CANBERRA

Features

- Six front panel selectable shaping time constants
- Noise ≤4.0 µV RMS referred to input, gain ≥100 and 2 µs shaping
- Drift ≤±10 µV dc/°C
- Active baseline restorer for optimum performance

Model 2022 Spectroscopy Amplifier

Description

The Model 2022 Spectroscopy Amplifier offers excellent resolution performance in a low cost, single width NIM module. CANBERRA's well known filter shaping provides improved pulse symmetry, minimum sensitivity of output amplitude to variations in detector rise time, and maximum signal to noise ratio. Unipolar shaping is achieved with one differentiator and two active filter integrators. The differentiator is placed early in the amplifier to insure good overload recovery. The integrators are placed late to minimize noise contribution from the gain stages. The amplifier offers six front panel selectable pulse shaping time constants: 0.5, 1, 2, 4, 8 and 12 µs.

The Model 2022 employs CANBERRA's unique baseline restorer for optimum performance with high resolution detector systems. The gated baseline restorer automatically adjusts the restoration rate and threshold optimizing performance to the incoming count rate and system noise level.

Simultaneous unipolar and bipolar outputs are available at both front and rear panel BNC connectors. The unipolar signal is used for spectral analysis. The bipolar output can be used for counting, timing, or gating.

The Model 2022 solid dc stability and low noise to provide a high performance spectroscopy amplifier in a single width NIM module.

Specifications

INPUTS

- INPUT – Accepts positive or negative pulses from an associated preamplifier; amplitude: ±10 V divided by the selected gain for linear response; ±12 V maximum; rise time: less than SHAPING time constant; decay time constant; 40 µs to ∞ for 0.5, 1, 2, 4 and 8 µs shaping time constants, 100 µs to ∞ for 12 µs shaping time constant; Z_{in} ≈ 1 kΩ; front and rear panel BNC connectors.

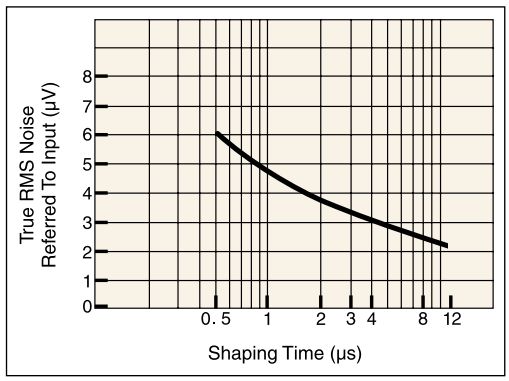

Figure 1
Typical Unipolar Output True RMS Noise (referred to input for gain of 100) vs. Shaping Time Constant

OUTPUTS

- UNIPOLAR OUTPUT – Provides positive linear active-filtered near-Gaussian shaped pulses; amplitude linear to +10 V, 12 V max.; dc restored; output dc level factory calibrated to 0±5 mV, front panel Z_{out} <1 Ω or ≈ 93 Ω, internally selectable; rear panel Z_{out} ≈ 93 Ω; short circuit protected; front and rear panel BNC connectors.

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- BIPOLAR OUTPUT – Provides prompt positive lobe leading linear active-filtered bipolar-shaped pulses; amplitude linear to +10 V, 12 V max., negative lobe is approximately 70% of positive lobe; dc coupled; output dc level ±25 mV; front panel Z_{out} <1 Ω or ≈ 93 Ω, internally selectable; rear panel Z_{out} ≈ 93 Ω; short circuit protected; front and rear panel BNC connectors.

FRONT PANEL CONTROLS

- COARSE GAIN – Rotary switch selects gain factors of X10, X30, X100, X300, X1000 and X3000.
- FINE GAIN – Ten-turn locking-dial precision potentiometer selects variable gain factor of X0.3 to X1.3; resetability ≤0.03%.
- INPUT POLARITY – Toggle switch selects the polarity of the incoming preamplifier signal.
- P/Z – Multi-turn screwdriver adjustable pole/zero potentiometer optimizes amplifier baseline recovery and overload performance for the preamplifier fall time constant and the 2022's pulse shaping chosen; 40 µs to ∞ for 0.5, 1, 2, 4 and 8 µs SHAPING time constants, 100 µs to ∞ for 12 µs SHAPING time constant.
- SHAPING TIME – Rotary switch provides 0.5, 1, 2, 4, 8 and 12 µs basic shaping time constants.

INTERNAL CONTROLS

- UNIPOLAR Z_{out} – Jumper plug provides Z_{out} ≤1 Ω or ≈ 93 Ω for the front panel UNIPOLAR output. Shipped in the ≤1 Ω position.
- BIPOLAR Z_{out} – Jumper plug provides Z_{out} ≤1 Ω or ≈ 93 Ω for the front panel BIPOLAR output. Shipped in the ≤1 Ω position.
- L/E – Jumper plug selects a linear or exponential restorer response. Shipped in the L (linear) position.

