

- Good time resolution over a wide range of pulse amplitudes with scintillation and semiconductor detectors
- 50-MHz count-rate capability
- 5 mV minimum threshold
- Time walk  $\leq 100$  ps for 100:1 dynamic range
- Constant-fraction, leading-edge, and slow-rise-time reject modes



The ORTEC Model 584 Constant-Fraction Discriminator allows good time resolution to be obtained from all commonly used detectors such as HPGe, silicon charged-particle, fast plastic, NaI(Tl), and photomultiplier tubes. Three timing modes are provided in the Model 584: constant-fraction, constant-fraction with slow-rise-time reject, and leading-edge. This economical unit has a minimum threshold of  $-5$  mV, allowing good timing measurements to very low energies. The maximum input signal acceptable without saturation is  $-5$  V, which provides a 1000:1 input dynamic range. The Model 584 is useful in high-count-rate applications to 50 MHz with  $\leq 20$  ns pulse-pair resolving time. The time walk of the Model 584 is  $\leq \pm 100$  ps for a 100:1 input dynamic range.

A variety of controls is provided, allowing optimization of the Model 584 in various applications. A precision 10-turn potentiometer sets the threshold from  $-5$  mV to  $-1$  V. The blocking time set by the Blocking Output Width is continuously adjustable from  $\leq 10$  to  $\geq 1000$  ns. This feature is useful for preventing multiple triggering on pulses from scintillators having long decay time, e.g., NaI(Tl). A front-panel LED indicates that the discriminator has been triggered and can therefore be used to set the threshold just above the noise. Walk is adjusted by a front-panel 20-turn potentiometer. The Constant-Fraction Monitor on the front panel can be used to optimize walk adjustment. Since the constant-fraction shaping delay is selected by external cable, the optimum delay for a specific detector application is easily selected.

Four NIM-standard output signals are available from the Model 584. The positive output signal is continuously variable from  $\leq 0.5$  to  $\geq 2.5$   $\mu$ s by means of a printed wiring board (PWB) potentiometer. The polarity of the positive output is PWB selectable to be either a NIM-standard positive output signal or the complement signal. The two timing output signals are NIM-standard fast negative logic signals, each having a 2-ns rise time and a 5-ns width FWHM. The blocking output signal is a NIM-standard fast negative logic signal whose width is adjustable from  $\leq 10$  to  $\geq 1000$  ns.

The Model 584 can be gated externally. A rear-panel locking toggle switch selects either Gated or Ungated operation. In the Gated Mode, a printed wiring board jumper selects the Bin Gate line in the NIM bin, a NIM-standard positive signal via the rear-panel BNC connector, or a NIM-standard negative signal via the rear-panel BNC connector.

Logic current for the Model 584 is selected from either the  $-6$  V or  $-12$  V NIM supply by means of a rear-panel locking toggle switch. The Model 584 is within the allotment of current for a single-width NIM module for a NIM Class V power supply when the logic current is obtained from  $-6$  V.

## Specifications

### PERFORMANCE

**INPUT** Accepts negative input signals from 0 V to  $-5$  V without saturation; dc-coupled;  $Z_{in} = 50 \Omega$ ; reflections  $\leq \pm 5\%$  for  $t_r \leq 2$  ns.

**THRESHOLD RANGE**  $-5$  mV to  $-1$  V.

**THRESHOLD INTEGRAL NONLINEARITY**  $\leq \pm 0.25\%$  of full scale.

**THRESHOLD INSTABILITY**  $\leq \pm 100 \mu$ V/ $^{\circ}$ C, 0 to  $50^{\circ}$ C.

**PROPAGATION DELAY** Nominally 25 ns, with external CF Delay  $\approx 2$  ns.

**MINIMUM PULSE-PAIR RESOLUTION**  $\leq 20$  ns.

**DEAD TIME** Nominally 20 ns or Blocking Output Width, whichever is greater.

**BLOCKING OUTPUT WIDTH** Adjustable from  $\leq 10$  to  $\geq 1000$  ns.

**TIME WALK**  $\leq \pm 100$  ps for the 100:1 input range from  $-20$  mV to  $-2$  V. Conditions: External CF Delay = 2 ns; input rise time  $\leq 1$  ns; input pulse width = 10 ns.

### CONTROLS

**THRESHOLD** Front-panel 10-turn precision locking potentiometer determines the discriminator threshold setting in the range from  $-5$  mV to  $-1$  V.

**TIMING MODE SWITCH** Front-panel 3-position locking toggle switch selects one of the three timing modes:

**CF (Constant-Fraction)** Attenuation factor is internally set at  $f = 0.2$  (can be changed upon request). An external 50- $\Omega$  coaxial cable must be provided for the constant-fraction shaping delay (CF Delay).

**SRT (Slow-Rise-Time) Reject** Provides constant-fraction timing and inhibits output signals that would be produced by leading-edge timing from the leading-edge arming discriminator. An input signal that does not

## Constant-Fraction Discriminator

cross the discriminator threshold before the constant-fraction zero-crossing time does not produce an output pulse.

**LE (Leading-Edge)** Inhibits timing from the constant-fraction circuitry. The timing is derived as the leading edge of the input signal crosses the discriminator threshold level.

**CF DELAY** Two front-panel BNC connectors accept 50- $\Omega$  coaxial cable to set the required constant-fraction shaping delay for the CF and SRT Modes: total delay is  $\approx 0.8$  ns plus the delay of the external cable. In the LE Mode, the user may either connect a piece of 50- $\Omega$  coaxial cable between these two connectors or connect a 50- $\Omega$  termination to each of the two connectors.

