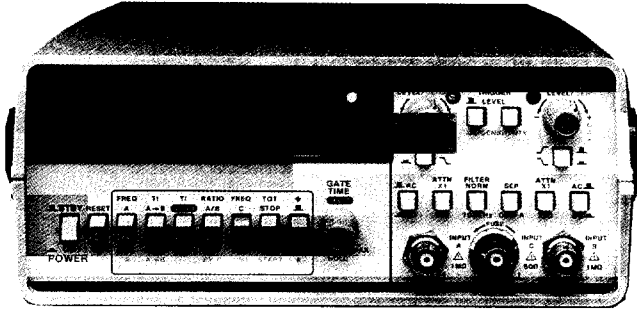


# ELECTRONIC COUNTERS

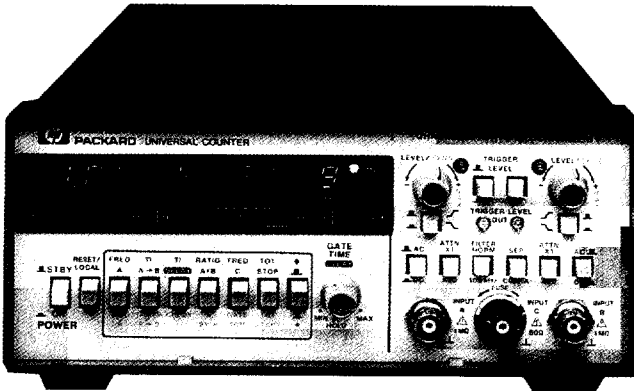
## Universal

HP 5315A, 5316B

- Frequency, period, ratio, and totalize to 100 MHz
- Portable and HP-IB models
- 1-GHz capability available
- 100-ns time interval, 10-ps T.I. averaging



HP 5315A



HP 5316B

SUPPORTED BY  
**HP ITG**  
SOFTWARE

DESIGNED FOR  
**HP-IB**  
SYSTEMS

### HP 5315A and HP 5316B Universal Counters

HP's economical HP 5315A and HP 5316B counters offer outstanding performance at affordable prices. A unique custom circuit called the MRC (Multiple Register Counter) packs counting and computing power into this popular counter series. Reciprocal counting techniques provide outstanding frequency resolution of 7 digits per second even at low frequencies. The continuously adjustable gate time allows automatic selection of sample size for easy trade-offs between measurement time and resolution.

### Versatile Measurement Capabilities

The MRC counters measure frequency to 100 MHz—up to 1.0 GHz with the optional Channel C—for CW and pulsed RF signals as narrow as 60 ms. Three time-interval measurements are possible: single-shot (100 ns to 100,000 s), averaging (down to 10 ps resolution), and time-interval delay. The MRC counters also measure/perform: Period A, Ratio A/B, A by B (totalizes A input between 2 events on B), and Totalize (manually gated mode).

Both channels offer input signal conditioning controls:  $\pm$  slope,  $\pm 2.5$  Vdc trigger level, and ac/dc coupling. A Separate/Common switch and 100-kHz low-pass filter for Channel A are included.

### A Choice of Portable or System Models

The HP 5315A, a portable, lightweight unit, includes a carrying handle and optional battery power for up to 4 hours continuous operation. The HP 5316A offers the measurement capabilities of the HP 5315A in a rack-and-stack metal case, built-in HP-IB capabilities, and front-panel access to Channel A and B trigger levels for easy measurement with a DVM.

### HP 5315A, 5316B Specifications

#### Input Characteristics (Channel A and Channel B)

**Range:** dc-coupled, 0 to 100 MHz; ac-coupled, 30 Hz to 100 MHz  
**Sensitivity:** 10 mV rms sine wave to 10 MHz; 25 mV rms sine wave to 100 MHz. 75 mV peak-to-peak pulse at minimum pulse width of 5 ns. Sensitivity can be varied continuously up to 500 mV rms nominal by adjusting sensitivity control. In sensitivity mode, trigger level is automatically set to 0 V nominal.

