

# AUTOMETRONIC

## 70 MHz COUNTER-TIMER

### 5500A

Programmable & Autoranging



- EASY TO USE – SELECTABLE RESOLUTION OF 4, 5, 6 OR 7 DIGITS
- DEPENDABLE ACCURACY – CRYSTAL CLOCK – PROPORTIONAL OVEN
- COMPACT HALF-RACK PACKAGE
- SIMPLIFIED "HANDS-OFF" OPERATION
- LOW COST – \$650.00
- IDEAL FOR AUTOMATED MEASUREMENTS – AUTORANGING IN ALL FREQUENCY AND TIMING MODES
- SYSTEMS ORIENTED – REMOTELY PROGRAMMABLE

The Ballantine 5500A Autometronic Counter-Timer is a unique new development. Its display logic is based on resolution of readout – not on units of time averaging. The 5500A is ideal for automated test stands as well as general purpose use over a wide range of industrial and laboratory applications. The 5500A is the first instrument to auto-range time interval measurements.

The 5500A Autometronic contains a patented† autoranging circuit that enables time and frequency measurements to be made without the need for any operator adjustments. The instrument automatically computes the dimensions of the measurement and position of the decimal point, and immediately displays the result on the numeric readout. The instrument is self-adjusting so that the most significant digit is in the left-most position. Range selection is concurrent with the measurement process. Frequency or time changes in the input signal are immediately displayed.

All measurements except frequency ratios and the counting of total events are referenced to an internal time base. This time base is derived either from an oven-stabilized internally-generated 10 MHz crystal clock or from an external source. A rear-panel switch permits selection of the internal or external clock.

The main signal input to the instrument is supplied by the CHANNEL A BNC jack on the front panel. The operating mode and display resolution are selected by switches on the front panel. The 5500A may also be externally programmed by a single contact to ground or equivalent TTL/DTL compatible active circuit. Units and decimal points are internally computed and displayed. Eight operating modes and six levels of resolution are remotely programmable.

The 5500A has ten operating modes and a test mode.

† Patent pending.



**BALLANTINE LABORATORIES, INC.**

FOUR DECADES OF INNOVATION IN ELECTRONIC INSTRUMENTATION

# 5500A AUTOMETRONIC COUNTER-TIMER

## COUNT

**Frequency:** 0-70 MHz.  
**Counter Range:** 1 to  $10^7$  counts.  
**Input:** Channel A.  
**Gate Time:** Manually selected.  
**Accuracy:** Absolute.  
**Readout:** Dimensionless.

## FREQUENCY

**Range:** 0-70 MHz.  
**Input:** Channel A.  
**Gate Time:** Automatically selected to fill the display (up to 1 sec), or 1 sec manual. The number of digits displayed can be selected as 4, 5, 6 or 7 by a front-panel switch.  
**Accuracy:**  $\pm 1$  count  $\pm$  time-base accuracy.  
**Readout:** kHz or MHz, with automatically positioned decimal point.

## PERIOD

**Range:** 100 nsec to  $10^7$  seconds.  
**Input:** Channel A.  
**Clock Frequency:** 100 nsec to 1 second in decimal steps, automatically selected to fill the display. The number of digits displayed can be selected as 4, 5, 6 or 7 by a front-panel switch.  
**Resolution:** 0.1  $\mu$ sec to 1 sec, automatically selected for maximum resolution.  
**Accuracy:**  $\pm 1$  count  $\pm$  time-base accuracy  $\pm$  trigger error\*.  
**Readout:**  $\mu$ sec, msec or sec, with automatically positioned decimal point.

## POSITIVE OR NEGATIVE PULSE WIDTH

**Range:** 0.1  $\mu$ sec to  $10^7$  sec.  
**Input:** Channel A.  
**Clock Frequency:** 100 nsec to 1 second in decimal steps, automatically selected to fill the display. The number of digits displayed can be selected as 4, 5, 6 or 7 by a front-panel switch.  
**Slope Selection:** Automatically selected.  
**Resolution:** 0.1  $\mu$ sec to 1 sec, automatically selected for maximum resolution.  
**Accuracy:**  $\pm 1$  count  $\pm$  time-base accuracy  $\pm$  trigger error\*.  
**Readout:**  $\mu$ sec, msec or sec, with automatically positioned decimal point.

