



SIGNAL PROCESSING

2026

Spectroscopy Amplifier

The 2026 amplifier provides the features and performance of a research amplifier in an easy to use single width NIM module.



FEATURES

- Gaussian/Triangular shaping
- Super fine gain control
- Pileup rejector and live time corrector
- Automatic baseline recovery rate and threshold
- Differential input
- Excellent overload recovery
- Compact single width NIM

DESCRIPTION

The Model 2026 amplifier provides the features and performance of a research amplifier in an easy to use single width NIM module. Now you can have the flexibility you need without the amplifier set-up and adjustment aggravation you don't need.

The 2026 unit lets you select either Gaussian or Triangular pulse shaping for the Unipolar output with a convenient front panel switch. In addition, it offers a choice of six front panel switch-selectable shaping time constants for each of the pulse shaping methods. This direct control of both the shaping method and time constants lets you select the configuration that will optimize resolution and throughput performance based on your application.

The 2026 unit's Pileup Rejector/Live Time Corrector (PUR/LTC) circuitry allows quantitative gamma analysis with minimal dependence on system count rate. The PUR circuit interrogates incoming pulses for pile up and generates a signal that prevents the ADC from converting the piled up events. The LTC circuit then generates a system dead time that extends the collection time to compensate for the events lost due to pileup rejection. The result: lower background, better resolution and accurate live time information for the best possible analysis results.

But don't worry about setting up this amplifier. Many of the 2026 unit's features are self-adjusting so you get the performance you need and a trouble-free setup. The 2026 amplifier automatically adjusts the PUR threshold just above your system noise level, insuring PUR efficiency and minimizing the spectral distortion caused by pile up at high count rates. The restoration rate and threshold of the gated baseline restorer are also automatically optimized for both low and high count rate applications. With all these automatic features the 2026 unit gives you consistently better data for your activity calculations, regardless of the count rate, the application or the operator.

The 2026 amplifier lets you position peaks precisely and easily with its Super Fine Gain (SFG) control. The SFG provides gain resolution better than 1 in 16 000 (0.00625%), allowing greater precision for more accurate peak location in less time. This feature is now a requirement, instead of a luxury, for most spectroscopy systems. This is especially true in applications using detector arrays in which the inputs from several detectors must be combined into a single spectrum.

The excellent overload recovery characteristics of the 2026 unit make it ideal for use with today's high throughput reset preamplifiers such as the Mirion 2101 Transistor Reset Preamplifier. This allows you to assemble a high resolution spectroscopy system without the energy rate limitations normally associated with RC preamplifiers.

The Model 2026 unit's wide gain range allows you to use it with a wide range of detectors including germanium, silicon, scintillation, proportional counters or pulsed ion chambers. The versatility of the 2026 amplifier is further enhanced by a bipolar output for use in timing and gating applications.

SPECIFICATIONS

Inputs

- Input (Front Panel): BNC connector accepts positive or negative tail pulses from an associated preamplifier; amplitude ± 10 V divided by the selected gain, ± 25 V maximum; rise time: less than shaping time constant; decay time constant: $40 \mu\text{s}$ to ∞ ; polarity set with the POLARITY switch. Z_{in} changes with COARSE GAIN and POLARITY settings, $2.1 \text{ k}\Omega > Z_{in} > 0.5 \text{ k}\Omega$; front panel BNC connector
- Input (Rear Panel): BNC connector is wired in parallel with the front panel INPUT BNC when the internal NORM/DIFF slide switch is set to NORM; functionality and specification are the same as the front panel INPUT BNC; with the DIFF mode selected the rear panel BNC accepts a preamplifier ground reference. Z_{in} changes with COARSE GAIN and POLARITY settings, $2.1 \text{ k}\Omega > Z_{in} > 0.5 \text{ k}\Omega$; front panel BNC connector
- Inhibit: Accepts a standard TTL logic signal from associated reset preamplifier; used to extend the Dead Time signal, inhibit and reset the pileup rejector during the preamplifier's reset cycle; positive true or negative true signal polarities, internally selectable; Loading: $5.2 \text{ k}\Omega$ resistor connected to +5 V for positive true or ground for negative true; rear panel BNC connector