**Dynamic range:** 30 mV to 5 V peak-to-peak, 0 to 10 MHz; 75 mV to 5 V peak-to-peak, 10 to 100 MHz

**Coupling:** ac or dc, switchable

**Filter:** Low-pass, switchable in or out of Channel A. 3 dB point at 100 kHz nominally.

**Impedance:** 1 M  $\Omega$  nominal shunted by less than 40 pF.

**Signal operating range:** +2.5 Vdc to -2.5 Vdc

**Attenuator:**  $\times 1$  or  $\times 20$  nominal

**Trigger level:** Variable between +2.5 Vdc and -2.5 Vdc

**Slope:** Independent selection of + or - slope

**Common input:** All specifications are the same as A and B except:  
**Sensitivity:** 20 mV rms sine wave to 10 MHz; 50 mV rms to 100 MHz; 150 mV peak-to-peak at a minimum pulse width of 5 ns.

**Dynamic range:** 60 mV to 5 V peak-to-peak to 10 MHz; 150 mV to 5 V peak-to-peak, 10 to 100 MHz.

**Impedance:** 500 k  $\Omega$  nominal shunted by less than 70 pF

#### Frequency and Period (Channel A)

**Range:** 0.1 Hz to 100 MHz; 10 ns to  $10^5$  s (period)

**Resolution:** See Graph 1.

**Accuracy:**  $\pm$  resolution  $\pm$  timebase error (Graph 2)

#### Time Interval

**Range:** 100 ns to  $10^5$  s     **LSD displayed:** 100 ns

**Resolution:**  $\pm$  LSD  $\pm$  noise trigger error (Graph 3)

**Accuracy:**  $\pm$  resolution  $\pm$  timebase error (Graph 2)

#### Time Interval Average

**Range:** 0 ns to  $10^5$  s

**LSD displayed:** 100 ns/ $\sqrt{N}$ , 10 ps max

**Number of intervals averaged (N):**  $N = \text{Gate Time} \times \text{FREQ}$

**Minimum dead time (stop to start):** 200 ns

**Resolution:**  $\pm$  LSD  $\pm$  [noise trigger error (Graph 3)]/ $\sqrt{N}$

**Accuracy:**  $\pm$  resolution  $\pm$  timebase error (Graph 2)  $\pm 4$  ns

#### Time Interval Delay (Holdoff)

Front-panel knob inserts a variable delay of nominally 500  $\mu$ s to 20 ms between START (channel A) and enabling of STOP (Channel B). Electrical inputs during delay time are ignored. Delay time may be digitally measured by simultaneously pressing T.I. Averaging, T.I. Delay, and blue key. Other specifications are identical to Time Interval.

#### Ratio

**Range:** 0.1 MHz to 100 MHz, both channels

**LSD:**  $[(2.5 \times \text{Period A})/\text{gate time}] \times \text{ratio}$

#### Totalize

**Manual:** 0 to 100 MHz

**A gated by B:** Totalizes input A between two events of B. Instrument must be reset between measurements. Gate opens on A slope, closes on B slope.

#### General

##### Standard Timebase

**Frequency:** 10 MHz

**Aging rate:**  $< 3 \times 10^{-7}/\text{mo}$

**Temperature:**  $\pm 5 \times 10^{-6}$ ,  $0^\circ$  to  $50^\circ$  C

**Line voltage:**  $< 1 \times 10^{-7}$  for a  $\pm 10\%$  variation

**Check:** Counts internal 10-MHz reference frequency

**Error light:** LED activated if logic error found during self-check.

**Display:** 8-digit LED display, with engineering units annunciator

**Overflow:** Frequency and totalize measurements only; 8 least significant digits displayed and front panel LED actuated.

**Gate time:** Continuously variable, nominally from 60 ms to 10 s or 1 period of the input, whichever is longer.

**Sample rate:** Up to 7 readings per second nominal except in time-interval mode, where it is continuously variable nominally from 250 ms to 10 s via gate time control.