## PERIOD AVERAGE

**Range:** 100 Hz to 1 MHz, 4-digit resolution.  
10 Hz to 1 MHz, 5-digit resolution.  
1 Hz to 1 MHz, 6-digit resolution.  
0.1 Hz to 1 MHz, 7-digit resolution.  
**Input:** Channel A.  
**Periods Averaged:** 1 to 1000, automatically selected for maximum resolution.  
**Clock Frequency:** 1 MHz.  
**Accuracy:**  $\pm 1$  count  $\pm$  time-base accuracy  $\pm$  trigger error\*.  
**Readout:**  $\mu$ sec, with automatically positioned decimal point.

## TIME A $\rightarrow$ B

**Range:** 0.1  $\mu$ sec to  $10^7$  sec.  
**Input:** Start Signal: Channel A. Stop Signal: Channel B. Can be common or separate.  
**Clock Frequency:** 100 nsec to 1 second in decimal steps, automatically selected to fill the display. The number of digits displayed can be selected as 4, 5, 6 or 7 by a front-panel switch.  
**Resolution:** 0.1  $\mu$ sec to 1 sec, automatically selected for maximum resolution.  
**Accuracy:**  $\pm 1$  count  $\pm$  time-base accuracy  $\pm$  trigger error of A\*  $\pm$  Trigger error of B\*.  
**Readout:**  $\mu$ sec, msec or sec, with automatically positioned decimal point.

## RATIO A/NB

**Range:** Channel A: 0-70 MHz. Channel B: 0-10 MHz.  
**Input (F1):** Channel A.  
**Input (F2):** Channel B.  
**Measures:** F1/F2.  
**Number of Cycles of F2 Averaged:** 1 to 1000 automatically selected for maximum resolution.  
**Accuracy:**  $\pm 1$  count of F1  $\pm$  trigger error of F2\*.  
**Readout:** Dimensionless, with automatically positioned decimal point.

## TIME INTVL

**Range:** 0.1  $\mu$ sec to  $10^7$  sec.  
**Clock Frequency:** 100 nsec to 1 second in decimal steps, automatically selected to fill the display. The number of digits displayed can be selected as 4, 5, 6 or 7 by a front-panel switch.  
**Gate Signal:** Via rear panel connector. Contact closure to ground or saturated transistor will control the gate time.  
**Resolution:** 0.1  $\mu$ sec to 1 sec, automatically selected for maximum resolution.  
**Accuracy:**  $\pm 1$  count  $\pm$  time-base accuracy  $\pm$  gate error.\*\*  
**Readout:**  $\mu$ sec, msec or sec, with automatically positioned decimal point.

## INPUT CHANNELS A AND B

**Range:** Channel A,  
DC coupled: DC-70 MHz  
AC coupled: 20 Hz-70 MHz  
HF Rejection: Attenuates signals above 1 kHz approx.  
Channel B,  
DC coupled: DC-10 MHz  
AC coupled: 20 Hz-10 MHz  
HF Rejection: Attenuates signals above 1 kHz approx.  
**Impedance:** 1 megohm shunted by 25 pF approx.  
**Sensitivity:** 25 mV rms sine wave 0-2 MHz.  
50 mV rms sine wave 2-10 MHz.  
100 mV rms sine wave 10-70 MHz (channel A only).  
Channel A, 0.3 V peak-to-peak pulse, 7 nsec min pulse width.  
Channel B, 0.3 V peak-to-peak pulse, 50 nsec min pulse width.  
**Preset:** Sets trigger reference to 0 volts.  
**Attenuation:** X1, X10, X100.  
**Trigger Level:** Continuously adjustable  $\pm 1$  V,  $\pm 10$  V,  $\pm 100$  V, dependent upon setting of attenuator.  
**Slope:** Independent selection of positive or negative slope.  
**Overload Protection:** 250 V rms on X10 and X100 attenuator settings, 120 V rms on X1 attenuator setting up to 1 kHz, decreasing to 10 V rms above 10 MHz.  
**Shaped Outputs A and B:** Terminals on the rear panel for external monitoring of the triggering points on the input signals.

