. For this reason CAEN has developed a new line of fully independent Desktop and Rack-Mount High Voltage Power Supplies. Offered with various V/I output configurations, CAEN Desktop and Rack-Mount Power Supplies are flexible enough to bias a wide range of detector types. These Power Supplies support the GECO2020 Control Software, multiple control options (Local or Remote via USB/Ethernet), and may function as independent units or they may be daisy-chained for system building.

PCB Power Supplies

In response to growing market demand CAEN has recently developed a new High Voltage Power Supply family in PCB form. These PCB HV Power Supplies are particularly well suited for astroparticle applications in which an array of detectors is spread over a very large area. For such applications the traditional centralized approach to detector bias becomes unwieldy. For distributed power the new CAEN PCB DC/DC converter is the perfect solution, combining high performance, reliability, and remote control capability (analog or digital) in a compact, cost effective package.

High Power Low Voltage System

For large experiments a basic requirement is often overlooked, the need for channels which provide high power and low voltage. This power configuration is typically required for customized front-end electronics which are located in the detector bay. The best possible solution for this requirement is an extremely reliable external power supply with remote wire sensing capability. All of the above have been integrated into the SY8800 Universal Multichannel Low Voltage Power Supply System, which combines traditional CAEN quality and reliability into a powerful, flexible, modular solution.

Power Supplies Control Software

All CAEN power supplies share a number of fundamental design concepts. This cross-platform foundation has allowed CAEN to develop a set of Control Software tools which support the user regardless of standard, model, or form factor.

Ranging from OPC Servers, to LabVIEW Instrument Drivers, to a dedicated, flexible, and powerful software suite with advanced Graphical User Interface (GECO2020), CAEN HV Power Supply users will be provided the right CAEN Control Software tool for the job.

Find CAEN PSU best fit by channel

	Form Factor					Mainframe Systems and VME crate	
Number of channels per device	PCB Mount	NIM	VME	Desktop	Rack	Mainframe	VME Crate
1	A75xx	N14xx		DT547x			
2	A7560	N14xx, N1570					
4		N14xx, N14xxET, NDT14xx		DT55xxE, DT14xxET	R14xx		
6			V65xx			SY4527, SY4527LC, SY5527, SY5527LC	21, 8, 4, 2 slots
8		N803x		DT803x	R14xx, R803x	SY4527, SY4527LC, SY5527, SY5527LC	
12						SY4527, SY4527LC, SY5527, SY5527LC	21, 8, 4 slots
16					R803x	SY4527, SY4527LC, SY5527, SY5527LC	
Up to 18						SY4527, SY4527LC, SY5527, SY5527LC	21, 8, 4 slots
Up to 42						SY4527, SY4527LC, SY5527, SY5527LC	21, 8 slots
Up to 120						SY4527, SY4527LC, SY5527, SY5527LC	21 slots
Up to 192						SY4527, SY4527LC, SY5527, SY5527LC	
Up to 288						SY4527, SY4527LC, SY5527	
Up to 480						SY4527, SY4527LC	
Up to 768						SY4527	

CAEN Electronic Instrumentation

Power Supplies

UNIVERSAL MULTICHANNEL SYSTEMS

Mainframes

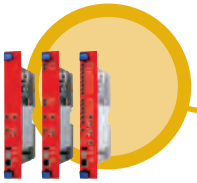
SY4527 and SY5527 - Universal Multichannel Systems

Mechanics

The completely redesigned mainframe is available in two versions: A large experimental system capable of housing up to 16 HV/LV boards (SY4527), and a more compact laboratory version able to house up to 6 HV/LV boards (SY5527). Whether the experiment is 10,000 channels or 10, CAEN mainframes can be tailored to provide the perfect solution.

Modularity

Our new mainframe systems have been designed to afford maximum flexibility, allowing the user to adapt components to the specifications of the experiment. This modularity also enhances system upgrade and maintenance procedures thanks to an extremely simple CPU and Power Supply replacement process.



CPU

All mainframes settings, I/O, and parameters may be monitored and controlled via the completely redesigned CPU module, which is available in three different versions (BASIC, ADVANCED, and FULL).

Control Software

All CAEN Mainframes include GECO2020, a powerful, flexible, user-friendly graphical control software which allows the user to manage, set, and monitor all system parameters and HV/LV channels. The standard software can be further enhanced with an advanced set of features which includes LOGGING and SCRIPTING capability.

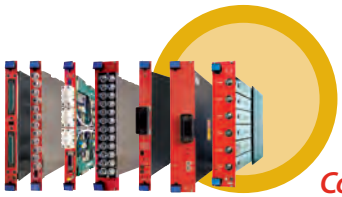
Four simple steps to build your *Mainframe!*

1. SELECT A CHASSIS…
2. SELECT A CPU…
3. ADD MORE POWER…
4. ADD THE ACCESSORIES…

…and now you can pick the perfect HV/LV board for the application from our extensive Catalog!

Control Interface

The system can be controlled either LOCALLY, via the new Touchscreen LCD, or REMOTELY via Gigabit Ethernet or Wi-Fi connection. Web based control is also provided.



Compatibility

Our new Mainframes now support high speed communication and are fully backward-compatible with boards developed for the previous SY1527/SY2527 family (HV & LV power supplies, branch controllers, ...).

Power Supply Units

Mix and Match from the three available power supplies to design the perfect output configuration for your application (output range 600W to 4200W).

Mainframes

SYx527 - SYx527LC

Software Tools available free!

Improved mechanics, modularity and compatibility at your service

SYx527 and SYx527LC

Reliability, Modularity, Compatibility, Connectivity, and User-Friendly: These are the concepts upon which the CAEN SYx527 and SYx527LC Mainframe Systems were developed. Our mainframe systems are specifically designed to provide ideal V/I output and monitoring for any detector technology employed in Modern Physics. Whether you are using SiPM or RCP, Wire Chambers or PMT, HPGe or GEM, our mainframes systems have you covered.

The flexible and modular nature of the SYx527 and SY527LC has resulted in a Mainframe System which can be customized for a very wide range of experimental situations, from the smallest test-bench to the largest international experiment.

The line consists of four different mainframe versions:

- The **SY4527** is a 19" wide/8U high mainframe which can house up to 16 HV/LV boards and provide up to 4200W power output.
- The **SY5527** is a 19" wide/4U high mainframe which can house up to 6 boards and provide up to 1800W power output.
- The **SY4527LC** is a 19" wide/8U high mainframe which can house up to 10 boards and provide up to 600W power output. (~20 cm shorter than the standard version).
- The **SY5527LC** is a 19" wide/4U high mainframe which can house up to 4 boards and provide up to 400W power output. (~20 cm shorter than the standard version)

SYx527

Features

- Modular design makes upgrade and maintenance simple and straightforward
- The modular CPU is available in three versions (BASIC, ADVANCED, FULL), allowing the user to customize the interface to experimental specifications
- Control options include REMOTE (Gigabit Ethernet - SNMP compatible - or optional Wi-Fi) and LOCAL (optional LCD Color Touchscreen)
- Backward compatible with all boards (power supplies, distributors, branch controllers) developed for the previous SY1527/SY2527 Mainframe Systems
- Available in a PREMIUM edition which includes features such as LCD Touchscreen, Wi-Fi Connectivity, and Advanced Software suite
- Includes flexible, powerful, GUI-based Control Software (GECO2020)
- Advanced Trip Handling
- Hardware Current and Voltage Protection
- Reset and Interlock Control
- Modular Power Supply supports easy expansion and upgrade
- Simple, User-Friendly process to upgrade firmware
- Responsive and accurate set & monitoring of channel parameters
- Multi-Mainframe System control capability via GECO2020 control software
- Intranet supported access for enhanced security
- Connectivity via Gigabit Ethernet or Wi-Fi
- Integrated EPICS IOC
- OPC Server for simple integration into Detector Control System (DCS)
- Java-based Web-browser control option for uncomplicated connectivity and control

Overview

The SYx527 System is the fully equipped experimental version of CAEN's latest line of mainframe High Voltage and Low Voltage Power Supplies. Our innovative approach to power generation and distribution is founded upon a few basic principles: Reliability, Modularity, Flexibility, and User-Friendliness. Instituting this approach, a single CAEN Mainframe can simultaneously provide HV bias to nearly any detector technology utilized in Modern Experimental Physics, while at the same time support Low Voltage boards to drive front-end and peripheral electronics, house generic I/O boards for condition monitoring (temp, pressure, etc..), and support branch controllers for system propagation and control. Modularity, flexibility, and reliability are interwoven into the DNA of the SYx527, enabling the system to meet and exceed almost any experimental requirement.

The SYx527 Mainframe is housed in a 19" wide euro-mechanics rack and hosts four main sections:

- **Board Section:** With 6 (SY5527) or 16 (SY4527) slots to accommodate HV/LV boards, distributors, and branch controllers
- **Fan Tray Section**: Includes 3 (SY5527) or 6 (SY4527) fans which support user-programmable speed regulation and are aligned to maximize air flow
- **Power Supply Section**: Consists of one primary power supply and space for booster power supplies (Max: 1800W for SY5527 and 4200W for SY4527)
- **CPU** and **Front Panel Section**: Includes all interface and communication

The CPU controller is offered in three versions: BASIC, ADVANCED and FULL:

- The **BASIC** version provides communication interface, RESET control, INTERLOCK control, and STATUS LED indicators
- The **ADVANCED** builds upon the above by adding beam handshake management connectors (CH-ON, GEN, VSEL, ISEL)
- The **FULL** version provides a complete array of panel connectors, an ENABLE control section, and fan speed control

The Power Supply Unit (PSU) is also available in three versions: **PRIMARY**, **OPTIONAL SINGLE** and **OPTIONAL DOUBLE**.

- The **Primary PSU** (A4531) is the standard SYx527 power supply block. It includes the SERVICE and 600W PSU within a single slot module. Each SY4527/SY5527 includes one A4531 Primary Power Supply
- The **Optional Single PSU** provides an additional 600W of power in a single slot module
- The **Optional Double PSU** provides an additional 1200W of power in a single slot module

Please note: The PRIMARY PSU will be providing power to the boards installed into the mainframe as well as to the motherboard control electronics (CPU). When configuring the SYx527 power output customers should take this factor into consideration. For some applications, especially those which include Low Voltage/High Amperage boards, the power requirement must be carefully considered to avoid failures and maximum component life expectancy. For configuration questions or concerns we recommend that you contact your CAEN representative and/or technical support.

CAEN has continued its tradition of user-friendliness by including the powerful, flexible GECO2020 Control Software, and extended that tradition to local control, which is available via an optional LCD Touchscreen.

The SYx527 Systems have been engineered with an emphasis on modularity. Critical components (PSU units, CPU, Board Sections) are completely modular, which greatly enhances and simplifies maintenance and upgrade. Additionally, in the unlikely event of a repair situation this modular design can ease the return process and even eliminate downtime.

Legacy CAEN customers will also be happy to learn that the SYx527 Mainframe System is backward compatible with boards designed for the previous SY1527/SY2527 Mainframe Systems.

A base SYx527 configuration consists of one 600W Primary Power Supply unit, one Basic CPU controller, and one HV/LV board. Of course, users may add to or upgrade these components as required by their experimental specifications.

For applications in which magnetic fields or radiation are an added obstacle the SYx527 system supports a distributed solution, into which "branch controller" boards are integrated For such a configuration, branch controller boards are installed into the system mainframe and coupled to specially designed magnetic field and radiation tolerant on-detector "remote boards", thus removing sensitive electronics from potentially hazardous areas. CAEN has developed a sophisticated trip handling mechanism, which allows the control software to monitor trip conditions on the channels remotely.

All SYx527 Systems support Live Insertion/Extraction of the boards, which can greatly reduce down time of the global system and facilitate continuous access to the computing core and peripherals of the system. The Gigabit Ethernet interface and optional Wi-Fi interface allow fast and easy connectivity and control. Multiple control options are provided, including OPC Server, EPICS, LabVIEW, DCS and SCADA control system support.

For System Building, the Power Supply Section and Board Section may be externally synchronized via front panel connectors. Maintenance and upgrading, which constitute a major component of system reliability, are further enhanced by a feature which permits network facilities and administrators remote access.

Ordering Options - SY4527

Code	Description
WSY4527BSCXA	SY4527 - Universal Multichannel Power Supply System - BASIC 600W
WSY4527ADVXA	SY4527 - Universal Multichannel Power Supply System - ADVANCED 600W
WSY4527FLLXA	SY4527 - Universal Multichannel Power Supply System - FULL 600W
WSY4527PREXA	SY4527 Premium - Includes SY4527 FULL, A4534, A4535, SW4536

Ordering Options - SY5527

Code	Description
WSY5527BSCXA	SY5527 - Universal Multichannel Power Supply System - BASIC 600W
WSY5527ADVXA	SY5527 - Universal Multichannel Power Supply System - ADVANCED 600W
WSY5527FLLXA	SY5527 - Universal Multichannel Power Supply System - FULL 600W
WSY5527PREXA	SY5527 Premium - Includes SY5527 FULL, A5534, A4535, SW4536

SYx527LC

Features

- SY4527LC: Houses up to 10 boards and includes a 600W power supply
- SY5527LC: Houses up to 4 boards and includes a 400W power supply
- Supports Ad-hoc boards for peripheral systems
- Fully compatible with SYx527 HV/LV boards
- ~20cm shorter (depth) than the standard SYx527 versions

Overview

The SYx527LC Systems represent a cost effective alternative for those who are constrained by fiscal opportunity. The SYx527LC systems support and are fully compatible with the complete line of power supply boards and distributor boards developed for the SY4527 and SY5527 mainframes. The front panel of each mainframe houses the BASIC version of the A4528 CPU Modules as well as the mainframe power supply unit. The SY4527LC and SY5527LC include 600W and 400W power supplies, respectively.

Ordering Options - SYx527LC

Code	Description
WSY4527LCXAA	SY4527LC - 10 Slot Low Cost Universal Multichannel Power Supply System
WSY5527LCXAA	SY5527LC - 4 Slot Low Cost Universal Multichannel Power Supply System
WSW4536XAAAA	SW4536 - SY4527/SY5527 Control software functionality enhancement activation code

Ordering Options - SYx527 Accessories

Code	Description
WA4534XAAAAA	A4534 - SY4527 10.4" LCD Touchscreen color Display Unit
WA4537XAAAAA	A4537 - SY4527 5.7" LCD Touchscreen color Display Unit
WA5534XAAAAA	A5534 - SY5527 5.7" LCD Touchscreen color Display Unit
WA4535XAAAAA	A4535 - SY4527/SY5527 Wi-Fi Dongle for Wireless connectivity
WSW4536XAAAA	SW4536 - SY4527/SY5527 Control software functionality enhancement activation code
WA4528ADVXAA	A4528 - SY4527/SY5527 CPU Module ADVANCED
WA4528BSCXAA	A4528 - SY4527/SY5527 CPU Module BASIC
WA4528FLLXAA	A4528 - SY4527/SY5527 CPU Module FULL
WA4531XAAAAA	A4531 - SY4527/SY5527 Primary Power Supply 600W
WA4532S600XA	A4532 - SY4527/SY5527 Optional Single Power Supply Unit 600W
WA4533D1200X	A4533 - SY4527/SY5527 Optional Double Power Supply Unit 1200W

Mainframes compare

In the following tables all the mainframes belonging to the family are listed together with an overview of the relevant parameters. Mainframes in the images represent one of the possible configuration.




Modularity

Mainframe	SY4527	SY4527LC	SY5527	SY5527LC
HV BoardsSlots	16	10	6	4
Power(W)	600-4200 (1)	600	600-1800	400
LCD Display	10,4/5,7" (1)	No	5,7"	No
Heigth, Depth	8U, 747mm	8U, 546 mm	4U, 747mm	4U, 546mm
Max # channels	768	480	288	192

(1) 1800 W with 10" Display or 4200 W with 5,7" Display

CPU Modules and Power Supply Units

CPU Modules

A4528x CPU Modules
3 different CPU modules for SYx527: Basic, Advanced, Full.

Basic version

- Communication interfaces
- RESET control
- INTERLOCK control
- Status LEDs

Mod. 4528BSC

Advanced version

- Communication interfaces
- RESET control
- INTERLOCK control
- Status LEDs
- Beam handshake management connectors (CH-ON, GEN, VSEL, ISEL)

Mod. 4528ADV

Full version

- Communication interfaces
- RESET control
- INTERLOCK control
- Status LEDs
- Beam handshake management connectors (CH-ON, GEN, VSEL, ISEL)
- CHK PASS, RST FLAG, OVV, UNV, OVC, TRIP, KILL and HV SYNC connectors
- ENABLE control section
- Front panel Fan speed control

Mod. 4528FLL

Power Supply Units

A453x Power Supply Units
3 different Power Supplies for SYx527: Primary, Optional Single, Optional Double.

Primary PSU - 600 W

This is the basic building block of the SY4527, SY5527, and SY4527LC (400W version included with SY5527LC).

Mod. A4531

Optional Single PSU - 600 W

This booster power supply adds 600W of power in a single slot module to either the SY4527 or SY5527 Mainframe System. This is an optional item which may be ordered separately.

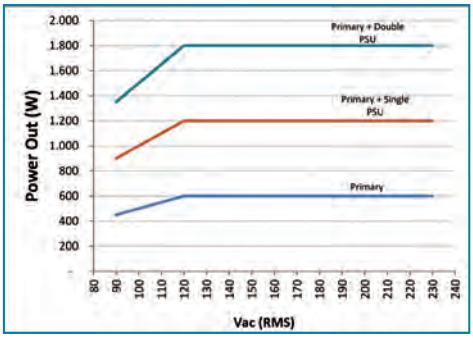
Mod. A4532

Optional Double PSU - 1200 W

This booster power supply adds 1200W of power in a single slot module to either the SY4527 or SY5527 Mainframe System. This is an optional item which may be ordered separately.

Mod. A4533

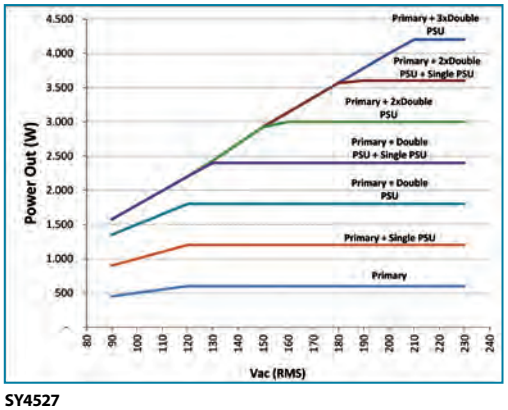
Note: In SY4527 the max number of PSU which can be installed is 4 (1 Primary and 3 Optional). In case the SY4527 is equipped with LCD display the max number is 2 (1 Primary and 1 Optional). In SY5527 the max number of PSU which can be installed is 2 (1 Primary and 1 Optional).



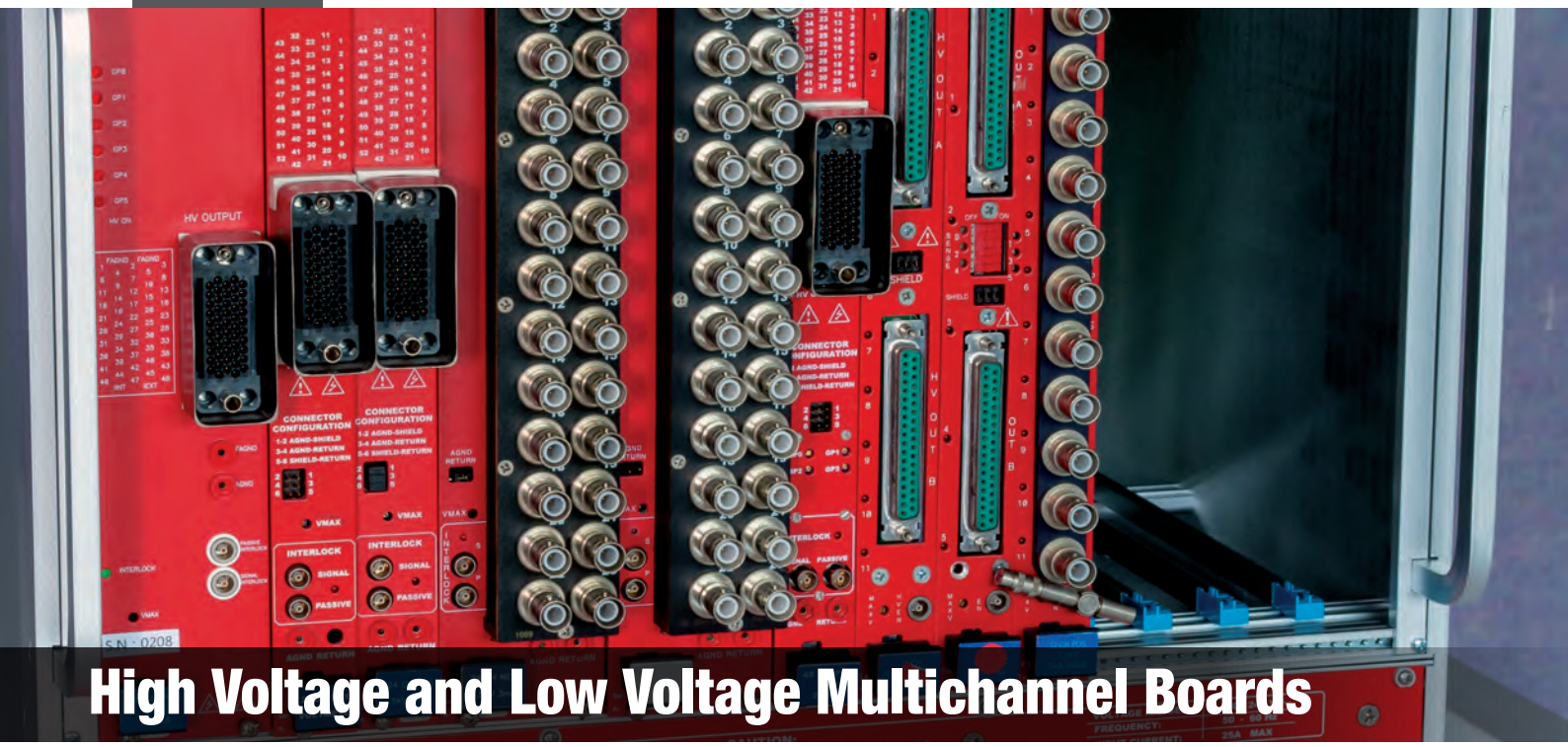
SY5527

The following charts show the available output power depending on installed Power Supply Units and input power voltage line for both Mainframes.

(Maximum Output Power vs. Power Supply Units and power voltage line)



SY4527



High Voltage and Low Voltage Multichannel Boards

CAEN provides power supply boards featuring full **independent channels**. Each channel mounts its own DC-DC converter, voltage and maximum supplied current can be adjusted independently over the full dynamic range.

The power supplies that we realize are suited also for applications where the detector power consumption is demanding: e.g. systems of multiple phototubes which require currents of few mA per channel. In other cases the current consumption could be smaller than 1 mA and the measurement of the current consumption could be an important parameter. CAEN provides power supplies with current resolution down to few pA.

Moreover, for costumers which need both accurate current monitoring and high power output we provide **Dual Range** power supplies: the user can switch between an high current regime and a low one, with the possibility to improve the absolute precision of the current monitor.

CAEN goal is the customer satisfaction and its R&D collaborates with researchers to develop products for special requests. Our company delivers high profile power supplies to match the requirements of new detector technologies and to guarantee long term stability of the specifications. CAEN is proud to have provided the devices and the technical support which allowed experimental collaborations of the last decades to develop their apparatus and achieve their scientific goals. Several major particle physics experiments, and more recently the CMS and ALICE collaborations, entrusted CAEN with the realization of the power supplies for their Silicon trackers. We provided for instance our low voltage power supplies with Remote Sensing Lines to control the voltage drop along the power lines and we also developed power supply units able to operate in extreme conditions of radiation and magnetic fields.

Highlights

- Fully independent channels
- Set current and voltage, remotely and locally
- High current resolution, or high output power or dual range
- Live insertion
- Multiple choice of connector types and adapters: SHV, CPE, DB, Radiall
- Multiple choice of channel grounding
- Remote and programmable interlocks
- Overvoltage and undervoltage programmable protections
- Overcurrent programmable protection and constant current mode

Single Channel Behaviour

Each channel feature a set of programmable parameters that allows the user a full control: two voltage values (V0SET, V1SET), two current limit values (I0SET, I1SET) and the maximum rate of change of the voltage (V/s). The latter owns two distinct values are available, Ramp-Up and Ramp-Down. Any command to change the voltage will result in a linear voltage increase or decrease with time, the rates being determined by the Ramp-Up or Ramp-Down parameters, respectively. The boards features also programmable (ISET) or fixed (IMAX) current hardware protections and their value represent a software-controlled hardware limitation on the channels' currents. The channel cannot draw a current higher than its programmed limit. If a channel tries to draw a current larger than the programmed limit, it is flagged to be in OVERCURRENT. The System detects this state as a fault and reacts according to the setting of the TRIP parameter, namely:

1 **TRIP = infinite (constant CURRENT mode)**
If the board has programmable or fixed current hardware protections, the output voltage is varied to keep the current below the programmed limit. The channel behaves like a current generator.

2. **TRIP = finite value (TRIP mode)**
In this case, the channel behaves as in the constant current mode for a time equal to the finite value set as TRIP parameter, and then

it is switched off according to the selected Power-Down option (Kill/Ramp-Down). If the Kill option is selected, the channel will be switched off immediately. If the Ramp-Down option is selected the voltage will drop to zero at a rate determined by the value of the Ramp-Down parameter programmed for that channel.

Other indicators are foreseen to signal the channel status, such as OVERVOLTAGE, UNDERVOLTAGE and CHANNEL ON.

Power Supply Grounding

CAEN Power Supply units can be distinguished according to their connection to electrical ground. We provide three main boards architectures:

- **Common Ground**
- **Common Floating Return**
- **Individual Floating Channel**

The **Common Ground** configuration is somehow the simplest.

Power supplies of this kind have the channel voltage reference hardwired to the chassis/crate ground.

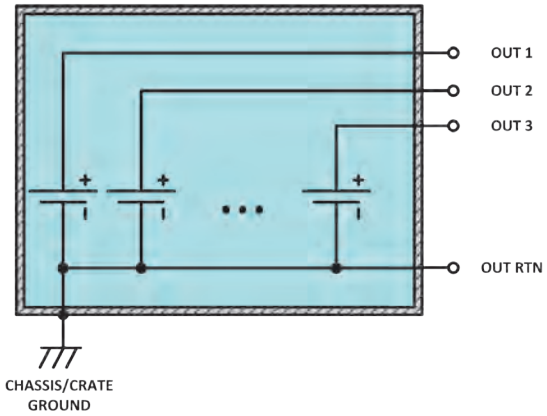


Figure 1: Common Ground Board

The **Common Floating Return** boards have channels sharing one common ground, which is insulated from the chassis/crate ground. This feature may help to minimize problems of ground-loops. The level of insulation from the channel return to chassis/crate ground may vary between different typologies of boards.

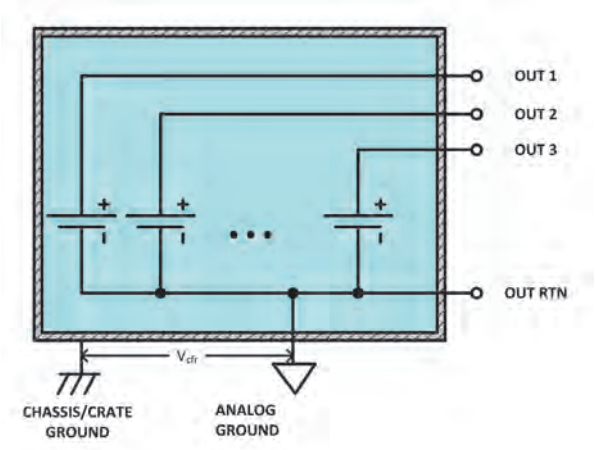


Figure 2: Common Floating Return Board

Generally the common floating return is insulated from chassis /crate ground up to few tens of volts.

The **Individual Floating Channel** boards have independent channel returns insulated from chassis/crate ground from few tens of volts up to 5 kV.

In this configuration each channel can be connected to a different ground. If the maximum floating voltage is higher than the maximum channel voltage the channel is defined as FULL FLOATING.

A FULL FLOATING channel behave exactly like a battery; by grounding the + terminal it's possible to get a negative voltage and by grounding the - terminal it's possible to get a positive voltage (and it is also possible to mix positive and negative polarity outputs).

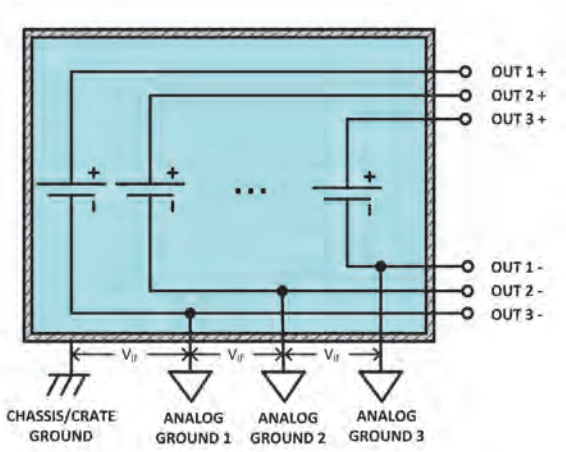


Figure 3: Individual Floating Channel Board

Safety Features

Different safety features were designed for our power supplies. Some of them are general, some other are model-dependent. A full list of the solution implemented follows:

- **Channels can be enabled or disabled** through the Global Interlock logic.
- **Remote Enable/Disable**: front panel independent contacts available for all channels.
- **Common Interlock** logic for channels enable/disable and individual input signal for channel Kill function (only Desktop and NIM modules)
- A **global enable/disable connector** allows to disable the channels and it is also possible, via front panel logic signals, to enable individually each channel (only Low Voltage modules)
- **Overvoltage and Undervoltage warning** allows to disable the channels and it is also possible, via front panel logic signals, to enable individually each channel (only Low Voltage modules).
- **Hardware VMAX and IMAX**: maximum output voltage and maximum output current value can be fixed, via front panel potentiometer, at the same common value for all the board channels. IMAX and VMAX values can be read out via software.
- **Software VMAX and IMAX**: maximum output voltage and maximum output current value can be fixed via control software at channel by channel specific value
- **Overcurrent detection**: when a channel attempts to exceed the programmed (ISET) or fixed (IMAX) current limit, it signaled to be in "overcurrent" and enter in a TRIP status: the channel is switched off after a programmable TRIP time.
- **Safety Board Interlock**: this protection disables the HV generation when the HV outputs are not connected to their loads

(only for Multipin Connector versions).

- **Status Overcurrent Bit**: 0÷5 V (only PCB modules)
- **Status On/Off Bit**: 0÷5 V (only PCB modules)
- **Protection against short circuits, sparks and humidity** (only PCB modules)

Ripple and Noise Behaviour

Fast, switched mode power delivery allow high efficiency conversion in switching generators, but creates wideband harmonic energy too, and this undesirable energy appears as radiated and conducted components; actually, switching regulator output noise consist of coherent, high frequency residues directly related to the regulator's switching, and these unsought components are usually called noise.

All CAEN Multichannel power supplies are optimized in order to provide output voltage with low ripple and noise levels. Their contribution can be divided taking into account three different frequency ranges.

The main frequency oscillation of the converter. CAEN power supplies features, on the output line, a filter that attenuates the high frequency components by some tens of dB depending on the components used. The switching frequency of CAEN power supplies ranges from some tens of kHz to about 300 kHz so, in case of frequencies around the fundamental and the switching harmonic, the spectrum amplitude can be reduced to few mV. This component depends on the load so it became less significant as the load is reduced.

Contribution from non-ideal electronic components present in the feedback circuit. This noise component sits in the 10 Hz –few kHz frequency range. Several possible channel control layers can be used, i.e. current set point feedback, Vmax loop, Imax loop e other dedicated controls implemented on specific channel typology. Working on the stabilization in terms of amplitude and phase, the peak-to-peak value of this component can be reduced to few mV.

The last component includes the **frequencies between about few Hz fractions (about 0.01) to 10 Hz** and typically are neglected in the spectroscopy applications. A possible contribution of the order of some tens of millivolts on the output voltage can come from the reference voltage generator and its control circuit. In this range, solutions that can be applied in all possible application do not exist. A detailed study of the circuit has to be performed and a specific solution could be provided.

Contribution coming from lower frequency ranges are typically related to a change of temperature that can produce a drift of the output voltage. If the mathematical correlation between the channel Vout (or Vset) and the environmental temperature has been established, a temperature control loop would allows to suppress this drift. Ripple and noise frequency ranges are divided during CAEN test measurements as follows:

- f < 10 Hz to check the power supply long term and thermal stability
- 10 Hz < f < 10 kHz in which many components contribute such as 50 Hz main supply and the single channel feedback loop circuit
- f > 10 kHz in which the main contribution is given by the power supply switching frequency.

Ripple, Noise and Validation Measurements

Every CAEN Power Supply is fully tested before shipping, according to specifications described by the designers, and doesn't need any further check. It is possible, anyway, to schedule a periodic

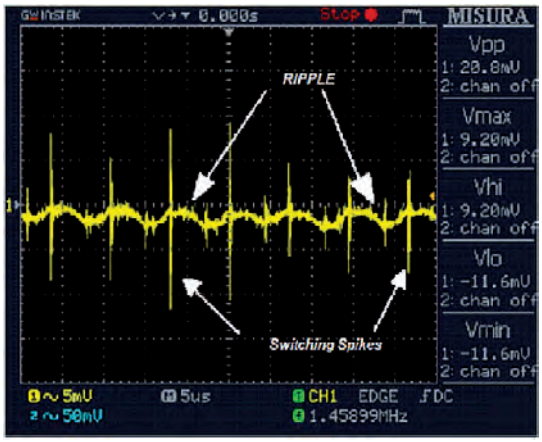


Figure 4: Example of possible power supply noise pattern

service by contacting our maintenance division and organize repairs, verification or recalibrations. Tests are performed by skilled personnel with very long experience, but CAEN provides also some dedicated documentation that describes some general purpose "guidelines", about how to test each power supply specification in a thorough and safe way, that apply to all CAEN standard power supplies. Technicians usually refer to specific internal procedures to perform factory checks, and at the end of every inspection a specific test report, including rated values and acceptance levels, is filled.

As example we will describe here how the ripple measurements are performed by CAEN.

- Let's define **ripple** as the amount of AC, narrowband, switching frequency that is superimposed on the DC output voltage.
- Let's define **switching spikes** as the wideband, switching frequency, rapid oscillations superimposed on the ripple.
- Let's define **noise** as the sum of ripple and switching spikes.

You can specify noise in a switching regulator's output in a large number of ways: it is sometimes referred to as the maximum AC voltage expressed as RMS percentage of the rated DC output voltage at full load, while in industrial environment they often describe peak-to-peak noise in a 20 MHz bandpass, but, as realistically electronic systems are quite jammed by spectral energy also beyond 20 MHz, this specification doesn't sound adequate; considering that characteristic switching frequency in CAEN high voltage power supplies is some hundreds of kHz, and in order to take in account the several frequency components of switching spikes too, it seems appropriate to specify peak-to-peak noise in a verified 100 MHz bandwidth.

Reliable low level measurements in this bandpass require careful instrumentation choice and connection practices, and in fact our studies began by selecting proper test instrumentation and verifying bandwidth and noise of the entire setup; we typically consider a purely resistive load, namely the worst case, as, for capacitor input filter networks, ripple is directly proportional to load current, decreasing in value with decreasing current. CAEN power supplies have very low high frequency (tens to hundreds kHz) ripple, in the order of some units or tens of mV.

Required instrumentation

Very low level measurements require that test device do not introduce errors or noise; for this reason every test device has been designed in order not to invalidate the parameters verification. CAEN high voltage ripple measure setups provide therefore specifically engineered circuits, yearly verified and calibrated, described hereinafter.

- **CAEN HV splitter**: it is a simple insulated shunt, allowing to connect all the devices together. Connectors are chosen on the base of required voltage insulation and current rate.
- **CAEN ripple checker**: it basically consists of a DC blocking capacitor, which allows measurement of the ripple voltage using an AC RMS voltmeter or an oscilloscope.

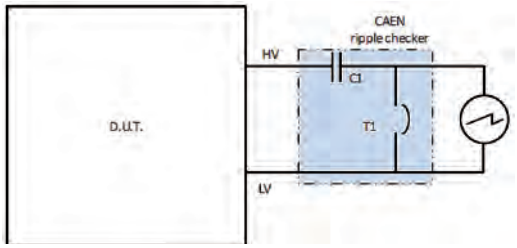


Figure 5: A simplified scheme of the CAEN ripple checker

A simplified schematic is shown in Figure 5.

Conceptually CAEN ripple checker consists of a capacitor of adequate value and of a switch or an equivalent solution that protect the measurement instrument:

  - the switch is normally closed to prevent oscilloscope from damage during transients, and it is open at regime; it can be manually operated or implemented by remote control via relais.
  - C1 must be capable of withstanding the maximum voltage to be applied, and has to be chosen to pass the lowest frequencies of interest without attenuation.

- **CAEN HV voltmeter:** it is a verified calibration, high voltage insulation voltmeter, with high input impedance (hundreds to thousands MΩ) and proper input connector.
- **CAEN HV load**: dimensioning the load is a straightforward task, but it may not be an easy task because of the high voltages involved and power considerations
- **Oscilloscope**: on the basis of our considerations regarding a 100 MHz verified band, it seems a proper choice to use a 300 MHz oscilloscope; maximum y-axis sensitivity should be 5 mV to discriminate very low signals.

Test setup

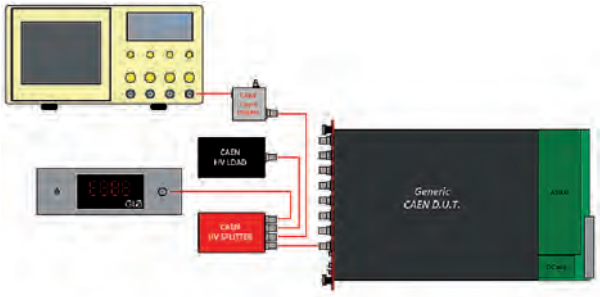


Figure 6: Ripple and noise measurement setup

The measurement setup has been prepared as shown in Figure 6

Measurement procedure example

An example of a two-steps measurement procedure performed is the following:

Step 1. Oscilloscope settings:

- acquisition mode: peak detect
- band limit: off
- channel sensitivity: minimum
- time base: Fsw-1/div as to see at least some periods avoiding aliasing artifacts
- trigger mode: single sequence
- trigger threshold: expected threshold
- coupling: dc

Output voltage set at 10% (50%, 90%) of full range for channel under test, the relevant load connected, peak-to-peak ripple value read on the oscilloscope and snapshot saved providing the threshold data.

Step 2. Oscilloscope Settings:

- acquisition mode: peak detect
- band limit: off
- channel sensitivity: minimum
- time base: 10 msec/div as to investigate low frequency behaviour
- trigger mode: single sequence
- trigger threshold: expected threshold
- coupling: dc

Output voltage set at 10% (50%, 90%) of full range for channel under test, the relevant load connected, peak-to-peak ripple value read on the oscilloscope and snapshot saved providing the threshold data.

A typical measurement output is shown in Figure 7.

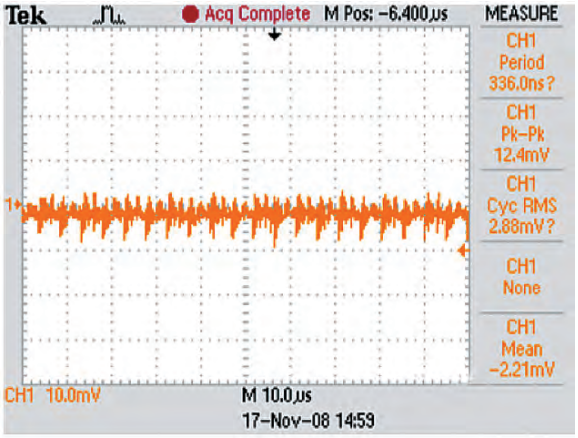


Figure 7: Typical output of a CAEN power supply noise and ripple measurement

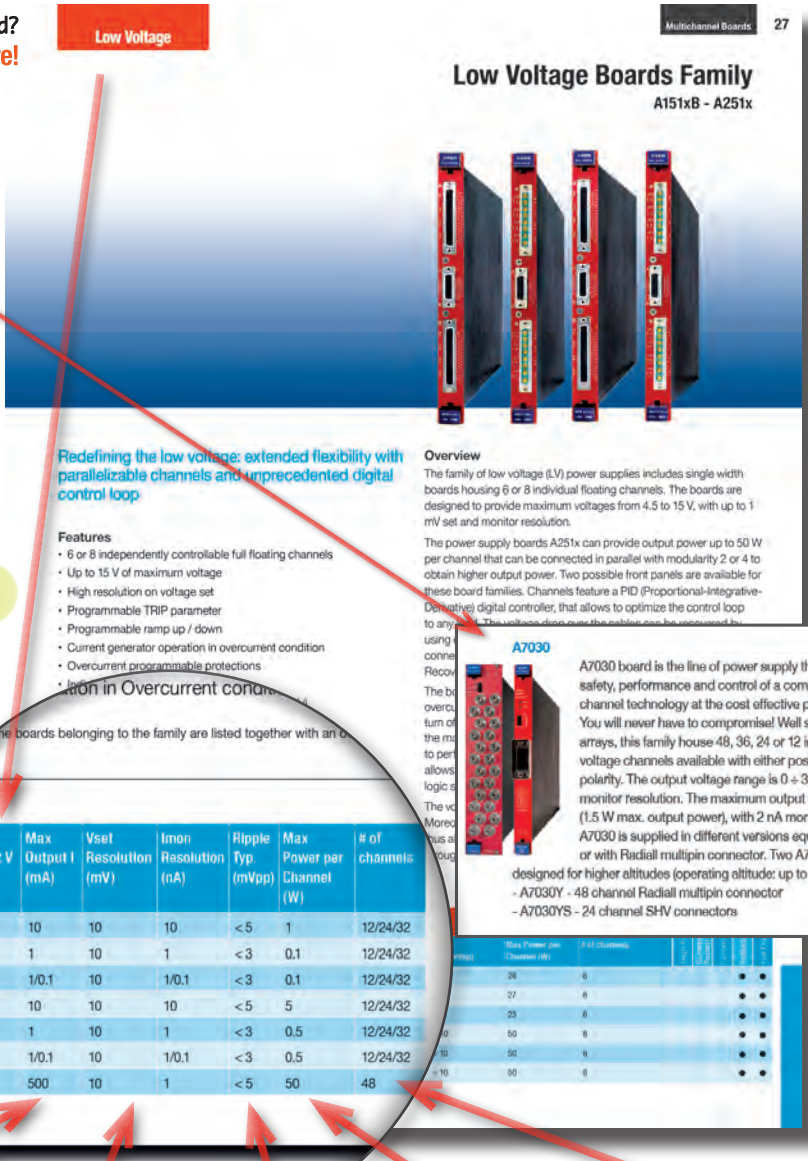
How to find your Power Supply

Which voltage do you need?
Find the voltage range here!

Low Voltage

Do you have a specific detector to power?
Look at the single board detailed description to find the most suitable model for your experimental setup!

We have many boards designed for specific applications!



Have a look at the family key features

How much Current does your application require?

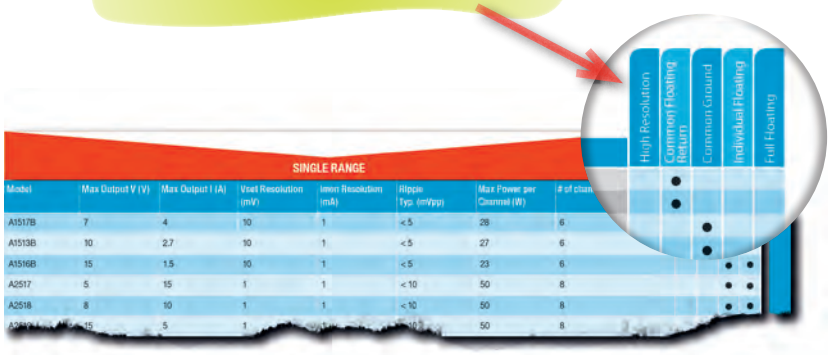
Interested in Set and Monitor resolution? You find them here!

Worried about the noise? Look at the ripple levels

How much power do you need? You find it here!

How many channels do you need? Here you find the board channel number

Is grounding a major concern?
Look at the different options here!



And finally choose your model!

Low Voltage Boards Family

A151xB - A251x

Redefining the low voltage: extended flexibility with parallelizable channels and unprecedented digital control loop

Features

- 6 or 8 independently controllable full floating channels
- Up to 15 V of maximum voltage
- High resolution on voltage set
- Programmable TRIP parameter
- Programmable ramp up / down
- Current generator operation in overcurrent condition
- Overcurrent programmable protections
- Individual remote sense lines
- Individual Line Drop Recovery (only A151xB boards)
- 50 W Max channel output power (only A251x boards)
- Full Digital PID Control Loop (only A251x boards)
- 1/10 mV voltage monitor resolution
- Up to 1 mA current monitor resolution
- Voltage ripple smaller than 5/10 mVpp

Overview

The family of low voltage (LV) power supplies includes single width boards housing 6 or 8 individual floating channels. The boards are designed to provide maximum voltages from 4.5 to 15 V, with up to 1 mV set and monitor resolution. The power supply boards A251x can provide output power up to 50 W per channel that can be connected in parallel with modularity 2 or 4 to obtain higher output power. Two possible front panels are available for these board families. Channels feature a PID (Proportional-Integrative-Derivative) digital controller, that allows to optimize the control loop to any load. The voltage drop over the cables can be recovered by using either the featured Remote Sensing Lines (A251x boards), to be connected on the load for sensing the drop, or an automatic Line Drop Recovery system (the A151xB boards are equipped with both features). A global enable/disable connector allows to disable the channels and it is also possible, via front panel logic signals, to enable individually each channel.

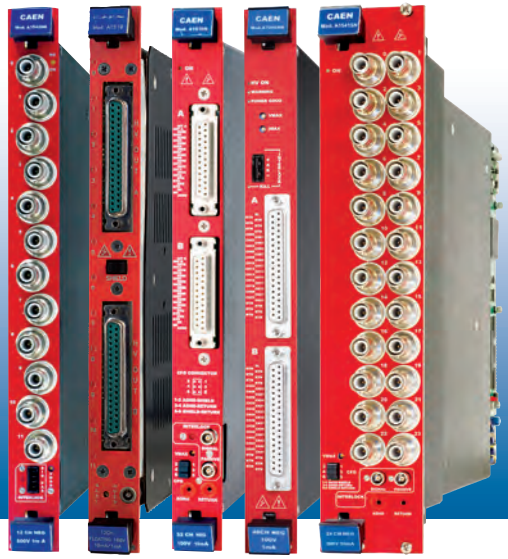
All the boards are provided with both current and voltage protections. If overcurrent occurs, the channel is signaled to be in “overcurrent” and is switched off (A251x boards) while for A151xB boards the relevant channel can be programmed either to turn off after a programmable trip time or to remain on and to provide the maximum allowed current. This particular feature allows the module to perform as a current generator.

The voltage ramp rates may be set independently for each channel. Moreover the individual floating channels allow on-detector grounding, thus allowing to reduce the noise level. Output channels are delivered through DB37 or D-sub 8 (on A251x family) connectors.

SINGLE RANGE								High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
Model	Max Output V (V)	Max Output I (A)	Vset Resolution (mV)	Imon Resolution (mA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels					
A1517B	7	4	10	1	< 5	28	6				●	●
A1513B	10	2.7	10	1	< 5	27	6				●	●
A1516B	15	1.5	10	1	< 5	23	6				●	●
A2517	5	15	1	1	< 10	50	8				●	●
A2518	8	10	1	1	< 10	50	8				●	●
A2519	15	5	1	1	< 10	50	8				●	●

Up to 100 V High Voltage Family

A1539 - A1540(H) - A1510 - A7040



Your new generation silicon and solid state detector deserves only the best!

Features

- From 12 to 48 independently controllable High Voltage channels
- 0 ÷ 100 V output voltage
- Maximum Current: 1mA, 10 mA or 1 mA/100 µA (dual range board)
- Individual Enable (A1510 only)
- Either DB37, DB25 or SHV connectors
- Available with either positive, negative or mixed polarity
- Up to 20 nA / 100 pA current set / monitor resolution
- Up to 2 / 0.2 mV voltage set / monitor resolution
- Extreme Low ripple, down to < 3 mVpp
- 3 different channel grounding
  - Common Ground (AGxxxx)
  - Common Floating return (Axxxx)
  - Full Floating (A1510 only)
- Independently programmable for each channel:
  - Output voltage
  - Current limit
  - Ramp up/down
  - TRIP parameter
- Current generator operation in overcurrent condition
- Specific design for double side silicon detector (A1510)

Overview

This family of high voltage power supplies includes boards housing up to 48 independent output channels designed to provide voltage up to 100 V and current up to 20 mA.

All the boards are compatible with all CAEN Universal Multichannel Power Supply Systems and are available with two different grounding options: Common Ground (AGxxxx) or Common Floating Return (Axxxx) excluding the A1510 board which is Fully Floating. Common Floating Return allows on-detector grounding reducing the noise level; the floating return is insulated from the crate earth up to ±50 V (with a 65 V hardware limit).
The HV Ramp up/down rates may be selected independently for each channel in the 1 ÷ 50 V/s range (1 V/s step)

All the boards are provided with both current and voltage protections. If overcurrent occurs, the corresponding channel can be programmed either to turn off after a programmable trip time or to keep on providing the maximum allowed current. This feature allows the module to perform as a current generator.

The channels can be enabled or disabled through the Interlock logic. The voltage ramp rates may be set independently for each channel. The costumer can choose between different channel grounding.

The family is composed by three groups of boards detailed here below.

A1539 / AG539 / A1540(H) / AG540

These boards house up to 32 independent High Voltage channels available with either positive, negative or mixed polarity and equipped with SHV or DB25 connectors. The maximum output current is 10 mA, (200 nA step) with 10 nA monitor resolution for the A1539, 1 mA, (20 nA step) with 1 nA monitor resolution for the A1540 and 1mA/100nA (20 nA steps) for the A1540H. Mixed version with 6/12 positive and 6/12 negative channels are also available. A version able to provide up to 100 V / 20 mA (A1539B) is available.

NEW

A7040

A7040 is the new high density general purpose power supply offering you all the safety, performance and control of a completely independent channel technology at the cost effective price of a distributor! Well suited for large Silicon detectors arrays, this family house 48 independent High Voltage channels available with either positive or negative polarity, equipped with DB37 connector. The maximum output current is 1 mA, with 2 nA monitor resolution. The maximum output voltage can be set through a potentiometer to a value which is common to all channels and can be read out via software.

A1510

A1510 board houses 12 independent output channels and is able to provide up to 100 with 20 mV of set and monitor voltage resolution. The A1510 offers 1 mA / 10 mA dual current range (selectable via internal jumpers) and its channels can be individually enabled or disabled. The voltage ramp rates may be set independently for each channel. Additionally, it features individual fully floating channels allowing on-detector grounding, thus providing the best reduction of the voltage ripple and avoiding ground loops which may increase noise level.

Moreover, the A1510 boards, specifically designed for the double-side silicon detector features on the output connector a ½ CHx reference: it is a reference voltage (high impedance, thus not available as a power source) whose value is ½·|CHx+| and allow a symmetric supply to the detector.

SINGLE RANGE

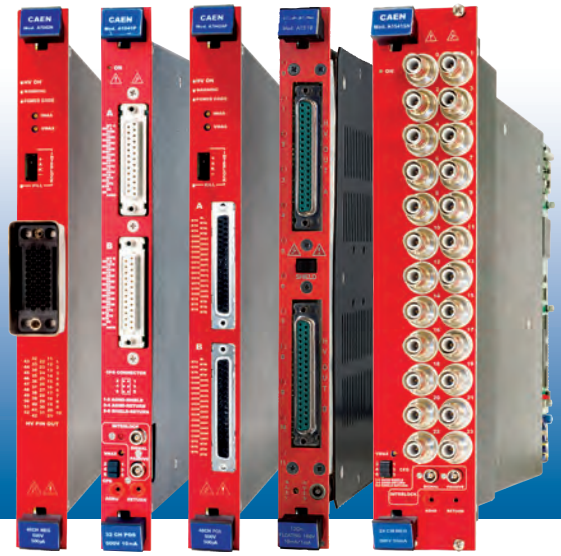
Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels	High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
A1539	100	10	10	10	< 3	1	12/24/32		●			
NEW A1539B	100	20	10	20	< 10	2	32		●			
AG539	100	10	10	10	< 3	1	12/24/32			●		
A1540	100	1	10	1	< 3	0.1	12/24/32		●			
AG540	100	1	10	1	< 3	0.1	12/24/32			●		
NEW A7040	100	1	2	2	< 5	0.1	48		●			

DUAL RANGE

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels	High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
A1540H	100	1/0.1	10	1/0.1	< 3	0.1	12/24/32	●	●			
A1510	100	10/1	20	1000/100	< 15	1	12				●	●

Up to 500 V High Voltage Family

A154x - A151x - A7042



Power, resolution, flexibility and high channel density. The solution for your silicon detector array is here

Features

- From 12 to 48 independently controllable High Voltage channels
- 0 ÷ 500 V output voltage (0 ÷ 250 V, A1519B only)
- Maximum Current 0.5, 1, 10 mA or 1 mA/100 µA (dual range boards)
- Individual Enable (A151x only)
- Either DB37, DB25, Radiall Multipin or SHV connectors
- Available with either positive, negative or mixed polarity
- Up to 20 nA, 100 pA current set / monitor resolution
- Up to 10 mV / 1 mV voltage set / monitor resolution
- Very Low ripple, down to < 5 mVpp
- 3 different channel grounding
  - Common Ground (AGxxxx)
  - Common Floating return (Axxxx)
  - Full Floating (A151x only)
- Independently programmable for each channel:
  - Output voltage
  - Current limit
  - Ramp up/down
  - TRIP parameter
- Current generator operation in overcurrent condition
- Specific design for double side silicon detector (A151x)

Overview

This family of high voltage power supplies includes boards housing up to 48 independent output channels designed to provide voltage up to 500 V and current up to 10 mA.

All the boards are compatible with all CAEN Universal Multichannel Power Supply Systems and are available with two different grounding options: Common Ground (AGxxxx) or Common Floating Return (Axxxx), excluding the A151x family which is Fully Floating. Common Floating Return allows on-detector grounding reducing the noise level; the floating return is insulated from the crate earth up to ±50 V (with a 65 V hardware limit).
All the boards are provided with both current and voltage protections. If overcurrent occurs, the corresponding channel can be programmed either to turn off after a programmable trip time or to keep on providing the maximum allowed current. This feature allows the module to perform as a current generator.

The channels can be enabled or disabled through the Interlock logic. The voltage ramp rates may be set independently for each channel. The costumer can choose between different channel grounding. The HV Ramp up/down rates may be selected independently for each channel in the 1 ÷ 50 V/s range (1 V/s step) for the A151x, while in the 1 ÷ 100 V/s range (1 V/s step) for the x542, x541 and x7042 boards.

The family is composed by three groups of boards detailed here below.

A1541 / AG541 / A1542(H) / AG542

these boards house up to 32 independent High Voltage channels available with either positive, negative or mixed polarity and equipped with SHV or DB25 connectors. The maximum output current is 10 mA, (200 nA step) with 10 nA monitor resolution for the A1541, 1 mA, (20 nA step) with 1 nA monitor resolution for the A1542 and 1 mA / 100 µA (20 nA steps) for the A1542H. Mixed versions with 6/12 positive and 6/12 negative channels are also available.

A7042

A7042 is the new line of high density general purpose power supplies offers you all the safety, performance and control of a completely independent channel technology at the cost effective price of a distributor! Well suited for large Silicon detectors arrays, this family house 48 independent High Voltage channels available with either positive or negative polarity, equipped with Radiall Multipin or DB37 connector. The maximum output current is 500 µA, with up to 1 nA monitor resolution. The maximum output voltage can be set through a potentiometer to a value which is common to all channels and can be read out via software.

A1511B / A1512 / A1519B

These boards house 12 independent output channels and are able to provide voltage up to 500 V with up to 50 mV of set and monitor voltage resolution. They provide 1 mA / 10 mA (A1511B) and 1 mA / 100 µA (A1512 and A1519B) dual current ranges and their channels can be individually enabled or disabled. The voltage ramp rates may be set independently for each channel. Additionally, they features individual fully floating channels allowing on-detector grounding, thus providing the best reduction of the voltage ripple and avoiding ground loops which may increase noise level.

Moreover, the A151x boards, specifically designed for the double-side silicon detectors features on the output connector a ½ CHx reference: it is a reference voltage (high impedance, thus not available as a power source) whose value allows a symmetric supply to the detector.

SINGLE RANGE

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels	High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
A1541	500	10	10	10	< 3	5	12/24/32		●			
AG541	500	10	10	10	< 3	5	12/24/32			●		
A1542	500	1	10	1	< 3	0.5	12/24/32		●			
AG542	500	1	10	1	< 3	0.5	12/24/32			●		
A7042	500	0.5	10	1	< 5	0.25	48		●			

DUAL RANGE

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels	High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
A1542H	500	1/0.1	10	1/0.1	< 3	0.5	12/24/32	●	●			
A1519B	250	1/0.1	50	100/10	< 30	0.25	12				●	●
A1511B	500	10/1	100	1000/100	< 30	5	12				●	●
A1512	500	1/0.1	100	100/10	< 30	0.5	12				●	●

Multichannel Boards Accessories

Mod. A996

Mod. A995

Mod. R648

For boards with Radiall 52 pin connector are available the following accessories:
- Mate cable connector (Mod. A996) and relevant insertion/extraction tool (Mod. A995)
- R648 48-36 Channel Radiall to SHV connector Adapter (Max: 3kV - 19'' Rack)

Up to 1.5 kV High Voltage Family

A1515 - A1538D - A7038

A tailored solution for multi-layered GEM, PMT and MicroMegas detectors. All detector features under your control

Features

- From 12 to 48 independently controllable High Voltage channels
- 0 ÷ 1.5 kV (A1538D) and 0 ÷ 1/1.3/1.4 kV output voltage (A1515)
- Maximum Current 10 mA, 0.1 or 1/0.1, 3/0.3 mA (dual range boards)
- Radiall Multipin, SHV or DB37 connectors
- Available with either positive or negative polarity (A1538D and A7038)
- Up to 2 nA / 100 pA current set / monitor resolution
- Up to 20 mV / 2 mV voltage set / monitor resolution
- Very low ripple, down to < 5 mVpp
- 3 different channel grounding
  - Common Ground (AGxxxx)
  - Common Floating return (Axxxx)
  - Full Floating (A1515 only)
- Independently programmable for each channel:
  - Output voltage
  - Current limit
  - Ramp up/down
  - TRIP parameter
- Current generator operation in overcurrent condition
- Specific design for GEM and Vertex detector and dedicated accessories (A1515 boards only)

Overview

This family of High Voltage power supplies includes boards housing up to 48 output channels. The boards are designed to provide voltage up to 1.5 kV, and current up to 10 mA.

All the boards are compatible with all CAEN Universal Multichannel Power Supply Systems. The available grounding option, depending on the family are the following: Common Ground (AGxxxx) or Common Floating Return (Axxxx), excluding the A1515 family which is Fully Floating up to 5 kV as detailed below. Common Floating Return allows on-detector grounding reducing the noise level; the floating return is insulated from the crate earth up to ±50 V (with a 65 V hardware limit).
All the boards are provided with both current and voltage protections. If overcurrent occurs, the corresponding channel can be programmed either to turn off after a programmable trip time or to keep on providing the maximum allowed current. This particular feature allows the module to perform as a current generator.
The HV ramp-up and ramp-down rates may be selected, for each channel, in the 1 ÷ 100 V/s range (1 V/s step) for the A1515 family and in the 1 ÷ 500 V/s range (1 V/s step) for the A1538 and A7038 family.

The family is composed by three groups of boards detailed here below

A1538D / AG538D

A1538D is a single width (5TE wide) board housing 12 independent high voltage and high-power channels. The output voltage range is 0 ÷ 1.5 kV, with 10 mA maximum output current (12W channel max output power) and 50 mV set and monitor resolution. The board is available with either positive or negative output polarity and equipped with SHV coaxial connector.

A1515 boards

A1515x boards house 14 or 16 independent, fully floating High Voltage channels and five special versions are perfectly suited for GEM detectors. All versions are equipped with Radiall Multipin connectors. The channels have floating return, independent one from another, insulated up to 5 kV. The output voltage range is 0 ÷ 1/1.3/1.4 kV, with 20 mV set and monitor resolution. Maximum output current is 1/3 mA. The output channels offer

dual current ranges (software selectable):

- High Power
  - 0 ÷ 1 mA, Imon resolution: 1 nA (A1515TG/QG/CG/V)
  - 0 ÷ 3 mA, Imon resolution: 4 nA (A1515TGHP)
- High Resolution
  - 0 ÷ 100 µA, Imon resolution: 100 pA (A1515TG/QG/CG/V)
  - 0 ÷ 300 µA, Imon resolution: 400 pA (A1515TGHP)

Five special version of the board (A1515TG/QG/CG/TGHP/V) have been designed specifically for Gas Electron Multiplier (GEM) detectors (Triple, Triple designed for high rate, Quadruple, Cylindrical GEM detectors and Vertex detectors). These boards have the channels internally stacked in order to power up 2 independent Triple GEM / Quadruple GEM / Triple Cylindrical GEM chambers. This configuration permits to avoid any possible issue related to the detector discharge and avalanche effects and gives the possibility to fine tune the voltage on each detector layer easily.

A CAEN SY4527 mainframe equipped with 16 boards can power 32 detectors and the high maximum current available on each channel allows managing the high segmentation of these detectors in the best way. The high max current per channel feature designed into these boards is beneficial for managing the high segmentation of GEM detectors, as it will allow discrete detector layers to perform even in the event of a short. In addition, the 2-quadrant 100 µA low current range allows a 100 pA current monitoring resolution which allows the monitoring of ion backflow currents and also to perform real-time detector diagnostics.

In the GEM dedicated version of the A1515 in the overcurrent condition causes the following actions:

- A1515 or A1515TG/QG/CG/TGHP/V (not in GEM-mode): the channel is switched off. Output voltage will drop to zero at Ramp-down rate. If TRIP is set to “constant current mode”, the channel behaves like a current generator
- A1515TG/QG/CG/TGHP/V (in GEM-mode): all stacked channels are switched off following a programmed sequence. Output voltages will drop to zero at Ramp-down rates. If TRIP is set to “constant current mode”, the channel behaves like a current generator.

The channels can be enabled or disabled through the Interlock logic. The voltage ramp rates may be set independently for each channel.

NEW

A7038

A7038 is a 32 or 48 independent high voltage channels board available in different versions equipped with SHV or with DB37 connectors.
The output voltage range is 0 ÷ 1 kV (20 mV set and 2 mV monitor resolution), with 100 µA maximum output current (2 nA set and 500 pA monitor resolution).

SINGLE RANGE

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels	High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
NEW A7038	1000	0.1	20	0.5	<10	0.1	32/48		●			
A1538D	1500	10	50	200	< 20	12	12		●			
AG538D	1500	10	50	200	< 20	12	12			●		

DUAL RANGE

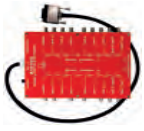
Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)[2]	Max Power per Channel (W)	# of channels	High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
A1515TG	1000	1/0.1	20	1/0.1	< 10 (CM) < 5 (DM)	0.7	14	●			●	●
A1515QG	1000	1/0.1	20	1/0.1	< 10 (CM) < 5 (DM)	0.7	16	●			●	●
A1515CG	1300 [1]	1/0.1	20	1/0.1	< 10 (CM) < 5 (DM)	0.7	14	●			●	●
A1515TGHP	1000 [3]	3/0.3 (1.5 W max)	20	4/0.4	< 10 (CM) < 5 (DM)	1.5 / 0.7	14	●			●	●
NEW A1515V	1400	3/0.3	20	1/0.1	< 10 (CM) < 5 (DM)	0.7	16	●			●	●
A1515	1000	1/0.1	20	1/0.1	< 10 (CM) < 5 (DM)	0.7	16	●			●	●

[1] n° 2 channels Max. Voltage: 1.3 kV; n° 12 channels Max. Voltage: 1 kV
[2] (CM): Common Mode; (DM): Differential Mode
[3] n° 8 channels Max. Voltage: 1 kV; n° 6 channels Max. Voltage: 600 V

Multichannel Boards Accessories

Mod. A996

Mod. A995



Mod. A1015G

Mod. A1015

The following accessories are available: Mate cable connector (Mod. A996), the relevant insertion/extraction tool (Mod. A995), 16 Floating Channel Multipin Radiall to SHV connector Adapter (Mod. A1015), 14/16 Stacked Channel Multipin Radiall to SHV connector Adapter (Mod. A1015G) and Analog Voltage Monitor for A1515 Family (Mod. A1015VM).

Up to 3.5 kV High Voltage Family

A7030 - A7236 - A7435

High power, high resolution, high channel density. Forget about distributors, no more compromise for your photomultiplier array!

Features

- From 12 to 48 independently controllable High Voltage channels
- 3.5 kV maximum output voltage
- Maximum Current 3.5 mA
- Either Radiall Multipin or SHV connectors
- Available with either positive or negative polarity
- Up to 10 nA / 500 pA current set / monitor resolution
- Up to 5 mV voltage set / monitor resolution
- Very Low ripple, down to < 5 mVpp
- 2 different channel grounding
  - Common Ground (AGxxxx)
  - Common Floating return (Axxxx)
- Independently programmable for each channel:
  - Output voltage
  - Current limit
  - Ramp up/down
  - TRIP parameter
- Current generator operation in overcurrent condition
- Specific design for High Altitudes 0÷5000 m (A7030 only)

Overview

This family of High Voltage power supplies includes single and double width boards housing up to 48 output channels. The boards are designed to provide voltage up to 3.5 kV, and current up to 3.5 mA.
All the boards are compatible with all CAEN Universal Multichannel Power Supply Systems. The available grounding option, depending on the family are the following: Common Ground (AGxxxx) or Common Floating Ground (Axxxx). Common Floating Return allows on-detector grounding reducing the noise level; the floating return is insulated from the crate earth up to ±25 V.
The HV ramp-up and ramp-down rates may be selected, for each channel, in the 1 ÷ 500 V/s range (1 V/s step).

The boards are provided with both current and voltage protections. If overcurrent occurs, the relevant channel can be programmed either to turn off after a programmable trip time or to remain on and to provide the maximum allowed current. This feature allows the module to perform as a current generator. Channels may be enabled or disabled via the Interlock logic. The voltage ramp rates may be set independently for each channel.

The family is composed by three groups of boards detailed here below.

A7030

A7030 is the line of power supply that offers you all the safety, performance and control of a completely independent channel technology at the cost effective price of a distributor! You will never have to compromise! Well suited for large PMT arrays, housing 48, 36, 24 or 12 independent high voltage channels available with either positive or negative polarity. The output voltage range is 0 ÷ 3 kV, with 5 mV monitor resolution. The maximum output current is 1 mA (1.5 W max. output power), with 2 nA monitor resolution. The A7030 is supplied in different versions equipped with SHV or with Radiall multipin connector. Two A7030 versions are designed for higher altitudes (operating altitude: up to 5000 m):
- A7030Y - 48 channel Radiall multipin connector
- A7030YS - 24 channel SHV connectors

A7236 / AG7236 / A7435 / AG7435

A7236 and A7435 are the new pair of CAEN general purpose power supplies that will provide you with tremendous power and resolution performance at a cost effective price! You will never have to compromise again. The x7435 and x7236 house 12, 24 or 32 independent high voltage channels, available with either positive or negative polarity. The boards are available in different versions equipped with SHV or Radiall Multipin connectors. The output voltage range is 0 ÷ 3.5 kV, with 5 mV of set and monitor resolution. The output channels offer dual current ranges (software selectable):

- A7236/AG7236 Dual range current
  - High Power: 0 ÷ 1.5 mA; Iset/Imon resolution: 10/5 nA (4 W max.)
  - High Resolution: 0 ÷ 150 µA (Iset/Imon resolution: 10/500 pA)
- A7435/AG7435 Dual range current
  - High Power: 0 ÷ 3.5 mA; Iset/Imon resolution: 10 nA (9 W max.)
  - High Resolution: 0 ÷ 350 µA; Iset/Imon resolution: 10/1 nA

SINGLE RANGE

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels	High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
A7030	3000	1	50	2	< 5	1.5	12/24/36/48		●			

DUAL RANGE

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels	High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
A7236	3500	1.5	5	5/0.5	< 10	4	12/24/32	●	●			
AG7236	3500	1.5	5	5/0.5	< 10	4	12/24/32	●		●		
A7435	3500	3.5	5	10/1	< 15	9	12/24		●			
AG7435	3500	3.5	5	10/1	<15	9	12/24			●		

Multichannel Boards Accessories

Mod. A996

Mod. A995

Mod. A647

Mod. R647

Mod. A649

Mod. R649

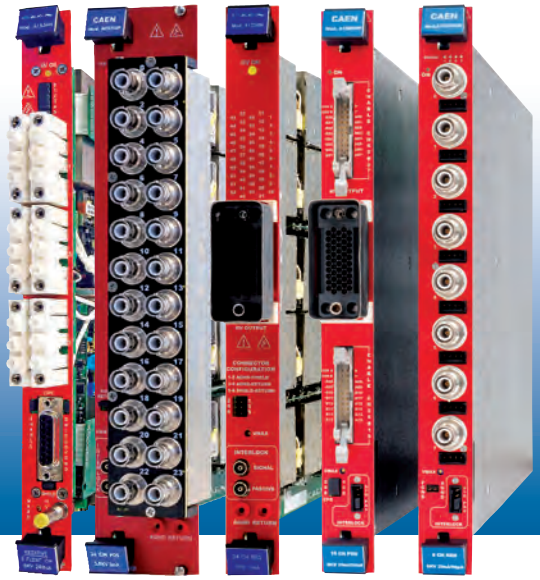
Mod. A648

Mod. R648

For boards with Radiall 52 pin connector are available the following accessories: A995 Insertion/extraction tool for A996, A996 52 pin cable connector, A647 24 Channel Multipin Radiall to SHV connector Adapter (Max: 8kV - Desktop), A648 48-36 Channel Multipin Radiall to SHV connector Adapter (Max: 3kV - Desktop), R647 24 Channel Multipin Radiall to SHV connector Adapter (Max: 8kV - 19'' Rack), R648 48-36 Channel Radiall to SHV connector Adapter (Max: 3kV - 19'' Rack), 32 Channel Radiall Multipin to SHV Adapter (Mod. A649 - R649)

Up to 8 kV High Voltage Family

A1550 - A1561H - A15x0H - A1534



Need to power a Wire Chamber, double gap RPC or Germanium detector? Your precious detector deserves extra safety and performance. This is the family for you!

Features

- From 12 to 24 independently controllable High Voltage channels
- 8 kV maximum output voltage
- Maximum Current 1 mA
- Either Radiall Multipin or SHV connectors
- Available with either positive or negative polarity
- Up to 500 pA/50 pA current set / monitor resolution
- Up to 100 mV/10 mV voltage set / monitor resolution
- Very Low ripple, down to < 5 mV
- 3 different channel grounding
  - Common Ground (AGxxxx)
  - Common Floating return (Axxxx)
  - Individual Floating (A1534 only)
- Independently programmable for each channel:
  - Output voltage
  - Current limit
  - Ramp up/down (1 ÷ 500 V/sec)
  - TRIP parameter
- Current generator operation in overcurrent condition
- Specific design for Germanium detectors (A15x0H only)

Overview

This family of High Voltage power supplies includes single and double width boards housing up to 24 output channels. The boards are designed to provide voltage up to 8 kV, and current up to 1 mA with up to 100 mV set and 10 mV monitor resolution. All the boards are compatible with all CAEN Universal Multichannel Power Supply Systems. The available grounding option, depending on the family are the following: Common Ground (AGxxxx) or Common Floating Ground (Axxxx) except for the A1534 that features individual floating channels insulated up to 100V. Common Floating Return allows on-detector grounding reducing the noise level; the floating return is insulated from the crate earth up to ±50 V (with a 65 V hardware limit).
The HV ramp-up and ramp-down rates may be selected, for each channel, in the 1 ÷ 500 V/s range (1 V/s step).
The boards are provided with both current and voltage protections. If overcurrent occurs, the relevant channel can be programmed either to turn off after a programmable trip time or to remain on and to provide the maximum allowed current. This particular feature allows the module to perform as a current generator. Channels may be enabled or disabled via the Interlock logic. The voltage ramp rates may be set independently for each channel.

The family is composed by five groups of boards detailed here below.

A1550 / AG550

A1550 houses 12 or 24 independent high voltage channels and is available in different versions equipped with SHV or with Radiall Multipin connector.
The output voltage range is 0 ÷ 5 kV, with 500 mV set and monitor resolution. The maximum output current 1 mA , with 100 nA current set and monitor resolution. The board is available with either positive or negative output polarity.

A1561H / AG561H

A1561H houses 12 Independent high voltage channels and is available with positive, negative or mixed polarity. The output voltage range is 0 ÷ 6 kV with 10 mV monitor resolution. The maximum output current is 20 µA with 50 pA monitor resolution.

A1534

A1534 is a single width board housing 6 High Voltage floating channels equipped with CPE connectors. The channels feature independent returns, insulated up to 100 V between each other. The board is available with positive or negative polarity and is non-reversible. The output voltage range is 0 ÷ 8 kV (200 µA maximum output current) with 0.5 V monitor resolution.

A1560H / A1580H

A15x0H boards are specifically designed for **Germanium detector**. They house 8 or 16 independent channels equipped with an **individual enable** and with SHV or Radiall Multipin connector. Positive, negative or mixed polarities are available. The output voltage range is 0 ÷ 6 kV (A1560H) or 0 ÷ 8 kV (A1580H), with 10 mV monitor resolution. The maximum output current is 20 µA, with 50 pA monitor resolution. The HV ramp-up and ramp-down rates may be selected, for each channel, in the 1 ÷ 500 V/s range (1 V/s step).

A7460

A7460 houses 12 independent high voltage channels with dual current full scale range and is available with positive, negative or mixed polarity.
The output voltage range is 0 ÷ 6 kV with 10 mV set/monitor resolution. The maximum output current is 1 mA with a 5nA setting resolution. The monitor resolution is 5 nA in the high range (1 mA) and 500 pA in the low range (100 µA).

SINGLE RANGE

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels	High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
A1550	5000	1	500	100	< 25	5	12/24		●			
AG550	5000	1	500	100	< 25	5	12/24			●		
A1561H	6000	0.02	100	0.05	< 5	0.12	12	●	●			
AG561H	6000	0.02	100	0.05	< 5	0.12	12	●		●		
A1560H	6000	0.02	100	0.05	< 5	0.12	8/16	●	●			
A1580H	8000	0.02	200	0.05	< 5	0.16	8/16	●	●			
A1534	8000	0.2	500	20	< 50	1.6	6				●	

DUAL RANGE

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels	High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
CS A7460	6000	1/0.1	10	5/0.5	T.B.D.	6	12		●			

Multichannel Boards Accessories

Mod. A996

Mod. A995

Mod. A647

Mod. R647

The following accessories are available: Mate cable connector (Mod. A996), the relevant insertion/extraction tool (Mod. A995), A647 24 Channel Multipin Radiall to SHV connector Adapter (Max: 8kV - Desktop), R647 24 Channel Multipin Radiall to SHV connector Adapter (Max: 8kV - 19'' Rack),

Up to 15 kV High Voltage Family

A152x - A1590

If you work with Hybrid APD, single gap RPC or application that need up to 15 kV, these are the boards for you

Features

- Up to 16 high voltage channels
- 15 kV maximum output voltage
- Maximum Current 1 mA
- CPE, Radiall Multipin or Kings connectors
- Available with either positive, negative or mixed polarity
- Up to 1 nA /100 pA current set / monitor resolution
- Up to 200 mV/10 mV voltage set / monitor resolution
- Low Ripple, down to < 10 mVpp
- 2 different channel grounding
  - Common Ground (AGxxxx)
  - Common Floating return (Axxxx)
- Independently programmable for each channel:
  - Output voltage
  - Current limit
  - Ramp up/down (1 ÷ 500 V/sec)
  - TRIP parameter
- Current generator operation in overcurrent condition

Overview

This family of High Voltage power supplies includes single and double width boards housing up to 16 output channels. The boards are designed to provide voltage up to 15 kV and current up to 1 mA.
All the boards are compatible with all CAEN Universal Multichannel Power Supply Systems. The available grounding option, depending on the family are the following: Common Ground (AGxxxx) or Common Floating Return (Axxxx). Common Floating Return allows on-detector grounding reducing the noise level; the floating return is insulated from the crate earth up to ±50 V (with a 65 V hardware limit). The A1523, A1524 and A1526 boards feature the CPE HV output connectors and the relevant coaxial cable connectors (Mod. A997) are also available.

The HV ramp-up and ramp-down rates may be selected, for each channel, in the 1 ÷ 500 V/s range (1 V/s step).

The boards are provided with both current and voltage protections. If overcurrent occurs, the relevant channel can be programmed either to turn off after a programmable trip time or to remain on and to provide the maximum allowed current. This particular feature allows the module to perform as a current generator. Channels may be enabled or disabled via the Interlock logic. The voltage ramp rates may be set independently for each channel.

The maximum output voltage can be fixed, through a potentiometer located on the front panel, at the same common value for all the board channels and this value can be read out via software.

The family is composed by three groups of boards detailed here below.

A1590 / AG590

A1590 board is a double width module (10 TE wide) that houses 16 Independent high voltage channels delivered through Radiall 52 pin HV connectors. The board is available with either positive or negative output polarity. The output voltage range is 0 ÷ 9 kV with 10 mV set and monitor resolution while the Maximum output current is 50 µA with 100 pA monitor resolution.

A1523 / AG523 / A1524 / AG524

These models are double width (10 TE wide) boards that houses 6 independent high voltage channels, available with either positive, negative or mixed polarity (A1523 only). The output voltage can be programmed and monitored in the 0 ÷ 12 kV range with 1 V resolution. The maximum currents are:.

- A1523: 1 mA - Iset/Imon resolution: 100 nA
- A1524: 100 µA - Iset/Imon resolution: 10 nA

A global enable/disable connector allows to disable the channels when it is not terminated on 50 Ω.

A1526

A1526 a double width board (10 TE wide) specifically designed for the single gap RPC detector. Available for positive and negative polarity, it features 6 independently controllable HV channel equipped with CPE or Kings connectors. The output voltage can be programmed and monitored in the 0 ÷ 15 kV range with 1 V resolution. The current full scale can be fixed via internal jumpers either at 100 µA or at 1 mA.

A global enable/disable connector allows to disable the channels when it is not terminated on 50 Ω.

SINGLE RANGE

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (V)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels	High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
A1590	9000	0.05	0.2	0.1	< 10	0.45	16	●	●			
AG590	9000	0.05	0.2	0.1	< 10	0.45	16	●		●		
A1523	12000	1	1	100	< 30	12	6		●			
AG523	12000	1	1	100	< 30	12	6			●		
A1524	12000	0.1	1	10	< 30	1.2	6		●			
AG524	12000	0.1	1	10	< 30	1.2	6			●		

DUAL RANGE

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (V)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels	High Resolution	Common Floating Return	Common Ground	Individual Floating	Full Floating
A1526	15000	1/0.1	1	100/10	< 30	15	6		●			

Multichannel Boards Accessories

Mod. A997

The following accessories are available: HV coaxial cable connector for CPE HV (Mod. A997)

Up to 2 kV Bipolar High Voltage Family

A1588

4-Quadrant power supply for industrial and accelerator related applications

Features

- Four-quadrant bipolar power supply
- ±2 kV @ ±0.5 mA output ratings
- Common floating return
- SHV connectors
- Voltage ripple of < 10 mVpp
- Internal Hardware protections
- Excellent long-term output stability
- External interlocks (active + passive)

Overview

The A1588 board contains 8 independent channels providing High Voltage through SHV connectors; it is compatible with the CAEN Universal Multichannel Power Supply System (SY1527, SY2527, SY3527, SY4527, SY5527).

All channels are differential and can operate in the so called four-quadrant regimes supplying or operating as resistive load. It can provide, with an excellent long term output stability, a maximum voltage of ±2 kV (with 100 mV setting resolution) and a maximum current of ±500 µA. Moreover, the channels share a common floating return, which allows on-detector grounding reducing the noise level; the floating return is insulated from the crate earth up to ±50 V (with a 65 V hardware limit).

The board is provided with both current and voltage protections.

The maximum output voltage can be set through a potentiometer to a value which is common to all channels and can be read out via software. Channels may be enabled or disabled via the Interlock logic. The HV ramp-up and ramp-down rates may be selected independently for each channel in the 1 ÷ 500 V/s range (1 V/s step).

Specification

Model	Max Output V (kV)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels
A1588	2	0.5	100	100	< 10	1	8

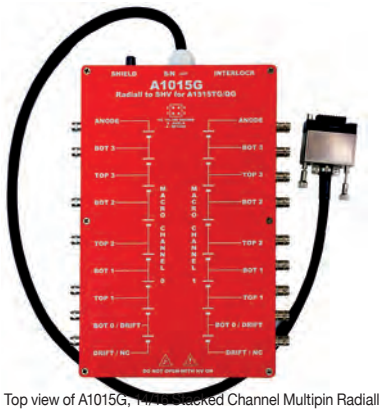
HV Adapters

A1015x - A64x - R64x (DB37 and Radiall to SHV cable)

The proper accessory for your lean setup

Features

- DB37 and Radiall to SHV
- INTERLOCK and SHIELD connection provided



Top view of A1015G, 14/16 Stacked Channel Multipin Radiall to SHV connector Adapter for A1515TG/A1515QG

Overview

A1015x – A64x – R64x is a family of cable adapter that allows to adapt the high density SY boards connectors (DB37 and Radiall) to the SHV one. The adapters belonging to this family forward the INTERLOCK and SHIELD connections through LEMO connectors as well. Available in desktop and rack form factor.

The A1015VM is not an adapter but an analog voltage monitor for A1515x family. It allows to monitor the voltage level for the triple or quadrupole GEM (the channels are internally stacked). The voltages can be monitored in two ways:

- in absolute value: checking the GEM or Transfer voltage with respect to the mass reference
- in differential value: checking the voltage level on each GEM or Transfer

Model Compare

Model	Channels	From	To	Max V.	Boards	Form Factor
A1015G	14/16	Multipin	SHV	5 kV	A1515TG/A1515QG	Desktop
A1015VM	-	-	-	-	A1515 Family	Desktop
A1015	16	Multipin	SHV	5 kV	A1515	Desktop
A646	12	DB37	SHV	500 V	Up to 500 V family	Desktop
A647	24	Multipin	SHV	8 kV	Up to 8 kV family	Desktop
A648	36/48	Multipin	SHV	3 kV	Up to 4 kV family	Desktop
A649B	32	Multipin	SHV	8 kV	Up to 8 kV family	Desktop
A649	32	Multipin	SHV	3 kV	Up to 4 kV family	Desktop
R647	24	Multipin	SHV	8 kV	Up to 8 kV family	19'' Rack
R648	36/48	Multipin	SHV	3 kV	Up to 4 kV family	19'' Rack
R649B	32	Multipin	SHV	8 kV	Up to 8 kV family	19" Rack
R649	32	Multipin	SHV	3 kV	Up to 4 kV family	19'' Rack

Low Voltage

S = Single width (5 TE wide)
D = Double width (10 TE wide)

A151xB - A251x

Model	Code	Description	S/D
A1517B	WA1517AXAAAA	A1517B - SYx527 L.V. channels 7 V 4 A Individual Floating (6 ch)	S
A1513B	WA1513AXAAAA	A1513B - SYx527 L.V. channels 10 V 2.7 A Individual Floating (6 ch)	S
A1516B	WA1516AXAAAA	A1516B - SYx527 L.V. channels 15 V 1.5 A Individual Floating (6 ch)	S
A2517	WA2517XAAAAA	A2517 - SYx527 L.V. channels 5V 15A (50W) - Individual Floating (8 ch)	S
A2518	WA2518XAAAAA	A2518 - SYx527 L.V. channels 8V 10A (50W) - Individual Floating (8 ch)	S
	WA2518AXAAAA	A2518A - SYx527 L.V. channels 8V 10A (50W) - DB37 conn. Individual Floating (8 ch)	S
A2519	WA2519XAAAAA	A2519 - SYx527 L.V. channels 15V 5A (50W) - Individual Floating (8 ch)	S
	WA2519AXAAAA	A2519A - SYx527 L.V. channels 15V 5A (50W) - DB37 conn. Individual Floating (8 ch)	S

Up to 100 V

S = Single width (5 TE wide)
D = Double width (10 TE wide)

A1539 - A1540(H) - A1510 - A7040

Model	Code	Description	S/D
A1539	WA1539DXAAAA	A1539DN - SYx527 H.V. channel -100 V 10 mA - SHV Conn. common floating (12 ch)	S
	WA1539DXMAAA	A1539DM - SYx527 H.V. channel (6ch +100V 10mA, 6ch -100V 10mA) - SHV Conn. common floating	S
	WA1539DXPAAA	A1539DP - SYx527 H.V. channel +100 V 10 mA - SHV Conn. common floating (12 ch)	S
	WA1539LXAAAA	A1539LN - SYx527 H.V. channel -100 V 10 mA - DB25 Conn. common floating (24 ch)	S
	WA1539LXPAAA	A1539LP - SYx527 H.V. channel +100 V 10 mA - DB25 Conn. common floating (24 ch)	S
	WA1539SXAAAA	A1539SN - SYx527 H.V. channel -100 V 10 mA - SHV Conn. common floating (24 ch 10TE wide)	D
	WA1539SXMAAA	A1539SM - SYx527 H.V. channel (12ch +100V 10mA, 12ch -100V 10mA) - SHV Conn. common floating (10TE)	D
	WA1539SXPAAA	A1539SP - SYx527 H.V. channel +100 V 10 mA - SHV Conn. common floating (24 ch 10TE wide)	D
	WA1539XAAAAA	A1539N - SYx527 H.V. channel -100 V 10 mA - DB25 Conn. common floating (32 ch)	S
	WA1539XPAAAA	A1539P - SYx527 H.V. channel +100 V 10 mA - DB25 Conn. common floating (32 ch)	S
A1539B	WA1539BXAAAA	A1539BN - SYx527 H.V. channel -100 V 20 mA - DB25 Conn. common floating (32 ch)	S
	WA1539BXPAAA	A1539BP - SYx527 H.V. channel +100 V 20 mA - DB25 Conn. common floating (32 ch)	S
AG539	WAG539DXAAAA	AG539DN - SYx527 H.V. channel -100 V 10 mA - SHV Conn. common ground (12 ch)	S
	WAG539DXMAAA	AG539DM - SYx527 H.V. channel (6ch +100V 10mA, 6ch -100V 10mA) - SHV Conn. common ground	S
	WAG539DXPAAA	AG539DP - SYx527 H.V. channel +100 V 10 mA - SHV Conn. common ground (12 ch)	S
	WAG539LXAAAA	AG539LN - SYx527 H.V. channel -100 V 10 mA - DB25 Conn. common ground (24 ch)	S
	WAG539LXPAAA	AG539LP - SYx527 H.V. channel +100 V 10 mA - DB25 Conn. common ground (24 ch)	S
	WAG539SXAAAA	AG539SN - SYx527 H.V. channel -100 V 10 mA - SHV Conn. common ground (24 ch 10TE wide)	D
	WAG539SXMAAA	AG539SM - SYx527 H.V. channel (12ch +100V 10mA, 12ch -100V 10mA) - SHV Conn. common ground (10TE)	D
	WAG539SXPAAA	AG539SP - SYx527 H.V. channel +100 V 10 mA - SHV Conn. common ground (24 ch 10TE wide)	D
	WAG539XAAAAA	AG539N - SYx527 H.V. channel -100 V 10 mA - DB25 Conn. common ground (32 ch)	S
	WAG539XPAAAA	AG539P - SYx527 H.V. channel +100 V 10 mA - DB25 Conn. common ground (32 ch)	S
A1540	WA1540DXAAAA	A1540DN - SYx527 H.V. channel -100 V 1 mA - SHV Conn. common floating (12 ch)	S
	WA1540DXMAAA	A1540DM - SYx527 H.V. channel (6ch +100V 1mA, 6ch -100V 1mA) - SHV common floating	S
	WA1540DXPAAA	A1540DP - SYx527 H.V. channel +100 V 1 mA - SHV Conn. common floating (12 ch)	S
	WA1540LXAAAA	A1540LN - SYx527 H.V. channel -100 V 1 mA - DB25 Conn. common floating (24 ch)	S
	WA1540LXPAAA	A1540LP - SYx527 H.V. channel +100 V 1 mA - DB25 Conn. common floating (24 ch)	S
	WA1540SXAAAA	A1540SN - SYx527 H.V. channel -100 V 1 mA - SHV Conn. common floating (24 ch 10TE wide)	D
	WA1540SXMAAA	A1540SM - SYx527 H.V. channel (12ch +100V 1mA, 12ch -100V 1mA) - SHV common floating (10TE wide)	D
	WA1540SXPAAA	A1540SP - SYx527 H.V. channel +100 V 1 mA - SHV Conn. common floating (24 ch 10TE wide)	D
	WA1540XAAAAA	A1540N - SYx527 H.V. channel -100 V 1 mA - DB25 Conn. common floating (32 ch)	S
	WA1540XPAAAA	A1540P - SYx527 H.V. channel +100 V 1 mA - DB25 Conn. common floating (32 ch)	S
A1540H	WA1540HDXAAA	A1540HDN - SYx527 H.V. channel -100V 1mA/100µA (100pA res) - SHV Conn. common floating (12 ch)	S
	WA1540HDXMAA	A1540HDM - SYx527 H.V. (6ch +100V 1mA/100µA, 6ch -100V 1mA/100µA) (100pA res) - SHV Conn. comm float	S
	WA1540HDXPAA	A1540HDP - SYx527 H.V.channel +100V 1mA/100µA (100pA res) - SHV Conn. common floating (12 ch)	S
	WA1540HLXAAA	A1540HLN - SYx527 H.V. channel -100V 1mA/100µA (100pA res) - DB25 Conn. common floating (24 ch)	S
	WA1540HLXPAA	A1540HLP - SYx527 H.V. channel +100V 1mA/100µA (100pA res) - DB25 Conn. common floating (24 ch)	S
	WA1540HSXAAA	A1540HSN - SYx527 H.V. channel -100V 1mA/100µA (100pA res) - SHV Conn. common floating (24 ch 10TE)	D
	WA1540HSXMAA	A1540HSM - SYx527 H.V. (12ch +100V 1mA/100µA, 12ch -100V 1mA/100µA) (100pA res) SHV c. float (10TE)	D
	WA1540HSXPAA	A1540HSP - SYx527 H.V. channel +100V 1mA/100µA (100pA res) - SHV Conn. common floating (24 ch 10TE)	D
	WA1540HXAAAA	A1540HN - SYx527 H.V. channel -100V 1mA/100µA (100pA res) - DB25 Conn. common floating (32 ch)	S
	WA1540HXPAAA	A1540HP - SYx527 H.V. channel +100V 1mA/100µA (100pA res) - DB25 Conn. common floating (32 ch)	S
AG540	WAG540DXAAAA	AG540DN - SYx527 H.V. channel -100 V 1 mA - SHV Conn. common ground (12 ch)	S
	WAG540DXMAAA	AG540DM - SYx527 H.V. channel (6ch +100V 1mA, 6ch -100V 1mA) - SHV Conn. common ground	S
	WAG540DXPAAA	AG540DP - SYx527 H.V. channel +100 V 1 mA - SHV Conn. common ground (12 ch)	S
	WAG540LXAAAA	AG540LN - SYx527 H.V. channel -100 V 1 mA - DB25 Conn. common ground (24 ch)	S
	WAG540LXPAAA	AG540LP - SYx527 H.V. channel +100 V 1 mA - DB25 Conn. common ground (24 ch)	S
	WAG540SXAAAA	AG540SN - SYx527 H.V. channel -100 V 1 mA - SHV Conn. common ground (24 ch 10TE wide)	D
	WAG540SXMAAA	AG540SM - SYx527 H.V. channel (12ch +100V 1mA, 12ch -100V 1mA) - SHV Conn. common ground (10TE wide)	D
	WAG540SXPAAA	AG540SP - SYx527 H.V. channel +100 V 1 mA - SHV Conn. common ground (24 ch 10TE wide)	D
	WAG540XAAAAA	AG540N - SYx527 H.V. channel -100 V 1 mA - DB25 Conn. common ground (32 ch)	S
	WAG540XPAAAA	AG540P - SYx527 H.V. channel +100 V 1 mA - DB25 Conn. common ground (32 ch)	S
A1510	WA1510XAAAAA	A1510 - SYx527 H.V. channels 100 V 10 mA Individual Floating (12 ch)	S
A7040	WA7040ANXAA4	A7040N - SYx527 H.V. channels -100 V 500 µA – DB37 Conn. common floating (48 ch)	S
	WA7040APXAA4	A7040P - SYx527 H.V. channels +100 V 500 µA – DB37 Conn. common floating (48 ch)	S

Up to 500 V

S = Single width (5 TE wide)
D = Double width (10 TE wide)

A154x - A151x - A7042

Model	Code	Description	S/D
A1511B	WA1511XAAAAA	A1511B - SYx527 H.V. channels 500 V 10/1 mA Individual Floating (12 ch)	S
A1512	WA1512XAAAAA	A1512 - SYx527 H.V. channels 500 V 1/0.1 mA Individual Floating (12 ch)	S
A1519B	WA1519XAAAAA	A1519B - SYx527 H.V. channels 250 V 1/0.1 mA floating (12 ch)	S
A1541	WA1541DXAAAA	A1541DN - SYx527 H.V. channel -500 V 10 mA - SHV Conn. common floating (12 ch)	S
	WA1541DXMAAA	A1541DM - SYx527 H.V. channel (6ch +500V 10mA, 6ch -500V 10mA) - SHV Conn. common floating	S
	WA1541DXPAAA	A1541DP - SYx527 H.V. channel +500 V 10 mA - SHV Conn. common floating (12 ch)	S
	WA1541LXAAAA	A1541LN - SYx527 H.V. channel -500 V 10 mA - DB25 Conn. common floating (24 ch)	S
	WA1541LXPAAA	A1541LP - SYx527 H.V. channel +500 V 10 mA - DB25 Conn. common floating (24 ch)	S
	WA1541SXAAAA	A1541SN - SYx527 H.V. channel -500 V 10 mA - SHV Conn. common floating (24 ch 10TE wide)	D
	WA1541SXMAAA	A1541SM - SYx527 H.V. channel (12ch +500V 10mA, 12ch -500V 10mA) - SHV Conn. common floating (10TE)	D
	WA1541SXPAAA	A1541SP - SYx527 H.V. channel +500 V 10 mA - SHV Conn. common floating (24 ch 10TE wide)	D
	WA1541XAAAAA	A1541N - SYx527 H.V. channel -500 V 10 mA - DB25 Conn. common floating (32 ch)	S
	WA1541XPAAAA	A1541P - SYx527 H.V. channel +500 V 10 mA - DB25 Conn. common floating (32 ch)	S
AG541	WAG541DXAAAA	AG541DN - SYx527 H.V. channel -500 V 10 mA - SHV Conn. common ground (12 ch)	S
	WAG541DXMAAA	AG541DM - SYx527 H.V. channel (6ch +500V 10mA, 6ch -500V 10mA) - SHV Conn. common ground	S
	WAG541DXPAAA	AG541DP - SYx527 H.V. channel +500 V 10 mA - SHV Conn. common ground (12 ch)	S
	WAG541LXAAAA	AG541LN - SYx527 H.V. channel -500 V 10 mA - Multipin Conn. common ground (24 ch)	S
	WAG541LXPAAA	AG541LP - SYx527 H.V. channel +500 V 10 mA - Multipin Conn. common ground (24 ch)	S
	WAG541SXAAAA	AG541SN - SYx527 H.V. channel -500 V 10 mA - SHV Conn. common ground (24 ch 10TE wide)	D
	WAG541SXMAAA	AG541SM - SYx527 H.V. channel (12ch +500V 10mA, 12ch -500V 10mA) - SHV Conn. common ground (10TE)	D
	WAG541SXPAAA	AG541SP - SYx527 H.V. channel +500 V 10 mA - SHV Conn. common ground (24 ch 10TE wide)	D
	WAG541XAAAAA	AG541N - SYx527 H.V. channel -500 V 10 mA - Multipin Conn. common ground (32 ch)	S
	WAG541XPAAAA	AG541P - SYx527 H.V. channel +500 V 10 mA - Multipin Conn. common ground (32 ch)	S
A1542	WA1542DXAAAA	A1542DN - SYx527 H.V. channel -500 V 1 mA - SHV Conn. common floating (12 ch)	S
	WA1542DXMAAA	A1542DM - SYx527 H.V. channel (6ch +500V 1mA, 6ch -500V 1mA) - SHV common floating	S
	WA1542DXPAAA	A1542DP - SYx527 H.V. channel +500 V 1 mA - SHV Conn. common floating (12 ch)	S
	WA1542LXAAAA	A1542LN - SYx527 H.V. channel -500 V 1 mA - DB25 Conn. common floating (24 ch)	S
	WA1542LXPAAA	A1542LP - SYx527 H.V. channel +500 V 1 mA - DB25 Conn. common floating (24 ch)	S
	WA1542SXAAAA	A1542SN - SYx527 H.V. channel -500 V 1 mA - SHV Conn. common floating (24 ch 10TE wide)	D
	WA1542SXMAAA	A1542SM - SYx527 H.V. channel (12ch +500V 1mA, 12ch -500V 1mA) - SHV common floating (10TE wide)	D
	WA1542SXPAAA	A1542SP - SYx527 H.V. channel +500 V 1 mA - SHV Conn. common floating (24 ch 10TE wide)	D
	WA1542XAAAAA	A1542N - SYx527 H.V. channel -500 V 1 mA - DB25 Conn. common floating (32 ch)	S
	WA1542XPAAAA	A1542P - SYx527 H.V. channel +500 V 1 mA - DB25 Conn. common floating (32 ch)	S
AG542	WAG542DXAAAA	AG542DN - SYx527 H.V. channel -500 V 1 mA - SHV Conn. common ground (12 ch)	S
	WAG542DXMAAA	AG542DM - SYx527 H.V. channel (6ch +500V 1mA, 6ch -500V 1mA) - SHV common ground	S
	WAG542DXPAAA	AG542DP - SYx527 H.V. channel +500 V 1 mA - SHV Conn. common ground (12 ch)	S
	WAG542LXAAAA	AG542LN - SYx527 H.V. channel -500 V 1 mA - DB25 Conn. common ground (24 ch)	S
	WAG542LXPAAA	AG542LP - SYx527 H.V. channel +500 V 1 mA - DB25 Conn. common ground (24 ch)	S
	WAG542SXAAAA	AG542SN - SYx527 H.V. channel -500 V 1 mA - SHV Conn. common ground (24 ch 10TE wide)	D
	WAG542SXMAAA	AG542SM - SYx527 H.V. channel (12ch +500V 1mA, 12ch -500V 1mA) - SHV common ground (10TE wide)	D
	WAG542SXPAAA	AG542SP - SYx527 H.V. channel +500 V 1 mA - SHV Conn. common ground (24 ch 10TE wide)	D
	WAG542XAAAAA	AG542N - SYx527 H.V. channel -500 V 1 mA - DB25 Conn. common ground (32 ch)	S
	WAG542XPAAAA	AG542P - SYx527 H.V. channel +500 V 1 mA - DB25 Conn. common ground (32 ch)	S
A1542H	WA1542HDXAAA	A1542HDN - SYx527 H.V. channel -500V 1mA/100µA (100pA res) - SHV Conn. common floating (12 ch)	S
	WA1542HDXMAA	A1542HDM - SYx527 H.V. (6ch +500V 1mA/100µA, 6ch -500V 1mA/100µA) (100pA res) - SHV Conn. comm float	S
	WA1542HDXPAA	A1542HDP - SYx527 H.V.channel +500V 1mA/100µA (100pA res) - SHV Conn. common floating (12 ch)	S
	WA1542HLXAAA	A1542HLN - SYx527 H.V. channel -500V 1mA/100µA (100pA res) - DB25 Conn. common floating (24 ch)	S
	WA1542HLXPAA	A1542HLP - SYx527 H.V. channel +500V 1mA/100µA (100pA res) - DB25 Conn. common floating (24 ch)	S
	WA1542HSXAAA	A1542HSN - SYx527 H.V. channel -500V 1mA/100µA (100pA res) - SHV Conn. common floating (24 ch 10TE)	D
	WA1542HSXMAA	A1542HSM - SYx527 H.V. (12ch +500V 1mA/100µA, 12ch -500V 1mA/100µA) (100pA res) SHV c. float (10TE)	D
	WA1542HSXPAA	A1542HSP - SYx527 H.V. channel +500V 1mA/100µA (100pA res) - SHV Conn. common floating (24 ch 10TE)	D
	WA1542HXAAAA	A1542HN - SYx527 H.V. channel -500V 1mA/100µA (100pA res) - DB25 Conn. common floating (32 ch)	S
	WA1542HXPAAA	A1542HP - SYx527 H.V. channel +500V 1mA/100µA (100pA res) - DB25 Conn. common floating (32 ch)	S
A7042	WA7042NXAAA4	A7042N - SYx527 H.V. channels -500 V 500 µA – Multipin Conn. common floating (48 ch)	S
	WA7042PXAAA4	A7042P - SYx527 H.V. channels +500 V 500 µA – Multipin Conn. common floating (48 ch)	S
	WA7042ANXAA4	A7042AN - SYx527 H.V. channels -500V/500µA - DB37 Conn. common floating (48 ch)	S
	WA7042APXAA4	A7042AP - SYx527 H.V. channels +500V/500µA - DB37 Conn. common floating (48 ch)	S

Up to 1.5 kV

S = Single width (5 TE wide) T = Triple width (15 TE wide)
D = Double width (10 TE wide)

A1515 - A1538D - A7038

Model	Code	Description	S/D/T
A1515	WA1515XAAAAA	A1515 - 16 Channel Floating 1kV, 0.1/1 mA Board	S
	WA1515TGXAAA	A1515TG - 14 Channel Floating 1kV, 0.1/1 mA Board for Triple GEM detectors	S
	WA1515QGXAAA	A1515QG - 16 Channel Floating 1kV, 0.1/1 mA Board for Quadruple GEM detectors	S
	WA1515CGXAAA	A1515CG - 14 Channel Floating 1.3/1kV, 1mA Board for Cylindrical GEM detectors	S
	WA1515TGHPXA	A1515TGHP - 14 Channel Floating 1kV, 3mA Board (1,5W max) for Triple GEM detectors	S
	WA1515VXAAAA	A1515V - 16 Channel Floating 1.3/1kV, 1 mA Board for Vertex detectors	S
A1538D	WA1538DXAAAA	A1538DN - SYx527 negative H.V. -1.5 kV 10 mA 12W - SHV Connector common floating (12 ch)	S
	WA1538DXPAAA	A1538DP - SYx527 positive H.V. +1.5 kV 10 mA 12W - SHV Connector common floating (12 ch)	S
AG538D	WAG538DXAAAA	AG538DN - SYx527 negative H.V. -1.5 kV 10 mA 12W - SHV Connector common ground (12 ch)	S
	WAG538DXPAAA	AG538DP - SYx527 positive H.V. +1.5 kV 10 mA 12W - SHV Connector common ground (12 ch)	S
A7038	WA7038ANXAA4	A7038AN - SYx527 H.V. channels -1 kV 100µA - DB37 Conn. common floating (48 ch)	S
	WA7038APXAA4	A7038AP - SYx527 H.V. channels +1 kV 100µA - DB37 Conn. common floating (48 ch)	S
	WA7038STNXA3	A7038STN - SYx527 H.V. channels -1 kV 100µA - SHV Conn. common floating (32 ch 15TE wide)	T
	WA7038STPXA3	A7038STP - SYx527 H.V. channels +1 kV 100µA - SHV Conn. common floating (32 ch 15TE wide)	T

Up to 3.5 kV

S = Single width (5 TE wide)
D = Double width (10 TE wide)

A7030 - A7236 - A7435

Model	Code	Description	S/D
A7030	WA7030NXAAA4	A7030N - SYx527 H.V. channels -3 kV 1 mA (1.5 W) – Multi-pin Conn. common floating (48 ch)	S
	WA7030PXAAA4	A7030P - SYx527 H.V. channels +3 kV 1 mA (1.5 W) – Multipin Conn. common floating (48 ch)	S
	WA7030TNXAA3	A7030TN - SYx527 H.V. channels -3 kV 1 mA (1.5 W) – Multipin Conn. common floating (36 ch)	S
	WA7030TPXAA3	A7030TP - SYx527 H.V. channels +3 kV 1 mA (1.5 W) – Multipin Conn. common floating (36 ch)	S
	WA7030LNXAA2	A7030LN - SYx527 H.V. channels -3 kV 1 mA (1.5 W) – Multipin Conn. common floating (24 ch)	S
	WA7030LPXAA2	A7030LP - SYx527 H.V. channels +3 kV 1 mA (1.5 W) – Multipin Conn. common floating (24 ch)	S
	WA7030SNXAA2	A7030SN - SYx527 H.V. channels -3 kV 1 mA (1.5 W) – SHV Conn. common floating (24 ch 10TE wide)	D
	WA7030SPXAA2	A7030SP - SYx527 H.V. channels +3 kV 1 mA (1.5 W) – SHV Conn. common floating (24 ch 10TE wide)	D
	WA7030DNXAA1	A7030DN - SYx527 H.V. channels -3 kV 1 mA (1.5 W) – SHV Conn. common floating (12 ch)	S
	WA7030DPXAA1	A7030DP - SYx527 H.V. channels +3 kV 1 mA (1.5 W) – SHV Conn. common floating (12 ch)	S
	WA7030YNXAA4	A7030YN - SYx527 H.V. ch -3 kV 1 mA (1.5 W) - Multipin Conn. common floating (48 ch) High Altitude	S
	WA7030YPXAA4	A7030YP - SYx527 H.V. ch +3 kV 1 mA (1.5 W) - Multipin Conn. common floating (48 ch) High Altitude	S
	WA7030YSNXA2	A7030YSN - SYx527 H.V. ch -3 kV 1 mA (1.5 W) - SHV Conn. common floating (24 ch 10TE wide) High Altitude	D
	WA7030YSPXA2	A7030YSP - SYx527 H.V. ch +3 kV 1 mA (1.5 W) - SHV Conn. common floating (24 ch 10TE wide) High Altitude	D
A7236	WA7236DNXAA1	A7236DN - SYx527 H.V. channels -3.5KV 1.5mA (4W) - SHV Conn. common floating (12ch)	S
	WA7236DPXAA1	A7236DP - SYx527 H.V. channels +3.5KV 1.5mA (4W) - SHV Conn. common floating (12ch)	S
	WA7236NXAAA3	A7236N - SYx527 H.V. channels -3.5KV 1.5mA (4W) -Multi-pin Conn. common floating (32ch)	S
	WA7236PXAAA3	A7236P - SYx527 H.V. channels +3.5KV 1.5mA (4W) -Multi-pin Conn. common floating (32ch)	S
	WA7236SNXAA2	A7236SN - SYx527 H.V. channels -3.5KV 1.5mA (4W) - SHV Conn. common floating (24ch, 10TE)	D
	WA7236SPXAA2	A7236SP - SYx527 H.V. channels +3.5kV 1.5mA (4W) - SHV Conn. common floating (24ch, 10TE)	D
AG7236	WAG7236DNXA1	AG7236DN - SYx527 H.V. channels -3.5kV 1.5mA (4W)- SHV Conn. common ground (12 ch)	S
	WAG7236DPXA1	AG7236DP - SYx527 H.V. channels +3.5kV 1.5mA (4W)- SHV Conn. common ground (12 ch)	S
	WAG7236NXAA3	AG7236N - SYx527 H.V. channels -3.5kV 1.5mA (4W) - Multipin Conn. common ground (32 ch)	S
	WAG7236PXAA3	AG7236P - SYx527 H.V. channels +3.5kV 1.5mA (4W) - Multipin Conn. common ground (32 ch)	S
	WAG7236SNXA2	AG7236SN - SYx527 H.V. channels -3.5kV 1.5mA (4W)- SHV Conn. common ground (24 ch, 10TE)	D
	WAG7236SPXA2	AG7236SP - SYx527 H.V. channels +3.5kV 1.5mA (4W)- SHV Conn. common ground (24 ch, 10TE)	D
A7435	WA7435DNXAA1	A7435DN - SYx527 H.V. channels -3.5kV 3.5mA (9W) - SHV Conn. common floating (12 ch)	S
	WA7435DPXAA1	A7435DP - SYx527 H.V. channels +3.5kV 3.5mA (9W) - SHV Conn. common floating (12 ch)	S
	WA7435NXAAA2	A7435N - SYx527 H.V. channels -3.5kV 3.5mA (9W) - Multi-pin Conn. common floating (24 ch)	S
	WA7435PXAAA2	A7435P - SYx527 H.V. channels +3.5kV 3.5mA (9W) - Multipin Conn. common floating (24 ch)	S
	WA7435SNXAA2	A7435SN - SYx527 H.V. channels -3.5kV 3.5mA (9W) - SHV Conn. common floating (24 ch,10TE)	D
	WA7435SPXAA2	A7435SP - SYx527 H.V. channels +3.5kV 3.5mA (9W) - SHV Conn. common floating (24 ch,10TE)	D
AG7435	WAG7435DNXA1	AG7435DN - SYx527 H.V. channels -3.5kV 3.5mA (9W) SHV Conn. common ground (12 ch)	S
	WAG7435DPXA1	AG7435DP - SYx527 H.V. channels +3.5kV 3.5mA (9W) SHV Conn. common ground (12 ch)	S
	WAG7435NXAA2	AG7435N - SYx527 H.V. channels -3.5kV 3.5mA (9W) - Multipin Conn. common ground (24 ch)	S
	WAG7435PXAA2	AG7435P - SYx527 H.V. channels +3.5kV 3.5mA (9W) - Multipin Conn. common ground (24 ch)	S
	WAG7435SNXA2	AG7435SN - SYx527 H.V. channels -3.5kV 3.5mA (9W) SHV Conn. common ground (24 ch, 10TE)	D
	WAG7435SPXA2	AG7435SP - SYx527 H.V. channels +3.5kV 3.5mA (9W) SHV Conn. common ground (24 ch, 10TE)	D

Up to 8 kV

S = Single width (5 TE wide)
D = Double width (10 TE wide)

A1550 - A1561H - A15x0H - A1534

Model	Code	Description	S/D
A1534	WA1534XNAAAA	A1534N - SYx527 H.V. channels -8 kV 200 µA Individual floating (6 ch)	S
	WA1534XPAAAA	A1534P - SYx527 H.V. channels +8 kV 200 µA Individual floating (6 ch)	S
A1550	WA1550DXAAAA	A1550DN - SYx527 H.V. channels -5 kV 1 mA - SHV Conn. common floating (12 ch)	S
	WA1550DXPAAA	A1550DP - SYx527 H.V. channels +5 kV 1 mA - SHV Conn. common floating (12 ch)	S
	WA1550SXAAAA	A1550SN - SYx527 H.V. channels -5 KV 1 mA - SHV Conn. common floating (24 ch 10TE wide)	D
	WA1550SXPAAA	A1550SP - SYx527 H.V. channels +5 kV 1 mA - SHV Conn. common floating (24 ch 10TE wide)	D
	WA1550XAAAAA	A1550N - SYx527 H.V. channels -5 kV 1 mA - Multipin Conn. common floating (24 ch)	S
	WA1550XPAAAA	A1550P - SYx527 H.V. channels +5 kV 1 mA - Multipin Conn. common floating (24 ch)	S
AG550	WAG550DXAAAA	AG550DN - SYx527 H.V. channels -5 KV 1 mA - SHV Conn. common ground (12 ch)	S
	WAG550DXPAAA	AG550DP - SYx527 H.V. channels +5 KV 1 mA - SHV Conn. common ground (12 ch)	S
	WAG550XAAAAA	AG550N - SYx527 H.V. channels -5 KV 1 mA - Multipin Conn. common gound (24 ch)	S
	WAG550XPAAAA	AG550P - SYx527 H.V. channels +5 KV 1 mA - Multipin Conn. common ground (24 ch)	S
A1560H	WA1560HDMEAA	A1560HDME - SYx527 H.V. (4ch +6kV 20µA, 4ch -6kV 20µA) (50pA res) Ind EN - SHV Conn. comm floating	S
	WA1560HDNEAA	A1560HDNE - SYx527 H.V. -6 kV 20 µA (50pA res) Individual Enable - SHV Conn. common floating (8 ch)	S
	WA1560HDPEAA	A1560HDPE - SYx527 H.V. +6 kV 20 µA (50pA res) Individual Enable - SHV Conn. common floating (8 ch)	S
	WA1560HNEAAA	A1560HNE - SYx527 H.V. -6 kV 20 µA (50pA res) Individual Enable - Multipin Conn. comm float (16 ch)	S

	WA1560HPEAAA	A1560HPE - SYx527 H.V. +6 kV 20 µA (50pA res) Individual Enable - Multipin Conn. comm float (16 ch)	S
A1561H	WA1561HDMAAA	A1561HDM - SYx527 H.V. 6 ch channels +6 kV 20 µA + 6 ch channels -6 kV 20 µA - SHV - 50pA res.	S
	WA1561HDNAAA	A1561HDN - SYx527 H.V. channels -6 kV 20 µA SHV (12 ch) - 50pA res.	S
	WA1561HDPAAA	A1561HDP - SYx527 H.V. channels +6 kV 20 µA SHV (12 ch) - 50pA res.	S
AG561H	WAG561HDMAAA	AG561HDM - SYx527 H.V. 6 ch channels +6 KV 20 µA + 6 ch channels -6 KV 20 µA - SHV - 50pA res.	S
	WAG561HDNAAA	AG561HDN - SYx527 H.V. channels -6 KV 20 µA SHV (12 ch) - 50pA res.	S
	WAG561HDPAAA	AG561HDP - SYx527 H.V. channels +6 KV 20 µA SHV (12 ch) - 50pA res.	S
A1580H	WA1580HDMEAA	A1580HDME - SYx527 H.V. (4ch +8kV 20µA, 4ch -8kV 20µA) (50pA res) Ind EN - SHV Conn. comm floating	S
	WA1580HDNEAA	A1580HDNE - SYx527 H.V. -8 kV 20 µA (50pA res) Individual Enable - SHV Conn. common floating (8 ch)	S
	WA1580HDPEAA	A1580HDPE - SYx527 H.V. +8 kV 20 µA (50pA res) Individual Enable - SHV Conn. common floating (8 ch)	S
	WA1580HNEAAA	A1580HNE - SYx527 H.V. -8 kV 20 µA (50pA res) Individual Enable - Multipin Conn. comm float (16 ch)	S
	WA1580HPEAAA	A1580HPE - SYx527 H.V. +8 kV 20 µA (50pA res) Individual Enable - Multipin Conn. comm float (16 ch)	S
A1580H	WA1580HDMEAA	A1580HDME - SYx527 H.V. (4ch +8kV 20µA, 4ch -8kV 20µA) (50pA res) Ind EN - SHV Conn. comm floating	S
	WA1580HDNEAA	A1580HDNE - SYx527 H.V. -8 kV 20 µA (50pA res) Individual Enable - SHV Conn. common floating (8 ch)	S
	WA1580HDPEAA	A1580HDPE - SYx527 H.V. +8 kV 20 µA (50pA res) Individual Enable - SHV Conn. common floating (8 ch)	S
	WA1580HNEAAA	A1580HNE - SYx527 H.V. -8 kV 20 µA (50pA res) Individual Enable - Multipin Conn. comm float (16 ch)	S
	WA1580HPEAAA	A1580HPE - SYx527 H.V. +8 kV 20 µA (50pA res) Individual Enable - Multipin Conn. comm float (16 ch)	S

Up to 15 kV

S = Single width (5 TE wide)
D = Double width (10 TE wide)

A152x - A1590

Model	Code	Description	S/D
A1523	WA1523XAAAAA	A1523N - SYx527 H.V. channels -12 kV 1 mA - CPE Conn. common floating (6 ch 10TE wide)	D
	WA1523XPAAAA	A1523P - SYx527 H.V. channels +12 kV 1 mA - CPE Conn. common floating (6 ch 10TE wide)	D
	WA1523XMAAAA	A1523M - SYx527 H.V. channels (3CH+12 kV 1 mA,3CH-12 kV 1mA)- CPE Conn. common floating (10TE wide)	D
A1524	WA1524XAAAAA	A1524N - SYx527 H.V. channels -12 kV 100 µA - CPE Conn. common floating (6 ch 10TE wide)	D
	WA1524XPAAAA	A1524P - SYx527 H.V. channels +12 kV 100 µA - CPE Conn. common floating (6 ch 10TE wide)	D
AG523	WAG523XAAAAA	AG523N - SYx527 H.V. channels -12 kV 1 mA - CPE Conn. common ground (6 ch 10TE wide)	D
	WAG523XPAAAA	AG523P - SYx527 H.V. channels +12 kV 1 mA - CPE Conn. common ground (6 ch 10TE wide)	D
	WAG523XMAAAA	AG523M - SYx527 H.V. channels (3CH +12 KV 1 mA, 3CH -12 KV 1 mA) CPE Conn. common ground (10TE)	D
AG524	WAG524XAAAAA	AG524P - SYx527 H.V. channels +12 kV 100 µA - CPE Conn. common ground (6 ch 10TE wide)	D
	WAG524XNAAAA	AG524N - SYx527 H.V. channels -12 kV 100 µA - CPE Conn. common ground (6 ch 10TE wide)	D
A1590	WA1590NAAAAA	A1590N - SYx527 H.V. channels -9 kV 50 µA - Multipin Conn. common float (6 ch 10TE wide)	D
	WA1590PAAAAA	A1590P - SYx527 H.V. channels +9 kV 50 µA - Multipin Conn. common float (6 ch 10TE wide)	D
AG590	WAG590NAAAAA	AG590N - SYx527 H.V. channels -9 kV 50 µA - Multipin Conn. common ground (6 ch 10TE wide)	D
	WAG590PAAAAA	AG590P - SYx527 H.V. channels +9 kV 50 µA - Multipin Conn. common ground (6 ch 10TE wide)	D
A1526	WA1526XNAAAA	A1526N - SYx527 H.V. channels -15 KV 1/0.1 mA - CPE Conn. common floating (6 ch 10TE wide)	D
	WA1526XAAAAA	A1526P - SYx527 H.V. channels +15 KV 1/0.1 mA - CPE Conn. common floating (6 ch 10TE wide)	D
	WA1526KXAAAA	A1526KP - SYx527 H.V. channels +15 KV 1/0.1 mA - KINGS Conn. common floating (6 ch 10TE wide)	D
	WA1526KXNAAA	A1526KN - SYx527 H.V. channels -15 KV 1/0.1 mA - KINGS Conn. common floating (6 ch 10TE wide)	D

Up to 2 kV Bipolar

S = Single width (5 TE wide)
D = Double width (10 TE wide)

A1588

Model	Code	Description	S/D
A1588	WA1588XAAAAA	A1588 - SYx527 4 Quadrant Bipolar 8 HV Ch's ±2kV/500µA - SHV Comm.	S

HV Adapters

A1015x - A64x - R64x (DB37 and Radiall to SHV cable)

Code	Description
WA1015GXAAAA	A1015G - 14/16 Stacked Channel Multipin Radiall to SHV connector Adapter for A1515TG/A1515QG board
WA1015VMXAAA	A1015VM - Analog Voltage Monitor for A1515/A1515TG/A1515QG board
WA1015XAAAAA	A1015 - 16 Floating Channel Multipin Radiall to SHV connector Adapter for A1515 board
WA646XAAAAAA	A646 - DB37 to SHV Adapter for 12 ch HV Boards (Max: 500V - Desktop)
WA647XAAAAAA	A647 - Multipin to SHV Adapter for 24 ch HV Boards (Max: 8kV - Desktop)
WA648XAAAAAA	A648 - Multipin to SHV Adapter for 48 / 36 ch HV Boards (Max: 3kV - Desktop)
WA649BXAAAAA	A649B - Multipin to SHV Adapter for 32 ch HV Boards (max 8kV)
WA649XAAAAAA	A649 - Multipin to SHV Adapter for 32 ch HV Boards (Max: 3kV - Desktop)
WR647XAAAAAA	R647 - Multipin to SHV Adapter for 24 ch HV Boards (Max: 8kV - 19" Rack)
WR648XAAAAAA	R648 - Multipin to SHV Adapter for 48 / 36 ch HV Boards (Max: 3kV - 19" Rack)
WR649BXAAAAA	R649B - 19" Multipin to SHV Adapter for 32 ch HV Boards (Max 8kV)
WR649XAAAAAA	R649 - Multipin to SHV adapter for 32 ch HV Boards (Max: 3kV - 19" Rack)


40
YEARS OF INNOVATION
1979-2019

CAEN Electronic Instrumentation

Power Supplies

VME-NIM POWER SUPPLIES

V65xx

6 Channel up to 6 kV Family

Overview

The VME power supply family is a 6U modules family housing 6 independent High Voltage channels able to provide up to 6 kV and 3 mA. The units are available with either positive, negative or mixed polarity.