**Operating temperature:**  $0^\circ$  to  $50^\circ$  C

**Power:** 100, 120, 220, 240 V (+5%, -10%) 48 to 66 Hz; 15 VA maximum (30 VA maximum, HP 5316B)

**Weight:** Net, 2.2 kg (4 lb 12 oz); shipping, 4.1 kg (9 lb)

**Size:** 98 mm H  $\times$  238 mm W  $\times$  276 mm D (3 $\frac{1}{2}$  in  $\times$  9 $\frac{1}{2}$  in  $\times$  10 $\frac{1}{2}$  in)

**Unique HP 5316B Specifications**

Rack-and-stack metal case; rear-panel, switchable ac power-line module.  
**Rackmount kit:** HP 5062-3972 recommended.  
**Oscillator output:** 10 MHz, 50 mV peak-to-peak into 50 Ω load on rear panel  
**External frequency standard input:** 1, 5, 10 MHz, 1 V rms into 500 Ω, or rear panel  
**Trigger-level output:** ± 5%, ± 15 mV over ± 2.0 Vdc range at front panel connectors  
**Size:** 88 mm H × 212 mm W × 415 mm D (3½ in × 8½ in × 16½ in)  
**Weight:** Net, 3.7 kg (8 lb 2 oz); shipping, 6.3 kg (14 lb)

**Hewlett-Packard Interface Bus Programming**

**Measurements:** Frequency A and C, Frequency A Armed by B, Period A, Totalize A Gated by B, Ratio A/B, Time Int. A→B, Time Int. Average A→B, Time Int. Delay, Read Gate Time.  
**Controls:** Gate Time Command, which sets long (60 ms to 10 s) or short (500 μs to 30 ms) range; Trigger Level Commands, which set Channel A and/or B slope (±) and Channel A and/or B trigger from -2.50 Vdc to +2.50 Vdc in steps of .01V.  
**HP-IB interface functions:** SH1, AH1, TI, L2, SR1, RL1, PP0, DC1, DT1, C0, E1 (see page 114)

**Options**

**Opt 001:** High-stability timebase (TCXO); see page 198  
**Frequency:** 10 MHz  
**Aging rate:**  $< 1 \times 10^{-7}/\text{mo}$   
**Temperature:**  $\pm 1 \times 10^{-5}$ , 0° to 40° C  
**Line voltage:**  $< 1 \times 10^{-8}$  for a ± 10% variation  
**Opt 002:** Battery (HP 5315A only)  
**Type:** Rechargeable lead-acid (sealed)  
**Capacity:** Typically 4 hours of continuous operation at 25° C  
**Recharging time:** Typically 16 hours to 98% of full charge, instrument non-operating. Charging circuitry included.  
**Low-voltage indicator:** Instrument turns off automatically when battery low. Discharge LED flashes slowly.  
**Line-failure action:** Instrument automatically switches to battery.  
**Weight:** Opt 002 adds 1.4 kg (3 lb) to weight of instrument.  
**Opt 003:** C Channel  
**Input range:** 50 to 1000 MHz, prescaled by 10  
**Sensitivity:** 15 mV rms sinewave (-23.5 dBm) to 650 MHz. 75 mV rms sinewave (-9.5 dBm) to 1000 MHz. Sensitivity can be decreased continuously by up to 20 dB nominal (50 to 500 MHz) and 10 dB nominal (500 to 1000 MHz) by adjusting sensitivity control. Trigger level is fixed at 0 V nominal.  
**Dynamic range:** 15 mV to 1 V rms (36 dB), 50 to 650 MHz, 75 mV to 1 V rms (20 dB), 650 to 1000 MHz  
**Signal operating range:** +5 Vdc to -5 Vdc  
**Coupling:** ac  
**Impedance:** 50 Ω nominal (VSWR, <2.5:1 typical)  
**Damage level:** ± 8 V (dc + ac peak), fuse protected  
**Resolution and accuracy:** Same as Frequency A (gate time × 10)

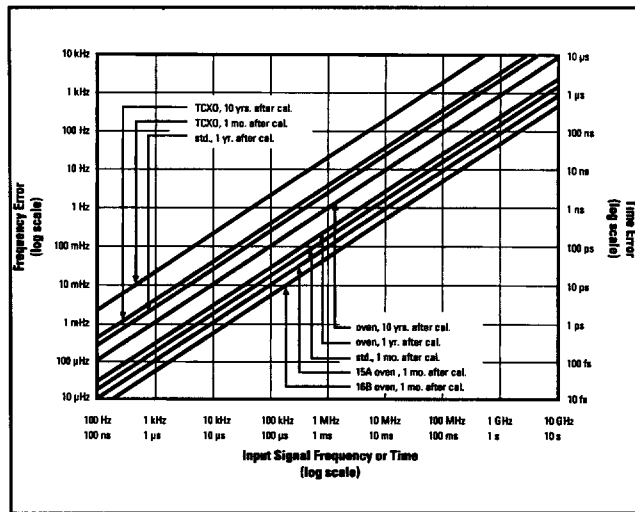
**Opt 004:** High-stability oven timebase (HP 5315A); see page 198.