## DISPLAY

**Numerical:** 6 digits (7 optional).  
**Units:** kHz, MHz,  $\mu$ sec, msec or sec, automatically computed and displayed.  
**Decimal Point:** Automatically selected.  
**Display Storage:** Prior reading is held while new reading is being made. Display time is adjustable from 0.2 to 5 seconds or held indefinitely.  
**Gate:** Lights up when counter gate is open.  
**Overrange:** Solid-state indicator that lights up when the counter capacity is exceeded. Due to the automatic gate selection, the counter capacity can be exceeded only when using the manually selected 1 sec gate time in Frequency mode or in the Period Average and Ratio modes.  
**Manual Reset:** Front-panel pushbutton switch resets the display and all registers, and initiates a new measurement.

## TIME BASE

**Crystal Frequency:** 10 MHz  
**Crystal Oven:** Self-regulating solid-state proportional oven.

## MODES OF OPERATION

**Aging Rate:** Less than 2 parts in  $10^8$  per day after 10 days of continuous operation. (less than 0.02 ppm per day)  
**Temperature Stability:** Less than 2 parts in  $10^6$  from  $0^\circ\text{C}$  to  $+50^\circ\text{C}$ . (Normally less than 0.04 ppm per  $^\circ\text{C}$ )  
**Line Voltage Stability:** Less than 5 parts in  $10^7$  for  $\pm 10\%$  line voltage change. (Nominally less than 0.05 ppm per % change)  
**Ext. Time Base Input:** Via rear panel BNC connector, 1 kHz to 10 MHz, 0.5 V rms into 1 Kohm.  
**Int. Time Base Output:** 1 MHz via rear panel BNC connector.

### GENERAL

**Display:** 6 gas discharge type numeric indicators (7 optional)  
**Operating Temperature:**  $0^\circ\text{C}$  ( $+32^\circ\text{F}$ ) to  $+50^\circ\text{C}$  ( $+122^\circ\text{F}$ ).  
**Power Requirements:** 115 or 230 volts  $\pm 10\%$ , 48 to 400 Hz, 25 watts, 25 watts.  
**Dimensions:** 3 1/2" (88 mm) H x 8 3/8" (212 mm) W x 12 1/2" (316 mm) D.  
**Weight:** 7 pounds (3.2 Kg).  
**Accessories Furnished:** Power cord, Service Manual.  
**Price:** \$650.00 fob Boonton, N.J.

### ACCESSORIES AVAILABLE

Description	Part No.	Price
Probe Kit - Attenuator 10:1/1:1 6 ft.	10601A	\$32.00
50 ohm 4 ft BNC-to-BNC coaxial cable	12249D	7.50
Display Extender Board	89400001A	12.00
6 ft cable to connect the 5500A to a digital recorder	12253A	60.00
6 ft cable to connect the 5500A for remote programming	12254A	50.00
Feed thru Termination, 50 $\Omega$ BNC	12630A	12.50
50 $\Omega$ 4 ft BNC to alligator cable	12250D	8.50

### OPTIONS AVAILABLE

Description	Price
7-DIGIT DISPLAY (Option No. 07)	\$35.00
PRINTER OUTPUT (Option No. 10)	75.00

**Logic:** Positive true  
**Form:** 4-line 1-2-4-8 BCD.  
 "1" state level:  $+5 \pm 0.5$  V, 2.5 Kohm source impedance nominal.  
 "0" state level:  $+0.25$  V at  $-1$  mA.

**Print Command:** Positive pulse of 5 V, DC coupled. Source impedance is 5 Kohm when in the "high" state and 500 ohm when in the "low" state. Pulse duration is 1 msec approx. Occurs at end of gate time.