The channels share a common floating return, which allows on-detector grounding reducing the noise level. HV outputs are delivered through SHV connectors. The HV output ramp-up and ramp-down rates may be selected independently for each channel in the 1 ÷ 100 V/s or 1 ÷ 500 V/s range with 1 V/s steps. The modules feature high Iset/Imon resolution (up to 1 nA). A Zoom option is available for Imon, increasing resolution up to 100 pA. The modules fit into both VME/VME64 standard and V430 crates.

Functional parameters can be programmed and monitored via VMEbus. A complete set of software tools is available to control these units, from low level libraries to graphical application software. For detailed information see the Power Supply Control Software section.

Safety features include:

- **Overvoltage and Undervoltage** warning when the output voltage differs from the programmed value
- Programmable via trimmer VMAX and IMAX hardware protection limit
- **Overcurrent** detection: if a channel tries to draw a current larger than its programmed limit, it enters TRIP status, keeping the maximum allowed value for a programmable time (TRIP), before being switched off. If TRIP is set to “constant current mode”, the channel behaves like a current generator.
- Channels can be enabled or disabled through the Global Interlock logic
- Channels individually enabled via front panel jumpers (passive or active mode available)

Available options:

- A6580 DC Input Power Equalizer
- Imon Zoom, increasing resolution up to 100 pA

CAEN HV Power Supplies now fit your rack in a flexible and reliable unit

Features

- 6 independent HV channels in 1 unit wide VME 6U module
- up to 6 kV and 3 mA output ranges
- Available with positive, negative or mixed polarity
- SHV coaxial output connectors
- Common floating return
- Low Ripple (Typ: from < 3 mVpp to < 15 mVpp)
- up to 1 nA Iset/Imon resolution (Optional Imon-Zoom: up to 100 pA)
- Status output
- Channel ON/Status LEDs
- Interlock logic for board enable
- Individual channel enable
- Optional A6580 DC Input Power Equalizer
- Module control via OPC Server

Control Software available: GECO2020 with user friendly GUI and CAEN HV Wrapper library for custom SW development. OPC Server also supported.

CAEN OPC Server | CAEN HV Wrapper | GECO 2020 | FREE

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Model Compare

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels
V6519	500	3	10	50 (5 with Imon Zoom)	< 3	1.5	6
V6533	4000	3	100	50 (5 with Imon Zoom)	< 12	9	6
V6534	6000	1	100	20 (2 with Imon Zoom)	< 15	6	6
V6521	6000	0.3	100	5 (0.5 with Imon Zoom)	< 3	1.8	6
V6521H	6000	0.02	100	1 (0.1 with Imon Zoom)	< 3	0.12	6

The V65xx boards allow to integrate HV channels into a VME-based DAQ system: if you want the power supplies side by side with front end electronics in your VME crate, the V65xx boards are the way to go. Modules control is guaranteed by the reliability of CAEN VME Bridges and the friendliness of CAEN Software tools: all data and parameters are easily organized and accessible on your desktop.

Easy Set-up via USB/Optical link thanks to

GECO2020 control software

Ordering Options

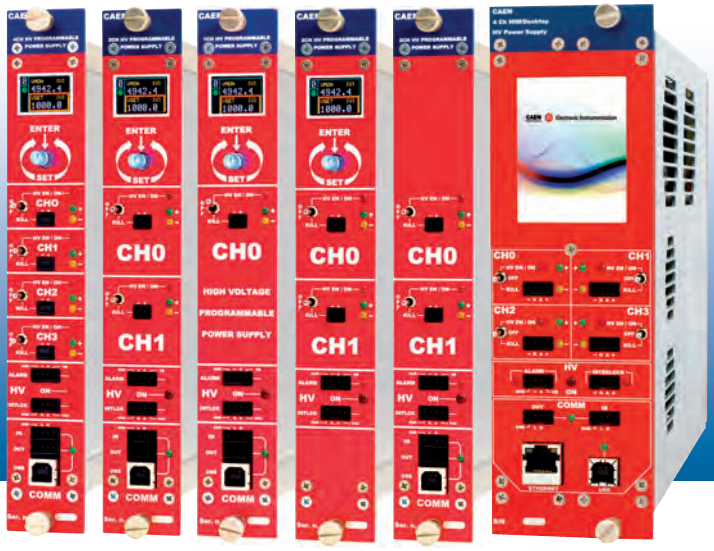
Model	Code	Description
V6519	WV6519MAAAAA	V6519M - 6 Channel VME Programmable High Voltage Power Supply (3 ch -500 V 3 mA, 3 ch +500 V 3 mA)
	WV6519XAAAAA	V6519N - 6 Channel VME Programmable High Voltage Power Supply (-500 V 3 mA)
	WV6519XPAAAA	V6519P - 6 Channel VME Programmable High Voltage Power Supply (+500 V 3 mA)
V6533	WV6533MAAAAA	V6533M - 6 Channel VME Programmable High Voltage Power Supply (3 ch -4 kV 3 mA, 3 ch +4 kV 3 mA, 9W)
	WV6533XAAAAA	V6533N - 6 Channel VME Programmable High VoltagePower Supply (-4 kV 3 mA 9 W max.)
	WV6533XPAAAA	V6533P - 6 Channel VME Programmable High VoltagePower Supply (+4 kV 3 mA 9 W max.)
V6534	WV6534MAAAAA	V6534M - 6 Channel VME Programmable High Voltage Power Supply (3 ch -6 kV 1 mA, 3 ch +6 kV 1 mA)
	WV6534XAAAAA	V6534N - 6 Channel VME Programmable High VoltagePower Supply (-6 kV 1 mA)
	WV6534XPAAAA	V6534P - 6 Channel VME Programmable High Voltage Power Supply (+6 kV 1 mA)
V6521	WV6521MAAAAA	V6521M - 6 Channel VME Programmable High Voltage Power Supply (3 ch -6 kV 300 µA, 3 ch +6 kV 300 µA)
	WV6521XAAAAA	V6521N - 6 Channel VME Programmable High Voltage Power Supply (-6 kV 300 µA)
	WV6521XPAAAA	V6521P - 6 Channel VME Programmable High Voltage Power Supply (+6 kV 300 µA)
V6521H	WV6521HAAAAA	V6521HN - 6 Channel VME Programmable High Voltage Power Supply (-6 kV 20µA/1nA res)
	WV6521HMAAAA	V6521HM - 6 Channel VME Programmable High Voltage Power Supply (3ch -6 kV 20µA, 3ch +6kV 20µA/1nA res)
	WV6521HPAAAA	V6521HP - 6 Channel VME Programmable High Voltage Power Supply (+6 kV 20µA/1nA res)
Options	WPERS065XX01	V65XX Customization - Imon Zoom x10
	WA6580XAAAAA	A6580 - DC Power Input Equalizer for V65XX Family

UP TO 8 kV

Reversible Polarity

NDT14xx - N14xxET - N14xx

1/2/4 Channel up to 8 kV Reversible Polarity Families with USB / RS232 / Ethernet / Touchscreen



Number of channels, polarity, connectivity, display and Vac plug: it's your choice!

Features

- 4/2/1 independent channels in 1U NIM module
- Channel polarity independently selectable
- SHV coaxial output connectors
- Common floating return
- Very Low Ripple
- Under/over-voltage alert, overcurrent and max. voltage protection
- Daisy-chain capability
- 2.8" color touch screen or OLED display
- Local and Remote control (USB 2.0/Ethernet)
- Optional selectable power requirement
- Interlock logic for board enable and Individual channel kill
- LabVIEW Driver available
- Software Tools for remote control
- 2U/Desktop (with 110-220 Vac) version available

Remember! Our NDT power supplies can work as a standalone unit like the classic desktop ones!

Control Software available: GECO2020 with user friendly GUI and CAEN HV Wrapper library for custom SW development. EPICS and LabVIEW also supported

CAEN HV Wrapper | CAEN LabVIEW | GECO 2020 | EPICS | FREE

Overview

The NIM power supply family provides a series of Independent High Voltage channels in 1U (N14xx) or 2U (NDT14xx, N14xxET) NIM module. N14xxET and NDT14xx families provides 4 channels, while N14xx are available in versions housing 4, 2 or 1 channels (N14xx, N14xxA, N14xxB). Each channel can provides up to 8 kV and 3 mA max output. The output polarity is independently selectable for each channel that features common floating return (common return insulated from the crate ground); HV outputs are delivered through SHV connectors.

The HV output ramp-up and ramp-down rates may be selected independently for each channel in the range 1 ÷ 50 V/s or 1 ÷ 500 V/s in 1 V/s steps. The modules feature hight Iset/Imon resolution (up to 1 nA). Each unit is provided with Imon Zoom(*), this feature increase Imon resolution up to 50 pA. Power supply control can be performed either locally, assisted by a 2.8" color touch screen or OLED display or remotely, via Ethernet, USB, RS232, RS485, the latter allowing to build a daisy chain network of modules N14xx. For those module not featuring the Ethernet interface, it is also possible to setup a control via TCP/IP by the Smart Fan Unit of CAEN NIM8301 as shown in the next page figure.

The NDT modules can work either as a standard NIM module or a desktop power supply thanks to the 110-220 AC plug. A complete set of software tools is available to control these units, from low level libraries to graphical application software. For detailed information see the Power Supply Control Software section.

(*) Imon Zoom is an option for N1419/A/B, N1470/A/B, N1471/A/B

Safety features include:

- **Overvoltage and Undervoltage** warning when the output voltage differs from the programmed value by more than 2% of set value (minimum 10 V).
- Programmable VMAX protection limit
- **Overcurrent** detection: if a channel tries to draw a current larger than its programmed limit, it enters TRIP status, keeping the maximum allowed value for a programmable time (TRIP), before being switched off. If TRIP is set to "constant current mode", the channel behaves like a current generator.
- Common Interlock logic for channels enable/disable and individual inputs signal for channel Kill function.

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Single Channel Features Compare

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Ground	Max Power per Channel (W)
Nx1419x	±500	0.2	10	5 (0.5 with Imon zoom)	< 3	Common Floating Return	0.1
Nx1471Hx	±5500	0.02	100	1 (0.05 with Imon zoom)	< 5	Common Floating Return	0.1
Nx1471x	±5500	0.3	100	5 (0.5 with Imon zoom)	< 5	Common Floating Return	1.65
Nx1470x	±8000	3	200	50 (5 with Imon zoom)	< 5-15	Common Floating Return	9 (<3 kV) / 8 (>3 kV)

Family Type	Form Factor	N. of Channel	Remote Interface			Local Interface		Vac plug for Desktop operation	Version	Channel Type			
			Ethernet	USB 2.0	RS232/ RS485	2.8" Touch Screen	Oled Display			±500 V 200 µA	±5.5 kV 20 µA	±5.5 kV 300 µA	±8 kV 3 mA (9W)
NDT14xx	NIM 2U	4	*	*	-	*	-	*	NDT1419	*			
									NDT1471H		*		
									NDT1471			*	
									NDT1470				*
N14xxET	NIM 2U	4	*	*	-	*	-	-	N1419ET	*			
									N1471HET		*		
									N1471ET			*	
									N1470ET				*
N14xx	NIM 1U	4 / 2 / 1	-	*	*	-	*	-	N1419/A/B	*			
									N1471H/A/B		*		
									N1471/A/B			*	
									N1470/A/B				*
		2	-	-	-	-	*	-	N1470AL				*
				*	*	-	-	-	N1470AR				*

Module control can take place either locally, assisted by a Graphic colour display, or remotely, via USB (1) or RS485 (1). It is also controllable via TCP/IP (2) by the Smart Fan Unit of CAEN NIM 8301 crate:

Special versions available:

- 2U NIM module plug USB/Ethernet and touch screen display (N14xxET).
- 2U NIM module with 110 - 220 Vac plug USB/Ethernet and touch screen display for desktop operation (NDT14xx).

Available options:

- A1480 DC Input Power Equalizer.

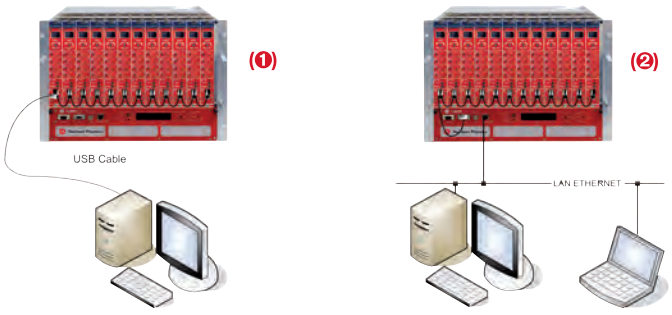


Figure 1: N14xx control can take place either locally (graphic colour display) or remotely via USB (1) or RS485 (1). It is also controllable via TCP/IP (2) through the Smart Fan Unit of CAEN NIM 8301 crate.

Ordering Options

Model	Code	Description
N1419	WN1419XAAAAA	N1419 - 4 Ch NIM Programmable HV Power Supply (±500V, 200µA, 5nA res.)
	WN1419AXAAAA	N1419A - 2 Ch NIM Programmable HV Power Supply (±500V, 200µA, 5nA res.)
	WN1419BXAAAA	N1419B - 1 Ch NIM Programmable HV Power Supply (±500V, 200µA, 5nA res.)
N1419ET	WN1419ETXAAA	N1419ET - 4 Channel 500V/200µA NIM HV Power Supply Module with Ethernet & 2.8" Touchscreen
NDT1419	WNDT1419AAAA	NDT1419 - 4 Ch NIM/Desktop Programmable HV Power Supply (±500V, 200µA, 5nA res.)
N1470	WN1470X08AAC	N1470 - 4 Ch NIM Programmable HV Power Supply (±8kV, 3mA, 50nA res.)
	WN1470A08AAC	N1470A - 2 Ch NIM Programmable HV Power Supply (±8kV, 3mA, 50nA res.)
	WN1470B08AAC	N1470B - 1 Ch NIM Programmable HV Power Supply (±8kV, 3mA, 50nA res.)
	WN1470ALCLAA	N1470AL - 2 Ch NIM Low Cost Locally Programmable HV Power Supply (±8kV, 3mA, 50nA res.)
	WN1470ALCRAA	N1470AR - 2 Ch NIM Low Cost Remotely Programmable HV Power Supply (±8kV, 3mA, 50nA res.)
N1470ET	WN1470ETXAAA	N1470ET - 4 Channel 8kV/3mA (9W) NIM HV Power Supply Module with Ethernet & 2.8" Touchscreen
NDT1470	WNDT1470AAAA	NDT1470 - 4 Ch NIM/Desktop Programmable HV Power Supply (±8kV, 3mA, 50nA res.)

Model	Code	Description
N1471	WN1471X05AAC	N1471 - 4 Ch NIM Programmable HV Power Supply (±5.5kV, 300µA, 5nA res.)
	WN1471A05AAC	N1471A - 2 Ch NIM Programmable HV Power Supply (±5.5kV, 300µA, 5nA res.)
	WN1471B05AAC	N1471B - 1 Ch NIM Programmable HV Power Supply (± 5.5kV, 300µA, 5nA res.)
N1471ET	WN1471ETXAAA	N1471ET - 4 Channel 5.5kV NIM HV Power Supply Module with Ethernet & 2.8" Touchscreen
NDT1471	WNDT1471AAAA	NDT1471 - 4 Ch NIM/Desktop Programmable HV Power Supply (±5.5kV, 300µA, 5nA res.)
N1471H	WN1471HX05AC	N1471H - 4 Ch NIM Programmable High CurrentRes. HV Power Supply (±5.5kV, 20µA, 1nA res.)
	WN1471HA05AC	N1471HA - 2 Ch NIM Programmable High CurrentRes. HV Power Supply (±5.5kV, 20µA, 1nA res.)
	WN1471HB05AC	N1471HB - 1 Ch NIM Programmable High CurrentRes. HV Power Supply (±5.5kV, 20µA, 1nA res.)
N1471HET	WN1471HETXAA	N1471HET - 4 Channel 5.5kV NIM HV Power Supply High Accuracy Module with Ethernet & 2.8" TouchScreen
NDT1471H	WNDT1471HAAA	NDT1471H - 4 Ch NIM/Desktop Programmable High CurrentRes. HV Power Supply (±5.5kV, 20µA, 1nA res.)
Options	WA1480XAAAAA	A1480 – DC Power Input Equalizer for N14XX Family and N1570
	WPERS0147001	N14XX Customization – Imon Zoom

NEW

N803x

8 Channel up to 6 kV Family with USB, Ethernet & Touchscreen

The new generation of CAEN NIM power supplies.
More channels, more power, more reliability

Features

- 8 independently controllable HV channels
- Very low ripple
- Four versions from 100 V up to 6kV, and from 1 mA to 10 mA
- BNC output connectors for the 100 V version and SHV coaxial connectors for the others
- Local control with a 2.8" touch screen display
- Remote control via Ethernet or USB 2.0
- Common ground
- Positive/negative or mixed polarity versions available
- Autonomous cooling
- Interlock logic for board enable and individual channel kill
- LabVIEW Driver available
- Software Tools for remote control
- The 100 V version has:
  - Temperature probe input for SiPM gain stabilization
  - Fast recovery output

Overview

The N803x is a CAEN Power Supply Family providing 8 Independent High Voltage channels in 2U NIM module. The channels share a Common Ground and four output ranges are available: 100 V/10 mA, 500 V/10 mA, 4 kV/3 mA (6W max), 6 kV/ 1 mA. The module is available with either positive or negative output polarity. Mixed version with 4 positive and 4 negative channels are also available

N803x units can be controlled either locally, thanks to a 2.8" touchscreen color LCD display with a complete user interface, or remotely, via USB or Ethernet, taking advantage of GECO2020 Control Software. EPICS and LabVIEW are supported. 100 V channels are delivered through BNC connectors, other versions feature SHV's. The three high current models feature high Imon resolution of 50 nA, while the 6 kV/ 1mA has a resolution of 5 nA. Each unit is provided with Imon Zoom which increases Imon resolution by a factor 10. The HV output RAMP-UP and RAMP-DOWN rates may be selected independently for each channel.

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Model Specifications

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels
N8031	100	10	0,5	50 (5 with Imon zoom)	< 3	1	8
N8032	500	10	2	50 (5 with Imon zoom)	< 5	5	8
N8033	4000	3	10	10 (1 with Imon zoom)	< 15	6	8
N8034	6000	1	20	5 (0.5 with Imon zoom)	< 15	6	8

Control Software available: GECO2020 with user friendly GUI and CAEN HV Wrapper library for custom SW development. EPICS and LabVIEW also supported

CAEN HV Wrapper CAEN LabVIEW GECO 2020 EPICS FREE

Ordering Option

Model	Code	Description
N8031	WN8031XAAAAA	N8031N - 8 Channel NIM Programmable High Voltage Power Supply (-100V 10mA) – BNC conn. - Common Ground
	WN8031XPAAAA	N8031P - 8 Channel NIM Programmable High Voltage Power Supply (+100V 10mA) – BNC conn. - Common Ground
	WN8031XMAAAA	N8031M - 8 Channel NIM Programmable High Voltage Power Supply (4ch -100V 10mA, 4ch +100V 10mA) – BNC conn. - Common Ground
N8032	WN8032XAAAAA	N8032N - 8 Channel NIM Programmable High Voltage Power Supply (-500V 10mA) – SHV conn. - Common Ground
	WN8032XPAAAA	N8032P - 8 Channel NIM Programmable High Voltage Power Supply (+500V 10mA) – SHV conn. - Common Ground
	WN8032XMAAAA	N8032M - 8 Channel NIM Programmable High Voltage Power Supply (4ch -500V 10mA, 4ch +500V 10mA) – SHV conn. - Common Ground
N8033	WN8033XAAAAA	N8033N - 8 Channel NIM Programmable High Voltage Power Supply (-4KV 3mA, 6W max) – SHV conn. - Common Ground
	WN8033XPAAAA	N8033P - 8 Channel NIM Programmable High Voltage Power Supply (+4KV 3mA, 6W max) – SHV conn. - Common Ground
	WN8033XMAAAA	N8033M - 8 Channel NIM Programmable High Voltage Power Supply (4ch -4KV 3mA, 4ch +4KV 3mA, 6W max) – SHV conn. - Common Ground
N8034	WN8034XAAAAA	N8034N - 8 Channel NIM Programmable High Voltage Power Supply (-6KV 1mA) – SHV conn. - Common Ground
	WN8034XPAAAA	N8034P - 8 Channel NIM Programmable High Voltage Power Supply (+6KV 1mA) – SHV conn. - Common Ground
	WN8034XMAAAA	N8034M - 8 Channel NIM Programmable High Voltage Power Supply (4ch -6KV 1mA, 4ch +6KV 1mA) – SHV conn. - Common Ground

N1570

2 Channel 15 kV/1 mA Reversible Power Supply with USB, Ethernet & Touchscreen

Up to 15 kV available with full local and remote control

Overview

The N1570 provides 2 independent High Voltage channels in a double width NIM mechanics. Each channel can provide a ± 15 kV max voltage, 1 mA max current and 10 W max power. The output polarity is independently selectable for each channel. Channels have common floating return (common return insulated from the crate ground); HV outputs are delivered through LEMO HV connectors. The HV output ramp-up and ramp-down rates may be selected independently for each channel in the range 1 ÷ 500 V/s in 1 V/s steps.

The module features 20 nA Iset/Imon resolution. Zoom (x 10) for Imon increases resolution to 2 nA. Module control can take place either locally thanks to a 2.8" Touchscreen Graphic color LCD display with a completely redesigned user interface or remotely, via USB or Ethernet, taking advantage of the GECO2020 Control Software.

Safety features include:

- **Overvoltage and Undervoltage** warning when the output voltage differs from the programmed value by more than 2% of set value (minimum 10 V).
- Programmable VMAX protection limit
- **Overcurrent** detection: if a channel tries to draw a current larger than its programmed limit, it enters TRIP status, keeping the maximum allowed value for a programmable time (TRIP), before being switched off. If TRIP is set to "constant current mode", the channel behaves like a current generator.
- Common Interlock logic for channels enable/disable and individual inputs signal for channel Kill function.

Features

- 2 independent channels in 2U NIM module
- 0 ÷ 15 kV output voltage
- 1 mA maximum output current (10 W max)
- Channel polarity independently selectable
- LEMO HV coaxial output connectors
- Common floating return
- Under/over-voltage alert, overcurrent and max. voltage protection
- Daisy-chain capability
- 2.8" color touch screen display
- Local and Remote control (USB 2.0/Ethernet)
- Interlock logic for board enable and Individual channel kill
- LabVIEW Driver available
- Software Tools for remote control
- Desktop and Rack versions available (coming soon)

Control Software available: GECO2020 with user friendly GUI and CAEN HV Wrapper library for custom SW development. EPICS and LabVIEW also supported

CAEN HV Wrapper · CAEN LabVIEW · GECO 2020 · EPICS · FREE

Available options:

- A1480 DC Input Power Equalizer.

Model Specifications

Model	Max Output V (kV)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (mA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels
N1570	±15	1	400	20 (2 with Imon zoom)	< 5 - 20	10	2

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Ordering Options

Code	Description
WN1570XAAAAA	N1570 - 2 Ch NIM Programmable HV Power Supply (± 15kV, 1mA, 20nA res.)
WA1480XAAAAA	A1480 – DC Power Input Equalizer for N14XX Family and N1570

N5424

Quad NIM Power Distributor

Overview

The N5424 is a 4-channel NIM power distribution and control module.

The individual voltage outputs (±6 V, ±12 V and ±24 V) are protected by electronic fuses which automatically recover after short circuit. All six voltages are surveyed for each of the four outputs. The status is displayed by LEDs. The module also helps to check the correct voltage levels of a NIM-bin. If a NIM-bin without ±24 V is used, the corresponding LEDs get off, and the voltage survey of those voltages is skipped.

Low-noise preamplifiers require DC power that is free of interference generated by other modules inserted in the bin. The mod. N5424 ensures this low-noise capability by filtering the power lines separately at each connector.

Do not forget to power your preamplifiers! Finalize your CAEN NIM based acquisition setup with our solution for your preamplifiers

Features

- Single-width NIM module
- Four DB9 connectors with ±6 V, ±12 V, ±24 V each
- Survey of all 6 voltages on each output
- Protection of all voltages by self-recovering electronical fuses
- Individually filtered outputs to ensure low noise operation
- Standard voltage output compatible to CAEN electronics and to many other manufacturers

Ordering Option

Code	Description
WN5424XAAAAA	N5424 - Quad NIM Power Distributor for A1422 Preamplifier

CAEN Electronic Instrumentation

Power Supplies

STANDALONE POWER SUPPLIES

DT55xxE

4 Channel up to 6 kV Family with USB & Ethernet

Overview

The DT55xxE is a CAEN Power Supply Family providing 4 independent High Voltage channels in a compact Desktop form factor. The units are available with either positive, negative or mixed polarity. High Voltage outputs are delivered through SHV connectors. DT55xxE units can be controlled, via USB or Ethernet, taking advantage of the new GECO2020 Control Software. EPICS and LabVIEW are also supported.

Different versions are available spanning from 500 V to 6 kV and from 20 µA to 3 mA (4 W maximum), meeting the needs of a wide range of applications. A Zoom option is available for Imon. This feature enhances the current monitoring, increasing the resolution of a x10 factor (up to 10 pA). The HV output Ramp-Up and Ramp-Down rates can be independently for each channel in the range 1 ÷ 500 V/s in 1 V/s steps (1 ÷ 100 V/s for DT5519E).

Safety features include:

- **Overvoltage and Undervoltage** warning when the output voltage differs from the programmed value (0.5% of the set value, minimum 3 V)
- Programmable hardware **VMAX**, **IMAX** protection limit
- **Overcurrent** detection: when a channel attempts to exceed the programmed current limit, it signaled to be in “overcurrent” and enter in a TRIP status. The output voltage is varied to keep the current below the programmed limit for a programmable TRIP time, then the channel is switched off. If TRIP is set to “constant current mode”, the channel behaves like a current generator.
- Common Interlock logic for channels enable/disable and individual input signal for channel Kill function.

Control Software available: GECO2020 with user friendly GUI and CAEN HV Wrapper library for custom SW development. EPICS and LabVIEW also supportedper library for custom SW development.

CAEN HV Wrapper CAEN LabVIEW GECO 2020 EPICS FREE

The whole New Desktop Power Supply Family from CAEN. Quality and Usability redesigned for your laboratory

Features

- 4 independent HV channels in a compact desktop module
- up to 6 kV / 3 mA output ranges
- Available with positive, negative or mixed polarity
- SHV coaxial output connectors
- Very Low Ripple (Typ: from 3 mVpp to 15 mVpp)
- Under/overvoltage alert, overcurrent and max. voltage protection
- Status output Channel ON/Status LEDs
- Remote control via USB 2.0 and Ethernet
- Interlock logic for unit enable and individual channel kill

Available options:

- Imon Zoom, increasing resolution up to 10 pA.

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Model Compare

Model	Max Output V (kV)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels
DT5519E	500	3	10	10 (1 with Imon Zoom)	< 3	1.5	4
DT5533E	4000	3	100	10 (1 with Imon Zoom)	< 12	4	4
DT5534E	6000	1	100	5 (0.5 with Imon Zoom)	< 15	4	4
DT5521E	6000	0.3	100	1 (0.1 with Imon Zoom)	< 3	1.8	4
DT5521HE	6000	0.02	100	0.1 (0.01 with Imon Zoom)	< 3	0.12	4

Ordering Options

Model	Code	Description
DT5519E	WDT5519EXNAA	DT5519EN - 4 Channel 500 V/3 mA Desktop HV Power Supply (USB/Ethernet) - Negative
	WDT5519EXPAA	DT5519EP - 4 Channel 500 V/3 mA Desktop HV Power Supply (USB/Ethernet) - Positive
	WDT5519EXMAA	DT5519EM - 4 Channel 500 V/3 mA Desktop HV Power Supply (USB/Ethernet) - Mixed
DT5533E	WDT5533EXNAA	DT5533EN - 4 Channel 4 kV/3 mA (4 W) Desktop HV Power Supply (USB/Ethernet) - Negative
	WDT5533EXPAA	DT5533EP - 4 Channel 4 kV/3 mA (4 W) Desktop HV Power Supply (USB/Ethernet) - Positive
	WDT5533EXMAA	DT5533EM - 4 Channel 4 kV/3 mA (4 W) Desktop HV Power Supply (USB/Ethernet) - Mixed
DT5534E	WDT5534EXNAA	DT5534EN - 4 Channel 6 kV/1 mA (4 W) Desktop HV Power Supply (USB/Ethernet) - Negative
	WDT5534EXPAA	DT5534EP - 4 Channel 6 kV/1 mA (4 W) Desktop HV Power Supply (USB/Ethernet) - Positive
	WDT5534EXMAA	DT5534EM - 4 Channel 6 kV/1 mA (4 W) Desktop HV Power Supply (USB/Ethernet) - Mixed
DT5521E	WDT5521EXNAA	DT5521EN - 4 Channel 6 kV/300 µA Desktop HV Power Supply (USB/Ethernet) - Negative
	WDT5521EXPAA	DT5521EP - 4 Channel 6 kV/300 µA Desktop HV Power Supply (USB/Ethernet) - Positive
	WDT5521EXMAA	DT5521EM - 4 Channel 6 kV/300 µA Desktop HV Power Supply (USB/Ethernet) - Mixed
DT5521H	WDT5521HENAA	DT5521HE - 4 Channel 6 kV/20 µA Desktop HV Power Supply (USB/Ethernet) - Negative
	WDT5521HEPAA	DT5521HE - 4 Channel 6 kV/20 µA Desktop HV Power Supply (USB/Ethernet) - Positive
	WDT5521HEMAA	DT5521HE - 4 Channel 6 kV/20 µA Desktop HV Power Supply (USB/Ethernet) - Mixed
Option	WPERS0550001	DT55XX - Customization - Imon Zoom

Remember! Our NDT power supplies can work as a standalone unit like the classic desktop ones!

For more information, please have a look to the NIM power supplies section on this catalogue or on our website.

UP TO 8 kV

Reversible Polarity

DT14xxET

4 Channel up to 8 kV Reversible polarity Family with USB, Ethernet & Touchscreen

Overview

The DT14xxET is a CAEN Power Supply Family providing 4 independent High Voltage channels in a Desktop form factor. Each channel features an independently selectable polarity and common floating return (common return insulated from the chassis ground). High Voltage outputs are delivered through SHV connectors. DT14xxET units can be controlled either locally, thanks to a 2.8" touchscreen color LCD display with a complete user interface, or remotely, via USB or Ethernet, taking advantage of the new GECO2020 Control Software. EPICS and LabVIEW are supported. Different versions are available spanning from 500 V to 8 kV and from 20 µA to 3 mA, meeting the needs of a wide range of applications. Each unit is provided with Imon Zoom. This feature enhances the current monitoring, increasing the resolution of a x10 or x20 factor according to the specific model.

The HV output Ramp-Up and Ramp-Down rates can be set independently for each channel in the range 1 ÷ 500 V/s in 1 V/s steps (1 ÷ 50 V/s for DT1419ET).

Safety features include:

- **Overvoltage and Undervoltage** warning when the output voltage differs from the programmed value (2% of the set value, minimum 10 V).
- Programmable hardware VMAX protection limit
- **Overcurrent** detection: when a channel attempts to exceed the programmed current limit, it signaled to be in "overcurrent" and enter in a TRIP status. The output voltage is varied to keep the current below the programmed limit for a programmable TRIP time, then the channel is switched off. If TRIP is set to "constant current mode", the channel behaves like a current generator.
- Common Interlock logic for channels enable/disable and individual input signal for channel Kill function.

Control Software available: GECO2020 with user friendly GUI and CAEN HV Wrapper library for custom SW development. EPICS and LabVIEW also supported

CAEN HV Wrapper | CAEN LabVIEW | GECO 2020 | EPICS | FREE

Simply the best Power Supply for your laboratory

Features

- 4 independent HV channels in a fully Desktop form factor
- Channel polarity independently selectable
- SHV coaxial output connectors
- Common floating return
- Very Low Ripple
- Under/overvoltage alert, overcurrent and max. voltage protection
- 2.8'' color touch screen display
- Local and Remote control (USB 2.0/Ethernet)
- Interlock logic for unit enable and individual channel kill

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Model Compare

Model	Max Output V (V)	Max Output I (µA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels
DT1419ET	±500	200	10	5 (0.5 with Izoom)	< 3	0.1	4
DT1471ET	±5500	300	10	5 (0.5 with Izoom)	< 5	1.65	4
DT1471HET	±5500	20	100	1 (0.05 with Izoom)	< 5	0.1	4
DT1470ET	±8000	3000	200	50 (5 with Izoom)	< 5 - 15	9 W (<3 kV output) 8 W (>3 kV output)	4

Ordering Options

Code	Description
WDT1419ETXAA	DT1419ET - 4 Channel 500V/200µA Desktop HV Power Supply Unit with Ethernet & Touchscreen
WDT1471ETXAA	DT1471ET - 4 Channel 5.5kV/300µA Desktop HV Power Supply Unit with Ethernet & Touchscreen
WDT1471HETXA	DT1471HET - 4 Channel 5.5kV/20 µA Desktop HV Power Supply High Accuracy Unit with Ethernet & Touchscreen
WDT1470ETXAA	DT1470ET - 4 Channel 8kV/3mA (9W max) Desktop HV Power Supply Unit with Ethernet & Touchscreen

DT803x NEW

8 Channel up to 6 kV Family with USB, Ethernet & Touchscreen

More channels, more power, more reliability in portable form factor

Features

- 8 independently controllable HV channels
- Very low ripple
- Four versions from 100 V up to 6 kV, and from 1 mA to 10 mA
- BNC (for 100 V version) or SHV coaxial connectors
- Local control with a 2.8" touch screen display
- Remote control via Ethernet or USB 2.0
- Common ground
- Available with positive, negative or mixed polarity
- Interlock logic for board enable and individual channel kill
- LabVIEW Driver available
- Software Tools for remote control
- The 100 V version has:
  - Temperature probe input for SiPM gain stabilization
  - Fast recovery output

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Model Compare

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels
DT8031	100	10	0.5	50 (5 with Izoom)	< 3	1	8
DT8032	500	10	2	50 (5 with Izoom)	< 5	5	8
DT8033	4000	3	10	10 (1 with Izoom)	< 15	6	8
DT8034	6000	1	20	5 (0.5 with Izoom)	< 15	6	8

Control Software available: GECO2020 with user friendly GUI and CAEN HV Wrapper library for custom SW development. EPICS and LabVIEW also supported

CAEN HV Wrapper · CAEN LabVIEW · GECO 2020 · EPICS · FREE

Overview

The DT803x is a CAEN Power Supply Family providing 8 Independent High Voltage channels in a Desktop form factor. The channels share a Common Ground and four output ranges are available: 100 V/10 mA, 500 V/10 mA, 4 kV/3 mA (6W max), 6 kV/ 1 mA. The module is available with either positive or negative output polarity. Mixed versions with 4 positive and 4 negative channels are also available

DT803x units can be controlled either locally, thanks to a 2.8" touchscreen color LCD display with a complete user interface, or remotely, via USB or Ethernet, taking advantage of GECO2020 Control Software. EPICS and LabVIEW are supported.
100 V channels are delivered through BNC connectors, other versions feature SHV's. The three high current models feature high Imon resolution of 50 nA, while the 6 kV/ 1mA has a resolution of 5 nA. Each unit is provided with Imon Zoom which increases Imon resolution by a factor 10. The HV output RAMP-UP and RAMP-DOWN rates may be selected independently for each channel

Ordering Options

Model	Code	Description
DT8031	WDT8031XAAAA	DT8031N - 8 Channel Desktop Programmable High Voltage Power Supply (-100V 10mA) - BNC conn. - Common Ground
	WDT8031XPAAA	DT8031P - 8 Channel Desktop Programmable High Voltage Power Supply (+100V 10mA) - BNC conn. - Common Ground
	WDT8031XMAAA	DT8031M - 8 Channel Desktop Programmable High Voltage Power Supply (4ch -100V 10mA, 4ch +100V 10mA) - BNC conn. - Common Ground
DT8032	WDT8032XAAAA	DT8032N - 8 Channel Desktop Programmable High Voltage Power Supply (-500V 10mA) - SHV conn. - Common Ground
	WDT8032XPAAA	DT8032P - 8 Channel Desktop Programmable High Voltage Power Supply (+500V 10mA) - SHV conn. - Common Ground
	WDT8032XMAAA	DT8032M - 8 Channel Desktop Programmable High Voltage Power Supply (4ch -500V 10mA, 4ch +500V 10mA) - SHV conn. - Common Ground
DT8033	WDT8033XAAAA	DT8033N - 8 Channel Desktop Programmable High Voltage Power Supply (-4KV 3mA, 6W max) - SHV conn. - Common Ground
	WDT8033XPAAA	DT8033P - 8 Channel Desktop Programmable High Voltage Power Supply (+4KV 3mA, 6W max) - SHV conn. - Common Ground
	WDT8033XMAAA	DT8033M - 8 Channel Desktop Programmable High Voltage Power Supply (4ch -4KV 3mA, 4ch +4KV 3mA, 6W max) - SHV conn. - Common Ground
DT8034	WDT8034XAAAA	DT8034N - 8 Channel Desktop Programmable High Voltage Power Supply (-6KV 1mA) - SHV conn. - Common Ground
	WDT8034XPAAA	DT8034P - 8 Channel Desktop Programmable High Voltage Power Supply (+6KV 1mA) - SHV conn. - Common Ground
	WDT8034XMAAA	DT8034M - 8 Channel Desktop Programmable High Voltage Power Supply (4ch -6KV 1mA, 4ch +6KV 1mA) - SHV conn. - Common Ground

UP TO 8 kV

Reversible Polarity

NEW

HiVolta (DT1415ET)

8 Channel 1 kV/1 mA Floating Stackable Power Supply with USB, Ethernet & Touchscreen

Just stack and play!

Overview

HiVolta is a new CAEN Power Supply which provides 8 independent High Voltage channels in a Desktop form factor.

Each channel features an individual floating return that allows to stack them alike batteries. High Voltage outputs are delivered though SHV connectors. Thanks to 8 independent HV channels 1 kV / 1 mA, 600 mW max) with individual floating, the user can stack freely the eight 1 kv / 1 mA channels to create the desired stack of voltages up to 5 kV.

HiVolta can be controlled either locally, thanks to a 2.8" touchscreen color LCD display with a complete user interface, or remotely, via USB or Ethernet, taking advantage of the new GECO2020 Control Software. EPICS and LabVIEW are supported.

Each unit is provided with a dual range current monitoring (100 µA / 1 mA). This feature enhances the current monitor resolution of a x10 factor in the low range, allowing for accurate detector diagnostics.

The HV output Ramp-Up and Ramp-Down rates can be set independently for each channel in the range 1 to 100 V/s in 1 V/s steps.

Safety features include:

- Overvoltage and Undervoltage warning when the output voltage differs from the programmed value
- Overcurrent detection: when a channel attempts to exceed the programmed current limit, it is signaled to be in "overcurrent" and the channel enter in a TRIP status. The output voltage is varied to keep the current below the programmed limit for a programmable TRIP time. Overcurrent lasting more than set value, causes the output voltage to drop to zero at Ramp-down rate. If TRIP is set to "constant current mode", the channel behaves like a current generator
- Common Interlock logic for channels enable/disable and individual input signal for channel Kill function
- ALARM and HVON output signals for an easy integration is safety systems

The flexibility of 8 stackable channels in a portable solution suitable for all kind of detectors!

Features

- 8 independent HV channels
- Channels are reversible, fully floating up to 5 kV each and stackable in one or more groups
- SHV coaxial output connectors (3 for each channel) for easy channel-to-channel interconnection using standard SHV-SHV cables
- Synchronous or ordered ON/OFF/KILL operation of selected channels
- Dual Range Current monitoring with up to 100 pA resolution
- Very Low Ripple: typical < 5 mVpp
- Ramp-Up/Down rates independently programmable in the range 1÷100 V/s in 1 V/s steps
- Under/overvoltage alert, overcurrent and max. voltage protection
- Interlock logic for unit enable and individual channel kill
- Local control with 2.8'' color touch screen display
- Remote control with USB2.0 / Ethernet connections

Control Software available: GECO2020 with user friendly GUI and CAEN HV Wrapper library for custom SW development. EPICS and LabVIEW also supported

CAEN HV Wrapper | CAEN LabVIEW | GECO 2020 | EPICS | FREE

Ordering Option

Code	Description
WDT1415ETXAA	DT1415ET - 8Ch Floating Reversible 1kV/1mA (600 mW) Desktop HV Power Supply Module for MPGD

DT547x

Single Channel up to 5 kV USB Powered Family

Single Channel USB

CAEN High Voltage power supplies now available in a compact, easy and handy device

Features

- Single Desktop HV channel powered and controlled by USB
- Channel Enable/Disable via front panel switch
- Available with positive or negative polarity
- SHV coaxial output connector
- From 500 V to 5 kV, 1 W maximum power
- Imon Zoom (x10)
- Remote control through USB 2.0
- LabVIEW Instrument Driver
- Dedicated LabVIEW Software

Safety features include:

- Channel can be enabled or disabled through the front panel manual switch or via Interlock logic.
- **Overvoltage and Undervoltage** warning when the output voltage differs from the programmed value.
- **Overcurrent** detection: when the channel attempts to exceed the programmed current limit, it signaled to be in "overcurrent" and enter in a TRIP status. The output voltage is varied to keep the current below the programmed limit for a programmable TRIP time, then the channel is switched off. If TRIP is set to "constant current mode", the channel behaves like a current generator.
- Hardware VMAX: maximum output voltage can be set via front panel potentiometer. VMAX value can be read out via software.

Overview

The DT547x is a CAEN Power Supply Family providing a Single High Voltage channel in a small size Desktop form factor.

The unit is powered and controlled by any Laptop/PC USB 2.0 port and this make it a really portable and practical solution for testing and educational needs.

A dedicated LabVIEW based Control Software allows for an easy set and monitor of the High Voltage parameters.

The High Voltage output is delivered through SHV connector.

Three versions are available spanning from 500 V to 5 kV and from 200 µA to 1 mA, meeting the needs of a wide range of applications.

Each unit is provided with Imon Zoom. This feature enhances the Current monitoring, increasing the resolution of a x10 factor according to the specific model.

The HV output Ramp-Up and Ramp-Down rates can be set independently in the range 1 ÷ 500 V/s in 1 V/s steps (1 ÷ 100 V/s for DT5472.

DT547x models features:

CAEN LabVIEW FREE

- LabVIEW Instrument Driver
- DT547x Control software: LabVIEW Control software with Logging Capability. DT547x Control software allows to set and monitor, through a Graphical User Interface, all the unit's functional parameters. When DT547x Control Software runs, it creates a data-log file that records the changes of the monitoring parameters.

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Model Compare

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (V)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Ch (W)
DT5470	5000	0.2	1	4 (0.4 with Imon Zoom)	< 10	1
DT5471	3000	0.5	0.5	10 (1 with Imon Zoom)	< 10	1
DT5472	500	1	0.1	20 (2 with Imon Zoom)	< 10	0.5

Ordering Options

Model	Code	Description
DT5470	WDT5470XNAAA	DT5470N - 1 Channel -5 kV/200 µA USB HV Power Supply Unit
	WDT5470XPAAA	DT5470P - 1 Channel +5 kV/200 µA USB HV Power Supply Unit
DT5471	WDT5471XNAAA	DT5471N - 1 Channel -3kV/500µA (1W max) USB HV Power Supply Unit
	WDT5471XPAAA	DT5471P - 1 Channel +3kV/500µA (1W max) USB HV Power Supply Unit
DT5472	WDT5472XNAAA	DT5472N - 1 Channel -500 V/1 mA USB HV Power Supply Unit
	WDT5472XPAAA	DT5472P - 1 Channel +500 V/1 mA USB HV Power Supply Unit

NEW

DT5485P

Single Channel 85 V/10 mA USB Power Supply Module for SiPM

Software

ZEUS is a Windows compatible software that allows to control multiple DT5485P modules using USB connection. The software is based on a user friendly GUI that allows the parameters configuration and the data logging on file. It integrates realtime plot capabilities (voltage, current and temperature) with the possibility to superimpose measurements from several modules.

ZEUS software is the simplest way to program temperature LUT compensation.

CAEN ZEUS FREE

A compact and reliable solution for your SiPM array

Features

- Powered and controlled by USB
- 20-85 V Output Voltage on LEMO connector
- 10 mA Output Current
- 1 mV Output Voltage step
- Less than 300 µV rms noise
- Extremely compact 84x76x22 mm^3
- Automatic temperature feedback on the output voltage
- Temperature probe included
- Internal memory for permanent storage of calibration and configuration
- Real-time Output Voltage and Output Current monitoring
- 60 nA resolution on measured Output Current
- 1.5 mV resolution on measured Output Voltage
- 0.05 °C resolution on measured Temperature
- Power consumption: 100 mW (without load)
- ZEUS control software available

Overview

The DT5485P SiPM Power Module is a compact desktop solution to provide stable and noiseless power supply for single and array / matrix SiPM detectors.

High resolution Output Voltage and Output Current measurements enable the DT5485P to be used for I-V detector characterization. The module integrates a temperature HV loop that regulates the SiPM output voltage as a programmable function of the SiPM temperature coefficient (temperature probe included).

Ordering Option

Code	Description
WDT5485XPAAA	DT5485P - Digital Controlled Power Supply for SiPM +85V 10mA

Developed in collaboration with Nuclear Instruments

DT75xx

HV Carrier board

NEW

Evaluate and test PCB HV Power Supply on your desk

Features

- Desktop Module for PCB High Voltage Power Supply A750x family
- SHV HV Output Connector
- Small form factor 154x164x50 mm^3 (WxLxH)
- Powered by 100-230Vac
- Six models of A750x are available:
  - A7501 (2100 V / 100 µA)
  - A7502 (2100 V / 100 µA)
  - A7504 (4000 V / 100 µA)
  - A7505 (1600 V / 500 µA)
  - A7508 (800 V / 50 µA)
  - A7511 (1100 V / 1 mA)
- High operating temperature range:
  - A7501: -40 °C ÷ +70 °C
  - A7502: -40 °C ÷ +70 °C
  - A7504: -10 °C ÷ +50 °C
  - A7505: -55 °C ÷ +80 °C
  - A7508: -40 °C ÷ +70 °C
  - A7511: -10 °C ÷ +50 °C
- Positive or negative polarity

Overview

The DT75xx is a Desktop module, housing an Evaluation Board for A750x channels. It allows to use the A750x PCB mount channels as desktop power supplies, for test and evaluation purposes.
The A750x is a line of compact, high efficiency, low noise single channel High Voltage DC/DC converters in a PCB mount form factor. Each device can supply a High Voltage output according to an external reference voltage level (Vset) provided by the user.

Thanks to their excellent stability and special design, A750x Power Supplies are engineered to work in harsh environment and under severe temperature variations.

For more info about A750x family refer to pag. 76

A750x Model Compare

Model	Maximum Output V (V)	Maximum Output I (µA)	Ripple Typ. (mVpp)	Vset Input (V)	Imon Output (V)	Vmon Output (V)	Power req (mW)	Voltage Supply (Vin)
A7501	2100	100	< 5	0 ÷ +2.5	0 ÷ +2.5	0 ÷ +5	< 400	+12V (±5%)
A7502	2100	100	< 5	0 ÷ +2.5	0 ÷ +2.5	0 ÷ +2.5	< 500	+5V (±5%)
A7504	4000	100	< 10	0 ÷ +2.6	0 ÷ +2.5	0 ÷ +2.5	< 600	+12V (±5%)
A7505	1600	500	< 5	0 ÷ +2.6	0 ÷ +2.5	0 ÷ +2.5	< 1600	+12V (±5%)
A7508	800	50	< 3	0 ÷ +2	0 ÷ +2	0 ÷ +2	< 100	+5V (±5%)
A7511	1100	1000	T.B.D.	0 ÷ +2	0 ÷ +2	0 ÷ +2	< 1600	+12V (±5%)

Ordering Options

Code	Description
WDT75XXEVAAA	DT75xx - Evaluation Board for A75xx channels

DT5423

Quad Desktop Linear Power Distributor

Overview

The DT5423 is a desktop linear power supply for A1422 and A1424 preamplifiers and DT57xx Digitizers family. It provides four standard 9-pin "D-type" female connectors to supply up to four A1422 or A1424 preamplifiers. Each output is filtered and fuse protected. The +12 V power supply for the digitizer is provided through a 6 pin Shielded Miniature Circular DIN Connector.

A compact and easy to use solution to power your CAEN preamplifier!

Features

- Four DB9 connectors to supply A1422 family and A1424 preamplifiers
- One plug connector to supply DT57xx family desktop digitizers
- Four DB9 connectors with ±12 V each
- Very Low Noise

Ordering Option

Code	Description
WDT5423XAAAA	DT5423 - Desktop Power Supply for A1422-A1424 Amplifiers & DT57xx Digitizers

R14xxET

4/8 Channel up to 8 kV Reversible Polarity Family with USB, Ethernet & Touchscreen

19” Rack-mount with Ethernet & Touchscreen

CAEN HV Power Supplies now fit your rack in a flexible and reliable unit

Features

- 4 or 8 independent HV channels in a 2U, 19” Rackmount unit
- Channel polarity independently selectable
- SHV coaxial output connectors
- Common floating return
- Very Low Ripple
- Under/overvoltage alert, overcurrent and max. voltage protection
- 2.8” color touch screen display
- Local and Remote control (USB 2.0/Ethernet)
- Interlock logic for unit enable and individual channel kill

Control Software available: GECO2020 with user friendly GUI and CAEN HV Wrapper library for custom SW development. EPICS and LabVIEW also supported

CAEN HV Wrapper | CAEN LabVIEW | GECO 2020 | EPICS | FREE

Overview

The R14xxET is a CAEN Power Supply Family providing 4 or 8 independent High Voltage channels in a 2U, 19” Rack-mount unit. Each channel features an independently selectable polarity and common floating return (common return insulated from the chassis ground). High Voltage outputs are delivered through SHV connectors. R14xxET units can be controlled either locally, thanks to a 2.8” touchscreen color LCD display with a complete user interface, or remotely, via USB or Ethernet, taking advantage of the new GECO2020 Control Software. EPICS and LabVIEW are supported.

Different versions are available spanning from 500 V to 8 kV and from 20 µA to 3 mA, meeting the needs of a wide range of applications.

Each unit is provided with Imon Zoom. This feature enhances the current monitoring, increasing the resolution of a x10 or x20 factor according to the specific model.

The HV output Ramp-Up and Ramp-Down rates can be set independently for each channel in the range 1 ÷ 500 V/s in 1 V/s steps (1 ÷ 50 V/s for R1419ET / R1419ETD).

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Model Compare

Model	Max Output V (V)	Max Output I (µA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels
R1419ET	±500	200	10	5 (0.5 with Izoom)	< 3	0.1	4
R1419ETD	±500	200	10	5 (0.5 with Izoom)	< 3	0.1	8
R1471ET	±5500	300	100	5 (0.5 with Izoom)	< 5	1.65	4
R1471ETD	±5500	300	100	5 (0.5 with Izoom)	< 5	1.65	8
R1471HET	±5500	20	100	1 (0.05 with Izoom)	< 5	0.1	4
R1471HETD	±5500	20	100	1 (0.05 with Izoom)	< 5	0.1	8
R1470ET	±8000	3000	200	50 (5 with Izoom)	< 5 - 15	9 W (<3 kV) 8 W (>3 kV)	4
R1470ETD	±8000	3000	200	50 (5 with Izoom)	< 5 - 15	9 W (<3 kV) 8 W (>3 kV)	8

Ordering Options

Model	Code	Description
R1419ET	WR1419ETXAAA	R1419ET - 4 Channel 500V/200µA 19” HV Power Supply Unit with Ethernet & Touchscreen
	WR1419ETDXAA	R1419ETD - 8 Channel 500V/200µA 19" HV Power Supply Unit with Ethernet & Touchscreen
R1471ET	WR1471ETXAAA	R1471ET - 4 Channel 5.5kV/300µA 19” HV Power Supply Unit with Ethernet & Touchscreen
	WR1471ETDXAA	R1471ETD - 8 Channel 5.5kV/200µA 19" HV Power Supply Unit with Ethernet & Touchscreen
R1471HET	WR1471HETXAA	R1471HET - 4 Channel 5.5kV/20 µA 19” HV Power Supply High Accuracy Unit with Ethernet & Touchscreen
	WR1471HETDXA	R1471HETD - 8 Channel 5.5kV/20 µA 19" HV Power Supply High Accuracy Unit with Ethernet & Touchscreen
R1470ET	WR1470ETXAAA	R1470ET - 4 Channel 8kV/3mA (9W max) 19” HV Power Supply Unit with Ethernet & Touchscreen
	WR1470ETDXAA	R1470ETD - 8 Channel 8kV/3mA (9W max) 19" HV Power Supply Unit with Ethernet & Touchscreen

NEW

R803x

8/16 Channel up to 6 kV Family with USB, Ethernet & Touchscreen

Overview

The R803x is a new CAEN Power Supply Family providing 8 or 16 Independent High Voltage channels in a 2U, 19" Rack-mount unit.

The channels share a Common Ground and four output ranges are available: 100 V/10 mA, 500 V/10 mA, 4 kV/3 mA (6W max), 6 kV/ 1 mA.

The module is available with either positive or negative output polarity. Mixed version with 4/8 positive and 4/8 negative channels are also available.

R803x units can be controlled either locally, thanks to a 2.8" touchscreen color LCD display with a complete user interface, or remotely, via USB or Ethernet, taking advantage of GECO2020 Control Software. EPICS and LabVIEW are supported.

100 V channels are delivered through BNC connectors, other versions feature SHV's. The three high current models feature high Imon resolution of 50 nA, while the 6 kV/ 1mA has a resolution of 5 nA. Each unit is provided with Imon Zoom which increases Imon resolution by a factor 10

The HV output RAMP-UP and RAMP-DOWN rates may be selected independently for each channel.

Safety features include:

- **Overvoltage and Undervoltage** warning when the output voltage differs from the programmed value by more than 2% of set value (minimum 10 V).
- **Programmable VMAX, IMAX** protection limit via front panel potentiometers. (VMAX. IMAX values can be read via software)
- **Overcurrent detection**: if a channel tries to draw a current larger than its programmed limit, it enters TRIP status, keeping the maximum allowed value for a programmable time (TRIP), before being switched off. If TRIP is set to "constant current mode", the channel behaves like a current generator.
- **Common Interlock logic** for channels enable/disable and individual inputs signal for channel Kill function.

The new generation of CAEN rack-mount power supplies. More channels, more power, more reliability now also in your rack.

Features

- 8 or 16 independently controllable HV channels in a 2U, 19" Rackmount unit
- Very low ripple
- Four versions from 100 V up to 6kV, and from 1 mA to 10 mA
- BNC (for 100 V version) or SHV coaxial connectors
- Local control with a 2.8" touch screen display
- Remote control via Ethernet or USB 2.0
- Common ground
- Available with positive, negative or mixed polarity
- Interlock logic for board enable and individual channel kill
- LabVIEW Driver available
- Software Tools for remote control
- The 100 V version has:
  - Temperature probe input for SiPM gain stabilization
  - Fast recovery output

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Model Compare

Model	Max Output V (V)	Max Output I (mA)	Vset Resolution (mV)	Imon Resolution (nA)	Ripple Typ. (mVpp)	Max Power per Channel (W)	# of channels
R8031	100	10	0.5	50 (5 with Izoom)	< 3	1	8
R8031D	100	10	0.5	50 (5 with Izoom)	< 3	1	16
R8032	500	10	2	50 (5 with Izoom)	< 5	5	8
R8032D	500	10	2	50 (5 with Izoom)	< 5	5	16
R8033	4000	3	10	10 (1 with Izoom)	< 15	6	8
R8033D	4000	3	10	10 (1 with Izoom)	< 15	6	16
R8034	6000	1	20	5 (0.5 with Izoom)	< 15	6	8
R8034D	6000	1	20	5 (0.5 with Izoom)	< 15	6	16

Control Software available: GECO2020 with user friendly GUI and CAEN HV Wrapper library for custom SW development. EPICS and LabVIEW also supported

CAEN HV Wrapper CAEN LabVIEW GECO 2020 EPICS FREE

Ordering Option

Model	Code	Description
R8031	WR8031DXAAAA	R8031DN - 16CH Rack-mount Programmable HV PowerSupply(-100V 10mA) - BNC conn. - Common Gnd
	WR8031DXMAAA	R8031DM - 16CH Rack-mount Programmble HV P.S.(8ch-100V 10mA,8ch +100V 10mA) - BNC conn. - C. Gnd
	WR8031DXPAAA	R8031DP - 16CH Rack-mount Programmable HV Power Supply(+100V 10mA) - BNC conn. - Common Gnd
	WR8031XAAAAA	R8031N - 8CH Rack-mount Programmable HV Power Supply (-100V 10mA) - BNC conn. - Common Gnd
	WR8031XMAAAA	R8031M - 8CH Rack-mount Programmable HV P.S.(4ch -100V 10mA,4ch +100V 10mA) - BNC conn. - Common Gnd
	WR8031XPAAAA	R8031P - 8 Channel Rack-mount Programmable High Voltage Power Supply (+100V 10mA) - BNC conn. - Common Ground
R8032	WR8032DXAAAA	R8032DN - 16CH Rack-mount Programmable HV Power Supply (-500V 10mA) - SHV conn. - Common Gnd
	WR8032DXMAAA	R8032DM - 16CH Rack-mount Programmble HV P.S.(8ch-500V 10mA,8ch +500V 10mA) - BNC conn. - C. Gnd
	WR8032DXPAAA	R8032DP - 16CH Rack-mount Programmable HV Power Supply (+500V 10mA) - SHV conn. - Common Gnd
	WR8032XAAAAA	R8032N - 8CH Rack-mount Programmable HV Power Supply (-500V 10mA) - SHV conn. - Common Gnd
	WR8032XMAAAA	R8032M - 8CH Rack-mount Programmable HV P.S.(4ch -500V 10mA,4ch +500V 10mA) - SHV conn. - Common Gnd
	WR8032XPAAAA	R8032P - 8CH Rack-mount Programmable HV Power Supply (+500V 10mA) - SHV conn. - Common Gnd
R8033	WR8033DXAAAA	R8033DN - 16CH Rack-mount Programmable HV Power Supply (-4KV 3mA) - SHV conn. - Common Gnd
	WR8033DXMAAA	R8033DM - 16CH Rack-mount Programmble HV P.S.(8ch-4KV 3mA,8ch +4KV 3mA) - SHV conn. - C. Gnd
	WR8033DXPAAA	R8033DP - 16CH Rack-mount Programmable HV Power Supply (+4KV 3mA) - SHV conn. - Common Gnd
	WR8033XAAAAA	R8033N - 8CH Rack-mount Programmable HV Power Supply (-4KV 3mA) - SHV conn. - Common Gnd
	WR8033XMAAAA	R8033M - 8CH Rack-mount Programmable HV P.S.(4ch -4KV 3mA,4ch +4KV 3mA) - SHV conn. - Common Gnd
	WR8033XPAAAA	R8033P - 8CH Rack-mount Programmable HV Power Supply (+4KV 3mA) - SHV conn. - Common Gnd
R8034	WR8034DXAAAA	R8034DN - 16CH Rack-mount Programmable HV Power Supply (-6KV 1mA) - SHV conn. - Common Gnd
	WR8034DXMAAA	R8034DM - 16CH Rack-mount Programmble HV P.S.(8ch-6KV 1mA,8ch +6KV 1mA) - SHV conn. - C. Gnd
	WR8034DXPAAA	R8034DP - 16CH Rack-mount Programmable HV Power Supply (+6KV 1mA) - SHV conn. - Common Gnd
	WR8034XAAAAA	R8034N - 8CH Rack-mount Programmable HV Power Supply (-6KV 1mA) - SHV conn. - Common Gnd
	WR8034XMAAAA	R8034M - 8CH Rack-mount Programmable HV P.S.(4ch -6KV 1mA,4ch +6KV 1mA) - SHV conn. - Common Gnd
	WR8034XPAAAA	R8034P - 8CH Rack-mount Programmable HV Power Supply (+6KV 1mA) - SHV conn. - Common Gnd

A750x

Single Channel up to 4 kV High Performance Power Supply Modules

Model Compare

Model	Maximum Output V (V)	Maximum Output I (µA)	Ripple Typ. (mVpp)	Vset Input (V)	Imon Output (V)	Vmon Output (V)	Power req (mW)	Voltage Supply (Vin)
A7501	2100	100	< 5	0 ÷ +2.5	0 ÷ +2.5	0 ÷ +5	< 400	+12V (±5%)
A7502	2100	100	< 5	0 ÷ +2.5	0 ÷ +2.5	0 ÷ +2.5	< 500	+5V (±5%)
A7504	4000	100	< 10	0 ÷ +2.6	0 ÷ +2.5	0 ÷ +2.5	< 600	+12V (±5%)
A7505	1600	500	< 5	0 ÷ +2.6	0 ÷ +2.5	0 ÷ +2.5	< 1600	+12V (±5%)
A7508	800	50	< 3	0 ÷ +2	0 ÷ +2	0 ÷ +2	< 100	+5V (±5%)
A7511	1100	1000	T.B.D.	0 ÷ +2	0 ÷ +2	0 ÷ +2	< 1600	+12V (±5%)

Ordering Options

Model	Code	Description	
A7501	WA7501NXAAAA	A7501N -2.1kV 100µA HV Power Supply Module (12V in)	
	WA7501PXAAAA	A7501P +2.1kV 100µA HV Power Supply Module (12V in)	
A7502	WA7502NXAAAA	A7502N -2.1kV 100µA HV Power Supply Module (5V in)	
	WA7502PXAAAA	A7502P +2.1kV 100µA HV Power Supply Module (5V in)	
A7504	WA7504NXAAAA	A7504N -4kV 100µA HV Power Supply Module (12V in)	
	WA7504PXAAAA	A7504P +4kV 100µA HV Power Supply Module (12V in)	
A7505	WA7505NXAAAA	A7505N -1.6kV 500µA HV Power Supply Module (12V in)	
	WA7505PXAAAA	A7505P +1.6kV 500µA HV Power Supply Module (12V in)	
A7508	WA7508NXAAAA	A7508N -800V 50µA HV Power Supply Module (5V in)	
	WA7508PXAAAA	A7508P +800V 50µA HV Power Supply Module (5V in)	
A7511	WA7511XNAAAA	A7511N -1100V 1000µA HV Power Supply Module (12V in)	NEW
	WA7511XPAAAA	A7511P +1100V 1000µA HV Power Supply Module (12V in)	NEW

Safety Features include:

- **Overcurrent detection:** if the channel attempts to draw a current larger than Iset, the output voltage is varied to keep the current below Iset limit. The channel behaves like a current generator.
- **Status Overcurrent Bit:** 0÷5 V (low = OVC)
- **Status On/Off Bit:** 0÷5 V (low = OFF)
- **Protected against short circuits, sparks and humidity**

A desktop evaluation board (Mod. DT75xx) is available for easy testing of the A750x modules.

Delivering the excellence of CAEN High Voltage Technology in the palm of your hand!

Features

- Single channel PCB mount High Voltage Power Supply
- High efficiency and low power consumption
- Six models available:
  - A7501 (2100 V / 100 µA)
  - A7502 (2100 V / 100 µA)
  - A7504 (4000 V / 100 µA)
  - A7505 (1600 V / 500 µA)
  - A7508 (800 V / 50 µA)
  - A7511 (1100 V / 1 mA)
- Positive or negative polarity
- Analog voltage and current Set and Monitor levels
- Very low ripple and noise
- Excellent stability
- Compact package 54x29x17 mm^3 (WxLxH)
- High operating temperature range:
  - A7501: -40 °C ÷ +70 °C
  - A7502: -40 °C ÷ +70 °C
  - A7504: -10 °C ÷ +50 °C
  - A7505: -55 °C ÷ +80 °C
  - A7508: -40 °C ÷ +70 °C
  - A7511: -10 °C ÷ +50 °C

Overview

The A750x is a new line of compact, high efficiency, low noise single channel High Voltage DC/DC converters in a PCB mount form factor. Each device can supply a High Voltage output according to an external reference voltage level (Vset) provided by the user.

Maximum current setting (Iset), voltage monitor (Vmon) and current monitor (Imon) are also available. These features make the A750x family suitable for integration in user designed systems or embedded applications.

Six models are currently available, A7501, A7502, A7504, A7505, A7508, A7511, supplying up to 2100 V/100 µA, 4000 V/100 µA, 1600 V/500 µA, 800 V/50 µA and 1100 V/1 mA respectively. Each A750x can be provided with either positive or negative polarity. Other models can be designed on request.

Thanks to their excellent stability and special design, A750x Power Supplies are engineered to work in harsh environment and under severe temperature variations.

CAD Altium library components and 3D step models are available on request.

A7560

2 Channels ±6 kV/10 µA High Performance Bipolar Power Supply Module

The reliability of CAEN digital control technology now available also in a compact HV power supply

Features

- Double channel, opposite polarity PCB mount High Voltage Power Supply
- High efficiency +6 kV/10 µA, -6 kV/10 µA output ranges
- Vin: from +5 V - 20% to +12 V + 10%
- General On/Off: 0-5 V
- Power requirement: < 2.5 W @ full power
- Low ripple and noise
- Setting DAC: 16-bit
- Monitor ADC: 20-bit
- Serial Line: USART (TX, RX)
- Embedded digital control for enhanced performances
- Compact package 49x49x23 mm^3 (WxLxH)
- HV out by wire
- Works in magnetic field up to 1 kGauss (optional)
- Available also with analog control

Overview

The A7560 is a compact, high efficiency, low noise double channel High Voltage DC/DC converter in a PCB mount form factor. It can supply a double output High Voltage with opposite polarity according to the user setting.

The module features a digital control managed by an embedded low-power micro-controller. By running a dedicated resident firmware, it can handle calibration, ramp up/down rates, power-on sequence, inner SPI serial bus and self-compensation of nonlinearities for enhanced accuracy.

The micro-controller updates every 5 ms set voltage and current limit of A7560 HV channel, via a 16-bit DAC while sampling voltage and current values via a 24-bit sigma delta ADC.

The unit can be externally controlled and configured by means of an USART serial link. It provides all the relevant information as Voltage and Current monitors, Status and Overcurrent for the safety of detectors as RPCs and others. These features make A7560 suitable for integration in user designed systems or embedded applications.

The A7560 is able to work in magnetic field up to 1 kGauss.

Safety Features

- Overcurrent detection: if the channel attempts to draw a current larger than Iset, the output voltage is automatically adjusted to keep the current below Iset limit. Under this condition, the channel behaves as a current generator.
- Protected against short circuits, sparks and humidity

Ordering Options

Code	Description
WA7560AMXAAA	A7560AM PCB Power Supply +/-6kV 10µA HV PWS Module with Analog Control working in Magnetics Field
WA7560DMXAAA	A7560DM PCB Power Supply +/-6kV 10µA HV PWS Module with Digital Control working in Magnetics Field
WA7560DTMXAA	A7560DTM PCB Power Supply +/-6kV 10µA HV PWS Module with TTL Digital Control working in Magnetics Field

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Model Specification

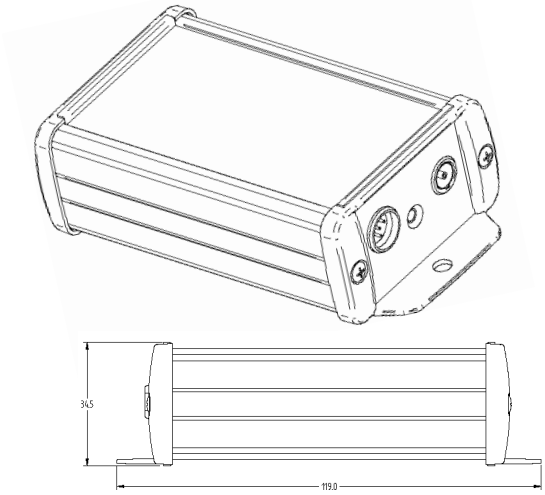
Model	Max Output V (kV)	Max Output I (µA)	Ripple Typ. (mVpp)	Power requirement (W)
A7560	±6	10	< 10	< 2.5

NEW

A750xB

Single Channel High Reliability, High Voltage Power Supply Boxes

Packaging



A tailored solution for Large Area experiments in harsh environment

Features

- Based on A7501 and A7505 PCB mount HV DC-DC converter
- Temperature working range: -10°C ÷ 70°C
- Designed for long working life in harsh environment
  - Architectural materials chosen to minimize issues due to thermal expansion
  - Layout optimized for the worst foreseen environmental condition
  - Redundancy of internal connections
  - Connection and cabling with stress relief on solder points
  - Stress absorption with silicon resin
  - Several solutions from Aerospace electronics design
- Assembly optimized for easy maintenance operation

Overview

A750xB is a solution designed for operating in challenging environmental conditions and high thermal excursions.

It relies on the high efficiency PCB High Voltage power supply A7501 / A7505 embedded in a custom carrier.

In order to assure its functionality for long working periods under severe environmental conditions, several dedicated technical and electrical precautions have been implemented such as stress relief techniques on cabling and soldering points, electrical redundancies, PCB layout design, and use of specific materials to minimize the thermal expansion on PCB and housing mechanics.

These features make A750xB boxes ideal for Large Area experiments where the possibility of a prompt maintenance intervention is reduced.

Safety Features

- Overcurrent detection: if the channel attempts to draw a current larger than Iset, the output voltage is automatically adjusted to keep the current below Iset limit. Under this condition, the channel behaves as a current generator.
- Protected against short circuits, sparks and humidity

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Model Specification

Model	Maximum Output V	Maximum Output I	Ripple (Typ.)	Output Connector	Imon /Temperature remote inputs
A7501B	2100 V	100 µA	5 mVpp	LEMO HV	yes
A7505B	1600 V	500 µA	5 mVpp	SHV	no

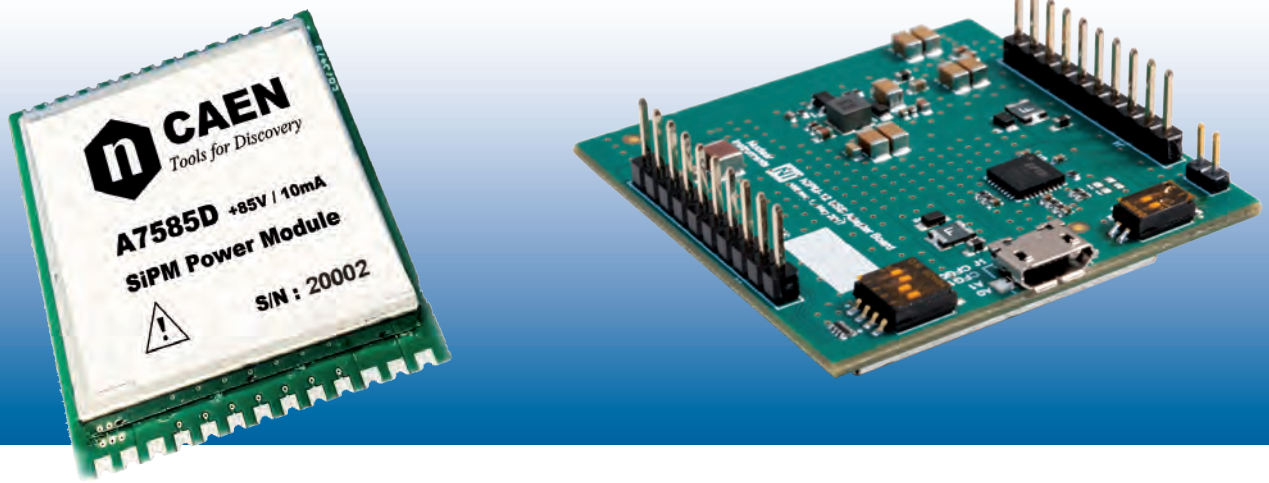
Ordering Options

Model	Code	Description
A7501B	WA7501PBXAAA	A7501BP +2.1kV 100µA HV Power Supply Module BOXED
	WA7501NBXAAA	A7501BN -2.1kV 100µA HV Power Supply Module BOXED
A7505B	WA7505PBXAAA	A7505BP +1.6kV 500µA HV Power Supply Module BOXED
	WA7505NBXAAA	A7505BN -1.6kV 500µA HV Power Supply Module BOXED

A7585D

NEW

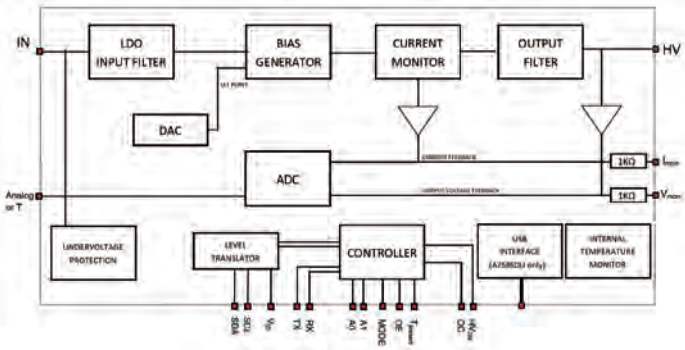
Single Channel 85 V/10 mA Power Supply Module for SiPM with UART, I2C & USB



Software

ZEUS is a Windows compatible software that allows to control multiple A7585D modules using RS232 or USB connection. The software is based on a user friendly GUI that allows the parameters configuration and the data logging on file. It integrates realtime plot capabilities (voltage, current and temperature) with the possibility to superimpose measurements from several modules.

ZEUS software is the simplest way to program temperature LUT compensation.



CAEN ZEUS FREE

Developed in collaboration with Nuclear Instruments

A compact and reliable solution for your SiPM array

Features

- 20-85 V Output Voltage
- 10 mA Output Current
- 1 mV Output Voltage step
- Less than 300 µV rms noise
- User Selectable Digital / Analog output voltage control
- Automatic temperature feedback on the output voltage
- Support for remote analog temperature sensor on the detector unit
- Internal memory for permanent storage of calibration and configuration
- UART/I2C digital control + Analog input (0-4.5 V)
- Real-time Output Voltage and Output Current monitoring
- 60 nA resolution on measured Output Current
- 1.5 mV resolution on measured Output Voltage
- 0.05 °C resolution on measured Temperature
- Extremely compact: 35x39x5 mm^3
- Input Voltage: 5-26 V
- Power consumption: 100 mW (without load)
- ZEUS control software available

Overview

The A7585 SiPM Power Module is a compact and integrated solution to provide stable and noiseless power supply for single and array / matrix SiPM detectors.

High resolution Output Voltage and Output Current measurements enable the A7585 to be used for I-V detector characterization. Digital (UART, I2C and USB with adapter) and analog control interface are runtime selectable by a single pin or a digital command.

The module integrates a temperature HV loop that regulates the SiPM output voltage as a programmable function of the SiPM temperature coefficient.

Ordering Option

Code	Description
WA7585DXAAAA	A7585D - Digital Controlled Power Supply for SiPM 85V/10mA
WA7585DUXAAA	A7585DU - Digital Controlled Power Supply for SiPM 85V/10mA with Micro-USB


40
YEARS OF INNOVATION
1979-2019

CAEN Electronic Instrumentation

Power Supplies

EASY
(Embedded Assembly SYstem)

EASY (Embedded Assembly SYstem)

We celebrate 20 years of CAEN EASY, the power supply system designed for LHC experiments

CAEN restarted an intensive R&D program on power supplies for the demanding environment of High Luminosity LHC (HL-LHC)

1998

DESIGNED FOR LHC

At the dawn of LHC CAEN started an ambitious R&D program to design and build a new generation of power supplies capable to cope with the demanding conditions of the new hadron collider.

Many new challenges had to be faced by the engineering team who had to move in an uncharted territory without the support of detailed simulation and purposely built test facility.

2008

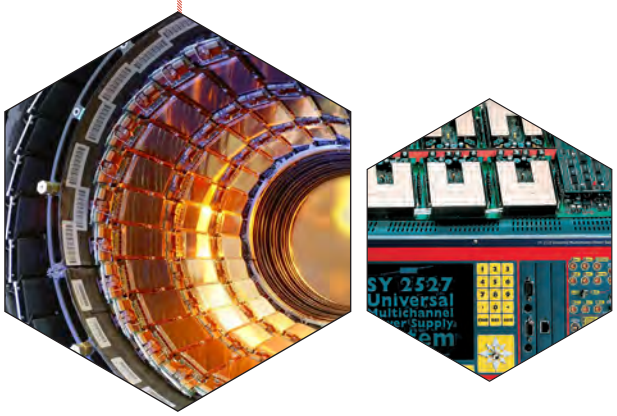
LHC COMMISSIONING

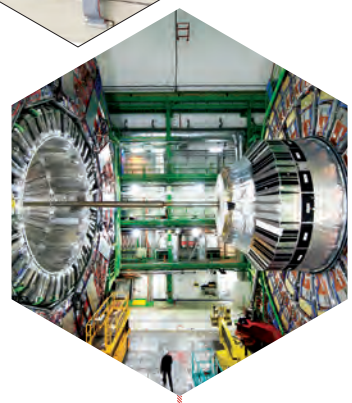
By the startup of the LHC more than 7000 EASY modules were built in many different variants to satisfy all experimental needs. The approach was to create a scalable system with basic building blocks that could suit various requirements, the standard catalog products constitute the backbone in “safe area” were the controls and essential services are situated, then in the hostile area there are the EASY products with its own crates, bulk power supplies and electronic boards.

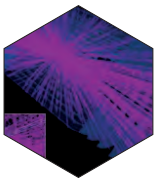
2000

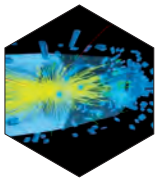
FIRST LHC PROTOTYPES

At the beginning of the new century, in collaboration with universities and research centers, CAEN produced the first prototypes for the LHC derived from its SASY2000 family: the EASY was born. The design was driven by the research of components that were rad-tolerant up to 15 kRad and resilient to magnetic fields up to 2 kGauss.









2015

LHC RUN 2 AND FIRST UPGRADES

During the first long shutdown of the LHC some experiments started to upgrade their systems, the EASY solution proved one more time to be effective and easily adaptable to new requirements, one of this is for sure the CMS Phase 1 Pixel upgrade where the old A4603 were modified to power DC-DC converter at 12 V rather than directly the load at ~2 V.

Other detectors followed the same approach moving to DC-DC POL converters and CAEN answered with H versions of its EASY 3000 modules.

2025 >

HL-LHC

High Luminosity LHC is the next step of the LHC machine, with almost double luminosity it will collect in ten years ten times the data of the first 10 years of “standard” LHC operations. The increased collisions rate will pose a serious threat to electronics, which will need improved radiation resilience to be able to operate safely in such environment.

Fortunately, the knowhow gathered during the design and operation of the LHC will give the necessary background to build the new EASY6000 family.

2012

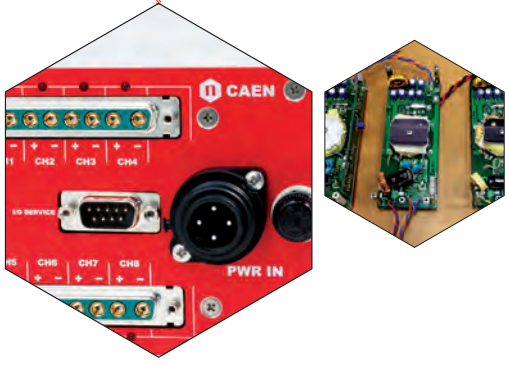
HIGGS BOSON DISCOVERY

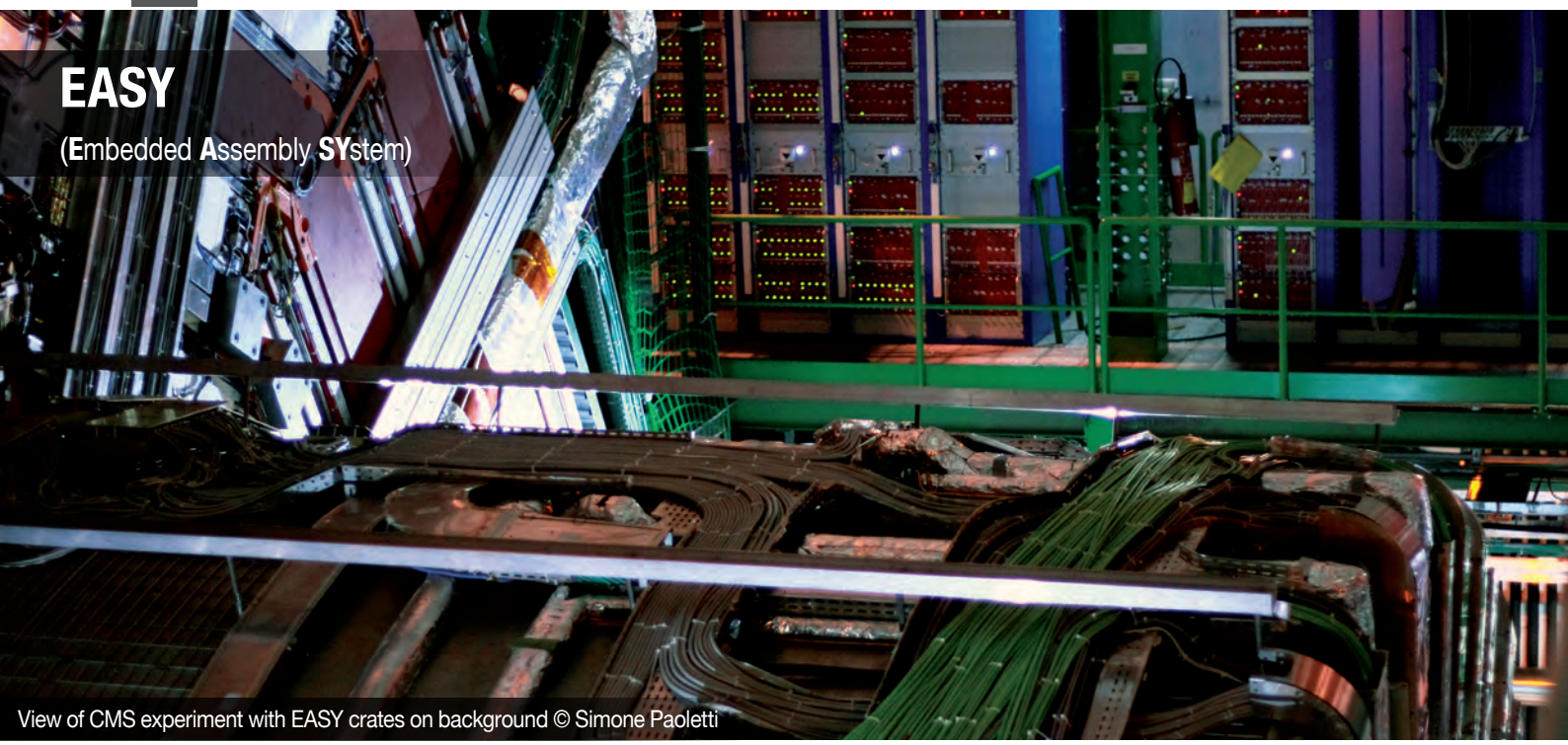
After 10 years from the original design and 4 years of continuous operations EASY modules performed magnificently allowing the experiments to record data with unprecedented efficiency and announce to the World the discovery of the Higgs boson July 4th 2012.

2018

EASY BRIC 1

In January 2018 a new module with enhanced resilience, tested with an integrated dose of 20 kRad and in a 5 kGauss magnetic field, was presented at CERN. The B and Rad tolerant Intermediate Converter is a simple DC-DC converter but it embodies CAEN will to pursue R&D in hostile area, providing in a small form factor a 1600 W liquid cooled converter with a power density never achieved before.





EASY

(**E**mbedded **A**ssembly **SY**stem)

View of CMS experiment with EASY crates on background © Simone Paoletti

EASY: the CAEN solution for powering in hostile areas

EASY (Embedded Assembly SYstem) is the CAEN high/low voltage power supply solution every time residual magnetic fields and/or radiation become an issue.

Why EASY?

CAEN developed different solutions to satisfy the requirements from LHC experiments where electronic equipment deals with high radiation dose and strong residual magnetic fields. To provide safe and reliable operations in these "hostile areas", CAEN created a new product line featuring rad-tolerant and magnetic resistant components with excellent performance also in normal conditions, this patented technology is the backbone of all EASY modules.

Widely used in LHC experiments the EASY solutions have been declined in more than 7 500 electronic units containing about 200 000 sub-boards.

System Concept

The EASY power supply can be directly located in the hostile area while the control of the system can be done remotely using a Branch Controller (model A1676A) inserted in a SY4527 or SY5527 mainframe located in the control room. Through the mainframe users can immediately and automatically control all board with the Detector Control System or any other custom control software, this is achieved using OPC server that runs on the mainframes.

Flexibility and Compatibility

Each branch controller can handle up to 6 EASY crates. The A1676A is a one-unit wide board so the SY4527 and SYS5527 can house up to 16 and 6 branch controller boards respectively and therefore enabling the monitoring of 96 or 36 EASY modules. The A1676A can work side by side with standard HV/LV boards so a single SY4527 can be used for multiple applications.

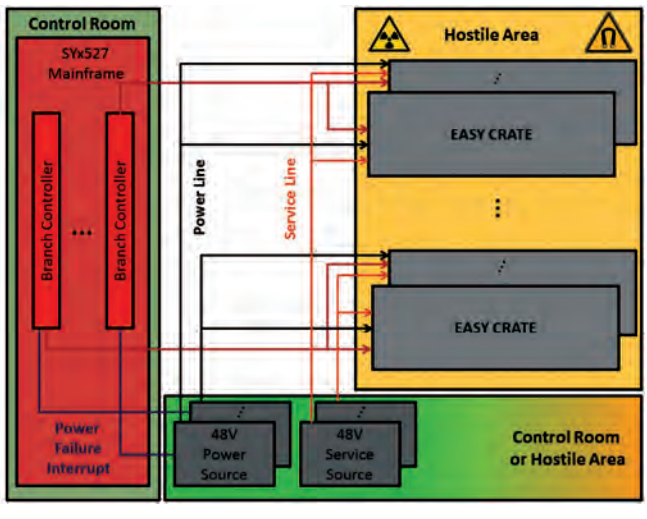
The EASY family provides a wide variety of output voltages to satisfy the requirement of most detector and front-end electronics including POL DC/DC converters (LV up to 100 A and HV up to 12 kV), giving an unique interface and a cost effective setup for all experimental requirements.

Architecture

The EASY3000 (for boards up to 40 cm long, A3XXX family) can house up to 10 boards (depending on board width). As illustrated in the figure below, the branch controller is the EASY interface between the mainframe unit (SY4527 or SY5527) and the remote boards in the EASY create. The branch controller role is to configure the EASY channels as the belong to the supply unit slot in which the branch controller is placed. In this way all channels of the EASY boards will be considered as channels of the branch controller board, increasing the number of channels the system can handle.

Tolerances

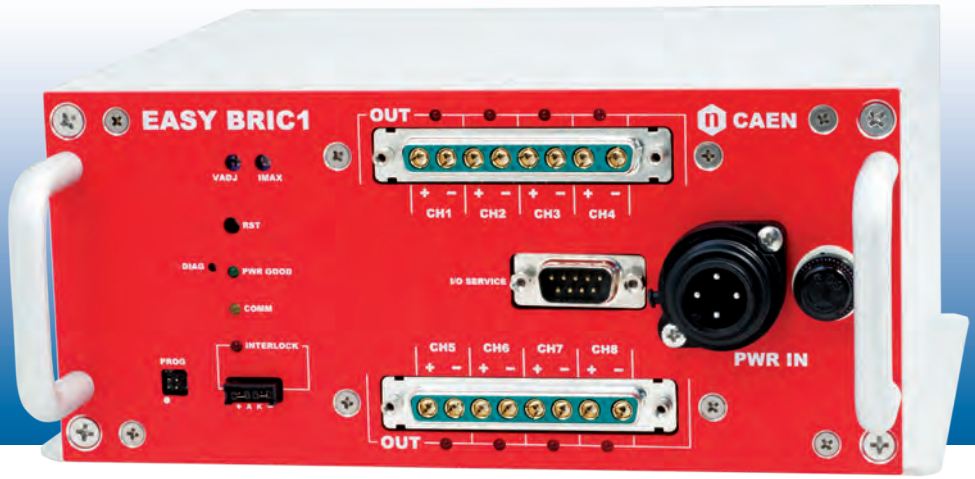
- Magnetic field: up to 2 kGauss
- Radiation:
  - up to $1 \cdot 10^{11}$ p/cm^2 Total Dose
  - up to $2 \cdot 10^{12}$ n/cm^2 Total Dose
  - up to 15 kRad Total Integrated Dose



EASY BRIC1

NEW

B and Rad tolerant Intermediate Converter



Technical Specification

N. of channels	8
Input Voltage	270 ÷ 300 VDC
Output Voltage	10 ÷ 12 VDC, programmable with trimmer
Output Voltage accuracy	1% FS
Maximum Output Current	16 A DC
Abs. Max. Output Current	17 A DC
Vmon Resolution	10 mV
Imon resolution	10 mA
Output Voltage hardware limit (Vmax)	12.1 VDC
Trip time	~1 s for overcurrent, <0.1 s for overvoltage
Ripple (Differential and Common mode)	< 20 mVpp (0 ÷ 30 MHz)
Redundancy	Parallel connection of channels possible
Controls	Remote ON/OFF for each channel
Conversion efficiency	≥ 80% above 50% full load
Maximum output power	190 W per channel (1.5 kW total)

Tolerances

- **Ionizing Radiation (Total Dose)** 200 Gy
- **Displacement Damage** $5.8 \cdot 10^{12}$ 1-MeV Eq. n/cm^2
- **Single Event Fluence** $1.0 \cdot 10^{12}$ p/cm^2 (E > 20 MeV)
- **Magnetic Field** 0.5 T

Overview

The B and Rad tolerant Intermediate Converter (BRIC) is a brand new product of the EASY family built to endure the harsh condition of High Luminosity LHC at CERN.

Its design started in 2016 taking advantage of all the experience CAEN built from the LHC construction and years of operation. A carefully planned test campaign validated all the components up to 200 Gy TID as well as the complete module. This total dose is what is expected to be reached in most of the experimental areas of HL-LHC at the end of 2035.

The magnetic field tests were also performed, and the BRIC 1 has shown efficiencies above 80% up to 0.5 T, not matter the orientation of the field lines with respect of the DC-DC channel and therefore the magnetic coils present on the board.

The BRIC 1 is an insulated DC-DC converter capable of converting low voltage power lines from 300 V to 12 V with a maximum power of 1.5 kW over 8 channels. It has been designed to drive POL DC-DC converters (i.e. the CERN FEAST ASIC) used on present and upcoming detectors and front-end electronics in Big Physics experiments Its compact design and radiation resilience allow an easy installation even close to the dense area near the collider interaction points. The BRIC 1 features a compact liquid cooled plate for heat dissipation and no movable part to work seamlessly inside or outside strong magnetic fields.

The remote control, based on the robust RS-485 communication bus, is performed with a simple command-based protocol which allows the monitoring of output voltages and currents as well the remote on/off of each channel. An INTERLOCK port is also available to shut down the device in case of any safety issue in the experimental area occurs.

The BRIC 1 is the first building block of the new EASY6000 family, the CAEN product line for future HEP hostile environment electronics.

EASY Family

Power Supplies

CFG = Common Floating Ground FF = Full Floating
IF = Individual Floating

Model	# Channels	Voltage Range	Max Output Current per ch.	Max Output Power per ch.	Width (slots)	Max Modules per Crate	Max Channels Per Crate	Working in Hostile Area	Ground
A3006	6 (4 pos. / 2 neg.)	± (4 ÷ 16) V	6 A	90 W	4	5	30	Yes	CFG
A3009	12	1.5 ÷ 8 V	9 A	45 W	4	5	60	Yes	FF
A3009B	12	2 ÷ 8 V	9 A	45 W	4	5	60	Yes	FF
A3009K	12	0.5 ÷ 2 V	9 A	18 W	4	5	60	Yes	FF
A3009HBP	12	8 ÷ 14 V	3 A	42 W	4	5	60	Yes	IF
A3016	6	2 ÷ 8 V	16 A	90 W	4	5	30	Yes	FF
A3016B	6	2 ÷ 8 V	16 A	90 W	4	5	30	Yes	FF
A3016HBP	6	6 ÷ 16 V	8 A	90 W	4	5	30	Yes	IF
A3016HP	6	6 ÷ 16 V	8 A	90 W	4	5	30	Yes	IF
A3025	4	2 ÷ 8 V	25 A	150 W	4	5	20	Yes	FF
A3025B	4	2 ÷ 8 V	25 A	150 W	4	5	20	Yes	FF
A3025HBP	4	8 ÷ 14 V	10 A	140 W	4	5	20	Yes	IF
A3050	2	2 ÷ 8 V	50 A	300 W	4	5	10	Yes	FF
A3050B	2	2 ÷ 8 V	50 A	300 W	4	5	10	Yes	FF
A3050HBP	2	8 ÷ 14 V	20 A	280 W	4	5	10	Yes	IF
A3100	1	2 ÷ 8 V	100 A	600 W	4	5	5	Yes	FF
A3100B	1	2 ÷ 8 V	100 A	600 W	4	5	5	Yes	FF
A3100HBP	1	8 ÷ 14 V	40 A	560 W	4	5	5	Yes	IF
A3602	3	2 ÷ 7 V	5 A	35 W	4	10	30	Yes	FF
A3501 p/n	12	0 ÷ 100 V	1 mA	100 mW	2	10	120	Yes	IF
A3512 p/n	6	0 ÷ 12 kV	1 mA	12 W	3	7	42	Yes	IF
A3535 p/n	32	0 ÷ 3.2 kV	0.5 mA	1.75 W	4	5	160	Yes	CFG
A3540 p/n	12	0 ÷ 4 kV	1 mA	4 W	2	10	120	Yes	IF

Remote Controllers

Model	Description	Output Control Line	Working in Hostile Area
A1676A	Branch Controller	6	Yes

EASY Crates

Model	Description	Max Modules per Crate	Depth	Height	Width	Width T.E.	Working in Hostile Area
EASY3000	Crate	10	65 cm	6 U	19”	84	Yes
EASY3000B	Crate with Bolt Conn.	10	65 cm	6 U	19”	84	Yes
EASY3000S	Front Access Crate	10	65 cm	6 U	19”	84	Yes
EASY3000M	Mini Crate	4	50 cm	6 U	7.2”	36	Yes

Fun Units

Model	Description	Depth	Height	Width	Width T.E.	Working in Hostile Area
A3000FB	Fan Unit for EASY3000	65 cm	2 U	19”	84	No
A3000F	Fan Unit for EASY3000	65 cm	2 U	19”	84	No

Bulk Power Supplies

Model	Description	AC Input	DC Input	Max Output Power	Working in Hostile Area
A3484	AC/DC Converter for EASY3000	400V 3-phase	48 V	2500 W	No
A3485	AC/DC Converter for EASY3000	400V 3-phase	48 V	5000 W	No
A3486	AC/DC Converter for EASY3000	400V 3-phase	48 V	2x2000 W or 1x4000 W	Yes

Front-End Boards

Model	Description	Ch. per Module	Max Output Voltage	Max Output Current	Resolution	Width (slots)	Max Modules per Crate	Working in Hostile Area
A3802	DAC	128	4 V	10 mA	12 bit	1	10	Yes
A3801	ADC	128	0 ÷ 10 V	15-bit	2	10	Yes	
A3801A	Temperature Sensor	128	-4 ÷ +125 °C	15-bit	2	10	Yes	

CAEN Electronic Instrumentation

Power Supplies

HIGH POWER LOW VOLTAGE SYSTEM

SY8800 (1250 W US - 2500 W EU)

Universal Multichannel Low Voltage Power Supply System

High Density and High Power for your low voltage applications

Features

- 3U x 19" x 35 cm crate size
- 5 free slots for Power Modules
- Floating channels
- Local and Remote Control
- Remote control via Ethernet, USB, CANBUS and RS232
- Max output power: 2.5 kW @ 220 Vac, 1.25 kW @ 115 Vac
- Up to 8 independent channels
- Low noise
- 6 Power Modules available:
  - 2 ÷ 7 V 550/1100 W
  - ±7 ÷ 16 V 550/1100 W
  - ±20 ÷ 28 V 550/1100 W
- 10 mV Voltage Set/Monitor resolution
- 100/200 mA Current Set/Monitor resolution (2 ÷ 7 V)
- 20/40 mA Current Set/Monitor resolution (±7 ÷ 16 V/±20 ÷ 28 V)
- Individual channel ON/OFF
- Sense wires for the voltage drop recovery
- 4 Analog Input, 4 Digital Input, 4 Digital Output
- Fans embedded for vertical cooling

Overview

The SY8800 is a high density floating low voltage power supply system, designed to power low noise electronics with medium and high currents.

