



Innovator In Spectroscopy Equipment

TIME TO AMPLITUDE CONVERTER MODEL TAC2038



NUCLEAR INSTRUMENTS MODULE



Innovator In Spectroscopy Equipment

TIME TO AMPLITUDE CONVERTER MODEL TAC2038

Features:

- Usable time range: 10 ns to 1 ms (2ms optional)
- 15 ranges of Time-to-Amplitude Conversion
- Valid Start and Valid Conversion outputs
- Selectable output delay and width
- Output synchronized with a stop or external strobe signal
- Provision to reject unwanted start input signals
- Positive or negative input signals

Description:

The Model 2038 Time-to-Amplitude Converter generates a rectangular output pulse whose peak amplitude is linearly proportional to the time interval between a START and STOP input pulse pair. The Model 2038 is flexible for your nuclear timing analysis needs. The basic Time-to-Amplitude Conversion (TAC) analyzes the time relationships between random events, such as nuclear decay, that occur within a selected interval of time. The Model 2038 is ideal for time of flight, positron lifetime, pulse shape analysis in particle studies, and pulse pair timing in position-sensitive detector systems. To meet these needs, the Model 2038 offers 15 time ranges from 10ns to 1ms (2m opt). The positive unipolar TAC output is essentially flat topped for accurate measurement by an analog-to digital converter (ADC).

The Model 2038's start input can be inhibited by a pulse or a dc level at the rear-panel Gate Input connector. Valid Start and Valid Conversion outputs are provided for each accepted start and stop input, respectively. The duration of the Valid Start output indicates the interval from the accepted start until the end of reset. The Valid Conversion output occurs from the end of the internal delay after stop to the end of reset. The selectable TAC output width and variable delay, which are easily adjusted, further serve to make the Model 2038 a flexible instrument, easily adapted into many time spectroscopy systems. The output of the TAC may be synchronized with the stop signal or an external strobe signal to further enhance its versatility. The Model 2038 is dc-coupled and gated so that input count rates will not paralyze or otherwise hinder normal operation. The TAC output should be connected to the dc-coupled input of a multichannel analyzer for optimum high-count-rate performance.





Innovator In Spectroscopy Equipment

TIME TO AMPLITUDE CONVERTER MODEL TAC2038

Specifications:

Inputs

- All four inputs listed below are dc-coupled, edge triggered, and printed wiring board (PWB) jumper selectable to accept either negative or positive NIM standard signals. Input impedance is 50Ω in the negative position and $>1k\Omega$ in the positive position. The threshold is nominally -400 mV in the negative position and $+2\text{ V}$ in the positive position.
- Strobe: Front-panel BNC connector provides an external means to strobe a valid output signal from the TAC in the Ext Strobe mode. The input signal, exceeding threshold within the Ext Strobe reset interval after the Stop input, initiates the read cycle for the linear gate to the TAC output. Factory-set in the positive input position. Ext Strobe reset interval has a minimum value of $\sim 0.5\text{ }\mu\text{s}$ and a maximum value of nominally $10\text{ }\mu\text{s}$.
- Start: Front-panel BNC connector initiates time conversion when Start input signal exceeds threshold. Factory-set in the negative input position.
- Stop: Front-panel BNC connector terminates time conversion when Stop input signal exceeds threshold. Factory-set in the negative input position.
- Gate: Rear-panel BNC connector provides an external means of gating the Start circuitry in either Coincidence or Anticoincidence with the Start input signal. Gate input signal must cross threshold $\geq 10\text{ ns}$ prior to the Start input signal and must overlap the trigger edge of the Start input signal. Factory-set in the positive input position.

Outputs

- **TAC Output:**
 - Front-panel BNC connector provides unipolar pulse.
 - Amplitude 0 V to $+10\text{ V}$ proportional to Start/Stop input time difference.
 - Time End of delay period in Int Strobe mode; prompt with Strobe input in Ext Strobe mode.
 - Width Adjustable by PWB potentiometer from $\leq 1\text{ }\mu\text{s}$ to $\geq 3\text{ }\mu\text{s}$.
 - Impedance $Z_0 < 10\Omega$. Rise Time $\sim 250\text{ ns}$. Fall Time $\sim 250\text{ ns}$.
- **Valid ST:**
 - Rear-panel BNC connector provides NIM-standard slow positive logic level signal.
 - Amplitude Nominally $+5\text{ V}$. Complement signal selectable by PWB jumper.
 - Time and Width From accepted Start input to end of reset.
 - Impedance $Z_0 < 10\Omega$. Rise Time $\leq 50\text{ ns}$. Fall Time $\leq 50\text{ ns}$.