**Inhibit Input:** A positive pulse of 3 V minimum and 50 V maximum will inhibit the recycling circuitry of the counter.

**Connector:** Amphenol 57-40500-375 (50-pin blue ribbon). Mating connector

Amphenol 57-30500-375. P/N 31100500A \$12.50

**REMOTE PROGRAMMING (Option No. 02)** \$75.00

Permits function and resolution to be remotely selected by a single contact to ground or equivalent active circuit. (TTL & DTL compatible)  
 The time base is automatically selected for maximum resolution. Mating connector (24-pin Blue Ribbon) Amphenol 57-30240-375, P/N 31100370A \$12.50

\* Trigger error is less than 0.3% of one period divided by the number of periods averaged, for signals with a signal-to-noise ratio of 40 db or better, and 100 mV rms amplitude.

\*\* For any waveshape, trigger error is less than

0.0025 Microseconds.

$\pm$ Signal slope (Volts/ $\mu$ s)

### COUNT MODE

In the COUNT mode, the 5500A operates as a simple total events counter. The input to the counting circuits is the signal applied to the CHANNEL A jack. ON-OFF gating is controlled manually by a front-panel switch.

### FREQUENCY MODE

FREQUENCY mode provides direct measurement of the average frequency of any signal from 0 to 70 MHz. The input signal to the counting circuits is applied to the CHANNEL A jack. Input trigger circuits are DC or AC coupled. Trigger leveling and 3 ranges of attenuation are provided as well as a low pass filter for noisy input signals. The display resolution is maximized by automatic selection of the gate time.

### PERIOD MODE

PERIOD mode provides direct measurement of a single period of an input signal. The input to the counting circuits is the automatically-selected time-base frequency. The time interval over which counting is enabled is the period of the signal applied to CHANNEL A. Display resolution is automatically maximized with best resolution of 100 nanoseconds.

### POSITIVE PULSE WIDTH MODE

POSITIVE PULSE WIDTH mode provides direct measurement of the time between the leading and trailing edges of a pulse. The input to the counting circuits is the automatically selected time-base frequency. The time interval over which counting is enabled is the time between the leading and trailing edges of the signal applied to CHANNEL A.

### NEGATIVE PULSE WIDTH MODE

NEGATIVE PULSE WIDTH mode provides direct measurement of the time between the trailing and leading edges of a pulse. The input to the counting circuits is the automatically selected time-base frequency. The time interval over which counting is enabled is the time between the trailing and leading edges of the signal applied to the CHANNEL A jack.

### PERIOD AVERAGE MODE

PERIOD AVERAGE mode provides direct measurement of the average period of an input signal. The number of periods averaged is automatically variable from 1 to  $10^3$  in decade steps. The time interval over which counting is enabled is the average period of the signal applied to CHANNEL A. The input to the counting circuits is a 1 MHz signal derived from the 10 MHz clock.

### RATIO A/NB MODE

RATIO A/NB mode provides measurement of the frequency ratio of two input signals. Signal B is automatically averaged over from 1 to  $10^3$  cycles. The signals may be applied to either of the input jacks.

### TIME A - B MODE

Time A → B mode provides a measurement of the elapsed time between two pulses connected to the 5500A. One pulse is applied to CHANNEL A and the other to CHANNEL B. The input to the counting circuits is the automatically selected time-base frequency. Counting is enabled by the CHANNEL A signal input and is inhibited by the signal connected to CHANNEL B. Full DC coupled trigger circuits permit measurement on even the most erratic waveforms.

