N1168

16 ch Fast Scintillator Programmable Signal Processor and 16 ch CFD

NIM	16	2 ÷ 512
Package	No. of Channels	Gain

The CAEN N1168 is a one-unit-wide NIM module combining a 16-channel programmable fast/slow signal processor with a 16-channel constant fraction discriminator (CFD) for scintillator detectors. It provides independent SLOW integration and FAST/AUX peak outputs, with three programmable shaping times and independent 2-bit coarse and 8-bit fine gain. Inputs are hardware-selectable positive or negative. Each CFD channel offers 12-bit programmable threshold, five crossing delays, programmable delay and width, and automatic walk compensation. ECL CFD, OR, multiplicity and pile-up rejection outputs are provided.

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Overview

Product Highlights

- 16 channels in a one unit wide NIM module
- Fast Scintillator application
- Completely programmable via USB, RS485 and Ethernet
- 2 bit Coarse Gain and 8 bit Fine Gain, independent for Slow and Fast/Aux output
- ECL CFD output, with Delay and Width Individually programmable
- CFD Threshold Individually programmable with 12 bit resolution
- OR output with individual channel enabling
- Multiplexed Slow, Fast/Aux and CFD output
- Pile-up rejector
- Fast – Slow signal discrimination
- Positive or negative inputs, hardware selectable
- 3 Programmable shaping time per channel
- Automatic DC Restorer for Fast/Aux and Slow output
- CFD Crossing Delay hardware settable in 5 steps
- CFD walk automatically adjusted
- Multiplicity output
- Multiplicity trigger output

Product Description

AT A GLANCE	
Package	**NIM**
No. of Channels	**16**
Gain	**2 ÷ 512**
Coupling	**DC**
Shaping	**Gaussian type**
Input Impedance (Ω)	**50**

The CAEN **Mod.N1168** is suitable for several type of scintillator detectors, particularly where 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 BaF2 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 overcomes the inconveniences of the standard approach with two gates and QDC setup.

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Overview (continued)

The board has two outputs for each input channel, where the first output is proportional to the integration charge (called SLOW output), and the second is proportional to the signal amplitude (called FAST output). The latter gives information of the shape of the input pulse, thus giving information to perform pulse shape discrimination with detectors that have a different response to particles, like gamma-neutrons.

For scintillator detectors with a single light component, the AUX output, that is a second slow output, can be used as a second total energy signal, meeting the requirements of dual energy range experimental setups, avoiding the split of the signal on two shaping amplifiers.
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 matches the requirements of the new class of high energy resolution scintillators (LaBr3), over a large energy dynamics applications range, and also in a very low discrimination level.

A software tool that allows an easy management of all the functional parameters of the CAEN Spectroscopy Amplifiers is available too; supported operating systems are Windows and Linux.

(Designed in collaboration with INFN Milano).

Technical Specifications

Packaging	One unit wide NIM unit
Power requirements	1.7 A @ +6V; 2.5 A @ -6V; 400 mA @ +12V; 220mA @ -12V
Input	Positive or negative pulses, max. amplitude of ±3V, 50 Ω impedance. Input polarity jumper selectable
Slow OUT	Unipolar gaussian; dynamic range 0 ÷ +8V max (on 1MΩ), 50 Ω back termination; offset adjust: -400 ÷ +400 mV; 8-bit resolution; common to all channels
Fast/Aux OUT	Unipolar gaussian; dynamic range 0 ÷ +8V max (on 1MΩ), 50 Ω back termination; offset adjust: -400 ÷ +400 mV; 8-bit resolution; common to all channels
CFD OUT	
Diff. ECL output; width 50÷1150 ns, 5 bit adjustable	
MUX	
Output, on LEMO connector and on double row connector; options: Slow, Fast/Aux selectable, disabled; 0÷+8V max (on 1MΩ); 50Ω output impedance; high impedance when disabled. N.B. MUX out are attenuated by ~0.5 factor versus SLOW & FAST/AUX OUT; when used, they must be terminated on HIGH impedance	
OR	Logical OR of the CFD Output, on LEMO connector, standard NIM output, width 145÷1250 ns, 5 bit adjustable. Individually Enabled
MUX CFD	
CFD out of channel with MUX enabled. Std. NIM output on double row connector	

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MUL

Multiplicity out: analog sum of CFD OUT, -800µA output per hit; -40mV on 50 Ω

MUL DISC

Standard NIM output on double row connector; Multiplicity Trigger Discriminator (Time over threshold) with Programmable Threshold.

Gain	Product of coarse and fine gain setting. Coarse: 4-step adjustable (nominal: 1x, 4x, 16x, 64x); Fine: 0 ÷ 191 steps adjustable. Total range: 2.3÷312 for Negative inputs. With positive inputs, all values are halved
Shaping time	Slow Out-AUX: 0.2, 0.4, 0.8 µs; Fast Out: 0.2, 0.4 µs
Integral non linearity	t.b.d
FAST-SLOW Crosstalk	<-50 dB measured on FAST OUT, induced by SLOW OUT on same channel
Slow equivalent Input Noise	< 92 µV (Gain=100x; (0.2 µs shaping time)
Fast equivalent Input Noise	< 135 µV (Gain=100x; (0.2 µs shaping time)
FAST-SLOW rejection	< 30 dB
CFD Threshold	0 ÷ 4095 mV; 1mV step (12 bit resolution)
CFD Zero Crossing Delay	Selectable by jumper (5 steps): 1.5ns, 3ns, 4.5ns, 6ns, 7.5ns
Delay on CFD ECL Output	Range: (20ns – 1100 ns) 5-bit resolution, individually programmable and disable
Pile-up rejection	Individually selectable; when a pile-up event occurs within 3T output saturation is forced
CFD Threshold	0 ÷ 4095 mV (12 bit resolution)
CFD Zero Crossing Delay	Selectable by jumper (5 steps): 1.5ns, 3ns, 4.5ns, 6ns, 7.5ns
Delay on CFD ECL Output	Range: (20ns – 1100 ns) 5 bit resolution, individually programmable and disabled

Interfaces

- USB: USB B type female connector; USB 2.0 compliant
- ETH: 10/100 Base-T female connector; TTL signals (TCP/IP)
- RS485 on 10+10 pin header General I/O

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Ordering Information

ORDERING CODE	DESCRIPTION
WN1168XAAAAA	N1168 – 16 Ch Fast Scintillator Programmable Signal Processor and 16 ch CFD

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

Accessories

A385 — Adapter 2.54mm 34-pin female to 16x LEMO 00 female (or MCX male) – 50 cm / 1 m

A952 — Cable assembly 2.54mm 34 pin female to 2.54mm 34 pin female - 50 cm

Related Products

N1068 — 16 ch Programmable Spectroscopy Amplifier and 16ch CFD

N6741 — 32 Ch Peak Sensing ADC

NIM8302 — 5U 10 slot 150 W Compact Crate

NIM8302P — 5U 5 slot 150 W Portable Crate

NIM8303 — 5U 12 slot 300/600 W Crate

NIM8304 — 7U 12 slot smart fan unit Switching 2000 W Crate

NIM8305 — 2 Slot Switching 450 W Mini Crate

NIM8306 — 2 Slot Switching 750 W Mini Crate

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