Six Power modules have been developed so far:

- 2 ÷ 7 V 550/1100 W (typ. 110/220 A @5 V)
- ±7 ÷ 16 V 550/1100 W (typ. 23/46 A @±12 V)
- ±20 ÷ 28 V 550/1100 W (typ. 11/22 A @± 24 V)

The system is provided with Remote Sensing Lines to compensate for the voltage drop over the connection cables. Safety features include:

- Over / under voltage protection when the output voltage differs from the programmed value
- Programmable maximum channel output voltage limit (VOVP): the channel is tripped off when its output voltage exceeds VOVP.
- Overcurrent detection: if a channel tries to draw a current larger than its programmed limit, it is switched off.
- Channels can be enabled or disabled through the Interlock logic.

The voltage output Ramp Up/Down time may be selected independently for each channel in 5 ms steps. Module control can take place either locally, assisted by a Graphic OLED display or remotely, via Ethernet, USB, CANBUS and RS232.

Control Software available: CAEN HV Wrapper library for custom SW development.

CAEN HV Wrapper FREE

In the following tables all the boards belonging to the family are listed together with an overview of the relevant parameters and of all the available Ordering Options.

Module Compare

Module	Voltage Range	Channels per module	Max Current	Max Power	Module width	Vset/ Vmon res.	Iset/Imon res.
M01	2 V÷7 V	1	110 A	550 W	1	10 mV	100 mA
M21	2 V÷7 V	1	220 A	1100 W	2	10 mV	200 mA
B01	± 7 V÷16 V	2	23 A	550 W	1	10 mV	20 mA
B21	± 7 V÷16 V	2	46 A	1100 W	2	10 mV	40 mA
B02	± 20 V÷28 V	2	11 A	550 W	1	10 mV	20 mA
B22	± 20 V÷28 V	2	22 A	1100 W	2	10 mV	40 mA

Ordering Options

Code	Description
WSY8800XXXXX	SY8800 - Universal Multichannel Low Voltage Power Supply System (1250W US - 2500W EU)
WPERS8800M01	M01 - 1 Ch. LV Floating Power Module 2V÷7V / 110A (550W)
WPERS8800M21	M21 - 1 Ch. LV Floating Power Module 2V÷7V / 220A (1100W)
WPERS8800B01	B01 - 2 Ch. LV Floating Power Module ± 7V÷16V / 23A (550W)
WPERS8800B21	B21 - 2 Ch. LV Floating Power Module ± 7V÷16V / 46A (1100W)
WPERS8800B02	B02 - 2 Ch. LV Floating Power Module ± 20V÷28V / 11A (550W)
WPERS8800B22	B22 - 2 Ch. LV Floating Power Module ± 20V÷28V / 22A (1100W)

CAEN Electronic Instrumentation

Power Supplies

POWER SUPPLY CONTROL SOFTWARE

GECO2020

GEneral COntrol Software for CAEN HV Power Supplies

FREE

Simply your Plug & Play control software for all CAEN power supplies

Overview

GECO2020 is a graphical application that allows to manage all the CAEN Power Supplies whatever their form factor (Multichannel Power Supply System, VME, NIM, Rack or Desktop).

Operation with V65xx VME Power Supplies requires the use of CAEN VME Bridges; NDT-DT-R14xxET NIM, Desktop, Rack Modules can be controlled via USB and Ethernet; N14xx NIM modules can be controlled via USB and Ethernet, if CAEN NIM8301/8304 Crates are used.

The Multichannel Power Supply Systems can be controlled via Ethernet or Wi-Fi.

All Mainframe, Board and Channel and parameters related to the SY4527 and SY5527 Power Supply Systems, and to the VME, NIM, Rack and Desktop Programmable HV Power Supplies can be easily monitored and programmed: from the speed of the rack cooling fans to the channel HV ramp rates.

Additional features include channel groups management, custom channel configuration.

Features

- CAEN General Control SW for High Voltage Modules and Systems: SYx527, N14xx, N14xxET, NDT14xx, DT14xxET, R14xxET, V65xx, DT55xxE power supplies are managed by the host PC running the CAEN GECO2020
- Dashboard capability: easy multi-system control, also with set ups mixing various power supply types (SYx527, NIM, VME, DT etc.).
- Optional advanced Scripting and Logging capabilities for SYx527 systems: you can create your system configuration files that can be recalled at any time and log files recording any functional parameter change.
- Logging capability for NIM, VME and Desktop power supplies: keep trace of any functional parameter change.
- Improved Graphical User Interface friendliness
- Management via external Host PC running Windows (32-64 bit) or Linux (32-64 bit)
- Power Supply control via Ethernet, USB, Optical Link communication paths (depending on power supply unit availability)

Many systems, one software interface: full parallel control with GECO2020

FREE

OPC Server

for CAEN Power Supplies

Your OPEN interface for Plug & Play connectivity

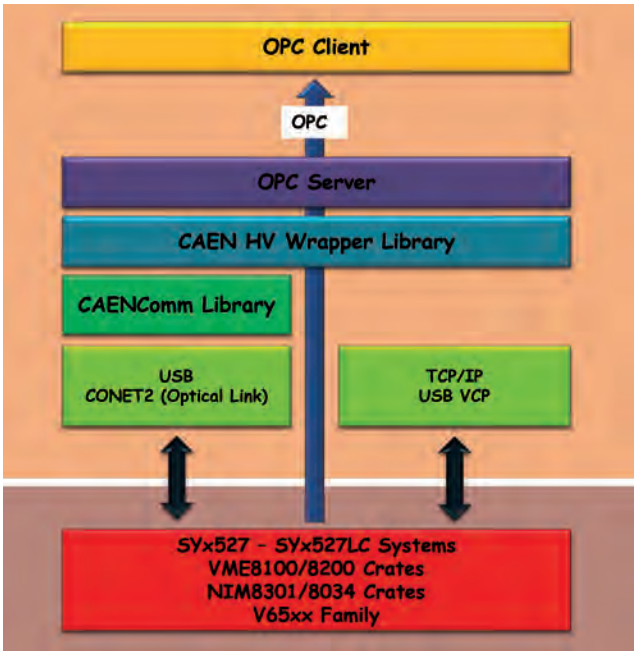
Overview

CAEN, in close collaboration with CERN, has developed an OPC server which allows powerful, flexible and yet simple control of its power supply systems by any OPC compliant client application. OPC (OLE for Process Control) is an open interface based on the OLE/COM and DCOM technology; OPC offers "Plug & Play" connectivity between disparate hardware devices. The introduction of the OPC interface has caused the number of driver developments, which manufacturers implement for their hardware products, to be reduced to only one: the OPC server. On the other hand, OPC client applications, from any vendor, can communicate with the OPC server to exchange data in a standard way. Each device property is accessed via an OPC item.

Features

- OPC (OLE for Process Control) Server: open interface based on OLE/COM and DCOM technology
- Windows (32-64 bit) Operating System supported
- Ideal for heterogeneous set ups: each device parameter is accessed via an OPC item
- Ethernet, USB, Optical Link communication paths (depending on used device)
- Supports SYx527(LC), V65xx, VME8x00, NIM8301/8304
- Allows powerful, flexible and easy control of CAEN power supplies via OPC client application
- Developed in close collaboration with CERN
- Coming soon new version full compliant with OPC-UA (Windows and Linux supported)

Full control of your remote power supply system with the OPC server



The OPC Server in the CAEN software and libraries conceptual scheme

CAEN HV Wrapper

Library for CAEN Power Supply Control

FREE

Do you need to integrate CAEN Power Supplies in your control software? Here you have all you need

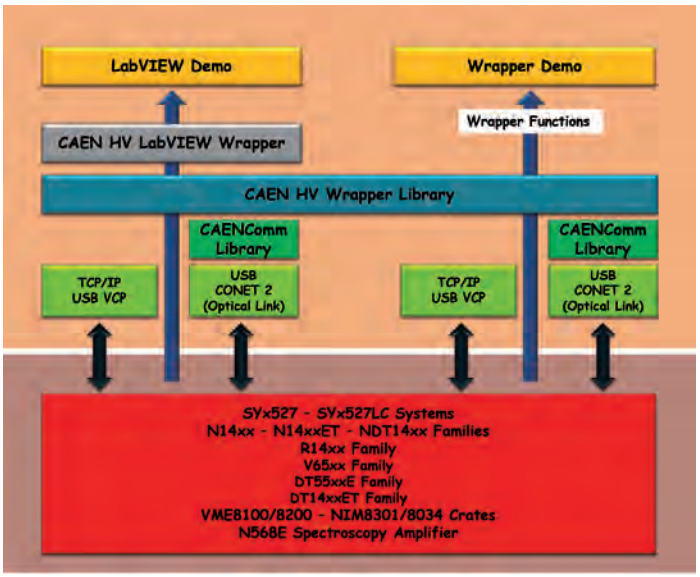
Overview

CAEN HV Wrapper is a set of ANSI C functions which allows to control CAEN devices. It contains a generic software interface independent by the Power Supply models and by the communication path used to exchange data with them.

CAEN HV Wrapper is logically located between a higher level application and the device to be accessed.

Features

- Function Library for full control of all the CAEN Power Supply products, through the development of higher level applications, such as the CAEN GECO2020
- Available for Windows (C, LabVIEW) and Linux (C) operating systems
- Unit control via Ethernet, USB, Optical Link communication paths (depending on device availability)
- Supports SYx527 systems, NIM/VME/Desktop/Rack power supplies, NIM/VME crates, N568E spectroscopy amplifier
- Available both as ANSI C function set and LabVIEW VI's suite



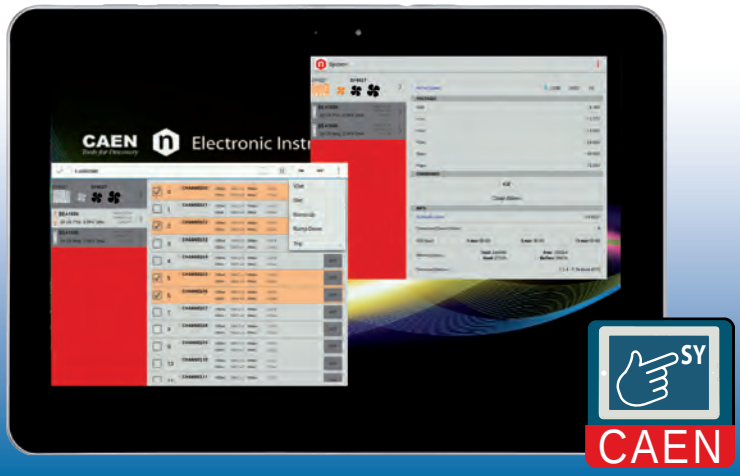
The HV Wrapper Library in the CAEN software and libraries conceptual scheme

FREE

ANDROID APP ON Google Play

CAEN SY Smart Touch

for SY4527 and SY5527 Systems



View of the Smart Touch monitor and control windows on your tablet

Power Supplies Control & Monitor at your finger tips!

Overview

The CAEN SY Smart Touch control software is the tool that allows to manage the SYx527 Multichannel Power Supply Systems through the CAEN 10.4" and 5.7" LCD Color Touchscreens (optional items for the SYx527 systems); all the system parameters and controls are available at your finger tip!

If your SYx527 is connected to the network, the CAEN SY Smart Touch App for Android™ devices provides also a remote system full control from your smartphone or tablet.

Features

- Allows standalone control for SY4527 and SY5527 systems
- All system parameters available at your finger tip
- Dedicated Android application for SY4527/SY5527 system control via Smartphone or Tablet. Available for free download from App Store

HiVoCS

Web based Control Software for SY4527 and SY5527 Systems

FREE

The web interface to control our instruments from any computer. No software required! Simply open your browser

Overview

The HiVoCS is the web tool that allows to manage the SY4527/SY5527 Connection status and system/board upgrade; the featured channel controller allows to handle all the functional parameters of the HV boards. Moreover the tool implements also the EPICS (Experimental Physics and Industrial Control System) service support.

Features

- Web based tool: open your browser, type the SYx527 IP address, log-in and manage the system!
- Includes CAEN HVPSS Channels Controller to manage HV channels parameters (requires Java Runtime Engine pre-installed)
- Allows to manage all power supplies and to install firmware upgrades
- Management via external Host PC running Windows or Linux
- Allows to access SYx527 systems via Ethernet
- Includes EPICS service support

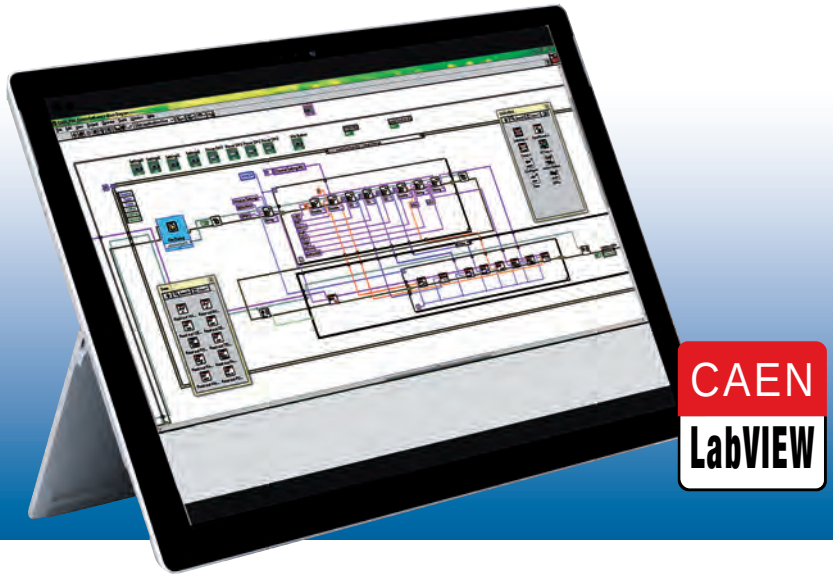
Coming Soon: HiVOCS 2.0

- New web interface
- Fluid responsible layout
- Compatible with Windows, Linux and Mac
- Full management of crate and boards
- Voltage and current plotting capability
- Remote alarm reporting
- Programmable channel configuration storage
- Logging capability

FREE

LabVIEW Instrument Driver

for Power Supply Modules



Increased LabVIEW support. Free VI download from CAEN website

A user friendly LabVIEW interface for controlling your setup

Overview

Power Supply Modules LabVIEW Instrument Driver is a set of VI's, developed for LabVIEW 2009 and later releases (LabVIEW™ is a Trademark of National Instruments Corp.), that allow to configure and monitor all parameters of remotely controlled CAEN Programmable HV Power Supply modules. The supported power supplies are: N14xx, N1570, N14xxET, NDT14xx, R14xxET, DT14xxET, DT55xxE, N803x, DT803x, R803x, HIVolta (Coming Soon) and DT547x families. LabView Demo Control applications are also provided.

Features

- LabVIEW Instrument Driver for CAEN NIM, Desktop and Rack mounting Power supplies
- Ethernet and USB communication paths supported (depending on module)
- Demo control SW included (executable and source code)
- VI's organized in groups, for developer's friendliness
- Also available in the download area of the National Instruments website

EPICS Input/Output Controller

for SYx527 Systems and Power Supply Modules

FREE

Features

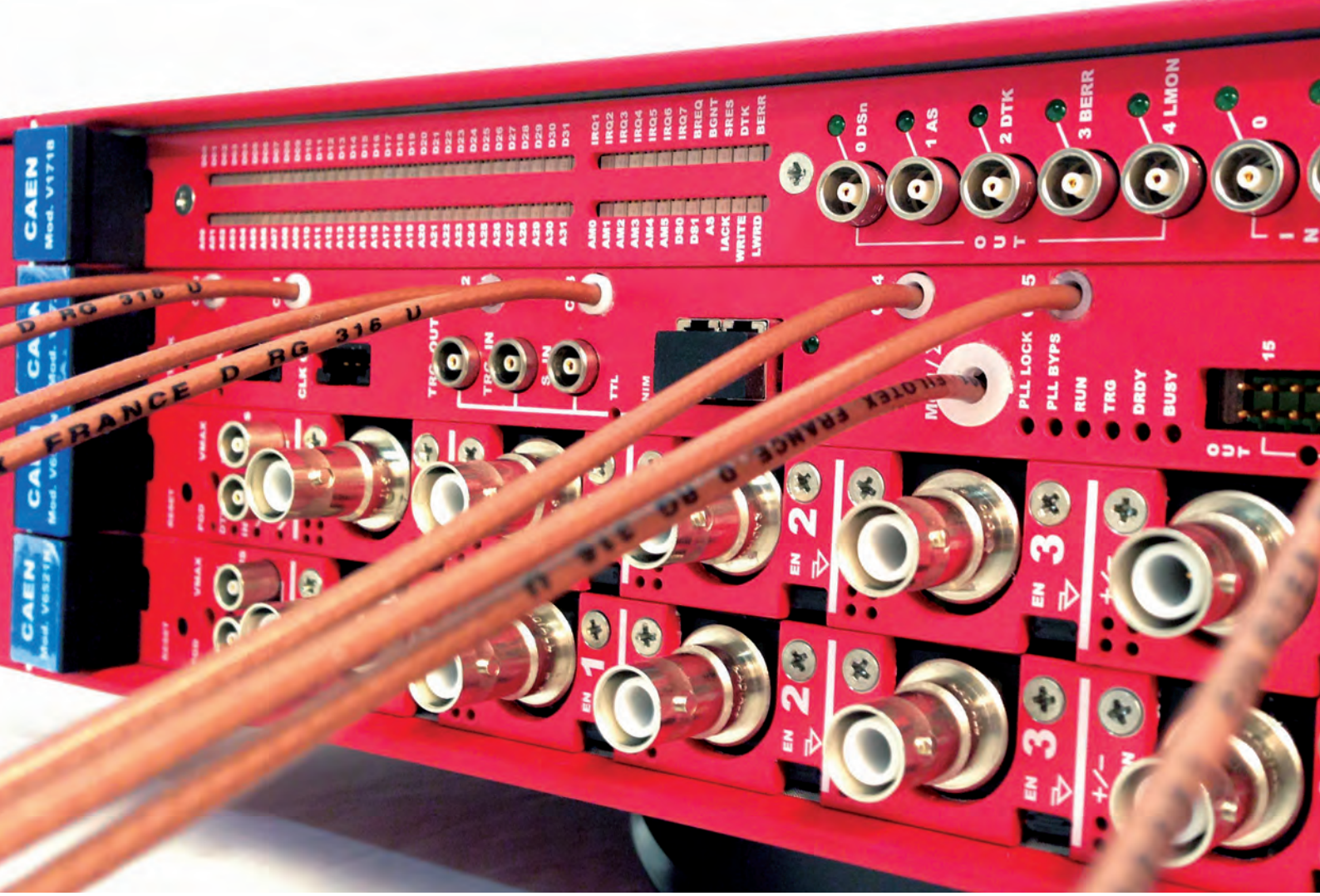
- EPICS Input/Output Controller (IOC) providing functional Process Variables (PVs)
- Two versions available:
  - EPICS IOC (SY4527/SY5527): for SY4527 and SY5527 Systems (embedded by HiVoCS)
  - EPICS IOC (PSM): for NDT14xx, R14xxET, DT14xxET, N14xxET, N14xx and DT55xxE Power Supply Families. Coming soon for N803x, DT803x, R803x & HiVolta (Linux)
- Ethernet and USB communication paths supported (depending on system)
- Requires an EPICS client software run by Host PC, to manage all HV system parameters
- For more information about EPICS visit Argonne National Laboratory EPICS site: http://www.aps.anl.gov/epics/

The EPICS drivers are here. Download them for free for easy integration and control

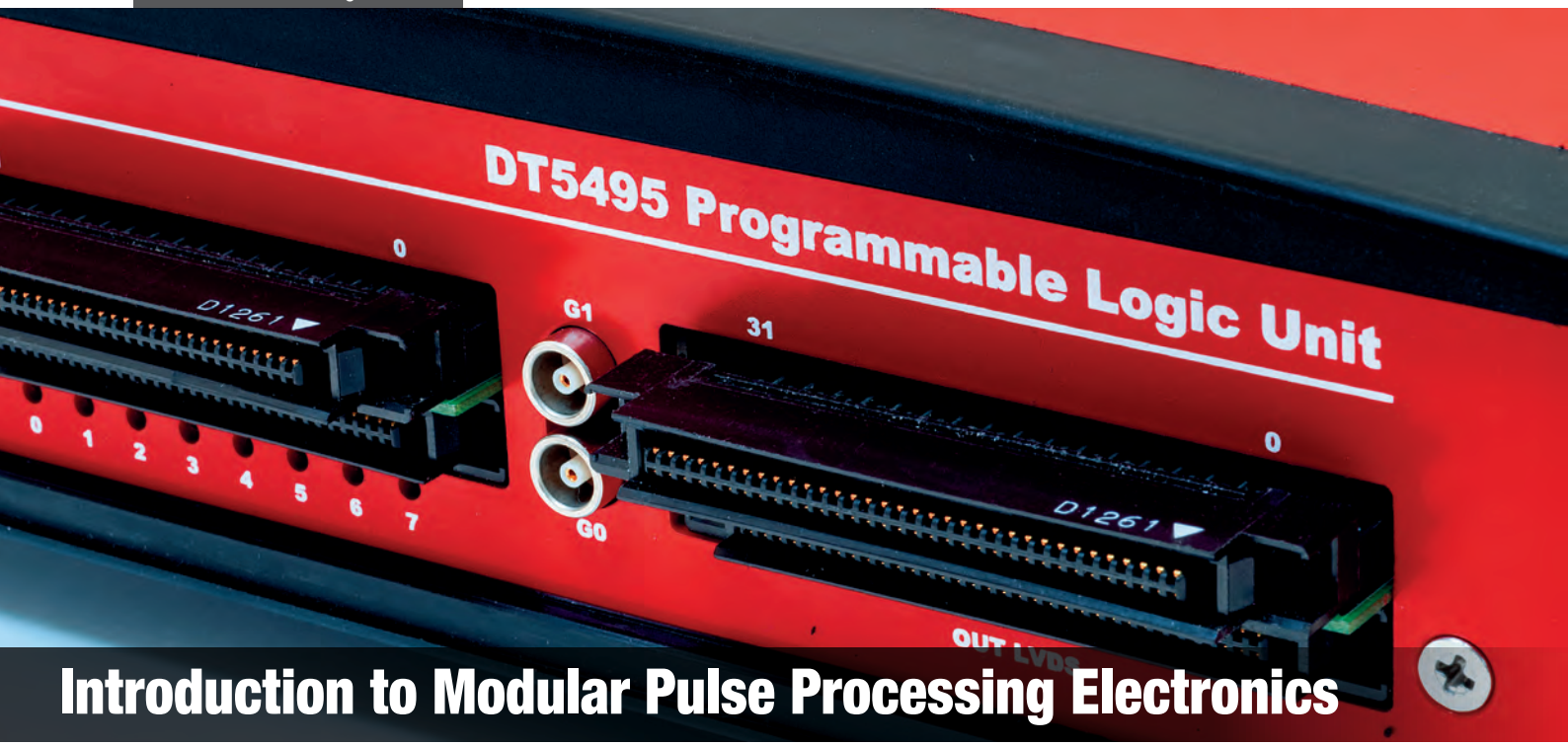
Overview

EPICS (Experimental Physics and Industrial Control System) is a set of software tools and applications which provide a software infrastructure for use in building distributed control systems, widely used to control experimental physics and industrial electronics.

The most recent CAEN Power Supplies integrates an EPICS Service that provides access to a Process Variable using the Channel Access Protocol. Process Variable is a named piece of data associated with the system, such as status, readback, setpoint, parameter.



MODULAR PULSE PROCESSING ELECTRONICS



Introduction to Modular Pulse Processing Electronics

Since the early years of its life, CAEN has provided modular electronics to laboratories and experiments of different size and in many different fields of Physics research.

The main distinctive feature of CAEN products is the ability to handle the multiplicity of signal channels provided by the detectors at the most challenging output rates.

CAEN provides a complete and ever increasing set of instrumentation, from Preamplifiers to Data Acquisition to Triggering Electronics and Logic Functions. Most of the instrumentation is available in the most popular standard form factors such as Dekstop, VME, NIM, and bus protocols like PCI/PCIe.

CAEN production includes also Powered Crates to house NIM/VME modules and Crate controllers for VME to handle and acquire data from the relevant boards.

To overcome the limits of traditional analog acquisition chains, CAEN has recently extended its products range to the introduction of a complete family of Digitizers. It consists of several models differing in sampling frequency, resolution, number of channels, form factor, memory size and other parameters.

In parallel with the hardware development, CAEN has put a great effort in developing algorithms for the Digital Pulse Processing (DPP). A DPP algorithm can be installed on the FPGA of the digitizer allowing on-line analysis and implementing new acquisition methods that go beyond the simple waveform recording.

From traditional chains to digitizers, CAEN can provide the best Modular Pulse Processing Instrumentation for your applications.

Waveform Digitizers

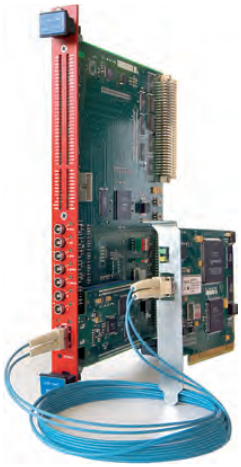
The basic principle is to acquire the complete signal from an input channel, convert it to digital by using a fast ADC, then perform calculations on the digital data directly on an FPGA available on board.

A digitizer with DPP becomes a new instrument that digitally replaces most of the traditional modules, such as Multi and Single Channel Analyzers, QDCs, TDCs, Discriminators and many others.

Available in different form factors, VME, NIM and Desktop, they are the result of all the experiences collected by CAEN in signal processing and data acquisition systems, and designed upon the application context, such as Medical Imaging, Homeland Security and Environmental Monitoring.

CAEN opens a new frontier in Digitizers! Implementing customized algorithms for signal processing is now possible by the first Open-FPGA CAEN Digitizer and the powerful, easy-to-use Sci-Compiler console for user firmware generation even without knowing of FPGA programming language!

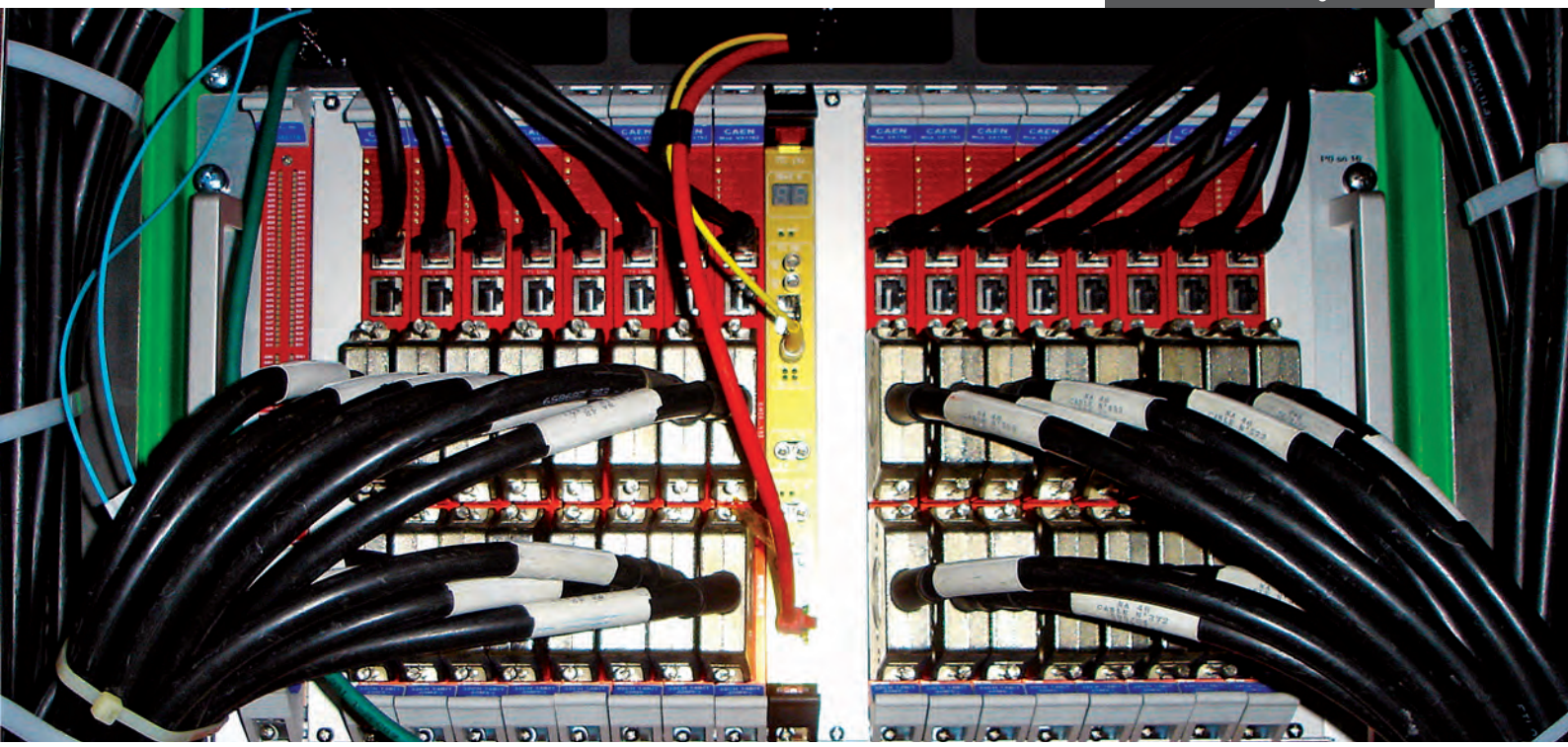
VME Electronics



The VERSAmodule Eurocard bus is one of the trademarks of CAEN instrumentation catalog. Widely used both in the industry and in the research communities, it combines reliability, robustness and flexibility.

CAEN VME products represent a benchmark both in test and measurements and in small and large data acquisition installations.

CAEN is proud of offering the largest selection of VME boards for the research community.



NIM Electronics

The NIM-Nuclear Instrumentation Module standard is a very popular form factor widely used in experimental particle and nuclear physics setups.

Defined the first time by the U.S. Atomic Energy Commission's report TID-20893 in 1968-1969, it is still nowadays widely used in universities and research centers around the world mainly because of its simplicity.

CAEN offers a wide selection of NIM instrumentation for test setups and data acquisition.

Preamplifiers

The preamplifier is usually the first stage in the electronic chain and its role is to amplify the detector signal to a level suitable for further electronics modules.

According to the timing and amplitude specifications of the input signal, CAEN offers a selection of preamplifiers suitable for both small applications and large Nuclear/Subnuclear Physics experiments, providing the right choice for a good data acquisition chain.

Desktop

CAEN Desktop products are developed according to the mobility needed today and to the requests of new generation laboratories.

The small and handy form factor together with the wide range of modules available as Desktop board, are the keys to build a complete and compact DAQ system in your lab.

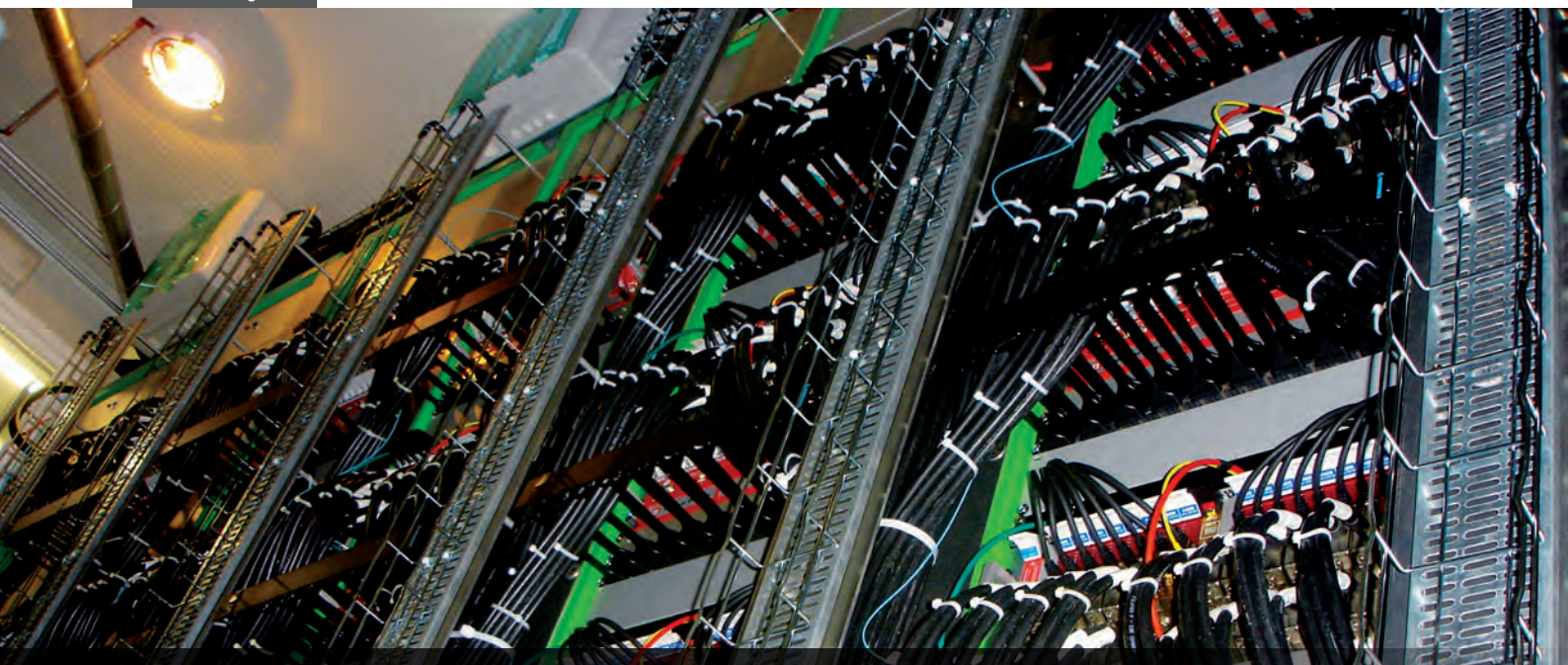
CAEN can offer a selection of Desktop boards ranging from Digitizers to High Voltage, passing through SiPM Readout Systems, Programmable Boards, Peak Sensing ADC.


40
YEARS OF INNOVATION
1979-2019

CAEN Electronic Instrumentation

Modular Pulse Processing Electronics

WAVEFORM DIGITIZERS



Introduction to Waveform Digitizers

CAEN has developed a complete family of digitizers which may differ in sampling frequency, resolution, number of channels, form factor, memory size, firmware algorithms and other specifications

The table below lists all models currently available. In parallel with the hardware development, CAEN has made a big effort to extend the digitizer functions by developing algorithms for the Digital Pulse Processing (DPP); by a simple firmware upgrade, the user can install a DPP algorithm on the FPGA of the digitizer, run it online and implement new acquisition methods that go beyond the simple waveform recording. A digitizer with DPP becomes a new instrument that digitally replaces most of the traditional modules such as Multi and Single-Channel Analyzers, QDCs, TDCs, Discriminators and many others.

Moreover, a new branch of digitizers with open FPGA is now available with DT5550SE, where the users can write their own firmware. A user-friendly software makes easy to write the firmware event to unexperienced customers.

Model (1)	Form Factor	N. of ch. (2) Single-Ended	Max. Sampling Frequency (MS/s) (2)	Resolution (bit)	Input Dynamic Range (Vpp) (2)	Bandwidth (MHz) (2)	Memory (MS/ch) (2)	OPEN FPGA
x720	VME	8	250	12	2	125	1.25 / 10	
	Desktop/NIM	4 / 2						
x724	VME	8	100	14	0.5 / 2.25 / 10	40	0.5 / 4	
	Desktop/NIM	4 / 2						
x725	VME	16 / 8	250	14	0.5 - 2	125	0.64 / 5.12	
	Desktop/NIM	8						
x730	VME	16 / 8	500	14	0.5 - 2	250	0.64 / 5.12	
	Desktop/NIM	8						
x740	VME	64	62.5	12	2 / 10	30	0.19 / 1.5	
	Desktop/NIM	32						
x751	VME	8 - 4	1000 - 2000	10	1 / 0.2	500	1.8 - 3.6 / 14.4 - 28.8	
	Desktop/NIM	4 - 2						
x761	VME	2	4000	10	1	1000	7.2 / 57.6	
	Desktop/NIM	1						
SWITCHED CAPACITOR x742	VME	32+2	5000 (3)	12	1	500	0.128 / 1	
	Desktop/NIM	16+1						
SWITCHED CAPACITOR x743	VME	16	3200 (3)	12	2.5	500	0.007	
	Desktop/NIM	8						
DT5550SE	Desktop	32	80	14	2	40	0.016	●

CS

(1) The x in the model name is V1 for VME, VX1 for VME64X, DT5 for Desktop and N6 for NIM

(2) "size 1 / size 2" means "hard coded by ordering option"
"size 1 - size 2" means "software selectable"

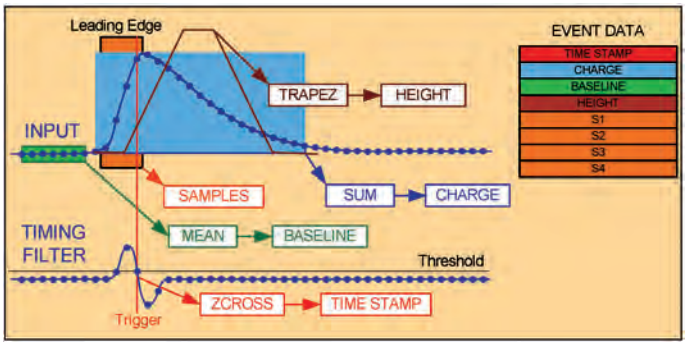
(3) Sampling frequency of the analog memory (switched capacitor array); A/D conversion takes place at lower speed (thus generating a Dead Time).

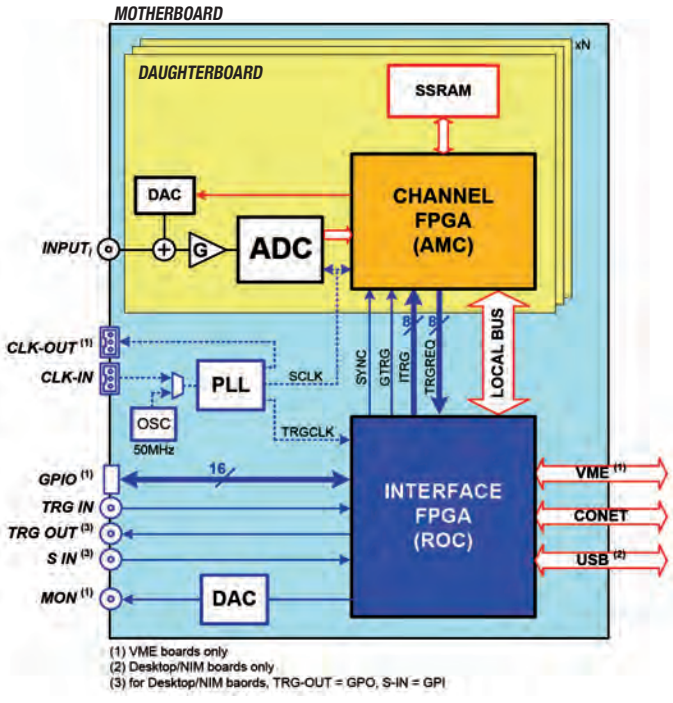
Principle of Operation

CAEN Waveform Digitizers are devices able to continuously acquire analog input signals, which are sampled by fast ADCs and stored into digital memories where they are avaiable for readout through different communication interfaces (USB, VMEBus, Optical Link). Depending on the FPGA firmware, the digitizer can work like an oscilloscope to acquire raw waveforms, or perform online processing to calculate parameters such as pulse height, charge, time stamp, pulse shape discrimination. In the latter case, the output data is a time-stamped list of parameters. Data reductions and zero suppression algorithms are also available. Digitization in CAEN digitizers is based on two main technics: **Flash ADC** and **Switched Capacitor Arrays**. Flash ADC are the fastest A/D converters, where the sampling and the analog-to-digital conversion are made practically at the same time. Flash ADC are so not affected by dead-time due to conversion. In the Switched Capacitor Arrays, the sampling and the A/D conversion take place at different times, thus introducing a dead-time. Despite of the dead-time, the Switched Capacitor Array Digitizers are able to sample the input pulse at very high frequency, up to 5 GS/s, with high channel density, while the highest Flash ADC frequency is 4 GS/s with a quite low number of channels. If compared to a commercial digital oscilloscope, the waveform digitizer presents a list of differences which make it an advanced instrument for many applications:

- Waveform recording with no dead-time due to conversion (Flash ADC digitizers)
- Independent channel self-triggering and event acquisition
- On-line digital pulse processing (DPP) algorithms
- Data reduction
- Multi-board synchronization for system scalability
- Communication interfaces with high bandwidth readout

The benefits of the digital approach are great stability and reproducibility, ability to reprogram and adjust the algorithms to the application, ability to preserve the information of the signal along the entire acquisition chain, flexibility, better correction of baseline fluctuation, pile-up, ballistic deficit, etc.. All in one board.





CAEN Digitizer block diagram:

- A motherboard which contains one FPGA for the readout interfaces and the services, and defines the form factor.
- One or more daughterboards which define the type of digitizer and contain the signal conditioning input stage, the ADCs, the FPGA for the data processing and the memories.

1. Signal Digitization and Pulse Processing.

The Flash ADC technology has improved significantly in the last decades providing always higher resolution and faster sampling speed. The use of Flash ADCs in acquisition boards makes possible to convert the analog signal preserving the information required by the experimental activities and the applications of nuclear techniques.

Digital acquisition devices described in this section represent multichannel waveform digitizers providing time information and digitized signal waveforms through fast communication interfaces, allowing the user to operate post-processing data analysis.

The waveform digitizers integrate also field programmable gate arrays (FPGA) which are able to acquire the information from Flash ADC in real time and process it. Algorithms can be programmed, and their parameters can be adjusted to different experimental conditions. Such algorithms may be the digital replacement of the traditional analog signal processing, so that the waveform digitizer embeds different functions in one single board. In particular, it is possible to replace timing filters such as Constant Fraction Discriminators, shaper amplifier, Peak Sensing ADC, QDC, TDC, etc.

Most of the algorithms are implemented at firmware level inside the FPGA, which also manages the overall acquisition and data transfer. The firmware can be also programmed by the user in case of open FPGA option. The provided software tools configure the digitizer, handle the acquisition, perform the data readout and allow for the digitizer firmware upgrade. More advanced software also feature specific analysis tools, such as peak fitting.

2. High flexibility of trigger configuration

Each channel of the digitizer is able to digitally discriminate the input and generate a trigger when a pre-defined condition is met; in the basic implementation, this is just a programmable threshold which is continuously compared to the digitized input, while more advanced algorithms (digital CFD, timing filters, etc.) are implemented in special DPP firmware. The individual channel self-trigger can be used to generate a global trigger for a simultaneous acquisition of all the channels within a board, can be propagated to the front panel connectors in order to make a multi-board triggering logic or can be used locally for an independent acquisition channel by channel (DPP mode only). It is also possible to combine the individual self-triggers to create a configurable coincidence or anticoincidence logic, either within the board or across multiple digitizers through additional external boards.

3. Memory Management and Data Readout

The Digitizer acquires events consecutively using a multi-buffer memory management where the events are continuously written and read to and from the digitizer. This approach significantly reduces the dead-time, which in case of flash ADC digitizers can be of the order of few tens of ns. In case of Waveform Recording firmware, it is also possible to acquire events with overlapping acquisition windows.

Thanks to the supported communication interfaces, the maximum tranfer rate for the readout can vary from 30 MB/s by USB2.0, to 80 MB/s by CAEN proprietary optical protocol (CONET), to 120 MB/s achievable by VMEbus and 2eSST protocol, up to 240 MB/s by the USB3.0 of the DT5550SE (Open FPGA) digitizer.

The ability to reach the rates above (readout efficiency) mostly depends on the acquisition management, on the number of the acquiring channels and the length of the acquisition window, as well as on the acquisition software, which must be optimized to avoid the loss of time and to save the data at the same time.

4. Scalability and Synchronization of Multi-Board Systems

Multiple digitizers can be synchronized for applications requiring a high channel density.
The synchronization of CAEN digitizers implies:

- Clock synchronization, so that the ADC channels of all the boards do share the same clock. The common clock reference can be internally generated or provided by an external clock source. Each digitizer features a programmable PLL able to generate the sampling clocks locked at the clock reference. The common clock reference can be distributed in fan-in to all the boards or in daisy-chain board by board using the first one as a clock master (VME modules only) or through an external clock generator (DT4700).
- Trigger time stamp alignment, so that the ADC channels of all the boards do share the same time reference allowing the off-line event reconstruction upon the triggers arrival. Start acquisition and time reference can be synchronized by using an external signal which is propagated from board to board through in-out daisy-chain.
- Trigger propagation and/or correlation, involving trigger distribution from channel to channel and from board to board basing on a programmable trigger logic. The digitizer allows for different trigger source options: external on the TRG-IN front panel connector, software by register write and channel over/under-threshold (self-trigger). All these kinds of trigger can be combined to make coincidence, anti-coincidence, majority, global triggers and other functions.
- Event data synchronization, to keep them aligned across boards (same trigger => same data). As soon as at least one board enters the busy condition (digital memory buffer is almost full), the acquisition of all the boards must be vetoed for the time the busy condition remains on. A global Busy signal is used to veto; the busy and veto logics can be implemented by properly configuring the boards (for Daisy chain or fan-in distribution) and may require additional external hardware.

Acquisition Modes

CAEN Digitizers can be operated in different acquisition modes which are implemented by specific firmware and supported by dedicated software, as introduced in the next sections.

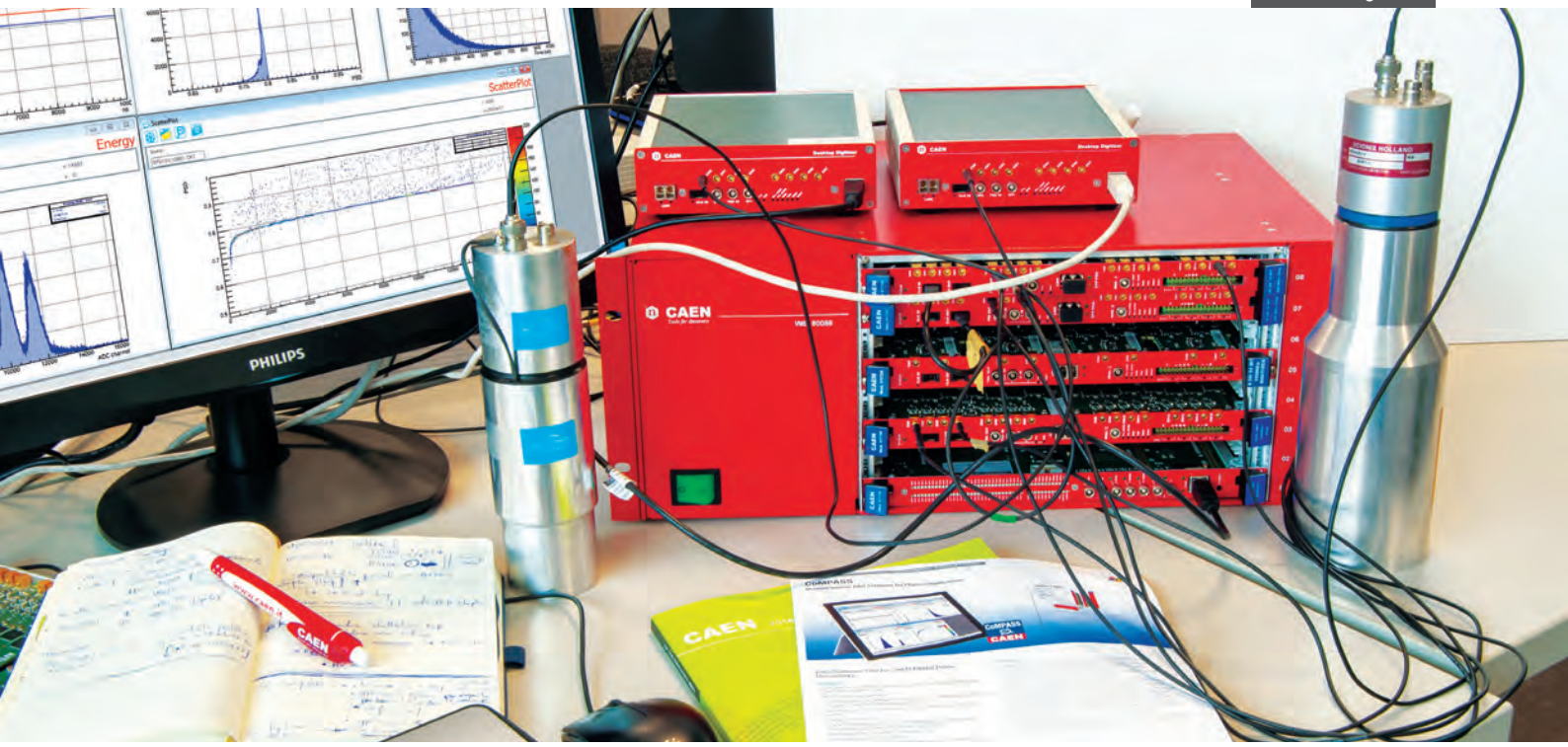
1. Waveform Recording

The digitizer is able to acquire, digitalize and record the input pulse within a programmable time window. Simplified zero suppression functions can be configured. All CAEN digitizers are equipped with their proper waveform recording firmware. CAENScope and WaveDump software are provided to manage the acquisition. Data can be saved in real time for offline analysis.

Furthermore, the 742 and 743 families, which come with two different switched capacitor chips, are well suitable for high precision time measurement of fast signals. WaveDump (742) and WaveCatcher (743) are the dedicated control software.

2. Digital Pulse Processing (DPP)

A special algorithm inside the FPGA not only acquires the waveform, but also performs additional processing to get a set of significant information like energy, pulse shape and precise timing. Each CAEN DPP firmware is a pay firmware, available in a free trial version for evaluation, and requiring a license for full-time operating.



Pulse Height Analysis for gamma ray spectroscopy applies to voltage signals coming from HPGe/Si detectors and Scintillators coupled with Charge Sensitive Preamplifiers. It works upon independent channels event acquisition and in time stamped list mode. Energy spectra are built by the provided software, such as CoMPASS and MC^{2}Analyzer. The DPP-PHA is CAEN firmware provided for the pulse height analysis.

Pulse Shape Discrimination for gated charge integration and gamma-neutron discrimination is suited for current signals coming from Scintillators, Gas tubes, SiPM and PMT. Works upon independent channels event acquisition and in time stamped list mode. Features digital CFD and timing interpolation for high resolution time information, as well as pulse shape discrimination. Energy spectra , PSD and Time are built by the new CoMPASS software. The DPP-PSD is CAEN firmware provided for the pulse shape discrimination and charge integration.

Charge to Digital Conversion implements a Gated Integrator receiving signals directly from the detector (no charge preamp required). Suited for Scintillators and Gas detectors with medium-slow decay time, but can also work with faster detectors such as $LaBr_3$. Designed for high channel density digitizers, can be used for multi-channel acquisition in Detector Array systems. It features independent channel acquisition with self-gating capability for the charge integration (no additional delay lines, no external discriminator). Time-stamped list mode provides timing information as well as energy information for spectra calculation. The DPP-QDC is CAEN firmware provided for the charge-to-digital conversion.

Zero Length Encoding for advanced zero suppression works with a common trigger and simultaneous acquisition on all channels. The digitized waveforms are transferred in compressed mode by suppressing baseline and empty channels. The DPP-ZLEplus is CAEN firmware provided for the zero length encoding.

Dynamic Acquisition Window is suited for zero suppression with trigger-less acquisition systems. It works in waveform mode and upon independent channels event acquisition, dynamically stretching the acquisition window (record length) to fit the actual input pulse duration. The DPP-DAW is CAEN firmware provided for the independent-channel event acquisition with dynamic window.

3. Open FPGA

By the DT5550SE digitizer, the user can take an active part in the digitizer operating functions, being able to program the on-board FPGA with his own firmware, implementing the desired algorithms, personalizing trigger logics and readout.

The **SCI-Compiler** software, dedicated to this digitizer, makes possible to develop the firmware even to not experienced users and to load it on the on-board open FPGA. It automatically generates the Drivers and C libraries for the specific project, and finally allows to design user interfaces (GUI); all these features in a unique software.

Software Tools

CAEN provides interfaces and dedicated user-friendly software GUI to control the acquisition of its boards and provide preliminary data analysis. Drivers to integrate the boards in the host PC system, libraries and Demos for software custom development, and configuration software utilities are also available for more experienced customers.

Depending on the final purpose, the user can find the best fitting CAEN hardware and firmware combination by the table below.

Model	ICH	WV	TS	TDC	QDC	CFD	PHA	PSD	ZS	DAW	OPEN FPGA	FIRMWARE [1]	SOFTWARE
x720	●	●	●		●			●				DPP PSD	CoMPASS CAEN
		●	●						●			WAVEFORM RECORDING	WAVE DUMP CAEN, SCOPE CAEN
x724	●	●	●				●					DPP PHA	CoMPASS CAEN, MC² CAEN
	●	●	●							●		DPP DAW	DAW CAEN
		●	●						●			WAVEFORM RECORDING	WAVE DUMP CAEN, SCOPE CAEN
x725 / x730	●	●	●	●	●	●		●				DPP PSD	CoMPASS CAEN
	●	●	●	●			●					DPP PHA	MC² CAEN, CoMPASS CAEN
		●	●						●			DPP ZLE PLUS	ZLE+ CAEN
	●	●	●							●		DPP DAW	DAW CAEN
		●	●									WAVEFORM RECORDING	WAVE DUMP CAEN, SCOPE CAEN
x740[2]	●	●	●									DPP QDC	QDC CAEN, CoMPASS CAEN
		●	●									WAVEFORM RECORDING	WAVE DUMP CAEN, SCOPE CAEN
x751	●	●	●	●	●	●		●				DPP PSD	CoMPASS CAEN
		●	●						●			DPP ZLE PLUS	ZLE+ CAEN
		●	●									WAVEFORM RECORDING	WAVE DUMP CAEN, SCOPE CAEN
x761		●	●									WAVEFORM RECORDING	WAVE DUMP CAEN
x742		●	●									WAVEFORM RECORDING	WAVE DUMP CAEN
x743		●	●		●							WAVEFORM RECORDING	OPEN WAVECATCHER
DT5550SE	●	●	●								SCI-COMPILER CAEN	SCI 5550	SCI 5550 readout software CAEN

(1) DPP firmware: free trial version. Waveform Recording firmware: free download / **(2)** DPP-QDC firmware is supported by x740D version only

List of the features acronyms

ICH (Independent channels): the channels can trigger and acquire data independently and can be correlated using a user-defined (anti)coincidence logic criteria

WV (Waveforms): acquisition of a programmable number of ADC samples (raw waveforms)

TS (Timestamp): trigger coarse time stamp with low resolution (10-20 ns)

TDC (Time to Digital Converter): fine time stamp information from the interpolation fast digital discriminator filter with high resolution (sub-ns resolution)

QDC (Charge to Digital Converter): gated integrator (charge)

CFD (Constant Fraction Discriminator): digital Constant Fraction Discriminator with programmable delay and fraction. Works in combination with TDC

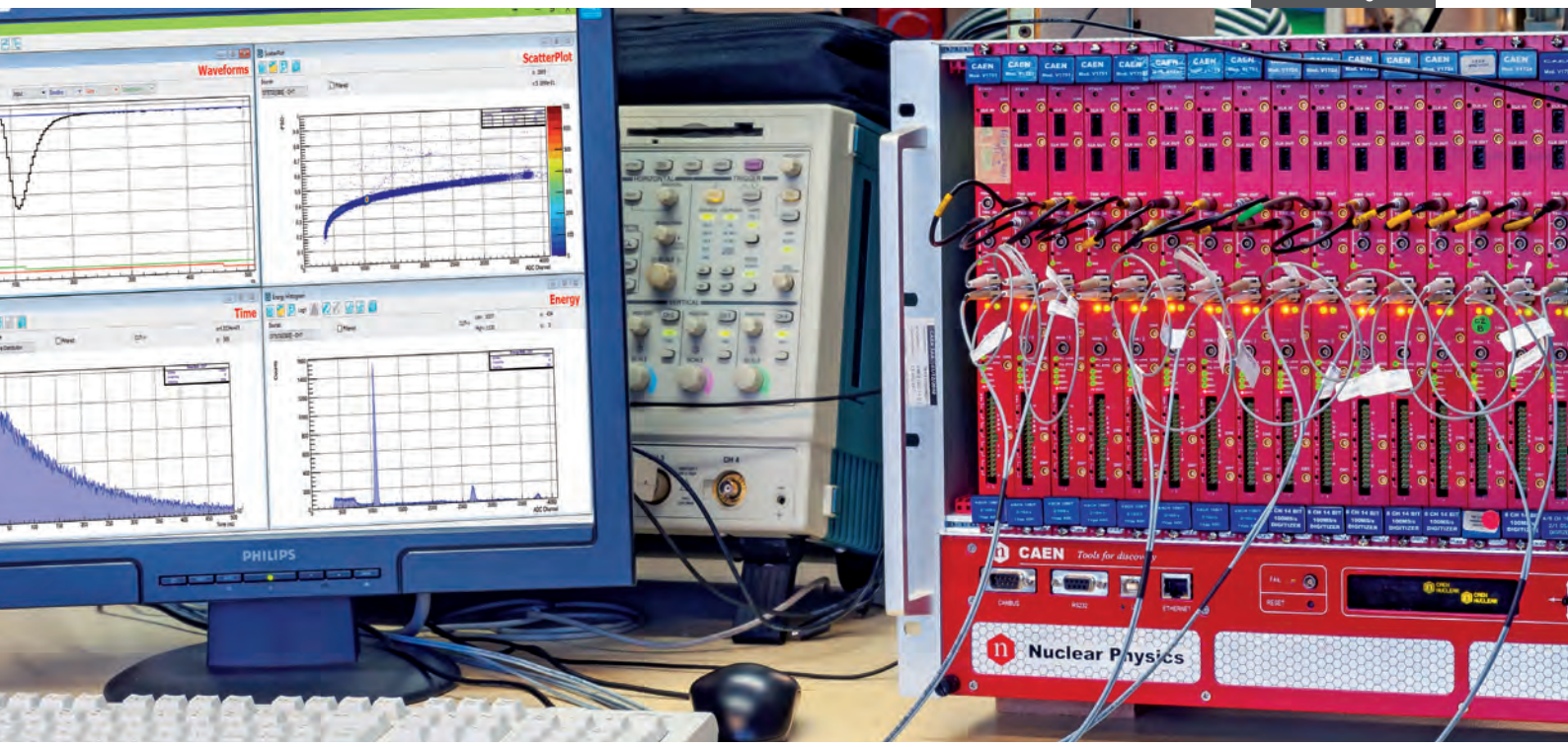
PHA (Pulse Height Analysis): pulse height of any exponential signals or coming from charge sensitive preamplifier

PSD (Pulse Shape Discrimination): particle discrimination via double gated integration

ZS (Zero Suppression): acquisition of a programmable number of ADC samples with zero suppression

DAW (Dynamic Acquisition Window): acquisition of a dynamically adjusted number of ADC samples

Open FPGA: possibility to personalize the FPGA firmware from the acquisition up to the pulse processing algorithm



Application Notes

CAEN provides a wide selection of application notes, white papers and scientific articles focused on digitizers and their use in different fields. In these documents, the capability and flexibility of CAEN digitizers are well exploited showing their physics-driven development.

Here follows a brief selection:

AN2086 Synchronization of CAEN Digitizers in Multiple Board Acquisition Systems

AN2503 Charge Integration: Analog Vs. Digital

AN2506 Digital Gamma Neutron discrimination with Liquid Scintillators

AN2508 CAEN Digital Pulse Height Analyser a digital approach to Radiation Spectroscopy

AN3250 Pulse Shape Discrimination with different CAEN digitizers running DPP-PSD firmware

AN3251 Time Measurements with CAEN Waveform Digitizers

AN5157 A Readout System with CAEN Digitizer for Clover Detectors with Anti-Compton Shield

AN5830 Comparison between two CAEN MCAs and two CAEN Digitizers

AN5995 Dead Time characterization of the x725-x730 Digitizer Family with DPP-PSD

AN2770 Digital ToF Measurements of Fast Neutrons in a Spallation Neutron Source

AN6308 Downsampling measurements with CAEN Digitizer 720/724/740/751 families

WP2081 Digital Pulse Processing in Nuclear Physics

AR2614 Tests of PMT Signal Read-out in a Liquid Argon Dark Matter Detector with a New Fast Waveform Digitizer

AR2613 Special nuclear material detection with a mobile multi-detector system

AR2612 First demonstration of a Compton gamma imager based on silicon photomultipliers

AR2593 Diamond detectors for fast neutron measurements at pulsed spallation sources

AR5151 Uncovering Special Nuclear Materials by Low-energy Nuclear Reaction Imaging

AR5553 Neutron-gamma discrimination via PSD plastic scintillator and SiPMs

GD2783 First Installation Guide to Desktop Digitizers & MCA

GD2827 How to make coincidences with CAEN digitizers

All these documents are available for download in the Document Library section of CAEN website.

720 Digitizer Family

8/4/2 Ch. 12-bit 250 MS/s Digitizer

APPLICATIONS

- Nuclear and Particle Physics
- Dark Matter and Astroparticle Physics
- Fast Neutron spectroscopy, Fusion Plasma diagnostics
- Environmental monitoring, Homeland Security

FORM FACTOR

VME64 VME64X NIM DESKTOP

FUNCTIONS

ICH WV TS QDC PSD ZS

A cost- effective, general purpose choice

APPLICATION NOTES

- AN2086
- AN2503
- AN2506
- AN3250
- AN6308
- GD2783
- GD2827

Overview

The 720 is a family of CAEN Waveform Digitizers able to perform basic waveform recording and run online advanced algorithms (DPP) of charge integration and pulse shape discrimination. Data is read by a Flash ADC, 12-bit resolution and 250 MS/s 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. In the waveform recording mode, algorithms of zero suppression are also implemented to reduce the data throughput.

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.

In case of DPP mode, data can be saved in time-stamped list mode to support higher input rates and improving the throughput performances. Piled-up events can be rejected or saved for offline analysis. The acquisition in DPP mode is fully controlled by the CoMPASS software, which manages the algorithm parameters, builds plots and saves the relevant energy, time, and PSD spectra.

In case of waveform recording mode, the user can take advantage of the CAENScope and WaveDump software to access and save the waveforms. Libraries and demo software in C and LabView are available for integration and customization of specific acquisition systems.

720 family comes in three form factors: VME (8 input channels), NIM (4 or 2 input channels) and Desktop (4 or 2 input channels). The desktop form factor is also included in the Educational Kit for the readout of the SiPMs.

The communication to and from the board is provided through the following interfaces: USB (Desktop and NIM form factors), VMEbus (VME form factor), and Optical Link (all form factors).

Features

- 12-bit @ 250 MS/s
- Analog inputs on MCX coax. connectors
- VME64/VME64X (8 ch.), NIM (4 or 2 ch.) and Desktop (4 or 2 ch.) modules
- 2 Vpp input dynamic range with programmable DC offset adjustment
- Algorithms for Digital Pulse Processing (DPP)
- VME, USB and Optical Link communication interfaces
- Multi-board synchronization features
- Daisy chain capability
- Demo software tools, Control Software for waveform recording and DPP firmware, C and LabVIEW libraries

Firmware	Software	ICH	WV	TS	QDC	PSD	ZS
WAVEFORM RECORDING	WAVE DUMP CAEN, SCOPE CAEN		•	•			•
DPP PSD	CoMPASS CAEN	•	•	•	•	•	

Technical Specifications

GENERAL

Form Factor

1-unit wide, 6U VME64/VME64X

1-unit wide NIM

154x50x164 mm^3 (WxHxD) Desktop

ANALOG INPUT

Channels

8 channels, single ended (VME)

4/2 channels, single ended (NIM, Desktop)

Impedance

50 Ω

Connector

MCX

Full Scale Range (FSR)

2 Vpp

Bandwidth

125 MHz

Offset

Programmable DAC for DC offset adjustment. Range: ±1 V

DIGITAL CONVERSION

Resolution

12 bits

Sampling rate

250 MS/s simultaneously on each channel

29.4 MS/s minimum by hardware downsampling (*)

ADC CLOCK GENERATION

Clock source: internal/external

On-Board PLL provides ADC sampling clock generation from an internal (50 MHz loc. oscillator) or external reference (50 MHz or 62.5 MHz; other options on request) on front panel CLK-IN connector.

MEMORY

1.25 MS/ch or 10 MS/ch Multi-Event Buffer divisible into 1 ÷ 1024 buffers with independent read and write access.

Programmable event size and pre- / post-trigger

TRIGGER

Trigger sources

Self-trigger: channel over/under threshold for either Common or Individual (DPP firmware only) trigger generation

External-trigger: Common by TRG-IN or Individual by LVDS connectors (DPP firmware only)

Software-trigger: Common by software command

Trigger propagation

TRG-OUT (VME) / GPO (NIM and Desktop) digital output

Trigger Time Stamp

Waveform recording firmware: 31-bit counter, 16 ns resolution, 17 s range (**); 48-bit extension by firmware

DPP-PSD Firmware: 32-bit counter, 4 ns resolution, 17 s range; 47-bit extension by firmware; 64-bit extension by software

SYNCHRONIZATION

Clock propagation

Daisy chain (VME only) by CLK-IN/CLK-OUT connectors

One-to-many clock distribution from an external clock source

Clock Cable delay compensation

Acquisition Synchronization

Sync Start/Stop by digital I/O (S-IN, TRG-IN or GPI input, TRG-OUT or GPO output)

External Trigger Time Stamp reset

LVDS I/O (VME only)

16 general purpose LVDS I/Os controlled by FPGA

Busy, Data Ready, Memory full, Individual Trig-Out and other functions can be programmed

An Input Pattern from the LVDS I/Os can be associated to each trigger as an event marker

ANALOG MONITOR (VME only)

12-bit/125 MHz DAC FPGA controlled output with four operating modes: Trigger Majority / Test Pulses / Memory Occupancy / Voltage Level

COMMUNICATION INTERFACE

Optical Link

CAEN CONET proprietary protocol, up to 80 MB/s transfer rate

Daisy chainable: it is possible to connect up to 8/32 ADC modules to a single Optical Link Controller (Mod. A2818/A3818)

USB (NIM and Desktop direct, VME via V1718 bridge)

USB 2.0 compliant

Transfer rate up to 30 MB/s

VME

VME 64X compliant

Data transfer mode: BLT32, MBLT64 (70 MB/s using CAEN Bridge), CBLT32/64, 2eVME, 2eSST (up to 200 MB/s)

POWER CONSUMPTIONS

Desktop: 1.5 A @ 12 V (Typ.)

NIM: 2.9 A @ +6 V, 90 mA @ -6 V

VME: 4 A @ +5 V, 200 mA @ +12 V, 200 mA @ -12 V

Ordering Options

Code	Description	Form Factor
WDT5720BXAAA	DT5720B - 4 Ch. 12 bit 250 MS/s Digitizer: 1.25MS/ch, C20, SE	Desktop
WDT5720CXAAA	DT5720C - 2 Ch. 12 bit 250 MS/s Digitizer: 1.25MS/ch, C20, SE	Desktop
WDT5720DXAAA	DT5720D - 4 Ch. 12 bit 250 MS/s Digitizer: 10MS/ch, C20, SE	Desktop
WDT5720EXAAA	DT5720E - 2 Ch. 12 bit 250 MS/s Digitizer: 10MS/ch, C20, SE	Desktop
WN6720BXAAAA	N6720B - 4 Ch. 12 bit 250 MS/s Digitizer: 1.25MS/ch, C20, SE	NIM
WN6720CXAAAA	N6720C - 2 Ch. 12 bit 250 MS/s Digitizer: 1.25MS/ch, C20, SE	NIM
WN6720DXAAAA	N6720D - 4 Ch. 12 bit 250 MS/s Digitizer: 10MS/ch, C20, SE	NIM
WN6720EXAAAA	N6720E - 2 Ch. 12 bit 250 MS/s Digitizer: 10MS/ch, C20, SE	NIM
WV1720EXAAAA	V1720E - 8 Ch. 12 bit 250 MS/s Digitizer: 1.25MS/ch, C20, SE	6U-VME64
WV1720GXAAAA	V1720G - 8 Ch. 12 bit 250 MS/s Digitizer: 10MS/ch, C20, SE	6U-VME64
WVX1720EXAAA	VX1720E - 8 Ch. 12 bit 250 MS/s Digitizer: 1.25MS/ch, C20, SE	6U-VME64X
WVX1720GXAAA	VX1720G - 8 Ch. 12 bit 250 MS/s Digitizer: 10MS /ch, C20, SE	6U-VME64X
WFWDPPNGAA20	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (8ch x720)	6U-VME64 VME64X
WFWDPPNGAD20	DPP-PSD Digital Pulse Processing for Pulse Shape Discrimination (4/2ch x720)	Desktop NIM

Accessories

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

A654
MCX to LEMO Cable Adapter

A659
MCX to BNC Cable Adapter

A317
Clock Distribution Cable

A318
SE to Differential Clock Cable Adapter

AI2700
Optical Fiber Series

Cables for CONET Optical Link Networks

DT4700
Clock Generator and FAN-OUT

(*) The minimum value may depend on the digitizer model, on the firmware or on the hardware downsampling mode (refer to AN6308 - Downsampling measurement with CAEN Digitizer 720/724/740/751 families)

(**) Trigger Logic and Trigger Time Stamp counter operate at 125 MHz (i.e. 8 ns or 1/2 ADC clock cycles), while the counter value is read at a frequency of 62.5 MHz (i.e. 16 ns).

724 Digitizer Family

8/4/2 Ch. 14-bit 100 MS/s Digitizer

APPLICATIONS

- Nuclear and Particle Physics
- X-ray and Gamma Spectroscopy with HPGe, Silicon detectors
- Spectroscopic Imaging for Homeland Security
- Segmented detectors, Medical Imaging, Material science

FORM FACTOR

VME64 VME64X NIM DESKTOP

FUNCTIONS

ICH WV TS PHA ZS DAW

Ideal for high resolution detectors

APPLICATION NOTES

- AN2508
- AN2086
- AN5157
- AN6308
- GD2783
- GD2827

Overview

The 724 is a family of CAEN Waveform Digitizers able to perform basic waveform recording and run online advanced algorithms (DPP) of pulse height analysis and dynamic acquisition window. Data is read by a Flash ADC, 14-bit resolution and 100 MS/s sampling rate, which is well suited for high resolution detectors as Silicon, HPGe or inorganic scintillators like NaI or CsI coupled with Charge Sensitive Preamplifiers. In the waveform recording mode, algorithms of zero suppression are also implemented to reduce the data throughput. 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.

In case of DPP mode, data can be saved in time-stamped list mode to support higher input rates and improving the throughput performances. Piled-up events can be rejected or saved for offline analysis. The acquisition in DPP mode is fully controlled by the CoMPASS and MC^{2}Analyzer software, which manage the algorithm parameters, build the plots and saves the relevant energy and time spectra. In case of waveform recording mode, the user can take advantage of the CAENScope and WaveDump software to access and save the waveforms. Libraries and demo software in C and LabView are available for integration and customization of specific acquisition systems.

724 family comes in three form factors: VME (8 input channels), NIM (4 or 2 input channels) and Desktop (4 or 2 input channels). The communication to and from the board is provided through the following interfaces: USB (Desktop and NIM form factors), VMEbus (VME form factor), and Optical Link (all form factors).

Features

- 14-bit @ 100 MS/s
- Analog inputs on MCX coax. connectors
- VME64/VME64X (8 ch.), NIM (4 or 2 ch.) and Desktop (4 or 2 ch.) modules
- 0.5, 2.25 or 10 Vpp input dynamic range with programmable DC offset adjustment
- Sampling rate decimation factor (software selectable)
- Algorithms for Digital Pulse Processing (DPP)
- VME, USB and Optical Link communication interfaces
- Multi-board synchronization features
- Daisy chain capability
- Demo software tools, Control Software for waveform recording and DPP firmware, C and LabVIEW libraries

Firmware	Software	ICH	WV	TS	PHA	ZS	DAW
WAVEFORM RECORDING	WAVE DUMP CAEN, SCOPE CAEN		•	•		•	
DPP PHA	MC² CAEN, CoMPASS CAEN	•	•	•	•		
DPP DAW	DAW CAEN	•	•	•			•

Technical Specifications

GENERAL

Form Factor

1-unit wide, 6U VME64/VME64X

1-unit wide NIM

154x50x164 mm^3 (WxHxD) Desktop

ANALOG INPUT

Channels

8 channels, single ended (VME)

4/2 channels, single ended (NIM, Desktop)

Impedance

50 Ω (2.25 and 0.5 Vpp), 1 kΩ (10 Vpp)

Connector

MCX

Full Scale Range (FSR)

2.25 Vpp (0.5 or 10 Vpp by ordering code)

Bandwidth

40 MHz

Offset

Programmable DAC for DC offset adjustment. Range: ±1.125 @ 2.25 Vpp, ±0.25 @ 0.5 Vpp, ±5 V @ 10 Vpp

DIGITAL CONVERSION

Resolution

14 bits

Sampling rate

100 MS/s simultaneously on each channel

16.1 MS/s minimum by hardware downsampling (*)

781 kS/s minimum by firmware decimation (8-step programmable)

ADC CLOCK GENERATION

Clock source: internal/external

On-Board PLL provides ADC sampling clock generation from an internal (50 MHz loc. oscillator) or external reference (50 MHz; other options on request) on front panel CLK-IN connector

MEMORY

512 kS/ch or 4 MS/ch Multi-Event Buffer divisible into 1 ÷ 1024 buffers with independent read and write access

Programmable event size and pre- / post-trigger

TRIGGER

Trigger sources

Self-trigger: channel over/under threshold for either Common or Individual (DPP firmware only) trigger generation

External-trigger: Common by TRG-IN or Individual by LVDS connectors (DPP firmware only)

Software-trigger: Common by software command

Trigger propagation

TRG-OUT (VME) / GPO (NIM and Desktop) digital output

Trigger Time Stamp

Waveform recording FW: 31-bit counter, 20 ns resolution, 21 s range (**); 48-bit extension by FW

DPP-PHA Firmware: 30-bit counter, 10 ns resolution, 10 s range; 46-bit extension by firmware; 64-bit extension by software

DPP-DAW Firmware: 31-bit counter, 10 ns resolution, 21 s range; 64-bit extension by software

SYNCHRONIZATION

Clock propagation

Daisy chain (VME only) through CLK-IN/CLK-OUT connectors

One-to-many clock distribution from an external clock source

Clock Cable delay compensation

Acquisition Synchronization

Sync Start/Stop through digital I/O (S-IN, TRG-IN or GPI input, TRG-OUT or GPO output)

External Trigger Time Stamp reset

LVDS I/O (VME only)

16 general purpose LVDS I/Os controlled by FPGA

Busy, Data Ready, Memory full, Individual Trig-Out and other functions can be programmed

An Input Pattern from the LVDS I/Os can be associated to each trigger as an event marker

ANALOG MONITOR (VME only)

12-bit/100 MHz DAC FPGA controlled output with five operating modes: Inspection / Trigger Majority / Test Pulses / Memory Occupancy / Voltage Level

COMMUNICATION INTERFACE

Optical Link

CAEN CONET proprietary protocol, up to 80 MB/s transfer rate

Daisy chainable: it is possible to connect up to 8/32 ADC modules to a single Optical Link Controller (Mod. A2818/A3818)

USB (NIM and Desktop direct, VME via V1718 bridge)

USB 2.0 compliant (transfer rate up to 30 MB/s)

VME

VME 64X compliant

Data transfer mode: BLT32, MBLT64 (70 MB/s using CAEN Bridge), CBLT32/64, 2eVME, 2eSST (up to 200 MB/s)

POWER CONSUMPTIONS

Desktop: 1.7 A @ 12 V (Typ.)

NIM: 3.9 A @ +6 V, 90 mA @ -6 V

VME: 4.5 A @ +5 V, 200 mA @ +12 V, 200 mA @ -12 V

Ordering Options

Code	Description	Form Factor
WDT5724BXAAA	DT5724B - 4 Ch. 14 bit 100 MS/s Digitizer: 512kS/ch, C20, SE	Desktop
WDT5724CXAAA	DT5724C - 2 Ch. 14 bit 100 MS/s Digitizer: 512kS/ch, C20, SE	Desktop
WDT5724FXAAA	DT5724F - 4 Ch. 14 bit 100 MS/s Digitizer: 4MS/ch, C20, SE	Desktop
WDT5724GXAAA	DT5724G - 2 Ch. 14 bit 100 MS/s Digitizer: 4MS/ch, C20, SE	Desktop
WN6724BXAAAA	N6724B - 4 Ch. 14 bit 100 MS/s Digitizer: 512kS/ch,C20, SE	NIM
WN6724CXAAAA	N6724C - 2 Ch. 14 bit 100 MS/s Digitizer: 512kS/ch, C20, SE	NIM
WN6724FXAAAA	N6724F - 4 Ch. 14 bit 100 MS/s Digitizer: 4MS/ch,C20, SE	NIM
WN6724GXAAAA	N6724G - 2 Ch. 14 bit 100 MS/s Digitizer: 4MS/ch, C20, SE	NIM
WV1724EXAAAA	V1724E - 8 Ch. 14 bit 100 MS/s Digitizer: 4MS/ch, C20, SE	6U-VME64
WV1724GXAAAA	V1724G - 8 Ch. 14 bit 100 MS/s Digitizer: 512KS/ch, C20, SE	6U-VME64
WVX1724EXAAA	VX1724E - 8 Ch. 14 bit 100 MS/s Digitizer: 4MS/ch, C20, SE	6U-VME64X
WPERS0172401	724 Customization - 10Vpp Input Range, SE	ALL
WPERS0172402	724 Customization - 500mVpp Input Range, SE	ALL
WFWDPPTFAAAA	DPP-PHA - Digital Pulse Processing for Pulse Height Analysis (8ch x724)	6U-VME64 VME64X
WFWDPPDAWXEA	DPP-DAW - Digital Pulse Processing with Dynamic Acquisition Window (8ch x724)	6U-VME64 VME64X
WFWDPPTFAD24	DPP-PHA - Digital Pulse Processing for Pulse Height Analysis (4/2ch x724)	Desktop NIM
WFWDPPDAWXED	DPP-DAW - Digital Pulse Processing with Dynamic Acquisition Window (4/2ch x724)	Desktop NIM

Accessories

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

A654
MCX to LEMO Cable Adapter

A659
MCX to BNC Cable Adapter

A317
Clock Distribution Cable

A318
SE to Differential Clock Cable Adapter

AI2700
Optical Fiber Series

Cables for CONET Optical Link Networks

DT4700
Clock Generator and FAN-OUT

(*) The minimum value may depend on the digitizer model, on the firmware or on the hardware downsampling mode (refer to AN6308 - Downsampling measurement with CAEN Digitizer 720/724/740/751 families)

(**) Trigger Logic and Trigger Time Stamp counter operate at 100 MHz (i.e. 10 ns or 1 ADC clock cycle), while the counter value is read at a frequency of 50 MHz (i.e. 20 ns).

725 Digitizer Family

16/8 Ch. 14-bit 250 MS/s Digitizer

APPLICATIONS

- Nuclear and Particle Physics
- Dark Matter and Astroparticle Physics
- Fast Neutron spectroscopy
- Homeland Security

FORM FACTOR

VME64 VME64X NIM DESKTOP

FUNCTIONS

ICH WV TS TDC QDC CFD PHA PSD ZS DAW

Maximum flexibility

APPLICATION NOTES

- AN5157
- AN5995
- GD2783
- GD2827

Overview

The 725 is a family of CAEN Waveform Digitizers able to perform basic waveform recording and run online advanced algorithms (DPP) for digital pulse processing: charge integration and pulse shape discrimination with constant fraction timing, pulse height analysis, zero-length encoding, and dynamic acquisition window. The wide selection of DPP algorithms supported by this family makes the 725 a "must-have" for any kind of nuclear physics application. Data is read by a Flash ADC, 14-bit resolution and 250 MS/s 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. 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.

In case of DPP mode, data can be saved in time-stamped list mode to support higher input rates and improving the throughput performances. Piled-up events can be rejected or saved for offline analysis. The acquisition in DPP mode is fully controlled by the CoMPASS and MC^{2}Analyzer software, which manage the algorithm parameters, build the plots and saves the relevant energy, time, and PSD spectra. In case of waveform recording mode, the user can take advantage of the CAENScope and WaveDump software to access and save the waveforms.

Libraries and demo software in C and LabView are available for integration and customization of specific acquisition systems. 725 family comes 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 (Desktop and NIM form factors), VMEbus (VME form factor), and Optical Link (all form factors).

Features

- 14-bit @ 250 MS/s
- Analog inputs on MCX coax. connectors
- VME64/VME64X (16/8 ch.), NIM (8 ch.) and Desktop (8 ch.) modules
- 0.5 and 2 Vpp software selectable input dynamic range with programmable DC offset adjustment
- Algorithms for Digital Pulse Processing (DPP)
- VME, USB and Optical Link communication interfaces
- Multi-board synchronization features
- Daisy chain capability
- Demo software tools, Control Software for waveform recording and DPP firmware, C and LabVIEW libraries

Firmware	Software	ICH	WV	TS	TDC	QDC	CFD	PHA	PSD	ZS	DAW
WAVEFORM RECORDING	WAVE DUMP CAEN, SCOPE CAEN		•	•							
DPP PSD	CoMPASS CAEN	•	•	•	•	•	•		•		
DPP PHA	MC^2 CAEN, CoMPASS CAEN	•	•	•	•			•			
DPP ZLE PLUS	ZLE$^+$ CAEN		•	•						•	
DPP DAW	DAW CAEN	•	•	•							•

Technical Specifications

GENERAL

Form Factor

1-unit wide, 6U VME64/VME64X

1-unit wide NIM

154x50x164 mm^3 (WxHxD) Desktop

ANALOG INPUT

Channels

16/8 channels, single ended (VME)

8 channels, single ended (NIM, Desktop)

Impedance

50 Ω

Connector

MCX

Full Scale Range (FSR)

2 Vpp (0.5 Vpp software selectable)

Bandwidth

125 MHz

Offset

Programmable DAC for DC offset adjustment. Range: ±1 V @ 2 Vpp, ±0.25 V @ 0.5 Vpp

DIGITAL CONVERSION

Resolution

14 bits

Sampling rate

250 MS/s simultaneously on each channel

ADC CLOCK GENERATION

Clock source: internal/external

On-Board PLL provides ADC sampling clock generation from an internal (50 MHz loc. oscillator) or external reference (50 MHz or 62.5 MHz; other options on request) on front panel CLK-IN connector.

MEMORY

640 kS/ch or 5.12 MS/ch Multi-Event Buffer divisible into 1 ÷ 1024 buffers with independent read and write access. Programmable event size and pre- /post-trigger

TRIGGER

Trigger source

Self-trigger: channel over/under threshold for either Common or Individual (DPP firmware only) trigger generation

External-trigger: Common by TRG-IN or Individual by LVDS connectors (DPP firmware only)

Software-trigger: Common by software command

Trigger propagation

TRG-OUT (VME) / GPO (NIM, Desktop) digital output

Trigger Time Stamp

Waveform recording firmware/DPP-DAW/DPP-ZLE: 31-bit counter, 16ns resolution, 17 s range(*); 48-bit extension by firmware

DPP-PHA/PSD: 31-bit counter, 4 ns resolution, 8 s range; 47-bit extension by firmware; 10-bit and 4 ps fine time stamp by digital CFD; 64-bit extension by software

SYNCHRONIZATION

Clock propagation

Daisy chain (VME only) through CLK-IN/CLK-OUT connectors

One-to-many clock distribution from an external clock source

Clock Cable delay compensation

Acquisition Synchronization

Sync Start/Stop through digital I/O (S-IN, TRG-IN or GPI input, TRG-OUT or GPO output)

External Trigger Time Stamp reset

LVDS I/O (VME only)

16 general purpose LVDS I/Os controlled by FPGA

Busy, Data Ready, Memory Full, Individual Trg-Out and other functions can be programmed

An Input Pattern from the LVDS I/Os can be associated to each trigger as an event marker

ANALOG MONITOR (VME only)

12-bit/125 MHz DAC FPGA controlled output with four operating modes:

Trigger Majority / Test Pulses / Memory Occupancy / Voltage Level

COMMUNICATION INTERFACE

Optical Link

CAEN CONET proprietary protocol,up to 80 MB/s transfer rate

Daisy chainable: it is possible to connect up to 8/32 ADC modules to a single Optical Link Controller (Mod.A2818/A3818)

VME

VME 64X compliant

Data transfer mode: BLT32, MBLT64 (70 MB/s using CAEN Bridge), CBLT32/64, 2eVME, 2eSST (up to 200 MB/s)

(*) Trigger Logic and Trigger Time Stamp counter operate at 125 MHz (i.e. 8 ns or 2 ADC clock cycles), while the counter value is read at a frequency of 62.5 MHz (i.e. 16 ns).

POWER CONSUMPTIONS

Desktop: TBD

NIM: TBD

VME:	V1725	V1725x
	5.2 A @ +5 V	TBD
	750 mA @ +12 V	
	-12 V not used	

Ordering Options

Code	Description	Form Factor
WDT5725XAAAA	DT5725 - 8 Ch. 14 bit 250 MS/s Digitizer: 640kS/ch, CE30, SE	Desktop
WDT5725BXAAA	DT5725B - 8 Ch. 14 bit 250 MS/s Digitizer: 5.12MS/ch, CE30, SE	Desktop
WN6725XAAAAA	N6725 - 8 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	NIM
WN6725BXAAAA	N6725B - 8 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	NIM
WV1725XAAAAA	V1725 - 16 Ch. 14 bit 250 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64
WV1725BXAAAA	V1725B - 16 Ch. 14 bit 250 MS/s Digitizer: 5.12MS/ch, CE30, SE	6U-VME64
WV1725CXAAAA	V1725C - 8 Ch. 14 bit 250 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64
WV1725DXAAAA	V1725D - 8 Ch. 14 bit 250 MS/s Digitizer: 5.12MS/ch, CE30, SE	6U-VME64
WVX1725XAAAA	VX1725 - 16 Ch. 14 bit 250 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64X
WVX1725BXAAA	VX1725B - 16 Ch. 14 bit 250 MS/s Digitizer: 5.12MSch, CE30, SE	6U-VME64X
WVX1725CXAAA	VX1725C - 8 Ch. 14 bit 250 MS/s Digitizer: 640kS/c, CE30, SE	6U-VME64X
WVX1725DXAAA	VX1725D - 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 License for 16ch x 725 Digital Pulse Processing	6U-VME64 VME64X
WFWDPPS2501D	DPP-SUP - Super License for 8ch x 725 Digital Pulse Processing	ALL

Accessories

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

A654
MCX to LEMO Cable Adapter

A659
MCX to BNC Cable Adapter

A317
Clock Distribution Cable

A318
SE to Differential Clock Cable Adapter

AI2700
Optical Fiber Series

Cables for CONET Optical Link Networks

DT4700
Clock Generator and FAN-OUT

730 Digitizer Family

16/8 Ch. 14-bit 500 MS/s Digitizer

APPLICATIONS

- Nuclear and Particle Physics
- Dark Matter and Astroparticle Physics
- Fast Neutron spectroscopy
- Homeland Security

FORM FACTOR

VME64 VME64X NIM DESKTOP

FUNCTIONS

ICH WV TS TDC QDC CFD PHA PSD ZS DAW

The CAEN top level digitizer

APPLICATION NOTES

- AN3250
- AN3251
- AN5157
- AN5830
- AN5995
- GD2783
- GD2827

Overview

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

Data is read by a Flash ADC, 14-bit resolution and 500 MS/s 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. In case of DPP mode, data can be saved in time-stamped list mode to support higher input rates and improving the throughput performances. Piled-up events can be rejected or saved for offline analysis. The acquisition in DPP mode is fully controlled by the CoMPASS and MC^{2}Analyzer software, which manage the algorithm parameters, build the plots and saves the relevant energy, time, and PSD spectra. In case of waveform recording mode, the user can take advantage of the CAENScope and WaveDump software to access and save the waveforms. Libraries and demo software in C and LabView are available for integration and customization of specific acquisition systems.

730 family comes 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 (Desktop and NIM form factors), VMEbus (VME form factor), and Optical Link (all form factors).

Features

- 14-bit @ 500 MS/s
- Analog inputs on MCX coax. connectors
- VME64/VME64X (16/8 ch.), NIM (8 ch.) and Desktop (8 ch.) modules
- 0.5 and 2 Vpp input dynamic range with programmable DC offset adjustment
- Algorithms for Digital Pulse Processing (DPP)
- VME, USB and Optical Link communication interfaces
- Multi-board synchronization features
- Daisy chain capability
- Demo software tools, Control Software for waveform recording and DPP firmware, C and LabVIEW libraries

Firmware	Software	ICH	WV	TS	TDC	QDC	CFD	PHA	PSD	ZS	DAW
Waveform Recording	WaveDump, CAENScope		•	•							
DPP PSD	CoMPASS	•	•	•	•	•	•		•		
DPP PHA	MC^{2}Analyzer, CoMPASS	•	•	•	•			•			
DPP ZLE PLUS	ZLE		•	•						•	
DPP DAW	DAW	•	•	•							•

Technical Specifications

GENERAL

Form Factor
1-unit wide, 6U VME64/VME64X

1-unit wide NIM

154x50x164 mm^3 (WxHxD) Desktop

ANALOG INPUT

Channels
16/8 channels, single ended (VME)

8 channels, single ended (NIM, Desktop)

Impedance
50 Ω

Connector
MCX

Full Scale Range (FSR)
2 Vpp (0.5 Vpp software selectable)

Bandwidth
250 MHz

Offset
Programmable DAC for DC offset adjustment. Range: ±1 V @ 2 Vpp, ±0.25 V @ 0.5 Vpp

DIGITAL CONVERSION

Resolution
14 bits

Sampling rate
500 MS/s simultaneously on each channel

ADC CLOCK GENERATION

Clock source: internal/external

On-Board PLL provides ADC sampling clock generation from an internal (50 MHz loc. oscillator) or external reference (50 MHz or 62.5 MHz; other options on request) on front panel CLK-IN connector

MEMORY

640 kS/ch or 5.12 MS/ch Multi-Event Buffer divisible into 1 ÷ 1024 buffers with independent read and write access.

Programmable event size and pre- /post-trigger

TRIGGER

Trigger source
Self-trigger: channel over/under threshold for either Common or Individual (DPP firmware only) trigger generation

External-trigger: Common by TRG-IN or Individual by LVDS connectors (DPP firmware only)

Software-trigger: Common by software command

Trigger propagation
TRG-OUT (VME) / GPO (NIM, Desktop) digital output

Trigger Time Stamp
Waveform recording firmware/DPP-DAW/DPP-ZLE: 31-bit counter, 16 ns resolution, 17 ns range(*); 48-bit extension by firmware

DPP-PHA/PSD: 31-bit counter, 2 ns resolution, 4 s range; 47-bit extension by firmware; 10-bit and 2 ps fine time stamp by digital CFD; 64-bit extension by software

SYNCHRONIZATION

Clock propagation
Daisy chain (VME only) through CLK-IN/CLK-OUT connectors

One-to-many clock distribution from an external clock source

Clock Cable delay compensation

Acquisition Synchronization
Sync Start/Stop through digital I/O (S-IN, TRG-IN or GPI input, TRG-OUT or GPO output)

External Trigger Time Stamp reset

LVDS I/O (VME only)

16 general purpose LVDS I/Os controlled by FPGA

Busy, Data Ready, Memory full, Individual Trig-Out and other functions can be programmed

An Input Pattern from the LVDS I/Os can be associated to each trigger as an event marker

ANALOG MONITOR (VME only)

12-bit/125 MHz DAC FPGA controlled output with four operating modes: Trigger Majority / Test Pulses / Memory Occupancy / Voltage Level

COMMUNICATION INTERFACE

Optical Link
CAEN CONET proprietary protocol, up to 80 MB/s transfer rate

Daisy chainable: it is possible to connect up to 8/32 ADC modules to a single Optical Link Controller (Mod. A2818/A3818)

USB (NIM and Desktop direct, VME via V1718 bridge)

USB 2.0 compliant
Transfer rate up to 30 MB/s

VME
VME 64X compliant

Data transfer mode: BLT32, MBLT64 (70 MB/s using CAEN Bridge), CBLT32/64, 2eVME, 2eSST (up to 200 MB/s)

(*) Trigger Logic and Trigger Time Stamp counter operate at 125 MHz (i.e. 8 ns or 4 ADC clock cycles), while the counter value is read at a frequency of 62.5 MHz (i.e. 16 ns).

POWER CONSUMPTIONS

Desktop: 2.8 A @ 12 V (Typ.)

NIM: 4.9 @ +6 V, 250 mA @ -6 V

NIM:	N6730	N6730B		
	4.9 A @ +6 V	6.5 A @ +6 V		
	250 mA @ -6 V	250 mA @ -6 V		
VME:	V1730	V1730B	V1730C	V1730D
	8.2 A @ +5 V	10.2 A @ +5 V	5 A @ +5 V	6.5 A @ +5 V
	840 mA @ +12 V	840 mA @ +12 V	400 mA @ +12 V	400 mA @ +12 V
	-12 V not used	-12 V not used	400 mA @ -12 V	400 mA @ -12 V

Ordering Options

Code	Description	Form Factor
WDT5730XAAAA	DT5730 - 8 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	Desktop
WDT5730BXAAA	DT5730B - 8 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	Desktop
WN6730XAAAAA	N6730 - 8 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	NIM
WN6730BXAAAA	N6730B - 8 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	NIM
WV1730XAAAAA	V1730 - 16 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64
WV1730BXAAAA	V1730B - 16 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	6U-VME64
WV1730CXAAAA	V1730C - 8 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64
WV1730DXAAAA	V1730D - 8 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	6U-VME64
WVX1730XAAAA	VX1730 - 16 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64X
WVX1730BXAAA	VX1730B - 16 Ch. 14 bit 500 MS/s Digitizer: 5.12MS/ch, CE30, SE	6U-VME64X
WVX1730CXAAA	VX1730C - 8 Ch. 14 bit 500 MS/s Digitizer: 640kS/ch, CE30, SE	6U-VME64X
WVX1730DXAAA	VX1730D - 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 License for 16ch x 730 Digital Pulse Processing	6U-VME64 VME64X
WFWDPPS3001D	DPP-SUP - Super License for 8ch x 730 Digital Pulse Processing	ALL

Accessories

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

A654
MCX to LEMO Cable Adapter

A659
MCX to BNC Cable Adapter

A317
Clock Distribution Cable

A318
SE to Differential Clock Cable Adapter

AI2700
Optical Fiber Series

Cables for CONET Optical Link Networks

DT4700
Clock Generator and FAN-OUT

740 Digitizer Family

64/32 Ch. 12-bit 62.5 MS/s Digitizer

APPLICATIONS

- Nuclear and Particle Physics
- Neutrino Physics
- Spectroscopic Imaging
- Homeland Security

FORM FACTOR

VME64 VME64X NIM DESKTOP

FUNCTIONS

ICH WV TS QDC

Very high channel density

APPLICATION NOTES

- AN6308
- GD2783
- GD2827

Overview

The 740 is a high channel density CAEN Waveform Digitizer family able to perform basic waveform recording and run online advanced algorithms (DPP) of charge integration. Both the elevate number of channels per board (32 for Desktop and NIM form factor, 64 for VME) and the DPP algorithm make the board a digital replacement of a traditional QDC. Data is read by a Flash ADC, 12-bit resolution and 62.5 MS/s sampling rate, which is well suited for mid-slow signals as the ones coming from inorganic scintillators coupled to PMTs, gaseous detectors and others. Sampling rate can be further reduced using the decimation feature. The acquisition can be channel independent and externally vetoed/gated. Multiple boards can be synchronized to build up complex systems.

In case of DPP mode, data can be saved in time-stamped list mode to support higher input rates and improving the throughput performances. The acquisition in DPP mode is fully controlled by the CoMPASS software (Coming Soon), which manages the algorithm parameters, builds the plots and saves the relevant energy and time spectra. In case of waveform recording mode, the user can take advantage of the CAENScope and WaveDump software to access and save the waveforms. Libraries and demo software in C and LabView are available for integration and customization of specific acquisition systems.

740 family comes in three form factors: VME (64 input channels), NIM (32 input channels) and Desktop (32 input channels). The communication to and from the board is provided through the following interfaces: USB (Desktop and NIM form factors), VMEbus (VME form factor), and Optical Link (all form factors).

Features

- 12-bit @ 62.5 MS/s
- Analog inputs on ERNI SMC connectors
- VME64/VME64X (64 ch.), NIM (32 ch.) and Desktop (32 ch.) modules
- 2 or 10 Vpp input dynamic range with programmable DC offset adjustment
- Sampling rate decimation factor (software selectable)
- Algorithms for Digital Pulse Processing (DPP)
- VME, USB and Optical Link communication interfaces
- Multi-board synchronization features
- Daisy chain capability
- Demo software tools, Control Software for waveform recording and DPP firmware, C and LabVIEW libraries

Firmware	Software	ICH	WV	TS	QDC
WAVEFORM RECORDING	WAVE DUMP CAEN		•	•	
DPP QDC	QDC CAEN / CoMPASS CAEN	•	•	•	•

DPP-QDC firmware is supported by x740D version only

Technical Specifications

GENERAL

Form Factor

1-unit wide, 6U VME64/VME64X

1-unit wide NIM

154x50x164 mm^3 (WxHxD) Desktop

ANALOG INPUT

Channels

64 channels, single ended (VME); 32 channels, single endend (NIM)

32 channels, single endend (Desktop) or 16 channels by auxiliary on-board connectors

Impedance

50 Ω (2 Vpp), 1 kΩ (10 Vpp)

Connector

ERNI SMC Dual Row 68pin (VME, NIM and Desktop)

MCX auxiliary (Desktop)

Full Scale Range (FSR)

2 or 10 Vpp (by ordering code)

Bandwidth

30 MHz

Offset

Programmable DAC for DC offset adjustment per each 8-channel group

Range: ±1 V @ 2 Vpp, ±5 V @ 10 Vpp

DIGITAL CONVERSION

Resolution

12 bits

Sampling rate

62.5 MS/s simultaneously on each channel (65 MS/s using external clock)

16.1 MS/s minimum by hardware downsampling (*)

488 kS/s minimum by firmware decimation (8-step programmable)

ADC CLOCK GENERATION

Clock source: internal/external

On-Board PLL provides ADC sampling clock generation from an internal (50 MHz loc. oscillator) or external reference (50 MHz or 62.5 MHz; other options on request) on front panel CLK-IN connector.

MEMORY

192 kS/ch or 1.5 MS/ch Multi-Event Buffer divisible into 1 ÷ 1024 buffers with independent read and write access. Programmable event size and pre- /post-trigger

TRIGGER

Trigger sources

Self-trigger: channel over/under threshold for either Common or Individual (DPP firmware only) trigger generation

External-trigger: Common by TRG-IN or Individual by LVDS connectors (DPP firmware only)

Software-trigger: Common by software command

Trigger propagation

TRG-OUT (VME) / GPO (NIM and Desktop) digital output

Trigger Time Stamp

Waveform recording firmware: 31-bit counter, 16 ns resolution, 17 s range(**); 48-bit extension by firmware

DPP-QDC Firmware: 32-bit counter, 16 ns resolution, 68 s range; 48-bit extension by firmware; 64-bit extension by software

SYNCHRONIZATION

Clock propagation

Daisy chain (VME only) through CLK-IN/CLK-OUT connectors

One-to-many clock distribution from an external clock source

Clock Cable delay compensation

Acquisition Synchronization

Sync Start/Stop through digital I/O (S-IN, TRG-IN or GPI input, TRG-OUT or GPO output)

External Trigger Time Stamp reset

LVDS I/O (VME only)

16 general purpose LVDS I/Os controlled by FPGA

Busy, Data Ready, Memory full, Individual Trig-Out and other functions can be programmed An Input Pattern from the LVDS I/Os can be associated to each trigger as an event marker

ANALOG MONITOR (VME only)

12-bit/125 MHz DAC FPGA controlled output with four operating modes: Trigger Majority / Test Pulses / Memory Occupancy / Voltage Level

COMMUNICATION INTERFACE

Optical Link

CAEN CONET proprietary protocol, up to 80 MB/s transfer rate

Daisy chainable: it is possible to connect up to 8/32 ADC modules to a single Optical Link Controller (Mod. A2818/A3818)

USB (NIM and Desktop direct, VME via V1718 bridge)

USB 2.0 compliant (transfer rate up to 30 MB/s)

VME

Data transfer mode: BLT32, MBLT64 (70 MB/s using CAEN Bridge), CBLT32/64, 2eVME, 2eSST (up to 200 MB/s)

POWER CONSUMPTIONS

Desktop: 1.9 A @ 12 V (Typ.)

NIM: 3.9 A @ +6 V, 420 mA @ -6 V

VME: 4.5 / 4.9 A @ +5 V, 250 mA @ +12 V, -12 V not used

(**) Trigger Logic and Trigger Time Stamp counter operate at 125 MHz (i.e. 8 ns or 1/2 ADC clock cycles), while the counter value is read at a frequency of 62.5 MHz (i.e. 16 ns).

Ordering Options

Code	Description	Form Factor
WDT5740XAAAA	DT5740 - 32 Ch. 12 bit 62.5 MS/s Digitizer: 192kS/ch, EP3C16, SE	Desktop
WDT5740CXAAA	DT5740C - 10Vpp input 32 Ch. 12 bit 62.5MS/s Digitizer: 192kS/ch, EP3C16, SE	Desktop
WDT5740DXAAA	DT5740D - 32 Ch. 12 bit 62.5 MS/s Digitizer: 192kSch, EP3C40, SE	Desktop
WN6740DXAAAA	N6740D - 32 Ch. 12 bit 62.5 MS/s Digitizer: 192kS/ch, EP3C40, SE	NIM
WN6740XAAAAA	N6740 - 32 Ch. 12 bit 62.5 MS/s Digitizer: 192kS/ch, EP3C16, SE	NIM
WN6740CXAAAA	N6740C - 10Vpp input 32 Ch. 12 bit 62.5 MS/s Digitizer: 192kS/ch, EP3C16, SE	NIM
WV1740XAAAAA	V1740 - 64 Ch. 12 bit 62.5 MS/s Digitizer: 192kS/ch, EP3C16, SE	6U-VME64
WV1740AXAAAA	V1740A - 10Vpp input 64ch 12bit 62.5MS/s Digitizer: 1.5 MS/ch, EP3C16, SE	6U-VME64
WV1740BXAAAA	V1740B - 64 Ch. 12 bit 62.5 MS/s Digitizer: 1.5 MS/ch, EP3C16, SE	6U-VME64
WV1740CXAAAA	V1740C - 10Vpp input 64ch 12bit 62.5MS/s Digitizer: 192kS/ch, EP3C16, SE	6U-VME64
WV1740DXAAAA	V1740D - 64 Ch. 12 bit 62.5 MS/s Digitizer: 192kS/ch, EP3C40, SE	6U-VME64
WVX1740XAAAA	VX1740 - 64 Ch. 12 bit 62.5 MS/s Digitizer: 192kS/ch, EP3C16, SE	6U-VME64X
WVX1740AXAAA	VX1740A - 10Vpp input 64 Ch. 12 bit 62.5 MS/s Digitizer: 1.5 MS/ch, EP3C16, SE	6U-VME64X
WVX1740BXAAA	VX1740B - 64 Ch. 12 bit 62.5 MS/s Digitizer: 1.5 MS/ch, EP3C16, SE	6U-VME64X
WVX1740CXAAA	VX1740C - 10Vpp input 64 Ch. 12 bit 62.5 MS/s Digitizer: 192 KS/ch, EP3C16, SE	6U-VME64X
WVX1740DXAAA	VX1740D - 64 Ch. 12 bit 62.5 MS/s Digitizer: 192kSch, EP3C40, SE	6U-VME64X
WFWDPPQDCAAA	DPP-QDC- Digital Pulse Processing for Time Stamped Digital QDC (64ch x740D)	6U-VME64 VME64X
WFWDPPQDCAAA	DPP-QDC - Digital Pulse Processing for Time Stamped Digital QDC (32ch x740D)	Desktop NIM

Accessories

A746D
32 Channel Adapter for LEMO connector

A746B
64 Channel Adapter for LEMO connector

A746E
32ch Adapter for Lemo connector

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

A654
MCX to LEMO Cable Adapter

A659
MCX to BNC Cable Adapter

A317
Clock Distribution Cable

A318
SE to Differential Clock Cable Adapter

AI2700
Optical Fiber Series

Cables for CONET Optical Link Networks

DT4700
Clock Generator and FAN-OUT

(*) The minimum value may depend on the digitizer model, on the firmware or on the hardware downsampling mode (refer to AN6308 - Downsampling measurement with CAEN Digitizer 720/724/740/751 families)

751 Digitizer Family

8-4/4-2 Ch. 10-bit 1/2 GS/s Digitizer

APPLICATIONS

- Nuclear and Particle Physics
- Dark Matter and Astroparticle Physics
- Fast Neutron spectroscopy
- Fusion Plasma diagnostic, Homeland Security

FORM FACTOR

VME64 VME64X NIM DESKTOP

FUNCTIONS

ICH WV TS TDC QDC CFD PSD ZS

Well suited for fast signals

APPLICATION NOTES

- AN2770
- AN2086
- AN3250
- AN3251
- AN6308
- GD2783
- GD2827

Overview

The 751 is a family of CAEN Waveform Digitizers able to perform basic waveform recording and run online advanced algorithms (DPP) of charge integration and pulse shape discrimination with constant fraction timing and zero-length encoding. Data is read by a Flash ADC, 10-bit resolution and 1GS/s sampling rate (2GS/s using half of the channels in DES mode), which is well suited for fast signals as the ones coming from fast organic, inorganic and liquid scintillators coupled to PMTs or Silicon Photomultipliers, Diamond detectors and others. 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.

In case of DPP mode, data can be saved in time-stamped list mode to support higher input rates and improving the throughput performances. Piled-up events can be rejected or saved for offline analysis. The acquisition in DPP mode is fully controlled by the CoMPASS software, which manages the algorithm parameters, builds, plots and saves the relevant energy, time, and PSD spectra. In case of waveform recording mode, the user can take advantage of the CAENScope and WaveDump software to access and save the waveforms.

Libraries and demo software in C and LabView are available for integration and customization of specific acquisition systems.

751 family comes in three form factors: VME (8-4 input channels), NIM (4-2 input channels) and Desktop (4-2 input channels). The communication to and from the board is provided through the following interfaces: USB (Desktop and NIM form factors), VMEbus (VME form factor), and Optical Link (all form factors).

Features

- 10-bit @ 1-2 GS/s
- Analog inputs on MCX coax. connectors
- VME64/VME64X (8-4 ch.), NIM (4-2 ch.) and Desktop (4-2 ch.) modules
- 0.2 or 1 Vpp input dynamic range with programmable DC offset adjustment
- Algorithms for Digital Pulse Processing (DPP)
- VME, USB and Optical Link communication interfaces
- Multi-board synchronization features
- Daisy chain capability
- Demo software tools, Control Software for waveform recording and DPP firmware, C and LabVIEW libraries

Firmware	Software	ICH	WV	TS	TDC	QDC	CFD	PSD	ZS
WAVEFORM RECORDING	WAVE DUMP CAEN, SCOPE CAEN		•	•					
DPP PSD	CoMPASS CAEN	•	•	•	•	•	•	•	
DPP ZLE PLUS	ZLE CAEN		•	•					•

Technical Specifications

GENERAL

Form Factor

1-unit wide, 6U VME64/VME64X

1-unit wide NIM

154x50x164 mm^3 (WxHxD) Desktop

ANALOG INPUT

Channels

8-4 channels, single ended (VME)

4-2 channels, single ended (NIM, Desktop)

Impedance

50 Ω @ 1 and 0.2 Vpp

Connector

MCX

Full Scale Range (FSR)

1 Vpp (0.2 Vpp by customization code)

Bandwidth

500 MHz

Offset

Programmable DAC for DC offset adjustement. Range: ±0.5 V @ 1 Vpp, ±0.1 V @ 0.2 Vpp

DIGITAL CONVERSION

Resolution

10 bits

Sampling rate

1 GS/s simultaneously on each channel (double in DES mode)

250 MS/s minimum by hardware downsampling (*)

ADC CLOCK GENERATION

Clock source: internal/external

On-Board PLL provides ADC sampling clock generation from an internal (50 MHz loc. oscillator) or external reference (50 MHz or 62.5 MHz; other options on request) on front panel CLK-IN connector.

MEMORY

1.835 MS/ch (3.6 MS/ch in DES mode) or 14.4 MS/ch (28.8 MS/ch in DES mode) Multi-Event Buffer divisible into 1 ÷ 1024 buffers with independent read and write access.