- LG (Linear Gate): Accepts a standard TTL Logic signal from associated Mirion ADC. Indicates to the 2026 unit that the ADC is acquiring an event; logic low during ADC acquire, returns high at conclusion; loading: $4.7 \text{ k}\Omega$ pull up resistor to +5 V; accessible through pin 1 of the rear panel PUR connector

Outputs

- UNI: Provides positive, linear actively filtered shaped pulses; amplitude linear to +10 V, 12 V max.; dc restored; output dc level factory calibrated to 0 ± 5 mV; front panel $Z_{out} < 1 \Omega$ or 93Ω , internally selectable; rear panel Z_{out} is 93Ω ; short circuit protected; front and rear panel BNC connectors
- BI: Provides prompt positive lobe leading linear active filter bipolar shaped pulses; amplitude linear to +10 V, 12 V max., negative lobe is approximately 70% of positive lobe; dc coupled; output dc level $< \pm 10$ mV; front panel $Z_{out} < 1 \Omega$ or 93Ω ; internally selectable; rear panel Z_{out} is 93Ω ; short circuit protected; front and rear panel BNCs
- DT/BSY: Rear panel BNC with two functions: Dead Time or Busy Time, internally selected; TTL output with $1 \text{ k}\Omega$ pull up resistor through a 47Ω series resistor
 - DT: Provides a negative true TTL logic signal and when ORED with ADC dead time, provides Live Time correction for the amplifier and pileup rejector. Operational only with PUR/LTC invoked by installation of the C1514 PUR/LTC cable between the amplifier and the ADC
 - BSY: Provides a negative true TTL logic signal that represents the amplifier busy time; logic low during amplifier processing time or from external INHIBIT
- Reject: Provides a positive true TTL logic signal that is used to initiate an ADC reject sequence. Operational only with PUR/LTC invoked by installation of the C1514 PUR/LTC cable between the 2026 amplifier and the ADC. REJECT is set true for piled up events (determined by the 2026 unit), negative unipolar output signals that exceed -500 mV and while the rear panel INHIBIT is true. REJECT provides TTL output with a $1 \text{ k}\Omega$ pull up resistor through 47Ω series resistor; accessible through pin 2 of the rear panel PUR connector
- ICR (Incoming Count Rate): Provides a standard TTL logic signal corresponding to input count rate; disabled by INHIBIT; positive true; width nominally 150 ns , TTL output with $1 \text{ k}\Omega$ pull up resistor through 47Ω output resistor; rear panel BNC connector

Front Panel Controls and Indicators

- Coarse gain: Eight-position rotary switch selects gain factors of X5, X10, X20, X50, X100, X200, X500, and X1000
- Fine gain: Ten-turn locking dial precision potentiometer selects variable gain factor of X0.5 to X1.5; resetability 0.03%
- SFG (Super Fine Gain): Multi-turn screwdriver potentiometer adjusts fine gain; resolution better than 0.00625% (1 in 16 000); adjustment range: 1% of the FINE GAIN RANGE
- P/Z: Multi-turn screwdriver adjustable pole/zero matching potentiometer optimizes amplifier baseline recovery and overload performance for the preamplifier's fall time constant and the amplifier's chosen shaping time; range: $40 \mu\text{s}$ to ∞
- Mode: Two-position toggle switch selects semi-triangular or semi-Gaussian pulse shaping for the unipolar (UNI) output
- Shaping time: Six-position rotary switch provides 0.5, 1, 2, 4, 6 and $12 \mu\text{s}$ shaping time constants
- Limit: Momentary pushbutton switch clamps the UNI signal to approximately ± 300 mV, which minimizes oscilloscope overload for precise P/Z adjustment
- Polarity: Two-position toggle switch selects positive or negative input polarity to match the incoming preamplifier signal polarity
- PUR Accept/Reject: Multi-color green/yellow/red LED indicates pile up status when PUR is selected. Appears green for approximately up to 40% of pulses rejected, yellow for 40-70%, and red for 70% and above

