ORTEC®

551
Timing Single-Channel Analyzer

- **Single-channel analyzer and timing signal derivation**
- **Trailing-edge constant-fraction timing provides walk <±3 ns for 100:1 dynamic range**
- **Integral, normal, and window modes**
- **Separate lower-level and upper-level discriminator outputs**
- **DC-coupled**
- **Adjustable delay 0.1 to 11 µs**
- **Provision for external baseline sweep**

The ORTEC Model 551 Timing Single-Channel Analyzer performs the dual functions of single-channel pulse-height analysis and timing signal derivation.

The patented* trailing-edge constant-fraction timing technique provides unexcelled timing on either unipolar or bipolar signals and shows better results than are possible with conventional leading-edge discriminators.

With SCAs that utilize leading-edge timing, the rise time of the input pulses causes degradation of time resolution because the pulses have varying amplitudes.

Constant-fraction timing compensates for varying amplitudes and essentially eliminates this timing shift, giving consistently better timing results.

For the internally set 50% fraction, the output occurs soon after the midpoint on the linear input trailing edge to facilitate gating and accumulation of data at very high input rates. This technique also minimizes timing shift and dead time when used with sodium iodide, silicon, and germanium detectors, thereby allowing better system time resolution and higher counting rates.

The constant-fraction technique makes it possible to realize significant improvements in time resolution in most timing applications. Notice that analysis is made of the main amplifier output. This technique allows optimization of time resolution and extension of dynamic range for neutron-gamma discrimination and other timing applications. Walk of <3 ns for 100:1 dynamic range using input pulses from a pulser is possible.

The Model 551 is versatile, with three basic operating modes provided. In the Window mode, the unit operates as a high-resolution, narrow (0 to 10%) window, single-channel analyzer. For wide-window applications, the Normal mode is used. In this mode the upper-level and lower-level controls are independently variable from 0 to 10 V, and an output is generated for pulses analyzed between the levels. Through use of the separate rear-panel LL Out and UL Out outputs, the unit can operate as a dual wide-dynamic-range integral discriminator for leading-edge timing or for pulse routing.

The dc-coupled input of the Model 551 makes it possible to take full advantage of the baseline restoration of the main amplifier for maximum performance at widely varying counting rates.

The continuously adjustable output delay (two ranges covering 0.1 to 11 µs) makes it possible to align output signals that have actual time differences without a need for additional delay devices or modules. Alternatively an External strobe input can be used to cause an SCA output at the desired time.

For an application where it is desirable to scan an entire spectrum, an external base-line sweep input is provided via the rear-panel LL Ref Ext BNC connector. In this mode of operation, the baseline (lower-level threshold) on which a window is riding is swept through an energy range and the count rate is recorded as a function of energy.

*U.S. Patent No. 3,714,464.

Specifications

PERFORMANCE

DYNAMIC RANGE 200:1.

PULSE-PAIR RESOLVING TIME Output pulse width plus Delay (as selected by the front-panel Delay controls), plus 100 ns for fast NIM output or plus 200 ns for positive NIM output. Minimum resolving time for negative output 220 ns; for positive output 800 ns.

THRESHOLD TEMPERATURE INSTABILITY ≤±0.01%/°C of full scale, 0 to 50°C using a NIM Class A power supply (referenced to –12 V).

DISCRIMINATOR NONLINEARITY ≤±0.25% of full scale (integral) for both discriminators.

DELAY TEMPERATURE INSTABILITY ≤±0.03%/°C of full scale, 0 to 50°C.

DELAY NONLINEARITY <±2% of delay range.

WINDOW WIDTH CONSTANCY ≤±0.1% variation of full-scale window width over the linear range 0 to 10 V.

MINIMUM INPUT THRESHOLD 50 mV for lower-level discriminator.

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TIME SHIFT vs PULSE HEIGHT (WALK)

Walk (ns)		Dynamic Range
System A	System B	
±1.0	±2.0	10:1
±2.5	±4.0	50:1
±3.0	±4.0	100:1

System A: Using an ORTEC Model 460 Amplifier, single delay-line mode, integrate ≤0.1 µs with 1-µs delay line.

System B: Using an ORTEC Model 570, 571, or 572 Amplifier, unipolar output with 0.5-µs shaping time. Input from ORTEC Model 419 Pulser.