Programmable event size and pre- /post-trigger

TRIGGER

Trigger source

Self-trigger: channel over/under threshold for either Common or Individual (DPP firmware only) trigger generation

External-trigger: Common by TRG-IN or Individual by LVDS connectors (DPP firmware only)

Software-trigger: Common by software command

Trigger propagation

TRG-OUT (VME) / GPO (NIM and Desktop) digital output

Trigger Time Stamp

Waveform recording firmware, DPP-ZLE: 31-bit counter, 16 ns resolution, 17 s range (**); 48-bit extension by firmware

DPP-PSD Firmware: 32-bit counter, 1 ns resolution (1 ps fine time stamp resolution with dCFD), 4 s range, 48-bit extension by firmware; 64-bit extension by software

SYNCHRONIZATION

Clock propagation

Daisy chain (VME only) through CLK-IN/CLK-OUT connectors

One-to-many clock distribution from an external clock source

Clock Cable delay compensation

Acquisition Synchronization

Sync Start/Stop through digital I/O (S-IN, TRG-IN or GPI input, TRG-OUT or GPO output)

External Trigger Time Stamp reset

LVDS I/O (VME only)

16 general purpose LVDS I/Os controlled by FPGA

Busy, Data Ready, Memory full, Individual Trig-Out and other functions can be programmed An Input Pattern from the LVDS I/Os can be associated to each trigger as an event marker

ANALOG MONITOR (VME only)

12-bit/125 MHz DAC FPGA controlled output with four operating modes: Trigger Majority / Test Pulses / Memory Occupancy / Voltage Level

COMMUNICATION INTERFACE

Optical Link

CAEN CONET proprietary protocol, up to 80 MB/s transfer rate

Daisy chainable: it is possible to connect up to 8/32 ADC modules to a single Optical Link Controller (Mod. A2818/A3818)

USB (NIM and Desktop direct, VME via V1718 bridge)

USB 2.0 compliant

Transfer rate up to 30 MB/s

VME

VVME 64X compliant

Data transfer mode: BLT32, MBLT64 (70 MB/s using CAEN Bridge), CBLT32/64, 2eVME, 2eSST (up to 200 MB/s)

POWER CONSUMPTIONS

Desktop: 1.8 A @ 12 V (Typ.)

NIM: 3.9 A @ +6 V, 120 mA @ -6 V

VME: 6.5 A @ +5 V, 200 mA @ +12 V, 300 mA @ -12 V

Ordering Options

Code	Description	Form Factor
WDT5751XAAAA	DT5751 - 2/4 Ch. 10 bit 2/1 GS/s Digitizer: 3.6/1.8MS/ch, EP3C16, SE	Desktop
WN6751XAAAAA	N6751 - 2/4 Ch. 10 bit 2/1 GS/s Digitizer: 3.6/1.8MS/ch, EP3C16, SE	NIM
WN6751CXAAAA	N6751C - 2/4 Ch. 10 bit 2/1 GS/s Digitizer: 28.8/14.4MS/ch, EP3C16, SE	NIM
WV1751XAAAAA	V1751 - 4/8 Ch. 10 bit 2/1 GS/s Digitizer: 3.6/1.8MS/ch, EP3C16, SE	6U-VME64
WV1751CXAAAA	V1751C - 4/8 Ch. 10 bit 2/1 GS/s Digitizer: 28.8/14.4MS/ch, EP3C16, SE	6U-VME64
WVX1751XAAAA	VX1751 - 4/8 Ch. 10 bit 2/1 GS/s Digitizer: 3.6/1.8MS/ch, EP3C16, SE	6U-VME64X
WVX1751CXAAA	VX1751C - 4/8 Ch. 10 bit 2/1 GS/s Digitizer: 28.8/14.4MS/ch, EP3C16, SE	6U-VME64X
WPERS0175102	751 Customization - 200 mVpp Input Range, SE	ALL
WFWDPPNGAA51	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (8ch x751)	6U-VME64 VME64X
WFWDPPNGAD51	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (4ch x751)	Desktop NIM
WFWDPPZLAA51	DPP-ZLE - Digital Pulse Processing Zero Length Encoding for (8ch x751)	6U-VME64 VME64X
WFWDPPZLAD51	DPP-ZLE - Digital Pulse Processing Zero Length Encoding for (4ch x751)	Desktop NIM

Accessories

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

A654
MCX to LEMO Cable Adapter

A659
MCX to BNC Cable Adapter

A317
Clock Distribution Cable

A318
SE to Differential Clock Cable Adapter

AI2700
Optical Fiber Series

Cables for CONET Optical Link Networks

DT4700
Clock Generator and FAN-OUT

(*) The minimum value may depend on the digitizer model, on the firmware or on the hardware downsampling mode (refer to AN6308 - Downsampling measurement with CAEN Digitizer 720/724/740/751 families)

(**) Trigger Logic and Trigger Time Stamp counter operate at 125 MHz (i.e. 8 ns or 1/2 ADC clock cycles), while the counter value is read at a frequency of 62.5 MHz (i.e. 16 ns).

761 Digitizer Family

2/1 Ch. 10-bit 4 GS/s Digitizer

APPLICATIONS

- High resolution Time of Flight
- Optical Physics
- Fast Neutron spectroscopy

FORM FACTOR

VME64 VME64X NIM DESKTOP

FUNCTIONS

WV TS

The fastest Flash ADC of the series

APPLICATION NOTES

- AN3251
- GD2783

Overview

The 761 is the family of CAEN Waveform Digitizers with the highest sampling rate Flash ADC (10 bit @ 4GS/s). It can record fast signals from fast organic, inorganic and liquid scintillators coupled to PMTs or Silicon Photomultipliers, Diamond detectors and others, and save them with high efficiency and precision for advanced timing analysis. The acquisition can be externally vetoed/gated. 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. The acquisition is fully controlled by the WaveDump software, which manages the settings, plots and saves the waveforms. Libraries and demo software in C and LabView are available for integration and customization of specific acquisition systems.

761 family comes in three form factors: VME (2 input channels), NIM (1 input channel) and Desktop (1 input channel). The communication to and from the board is provided through the following interfaces: USB (Desktop and NIM form factors), VMEbus (VME form factor), and Optical Link (all form factors).

Features

- 10-bit @ 4 GS/s
- Analog inputs on MCX coax. connectors
- VME64/VME64X (2 ch.), NIM (1 ch.) and Desktop (1 ch.) modules
- 1 Vpp input dynamic range with programmable DC offset adjustment
- VME, USB and Optical Link communication interfaces
- Multi-board synchronization features
- Daisy chain capability
- Demo software tools, C and LabVIEW libraries

Firmware	Software	WV	TS
WAVEFORM RECORDING	WAVE DUMP CAEN	•	•

Technical Specifications

GENERAL

Form Factor
1-unit wide, 6U VME64/VME64X

1-unit wide NIM

154x50x164 mm^3 (WxHxD) Desktop

ANALOG INPUT

Channels
2 channels, single ended (VME)

1 channel, single ended (NIM, Desktop)

Impedance
50 Ω

Connector
MCX

Full Scale Range (FSR)
1 Vpp

Bandwidth
1 GHz

Offset
Programmable DAC for DC offset adjustement. Range: ±0.5 V

DIGITAL CONVERSION

Resolution
10 bits

Sampling rate
4 GS/s simultaneously on each channel

ADC CLOCK GENERATION

Clock source: internal/external

On-Board PLL provides ADC sampling clock generation from an internal (50 MHz loc. oscillator) or external reference (50 MHz or 62.5 MHz; other options on request) on front panel CLK-IN connector.

MEMORY

7.2 MS/ch or 57.6 MS/ch Multi Event Buffer divisible into 1 ÷ 1024 buffers with independent read and write access

Programmable event size and pre- /post-trigger

TRIGGER

Trigger source
Self-trigger: channel over/under threshold for Common trigger generation

External-trigger: Common by TRG-IN connector

Software-trigger: Common by software command

Trigger propagation
TRG-OUT (VME) / GPO (NIM and Desktop) digital output

Trigger Time Stamp
31-bit counter, 16 ns resolution, 17 s range(*); 48-bit extension by firmware

SYNCHRONIZATION

Clock propagation
Daisy chain (VME only) through CLK-IN/CLK-OUT connectors

One-to-many clock distribution from an external clock source

Clock Cable delay compensation

Acquisition Synchronization
Sync Start/Stop through digital I/O (S-IN, TRG-IN or GPI input, TRG-OUT or GPO output)

External Trigger Time Stamp reset

LVDS I/O (VME only)

16 general purpose LVDS I/Os controlled by FPGA

Busy, Data Ready, Memory full, Individual Trig-Out and other functions can be programmed An Input Pattern from the LVDS I/Os can be associated to each trigger as an event marker

ANALOG MONITOR (VME only)

12-bit/125 MHz DAC FPGA controlled output with four operating modes: Trigger Majority / Test Pulses / Memory Occupancy / Voltage Level

COMMUNICATION INTEFRACE

Optical Link
CAEN CONET proprietary protocol, up to 80 MB/s transfer rate

Daisy chainable: it is possible to connect up to 8/32 ADC modules to a single Optical Link Controller (Mod. A2818/A3818)

USB (NIM and Desktop direct, VME via V1718 bridge)
USB 2.0 compliant

Transfer rate up to 30 MB/s

VME
VME 64X compliant

Data transfer mode: BLT32, MBLT64 (70 MB/s using CAEN Bridge), CBLT32/64, 2eVME, 2eSST (up to 200 MB/s)

POWER CONSUMPTIONS

Desktop: 1.8 A @ 12 V (Typ.)

NIM: 3.9 A @ +6 V, 120 mA @ -6 V

VME: 6.5 A @ +5 V, 200 mA @ +12 V, 300 mA @ -12 V

(*) Trigger Logic and Trigger Time Stamp counter operate at 125 MHz (i.e. 8 ns or 32 ADC clock cycles), while the counter value is read at a frequency of 62.5 MHz (i.e. 16 ns)

Ordering Options

Code	Description	Form Factor
WDT5761XAAAA	DT5761 - 1 Ch.10 bit 4 GS/s Digitizer: 7.2MS/ch, EP3C16, SE	Desktop
WN6761XAAAAA	N6761 - 1 Ch. 10 bit 4 GS/s Digitizer: 7.2Ms/ch, EP3C16, SE	NIM
WV1761XAAAAA	V1761 - 2 Ch.10 bit 4 GS/s Digitizer: 7.2MS/ch, EP3C16, SE	6U-VME64
WV1761CXAAAA	V1761C - 2 Ch. 10 bit 4 GS/s Digitizer: 57.6MS/ch, EP3C16, SE	6U-VME64
WVX1761XAAAA	VX1761 - 2 Ch.10 bit 4 GS/s Digitizer: 7.2MS/ch, EP3C16, SE	6U-VME64X
WVX1761CXAAA	VX1761C - 2 Ch. 10 bit 4 GS/s Digitizer: 57.6MS/ch, EP3C16, SE	6U-VME64X

Accessories

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

A654
MCX to LEMO Cable Adapter

A659
MCX to BNC Cable Adapter

A317
Clock Distribution Cable

A318
SE to Differential Clock Cable Adapter

AI2700
Optical Fiber Series

Cables for CONET Optical Link Networks

DT4700
Clock Generator and FAN-OUT

742 Digitizer Family

32+2/16+1 Ch. 12-bit 5 GS/s Digitizer

APPLICATIONS

- Nuclear and Particle Physics
- Astroparticle Physics
- Time of Flight
- Medical Imaging (PET)

FORM FACTOR

VME64 VME64X NIM DESKTOP

FUNCTIONS

WV TS

Very fast Switched Capacitor Digitizer with high channel density

APPLICATION NOTES

- AN3251
- GD2783

Overview

The 742 is the Switched Capacitor Digitizer family, based on the DRS4 chip by PSI, with the highest sampling frequency (5GS/s) and channel density. It can record very fast signals from scintillators coupled to PMTs, Silicon Photomultipliers, APD, Diamond detectors and others, and save them with high efficiency and precision for advanced timing analysis. The 742 family has an additional channel (two channels in case of VME boards) which can be used as time reference for time of flight measurements. The resolution of this kind of measurements can reach up to 50 ps.

The analog inputs are continuously sampled by the 1024 capacitive cells in the DRS4 chip at a frequency that is software selectable amongst 5 GS/s, 2.5 GS/s, 1 GS/s and 750 MS/s. Once the trigger condition is met, the capacitors are released, data is converted by a 12-bit ADC at a lower frequency and stored into a digital memory buffer. As the sampling and the analog-to-digital conversion are not simultaneous, a dead-time is introduced, during which the board cannot accept other triggers. Multiple boards can be synchronized to build up complex systems.

The acquisition is fully controlled by the WaveDump software, which manages the settings, plots and saves the waveforms. Libraries and demo software in C and LabView are available for integration and customization of specific acquisition systems.

742 family comes in three form factors: VME (32 input channels + 2 additional channels), NIM (16 input channels + 1 additional channel) and Desktop (16 input channels + 1 additional channel). The communication to and from the board is provided through the following interfaces: USB (Desktop and NIM form factors), VMEbus (VME form factor), and Optical Link (all form factors).

Features

- 12-bit @ 5 GS/s, 1024 samples per event
- 5, 2.5, 1 and 0.75 GS/s software selectable sampling frequencies
- Analog inputs on MCX coaxial connectors
- VME64/VME64X (32+2 ch.), NIM (16+1 ch.) and Desktop (16+1 ch.) modules
- 1 Vpp input dynamic range with programmable DC offset adjustment
- VME, USB and Optical Link communication interfaces
- Multi-board synchronization features
- Daisy chain capability
- Demo software tools, C and LabVIEW libraries, Readout Software

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x742 is based on the DRS4 a Switched Capacitor Array. This technology

relies on a set of capacitors that continuously sample the analog input signals. As soon as the trigger is issued, capacitors are decoupled from the input signals with a time interval from each other that is the sampling period.

The trigger therefore freezes the currently stored signal in the sampling capacitance cells. Subsequently the cells are multiplexed into the 12-bit ADC.

Firmware	Software	WV	TS
WAVEFORM RECORDING	WAVE DUMP CAEN	•	•

Technical Specifications

GENERAL

Form Factor
1-unit wide, 6U VME64/VME64X
1-unit wide NIM
154x50x164 mm^3 (WxHxD) Desktop

ANALOG INPUT

Channels
32+2 channels, single ended (VME)
16+1 channels, single ended (NIM, Desktop)

Impedance
50 Ω

Connector
MCX

Full Scale Range (FSR)
1 Vpp (2 Vpp by customization code)

Bandwidth
500 MHz

Offset
Programmable DAC for DC offset adjustment per channel or 8-channel group. Range: ±1 V

TR0 TR1 Analog Inputs
Special inputs (MCX, 50 Ω) for fast local trigger and high resolution timing reference
NIM/LVTTL signals also supported

DIGITAL CONVERSION

Switched Capacitor array
Domino Ring Sampler chip (DRS4) serving 8+1 channels
1024 storage cells per channel (200 ns minimun recorded time per event)

Resolution
12 bits

Sampling rate
5 GS/s simultaneously on each channel (2.5 - 1 - 0.75 GS/s software selectable)

Dead Time for Event A/D Conversion
110 µs analog inputs only; 181 µs analog inputs + TR0, TR1 inputs

CLOCK GENERATION

Synchronization clock source: internal/external
On-Board PLL provides generation of main board clocks from an internal (50 MHz loc. oscillator) or external reference (50 MHz or 58 MHz; other options on request) on front panel CLK-IN connector.

MEMORY

128 kS/ch or 1 MS/ch (1 event = 1024 samples per event) Multi-Event Buffer

TRIGGER

Trigger source
Self-trigger: logic OR combination of channels under/over threshold (each channel self-trigger drives two 8-ch groups)
Fast (Low Latency) trigger programmable threshold on TR0 and TR1 (each TRn signal drives two 8-ch groups)
External-trigger: Common by TRG-IN connector
Software-trigger: Common by software command

Trigger propagation
TRG-OUT (VME) / GPO (NIM and Desktop) digital output

Trigger Time Stamp
30-bit counter, 8.5 ns resolution, 9 s range

LVDS I/O (VME only)

16 general purpose LVDS I/Os controlled by FPGA
Busy, Data Ready, Memory full, Individual Trig-Out and other functions can be programmed An Input Pattern from the LVDS I/Os can be associated to each trigger as an event marker

SYNCHRONIZATION

Clock propagation
Daisy chain (VME only) through CLK-IN/CLK-OUT connectors
One-to-many clock distribution from an external clock source
Clock Cable delay compensation

Acquisition Synchronization
Sync Start/Stop through digital I/O (S-IN, TRG-IN or GPI input, TRG-OUT or GPO output)
External Trigger Time Stamp reset

COMMUNICATION INTEFRACE

Optical Link
CAEN CONET proprietary protocol, up to 80 MB/s transfer rate
Daisy chainable: it is possible to connect up to 8/32 ADC modules to a single Optical Link Controller (Mod. A2818/A3818)

USB (NIM & Desktop direct, VME via V1718 bridge)
USB 2.0 compliant
Transfer rate up to 30 MB/s

VME
VME 64X compliant
Data transfer mode: BLT32, MBLT64 (70 MB/s using CAEN Bridge), CBLT32/64, 2eVME, 2eSST (up to 200 MB/s)

POWER CONSUMPTIONS

Desktop: 1.7 A @ 12 V (Typ.)
NIM: 3.9 A @ +6 V, 90 mA @ -6 V
VME: 5.5 A @ +5 V, 200 mA @ +12 V, 300 mA @ -12 V

Ordering Options

Code	Description	Form Factor
WDT5742XAAAA	DT5742 - 16+1 Ch. 12 bit 5 GS/s Switched-Capacitor Digitizer: 128 events/ch (1kS/event), EP3C16, SE	Desktop
WDT5742BXAAA	DT5742B - 16+1 Ch. 12 bit 5 GS/s Switched-Capacitor Digitizer: 1024 events/ch (1kS/event), EP3C16, SE	Desktop
WN6742XAAAAA	N6742 - 16+1 Ch. 12 bit 5 GS/s Switched-Capacitor Digitizer: 128 events/ch (1kS/event), EP3C16, SE	NIM
WN6742BXAAAA	N6742B - 16+1 Ch. 12 bit 5 GS/s Switched-Capacitor Digitizer: 1024 events/ch (1kS/event),EP3C16, SE	NIM
WV1742XAAAAA	V1742 - 32+2 Ch. 12 bit 5 GS/s Switched-Capacitor Digitizer: 128 events/ch (1kS/event), EP3C16, SE	6U-VME64
WV1742BXAAAA	V1742B - 32+2 Ch. 12 bit 5 GS/s Switched-Capacitor Digitizer: 1024 events/ch (1kS/events), EP3C16, SE	6U-VME64
WVX1742XAAAA	VX1742 - 32+2 Ch. 12 bit 5 GS/s Switched-Capacitor Digitizer: 128 events/ch (1kS/event), EP3C16, SE	6U-VME64X
WVX1742BXAAA	VX1742B - 32+2 Ch. 12 bit 5GS/s Switched-Capacitor Digitizer: 1024 events/ch (1kS/event), EP3C16, SE	6U-VME64X
WPERS0174201	X742 Customization - 2 Vpp Input Range	ALL

Accessories

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

A654
MCX to LEMO Cable Adapter

A659
MCX to BNC Cable Adapter

A317
Clock Distribution Cable

A318
SE to Differential Clock Cable Adapter

AI2700
Optical Fiber Series

Cables for CONET Optical Link Networks

DT4700
Clock Generator and FAN-OUT

743 Digitizer Family

16/8 Ch. 12-bit 3.2 GS/s Digitizer

APPLICATIONS

- Nuclear and Particle Physics
- Astroparticle Physics
- Time of Flight
- Medical Imaging (PET)

FORM FACTOR

VME64 VME64X NIM DESKTOP

FUNCTIONS

WV TS QDC

Very fast Switched Capacitor Digitizer with high channel density

APPLICATION NOTES

- GD2783

Overview

The 743 is the Switched Capacitor Digitizer family, based on the SAMLONG chip and developed in collaboration with CEA/IRFU, with a good compromise between high sampling frequency (3.2GS/s) and channel density. It can record very fast signals from scintillators coupled to PMTs, Silicon Photomultipliers, APD, Diamond detectors and others, and save them with high efficiency and precision for advanced timing analysis.
The analog inputs are continuously sampled by the 1024 capacitive cells in the SAMLONG chip at a frequency that is software selectable amongst 3.2 GS/s, 1.6 GS/s, 0.8 GS/s, and 0.4 GS/s. Once the trigger condition is met, the capacitors are released, data is converted by a 12-bit ADC at a lower frequency and stored into a digital memory buffer. As the sampling and the analog-to-digital conversion are not simultaneous, a dead-time is introduced, during which the board cannot accept other triggers.

On-board charge mode allows for charge integration and fast histogramming. The acquisition can be in coincidence, majority mode and externally gated. Multiple boards can be synchronized to build up complex systems.

The acquisition is fully controlled through the WaveCatcher software by CNRS/IN2P3/LAL, which manages the settings, plots and saves waveforms and histograms, and includes advanced measurements (noise, time, rate). Libraries and demo software in C are available for integration and customization of specific acquisition systems.

743 family comes in three form factors: VME (16 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 (Desktop and NIM form factors), VMEbus (VME form factor), and Optical Link (all form factors).

Features

- 12-bit @ 3.2 GS/s, 1024 samples per event
- 3.2, 1.6, 0.8, 0.4 GS/s software selectable sampling frequencies
- Analog inputs on MCX coaxial connectors
- VME64/VME64X (16 ch.), NIM (8 ch.) and Desktop (8 ch.) modules
- 2.5 Vpp input dynamic range with programmable DC offset adjustment
- One discriminator per channel with programmable threshold
- Adjustable post-trigger delay (up to 1.25 µs @ 3.2 GS/s)
- One embedded pulser per channel for test and reflectometry applications
- On-board charge calculation for fast histogramming
- VME, USB and Optical Link communication interfaces
- Multi-board synchronization features
- Daisy chain capability
- Demo software tools, C and LabVIEW libraries, Readout Software

x743 is based on the SAMLONG, a Switched Capacitor Array. This technology relies on a set of capacitors that continuously sample the analog input signals at a fixed time interval which corresponds to the sampling period. When the trigger is issued, capacitors are decoupled from the input signals after a programmable delay. The trigger therefore freezes the currently stored signal in the sampling capacitance cells. Subsequently the cells are multiplexed into the 12-bit ADC.

x743 features an embedded Charge Mode, where the pulse integration window is defined by the user. This feature allows to perform on-line processing on detector signal directly digitized.

Firmware	Software	WV	TS	QDC
WAVEFORM RECORDING	CAEN WAVECATCHER	•	•	•

Technical Specifications

GENERAL

Form Factor
1-unit wide, 6U VME64/VME64X
1-unit wide NIM
154x50x164 mm^3 (WxHxD) Desktop

ANALOG INPUT

Channels
16 channels, single ended (VME)
8 channels, single ended (NIM, Desktop)

Impedance
50 Ω

Connector
MCX

Full Scale Range (FSR)
2.5 Vpp

Bandwidth
500 MHz

Offset
Programmable DAC for DC offset adjustment
Range: ±1.25 V

DIGITAL CONVERSION

Switched Capacitor array
SAMLONG fast analog memory chip serving 2 channels
1024 storage cells per channel (320 ns minimun recorded time per event)

Resolution
12 bits

Sampling rate
3.2 GS/s simultaneously on each channel (1.6 - 0.8 - 0.4 GS/s software selectable)

Dead Time for Event A/D conversion
125 µs (max. @1024 samples)

CLOCK GENERATION

Synchronization clock source: internal/external
On-Board PLL provides generation of main board clocks from an internal (50 MHz loc. oscillator) or external reference (50 MHz; other options on request) on front panel CLK-IN connector

MEMORY

7 kS/ch (1 event = 1024 samples) Multi-Event Buffer

TRIGGER

Trigger source
Self-trigger: logic combination (OR, AND or MAJORITY) of channels under/over threshold for common trigger generation
External-trigger: Common by TRG-IN connector
Software-trigger: Common by software command

Trigger propagation
TRG-OUT (VME) / GPO (NIM and Desktop) digital output

Trigger Time Stamp
40-bit counter, 5 ns resolution, 90 minutes range (@ 3.2 GS/s)

LVDS I/O (VME only)

16 general purpose LVDS I/Os controlled by FPGA
Busy, Data Ready, Memory full, Individual Trig-Out and other functions can be programmed An Input Pattern from the LVDS I/Os can be associated to each trigger as an event marker

SYNCHRONIZATION

Clock propagation
Daisy chain (VME only) through CLK-IN/CLK-OUT connectors
One-to-many clock distribution from an external clock source Clock Cable delay compensation

Acquisition Synchronization
Sync Start/Stop through digital I/O (S-IN, TRG-IN or GPI input, TRG-OUT or GPO output)
External Trigger Time Stamp reset

COMMUNICATION INTEFRACE

Optical Link
CAEN CONET proprietary protocol, up to 80 MB/s transfer rate
Daisy chainable: it is possible to connect up to 8/32 ADC modules to a single Optical Link Controller (Mod. A2818/A3818)

USB (NIM and Desktop direct, VME via V1718 bridge)
USB 2.0 compliant
Transfer rate up to 30 MB/s

VME
VME 64X compliant
Data transfer mode: BLT32, MBLT64 (70 MB/s using CAEN Bridge), CBLT32/64, 2eVME, 2eSST (up to 200 MB/s)

POWER CONSUMPTIONS

Desktop: 1.5 A @ 12 V (Typ.)
NIM: 2.9 A @ +6 V, 500 mA @ -6 V
VME: 4 A @ +5 V, 625 mA @ +12 V, -12 V not used

Ordering Options

Code	Description	Form Factor
WDT5743XAAAA	DT5743 - 8 Ch. 12 bit 3.2GS/s Switched-Capacitor Digitizer: 7 events/ch (1kS/event), EP3C16, SE	Desktop
WN6743XAAAAA	N6743 - 8 Ch. 12 bit 3.2GS/s Switched-Capacitor Digitizer: 7 events/ch (1kS/event), EP3C16, SE	NIM
WV1743XAAAAA	V1743 - 16 Ch. 12 bit 3.2GS/s Switched-Capacitor Digitizer: 7 events/ch (1kS/event), EP3C16, SE	6U-VME64
WVX1743XAAAA	VX1743 - 16 Ch. 12 bit 3.2GS/s Switched-Capacitor Digitizer: 7 events/ch (1kS/event), EP3C16, SE	6U-VME64X

Accessories

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

A654
MCX to LEMO Cable Adapter

A659
MCX to BNC Cable Adapter

A317
Clock Distribution Cable

A318
SE to Differential Clock Cable Adapter

AI2700
Optical Fiber Series

Cables for CONET Optical Link Networks

DT4700
Clock Generator and FAN-OUT

COMING SOON

DT5550SE

32 Ch. 14-bit 80 MS/s Digitizer

APPLICATIONS
- Segmented Detectors
- PMT, HPGe Detectors
- SiPM Matrices

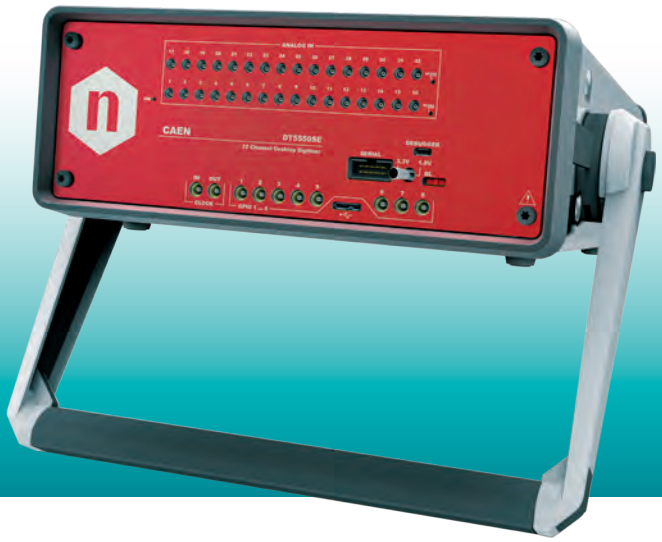
FORM FACTOR

DESKTOP

FUNCTIONS

ICH WV TS PHA OPEN FPGA

Personalize your Digitizer through the open FPGA and programmable I/Os



Features

- 14-bit @ 80 MS/s
- Analog inputs on MCX connectors (single ended)
- Desktop module (32 channels)
- 2 Vpp input dynamic range with programmable DC offset adjustment
- Open FPGA (Xilinx Kintex-7 family)
- Default firmware for waveform recording and trapezoidal filter for PHA
- User-customizable system firmware through the open FPGA and integrated sequencer:
  - Readout of multi-channel detectors with ad-hoc pre-processing logic (e.g. zero suppression, pedestal subtraction)
  - Digitizer with trapezoid filter for PHA or charge integration with ad-hoc filtering chain
  - TDC and time tagging application
  - Waveform digitization
  - Complex triggering logic
- USB3.0 bus for fast data transfer (FTDI Driver Win/Lin/MacOS/ Android)
- Multi-board synchronization features
- 8 programmable I/O on LEMO connectors
- Fully supported by SCI-Compiler software tool for the user application firmware/software design (LICENSE INCLUDED)
- Fully-featured and open source SCI-5550 Readout Software for the default firmware control

Overview

The DT5550SE is a 14-bit and 80 MS/s ADC Digitizer with 2 Vpp of input dynamic range and DC offset adjustment, developed with the Nuclear Instrument technical partnership.

It is available in a compact desktop form factor providing 32 analog input channels on single ended MCX connectors. The DT5550SE is well suited either for multi-channel segmented detectors, or PMT coupled detectors, HPGe and SiPM matrices.

Thanks to the on-board open FPGA and I/Os, the user can develop customized firmware for the most common readout and processing functions. Sequencer, waveform recorder with pre-processing or digitizer with post-processing algorithms, TDC, complex trigger logic, and real-time signal processing can be implemented ad hoc. The integrated debugger, accessible by USB, allows debugging and fast firmware upgrading directly to the FPGA (compatible with Xilinx tools for advanced users).

The digitizer is provided with a SCI-Compiler license. This software is a complete compiling tool which allows to develop the firmware application, even without being an expert of FPGA programming languages, and to easily and fastly load the firmware on the board. It also offers tools to design GUI-based control software. For each firmware project, the relevant drivers and libraries (C, C++, C#, Python) are automatically generated by SCI-Compiler.
In order to start using the DT5550SE right away, the digitizer is equipped with a default firmware implementing the waveform recording and charge integration functions, fully controlled by SCI-5550 Readout Software. This software configures the acquisition system parameters, manages the realtime oscilloscope feature and the pixel-indipendent energy spectrum calculation. Common trigger or independent channel trigger mode can be selected; the result is shown in a heat map plot. The detector map can be easily configured by the user. The user can further customize the firmware and software, by mean of the provided relevant SCI-Compiler projects.

Firmware	Software	ICH	WV	TS	PHA	OPEN FPGA
SCI 5550	SCI 5550 readout software CAEN	•	•	•	•	SCI-COMPILER CAEN

Technical Specifications

GENERAL

Form Factor
255x140x330 mm^3 (WxHxD) Desktop

ANALOG INPUT

Channels
32 channels, single ended

Impedance
50 Ω

Connector
MCX

Full Scale Range (FSR)
2 V

Bandwidth
40 Mhz

Offset
Adjustable DC offset in the full scale range

DIGITAL CONVERSION

Resolution
14 bits

Sampling rate
80 MS/s simultaneously on each channel

ADC CLOCK GENERATION
Clock source: internal/external

On-board PLL provides ADC sampling frequency generation from internal (25 MHz loc. oscillator) or external (CLOCK IN LEMO connector) reference

MEMORY
16000 S/ch

FPGA

Open FPGA
Xilinx XC7K160T (Kintex-7 family)

TRIGGER

Trigger sources
Internal/external (managed by the default firmware)

Complex trigger logic implementable by the user on the Open FPGA

Trigger propagation
Through programmable LEMO I/O

Trigger Time Stamp
Configurable by the Open FPGA

Default firmware: 32-bit counter, 12.5 ns resolution, 50 s range

SYNCHRONIZATION

Clock propagation
LEMO Clock IN/OUT connectors

Acquisition Synchronization
Through programmable LEMO I/O

COMMUNICATION INTERFACE

USB 3.0
transfer rate up to 240 MB/s, back compatible with USB 2.0

POWER CONSUMPTIONS
0.5A @ 12V (Typ.)

Ordering Options

Code	Description	Form Factor
WDT5550XSEAAA	DT5550SE - 32 Ch. 14 bit 80 MS/s Digitizer: Open FPGA, Single Ended	Desktop

Accessories

A654
MCX to LEMO Cable Adapter

A659
MCX to BNC Cable Adapter

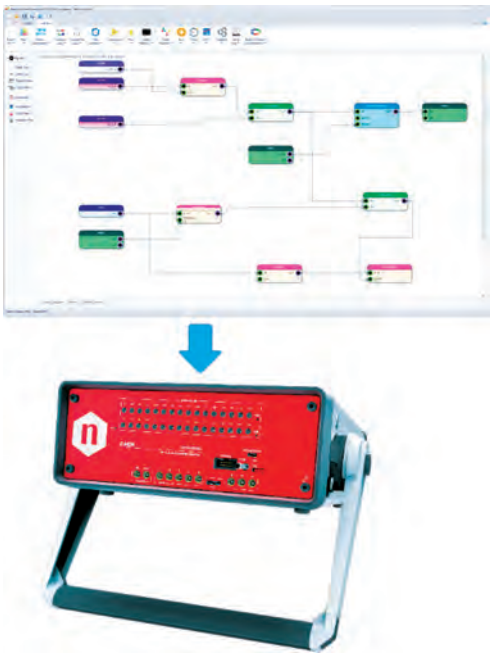
Software

SCI-Compiler

SCI-Compiler software is a graphical platform for easy FPGA programming provided with DT5550SE to realize a complete custom firmware. It allows to:

- Automatically generate the VHDL source code, with no need of FPGA programming expertise, the drivers and libraries (C/C++/C#/Python) compilable in Windows/Linux/MacOS;
- Load the custom firmware directly on the FPGA ;
- Automatically generate example code (to be compiled on Windows/Linux/MacOS)
- Design GUI-based control interfaces.

Refer to page 132 for a detailed description.



Acquistion Modes

Firmware and Sofware Selection

Thanks to their flexibility, CAEN Digitizers can be operated as pure waveform recorders or can run special algorithms to process the digitized pulses and extract a set of significant information like energy, pulse shape and precise timing.

Each acquisition mode makes use of a specific firmware and software to tailor the digitizer capabilities to the user's needs.

Hardware

Open FPGA Digitizer

SCI-COMPILER CAEN

Firmware

Waveform Recording Firmware

WAVEFORM RECORDING

Digital Pulse Processing (DPP) Firmware

DPP DAW | DPP ZLE PLUS | DPP PHA | DPP QDC | DPP PSD

Demo Firmware

SCI 5550

Custom Firmware

Software

Waveform Recording Software

SCOPE CAEN

WAVE DUMP CAEN

CAEN WAVECATCHER

DPP Software

CoMPASS CAEN | MC² CAEN

ZLE+ CAEN | QDC CAEN

DAW CAEN

Demo Software

SCI 5550 readout software CAEN

Auto generated Software

Custom Software

Custom Driver

Custom Library

CAEN Electronic Instrumentation

Modular Pulse Processing Electronics

DIGITIZER SOFTWARE & FIRMWARE

NEW

SCI-Compiler

User Firmware Generator and Compiler for CAEN Programmable Boards

FREE TRIAL

Supported boards

digitizers:
DT5550SE

other boards:
DT5495
V2495
DT5550
DT5550W

Open FPGA Tool

Features

- Block diagram based user firmware generator and compiler for CAEN programmable boards:
  - DT5495 - V2495 Programmable Logic Unit support (LICENSE NOT INCLUDED)
  - DT5550, DT5550SE and DT5550W support for pulse processing and readout system development (LICENSE INCLUDED)
- Automatic VHDL generation starting from logic blocks and virtual instruments
- Very simple generation of complex logic: schematics based design
- Advanced signal processing block: PHA based on Trapezoidal Filter, Charge Integration or Peak Stretcher, 500 ps resolution TDC, Oscilloscope, Digitizer, MCA (DT5550 only)
- Advanced sequencer Design based on graphical representation of State Machine ideal to implement custom ASIC readout system
- Automatic generation of drivers, libraries and demo software for Windows, Linux and macOS to implement communication between devices and PC software through USB, ethernet and VME protocol.

It creates

- Software and C/C++/C#/Python Libraries
- Driver
- Firmware

Common Application

- Readout of digital and analog ASICs using DT5550 or DT5550W
- Complex trigger logic
- Event Counters
- Single Channel (SCA) and Multi Channel Analyser (MCA)
- Time to Digital Converter
- Replacement for any old digital NIM module logic based system
- Time tagging logic
- Particle realtime Time of Arrival distribution calculation
- Waveform digitizer
- Logic Analyzer
- X-Ray and Gamma Ray Imaging
- SiPM testing and characterization (using DT5550-AFEs and DT5550)
- Custom board prototyping

Overview

SCI(entific) Compiler is Windows based software designed to accelerate the firmware implementation for signal processing in scientific instrumentation and is targeted to generate custom applications for nuclear physics world. SCI-Compiler is an automatic code generator that, starting from a graphical block diagram, generates a VHDL piece of code that implements the required function. Moreover, SCI-Compiler is able to generate C libraries and drivers to be used in Windows, Linux and macOS for software implementation.

SCI-Compiler uses a prebuilt library set containing macroblocks with complex function. Each macroblock could be imagined as a modular instrument (MCA, Oscilloscope, Digitizer, TDC) that the user could connect with each other.

Programming with SCI-Compiler is much more similar to implement an experimental setup than developing a software.

What is SCI-Compiler

The increasing use of programmable logic devices in trigger and data acquisition systems makes clear that having a general purpose platform and technicians dedicated to the firmware development is becoming more and more important. The advantage of employing programmable logic devices with respect to standard logic modules (like NIM logic modules) is remarkable: a single programmable logic device includes the potentiality of hundreds of thousands of standard logic modules. For the technicians, who usually work with standard logic modules, the use of specific languages like VHDL or Verilog for the firmware development could represent a limitation in the spread of these powerful devices.

We introduce an innovative method to simplify the firmware development. This method is based on a graphical programming interface consisting of blocks specifically developed for nuclear physics applications. For instance, any trigger logic could be implemented by connecting specific blocks in the graphical interface, as easily as physically connecting NIM modules in a rack.

The SCI-Compiler software allows to develop both purely digital applications, exploiting blocks like scaler, counter, pattern matching, logic analyzer and state machine, and analog processing applications, such as custom multichannel analyzer using charge integration, trapezoidal filter, spectrum and oscilloscope blocks. In addition, the SCI-Compiler

software provides the function to read and test the ASICs, enabling the user to develop a sequencer for the ASIC control.

The SCI-Compiler software focuses the attention only on the functional blocks of the application to be implemented and does not require a deep knowledge of the device in use, enabling the employment of programmable logic devices also to users who are not experts in firmware development.

Supported Hardware

SCI-compiler has been designed to generate code for some particular hardware platform designed by CAEN. Presently, SCI-Compiler supports the following CAEN products:

- DT5495 - V2495 Programmable Logic Units (pp. 174, 156)
- DT5550 DAQ System with User Programmable FPGA and sequencer (p. 172)
- DT5550SE Digitizer (p. 118)
- DT5550W Weeroc ASICs Development system (p. 212)

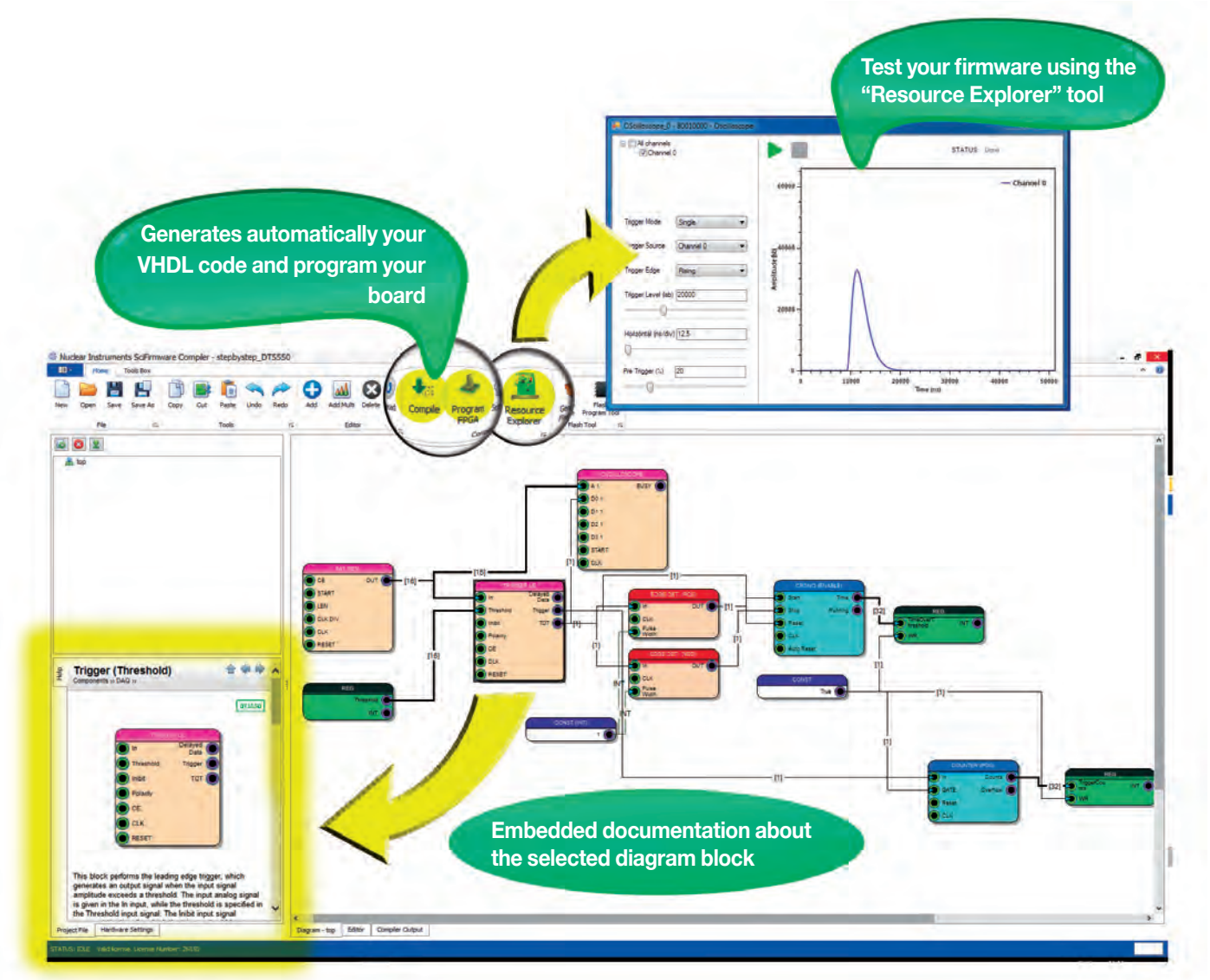
SCI-Compiler License

The SCI-Compiler license unlocks all feature needed to manage the target board and includes one year of free upgrade.

SCI-Compiler works with a physical license key, included in the delivered kit, and a code, generated by SCI-Compiler, which is strictly linked to the board.

Ordering Option

Code	Description
WSW555XAAAAA	SW555 - SCI-Complier User Firmware Generator



Block diagram of a firmware in SCI-Compiler

CoMPASS

Multiparametric DAQ Software for Physics Applications

FREE

Digitizer Family
720 724
725 730
740(*)(**) 751

Digital Pulse Analyzer
DT5790(**)

MCA Family
780, 781(**)

(*) 740D models only
(**) Coming Soon

Supported Firmware

DPP PSD | DPP PHA | DPP QDC CS | FREE TRIAL

DAQ Software Tool for CAEN Digital Pulse Processing

Features

- Software for simultaneous DPP acquisition, including DPP-PHA, DPP-PSD and DPP-QDC (Coming Soon)
- Multi-board management
- Synchronization of multiple boards even from different families, Time Correlation between different channels
- Simultaneous plot of waveforms, energy, time, PSD, and TOF spectra
- Energy calibration
- Digital Constant Fraction Discrimination for fine time stamp interpolation (pico second intrinsic resolution)
- Selectable filters on energy, time and PSD
- Advanced data saving options:
  - Data from board is recorded for the whole acquisition run
  - Time ordered recording of channels acquired data (list mode)
  - Spectra saving
- Data can be retrieved offline for additional filtering and analysis
- ROOT format data saving

Applications

- Nuclear spectroscopy
- Clover detectors
- HPGe, Silicon Drift Detectors
- Neutron physics with scintillation detectors
- Multiple boards synchronization
- Homeland security
- Precise Timing for Time of Flight measurements

Overview

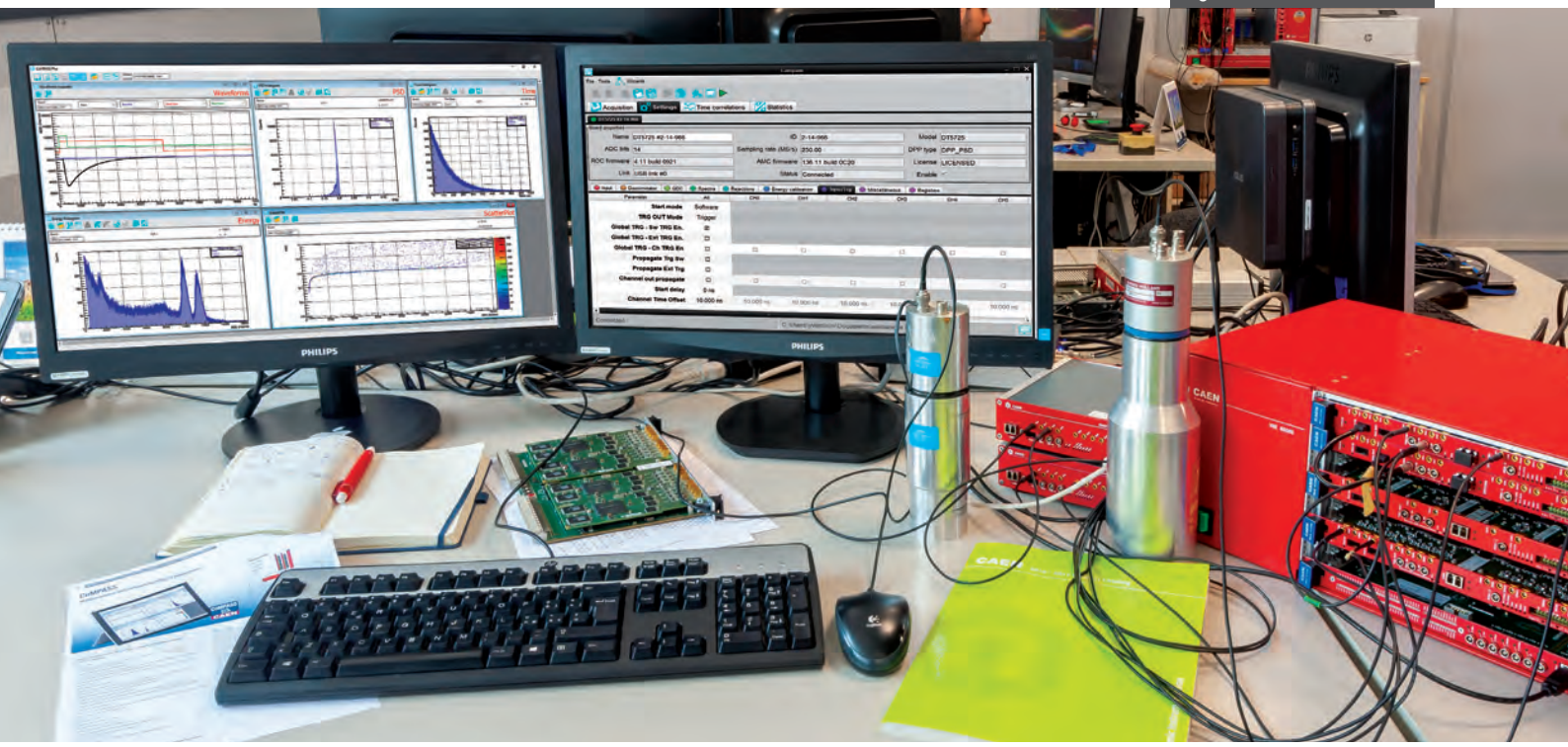
CAEN Multi-PArameter Spectroscopy Software (CoMPASS) is the DAQ software from CAEN able to implement a Multiparametric Data Acquisition for Physics Applications: the detectors can be connected directly to the digitizers/MCAs inputs and the software acquires energy, timing, and PSD spectra at the same time.

CoMPASS software has been designed as a user-friendly interface to manage the acquisition with all the CAEN DPP algorithms. It allows an easy setting of the acquistion parameters and to display up to six different plots and histograms at the same time.

CoMPASS can manage multiple boards and allows an easy synchronization of multiboard systems. Among the most important features, CoMPASS allows to implement event correlation between different channels (in hardware and/or software), apply energy, PSD and time selections, calculate and show the acquistion statistics (trigger rates, data throughput, percentage of discarded events due to the selections, etc...), perform a basic mathematical analysis of the recorded spectra (ROI selection, background subtraction, peak fitting, etc), save the output data files (raw data, lists, waveforms, spectra) and use the saved files to run offline with different processing parameters.

The user familiar with the ROOT Analysis Framework, CoMPASS provides also the possibility of saving the output files (lists waveforms and spectra) in the ROOT TTree format for an easy post processing with user made analysis code.

CoMPASS software supports CAEN x720, x724, x725, x730, x751 digitizer families running the DPP-PSD and DPP-PHA, and the x781 MCA family. Support for x740D with DPP-QDC, to the CAEN DT5780 MCA and to the DT5790 Analyzer is coming soon.



Multiboard management and data acquisition with CoMPASS.
CoMPASS is able to handle different boards, with different form-factor, running supported DPP firmware, even in synchronized mode.
A powerful tool to easily manage extended experimental setup, where different measurements from more detectors are needed

Software	Firmware	Features	720	724 (1)	725	730	740 (2)	751
CoMPASS CAEN	DPP PSD	ICH (Independent channels)	●		●	●		●
		WV (Waveforms)	●		●	●		●
		TS (Timestamp)	●		●	●		●
		TDC (Time to Digital Converter)			●	●		●
		QDC (Charge to Digital Converter)	●		●	●		●
		CFD (Constant Fraction Discriminator)			●	●		●
		PSD (Pulse Shape Discrimination)	●		●	●		●
	DPP PHA	ICH (Independent channels)		●	●	●		
		WV (Waveforms)		●	●	●		
		TS (Timestamp)		●	●	●		
		PHA (Pulse Height Analysis)		●	●	●		
		TDC (Time to Digital Converter)			●	●		
	DPP QDC	ICH (Independent channels)					●	
		WV (Waveforms)					●	
		TS (Timestamp)					●	
		QDC (Charge to Digital Converter)					●	

(1) DPP-PHA firmware is no longer supported for x724 models with C4 AMC FPGA option
(2) DPP-QDC firmware runs only on x740D models

WaveDump

Open Source Acquisition Software for Developers

FREE

Digitizer Family

720 724
725 730
740 742
751 761

Supported Firmware

WAVEFORM RECORDING

FREE

Features

- Basic console for waveforms acquisition
- Multichannel waveform plot
- Advanced mode configuration:
  - common board settings
  - individual settings for threshold and DC offset adjustment
  - 725-730-751 ADC calibration
- Advanced mathematical functions: amplitude spectra and FFT
- Configuration of 742 boards and DRS4 chip corrections
- Family-specific function setting (e.g. Decimation for 724 and 740 boards)
- Multi format (ASCII, binary) data saving
- Source files and Visual Studio project open source for developers

Overview

WaveDump is a basic console application supporting digitizers running Waveform Recording firmware. WaveDump 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. It is then possible to read the data, display the readout and trigger rate. Moreover, it is possible to apply some post-processing (e.g. FFT and amplitude histogram), save data into a file and also plot the waveforms using Gnuplot third-party graphical utility.

WaveDump is a very helpful example of C code demonstrating the use of libraries and methods for an efficient readout and data analysis. Expert users can start with this demo to write their own acquisition software to exploit the full potentialities of the digitizers. Source files and the VS project are available for free download.

Applications

- Signal inspection and waveform recording
- Research and development of prototypes
- Data collection for offline statistical analysis
- Beam monitoring
- Sensors readout and detectors' performances
- Lidar

Software	Firmware	Features	720	724	725	730	740	742	751	761
WAVE DUMP CAEN	WAVEFORM RECORDING	WV (Waveforms)	●	●	●	●	●	●	●	●
		TS (Timestamp)	●	●	●	●	●	●	●	●

FREE

MC²Analyzer

User Friendly Software for Digital Pulse Height Analysis

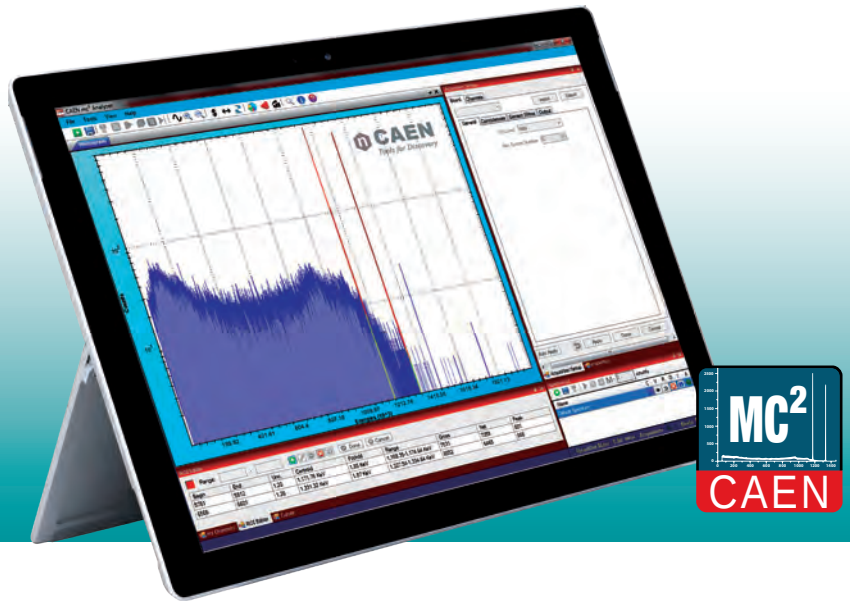
Digitizer Family

724
725
730

Supported Firmware

FREE TRIAL

DPP PHA



Overview

MC²Analyzer is a software specifically designed to manage CAEN Digital MCAs (780/781 families, Hexagon, DT5770, and Gamma *stream*) as well as CAEN digitizers running DPP-PHA firmware, like 724, 725 and 730 families.

The DPP-PHA firmware implements a digital trapezoidal filter on the input pulse, which replaces the traditional analog chain of shaping amplifier and peak sensing ADC. The MCA is therefore directly connected to the charge sensitive preamplifier, with no need of additional devices. The PHA algorithm is able to perform online baseline restoration, ballistic effect corrections, and to manage the pile-up for the live time information. PHA and time-stamped list acquisition modes are available.

MC²Analyzer software allows the user to program the relevant DPP-PHA parameters, to manage the HV channels configuration (x780, Hexagon and Gamma *stream* only), to collect the spectra and perform basic mathematical analysis, like energy calibration, peak search, background subtraction, peak fitting, etc.

The software is designed with multi-channel and multi-board capabilities: it can handle several boards and manage the data acquisition from each of them at the same time.

Features

- Designed for:
  - 724, 725 and 730 Digitizer families
  - 770/780/781 Digital MCA families, Hexagon and Gamma *stream*
- Trapezoidal filter replacing shaping amplifier and peak sensing ADC
- Online baseline restoration and ballistic effect correction
- Online pile-up correction for live-time measurement
- PHA and time-stamped list mode available
- Full setting of all the relevant DPP-PHA parameters and power supplies for DT5780, Hexagon and Gamma *stream*
- Complete simultaneous control of multiple boards
- Basic mathematical analysis on collected spectra (peak search, background subtraction, peak fitting, etc.)
- Provides Energy, Time Stamp lists and histograms in ASCII and ANSI N42.42 format (energy spectra for D5770 only)

Applications

- Nuclear spectroscopy
- HPGe, silicon drift, silicon strip detectors
- Slow scintillation detectors like NaI(Tl)
- Anti-compton shielding
- Homeland security
- Environmental survey
- Ion beam analysis
- Nuclear medicine

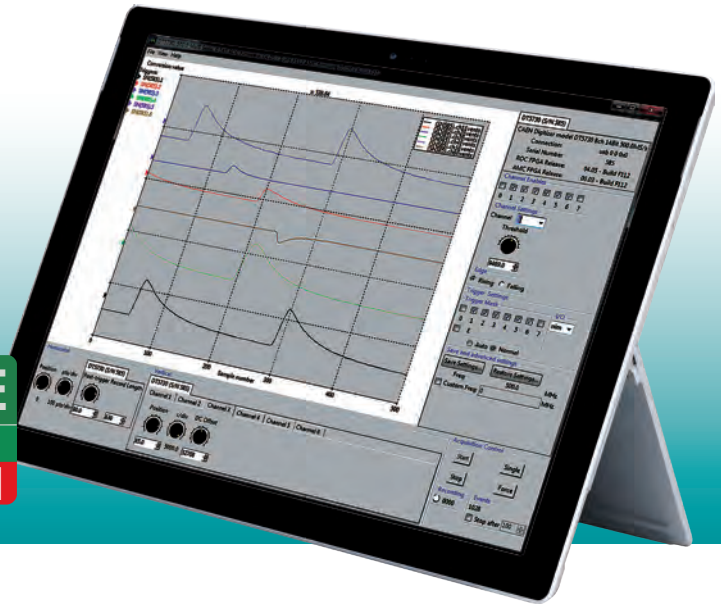
Software	Firmware	Features	724 (1)	725	730
MC² CAEN	DPP PHA	ICH (Independent channels)	●	●	●
		WV (Waveforms)	●	●	●
		TS (Timestamp)	●	●	●
		PHA (Pulse Height Analysis)	●	●	●
		TDC (Time to Digital Converter)		●	●

(1) DPP-PHA firmware is no longer supported for x724 models with C4 AMC FPGA option

CAENScope

Signal Inspection and Waveform Recording Software

FREE



Digitizer Family

720 724
725 730
740 751

Supported Firmware

WAVEFORM RECORDING

FREE

Features

- User friendly single frame GUI with intuitive controls
- Extended plot and record capability of 12 simultaneous traces
- High configuration flexibility:
  - individual channel enable/disable
  - individual channel trigger threshold and DC offset adjustment
  - common trigger among channels
  - external trigger enable/disable
  - auto trigger
  - arithmetic operations between channels
  - continuous data recording or by number of events
- Multi-format (ASCII, binary) data saving
- Import/Export of recorded waveforms and software settings
- Compliant with Windows and Linux platforms

Overview

CAENScope is a user friendly software interface to specifically control CAEN digitizers running Waveform Recording firmware.

CAEN Scope allows the user to easily connect to a single board, retrieve the hardware information, manage the acquisition and data recording.

Parameters and controls are all arranged in a single frame to manage the channels, the trigger (e.g. external, software or channel trigger) and the traces (e.g. vertical and horizontal digital settings, and hardware settings as well). Up to 12 traces can be simultaneously plotted.

A wave recording session can be programmed even by number of events and then saved to files in a Binary (SQLite db) or Text (XML) format. It is possible to load a recorded session and have it on the display with the recording date and the trace from each enabled channel, scrolling it event by event. The user can also export and import the software settings at his convenience.

Applications

- Signal inspection and waveform recording
- Research and development of prototypes
- Data collection for offline statistical analysis
- Beam monitoring
- Sensors readout and detectors' performances
- Lidar

Software	Firmware	Features	720	724	725	730	740	751
SCOPE CAEN	WAVEFORM RECORDING	WV (Waveforms)	●	●	●	●	●	●
		TS (Timestamp)	●	●	●	●	●	●

FREE

WaveCatcher

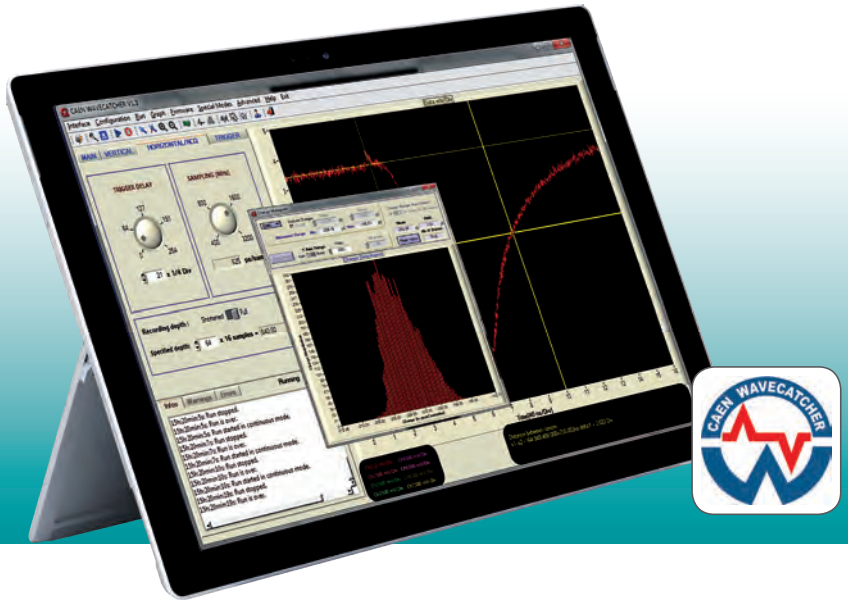
Advanced Software Tool for 743 Digitizers

Digitizer Family

743

Supported Firmware

FREE



Overview

The WaveCatcher software and the Waveform Recording firmware for 743 family is a complete oscilloscope-like tool made by CNRS/IN2P3/LAL, which is able to control a single board belonging to the CAEN 743 Digitizer series.

A graphical user friendly interface is available to take benefit of all the functions of the hardware: selectable sampling frequency, different trigger modes, waveforms and charge data acquisition, channel pulses, etc.

The system also features different tools for on-line measurements and histograms plotting: graphical cursors, noise level, raw hit rates, charge amplitude and time measurements, time distance histograms between channels (fixed threshold and digital CFD methods), charge histograms, FFT, etc.

All acquired data and computed measurements can be saved to files for further off-line analysis.

Features

- Software by CNRS/IN2P3/LAL to control x743 digitizers
- Single-board communication and data acquisition management
- Friendly Graphical User Interface for board configuration and on-line measurements setting
- Waveforms, charge and time histograms advanced plotting
- Advanced menu for Rate, Noise and Time measurements
- Saving and recalling options for configuration parameters and data
- Data saving (waveforms and/or measurements) in ASCII and Binary file formats for storage or off-line analysis
- Compliant with Windows OS and Linux (Coming Soon)

Applications

- Signal inspection and waveform recording
- Research and development
- Precise timing for Time of Flight measurements
- Lidar

Software	Firmware	Features	743
		WV (Waveforms)	●
		TS (Timestamp)	●
		QDC (Charge to Digital Converter)	●

DPP-PSD

Digital Charge Integration and Pulse Shape Analysis

FREE TRIAL

Digitizer Family

720
725
730
751

Supported Software

CoMPASS CAEN

FREE

Features

- Digital solution equivalent to Dual Gate QDC + Discriminator + Gate Generator
- Double charge integration for Pulse Shape Discrimination
- Single gate integration for energy spectra calculation
- Self-Gating (no discriminator) with digital noise filtering
- No delay line is needed to fit the position of the pulse inside the gate
- Programmable width and position of the two gates
- Automatic baseline subtraction (pedestal)
- Digital Constant Fraction Discrimination for fine time stamp interpolation (pico-second intrinsic resolution)
- Dead-timeless acquisition (no conversion time)
- On-line coincidences/anti-coincidences acquisition mode among channels
- Extremely high dynamic range
- Timing information (pulse time stamps)
- Free downloadable firmware trial version

Applications

- Spectroscopy with scintillation organic/inorganic detectors
- SiPM readout systems
- Neutron physics with liquid scintillation detectors
- Acquisition from phoswich detectors
- Time-dependent spectroscopy
- Precise timing for Time of Flight measurements
- Homeland security
- Neutron imaging
- PET
- Tagged neutron for inspection systems

Overview

DPP-PSD firmware is fully controlled by CoMPASS, the CAEN multi-parametric spectroscopy software for Physics applications.

A digitizer running the DPP-PSD firmware becomes a multichannel data acquisition system for nuclear physics or other applications requiring radiation detectors. The digitizer accepts signals directly from the detector and implements a digital replacement of Dual Gate QDC, Discriminator and Gate Generator. All these functions are performed inside the board FPGA without any use of external cables, nor additional boards or delay lines. Therefore, a single compact system takes care of the acquisition, replacing the traditional analog boards. It is also possible to realize multi-board systems: the front panel clock, the trigger and the general purpose LVDS I/Os connectors (VME only) make possible the synchronization of multiple boards.

Ordering Option

Code	Description
WFWDPPNGAA20	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (8ch x 720)
WFWDPPNGAA51	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (8ch x 751)
WFWDPPNGAA30	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (16ch x 730)
WFWDPPNGAA25	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (16ch x 725)
WFWDPPNGAD20	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (4/2ch x 720)
WFWDPPNGAD25	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (8ch x 725)
WFWDPPNGAD30	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (8ch x 730)
WFWDPPNGAD51	DPP-PSD - Digital Pulse Processing for Pulse Shape Discrimination (4ch x 751)

Software	Firmware	Features	720	725	730	751
CoMPASS CAEN	DPP PSD	ICH (Independent channels)	●	●	●	●
		WV (Waveforms)	●	●	●	●
		TS (Timestamp)	●	●	●	●
		TDC (Time to Digital Converter)		●	●	●
		QDC (Charge to Digital Converter)	●	●	●	●
		CFD (Constant Fraction Discriminator)		●	●	●
		PSD (Pulse Shape Discrimination)	●	●	●	●

FREE TRIAL

DPP-QDC

Digital Pulse Processing for Charge to Digital Converter

Digitizer Family

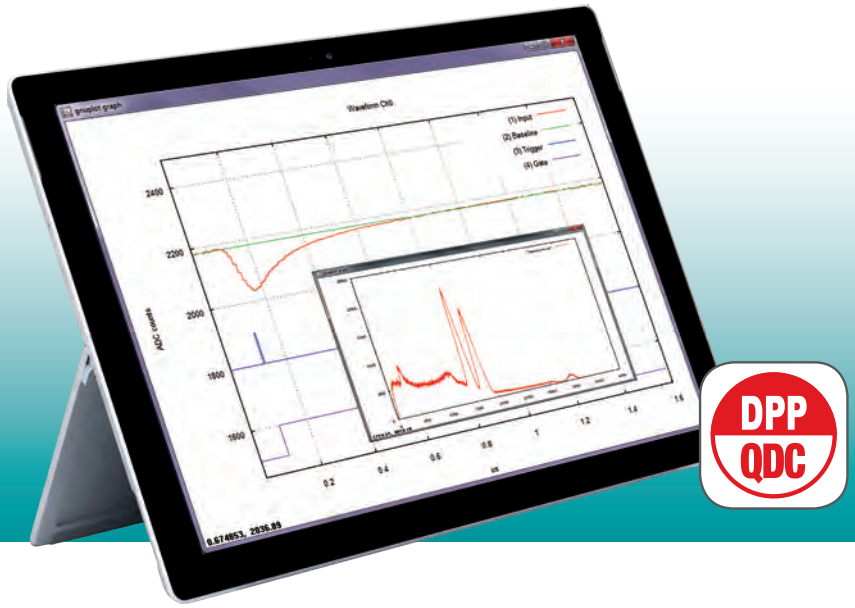
740(*)

(*) 740D models only

Supported Software

FREE CoMPASS CAEN

FREE QDC CAEN



Overview

Tired of your old QDC? Try the new digital QDC algorithm for 740 digitizer series. Digital QDC is specifically supported by x740D models mounting EP3C40 Altera FPGA. 740D digitizer series running DPP-QDC firmware become multi-channel 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 Single Gate QDC, Discriminator and Gate Generator.

The algorithm is able to self-trigger up to 32/64 channels independently, according to the board form factor. Furthermore, the trigger filter of each channel can be programmed independently to allow for a fine tuning of the threshold. The integration gate itself can be programmed independently to get the best resolution from different detector systems.

The new digital QDC is able to self gate on the input pulse with no need of additional delay lines, nor external discriminator.

It is particularly suitable for segmented detector configuration, where multiple channels need to be acquire simultaneously.

DPP-QDC firmware is fully supported by CoMPASS, the CAEN multi-parametric spectroscopy software for Physics applications.

A demo software (DPP-QDC Demo Software) is available with C source files and Visual Studio project to help users to dial with the DPP-QDC firmware and develop their own control software. CoMPASS support to DPP-QDC is coming soon.

Ordering Option

Code	Description
WFWDPPQDCAAA	DPP-QDC- Digital Pulse Processing for Time Stamped Digital QDC (64ch x 740)
WFWDPPQDCDAA	DPP-QDC- Digital Pulse Processing for Time Stamped Digital QDC (32ch x 740)

Features

- Digital solution equivalent to Single Gate QDC + Discriminator + Gate Generator
- **Runs only on x740D models**
- Single gate integration for Energy spectra calculation
- Self-Gating (no discriminator) with digital noise filtering
- No delay line is needed to fit the position of the pulse inside the gate
- Independent 32 (Desktop, NIM) - 64 (VME) channel self-trigger
- Trigger adjustment for single channel
- Programmable gate width and position for single channel
- Automatic Baseline subtraction (pedestal)
- Dead-timeless acquisition (no conversion time)
- Provides also timing information (pulse time stamps)
- Free downloadable firmware trial version
- Demo software to handle 740 digitizer family running DPP-QDC firmware
- Fully supported by CoMPASS, the CAEN multi-parametric spectroscopy software for Physics applications (Coming Soon)

Applications

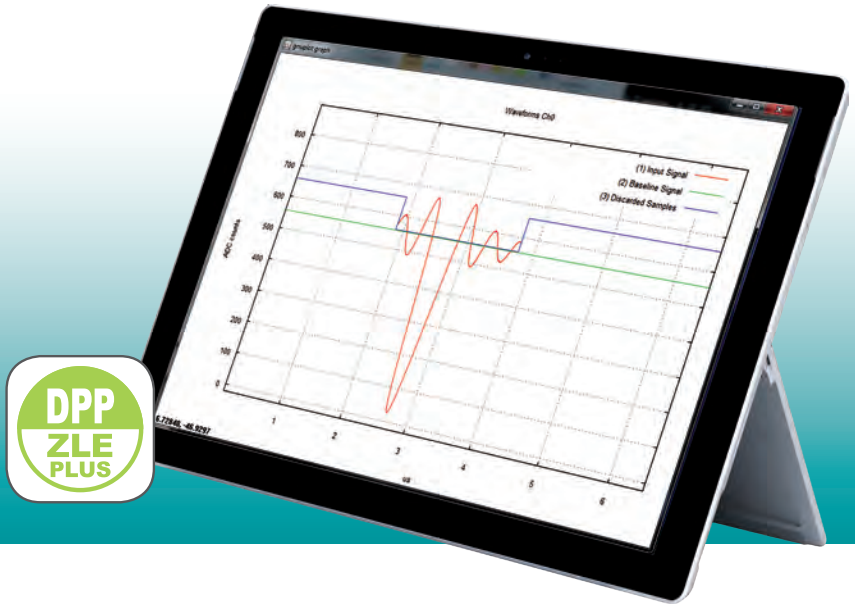
- Spectroscopy with scintillation detectors, as NaI(Tl), $LaBr_3$(Ce), $CeBr_3$
- Suitable for applications with detector arrays
- Homeland security
- Environmental survey
- Compton camera

Software	Firmware	Features	740
CoMPASS CAEN, QDC CAEN	DPP QDC	ICH (Independent channels)	●
		WV (Waveforms)	●
		TS (Timestamp)	●
		QDC (Charge to Digital Converter)	●

DPP-ZLEplus

Advanced Zero Length Encoding

FREE TRIAL



Digitizer Family

725
730
751

Supported Software

ZLE+ CAEN

FREE

Features

- Input signal baseline calculation channel by channel
- Acquisition window generated by an external trigger
- Enhanced Zero Suppression of input signals within the acquisition window
- Upper and Lower Threshold referred to the baseline or to an absolute value
- Programmable Look Back and Look Ahead windows
- Timing information (trigger time stamps)
- Data plotting using Gnuplot graphical engine
- Source files and Visual Studio project provided for developers

Applications

- Neutrino experiments
- Large number of detectors driven by an external trigger
- Drift chambers, TPC, Cherenkov detectors
- Application requiring an effective data reduction

Overview

CAEN provides open source demo software for a first approach to DPP-ZLEplus algorithm principles and basic control of the digitizer.

The Zero Length Encoding (DPP-ZLEplus) firmware has been developed for the 725, 730 and 751 digitizer families. It allows the user to transfer the digitized waveforms in compressed mode, performing an enhanced Zero Suppression algorithm on the input signals.

DPP-ZLEplus continuously calculates the baseline of the input signals and, whenever an external trigger occurs, it searches for the significant input pulses within a user-defined acquisition window. An input pulse is considered significant if it either exceeds an Upper Threshold or falls below a Lower Threshold referred either to the calculated baseline or absolute values.

A demo software (DPP-ZLEplus Demo Software) is available with C source files and Visual Studio project to help users to dial with the DPP-ZLEplus firmware and develop their own control software.

Ordering Option

Code	Description
WFWDPPZLAA51	DPP-ZLEplus - Digital Pulse Processing Zero Length Encoding for (8ch x 751)
WFWDPPZLAD51	DPP-ZLEplus - Digital Pulse Processing Zero Length Encoding for (4ch x 751)
WFWDPPZLAA25	DPP-ZLEplus - Digital Pulse Processing Zero Length Encoding for (16ch x 725)
WFWDPPZLAA30	DPP-ZLEplus - Digital Pulse Processing Zero Length Encoding for (16ch x 730)
WFWDPPZLAD25	DPP-ZLEplus - Digital Pulse Processing Zero Length Encoding for (8ch x 725)
WFWDPPZLAD30	DPP-ZLEplus - Digital Pulse Processing Zero Length Encoding for (8ch x 730)

Software	Firmware	Features	725	730	751
ZLE+ CAEN	DPP ZLE PLUS	WV (Waveforms)	●	●	●
		TS (Timestamp)	●	●	●
		ZS (Zero Suppression)	●	●	●

FREE TRIAL

DPP-DAW

Channel Independent Zero Suppression with Dynamic Acquisition Window

Digitizer Family

724
725
730

Supported Software

FREE

Overview

The Dynamic Acquisition Window (DPP-DAW) firmware has been developed to improve the zero suppression capabilities of the CAEN 724, 725 and 730 digitizer family and allow for trigger-less acquisition systems.

By running DPP-DAW firmware, each digitizer channel is able to self-trigger and acquire data independently from the others.

DPP-DAW can dynamically adjust the record length of every triggered event according to its Time Over Threshold to fit the actual duration of the input pulses. This prevents that a pulse larger than the expected gets chopped because of a too short acquisition window.

DPP-DAW is able to continuously evaluate the signal baseline and refer a trigger threshold to its value. Therefore, the threshold can follow the baseline drift of the input signal without changing the trigger conditions of the data acquisition system.

The user can set a minimum record length, a pre-trigger and a minimum under-threshold not to lose those samples of interest before and after the Time Over Threshold. This allows for a full reconstruction of the digitized pulses.

DPP-DAW can accept an external veto to inhibit the data acquisition. A programmable input delay is available to compensate for the latency due to the veto generation if managed by an external logic unit.

It is possible to store not only the over-threshold part of the significant pulses, but also the samples before and after the threshold crossing points by means of programmable Look Back and Look Ahead windows.

CAEN provides open source demo software (DPP-DAW Demo Software) for a first approach to DPP-DAW algorithm principles and basic control of the digitizer.

Features

- Independent channel self-trigger
- Automatic adjustment of the acquisition window length to match the actual input pulse duration
- User defined minimum record length and pre-trigger for a complete event reconstruction
- Continuous signal baseline calculation for baseline drift compensation
- Programmable input delay to compensate for veto generation latency
- Channel Trigger Time Tag for event correlation

Applications

- Neutrino experiments
- Large number of detectors
- Drift chambers, TPC, Cherenkov detectors
- Application requiring an effective data reduction

Ordering Option

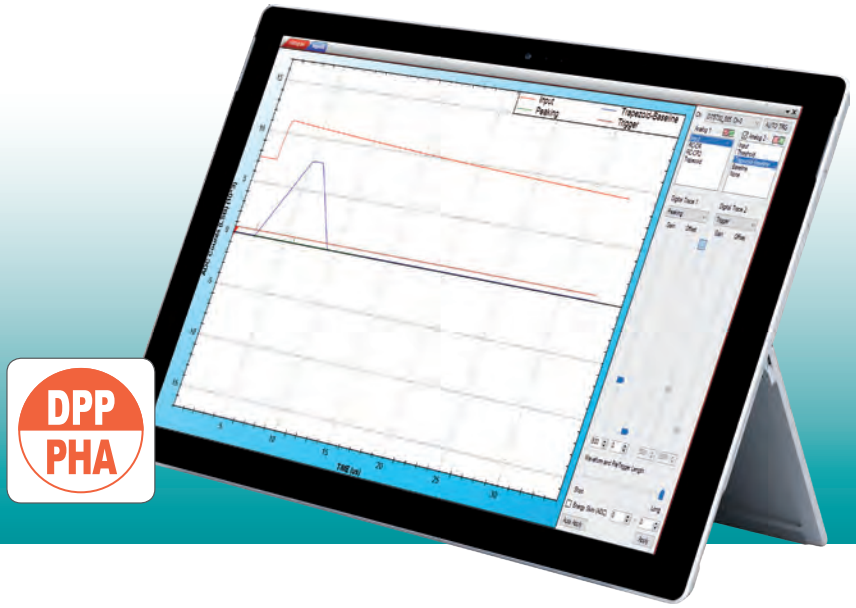
Code	Description
WFWDPPDAWXEA	DPP-DAW - Digital Pulse Processing with Dynamic Acquisition Window (8ch x 724)
WFWDPPDAWXED	DPP-DAW - Digital Pulse Processing with Dynamic Acquisition Window (4/2 ch x 724)
WFWDPPDWAD25	DPP-DAW - Digital Pulse Processing with Dynamic Acquisition Windows (8ch x 725)
WFWDPPDWAA25	DPP-DAW - Digital Pulse Processing with Dynamic Acquisition Windows (16ch x 725)
WFWDPPDWAD30	DPP-DAW - Digital Pulse Processing with Dynamic Acquisition Windows (8ch x 730)
WFWDPPDWAA30	DPP-DAW - Digital Pulse Processing with Dynamic Acquisition Windows (16ch x 730)

Software	Firmware	Features	724	725	730
DAW CAEN	DPP DAW	ICH (Independent channels)	●	●	●
		WV (Waveforms)	●	●	●
		TS (Timestamp)	●	●	●
		DAW (Dynamic Acquisition Window)	●	●	●

DPP-PHA

Digital Pulse Processing for the Pulse Height Analysis

FREE TRIAL



Digitizer Family

724
725
730

Supported Software

CoMPASS FREE

MC² FREE

Features

- Digital solution equivalent to Shaping Amplifier and Peak Sensing ADC
- Trapezoidal Filter for Pulse Height Analysis
- Energy spectra measurements
- Self-Trigger using RC-CR2 digital algorithm
- Online baseline restoration and ballistic effect correction
- Programmable input offset, trigger and energy filter parameters
- Online correction of pile-up for high counting rate measurements
- On-line coincidences/anti-coincidence acquisition mode among channels
- Timing information (pulse timestamps and/or rise/fall time)
- Digital Constant Fraction Discriminator for fine time stamp interpolation (pico-second intrinsic resolution)
- Free downloadable firmware trial version

Applications

- Nuclear Spectroscopy
- HPGe, silicon drift, silicon strip detectors
- Readout of PMT with slow scintillation detectors (i.e. Na(TI))
- Anti-Compton shielding
- Ion Beam analysis
- Homeland security
- Nuclear medicine

Overview

DPP-PHA firmware is fully controlled by CoMPASS, the CAEN multi-parametric spectroscopy software for Physics application, and by MC²Analyzer, the CAEN software for Digital Pulse Height Analysis.

A digitizer running DPP-PHA firmware becomes a multichannel data acquisition system for nuclear physics or other applications requiring radiation detectors. The digitizers accept signals directly from Charge Sensitive Preamplifiers or photomultipliers and implement a digital replacement of Shaping Amplifier and Peak Sensing ADC, allowing the user to perform energy and time measurements. All these functions are performed inside the FPGA without any use of external cables, nor additional boards or delay lines. Therefore, a single compact system takes care of the acquisition, replacing the traditional analog boards. It is also possible to realize multi-board systems and, eventually, perform coincidences among channels thanks to the DPP-PHA firmware features: the front panel clock, the trigger and the general purpose LVDS I/Os connectors (VME only) make possible to synchronize multiple boards.

Software	Firmware	Features	724 (1)	725	730
MC²	DPP PHA	ICH (Independent channels)	●	●	●
		WV (Waveforms)	●	●	●
		TS (Timestamp)	●	●	●
CoMPASS		PHA (Pulse Height Analysis)	●	●	●
		TDC (Time to Digital Converter)		●	●

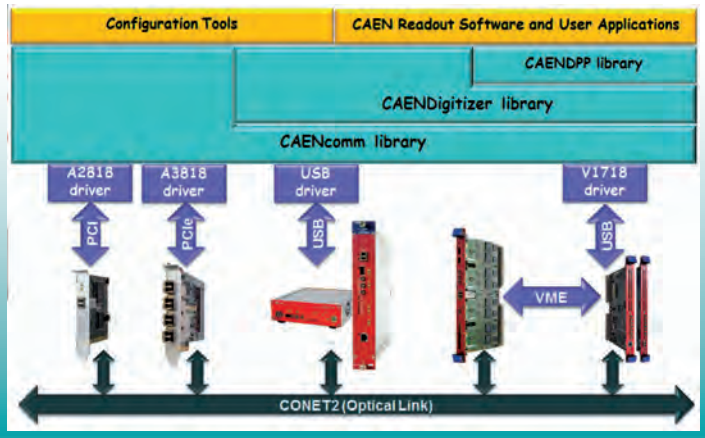
(1) DPP-PHA firmware is no longer supported by x724 models with C4 AMC FPGA option

Ordering Option

Code	Description
WFWDPPTFAAAA	DPP-PHA - Digital Pulse Processing for Pulse Height Analysis (8ch x 724)
WFWDPPTFAA25	DPP-PHA - Digital Pulse Processing for Pulse Height Analysis for (16ch x 725)
WFWDPPTFAD24	DPP-PHA - Digital Pulse Processing for Pulse Height Analysis (4/2 ch x 724)
WFWDPPTFAD30	DPP-PHA - Digital Pulse Processing for Pulse Height Analysis (8ch x 730)
WFWDPPTFAD25	DPP-PHA - Digital Pulse Processing for Pulse Height Analysis for (8ch x 725)
WFWDPPTFAA30	DPP-PHA - Digital Pulse Processing for Pulse Height Analysis (16ch x 730)

FREE

Drivers, Libraries and Configuration Tools



Software Tools

CAEN Comm | CAEN Digitizer | CAEN DPP

CAEN VME Demos | CAEN SyncTest | CAEN Upgrader

CAEN makes available a family of software tools, compliant to Windows and Linux platforms (32-64 bit), to integrate the hardware into the host PC system, to provide the developer with a middle layer for custom programming, to let the user completely and easily configure and retrieve information from a large number of CAEN boards including digitizers:

Drivers

Depending on the physical communication channel:

- USB: USB2.0 compliant
- Optical Link: proprietary CONET protocol managed by A2818 PCI / A3818 PCIe Controllers
- VMEbus: accessed by V1718 / V2718 Bridges

Libraries

C and LabVIEW middleware, including demos and examples for user's development.

Configuration Tools

Friendly software applications for the firmware upgrade or to direct access the board registers for a low level full configuration and control.

Type	Library / Tool name	Firmware type		Programming language	Third-party required software	Supported communication channels	Supported boards
		Digital Pulse Processing Firmware	Waveform recording firmware				
Library	CAEN Comm	*	*	C, LabVIEW [a]	NI LabVIEW Development System	USB, CONET, VMEbus	VME, NIM and Desktop digitizers, Digital MCAs and DT5790, V65xx power supply boards, V1x90x TDCs, V2495, DT5495 Programmable Logic Unit
	CAEN Digitizer	*	*	C, LabVIEW [a]	NI LabVIEW Development System	USB, CONET, VMEbus	VME, NIM and Desktop digitizers[b], Digital MCAs and Digital Pulse Analyzer DT5790
	CAEN DPP	* (DPP-PHA only)		C		USB, CONET, VMEbus	VME, NIM and Desktop digitizers running DPP-PHA firmware, Digital MCAs
Configuration Tools	CAEN Upgrader	*	*	C, Java	Java Runtime Environment	USB, CONET, VMEbus	VME, NIM and Desktop Digitizers, Digital MCAs and DT5790, V1x90 TDCs, V2495, DT5495, V1718/V2718 VME Bridges, V65xx HV Power Supplies, A2818/A3818 PCI/PCIe Controllers
	CAEN SyncTest		*	C	Gnuplot (Linux only)	USB, CONET, VMEbus	VME digitizers V1720/V1724/V1740/V1751
	CAEN VME Demos	*	*	C/C++, LabVIEW [a]	Microsoft.NET framework, LabVIEW Run-Time Engine	USB, CONET, VMEbus	VME, NIM and Desktop digitizers, V1718/V2718 VME Bridges

(a) Windows only
(b) The LabVIEW library doesn't support 743 digitizer family, DPP-ZLEplus and DPP-QDC firmware

CAENUpgrader

FREE

Firmware Upgrade Tool for Front-end Boards Bridges & VME Power Supply

CAENUpgrader is a software tool with a Java Graphical User Interface (for Windows and Linux OS) to easily upgrade the firmware on a large selection of CAEN boards, such us digitizers and MCAs, bridges and controllers, VME power supply boards. It reunites all the functions included in the cvUpgrade, CAENBridgeUpgrade and PLLConfig CAEN software, also allowing to configure the PLL settings of VME digitizers (i.e. set the ADC sampling frequency, enable the clock output, etc.), to get the hardware and firmware information and load the license to unlock the pay firmware (e.g. DPP firmware), to control the firmware boot for the NIM and Desktop digitizers.

CAEN VME Demos

FREE

Demo Applications for CAEN Bridges Control

CAEN VME Demos are simple software developed in C/C++ source code and LabVIEW. Versions featuring friendly graphical interfaces are provided for Windows machines.

The demos allow for a full board configuration at low level by direct access (read/write) to the registers. Moreover, they represent a starting point for the development of user-specific applications for CAEN Bridges (V1718/VX1718/V2718/VX2718/A2818/A3818) control.

CAEN SyncTest

FREE

Demo Software for CAEN Digitizers Synchronization

CAEN SyncTest is a simple Demo software to demonstrate multi-board synchronization with CAEN VME digitizers running the waveform recording firmware. It includes the most relevant commands to adjust the configuration parameters of the boards and read the acquired event data. It represents an example for setting synchronization and trigger distribution, and is provided as an archive of ANSI C source and header files.

SyncTest can be adapted to different synchronization setup and to different VME Dgitizer families.

Libraries

CAENComm

FREE

Interface Library for CAEN Data Acquistion Modules

The purpose of the CAENComm library is to implement a common interface to the higher software layers, masking the details of the physical channel and its protocol, thus making the libraries and applications that rely on the CAENComm independent from the physical layer.

CAENComm is based on CAENVMElib, a library developed specifically for USB-VME bridge (Mod. V1718) and PCI-VME (Mod. V2718), which implements the basic functions for accessing the VME bus (besides other specific functions for these bridges). For this reason, it is necessary that the CAENVMELib is already installed on your PC before installing the CAENComm; however, the CAENVMELib is completely transparent to the user.

The library pack includes a ready-to-use demo application, Java and LabVIEW version, including source files as reference for user development.

CAENDigitizer

FREE

Library of Functions for CAEN Digitizers High Level Management

CAENDigitizer contains the functions to program CAEN boards like Digitizers, Digital MCAs and Digital Pulse Analyzers, to manage the acquisition, execute the readout, unpack the data, send triggers, etc. This library is designed specifically to support both default and DPP firmware.

CAENDigitizer library relies on the CAENComm and CAEVMELib libraries, allowing to implement a common interface to the higher software layers, masking the details of the physical channel and its protocol. Libraries and applications that rely on the CAENDigitizer become this way independent from the physical layer.

The Library is provided with examples and demo applications, C and LabVIEW version, including source files and sub-VIs as reference for user development.

CAENDPP

FREE

High Level Library for CAEN Boards Running DPP Firmware

CAENDPP is a high level library designed to completely control exclusively CAEN digitizers running DPP-PHA firmware and Digital MCAs.

The library allows the user to manage all the relevant board settings, DPP parameters configuration, data acquisition storage. Configuration of synchronized start/stop acquisition is supported in multi-board hardware setup, as well as the single board can be configured for coincidences or anticoincidences among channels. Histograms are built at the library level and managed through specific library functions; other advanced histogram functions are provided (e.g. histogram recovery). Lists of data can be automatically saved to output files. HV management is also handled by the library, if supported by the board.

CAENDPP is provided with examples and Demo applications, including source files, as reference for user development.


40
YEARS OF INNOVATION
1979-2019

Modular Pulse Processing Electronics

NIM

ADCs (Peak Sensing) > Multichannel Analyzers

N957

8k Multichannel Analyzer

Features

- Single input Multichannel Analyzer
- Fully computer controlled MCA
- 8k ADC, fast conversion time with linearization enhancement circuit
- List mode acquisition
- Suitable for HPGe, NaI(Tl), CdTe and other detector types
- USB 2.0 communication interface
- Libraries, Demos (C and LabVIEW) and Software tools for Windows and Linux

Overview

The N957 is an 8k Multichannel Analyzer (MCA) with an USB port, housed in a 1-unit wide NIM module. The MCA performs the function of collecting the input signals and producing an output, in the form of the converted values of the input signal's peaks.

The input pulses can be the ones produced by a standard spectroscopy amplifier's output. They can be Gaussian, semi-Gaussian or square waves, unipolar (positive) or bipolar, in a range from 0 to 10 V, with a rise time greater than 0.1 µs.

The trigger can be either "on signal" (Auto Gate mode) or "external" (External Gate mode). In the first case a discriminator, with a settable threshold, enables the conversion. In the second case, an external gate is fed to the module via a front panel GATE connector. The input channel has a peak amplitude stretcher, whose output is digitised by a 13-bit ADC featuring a sliding scale technique, to improve the differential non-linearity.

The converted values are stored into a 64 kSamples buffer memory. The unit hosts an USB 2.0 port, which allows a simple control and data-acquisition via PC.

Libraries for Windows and Linux are available.

Firmware upgrade can be performed via USB.

Code	Description
WN957XAAAAAA	N957 - 8K Multichannel Analyzer

Analog Pulse Processors

N914

8 Fold Photomultiplier Pulse Processor

Features

- Designed to process signals generated by Photomultipliers
- 8-channel charge preamplifier and integrator
- Dual sensitivity (-0.83 mV/pC and -8.3 mV/pC)
- Built-in discriminator delivers:
  - Majority output
  - Digital signal for arrival times detection
- Sum outputs available

Overview

The N914 is an 8-channel Charge Preamplifier and Integrator, housed in a 1-unit wide NIM module.

It is designed to process signals generated by Photomultipliers. The module is provided with LEMO 00 connectors for both input and output signals, except for the T# output which is available through a 16-pin flat cable connector.

The Photomultiplier signal at the input is buffered and processed in several ways:

- The OL# output provides the signal processed by a gateless charge preamplifier and integrator
- The OH# output provides the signal processed by a gateless charge preamplifier and integrator, followed by a 10x gain stage
- The OLSUM output provides the analog sum of the OL# outputs
- The OHSUM output provides the analog sum of the OH# outputs
- The ASUM output provides the analog sum of the CH# inputs
- The MALU output provides a step function (Majority) with a height proportional to the number of channels simultaneously over a threshold, settable either individually or globally.
- The T_OUT# output provides a discriminator output converted into a digital signal, that can be provided to a TDC input for arrival times recording.

Code	Description
WN914WXAAAAA	N914 - 8 fold Photomultiplier Pulse Processor

Amplifiers (Fast)

N978

4 Channel Variable Gain Fast Amplifer

Features

- x10 adjustable gain (x1 steps)
- Input bandwidth up to 250 MHz
- 50 Ω input impedance
- ±2 V output dynamics
- 50 Ω loads driven
- Cascadeable channels
- Rise/fall time smaller than 1.5 ns
- I/O delay smaller than 3 ns

Overview

The N978 is a 4-channel Fast Rise Time Amplifier, housed in a 1-unit wide NIM module. Each channel features a voltage gain that varies in the range 0 ÷ 10.

Channels are non-inverting and bipolar: they amplify both positive and negative signals. Input bandwidth is 250 MHz for signals up to 50 mVpp and decreases for larger ones (up to 100 MHz @ 300 mVpp). Gain setting can be performed independently for each channel via four rotary knobs. Channels can be cascaded in order to obtain larger gain values.

Each channel is provided with three LEMO 00 connectors, one for the input and two bridged for the output. The board features a ±2 V output dynamics. Four screw-trimmers (one per channel) allow the offset calibration which operates over a ±30 mV range.

Code	Description
WN978XAAAAAA	N978 - 4 Channel Variable Gain Fast Amplifier

Amplifiers (Fast)

Amplifiers (Spectroscopy)

N979

16 Channel Fast Amplifier

Features

- x10 fixed gain (Optional in x2 ÷ x9 range)
- Input bandwidth up to 250 MHz
- 50 Ω input impedance
- ±2 V output dynamics
- 50 Ω loads driven
- Cascadeable channels
- Rise/fall time smaller than 1.5 ns
- I/O delay smaller than 3 ns

Overview

The N979 is a 16 channel Fast Rise Time Amplifier housed in a 1-unit wide NIM module. Each channel features a fixed voltage gain of 10; fixed gain values in the x2 ÷ x9 range (gain step = 1) are available on request.

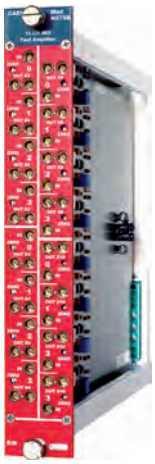
Channels are bipolar, non-inverting. Channels can be cascaded in order to obtain larger gain values. Input bandwidth is 250 MHz for signals up to 50 mVpp and decreases for larger ones (up to 130 MHz @ 300 mVpp).

Each channel is provided with three LEMO 00 connectors, one for the input and two bridged for the output. The board features a ±2 V output dynamics. 16 screw-trimmers (one per channel) allow the offset calibration which operates over a ±30 mV range. The features include an input overvoltage protection.

Code	Description
WN979XAAAAAA	N979 - 16 Channel Fixed Gain Fast Amplifier
WPERS0097902	N979 Customization - Total Gain = x2
WPERS0097903	N979 Customization - Total Gain = x3
WPERS0097904	N979 Customization - Total Gain = x4
WPERS0097905	N979 Customization - Total Gain = x5
WPERS0097906	N979 Customization - Total Gain = x6
WPERS0097907	N979 Customization - Total Gain = x7
WPERS0097908	N979 Customization - Total Gain = x8
WPERS0097909	N979 Customization - Total Gain = x9

N979B

16 Channel Mixed Gain Fast Amplifier



Features

- 4 x 4 ch. with different Fixed Gain: x2, x4, x8, x10
- Input bandwidth up to 250 Mhz
- 50 Ω input impedance
- ±2 V output dynamics
- 50 Ω loads driven
- Cascadeable channels
- Rise/fall time smaller than 1.5 ns
- I/O delay smaller than 3 ns

Overview

The N979B is a 16 channel fast rise time amplifier housed in a 1-unit NIM module. N979B channels are divided into 4 groups with different fixed gain: x2, x4, x8, x10.

Channels are bipolar, non-inverting. Channels can be cascaded in order to obtain larger gain values. Input bandwidth is 250 MHz for signals up to 50 mVpp and decreases for larger ones (up to 130 MHz @ 300 mVpp).

Each channel is provided with three LEMO 00 connectors, one for the input and two bridged for the output. The board features a ±2 V output dynamics. 16 screw-trimmers (one per channel) allow the offset calibration which operates over a ±30 mV range. The features include an input overvoltage protection.

Code	Description
WN979XBAAAAA	N979B - 16 Channel Mixed Gain Fast Amplifier

N968

Spectroscopy Amplifier

Features

- Gain Range continuously variable from 1 to 3000
- Integral non-linearity < ± 0.025% for 2 µs shaping time
- Unipolar output noise < 4.0 µV rms for gain=100 and < 3.5 µV rms for gain=1000 (@ 3µs shaping time)
- Bipolar zero cross-over walk < ± 3 ns (@ 50:1 dynamic range, 2 µs shaping time)
- LED indicator for high precision pole-zero cancellation without using oscilloscope
- Active filter networks with wide range of shaping times
- Gated baseline restorer with automatic controls of threshold and restoring rate
- Pile-up rejector and live-time corrector

Overview

The N968 is a single channel Spectroscopy Amplifier, housed in a 1-unit wide NIM module. It accepts the typical outputs generated from either optical feedback or resistor feedback preamplifiers connected with nuclear particle detectors. The output is quasi Gaussian with 0 to +10 V output dynamics. A front panel switch allows to select between positive and negative input signals. Gain setting can be performed continuously in the 10 ÷ 1500 range, product of Coarse, Fine and Superfine Gain. Two internal jumpers allow to set a x0.1 attenuation and a further x2 amplification, thus extending the gain range to 1 ÷ 3000. The shaping time values are 0.5, 1, 2, 3, 6, 10 µs.

The Pole Zero cancellation is performed via a front panel screw-trimmer. The module features also a Bipolar output (to be used for timing purposes), an advanced Gated Baseline Restorer circuit (with manual or automatic threshold setting) and a Pile Up Rejector which allows to reject piled up events.

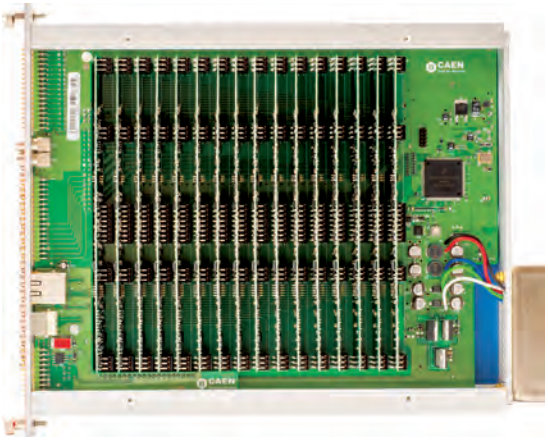
Code	Description
WN968XAAAAAA	N968 - Spectroscopy Amplifier

Amplifiers (Spectroscopy)

N1068

16 ch Programmable Spectroscopy Amplifier with Time Filter, CFD and Pile-Up Rejection

CAEN state-of-the-art Multi Channel Spectroscopy Amplifier & Constant Fraction Discriminator now merged in a single NIM programmable unit.



Spectroscopy Amplifier Control Software - Channel Setting

Overview

The N1068 is a 16 channel Programmable Spectroscopy Amplifier with Time Filter, 30% Constant Fraction Discriminator (CFD) and pile-up rejection implemented in a single width NIM module. This module is designed to be used with Silicon, Germanium, and many other detectors types connected to charge sensitive preamplifiers. Also adapted for fast unipolar input signal like PMT and all fast charge detectors. Available dedicated version for germanium detectors: N1068GE (Coming Soon). The first part of the Amplifier circuits is the polarity selector circuit which select the positive or negative input polarity. Follow two different sections which provide the Energy and Timing information.

The Energy section is composed by a Spectroscopy amplifier with CR-RC5 shaping type and four different time constants (0.5, 1, 2, 4 µs, extended up to 16 µs for N1068GE), pole-zero compensation, a 8-step coarse gain (2, 4, 8, 16, 32, 64, 128, 256), a 7-bit fine gain (from 1 to 2) and a DC restorer circuit.

The Timing section is composed by a Timing filter with a differential stage followed by an integration stage both with two time constants. An amplifier stage provides 4 gain value. This timing signal is sent to a Constant Fraction Discriminator section. The CFD has an auto walk compensation and the delay time is selectable individually for each channel by 5 step jumper.

A delay on the ECL CFD output are also available. It can be individually Enabled and programmed in a range of 200 ns to 800 ns with 12-bit resolution. The trigger stage foresees a Programmable Multiplicity Trigger and Multiplicity Chaining with a Sum Output available as well.

Pile-up rejection is configurable individually for each channel. When enabled each time a pile-up event occurs, the Energy output is set to the saturation value. The USB 2.0, Ethernet and RS485 interfaces allow to handle most functional parameters such as Shaping Time, Coarse and Fine Gain, Input Polarity, CFD Thresholds, Pole-Zero Adjustment etc. The board is available in both Single Ended (50 Ω impedance) and Differential (110 Ω impedance) versions.
The N1068 is supported by freely downloadable CAEN-CSA software, available for both Windows and Linux OS.

Features

- 16 channels in a one unit wide NIM module
- Differential and Single ended versions available
- Pile-up rejection
- Programmable input polarity
- ±4 V input dynamics on 50 and 110 Ω
- Active baseline restorer
- CFD with 5 step delay individually selectable
- Timing filter amplifiers with programmable differentiation and integration time
- CFD, Energy or Timing filter multiplexed output
- Programmable delay on ECL CFD output
- Programmable timing filter amplifiers
- Multiplicity trigger with programmable threshold
- Programmable 4 shaping time per channel
- Programmable fast unipolar input mode for PMT and all fast charge detectors
- 8 step coarse gain and 7 bit fine gain for energy amplifier
- Low Noise
- Programmable pole-zero adjustment
- Fully programmable via USB, Ethernet and RS485
- OR output and Multiplicity output
- Low Power

Software

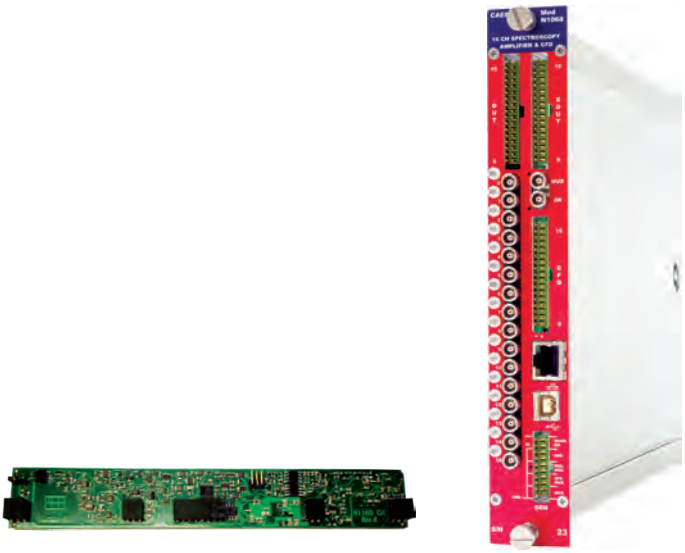
CSA CAEN | CAEN HV Wrapper | FREE

Code	Description
WN1068SXAAAA	N1068S - 16 ch Programmable Spectroscopy Amplifier and 16 ch CFD Single Ended Inputs
WN1068DXAAAA	N1068D - 16 ch Programmable Spectroscopy Amplifier and 16 ch CFD Differential Inputs
WN1068GEXAAA	N1068GE- 16 ch Programmable Spectroscopy Amplifier and 16 ch CFD for Germanium Detectors

N1168

16 ch Fast Scintillator Programmable Signal Processor and 16 ch CFD

COMING SOON



Features

- 16 channels in a one unit wide NIM module
- Fast Slow signal discrimination
- Fast Scintillator application
- Positive or negative inputs hardware selectable on each channel
- Completely programmable via USB, RS485 and Ethernet
- Programmable shaping time per channel
- 4 step coarse gain and 8 bit fine gain for energy amplifier
- CFD threshold adjustable for each channel with 12-bit resolution
- 16 energy Gaussian outputs with DC restore
- 16 fast pick Gaussian outputs with DC restore
- 16 channel CFD
- Multiplexed Fast, Slow and CFD output
- Multiplicity output
- OR output
- Multiplicity trigger output
- Pile-up rejector

Overview

The N1168 module is suitable for several type of scintillator detectors particularly were different decay time of the scintillation light are present. This module allows to obtain the full handling of the detector signal giving the total energy, amplitude of the fast component and the time information.

The analysis of the two dimensional spectrum (fast versus total) allows an excellent gamma-neutron separation for liquid scintillators or CLYC detectors, gamma-charged particle separation for BaF_2 detectors and to disentangle the gamma interaction in the different parts of a phoswich detector.

For scintillator detectors with a single light component, the fast output can be used as a second total energy output meeting the requirements of dual energy range experimental setups, avoiding the split of the signal on two shaping amplifiers.

The module is very simple to use and overcome the inconveniences of the standard approach with two gates and QDC setup.

A gate-free fast stretcher circuit captures the leading edge peak value of the signal, that is subsequently Gaussian shaped to allow simple acquisition by a peak-sensing ADC.

The total energy circuit basically consists of an integrator, followed by a Gaussian shaper amplifier.

The time information is given by a Constant Fraction Discriminator with selectable delay line and an automatically walk compensation circuit.

The very low noise level of the module match the requirements of the new class of high energy resolution scintillators ($LaBr_3$) over a large dynamics energy range applications and also in a very low discrimination level.

(Designed in collaboration with INFN Milano).

Amplifiers (Spectroscopy)

N1568A

16 Ch Programmable Spectroscopy Amplifier & Dual 16 Ch CFD (30%; 80%)

Accessories

N1568ADAT
USB RS485 Adapter Board

Features

- Positive or negative inputs accepted on each channel
- ±4 V input dynamics on 50 Ω
- Gain: 0.8 - 182
- 2 bit coarse gain and 192 step fine gain for energy amplifier
- 2 bit coarse gain for timing amplifier
- Programmable (2 bit) shaping time per channel (0.5 ÷ 4 µs)
- 8 bit pole zero adjustment
- 16 energy Gaussian outputs (programmable polarity)
- Dual 16 channel CFD (30% constant fraction) ECL output
- 16 channel CFD (80% constant fraction) ECL output
- Libraries, Demos (C and LabVIEW) and Software tools for Windows and Linux

Overview

The N1568A is a 16-channel Spectroscopy Amplifier and dual 16-channel Constant Fraction Discriminator (30% and 80% constant fraction), housed in a 1-unit wide NIM module.

This module is designed to be used with silicon detectors connected to charge preamplifiers, where the measurement of charges collection time allows to obtain the identification in Z of the particles caught by the detector. The rise time is measured via two constant fraction discriminators (30% and 80% of rise time respectively).

Each channel is composed by two sections: Energy section (A) and Timing section (B). The input signal is sent to both sections simultaneously. Section A processes the input signal with a differential circuit, followed by the gain stages (coarse: 2-bit; fine: 192 step), and finally by the shaping. Section B processes the signal with a low noise differential stage (500 ns) followed by a 2-bit programmable linear gain stage; the signal is then fed to two low walk and high resolution Constant Fraction Discriminator sections (30% and 80% constant fraction respectively).

The discriminators share an 8-bit common threshold; the discriminators delay is adjustable via PCB jumpers (6 steps from 15 to 150 ns).

Code	Description
WN1568AXAAAA	N1568A - 16 Ch. Programmable
WN1568ADATXX	N1568 - USB-RS485 Adapter

N568E - N568ELC - N568EB

16 Channel Programmable Spectroscopy Amplifier

Software

CSA CAEN — CAEN HV Wrapper — FREE

Features

- 16 channels
- Positive or negative inputs accepted on each channel
- Wide gain range: 0.15 to 480 per channel
- Programmable shaping time per channel
- Programmable pole-zero cancellation per channel
- 16 normal or inverted outputs (further 10x amplification outputs also available)
- 16 fast amplifier outputs for timing purposes
- Energy and timing multiplexed outputs
- Completely programmable via USB and Ethernet
- Input noise smaller than 15 µV RMS @ Gain=100 (N568E)
- Supported by CAEN-CSA software

Overview

The N568E is a 16 channel spectroscopy amplifier implemented in a single-width NIM module. The following versions are available:

· N568ELC: Shaping time: 0.2, 1, 3, 6 µs; Equivalent input noise < 25 µV RMS

· N568E: Shaping time: 0.2, 1, 3, 6 µs; Equivalent input noise < 15 µV RMS

· N568EB: Shaping time: 0.1, 0.2, 1, 3 µs; Equivalent input noise < 15 µV RMS

For each channel the amplification gain, the output polarity, the shaping time and the pole-zero cancellation, are remotely programmable, either via USB or Ethernet; the RS485 port allows to connect up to 32 daisy chained modules. The gain ranges from 0.15 to 480.

The working parameter values are automatically stored in a non-volatile memory. A semi-Gaussian output is provided either with the programmed gain (OUT) or with a further 10x amplification (XOUT), either direct or inverted. A Common Offset can be programmed via software and allows to shift the baseline of the output. A FOUT output provides a fast amplification for timing purposes (fixed gain factor of 20). A MUX OUT allows to monitor both the OUT and the FOUT outputs of a single channel.

