

## ORTEC 442 LINEAR GATE AND STRETCHER

### 1. DESCRIPTION

#### 1.1 General

The ORTEC 442 Linear Gate and Stretcher is designed to increase the duration of short input pulses by stretching their peak amplitudes for a required minimum pulse width. This effectively reduces the bandwidth requirements of analog-to-digital converters in multichannel pulse height analyzers, and improves the resulting linearity. The linear gate included in the 442 permits selective control of the acceptance of input pulses, and is also used to prevent positive-on-positive pulse pile-up.

#### 1.2 Basic Functions

The purpose of the 442 is to accept linear signals, during its permissive gating periods, from any linear source, and to reshape the input signal as required to provide a suitable waveform into a circuit which measures the peak amplitude. Any reshaping of the input pulse must retain the linear parameter of the input signal, which is its relative peak amplitude. The pulse width of the input is unimportant except from the practical viewpoint of having the peak amplitude exist long enough to permit accurate response and measurement.

The input gate can be controlled from an external source, and operated in either a coincidence or an anticoincidence mode. The gate period generator will be triggered on the leading edge of a gate input pulse, and continue for the effective period set by the front panel adjustment. The Gate Period must overlap the linear input pulse peak for coincidence mode operation, or must overlap the discriminator response for anticoincidence mode.

A linear input pulse must exceed the adjusted discriminator level to initiate a response in the 442. When the discriminator fires, it initiates the stretch action unless the gate control is in the external coincidence mode and a gate pulse is not present. The input gate remains open only until the peak of the linear pulse has been detected, and is again closed to prevent pileup. An output pulse will be generated if a peak is detected, and occurs at an adjusted delay following the input peak for an adjusted width. Both the delay and width adjustments are front panel controls on the 442. The input gate cannot be opened again until the output pulse has been completed *and* the linear input pulse has permitted the discriminator to reset. This internal logic prevents pulse pileup and false amplitude outputs for the system.

Short duration linear pulses are associated normally with biased amplifiers. The 442 can be used in this, or any other, system to assure an adequate duration of the peak amplitude where a pulse width might be too short, or where the width variations would otherwise produce a non-linear response or measurement. It may be used at any point in the linear system after a basic linear amplifier, and its gating function permits logical placement directly after the linear amplifier. For best system performance the 442 should precede the biased amplifier.

## 2. SPECIFICATIONS

### LINEAR INPUT

POLARITY: Positive unipolar, or bipolar with positive portion leading

AMPLITUDE: +0.1 to +10 volts, linear range;  $\pm 12$  volts maximum

RISE TIME: 100 nsec to  $10\mu\text{sec}$

INPUT IMPEDANCE:  $\sim 1000$  ohms

INPUT CIRCUIT: Switch selectable, DC-Coupled, or DC-Restored for either High or Low count rate

### GATE INPUT

FUNCTION: Optional external control for switch selectable coincidence or anticoincidence mode triggering

INPUT PUSLES: Standard NIM<sup>1</sup> Slow Logic pulse, triggers selected gate function at +3 volts (100 nsec min width); protected to  $\pm 25$  volts

### INPUT DISCRIMINATOR

FUNCTION: Adjustable to eliminate response to small input (noise) pulse amplitudes. Initiates stretcher response when triggered

RANGE: +0.1 to 1 volt, front panel adjusted

DURATION: Remains triggered while input level exceeds adjusted sensitivity

### LINEAR OUTPUT

POLARITY: Positive

AMPLITUDE: +0.1 to +10 volts, equal to peak of the accepted linear input pulse

RISE TIME: 300 nsec

WIDTH: Adjusted by front panel control; range 0.5 to  $5\mu\text{sec}$

DELAY: Adjusted by front panel control; range 0.3 to  $3\mu\text{sec}$  after input pulse peak

OUTPUT IMPEDANCE:  $< 1$  ohm on front panel, 93 ohms on rear panel

NON-LINEARITY:  $< 0.1\%$  with pulse amplitude droop  $< 0.5$  millivolts/ $\mu\text{sec}$

BASELINE ADJUST:  $\pm 1.5\text{V}$  DC Adjust on front panel

### BUSY OUTPUT

FUNCTION: Produces a pulse equal in width to the internally created dead time

BUSY: +5 volts nominal, when linear pulse cannot be accepted

NOT BUSY: 0 volts nominal, when linear pulse can be accepted

OUTPUT IMPEDANCE:  $< 10$  ohms

### FRONT PANEL CONTROLS

DC-COUPLE, BLR HIGH, BLR LOW: Three position slide switch, selects input circuit desired