CONTROLS

LOWER LEVEL Front-panel 10-turn potentiometer adjustable from 0 to 10 V; when the rear-panel LL Ref mode switch is set on Int, determines the threshold setting for the lower-level discriminator. When the LL REF mode switch on the rear panel is in the EXT position, this control is ineffective.

WINDOW OR UPPER LEVEL Front-panel 10-turn potentiometer determines the window width (0 to +1 V) in the Window mode or the upper-level (0 to +10 V) threshold in the Normal mode. This control is disabled in the Integral mode.

INT/NOR/WIN Front-panel 3-position locking toggle switch selects one of three operating modes:
Integral LL sets a single-discriminator threshold (0 to +10 V) and UL is disabled.
Normal UL and LL are independently adjustable levels (0 to +10 V).
Window LL sets the baseline level (0 to +10 V) and UL sets the window width (0 to +1 V).

DELAY RANGE Front-panel locking toggle switch selects delay ranges of 0.1 to 1.1 µs or 1.0 to 11 µs.

DELAY Front-panel 10-turn potentiometer for continuous adjustment of output delay over selected range. In the external strobe mode the delay control adjusts the automatic reset time from ≈5 µs to 50 µs.

WALK ADJUST Front-panel screwdriver adjustment for precise setting of walk compensation.

LL REF MODE Rear-panel 2-position locking toggle switch selects either the front-panel LL potentiometer or the voltage signal applied to the rear-panel LL REF EXT connector as the LL discriminator reference threshold.

STROBE Rear-panel 2-position locking toggle switch selects either Internal or External source for the SCA output signal strobe function.

INPUTS

SIGNAL INPUT Front-panel dc-coupled BNC connector accepts positive unipolar or bipolar signal, 0 to +10 V linear range, ±12 V maximum; width 100 ns; 1000-Ω input impedance. Rear-panel ac-coupled BNC connector accepts positive unipolar or bipolar signal, 0 to +10 V linear range, ±100 V maximum; width 0.2 to 10 µs; 1000-Ω input impedance.

LL REF EXT When the rear-panel LL REF mode switch is on EXT, the rear-panel LL REF EXT BNC connector accepts the lower-level biasing (an input of 0 to –10 V on this connector corresponds to a range of 0 to 10 V for the lower-level discriminator setting). Input protected to ±24 V.

EXT STROBE INT When the rear-panel EXT/INT STROBE locking toggle switch is in EXT, the rear-panel EXT STROBE IN BNC connector accepts a positive NIM-standard input, nominally +5 V, 500 ns wide, to cause an output to occur from the SCA. The external strobe should be given within 5 µs (or 50 µs as determined by the front-panel Delay control) of the linear input. At the end of this period, the Model 551 resets its internal logic without producing an output signal.

OUTPUTS

SCA POS OUT Front- and rear-panel BNC connectors provide positive NIM-standard output, nominally +5 V; 500 ns wide; 10-Ω output impedance. For internal strobe the output occurs at the midpoint of the linear input trailing edge plus the output Delay as selected by the front-panel controls. For external strobe the output occurs at the time of strobe signal.

SCA NEG OUT Front-panel BNC connector provides fast NIM-standard output, nominally –16 mA (–800 mV on 50-Ω load); width ≤20 ns; rise time ≤5 ns; ≤10-Ω output impedance. Output occurs at the mid-point of the linear trailing edge plus the output Delay as selected by the front-panel controls.

LL OUT Rear-panel BNC connector provides positive NIM-standard output, nominally +5 V, 500 ns wide; ≤10-Ω output impedance. Output occurs as leading edge of linear input crosses the LL threshold.

UL OUT Rear-panel BNC connector provides NIM-standard output, nominally +5 V, 500 ns wide; ≤10-Ω output impedance. Output occurs as leading edge of linear input crosses the UL threshold.

ELECTRICAL AND MECHANICAL

POWER REQUIRED +12 V, 160 mA; –12 V, 110 mA; +24 V, 90 mA; –24 V, 50 mA.

WEIGHT
Net 1.1 kg (2.5 lb).
Shipping 2.25 kg (5.0 lb).

DIMENSIONS NIM-standard single-width module 3.43 X 22.13 cm (1.35 X 4.714 in.) per DOE/ER-0457T.

Related Equipment

The Model 551 is compatible with all ORTEC amplifiers and other amplifiers having a 0 to 10 V positive, linear output range.

Ordering Information

To order, specify:

Model	Description
551	Timing Single-Channel Analyzer

Specifications subject to change
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