The N568E is supported by freely downloadable CAEN-CSA software, available for both Windows and Linux OS.

Code	Description
WN568EXAAAAA	N568E - 16 Channel Ethernet Prog. Spectroscopy Amplifier (0.2, 1, 3, 6 µs - 50 Ω)
WN568ELCXAAA	N568ELC - 16 Channel Low Cost Ethernet Prog. Spectroscopy Amplifier (0.2, 1, 3, 6 µs - 50 Ω)
WN568EXBBAAA	N568EB - 16 Channel Progr. Spectroscopy Amplifier (0.1, 0.2, 1, 3 µs - 50 Ω)

Attenuators

Coincidence/Logic/Trigger Units

N858
Dual Attenuator

Features
- Attenuation adjustable from 0 to 44.5 dB
- Input bandwidth larger than 300 MHz
- 100 mW maximum input power
- No power supply required

Overview
The N858 is a dual Attenuator, housed in a 1-unit wide NIM module. Its function is performed by resistive cells, so the module does not require any power supply. Attenuation ranges from 0 to 44.5 dB for each section (0.5 dB steps).

Each section is provided with two LEMO 00 connectors, one for the input (50 Ω impedance) and one for the output, and seven toggle switches for the attenuation settings.

Code	Description
WN858XAAAAAA	N858 - Dual Attenuator (0 to 44.5 dB)

N113
Dual OR 12 In - 2 Out

Features
- 2 independent OR sections, 12 inputs each
- 1 GATE signal per section
- Cascadeable sections
- Less than 10 ns input/output delay

Overview
The N113 is a dual OR with 12 inputs and 2 outputs per section, housed in a 1-unit wide NIM Module. Via 4 internal jumpers, the module can be converted to a single OR with 24 inputs, with either an independent or a common gate control.

All input/output signals are std. NIM. The outputs can be "gated" via two front panel GATE inputs with their relevant switches.

Code	Description
WN113XAAAAAA	N113 - Dual OR 12 In-2 Out

N405
Triple 4-Fold Logic Unit/Majority with VETO

Features
- Three independent sections with 4 standard NIM inputs each
- AND, OR, MAJORITY function selectable for each section
- One auxiliary LIN output per section (width equal to logic function occurrence time)
- NIM shaped outputs with fan-out of 2
- One complementary NIM shaped output per section
- One VETO input per section
- Front panel trimmer for output width adjustment on each section

Overview
The N405 is a triple Logic Unit/Majority, housed in a 1-unit wide NIM module. Its functions are selectable via internal jumpers and external lever switches.

Each section accepts up to 4 input signals and a VETO input and provides 4 outputs (2 normal and 1 complementary, shaped, plus 1 LIN). The LIN output has a duration equal to the occurrence time of the logic function, programmed via the front panel lever switches. The shaped output widths can be set via front panel trimmers in the range from 6 ns to 800 ns.

LOGIC UNIT MODE
Each input signal can be enabled or disabled by means of a front panel lever switch. Each section can be programmed to perform either the AND or the OR functions via front panel switch. When only one input signal is enabled, the section acts as a logic FAN-OUT independently from the selected mode.

MAJORITY MODE
The front panel enable/disable lever switches are used to set the majority level. The AND/OR lever switch must be set in the AND position.

Code	Description
WN405XAAAAAA	N405 - Triple 4-Fold Logic Unit/Majority with Veto

Coincidence/Logic/Trigger Units

N455
Quad Coincidence Logic Unit

Features
- 4 independent sections
- Two inputs per section
- 130 MHz max. input frequency
- 6 ns double pulse resolution
- 10 ns I/O delay
- Switch selectable AND/OR logical function
- Adjustable output FWHM (4 to 650 ns)
- Overlap output
- Common VETO

Overview
The N455 is a quad Coincidence Logic Unit, housed in a 1-unit wide NIM module.

Each of the 4 sections performs the logic function (AND, OR) selected via the relevant front panel switch.

Each section has 3 normal and 1 complementary NIM shaped outputs with adjustable width via front panel trimmer and an additional overlap output (OVP OUT) whose width is equal to the occurrence time of the logic function.

The OVP OUT allows to obtain an output signal with the minimum input/output delay. A common VETO input signal is available to disable all the output signals.

(ISN-GRENOBLE design)

Code	Description
WN455XAAAAAA	N455 - Quad Coincidence Logic Unit

Discriminators

N605 - 4 Channel 200 MHz Constant Fraction Discriminator

Redesigning a classic: the new Constant Fraction Discriminator for fast high performance detectors

N605 rear view

Features
- Four independent Constant Fraction Discriminators for fast detectors with sub-ns rise time
- Independently adjustable discriminators parameters (T, W, Z)
- Double pulse resolving time down to 5 ns
- Fine threshold adjustment from -15 to -1000 mV
- Fine walk correction with zero-crossing adjustment
- Exceptional low walk jitter < 50 ps
- Adjustable output signal width
- CFD monitor output
- Common veto input and individual gates for coincidence or anticoincidence options

Applications
- Fast Scintillators
- PMTs
- Silicon Detectors
- MCP

Overview
The N605 houses four independent 20% Constant Fraction Discriminators (CFD) in 1-unit wide NIM.

The module is intended for high resolution time measurements, where fast signals with rise time as low as 0.8 ns are involved.

Those may involve the use of radiation detectors made of fast scintillators, PMT, microchannel plates and fast semiconductor detectors.

The module guarantees exceptional low walk jitter, lower than 50 ps, for signals spreading over a wide range of amplitude, from -5 V to -50 mV.

The unit is provided with independent threshold discriminators to reject signal baseline noise. Front panel test point and trimmer permits the precise measurement of the threshold, in the range from -15 mV down to -1 V. Each channel can be adjusted for the zero crossing level of the discriminator to minimize the time walk. Moreover the N605 has a CFD signal monitor output connector on the front panel to facilitate the correct adjustment of the working parameters.

Each channel has a fan-out of 3 timing output signals provided with NIM standard. The outputs can be selected to operate both in blocking and updating mode: the first is intended to minimize multiple triggering when slow scintillators are used, while the second is intended to reduce dead time in event of high rate condition. The board is provided with fast VETO input and individual GATE inputs to operate coincidence or anticoincidence logic conditions with the timing signal.

Code	Description
WN605XAAAAAA	N605 - 4 Channel 200 MHz Constant Fraction Discriminator

N840 - N841

8/16 Channel Leading Edge Discriminators

Features

- Individually programmable thresholds
- Selectable Updating/Non Updating mode
- Programmable output width
- TEST and VETO inputs
- OR and CURRENT SUM outputs
- 4 digit LED display

Overview

The N840 (N841) is an 8 (16) channel Leading Edge Discriminator, housed in a 1-unit wide NIM module. The module accepts 8 (16) negative inputs and produces 2x8 (2x16) NIM outputs (NIM outputs are provided with a fan-out of 2) and 8 (16) /NIM outputs (complementary) on 24 (48) front panel LEMO 00 connectors.

The pulse forming stage of the discriminator produces an output with adjustable width in a range from 5 ns to 40 ns. Each channel can operate either in Updating or Non-Updating mode according to on-board jumpers position. The discriminator thresholds are individually programmable in a range from -1 mV to -255 mV (1 mV step) via an 8-bit DAC. The minimum detectable signal is -5 mV. The back panel houses VETO and TEST inputs, an OR and a CURRENT SUM output, which provides a current proportional to the input multiplicity, i.e. to the number of channels over threshold, at a rate of -1.0 mA per hit (-50 mV per hit into a 50 Ω load) ±20%.

Settings can be performed via front panel switches and checked via a 4-digit LED display.

Code	Description
WN840XAAAAAA	N840 - 8 Channel Leading Edge Discriminator 50 Ω Negative
WN841XAAAAAA	N841 - 16 Channel Leading Edge Discriminator 50 Ω Negative

N842 - N843

8/16 Channel Constant Fraction Discriminators

Features

- Individually programmable thresholds
- Programmable output width
- Programmable dead time
- TEST and VETO inputs
- OR and CURRENT SUM outputs
- 4-digit LED display

Overview

The N842 (N843) is an 8 (16) channel Constant Fraction Discriminator, housed in a 1-unit wide NIM module. It accepts 8 (16) negative inputs and produces 2x8 (2x16) NIM outputs (provided with a fan-out of 2) and 8 (16) complementary NIM outputs on 24 (48) front panel LEMO 00 connectors.

The constant fraction delay is defined by a delay line network of 20 ns with 5 taps. The timing stage of the discriminator produces an output with adjustable width (range: 16.5 ÷ 273 ns). Moreover, in order to protect against multiple pulsing, it is possible to program a dead time where the module is inhibited from retriggering. The maximum time walk is ±400 ps (for input signals in the range -0.05 ÷ -5 V with 25 ns rise time). The constant fraction value is 20%. The individual thresholds are programmable in a range from -1 to -255 mV (1 mV step) via an 8-bit DAC. The module can operate also with small (< 10 mV) input signals,(in this case the Constant Fraction operation is not performed, i.e. the time walk is higher). The channels' threshold, output width and dead time can be programmed via two lever switches and one rotary switch placed on the front panel. The back panel houses VETO and TEST inputs, an OR and a CURRENT SUM output, which provides a current proportional to the input multiplicity, i.e. to the number of channels over threshold, at a rate of -1.0 mA per hit (-50 mV per hit into a 50 Ω load) ±20%.

Settings can be performed via front panel switches and checked via a 4-digit LED display.

Code	Description
WN842XAAAAAA	N842 - 8 Channel Constant Frac. Discriminator (Delay 20 ns; F = 20%)
WN843XAAAAAA	N843 - 16 Channel Constant Frac. Discriminator (Delay 20 ns; F = 20%)

N844 - N845

8/16 Channel Low Threshold Discriminators

Features

- Individually programmable thresholds
- Programmable output width
- TEST and VETO inputs
- OR and CURRENT SUM outputs
- 4-digit LED display
- Minimum detectable signals: -3 mV

Overview

The N844 (N845) is an 8 (16) channel Low Threshold Leading Edge Discriminator, housed in a 1-unit wide NIM module. The module accepts 8 (16) inputs and produces 2x8 (2x16) NIM outputs (NIM outputs are provided with a fan-out of 2) + 8 (16) /NIM outputs (complementary) on 24 (48) front panel LEMO 00 connectors.

The pulse forming stage of the discriminator produces an output with adjustable width in a range from 6 to 95 ns. The channels operate in updating mode. The discriminator thresholds are individually programmable in a range from -1 mV to -255 mV (1 mV step) via an 8-bit DAC. The minimum detectable signal is -3 mV. A positive input version (Model N844P), with the thresholds programmable in the 1 mV to 255 mV range, is also available. The back panel houses VETO and TEST inputs, a logical OR output (the relevant OR LED lights up if at least one channel is over threshold) and a CURRENT SUM output, which provides a current proportional to the input multiplicity, i.e. to the number of channels over threshold, at a rate of -1.0 mA per hit (-50 mV per hit into a 50 Ω load) ±20%.

Settings can be performed via front panel switches and checked via a 4-digit LED display.

Code	Description
WN844XAAAAAA	N844 - 8 Channel Low Threshold Discriminator 50 Ω Negative Inputs
WN844PXAAAAA	N844P - 8 Channel Low Threshold Discriminator 50 Ω Positive Inputs
WN845XAAAAAA	N845 - 16 Channel Low Threshold Discriminator 50 Ω Negative Inputs
WN844POLEXCH	N844 Polarity Exchange

Fan In-Fan Out Units

Scalers

N454
4 - 8 Logic Fan In-Fan Out

Features
- 4 independent sections with 4 inputs each
- OR output with fan out of four per section
- Possibility of cascading channels to form a dual 8-fold Fan In-Fan Out
- Input/output delay less than 7 ns
- 100 MHz max. input frequency

Overview
The N454 is a quad Logic Fan In-Fan Out, housed in a 1-unit wide NIM module. Each section accepts 4 input NIM signals and performs the logic OR of the inputs. The result of the function is provided as 4 normal and 2 complementary NIM signals via 6 front panel connectors.

The unit can be programmed, via a front panel switch, to operate either as 4 OR sections (4 inputs/4 outputs) or 2 OR sections (8 inputs/8 outputs).

(ISN-GRENOBLE design)

Code	Description
WN454XAAAAAA	N454 - 4-8 Logic Fan In-Fan Out

N625
Quad Linear Fan In-Fan Out

Features
- Four independent sections
- Bipolar inputs
- Four 4 Input + 4 Output Fan In-Fan Out sections
- 1 Discriminator Channel featured
- Inverting or non-inverting mode, independently selectable on each section
- 100 MHz bandwidth

Overview
The N625 is a quad Linear Fan In-Fan Out, housed in a 1-unit wide NIM module. Each Fan In-Fan Out section has 4 Inputs and 4 Outputs and provides, on all its output connectors, either the sum of the signals fed to the inputs or its inverted complementary. Fan In-Fan Out inputs are bipolar, while the output can be either inverting or non-inverting (jumper selectable independently for each section). Both input and output signals are DC coupled. Maximum allowed input amplitude is ±1.6 V. Moreover each Fan In-Fan Out section features a screwdriver trimmer which allows the DC offset adjustment. The module houses also a Discriminator channel, which has one DC coupled input (polarity selectable by jumper). The discriminator threshold is adjustable via screwdriver and monitorable via test point; the output is NIM standard, its width is also adjustable via screwdriver. Front panel LEDs allow to monitor all the mode and gain (i.e. output polarity) adjustments performed via internal jumpers.

Code	Description
WN625XAAAAAA	N625 - Quad Linear Fan In-Fan Out

N1145
Quad Scaler and Preset Counter / Timer

Features
- Four 8-digit up-counters with 250 MHz max. counting rate
- One 7-digit down-counter with 80 MHz max. counting rate
- NIM and TTL inputs
- One LED display per section
- Up to three sections can be cascaded for 24-digit counting
- Frequency and frequencies ratio measurements
- Individual GATE and RESET per counter
- Manual or pulse triggered RESET

Overview
The N1145 is a quad Scaler and Preset Counter, housed in a 2-units wide NIM module.

The module features four independent 8-digit up-counters, plus a fifth 7-digit down- counter that can be used either as a preset counter or timer.

The counters can have different operating modes and can be variously interconnected, thus allows to use the module as a flexible and powerful tool for several applications involving time, frequency and ratio measurements. All counters accept either TTL or NIM inputs. All control and output signals are standard NIM. The maximum input frequency is 250 MHz and the minimum pulse width is 2 ns for the up-counters, and respectively 80 MHz and 3 ns for the down-counter. All input and output connectors and all control switches are located on the front panel. All input and output connectors are LEMO 00 type.

Code	Description
WN1145XAAAAA	N1145 - Quad Scaler and Preset Counter-Timer

Timing Units

Translators

N93B
Dual Timer

Features
- Manual or pulse triggered START (NIM or ECL input)
- Monostable (retriggerable) or bistable operation
- NIM and ECL output pulses from 50 ns to 10 s
- Manual or pulse triggered RESET
- (NIM and ECL) END-MARKER output pulse
- VETO input

Overview
The N93B is a dual Timer, housed in a 1-unit wide NIM module.

Each timer section is a triggered pulse generator which provides NIM and ECL pulses (width from 50 ns to 10 s) when triggered. The output pulses are available both in normal and complementary mode.

Timers can be re-triggered with the END MARKER signal.

The coarse adjustment of the output width can be performed via a 10-position rotary switch, while the fine adjustment can be performed via a precision potentiometer.

The START trigger can be provided either via an external signal or manually via a front panel switch.

Desktop (DT993) and VME (V993C) versions are also available

Code	Description
WN93BXAAAAAA	N93B - Dual Timer (from CERN type 2255)
WV993XCAAAAA	V993C - Dual Timer (no JAUX)
WDT993XAAAAA	DT993 - Dual Timer Desktop

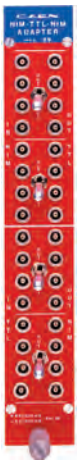
N108A
Dual Delay

Features
- Delay from 0 to 63.5 ns (+ 1.6 ns offset) per section
- No power supply required
- 0.5 ns steps
- ±100 ps accuracy on 0.5 to 8 ns delay lines, ±200 ps on higher lines
- VSWR < 1.15

Overview
The N108A is a dual Delay, housed in a 1-unit wide NIM module. Delay values range from 0 to 63.5 ns (+ 1.6 ns offset) per section, adjustable in 0.5 ns steps. The delay lines consist of calibrated coaxial cables for high accuracy delay and do not require power supply.

Code	Description
WN108AXAAAAA	N108A - Dual Delay Unit (1.6 to 65.1 ns)

N89
NIM - TTL - NIM Adapter



Features
- 8 NIM to TTL, 8 TTL to NIM translator channels
- Less than 10 ns Input/Output delay
- 60 MHz max operating frequency
- No duty-cycle limitations

Overview
The N89 is a dual NIM to TTL and TTL to NIM Adapter, housed in a 1-unit wide NIM module. Each section consists of 4 NIM to TTL converters and 4 TTL to NIM converters. All inputs are DC coupled. On each section, a front panel switch allows the output signals to be either normal or complementary. The unit is capable of driving remote 50 Ω loads with minimum signal degradation. Fast rise and fall times (2 ns) ensure reliable performance at minimum pulse width (10 ns) and maximum frequency (60 MHz)

Code	Description
WN89XXAAAAAA	N89 - NIM-TTL-NIM Adapter

Translators

N638

16 Channel NIM-ECL/ECL-NIM Translator and Fan Out

Features

- 16 independent NIM to ECL/NIM and ECL to NIM/ECL channels
- NIM fan-out of 2
- 300 MHz maximum operating frequency
- 2 COMMON IN input with a Fan Out of 16 NIM and 8 ECL
- I/O delay from 1.5 to 3.5 ns, depending on input type

Overview

The N638 is a 16 channel NIM to ECL and ECL to NIM Translator, housed in a 1-unit wide NIM module.

Each of the 16 channels accepts either a NIM or an ECL signal and provides two NIM and one ECL outputs.

The NIM and ECL inputs for each channel are OR-ed prior to Fan Out. The maximum operating frequency is 300 MHz.

Two couples of front panel input bridged connectors accept two COMMON IN NIM signals; each common signal allows the use of the module as a Fan Out of 16 NIM and 8 ECL signals.

Code	Description
WN638XAAAAAA	N638 - 16 Channel NIM-ECL/ECL-NIM Translator and Fan Out

Digital Peak Sensing ADC

NEW

N6741

32 channel Peak Sensing ADC

Features

- 1-unit wide NIM Module
- 1k, 2k, 4k 8k, 16k Peak Sensing ADC
- 32 input channels, single ended, ERNI SMC (Zin: 1 kΩ)
- Low dead time (re-triggering less than 100 ns after the previous gate closes)
- Sliding scale algorithm for DNL reduction over 1/16 of the full ADC scale
- 4 Vpp Full Scale Range (3.75 Vpp with sliding scale enabled)
- Full-scale INL < 0.05% over 1 : 99% FSR
- Accepts positive and negative inputs
- Zero Suppression with programmable threshold
- Multi-Event Buffer (512 event/channel)
- Common Gate mode (32 channels converted at once) with linear gate width or programmable by software
- Individual Gate mode with 32 independent self-gating channels
- Fast Clear input to abort the conversion
- Internal dead-time counters
- Extended Time Stamp (48 bit)
- USB2.0 and Optical link (CAEN CONET proprietary protocol) communication interfaces
- Daisy chain capabilities
- Windows and Linux drivers, C and LabVIEW libraries, demo software and firmware upgrade tool
- Firmware upgradable by the user

Overview

The N6741 is a Peak Sensing ADC belonging to a new generation of detector readout systems based on a mixed analog-digital acquisition chain, combining a high channel density (32 channels) and a low dead time.

Conversion gain ranges from 1k up to 16k with a low differential non linearity (DNL) by the sliding scale method. The FLASH ADC architecture makes possible to achieve an extremely low conversion time of the pulse peak, so new conversions take place less than 100 ns after the previous gates close.

Receiving the typical signal from a Shaping Amplifier (e.g. CAEN N1068), the FPGA identifies the pulse peak of the pulse within a gate by means of digital filters. The energy data are stored with a time stamp in a multi-event buffer and are available for readout by USB or optical link interface (Daisy-chainable). Data throughout can be reduced by the Zero Suppression algorithm with programmable thresholds.

The front panel hosts LEMO (NIM/TTL) inputs for the Gate and for the event discard during the acquisition in case of pile-up. The Gate can be linear (same width as the external signal) or re-formed with programmable width. Specific I/Os allow for multi-board synchronization and for Gate propagation.

The N6741 is provided with drivers for the supported communication interfaces, C and LabVIEW libraries, demo software for an easy board understanding. Firmware upgrade can be performed via optical link or USB by the user.

Accessories

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

A746D
32 Channel Adapter for LEMO connector

AI2700
Optical Fiber Series

Cables for CONET Optical Link Networks

DT4700
Clock Generator and FAN-OUT

Code	Description
WN6741XAAAAA	N6741 - Fast 32 channel Peak Sensing ADC

Digitizers

CAEN Digitizers are also available in NIM form factor: for complete information see pages in Model Compare table below.

Model Compare

Model	No. of Channels	Max Sampling Rate (MS/s)	Bandwidth (MHz)	Full Scale Range (V)	Resolution (bits)	Board Memory (Samples/ch)	Analog Input Connectors	See Page
N6720	4 / 2	250	125	2	12	1.25 M / 10 M	MCX	100
N6724	4 / 2	100	40	0.5 / 2.25 / 10	14	512 k / 4 M	MCX	102
N6725	8	250	125	0.5 - 2	14	640 k / 5.12 M	MCX	104
N6730	8	500	250	0.5 - 2	14	640 k / 5.12 M	MCX	106
N6740	32	62.5	30	2 / 10	12	192 k	SMC 68P	108
N6742(1)	16 + 1(2)	5000(3)	500	1	12	128 / 1024 events(4)	MCX	114
N6743(5)	8	3200(3)	500	2.5	12	7 events(4)	MCX	116
N6751	2(6) - 4	2000(6) - 1000	500	0.2 / 1	10	3.6 M(6) - 1.8 M / 28.8 M(6) - 14.4 M	MCX	110
N6761	1	4000	1000	1	10	7.2 M	MCX	110

(1) Based on DRS chip: 5 GS/s Switched Capacitor Array, 8+1 channels with 1024 storage cells each.
(2) Additional analog input(s) allow for low latency triggers
(3) Sampling frequency of the analog memory (switched capacitor array); A/D conversion takes place at lower speed (dead-time).
(4) 1 event = 1 k samples.
(5) Based on SAMLONG chip: 3.2 GS/s Switched Capacitor Array, 2 channels with 1024 storage cells each.
(6) If operating in Dual Edge Sampling (DES) mode.

Digital Multichannel Analyzers

CAEN Digital Multichannel Analyzers are also available in NIM form factor: for complete information see pages in Model Compare table below.

Model Compare

Model	No. of Inputs	Coupling	Channels	No. of LV Preamp. Outputs	No. of HV Outputs	HV Power Output	Acquisition Modes	Interfaces	See Page
N6780M	2	DC	16 K	2	2	+5 kV/300 µA -5 kV/300 µA	SI, LM, Coinc.	USB 2.0, Optical Link	220
N6780N	2	DC	16 K	2	2	-5 kV/300 µA (2 output)	SI, LM, Coinc.	USB 2.0, Optical Link	220
N6780P	2	DC	16 K	2	2	+5 kV/300 µA (2 output)	SI, LM, Coinc.	USB 2.0, Optical Link	220
N6781	4	DC	16 K	0	0	n/a	SI, LM, Coinc.	USB 2.0, Optical Link	221
N6781A	2	DC	16 K	0	0	n/a	SI, LM, Coinc.	USB 2.0, Optical Link	221

SI: Signal Inspector.
LM: List Mode
Coinc: Coincidence.

Digital Detector Emulators

CAEN Digital Detector Emulators are also available in NIM form factor: for complete information see page 257.

Model Specification

Model	No. of Channels	D/A Sample rate	Maximum Rate	Multiple shapes on a single channel	Minimum rising time (fast mode)	Correlated events simulation	Custom Sequence of energy and time	Analog Input	Interfaces	See Page
NDT6800	2	125 MHz	10 Mcps / 5 Mcps (Poisson)	Yes (2 Different)	8 ns	Yes	Yes	No	USB 2	257


40
YEARS OF INNOVATION
1979-2019

Modular Pulse Processing Electronics

VME

ADCs (Peak Sensing)

V1785

8 Channel Dual Range Multievent Peak Sensing ADC

Features

- Two simultaneous input ranges: 0 ÷ 4 V / 0 ÷ 500 mV
- 12-bit resolution with 15-bit dynamics
- 125 µV LSB on low range, 1mV LSB on high range
- 2.8 µs / 8 ch conversion time
- 600 ns fast clear time
- Zero and overflow suppression for each channel
- ±0.1% Integral Non Linearity
- ±1.5% Differential Non Linearity
- 32-event buffer memory
- MBLT and CBLT data transfer
- Multicast commands
- Live insertion

Overview

The V1785 is an 8 channel Peak Sensing Analog-to-Digital Converter, housed in a 1-unit wide VME 6U module. Each channel is able to detect and convert the peak value of the positive analog signals (with > 50 ns rise time) provided to the relevant connectors. Accepted input voltage range is 0 ÷ 4 V. Each channel is processed by two gain stages (x1 and x8) operating in parallel, followed by the ADC stage. A dual input range is featured: 0 ÷ 4 V (1 mV LSB) and 0 ÷ 500 mV (125 µV LSB); this allows to avoid saturation with larger input signals while increasing resolution with smaller ones. The ADCs use a sliding scale technique in order to reduce the differential non-linearity.

Programmable zero suppression, multievent buffer memory, trigger counter and test features complete the flexibility of the unit.

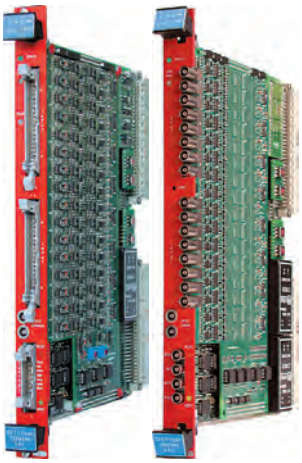
The device supports MBLT and CBLT readout modes.

The board features also live insertion, allowing the User to insert (or remove) the board into (or from) the crate without switching the latter off.

Code	Description
WV1785XNCAAA	V1785NC - 8 Ch. Dual Range Multievent PeakSensing ADC

V785 - V785N

32/16 Channel Multievent Peak Sensing ADC



Features

- 0 ÷ 4 V input range
- Full 12-bit resolution
- 5.7 µs / 32 ch and 2.8 µs / 16 ch conversion times
- 600 ns fast clear time
- Zero and overflow suppression for each channel
- ±0.1% integral non linearity
- ±1.5% differential non linearity
- 32 event buffer memory
- MBLT and CBLT data transfer
- Multicast commands
- Live insertion

Overview

The V785 (V785N) is a 32 (16) channel Peak Sensing Analog-to-Digital Converter, housed in a 1-unit wide VME 6U module. Each channel is able to detect and convert the peak value of the positive analog signals (with > 50 ns rise time) provided to the relevant input connectors (header type for V785, LEMO 00 for V785N). Accepted input voltage range is 0 ÷ 4 V (0 ÷ 8 V for Mod. V785AG, see Ordering Information here below).

The outputs of the peak detecting sections are multiplexed and subsequently converted by two fast 12-bit ADCs (V785: 5.7 µs for all channels, V785N: 2.8 µs for all channels). The integral non linearity is ±0.1% of full scale range (FSR), measured from 2% to 97% of FSR; the differential non linearity is ±1.5% of FSR, measured from 3% to 100% of FSR. The ADCs use a sliding scale technique to reduce the differential non-linearity.

Programmable zero suppression, multievent buffer memory, trigger counter and test features complete the flexibility of the unit.

The device supports MBLT and CBLT readout modes.

A 16 channel flat cable to LEMO input adapter (Mod. A385, see Accessories section) is available for the V785 (each V785 requires two A385 adapters for all 32 channels). The boards support a live insertion feature, allowing the User to insert (or remove) the board into (or from) the crate without switching the latter off.

Code	Description
WV785XACAAAA	V785AC - 32 Channel Peak Sensing ADC (4V, No 12V DCDC, live ins)
WV785XAGAAAA	V785AG - 32 Channel Peak Sensing ADC (8V, No 12V DCDC, live ins)
WV785XNCAAAA	V785NC - 16 Channel Peak Sensing ADC (4V, No 12V DCDC, live ins)
WA385XAAAAAA	A385 - 16 Channel Cable Adapter (Flat to LEMO) for V785, 50cm ±10% cables

Accessories

A385
16 Channel Flat-to-LEMO Cable Adapter

Amplifiers (Fast)

V974

4 Channel Variable Gain Fast Amplifier

Features

- Input bandwidth up to 170 MHz
- x10 adjustable gain with x1 steps
- 50 Ω input impedance
- ±2 V output dynamics
- Drives 50 Ω loads
- Cascadeable channels
- Rise/fall time <3 ns with a 25 mV unipolar input amplitude

Overview

The V974 is a 4 channel Variable Gain Fast Rise Time Amplifier, housed in a 1-unit wide VME 6U module. The voltage gain for each channel is adjustable, via four rotary switches, from 1 to 10 in x1 steps.

Channels are non-inverting and bipolar: they amplify both positive and negative signals. Input bandwidth is 170 MHz for signals up to 50 mVpp and decreases for larger ones (up to 100 MHz @ 400 mVpp). Channels can be cascaded in order to obtain larger gain values.

Each channel is provided with three LEMO 00 connectors, one for the input and two bridged for the output. The board features a ±2 V output dynamics. 4 screw-trimmers (one per channel) allow the offset calibration which operates over a ±25 mV range. The outputs feature a short circuit protection.

The module does not require a VME interface, as it uses only the power lines of the VME crate.

Code	Description
WV974XBAAAAA	V974B - 4 Channel Variable Gain Fast Amplifier

V975

8 Channel Fast Amplifier

Features

- Input bandwidth up to 250 MHz
- x10 fixed gain
- 50 Ω input impedance
- ±2 V output dynamics
- Drives 50 Ω loads
- Cascadeable channels
- Rise/fall time <1.5 ns with a 25 mV unipolar input amplitude
- I/O delay <3 ns

Overview

The V975 is an 8 channel Fast Rise Time Amplifier, housed in a 1-unit wide VME 6U module. Each channel has a fixed voltage gain of 10.

Channels are bipolar, non-inverting and can be cascaded in order to obtain larger gain values. Input bandwidth is 250 MHz for signals up to 50 mVpp and decreases for larger ones (up to 110 MHz @ 400 mVpp).

Each channel is provided with three LEMO 00 connectors, one for the input and two bridged for the output. The board features a ±2 V output dynamics. Screw-trimmers (one per channel) allow the offset calibration which operates over a ±25 mV range. The outputs feature a short circuit protection.

The module does not require a VME interface, as it uses only the power lines of the VME crate.

Code	Description
WV975XBAAAAA	V975B - 8 Channel Fixed Gain Fast Amplifier

Attenuators

V859

Dual Attenuator

Features

- Attenuation adjustable from 0 to 44.5 dB
- Cascadeable sections
- Input bandwidth larger than 300 MHz
- 100 mW maximum input power
- No power supply required

Overview

The V859 is a dual Attenuator, housed in a 1-unit VME module. Its function is performed by resistive cells, so the module does not require any power supply. Attenuation ranges from 0 to 44.5 dB for each section (0.5 dB steps). The two sections can be cascaded in order to obtain a single section featuring a 0 ÷ 89 dB (0.5 dB step) attenuation.

Each section is provided with two LEMO 00 connectors, one for the input (50 Ω impedance) and one for the output, and seven toggle switches for attenuation setting. An additional switch allows to cascade the two sections.

Code	Description
WV859XAAAAAA	V859 - Dual Attenuator (0 to 44.5 dB)

Coincidence/Logic/Trigger Units

V2495
Programmable Logic Unit

Features

- User-programmable FPGA
- Compact Desktop form factor
- Up to 162 inputs, up to 130 outputs
- LVDS/ECL/PECL/NIM/TTL
- 3 expansion slots for piggyback board, wide selection of programmable functions:
  - Time OverThreshold
  - Counters
  - Logic Analyzer
  - Logic Ports
  - Coincidence
  - Scaler
  - Trigger Logic
  - Gate and Delay Generator
  - Rising/Falling Edge Identification
  - Pattern Matching
  - Input/Output Register
  - Rate Meter
  - Pattern Generator
- 32 independent programmable Gate and Delay Generator
- Ethernet (DT5495) and Mini-USB 2.0 Connection
- Supported by SCI-Compiler software tool (LICENSE NOT INCLUDED)

Accessories

A967
32 Channel Cable Adapter

Software

CAEN Upgrader — FREE

Firmware

FW 2495SC — FREE TRIAL

SCI-COMPILER CAEN — FREE TRIAL

Overview

The V2495 is the completely new version of the CAEN bestseller VME General Purpose Programmable Unit V1495. This new design brings a simpler connectivity, a 150% increase in the logic resources, more programmable Gate&Delay generators and it does all this remaining compatible with previous I/O expansion boards. These boards are a suitable solution for the implementation of digital functions such as Coincidence, Trigger Logic, Gate and Delay generator, Input/Output Register and more.

The architecture of the V2495 is based on the User FPGA (Altera Cyclone V GX C4, 50K Logic Elements) which is directly interfaced to the front panel I/Os (up to 162 inputs and up to 130 outputs) and to an internal local bus.

The user firmware can be easily uploaded by the min-USB port on the front panel, while controlled through the USB2.0 and VME supported interfaces.

The V2495 is also completed by 32 internal delay lines that can be used to generate programmable gate and delay signals. The channel interface can be freely expanded by adding up to three independent piggyback boards (there are 3 expansion slots interfaced to the User FPGA), choosing between the five available types:

- A395A 32 LVDS/ECL/PECL input channels
- A395B 32 LVDS output channels
- A395C 32 ECL output channels
- A395D 8 NIM/TTL input/output channels
- A395E 8 Analog output 16-bit channels

Therefore, the V2495 can achieve a maximum number of 194 I/O channels.

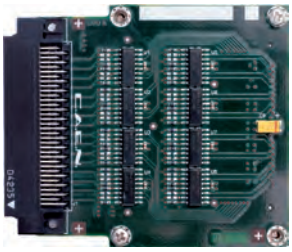
A set of free Firmware demos, complete of full source codes, is available to help the user firmware development. In addition, CAEN provides the FW2495SC pay firmware to use the board as a 160-channel Scaler (see p. 158).

Users who want to develop firmware even without being VHDL or Verilog experts, can purchase a license of the SCI-Compiler software. SCI-Compiler allows to design the firmware by blocks in a graphical intuitive way, generates the firmware code and loads it on the board. In addition to the VHDL source code, the software generates C/C++/C#/Python libraries, drivers and example code (to be used in Windows, Linux and macOS) for the specific firmware project (see p. 122).

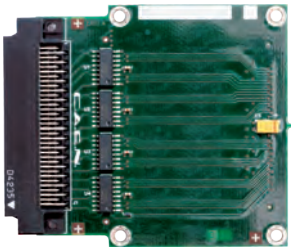
Desktop version (DT5495) is also available (see p. 174)

A395A - A395B - A395C - A395D - A395E

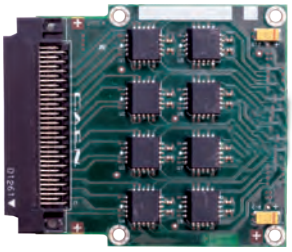
Piggyback boards for Vx495 and DT5495



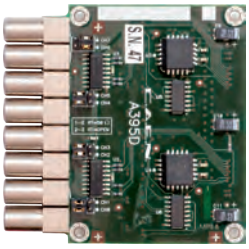
A395A - 32 LVDS/ECL/PECL input channels



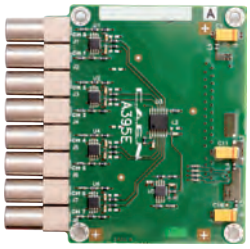
A395B - 32 LVDS output channels



A395C - 32 ECL output channels

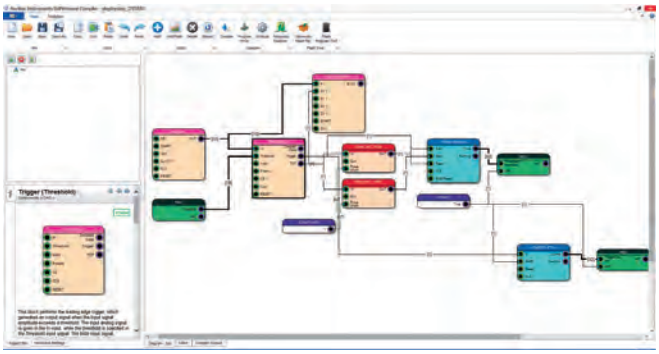


A395D - 8 NIM/TTL input/ output channels



A395E - 8 Analog output 16-bit channels

Model	A395A	A395B	A395C	A395D	A395E
No. of channels	32	32	32	8	8
Channel type	Digital Input	Digital Output	Digital Output	Digital I/O selectable	Analog Output
Description	Differential LVDS/ECL/PECL	Differential LVDS	Differential ECL	NIM/TTL	16-bit resolution Output range: ± 5 V @10 kΩ RL ± 4 V @200 Ω RL
Note	single ended TTL optional	LVDS 100 Ω RI	ECL	NIM/TTL selectable 50 Ω Rt	DAC board equipped with DT5495 - Vx495 Firmware and VHDL source for custom development
Bandwidth	200 MHz	250 MHz	300 MHz	250 MHz	-
Front panel connector	3M P50E-068-P1-SR1 type (34+34) pins	3M P50E-068-P1-SR1 type, (34+34) pins	3M P50E-068-P1-SR1 type, (34+34) pins	LEMO 00	LEMO 00



SCI-Compiler

CAEN announces that the DT5495 and V2495 boards are supported by SCI-Compiler, the new Open FPGA Firmware generator. To implement, load and operate your customized functions is now an intuitive and easier task, even without requiring VHDL expertize (see p. 122).

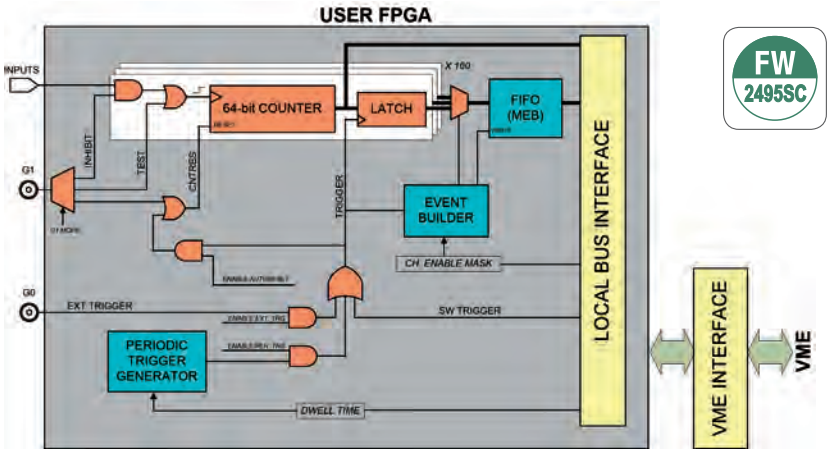
Evaluate SCI-Compiler on your V2495 in a free trial version and purchase the lincese for a full-time use!

Code	Description	
WV2495XAAAAA	V2495 - VME Programmable Logic Unit	
WA395XAAAAAA	A395A - 32 LVDS/ECL/PECL input channels interface for Vx495 & DT5495	
WA395XBAAAAA	A395B - 32 LVDS output channels interface for Vx495 & DT5495	
WA395XCAAAAA	A395C - 32 ECL output channels interface for Vx495 & DT5495	
WA395XDAAAAA	A395D - 8 NIM/TTL input/output channels interface for Vx495 & DT5495	
WA395XEAAAAA	A395E - 8 channel 16Bit ± 5V DAC for Vx495 & DT2495	
WA967XAAAAAA	A967 - 32 Channel Cable Adapter (1x32 to 2x16) for V767, V862, V1190, VX1190, Vx495, DT5495	
WFW2495SCXAA	FW2495SC - 160 Channels Latching Scaler for V2495 & DT5495	NEW

Scaler Firmware

NEW FW2495SC

160 Ch 200 MHz Multievent latching Scaler



FW 2495SC

FREE TRIAL

Features

- Up to 160 Channel Latching Scaler
- Up to 200 MHz of couting frequency
- 64-bit channel depth
- Multichannel scaler operation with programmable dwell time from 1 µs to ~ 4000 s
- 4 k x 32 bits multievent buffer memory
- 64 bit Trigger time tag
- VME Block Transfer support
- Event payload legacy option for V1495 compliance
- Windows compliant demo program with C source files and VS project for developers

Overview

FW2495SC is a FPGA firmware for CAEN V2495 and DT5495 models that allows to use the boards as a Multievent latching scaler housing up to 160 independent counting channels (the maximum number of channels is achieved if the V2495/DT5495 is expanded with three A395A boards). Each channel has a programmable 32 or 64 bit counting depth and accepts LVDS/ ECL/PECL inputs; up to 200 MHz of counting frequency is supported.

Each counter is incremented at the leading edge of the input signal. As a trigger arrives, all counters are latched simultaneously and independently from the counting operations, that continue unaffected. Thanks to a synchronization technique, the counter value is significant, even when it is incremented during the readout. After the latched counter values have been made available for readout, the FPGA writes them into a FIFO memory (Multi Event Buffer or MEB) together with a data header and, optionally, the active channel masks. Events written in the MEB can be readout via VME. Once an event has been written, the Scaler can accept another trigger even if the previous event has not been readout yet, provided that the FIFO memory has enough space left for other data.

The trigger signal can be either fed to the G0 connector (NIM or TTL) or internally generated by the FPGA, with a specific trigger period (DWELL TIME) ranging from 1µs to 4000 s in 1-µs steps, or can be sent via VME, by a write access to a specific register. Trigger Time tag information can be programmed to be included in the event as a 32 or 64-bit format.

The lowest 32 bits of the counter values can be also read via VME on the fly, independently from the counting, trigger and event recording operations. The G1 connector can be alternatively used as Counting Inhibit, Test signal (parallel counting) or Counters reset.

The counters reset can be also asserted every time a trigger is sent (auto-reset option); in this way, the read values represent the counting value between two consecutive triggers instead of the absolute counting values since the board switch-on (or its last reset). The counters can also be reset via VME command.

The FW2495SC firmware features a configurable legacy option of the event payload, so that acquisition systems developed for the V1495 can be compatible with V2495 and DT5495.

Code	Description
WFW2495SCXAA	FW2495SC - 160 Channels Latching Scaler for V2495 and DT5495

Coincidence/Logic/Trigger Units

V976

Quad 4 Fold AND/OR/MAJ, NIM-TTL TTL-NIM Translator, Fan-In Fan-Out

Features

- Four independent sections with four channels each
- TTL and NIM inputs automatically detected
- NIM/TTL selectable output level
- AND, OR, Majority function with selectable number of inputs
- Logic Fan-In / Fan-Out
- Direct or inverted output

Overview

The V976 is a quad Logic Unit/Majority, Level Translator and Fan-In/Fan-Out, housed in a 1-unit wide VME 6U module.

Each section features 4 inputs and 4 outputs on LEMO 00 connectors and can operate as an AND/OR gate or as a 4 channel level translator (NIM to TTL / TTL to NIM). It is possible to use two or four sections together to obtain an 8 or 16 input Majority.

The logic functions can be selected via front-panel and internal switches. Some extra functions, such as a 1 to 12 Fan-Out, can be performed by cascading properly the module's sections.

The module accepts NIM and TTL inputs, while the outputs can be programmed to provide either NIM or TTL levels, either direct or inverted.

The module does not require a VME interface, as it uses only the power lines of the VME crate.

Code	Description
WV976XBAAAAA	V976B - Quad 4 Fold AND/OR/MAJ, NIM-TTL TTL-NIM Level Translator and Fan-In Fan-Out

V1718 - VX1718

VME/VME64X VME-USB 2.0 Bridge

Software

CAEN VME Demos

CAEN Upgrader

FREE

Overview

The V1718 (VX1718) is a VME to USB 2.0 Bridge, housed in a 1-unit wide VME (VME64X) 6U module.

The unit acts as a VME Master module and can be operated from the USB port of a standard PC. It can perform all the cycles foreseen by the VME64 (except those intended for 3U boards). The board can operate as VME System Controller (normally when plugged in the slot 1), acting as a Bus Arbiter in Multi-Master systems.

The VME bus activity can be monitored in detail, both locally (through an LED display) and remotely. The front panel includes also 5 TTL/NIM programmable outputs on LEMO 00 connectors (default assignment is: DS0/1, AS, DTACK, BERR and LOCATION MONITOR) and two programmable TTL/NIM inputs (on LEMO 00 connectors). The I/Os can be programmed via USB in order to implement functions such as Timer, Counter, Pulse Generator, I/O Register, etc.

The PC interface is USB 2.0 compliant, USB data transfer takes place through the High Speed Bulk Transaction protocol; the sustained data rate on the USB is up to 30 MByte/s in MBLT Read cycles. Thanks to the 128 KByte memory buffer, the activity on the VME bus is not slowed down by the transfer rate on the USB port.

The Module is provided with drivers which support the use with the most common PC platforms (Windows Vista, 7/8, Linux). Libraries and useful example programs in C/C++, .NET and LabVIEW are also provided (CAEN VMEDemos software). Firmware upgrade can be performed via USB using CAENUpgrader Tool .

Features

- No boot required, ready at power ON
- Up to 30 MByte/s sustained data transfer rate
- VME Master (arbiter or requester)
- VME Slave (register and test RAM access)
- Cycles: R/W, RMW, BLT, MBLT, IACK, ADO, ADOH
- Addressing: A16, A24, A32, CR/ CSR, LCK
- Data width: D8, D16, D32, D64
- System Controller capabilities
- Interrupt handler
- Front panel Dataway Display (available also from PC and VME)
- 5 outputs and 2 inputs, NIM or TTL, fully programmable
- Libraries, Demos (C and LabVIEW) and Software tools for Windows and Linux
- 2 models available:
  - V1718 (1-unit wide 6U VME)
  - VX1718 (1-unit wide 6U VME64X)

Code	Description
WV1718XAAAAA	V1718 - VME-USB 2.0 Bridge
WVX1718XAAAA	VX1718 - VME-USB 2.0 Bridge

Controllers

V2718 - VX2718

VME/VME64X VME-PCI Optical Link Bridge

Accessories

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

AI2700
Optical Fiber Series

Cables for CONET Optical Link Networks

Software

CAEN VME Demos

CAEN Upgrader

FREE

Features

- No boot required, ready at power ON
- PC control through A2818/A3818 Optical Controllers
- CONET1 OR CONET2 CAEN Proprietary Optical link Compatible
- PCI 32-bit/33 Mhz with A2818
- PCIe x8 with A3818
- Daisy chain capability
- Up to 80 MByte/s sustained data transfer rate
- VME Master (arbiter or requester)
- VME Slave (register and test RAM access)
- Cycles: RW, RMW, BLT, MBLT, IACK, ADO, ADOH
- Addressing: A16, A24, A32, CR/CSR, LCK
- Data width: D8, D16, D32, D64
- System Controller capabilities
- Interrupt handler
- Front panel Dataway Display (available also from PC and VME)
- 5 outputs and 2 inputs, NIM or TTL, fully programmable
- Libraries, Demos (C and LabVIEW) and Software tools for Windows and Linux
- 2 models available:
  - V2718 (1-unit wide 6U VME)
  - VX2718 (1-unit wide 6U VME64X)

Overview

The V2718 (VX2718) is a VME to PCI Optical Link Bridge, housed in a 1-unit wide VME (VME64X) 6U module.

The unit acts as a VME Master module and can be controlled by a standard PC equipped with PCI or PCIe CAEN Controller cards (Models. A2818 and A3818). The connection between the bridge and the A2818 takes place through an optical fiber cable (AI2700 - Optical Fiber Series). Multi crate sessions can be easily performed, since up to eight daisy chained bridges (via optical fiber cables) can be controlled by a single A2818/A3818, thus building a CONET (Chainable Optical Network).

The device can perform all the cycles foreseen by the VME64 (except those intended for 3U boards). The board can operate as VME System Controller (normally when plugged in the slot 1) acting as a Bus Arbiter in Multi-Master systems. The VME bus activity can be monitored in detail, both locally (through a LED display) and remotely.

The front panel includes also 5 TTL/NIM programmable outputs on LEMO 00 connectors (default assignment is: DS0/1, AS, DTACK, BERR and LOCATION MONITOR) and two programmable TTL/NIM inputs (on LEMO 00 connectors). The I/Os can be programmed via PCI/PCIe in order to implement functions such as Timer, Counter, Pulse generator, I/O register, etc.

The sustained data transfer rate is up to 80 MByte/s. Thanks to the 128 KByte memory buffer, the activity on the VME bus is not slowed down by the transfer rate on the CONET when several bridges units share the same network.

A2818 and A3818 are provided with drivers for Windows Vista/7/8, Linux. Libraries and useful example programs in C/C++, .NET and LabVIEW are also provided. Firmware upgrade can be performed via PCI/PCIe using CAENUpgrader Tool.

Code	Description
WA2818XAAAAA	A2818 - PCI Optical Link Controller
WK2718XAAAAA	V2718KIT - VME-PCI Bridge (V2718) + PCI Optical Link (A2818) + Optical Fibre 5m duplex (AY2705)
WV2718XAAAAA	V2718 - VME-PCI Bridge
WKX2718XAAAA	VX2718KIT - VME-PCI Bridge (VX2718) + PCI Optical Link (A2818) + Optical Fibre 5m duplex (AY2705)
WVX2718XAAAA	VX2718 - VME-PCI Bridge
WA3818AXAAAA	A3818 - PCIe 1 Optical Link Controller
WA3818BXAAAA	A3818 - PCIe 2 Optical Link Controller
WA3818CXAAAA	A3818 - PCIe 4 Optical Link Controller
WK2718XBAAAA	V2718KITB - VME-PCI Bridge (V2718) + PCIe Optical Link (A3818A) + Optical Fibre 5m duplex (AY2705)

V812

16 Channel Constant Fraction Discriminator

Accessories

A954
16 Channel to 2x8 Channel Cable Adapter

Features

- Thresholds individually programmable via VME
- Constant fraction for precise discrimination timing
- ECL outputs with fan-out of two
- Programmable output width
- Global VETO and TEST inputs
- Mask register for individual channel enable/disable
- OR, CURRENT SUM and MAJORITY outputs

Overview

The V812 is a 16 channel Constant Fraction Discriminator, housed in a 1-unit wide VME 6U module. The module accepts 16 negative inputs and generates ECL pulses when the input signals exceed a given threshold.

Constant fraction technique allows to precisely determine the timing of the discrimination. The pulse forming stage of the discriminator produces an output pulse with adjustable width (via VME) in a range from 15 ns to 250 ns. Moreover, in order to protect against multiple pulsing, it is possible to program via VME a dead time, from 150 ns to 2 µs, during which the discriminator is inhibited from retriggering.

The discriminator thresholds can be individually programmed via VME in a range from -1 mV to -255 mV (1 mV step) through an 8-bit DAC. Each channel can be turned on or off via VME by using a mask register.

A CURRENT SUM output provides a current proportional to the input multiplicity, i.e. to the number of channels over threshold, at a rate of -1.0 mA per hit (-50 mV per hit into a 50 Ω load). A MAJORITY output provides a NIM signal if the number of input channels over threshold exceeds the Majority programmed value.

Several V812 boards can be connected in a daisy chain via the CURRENT SUM output: in this case, by switching the majority logic to “External”, it is possible to obtain a MAJORITY signal when the number of active channels in the chained modules exceeds a global Majority level. The logic OR of discriminator outputs is available on a front panel NIM signal.

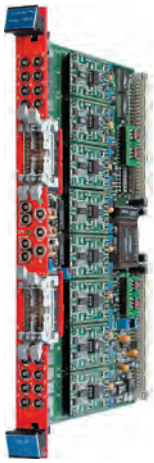
Code	Description
WV812XBAAAAA	V812B - 16 Channel Constant Fraction Discriminator
WA954XAAAAAA	A954 - 16 Channel to 2x8 Channel Cable Adapter

V814

16 Channel Low Threshold Discriminator

Accessories

A954
16 Channel to 2x8 Channel Cable Adapter



Features

- Thresholds individually programmable via VME
- ECL outputs with fan-out of two
- Non updating operation
- Programmable output width
- Mask register for individual channel enable/disable
- Global VETO and TEST inputs
- OR, CURRENT SUM and MAJORITY outputs
- High sensitivity with small signals
- Negative or Positive input version available
- Minimum detectable signals: -3 mV

Overview

The V814 is a 16 channel Low Threshold Discriminator, housed in a 1-unit wide VME 6U module. The board accepts 16 negative (positive on request) inputs and produces 16 differential ECL outputs with a fan-out of two on four front panel fat cable connectors. Maximum input frequency is 60 MHz.

The pulse forming stage of the discriminator produces an output pulse whose width is adjustable in a range from 6 to 95 ns via VME. The discriminator thresholds are individually settable in a range from -1 mV to -255 mV (1 mV step), via VME through an 8-bit DAC. The minimum detectable signal is -3 mV. A positive input version (Model V814P), with the thresholds settable in the 1 mV to 255 mV range, is also available. Each channel can be turned on or off via VME by using a mask register.

A Current Sum output generates a current proportional to the input multiplicity, i.e. to the number of channels over threshold, at a rate of -1.0 mA per hit (-50 mV per hit into a 50 Ω load). A MAJORITY output connector provides a NIM signal if the number of input channels over threshold exceeds the MAJORITY programmed value.

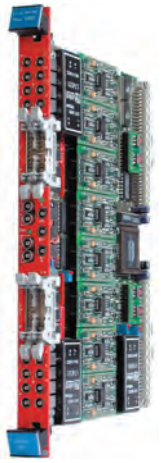
Several V814 boards can be connected in a daisy chain via the Current Sum output: in this case, by switching the majority logic to External, it is possible to obtain a Majority signal when the number of active channels in the chained modules exceeds a global Majority level. The logic OR of discriminator outputs is available on a front panel NIM signal.

Code	Description
WV814XBAAAAA	V814B - 16 Channel Low Threshold Discriminator
WV814XPBAAAA	V814PB - 16 Channel Low Threshold Discriminator Positive Inputs
WA954XAAAAAA	A954 - 16 Channel to 2x8 Channel Cable Adapter

Discriminators

V895

16 Channel Leading Edge Discriminator



Accessories

A954
16 Channel to 2x8 Channel Cable Adapter

Features

- Thresholds individually programmable via VME
- ECL outputs with fan-out of two
- Selectable Updating/Non Updating mode
- Programmable output width
- Global VETO and TEST inputs
- Mask register for individual channel enable/disable
- OR, CURRENT SUM and MAJORITY outputs

Overview

The V895 is a 16 channel Leading Edge Discriminator, housed in a 1-unit wide VME 6U module. The board accepts 16 negative (positive on request) inputs and produces 16 differential ECL outputs with a fan-out of two on four front panel fat cable connectors.

Maximum input frequency is 140 MHz. The pulse forming stage of the discriminator produces an output pulse whose width is adjustable in a range from 5 to 40 ns via VME. Each channel can operate either in Updating or Non-Updating mode according to on-board jumpers position.

The discriminator thresholds are individually settable in a range from -1 mV to -255 mV (1 mV step), via VME through an 8-bit DAC. The minimum detectable signal is -5 mV. Each channel can be turned on or off via VME by using a mask register.

A Current Sum output generates a current proportional to the input multiplicity, i.e. to the number of channels over threshold, at a rate of -1.0 mA per hit (-50 mV per hit into a 50 Ω load).

A MAJORITY output connector provides a NIM signal if the number of input channels over threshold exceeds the MAJORITY programmed value. Several V895 boards can be connected in a daisy chain via the Current Sum output: in this case, by switching the majority logic to External, it is possible to obtain a Majority signal when the number of active channels in the chained modules exceeds a global Majority level. The logic OR of discriminator outputs is available on a front panel NIM signal.

Code	Description
WV895XBAAAAA	V895B - 16 Channel Leading Edge Discriminator
WA954XAAAAAA	A954 - 16 Channel to 2x8 Channel Cable Adapter

Fan In-Fan Out Units

V925

Quad Linear Fan In-Fan Out

Features

- Four independent sections
- Bipolar inputs
- Three 4 In / 4 Out and one 3 In / 3 Out sections
- One Discriminator channel
- Inverting or non-inverting mode independently selectable on each section
- 120 MHz bandwidth

Overview

The V925 is a Quad Linear Fan In-Fan Out, housed in a 1-unit wide VME 6U module. The board features three 4 In/ 4 Out and one 3 In/ 3 Out sections; one Discriminator channel is also featured. Each Fan In-Fan Out section produces, on all its output connectors, the sum of the signals fed to the inputs, which can also be inverted. Fan In/Fan Out inputs are bipolar, while the output can be either inverting or non inverting (jumper selectable independently for each section). Both input and output signals are DC coupled.

Maximum input amplitude is ±1.6 V. Moreover each Fan In-Fan Out section features a screwdriver trimmer which allows the DC offset adjustment. The discriminator channel has one DC coupled input (trigger slope leading/trailing is jumper selectable), the threshold is screwdriver adjustable and monitorable via test point; the output is NIM standard, its width is screwdriver adjustable. Front panel LEDs allow to monitor all the mode, gain and polarity adjustments performed via internal jumpers.

Code	Description
WV925XAAAAAA	V925 - Quad Linear Fan In-Fan Out

I/O Registers

V977

16 Channel I/O Register (Status A)

Features

- NIM and TTL inputs/outputs
- Individual channel enabling/disabling
- Software Input/Output generation
- Fully programmable RORA Interrupter
- Pushbutton TEST signal
- Status A capabilities
- Live insertion

Overview

The V977 is a 16 channel Input/Output Register, housed in a 1-unit wide VME 6U module. The board can operate either as a 16 channel general purpose I/O Register or as Multihit Pattern Unit; the operating mode is selected via VME and is signalled via front panel LEDs.

The module has 16 Inputs/Outputs; an on-board switch allows to select between NIM and TTL output signals, while NIM and TTL input signals are both accepted; 2 LEDs signal the I/O status for each channel. The module features an additional channel (TEST CHANNEL), which allows to send a test pulse via a front panel pushbutton.

Input channels can be individually/globally masked via VME or globally via a front panel GATE input. The channel status can be cleared either via VME or via the front panel common CLEAR input.

The channels global OR and /OR outputs are available as front panel signals and can be eventually masked. GATE and CLEAR signals can be either NIM or TTL; OR and /OR can be set at NIM or TTL level in the same way of the output channels. Live insertion is also supported.

Code	Description
WV977XBAAAAA	V977B - 16 Channel I/O Register (Status A)

QDCs

V792 - V792N

32/16 Channel Multievent QDC

Accessories

A392
16 Channel LEMO Adapters

A992
16 Channel Impedance Adapter

Features

- 0 ÷ 400 pC input range
- Full 12-bit resolution
- 100 fC LSB
- 5.7 µs / 32 ch and 2.8 µs / 16 ch conversion times
- 600 ns fast clear time
- Zero and overflow suppression for each channel
- ±0.1% integral non linearity
- ±1.5% differential non linearity
- 32 event buffer memory
- MBLT and CBLT data transfer
- Multicast commands
- Live insertion
- Libraries (C and LabVIEW) and Software tools for Windows and Linux

Overview

The V792 (V792N) is a 32 (16) channel Multievent QDC, housed in a 1-unit wide VME 6U module. The board features 32 (16) Charge-to-Digital Conversion (Integrating ADC) channels. The inputs of the board are 50 Ω terminated and can only accept negative current pulses. For each channel, the input charge is fed via flat cable header (LEMO 00 connectors for V792N) and converted to a voltage level by a QAC (Charge to Amplitude Conversion) section. Input range is 0 ÷ 400 pC. The outputs of the QAC sections are multiplexed and subsequently converted by two fast 12-bit ADCs. The integral non linearity is ±0.1% of Full Scale Range (FSR) measured from 5% to 95% of FSR. The ADCs use a sliding scale technique to improve the differential non-linearity.

The device supports MBLT and CBLT readout modes. Live insertion is also supported. A 16 ch. decoupling board (A992, see Accessories section) is available for the V792 to avoid ground loops and signal reflections when long flat cable (110 Ω) connections to the 50 Ω inputs are used (one V792 requires two A992 boards). A 16 channel flat cable to LEMO input adapter (A392, see Accessories section) is also available for the V792 (one V792 requires two A392 boards).

Code	Description
WV792XACAAAA	V792AC - 32 Channel Multievent QDC (No 12V DCDC, live ins)
WV792XNCAAAA	V792NC - 16 Channel Multievent QDC (No 12V DCDC, live ins)
WA385XAAAAAA	A385 - 16 Channel Cable Adapter (Flat to LEMO) for V785, 50cm ±10% cables
WA392XAAAAAA	A392 - 16 Channel Cable Adapter (Flat to LEMO) for V792, 50cm ±10% cables
WA385XMAAAAA	A385M - 16 Channel Cable Adapter (Flat to LEMO) for V785, 1m ±10% cables
WA392XMAAAAA	A392M - 16 Channel Cable Adapter (Flat to LEMO) for V792, 1m ±10% cables
WA992XAAAAAA	A992 - 16 Channel Impedance Adapter for V792

QDCs

V862

32 Channel Multievent Individual Gate QDC

Accessories

A967
32 Channel Cable Adapter

Features

- Individual Gate input per channel
- 0 ÷ 400 pC input range
- Full 12-bit resolution
- 100 fC LSB
- 5.7 µs / 32 ch conversion time
- 600 ns fast clear time
- Zero and overflow suppression for each channel
- ±0.1% integral non linearity
- ±1.5% differential non linearity
- 32 event buffer memory
- MBLT and CBLT data transfer
- Multicast commands
- Live insertion
- Libraries (C and LabVIEW) and Software tools for Windows and Linux

Overview

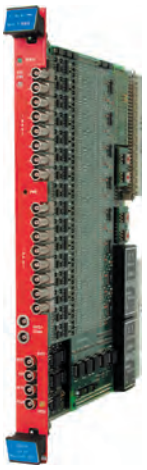
The V862 is a 32 channel Multievent QDC, housed in a 1-unit wide VME 6U module. The board features 32 Charge-to-Digital Conversion (Integrating ADC) channels. The inputs of the board are 50 Ω terminated and can only accept negative current pulses. Each channel has an independent gate input (GATE I) logically ANDed with a COMMON GATE input; the input charge on the i-th channel is converted to a voltage level by a QAC (Charge to Amplitude Conversion) section when both the GATE I and COMMON GATE signals are active. Input range is 0 ÷ 400 pC. The integral non linearity is ±0.1% of full scale range (FSR), measured from 2% to 97% of FSR; the differential non linearity is ±1.5% of FSR, measured from 3% to 100% of FSR. The ADCs use a sliding scale technique to reduce the differential non-linearity.

The outputs of the QAC sections are multiplexed and subsequently converted by two fast 12-bit ADCs (5.7 µs for 32 channels). The V862 offers a 32 event buffer memory; programmable zero suppression and trigger counter complete the features of the unit. The device supports MBLT and CBLT readout modes. Live insertion is also supported.

Code	Description
WV862XACAAAA	V862AC - 32 Channel Multievent QDC With Individual Gate (live insertion)
WA967XAAAAAA	A967 - 32 Channel Cable Adapter (1x32 to 2x16) for V767, V862, V1190, VX1190, Vx495, DT5495

V965 - V965A

16/8 Channel Dual Range Multievent QDC



Features

- Two simultaneous ranges: 0 ÷ 900 pC / 0 ÷ 100 pC
- 12-bit resolution with 15-bit dynamics
- 25 fC LSB on low range, 200 fC LSB on high range
- 2.8 µs / 8 ch conversion time
- 600 ns fast clear time
- Zero and overflow suppression for each channel
- ±0.1% Integral non linearity
- ±1.5% Differential non linearity
- 32 event buffer memory
- MBLT and CBLT data transfer
- Multicast commands
- Live insertion
- Libraries, Demos (C and LabVIEW) and Software tools for Windows and Linux

Overview

The V965 (V965A) is a 16 (8) channel Dual Range Multievent QDC, housed in a 1-unit wide VME 6U module. The board features 16 (8) Charge-to-Digital Conversion Integrating ADC channels. The inputs of the board are 50 Ω terminated and can only accept negative current pulses.

For each channel, the input charge is converted to a voltage level by a QAC (Charge to Amplitude Conversion) section. Each QAC output is then converted by two ADCs in parallel; one ADC is preceded by a x1 gain stage, the other by a 9x gain stage. A dual input range is then featured: 0 ÷ 900 pC (200 fC LSB) and 0 ÷ 100 pC (25 fC LSB); this allows to avoid saturation with big charge pulses while increasing resolution with small ones.

The outputs of the QAC sections are multiplexed and subsequently converted by two fast 12-bit ADCs. The ADCs use a sliding scale technique to improve the differential non-linearity. Programmable zero suppression, multi-event buffer memory, trigger counter and test features complete the flexibility of the unit.

The device supports MBLT and CBLT readout modes. Live insertion is also supported.

Code	Description
WV965XBAAAAA	V965 - 16 Channel Dual Range Multievent QDC (No 12V DCDC, live ins)
WV965AXBAAAA	V965A - 8 Channel Dual Range Multievent QDC (No 12V DCDC, live ins)

V1190-2eSST Family

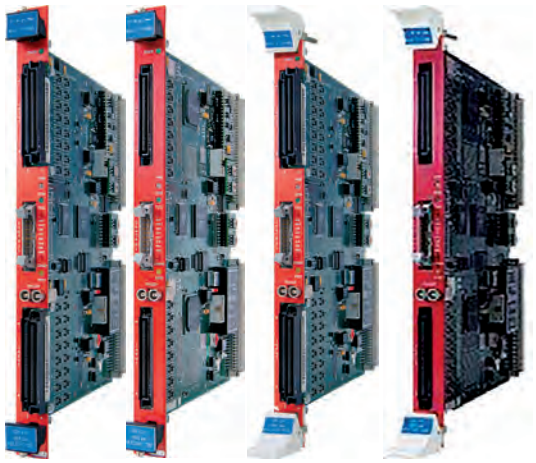
128/64 Channel Multihit TDC (100/200/800 ps)

Accessories

A967
32 Channel Cable Adapter

Software

CAEN Upgrader FREE



Overview

The boards of V1190-2eSST TDC family house 64/128 independent Multi-Hit/Multi-Event Time to Digital Conversion channels. The units feature High Performance Time to Digital Converter chips developed by CERN. LSB can be set at 100 ps (19-bit resolution, 52 µs FSR), 200 ps (19-bit, 104 µs FSR) or 800 ps (17-bit, 104 µs FSR).

The V1190-2eSST is available in 4 different versions:
- V1190A-2eSST: 128 channels (1-unit wide 6U VME)
- VX1190A-2eSST: 128 channels (1-unit wide 6U VME64X)
- V1190B-2eSST: 64 channels (1-unit wide 6U VME)
- VX1190B-2eSST: 64 channels (1-unit wide 6U VME64X)

The channels can be enabled for the detection of hits rising/falling edges or for their width measurement (both the edges' timing, and the hit width can be measured with the selected resolution). For each channel there is a digital adjustment for the zeroing of any offsets. The data acquisition can be programmed in "Events" ("Trigger Matching Mode", with a programmable time window) or in "Continuous Storage Mode". Both ECL and LVDS input signals are supported.

The board houses a 32k x 32-bit deep Output Buffer, that can be readout via VME in a completely independent way from the acquisition itself.

The device supports MBLT, CBLT and 2eSST readout modes. Live insertion is also supported.

Features

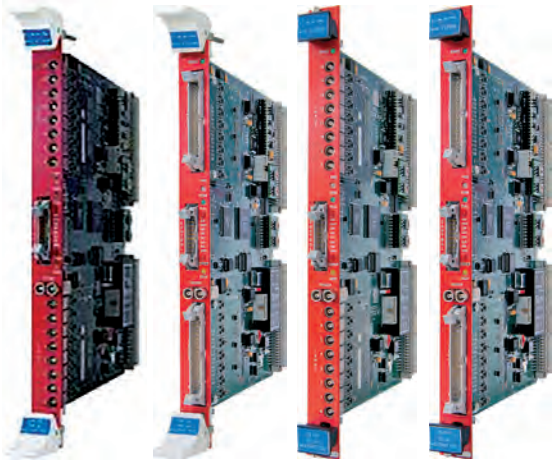
- 3 programmable ranges: 100 ps LSB (19-bit resolution), 200 ps LSB (19-bit) and 800 ps LSB (17-bit)
- 4 models available:
  - V1190A-2eSST: 128 ch. (6U VME)
  - VX1190A-2eSST: 128 ch. (6U VME64X)
  - V1190B-2eSST: 64 ch. (6U VME)
  - VX1190B-2eSST: 64 ch. (6U VME64X)
- ECL/LVDS inputs automatically detected
- 5 ns Double Hit Resolution
- Leading and Trailing Edge detection
- Trigger Matching and Continuous Storage acquisition modes
- 32k x 32-bit output buffer
- MBLT, CBLT and 2eSST data transfer
- Multicast commands
- Live insertion
- Libraries, Demos (C and LabVIEW) and Software tools for Windows and Linux

Code	Description
WA967XAAAAAA	A967 - 32 Channel Cable Adapter (1x32 to 2x16) for V767, V862, V1190, VX1190, Vx495, DT5495
WVX1190AEXAE	VX1190A - 2eSST 128 Ch. Multievent Multihit TDC 100-200-800 psec ECL/LVDS
WVX1190BEXAE	VX1190B - 2eSST 64 Ch. Multievent Multihit TDC 100-200-8 00 psec ECL/LVDS
WV1190AEXAAE	V1190A - 2eSST 128 Ch. Multievent Multihit TDC 100-200-800 psec ECL/LVDS
WV1190BEXAAE	V1190B - 2eSST 64 Ch. Multievent Multihit TDC 100-200-80 0 psec ECL/LVDS

TDCs

V1290-2eSST Family

32/16 Channel Multihit TDC



Software

CAEN Upgrader

FREE

Accessories

A954
16 Channel to 2x8 Channel Cable Adapter

Overview

The boards of V1290-2eSST TDC family house 16/32 independent Multi-Hit/Multi-Event Time to Digital Conversion channels The unit features High Performance Time to Digital Converter chips developed by CERN. LSB is 25 ps (21-bit resolution, 52 µs FSR). The module accepts both ECL and LVDS inputs (NIM inputs on V1290N e VX1290N).

The V2190-2eSST is available in 4 different versions:
- V1290A-2eSST: 32 channels (1-unit wide 6U VME)
- VX1290A-2eSST: 32 channels (1-unit wide 6U VME64X)
- V1290N-2eSST: 16 channels (1-unit wide 6U VME)
- VX1290N-2eSST: 16 channels (1-unit wide 6U VME64X)

The channels can be enabled for the detection of hits rising/falling edges. For each channel there is a digital adjustment for the zeroing of any offsets. The data acquisition can be programmed in “Events” (“Trigger Matching Mode”, with a programmable time window) or in “Continuous Storage Mode”.

The board houses a 32k x 32-bit deep Output Buffer, that can be readout via VME in a completely independent way from the acquisition itself.

The device supports MBLT, CBLT and 2eSST readout modes. Live insertion is also supported.

Features

- 4 models available:
  - V1290A-2eSST: 32 ch. (6U VME)
  - VX1290A-2eSST: 32 ch. (6U VME64X)
  - V1290N-2eSST: 16 ch. (6U VME)
  - VX1290N-2eSST: 16 ch. (6U VME64X)
- 25 ps LSB
- 21-bit resolution
- 52 µs full scale range
- 5 ns Double Hit Resolution
- Leading and Trailing Edge detection
- Trigger Matching and Continuous Storage acquisition modes
- 32k x 32-bit output buffer
- MBLT, CBLT and 2eSST data transfer
- Multicast commands
- Live Insertion
- Libraries, Demos (C and LabVIEW) and Software tools for Windows and Linux

Code	Description
WVX1290AEXAE	VX1290A - 2eSST 32 Ch. Multievent Multihit TDC 25 psec E CL/LVDS
WVX1290BNXAE	VX1290N - 2eSST 16 Ch. Multievent Multihit TDC 25 psec NIM
WV1290AEXAAE	V1290A - 2eSST 32 Ch. Multievent Multihit TDC 25 psec ECL/LVDS
WV1290BNXAAE	V1290N - 2eSST 16 Ch. Multievent Multihit TDC 25 psec NIM
WA954XAAAAAA	A954 - 16 Channel to 2x8 Channel Cable Adapter

TDCs

V775 - V775N

32/16 Channel Multievent TDC

Accessories

A954
16 Channel to 2x8 Channel Cable Adapter

Features

- Full scale range programmable from 140 ns to 1.2 µs
- 12-bit resolution with 15-bit dynamic range
- 35 ps LSB
- 5.7 µs / 32 ch and 2.8 µs / 16 ch conversion times
- 600 ns fast clear time
- Zero and overflow suppression for each channel
- ±0.1% integral non linearity
- ±1.5% differential non linearity
- 32 event buffer memory
- MBLT and CBLT data transfer
- Multicast commands
- Libraries, Demos (C and LabVIEW) and Software tools for Windows and Linux

Overview

The V775 (V775N) is a 32 (16) Channel Multievent TDC, housed in a 1-unit wide VME 6U module. The Full Scale Range can be selected via VME from 140 ns to 1.2 ms with 8-bit resolution. The board can operate both in COMMON START and in COMMON STOP mode. Each time interval between the COM signal and the input signal is converted into a voltage level by the TAC sections. The outputs of the TAC sections are multiplexed and subsequently converted by two fast ADC modules (5.7 ms conversion time). The V775N houses 16 channels on LEMO 00 connectors and shares most of its features with the Mod. V775.

The integral non linearity is ±0.1% of full scale range (FSR), measured from 2% to 95% of FSR; the differential non linearity is ±1.5% of FSR, measured from 3% to 100% of FSR. The ADCs use a sliding scale technique to reduce the differential non-linearity.

Programmable zero suppression, multievent buffer memory, trigger counter and test features complete the flexibility of the unit. The devices support MBLT and CBLT readout modes.

Code	Description
WV775XACAAAA	V775AC - 32 Channel Multievent TDC (No 12V DCDC, No live ins)
WV775XNCAAAA	V775NC - 16 Channel Multievent TDC (No 12V DCDC, No live ins)
WPERS0077501	V775 Customization - 12µS Full Scale
WA954XAAAAAA	A954 - 16 Channel to 2x8 Channel Cable Adapter

Timing Units

V972

Delay Unit

Features

- Completely passive delay via a set of calibrated coaxial cable stubs (50 Ω)
- 0 to 31.5 ns delay with 2.6 ns offset
- 0.5 ns resolution
- ±100 ps accuracy on 0.5 to 8 ns delay steps; ±200 ps accuracy on 16 ns step
- VSWR < 1.15

Overview

The V972 is a Delay Unit housed in a 1-unit wide VME 6U module. Delay values range from 0 to 31.5 ns (+ 2.6 ns offset), adjustable in 0.5 ns steps via front panel toggle switches. The delay lines consist of calibrated coaxial cables for high accuracy delay and do not require power supply.

Code	Description
WV972XAAAAAA	V972 - Delay Unit (2.6 to 34.1 ns)

Timing Units

V993C
Dual Timer

Features
- Dual triggered gate generator
- Manual or pulse triggered START (NIM, TTL or ECL)
- Monostable (re-trigger) or bistable operation
- NIM, TTL and ECL output pulses from 50 ns to 10 s
- Manual or pulse triggered RESET
- (NIM, TTL and ECL) END-MARKER pulse
- VETO input

Overview
The V993C is a Dual Timer, housed in a 2-Unit wide VME module.

Each timer section is a triggered pulse generator which provides NIM/TTL (NIM/TTL selection is performed via an on board switch) and ECL pulses (width from 50 ns to 10 s) when triggered. The output pulses are available both in normal and complementary mode.

Timers can be re-triggered with the END MARKER signal.

The coarse adjustment of the output width can be performed via a 9-position rotary switch, while the fine adjustment can be performed either via a 15 turn dial handle (with lock) or by providing an external voltage. The START trigger can be provided either via an external signal (NIM, TTL or ECL) or manually via a front panel switch.

The module features also VETO and RESET input signals. RESET is also available on a front panel switch.

The V993C is equipped with LEMO 00 connectors for NIM/TTL signals and male pin couples for ECL signals.

Desktop (DT993) and NIM (N93B) versions are also available

Code	Description
WV993XCAAAAA	V993C - Dual Timer (no JAUX)
WDT993XAAAAA	DT993 - Dual Timer Desktop
WN93BXAAAAAA	N93B - Dual Timer (from CERN type 2255)

Translators

V538A
8 Channel NIM-ECL/ECL-NIM Translator

Accessories

A954
16 Channel to 2x8 Channel Cable Adapter

Features
- 8 independent NIM to ECL/NIM and ECL to NIM/ECL channels
- NIM and ECL fan-out of 2
- 300 MHz maximum operating frequency
- COMMON IN input with a fan-out of 16 (both NIM and ECL)
- I/O delay <5 ns

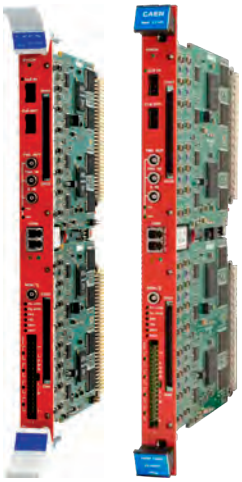
Overview
The V538A is an 8 channel NIM-ECL/ECL-NIM Translator, housed in a 1-unit wide VME module. Each of the 8 channels accepts a NIM or ECL signal and provides two NIM and two ECL outputs (OUT 0 ÷ 7 A, B). The NIM and ECL inputs of each channel are ORed prior to fan-out. The maximum operating frequency is 300 MHz.

Two front panel input bridged connectors accept a COMMON IN NIM signal, which allows the use of the module as a fan-out of 16 NIM and 16 ECL signals.

Code	Description
WV538XBAAAAA	V538AB - 8 Channel NIM-ECL/ECL-NIM Translator
WA954XAAAAAA	A954 - 16 Channel to 2x8 Channel Cable Adapter

V1741 - VX1741
64 channel Peak Sensing ADC

NEW



Accessories

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

A746B
64 Channel Adapter for LEMO connector

A317
Clock Distribution Cable

DT4700
Clock Generator and FAN-OUT

AI2700
Optical Fiber Series
Cables for CONET Optical Link Networks

Features

- 1-unit 6U VME Module
- 1k, 2k, 4k 8k, 16k Peak Sensing ADC
- 64 input channels, single ended, ERNI SMC (Zin: 1 kΩ)
- Low dead time (re-triggering less than 100 ns after the previous gate closes)
- Sliding scale algorithm for DNL reduction over 1/16 of the full ADC scale
- 4 Vpp Full Scale Range (3.75 Vpp with sliding scale enabled)
- Full-scale INL < 0.05% over 1 : 99% FSR
- Accepts positive and negative inputs
- Zero suppression with programmable threshold
- Multi-Event Buffer (512 event/channel)
- Common Gate mode (64 channels converted at once) with linear gate width or programmable by software
- Individual Gate mode with 64 independent self-gating channels
- Fast Clear input for the event discard (PUR)
- Extended Time Stamp (48 bit)
- Internal dead-time counters
- VME64/VME64x and Optical link (CAEN CONET proprietary protocol) communication interfaces
- Multi-board synchronization and Daisy chain capabilities
- Windows and Linux drivers, C and LabVIEW libraries, demo software and firmware upgrade tool
- Firmware upgradable by the user
- 2 models available:
  - V1741 (1-unit wide 6U VME)
  - VX1741 (1-unit wide 6U VME64X)

Overview

The V1741 (VX1741) is a Digital Peak Sensing ADC belonging to a new generation of detector readout systems based on a mixed analog-digital acquisition chain, combining a high channel density (64 channels) and a low dead time.

Conversion gain ranges from 1k up to 16k channels with a low differential non linearity (DNL) thanks to the sliding scale method.

The FLASH ADC architecture makes possible to achieve an extremely low conversion time of the pulse peak, so new conversions take place less than 100 ns after the previous gates close.

Receiving the typical slow signal from a Charge Sensitive Preamplifier followed by a Shaping Amplifier, the FPGA identifies the peak of the pulse within a gate by means of digital filters. The energy data are stored with the time stamp in a multi-event buffer and are available for the readout by VME bus or optical link interface (Daisy-chainable). Data throughput can be reduced by the Zero Suppression algorithm with programmable thresholds.

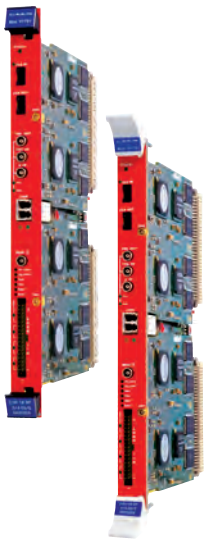
The front panel hosts LEMO (NIM/TTL) inputs for the Gate and for the event discard during the acquisition in case of pile-up. The Gate can be linear (same width as the external signal) or re-formed with programmable width. Specific I/Os allow for multi-board synchronization and for Gate propagation.

The V1741 is provided with drivers for the supported communication interfaces, C and LabVIEW libraries, demo software for an easy board understanding. Firmware upgrade can be performed via optical link or VMEbus by the user.

Code	Description	Form Factor
WV1741XAAAAA	V1741 - 64 channel Peak Sensing ADC	6U-VME64
WVX1741XAAAA	VX1741 - 64 channel Peak Sensing ADC	6U-VME64X

Digitizers

CAEN Digitizers are also available in VME form factor: for complete information see pages in Model Compare table below.



Model Compare

Model	Form Factor	No. of Channels	Max Sampling Rate (MS/s)	Bandwidth (MHz)	Full Scale Range (V)	Resolution (bits)	Board Memory (Samples/ch)	Analog Input Connectors	See Page
V1720	VME	8	250	125	2	12	1.25 M / 10 M	MCX	100
V1724	VME	8	100	40	0.5 / 2.25 / 10	14	512 k / 4 M	MCX	102
V1725	VME	8 / 16	250	125	0.5 - 2	14	640 k / 5.12 M	MCX	104
V1730	VME	8 / 16	500	250	0.5 - 2	14	640 k / 5.12 M	MCX	106
V1740	VME	64	62.5	30	2 / 10	12	192 k / 1.5 M	SMC 68P	108
V1742(1)	VME	32 + 2(2)	5000(3)	500	1	12	128 / 1024 events(4)	MCX	114
V1743(5)	VME	16	3200(3)	500	2.5	12	7 events(4)	MCX	116
V1751	VME	4(6) - 8	2000(6) - 1000	500	0.2 / 1	10	3.6 M(6) - 1.8 M / 28.8 M(6) - 14.4 M	MCX	110
V1761	VME	2	4000	1000	1	10	7.2 M / 57.6 M	MCX	110
VX1720	VME64X	8	250	125	2	12	1.25 M / 10 M	MCX	102
VX1724	VME64X	8	100	40	0.5 / 2.25 / 10	14	512 k / 4 M	MCX	102
VX1725	VME64X	8 / 16	250	125	0.5 - 2	14	640 k / 5.12 M	MCX	104
VX1730	VME64X	8 / 16	500	250	0.5 - 2	14	640 k / 5.12 M	MCX	106
VX1740	VME64X	64	62.5	30	2 / 10	12	192 k / 1.5 M	SMC 68P	108
VX1742(1)	VME64X	32 + 2(2)	5000(3)	500	1	12	128 / 1024 events(4)	MCX	114
VX1743(5)	VME64X	16	3200(3)	500	2.5	12	7 events(4)	MCX	116
VX1751	VME64X	4(6) - 8	2000(6) - 1000	500	0.2 / 1	10	3.6 M(6) - 1.8 M / 28.8 M(6) - 14.4 M	MCX	110
VX1761	VME64X	2	4000	1000	1	10	7.2 M / 57.6 M	MCX	110

(1) Based on DRS chip: 5 GS/s Switched Capacitor Array, 8+1 channels with 1024 storage cells each.
(2) Additional analog input(s) allow for low latency triggers
(3) Sampling frequency of the analog memory (switched capacitor array); A/D conversion takes place at lower speed (dead-time).
(4) 1 event = 1 k samples.
(5) Based on SAMLONG chip: 3.2 GS/s Switched Capacitor Array, 2 channels with 1024 storage cells each.
(6) If operating in Dual Edge Sampling (DES) mode.

Digital Multichannel Analyzers

CAEN Digital Multichannel Analyzers are also available in VME form factor: for complete information see page 222.

Model Specification

Model	No. of Inputs	Coupling	Channels	No. of LV Preamp. Outputs	No. of HV Outputs	HV Power Output	Acquisition Modes	Interfaces	See Page
V1781	8	DC	16 K	0	0	n/a	SI, LM, Coinc.	VME64X, Optical Link	222

SI: Signal Inspector.
LM: List Mode
Coinc: Coincidence.

Modular Pulse Processing Electronics

NEW DESKTOP PRODUCTS

NEW

DT5550

32 Channel DAQ System with User Programmable FPGA and Sequencer

Flexible and Compact Complete Readout System for Analog and Mixed Signals ASICs

Features

- Integrated system for the management of ASICs with multiplexed analog output and multi-channel detectors
- 32 analog input acquisition channels (fully differential, 2 Vpp dynamic range)
- 14 bit @ 80 MS/s ADC
- Default waveform recording and charge integration firmware
- 96 digital (48 differential) I/O on VHDCI connector with selectable 3.3V, 1.8V CMOS or LVDS for the sequencer and the management of external circuits
- 8 digital CMOS I/O on LEMO connector for external synchronization
- 8 dedicated I/O for UART/I2C/SPI
- Standard high density VHDCI I/O and analog connector:
  - 1 analog connector with 32 analog channels and an I2C bus
  - 2 digital connectors with 48 digital channels (each) and programmable power supply
- USB3.0 bus for fast data transfer (FTDI Driver Win/Lin/MacOS/Android)
- Integrated SPI master core and I2C/UART core
- 0 ÷ 5.5V, 2A power supply output for external circuit management
- 12V powered
- Fully supported by SCI-Compiler, graphical programmable compiler for user application development (LICENSE INCLUDED)
- Open FPGA for user-customizable firmware features:
  - Readout of both analog and digital front-end ASIC with customizable pre-processing logic like zero suppression, pedestal subtraction
  - Multichannel analyzer based on both trapezoidal filter or charge integration with customizable filtering chain
  - Time to digital conversion and time tagging application
  - Digitalization of waveforms
  - Complex triggering logic involving both analog and digital processing
- SCI-5550 Readout Software available to manage the default firmware

Applications

- Analog and Mixed Signals ASICs
- Multichannel Detectors
- SiPM

Overview

The DT5550 is a 32-channel readout system developed with the Nuclear Instruments technical partnership. It integrates an open FPGA programmable by the user to implement most common readout features, like a sequencer to handle the readout of both analog and digital front end ASIC, complex trigger logic, pulse height analysis and time tagging feature to readout multi-channel detectors (for example SiPM matrix).
The readout system is based on 32 14-bit 80 MS/s ADCs used to sample up to 32 analog inputs. The data acquired by the ADCs is then forwarded to an FPGA that can be configured by the user through a graphical developing platform (SCI-Compiler) and used as the sequencer for the system readout.
The DT5550 also integrates a reconfigurable area where it is possible to implement trigger logic, external circuit management, and real time signal processing. To facilitate the development process, SCI-Compiler software automatically generates the VHDL source code and C/C++/C#/Python libraries, with no need for the user to learn VHDL or Verilog to configure the board. The generated code is still available to the user that can customize it as needed.

To facilitate the user in the custom firmware development, a license of SCI-Compiler software is provided.
The DT5550 comes with a default firmware for the waveform recording and the charge integration which is managed by the free available SCI-5550 Readout Software.
Both firmware and software are SCI-Compiler based and user changeable by the provided SCI-Compiler projects.

Developed in collaboration with Nuclear Instruments

DT5550 rear panel

Accessories

DT5550AFE

DT5550AFE is a single-ended to differential adaptor with programmable DC offset and 1x fixed gain. The adaptor receives the single-ended signals on 32 MCX connectors and provides differential analog output and control signals on a single cable to the DT5550.

DT5550AFE front panel

Ordering Option

Code	Description
WDT5550XAAAA	DT5550 - 32 ch DAQ System with Programmable FPGA and Sequencer
WDT5550AFEXA	DT5550AFE - Single-Ended to Differential Input Adapter for DT5550

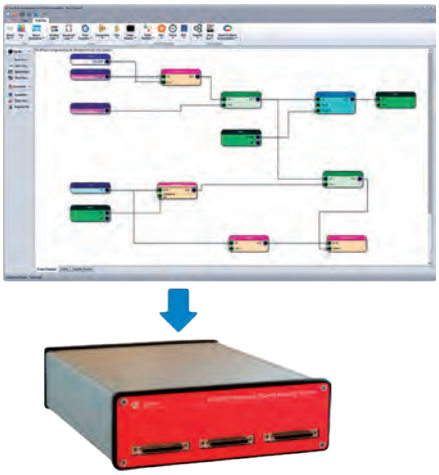
Software

SCI-Compiler

SCI-Compiler software is a graphical platform for easy FPGA programming provided with DT5550 to realize a complete custom firmware. It allows to:

- Automatically generate the VHDL source code, with no need of FPGA programming expertise, the drivers and libraries (C/C++/C#/Python) compilable in Windows/Linux/MacOS;
- Load the custom firmware directly on the FPGA ;
- Automatically generate example code (to be compiled on Windows/Linux/MacOS)
- Design GUI-based control interfaces.

Refer to page 132 for a detailed description.



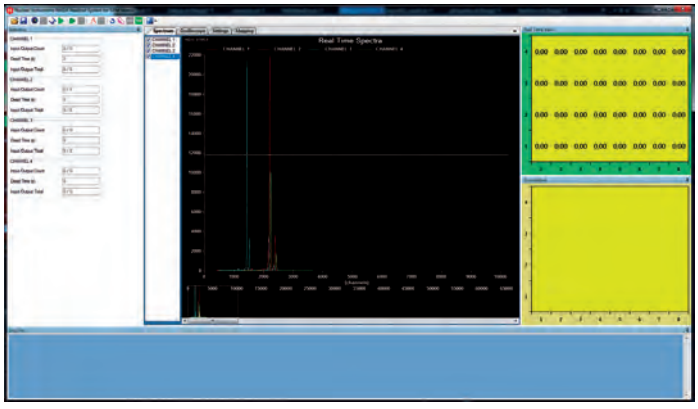
Build your firmware and store it on board with SCI-Compiler.

Software

SCI-5550 Readout Software

FREE

The SCI-5550 Readout Software is provided for free to support the DT5550 Default firmware. It configures the acquisition system parameters, manages the realtime oscilloscope feature and the pixel-independent energy spectrum calculation. Common trigger or independent channel trigger mode can be selected; the result is shown in a heat map plot. The detector map can be easily configured by the user. The user can further customize the software, as it is based on SCI-Compiler and open source.



Screenshot of the SCI-5550 Readout Software.

NEW

DT5495

Programmable Logic Unit

Expand the logic capabilities of your experiment with this new and fully programmable FPGA-based board

Features

- User Programmable FPGA
- Compact Desktop form factor
- Up to 162 inputs, up to 130 outputs
- LVDS/ECL/PECL/NIM/TTL
- 3 I/O expansion slots for optional piggyback boards.
- Wide selection of user-implementable functions:
  - Time Over Threshold
  - Counters
  - Logic Analyzer
  - Logic Ports
  - Coincidence
  - Scaler
  - Trigger Logic
  - Gate and Delay Generator
  - Rising/Falling Edge Identification
  - Pattern Matching
  - Input/Output Register
  - Rate Meter
  - Pattern Generator
- 32 independent programmable Gate and Delay Generators
- Ethernet and Mini-USB 2.0 Connection
- Supported by SCI-Compiler software tool (LICENSE NOT INCLUDED), more info on page 122

VME version (V2495) is also available (p. 156)

Overview

The DT5495 is the brand new desktop version of the CAEN bestseller VME General Purpose Programmable Unit V1495. This new design brings a simpler connectivity, a 150% increase in the logic resources, more programmable Gate&Delay generators and keeping this compatible with previous I/O expansion boards. The boards are a suitable solution for the implementation of digital functions such as Coincidence, Trigger Logic, Gate and Delay generator, Input/Output Register and more.
The architecture of the DT5495 is based on the User FPGA (Altera Cyclone V GX C4, 50K Logic Elements) which is directly interfaced to the front panel I/Os (up to 162 inputs and up to 130 outputs) and to an internal local bus.
The DT5495 can be controlled and programmed via USB or Ethernet. A Software tool is provided for free to easily upload the custom Firmware on the User FPGA.
The DT5495 is also completed by 32 internal delay lines that can be used to generate programmable gate and delay signals. The presence of expansion slots interfaced to the User FPGA makes easy to extend the channel interface by hosting up to three independent piggyback boards, choosing between five available types:

- A395A 32 LVDS/ECL/PECL input channels
- A395B 32 LVDS output channels
- A395C 32 ECL output channels
- A395D 8 NIM/TTL input/output channels
- A395E 8 Analog output 16-bit channels

Therefore, the DT5495 can achieve a maximum number of 194 I/O channels.

A set of free firmware demos, complete of full source codes, is available to help the user in the firmware development. In addition, the unit can be used as a 160 Channels Scaler thanks to FW2495SC CAEN Firmware (LICENSE NOT INCLUDED).

Software / Firmware

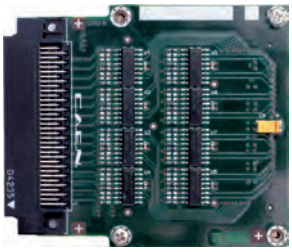
CAENUpgrader — CAEN Upgrader — FREE

SCI-Compiler — SCI-COMPILER CAEN — FREE TRIAL

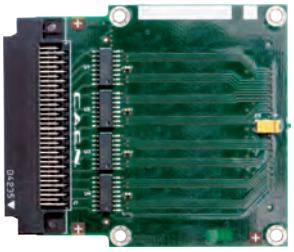
Scaler firmware — FW 2495SC — FREE TRIAL

A395A - A395B - A395C - A395D - A395E

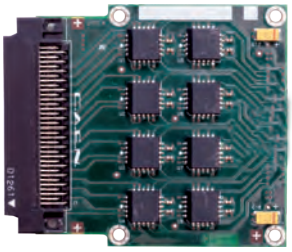
Piggyback boards for Vx495 and DT5495



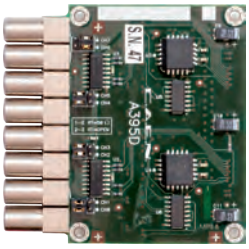
A395A - 32 LVDS/ECL/PECL input channels



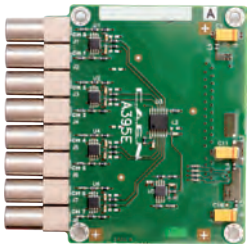
A395B - 32 LVDS output channels



A395C - 32 ECL output channels



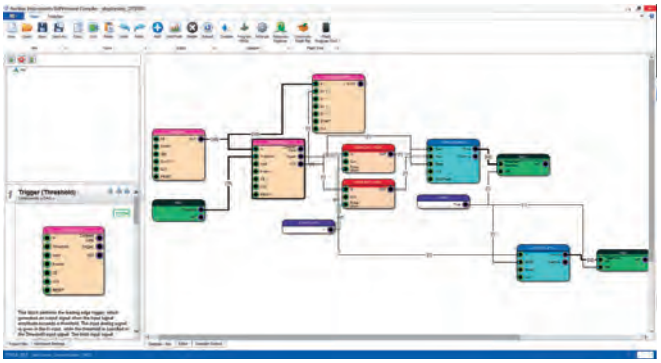
A395D - 8 NIM/TTL input/ output channels



A395E - 8 Analog output 16-bit channels

Piggyback Boards Compare

Model	A395A	A395B	A395C	A395D	A395E
No. of channels	32	32	32	8	8
Channel type	Digital Input	Digital Output	Digital Output	Digital I/O selectable	Analog Output
Description	Differential LVDS/ECL/PECL	Differential LVDS	Differential ECL	NIM/TTL	16-bit resolution Output range: ± 5 V @10 kΩ RL ± 4 V @200 Ω RL
Note	single ended TTL optional	LVDS 100 Ω RI	ECL	NIM/TTL selectable 50 Ω Rt	DAC board equipped with DT5495 - Vx495 Firmware and VHDL source for custom development
Bandwidth	200 MHz	250 MHz	300 MHz	250 MHz	-
Front panel connector	3M P50E-068-P1-SR1 type (34+34) pins	3M P50E-068-P1-SR1 type, (34+34) pins	3M P50E-068-P1-SR1 type, (34+34) pins	LEMO 00	LEMO 00



SCI-Compiler

CAEN announces that the DT5495 and V2495 boards are supported by SCI-Compiler, the new Open FPGA Firmware generator. To implement, load and operate your customized functions is now an intuitive and easier task, even without requiring VHDL expertize (see p. 122).

Evaluate SCI-Compiler on your DT5495 in a free trial version and purchase the lincese for a full-time use!

Ordering Option

Code	Description
WDT5495XAAAA	DT5495 - Desktop Programmable Logic Unit
WA395XAAAAAA	A395A - 32 LVDS/ECL/PECL input channels interface for Vx495 & DT5495
WA395XBAAAAA	A395B - 32 LVDS output channels interface for Vx495 & DT5495
WA395XCAAAAA	A395C - 32 ECL output channels interface for Vx495 & DT5495
WA395XDAAAAA	A395D - 8 NIM/TTL input/output channels interface for Vx495 & DT5495
WA395XEAAAAA	A395E - 8 channel 16Bit ± 5V DAC for Vx495 & DT2495
WA967XAAAAAA	A967 - 32 Channel Cable Adapter (1x32 to 2x16) for V767, V862, V1190, VX1190, Vx495, DT5495
WFW2495SCXAA	FW2495SC - 160 Channels Latching Scaler for V2495 & DT5495

NEW

DT5702 - A1702

32 Channel Silicon Photomultipliers Readout Front-End Board

A compact ASIC-based solution to readout SiPM arrays with coincidence trigger logic

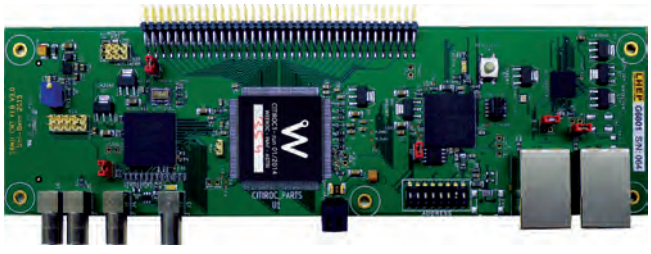
Features

- Based on Weeroc CITIROC 1A ASIC
- Amplification and shaping of the SiPMs output pulse
- Provides bias voltage in the range of 20-90 V individually adjustable for each channel
- Discrimination of shaped signal at configurable level from 0 to 50 SiPMs photo-electrons
- Provides basic coincidence of signals from each pair of adjacent even-odd channels
- Timing resolution up to 1 ns
- Formation of two independent timestamps
- Lemo I/O for time reference and control signals
- DAQ and control software with data output in ROOT format
- Daisy chain of up to 256 boards into one network interface
- Multiple boards event validation
- Efficient back-end communication based on Ethernet standard
- Trigger-independent firmware available (NEW)

Overview

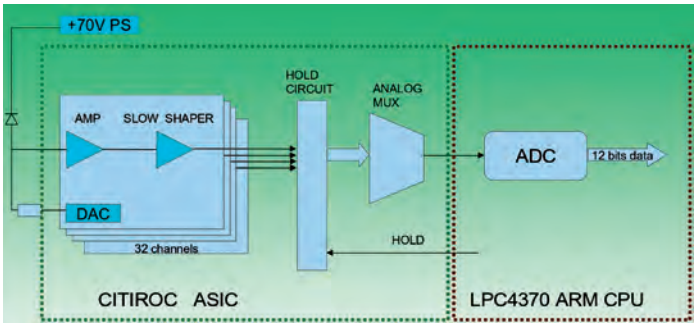
The DT5702/A1702 is a compact 32-channels Front-End Board (FEB) designed to perform energy and time measurements with SiPM arrays. Given the increasing use of SiPMs in physics experiments, this solution is a valid approach for a variety of applications thanks to its flexibility, compact form factor and channel density.
The board provides adjustable bias voltage to the detectors and is able to process and digitize the analog signals.
The analog input signal is processed by a Weeroc CITIROC 1A ASIC providing charge amplifier with configurable gain, fast shaping with the peaking time of 15 ns for trigger formation and slow shaping with configurable peaking time in the range of 12.5 ns to 87.5 ns for amplitude measurements. Thanks to these features the DT5702/A1702 has a wide range of possible applications: from veto systems of neutrino experiments to SiPM arrays imaging.
The triggering logic is realized by a XILINX Spartan-6 FPGA. A trigger independent firmware is available by ordering option, useful to extract triggering pixel positional information, improve timing resolution and estimate the time walk.
The communication interface of the board is a 3-port Ethernet switch, which allows connection to a host computer and daisy chain of multiple boards.

The board is also available in boxed (DT5702) and naked (A1702) version.

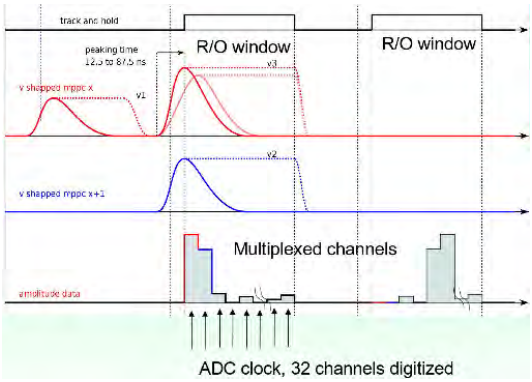


A1702 - Front-End Board.

DT5702 - A1702 Front-End Board is a custom design developed by the Albert Einstein Center for Fundamental Physics of the University of Bern for the readout of SiPM arrays used in the veto system of Liquid Argon Neutrino Experiment.



Block-scheme of analog signal processing circuit.



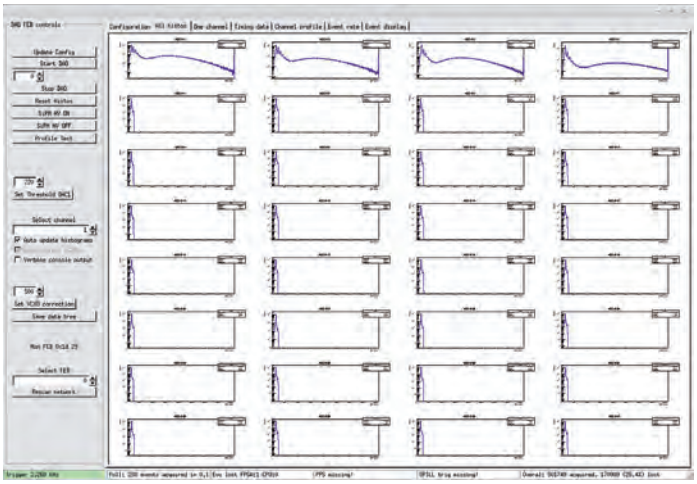
DT5702/A1702 readout of SiPM signals.

Software

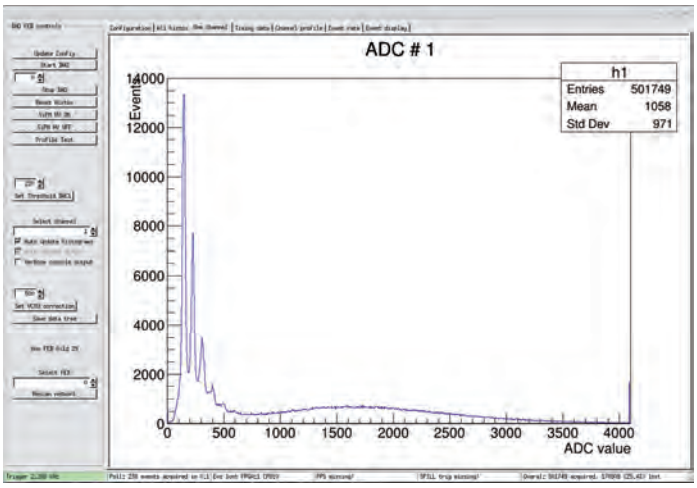
FEBDAQMULT

FREE

A data acquisition control software (FEBDAQMULT) with GUI is available in order to test the performances of DT5702/A1702 boards. The software is a C script based on Cern ROOT Data Analysis Framework and is tested on Linux OS. The code is open source and may serve as a template for more dedicated experiment-optimized DAQ software.



FEBDAQMULT GUI, 32-histograms per FEB summary.



FEBDAQMULT GUI, single histogram tab activated.

Ordering Option

Code	Description
WA1702XAAAAA	A1702 - 32-channel SiPM readout Front-End Board
WDT5702XAAAA	DT5702 - 32-channel SiPM readout Front-End Board BOXED

NEW

DT4700

Clock Generator and FAN-OUT

A compact and easy to use solution to synchronize your VME, NIM and desktop digitizers

Features

- 50 MHz, 62.5 MHz clock frequencies available and switch selectable
- Can be operated as a signal or a clock fan-out from another external source (maximum frequency 800 MHz)
- 10 differential LVDS outputs
- ± 5V, +12V or USB powered
- External Clk in LVDS, LVPECL
- Compatible with A317 clock distribution cable

Accessories

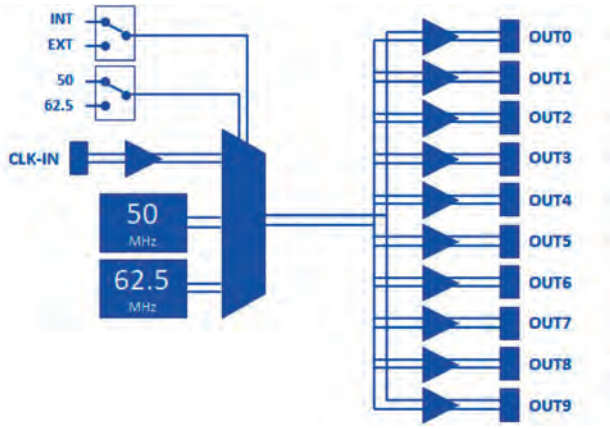
A317
The A317L (25 cm) - Clock Distribution Cable allows to perform CLK OUT - CLK IN connection

A318
SE to Differential Clock Cable Adapter

Overview

The DT4700 clock generator is a compact and easy to use desktop module that allows an easy synchronization of CAEN VME, NIM and desktop digitizers. It features 10 differential LVDS outputs, compatible with A317 clock distribution cable, each providing 50 or 62.5 MHz clock signal (switch selectable) required for the synchronization procedure. It also allows the possibility of working as a fan-out of a clock coming from another external source with a maximum frequency of 800 MHz.

The DT4700 can also be powered through the USB port on the rear panel or, using the included power split cable, from your digitizer supply. In addition the DT4700 can also be operated as a general purpose Fan-Out.



Block scheme of DT4700

Ordering Option

Code	Description
WDT4700XAAAA	DT4700 - Desktop Clock Generator

DT993

NEW

Desktop Dual Timer

One of the most useful modules ever made, today in a new and handy form.

Features

- Dual triggered gate generator
- Manual or pulse triggered START (NIM, TTL or ECL)
- Monostable (re-trigger) or bistable operation
- NIM, TTL and ECL output pulses from 50 ns to 10 s
- Manual or pulse triggered RESET
- (NIM, TTL and ECL) END-MARKER pulse
- VETO input

Overview

The DT993 Dual Timer is a desktop module housing two identical triggered pulse generators.

The module produces NIM/TTL (NIM/TTL selection is performed via an on-board switch) and ECL pulses whose width ranges from 50 ns to 10 s when triggered. Output pulses are provided normal and negated.

Timers can be re-triggered with the pulse end marker signal, a short pulse occurring at the end of each output pulse.

The coarse adjustment of the output width is provided via a 9-position rotary switch, the fine adjustment can be performed via either 15 turn dial handle (with lock) or by providing an external voltage.

The trigger START can be provided via either an external signal (NIM, TTL or ECL) or manually via a front panel switch.

The module features also VETO and RESET input signals.

RESET is also available on a front panel switch.

The DT993 is equipped with LEMO 00 connectors for NIM/TTL signals and male pin couples for ECL signals.

