

Model 2111 Timing Filter Amplifier

Features

- Wide gain range: 1.5 to 200
- Independent integration and differentiation
- Complementary transconductance output
- ≤ 8 ns rise time (typically 6 ns)
- Ultra low noise
- Pole/Zero cancellation
- Preamp power output

Applications

- Timing with Ge and NaI detectors
- General purpose wideband signal conditioning
- Signal to noise ratio optimization
- Ultra high count rate energy spectroscopy
- Rise time normalization

Description

The Model 2111 Timing Filter Amplifier is a wideband, pulse shaping amplifier designed to enhance timing analysis. By adjusting the time constant settings, the user can optimize pulse shape and slope-to-noise ratio when making timing measurements. The Model 2111 can also serve as a wideband or variable bandwidth general purpose amplifier and as a shaping amplifier for high rate energy spectroscopy applications.

When used in a timing system, the Model 2111 will enhance performance of moderate (NaI) to slow (HPGe) speed radiation detectors. The ± 5 V output capability into a 50 Ω load makes the unit ideally suited to drive constant fraction discriminators such as the Model 2126. The selectable 50/100 Ω input impedance and a preamp power connector on the rear of the unit allow operation with a variety of preamps and detectors.

The gain of the Model 2111 spans the range from 1.5 to 200, using four coarse gain settings and a fine gain control for continuous coverage. The 2111's output stage is fully complementary and can drive both positive and negative unipolar pulses or bipolar pulses into 50 Ω . A front panel toggle switch is provided to select inverted or non-inverted output polarity. Independent integrate and differentiate controls allow flexible control of shaping with selection of time constants between 10 ns and 500 ns. With integrate and differentiate controls set in the Out position, wideband rise time is less than 8 ns with a Differentiate time constant greater than 150 μ s. Pole/Zero cancellation overload recovery and high count rate performance for any Differentiate setting.

The flexible control of pulse shaping, the speed, and the wide dynamic range of the Model 2111 make it ideal for use in timing spectroscopy and other laboratory applications.

Specifications

INPUTS

- INPUT – Accepts positive or negative pulses or continuous signals from a detector, preamplifier, or other source; ac coupled; $Z_{in} = 50$ or 100 Ω for frequencies over 200 Hz, internal jumper selectable; dc input resistance ≈ 10 k Ω ; maximum input = ± 5 V divided by the amplifier gain, for linear output; protected to ± 11 V ac, peak; 9 V ac, RMS; ± 30 V dc.

OUTPUTS

- OUTPUT – ± 5 V into 50 Ω ; short circuit proof; current output requires an external 50 Ω load.



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CONTROLS

- COARSE GAIN – Rotary switch selects X3, X10, X30 or X100 gain.
- FINE GAIN – Single-turn potentiometer; range X0.5 to X2.
- POLARITY – Toggle switch selects INVerted or NON-INVerted OUTPUT polarity.
- DIFFERENTIATE – Rotary switch selects OUT (no time constant), or 10, 20, 50, 100, 200 or 500 ns shaping; decay time in OUT position $\approx 160 \mu\text{s}$.
- INTEGRATE – Rotary switch selects OUT (no time constant), or 10, 20, 50, 100, 200 or 500 ns shaping; amplifier time constant in OUT position $\approx 4 \text{ ns}$.
- P/Z – Twenty-turn screwdriver adjustable potentiometer cancels $20 \mu\text{s}$ to ∞ preamp time constants.

PERFORMANCE (with 50 Ω load)

- GAIN – X1.5 to X200.
- RISE TIME – $\leq 8 \text{ ns}$ (typically 6 ns) with both shaping controls OUT or 2.2 times the selected INTEGRATE time constant.
- NOISE – $\leq 10 \mu\text{V}$ with 200 ns INTEGRATE and DIFFERENTIATE time constants selected; $\leq 50 \mu\text{V RMS}$, referred to input with filter OUT.
- BANDPASS – 1 kHz to 45 MHz with both shaping controls OUT.
- NONLINEARITY – $\leq \pm 1\%$ integral.

- OVERSHOOT – $\leq 10\%$ with INTEGRATE OUT; $\pm 2\%$ with INTEGRATE time constant selected.
- GAIN DRIFT – $< 0.1\%/^{\circ}\text{C}$.
- DC DRIFT – $< 25 \mu\text{V}/^{\circ}\text{C}$.
- OUTPUT OFFSET – $\leq 3 \text{ mV}$.

CONNECTORS

- SIGNAL – INPUT and OUTPUT connectors are BNC type.
- PREAMP POWER – Amphenol type 17-10070; rear panel.

POWER REQUIREMENTS

+24 V dc – 55 mA +12 V dc – 170 mA*
 -24 V dc – 80 mA -12 V dc – 150 mA

*This exceeds the normal Bin power allotment of 167 mA for a single width module.

PHYSICAL

- SIZE – Standard single-width NIM module; 3.43 x 22.12 cm (1.35 x 8.71 in.) per DOE/ER-0457T.
- NET WEIGHT – 0.9 kg (2.0 lb).
- SHIPPING WEIGHT – 1.8 kg (4.0 lb).

ENVIRONMENTAL

- OPERATING TEMPERATURE – 0 to 50 $^{\circ}\text{C}$.
- OPERATING HUMIDITY – 0 to 80% relative, non-condensing. Meets the environmental conditions specified by EN 61010, Installation Category I, Pollution Degree 2.