Internal Controls and Jumpers

- Normal/Differential: Two-position slide switch selects rear panel INPUT BNC for DIFFERENTIAL input ground reference
- CM Bal: Multi-turn potentiometer equalizes the NORM and DIFF input gains to maximize the common-mode noise rejection; operates only in DIFF mode
- Restorer mode: Two-position internal jumper selects SYMMetrical or ASYMMetrical baseline restorer modes

Connectors

- With the exception of the PUR and PREAMP POWER connectors, all signal connectors are BNC type
- PUR: Rear panel Molex plug 03-06-1031
- Preamp power: Rear panel, Amphenol, type 17-10070

Performance

- Gain range: Continuously variable from X2.5 to X1500
- Temperature coefficients: UNIpolar: Gain – 0.005%/°C, dc level – $\leq \pm 7.5 \mu\text{V}/^\circ\text{C}$; BIpolar: Gain – $\leq \pm 0.007\%/^\circ\text{C}$, dc level – $\leq \pm 30 \mu\text{V}/^\circ\text{C}$
- Integral nonlinearity: $\leq \pm 0.04\%$ over total output range for 2 μs shaping
- Crossover walk: BIpolar output: $\leq \pm 3 \text{ ns}$ for 50:1 dynamic range and 2 μs shaping when used with Mirion Model 2037A Edge/Crossover Timing SCA
- Overload recovery: UNIpolar (BIpolar) output recovers to within $\pm 2\%$ (1%) of full scale output from X1000 overload in 2.5 (2.0) non-overloaded pulse widths at full gain, at any shaping time constant, and with P/Z properly set
- Noise contribution: $\leq 4.5 \mu\text{V}$ (7.0 μV) true RMS, UNIpolar (BIpolar) output referred to input, 2 μs shaping, and amplifier gain ≥ 100
- Pulse shaping: Near-Gaussian or near-triangular shape; one differentiator (two for bipolar); three active filter integrators realizing eight-pole shaping network; shaping time parameters referenced to 1 μs are listed in following table:

Parameter	Shaping Time Multiplier		
	Triangular	Gaussian	Bipolar
Time to peak	2.7	2.9	2.3
0.1% full scale output to peak	2.5	2.2	
Pulse width at half maximum	2.5	2.1	1.4
Pulse width at tenth maximum	5.6	5.0	
Pulse width at 1/100 maximum	6.7	6.2	
Bipolar crossover/Unipolar peak delay			0.8

- Restorer: Active gated. Restorer rate and threshold are set automatically by internal circuits
- Spectrum broadening: The FWHM of ^{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 change less than 6% for 2 μs Gaussian shaping, ASYM restorer mode, and with P/Z properly set. These results may not be reproducible if the 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 less than 0.02% for 2 μs Gaussian shaping, ASYM restorer mode, and with P/Z properly set
- Common mode rejection: 60 dB at 60 Hz; 20 dB at 1 MHz

Pileup Rejector/Live Time Corrector

- PUR: (Pileup Rejector) Enabled when the C1514 PUR/LTC cable is connected; disconnect C1514 cable to disable
- Pulse pair resolution: $\leq 500 \text{ ns}$
- Minimum detectable signal: Limited by detector/preamp noise characteristics
- Pur threshold: Threshold set automatically by internal circuit

Power Requirements

- +24 V dc – 110 mA +12 V dc – 220 mA
- –24 V dc – 130 mA –12 V dc – 160 mA
- These current requirements exceed the normal single-width Bin allotment of 167 mA for 12 V and 83 mA for 24 V

Accessories

- C1514 PUR/LTC and DT cable set

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: 1.0 kg (2.2 lb)
- Shipping weight: 1.9 kg (4.2 lb)

Environmental

- Operating temperature: 0 to 50 °C
- Operating humidity: 0 to 80% relative, non-condensing
- Meets the environmental conditions specified by EN 61010, Installation Category I, Pollution Degree 2