VME V993C and NIM N93B versions are also available

Ordering Option

Code	Description
WDT993XAAAAA	DT993 - Dual Timer Desktop

NEW

DT5741

32 channel Peak Sensing ADC

Features

- Compact desktop Module (154x50x164 mm^3)
- 1k, 2k, 4k 8k, 16k Peak Sensing ADC
- 32 input channels, single ended, ERNI SMC (Zin: 1 kΩ)
- 16 even channels optional on single ended MCX (Zin: 1 kΩ)
- Low dead time (re-triggering less than 100 ns after the previous gate closes)
- Sliding scale algorithm for DNL reduction over 1/16 of the full ADC scale
- 4Vpp Full Scale Range (3.75 Vpp with sliding scale enabled)
- Full-scale INL < 0.05% over 1 : 99% FSR
- Accepts positive and negative inputs
- Zero suppression with programmable threshold
- Multi-Event Buffer (512 event/channel)
- Common Gate mode (64 channels converted at once) with linear gate width or programmable by software
- Individual Gate mode with 64 independent self-gating channels
- Linear external gate width or software programmable
- Clear input for the event discard (PUR)
- Extended Time Stamp (48 bit)
- Internal dead-time counters
- USB2.0 and Optical link (CAEN CONET proprietary protocol) communication interfaces
- Daisy chain capabilities
- Windows and Linux drivers, C and LabVIEW libraries, demo software
- Firmware upgradeable by the user

Overview

The DT5741 is a Peak Sensing ADC belonging to a new generation of detector readout systems based on a mixed analog-digital acquisition chain, combining a high channel density (32 channels) and a low channels dead time.
Conversion gain ranges from 1k up to 16k channels with a low differential non linearity (DNL) by the sliding scale method.
The FLASH ADC architecture makes possible to achieve an extremely low conversion time of the pulse peak, so new conversions take place less than 100 ns after the previous gates close.

Receiving the typical signal from a Shaping Amplifier (e.g. CAEN N1068), the FPGA identifies the pulse peak of the pulse within a gate by means of digital filters. The energy data are stored with the time-stamp in a multi-event buffer and available for readout by USB or optical link interface (Daisy-chainable). Data throughout can be reduced by the Zero suppression algorithm with programmable thresholds.
The front panel hosts LEMO (NIM/TTL) inputs for the Gate and for the event discard during the acquisition in case of pile-up. The Gate can be linear (same width as the external signal) or re-formed with programmable width. Specific I/Os allow for multi-board synchronization and for Gate propagation.

The DT5741 is provided with drivers for the supported communication interfaces, C and LabVIEW libraries, demo software for an easy board understanding. Firmware upgrade can be performed via optical link or USB by the user.

Ordering Option

Code	Description
WDT5741XAAAA	DT5741 - 32 channel Peak Sensing ADC

Accessories

A2818
PCI CONET Controller

A3818
PCI Express CONET2 Controller

A318
SE to Differential Clock Cable Adapter

AI2700
Optical Fiber Series

Cables for CONET Optical Link Networks

DT4700
Clock Generator and FAN-OUT

A1427 Kit

NEW

Low Noise Fast Current Preamplifier and Discriminator

Cabri version

For Fission Chambers and Proton Recoil detectors

A1427 Preamplifier characteristics:

- Fast non inverting preamplifier, negative output (EOUT)
- Input impedance: 50 Ω AC coupled
- Output high impedance (EOUT)
- Bipolar output high impedance (FOUT)
- Test input (TEST IN) impedance: 50 Ω, negative polarity
- FOUT/DET IN gain (FOUT negative lobe):
  - FC version: 700÷2500
  - PR version: 500÷1500
- FOUT/TEST IN gain: 1/100 of DET IN gain
- Output noise (peak to peak) < 40 mV
- Up to 3 kV detector bias voltage (HV IN)
- Rbias: 200 kΩ

A1428 Discriminator characteristics:

- Input polarity negative
- Input impedance 50 Ω
- Threshold -1 mV to -100 mV
- Output: standard TTL signal
- Maximum frequency 15 MHz for Fission Chamber
- Maximum frequency 6 MHz for Proton Recoil

Overview

A1427 Kit contains a fast preamplifier (A1427) and a discriminator (A1428) assembled together. It is developed by CEA Saclay for the Cabri reactor in Cadarache and it is suitable for fission chambers, boron deposition proportional counters, ^{3}He counters and proton recoil counters.

The A1427 Kit is designed to work with high counting rate and it is specifically studied to be insensible to the external electromagnetic fields. CAEN provides two versions of the kit with different mechanics and connectors: one for desk use and one designed for the Cabri reactor.

A1427 is a fast and low noise current preamplifier with AC coupled input. It hosts two outputs: EOUT (unipolar) that can be integrated to calculate the energy associated to the input signal and FOUT (bipolar) that can be used to calculate the rate of the input signal, discriminating the negative pole using the A1428 discriminator that is specifically designed to fit with A1427. The discriminator thresholds is settable from -1 to -100 mV via a 10 turn rotary handle with lock.

The Kit is available in two different versions one for fission chambers (FC) the other for proton recoil detectors (PR).

We provide A1427 and A1428 separately and in the A1427 Kit configuration, that includes the A1427 and the A1428 assembled together, both for fission chambers and for proton recoil detectors.

Compare

Version	DET IN connector	HV IN connector	Power Supply	A142x dimensions WxHxL
A1427 Kit (Cabri)	NHV	Test point	+12 V,+5 V,-5 V through a wire-to-board terminal block	61x31x113 mm^3 (without connectors)
A1427 Kit	SHV	SHV	+12 V powered by an external AC-DC stabilized power supply provided with the kit	91x34x115 mm^3 (without connectors)

Ordering Option

Code	Description
WA1427CABFCA	A1427 Cabri Low Noise Fast Current Preamplifier for Fission Chamber
WA1427CABPRA	A1427 Cabri Low Noise Fast Current Preamplifier for Proton Recoil
WA1427FCAAAA	A1427 Low Noise Fast Current Preamplifier for Fission Chamber
WA1427PRAAAA	A1427 Low Noise Fast Current Preamplifier for Proton Recoil
WK1427CABFCA	A1427KIT with A1427 Cabri Preamp. + A1428 Cabri Discrimin. for Fission Chamber
WK1427CABPRA	A1427KIT with A1427 Cabri Preamp. + A1428 Cabri Discrimin. for Proton Recoil
WK1427FCAAAA	A1427KIT with A1427 Preamp. + A1428 Discrimin. for Fission Chamber
WK1427PRAAAA	A1427KIT with A1427 Preamp. + A1428 Discrimin. for Proton Recoil


40
YEARS OF INNOVATION
1979-2019

CAEN Electronic Instrumentation

Modular Pulse Processing Electronics

PREAMPLIFIERS

Charge Sensitive Preamplifiers

A422A

Charge Sensitive Preamplifier with Timing

Features

- Positive or negative input signals
- Energy sensitivity range of 5, 30 or 60 mV/MeV (Si equivalent)
- Low noise
- Timing output
- Up to 5 kV (positive or negative) detector bias voltage

Overview

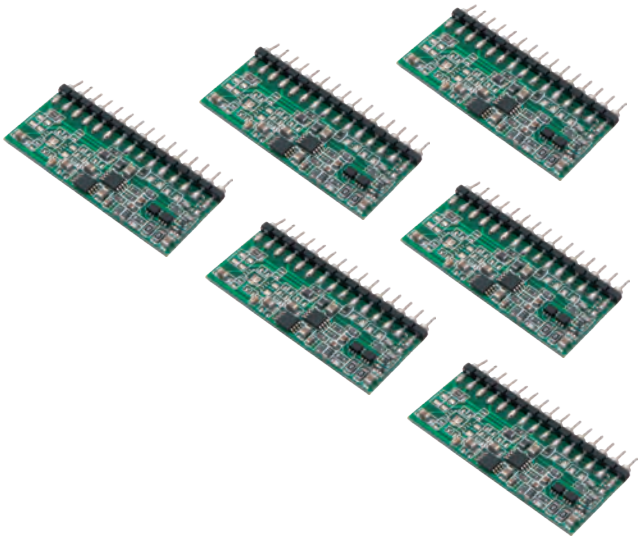
The A422A is a charge sensitive preamplifier, designed to be used with semiconductor detectors and in particular whenever the charge division is required (as in position sensitive silicon detectors). The unit accepts both positive and negative input pulses. A Test input for detector gain calibration and a HV input (up to 5 kV) for the detector bias are also included. The output is an inverting unipolar voltage pulse, proportional in amplitude to the integrated charge; decay time is 300 µs. A Timing output provides an unipolar inverting fast voltage pulse, with a 15 ns typical rise time, across a 50 Ω load. Three different sensitivities (5, 30 or 60 mV/MeV) can be selected.

Ordering Option

Code	Description
WA422AXAAAAA	A422A - Charge Sensitive Preamplifier with timing (Box)

A1422H

Low Noise Fast Rise Time Charge Sensitive Preamplifiers



Features

- Fast, low noise inverting preamplifier
- Positive or negative input signals
- Four available sensitivities (Si equivalent): 5, 45, 90 and 400 mV/MeV
- Up to 1000 pF detector capacitance supported
- Up to 800 V (positive or negative) detector bias voltage

Overview

The A1422H series are charge sensitive preamplifiers implemented on a single in-line package. Various sensitivity values are available and various detectors capacitances are supported:

- F2 type: up to 200 pF
  - sensitivity: 5, 45, 90, 400 mV/MeV (Si)
- F3 type: up to 1000 pF
  - sensitivity: 5, 45, 90 mV/MeV (Si)

All of them can be used in nuclear and subnuclear physics experiments, where very low noise, fast response and high counting rates are required. The modules accept both positive and negative input charge pulses and provide an energy output of ±4.5 V range on 50 Ω termination (±10 V on 1 kΩ). Moreover, a test input accepts positive and negative signals for calibration purposes.

Ordering Option

Detector capacitance pF	Gain mV/MeV	Ordering Code	Description
200	5	WA1422H005F2	A1422H005F2 - Charge Preamplifier Module, 5mV/MeV gain, Cdet<200pF
	45	WA1422H045F2	A1422H045F2 - Charge Preamplifier Module, 45mV/MeV gain, Cdet<200pF
	90	WA1422H090F2	A1422H090F2 - Charge Preamplifier Module, 90mV/MeV gain, Cdet<200pF
	400	WA1422H400F2	A1422H400F2 - Charge Preamplifier Module, 400mV/MeV gain, Cdet<200pF
1000	5	WA1422H005F3	A1422H005F3 - Charge Preamplifier Module, 5mV/MeV gain, Cdet<1000pF
	45	WA1422H045F3	A1422H045F3 - Charge Preamplifier Module, 45mV/MeV gain, Cdet<1000pF
	90	WA1422H090F3	A1422H090F3 - Charge Preamplifier Module, 90mV/MeV gain, Cdet<1000pF

A1422

Low Noise Fast Rise Time Charge Sensitive Preamplifiers (Boxed)

Overview

The A1422 series are charge sensitive preamplifiers packaged in a 1/4/8 channels box. Various sensitivity values are available and various detectors capacitances are supported:

F2 type: up to 200 pF; sensitivity: 5, 45, 90, 400 mV/MeV (Si equivalent)

F3 type: up to 1000 pF; sensitivity: 5, 45, 90 mV/MeV (Si equivalent)

All of them can be used in nuclear and subnuclear physics experiments, where very low noise, fast response and high counting rates are required. The modules accept both positive and negative input charge pulses and provide an energy output of ±4.5 range on 50 Ω termination (±10 V on 1 kΩ). Moreover, a test input accepts positive and negative signals for calibration purposes.

The Preamplifiers are available also as 15 pin single-in-line packaged modules (see Mod. A1422H).

The A1422 are implemented into alloy boxes and feature SHV connectors for the IN/DETECTOR and HV BIAS signals, LEMO connectors for the TEST IN and ENERGY OUT and a cable with a D-type 9 pin male connector for the power supply.

A customization is available to improve amplifier protection from transients at detector input connection.

Features

- Fast, low noise inverting preamplifier
- Four available sensitivities (Si equivalent):
  - 5 mV/MeV
  - 45 mV/MeV
  - 90 mV/MeV
  - 400 mV/MeV
- Up to 1000 pF detector capacitance supported
- 1, 4 and 8 channel model available
- Up to 2 kV (positive or negative) detector bias voltage

Ordering Option

Detector capacitance pF	Gain mV/MeV	No. of Channels	Ordering Code	Description
200	5	1	WA1422A005F2	A1422A005F2 - 1 Ch.Charge Preamplifier, 5mV/MeV gain, Cdet<200pF
		4	WA1422B005F2	A1422B005F2 - 4 Ch.Charge Preamplifier, 5mV/MeV gain, Cdet<200pF
		8	WA1422C005F2	A1422C005F2 - 8 Ch. Charge Preamplifier, 5mV/MeV gain, Cdet<200pF
	45	1	WA1422A045F2	A1422A045F2 - 1 Ch. Charge Preamplifier, 45mV/MeV gain, Cdet<200pF
		4	WA1422B045F2	A1422B045F2 - 4 Ch. Charge Preamplifier, 45mV/MeV gain, Cdet<200pF
		8	WA1422C045F2	A1422C045F2 - 8 Ch. Charge Preamplifier, 45mV/MeV gain, Cdet<200pF
	90	1	WA1422A090F2	A1422A090F2 - 1 Ch. Charge Preamplifier, 90mV/MeV gain, Cdet<200pF
		4	WA1422B090F2	A1422B090F2 - 4 Ch. Charge Preamplifier, 90mV/MeV gain, Cdet<200pF
		8	WA1422C090F2	A1422C090F2 - 8 Ch. Charge Preamplifier, 90mV/MeV gain, Cdet<200pF
	400	1	WA1422A400F2	A1422A400F2 - 1 Ch. Charge Preamplifier, 400mV/MeV gain, cdet<200pF
		4	WA1422B400F2	A1422B400F2 - 4 Ch. Charge Preamplifier, 400mV/MeV gain, Cdet<200pF
		8	WA1422C400F2	A1422C400F2 - 8 Ch. Charge Preamplifier, 400mV/MeVgain, Cdet<200pF
1000	5	1	WA1422A005F3	A1422A005F3 - 1 Ch.Charge Preamplifier, 5mV/MeV gain, Cdet<1000pF
		4	WA1422B005F3	A1422B005F3 - 4 Ch. Charge Preamplifier, 5mV/MeV gain, Cdet<1000pF
		8	WA1422C005F3	A1422C005F3 - 8 Ch. Charge Preamplifier, 5mV/MeV gain, Cdet<1000pF
	45	1	WA1422A045F3	A1422A045F3 - 1 Ch.Charge Preamplifier, 45mV/MeV gain, Cdet<1000pF
		4	WA1422B045F3	A1422B045F3 - 4 Ch. Charge Preamplifier, 45mV/MeV gain, Cdet<1000pF
		8	WA1422C045F3	A1422C045F3 - 8 Ch. Charge Preamplifier, 45mV/MeV gain, Cdet<1000pF
	90	1	WA1422A090F3	A1422A090F3 - 1 Ch.Charge Preamplifier, 90mV/MeV gain, Cdet<1000pF
		4	WA1422B090F3	A1422B090F3 - 4 Ch. Charge Preamplifier, 90mV/MeV gain, Cdet<1000pF
		8	WA1422C090F3	A1422C090F3 - 8 Ch. Charge Preamplifier, 90mV/MeV gain, Cdet<1000pF
Personalization		1	WPERS0142201	A1422A 1 Ch. Preamplifier Personalization for Improved Input ESD Protection
		4	WPERS0142204	A1422A 4 Ch. Preamplifier Personalization for Improved Input ESD Protection
		8	WPERS0142208	A1422A 8 Ch. Preamplifier Personalization for Improved Input ESD Protection

Charge Sensitive Preamplifiers

A1424

Scintillation Preamplifier

Overview

The A1424 is a preamplifier designed for Scintillation Detectors widely used in Nuclear and High Energy Physics where low noise, fast response and high counting rates are required.

The A1424 relies on an inverting Charge Sensitive Preamplifier which integrates both positive and negative input charge pulses coming from the Photodetector (e.g. PMT) coupled to the Scintillator. It provides a voltage signal in the ±4 V range on 50 Ω termination (±8 V on 1 kΩ) with exponential decay (τ = 50 µs) as Energy output. The height of the resulting pulse is proportional to the integrated charge. The sensitivity of the Charge Sensitive Preamplifier can be set via a 10 position rotary switch ranging from 0.8 to 10 mV/pC.

The A1424 is provided with a non-inverting buffer (gain ≈ 1). which reproduces the input signals coming from the detector as Fast output being useful for timing measurements. Moreover, a test input accepts positive and negative signals for calibration purposes.

Features

- Fast, low noise inverting preamplifier specifically designed for Scintillation Detectors
- Variable sensitivity from 0.8 to 10 mV/pC
- Fast output for timing measurements
- Test input for calibration

Ordering Option

Code	Description
WA1424XAAAAA	A1424 - Scintillation Preamplifier

Fast Preamplifiers

A1425

Fast Charge Sensitive Preamplifier

Overview

The A1425 is a fast and low noise preamplifier with AC coupled input. The fast rise time makes it suited for amplifying the signals from detectors as fast silicon sensors and diamond detectors.

It has been designed for spectroscopy applications, and can be combined with sub-nanosecond measurements of particle time-of flight. It is optimized for high-speed single MIP particle detection with diamond detectors, where the signal integrated change is extremely small. It integrates a high voltage input for detector bias up to 1 kV.

Features

- Fast, inverting preamplifier
- Sensitivity of 3.6 mV/fC
- ENC of 0.16 fC (1000 e)
- Output impedance of 50 Ω
- Output range 0 to 1 V
- Up to 1 kV (positive or negative) detector bias voltage

Ordering Option

Code	Description
WA1425XAAAAA	A1425 - Fast Charge Preamplifier

Fast Preamplifiers

A1426 CARDARELLI
Matched Charge Preamplifier

NEW

Overview

A1426 is a fast and low noise preamplifier with AC coupled input. It is composed by two amplification stages implementing BJT NPN silicon technology. The amplifier A1426 has been designed to be used with fast detectors as e.g. diamond detectors, thin silicon detectors with 100 ps time resolution and high counting rate RPC.

The main feature of the A1426 amplifier is that the input impedance can be matched to a 50 Ω transmission line, thus allowing to put the preamplifier far from the detector at a distance up to 100 m, without the deterioration of its response in terms of equivalent noise. In particular, A1426 has an input impedance very close to 50 Ω in the frequency range of interest. It shows a discrete matching in the range 6 MHz - 600 MHz, and a RL > 13 dB in the range 6 MHz - 320 MHz. Another important feature of A1426 is the fast shaping of the signal, down to 12 ns, that allows working at a rate of few MHz avoiding the problem of the signal pile-up. A1426 is suited for detectors installed in hostile environments with high radiation flux and high temperature. A1426 embeds an high voltage input and decoupling stage for detector bias rated up to 1 kV.

The module is powered by an external AC-DC stabilized power supply provided with the preamplifier.

Based on the fast preamplifier developed by R. Cardarelli, INFN Roma2

Features

- Fast, non-inverting preamplifier, positive output
- Up to 5 mV/fC sensitivity
- ENC of 0.3 fC (2000 e)
- Input impedance can be matched to a 50 Ω transmission line
- Amplifier can be very far from the detector (up to 100m)
- Output range 0 to 1 V
- Output impedance of 50 Ω
- Up to 1 kV (positive or negative) detector bias voltage

Optional **A1430** wide band pulse polarity inverter

Ordering Option

Code	Description
WA1426XAAAAA	A1426 CARDARELLI - Matched Preamplifier
WA1430XAAAAA	A1430 - Wide Band Pulse polarity Inverter
WA1431XAAAAA	A1431 3 meters 50 Ω triaxial cable with SMA straight plug for A1426
WA1432XAAAAA	A1431 10 meters 50 Ω triaxial cable with SMA straight plug for A1426
WA1433XAAAAA	A1431 30 meters 50 Ω triaxial cable with SMA straight plug for A1426

Wideband Amplifiers

A1423B
Wideband Amplifier

Overview

The A1423B is an inverting Wideband Amplifier designed for fast detectors, as SiPMs and Diamonds, having a bandwidth of ~ 1.5 GHz (-3 dB). The gain ranges from +18 dB to +54 dB and it is locally controlled through a rotary switch. The amplifier accepts both positive and negative input pulses and can provide an energy output in the ±1 V range across a 50 Ω load impedance.

The amplifier is AC decoupled with an input and output impedance of 50 Ω (SWR < 1.5:1) and can carry a bias voltage for the detector up to ±750 V. The A1423B is implemented in a shielded box and features SMA connectors for the HV BIAS, IN/DETECTOR and OUTPUT. The input circuit includes a protection network to prevent damage to the input circuit from transient generated in the IN/HV network (up to ±500 V).

Features

- Bandwidth: ~ 1.5 GHz (-3 dB)
- Positive or negative input signals
- Gain range: from +18 dB to +54 dB
- Output voltage: ±1V
- Input and output impedance 50 Ω, SWR < 1.5:1
- Noise Figure: 7 dB @ 1 GHz
- Up to 750 V (positive or negative) detector bias voltage

Ordering Option

Code	Description
WA1423XBAAAA	A1423B - Wide Band Preamplifier

Preamplifiers for Fission Chambers / Proton Recoil

NEW

A1427 Kit

Low noise fast current preamplifier and discriminator

Cabri version

A1427 Preamplifier characteristics:

- Fast non inverting preamplifier, negative output (EOUT)
- Input impedance: 50 Ω AC coupled
- Output high impedance (EOUT)
- Bipolar output high impedance (FOUT)
- Test input (TEST IN) impedance: 50 Ω, negative polarity
- FOUT/DET IN gain (FOUT negative lobe):
  - FC version: 700÷2500
  - PR version: 500÷1500
- FOUT/TEST IN gain: 1/100 of DET IN gain
- Output noise (peak to peak) < 40 mV
- Up to 3 kV detector bias voltage (HV IN)
- Rbias: 200 kΩ

A1428 Discriminator characteristics:

- Input polarity negative
- Input impedance 50 Ω
- Threshold -1 mV to -100 mV
- Output: standard TTL signal
- Maximum frequency 15 MHz for Fission Chamber
- Maximum frequency 6 MHz for Proton Recoil

Overview

A1427 Kit contains a fast preamplifier (A1427) and a discriminator (A1428) assembled together. It is developed by CEA Saclay for the Cabri reactor in Cadarache and it is suitable for fission chambers, boron deposition proportional counters, 3He counters and proton recoil counters.

The A1427 Kit is designed to work with high counting rate and it is specifically studied to be insensible to the external electromagnetic fields. CAEN provides two versions of the kit with different mechanics and connectors: one for desk use and one designed for the Cabri reactor.

A1427 is a fast and low noise current preamplifier with AC coupled input. It hosts two outputs: EOUT (unipolar) that can be integrated to calculate the energy associated to the input signal and FOUT (bipolar) that can be used to calculate the rate of the input signal, discriminating the negative pole using the A1428 discriminator that is specifically designed to fit with A1427. The discriminator thresholds is settable from -1 to -100 mV via a 10 turn rotary handle with lock.

The Kit is available in two different versions one for fission chambers (FC) the other for proton recoil detectors (PR).

We provide A1427 and A1428 separately and in the A1427 Kit configuration, that includes the A1427 and the A1428 assembled together, both for fission chambers and for proton recoil detectors.

Compare

Version	DET IN connector	HV IN connector	Power Supply	A142x dimensions WxHxL
A1427 Kit (Cabri)	NHV	Test point	+12V,+5V,-5 V through a wire-to-board terminal block	61x31x113 mm^3 (without connectors)
A1427 Kit	SHV	SHV	+12 V powered by an external AC-DC stabilized power supply provided with the kit	91x34x115 mm^3 (without connectors)

Ordering Option

Code	Description
WA1427CABFCA	A1427 Cabri Low Noise Fast Current Preamplifier for Fission Chamber
WA1427CABPRA	A1427 Cabri Low Noise Fast Current Preamplifier for Proton Recoil
WA1427FCAAAA	A1427 Low Noise Fast Current Preamplifier for Fission Chamber
WA1427PRAAAA	A1427 Low Noise Fast Current Preamplifier for Proton Recoil
WK1427CABFCA	A1427KIT with A1427 Cabri Preamp. + A1428 Cabri Discrimin. for Fission Chamber
WK1427CABPRA	A1427KIT with A1427 Cabri Preamp. + A1428 Cabri Discrimin. for Proton Recoil
WK1427FCAAAA	A1427KIT with A1427 Preamp. + A1428 Discrimin. for Fission Chamber
WK1427PRAAAA	A1427KIT with A1427 Preamp. + A1428 Discrimin. for Proton Recoil

N5424

Quad NIM Power distributor

Overview

The CAEN N5424 is a 4-channel NIM power distribution and control module.

The individual Voltage outputs (±6 V, ±12 V and ±24 V) are protected by electronic fuses which automatically recover after short circuit. All six voltages are monitored for each of the four outputs. The status is displayed by LEDs. The module also helps to check the correct voltage levels of a NIM-bin. If a NIM-bin without ±24 V is used, the corresponding LEDs get off, and the voltage control of those voltages is skipped.

Low-noise preamplifiers require DC power that is free of interference generated by other modules inserted in the bin. The mod. N5424 ensures this low-noise capability by filtering the power lines separately at each connector.

Features

- Single-width NIM module
- Four DB9 connectors with ±6 V, ±12 V, ±24 V each
- Survey of all 6 voltages on each output
- Protection of all voltages by self-recovering electronical fuses
- Individually filtered outputs to ensure low noise operation
- Standard voltage output compatible to CAEN electronics and to many other manufacturers

Ordering Option

Code	Description
WN5424XAAAAA	N5424 - Quad NIM Power Distributor for A1422 Preamplifier

DT5423

Quad Desktop Power distributor

Features

- Four DB9 connectors (±12 V) to supply A1422 family and A1424 preamplifiers
- One plug connector to supply DT57xx family desktop digitizers
- Very low noise

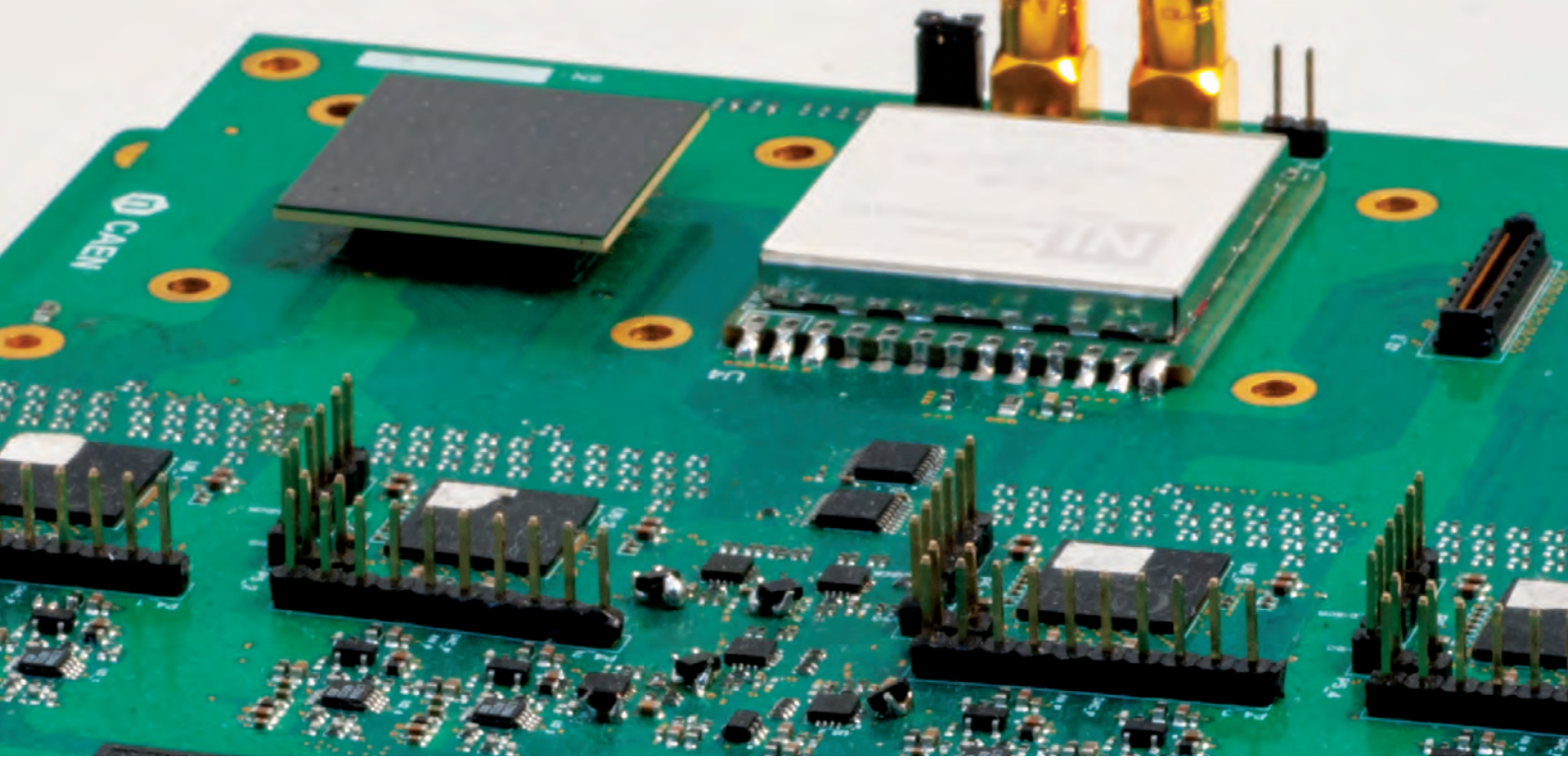
Overview

The DT5423 is a desktop power supply for A1422 and A1424 preamplifiers and DT57xx Digitizers family. It provides four standard 9-pin “D-type” female connectors to supply up to four A1422 or A1424 preamplifiers plus one plug connector to supply DT57xx desktop digitizers. Each output is filtered. The +12 V power supply for the digitizer is provided through a 6 pin Shielded Miniature Circular DIN Connector.

Ordering Option

Code	Description
WDT5423XAAAA	DT5423 - Desktop Power Supply for A1422-A1424 Amplifiers & DT57xx Digitizers


40
YEARS OF INNOVATION
1979-2019

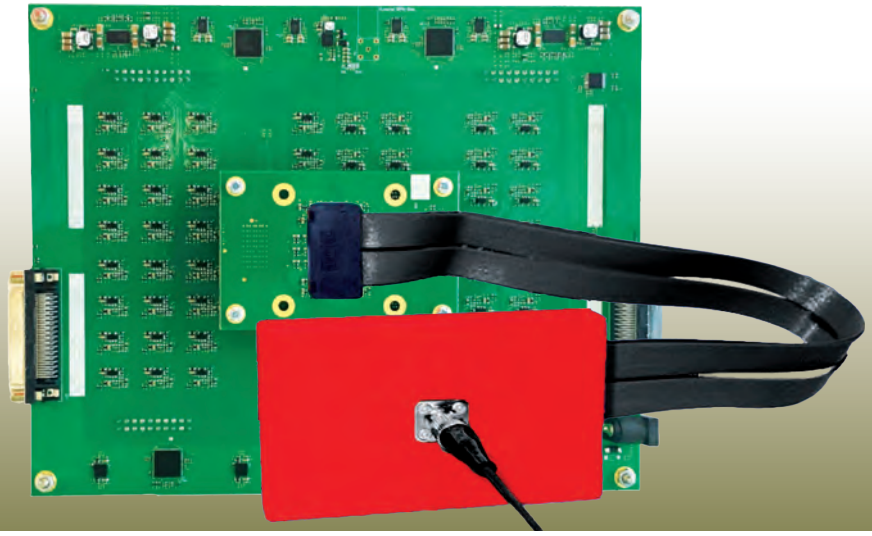


FRONT-END ELECTRONICS AND POWER SUPPLIES FOR SiPM

NEW

DT5550AFES

Multichannel Analog Front-End for SiPM



Real-Time Multichannel Readout System for SiPM Matrix and Array with Integrated Bias Generator

Features

- Connected to one or two DT5550, realizes a complete system for waveform recording, Imaging and Spectroscopy
- 32/64 trans-impedance based shaper amplifier
- Fully differential output
- Voltage levels, shaping time and connector designed to be connected to DT5550 Programmable DAQ system
- 400 ns shaping time
- Integrated low noise HV Power Supply (20-85 V)
- Fine HV regulation independent for each channel (0-2 V)
- User replaceable detector board to adapt the DT5550AFES to readout every SiPM [1]
- Ready to use detector board for Hamamatsu MPPC S1361S-1050N

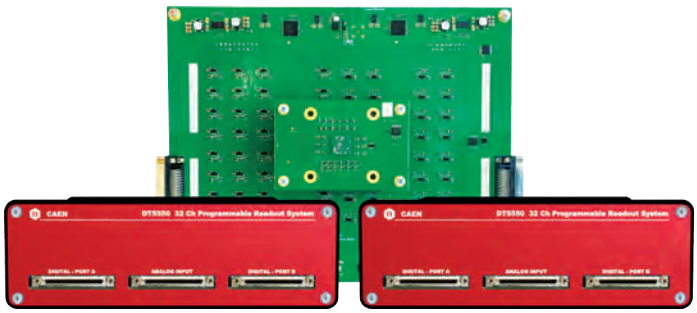
Overview

The DT5550AFES board is an outstanding readout system to be used with one or two DT5550 (refer to page 172). Depending on the channels number, it allows the readout of up to 64 independent SiPM channels making the solution ideal for SiPM matrix in imaging and spectroscopy applications. Opposed to the widely available ASIC based solutions, DT5550AFES allows the direct sampling of the analog signal generated by the SiPM in order to process it with user programmable digital pulse processing filter.

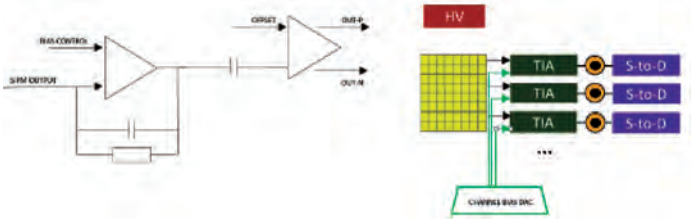
By using DT5550, it is possible to analyze the waveform, the energy spectrum and the image in both integral and framed (event by event) mode.

The analog frontend consists in indipendent transimpedance shaper amplfier (TIA) followed by a single ended to fully differential amplifier. Differential signal guarantees a better immunity to noise and crosstalk between channels. A fine control of the SiPM Bias Voltage could be applied (0 -2 V compared to the global BIAS voltage with a resolution of 60µV).

SiPM temperature is monitored using a digital temperature sensor.



DT5550AFES must be used in combination with DT5550.



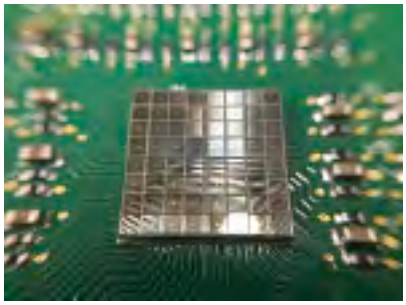
[1] *Micro-coaxial extension cable with strip connector allowing to adapt the detector board to any kind of experimental setup*

Developed in collaboration with Nuclear Instruments

DT5550AFES Detector Board
Plug-in board to adapt any SiPM matrix or array to the multi-row connector of the DT5550AFES.

- Ready to use with state-of-the-art Hamamatsu S13615-1050-N08 matrix
- Independent bias filter for each SiPM
- Integrated temperature sensor and identification EEPROM
- 4 mounting holes to hold a scintillator/fiber support
- Micro-coaxial cable to use the detector far from the main board

Detector Board PCB project useful to hold every type of SiPM Matrix, Array or single SiPM detector, is available for free.



Ordering Option

Code	Description
WA5550AFES6A	DT5550AFES – 64 Analog Front-End for SiPM
WA5550AFES3A	DT5550AFES – 32 Analog Front-End for SiPM COMING SOON
WA5550XAAAA	DT5550 - 32 ch DAQ System with Programmable FPGA and Sequencer

Software

SCI-5550AFES Readout Software

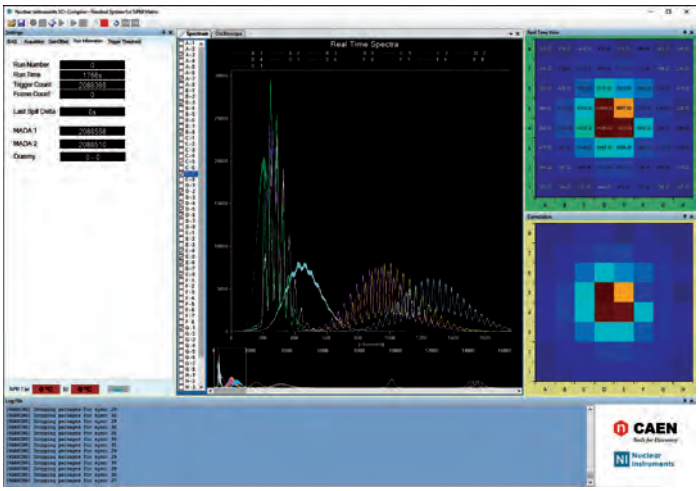
FREE

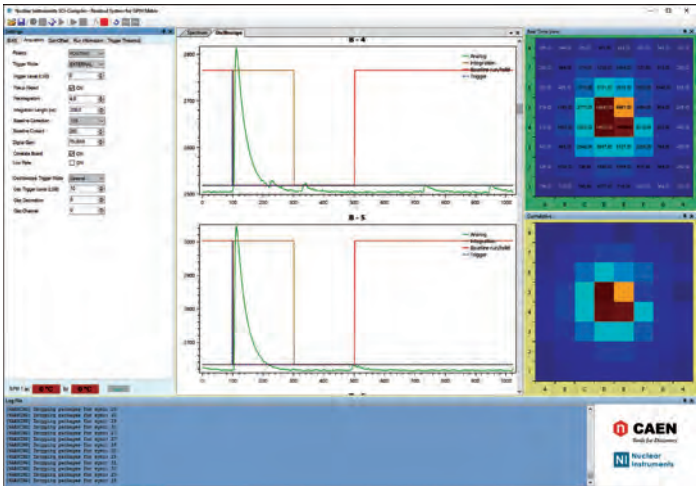
The complete system, DT5550 together with DT5550AFES board, is fully supported by SCI-Compiler software (see p. 122). A ready-to-use DAQ software is provided for free in order to acquire the waveforms and calculate the energy spectrum in realtime using charge integration default firmware.

The software allows to:

- Configure any parameters of the readout system including:
  - Bias voltage
  - Single detector fine bias regulation
  - Gain/Offset
  - Trigger mode (derivative internal, external, frame trigger)
  - Cable and logic delay compensation
  - Charge Integration configuration
  - Baseline restorer
- Monitor the SiPM temperature
- Grab the oscilloscope for each channel
- Fast dump the waveform on disk
- Calculate the realtime spectrum
- Calculate the realtime image (immediate and cumulative)
- Store the realtime image (event by event) to disk

The costumer can use the SCI-Compiler software to modify the DT5550 default firmware and extend its functions.





Screenshots of the SCI-5550AFES Readout Software

NEW

DT5550W

128 Channel SiPM Readout System

Real-time multichannel DAQ system for SiPM Matrices with user programmable FPGA

Features

- Based on Weeroc PETIROC2A/CITIROC1A ASIC
- Readout of up to 128 SiPM detectors
- Open FPGA
- Energy and time measurements
- 20 to 85 V integrated power supply (A7585D) for detector biasing available by ordering option
- On-board connectors fully matched with Hamamatsu S13361-3050AE-08 SiPM 64 channels matrix
- External sensor PCB adapter, with strip connectors for any kind of SiPM matrix or array interfacing (INCLUDED)
- Micro coaxial extension cable for sensor adapter kit available on request
- More than 200 high-speed digital I/Os interconnecting the motherboard to the piggyback
- 8 general purpose digital I/Os on LEMO Connectors for DAQ control signals (external trigger, busy, etc.)
- 3D-printed dark box for SiPMs
- Low-jitter (less than 1 ps) clock source as reference for on-chip TDC
- USB 3.0 bus for fast data transfer
- External AC adapter power supply
- Ready-to-use SCI-5550W Readout Software for SiPM imaging and spectroscopy
- Fully supported by SCI-Compiler software for easy FPGA programming (LICENSE INCLUDED)

Overview

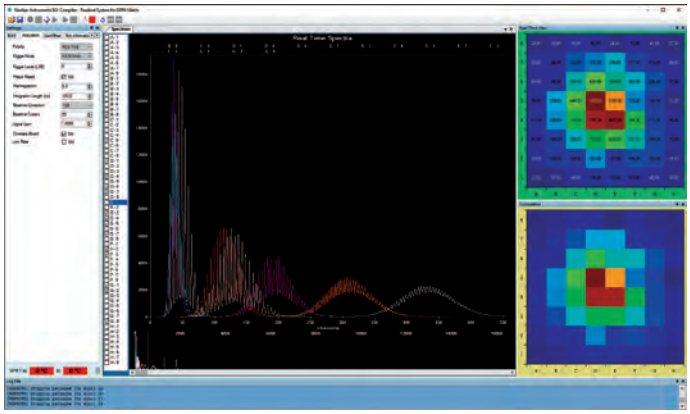
The DT5550W is a Desktop form factor DAQ platform designed to simultaneously read out up to 128 SiPM detectors. The board hosts up to 4 Weeroc chips offering the possibility to read out two 64-channels SiPM matrices connected directly on the board, with the possibility to use an external adapter and an extension cable to arrange the two detectors in several geometries. The architecture of the DT5550W is designed to adapt, in a simple and intuitive way, the hardware acquisition architecture to the user configuration: more than 200 digital signals interconnect the piggyback ASIC board with the motherboard, in order to have the possibility to read out and monitor all the signals from the ASICs by the FPGA.

The board distributes the clock to all chips minimizing the jitter. It also generates all power supply lines needed by the ASICs, using ultra-low noise linear regulator

Relying on the PETIROC ASICs and the CAEN A7585D Power Supply module, the board provides to the user a fully equipped DAQ system for any SiPM application that requires both accurate time resolution and precise energy measurements.

The DT5550W embeds a programmable FPGA that can be configured through the SCI-Compiler graphical developing platform, in order to implement a full working experimental setup minimizing the development time. The default firmware allows the user to perform energy, time of flight and integrated charge measurements.

Developed in collaboration with Nuclear Instruments



DAQ control software for DT5550W SiPM readout system .

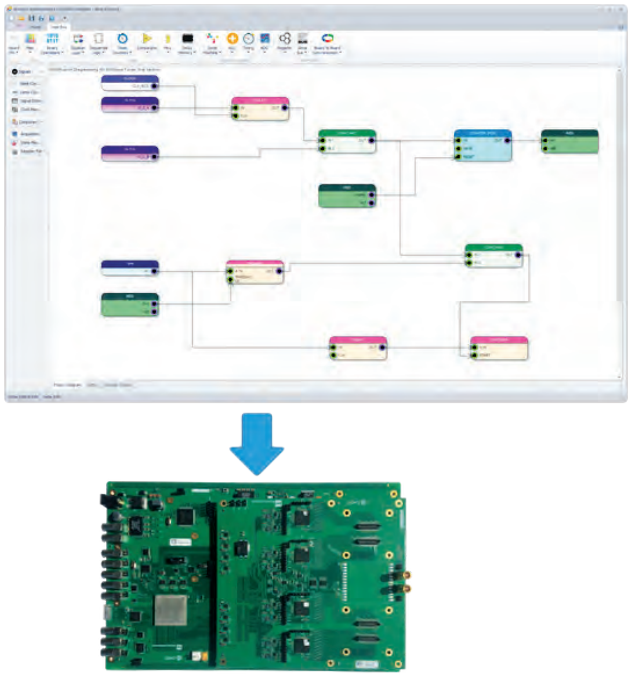
Software

SCI-5550W Readout Software

FREE

An open source control software with GUI for Windows is distributed as readout software and as an example to implement more complex systems. The GUI allows the user to:

- Configure the ASICs
- View both single frame shot and cumulative image of the SiPM matrix
- View realtime energy spectra
- View time distribution plot with respect to one channel
- Dump to file all data in output from the ASIC in binary or JSON format



Software

SCI-Compiler

SCI-COMPILER CAEN

LICENSE INCLUDED

DT5550W includes the SCI-Compiler software, a graphic tool for FPGA programming which allows the user to realize a customizable readout logic. All functions to configure the ASIC (from firmware or from PC), readout the ASIC, route the trigger to the FPGA are directly implemented in the “Weeroc” Palette. The software generates the VHDL source code, C/C++/C#/Python libraries, drivers and example code (to be used in Windows, Linux and MacOS) to help integrating the firmware automatically without requiring to be a VHDL expert.

Refer to p. 122 for detailed description.

Ordering Option

Code	Description	
WDT5550WXAAA	DT5550W - WeeROC ASICs Evaluation and DAQ System	
WW55PETI2AA1	A55PET1 - Piggyback Board with 1 PETIROC chip	
WW55PETI2AA2	A55PET2 - Piggyback Board with 2 PETIROC chip	
WW55PETI2AA4	A55PET4 - Piggyback Board with 4 PETIROC chip	
WW55CITI1AA2	A55CIT2 - Piggyback Board with 2 CITIROC chip	COMING SOON
WW55CITI1AA4	A55CIT4 - Piggyback Board with 4 CITIROC chip	COMING SOON
WA7585DXAAAA	A7585D - Digital Controlled Power Supply for SiPM 85V/10mA	

NEW DT5702 - A1702

32 Channel Silicon Photomultipliers Readout Front-End Board

A compact ASIC-based solution to readout SiPM arrays with coincidence trigger logic

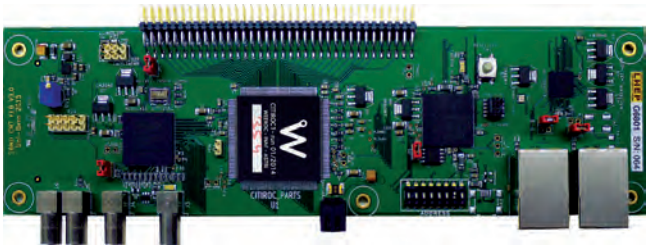
Features

- Based on Weeroc CITIROC 1A ASIC
- Amplification and shaping of the SiPMs output pulse
- Provides bias voltage in the range of 20-90 V individually adjustable for each channel
- Discrimination of shaped signal at configurable level from 0 to 50 SiPMs photo-electrons
- Provides basic coincidence of signals from each pair of adjacent even-odd channels
- Timing resolution up to 1 ns
- Formation of two independent timestamps
- Lemo I/O for time reference and control signals
- DAQ and control software with data output in ROOT format
- Daisy chain of up to 256 boards into one network interface
- Multiple boards event validation
- Efficient back-end communication based on Ethernet standard
- Trigger-independent firmware available (NEW)

Overview

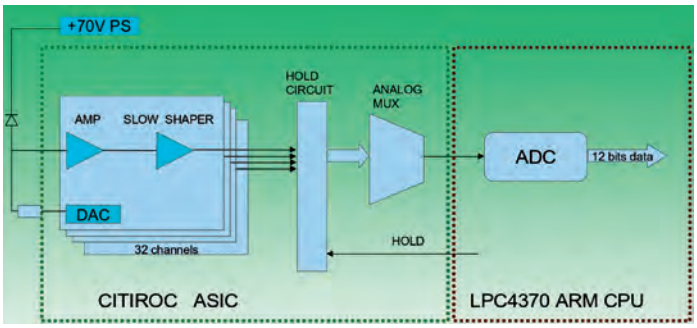
The DT5702/A1702 is a compact 32-channels Front-End Board (FEB) designed to perform energy and time measurements with SiPM arrays. Given the increasing use of SiPMs in physics experiments, this solution is a valid approach for a variety of applications thanks to its flexibility, compact form factor and channel density.
The board provides adjustable bias voltage to the detectors and is able to process and digitize the analog signals.
The analog input signal is processed by a Weeroc CITIROC 1A ASIC providing charge amplifier with configurable gain, fast shaping with the peaking time of 15 ns for trigger formation and slow shaping with configurable peaking time in the range of 12.5 ns to 87.5 ns for amplitude measurements. Thanks to these features the DT5702/A1702 has a wide range of possible applications: from veto systems of neutrino experiments to SiPM arrays imaging.
The triggering logic is realized by a XILINX Spartan-6 FPGA. A trigger independent firmware is available, useful to extract triggering pixel positional information, improve timing resolution and estimate the time walk.
The communication interface of the board is a 3-port Ethernet switch, which allows connection to a host computer and daisy chain of multiple boards.

The board is available in boxed (DT5702) and naked (A1702) version.

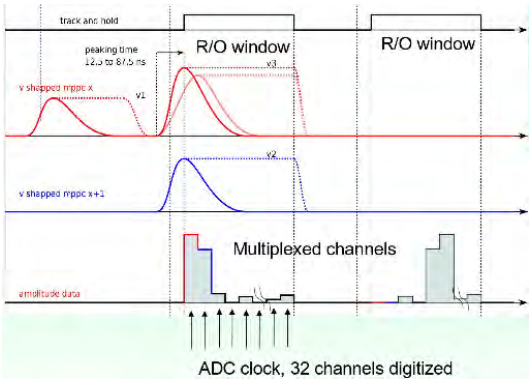


A1702 - Front-End Board.

DT5702 - A1702 Front-End Board is a custom design developed by the Albert Einstein Center for Fundamental Physics of the University of Bern for the readout of SiPM arrays used in the veto system of Liquid Argon Neutrino Experiment.



Block-scheme of analog signal processing circuit.



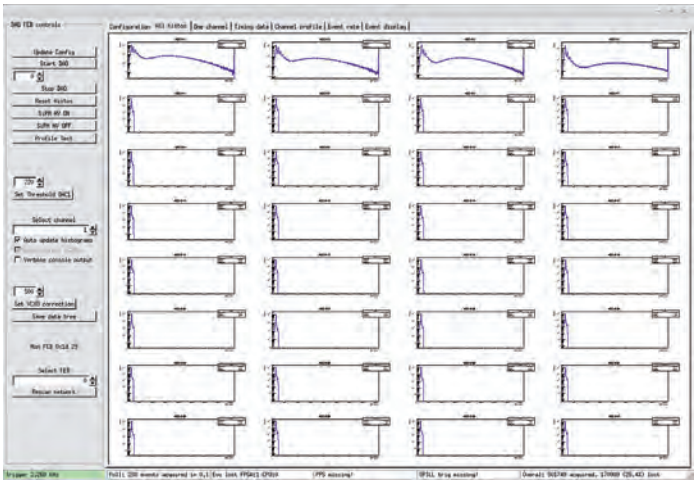
DT5702/A1702 readout of SiPM signals.

Software

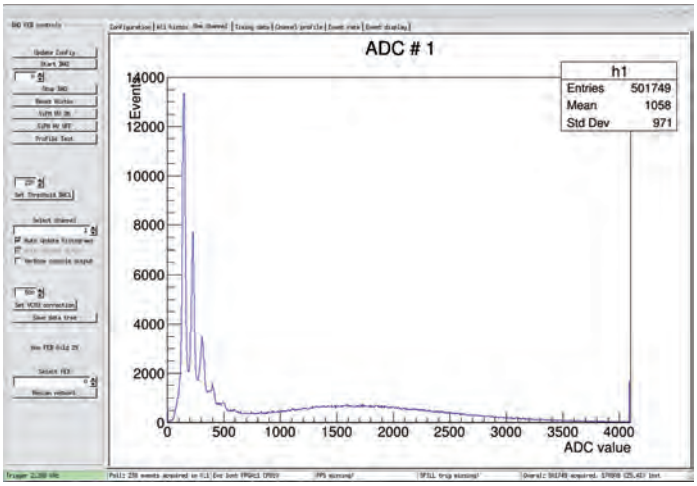
FEBDAQMULT

FREE

A data acquisition control software (FEBDAQMULT) with GUI is available in order to test the performances of DT5702/A1702 boards. The software is a C script based on Cern ROOT Data Analysis Framework and is tested on Linux OS. The code is open source and may serve as a template for more dedicated experiment-optimized DAQ software.



FEBDAQMULT GUI, 32-histograms per FEB summary.



FEBDAQMULT GUI, single histogram tab activated.

Ordering Option

Code	Description
WA1702XAAAAA	A1702 - 32-channel SiPM readout Front-End Board
WDT5702XAAAA	DT5702 - 32-channel SiPM readout Front-End Board BOXED

NEW

i-Spector

Intelligent Silicon Photomultiplier Tube

PMT replacement based on SiPM matrix with Power Supply and Remote Ethernet Control

Features

- Based on 12x12 or 18x18 mm^2 SiPMs area
- SiPM photocurrent to voltage conversion
- 180 ns shaping time
- x5 amplifier with 1 GHz BW
- LEMO analog output signal connection
- 20 V to 80 V integrated High Voltage
- Temperature, Voltage and Current monitor
- SiPM Temperature compensation on HV supply
- Remote Ethernet Control
- Web-based configuration and monitor interface
- Timing board used as Scaler, Rate Meter, Comparator, Gate and Delay, Coincidence, Veto, Event list and Time Over threshold
- Small form factor: 35 x 39 x 5.5 mm^3

Overview

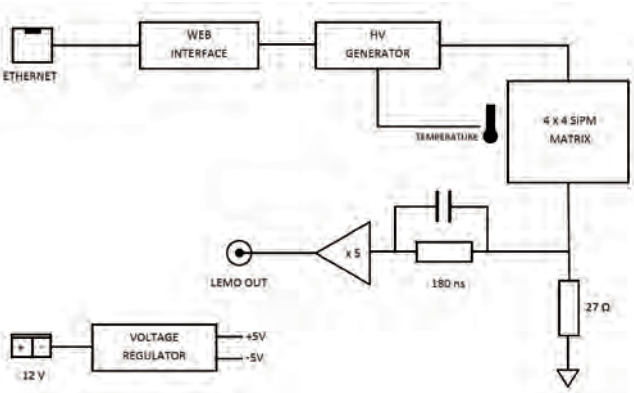
The i-Spector is an electronic system designed to replace existing system based on PMT. It is based on a large SiPM area (12x12 mm^2 or 18x18 mm^2) with integrated HV power supply, temperature, voltage and current monitor. The integrated HV power supply provides a low noise accurate power supply for the SiPM detector. All SIPMs of the area are connected in parallel to increase the active area of the matrix.

The system integrates a temperature compensation loop that changes the SiPM Bias Voltage as a function of the temperature.

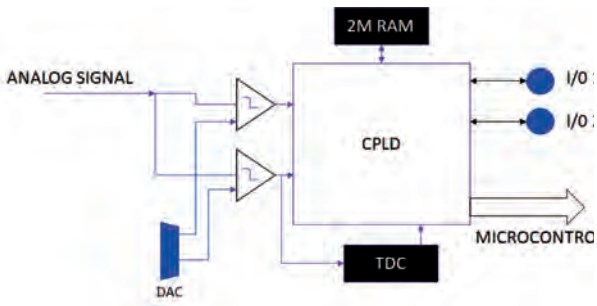
Multiple i-Spector tubes can be connected and controlled from a single PC. The API interface allows to control multiple devices using very simple http requests and JSON vectors.

The device can be controlled via ethernet connection and provide an amplified signal on an analog output. If dynamic change of parameters and monitor is not required, the configuration could be stored in the internal flash and the module could be used as a stand-alone unit without any external interconnection except the analog signal output as a standard PMT. This module can be used in combination with 725 and 730 Digitizer families.

i-Spector can be coupled with LaBr, NaI(Tl), CsI(Tl), BGO, Lyso, and others scintillator.

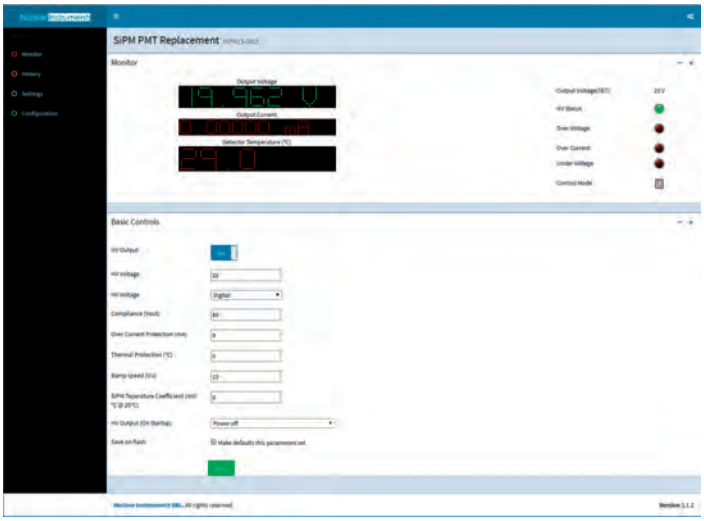


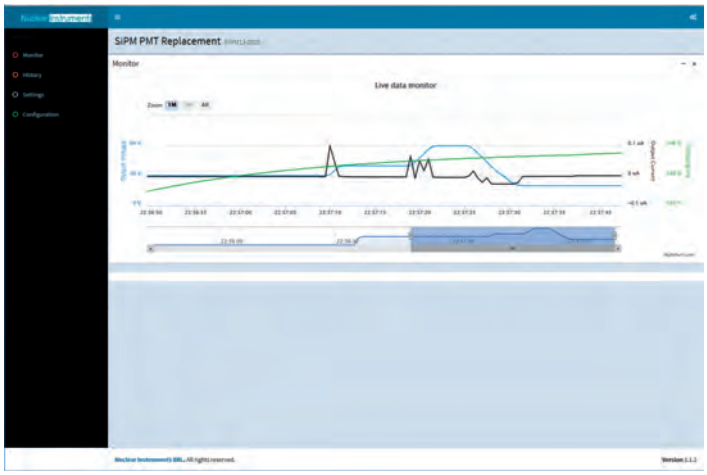
i-Spector block scheme



Timing board block scheme

Developed in collaboration with Nuclear Instruments





Screenshots of the i-Spector Web Interface

i-Spector front view with IS25X2 cover

Software

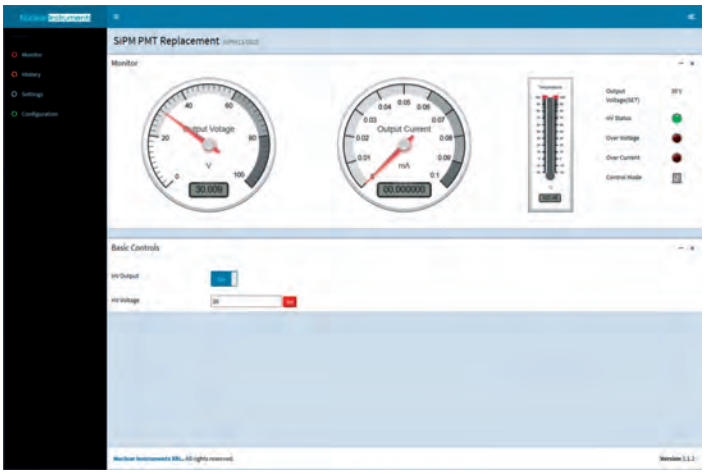
i-Spector Web Interface

FREE

i-Spector module can be easily controlled through its dedicated web-based interface with no software installation. The user can monitor the status of the module, configure the HV and connection parameters.

The homepage shows the status of the HV generator (voltage, current, enable and protection) and the temperature on the detector. The user can power on/off the HV and set the output voltage. On the left menu it is possible to access to the secondaries pages: Monitor, History, Settings and Ethernet Configuration.

Thanks to the internal circular memory buffer, i-Spector module is able to store up to 1 hour of output data consisting in voltage, current and sensor temperature samples. The last 1-hour recording can then be downloaded by the web interface.



Accessories

IS25X1
Cover tube compliant with 12x12 mm² detector size

IS25X2
Cover tube compliant with 18x18 mm² detector size

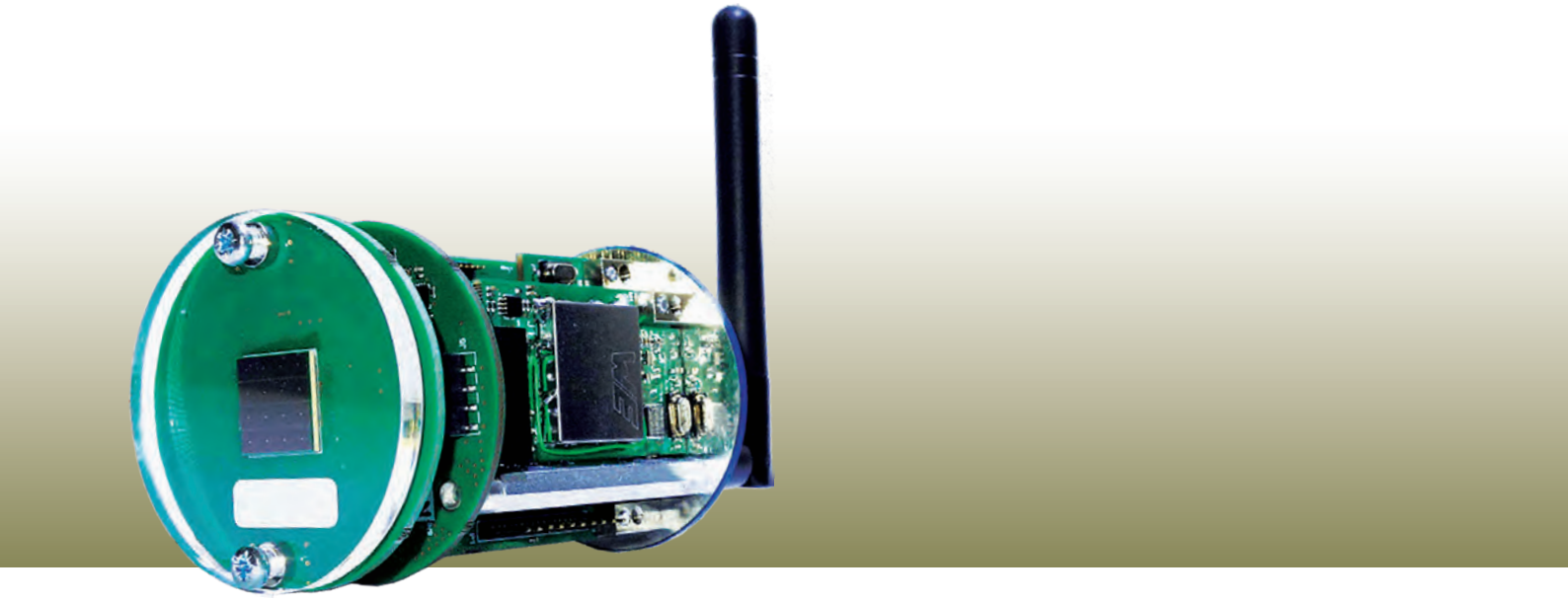
Ordering Option

	Code	Description
	WS2560ATX0AA	S2560TA i-Spector PLUS 12x12mm - OEM
	WS2560AX0AAA	S2560A i-Spector 12x12mm - OEM
COMING SOON	WS2560BTX0AA	S2560TB i-Spector PLUS 18x18mm - OEM
	WS2560BX0AAA	S2560B i-Spector 18x18mm - OEM
COMING SOON	WS2560CTX0AA	S2560TC i-Spector PLUS 24x24mm - OEM
	WS2560CX0AAA	S2560C i-Spector 24x24mm - OEM
COMING SOON	WS2560ATXAAA	S2560TA i-Spector PLUS 12x12mm - ASSEMBLY
	WS2560AXAAAA	S2560A i-Spector 12x12mm - ASSEMBLY
COMING SOON	WS2560BTXAAA	S2560TB i-Spector PLUS 18x18mm - ASSEMBLY
	WS2560BXAAAA	S2560B i-Spector 18x18mm - ASSEMBLY
COMING SOON	WS2560CTXAAA	S2560TC i-Spector PLUS 24x24mm - ASSEMBLY
	WS2560CXAAAA	S2560C i-Spector 24x24mm - ASSEMBLY

NEW

i-Spector Digital

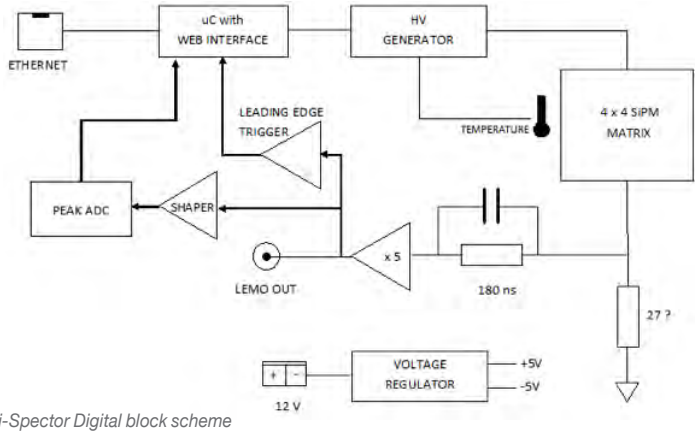
Intelligent Silicon Photomultiplier Tube with Digital MCA



A small SiPM-based tube to measure energy spectra onboard

Features

- Based on 12x12 or 18x18 mm^2 SiPMs area
- SiPM photocurrent to voltage conversion and shaping (180 ns)
- x5 signal amplifier with 1GHz BW
- Integrated 4k channels MCA for onboard spectrum calculation
- Leading edge trigger logic
- Up to 100 kcps sustainable input count rate
- Compact form factor (35 x 39 x 5.5 mm^3)
- LEMO analog output signal connection
- 20 to 80 V integrated High Voltage
- Temperature, voltage and current monitor
- SiPM Temperature compensation on HV supply
- Web based Spectrum Analysis tool with Fitting tools, automatic Peaks identification, Energy calibration
- REST API for automation control
- Remote ethernet controller
- LoRa radio modem (optional) for IoT and environmental applications, compatible with LoRaWAN Gateway



i-Spector Digital block scheme

Overview

The i-Spector Digital is an electronic system designed to replace existing systems based on PMT. It is based on a SiPM area (12x12 mm^2 or 18x18 mm^2) with integrated HV power supply for detector biasing, temperature, voltage and current monitor. It integrates a shaper, a peak stretcher and a peak ADC to implement a simple MCA. The microcontroller on board generates the spectrum, implements a pile-up rejection logic, manages ethernet communication and HV control. It is possible to regulate the HV voltage with a resolution of 20 mV and monitor the real voltage on the detector with a resolution of 1.9 mV. Moreover, it is possible to monitor the photocurrent with a resolution of 25 nA and the temperature on the detector. i-Spector Digital provides as output an analog amplified signal and a 4k channels Energy Spectrum calculated on board.

i-Spector Digital can be coupled with LaBr, NaI(Tl), CsI(Tl), BGO, Lyso, and other scintillators to obtain a fully functional DAQ system.

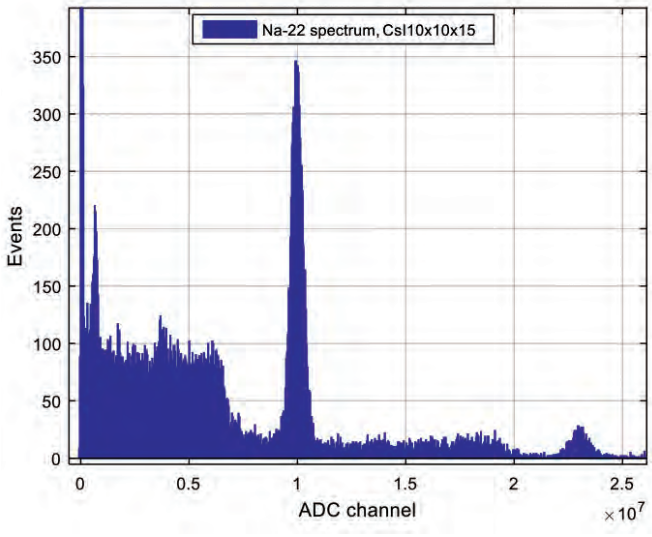
A web-based interface is available to configure and monitor the device, with the possibility to access the spectrum, process it online and download it.

Multiple i-Spector Digital devices can be connected and controlled from a single PC. The API interface allows to control multiple devices using very simple http requests and JSON vectors. Both HV parameters and MCA parameters can be controlled. It is possible to automate the spectrum download using the API interface.

i-Spector LoRa version is available: it can be controlled via a LoRa radio-modem and it is ready to connect to LoRa/LoRaWAN networks for IoT applications and environmental radiation monitoring.

i-Spector Digital front view with IS25X2 cover

Developed in collaboration with Nuclear Instruments



Na-22 Spectrum acquired with the i-Spector Digital

Software

MC²Analyzer (Coming Soon)

FREE

MC²Analyzer is the CAEN Software for Digital Spectroscopy.

It allows the user to set the relevant parameters, to collect the spectra and perform advanced mathematical analysis like energy calibration, peak search, background subtraction, peak fitting, etc. It is designed for multi-board capabilities: it can handle several boards and manage data acquisition from each of them at the same time.

i-Spector Digital - LoRa with IS25X2 cover

Accessories

IS25X1
Cover tube compliant with 12x12 mm² detector size

IS25X2
Cover tube compliant with 18x18 mm² detector size

Software

i-Spector Digital Web Interface

FREE

i-Spector Digital can be easily controlled through its dedicated web-based interface with no need to install software on your PC. The user can monitor the status of the module, configure the HV and connection parameters and visualize the energy spectrum in real time.

The web-based interface allows the user to perform online analysis (area under peak, fitting, …) and download the spectrum data.

Thanks to the internal circular memory buffer, i-Spector Digital module is able to store up to 1 hour of output data consisting in voltage, current and sensor temperature samples. The last 1-hour recording can then be downloaded by the web interface.

Screenshot of the i-Spector Digital Web Interface

Ordering Option

Code	Description
WS2570ALX0AA	S2570AL i-Spector Digital with LoRa 12x12mm - OEM
WS2570AX0AAA	S2570A i-Spector Digital 12x12mm - OEM
WS2570BLX0AA	S2570BL i-Spector Digital with LoRa 18x18mm - OEM
WS2570BX0AAA	S2570B i-Spector Digital 18x18mm - OEM
WS2570CLX0AA	S2570CL i-Spector Digital with LoRa 24x24mm - OEM
WS2570CX0AAA	S2570C i-Spector Digital 24x24mm - OEM
WS2570ALXAAA	S2570AL i-Spector Digital with LoRa 12x12mm - ASSEMBLY
WS2570AXAAAA	S2570A i-Spector Digital 12x12mm - ASSEMBLY
WS2570BLXAAA	S2570BL i-Spector Digital with LoRa 18x18mm - ASSEMBLY
WS2570BXAAAA	S2570B i-Spector Digital 18x18mm - ASSEMBLY
WS2570CLXAAA	S2570CL i-Spector Digital with LoRa 24x24mm - ASSEMBLY
WS2570CXAAAA	S2570C i-Spector Digital 24x24mm - ASSEMBLY

SP5600E

Photon Kit

A Modular Kit with a complete labVIEW-based software to test and characterize SiPM

Features

- 2 Channels, 12 bit, 250 MS/s Digitizer with Charge Integration firmware
- 2 Channels Power Supply and Amplification Unit with variable amplification gain up to 50 dB providing sensor bias with gain stabilization
- Ultra-fast LED Driver with Violet (405 nm) LED for SiPM Test
- 1 Mechanical adapter supporting a Hamamatsu MPPC 1.3x1.3 mm^2 model 50C
- 3 Additional PCBs without sensor for an easy SiPM mounting, up to 6x6 mm^2 active area
- USB 2.0 Connection
- A complete LabVIEW based Software Suite for remote control of the system and data analysis

Overview

CAEN provides a modular kit dedicated to Silicon Photomultipliers, representing the state-of-the-art in low light field detection with photon number resolving capabilities.
The SP5600E Kit is intended for users who want to test sensors and characterize them in preparation of their final detector configuration.
It is an all-in-one solution to help experimenters reduce the time and effort required to evaluated assorted sensors using vendor specific test systems.
A single solution gives the user a quality cross reference comparison between individual vendors sensors.

The kit comprises a 2-channel Desktop Digitizer with Charge Integration firmware which executes real-time processing of the raw data at both high and low data rates, a programmable power supply and conditioning unit which includes a bias power supply for the sensor, wide band amplifier with programmable gain from 1 - 50 dB, fast leading edge discriminator and time coincidence logic.
An ultra-fast LED Driver, with pulse width at ns level, tunable intensity and frequency, that provides a low-cost tool for the detector characterization, is also included in the kit together with one hardware SiPM sensor adapter (SiPM holder) which supports most common SiPM form factors.
All necessary cables and connectors are included.

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The SP5600 is a general purpose Power Supply and Amplification Unit, integrating up to two SiPMs in a mother & daughter architecture allowing for easy mounting and replacement of the sensors. Each channel can provide a digital output generated by the fast leading edge discriminators. A timing coincidence of the two channels is also available.

The DT5720 is a CAEN Desktop Waveform digitizer housing 2 channels 12 bit 250 MS/s ADC with a dedicated charge integration firmware for real time pulse processing.

The SP5601 is an ultra-fast LED Driver with pulse width at ns level, tunable intensity and frequency, that provides a low-cost tool for the detector characterization. The LED pulse generation can be triggered by an internal oscillator or by an external pulser.

The SP5650C is a sensor holder provided in the Educational Photon kit. The holder hosts a 1.3x1.3 mm^2 Silicon Photo- Multipliers; moreover, a probe inside the holders senses temperature variations, thus allowing the user to compensate for possible gain instability. The SP5650C is made of a mechanical structure providing a FC fiber connector and a PCB where the SiPM is soldered.

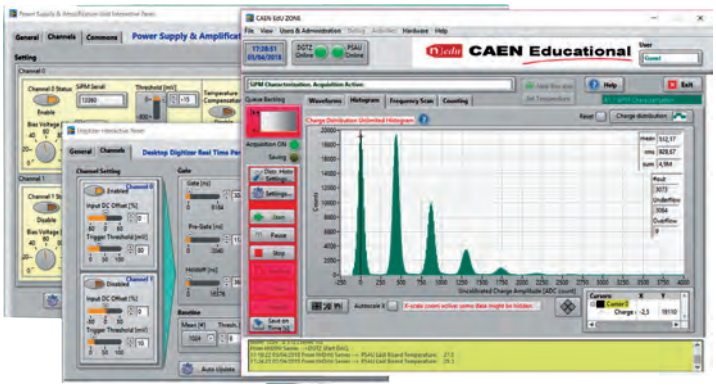
Software

CAEN EdU Zone Control Software

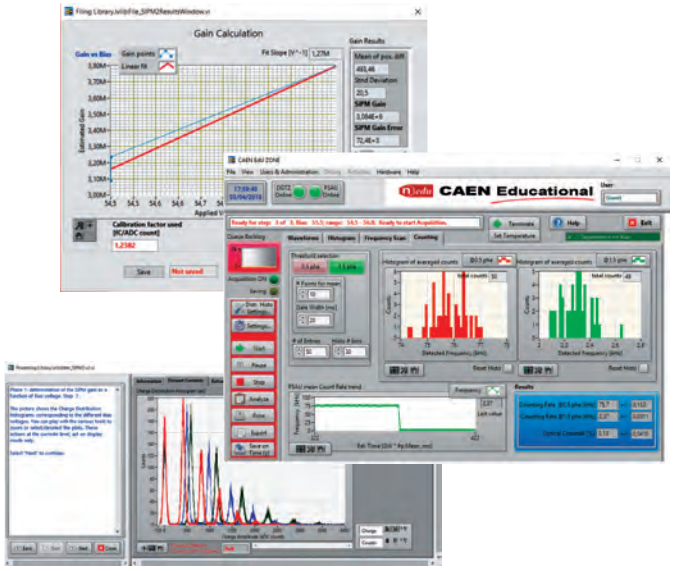
FREE

CAEN developed a dedicated control software for the full control of the system and the data analysis. Through a simple graphical interface, the user can manage all the parameters of both Power Supply, the Amplification Unit and the Digitizer. In few easy steps, the user can control the Bias and the Gain of the SiPM and also modify the thresholds and the digital outputs. In a dedicated window, the digitized signals can be monitored for real time fine tuning of the set-up. Energy Spectra, Charge vs time, Counting, Staircase plots and Time Distribution are also displayed.

Data analysis is supported by advanced tools implemented in the software itself. Nevertheless, the possibility to save the data to file has been also implemented for further analysis.



CAEN EdU Zone Control Software



CAEN EdU Zone Control Software Analysis Tool

Ordering Option

Code	Description
WK5600XEAAAA	SP5600E - Photon Kit

NEW

DT5485P

Single Channel 85 V/10 mA USB Power Supply Module for SiPM

Biasing your SiPMs has never been so straightaway!

Features

- Powered and controlled by USB
- 20-85 V Output Voltage on LEMO connector
- 10 mA Output Current
- 1 mV Output Voltage step
- Less than 300 µV rms noise
- Extremely compact 84x76x22 mm^3
- Automatic temperature feedback on the output voltage
- Temperature probe included
- Internal memory for permanent storage of calibration and configuration
- Real-time Output Voltage and Output Current monitoring
- 60 nA resolution on measured Output Current
- 1.5 mV resolution on measured Output Voltage
- 0.05 °C resolution on measured Temperature
- Power consumption: 100 mW (without load)
- ZEUS control software available

Overview

The DT5485 SiPM Power Module is a compact desktop solution to provide stable and noiseless power supply for single and array / matrix SiPM detectors.

High resolution Output Voltage and Output Current measurements enable the DT5485 to be used for I-V detector characterization.
The module integrates a temperature HV loop that regulates the SiPM output voltage as a programmable function of the SiPM temperature coefficient (temperature probe included).

Software

ZEUS

CAEN ZEUS FREE

ZEUS is a Windows compatible software that allows to control multiple DT5485P modules using USB connection. The software is based on a user friendly GUI that allows the parameters configuration and the data logging to file. It integrates realtime plot capabilities (voltage, current and temperature) with the possibility to superimpose measurements from several modules.

ZEUS software is the simplest way to program temperature LUT compensation.

Screenshot of the ZEUS software

Ordering Option

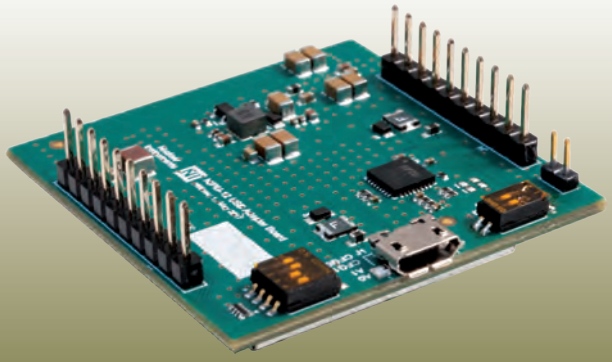
Code	Description
WDT5485PXAAA	DT5485P - Digital Dekstop Controlled Power Supply for SiPM 85V/10mA

Developed in collaboration with Nuclear Instruments

A7585D

NEW

Single Channel 85 V/10 mA Power Supply Module for SiPM with UART, I2C & USB



A compact and reliable solution for your SiPM array

Features

- 20-85 V Output Voltage
- 10 mA Output Current
- 1 mV Output Voltage step
- Less than 300 µV rms noise
- User Selectable Digital / Analog output voltage control
- Automatic temperature feedback on the output voltage
- Support for remote analog temperature sensor on the detector unit
- Internal memory for permanent storage of calibration and configuration
- UART/I2C digital control + Analog input (0-4.5 V)
- Version with micro-USB available
- Real-time Output Voltage and Output Current monitoring
- 60 nA resolution on measured Output Current
- 1.5 mV resolution on measured Output Voltage
- 0.05 °C resolution on measured Temperature
- Extremely compact: 35x39x5 mm^3
- Input Voltage: 5-26 V
- Power consumption: 100 mW (without load)
- ZEUS control software available

Overview

The A7585D SiPM Power Module is a compact and integrated solution to provide stable and noiseless power supply for single and array / matrix SiPM detectors. A desktop version (DT5485P) is available.

High resolution Output Voltage and Output Current measurements enable the A7585D to be used for I-V detector characterization. Digital (default: UART, I2C and optional: USB with adapter) and analog control interface are runtime selectable by a single pin or a digital command.

The module integrates a temperature HV loop that regulates the SiPM output voltage as a programmable function of the SiPM temperature coefficient.

Software

ZEUS

CAEN ZEUS FREE

ZEUS is a Windows compatible software that allows to control multiple A7585D and A7585DU modules using RS232 or USB connection. The software is based on a user friendly GUI that allows the parameters configuration and the data logging to file. It integrates realtime plot capabilities (voltage, current and temperature) with the possibility to superimpose measurements from several modules.

ZEUS software is the simplest way to program temperature LUT compensation.

Screenshot of the ZEUS software

Developed in collaboration with Nuclear Instruments

Ordering Option

Code	Description
WA7585DXAAAA	A7585D - Digital Controlled Power Supply for SiPM 85V/10mA
WA7585DUXAAA	A7585DU - Digital Controlled Power Supply for SiPM 85V/10mA with Micro-USB

NEW

x8031

Programmable Power Supplies for SiPM

Programmable power supplies for SiPM applications

Features

- 8/16 independently controllable HV channels
- Ripple typ. < 3 mVpp
- 0 ÷ 100 V output voltage
- 10 mA maximum output current
- Temperature probe input for SiPM gain stabilization
- Fast recovery output
- BNC output connectors
- Local control with a 2.8” touch screen display
- Remote control via Ethernet or USB 2.0
- Common ground
- Positive/negative or mixed polarity versions available
- Autonomous cooling
- Interlock logic for board enable and individual channel kill
- LabVIEW Driver available
- Software Tools for remote control

Control Software available: GECO2020 with user friendly GUI and CAEN HV Wrapper library for custom SW development. EPICS and LabVIEW also supported

CAEN HV Wrapper CAEN LabVIEW GECO 2020 EPICS FREE

Overview

The x8031 is a CAEN Power Supply Family providing 8 or 16 Independent High Voltage channels. The units are available in three formats: double width NIM mechanics, 19” rack module and Desktop case. NIM and Desktop versions feature 8 channels, the 19” rack units can house either 8 or 16 channels.
The channels share a Common Ground and the output voltage range is 0 ÷100 V, with 500 µV step/monitor resolution. The maximum output current is 10 mA, (50nA step) with 50 nA monitor resolution. Imon Zoom can increase Imon resolution up to 5 nA.

Products are available with either positive or negative output polarity. Mixed version with 4/8 positive and 4/8 negative channels are also available.

Channels outputs are delivered through BNC connectors. The HV output RAMP-UP and RAMP-DOWN rates may be selected independently for each channel in the range 1÷50 V/s in 1 V/s steps. The units house a Temperature probe input for SiPM gain stabilization (single/multi slope corrections) .

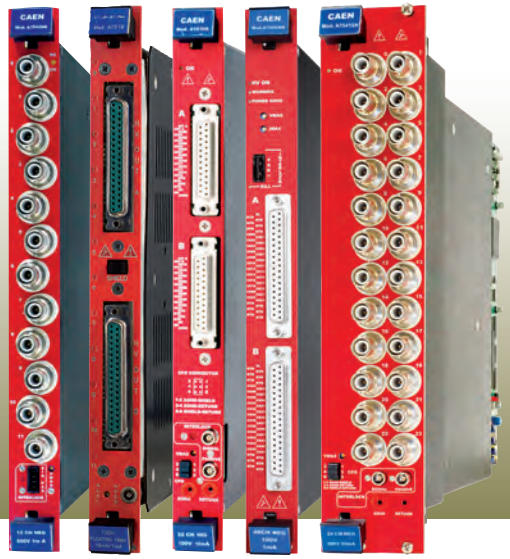
x8031 units can be controlled either locally, thanks to a 2.8” touchscreen color LCD display with a complete user interface, or remotely, via USB or Ethernet, taking advantage of GECO2020 Control Software. EPICS and LabVIEW are supported.

Ordering Option

Model	Code	Description
N8031	WN8031XAAAAA	N8031N - 8 Channel NIM Programmable High Voltage Power Supply (-100V 10mA) – BNC conn. - Common Ground
	WN8031XPAAAA	N8031P - 8 Channel NIM Programmable High Voltage Power Supply (+100V 10mA) – BNC conn. - Common Ground
	WN8031XMAAAA	N8031M - 8 Channel NIM Programmable High Voltage Power Supply (4ch -100V 10mA, 4ch +100V 10mA) – BNC conn. - Common Ground
DT8031	WDT8031XAAAA	DT8031N - 8 Channel Desktop Programmable High Voltage Power Supply (-100V 10mA) - BNC conn. - Common Ground
	WDT8031XPAAA	DT8031P - 8 Channel Desktop Programmable High Voltage Power Supply (+100V 10mA) - BNC conn. - Common Ground
	WDT8031XMAAA	DT8031M - 8 Channel Desktop Programmable High Voltage Power Supply (4ch -100V 10mA, 4ch +100V 10mA) - BNC conn. - Common Ground
R8031	WR8031XAAAAA	R8031N - 8 Channel Rack-mount Programmable High Voltage Power Supply (-100V 10mA) - BNC conn. - Common Ground
	WR8031XPAAAA	R8031P - 8 Channel Rack-mount Programmable High Voltage Power Supply (+100V 10mA) - BNC conn. - Common Ground
	WR8031XMAAAA	R8031M - 8 Channel Rack-mount Programmable High Voltage Power Supply (4ch -100V 10mA, 4ch +100V 10mA) - BNC conn. - Common Ground

Up to 100 V High Voltage Family

A1539 - A1540(H) - A1510 - A7040



Your new generation silicon and solid state detector deserves only the best!

Features

- From 12 to 48 independently controllable High Voltage channels
- 0 ÷ 100 V output voltage
- Maximum Current: 1mA, 10 mA or 1 mA/100 µA (dual range board)
- Individual Enable (A1510 only)
- Either DB37, DB25 or SHV connectors
- Available with either positive, negative or mixed polarity
- Up to 20 nA / 100 pA current set / monitor resolution
- Up to 2 / 0.2 mV voltage set / monitor resolution
- Extreme Low ripple, down to < 3 mVpp
- 3 different channel grounding
  - Common Ground (AGxxxx)
  - Common Floating return (Axxxx)
  - Full Floating (A1510 only)
- Independently programmable for each channel:
  - Output voltage
  - Current limit
  - Ramp up/down
  - TRIP parameter
- Current generator operation in overcurrent condition
- Specific design for double side silicon detector (A1510)

Overview

This family of high voltage power supplies includes boards housing up to 48 independent output channels designed to provide voltage up to 100 V and current up to 20 mA.

All the boards are compatible with all CAEN Universal Multichannel Power Supply Systems and are available with two different grounding options: Common Ground (AGxxxx) or Common Floating Return (Axxxx) excluding the A1510 board which is Fully Floating. Common Floating Return allows on-detector grounding reducing the noise level; the floating return is insulated from the crate earth up to ±50 V (with a 65 V hardware limit).
The HV Ramp up/down rates may be selected independently for each channel in the 1 ÷ 50 V/s range (1 V/s step)

All the boards are provided with both current and voltage protections. If overcurrent occurs, the corresponding channel can be programmed either to turn off after a programmable trip time or to keep on providing the maximum allowed current. This feature allows the module to perform as a current generator.

The channels can be enabled or disabled through the Interlock logic. The voltage ramp rates may be set independently for each channel. The costumer can choose between different channel grounding.

The family is composed by three groups of boards detailed on page 28.

A1423B
Wideband Amplifier

Amplify fast analog signals coming from SiPMs and carry an HV protected line directly to your detector

Features

- Bandwidth: ~ 1.5 GHz (-3 dB)
- Positive or negative input signals
- Gain range: from +18 dB to +54 dB
- Output voltage: ±1V
- Input and output impedance 50 Ω, SWR < 1.5:1
- Noise Figure: 7 dB @ 1 GHz
- Up to 750 V (positive or negative) detector bias voltage

Overview

The A1423B is an inverting Wideband Amplifier designed for fast detectors, as SiPMs and Diamonds, having a bandwidth of ~ 1.5 GHz (-3 dB). The gain ranges from +18 dB to +54 dB and it is locally controlled through a rotary switch. The amplifier accepts both positive and negative input pulses and can provide an energy output in the ±1 V range across a 50 Ω load.

The amplifier is AC decoupled with an input and output impedance of 50 Ω (SWR < 1.5:1) and can carry a bias voltage for the detector up to ±750 V. The A1423B is implemented in a shielded box and features SMA connectors for the HV BIAS, IN/DETECTOR and OUTPUT. The input circuit includes a protection network to prevent damage to the input circuit from transient generated in the IN/HV network (up to ±500 V).

Ordering Option

Code	Description
WA1423XBAAAA	A1423B - Wide Band Preamplifier

weeroc

CAEN

Tools for Discovery

WEEROC PRODUCTS

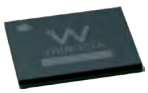
CAEN is the exclusive Weeroc Worldwide distributor, providing ASICs and ASICs-based development systems for the industry and the physics community.

CAEN
Tools for Discovery

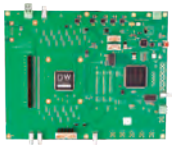
weeroc

CAEN is the exclusive Weeroc Worldwide distributor, providing ASICs and ASICs-based development systems for the industry and the physics community.

ASICs
Weeroc designs and provides analog and mixed ASICs for science and industry



Testboard
The simplest way to work with Weeroc ASICs



DT5550W
CAEN development and DAQ platform with programmable FPGA designed to read out multiple Weeroc ASICs

DT5702
APPLICATION
CAEN solution based on Weeroc CITIROC ASIC for the readout of SiPM arrays (p. 196)

CAEN and Weeroc

Weeroc is a spin-off company from Omega laboratory (IN2P3/CNRS French governmental agency for fundamental research in astrophysics, particle physics and nuclear physics) and today offers a full range of products to read out almost any kind of detector. In particular, it provides off-the-shelf programmable analog and mixed front-end ASICs for photon and particle detectors readout, together with Testboards specifically designed for each ASIC.

Weeroc main customers are the major actors in the fields of:

- Medical imaging
- Homeland security
- Nuclear protection
- Scientific instrumentation
- Space (launchers and satellites)

In order to widen the adoption of Weeroc ASICs, CAEN developed specifically the DT5550W a system designed to extensively test the ASICs. The DT5550W has a user programmable FPGA allowing the user to characterize the performance of one or multiple chips and build a complete DAQ system.

Moreover CAEN offers a solution (DT5702 see p. 196) based on CITIROC ASIC, for SiPM arrays readout.

Weeroc designs high-performance analog and mixed signal ASICs

We know there is a long way from a good idea to a good product. Weeroc provides all services to get your innovative project up and running. We are committed to fast and efficient design that will allow your product to embed dedicated state-of-the-art microelectronics in no time.

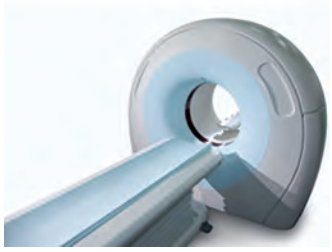
We can handle your project from the specification definition to the production and integration of your ASIC in your system.

Photodetectors read-out

What is the point to have state-of-the art photodetectors if you loose half the perfs in the first stage of your readout electronics?

Weeroc designs fully-integrated, low-power front-end ASICs. We can get the best out of your photodetectors.

Weeroc team has altogether over a century of experience in photodetector readout. When it comes to photodection, we know what we are talking about.



State-of-the-Art Medical Imaging

Anyone in the medical imaging field knows there is a major trend for number-of-channel increase in the upcoming systems. Furthermore, future medical imaging equipments will feature multi-modality and extreme sensitivity for better diagnostics and faster acquisition.

More channels, less room, less power budget, better performance... Weeroc designs customer specific readout chips to help them achieve the upcoming technical breakthrough in the medical imaging field.

Radiation Tolerant Design

Weeroc team comes from high energy physics field. They have designed rad-hard ASICs that are currently installed in CERN and in other worldwide research facilities.

Specific requirements such as radiation hardness, large temperature range, failure analysis is something we are used to.

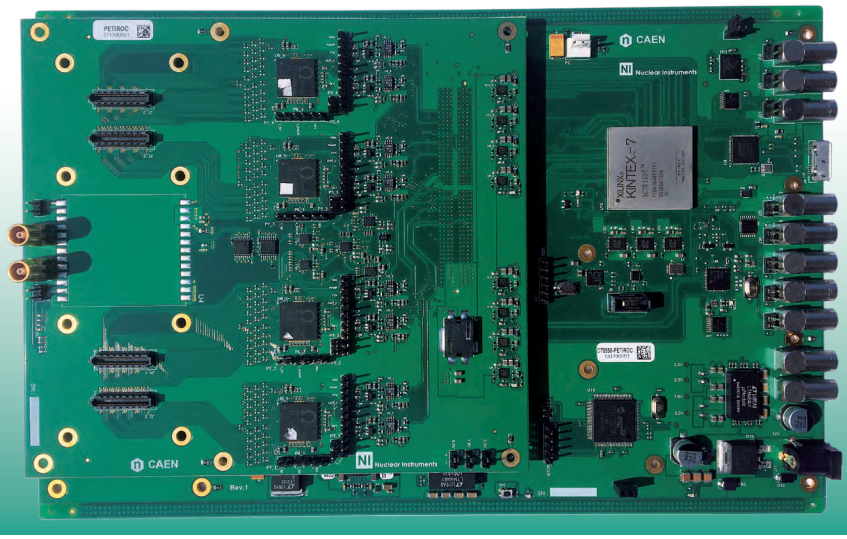
	SiPM	MA-PMT	PMT	APD	Pin-diode	Silicon strips	RPCs	Micromegas GEMS	
Maroc 3A	×	✓	✓						NEW
Catiroc 1	✖	×	✓						NEW
Spaciroc 3	×	✓	✓						COMING SOON
Citiroc 1A	✓								NEW
Petiroc 2A	✓						×		NEW
Photoroc 1A	×	✓	✓						COMING SOON
Triroc 1A	✓								NEW
Skiroc 2A				✓	✓	✓			COMING SOON
Hardroc 3B	×	×					✓		COMING SOON
Gemroc 1				✖	✖	✖		✓	COMING SOON

✓=Optimized for × =Compatibility ✖=Compatibility (not tested)

NEW

DT5550W

Weeroc ASICs Development System



Develop your DAQ system with Weeroc ASICs and the user programmable FPGA

Features

- Designed to be compatible with a wide selection of Weeroc ASICs for different types of detectors (SiPM, PMT, GEM, etc.)
- Open FPGA for user custom application
- Default firmware and control software to read out supported Weeroc ASICs and perform basic measurements with detectors
- Availability of external sensor adapter and HV power supply for SiPMs
- 8 analog acquisition channels, 14-bit 80 MS/s ADC to monitor ASIC outputs
- Programmable low jitter (less then 1 ps) clock source as reference for on chip TDC
- SPI and I2C controller for ASIC configuration
- USB 3.0 bus for fast data transfer
- 8 general purpose digital I/Os on LEMO Connectors for DAQ control signals (external trigger, busy, etc.)
- Fully supported by SCI-Compiler, graphical FPGA programmer for user application development (LICENSE INCLUDED)

WW55PETI2AA4 - PETIROC Piggyback Board

As an example of piggyback, the PETIROC board A55PET4 hosts 4 PETIROC chips offering to the user the possibility to read out 128 SiPM detectors. The board can be fitted with CAEN A7585D HV module to bias up to 2 matrices (64 channels), connected directly on the board, with the possibility to use an external adapter and an extension cable to arrange the two detectors in several geometries.

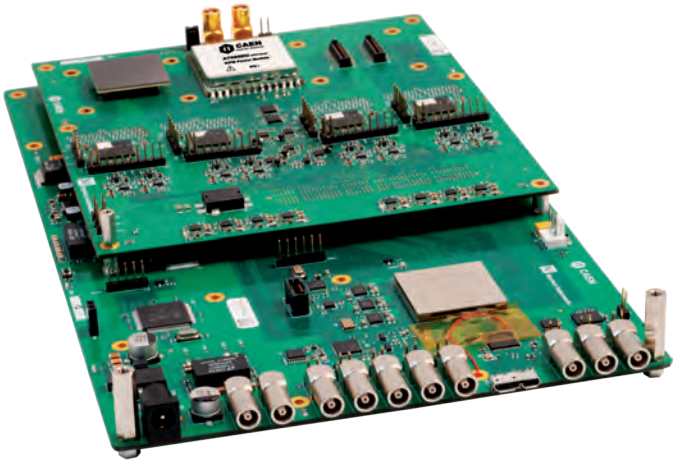
SCI-5550W Readout Software is available to control up to 4 PETIROC ASICs and the SCI-Compiler tool can be used to program the board FPGA for user custom applications. See front-end electronics and power supplies for SiPM section for more details.

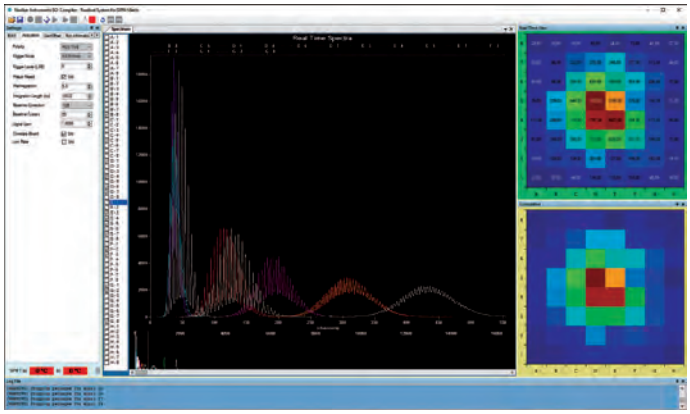
Overview

The DT5550W is a development and DAQ platform with programmable FPGA designed to read out Weeroc ASICs. This tool offers a complete solution to evaluate the characteristics of the ASIC and develop a ready-to-use experimental system for a wide variety of detectors (SiPMs, PMTs, GEMs, etc.). The full system is composed by two boards: a motherboard with an FPGA, USB 3.0 connectivity, power supply, ADCs and a replaceable piggyback board that hosts 1,2 or 4 Weeroc ASICs, detector connectors and high voltage power supply (if using SiPMs).

The DT5550W architecture allows to adapt, in a simple and intuitive way, the hardware acquisition to the user configuration: more than 200 digital signals interconnect the piggyback boards with the motherboard to read out and monitor all the signals from the ASICs with the FPGA. The DT5550W has an onboard 8 channels 14-bit 80 MS/s simultaneous sampling ADC to monitor analog outputs from the chip.

A default firmware is provided for each supported ASIC, allowing the user to read-out multiple ASICs and perform basic energy and time measurements with supported detectors.





DAQ control software for DT5550W with PETIROC piggyback board.

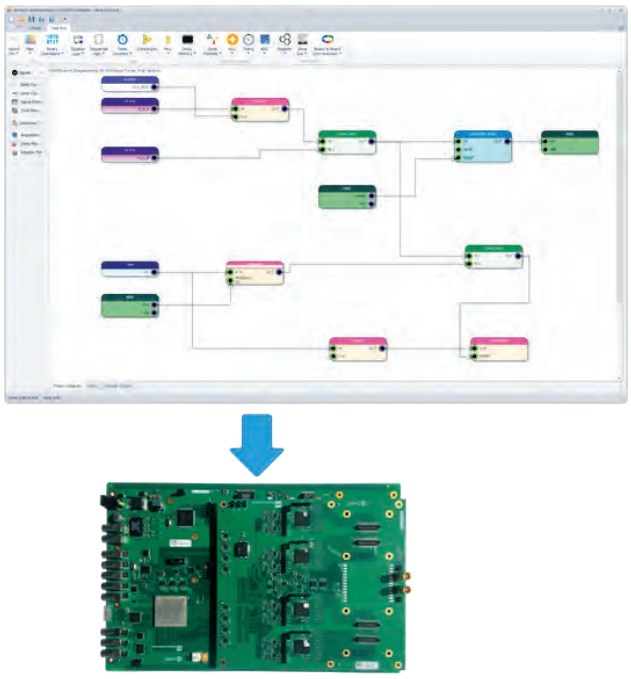
Software

SCI-5550W Readout Software

FREE

An open source control software with GUI for Windows is distributed as readout software and as example to implement more complex systems. The GUI allows the user to:

- Configure the ASICs
- View realtime energy spectra
- Make imaging with detector matrices (e.g.SiPM matrices)
- View time distribution plot with respect of one channel
- Dump on file all data in output of the ASIC in binary or JSON format



Software

SCI-Compiler

SCI-COMPILER CAEN

LICENSE INCLUDED

DT5550W includes the SCI-Compiler software, a graphic tool for FPGA programming which allows the user to realize a customizable readout logic. All functions to configure the ASIC (from firmware or from PC), to read out the ASIC, to route the trigger to the FPGA are directly implemented in the “Weeroc” Palette. The software generates the VHDL source code, C/C++/C#/Python libraries, drivers and example code (to be used in Windows, Linux and MacOS) to help integrating the firmware automatically without requiring to be a VHDL expert. Refer to page 122 for a detailed description.

Developed in collaboration with Nuclear Instruments

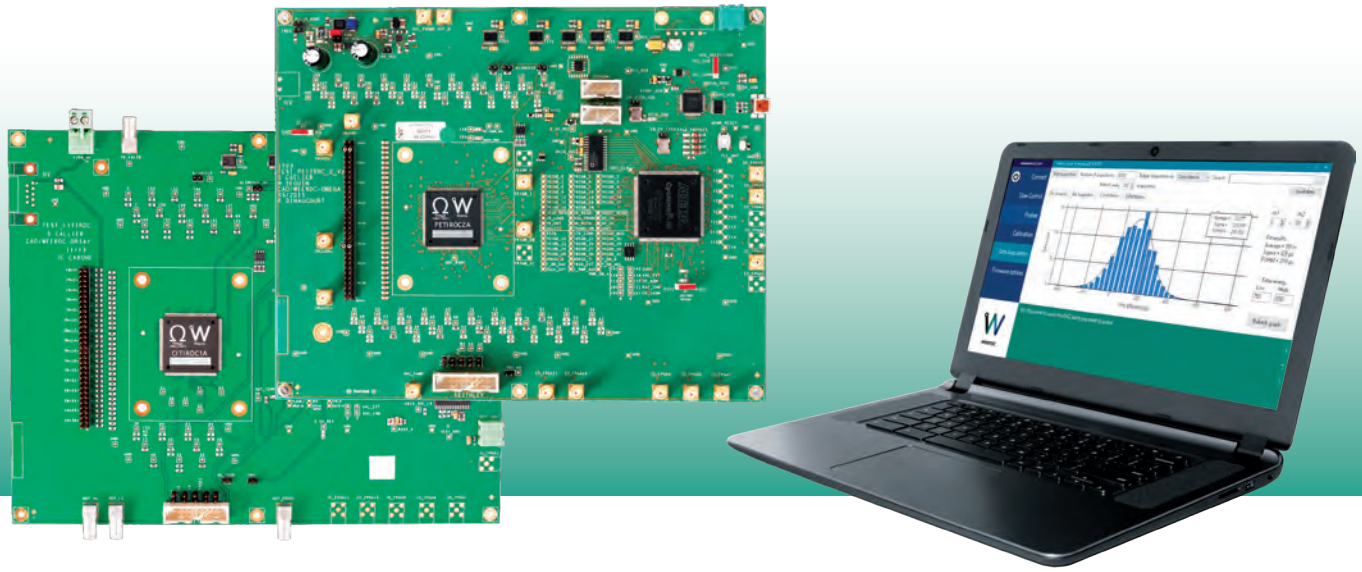
Ordering Option

Code	Description
WW55PETI2AA1	A55PET1 - Evaluation Board with 1 PETIROC chip
WW55PETI2AA2	A55PET2 - Evaluation Board with 2 PETIROC chip
WW55PETI2AA4	A55PET4 - Evaluation Board with 4 PETIROC chip
WW55CITI1AA2	A55CIT2 - Evaluation Board with 2 CITIROC chip
WW55CITI1AA4	A55CIT4 - Evaluation Board with 4 CITIROC chip
WDT5550WXAAA	DT5550W - Weeroc ASICS Evaluation System

NEW

Weeroc Testboards

Control Systems for Weeroc ASICs



A simple way to learn the use of Weeroc ASICs

Features

- Specific design for each Weeroc ASIC
- Hosting a small ASIC for easy DAQ management
- Easy characterization and debug of the ASIC
- Access to all ASIC's digital and analog I/Os
- ASIC internal signals monitor
- Data acquisition with real detectors
- Connections for an external High Voltage power supply
- Mini-USB for data transfer and board power supply
- Control and acquisition software for Windows OS (LabVIEW interface for TRIROC 1A board)

Overview

Weeroc Testboards are compact form factor platforms designed to control and read out Weeroc ASICs. This tool is suited to easily evaluate the characteristics of the ASIC and, thanks to its features, allows a versatile use with real detectors. The testboard provides easy access to all ASIC's digital and analog I/Os and implements a DAQ system consisting of an Altera Cyclone III FPGA and 12-bit ADCs.

The board hosts connections for detectors and the relative High Voltage distribution lines. Moreover, it provides the possibility to inject signals in the ASIC analog inputs using a generator.

A dedicated software for each different ASIC is available. It provides a simple GUI to set all the programmable parameters of the ASIC and allows the user to perform calibration and DAQ in an intuitive way. Some firmware options can also be set in order to manage DAQ within an experiment..

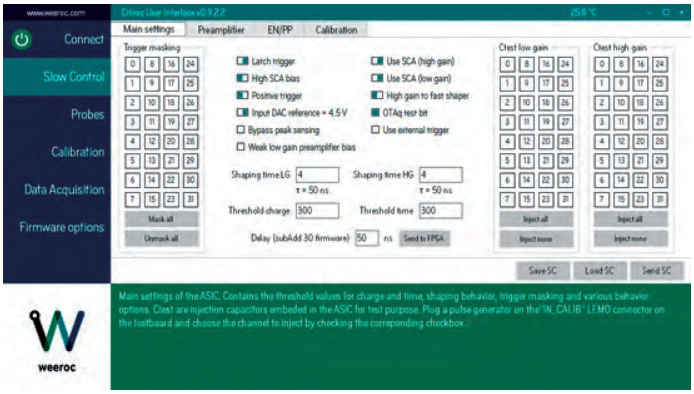
Software

Testboard Software

FREE

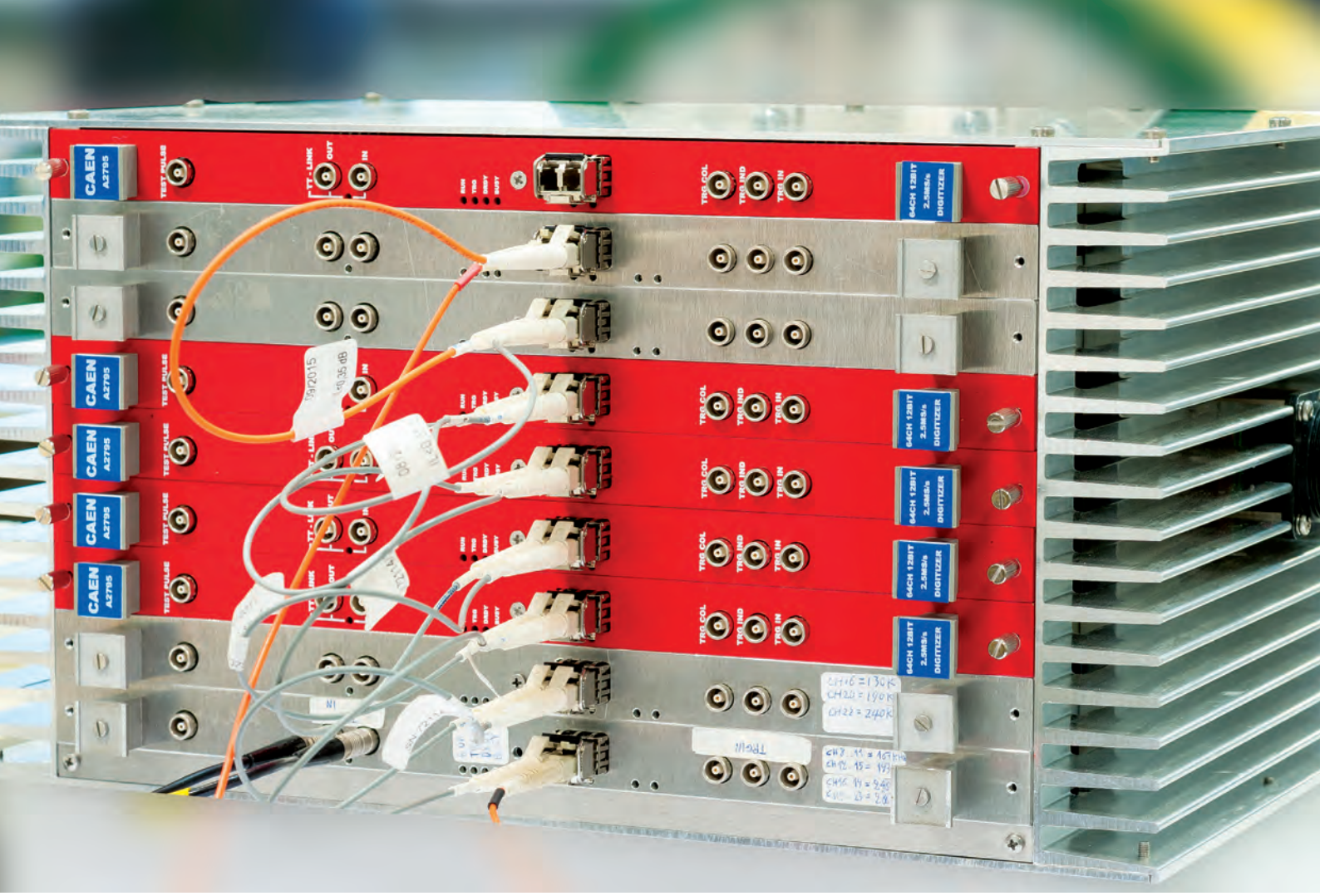
For each different testboard, a dedicated User Interface software for Windows OS is available for free download. It provides a simple GUI to set all the programmable parameters of the ASIC and allows the user to perform calibration and DAQ. Some firmware options can also be set.