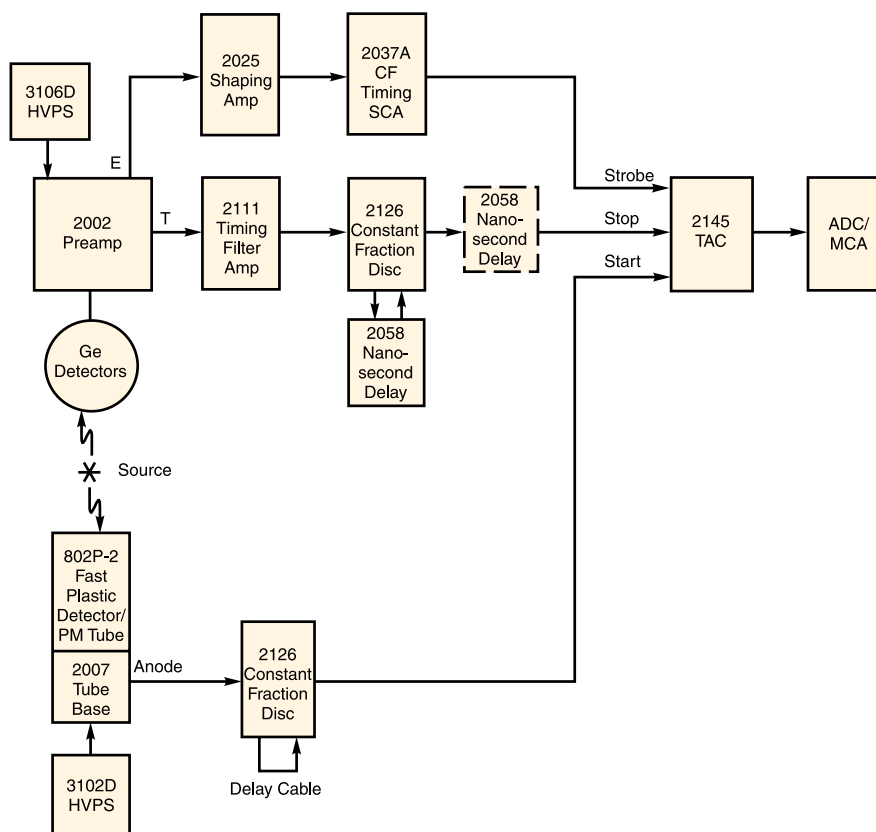


Figure 1
Timing with an HPGe Detector

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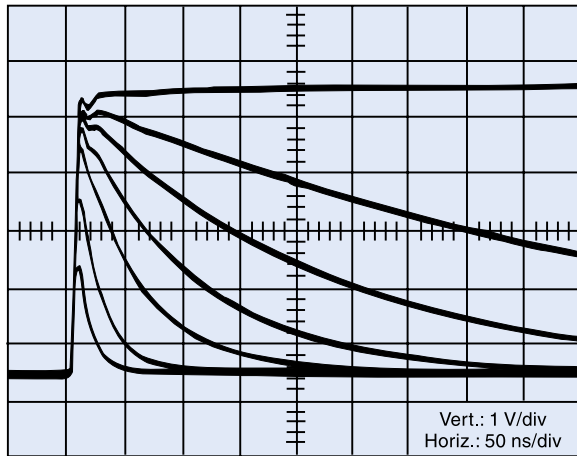


Figure 2a
Differentiation with Integration OUT
Differentiation set at OUT, 10, 20, 50, 100, 200 and 500 ns

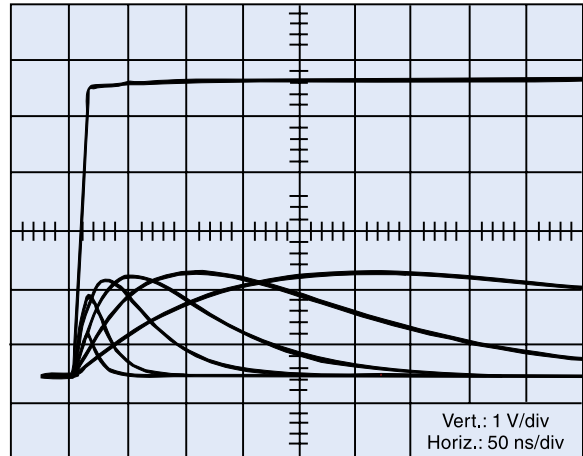


Figure 2c
Identical Integration and Differentiation settings
Controls set at OUT, 10, 20, 50, 100, 200 and 500 ns

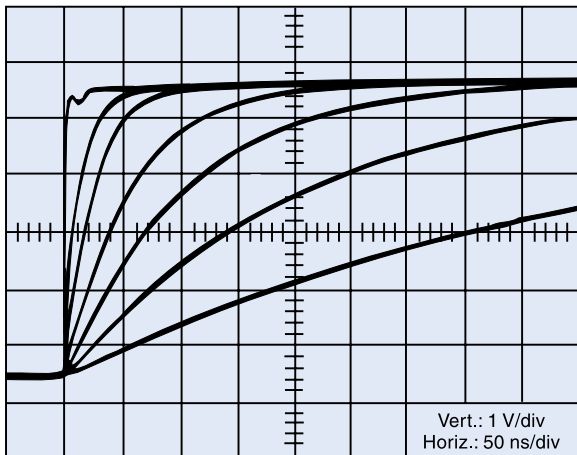


Figure 2b
Integration with Differentiation OUT
Integration set at OUT, 10, 20, 50, 100, 200 and 500 ns