**Frequency:** 10 MHz  
**Aging rate:**  $< 3 \times 10^{-8}/\text{mo}^*$   
**Temperature:**  $\pm 1 \times 10^{-7}$ , 0° to 50° C  
**Line voltage:**  $< 1 \times 10^{-8}$ , for a 10% variation  
 Oven will operate from fully charged battery for > 24 hours in standby mode.

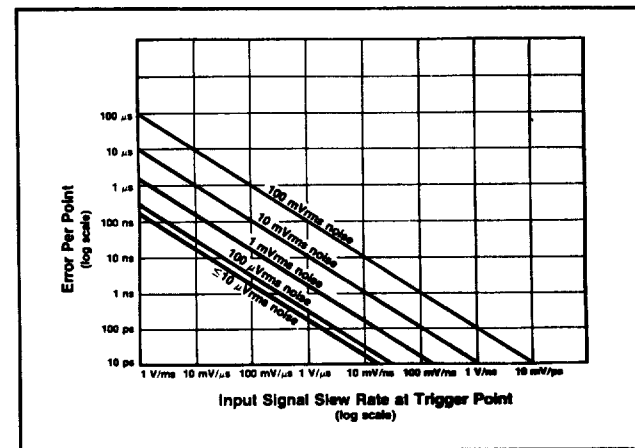
**Opt 004:** High-stability oven timebase (HP 5316B); see page 198.

**Frequency:** 10 MHz  
**Aging rate:**  $< 3 \times 10^{-8}/\text{mo}^{**}$   
**Temperature:**  $\pm 2 \times 10^{-8}$ , 0° to 50° C  
**Line voltage:**  $< 1 \times 10^{-9}$ , for a 10% variation

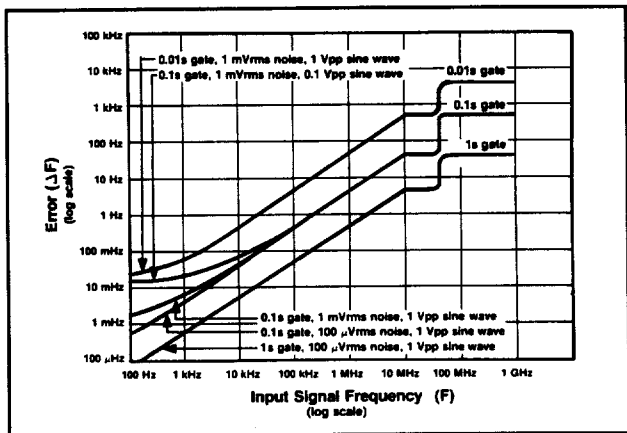
\* After 30 days continuous operation (ac power applied, in OFF or ON position).  
 \*\* After 30 days continuous operation.  $< 5 \times 10^{-9}/\text{mo.}$ , after 7 days continuous operation.



Graph 2. Timebase Error: Environment and aging of the crystal affects all measurements.



Graph 3. Input Noise Trigger Error: Noise on the input signal affects start/stop points for time-interval measurements.



Graph 1. Frequency Resolution Error: Noise on input signal and internal uncertainties affect frequency and period measurements.

**Ordering Information**

**HP 5315A** Universal Counter \$1,425  
**HP 5316B** Universal Counter \$1,755

**Options (for HP 5315A and HP 5316B)**

**Opt 001** TCXO Timebase + \$180  
**Opt 002** Battery Pack (HP 5315A only) + \$350  
**Opt 003** C Channel (1.0 GHz) + \$400  
**Opt 004** High-Stability Timebase + \$600  
**Opt W30** Extended Repair Service (see page 671) + \$45  
**Opt W32** Calibration Service (see page 671) + \$565

**HP 5315A Power Options (one option must be selected)**

**Opt 100** 90 to 105 Vac **Opt 220** 198 to 231 Vac  
**Opt 120** 108 to 126 Vac **Opt 240** 216 to 252 Vac

☎ For off-the-shelf shipment, call 800-452-4844.