**WALK** Front-panel 20-turn screwdriver adjustment sets the walk compensation for each application.

**CF MON** Front-panel BNC connector permits observation of the constant-fraction bipolar timing signal;  $Z_0 = 50 \Omega$ . 50- $\Omega$  coaxial cable required; 50- $\Omega$  termination suggested.

**WIDTH** Front-panel 20-turn screwdriver adjustment sets the width of the Blocking Output pulse. Variable from  $\leq 10$  to  $\geq 1000$  ns. Sets the instrument dead time for widths greater than nominally 20 ns.

**GATING MODE SWITCH** Rear-panel 2-position locking toggle switch controls the use of the Gate Inputs. (One of three Gate Input signal paths is selected by a PWB jumper.) **Gated** A "true" logic level from the selected Gate Input permits output signals to be generated by the discriminator. A "false" logic level from the selected Gate Input inhibits output signals from being generated by the discriminator. A set of Output signals already in progress is not terminated prematurely by a logic "false" signal from the selected Gate Input.

**Ungated** The signal level of the selected Gate Input does not inhibit normal generation of output signals from the discriminator (i.e., the discriminator is always enabled).

**LOGIC CURRENT SWITCH** Rear-panel 2-position locking toggle switch selects either the -6 V or the -12 V NIM supply line for providing current for the high-speed ECL logic used in the discriminator.

#### NOTES:

- (1) The module is within the current allotment for a single NIM width when using the -6 V position with a NIM Class V power supply or equivalent.
- (2) The module exceeds the current allotment for a single NIM width on the -12 V supply

when using the -12 V position. However, this position permits using the discriminator in bins with power supplies not providing -6 V.

**GATE INPUT JUMPER (G+, G-, or BG)** PWB jumper selects one of three Gate Input signal paths:

**G+** Selects the rear-panel BNC Gate Input connector to accept slow positive NIM input signal levels for gating; dc-coupled;  $Z_{in} > 1 \text{ k}\Omega$ .

**G-** Selects the rear-panel BNC Gate Input connector to accept fast negative NIM input signal levels for gating; dc-coupled;  $Z_{in} = 50 \Omega$ .

**BG** Selects the Bin Gate line (pin 36 of the NIM power connector block) to accept slow positive NIM input signal levels  $> +2 \text{ V}$  for gating; dc-coupled;  $Z_{in} > 1 \text{ k}\Omega$ .

**POSITIVE OUTPUT WIDTH (+ Width)** PWB 4-turn potentiometer sets the width of the slow positive NIM output signal in the range from  $\leq 0.5$  to  $\geq 2.5 \mu\text{s}$ .

**POSITIVE OUTPUT SIGNAL POLARITY (PO or  $\overline{\text{PO}}$ )** PWB jumper selects the slow positive NIM output signal (PO) or the complement output signal ( $\overline{\text{PO}}$ ).

#### INPUTS

**INPUT** Front-panel BNC connector accepts fast negative input signals from 0 V to -5 V without saturation; dc-coupled;  $Z_{in} = 50 \Omega$ ; reflections  $\leq \pm 5\%$  for  $t_r \geq 2 \text{ ns}$ .

**GATE INPUT** Rear-panel BNC connector; input signals accepted according to PWB Gate Input Jumper.

**G+ Jumper Position** Accepts slow positive NIM input signal levels for gating; dc-coupled;  $Z_{in} > 1 \text{ k}\Omega$ .

**G- Jumper Position** Accepts fast negative NIM input signal levels for gating; dc-coupled;  $Z_{in} = 50 \Omega$ .

#### OUTPUTS

**TIMING** Two front-panel BNC connectors provide simultaneous NIM-standard fast negative logic signals;  $t_r \approx 2 \text{ ns}$ ;  $t_f \approx 3 \text{ ns}$ ;  $t_w \approx 5 \text{ ns}$ .

**BK OUT** Front-panel BNC connector provides a NIM-standard fast negative logic pulse that occurs simultaneously with the Timing Outputs; width variable by front-panel adjustment from  $\leq 10$  to  $\geq 1000 \text{ ns}$ ;  $t_r \approx 2 \text{ ns}$ .

**POSITIVE** Front-panel BNC connector provides NIM-standard slow positive logic pulse simultaneously with Timing Outputs;  $Z_0 < 10 \Omega$ ; width variable by PWB width adjustment from  $\leq 0.5$  to  $\geq 2.5 \mu\text{s}$ . The associated LED is triggered for approximately 3 ms (updating) by each positive output pulse.

#### ELECTRICAL AND MECHANICAL

##### WEIGHT

**Net** 1.2 kg (2.6 lb).

**Shipping** 2.25 kg (5.0 lb)

**DIMENSIONS** NIM-standard single-width module 3.43 X 22.13 cm (1.35 X 8.714 in.) per DOE/ER-0457T.

##### POWER REQUIRED

###### Logic Current Switch\*

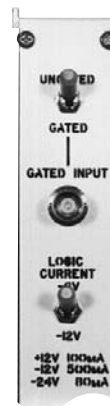
	Position	
	-6 V (mA)	-12 V (mA)
+12 V	100	100
-12 V	100	500
+6 V	0	0
-6 V	400	0
+24 V	0	0
-24 V	80	80
117 V ac	0	0

\*See "NOTES" on Logic Current Switch, "Controls" Section of Specifications.

#### Ordering Information

To order, specify:

Model	Description
584	Constant-Fraction Discriminator



Specifications subject to change  
011008

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