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.

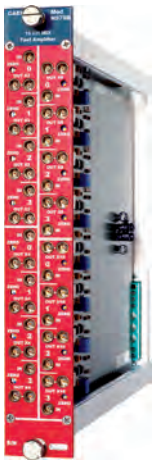
Channels are bipolar, non-inverting. Channels can be cascaded in order to obtain larger gain values. Input bandwidth is 250 MHz for signals up to 50 mVpp and decreases for larger ones (up to 130 MHz @ 300 mVpp).

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.

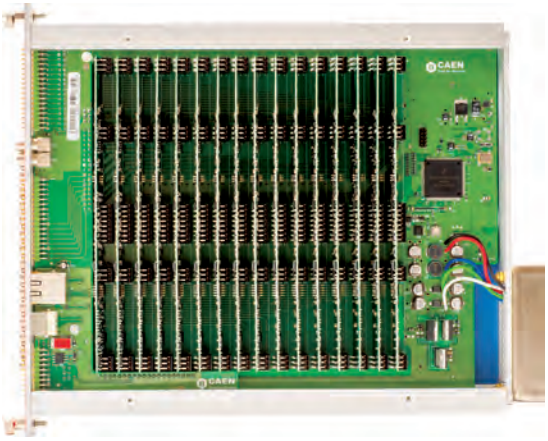
Code	Description
WN968XAAAAAA	N968 - Spectroscopy Amplifier

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

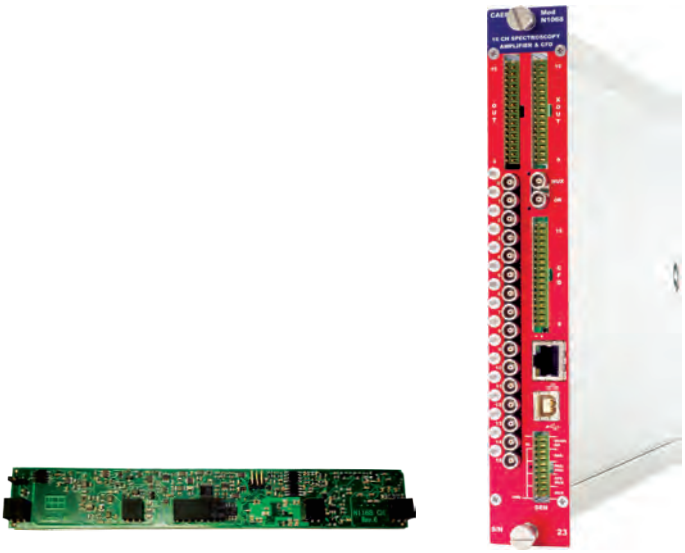
CSA CAEN | CAEN HV Wrapper | FREE

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

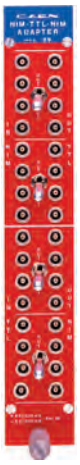
N108A
Dual Delay

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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YEARS OF INNOVATION
1979-2019