The TRIROC testboard is equipped with a LabVIEW User Interface.



Ordering Option

Code	Description
WWTBCATIROC1	Testboard for CATIROC 1 chip
WWTBCITIROC1	Testboard for CITIROC 1A chip
WWTBGEMROC1A	Testboard for GEMROC 1 chip
WWTBHARDROC3	Testboard per HARDROC 3B
WWTBMAROC3AA	Testboard for MAROC 3A chip
WWTBPETIROC2	Testboard for PETIROC 2A chip
WWTBPHOTORC1	Testboard for PHOTOROC 1A chip
WWTBTRIROC1A	Testboard for TRIROC 1A chip



LIQUID ARGON TPC READOUT SYSTEM

Readout Systems

A2795

Liquid Argon TPC Readout Board

Features

- Complete detector readout system, designed for liquid Argon TPC
- 64 Channels
- Preamplifiers on hybrid circuits (sold separately)
- 16 buffer (4K samples)
- Synchronization and trigger distribution over a single wire (TT-Link)
- Up to 85 MB/s Readout via daisy chainable optical link
- Libraries and Software tools for Windows and Linux

A2795 is a complete detector readout system, ideally suited for liquid Argon TPC, but easily customizable for a wide variety of detectors

Overview

CAEN is the unique company that has developed read-out systems for Liquid Argon TPC (Time Projection Chamber). Thanks to the great experience reached with the development of the read-out for the ICARUS T-600 experiment in close collaboration with INFN Padova, (V791, V789 & V816 Analog and digital board) and the implementation of the system SY2791, which was developed in collaboration with ETH Zurich, CAEN proposes now a new readout module, A2795, for liquid Argon TPC. The A2795, thanks to the collaboration with INFN Padova (conceptual design), has been designed and engineered for the new readout of the ICARUS T600 for its operation on neutrino beam at Fermilab experiment. The A2795 is a readout board, ideally suited for liquid Argon TPC (Time Projection Chamber). The board is housed in a custom crate that contains 9 acquisition modules A2795, with 64 channels each. In total, one crate can read up to 576 channels. The analog signals coming from the detector can feed directly the inputs of the A2795s, where the preamplifiers are arranged in arrays of plug-in hybrid circuits (8 channels each). This solution allows the preamplifier, which is detector and application dependent, to be re-designed or adapted to match the specific requirements. Thanks to the feature of preamplifier on socket, the A2795 is also ready to use also in “Cold Option” configuration, using charge preamplifier front-end into the Liquid Argon and housing on board a custom voltage translators/amplifiers just for ADC dynamic range matching. The preamplifier outputs are digitized by 12-bit 2.5MS/s ADCs and processed by the internal acquisition logic, implemented in a programmable FPGA, which provides the trigger logic, the data storage in local memory buffers and the readout through a proprietary optical link, controlled by the CAEN PCI express board A3818.

Thanks to this compact and modular solution, the readout electronics can be positioned very close to the detector, allowing the user to minimize the interconnecting cable length and its corresponding capacitance, reducing the noise. The optical fiber allows the system to be connected to the host PC as far as few dozens meters; the fiber guarantees easy cabling and absence of ground loops. One optical link of the PCI express card A3818 can control up to eight A2795 connected in daisy chain with the fibers. Because the A3818 owns four optical links, it can control and readout up to 2048 channels.

The system has been designed for the scalability: growing from a single crate with 576 channels up to experiments with thousands of channels is made easy by the TT-Link. This is a single wire bus (over a coaxial cable) connecting as many crates as needed, that distributes the same sampling clock to all the ADCs of the whole system and the same global commands, like triggers, start/stop acquisition, etc. thus keeping all the acquisition boards synchronized.

From the output of the preamplifier, the system operates as a waveform digitizer: the 64 serial outputs of the ADCs are connected to one FPGA which continuously reads the digital samples and writes them into an array of circular memory buffers. When the board is triggered, the FPGA saves the current buffer (i.e. an acquisition window); the event data are completed by a header and a time tag. The acquisition can continue without dead-time in a new circular buffer. A global trigger common to all the channels can be issued using software commands or an external signal.

CAEN provides a software package that contains the drivers for the PCI express board A3818, the libraries (in C) for the access to the optical link and some demos and examples of readout programs. Windows and Linux are both supported.

Ordering Option

Code	Description
WA2795XAAAAA	A2795 - Liquid Argon TPC Readout Board

DIGITAL SPECTROSCOPY

NEW

HEXAGON

Dual Independent 32k Digital Multichannel Analyzer

FORM FACTOR

DESKTOP

INTERFACES

USB Ethernet

The first fully standalone Spectroscopy Dual Digital MCA

Features

- Dual 32k Digital MCA & Pulse Processor
- Provides pulse height analysis (PHA), and Time-stamped list , multichannel scaling (MCS)(1), Single Channel Analyzer (SCA) (1) and Multi-PHA(1) modes.
- Suited for high resolution spectroscopy with HPGe, Silicon and scintillation detectors as NaI and $LaBr_3$
- Operates with Resistive Feedback and Transistor Reset preamplifiers
- Pole/zero compensation, baseline restoration, pile-up rejection and live time correction capabilities
- Digital and analog signal inspector for a fast setup and multi-trace monitoring
- 2 dual range HVPS channels (2 kV/1 mA and 5 kV/50 µA), software controlled, to fit for low-range and high-range bias Detectors.
- 2 dual range channels for preamplifier power supply (±12 V/100 mA and ±24 V/50 mA) on DB9 connectors with dedicated input for Detector Temperature read
- 2 BNC inputs for TRP inhibit or ADC gate
- Front panel OLED Display for time acquisition, readout and HVPS data monitoring
- Ethernet and USB readout interfaces
- Link for synchronizing multiple MCAs
- Programmable digital I/Os (e.g. ICR, SCA, MCS start/stop, MCS advance and sweep, etc.)(1)
- Fully controlled by the MC^2 Analyzer software for event acquisition and basic spectrum analysis
- SDK for custom software development(1)
- Single-input version with 2 mixed HV channels available
- Data logging capability up to more than 200.000 histograms
- On-board accessible ARM with Linux for user customizable routines and automated or unattended operations

Overview

Hexagon is a compact, stand-alone dual digital 32k MCA with integrated HV & Preamplifier Power Supply, available in desktop form factor. It is designed for high energy resolution semiconductor detectors, like HPGe and Silicon Detectors but also for scintillation detectors as NaI and $LaBr_3$.

Hexagon integrates advanced firmware algorithms operating Digital Pulse Processing for Pulse Height Analysis (PHA), MCS and time stamped list mode.

The embedded CPU running Linux is able to execute custom routines for automated operations. The processing algorithms can be easily adapted to different detectors and application ensuring effective data analysis even at high count rates. It provides advanced tools for configuring baseline restoration and pile-up rejection. Moreover, the module features on-board spectrum recording, acquisition settings logging and autonomous data acquisition when unconnected from external devices. Thanks to the two input simultaneous acquisition, the module is able to manage coincidence and anti-coincidence logic between detectors, allowing the user, for example, to easily take advantage of background rejection or anti-Compton techniques.

Hexagon embeds I/O connectors for SCA, MCS and Coincidence/ Anticoincidence functions, it integrates High Voltage Inhibit and TRP Inhibit. Clock and Synchronization connectors are provided, which allow the time stamp of multiple modules to be aligned with high accuracy. The module embeds an OLED screen to monitor real time the data acquisition results, e.g. ICR, OCR and dead time. Hexagon may provide at the same time energy, time stamp and the digitized pulse in a configurable time window (e.g. including the rising edge region) in order to perform further offline analysis.

Acquisition settings and mathematical analysis are performed through the MC^2 Analyzer software, providing energy spectra with up to 32k channels, which can be exported and imported in ASCII or N42.42 compliant files. CAEN further provides drivers for the supported communication interfaces, configuration software tools, C / LabVIEW libraries and Development kit (1).

Each high voltage power supply channel is hardware suitable for two HV ranges, selectable by software, to match a wider detectors class. The two HV channels can be ordered in three different polarity configurations: both channel positive, both channels negative and mixed.

(1) Coming Soon

Software

MC² CAEN

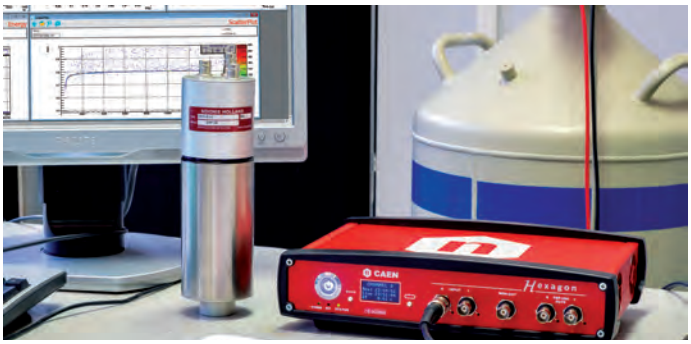
CoMPASS CAEN (1)

SDK HEXAGON CAEN (1)

Quantus CAEN (1)

Good Versatility

- Control Hexagon by CAEN Spectroscopy software: MC^2 Analyzer, CoMPASS [1] and Gamma Quantus [1].
- Extend Hexagon capabilities with the full access to the Embedded ARM Linux based CPU
- Easily develop software applications by using the SDK in your favorite programming language (C and the coming soon C++, Python and Java)



Software

Gamma Quantus

Hexagon will be supported by the coming Gamma Quantus, a general purpose, comprehensive and extensive software package for gamma-ray spectrum analysis and radionuclide identification and quantification.

Gamma Quantus software can analyze any recorded gamma-ray spectrum independently of the detector, geometry or sample used: from high-resolution Ge spectra to medium resolution scintillator spectra from $LaBr_3$ or the vastly-used NaI(Tl).

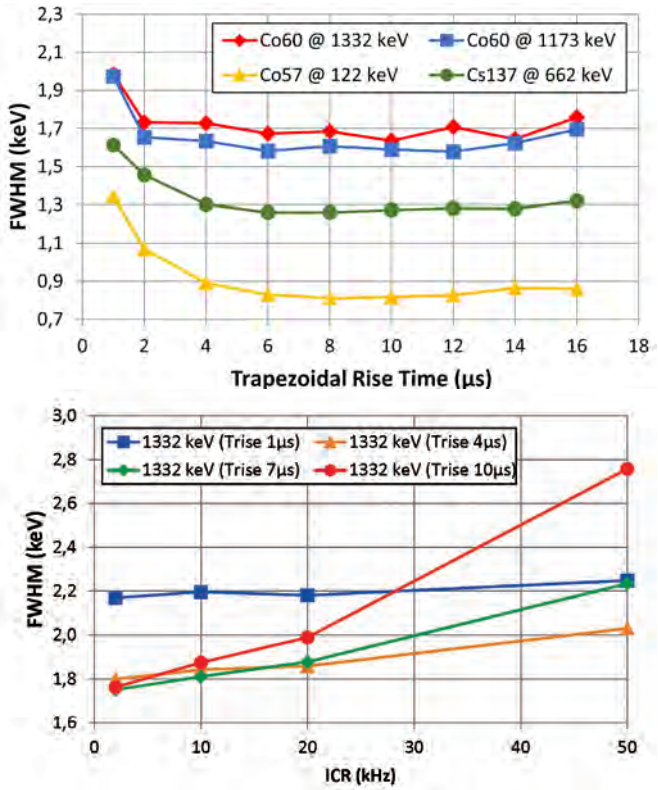
The package provides all the necessary tools and functions to perform the detailed analysis of complex gamma-ray spectra and the corresponding radionuclide quantification from the given sample. Multiple spectra can be simultaneously analyzed while acquiring data from several connected detectors.

Gamma Quantus software runs seamlessly on MS Windows, Linux or macOS.

Good Performance

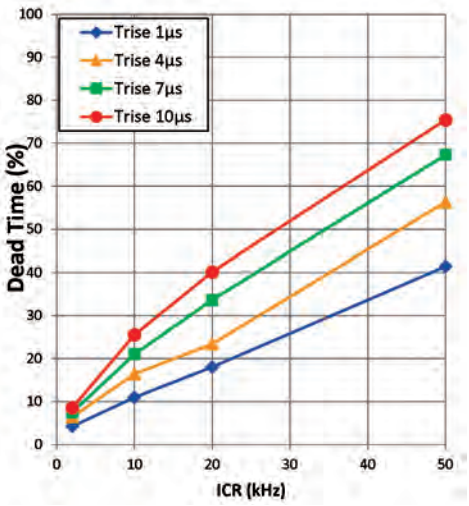
FWHM Resolution: 0.61 keV @ 122 keV, 1.63 keV @ 1332 keV(*)

(*) Tested with HPGe Mod. Canberra Cryo-Pulse 5 Plus Electrically Refrigerated Cryostat, equipped with iPA Preamplifier



Dead time vs Input Count Rate (ICR)

(Tested with HPGe Mod. Canberra 7229P, with 2001C Preamplifier)



Ordering Options

Code	Description
WDT5000XMAAA	HEXAGON-M - Dual Dig. MCA +2kV 1mA / +5kV 30µA, -2kV 1mA / -5kV 30µA, 2 LVPS ±12V/100mA, ±24V/50mA
WDT5000XNAAA	HEXAGON-N - Dual Digital MCA - 2 HVPS -2kV 1mA / -5kV 30µA, 2 LVPS ±12V/100mA, ±24V/50mA
WDT5000XPAAA	HEXAGON-P - Dual Digital MCA - 2 HVPS +2kV 1mA / +5kV 30µA, 2 LVPS ±12V/100mA, ±24V/50mA
WDT5001XMAAA	HEXAGON-one Digital MCA +2kV 1mA / +5kV 30µA, -2kV 1mA / -5kV 30µA, 2 LVPS ±12V/100mA, ±24V/50mA

780 MCA Family

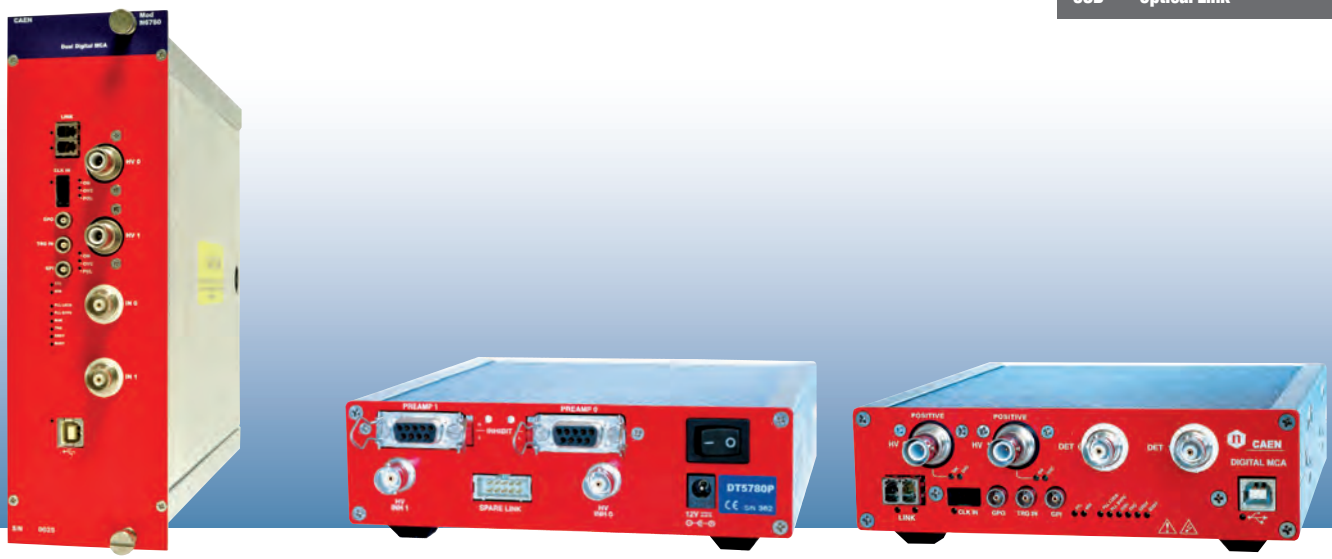
Dual Digital Multichannel Analyzer

FORM FACTOR

NIM DESKTOP

INTERFACES

USB Optical Link



Overview

The 780 MCA family is composed by compact, stand-alone dual digital 16k MCA with integrated HV & Preamplifier Power Supply, available in desktop and NIM from factors. They are designed for high energy resolution semiconductor detectors, like HPGe and Silicon detectors with resistive feedback Charge Sensitive Preamplifiers.

The 780 MCA family integrates advanced firmware algorithms operating Digital Pulse Processing for Pulse Height Analysis (PHA). The processing algorithms can be easily adapted to different detectors and application ensuring effective data analysis even at high count rates. It provides advanced tools for configuring baseline restoration and pile-up rejection. Thanks to the two input simultaneous acquisition, the modules are able to manage coincidence and anti-coincidence logic between detectors, allowing the user, for example, to easily take advantage of background rejection or anti-Compton techniques.

These MCAs may provide at the same time energy, time stamp and the digitized pulse in a configurable time window (e.g. including the rising edge region) in order to perform further offline analysis. Acquisition settings and basic mathematical analysis are performed through the MC²Analyzer software, providing energy spectra with up to 16k channels, which can be exported and imported in ASCII or N42.42 compliant files. CAEN further provides drivers for the supported communication interfaces; configuration software tools, C and LabVIEW libraries (CAENComm, CAENDigitzer, CAENDPP), demo applications and utilities.

A complete, compact solution for gamma spectroscopy

Features

- Dual independent 16k Digital MCA available in desktop and NIM form factors
- Dedicated to high resolution gamma ray spectroscopy with HPGe detectors
- Two HV power supply outputs and HV inhibit inputs for detector safety
- Two DB9 connectors for preamplifier power supply
- Digital oscilloscope function for an easy setup and signal monitoring
- Features Digital Pulse Processing for PHA, providing energy and time stamp in list mode
- Software adjustable digital shaping filter, baseline restoration
- On-line pile-up rejection and software dead time evaluation
- Suited for high count rate applications
- Configurable coincidence or anti-coincidence of signals
- USB 2.0 and Optical Link communication interfaces
- Drivers, libraries and API for Windows and Linux 32/64-bit
- MC²Analyzer software to manage the acquisition and to perform basic spectrum analysis

Ordering Options

Code	Description	Form Factor
WDT5780XMAAA	DT5780M - Dual Digital MCA - 1 HVPS +5kV/300uA, 1 HVPS -5kV/300uA, 2 LVPS ±12V/100mA, ±24V/50mA	Desktop
WDT5780XNAAA	DT5780N - Dual Digital MCA - 2 HVPS -5kV/300uA, 2 LVPS ±12V/100mA, ±24V/50mA	Desktop
WDT5780XPAAA	DT5780P - Dual Digital MCA - 2 HVPS +5kV/300uA, 2 LVPS ±12V/100mA, ±24V/50mA	Desktop
WDT5780SDXMA	DT5780SDM - Dual Digital MCA - 1 HVPS +500V/3mA, 1 HVPS -500V/3mA, 2 LVPS ±12V/100mA ±24V/50mA	Desktop
WDT5780SDXNA	DT5780SDN - Dual Digital MCA - 2 HVPS -500V/3mA, 2 LVPS ±12V/100mA, ±24V/50mA	Desktop
WDT5780SDXPA	DT5780SDP - Dual Digital MCA - 2 HVPS +500V/3mA, 2 LVPS ±12V/100mA, ±24V/50mA	Desktop
WDT5780SCXMA	DT5780SCM - Dual Digital MCA - 1 HVPS +4kV/3mA, 1 HVPS -4kV/3mA, 2 LVPS ±12V/100mA ±24V/50mA	Desktop
WDT5780SCXNA	DT5780SCN - Dual Digital MCA - 2 HVPS -4kV/3mA, 2 LVPS ±12V/100mA, ±24V/50mA	Desktop
WDT5780SCXPA	DT5780SCP - Dual Digital MCA - 2 HVPS +4kV/3mA, 2 LVPS ±12V/100mA, ±24V/50mA	Desktop
WN6780XMAAAA	N6780M - Dual Digital MCA - 1 HVPS +5kV/300µA, 1 HVPS -5kV/300uA, 2 LVPS ±12V/100mA, ±24V/50mA	NIM
WN6780XNAAAA	N6780N - Dual Digital MCA - 2 HVPS -5kV/300µA, 2 LVPS ±12V/100mA, ±24V/50mA	NIM
WN6780XPAAAA	N6780P - Dual Digital MCA - 1 HVPS +5kV/300µA, 2 LVPS ±12V/100mA, ±24V/50mA	NIM

Software

MC² CAEN

CoMPASS CAEN

Coming Soon

The high voltage supply channel can be ordered in three different versions to meet detector requirements: rated up to ±5 kV/300 µA for high purity germanium detectors, ±4 kV/3 mA (limited to 4 W) for scintillation detectors and ±500 V/3 mA for silicon and diamond detectors.

FORM FACTOR

NIM DESKTOP

INTERFACES

USB Optical Link

781 MCA Family

Dual / Quad Digital Multichannel Analyzer

Overview

The 781 MCA family is composed by compact, stand-alone Dual or Quad independent 16k digital MCA, available in Desktop and NIM form factors.

They are designed for high energy resolution semiconductor detectors, like HPGe and Silicon detectors with resistive feedback Charge Sensitive Preamplifiers.

The 781 MCA family integrates advanced firmware algorithms operating Digital Pulse Processing for Pulse Height Analysis (PHA). The processing algorithms can be easily adapted to different detectors and application ensuring effective data analysis even at high count rates. It provides advanced tools for configuring baseline restoration and pile-up rejection. Thanks to the multiple input simultaneous acquisition, the module is able to manage coincidence and anti-coincidence logic between detectors, allowing the user, for example, to easily take advantage of background rejection or anti-Compton techniques.

These MCAs can provide at the same time energy, time stamp and the digitized pulse in a configurable time window (e.g. including the rising edge region) in order to perform further offline analysis. Acquisition settings and basic mathematical analysis are performed through the new MC²Analyzer software, providing energy spectra with up to 16k channels, which can be exported and imported in ASCII or N42.42 compliant files. CAEN provides moreover drivers for the supported communication interfaces, configuration software tools, C and LabVIEW libraries (CAENComm, CAENDigitizer, CAENDPP), demo applications and utilities.

A compact and flexible solution for digital nuclear spectroscopy

Features

- Dual or Quad independent 16k digital MCA available in desktop and NIM form factors
- Dedicated to high resolution gamma ray spectroscopy with HPGe detectors
- Digital oscilloscope function for an easy setup and signal monitoring
- Software adjustable coarse and fine gain
- Features Digital Pulse Processing for PHA, providing energy and time stamp in list mode
- Software adjustable digital shaping filter, baseline restoration
- On-line pile-up rejection and software dead time evaluation
- Suited for high count rate applications
- Configurable coincidence or anti-coincidence of signals in the analog inputs
- USB 2.0 and Optical Link communication interfaces
- Drivers, libraries and API for Windows and Linux 32/64-bit
- MC²Analyzer software to manage the acquisition and perform basic spectrum analysis

Ordering Options

Code	Description	Form Factor
WDT5781AXAAA	DT5781A - 2 Channel Digital MCA	Desktop
WDT5781XAAAA	DT5781 - 4 Channel Digital MCA	Desktop
WN6781AXAAAA	N6781A - 2 Channels Digital MCA	NIM
WN6781XAAAAA	N6781 - 4 Channels Digital MCA	NIM

Software

MC² CAEN

CoMPASS CAEN

NEW

V1781

Octal Digital Multi Channel Analyser

FORM FACTOR

VME

INTERFACES

Optical Link

High density channel solution for digital spectroscopy

Features

- Eight independent 16k digital MCA in VME form factor
- Perfectly suited for high resolution gamma ray spectroscopy with single and segmented HPGe, Clover and Silicon detectors and compatible with medium-fast scintillator like NaI, CsI, BGO
- Four step of software selectable coarse gain
- Two jumper selectable dynamical ranges (0.2-0.4-0.8-1.6 Vpp and 1-2-4-8 Vpp)
- 10 µs AC coupling jumper selectable for TRP detectors
- Digital oscilloscope for an easy acquistion parameters setup and signal monitoring
- Features Digital Pulse Processing for PHA, providing Energy and Timestamp in list mode
- Software adjustable digital shaping filter, baseline restoration and fine gain
- Online pile-up rejection and software dead time evaluation
- Suited also for high count rate application
- Configurable coincidence or anti-coincidence of the input analog signals for background rejection and anti-compton shield
- VME and Optical Link communication interface
- Drivers, libraries and API for Windows and Linux 32/64 bit
- MC^{2}Analyzer software to manage the acquistion and perform basic spectrum analysis

Overview

The V1781 is the new CAEN Octal 16k digital MCA. Designed for high energy resolution semiconductor detector is perfectly suited for those application in which the number of input channels start becoming relevant such as when segmented HPGe, Clovers and silicon detectors are involved.

The V1781 provides four steps of software selectable coarse gain and two possible jumper selectable dynamical ranges (0.2-0.4-0.8-1.6 Vpp and 1-2-4-8 Vpp).

It is also compatible with Transitor reset preamplifier thanks to the jumper selectable 10 us AC coupling.

Like the other members of the x781 family, the V1781 integrates advanced firmware algorithm for the processing of any kind of exponential signal or coming from charge sensitive preamplifier and can be easily adapted to different detectors and application ensuring an effective processing even at high count rates.

These algorithms includes advanced tools for the baseline restoration and pile-up rejection.

Thanks to the multiple input simultaneous acquistion, the module is able to manage coincidence and anticoincidence logic between segment of the same detector or different detectors, allowing the user to take advantage of background rejection or anti-Compton techniques.

The V1781 provides at the same time energy, time stamp and, if required, digitized pulse in a configurable acquistion windows in order to perform further off line analysis.

Acquistion settings and simple analysis operation are performed using the MC^{2}Analyzer software that provides energy spectra up to 16k channels. The spectra can be exported and imported in ASCII o N42.42 compliant files.

CAEN provides also the drivers for the supported communication interfaces, C and Labview libraries (CAENComm, CAENDigitizer, CAENDPP) demo application and utilities.

Ordering Option

Code	Description
WXV1781XAAAA	V1781 - Octal Digital Multichannel Analyzer

Software

CoMPASS CAEN

MC^2 CAEN

Coming Soon

FORM FACTOR

DESKTOP

INTERFACES

USB Ethernet

DT5770

Compact Digital Multichannel Analyzer

A pocket-size, high performance and cost-effective solution for your spectroscopy applications.

Features

- Compact portable 16k Digital MCA
- Suited for high resolution gamma spectroscopy
- Support continuous and pulsed reset preamplifiers
- Software selectable coarse and fine gain
- DB9 connector for preamplifier power supply
- Features Pulse Height Analysis firmware for energy calculation
- Different acquisition modes are available: PHA and signal inspector for an easy setup and signal monitoring
- Software adjustable digital shaping filter, baseline restoration
- On-line pile-up rejection and software dead time evaluation
- USB and Ethernet communication interfaces
- MC²Analyzer software to manage the acquisition and perform basic spectrum analysis

DT5770 is also available in educational version SP5600EMU - Emulation Kit (see p. X).

Overview

The DT5770 is a compact portable Digital MCA for Gamma spectroscopy.

It is suited for high energy resolution semiconductor detectors, like HPGe and Silicon Drift Detector, connected to a Charge Sensitive Preamplifier. It integrates analog front-end with programmable gain and possible AC coupling.

The DT5770 relies on a dedicated firmware for Pulse Height Analysis (PHA). The firmware performs real time Digital Pulse Processing allowing an effective data analysis even at high count rate. It provides baseline restoration, pile-up rejection, dead time and live time estimation.

The DT5770 houses USB 2.0 and Ethernet interfaces.

The DT5770 can provide at the same time energy, time stamp and the digitized pulse in a configurable time window (e.g. including the rising edge region) in order to perform further offline analysis. Acquisition settings and mathematical analysis are performed through the new MC²Analyzer software, providing energy spectra with up to 16k channels, which can be exported and imported in ASCII or N42.42 compliant files. CAEN provides moreover drivers for the supported communication interfaces, DT5770 Upgrader tool and C libraries (CAENDPP library).

Software

MC² CAEN

Ordering Options

Code	Description
WDT5770AXAAA	DT5770 - Digital MCA - 1 LVPS ±12V/100mA ±24V/50mA

γstream

Active, stand-alone, fully featured MCA tube base for scintillation

FORM FACTOR

PORTABLE

INTERFACES

USB Ethernet Bluetooth Wi-Fi

Gamma Spectroscopy goes wireless with the innovative CAEN tube base digital MCA: Untie your detector and get on-line!

Features

- Compact, stand-alone, tube base MCA including high voltage power supply and preamplifier
- Specialized for NaI(Tl), $LaBr_3$(Ce), and $CeBr_3$ with standard 14-pin and 10-8 stages PMTs
- Multiple acquisition modes: PHA, Time stamped list mode, MCS(1), SCA(1) and signal inspector
- Gain stabilizer based on calibration with natural or reference radioactivity
- Software Development Kit for custom user application
- Built-in rechargeable battery (up to 6h of continuous acquisition)
- Data Storage to SSD
- Embedded GPS for data geolocation
- ARM based CPU for unattended operations
- GammaTOUCH App for Android
- Wireless and wired connectivity via USB, Ethernet, Bluetooth and WiFi

Overview

γstream is an active MCA integrated in a 14-pin PMT base for gamma-ray spectroscopy with scintillation detectors, suited for portable and mobile spectrometry. It integrates high voltage power supply, preamplifier and digital MCA. The embedded CPU runs an OS able to execute custom routines for automatic wireless spectroscopic analysis and data monitoring. Featured with battery and data-storage it is able to run without external connection or control. The flexibility on data logging modes makes γstream suitable for most survey situations.

It may acquire and record data in different modes: PHA, time stamped list mode, MCS(1), SCA (1) and signal inspector. γstream can also operate outdoor thanks to a front panel cover protecting from water and dust.

Wireless and wired connection interfaces are available: Wi-Fi, Bluetooth, USB and Ethernet. γstream can also be integrated in more complex systems thanks to auxiliary I/O connectors.

γstream is suited for a variety of environment thanks also to the software suites GammaTOUCH (Android OS) and MC²Analyzer (Windows OS), both provided with user-friendly GUIs.

(1) Coming Soon

γstream rear view. Internal divider can be adapted for NaI(Tl), $LaBr_3$(Ce), $CeBr_3$ detectors with standard 14-pin and 10-8 stages PMTs.

Software

CAEN MC² CAEN

Ordering Options

Code	Description
WS2580XAAAAA	S2580 - GAMMASTREAM - Standalone Gamma Ray Spectroscopy System
WS2580LBXAAA	S2580LB - GAMMASTREAM - Standalone Gamma Ray Spectroscopy System for LaBr (Ce)
WS2580GXAAAA	S2580G - GAMMASTREAM - Digital MCA Tube Base with GPS for Gamma-Ray Spectroscopy
WS2580LBGXAA	S2580LBG - GAMMASTREAM - Digital MCA Tube Base with GPS for LaBr3 (Ce) Gamma-Ray Spectroscopy

FORM FACTOR

DESKTOP

INTERFACES

Ethernet LoRa™

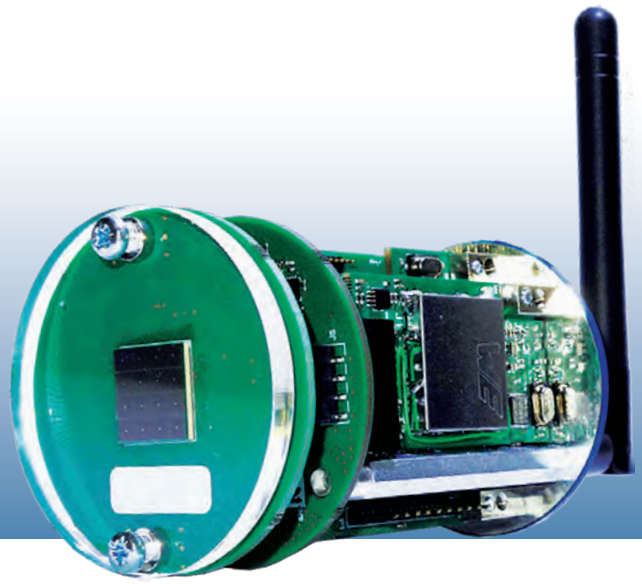
i-Spector Digital NEW

Intelligent Silicon Photomultiplier Tube with Digital MCA

Accessories

IS25X1
Cover tube compliant with 12x12 mm^2 detector size

IS25X2
Cover tube compliant with 18x18 mm^2 detector size



Developed in collaboration with Nuclear Instruments

Features

- Based on 12x12 mm^2 or 18x18 mm^2 SiPMs area
- SiPM photocurrent to voltage conversion and shaping (180 ns)
- x5 signal amplifier with 1GHz BW
- Integrated 4k channels MCA for onboard spectrum calculation
- Leading edge trigger logic
- Up to 100 kcps sustainable input count rate
- Compact form factor (35 x 39 x 5.5 mm)
- LEMO analog output signal connection
- 20 to 80 V integrated High Voltage
- Temperature, voltage and current monitor
- SiPM Temperature compensation on HV supply
- Web based Spectrum Analysis tool with Fitting tools, automatic Peaks identification, Energy calibration
- REST API for automation control
- Remote ethernet controller
- LoRa radio modem (optional) for IoT and environmental applications, compatible with LoRaWAN Gateway

i-Spector Digital Web Interface

i-Spector Digital can be easily controlled through its dedicated web-based interface with no need to install software on your PC. The user can monitor the status of the module, configure the HV and connection parameters and visualize the energy spectrum in real time.

The web-based interface allows the user to perform online analysis (area under peak, fitting, …) and download the spectrum data. i-Spector Digital has an internal circular buffer memory of an hour where it stores voltage, current and temperature of the sensor. The web-interface offers, as well, the possibility to download these “1-hour history” information.

Software

MC^2 CAEN Coming Soon

Overview

The i-Spector Digital is an electronic system designed to replace existing systems based on PMT. It is based on a SiPM area with integrated HV power supply for detector biasing, temperature, voltage and current monitor. It integrates a shaper, a peak stretcher and a peak ADC to implement a simple MCA. The microcontroller on board generates the spectrum, implements a pile-up rejection logic, manages ethernet communication and HV control. It is possible to regulate the HV voltage with a resolution of 20 mV and monitor the real voltage on the detector with a resolution of 1.9 mV. Moreover, it is possible to monitor the photocurrent with a resolution of 25 nA and the temperature on the detector. i-Spector Digital provides as output an analog amplified signal and a 4k channels Energy Spectrum calculated onboard. i-Spector Digital can be coupled with LaBr, NaI(Tl), CsI(Tl), BGO, Lyso, and others scintillator to obtain a fully functional DAQ system. A web-based interface is available to configure and monitor the device, with the possibility to access the spectrum, process it online and download it. Multiple i-Spector Digital devices can be connected and controlled from a single PC. The API interface allows to control multiple devices using very simple http requests and JSON vectors. Both HV parameters and MCA parameters can be controlled. It is possible to automate the spectrum download using the API interface. i-Spector LoRa version is available: it can be controlled via a LoRa radio-modem and it is ready to connect to LoRa/LoRaWAN networks for IoT applications and environmental radiation monitoring.

Ordering Option

Code	Description
WS2570ALX0AA	S2570AL i-Spector Digital with LoRa 12x12mm - OEM
WS2570AX0AAA	S2570A i-Spector Digital 12x12mm - OEM
WS2570BLX0AA	S2570BL i-Spector Digital with LoRa 18x18mm - OEM
WS2570BX0AAA	S2570B i-Spector Digital 18x18mm - OEM
WS2570CLX0AA	S2570CL i-Spector Digital with LoRa 24x24mm - OEM
WS2570CX0AAA	S2570C i-Spector Digital 24x24mm - OEM
WS2570ALXAAA	S2570AL i-Spector Digital with LoRa 12x12mm - ASSEMBLY
WS2570AXAAAA	S2570A i-Spector Digital 12x12mm - ASSEMBLY
WS2570BLXAAA	S2570BL i-Spector Digital with LoRa 18x18mm - ASSEMBLY
WS2570BXAAAA	S2570B i-Spector Digital 18x18mm - ASSEMBLY
WS2570CLXAAA	S2570CL i-Spector Digital with LoRa 24x24mm - ASSEMBLY
WS2570CXAAAA	S2570C i-Spector Digital 24x24mm - ASSEMBLY

MCA Compare Table

	MCA	DT5770	780 Family		781 Family		V1781	Gamma stream	Hexagon	i-Spector Digital
	Form Factor	Desktop	Desktop	NIM	Desktop	NIM	VME	Tube Base	Desktop	Desktop
	Inputs	1	2	2	2/4	2/4	8	1	1/2	1
	Input Connector	BNC	BNC	BNC	BNC	BNC	BNC	14-pin socket	BNC	n/a (3)
	Channels	16k	16k	16k	16k	16k	16k	2k	32k	4k
Power Supply	LV Preamp. Power Supply	±12 ±24 (x1)	±12 ±24 (x2)	±12 ±24 (x2)	n/a	n/a	n/a	n/a	±12 ±24 (x2)	n/a
Power Supply	No. of HV Outputs	n/a	2	2	n/a	n/a	n/a	1	2	1
Power Supply	HPGe (5 kV / 30 µA)		■	■					◘	
Power Supply	PMT (2 kV / 2 mA)		■					■	◘	
Power Supply	Si (500 V / 50 µA)		■						◘	
Power Supply	Diamond (200 V / 50 µA)		■						◘	
Power Supply	SiPM (70 V / 10 mA)									■
Acquistion Modes	PHA	●						●	●	●
Acquistion Modes	List Mode		●	●	●	●	●	●	●	
Acquistion Modes	Multi-PHA							●	▲	
Acquistion Modes	Coincidence Anti-Coincidence		●	●	●	●	●		●	
Acquistion Modes	MCS							▲	▲	
Acquistion Modes	SCA							▲	▲	
Acquistion Modes	Signal Inspector	●	●	●	●	●	●	●	●	●
Suited Detectors	High Resolution Semiconductors	●	● (1)	● (1)	● (1)	● (1)	●		●	
Suited Detectors	Semiconductors for charged particles	●	●	●	●	●	●		●	
Suited Detectors	Semiconductors	●	●	●	●	●	●		●	
Suited Detectors	Inorganic Scintillators	●	●	●	●	●	●	●	●	●
Suited Detectors	Organic Scintillators	●	●	●	●	●	●	●	●	●
Suited Detectors	Proportional Counters	●	●	●	●	●	●		●	
Interfaces	USB 2.0	●	●	●	●	●		●	●	
Interfaces	Ethernet	●						●	●	●
Interfaces	Optical Link (2)		●	●		●	●			
Interfaces	VME64X						●			
Interfaces	LoRA									●
Interfaces	Wi-Fi							●		
Interfaces	Bluetooth							●		
Software	SDK HEXAGON CAEN								▲	
Software	MC² CAEN	●	●	●	●	●	▲	●	●	▲
Software	CoMPASS CAEN		▲	▲	●	●	▲		▲	
Software	YQuantus CAEN								▲	
Software	CAEN							●		

■ Choose by ordering option

◘ Software selectable

(1) Not compliant with transistor reset preamplifier.

(2) To PCIe via A3818 - PCI Express CONET2 Controller

(3) Built-in SiPM array (12x12 mm^2 or 18x18 mm^2)

● Compliant

▲ Coming Soon

List of the features acronyms

Signal Inspection: mixed signal oscilloscope for detector signals, internal filters, control signals; SCA or event driven waveform capture (e.g. see the pulses that generate events in a ROI)

PHA (Pulse Height Analysis): pulse height spectrum (up to 32 K)

Multi-PHA: series of consecutive PHA spectra; SW or external TTL input Spectrum Advance command. No dead-time while switching to a new spectrum

List Mode: Output list with time-stamp and Energy

SCA: programmable LLD and ULD; can drive TTL outputs, internal readable counters, MCS and Signal Inspector

MCS: counts on Fast Discriminator, SCA or external inputs; programmable Dwell time or external Channel Advance command; Sweep Start command from SW or external input.

Coincidence/Anti-Coincidence: between 2 channels and/or external NIM/TTL Inputs. Applies to PHA, List Mode, SCA and MCS. Programmable coincidence window. Suitable for Anti-Compton or Background Active Shields with scintillators (e.g. CH0 reads HPGe, CH1 reads shield)

FORM FACTOR

DESKTOP

INTERFACES

USB Optical Link

DT5790

Dual Digital Pulse Shape Discriminator

Overview

The DT5790 is a 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.

It is a compact, stand-alone digital system that houses a two channel, 12 bit, 250 MS/s digitizer, two HV channels able to supply a bias voltage up to ±4 kV and current up to 3 mA (4 W maximum) and two connectors to power preamplifiers.

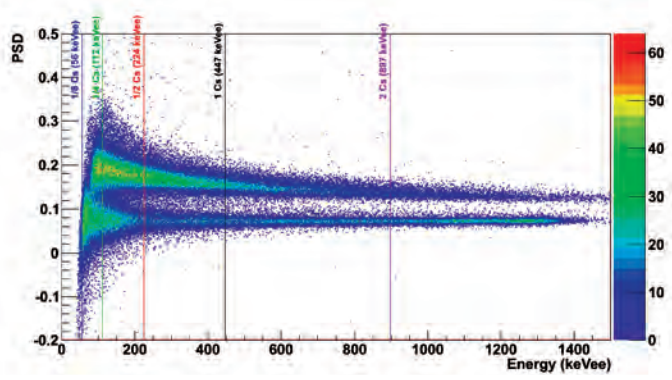
The DT5790 relies on a dedicated firmware developed for Charge Integration and Pulse Shape Discrimination (PSD). The PSD is based on an advanced on line Digital Dual Gate Charge Integration with no conversion dead time allowing an effective data analysis even at high count rate. It performs signal baseline calculation, dual gate self-generation with programmable parameters, double integration of both prompt and total charge for Pulse Shape Discrimination and pedestal subtraction for energy calculation. Thanks to the two input simultaneous acquisition, the module is able to manage coincidence and anti-coincidence between a pair of detectors, allowing the user to easily take advantage of background rejection or anti-Compton techniques.

The DT5790 provides at the same time energy, time stamp and the digitized pulse in a configurable time window (e.g. including the rising edge region) in order to perform further offline analysis. CAEN provides moreover drivers for the supported communication interfaces, configuration software tools, C and LabVIEW libraries (CAENComm, CAENDigitizer), demo applications and utilities.

An all-in-one solution for gamma-neutron discrimination

Features

- Dual digital charge-to-digital converter based on 12-bit 250 MS/s Flash ADCs
- Dedicated to organic or inorganic scintillation detectors
- Two HV power supply outputs rated up to ±4 kV/3 mA
- Two DB9 connectors for preamplifier power supply
- On-line digital pulse processing for charge integration and pulse shape discrimination
- No dead time due to conversion
- Digital oscilloscope function for an easy setup and signal monitoring
- Pile-up rejection
- Configurable coincidence or anti-coincidence of signals in the two analog inputs
- USB 2.0 and Optical Link communication interfaces
- Drivers, libraries and API for Windows and Linux 32/64-bit



Application Notes

AN2506 Digital Gamma Neutron discrimination with Liquid Scintillators

All these documents are available for download in the Document Library section of CAEN website.

Ordering Options

Code	Description
WDT5790XMAAA	DT5790M - 2 Channel 12 bit 250Ms/digitizer with 1HV ch +4kV/3mA 1HV ch -4kV/3mA for PSD
WDT5790XNAAA	DT5790N - 2 Channel 12 bit 250Ms/digitizer with 2HV ch -4kV/3mA for PSD
WDT5790XPAAA	DT5790P - 2 Channel 12 bit 250Ms/digitizer with 2HV ch +4kV/3mA for PSD

Software

PSD CAEN

CoMPASS CAEN Coming Soon

Software for Digital Spectroscopy

GammaTOUCH

γstream Control Software for Android™

FREE

Overview

GammaTOUCH is a software application for Android™ running on personal devices like smartphones or tablets, fully compatible with CAEN γstream device. It is designed as an easy-to-use assistant for outdoor operations and provides an immediate control of γstream. Energy spectra can be displayed, and statistics can be monitored runtime. Through the GammaTOUCH it is possible to integrate the GPS coordinates and time of the mobile device with the time-stamped event list.

ANDROID APP ON Google Play

MC²Analyzer (MC²A)

Digital MCA Data Acquisition and Analysis Software

FREE

Overview

MC²A is a software specifically designed to manage CAEN Digital MCA (Hexagon, 780/781 family, DT5770 and γstream) as well as CAEN digitizers running DPP-PHA (Digital Pulse Processing for the Pulse Height Analysis) firmware, like 724, 725 or 730 families.

It allows the user to set the relevant parameters, to manage the HV channels configuration (Hexagon, x780 and γ stream only), to collect the spectra and perform mathematical analysis, like energy calibration, peak search, background subtraction, peak fitting, etc.

It is designed for multi-channel and multi-board capabilities: it can handle several boards and manage the data acquisition from each of them at the same time.

CoMPASS

Multi-PArameter Spectroscopy Software

FREE

Overview

CAEN Multi-PArameter Spectroscopy Software (CoMPASS) is the new software from CAEN able to implement a Multi-parametric DAQ for Physics Applications, able to manage 781 MCA family and V1781 as well as 790 MCA family and DT5790 (COMING SOON).

CoMPASS can manage multiple boards and the event correlation between different channels, apply energy and PSD cuts, calculate and show the statistics (trigger rates, data throughput, etc…), save output data files (raw data, lists, waveforms, spectra) and use the saved files to run off-line with different processing parameters.

DPP-PSD Control Software

Graphical Interface for DPP-PSD Management

FREE

Overview

DPP-PSD Control Software is the graphical interface for managing the waveform digitizers running Pulse Shape Discrimination (DPP-PSD). It can manage single-board communication and acquisition of the DT5790 Digital Pulse Shape Discriminator.

The user can easily set all the DPP-PSD parameters, configure the DT5790, run the acquisition, readout data and plot or save the results in form of waveforms as well as charge and time tag histograms or lists.

POWERED CRATES

Introduction to CAEN Powered Crates

CAEN VME, NIM and Mixed Powered Crates: your modular electronics deserve only the finest accommodations!

Key Features

- Crates compliant with VME64, VME64X and NIM standards
- Several sizes tailored for all needs
- Mixed NIM/VME crate available
- Modular power supplies available in multiple configurations
- Modular Smart Fan units
- Thermal and electrical protections
- Remote connections to monitor and set the operational conditions
- VME crates with CBLT compliant automatic daisy chain

VME

NIM

MIXED

Overview

CAEN has decades of expertise in the design and production of VME and NIM powered crates. The full line of crates is intended to guarantee reliability and mechanical solidity. All CAEN VME or NIM boards can find a perfect match with our powered crates, which provide the necessary power supply, the proper air cooling and, in our top models, remote communication through the intelligent fan unit. Safety features are also implemented, as under/over voltage, short circuit and over temperature protections.

CAEN offers a selection of VME, NIM and Mixed Powered Crates with different configurations of power supplies and backplanes. Some crates can be ventilated with pluggable fan units, which also allow to have additional interfaces for remote monitoring and setting via CAN bus, Ethernet, USB and RS232.

Our customers can choose between several configurations able to meet the needs of complex applications and small setups. Many possible choices of crate formats and power supply units are available. The latter ones are designed to guarantee extreme low voltage ripple, in particular the linear power supplies for NIM crates, which are commonly used in applications where extreme low noise is demanding. The VME crates are equipped with backplanes compliant with the standards VME64 J1/J2, VME64X J1/J2 and VME64X J1/J0/J2, supporting the automatic daisy chain compliant with CBLT.

Automatic Daisy Chain capability supports IACKIN/ IACKOUT and CBLT

OLED Display guarantees optimal visibility in all environmental condition

Modularity and multiple power supply configurations

VME Powered Crates Family - Table comparing models

Model	Package	No. of Slots	Width	Height	Backplane connectors	Pluggable power supplies	Pluggable fan unit	Remote control	Max. Output power
VME8001	VME64	2 (6U)	19"	1U	VME64 J1/J2	No	No	No	170 W
VME8004B	VME64	4 (6U)	19"	2U	VME64 J1/J2	No	No	No	365 W
VME8004X	VME64X	4 (6U)	19"	2U	VME64X J1/J0J2	No	No	No	450 W
VME8008X	VME64X	8 (6U)	19"	4U	VME64X J1/J0J2	No	No	No	450 W
VME8008B	VME64	8 (6U)	19"	4U	VME64 J1/J2	No	No	No	490 W
VME8010	VME64	21 (6U)	19"	7U	VME64 J1/J2	No	No	No	470 W
VME8011	VME64	21 (6U)	19"	7U	VME64 J1/J2	Yes	No	No	470 W
VME8100	VME64 VME64X	21 (6U)	19"	8U	VME64 J1/J2 VME64X J1/J2 VME64X J1/J0/J2	Yes	Yes	RS232, USB (2.0), CANBUS, Ethernet	1200 W @ 100 Vac 2530 W @ 211 Vac
VME8200	VME64X	21 (6U) 21 Rear	19"	9U (8U + 1U Air Filter)	VME64X J1/J0/J2	Yes	Yes	RS232, USB (2.0), CANBUS, Ethernet	1200 W @ 100 Vac 2530 W @ 211 Vac

NIM & Mixed Powered Crates Family - Table comparing models

Model	Package	No. of Slots	Width	Height	Backplane connectors	Pluggable power supplies	Pluggable fan unit	Remote control	Max. Output power
NIM8301	NIM	12	19"	7U	NIM	Yes	Yes	RS232, USB (2.0), CANBUS, Ethernet	300 W / 600 W
NIM8302	NIM short size	10	19"	5U	NIM	Yes	No fan unit	No	150 W
NIM8303	NIM	12	19"	5U	NIM	Yes	No fan unit	No	300 W / 600 W
NIM8304	NIM	12	19"	7U	NIM	Yes	Yes	RS232, USB (2.0), CANBUS, Ethernet	1100 W @ 110 Vac 2200 W @ 220 Vac
NIM8305	NIM	2	170 mm	124 mm	NIM	No	No	No	430 W
NIM8306	NIM	2	170 mm	124 mm	NIM	No	No	No	720 W
NV8020A	NIM/VME64	NIM: 5 VME: 8	19"	7U	NIM/ VME64 J1/J2	NIM: Yes VME: No	No	No	NIM: 150 W VME: 365 W

VME

8U 21 Slot VME64/64X Enhanced Crate Series

VME8100

CAEN OPC Server CAEN HV Wrapper FREE

Overview

The VME8100 crates are based on a modularity concept and consist of three easy-to-exchange parts:

- The Subrack: 6U bin with 21 slot monolithic backplane (VME64 or VME64X)
- Pluggable power supply: available in different configurations providing up to 2500 W to the backplane
- Smart Fan Unit: 2U fan tray with OLED display, local controls and CAN bus, Ethernet, USB, RS232 interfaces for remote access to the crate

Safety features include: short circuit, over/undervoltage and over temperature protections.

Monitor and setting of the operational parameters are managed by a SBC controlled either locally thanks to a 4-directional switch and graphic OLED display or remotely via CAN bus, Ethernet, USB and RS232.

The VME backplane supports CBLT compliant automatic daisy chain.

User friendly control software completes the VME8100 features.

The crate is powered by 92 ÷ 264 Vac, 50 ÷ 60 Hz, power factor 0.98% (230 Vac).

An optional SNMP (Simple Network Management Protocol) agent is also available for the remote control of VME8100. SNMPv2 and SNMPv3 are supported.

Great performances, low ripple, customizable power, full set of local and remote controls, outstanding connectivity make this crate our top of the line!

Features

- 19” x 8U (6+2) enclosure
- 21 slot for 6U x 160 mm VME modules
- Available with VME64, VME64X compliant monolithic backplane
- Pluggable power supplies with different configurations up to 2500 W
- Pluggable 2U Smart Fan Unit
- Short circuit protection
- Over / Undervoltage protection
- Over temperature protection
- CAN bus, Ethernet, USB, RS232 interfaces for remote monitoring and control
- SBC controlled with graphic OLED display
- Automatic daisy chain, CBLT compliant
- Easy firmware upgrading
- Libraries, demos (C and LabVIEW) and software tools for Windows and Linux
- SNMP support available

The 2U Smart Fan Unit shows a 4-directional switch, OLED display and various interfaces (CAN bus, Ethernet, USB, RS232) for local and remote control of the crate.

The user can easily monitor all the operational parameters as supply voltages, fan speed and temperature.

Technical Specifications

Mechanics	8U bin for 6U x 160 mm VME cards, 21 slots, 2U space for fan tray			
Backplane	VME64 J1/J2, VME64X J1/J2 - J1/J0/J2 Automatic daisy chain, CBLT compliant			
Mains Input	Auto range: 92 ÷ 264 Vac, 50 ÷ 60 Hz, inrush current: <16 A @ 230 Vac power. fact. > 0.98 @ Output Power > 1 kW			
Fuse	External 16 A, type B/C			
Maximum Output Power	1200 W @ 100 Vac 2530 W @ 211 Vac			
Power Requirements	1760 W @ 100 Vac at full load 3600 W @ 211 Vac at full load			
Maximum Currents	110/220 A @ +5 V 20/40 A @ +/-12 V 110/220 A @ +3.3 V			
Isolation	CE acc. to EN 61010			
Load Regulation	< 10 mV for 0-100% load change @ +5 V < 10 mV for 0-100% load change @ +3.3 V < 15 mV for 0-100% load change @ +/-12 V			
Efficiency	75% ÷ 85% @ 230 Vac configuration dependent			
Noise and Ripple	Measured at output connector	+5 V < 10 mVpp, < 2 mVrms Typ: 6.0 mVpp, 1.5 mVrms +3.3 V < 10 mVpp, < 2 mVrms Typ: 6.0 mVpp, 1.5 mVrms +/-12 V < 10 mVpp, < 2 mVrms Typ: 4.5 mVpp, 1.0 mVrms	Measured at load (0.5 m wire)	+5 V < 5 mVpp, < 1.5 mVrms Typ: 2.5 mVpp, 0.5 mVrms +3.3 V < 5 mVpp, < 1.5 mVrms Typ: 2.5 mVpp, 0.5 mVrms +/-12 V < 10 mVpp, < 1.5 mVrms Typ: 5.5 mVpp, 0.5 mVrms
Temperature Sensors	Power Supply Control: nr. 1 FAN Unit: nr. 1 Backplane: nr. 8 (optional)			
Over Voltage Protection	Trip Off when the output voltage > 103% ÷ 120% (programmable) of set voltage			
Under Voltage Protection	Trip Off when the output voltage < 80% ÷ 97% (programmable) of set voltage			
Over Current Protection	Trip Off when the current > programmable Iset value			
Over Temperature Protection	Trip Off when temperature of a single Power Supply block > 90° C Signaled: - temperature FAN Unit > 50°C - temperature Power Supply Control > 65° C			
Operation	0 ÷ 50°C without derating			
Cooling Airflow	540 m³/h (at maximum fan speed)			
Interface	RS 232, USB (2.0), CAN bus, Ethernet			
Firmware	VME8100 firmware can be upgraded via Ethernet			

Ordering Options - VME8100

			Maximum currents			
Backplane	**Description**	**Ordering Code**	**+5V**	**+12V**	**-12V**	**+3.3V**
VME64 J1/J2	8U VME64 21 slot crate, J1/J2, smart fan unit	WV8100VME000	110 A	20 A	20 A	-
		WV8100VME002	110 A	40 A	40 A	-
		WV8100VME001	220 A	20 A	20 A	-
		WV8100VME003	220 A	40 A	40 A	-
VME64X J1/J2	8U VME64X 21 slot crate, J1/J2, smart fan unit	WV8100VME004	110 A	20 A	20 A	110 A
		WV8100VME006	110 A	20 A	20 A	220 A
		WV8100VME008	110 A	40 A	40 A	110 A
		WV8100VME005	220 A	20 A	20 A	110 A
		WV8100VME010	110 A	40 A	40 A	220 A
		WV8100VME007	220 A	20 A	20 A	220 A
		WV8100VME009	220 A	40 A	40 A	110 A
VME64X J1/J0/J2	8U VME64X 21 slot crate, J1/J0/J2, smart fan unit	WV8100VME011	110 A	20 A	20 A	110 A
		WV8100VME013	110 A	20 A	20 A	220 A
		WV8100VME015	110 A	40 A	40 A	110 A
		WV8100VME012	220 A	20 A	20 A	110 A
		WV8100VME017	110 A	40 A	40 A	220 A
		WV8100VME014	220 A	20 A	20 A	220 A
		WV8100VME016	220 A	40 A	40 A	110 A

Customizations - VME8100

Code	Description
WPERS0820001	Customization - SNMP for VME8100 and VME8200 families

VME

9U 21 Slot VME64X Enhanced Crate Series

VME8200

CAEN OPC Server
CAEN HV Wrapper
FREE

Overview

The VME8200 crates are based on a modularity concept and consist of four detachable parts:

- The Subrack: 6U bin with 21 slot monolithic backplane (VME64X J1/J0/J2). Rear side transition card cage able to house up to 21 3U or 6U x 80 mm Rear Transition Modules (RTM)
- Pluggable power supply: available in different configurations providing up to 2500 W to the backplane
- Smart Fan Unit: 2U fan tray with OLED display, local controls and CAN bus, Ethernet, USB, RS232 interfaces for remote access to the crate
- Removable 1U air filter

The power supply is placed under the VME bin, behind the Smart Fan Unit, in order to keep the rear side of the VME backplane completely accessible.

Safety features include: short circuit, over/undervoltage and over temperature protections.

Monitor and setting of the operational parameters are managed by a SBC controlled either locally thanks to a 4-directional switch and graphic OLED display or remotely via CAN bus, Ethernet, USB and RS232.

The VME64X backplane supports a CBLT compliant automatic daisy chain.

User friendly control software completes the VME 8200 features.

The crate is powered by 92 ÷ 264 Vac, 50 ÷ 60 Hz, power factor 0.98% (230 Vac).

An optional SNMP (Simple Network Management Protocol) agent is also available for the remote control of VME8200. SNMPv2 and SNMPv3 are supported.

Get the advantage of a full accessible backplane for Real Transition Modules

Features

- 19”x 9U (6+3) enclosure
- 21 slot for 6U x 160 mm VME modules
- VME64X compliant monolithic backplane
- Pluggable power supplies with different configurations up to 2500 W
- Pluggable 2U Smart Fan Unit
- Pluggable 1U air filter
- Full access to the rear side of VME backplane with rear side card cage for 3U/6U x 80mm transition modules
- Short circuit protection
- Over / Undervoltage protection
- Over temperature protection
- CAN bus, Ethernet, USB, RS232 interface for remote monitoring and control
- SBC controlled with graphic OLED display
- Automatic daisy chain, CBLT compliant
- Easy firmware upgrading
- Libraries, demos (C and LabVIEW) and software tools for Windows and Linux
- SNMP support available

VME8200 shows a full accessible rear side of its VME64X backplane and a full sized rear side card cage for 3U/6U x 80mm transition modules.

VME8200 is provided with a 1U, removable air filter to safely cool down the VME modules operating within the crate.

The 2U Smart Fan Unit shows a 4-directional switch, OLED display and various interfaces (CAN bus, Ethernet, USB, RS232) for local and remote control of the crate.

The user can easily monitor all the operational parameters as supply voltages, fan speed and temperature.

Technical Specifications

Mechanics	9U bin for 6U x 160 mm VME cards, 21 slots, 2U space for fan tray, 1U Air Filter overall dimensions: height 399.2 mm, width 482.4 mm (19''), depth 544.4 mm Rear J2/J0 area of the VME backplane available for 21 6U x 80 mm (or 3U x 80 mm) rear transition modules (RTM)			
Backplane	VME64X J1/J0/J2 Automatic daisy chain, CBLT compliant			
Mains Input	Auto range: 92 ÷ 264 Vac, 50 ÷ 60 Hz inrush current: < 16 A @ 230 Vac power. fact. > 0.98 @ Output Power > 1 kW			
Fuse	External 16 A, type B/C			
Maximum Output Power	1200 W @ 100 Vac 2530 W @ 211 Vac			
Power Requirements	1760 W @ 100 Vac at full load 3600 W @ 211 Vac at full load			
Maximum Currents	110/220 A @ +5 V 20/40 A @ +/-12 V 110/220 A @ +3.3 V			
Isolation	CE acc. to EN 60950			
Load Regulation	< 10 mV for 0-100% load change @ +5 V < 10 mV for 0-100% load change @ +3.3 V < 15 mV for 0-100% load change @ +/-12 V			
Efficiency	75% ÷ 85% @ 230 Vac configuration dependent			
Noise and Ripple	Measured at output connector	+5 V < 10 mVpp, < 2 mVrms Typ: 6.0 mVpp, 1.5 mVrms +3.3 V < 10 mVpp, < 2 mVrms Typ: 6.0 mVpp, 1.5 mVrms +/-12 V < 10 mVpp, < 2 mVrms Typ: 4.5 mVpp, 1.0 mVrms	Measured at load (0.5 m wire)	+5 V < 5 mVpp, < 1.5 mVrms Typ: 2.5 mVpp, 0.5 mVrms +3.3 V < 5 mVpp, < 1.5 mVrms Typ: 2.5 mVpp, 0.5 mVrms +/-12 V < 10 mVpp, < 1.5 mVrms Typ: 5.5 mVpp, 0.5 mVrms
Temperature Sensors	Power Supply Control: nr. 1 FAN Unit: nr. 1 Backplane: nr. 8 (optional)			
Over Voltage Protection	Trip Off when the output voltage > 103% ÷ 120% (programmable) of set voltage			
Under Voltage Protection	Trip Off when the output voltage < 80% ÷ 97% (programmable) of set voltage			
Over Current Protection	Trip Off when the current > programmable Iset value			
Over Temperature Protection	Trip Off when temperature of a single Power Supply block > 90° C Signaled: - temperature FAN Unit > 50°C - temperature Power Supply Control > 65° C			
Operation	0 ÷ 50°C without derating			
Cooling Airflow	540 m³/h (at maximum fan speed)			
Interface	RS 232, USB (2.0), CAN bus, Ethernet			
Firmware	VME8200 firmware can be upgraded via Ethernet			

Ordering Options - VME8200

			Maximum currents			
Backplane	**Description**	**Ordering Code**	**+5V**	**+12V**	**-12V**	**+3.3V**
VME64X J1/J0/J2	VME64X 9U, 21 Slot J1/J10/J2, smart fan unit, RTM	WV8200VME011	110 A	20 A	20 A	110 A
		WV8200VME012	220 A	20 A	20 A	110 A
		WV8200VME013	110 A	20 A	20 A	220 A
		WV8200VME014	220 A	20 A	20 A	220 A
		WV8200VME015	110 A	40 A	40 A	110 A
		WV8200VME016	220 A	40 A	40 A	110 A
		WV8200VME017	110 A	40 A	40 A	220 A

Customizations - VME8200

Code	Description
WPERS0820001	Customization - SNMP for VME8100 and VME8200 families

VME

7U 21 Slot VME64 Low Cost Crates

VME8010 - VME8011

Overview

The VME8010 and VME8011 are 21 slot VME crates, suitable for 6U x 160 mm boards, with VME64 compliant backplane. A 1U space is reserved for the fan tray.

The Unit is powered by 100 ÷ 240 Vac, 50 ÷ 60 Hz. The Mod. VME8011 has a pluggable Power Supply.

The power distribution is 60 A @+5 V, 6 A @-12 V, 8.9 A @+12 V.

Simple and reliable, a cost effective solution for your VME application

Features

- Low cost compact solution
- 19” x 7U (6+1) enclosure
- 21 slot for 6U x 160 mm VME modules
- 470 W Power Supply
- Pluggable power supply (VME8011 only)
- VME64 J1/J2 monolithic backplane
- Short circuit protection
- Over / Undervoltage protection
- Over temperature protection
- 1U space for Fan Unit
- Powered by 100 ÷ 230 Vac, 50 ÷ 60 Hz
- CBLT cycles supported

Ordering Options

Code	Description
WV8010VME000(*)	8010 - 7U VME64 Low cost 21 slot crate, J1/J2
WV8011VME000	8011 - 7U VME64 Low cost 21 slot crate, J1/J2

(*) NOT Pluggable Power Supply

Technical Specifications	
Mechanics	7U bin for 6U x 160 mm VME cards, 21 slots, 1U space for fan tray
Backplane	VME64 J1/J2
Mains input	Auto range: 85 ÷ 264 Vac, 47 ÷ 63 Hz inrush current: <40 A @ 264 Vac power. fact. > 0.99 Typical
Fuse	F10 A, fast type
Maximum Output Power	470 W @ 110 / 264 Vac
Power Requirements	645 W at full load
Maximum Currents	60 A @ +5 V, 6 A @ -12 V, 8.9 A @ +12 V
Isolation	CE acc. to EN 61010
Load Regulation	< 25 mV for 0-100% load change
Noise and Ripple	+5 V < 50 mV +12 V < 90 mV -12 V < 90 mV (measured at 90% of full load)
Over Current Protection	Trip off at 105-125% of the nominal values
Overvoltage Protection	Trip off at 120-130% of the nominal values
Internal Temperature Limits	Cut off: 110 °C heat sink, 70 °C ambient, autom. maximum fan speed if air above VME modules >45°C
Operation	0 ÷ 50°C without derating
Over Temperature Protection	Trip off all Output Voltages and PS internal fan
Efficiency	75% typical at 230 Vac & 100% rated power
Cooling Airflow	408 m³/h (at maximum fan speed)

VME
MINI CRATE SERIES

1U 2 Slot VME64
VME8001

Features
- 19” x 1U enclosure
- 2 slot for 6U x 160 mm VME modules
- 170 W Power Supply
- Short circuit protection
- Ventilation horizontal (side to side)
- VME64 J1/J2 monolithic backplane
- Powered by 100 ÷ 240 Vac, 50 ÷ 60 Hz

Overview
The VME8001 is a 2 slot VME crate, suitable for 6U x 160 mm boards, with VME64 compliant backplane. The Unit is powered by 110 ÷ 240 Vac, 50 ÷ 60 Hz. The power distribution is 16 A @ +5 V, 7 A @ +12 V, 0.7 A @ -12 V.

Note: VME8001 cooling airflow is not sufficient for CAEN Mod. V1740/VX1740, V1751/VX1751, V1730/VX1730, V1743/VX1743.

Technical Specifications	
Mechanics	19”x1U enclosure, depth: 300 mm, weight: 4.1 kg; 2 slots 6U, 160 mm VME boards
Backplane	VME 2 slot monolithic backplane
Mains Input	100 ÷ 230 Vac (50 ÷ 60 Hz)
Maximum Output Power	170 W
Power Requirements	310 W
Maximum Currents	16 A @ +5 V, 7 A @ +12 V, 0.7 A @ -12 V
Noise and Ripple (backplane connector)	Typical < 20 mVpp (20 MHz bandwidth)
Isolation	CE acc. to EN 61010
Operation	0 ÷ 50°C without derating

Ordering Options

Code	Description
WV8001VME000	VME8001 - VME64 1U Mini crate, 2 Slot J1/J2, (5V 16A, +12V 7A, -12V 0.7A)

2U 4 Slot VME64
VME8004B

Features
- 19” x 2U enclosure
- 4 slot for 6U x 160 mm VME modules
- 365 W Power Supply
- Short circuit protection
- VME64 J1/J2 monolithic backplane
- Horizontal Ventilation (side to side)
- Powered by 100 ÷ 240 Vac, 50 ÷ 60 Hz
- CBLT cycles supported

Overview
The Model VME8004B is a 4 slot VME crate, suitable for 6U x 160 mm boards, with VME64 compliant backplane.

The Unit is powered by 100 ÷ 240 Vac, 50 ÷ 60 Hz.

The power distribution is 25 A @ +5 V, 10 A @ +12 V, 10 A @ -12 V.

The crate provides Automatic Daisy Chain and support Chained Block Transfer (CBLT).

Technical Specifications	
Mechanics	19” x 2U enclosure, depth: 290 mm, weigth: 5.5 kg; 4 slots 6U, 160 mm VME boards
Backplane	VME64 J1/J2, 4 slot Automatic daisy chain
Mains Input	100 ÷ 240 Vac (50 ÷ 60 Hz)
Maximum Output Power	365 W
Power Requirements	465 W
Maximum Currents	25 A @ +5 V, 10 A @ +12 V, 10 A @ -12 V
Noise and Ripple (backplane connector)	+5 V: 10 mVpp; ±12 V: 20 mVpp Measured on 100 nF ceramic in parallel to 10 µF electrolytic
Power Supply Type	ROAL RCB600
Cooling Airflow	Horizontal Ventilation (side to side)

Ordering Options

Code	Description
WV8004BVME00	VME8004B - VME64 2U Mini crate, 4 Slot J1/J2, (5V 25A, +12V 10A, -12V 10A)

VME
MINI CRATE SERIES

2U 4 Slot VME64X

VME8004X

Features

- 19” x 2U enclosure
- 4 slot for 6U x 160 mm VME modules
- 450 W Power Supply
- Short circuit protection
- VME64x J1/J2/J0 monolithic backplane
- Horizontal Ventilation (side to side)
- Powered by 100 ÷ 240 Vac (50 ÷ 60 Hz)

Overview

The Model VME8004X is a 4 slot VME crate, suitable for 6U x 160 mm boards, with VME64x compliant backplane. The Unit is powered by 100 ÷ 240 Vac (50 ÷ 60 Hz). The power distribution is 25 A @ +5 V, 10 A @ +12 V, 10 A @ -12 V, 25 A @ 3.3 V. The VME8004X provides automatic daisy chain and supports CBLT data cycles.

Technical Specifications	
Mechanics	19” x 2U enclosure, depth: 290 mm, weight: 5.5 kg; 4 slots 6U, 160 mm VME boards
Backplane	VME64X J0/J1/J2, 4 slot Automatic daisy chain
Mains Input	100 ÷ 240 Vac (50 ÷ 60 Hz)
Maximum Output Power	450 W
Power Requirements	565 W
Maximum Currents	25 A @ +5 V, 10 A @ +12 V, 10 A @ -12 V, 25A @ 3.3 V
Noise and Ripple (backplane connector)	+5 V/+3.3 V: 10 mVpp; ±12 V: 20 mVpp. Measured on 100 nF ceramic in parallel to 10 µF electrolytic
Power Supply Type	ROAL RCB600
Cooling Airflow	Horizontal Ventilation (side to side)

Ordering Options

Code	Description
WV8004XVME00	VME8004X - VME64x 2U Mini crate,4 Slot J1/J0/J2, (5V 25A, +12V 10A, -12V 10A, 3.3V 25A)

4U 8 Slot VME64

VME8008B

Features

- 19” x 4U enclosure
- 8 slot for 6U x 160 mm VME modules
- 490 W Output Power
- Short circuit protection
- VME64 J1/J2 monolithic backplane
- Horizontal Ventilation (side to side)
- Powered by 100 ÷ 240 Vac (50 ÷ 60 Hz)
- CBLT cycles supported

Overview

The Model VME8008B is a 8 slot VME crate, suitable for 6U x 160 mm boards, with VME64 compliant backplane. The Unit is powered by 100 ÷ 240 Vac (50 ÷ 60 Hz). The power distribution is 50 A @ +5 V, 10 A @ +12 V, 10 A @ -12 V. The VME8008B provides Automatic daisy chain and supports Chained Block Transfer (CBLT).

Technical Specifications	
Mechanics	19” x 4U enclosure, depth: 290 mm, weight: 9.5 kg; 8 slots 6U, 160 mm VME boards
Backplane	VME64 J1/J2, 8 slot Automatic daisy chain
Mains Input	100 ÷ 240 Vac (50 ÷ 60 Hz)
Maximum Output Power	490 W
Power Requirements	600 W
Maximum Currents	50 A @ +5 V, 10 A @ +12 V, 10 A @ -12 V
Noise and Ripple (backplane connector)	+5 V: 10 mVpp; ±12 V: 20 mVpp. Measured on 100 nF ceramic in parallel to 10 µF electrolytic
Power Supply Type	ROAL RCB600
Cooling Airflow	Horizontal Ventilation (side to side)

Ordering Options

Code	Description
WV8008BVME00	VME8008B - VME64 4U Mini crate, 8 Slot J1/J2, (5V 50A, +12V 10A, -12V 10A)

VME
MINI CRATE SERIES

4U 8 Slot VME64X

VME8008X

Features

- 19” x 4U enclosure
- 8 slot for 6U x 160 mm VME modules
- 450 W Power Supply
- Short circuit protection
- VME64X J0/J1/J2 monolithic backplane
- Horizontal Ventilation (side to side)
- Powered by 100 ÷ 240 Vac (50 ÷ 60 Hz)
- CBLT cycles supported

Overview

The Model VME8008X is a 8 slot VME crate, suitable for 6U x 160 mm boards, with VME64X compliant backplane. The Unit is powered by 100 ÷ 240 Vac (50 ÷ 60 Hz). The power distribution is 25 A @ +5 V, 10 A @ +12 V, 10 A @ -12 V, 25 A @ +3.3 V. The VME8008X provides Automatic daisy chain and supports Chained Block Transfer (CBLT).

Technical Specifications	
Mechanics	19” x 4U enclosure, depth: 290 mm, weigth: 9.5 kg; 8 slots 6U, 160 mm VME boards
Backplane	VME64X J0/J1/J2, 8 slot Automatic daisy chain
Mains Input	100 ÷ 240 Vac (50 ÷ 60 Hz)
Maximum Output Power	450 W
Power Requirements	565 W
Maximum Currents	25 A @ +5 V, 10 A @ +12 V, 10 A @ -12 V, 25 A @ +3.3 V
Noise and Ripple (backplane connector)	+5 V/+3.3 V: 10 mVpp; ±12 V: 20 mVpp Measured on 100 nF ceramic in parallel to 10 µF electrolytic
Power Supply Type	ROAL RCB600
Cooling Airflow	Horizontal Ventilation (side to side)

Ordering Options

Code	Description
WV8008XVME00	VME8008X - VME64x 4U Mini crate,8 Slot J1/J0/J2, (5V 25A, +12V 10A, -12V 10A, 3.3V 25A)

NIM

7U 12 Slot Smart Fan Unit 300/600 W Crate

NIM8301

CAEN OPC Server
CAEN HV Wrapper
FREE

Overview

The NIM8301 is a 7U (5+2) full sized NIM crate (19"-12 slot) available with either 300 W or 600 W pluggable power supply.

The NIM modules operating within the crate are ventilated by a 2U Smart Fan Unit.

Safety features include: short circuit, over/undervoltage and over temperature protections.

Monitor and setting of the operational parameters are managed by a SBC controlled either locally thanks to a 4-directional switch and graphic OLED display or remotely via CAN bus, Ethernet, USB and RS232.

User-friendly control software completes the NIM 8301 features. The Unit is powered by 115 or 230 Vac, 50 ÷ 60 Hz.

Low Ripple Linear power supply! 300 W or 600 W, CANBUS, TCP/IP, RS232 and USB 2.0 control.

Features

- 19" x 7U (5+2) enclosure
- 12 NIM slot
- Equipped with long-life NIM connectors
- Pluggable Linear Power Supply (300 W and 600 W available)
- Pluggable 2U Fan Unit
- Short circuit protection
- Over / Undervoltage protection
- Over temperature protection
- CAN bus, Ethernet, USB and RS232 interface for remote monitoring and control
- SBC controlled with graphic OLED colour display
- Ergonomic pointer
- Libraries, Demos (C and LabVIEW) and Software tools for Windows and Linux
- Easy firmware upgrading

Ordering Options - NIM8301

			Maximum currents					
Form factor	Power	Ordering Code	+6V	-6V	+12V	-12V	+24V	-24V
7U 12 slot std size Smart Fan Unit	300 W	WNIM8301300W	17 A	17 A	3.4 A	3.4 A	3.4 A	3.4 A
	600 W	WNIM8301600W	45 A	45 A	8 A	8 A	8 A	8 A
		WNIM8301600Y	20 A	20 A	15 A	15 A	4 A	4 A
		WNIM8301600Z	45 A	45 A	18 A	18 A	-	-

Customizations

Code	Description
WPERS0833001	N8330 Customization - 110 VAC Input Adapting
WPERS0836001	N8360W Customization - 110 VAC Input Adapting

The 2U Smart Fan Unit shows a 4-directional switch, OLED display and various interfaces (CAN bus, Ethernet, USB, RS232) for local and remote control of the crate.

The user can easily monitor all the operational parameters as supply voltages, fan speed and temperature.

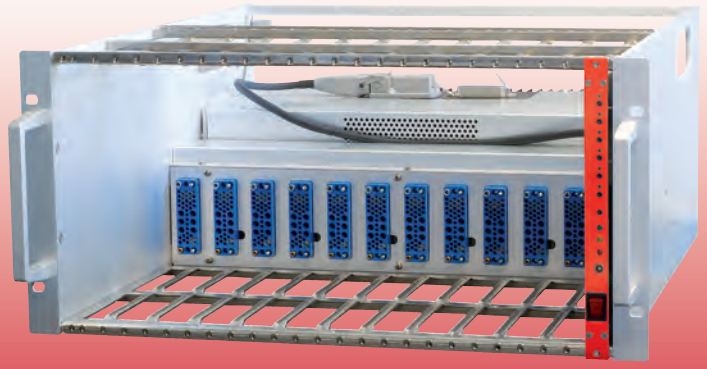
Technical Specifications

Mains Input	230 Vac or 115 Vac, 50 ÷ 60 Hz.			
Mechanics	19" x 7U (5+2) bin, 12 slot, 2U space for fan tray			
Maximum Output Power	300 / 600 W			
Interface	RS 232, USB (2.0), CAN bus, Ethernet			
Fuse	4 A Class T @ 300 W 220 Vac, 8 A Class T @ 300 W 115 Vac, 6.3 A Class T @ 600 W 220 Vac, 15 A Class T @ 600 W 115 Vac			
Maximum Currents	300 W	600 W		
	17 A @ ±6 V 3.4 A @ ±12 V 3.4 A @ ±24 V	45 A @ ±6 V 8 A @ ±12 V 8 A @ ±24 V	20 A @ ±6 V 15 A @ ±12 V 4 A @ ±24 V	45 A @ ±6 V 18 A @ ±12 V ±24 V not present
Output Current Characteristic	Foldback (Isc < 5 A Imax = Inominal +15%):	Foldback (Isc < 15 A Imax = Inominal +15%):	Foldback (Isc < 10 A Imax = Inominal +15%):	Foldback (Isc < 15 A Imax = Inominal +15%):
Isolation	CE acc. to EN 61010			
Power Requirements	610 W and 1150 W (for 300 W and 600 W) at full load			
Noise and Ripple	< 3 mVpp @ ±6 V, ±12 V, ±24 V (Typ.) < 5 mVpp @ ±6 V, ±12 V, ±24 V (Max.)			
Output Impedance	0.3 mΩ static			
Status Control	Alarm signalled by FAIL LED, FAIL signal and buzzer Alarm reason displayed on FAN unit OLED display and managed by remote control			
Temperature Sensors	Power Supply: nr. 4 @ 300W nr. 2 @ 600W FAN Unit: nr. 2 Backplane: nr. 6 (optional)			
Output Voltage Characteristic	dual tracking for all ±DC outputs Soft start; DC output calibration (manually)			
Over Voltage Protection	Trip Off when the output voltage > 110% of nominal voltage			
Under Voltage Protection	Trip Off when the output voltage < 90% of nominal voltage			
Over Current Protection	Trip Off when the current > programmable Iset value			
Over Temperature Protection	Trip Off when temperature of heat sink > 70° C or when transformer temperature > 110° C Signaled: - temperature FAN Unit > 50°C - temperature Power Supply Control > 65° C			
Cooling Airflow	540 m³/h (at maximum fan speed)			
Operation	0 ÷ 40°C without derating			
Firmware	NIM8301 firmware can be upgraded via Ethernet			

NIM

5U 12 Slot 300/600 W Crate

NIM8303



Overview

The CAEN Mod. NIM8303 is a 5U non ventilated NIM crate (19''-12 slot) available with both pluggable 300 W and 600 W power supplies.

Safety features include: short circuit protection, over / undervoltage protection, over temperature protection.

The Unit is powered by 115 or 230 Vac, 50 ÷ 60 Hz.

The Mod NIM8303 is equipped with a Control panel with mains switch, status LEDs, FAIL output (LEMO 00) and test pin for all DC voltages.

Features

- 19" x 5U enclosure
- 12 slot non-ventilated NIM bin
- Pluggable Linear Power Supply (300 W and 600 W available)
- Equipped with long-life NIM connectors
- Short circuit protection
- Over / Undervoltage protection
- Over temperature protection
- Control panel with mains switch, control LEDs and LEDs / test pins for all outputs
- Optional 1U rack mountable fan unit

Optional A83xx 1U fan tray available to properly ventilate the NIM modules operating within the crate

Ordering Options - NIM8303

			Maximum currents					
Form factor	Power	Ordering Code	+6V	-6V	+12V	-12V	+24V	-24V
5U 12 slot std size	300 W	WNIM8303300W	17 A	17 A	3.4 A	3.4 A	3.4 A	3.4 A
	600 W	WNIM8303600W	45 A	45 A	8 A	8 A	8 A	8 A
		WNIM8303600Y	20 A	20 A	15 A	15 A	4 A	4 A
		WNIM8303600Z	45 A	45 A	18 A	18 A	-	-

Customizations

Code	Description
WPERS0833001	N8330 Customization - 110 VAC Input Adapting
WPERS0836001	N8360W Customization - 110 VAC Input Adapting

Technical Specifications

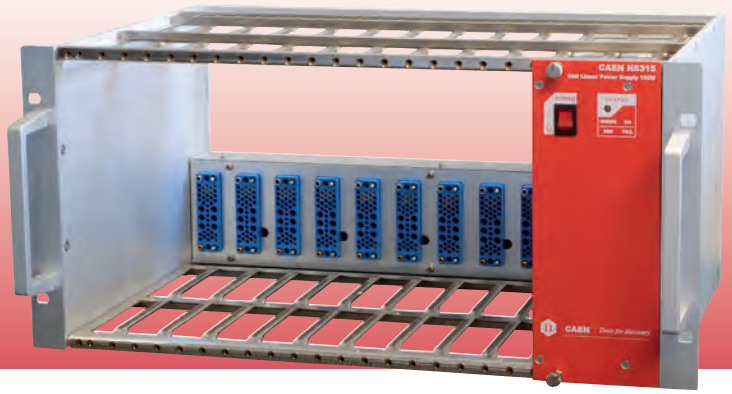
Mains input	230 Vac or 115 Vac, 50 ÷ 60 Hz.			
Mechanics	19" x 5U bin, 12 slot, non ventilated			
Maximum Output Power	300 / 600 W			
Fuse	4 A Class T @ 300 W 220 Vac, 8 A Class T @ 300 W 115 Vac, 6.3 A Class T @ 600 W 220 Vac, 15 A Class T @ 600 W 115 Vac			
Maximum Currents	300 W	600 W		
	17 A @ ±6 V 3.4 A @ ±12 V 3.4 A @ ±24 V	45 A @ ±6 V 8 A @ ±12 V 8 A @ ±24 V	20 A @ ±6 V 15 A @ ±12 V 4 A @ ±24 V	45 A @ ±6 V 18 A @ ±12 V ±24 V not present
Output Current Characteristic	Foldback (Isc < 5 A Imax = Inominal +15%):	Foldback (Isc < 15 A Imax = Inominal +15%):	Foldback (Isc < 10 A Imax = Inominal +15%):	Foldback (Isc < 15 A Imax = Inominal +15%):
Isolation	CE acc. to EN 61010			
Power Requirements	610 W and 1150 W (for 300 W and 600 W) at full load			
Noise and Ripple	< 3 mVpp @ ±6 V, ±12 V, ±24 V (Typ.) < 5 mVpp @ ±6 V, ±12 V, ±24 V (Max.)			
Output Impedance	0.3 mΩ static			
Status Control	±6 V, ±12 V, ±24 V LED and test point; GND test point ALARM signal, STATUS, OVERHEAT and OVERTEMPERATURE LED			
Temperature Sensors	Power Supply: nr. 4 @ 300W nr. 2 @ 600W			
Output Voltage Characteristic	dual tracking for all ±DC outputs Soft start; DC output calibration (manually)			
Over Voltage Protection	Trip Off when the output voltage > 110% of nominal voltage			
Under Voltage Protection	Trip Off when the output voltage < 90% of nominal voltage			
Over Current Protection	Trip Off when the current > programmable Iset value			
Over Temperature Protection	Trip Off when temperature of heat sink > 70° C or when transformer temperature > 110° C			
Operation	0 ÷ 40°C without derating			

NIM

5U 10/5 Slot 150 W Compact Crate

NIM8302

A portable 7 slot (5 free) also available



Overview

The CAEN Mod. NIM8302 is a compact (10 slot free) non ventilated 5U NIM crate (19'' - 10 free slot) provided with pluggable 150 W power supply. Safety features include: short circuit protection, over/undervoltage protection and over temperature protection. The Unit is powered by 115 or 230 Vac, 50 ÷ 60 Hz. On the front panel the status of power supply is indicated by green/red LED.

Features

- Cost effective, compact solution
- 19" x 5U enclosure
- 12 slot non-ventilated NIM bin (10 free slots)
- 2 slot, removable linear power supply (150 W)
- Equipped with long-life NIM connectors
- Short circuit protection
- Over / Undervoltage protection
- Over temperature protection
- Optional 1U rack mountable fan tray
- Available portable version 7 slot (5 free)

Technical Specifications	
Mechanics	19" x 5U bin, 12 slot (10 free), non ventilated 270 mm x 5U, 7 slot (5 free), non ventilated (portable version)
Mains Input	230 Vac or 115 Vac, 50 ÷ 60 Hz.
Maximum Output Power	150 W
Power Requirements	280 W at full load
Fuse External	External 2 A, class T (230 Vac)
Maximum Currents	5 A @ ±6 V, 3 A @ ±12 V, 1.5 A @ ±24 V
Load Regulation	< 0.5 % for 10-100% load change, < 0.02 % for ±10% line change
Isolation	CE acc. to EN 61010
Ripple	±6 V < 5 mVpp, ±12 V < 8 mVpp, ±24 V < 10 mVpp
Transient Response Recovey	0.15 ms for recovery to ±1% of voltage for 10-100% load change
Output Impedance	0.6 mΩ static
Output Voltage Characteristic	Dual tracking for all ±DC outputs, Soft start, DC output calibration (manually)
Output Current Characteristic	OVC protection / Trip Off
Over Voltage Protection	Trip Off when the output voltage > 130% of nominal voltage
Under Voltage Protection	Trip Off when the output voltage < 70% of nominal voltage
Over Current Protection	Trip Off when current: > 6 A @ +24 V, > 2 A @ -24 V, > 6 A @ +12 V, > 3.75 A @ -12 V, > 10 A @ ±6 V
Over Temperature Protection	Trip Off when temperature > 75° C
Temperature Sensors	nr.1
Status Control	Fail/Status LED signal
Operation	0 ÷ 45°C without derating

NEW

Optional A83Px 1U fan tray available to properly ventilate the A8302P crate

Optional A83xx 1U fan tray available to properly ventilate the NIM modules operating within the crate

Ordering Options - NIM8302

Code	Description
WNIM8302150W	NIM8302/15 - NIM 5U Compact crate, 10 slot, 150W (±6V 5A, ±12V 3A, ±24V 1,5A)
WN8315WAAAAA	N8315 - NIM Linear Power supply 150W (±6V 5A,±12V 3A, ±24V 1.5A)
WNIM8302P150	NIM8302P/15 - NIM Portable crate, 7 slot, 150W (±6V 5A, ±12V 3A, ±24V 1,5A)

NIM
MINI CRATE SERIES

2 Slot Switching 430 W
NIM8305

Features
- Cost effective, compact solution
- 12 A @ ±6 V and 12 A @ ±12 V output
- 2 air cooled NIM slots
- Ideal for small experiments, laboratories and universities
- Portable: 170 x 310 x 125 mm³ (WxHxD); 5 kg weight
- Equipped with long-life NIM connectors
- Wide AC input voltage range: 100 Vac to 240 Vac
- Active PFC
- Extra low noise switching power supply
- Power good and stand-by leds
- Short circuit protection

Overview
The CAEN Mod. NIM8305 is a 2 slot NIM crate with switching power supplies; the unit is provided with three ventilation fans. The NIM8305 delivers 12 A @ ±6 V and 12 A @ ±12 V. Safety features include: short circuit protection, over / under voltage protection, over temperature protection. The Unit is powered by 100 ÷ 240 Vac, 50 ÷ 60 Hz, power factor 0.98% (230 Vac).

Technical Specifications

Mechanics	2 NIM slots; dimensions: 124 x 170 x 310 mm³; 5 kg weight
Mains Input	100 ÷ 240 Vac, 50 ÷ 60 Hz, power factor 0.98% (230 Vac)
Maximum Output Power	430 W
Power Plug	C14 IEC Fused Inlet
Maximum Currents	12 A @ ±6 V, 12 A @ ±12 V
Isolation	CE acc. to EN 60950
Power Requirements	565 W at full load
Load Regulation	±50 mV - for 0-100% load change @ ± 6 V ±100 mV - for 0-100% load change @ ±12 V ±150 mV - for 0-100% load change @ ±24 V
Noise and Ripple (full load)	±6 V: Max 5 mVpp, 1 mVrms , Typ 2.5 mVpp, 0.5 mVrms ±12 V: Max 6mVpp, 1.5 mVrms, Typ 3 mVpp, 1 mVrms
Operation	0 ÷ 50°C without derating
Cooling Airflow	3 x Sunon KDE1206PHV1 cooling fans

Ordering Options

Code	Description
WNIM8305XAAA	NIM8305 - NIM crate, 2 slot, Switching PS (±6V 12A, ±12V 12A)

2 Slot Switching 720 W
NIM8306

Features
- Cost effective, compact solution
- 12 A @ ±6 V, 12 A @ ±12 V and 6 A @ ±24 V output
- 2 air cooled NIM slots
- Ideal for small experiments, laboratories and universities
- Portable: 170 x 310 x 125 mm³ (WxHxD); 5 kg weight
- Equipped with long-life NIM connectors
- Wide AC input voltage range: 100 Vac to 240 Vac
- Active PFC
- Extra low noise switching power supply
- Power good and stand-by leds
- Short circuit protection

Overview
The CAEN Mod. NIM8306 is a 2 slot NIM crate with switching power supplies; the unit is provided with three ventilation fans. The NIM8306 delivers 12 A @ ±6 V, 12 A @ ±12 V and 6 A @ ±24 V. Safety features include: short circuit protection, over / under voltage protection, over temperature protection. The Unit is powered by 100 ÷ 240 Vac, 50 ÷ 60 Hz, power factor 0.98% (230 Vac).

Technical Specifications

Mechanics	2 NIM slots; dimensions: 124 x 170 x 310 mm³; 5 kg weight
Mains input	100 ÷ 240 Vac, 50 ÷ 60 Hz, power factor 0.98% (230 Vac)
Maximum Output Power	720 W
Power Plug	C14 IEC Fused Inlet
Maximum Currents	12 A @ ±6 V, 12 A @ ±12 V, 6 A @ ±24 V
Isolation	CE acc. to EN 60950
Power Requirements	950 W at full load
Load Regulation	±50 mV - for 0-100% load change @ ± 6V ±100 mV - for 0-100% load change @ ±12 V ±150 mV - for 0-100% load change @ ±24 V
Noise and Ripple (full load)	±6 V: Max 5 mVpp, 1 mVrms , Typ 2.5 mVpp, 0.5 mVrms ±12 V: Max 6mVpp, 1.5 mVrms, Typ 3 mVpp, 1 mVrms ±24 V: Max 5mVpp, 1 mVrms, Typ 2.5 mVpp, 0.5 mVrms
Operation	0 ÷ 50°C without derating
Cooling Airflow	3 x Sunon KDE1206PHV1 cooling fans

Ordering Options

Code	Description
WNIM8306XAAA	NIM8306 - NIM crate, 2 slot, Switching PS (±6V 12A, ±12V 12A, ±24V 6A)

NIM
SWITCHING

7U 12 Slot Smart Fan Unit Switching 2000 W Crate

NIM8304

CAEN OPC Server
CAEN HV Wrapper
FREE

Overview

The NIM8304 is a 7U (5+2) full size NIM crate (19"-12 slot) with pluggable low noise switching power supply able to provide up to 2000 W @ 220 Vac or 1000 W @ 110 Vac.

The NIM modules operating within the crate are ventilated by a 2U Smart Fan Unit. Safety features include: short circuit, over/undervoltage and over temperature protections.

Monitor and setting of the operational parameters are managed by a SBC controlled either locally thanks to a 4-directional switch and graphic OLED display or remotely via CAN bus, Ethernet, USB and RS232.

User-friendly control software completes the NIM8304 features. The unit is powered by 92 ÷ 264 Vac, 50 ÷ 60 Hz, power factor 0.98% (230 Vac).

Features

- 19" x 7U (5+2) enclosure
- 12 NIM slot
- Equipped with long-life NIM connectors
- Pluggable Switching Power Supply up to 2000 W
- Pluggable 2U Fan Unit
- Short circuit protection
- Over / Undervoltage protection
- Over temperature protection
- CAN bus, Ethernet, USB and RS232 interface for remote monitoring and control
- SBC controlled with graphic OLED colour display
- Ergonomic pointer
- Easy firmware upgrading
- Libraries, Demos (C and LabVIEW) and Software tools for Windows and Linux

The 2U Smart Fan Unit shows a 4-directional switch, OLED display and various interfaces (CAN bus, Ethernet, USB, RS232) for local and remote control of the crate.

The user can easily monitor all the operational parameters as supply voltages, fan speed and temperature.

Ordering Options

Code	Description
WNIM8304XAAA	NIM8304 - NIM 7U crate, 12 slot, smart fan unit, 1000W US - 2000W EU (±6V 90A, ±12V 20A, ±24V 10A)

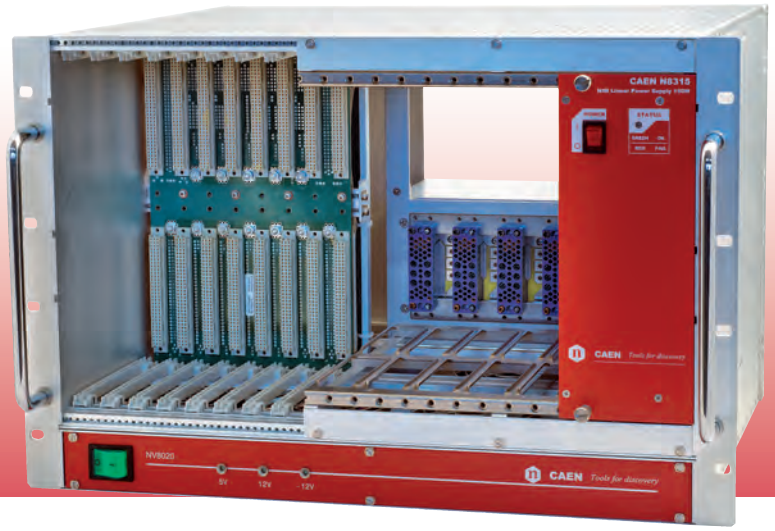
Technical Specifications

Mechanics	19" x 7U (5+2) bin, 12 slot, 2U space for fan tray			
Mains Input	92 ÷ 264 Vac, 50 ÷ 60 Hz, power. fact. > 0.98 % (230 VAC)			
Fuse	External 16 A, type B/C			
Maximum Output Power	1100 W @ 100 Vac 2200 W @ 211 Vac			
Power Requirements	1450 W @ 100 Vac 2850 W @ 211 Vac			
Maximum Currents	EU	90 A @ ±6 V 23 A @ ±12 V 11 A @ ±24 V	US	45 A @ ±6 V 11.5 A @ ±12 V 5.5 A @ ±24 V
Isolation	CE acc. to EN 61010			
Load Regulation	< 10 mV for 0-100% load change @ ±6 V < 10 mV for 0-100% load change @ ±12 V < 15 mV for 0-100% load change @ ±24 V			
Efficiency	75% ÷ 85% @ 230 Vac configuration dependent			
Noise and Ripple	±6 V < 10 mVpp, < 2 mVrms Typ: 6.0 mVpp, 1.5 mVrms ±12 V < 15 mVpp, < 2 mVrms Typ: 10 mVpp, 1.0 mVrms ±24 V < 15 mVpp, < 2 mVrms Typ: 10 mVpp, 1.0 mVrms			
Temperature Sensors	Power Supply Control: nr. 1 FAN Unit: nr. 1 Backplane: nr. 6 (optional)			
Over Voltage Protection	Trip Off when the output voltage > 103% ÷ 120% (programmable) of set voltage			
Under Voltage Protection	Trip Off when the output voltage < 80% ÷ 97% (programmable) of set voltage			
Over Current Protection	Trip Off when the current > programmable Iset value			
Over Temperature Protection	Trip Off when temperature of a single Power Supply block > 90° C Signaled: - temperature FAN Unit > 50°C - temperature Power Supply Control > 65° C			
Operation	0 ÷ 50°C without derating			
Cooling Airflow	540 m³/h (at maximum fan speed)			
Interface	RS 232, USB (2.0), CAN bus, Ethernet			
Firmware	NIM8304 firmware can be upgraded via Ethernet			

MIXED

7U Crate VME/NIM 8 Slot VME64 365 W, 5 Slot NIM 150 W

NV8020A



Overview

The NV8020A is a 19” x 7U 84TE mixed VME / NIM crate equipped with a 1U common fan unit.

The VME section features 8 slots suitable for 6Ux160 mm boards, with VME64 compliant backplane. The section is powered by universal AC input Power Supply. The Power distribution is 25 A @ +5 V, 10 A @ -12 V, 10 A @ +12 V.

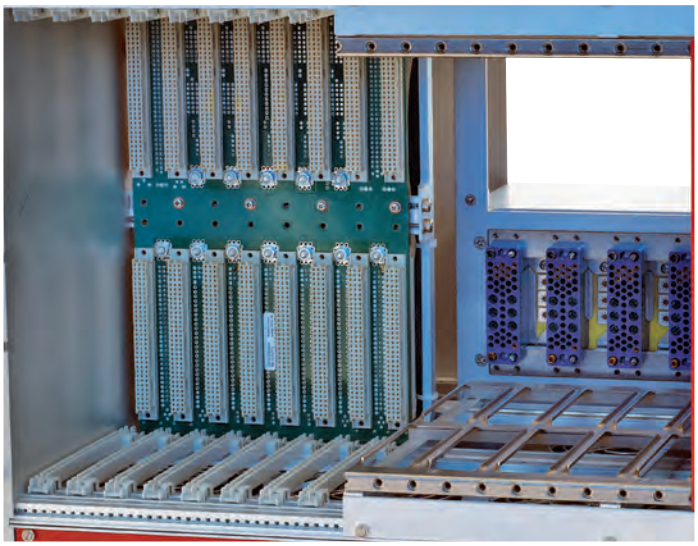
The NIM section consists of 7 NIM slots (5 free) provided with provided with 2.5U NIM slot linear power supply (150 W).

The Unit is powered by 110 or 220 Vac, 50 ÷ 60 Hz. On the front panel the status of power supply is indicated by green/red LED.

Two crates in 19”: VME and NIM have never been so close!

Features

- 19” x 7U (6+1) enclosure mixed VME/NIM crate
- VME section:
  - 8 slot for 6U x 160 mm VME modules
  - 365 W Power Supply
  - Low noise Power Supply
  - VME64 J1/J2 monolithic backplane
- NIM section:
  - 7 slot NIM (5 free slots)
  - 2 slot linear power supply (150 W)
- 1U space for Fan Unit
- Short circuit protection
- Over / Undervoltage protection
- Over temperature protection



NV8020A shows two independent sections in the same chassis: a 8 slot VME64 backplane and 5 free NIM slots.

This unit is therefore a perfect solution to mix boards of the two different standards in a single front end and data acquistion system.

Technical Specifications

Mechanics	19" x 7U 84TE mixed crate VME64 (8 slots for 6U x 160 mm boards) / NIM (5 free slots) 1U common fan unit; weight: 28 kg	
Section	VME64	NIM
Backplane	J1/J2 Automatic daisy chain, CBLT compliant	Equipped with long-life NIM connectors
Mains Input	100 ÷ 240 Vac, 50 ÷ 60 Hz	230 or 115 Vac, 50 ÷ 60 Hz
Maximum Output Power	365 W	160 W
Power Requirements	475 W at full load	280 W at full load
Fuse	1 External 3.15 A, type B/C	1 External 2 A, class T (230 Vac)
Maximum Currents	25 A @ +5 V 10 A @ -12 V 10 A @ +12 V	5 A @ ±6 V 3 A @ ±12 V 1.5 A @ ±24 V
Isolation	CE acc. to EN 60950	CE acc. to EN 61010
Load Regulation	< 1 % for 0-100% load change @ +5 V < 1 % for 0-100% load change @ ±12 V	< 0.5 % for 10-100% load change < 0.02 % for ±10% line change
Noise and Ripple (backplane connector)	+5 V < 10 mVpp ±12 V < 20 mVpp	±6 V < 5 mVpp ±12 V < 8 mVpp ±24 V < 10 mVpp
Power Supply Type	ROAL RCB600 power supplies	CAEN Mod. N8315

Maximum currents

Form factor	Mechanics	Backplane	+6 V	-6 V	+12 V	-12 V	+24 V	-24 V
NIM	NIM (5 free slots)	Equipped with long-life NIM connectors	5 A	5 A	3 A	3 A	1.5 A	1.5 A
Form factor	**Mechanics**	**Backplane**	**+5 V**	**+12 V**	**-12 V**	**-**	**-**	**-**
VME	VME64 (8 slots for 6Ux160mm boards)	VME64: J1/J2 Automatic daisy chain, CBLT compliant	25 A	10 A	10 A			

Ordering Options

Code	Description
WN8020AXAAAA	NV8020A - VME/NIM 7U crate, 8 slot VME64 365W, 5 slot NIM 150W
WN8315WAAAAA	N8315 - NIM Linear Power supply 150W (±6V 5A,±12V 3A, ±24V 1.5A)
WVN7U6S5SXAA	VMENIM7U - Crate VME/NIM, VME64, 8 Slot VME, 5 Slot NIM

NIM Linear Power Supply 150W

N8315

Features

- Slot linear power supply (150 W)
- 2.5 NIM slot width
- Short circuit protection
- Over / Under voltage protection
- Over temperature protection
- Front panel with status LED and mains switch

Overview

The N8315 is a 150 W NIM Linear Power supply, suitable to any NIM crate. Safety features include: short circuit protection, over/undervoltage protection, over temperature protection. The Unit is powered by 115 or 230 Vac, 50 ÷ 60 Hz. On the front panel the status of the power supply is indicated by green/red LED.

Ordering Options

Code	Description
WN8315WAAAAA	N8315 - NIM Linear Power supply 150W (±6V 5A,±12V 3A, ±24V 1.5A)

General Purpose 1U Fan Units

A83xx A83Px

NEW

A83xx Features

- 19”/1U rack mountable fan tray
- 3 ventilation fans
- 450 m^3/h air flow
- 47 dB noise

A83Px Features

- 270 mm/ 1U mountable fan tray
- 2 ventilation fans
- 300 m^3/h air flow
- 34 dB noise

Overview

A83xx and A83Px are suitable yet cost effective solution to properly ventilate NIM modules operating in those NIM bins that are not provided with a fan tray.

The units are powered by 110 or 230 V 50 ÷ 60 Hz AC (50 / 35 W).

- A83Px for NIM8302P portable crate
- A83XX for 19” rack mountable crates (NIM8303, NIM8302)

Ordering Options

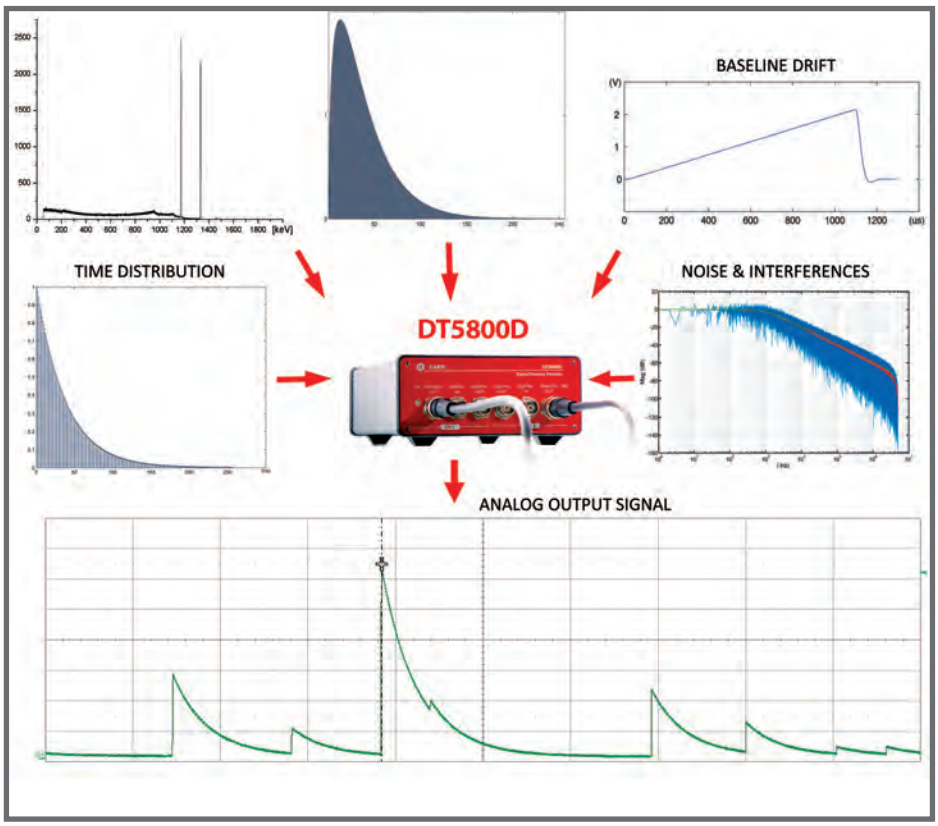
Code	Description
WA83XXFANXAA	A83XXA - General Purpose 1U Fan Unit 220Vac
WA83XXFANXAB	A83XXB - General Purpose 1U Fan Unit 110Vac
WA83PXFANXAA	A83PXA - General Purpose 1U Mini Fan Unit 220Vac
WA83PXFANXAB	A83PXB - General Purpose 1U Mini Fan Unit 110Vac

SIGNAL GENERATORS

Introduction to Digital Detector Emulators

Your powerful user-friendly solution for the emulation of any detection setup

- Energy spectrum emulation
- Time distribution emulation
- Pile-up emulation
- Noise emulation
- Multiple shapes emulation (DT4800 excluded models only)
- Programmable analog delay generator (2 channel versions only)
- Correlated events generation (2 channel versions only)



Block scheme of the event generation process.

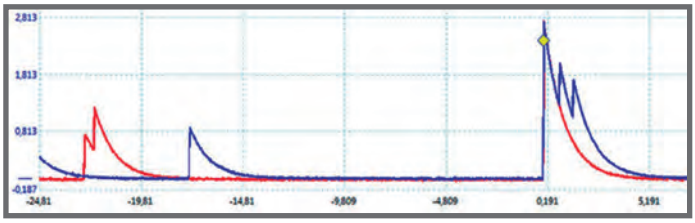
The Digital Detector Emulators are multichannel instruments for the emulation of radiation detection systems.

These devices represent an hardware application of the well-known Monte Carlo simulation method, synthesizing a continuous stream of pulses according to an user programmable set of statistical distributions such as energy spectra, time distribution, noise, etc.

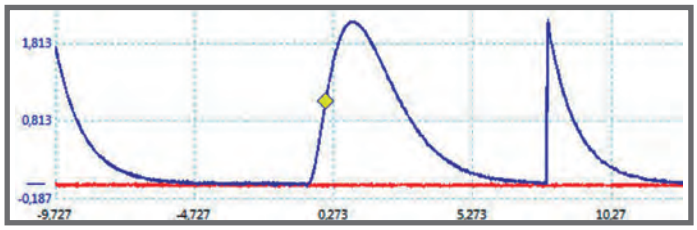
In addition, energy spectra and template waveforms acquired by other instrumentation (MCAs, digital oscilloscopes, etc.) can be loaded as a source of the emulation.

Signal pile-up is another experimental condition that can be fully emulated and controlled by the user.

When the emulation process is reset, the sequence can be either re-initialized with new random data or reproduced the same many times, in order to study, for example, the effect of acquisition changes on the same data set.



Generation of correlated events. CH1 in red, CH2 in blue. The yellow mask shows a correlated event sharing the same energy and timing in both channels.



Two different shapes in the same output channel.

Each channel can be independently programmed with its own statistics.

