

**ORTEC<sup>®</sup>**  
**MODEL 437A**

**TIME TO PULSE HEIGHT CONVERTER**

**RANGE**  
 $\mu$  sec.  
0.5 1 2 4 8

**AMPLITUDE**  
full range  
3v 5v 8v 10v

**MULTIPLIER**  
x1  
x10  
x100

**OUTPUT DELAY**  
0.5-2.5  $\mu$ sec.

**ANTI-COINC.**  
GATE COINC.

**INT. STROBE**  
EXT.

**START** **STOP**  
INPUT

**CONVERTER** **TRUE START**  
 $Z_o \approx 1\Omega$   $Z_o = 93\Omega$

**OUTPUT**

+12V 110mA  
+12V 135mA  
+15V 85mA  
-14V 115mA

SER.

**STROBE**

**INPUT**

**TRUE START**

**OUTPUT**

**CONVERTER BUSY**

**OUTPUT**

## ORTEC 437A TIME TO PULSE HEIGHT CONVERTER

### 1. DESCRIPTION

The ORTEC 437A Time to Pulse Height Converter is a general purpose laboratory instrument that provides output signals with amplitudes proportional to the time differences between Start and Stop inputs. Design features of the ORTEC Converter permit unique versatility for a wide variety of experiments. The 437A combines excellent time resolution, temperature stability, linearity, and dc-coupling into a start-to-stop converter with a very wide dynamic range. The bipolar output signal features a continuously variable delay and step-selectable ranges for both maximum amplitude and time.

Start-to-stop conversion, with a stop recognition enabled only by a valid start, eliminates pulse ambiguity. Internal fixed-threshold tunnel diode discriminators permit direct use of photomultiplier outputs. The input count rate is limited only by input pulse width. All inputs are direct coupled and nonparalyzable. All timing references are based on the time when an input pulse triggers an input discriminator on the negative leading edge of the pulse.

The output signal is gated internally and is shaped into a bipolar signal to prevent baseline shifting in an ac-coupled analyzer or in any other circuit to which it may be furnished. Internal gating also prevents analysis of over-range signals and external pile-up. Either coincidence or anticoincidence gating can be selected with a front panel switch.

The range of time differences, full scale, is step-selectable. The full scale output amplitude can represent a time difference as short as 50 nsec or as long as 80  $\mu$ sec or any of a variety of convenient intermediate intervals. The full scale amplitude is also switch-selectable from 3 through 10 V in 1-V increments.

When the instrument is strobed internally, the output signal is delayed by an adjusted time after the effective Stop. Delay adjustment is continuously variable between 0.5 and 2.5  $\mu$ sec, using the control on the front panel. When it is strobed externally, an output pulse will occur at the strobe time.

The timing reference for an accepted Start signal is available from the True Start output. This signal can be delayed externally and furnished as an External Strobe to time-synchronize each output signal with its Start event.

A Converter Busy output signal on the rear panel is present through each conversion and reset period. The Strobe Input and True Start output connectors are duplicated on both front and rear panels.

The ORTEC 437A is a double-width NIM standard module, per TID-20893 (Rev.) (2.70 by 8.75 in.). Its operating power is obtained from one of the ORTEC 401/402 Series Bins and Power Supplies. The Bin and Power Supply is capable of providing rack space and distributing power for up to 12 module widths.

### 2. SPECIFICATIONS

#### PERFORMANCE

**TIME RESOLUTION** 10 psec FWHM, 50-nsec range; 0.01% of range for higher ranges.

**TEMPERATURE STABILITY**  $\leq \pm 10$  psec/ $^{\circ}$ C, 50-nsec range;  $\leq \pm 0.015\%$ / $^{\circ}$ C, higher ranges.

**DIFFERENTIAL NONLINEARITY**  $\leq 2\%$ , 15 nsec to full range for 50-nsec and 100-nsec ranges;  $\leq 2\%$ , 10% to 100% for all higher ranges.

**INTEGRAL NONLINEARITY**  $\leq 0.1\%$ .

**INPUT COUNT RATE** Both Start and Stop inputs are direct-coupled and nonparalyzable.

**Start Rate** Max  $\geq 3 \times 10^6$  counts/sec random rate.  
**Stop Rate** Max  $\geq 30 \times 10^6$  counts/sec.

#### CONTROLS

**TIME RANGE** 5-position switch for 15 range choices: 0.05, 0.1, 0.2, 0.4, or 0.8  $\mu$ sec, multiplied by X1, X10, X100.