Innovator In Spectroscopy Equipment

TIME TO AMPLITUDE CONVERTER MODEL TAC2038

- **Valid CONV:**

- Rear-panel connector provides NIM-standard slow positive logic level signal to indicate a Valid Conversion.
- Amplitude Nominally +5 V. Complement signal selectable by PWB jumper.
- Time and Width From end of internal delay after Stop to end of reset.
- Impedance $Z_o < 10\Omega$. Rise Time ≤ 50 ns. Fall Time ≤ 50 ns

- **Controls (Front Panel)**

- Range: (ns) Three-position rotary switch selects full scale time interval of 50, 100, or 200 ns between accepted Start and Stop input signals.
- Multiplier: Five-position rotary switch extends time range by a multiplying factor of 1, 10, 100, 1K, or 10K.
- Delay: 20-turn screwdriver-adjustable potentiometer varies the delay of the TAC and SCA outputs from 0.5 μ s to 10.5 μ s, relative to an accepted Stop input signal; operable in the Int Strobe mode only.
- Strobe Mode: Two-position locking toggle switch selects either Internal or External source for initiating the strobe cycle to strobe valid information from the TAC and SCA outputs.
- Start Gate Mode: Two-position locking toggle switch selects Coincidence or Anticoincidence mode of operation for the Start circuitry. Start circuitry is enabled in the Coinc position or inhibited in the Anti position during the interval of a Start Gate input signal.
- Stop Gate Mode: Two-position locking toggle switch selects Coincidence or Anticoincidence mode of operation for the Stop circuitry. Stop circuitry is enabled in the Coinc position or inhibited in the Anti position during the interval of a Stop Gate input signal.
- SCA Window (ΔT): 10-turn precision locking potentiometer sets the SCA upper-level discriminator threshold from 0.05 V to 10.05 V above the Lower Level (T) setting.
- SCA Lower Level (T): 10-turn precision locking potentiometer sets the SCA lower level discriminator threshold from 0.05 V to 10.05 V.
- TAC Inhibit: Two-position locking toggle switch. In the Inhibit position, the TAC output is available only if the output amplitude is within the SCA window. In the Out position, the SCA has no effect on the TAC output.

- **Controls (Rear Panel)**

- Gate Mode: Two-position locking toggle switch selects Coincidence or Anticoincidence mode of operation for the Start circuitry. Start circuitry is enabled in the COINC position or inhibited in the ANTI position during the interval of a Gate input signal.
- Log CURR: Two-position locking toggle switch selects the use of ± 6 V or ± 12 V bin lines to provide current for the internal logic circuitry. In the ± 6 V position, the Model 2038 is within the current allotment for a single NIM width when using a NIM Standard Class V power supply. In the ± 12 V position, the Model 2038 exceeds the current allotment for a single NIM width on the +12 V and -12 V bin lines. However, this position allows the Model 2038 to be used with power supplies not providing +6 V and -6 V.



Innovator In Spectroscopy Equipment

TIME TO AMPLITUDE CONVERTER MODEL TAC2038

• Performance

- Time Resolution-FWHM: $\leq 0.01\%$ of full scale plus 5ps for all ranges
- Temperature Instability: $\leq \pm 0.01\%/^{\circ}\text{C}$ (± 100 ppm/ $^{\circ}\text{C}$) of full scale or ± 10 ps/ $^{\circ}\text{C}$ (whichever is greater), 0 to 50°C
- Differential Nonlinearity: Typically, $< 1\%$ from 10 ns or 2% of full scale (whichever is greater) to 100% of full scale
- Integral Nonlinearity: $\leq \pm 0.1\%$ from 10 ns or 2% of full scale (whichever is greater) to 100% of full scale
- Reset Cycle: Fixed $1.0\mu\text{s}$ for X1 and X10 Multipliers, fixed $5\mu\text{s}$ for X100 Multiplier, and fixed $50\mu\text{s}$ for x1K, and x10K Multipliers Occurs after Over Range, Strobe cycle, or EXT Strobe Reset cycle
- Start-to-Stop Conversion Time: Minimum $\leq 10\text{ns}$
- Input Count: Rate > 30 MHz

Electrical and Mechanical Power Required:

• Typical Power Requirements

- Logic Current Switch $\pm 6\text{V}$; +24 V, 45 mA; +12 V, 95 mA; +6 V, 140 mA; -24 V, 50 mA; -12 V, 140 mA; -6 V, 300 mA.
- Logic Current Switch $\pm 12\text{V}$; +24 V, 45 mA; +12 V, 210 mA; -24 V, 50 mA; -12 V, 405 mA.

• Physical

- Size: NIM-standard single-width module 3.43 X 22.13 cm (1.35 X 8.714 in.) per DOE/ER-0457T.
- Weight: Net 1.5 kg (3.3 lbs.), Shipping Weight 3.0 kg (7 lbs.).

• TAC2038 REV 1.0 90803