PERFORMANCE

- GAIN RANGE – Continuously variable from X3 to X3900, product of COARSE and FINE GAIN controls.
- GAIN DRIFT – ≤±0.0075%/°C.
- DC LEVEL DRIFT – UNIPOLAR output: ≤±10 µV/°C; BIPOLAR OUTPUT: ≤±50 µV/°C.
- INTEGRAL NON-LINEARITY – ≤±0.05%, over total output range for 2 µs shaping.
- CROSSOVER WALK – BIPOLAR output: ≤±3 ns for 50:1 dynamic range and 2 µs shaping when used with CANBERRA Model 2037A Edge/Crossover Timing Single Channel Analyzer.
- OVERLOAD RECOVERY – UNIPOLAR (BIPOLAR) output recovery to within ±2% (1%) of full scale output from X1000 overload in 2.5 (2.0) non-overloaded pulse widths, at full gain, any shaping time constant and pole/zero cancellation properly set.
- NOISE CONTRIBUTION – ≤4.0 µV true RMS UNIPOLAR (7.1 µV BIPOLAR) output referred to input, 2 µs shaping and amplifier gain ≥100.
- PULSE SHAPING – Near-Gaussian shape; one differentiator (two for bipolar), two active filter integrators; UNIPOLAR time to peak: 2.35X shaping time; pulse width: 7.3X shaping time BIPOLAR time to crossover: 2.8X shaping time, time to peak, pulse width and crossover times measured at 0.1% of full scale output; 1 µs SHAPING center frequency: 150 kHz; band width: 180 kHz; fc and BW for other shaping are multiples of that given for 1 µs.

- RESTORER – Active gated.
- SPECTRUM BROADENING – The FWHM of a ^{60}Co 1.33 MeV gamma peak for an incoming rate of 2 kcps to 100 kcps and a 9 V pulse height will typically change <14% for 2 µs shaping. These results may not be reproducible if associated detector exhibits an inordinate amount of long rise time signals.
- COUNT RATE STABILITY – The peak position of a ^{60}Co 1.33 MeV gamma peak for an incoming count rate of 2 kcps to 100 kcps and a 9 V pulse height will typically shift <0.024% for 2 µs shaping.

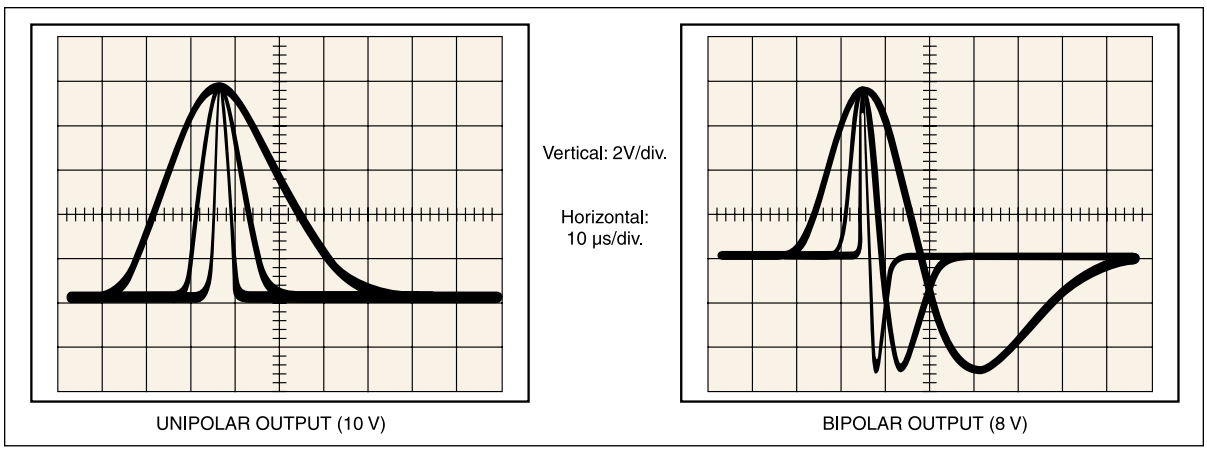

Figure 2
Model 2022 Shaping Selected for 12, 4 and 1 µs

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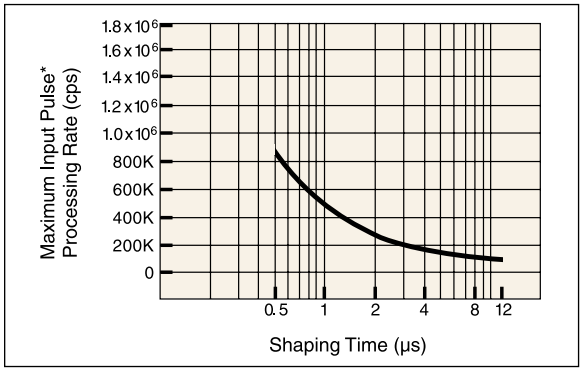

Figure 3
Typical Maximum Input Pulse Processing Rate vs. Shaping Time Constant

CONNECTORS

- All signal connectors are BNC type.
- PREAMP POWER – Rear panel, Amphenol type 17-10070.

POWER REQUIREMENTS

+24 V dc – 125 mA +12 V dc – 75 mA
–24 V dc – 150 mA –12 V dc – 65 mA

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 – 1.9 kg (4.1 lb).

ENVIRONMENTAL

- OPERATING TEMPERATURE – 0 to 50 °C.
- OPERATING HUMIDITY – 0-80% relative, non-condensing.
- Meets the environmental conditions specified by EN 61010, Installation Category I, Pollution Degree 2.