### TIME INTVL MODE

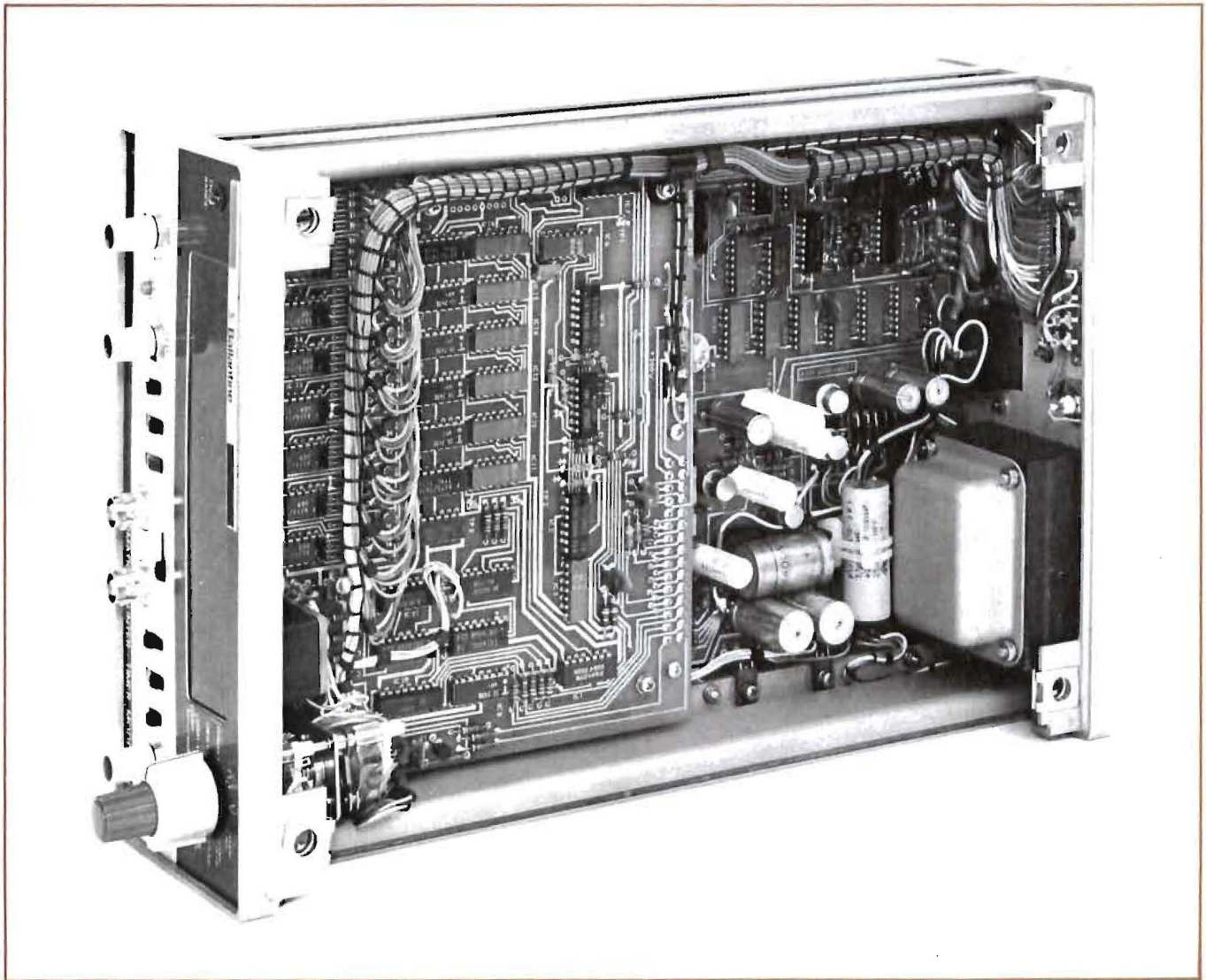
TIME INTVL mode permits measurement of the duration of a remote gating signal. The input to the counting circuits is the automatically selected time-base frequency. The time interval over which counting is enabled is controlled remotely by the logic levels of the gate signal applied to the REM. PROG. connector.

### REMOTE PROGRAMMING MODE (Option - O2)

REMOTE PROGRAMMING mode permits all functions to be remotely programmed by a contact closure to ground or a saturated transistor. Levels are TTL/DTL compatible.

### CHECK MODE

CHECK mode provides a quick confidence check of the instrument. In this mode, a 1 MHz signal, derived from the main clock, is applied to both input channels and the 5500A will read 1 MHz frequency with the resolution automatically maximized.



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