DISCRIMINATOR LEVEL: Screwdriver potentiometer, adjusts sensitivity level for input discriminator; range +0.1 to 1V

OUTPUT DELAY: Screwdriver potentiometer, adjusts delay period from input pulse peak to start of output pulse; range 0.3 to  $3\mu\text{sec}$

<sup>1</sup> NIM Standard Logic Pulses in accordance with preferred practices of AEC Report TID-20893 (Revised).

OUTPUT WIDTH: Screwdriver potentiometer, adjusts width of the output pulse; range 0.5 to 5 $\mu$ sec  
 NORMAL/GATED: Switch, selects exclusion (NORMAL) or inclusion (GATED) of optional external gating function

GATE PERIOD: Screwdriver potentiometer, adjusts duration of gating control from leading edge of Gate Input pulse; range 0.5 to 5 $\mu$ sec. Includes test point for monitoring adjusted gate period.

OUTPUT DC ADJUST: Screwdriver potentiometer, permits adjustment of output dc level between  $\pm 1.5V$ .

#### REAR PANEL CONTROL

COINCIDENCE/ANTICOINCIDENCE: Slide switch, selects effective mode for Gate Input function

#### FRONT PANEL CONNECTORS (All type BNC)

LINEAR INPUT: Accepts positive unipolar or bipolar pulses; linear range +0.1 to +10 volts

OUTPUT: Furnishes linear positive output pulses through  $Z_o < 1\Omega$ . Includes test point

GATE INPUT: Accepts optional NIM<sup>1</sup> Slow Logic pulses for Gated control, with selected coincidence or anticoincidence mode and adjusted effective period. Includes test point

#### REAR PANEL CONNECTORS (Type BNC)

OUTPUT: Furnishes linear positive output pulses through  $Z_o = 93\Omega$

BUSY: Furnishes +5 volt nominal signal through  $Z_o < 10\Omega$  through all periods when input pulses cannot be accepted. May be used for external control or for monitoring internally created dead time.

GAIN: Unity

INTEGRAL NONLINEARITY:  $< 0.1\%$ , for pulse rise time  $> 100$  nsec and pulse width  $> 400$  nsec

COUNTING RATE: DC-Coupled throughout when DC-Coupled Input is selected. The centroid of a pulser spectrum at 85% of full scale will shift less than 0.1% when modulated by  $5 \times 10^4$  counts/sec of random signals from <sup>137</sup>Cs source-detector combination with photopeak at 70% of full scale (DC-Coupled Mode,  $\tau \approx 1\mu$ sec). When DC restorer modes are used, count rate is dependent on shaping amplifier time constants and pulse undershoot.

OPERATING TEMPERATURE RANGE: 0 to 50°C

TEMPERATURE STABILITY: Gain shift less than 0.01%/°C, 0 to 50°C

POWER REQUIREMENTS: +24V 69mA +12V 75mA  
 -24V 76mA -12V 14mA

#### RELATED EQUIPMENT

The ORTEC 442 can be used effectively in any linear pulse system where it is advantageous to reshape a linear signal to a constant width. The output can be connected into a biased amplifier, the ADC input of a multichannel analyzer, a single channel analyzer, or any of the ORTEC 400 Series linear circuit modules. The input should have been amplified into the linear range of 0.1 to 10 volts (maximum) prior to the 442.

#### ORDERING INFORMATION

WEIGHT (Shipping): 4 pounds (1.9 kg)

WEIGHT (Net): 2 pounds (0.9 kg)

DIMENSIONS: Standard single width module (1.35 by 8.714 inches) per TID-20893 (Rev.)

**ORTEC**<sup>®</sup>

MODEL 442

**LINEAR GATE  
STRETCHER**

INPUT

DC  
COUPLE

DISC  
LEVEL



LOW

BLR

HIGH

OUTPUT

DELAY

WIDTH



0.3-3

0.5-5

$\mu$  Sec

NORMAL

GATE  
PERIOD



GATED

GATE



INPUT

LINEAR



DC  
ADJ

INPUT



OUTPUT

+24V 80mA  
-24V 80mA  
+12V 80mA  
-12V 20mA