**TIME RANGE MULTIPLIER** 3-position switch; X1, X10, or X100.

**GATING MODE** 2-position switch; Start input may be Coincidence or Anti-Coincidence gated.

**STROBING MODE** 2-position switch; Output may be strobed either Internal or External:

**Internal** Set by Output Delay control for Strobe to occur from 0.5 to 2.5  $\mu\text{sec}$  after Stop input.

**External** Prompt at External Strobe input.

**OUTPUT AMPLITUDE** 8-position switch for full range of 3 V to 10 V in 1-V steps.

**OUTPUT DELAY** Single-turn potentiometer; range 0.5 to 2.5  $\mu\text{sec}$ .

### INPUTS

**START** Threshold  $\approx 250$  mV, dc-coupled,  $Z = 50\Omega$   $\pm 10\%$ , protected to  $\pm 100$  V, pulse width 2 nsec min. Time slewing  $\approx 0.8$  nsec from X2 to X20 threshold. Accepted only when 437A is not busy. Front panel BNC connector.

**STOP** Same as Start, but enabled only by a valid Start. Stop signal must be accepted within the conversion time range to generate an Output signal. Front panel BNC connector.

**GATE** +2 V min, dc-coupled,  $Z \approx 1$  k $\Omega$ , protected to  $\pm 30$  V. Gates the Output pulse when Strobe Mode switch is set at External. A delayed True Start output pulse will normally be used for this input, and should be delayed no less than the selected time range for proper operation. Front and rear panel BNC connectors.

**EXTERNAL STROBE** +2 V minimum, dc-coupled,  $Z \approx 1$  k $\Omega$ , protected to  $\pm 30$  V. Gates the Output pulse when Strobe Mode switch is set at Ext.

### OUTPUTS

**CONVERTER OUTPUT** Two identical pulses, furnished through two different output impedances, 1 $\Omega$  and 93 $\Omega$ . Bipolar, positive leading edge, constant pulse shape inde-

pendent of range or amplitude. Each pulse amplitude is proportional to a Start-to-Stop time difference. Open circuit full range amplitude is 3 V to 10 V in 1-V increments, to represent switch-selected full range of time. Front panel BNC connector.

**TRUE START** +5-V nom (+4-V min) signal for each accepted Start input signal; the output will be present from each accepted Start until the beginning of the subsequent reset.  $Z_0 < 10\Omega$ , dc-coupled. Front and rear panel BNC connectors.

**CONVERTER BUSY** +5-V nom (+4-V min) signal; the output will be present from each valid start until the end of the subsequent reset.  $Z_0 < 10\Omega$ , dc-coupled. Rear panel BNC connector.

### ELECTRICAL AND MECHANICAL

#### POWER REQUIREMENTS

+24 V, 75 mA; +12 V, 105 mA;  
-24 V, 110 mA; -12 V, 100 mA.

**WEIGHT (Shipping)** 4.5 lb (2.1 kg).

**WEIGHT (Net)** 2.5 lb (1.1 kg).

**DIMENSIONS** Standard NIM double-width module (2.70 by 8.714 in.) per TID-20893 (Rev.).

#### RELATED EQUIPMENT

The 437A can accept Start and Stop signals from fast discriminators, the timing output of a photomultiplier base, or an instrument such as the ORTEC 453 Constant Fraction Timing Discriminator. Typical ORTEC Fast Discriminators include the 260 and 436. ORTEC PM Bases with timing outputs include the 265, 269, 270, and 271. The 437A output has a standard bipolar shape and is a linear pulse with a selected full scale amplitude which can be normalized for input to all ORTEC analog processing modules and to all available multichannel ADC's. All input and output signals conform to the Preferred Practices of AEC Report TID-20893 (Rev.).

## 3. INSTALLATION INSTRUCTIONS

### 3.1. GENERAL

An ORTEC 401/402 Series Bin and Power Supply, from which the 437A will obtain its operating power, is intended for rack mounting. Therefore if any vacuum tube equipment is operated in the same rack, there must be sufficient cooling air circulation to prevent any localized

heating of the all-transistor circuits in the 437A and in the other modules and the Power Supply. Rack-mounted equipment subjected to the temperatures in vacuum tube equipment can exceed the maximum for which the transistorized circuits are designed unless this precaution is taken. The 437A should not be subjected to temperatures in excess of 120°F (50°C).