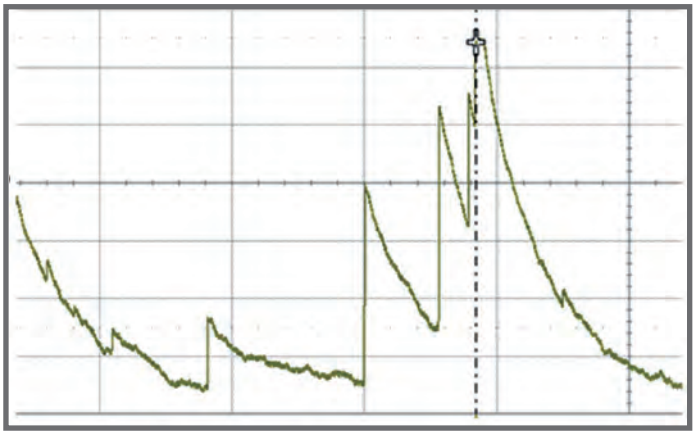
Moreover, the user can either run different channels by uncorrelating or correlating them in different ways:

1. Channel 1 sequence can be a copy of Channel 0 one shifted in time
2. A subset of events from Channel 1 can share the same Energy Spectrum of Channel 0
3. The two channels can work in a Master/Slave configuration, in which Channel 0 works as a trigger for Channel 1 that conserves its own statistics

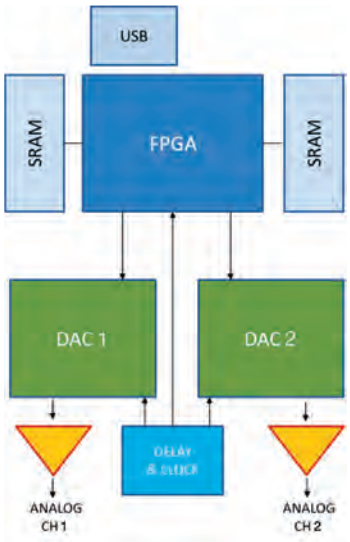
Another interesting feature (DT4800 excluded) is the possibility to generate different pulse shapes on the same channel with a predefined "mixture" percentage of the two, in order to emulate for example neutron pulses in a gamma ray background. The capability to add different noise and interference figures improves the emulation process, giving the possibility to operate out of ideal but not realistic conditions.

The Digital Detector Emulators are controlled by a dedicated Control Software with advanced graphical user interface for a full control of all the emulation parameters.

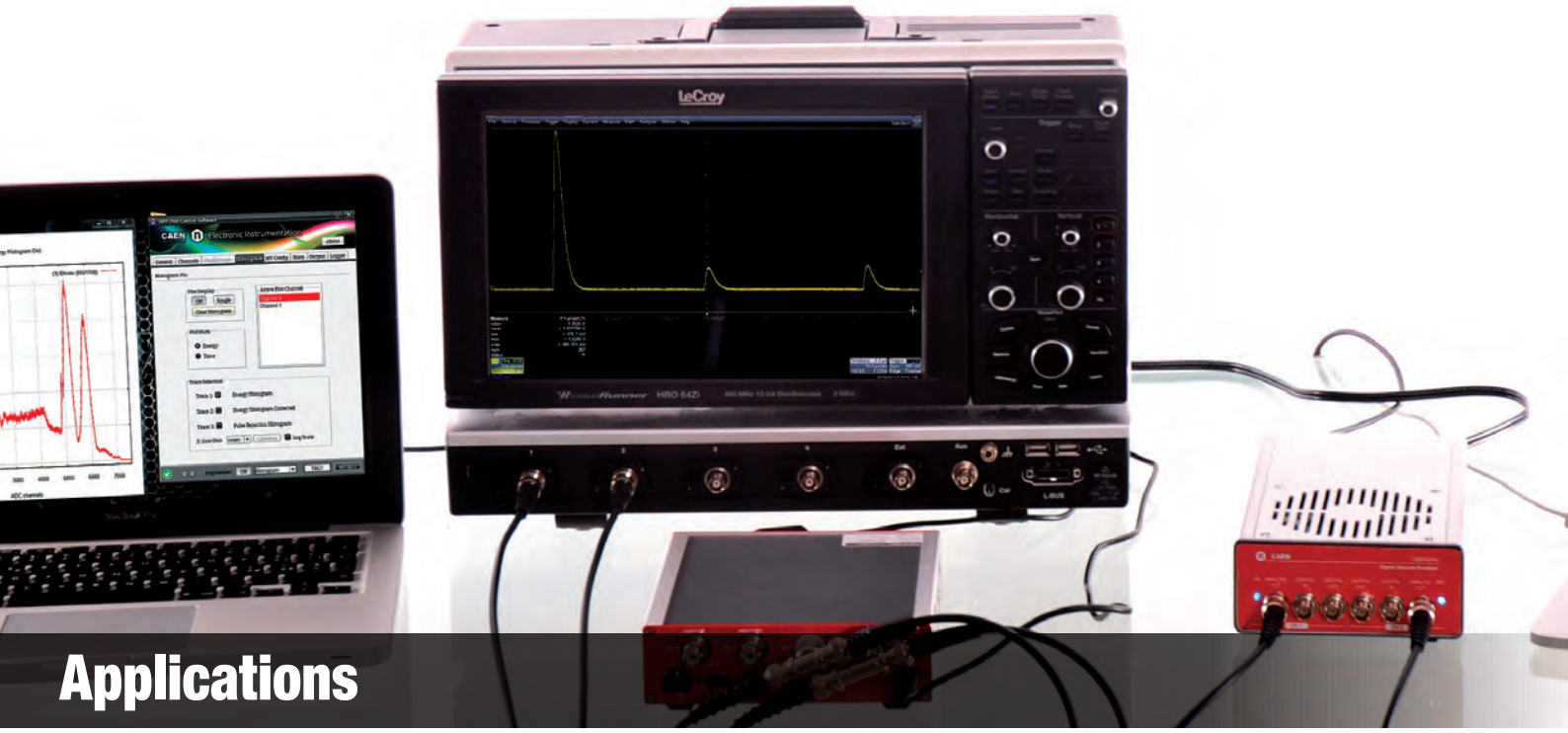
These features, together with the possibility to work as waveform/function generators, make the Digital Detector Emulators the perfect tools for testing and developing DAQ solutions, bringing an experimental setup on your desktop.



Final analog output of the Digital Detector Emulator.



Block diagram of the Digital Detector Emulator.



Applications

Remote Experimentation

Through the use of CAEN digitizers and digital MCAs it is possible to acquire and store both waveforms and energy spectra from real radiation detectors. The resulting files can be imported in the Digital Detector Emulators and used as a source for the emulation process.

It is therefore possible to emulate the real setup even without having a direct access to it.

Moreover, the user can modify the original experimental conditions by tuning emulation parameters like rate, pile-up, noise, etc. This extends the emulation process beyond the experimental conditions achievable in a lab.

Time To Digital Converter

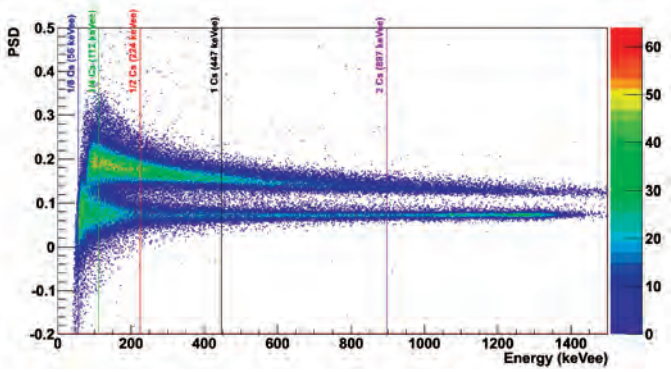
The Digital Detector Emulators can be coupled with a CAEN TDC module for a precise test of time resolution.

Usually, a delay generator or a simple pulser are used to generate signals with fixed amplitude and shape. With Digital Detector Emulators it is possible to test timing resolution in a more general condition, using signals with variable amplitude and shape and adding the typical issues that affect real setups like noise, baseline drift and pile-up.

Pulse Shape Discriminator

In several applications the ability to distinguish different pulse shapes is important to discriminate the kind of particles interacting within the detector. This is, for example, the case of neutron-gamma discrimination where neutron sources are difficult to handle.

The Digital Detector Emulators are able to simulate different pulse shapes on the same channel (DT4800 excluded) allowing for detailed studies of such applications.



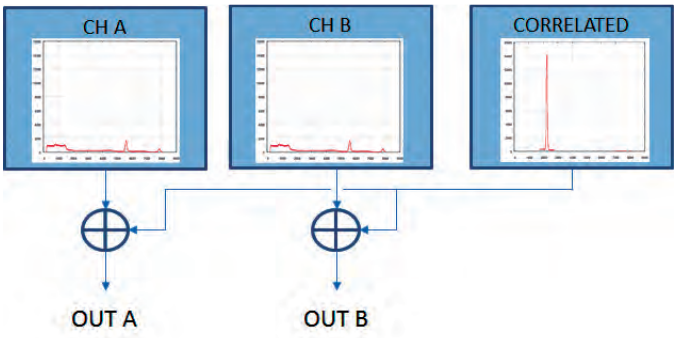
Pulse Shape Discrimination between neutrons and gammas

Correlated Events

In applications where multiple detectors are used, it is often required to extract correlated events from the background.

In addition to the energy spectra independently programmable on each channel, the Digital Detector Emulators (DT4800 excluded) are able to define a third common spectrum that is added to the others.

In this way, it is possible to test and measure the performances of user defined coincidence algorithm.



Energy spectrum correlation among channels

FORM FACTOR

DESKTOP

INTERFACES

USB 3

DT5810B

Fast Digital Detector Emulator

Overview

The DT5810B is the model of the Detector Emulator family with the fastest signal output. Thanks to an updated and faster DAC it is now possible to emulate the behavior of some of the fastest detectors on the market with 1 ns rise time. The Digital Detector Emulator is the only synthesizer of random pulses that is also an emulator of radiation detector signals with the possibility to configure energy and time distribution.

The stream of emulated signals becomes a statistical sequence of pulses, reflecting the programmed input features. When the emulation process is resetted, the kernels of generators can be either re-initialized with new random data making the sequence always different, or they can be stored to reproduce the same sequence many times.

Each Digital Detector Emulator channel is able to emulate a radiation source and to provide it either with fully independent parameters (energy spectra, signal shapes, temporal distributions of the events, noise characteristics, etc.) or with some of them correlated with those of the other channel. For example the events can be time-correlated (steps of 1 ns), or a subset of events can share the same energy spectrum. It is also possible to set the channels in a master/slave configuration, where the first channel works as a trigger for the second one.

The output amplitude is selectable at ±2 V with 50 Ohm or ±8 V at high impedance. The unit can operate in the same three modes as the 5800 Family (Pulser Mode, Emulation Mode and Waveform Generator Mode). The Waveform Generator supports not only standard waveforms: e.g. sinusoidal, squared, ramp shape, etc. but also arbitrary waveforms customized by the user.

The DT5810B is equipped with an analog channel input through which it is possible to sample a real signal and add it to the signal generated by the emulator: in this way it is possible to emulate a source not actually present or hardly available. Moreover, the analog input allows to characterize a detector, acquiring shape and spectrum of its output signal.

Features

- 1 ns Rise Time
- Pulser/Emulator/Function Generator operating modes
- Energy spectrum emulation
- Time distribution emulation
- Custom signal shape emulation
- Pile-up emulation
- Noise and periodic interference emulation
- Baseline drift
- 1 ns/step programmable delay generator
- Correlated signals generation on the two output channels
- Up to four shapes on the same channel for testing the pulse shape discrimination
- Continuous and pulsed reset preamplifier emulation
- Analog input for recording signals from real detectors
- User Friendly Control SW with Graphical User Interface

FREE

Screenshot of the pulse generation in the graphical user interface provided with the Digital Detector Emulator.

Ordering Option

Code	Description
WDT5810BXAAA	DT5810B - Dual Channel Desktop FAST Digital Detector Emulator with channel correlation

DT4800

Micro Digital Detector Emulator

FORM FACTOR

DESKTOP

INTERFACES

USB 2 (Mini USB)

Overview

The DT4800, called Micro Digital Detector Emulator, is the most compact and cost effective model of the Detector Emulator family and it is particularly suited for single detector emulation and educational purposes. The unit features one analog output, one digital input, and one digital output. As a Pulser it can generate exponential decay signals with programmable Rise Time and Fall Time up to a rate of 1 Mcps. The rate can be fixed or it can follow a Poissonian distribution.

In Emulation mode the unit can reproduce signals from a real energy spectrum that can be uploaded in the form of CSV or ANSI N42.42 files. A database of nuclides is provided to generate specific emission lines and Gaussian noise can be added. An user friendly control software is provided with the unit.

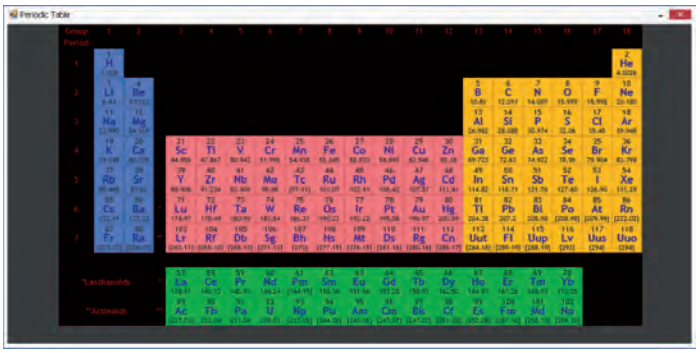
Features

- Pulser/Emulator operating modes
- Real Energy spectrum emulation
- Time distribution emulation (Poisson)
- Noise emulation
- Continuous pre-amplifier emulation
- Nuclides database
- User Friendly Control SW with Graphical User Interface

DT4800 is also available in educational version SP5600EMU - Emulation Kit (see p. X).

FREE

A dedicated graphical user interface allows to manage the DT4800 by providing emulated spectra.



The isotopes database interface.

Ordering Option

Code	Description
WDT4800XAAAA	DT4800 - Micro Digital Detector Emulator

FORM FACTOR

NIM DESKTOP

INTERFACES

USB 2

DT5800 - NDT6800

Digital Detector Emulators

Features

- Pulser/Emulator/Arbitrary Waveform Generator operating modes
- Energy spectrum emulation
- Time distribution emulation
- Custom signal shape emulation
- Pile-up emulation
- Noise and periodic interference emulation
- Baseline drift
- 12 ps/step programmable delay generator
- Correlated signals generation on the two output channels
- Multiple shapes on the same channel for testing of pulse shape discrimination
- Continuous and pulsed reset pre-amplifier emulation
- User Friendly Control SW with Graphical User Interface

Overview

The DT5800 and NDT6800 are Dual Channel Detectors Emulators. They can be operated as Desktop units and the NDT6800 can also be used in a NIM crate. These instruments share the same functionalities 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.

FREE

Screenshot of an emulated spectra in the graphical user interface provided with the Digital Detector Emulators.

Ordering Option

Code	Description
WDT5800DXAAA	DT5800D - Dual Channel Desktop Digital Detector Emulator with channel correlation
WNDT6800DXAA	NDT6800D - Dual Channel NIM/Desktop Digital Detector Emulator with channel correlation

Emulator Comparison Table

	DT4800	DT5800 - NDT6800	DT5810B
OVERVIEW			
Channels	1	2	2
Energy Resolution (Pulser)	14-bit	16-bit	16-bit
Energy (Emulation)	14-bit	14-bit	14-bit
D/A Resolution	14-bit	16-bit	16-bit
D/A Sample rate	200 MHz	125 MHz	1 GHz
Output Range (Fast Edge)	±2.5 V (50 Ω), ±5.5 V (hi-Z)	±2 V (50 Ω), ±4 V (hi-Z)	±2 V (50 Ω), ±4 V (hi-Z)
Output Range (Slow Edge)			±8 V (hi-Z)
TIMEBASE			
Costant Rate Generation	Yes	Yes	Yes
Poisson Distribution	Yes	Yes	Yes
Maximum Rate	1 Mcps	10 Mcps / 5 Mcps (Poisson)	50 Mcps/ 20 Mpcs (Poisson)
Deadtime emulation	No	Yes	Yes
SHAPE			
Exponential Signal (Digital RC Mode)	Yes	Yes	Yes
Memory based arbitrary shape generation	No	Yes	Yes
Decay Time	from 20 ns to 1 ms	from 20 ns to 10 ms	from 5 ns to 10 ms
Signal Shape Length		4096	4096
Multiple shapes on a single channel	No	Yes (2 different)	Yes (4 different)
Minimum rising time (fast mode)	7 ns	8 ns	1 ns
Minimum rising time (slow mode)	30 ns	30 ns	16 ns
NOISE			
Random Noise	No	Yes	Yes
White Noise (Gaussian)	Yes	Yes	Yes
Random Walk	Yes	Yes	Yes
1/f noise	No	Yes	Yes
Interference Generation	No	Yes	Yes
BASELINE			
Baseline drift	No	Yes	Yes
CORRELATED EVENTS SIMULATION			
Correlated events simulation	No	Yes	Yes
Time resolution		12 ps	1 ns
Additional channel for correlated event with indipendent statistics	No	Yes	Yes
IO			
Digital IO	1 In / 1 Out	1 In / 1 Out per channel	1 In / 1 Out per channel
External Trigger	Yes	Yes	Yes
Trigger Out	Yes	Yes	Yes
SEQUENCE GENERATION			
Sequence of energy and time	No	Yes	Yes
FUNCTION GENERATION			
Arbitrary Waveform Generation	No	1 Mcps wave	10 Mcps wave
Function Generation	No	Yes (10 MHz)	Yes (100 MHz)
ANALOG INPUT			
Analog Input	No	No	Yes - 1 channel
Signal recording	No	No	Yes
Pulse Height Analysis	No	No	Yes
ADC N bit			14
ADC sample rate			150 MS/s
Input dynamic range			0.75 V, 2 V, 5 V, 10 V
CONNECTIVITY			
Interface	USB 2 (Mini USB)	USB 2	USB 3
Power Supply	5 V - 400 mA	12 V - 4 A	12 V - 4 A
Display Interface	No	No	Yes
SOFTWARE			
DLL for automation	Yes (c++)	Yes (.net)	Yes (c++)
SOFTWARE: Digital Detector Emulator Control Center for DT5810D	No	No	Yes
SOFTWARE: DT4800 Digital Detector Emulator Software	Yes	No	No
SOFTWARE: Detector Emulator Software	No	Yes	No

DT4700

NEW

Clock Generator and FAN-OUT

Features

- 50 MHz, 62.5 MHz clock frequencies available and switch selectable
- Can be operated as a signal or a clock fan-out from another external source (maximum frequency 300 MHz)
- 10 differential LVDS outputs
- USB powered or by external power supply (5÷12 V)
- External Clk in LVDS, LVPECL
- Compatible with A317 clock distribution cable

Accessories

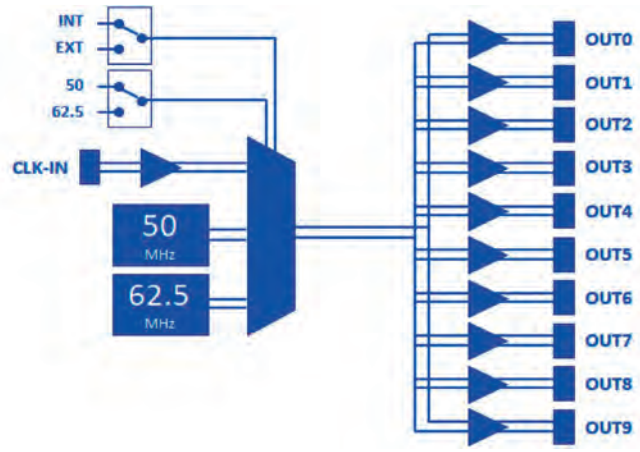
A317
The A317L (25 cm) - Clock Distribution Cable allows to perform CLK OUT - CLK IN connection

A318
SE to Differential Clock Cable Adapter

Overview

The DT4700 clock generator is a compact and easy to use desktop module that allows an easy synchronization of CAEN VME, NIM and desktop digitizers. It features 10 differential LVDS outputs, compatible with A317 clock distribution cable, each providing 50 or 62.5 MHz clock signal (switch selectable) required for the synchronization procedure. It also allows the possibility of working as a fan-out of a clock coming from another external source with a maximum frequency of 300 MHz.

The DT4700 can also be powered through the USB port on the rear panel or, using the included power split cable, from your digitizer supply. In addition the DT4700 can also be operated as a general purpose Fan-Out.



Block scheme of DT4700

Ordering Option

Code	Description
WDT4700XAAAA	DT4700 - Desktop Clock Generator and FAN-OUT

FORM FACTOR

DESKTOP

SP5601 - SP5605

LED Drivers

Overview

SP5601

The SP5601 is a fast LED driver and represents the ideal tool for SiPM tests and characterization, through a triggered light burst of intensity down to a few photons and up to a number saturating the sensors. The SP5601 features tunable intensity and repetition rate: the LED driver can be triggered either via the internal pulse generator, or via an external source; the optical signal is routed to the sensor through a fiber, FC interfaced.

SP5605

The SP5605 is a fast UV (ultra-violet) LED driver and this is the first available UV LED tool for Photodetectors tests and characterization. The SP5605 provides a triggered light burst of intensity from few photons to about 27000 photons. The SP5605 features tunable intensity and repetition rate. Indeed the UV LED driver can be triggered either via the internal pulse generator, or via an external source. The sensor guarantees constant wavelength signal from 100 Hz to 1.5 kHz. The optical signal is routed to the sensor through a fibre, FC interfaced.

Features

- Pulse width:
  - 8 ns (SP5601)
  - 4ns (SP5605)
- LED color:
  - Violet (400 nm), 1500 mcd (SP5601)
  - UV (245 nm), 0-27000 photons (SP5605)
- Pulse generator: internal/external
- Output Frequency:
  - From 100 Hz to 1500 Hz (SP5605)
  - From 500 Hz to 5 MHz (SP5601)
- Optical output connectors: FC
- Optical fibers included
- Dimension:
  - 79 x 42 x 102 mm^3 (WxHxD) - SP5601
  - 80 x 42 x 80 mm^3 (WxHxD) - SP5605

Ordering Option

Code	Description
WSP5601XAAAA	SP5601 - Led Driver for SIPM development kit
WSP5605XAAAA	SP5605 - UV Led Driver

ACCESSORIES

A2818 PCI CONET Controller

The A2818 is a 32-bit 33 MHz PCI card, which allows the control, through a standard PC, of up to 8 CAEN Optical Slave Cards (CAEN VME Bridge or Digitizers). The communication protocols used are the CONET1 or the new CONET2 (A dedicated firmware for the desired protocol must be installed on the board). Optical fiber cables are used as physical transmission line (see AI2700 Optical Fiber Series). The card drivers, together with C functions libraries and demo programs are provided for both Windows and Linux Users.

Code	Description
WA2818XAAAAA	A2818 - PCI Optical Link Controller

A3818 PCI Express CONET2 Controller

The A3818 is a PCI Express card that can plug into any x8/x16 PC PCI Express slot (1.1 or higher), which allows the control up to 4 CONET2 independent networks (each network can be made of up to 8 CONET2 slaves).
The communication path uses optical fiber cables as physical transmission line (see AI2700 Optical Fiber Series).
The card drivers, together with C functions libraries and demo programs are provided for both Windows and Linux Users.

Code	Description
WA3818AXAAAA	A3818 - PCIe 1 Optical Link
WA3818BXAAAA	A3818 - PCIe 2 Optical Link
WA3818CXAAAA	A3818 - PCIe 4 Optical Link

A1481 Kill Signal Adapter for N14xx Series

The A1481 Kill Signal Adapter is a pluggable adapter that allows external 5Volt signal level to enable the HV channel of the N14xx NIM HV Power Supply series. This is necessary in order to use the modules with some detectors. Kill input is provided through LEMO connectors (1, 2 and 4 channel versions are available).

Code	Description
WA1481XAAAAA	A1481 - 4 Ch. N14xx Kill Signal Adapter
WA1481A2AAAA	A1481A - 2 Ch. N14xx Kill Signal Adapter
WA1481B1AAAA	vA1481B - 1 Ch. N14xx Kill Signal Adapter

A385 - A392 16 Channel LEMO Adapters

The A385 and A392 allows to provide respectively the V785 and the V792, with LEMO 00 input connectors, adapting them to the flat connectors. The A385 and A392 fit into one 17+17 pin male flat type connector and are provided with 16 LEMO 00 male connectors each. The A385 can also be used to match the output flat connectors of the N568E/EB/ELC Spectroscopy Amplifier with the LEMO input connectors of a discriminator (such as V812, V895 etc.). The devices are completely passive mechanical adapters for analog signals and feature 50 cm long cables.

Code	Description
WA385XAAAAAA	A385 - 16 Channel Cable Adapter (Flat to LEMO) for V785, 50cm / ±10% cables
WA392XAAAAAA	A392 - 16 Channel Cable Adapter (Flat to LEMO) for V792, 50cm / ±10% cables
WA385XMAAAAA	A385M - 16 Channel Cable Adapter (Flat to LEMO) for V785, 1m / ±10% cables
WA392XMAAAAA	A392M - 16 Channel Cable Adapter (Flat to LEMO) for V792, 1m / ±10% cables

A654 MCX to LEMO Cable Adapters

The A654 adapter allows to adapt the MCX input connectors (used on CAEN Waveform digitizers) into LEMO 00 connectors. CAEN provides kits with 1, 4, 8 cable adapters.

Code	Description
WA654XAAAAAA	A654 - Single Channel MCX to LEMO Cable Adapter
WA654K4AAAAA	A654 KIT4 - 4 MCX TO LEMO Cable Adapter
WA654K8AAAAA	A654 KIT8 - 8 MCX TO LEMO Cable Adapter

A659 MCX to BNC Cable Adapters

The A659 allows to adapt one MCX input connector (used on most digitizers) into one BNC connector, through 1 meter long RG174 cable.

CAEN provides kits with 1, 4, 8 cable adapters.

Code	Description
WA659XAAAAAA	A659 - Single Channel MCX to BNC Cable Adapter
WA659K4AAAAA	A659 KIT4 - 4 MCX TO BNC Cable Adapter
WA659K8AAAAA	A659 KIT8 - 8 MCX TO BNC Cable Adapter

64 Channel Adapter for LEMO Connector (VME) A746B

The A746B allows to adapt one ERNI SMC-114805 high density flat connector (used on V1740 and VX1740) into 64 LEMO connectors.

Code	Description
WA746BXAAAAA	A746B - 64 Ch. Adapter for LEMO connector

32 Channel Adapter for LEMO connector (NIM) A746D

The A746D allows to adapt one ERNI SMC 114805 high density flat connector (used on N6740) into 32 LEMO connectors.

Code	Description
WA746DXAAAAA	A746D - 32 Ch. Adapter for Lemo connector

32 Channel Adapter for LEMO Connector (DT) A746E

The A746E allows to adapt one ERNI SMC 114805 high density flat connector (used on DT5740) into 32 LEMO connectors.

Code	Description
WA746EXAAAAA	A746E - 32 Ch. Adapter for Lemo connector

16 Channel to 2x8 Channel Cable Adapter A954

The A954 allows to adapt one 17+17-pin, female Header-type connector (16 pin couples connected) into two 8+8-pin, female Header-type connectors, through one split 50 cm long flat cable (split lenght is 20 cm). It can be used on all CAEN modules featurlng the 3M 3431 Connector.

Code	Description
WA954XAAAAAA	A954 - 16 Channel to 2x8 Channel Cable Adapter

32 Channel Cable Adapter for V767, V862, V1190, VX1190, Vx495, DT5495 A967

The A967 allows to adapt one Robinson Nugent high density flat connector (used on V862, V767, V767A, V1190A/B, VX1190A/B, V1495, V2495 and DT5495) into two 17+17-pin Header-type male connectors with locks through two 25 cm long flat cables.

Code	Description
WA967XAAAAAA	A967 - 32 Channel Cable Adapter (1x32 to 2x16) for V767, V862, V1190, VX1190, Vx495, DT5495

16 Channel Impedance Adapter A992

The A992 is a plug-in card, provided with 16 independent input channels on a 34 pin male header connector, to be inserted into the V792 QDC's front panel connectors (one V792 requires two A992 adapters). The card matches the QDC's input impedance from 50 Ω to 110 Ω, decouples the QDC's and the source's ground and converts differential signals into single ended signals.

Code	Description
WA992XAAAAAA	A992 - 16 Channel Impedance Adapter for V792

USB RS485 Adapter Board N1568ADAT

The N1568ADAT converts from USB to RS-485. The converter allows to use the modules with laptop computers that do not have a serial port. The device is provided with drivers and installation instructions supporting the most used OS's

Code	Description
WN1568ADATXX	N1568 - USB-RS485 Adapter

A995 Insertion/Extraction Tool for A996

The A995 Insertion/Extraction Tool allows to either insert or remove the pin contacts from the 52 Pin HV cable connector (Mod. A996) designed to be used with the CAEN boards featuring the Multipin connector Radiall 691803004 type. The A995 has one “half-tube” needle on one side for contact insertion and one “tube” needle on the opposite side for contact extraction.

Code	Description
WA995XAAAAAA	A995 - Insertion/extraction tool Radiall 282549024 for A996

A996 52 Pin Cable Connector

The A996 is the 52 Pin HV cable connector designed to be used with the CAEN boards featuring the Multipin connector Radiall 691803004 type. The connector must be assembled by using the A995 Insertion/Extraction Tool, which allows to either insert or remove the pin contacts from the connector.

Code	Description
WA996XAAAAAA	A996 - 52 pin cable connector

A997 HV Coaxial Cable Connector for CPE HV

The A997 is the female cable connector to be mated with the CPE 23.100.151-046 type male panel connector (used on boards with output larger than 12 kV, such as A1526, A1523, A1524, AG523, AG524).

Code	Description
WA997XAAAAAA	A997 - HV coaxial cable connector for CPE HV

A309 - A310 - A311 - A312 - A313 Single Channel Fixed Attenuators

The A309, A310, A311, A312 and A313 are simple devices that provide a fixed attenuation (1, 3, 6, 12 and 20 dB respectively). The attenuators are 50 Ω adapted and feature LEMO female type connectors; they do not require any power supply since they are made up of resistive cells.

Code	Description
WA309XAAAAAA	A309 - Single Channel Fixed Attenuator (1dB)
WA310XAAAAAA	A310 - Single Channel Fixed Attenuator (3dB)
WA311XAAAAAA	A311 - Single Channel Fixed Attenuator (6dB)
WA312XAAAAAA	A312 - Single Channel Fixed Attenuator (12dB)
WA313XAAAAAA	A313 - Single Channel Fixed Attenuator (20dB)

AI2700 Optical Fiber Series

Cables for CONET1/CONET2 Optical Link Networks.

Code	Description
WAI2703XAAAA	AI2703 - Optical Fibre 30cm. simplex
WAI2705XAAAA	AI2705 - Optical Fibre 5 m. simplex
WAI2720XAAAA	AI2720 - Optical Fibre 20 m. simplex
WAI2730XAAAA	AI2730 - Optical Fibre 30 m. simplex
WAI2740XAAAA	AI2740 - Optical Fibre 40 m. simplex
WAY2705XAAAA	AY2705 - Optical Fibre 5 m. duplex
WAY2720XAAAA	AY2720 - Optical Fibre 20 m. duplex
WAY2730XAAAA	AY2730 - Optical Fibre 30 m. duplex

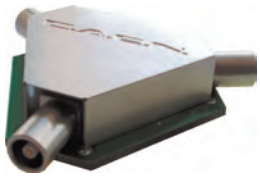
A483 HV Bidirectional Passive HV Filter

The A483 is a bidirectional passive HV filter. The filter has a Maximum Input Voltage of ±8 kV. The Ripple Rejection is 20 dB (26 dB @ 36 KHz), measured with 50 mVpp (40 mVpp @ 36 KHz) input ripple, 8 kV Input DC Voltage and 8 µA Output Current. It does not require any power supply since it is made up of passive components. The module is designed to be used together with a HV Power Supply when a low ripple is required. The High Voltage input and output are provided by SHV connectors.

Code	Description
WA483XAAAAAA	A483 - HV Filter (8KV)

Splitter A315

The A315 splits one input on two output signals. All the connectors are LEMO female type. The splitter is adapted for 50 Ω lines. The device is completely passive (no power supply is required); the amplitude on each output is one half of that on the input.



Code	Description
WA315XAAAAAA	A315 - Splitter

Clock Distribution Cables A317

The A317 - Clock Distribution Cable allows to perform CLK OUT - CLK IN connection on V17XX digitizers.

Code	Description
WA317XAAAAAA	A317 - Clock Distribution Cable (12 cm)

The A317L - Clock Distribution Cable can be used with DT4700 and CAEN digitizers for clock FAN-IN /

Code	Description
WA317LXAAAAA	A317L - Clock Distribution Cable (25 cm)

Single-Ended to Differential Cable Adapter A318

The A318 cable adapter can be typically used with CAEN digitizers to operate in external clock mode. It allows to convert a single-ended clock signal, coming from an external clock unit, into differential to be accepted by the dedicated digitizer front panel input connector (CLK-IN).

Code	Description
WA318XAAAAAA	A318 - Single-ended to Differential cable adapter

HV Adapters (Multipin to SHV coaxial) A1015x - A64x - R64x

The A64X - R64x is a family of cable adapters, that allow to adapt the high density SYx527 boards connectors (52pin Radiall and DB37) to the SHV coaxials. The adapters in this family provide the INTERLOCK and SHIELD connections through LEMO connectors and are available both as desktop and 19" rack modules.

The A1015VM is not an adapter but an analog voltage monitor for A1515/A1515TG/A1515QG boards. It allows to monitor the voltage level for the triple or quadrupole GEM (the channels are internally stacked). The voltages can be monitored in two ways:

- in absolute value: checking the GEM or Transfer voltage with respect to the mass reference
- in differential value: checking the voltage level on each GEM or Transfer

Code	Description
WA646XAAAAAA	A646 - DB37 to SHV Adapter for 12 ch HV Boards (Max: 500V - Desktop)
WA647XAAAAAA	A647 - Multipin to SHV Adapter for 24 ch HV Boards (Max: 8kV - Desktop)
WA648XAAAAAA	A648 - Multipin to SHV Adapter for 48 ch HV Boards (Max: 3kV - Desktop)
WA649XAAAAAA	A649 - Multipin to SHV Adapter for 32 ch HV Boards (Max: 3kV - Desktop)
WA649BXAAAAA	A649B - Multipin to SHV Adapter for 32 channel HV Boards (max 8kV)
WR647XAAAAAA	R647 - Multipin to SHV Adapter for 24 ch HV Boards (Max: 8kV - 19'' Rack)
WR648XAAAAAA	R648 - Multipin to SHV Adapter for 48 ch HV Boards (Max: 3kV - 19'' Rack)
WR649XAAAAAA	R649 - Multipin to SHV adapter for 32 ch HV Boards (Max: 3kV - 19'' Rack)
WR649BXAAAAA	R649B - 19" Multipin to SHV Adapter for 32 channe HV Boards (Max 8kV)
WA1015XAAAAA	A1015 - 16 Floating Channel Multipin Radiall to SHV connector Adapter for A1515 board
WA1015GXAAAA	A1015G - 14/16 Stacked Channel Multipin Radiall to SHV connector Adapter for A1515TG/A1515QG board
WA1015VMXAAA	A1015VM - Analog Voltage Monitor for A1515/A1515TG/A1515QG board

General Purpose 1U Fan Unit A83xx

The A83xx is a 19" Rack mount 1U fan unit. The unit provides a 450 m^3/h air flow (50 W power requirement)

Code	Description
WA83XXFANXAA	A83xx General Purpose 1U Fan Unit 220Vac
WA83XXFANXBA	A83xxB General Purpose 1U Fan Unit 110Vac

General Purpose 1U Mini Fan Unit A83Px NEW

The A83Px is a 270 mm/ 1U mountable fan tray, designed for NIMA8302P portable crate. The unit provides a 300 m^3/h air flow (35 W power requirement)

Code	Description
WA83PXFANXAA	A83PXA - General Purpose 1U Mini Fan Unit 220Vac
WA83PXFANXAB	A83PXB - General Purpose 1U Mini Fan Unit 110Vac

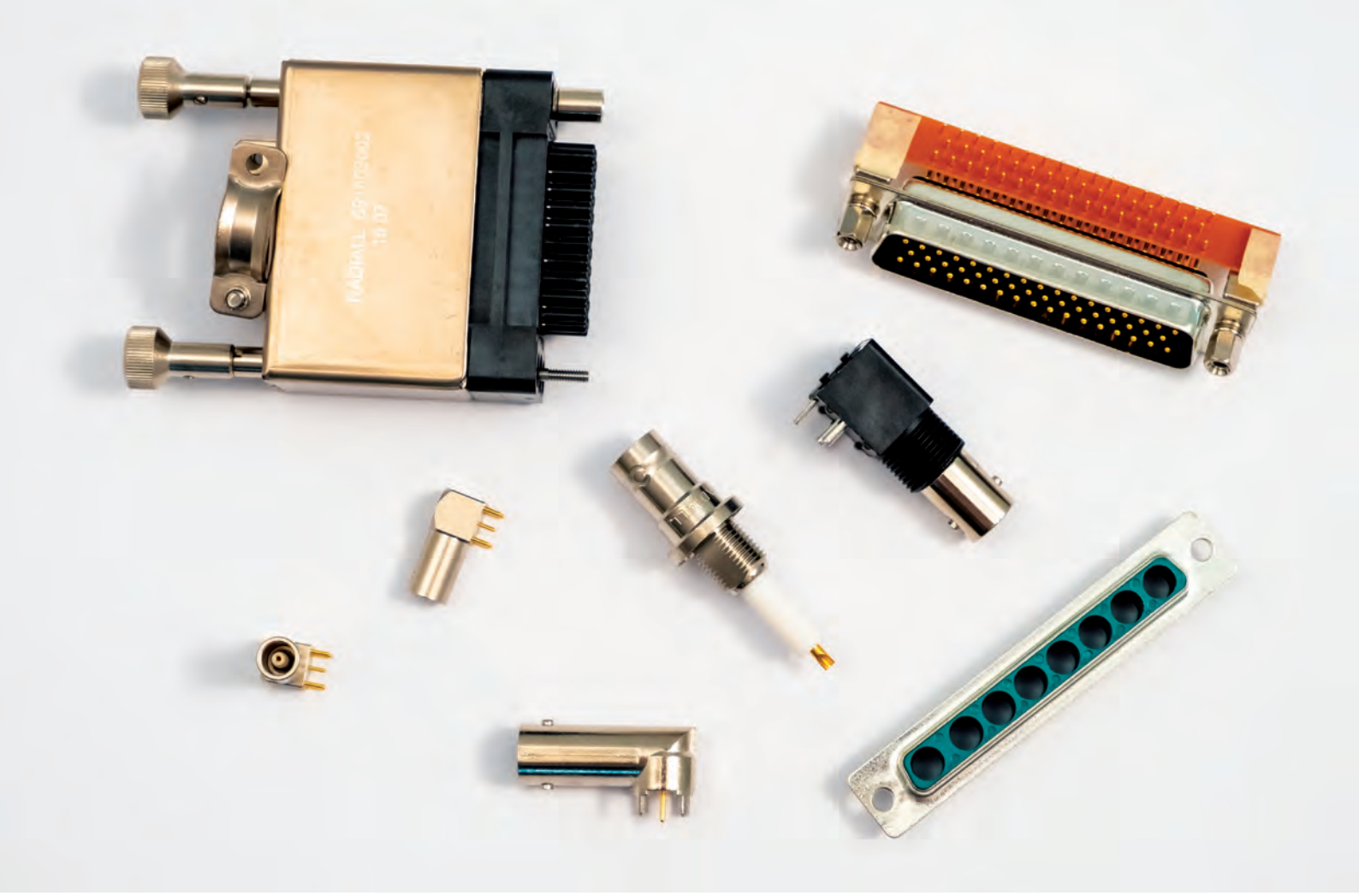
NEW A1430 Wide band pulse polarity inverter

Code	Description
WA1430XAAAAA	A1430 - Wide Band Pulse polarity Inverter

NEW DT5550AFE 32 Channel Adapter for MCX connector

The DT5550AFE is a single-ended to differential adaptor with programmable DC offset and 1x fixed gain which receives the single-ended signals on 32 MCX connectors and provides differential analog output and control signals on a single cable to the DT5550.

Code	Description
WDT5550AFEXA	Single-ended to differential input adaptor for DT5550



CONNECTORS

Power Supply Connectors

APP PC5933T

n. 1

Factory Name	APP PC5933T
Description	Vertical contact MINI P/CLAW APP PC5933T type
Other features	-

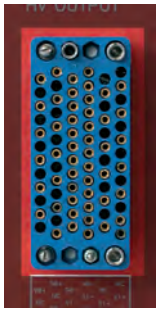
APP30 1317G4

n. 2

Factory Name	APP30 1317G4 / PP30 1327BK / PP30 1327G6BK
Description	APP30 1317G4 type
Other features	APP30 MOUNTING WINGS 1399G8BK type – Black: PP30 1327G6BK APP – Red: PP30 1327BK APP – Vert. contact PP30 1317G4 APP – Mounting: PP30 MOUNTING WINGS 1399G8BK APP

AMP 75

n. 3



Factory Name	AMP 201311-3
Description	HV multipin connector
Other features	Mates with AMP 201310 cable connector; suitable for operation in the -55 ÷ +150 °C range

Radiall 52

n. 4

Factory Name	Radiall 691 803 004
Description	HV multipin connector
Other features	Mates with Radiall 691 802 002 and CAEN Mod. A996 cable connectors; up to 9 kV supported

SHV

n. 5

Factory Name	Radiall R317580
Description	HV coaxial connector
Other features	Supports up to 8 kV

CPE 3 Pole

n. 6

Factory Name	CPE 28-019
Description	HV 3 Pin Panel Male Connector
Other features	supports up to 18 kV

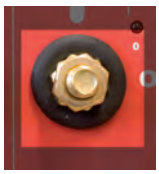
CPE HV

n. 7

Factory Name	CPE 23.100.151.046
Description	HV Coaxial Connector
Other features	supports up to 18 kV; mates with HV Cable Connector CPE 23.100.052.045

Brass hexagon head bolt

n. 8



Factory Name	RS Stock no. 483-2390
Description	Brass hexagon head set screw, M6x30mm
Other features	-

LEMO HV

n. 9

Factory Name	LEMO HV ERA3S415CTL
Description	LEMO HV Female (panel)
Other features	Mates with LEMO HV MALE FFB3S415CPAC-10W

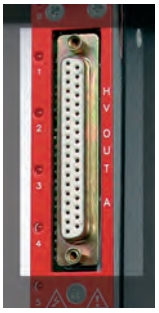
Kings

n. 10

Factory Name	KINGS 1064-1
Description	KINGS HV coaxial connector
Other features	Supports up to 15 kV

DB37

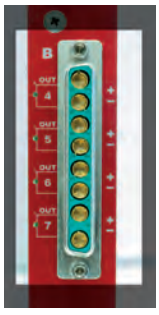
n. 11



Factory Name	FCI DCPV37S300GT
Description	DB37 Female connector
Other features	-

D-Sub 8W8 socket

n. 12



Factory Name	DC8W8SA00LF
Description	Power Connector 8W8 Socket
Other features	mates with DC8W8PA00LF

D-Sub26

n. 13

Factory Name	FCI ICD26S13E4GV00LF
Description	Connector High Density D-Sub SKT 26 POS 2.28mm Solder RA Thru-Hole 26 Terminal Port
Other features	-

Front-end Connectors

Robinson Nugent 68 pin boardmount connector

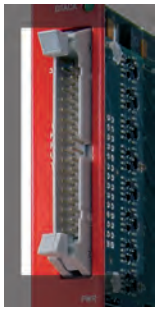
n. 14

Factory Name	3M P50E-068P1-SR1
Description	Robinson Nugent 68 pin straight angle thru-hole boardmount connector
Other features	Mates with: 3M P25E-068S (SY2791) 3M P50E-068S (other modules)

Header-type connectors

n. 15

Factory Name	3M 3431-6202 (17+17 pin); 3M 3408-5202 (8+8 16 pin)
Description	Header-type connector
Other features	Available with different pin sets; the 17+17 connector mates with 3M 3414-6600 wiremount connector



LEMO

n. 16

Factory Name	Fischer DP101A004-51
Description	LEMO type coaxial connector
Other features	-

BNC

n. 17

Factory Name	Radiall R141603
Description	BNC type coaxial connector
Other features	-

Strip Header

n. 18

Factory Name	AMP 5/826634/0 (17+17 pin)
Description	Male strip header (17+17 pin)
Other features	the 17+17 connector mates with 3M 3414-6600 wiremount connector

USB

n. 19

Factory Name	AMP 787780-2
Description	USB Type B
Other features	-

LC

n. 20

Factory Name	Agilent HFBR-5911L/AL
Description	LC type duplex connector
Other features	-

LEMO EPG0B

n. 21

Factory Name	EPG.0B.302.HLN
Description	LEMO 2 pin type
Other features	-

MCX connector

n. 22

Factory Name	SUHNER CS 85MCX-50-0-16
Description	50 Ω MCX connector
Other features	-

SMC 68 pin connector

n. 23

Factory Name	ERNI SMC-114805
Description	Dual Row 68 pin connectors
Other features	-

AMP 3 pin connector

n. 24

Factory Name	AMP 3-102203-4
Description	3 pin connector
Other features	-

SMA

n. 25

Factory Name	Johnson 142-0701-871
Description	SMA 50 Ohn connector
Other features	-

+12V connector

n. 26

Factory Name	RAPC722X SWITCHCRAFT
Description	PCB DC Power Jack
Other features	-

Front-end Connectors

Mini USB

n. 27

Factory name	MOLEX SD-54819-026
Description	USB Mini type
Other features	-

Micro USB

n. 28

Factory name	MOLEX 0473460001
Description	USB Micro type
Other features	-

Serial ATA Signal Plugs

n. 29

Factory name	MOLEX 47080-4005
Description	1.27 mm Pitch Serial ATA Shrouded Signal Plug
Other features	-

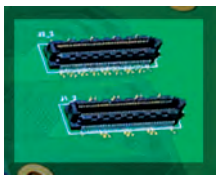
VHDCI

n. 30

Factory name	MOLEX 71430-0008
Description	0.80mm Pitch VHDCI Receptacle, 68 Circuits
Other features	-

Samtec SS4-40-3.00-L-D-K-TR n. 31

Factory name	0.40 mm Razor Beam™ LP Ultra Fine Pitch Socket Strip
Description	Samtec 28+ Gbps Solution, Ultra fine 0.40 mm pitch; 80 I/Os
Other features	-



CROSS REFERENCE TABLES

Cross Reference Tables Index

colour red = new product colour green = coming soon product

Universal Multichannel Systems - Mainframes

T1

Model	Max power (W)	Power requirements	Width	Height	Depth	Supported boards	Max # boards	Local control	Remote control	p.
SY4527	4200 @ 220 Vac 1990 @ 110 Vac	100 ÷ 240 Vac / 50 ÷ 60 Hz Max Power: 5500 W @ 220 Vac 2750 W @ 110 Vac	19”	8U	75 cm (with handles)	A15xx, A18xx, A19xx, A251x, A29xx, AG5xx, AG9xx, AP932, AG7xxx, A7xxx, A1676A	16	10.4” or 5.7” touchscreen color LCD (opt.)	Gb Ethernet, Wi-Fi (opt.)	16
SY5527	1800 @ 220 Vac 1850 @ 110 Vac	100 ÷ 240 Vac / 50 ÷ 60 Hz Max Power: 2500 W @ 220 Vac 2340 W @ 110 Vac	19”	4U	75 cm (with handles)	A15xx, A18xx, A19xx, A251xx , A29xx, AG5xx, AG9xx, AP932, AG70xx, A70xx, A1676A	6	5.7” touchscreen color LCD (opt.)	Gb Ethernet, Wi-Fi (opt.)	16
SY4527LC	600 @ 220 Vac 550 @ 110 Vac	100 ÷ 240 Vac / 50 ÷ 60 Hz Max Power: 1050 W @ 220 Vac 1020 W @ 110 Vac	19”	8U	56 cm (with handles)	A15xx, A18xx, A19xx, A251xx , A29xx, AG5xx, AG9xx, AP932, AG70xx, A70xx, A1676A	10	No	Gb Ethernet, Wi-Fi (opt.)	20
SY5527LC	400 @ 220 Vac 350 @ 110 Vac	100 ÷ 240 Vac / 50 ÷ 60 Hz Max Power: 700 W @ 220 Vac 660 W @ 110 Vac	19”	4U	49 cm (with handles)	A15xx, A18xx, A19xx, A251xx , A29xx, AG5xx, AG9xx, AP932, AG70xx, A70xx, A1676A	4	No	Gb Ethernet, Wi-Fi (opt.)	20
SY8800	2500 @ 220 Vac 1250 @ 110 Vac	3300 @ 220 Vac 2000 @ 115 Vac	19”	3 U	35 cm	Mx1, Bx1, Bx2	5	OLED display Ergonomic Pointer	RS232, Ethernet CAN bus, USB 2.0	70

Universal Multichannel Systems - Individual Floating Channel Boards

T2

Model	No. of Channels	Max Output V	Max Output I	Vset/Vmon Resolution	Iset/Imon Resolution	Max. Ramp Up/Down Rate	Ripple Typ.	Connectors	Max Power per Channel	p.
A1510	12	100 V	10 / 1 mA selectable	20 mV	1 / 0.1 µA	50 V/s	< 15 mVpp	DB37	1 W	28
A1511B	12	500 V	10 / 1 mA selectable	100 mV	1 / 0.1 µA	50 V/s	< 30 mVpp	DB37	5 W	30
A1512	12	500 V	1 / 0.1 mA selectable	100 mV	100 / 10 nA	50 V/s	< 30 mVpp	DB37	0.5 W	30
A1513B	6	10 V	2.7 A	10 mV	1 mA	20 V/s	< 5 mVpp	DB37	27 W	27
A1516B	6	15 V	1.5 A	10 mV	1 mA	30 V/s	< 5 mVpp	DB37	23 W	27
A1517B	6	7 V	4 A	10 mV	1 mA	15 V/s	< 5 mVpp	DB37	28 W	27
A1519B	12	250 V	1 / 0.1 mA selectable	50 mV	100 / 10 nA	50 V/s	< 30 mVpp	DB37	0.25 W	30
A1515	16	1000 V	1 / 0.1 mA selectable	20 mV	Iset: 20 nA Imon: 1 / 0.1 nA	100 V/s	< 10 mVpp (CM) < 5 mVpp (DM)	Radiall Multipin	0.7 W	32
A1515CG	14 [1]	1300 V	1 / 0.1 mA selectable	20 mV	Iset: 20 nA Imon: 1 / 0.1 nA	100 V/s	< 10 mVpp (CM) < 5 mVpp (DM)	Radiall Multipin	0.7 W	32
A1515QG	16	1000 V	1 / 0.1 mA selectable	20 mV	Iset: 20 nA Imon: 1 / 0.1 nA	100 V/s	< 10 mVpp (CM) < 5 mVpp (DM)	Radiall Multipin	0.7 W	32
A1515TG	14	1000 V	1 / 0.1 mA selectable	20 mV	Iset: 20 nA Imon: 1 / 0.1 nA	100 V/s	< 10 mVpp (CM) < 5 mVpp (DM)	Radiall Multipin	0.7 W	32
A1515TGHP	14 [2]	1000 V	3 / 0.3 mA selectable	20 mV	Iset: 20 nA Imon: 4 / 0.4 nA	100 V/s	< 10 mVpp (CM) < 5 mVpp (DM)	Radiall Multipin	1.5 W	32
A1515V	16	1400 V	1 / 0.1 mA selectable	20 mV	Iset: 20 nA Imon: 1 / 0.1 nA	100 V/s	< 10 mVpp (CM) < 5 mVpp (DM)	Radiall Multipin	0.7 W	32
A2517	8	5 V	15 A	1 mV	10 / 1 mA	1 ms (min. ramp time)	< 10 mVpp	D-Sub 8W8	50 W	27
A2518	8	8 V	10 A	1 mV	10 / 1 mA	1 ms (min. ramp time)	< 10 mVpp	D-Sub 8W8, DB37	50 W	27
A2519	8	15 V	5 A	1 mV	10 / 1 mA	1 ms (min. ramp time)	< 10 mVpp	D-Sub 8W8, DB37	50 W	27

[1] n° 2 channels Max. Voltage: 1.3 kV; n° 12 channels Max. Voltage: 1 kV

[2] n° 8 channels Max. Voltage: 1 kV; n° 6 channels Max. Voltage: 600 V

Universal Multichannel Systems - Common Ground Boards

T3

Model	No. of Channels	Max Output V	Max Output I	Vset/Vmon Resolution	Iset/Imon Resolution	Max. Ramp Up/ Down Rate	Ripple Typ.	Connectors	Max Power per Channel	p.
AG523	6	12000 V	1 mA	1000 mV	100 nA	500 V/s	< 30 mVpp	CPE HV	12 W	38
AG524	6	12000 V	0.1 mA	1000 mV	10 nA	500 V/s	< 20 mVpp	CPE HV	1.2 W	38
AG538D	12	1500 V	10 mA	50 mV	200 nA	500 V/s	< 20 mVpp	SHV	12 W	32
AG539(1)	12 / 24 / 32	100 V	10 mA	10 / 1 mV	200 / 10 nA	50 V/s	< 3 mVpp	SHV / DB25	1 W	28
AG540(1)	12 / 24 / 32	100 V	1 mA	10 / 1 mV	20 / 1 nA	50 V/s	< 3 mVpp	SHV / DB25	0.1 W	28
AG541(1)	12 / 24 / 32	500 V	10 mA	200 / 1 mV	10 / 1 nA	100 V/s	< 3 mVpp	SHV / DB25	5 W	30
AG542(1)	12 / 24 / 32	500 V	1 mA	20 / 1 mV	10 / 1 nA	100 V/s	< 3 mVpp	SHV / DB25	0.5 W	30
AG550(1)	12 / 24 / 32	5000 V	1 mA	500 mV	100 nA	500 V/s	< 25 mVpp	SHV / Radiall 52	5 W (1.5 W if 32 channels)	36
AG590	16	9000 V	50 µA	200 / 10 mV	1 nA / 100 pA	500 V/s	< 10 mVpp	Radiall 52	0.45 W	38
AG7236	12 / 24 / 32	3500 V	1.5 mA, 150 µA selectable	5 mV	Iset: 10 nA Imon: 5 / 0.5 nA	500 V/s	< 10 mVpp	SHV /Radiall 52	4 W	34
AG7435	12 / 24	3500 V	3.5 mA, 350 µA selectable	5 mV	Iset: 10 nA Imon: 10 / 1 nA	500 V/s	< 15 mVpp	SHV /Radiall 52	9 W	34

(1) Available with positive, negative or mixed polarity.

Universal Multichannel Systems - Common Floating Return Boards

T4

Model	No. of Channels	Max Output V	Max Output I	Vset/Vmon Resolution	Iset/Imon Resolution	Max. Ramp Up/Down Rate	Ripple Typ.	Connectors	Max Power per Channel	p.
A1523	6	12000 V	1 mA	1000 mV	100 nA	500 V/s	< 30 mVpp	CPE HV	12 W	38
A1524	6	12000 V	0.1 mA	1000 mV	10 nA	500 V/s	< 20 mVpp	CPE HV	1.2 W	38
A1526	6	15000 V	1 / 0.1 mA selectable	1000 mV	100 / 10 nA	500 V/s	< 30 mVpp	CPE HV	15 W	38
A1538D	12	1500 V	10 mA	50 mV	200 nA	500 V/s	< 20 mVpp	SHV	12 W	32
A1539(1)	12 / 24 / 32	100 V	10 mA	10 / 1 mV	200 / 10 nA	50 V/s	< 3 mVpp	SHV / DB25	1.5 W	28
A1539B	32	100 V	20 mA	10 / 1 mV	500 / 20 nA	50 V/s	< 10 mVpp	DB25	2 W	28
A1540(1)	12 / 24 / 32	100 V	1 mA	10 / 1 mV	20 / 1 nA	50 V/s	< 3 mVpp	SHV / DB25	0.1 W	28
A1540H(1)	12 / 24 / 32	100 V	1 mA / 100 µA selectable	10 / 1 mV	Iset: 20 nA Imon: 1 / 0.1 nA	50 V/s	< 3 mVpp	SHV / DB25	0.1 W	28
A1541(1)	12 / 24 / 32	500 V	10 mA	10 / 1 mV	200 / 1 nA	100 V/s	< 3 mVpp	SHV / DB25	5 W	30
A1542(1)	12 / 24 / 32	500 V	1 mA	10 / 1 mV	20 / 1 nA	100 V/s	< 3 mVpp	SHV / DB25	0.5 W	30
A1542H(1)	12 / 24 / 32	500 V	1 mA / 100 µA selectable	10 / 1 mV	Iset: 20 nA Imon: 1 / 0.1 nA	100 V/s	< 3 mVpp	SHV / DB25	0.5 W	30
A1550(1)	12 / 24	5000 V	1 mA	500 mV	100 nA	500 V/s	< 25 mVpp	SHV / Radiall 52	5 W	36
A1560H(1)	8 / 16	6000 V	20 µA	100 / 10 mV	500 / 50 pA	500 V/s	< 5 mVpp	SHV / Radiall 52	120 mW	36
A1561H	12	6000 V	20 µA	100 / 10 mV	500 / 50 pA	500 V/s	< 5 mVpp	SHV	120 mW	36
A1580H	8 / 16	8000 V	20 µA	200 / 10 mV	500 / 50 pA	500 V/s	< 5 mVpp	SHV / Radiall 52	160 mW	36
A1590	16	9000 V	50 µA	200 / 10 mV	1 nA / 100 pA	500 V/s	< 10 mVpp	Radiall 52	0.45 W	38
A7030	12/24/36/48	3000 V	1 mA	50 / 10 mV	20 / 2 nA	500 V/s	< 5 mVpp	SHV / Radiall 52	1.5 W	34
A7038	32 / 48	1000 V	0.1 mA	20 / 2 mV	2 nA / 500 pA	500 V/s	< 10 mVpp	SHV / DB37	0.1 W	32
A7040	48	100 V	1 mA	2 / 0.2 mV	20 / 2 nA	50 V/s	< 5 mVpp	DB37	50 mW	28
A7042	48	500 V	500 µA	10 / 1 mV	10 / 1 nA	100 V/s	< 5 mVpp	Radiall 52 / DB37	250 mW	30
A7236	12 / 24 / 32	3500 V	1.5 mA, 150 µA selectable	5 mV	Iset: 10 nA Imon: 5 / 0.5 nA	500 V/s	< 10 mVpp	SHV / Radiall 52	4 W	34
A7435	12 / 24	3500 V	3.5 mA, 350 µA selectable	5 mV	Iset: 10 nA Imon: 10 / 1 nA	500 V/s	< 15 mVpp	SHV / Radiall 52	9 W	34
A7460	12	6000 V	1 mA / 100 µA selectable	10 mV	Iset: 5 nA Imon: 5 / 0.5 nA	500 V/s	T.B.D.	SHV	6 W	36

(1) Available with positive, negative or mixed polarity.

VME High Voltage Power Supplies

T5

Model	No. of Channels	Max Output V	Max Output I	Vset/Vmon Resolution	Iset/Imon Resolution	Max. Ramp Up/Down Rate	Ripple Typ.	Connectors	Max Power per Channel	Features	p.
V6519	6	500 V	3 mA	10 mV	Iset: 50 nA Imon: 50 / 5 nA(1)	100 V/s	< 3 mVpp	SHV	1.5 W	Common Floating Return	48
V6521	6	6000 V	300 µA	0.1 V	Iset: 5 nA Imon: 5 / 0.5 nA(1)	500 V/s	< 3 mVpp	SHV	1.8 W	Common Floating Return	48
V6521H	6	6000 V	20 µA	0.1 V	Iset: 1 nA Imon: 1 / 0.1 nA(1)	500 V/s	< 3 mVpp	SHV	0.12 W	Common Floating Return	48
V6533	6	4000 V	3 mA	0.1 V	Iset: 50 nA Imon: 50 / 5 nA(1)	500 V/s	< 12 mVpp	SHV	9 W	Common Floating Return	48
V6534	6	6000 V	1 mA	0.1 V	Iset: 20 nA Imon: 20 / 2 nA(1)	500 V/s	< 15 mVpp	SHV	6 W	Common Floating Return	48

All Modules are available with positive, negative or mixed polarity.
(1) Optional Imon zoom.

NIM High Voltage Power Supplies

T6

Model	No. of Channels	Max Output V	Max Output I	Vset/Vmon Resolution	Iset/Imon Resolution	Max. Ramp Up/Down Rate	Ripple Typ.	Connectors	Max Power per Channel	Features	p.
N1419	4	±500 V	0.2 mA	0.01 V	Iset: 5 nA Imon: 5 / 0.5 nA(1)	100 V/s	< 3 mVpp	SHV	0.1 W	Common Floating Return	50
N1419A / B	2 / 1	±500 V	0.2 mA	0.01 V	Iset: 5 nA Imon: 5 / 0.5 nA(1)	100 V/s	< 3 mVpp	SHV	0.1 W	Common Floating Return	50
N1419ET	4	±500 V	0.2 mA	0.01 V	Iset: 5 nA Imon: 5 / 0.5 nA(1)	100 V/s	< 3 mVpp	SHV	0.1 W	Common Floating Return	50
N1470	4	±8000 V	3 mA	0.2 V	Iset: 50 nA Imon: 50 / 5 nA(1)	500 V/s	< 5 - 15 mVpp	SHV	9 W (< 3 kV) 8 W (> 3 kV)	Common Floating Return	50
N1470A / B	2 / 1	±8000 V	3 mA	0.2 V	Iset: 50 nA Imon: 50 / 5 nA(1)	500 V/s	< 5 - 15 mVpp	SHV	9 W (< 3 kV) 8 W (> 3 kV)	Common Floating Return	50
N1470AL	2	±8000 V	3 mA	0.2 V	Iset: 50 nA Imon: 50 / 5 nA(1)	500 V/s	< 5 - 15 mVpp	SHV	9 W (< 3 kV) 8 W (> 3 kV)	Common Floating Return Local control only	50
N1470AR	2	±8000 V	3 mA	0.2 V	Iset: 50 nA Imon: 50 / 5 nA(1)	500 V/s	< 5 - 15 mVpp	SHV	9 W (< 3 kV) 8 W (> 3 kV)	Common Floating Return Remote control only	50
N1470ET	4	±8000 V	3 mA	0.2 V	Iset: 50 nA Imon: 50 / 5 nA(1)	500 V/s	< 5 - 15 mVpp	SHV	9 W (< 3 kV) 8 W (> 3 kV)	Common Floating Return	50
N1471	4	±5500 V	0.3 mA	0.1 V	Iset: 5 nA Imon: 5 / 0.5 nA(1)	500 V/s	< 5 mVpp	SHV	1.65 W	Common Floating Return	50
N1471A / B	2 / 1	±5500 V	0.3 mA	0.1 V	Iset: 5 nA Imon: 5 / 0.5 nA(1)	500 V/s	< 5 mVpp	SHV	1.65 W	Common Floating Return	50
N1471ET	4	±5500 V	0.3 mA	0.1 V	Iset: 5 nA Imon: 5 / 0.5 nA(1)	500 V/s	< 5 mVpp	SHV	1.65 W	Common Floating Return	50
N1471H	4	±5500 V	0.02 mA	0.1 V	Iset: 1 nA Imon: 1 / 0.05 nA(1)	500 V/s	< 5 mVpp	SHV	0.1 W	Common Floating Return	50
N1471HA / B	2 / 1	±5500 V	0.02 mA	0.1 V	Iset: 1 nA Imon: 1 / 0.05 nA(1)	500 V/s	< 5 mVpp	SHV	0.1 W	Common Floating Return	50
N1471HET	4	±5500 V	0.02 mA	0.1 V	Iset: 1 nA Imon: 1 / 0.05 nA(1)	500 V/s	< 5 mVpp	SHV	0.1 W	Common Floating Return	50
N1570	2	±15000 V	1 mA	0.4 V	Iset: 20 nA Imon: 20 / 2 nA(1)	500 V/s	< 5 - 20 mVpp	HV LEMO	10 W	Common Floating Return	53
N8031(2)	8	100 V	10 mA	0.5 mV	Iset: 50 nA Imon: 50 / 5 nA(1)	50 V/s	< 3 mVpp	BNC	1 W	Common Ground	52
N8032(2)	8	500 V	10 mA	2 mV	Iset: 50 nA Imon: 50 / 5 nA(1)	100 V/s	< 5 mVpp	SHV	5 W	Common Ground	52
N8033 (2)	8	4000 V	3 mA	10 mV	Iset: 10 nA Imon: 10 / 1 nA(1)	500 V/s	< 15 mVpp	SHV	6 W	Common Ground	52
N8034(2)	8	6000 V	1 mA	20 mV	Iset: 5 nA Imon: 5 / 0.5 nA(1)	500 V/s	< 15 mVpp	SHV	6 W	Common Ground	52
NDT1419	4	±500 V	0.2 mA	0.01 V	Iset: 5 nA Imon: 5 / 0.5 nA(1)	100 V/s	< 3 mVpp	SHV	0.1 W	Common Floating Return NIM/Desktop	50
NDT1470	4	±8000 V	3 mA	0.2 V	Iset: 50 nA Imon: 50 / 5 nA(1)	500 V/s	< 5 - 15 mVpp	SHV	9 W (< 3 kV) 8 W (> 3 kV)	Common Floating Return NIM/Desktop	50
NDT1471	4	±5500 V	0.3 mA	0.1 V	Iset: 5 nA Imon: 5 / 0.5 nA(1)	500 V/s	< 5 mVpp	SHV	1.65 W	Common Floating Return NIM/Desktop	50
NDT1471H	4	±5500 V	0.02 mA	0.1 V	Iset: 1 nA Imon: 1 / 0.05 nA(1)	500 V/s	< 5 mVpp	SHV	0.1 W	Common Floating Return NIM/Desktop	50

(1) Imon zoom; Imon Zoom is an option for N1419/A/B, N1470/A/B, N1471/A/B
(2) Available with positive, negative or mixed polarity.

Desktop and Rack-mount High Voltage Power Supplies

T7

Model	No. of Channels	Max Output V	Max Output I	Vset/Vmon Resolution	Iset/Imon Resolution	Max. Ramp Up/ Down Rate	Ripple Typ.	Connectors	Max Power per Channel	Features	p.
DT1419ET	4	±500 V	200 µA	10 mV	Iset: 5 nA Imon: 5 / 0.5 nA(1)	100 V/s	< 3 mVpp	SHV	0.1 W	Remote control via USB or Ethernet	58
DT1470ET	4	±8000 V	3 mA	200 mV	Iset: 50 nA Imon: 50 / 5 nA(1)	500 V/s	< 5 - 15 mVpp	SHV	9 W (< 3 kV) 8 W (> 3 kV)	Remote control via USB or Ethernet	58
DT1471ET	4	±5500 V	300 µA	100 mV	Iset: 5 nA Imon: 5 / 0.5 nA(1)	500 V/s	< 5 mVpp	SHV	1.65 W	Remote control via USB or Ethernet	58
DT1471HET	4	±5500 V	20 µA	100 mV	Iset: 1 nA Imon: 1 / 0.05 nA(1)	500 V/s	< 5 mVpp	SHV	0.1 W	Remote control via USB or Ethernet	58
DT5470	1	5000 V	200 µA	Vset: 1 V Vmon: 100 mV	Iset: 40 nA Imon: 4 / 0.4 nA(1)	500 V/s	< 20 mVpp	SHV	1 W	Powered and controlled by USB	61
DT5471	1	3000 V	500 µA	Vset: 500 mV Vmon: 50 mV	Iset: 100 nA Imon: 10 / 1 nA(1)	500 V/s	< 20 mVpp	SHV	1 W	Powered and controlled by USB	61
DT5472	1	500 V	1 mA	Vset: 100 mV Vmon: 10 mV	Iset: 200 nA Imon: 20 / 2 nA(1)	100 V/s	< 10 mVpp	SHV	0.5 W	Powered and controlled by USB	61
DT5485P	1	85 V	10 mA	1 mV	Iset: 100 nA Imon: 10 nA	10 V/s	< 0.1 mVpp	LEMO	0.85 W	Powered and controlled by USB, Temperature HV Loop for SiPM	62
DT5519E	4	500 V	3 mA	Vset: 10 mV Vmon: 1 mV	Iset: 50 nA Imon: 10 / 1 nA(1)	100 V/s	< 3 mVpp	SHV	1.5 W	Remote control via USB or Ethernet	56
DT5521E	4	6000 V	300 µA	Vset: 100 mV Vmon: 50 mV	Iset: 5 nA Imon: 1 / 0.1 nA(1)	500 V/s	< 3 mVpp	SHV	1.8 W	Remote control via USB or Ethernet	56
DT5521HE	4	6000 V	20 µA	Vset: 100 mV Vmon: 50 mV	Iset: 0.5 nA Imon: 0.1 / 0.01 nA(1)	500 V/s	< 3 mVpp	SHV	0.12 W	Remote control via USB or Ethernet	56
DT5533E	4	4000 V	3 mA	Vset: 100 mV Vmon: 10 mV	Iset: 50 nA Imon: 10 / 1 nA(1)	500 V/s	< 12 mVpp	SHV	4 W	Remote control via USB or Ethernet	56
DT5534E	4	6000 V	1 mA	Vset: 100 mV Vmon: 50 mV	Iset: 20 nA Imon: 5 / 0.5 nA(1)	500 V/s	< 15 mVpp	SHV	4 W	Remote control via USB or Ethernet	56
DT8031	8	100 V	10 mA	0.5 mV	Iset: 50 nA Imon: 50 / 5 nA(1)	50 V/s	< 3 mVpp	BNC	1 W	Remote control via USB or Ethernet	59
DT8032	8	500 V	10 mA	2 mV	Iset: 50 nA Imon: 50 / 5 nA(1)	100 V/s	< 5 mVpp	SHV	5 W	Remote control via USB or Ethernet	59
DT8033	8	4000 V	3 mA	10 mV	Iset: 10 nA Imon: 10 / 1 nA(1)	500 V/s	< 15 mVpp	SHV	6 W	Remote control via USB or Ethernet	59
DT8034	8	6000 V	1 mA	20 mV	Iset: 5 nA Imon: 5 / 0.5 nA(1)	500 V/s	< 15 mVpp	SHV	6 W	Remote control via USB or Ethernet	59
HiVolta (DT1415ET)	8	1000 V	1 mA	20 mV	Iset: 5 nA Imon: 5 / 0.5 nA(1)	500 V/s	< 15 mVpp	SHV	0.6 W	Remote control via USB or Ethernet	60
R1419ET	4 / 8	±500 V	200 µA	10 mV	Iset: 5 nA Imon: 5 / 0.5 nA(1)	100 V/s	< 3 mVpp	SHV	0.1 W	Remote control via USB or Ethernet, Rack-mount	65
R1470ET	4 / 8	±8000 V	3 mA	200 mV	Iset: 50 nA Imon: 50 / 5 nA(1)	500 V/s	< 5 - 15 mVpp	SHV	9 W (< 3 kV) 8 W (> 3 kV)	Remote control via USB or Ethernet, Rack-mount	65
R1471ET	4 / 8	±5500 V	300 µA	100 mV	Iset: 5 nA Imon: 5 / 0.5 nA(1)	500 V/s	< 5 mVpp	SHV	1.65 W	Remote control via USB or Ethernet, Rack-mount	65
R1471HET	4 / 8	±5500 V	20 µA	100 mV	Iset: 1 nA Imon: 1 / 0.05 nA(1)	500 V/s	< 5 mVpp	SHV	0.1 W	Remote control via USB or Ethernet, Rack-mount	65
R8031	8 / 16	100 V	10 mA	0.5 mV	Iset: 50 nA Imon: 50 / 5 nA(1)	50 V/s	< 3 mVpp	BNC	1 W	Remote control via USB or Ethernet, Rack-mount	66
R8032	8 / 16	500 V	10 mA	2 mV	Iset: 50 nA Imon: 50 / 5 nA(1)	100 V/s	< 5 mVpp	SHV	5 W	Remote control via USB or Ethernet, Rack-mount	66
R8033	8 / 16	4000 V	3 mA	10 mV	Iset: 10 nA Imon: 10 / 1 nA(1)	500 V/s	< 15 mVpp	SHV	6 W	Remote control via USB or Ethernet, Rack-mount	66
R8034	8 / 16	6000 V	1 mA	20 mV	Iset: 5 nA Imon: 5 / 0.5 nA(1)	500 V/s	< 15 mVpp	SHV	6 W	Remote control via USB or Ethernet, Rack-mount	66

DT55xxE, DT80xx, R80xx: available with positive, negative or mixed polarity. DT14xxET and R14xxET: channel polarity independently selectable.
HiVolta: channel polarity independently selectable, fully floating up to 5 kV and stackable.
(1) Imon zoom.

PCB High Voltage Power Supplies

T8

Model	No. of Channels	Max Output V	Max Output I	Vset Input (V)	Vmon Output (V)	Imon Output (V)	Ripple Typ.	Power requirement (mW)	Operating temperature	Voltage Supply (Vin)	p.
A7501	1	2100 V	100 µA	0 ÷ +2.5	0 ÷ +5	0 ÷ +2.5	< 5 mVpp	< 400	-40 °C ÷ +70 °C	+12V (±5%)	76
A7502	1	2100 V	100 µA	0 ÷ +2.5	0 ÷ +2.5	0 ÷ +2.5	< 5 mVpp	< 500	-40 °C ÷ +70 °C	+5V (±5%)	76
A7504	1	4000 V	100 µA	0 ÷ +2.6	0 ÷ +2.5	0 ÷ +2.5	< 10 mVpp	< 1000	-10 °C ÷ +50 °C	+12V (±5%)	76
A7505	1	1600 V	500 µA	0 ÷ +2.6	0 ÷ +2.6	0 ÷ +2.6	< 5 mVpp	< 1600	-55 °C ÷ +80 °C	+12V (±5%)	76
A7508	1	800 V	50 µA	0 ÷ +2.5	0 ÷ +2.5	0 ÷ +2.5	< 5 mVpp	< 100	-40 °C ÷ +70 °C	+5V (±5%)	76
A7511	1	1100 V	1 mA	0 ÷ +2	0 ÷ +2	0 ÷ +2	T.B.D.	< 1600	-10 °C ÷ +50 °C	+12V (±5%)	76
A7560	1	±6000 V	10 µA	0 ÷ +2	0 ÷ +2	0 ÷ +2	< 10 mVpp	< 2000	-10 °C ÷ +40 °C	from +5 V (-20%) to +12 V (+10%)	69
A7585D	1	85 V	10 mA	0 ÷ +4.5	0 ÷ +4.5	0 ÷ +4.5	< 0.1 mVpp	< 100	-20 °C ÷ +80 °C	+5V (Max +24V)	71

Powered Crates

T9

Model	Package	No. of Slots	Width	Height	Backplane connectors	Pluggable power supplies	Pluggable fan unit	Remote control	Output power	p.
NIM8301	NIM	12	19"	7U	NIM	Yes	Yes	RS232, USB (2.0), CANBUS, Ethernet	300 W / 600 W	240
NIM8302	NIM Compact	12 (10 free)	19"	5U	NIM	Yes	No fan unit	No	150 W	244
NIM8302P	NIM Portable	7 (5 free)	270 mm	5U	NIM	Yes	No fan unit	No	150 W	244
NIM8303	NIM	12	19"	5U	NIM	Yes	No fan unit	No	300 W / 600 W	242
NIM8304	NIM	12	19"	7U	NIM	Yes	Yes	RS232, USB (2.0), CANBUS, Ethernet	1100 W @ 110 Vac 2200 W @ 220 Vac	246
NIM8305	NIM Mini	2	170 mm	124 mm	NIM	No	No	No	430 W	245
NIM8306	NIM Mini	2	170 mm	124 mm	NIM	No	No	No	720 W	245
NV8020A	NIM / VME64	NIM: 5 VME: 8	19"	7U	NIM / VME64 J1/J2	NIM: Yes VME: No	No	No	NIM: 150 W VME: 365 W	248
VME8001	VME64	2 (6U)	19"	1U	VME64 J1/J2	No	No	No	170 W	237
VME8004B	VME64	4 (6U)	19"	2U	VME64 J1/J2	No	No	No	365 W	237
VME8004X	VME64X	4 (6U)	19"	4U	VME64X J1/J0/J2	No	No	No	450 W	238
VME8008B	VME64	8 (6U)	19"	4U	VME64 J1/J2	No	No	No	490 W	238
VME8008X	VME64X	8 (6U)	19"	4U	VME64X J1/J0/J2	No	No	No	450 W	239
VME8010	VME64	21 (6U)	19"	7U	VME64 J1/J2	No	No	No	470 W	236
VME8011	VME64	21 (6U)	19"	7U	VME64 J1/J2	Yes	No	No	470 W	236
VME8100	VME64, VME64X	21 (6U)	19"	8U	VME64 J1/J2, VME64X J1/J2, VME64X J1/J0/J2	Yes	Yes	RS232, USB (2.0), CANBUS, Ethernet	1200 W @ 100 Vac 2530 W @ 211 Vac	232
VME8200	VME64X	21 (6U), 21 Rear	19"	9U: (8U + 1U Air Filter)	VME64X J1/J0/J2	Yes	Yes	RS232, USB (2.0), CANBUS, Ethernet	1200 W @ 100 Vac 2530 W @ 211 Vac	234

ADCs (Peak Sensing)

T10

Model	Package	No. of Inputs	Resolution (channels)	Conversion Time (µs)	Full Scale Range (V)	Multi Event Buffer size	Connectors	p.
DT5741	Desktop	32	1k, 2k, 4k, 8k, 16k	0.1	4	1024 events / ch	ERNI SMC	180
N6741	NIM	32	1k, 2k, 4k, 8k, 16k	0.1	4	1024 events / ch	ERNI SMC	150
N957	NIM	1	8k	0.8	10	64k events / ch	LEMO	140
V1741	VME	64	1k, 2k, 4k, 8k, 16k	0.1	4	1024 events / ch	ERNI SMC	169
V1785	VME	8	4k	2.8	4 / 0.5 (Dual)	32 events / ch	LEMO	154
V785	VME	32	4k	5.7	4 / 8	32 events / ch	Std. Flat	154
V785N	VME	16	4k	2.8	4	32 events / ch	LEMO	154
VX1741	VME64X	64	1k, 2k, 4k, 8k, 16k	0.1	4	1024 events / ch	ERNI SMC	169

Digitizers

T11

Model	Package	No. of Channels	Max Sampling Rate (MS/s)	Bandwidth (MHz)	Full Scale Range (V)	Resolution (bits)	LSB (µV)	Board Memory (Samples/ch)	Analog Input Connectors	p.
DT5550SE	Desktop	32	80	40	2	14	120	16 k	MCX	118
DT5720	Desktop	4 / 2	250	125	2	12	500	1.25 M / 10 M	MCX	100
DT5724	Desktop	4 / 2	100	40	0.5 / 2.25 / 10	14	30 / 140 / 600	512 k / 4 M	MCX	102
DT5725	Desktop	8	250	125	0.5 - 2	14	30 - 120	640 k / 5.12 M	MCX	104
DT5730	Desktop	8	500	250	0.5 - 2	14	30 - 120	640 k / 5.12 M	MCX	106
DT5740	Desktop	32 - 16(1)	62.5	30	2 / 10	12	500 / 2500	192 k	SMC 68P - MCX	108
DT5742(2)	Desktop	16 + 1(2.1)	5000(3)	500	1	12	250	128 / 1024 events(4)	MCX	114
DT5743(5)	Desktop	8	3200(3)	500	2.5	12	600	7 events(4)	MCX	116
DT5751	Desktop	2(6) - 4	2000(6) - 1000	500	0.2 / 1	10	200 / 1000	3.6 M(6) – 1.8 M	MCX	110
DT5761	Desktop	1	4000	1000	1	10	1000	7.2 M	MCX	112
N6720	NIM	4 / 2	250	125	2	12	500	1.25 M / 10 M	MCX	100
N6724	NIM	4 / 2	100	40	0.5 / 2.25 / 10	14	30 / 140 / 600	512 k / 4 M	MCX	102
N6725	NIM	8	250	125	0.5 - 2	14	30 - 120	640 k / 5.12 M	MCX	104
N6730	NIM	8	500	250	0.5 - 2	14	30 - 120	640 k / 5.12 M	MCX	106
N6740	NIM	32	62.5	30	2 / 10	12	500 / 2500	192 k	SMC 68P	108
N6742(2)	NIM	16 + 1(2.1)	5000(3)	500	1	12	250	128 / 1024 events(4)	MCX	114
N6743(5)	NIM	8	3200(3)	500	2.5	12	600	7 events(4)	MCX	116
N6751	NIM	2(6) - 4	2000(6) - 1000	500	0.2 / 1	10	200 / 1000	3.6 M(6) - 1.8 M / 28.8 M(6) - 14.4 M	MCX	110
N6761	NIM	1	4000	1000	1	10	1000	7.2 M	MCX	110
V1720	VME	8	250	125	2	12	500	1.25 M / 10 M	MCX	100
V1724	VME	8	100	40	0.5 / 2.25 / 10	14	30 / 140 / 600	512 k / 4 M	MCX	102
V1725	VME	8 / 16	250	125	0.5 - 2	14	30 - 120	640 k / 5.12 M	MCX	104
V1730	VME	8 / 16	500	250	0.5 - 2	14	30 - 120	640 k / 5.12 M	MCX	106
V1740	VME	64	62.5	30	2 / 10	12	500 / 2500	192 k / 1.5 M	SMC 68P	108
V1742(2)	VME	32 + 2(2.1)	5000(3)	500	1	12	250	128 / 1024 events(4)	MCX	114
V1743(5)	VME	16	3200(3)	500	2.5	12	600	7 events(4)	MCX	116
V1751	VME	4(6) - 8	2000(6) - 1000	500	0.2 / 1	10	200 / 1000	3.6 M(6) - 1.8 M / 28.8 M(6) - 14.4 M	MCX	110
V1761	VME	2	4000	1000	1	10	1000	7.2 M / 57.6 M	MCX	110
VX1720	VME64X	8	250	125	2	12	500	1.25 M / 10 M	MCX	100
VX1724	VME64X	8	100	40	0.5 / 2.25 / 10	14	30 / 140 / 600	512 k / 4 M	MCX	102
VX1725	VME64X	8 / 16	250	125	0.5 - 2	14	30 - 120	640 k / 5.12 M	MCX	104
VX1730	VME64X	8 / 16	500	250	0.5 - 2	14	30 - 120	640 k / 5.12 M	MCX	106
VX1740	VME64X	64	62.5	30	2 / 10	12	500 / 2500	192 k / 1.5 M	SMC 68P	108
VX1742(2)	VME64X	32 + 2(2.1)	5000(3)	500	1	12	250	128 / 1024 events(4)	MCX	114
VX1743(5)	VME64X	16	3200(3)	500	2.5	12	600	7 events(4)	MCX	116
VX1751	VME64X	4(6) - 8	2000(6) - 1000	500	0.2 / 1	10	200 / 1000	3.6 M(6) - 1.8 M / 28.8 M(6) - 14.4 M	MCX	110
VX1761	VME64X	2	4000	1000	1	10	1000	7.2 M / 57.6 M	MCX	110

(1) 32 channels on SMC connector, 16 channels on MCX connectors.
(2) Based on DRS chip: 5 GS/s Switched Capacitor Array, 8+1 channels with 1024 storage cells each.
(2.1) Additional analog input(s) allow for low latency triggers
(3) Sampling frequency of the analog memory (switched capacitor array); A/D conversion takes place at lower speed (dead-time).
(4) 1 event = 1 k samples.
(5) Based on SAMLONG chip: 3.2 GS/s Switched Capacitor Array, 2 channels with 1024 storage cells each.
(6) If operating in Dual Edge Sampling (DES) mode.

Amplifiers (Fast)

T12

Model	Package	No. of Channels	Gain	Bandwidth (MHz)(1)	Coupling	Input Impedance (Ω)	Output Rise Time (ns)	Output Range (V)	Equivalent Input Noise (µV RMS)	In Conn.	Out Conn.	p.
N978	NIM	4	1 ÷ 10	250 (gain: 10x)	DC	50	< 1.5	± 2	< 50 (gain: 10x)	LEMO	LEMO	140
N979	NIM	16	10 (Optional in 2 ÷ 9 range)	250 (gain: 10x)	DC	50	< 1.5	± 2	< 50 (gain: 10x)	LEMO	LEMO	141
N979B	NIM	16	2, 4, 8, 10	250 (gain: 10x)	DC	50	< 1.5	± 2	< 50 (gain: 10x)	LEMO	LEMO	141
V974	VME	4	1 ÷ 10	170 (gain: 10x)	DC	50	< 3	± 2	< 70 (gain: 10x)	LEMO	LEMO	155
V975	VME	8	10	250	DC	50	< 1.5	± 2	< 50	LEMO	LEMO	155

(1) Bandwidth measured with ±25 mV input signal.

Amplifiers (Spectroscopy)

T13

Model	Package	No. of Channels	Gain	Coupling	Shaping	Input Impedance (Ω)	Output Rise Time (ns)	Output Range (V)	Integral Non-linearity	Equivalent Input Noise (µV RMS)	In Conn.	Out Conn.	p.
N1068	NIM	16	Coarse: 8 step Fine: 7-bit	DC	Gaussian type	50 (Single Ended) 110 (Differential)	-	±8 on 1 MΩ	< 0.005%(2)	< 15 (@gain=100)	LEMO / Strip Header	Strip Header	142
N1568A	NIM	16	0.8 ÷ 192	DC	Gaussian type	50	-	±8 on 1 MΩ	< 0.005%(2)	< 10	Strip Header	Strip Header	144
N568EB	NIM	16	0.15 ÷ 480	DC	Gaussian type	50	25(1)	±8 on 1 MΩ	< 0.05%	< 15 (@gain=100)	LEMO	Strip Haeder	144
N568ELC	NIM	16	0.15 ÷ 480	DC	Gaussian type	50	25(1)	±8 on 1 MΩ	< 0.05%	< 25 (@gain=100)	LEMO	Strip Haeder	144
N568E	NIM	16	0.15 ÷ 480	DC	Gaussian type	50	25(1)	±8 on 1 MΩ	< 0.05%	< 15 (@gain=100)	LEMO	Strip Haeder	144
N968	NIM	1	1 ÷ 3000	DC	semi-Gaussian	1000	-	10 on 1 MΩ	< 0.025%	< 3.5 (@gain=1000)	BNC	BNC	141

(1) Typical value on FAST_OUT.
(2) 20÷90% of the full scale @ Gain=Max and 4 µs shaping time.

Attenuators

T14

Model	Package	No. of Channels	Range per Section (dB)	Resolution (dB)	Max Frequency (MHz)	I/O Delay (ns)	Insert Loss (dB)	I/O Connectors	p.
N858	NIM	2	0 ÷ 44.5	0.5	300	< 5	< 0.10	LEMO	145
V859	VME	2	0 ÷ 44.5	0.5	300	< 5	< 0.10	LEMO	155

Charge Sensitive Preamplifiers

T15

Model	Package	No. of Channels	Sensitivity (mV/MeV)	Equivalent Input Noise FWHM (keV)	Output Rise Time (ns)	Output Range (V)	Integral Non-linearity	Max Detector Bias Voltage (V)	Test Capacitance (pF)	In Conn.	Out Conn.	p.
A422A	Shielded box	1	5 / 30 / 60	< 17.5 @ 1 nF	< 50	±8(2) ±4(1)	< 0.045%	±5000	10	SHV	BNC	184
A1422	Shielded box	1 / 4 / 8	5 / 45 / 90 / 400	< 4.7 @0pF(4) < 2.2 @0pF(5) < 10.5 @390pF(6) < 5.8 @390pF(7)	< 5 @0pF(8) < 10 @0pF(9) < 70 @0pF(10) < 20 @390pF(6) < 25 @390pF(11) < 45 @390pF(12)	±4(1) ±10(3)	<± 0.05% (0 ÷ ±10 V peak output)	±2000	1/10	SHV or BNC	LEMO or BNC	185
A1422H	15 pin SIP module	1	5 / 45 / 90 / 400	< 4.7 @0pF(4) < 2.2 @0pF(5) < 10.5 @390pF(6) < 5.8 @390pF(7)	< 5 @0pF(8) < 10 @0pF(9) < 70 @0pF(10) < 20 @390pF(6) < 25 @390pF(11) < 45 @390pF(12)	±4(1) ±10(3)	<± 0.05% (0 ÷ ±10 V peak output)	±800	1/10	-	-	184

(1) Measured with 50 Ω termination; (2) Measured with 1 MΩ termination; (3) Measured with 1 kΩ termination; (4) F2 type, gain: 5 mV/MeV; (5) F2 type, gain: 45/90/400 mV/MeV; (6) F3 type, gain: 5 mV/MeV; (7) F3 type, gain: 45/90 mV/MeV; (8) F2 type, gain: 5/45 mV/MeV; (9) F2 type, gain: 90 mV/MeV; (10)F2 type, gain: 400 mV/MeV; (11) F3 type, gain: 45 mV/MeV (12) F3 type, gain: 90 mV/MeV.

Charge Sensitive Preamplifiers (Scintillation Detectors)

T16

Model	Package	No. of Channels	Sensitivity (mV/pC)	Noise	Output Rise Time (ns)	Output Range (V)	Integral Non-linearity	Test Capacitance (pF)	In Conn.	Out Conn.	p.
A1424	Shielded box	1	0.8, 0.9, 1.1, 1.3, 1.5, 1.7, 2.5, 3, 5, 10 selectable	3.2 fC with 10 mV/pC sensitivity (max.); 8.5 fC with 0.8 mV/pC sensitivity (min.)	ENERGY Out < 60 FAST Out < 2.3	± 8(1) ± 4(2)	< 0.02%	100	LEMO	LEMO	186

(1) Measured with 1 kΩ termination; (2) Measured with 50 Ω termination.

Fast Preamplifiers

T17

Model	Package	Inputs	Mode	Sensitivity (mV/fC)	Output Range (V)	ENC Noise (fC)	Input Impedance (Ω)	Output Impedance (Ω)	Detector HV Rating (kV)	p.
A1425	Shielded box	1	Inverting	3.6	0 ÷ 1 (50 Ω termination)	0.16	AC coupled	50	1	186
A1426	Shielded box	1	Non-Inverting	up to 5	0 ÷ 1 (open circuit)	0.3	50	50	1	187

Coincidence/Logic/Trigger Units

T18

Model	Package	No. Of Sections	Function	Inputs per Section	Outputs per Section	I/O Delay (ns)	Input Bandwidth (MHz)	Majority	Strobe/ Veto	Connectors	p.
N113	NIM	2	OR	12 NIM	2 NIM	< 10	130	No	Yes	LEMO	145
N405	NIM	3	Logic Unit	4 NIM	2+/1 NIM, 1 NIM Linear	< 14	100	Yes	Yes	LEMO	145
N455	NIM	4	OR / AND	2 NIM	3+/1 NIM, 1 NIM Overlap	< 16	130	No	Yes	LEMO	146
V2495	VME	1	Programmable Trigger Unit FPGA: Cyclone V 5CGXC4 (50 K LEs)	64 ECL/ PECL/ LVDS+2 bidirectional NIM/TTL (expandable up to 162)	32 LVDS+2 bidirectional NIM/TTL (expandable up to 130)	n/a	tbd	Yes	Yes	Robinson Nugent Flat/ LEMO	156
DT5495	Desktop	1	Programmable Trigger Unit FPGA: Cyclone V 5CGXC4 (50 K LEs)	64 ECL/ PECL/ LVDS+2 bidirectional NIM/TTL (expandable up to 162)	32 LVDS+2 bidirectional NIM/TTL (expandable up to 130)	n/a	tbd	Yes	Yes	Robinson Nugent Flat/ LEMO	153
V976	VME	4	Logic Unit	4 NIM/TTL	4 NIM/TTL	< 9	150	Yes	No	LEMO	158

Controllers

T19

Model	Package	Link	Max Transfer Rate (MByte/s)	No. of Links	Programmable I/O	Data-way Display	I/O Connectors	p.
V1718	VME	USB 2.0 -> VME	30	1	5 out + 2 in TTL/NIM	Yes	LEMO	159
V2718	VME	Optical Link -> VME	80	1	5 out + 2 in TTL/NIM	Yes	LEMO	160
VX1718	VME64X	USB 2.0 -> VME	30	1	5 out + 2 in TTL/NIM	Yes	LEMO	159
VX2718	VME64X	Optical Link -> VME	80	1	5 out + 2 in TTL/NIM	Yes	LEMO	160
A2818	PCI	PCI -> Optical link	80	1	n / a	n / a	n / a	262
A3818	PCIe	PCIe -> Optical link	80	1 / 2 / 4	n / a	n / a	n / a	262

Discriminators

T20

Model	Package	No. of Channels	Function	Updating	Min Input (mV)	Output Width (ns)	I/O Delay (ns)	Outputs	Input Bandwidth (MHz)	In Conn.	Out Conn.	p.
N605	NIM	4	Const. Fraction	Selectable	- 20	2 ÷ 500	n/a(1)	3 NIM	250	LEMO	LEMO	146
V812	VME	16	Const. Fraction	No	- 5	15 ÷ 250	n/a(1)	2 ECL	n/a	LEMO	Std. Flat	161
V814(2)	VME	16	Low Threshold	No	- 3	6 ÷ 95	10	2 ECL	60	LEMO	Std. Flat	161
N840	NIM	8	Leading Edge	Selectable	- 5	5 ÷ 40	10	2 + /1 NIM	140	LEMO	LEMO	147
N841	NIM	16	Leading Edge	Selectable	- 5	5 ÷ 40	10	2 + /1 NIM	140	LEMO	LEMO	147
N842	NIM	8	Const. Fraction	No	- 5	16.5 ÷ 273	n/a(1)	2 + /1 NIM	n/a	LEMO	LEMO	147
N843	NIM	16	Const. Fraction	No	- 5	16.5 ÷ 273	n/a(1)	2 + /1 NIM	n/a	LEMO	LEMO	147
N844(2)	NIM	8	Low Threshold	No	- 3	5 ÷ 90	10	2 + /1 NIM	60	LEMO	LEMO	147
N845	NIM	16	Low Threshold	No	- 3	5 ÷ 90	10	2 + /1 NIM	60	LEMO	LEMO	147
V895	VME	16	Leading Edge	Selectable	- 5	5 ÷ 40	10	2 ECL	140	LEMO	Std. Flat	162

(1) For constant fraction discriminators, the I/O delay depends on delay set value.
(2) Also available with positive inputs.

Fan In-Fan Out Units(1)

T21

Model	Package	No. of Sections	Type	Inputs per Section	Outputs per Section	I/O Delay (ns)	Input Bandwidth (MHz)	Connectors	p.
DT5495	Desktop	1	Logic User-customizable FPGA: Cyclone V 5CGXC4 (50 K LEs)	64 ECL/PECL/LVDS +2 bidirectional NIM/TTL (expandable up to 162)	32 LVDS +2 bidirectional NIM/TTL (expandable up to 130)	a/n	200 - 250	Robinson Nugent Flat/LEMO	174
N454	NIM	4	Logic	4 NIM	4+/2 NIM	< 8	100	LEMO	148
N625	NIM	4	Linear	4 Bipolar	4 Bipolar	< 4	100	LEMO	148
V2495	VME	1	Logic User-customizable FPGA: Cyclone V 5CGXC4 (50 K LEs)	64 ECL/PECL/LVDS +2 bidirectional NIM/TTL (expandable up to 162)	32 LVDS +2 bidirectional NIM/TTL (expandable up to 130)	a/n	200 - 250	Robinson Nugent Flat/LEMO	156
V925	VME	4	Linear	3x4+1x3 Bipolar	3x4+1x3 Bipolar	< 4	120	LEMO	162
V976	VME	4	Logic	4 NIM/TTL	4 NIM/TTL	< 9	150	LEMO	158

(1) All modules are DC coupled.

I/O Registers

T22

Model	Package	No. of Sections	Function	Inputs per Section	Outputs per Section	In Connectors	Out Connectors	p.
DT5495	Desktop	1	Programmable I/O register FPGA: Cyclone V 5CGXC4 (50 K LEs)	64 ECL/PECL/LVDS +2 bidirectional NIM/TTL (expandable up to 162)	32 LVDS +2 bidirectional NIM/TTL (expandable up to 130)	Robinson Nugent Flat/ LEMO	Robinson Nugent Flat/ LEMO	174
V2495	VME	1	Programmable I/O register FPGA: Cyclone V 5CGXC4 (50 K LEs)	64 ECL/PECL/LVDS +2 bidirectional NIM/TTL (expandable up to 162)	32 LVDS +2 bidirectional NIM/TTL (expandable up to 130)	Robinson Nugent Flat/ LEMO	Robinson Nugent Flat/ LEMO	156
V977	VME	1	Pattern Unit, I/O register	16 NIM / TTL	16 NIM / TTL	LEMO	LEMO	163

QDCs

T23

Model	Package	No. of Channels	Resolution (bits)	Conversion Time (µs)	LSB (fC)	Full Scale Range (pC)	Gate Width (µs)	Fast Clear (µs)	Connectors	Features	p.
V792	VME	32	12	5.7	100	400	0.05(1)	0.6	Std. Flat	-	163
V792N	VME	16	12	2.8	100	400	0.05(1)	0.6	LEMO	-	163
V862	VME	32	12	5.7	100	400	0.05(1)	0.6	Robinson Nugent Flat	individual gate	164
V965	VME	16	12 (15 dyn.)	5.7	25 / 200	100 / 900	0.05(1)	0.6	LEMO	dual range	164
V965A	VME	8	12 (15 dyn.)	2.8	25 / 200	100 / 900	0.05(1)	0.6	LEMO	dual range	164

(1) Minimum Gate Width.

Scalers

T24

Model	Package	No. of Channels	Input Type	Count Rate (MHz)	Channel Depth	Connectors	p.
FW2495SC(1)	VME	64 (expandable up to 128)	ECL / LVDS / PECL NIM / TTL(2)	200 - 250	32 bit	Robinson Nugent Flat / LEMO	158
N1145	NIM 2U	4+1 downcounter	NIM / TTL	4x250 + 1x80	4x8 + 1x7 digit	LEMO	148

(1) Firmware for Mod. V2495 and DT5495
(2) For NIM / TTL max 16 channels.

TDCs

T25

Model	Package	No. of Channels	Resolution (bit)	Type	Conversion Time (µs)	LSB (ps)	Full Scale Range (µs)	Input Type	Connectors	p.
V1190A-2eSST	VME	128	19 / 17(1)	Multihit Digital TDC(2)	-	100 / 200 / 800	52 / 104	ECL / LVDS	Robinson Nugent Flat	165
V1190B-2eSST	VME	64	19 / 17(1)	Multihit Digital TDC(2)	-	100 / 200 / 800	52 / 104	ECL / LVDS	Robinson Nugent Flat	165
V1290A-2eSST	VME	32	21	Multihit Digital TDC(2)	-	25	52	ECL / LVDS	Std. Flat	166
V1290N-2eSST	VME	16	21	Multihit Digital TDC(2)	-	25	52	NIM	LEMO	166
V775	VME	32	12	Analog TDC	5.7	35 / 300	0.14 / 1.2	ECL	Std. Flat	167
V775N	VME	16	12	Analog TDC	2.8	35 / 300	0.14 / 1.2	NIM	LEMO	167
VX1190A-2eSST	VME64X	128	19 / 17(1)	Multihit Digital TDC(2)	-	100 / 200 / 800	52 / 104	ECL / LVDS	Robinson Nugent Flat	165
VX1190B-2eSST	VME64X	64	19 / 17(1)	Multihit Digital TDC(2)	-	100 / 200 / 800	52 / 104	ECL / LVDS	Robinson Nugent Flat	165
VX1290A-2eSST	VME64X	32	21	Multihit Digital TDC(2)	-	25	52	ECL / LVDS	Std. Flat	166
VX1290N-2eSST	VME64X	16	21	Multihit Digital TDC(2)	-	25	52	NIM	LEMO	166

(1) Depending on the selected range.
(2) Based on HPTDC (High Performance Time to Digital Converter) chip developed by CERN/ECP-MIC Division.

Timing Units

T26

Model	Package	No. of Sections	Function	Inputs per Section	Outputs per Section	Output Width/Delay	In Conn.	Out Conn.	p.
DT993	NIM	2	Timer	1 NIM/TTL + 1 ECL	2+/1 NIM/TTL+ 1 ECL	50 ns ÷ 10 s	LEMO / Pin couple	LEMO / Pin couple	179
N108A	NIM	2	Delay	1 Analog	1 Analog	1.6 ÷ 65.1 ns	LEMO	LEMO	149
N93B	NIM	2	Timer	1 NIM + 1 ECL	2+/1 NIM+ 1 ECL	50 ns ÷ 10 s	LEMO / Pin couple	LEMO / Pin couple	149
V972	VME	1	Delay	1 Analog	1 Analog	2.6 ÷ 34.1 ns	LEMO	LEMO	167
V993C	VME 2U	2	Timer	1 NIM/TTL + 1 ECL	2+/1 NIM/TTL+ 1 ECL	50 ns ÷ 10 s	LEMO / Pin couple	LEMO / Pin couple	168

Translators

T27

Model	Package	No. Of Sections	Function	Inputs per Section	Outputs per Section	I/O delay (ns)	Input Bandwidth (MHz)	In Conn.	Out Conn.	p.
DT5495	Desktop	1	Depending on board configuration	64 ECL/PECL/LVDS +2 bidirectional NIM/TTL (expandable up to 162)	32 LVDS+2 bidirectional NIM/ TTL (expandable up to 130)	tbd	200 - 250	Robinson Nugent Flat/ LEMO	Robinson Nugent Flat/ LEMO	174
N638	NIM	2	NIM to ECL/NIM; ECL to NIM/ECL	8 NIM / 8 ECL	2x8 NIM / 8 ECL	< 3.5	300	LEMO / Std. Flat	LEMO / Std. Flat	150
N89	NIM	2	NIM to TTL; TTL to NIM	4 + 4	4 + 4	< 10	60 / 40	LEMO	LEMO	149
V2495	VME	1	Depending on board configuration	64 ECL/PECL/LVDS +2 bidirectional NIM/TTL (expandable up to 162)	32 LVDS+2 bidirectional NIM/ TTL (expandable up to 130)	tbd	200 - 250	Robinson Nugent Flat/ LEMO	Robinson Nugent Flat/ LEMO	156
V538A	VME	1	NIM to ECL/NIM; ECL to NIM/ECL	8 NIM / 8 ECL	2x8 NIM / 2x8 ECL	< 3	300	LEMO / Std. Flat	LEMO / Std. Flat	168
V976	VME	4	NIM to TTL; TTL to NIM	4	4	< 11.5	150	LEMO	LEMO	158

Digital MCAs

T28

Model	Package	No. of Inputs	Coupling	Channels	No. of LV Preamp. Outputs	No. of HV Outputs	HV Power Output	Acquisition Modes	Interfaces	p.
DT5770	Desktop	1	DC/AC	16 K	1	0	n/a	SI, PHA	USB 2.0, Ethernet	223
DT5780M	Desktop	2	DC	16 K	2	2	+5 kV/300 µA -5 kV/300 µA	SI, LM, Coinc.	USB 2.0, Optical Link	220
DT5780N	Desktop	2	DC	16 K	2	2	-5 kV/300 µA (2 output)	SI, LM, Coinc.	USB 2.0, Optical Link	220
DT5780P	Desktop	2	DC	16 K	2	2	+5 kV/300 µA (2 output)	SI, LM, Coinc.	USB 2.0, Optical Link	220
DT5780SCM	Desktop	2	DC	16 K	2	2	+4 kV/3 mA (4 W max) -4 kV/3 mA (4 W max)	SI, LM, Coinc.	USB 2.0, Optical Link	220
DT5780SCN	Desktop	2	DC	16 K	2	2	-4 kV/3 mA (2 output) (4 W max)	SI, LM, Coinc.	USB 2.0, Optical Link	220
DT5780SCP	Desktop	2	DC	16 K	2	2	+4 kV/3 mA (2 output) (4 W max)	SI, LM, Coinc.	USB 2.0, Optical Link	220
DT5780SDM	Desktop	2	DC	16 K	2	2	+500 V/3 mA -500 V/3 mA	SI, LM, Coinc.	USB 2.0, Optical Link	220
DT5780SDN	Desktop	2	DC	16 K	2	2	-500 V/3 mA (2 output)	SI, LM, Coinc.	USB 2.0, Optical Link	220
DT5780SDP	Desktop	2	DC	16 K	2	2	+500 V/3 mA (2 output)	SI, LM, Coinc.	USB 2.0, Optical Link	220
DT5781	Desktop	4	DC	16 K	0	0	n/a	SI, LM, Coinc.	USB 2.0, Optical Link	221
DT5781A	Desktop	2	DC	16 K	0	0	n/a	SI, LM, Coinc.	USB 2.0, Optical Link	221
HEXAGON-M	Desktop	2	AC/DC	32 K	2	2	+2kV 1mA / +5kV 30µA -2kV 1mA / -5kV 30µA	SI, LM, PHA, Multi-PHA(2), MCS(2), SCA(2), Coinc.	USB 2.0, Ethernet	218
HEXAGON-N	Desktop	2	AC/DC	32 K	2	2	-2kV 1mA / -5kV 30µA	SI, LM, PHA, Multi-PHA(2), MCS(2), SCA(2), Coinc.	USB 2.0, Ethernet	218
HEXAGON-P	Desktop	2	AC/DC	32 K	2	2	+2kV 1mA / +5kV 30µA	SI, LM, PHA, Multi-PHA(2), MCS(2), SCA(2), Coinc.	USB 2.0, Ethernet	218
HEXAGON-one	Desktop	1	AC/DC	32 K	2	2	+2kV 1mA / +5kV 30µA -2kV 1mA / -5kV 30µA	SI, LM, PHA, Multi-PHA(2), MCS(2), SCA(2)	USB 2.0, Ethernet	218
i-Spector Digital	Desktop	1	AC/DC	2 K	1	1	+80 V	SI, PHA	Ethernet, LoRa	225
N6780M	NIM	2	DC	16 K	2	2	+5 kV/300 µA -5 kV/300 µA	SI, LM, Coinc.	USB 2.0, Optical Link	220
N6780N	NIM	2	DC	16 K	2	2	-5 kV/300 µA (2 output)	SI, LM, Coinc.	USB 2.0, Optical Link	220
N6780P	NIM	2	DC	16 K	2	2	+5 kV/300 µA (2 output)	SI, LM, Coinc.	USB 2.0, Optical Link	220
N6781	NIM	4	DC	16 K	0	0	n/a	SI, LM, Coinc.	USB 2.0, Optical Link	221
N6781A	NIM	2	DC	16 K	0	0	n/a	SI, LM, Coinc.	USB 2.0, Optical Link	221
S2580(1)	Tube Base (14 pin socket)	1	AC	2 K	n/a	1	+1500 V/500 µA	SI, LM, PHA, MCS(2), SCA(2), Multi-PHA	USB 2.0, Ethernet, WiFi, Bluetooth	224
S2580G(1)	Tube Base (14 pin socket)	1	AC	2 K	n/a	1	+1500 V/500 µA	SI, LM, PHA, MCS(2), SCA(2), Multi-PHA	USB 2.0, Ethernet, WiFi, Bluetooth	224
S2580LB(1)	Tube Base (14 pin socket)	1	AC	2 K	n/a	1	+1500 V/500 µA	SI, LM, PHA, MCS(2), SCA(2), Multi-PHA	USB 2.0, Ethernet, WiFi, Bluetooth	224
S2580LBG(1)	Tube Base (14 pin socket)	1	AC	2 K	n/a	1	+1500 V/500 µA	SI, LM, PHA, MCS(2), SCA(2), Multi-PHA	USB 2.0, Ethernet, WiFi, Bluetooth	224
V1781	VME	8	DC	16 K	0	0	n/a	SI, LM, Coinc.	VME64X, Optical Link	222

(1) Version of Gamma stream.
(2) Coming soon.

SI: Signal Inspector.
LM: List Mode
Coinc: Coincidence.

Digital Detector Emulators

T29

Model	Package	No. of Channels	D/A Sample rate	Maximum Rate	Multiple shapes on a single channel	Minimum rising time (fast mode)	Correlated events simulation	Custom Sequence of energy and time	Analog Input	Interfaces	p.
DT4800	Desktop	1	200 MHz	1 Mcps	No	7 ns	No	No	No	Mini USB	256
DT5800	Desktop	2	125 MHz	10 Mcps / 5 Mcps (Poisson)	Yes (2 Different)	8 ns	Yes	Yes	No	USB 2	257
DT5810B	Desktop	2	1 GHz	30 Mcps	Yes (4 Different)	1 ns	Yes	Yes	Yes 1 channel	USB 3	255
NDT6800	NIM	2	125 MHz	10 Mcps / 5 Mcps (Poisson)	Yes (2 Different)	8 ns	Yes	Yes	No	USB 2	257

Product Index / 720 Digitizer Family - A3050HBP

Product Index / A309 - A996

Product Index / A997 - DT75xx

Product Index / DT8031 - N8033

Product Index / N8034 - V1743

Product Index / V1751 - ZEUS

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