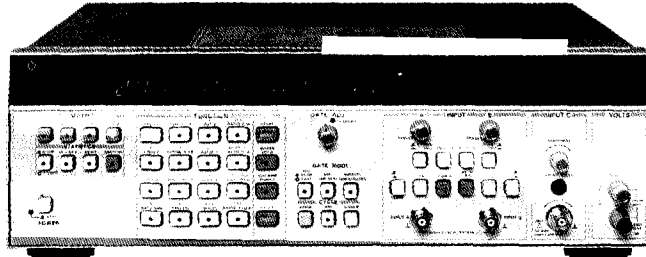


ELECTRONIC COUNTERS

Universal Systems Counter and Preamplifier

HP 5335A, 10855A

- A high-performance 200 MHz/2-ns universal counter
- Built-in automatic rise time, duty cycle, pulse width, slew rate and phase measurements
- Advanced automatic triggering capabilities
- HP-IB plus math and statistics functions standard



HP 5335A



HP 5335A Universal Counter

Designed for bench or systems applications, the HP 5335A has 20 measurement functions, all automatically selected by push-button or by HP-IB. These functions, plus greatly expanded arming and triggering capability, make the HP 5335A a powerful universal counter. Math and statistics features, matched Channel A and B input amplifiers, and HP-IB are all included in the standard unit.

The HP 5335A can automatically measure waveform characteristics. With a signal source, rise and fall times, output slew rate, and propagation times can be measured with one test setup. Duty cycle can be measured to see the distortion on a square wave through the amplifier due to different rising and falling slew rates. Phase measurements are push-button selectable and performed automatically.

Advanced Triggering and Full Measurement Capabilities

The HP 5335A offers several powerful features:

Manual and Automatic Triggering: In manual, the ± 5 Vdc range reduces the need for input attenuators. Two auto trigger modes (front-panel or HP-IB control) select 10 to 90% rise/fall-time trigger points, 50% phase trigger points, or a preset value, then track dc offset to remain on the trigger point.

Trigger Level DVM: View both input channel trigger levels.

Frequency: Measure to 200 MHz on Channel A, 100 MHz on Channel B, and 1.3 GHz on optional Channel C. Resolution is 9 digits per second over the entire frequency range.

Time Intervals: Matched custom input amplifiers reduce trigger errors between Channels A and B. Analog interpolation converts the clock to a 1-GHz-equivalent time base, yielding single-shot time-interval measurements better than 2 ns (100 ps with averaging).

Math and Statistics: Averaging can extend resolution for all measurements except phase. Sample sizes are selectable: 100 or 1000. The HP 5335A calculates standard deviation. Built-in math functions (scale, offset, and normalize) simplify conversions for viewing flow, speed, pressure, and temperature parameters, and can be set individually for each measurement function.

HP 10855A 2-1300 MHz Preamplifier

The HP 10855A Preamplifier enhances measurements of very low-level signals. The ± 1.5 dB flat response reduces distortion in non-sinusoidal waveforms. The HP 10855A operates with instruments having probe power outlets, or with the HP 1122A Probe Power Supply. The HP 5334A/5335A Option 030 and HP 5328B Option 031 counters support the HP 10855A.

HP 10855A Specifications

Frequency Range: 2 MHz to 1300 MHz

Gain (minimum): 22 dB; 24 dB typical

Gain Flatness Across Full Frequency Range: ± 1.5 dB

Noise Figure: < 8.5 dB typical

Output power for 1 dB gain compression 0 dBm

Harmonic Distortion: -30 dB for -15 dBm output, typical; -25 dBm for < -66 dB output, typical

VSWR: < 2.9 , typical

Impedance: 50 Ω nominal

Reverse Isolation: > 45 dB

Maximum Input: 3.5 V rms (+ 24 dBm), fuse protected

HP 5335A Specifications

Input Characteristics (Channels A and B)

Range: dc-coupled, 0 to 100 MHz;

ac, 1 M Ω , 30 Hz to 100 MHz; 50 Ω , 200 kHz to 100 MHz

Note: Channel A range 200 MHz in Frequency A and Ratio modes.

Sensitivity (X1): 25 mV rms sinewave.

75 mV peak-to-peak pulse, minimum pulse width of 5 ns

Dynamic Range (X1): 75 mV to 5 V peak-to-peak, to 100 MHz;

75 mV to 2.5 V peak-to-peak, > 100 MHz

Signal Operating Range (X1, dc): -5 to 5 Vdc

Trigger Level Range (X1)

Auto Trigger OFF

Preset: Set to 0 Vdc nominal; adjustable: -5 to $+5$ Vdc

Auto Trigger ON

Preset: Set to nominal 50% point of input signal.

Adjustable: Nominally between $+$ and $-$ peaks of input signal.

Auto Trigger (X1), (Requires Repetitive Signal)

Range (50% duty cycle): dc-coupled, 30 Hz to 200 MHz

ac: 1 M Ω , 30 Hz to 200 MHz; 50 Ω , 200 kHz to 200 MHz

Minimum signal: 100 mV rms

Duty cycle range: 10% to 90%

Response time: 3 s, typical

Coupling: ac or dc, switchable

Impedance: 1 M Ω , nominal, shunted by < 35 pF or 50 Ω nominal, switchable. In Common A, 1 M Ω is shunted by < 50 pF.

Attenuator: $\times 1$ or $\times 10$ nominal, switchable

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

Channel Input: Separate or Common A, switchable

Frequency A

Range: 0 to 200 MHz, prescaled by 2

LSD Displayed: $\frac{1 \text{ ns}}{\text{gate time}} \times \text{freq. (e.g. 9 digits in a second)}$

Resolution: $\pm (2 \times \text{LSD}) \pm 1.4 \times \frac{\text{trigger error}}{\text{gate time}} \times \text{freq}$

Accuracy: $\pm (\text{resolution}) \pm (\text{timebase error}) \times \text{freq}$

Period A

Range: 10 ns to 10^7 s

LSD Displayed: $\frac{1 \text{ ns}}{\text{gate time}} \times \text{PER. (e.g. 9 digits in a second)}$

Period Average: Select MEAN function, and $n = 100$ or 1000

Time Interval A \rightarrow B

Range: 0 ns to 10^7 s

LSD Displayed: 1 ns (100 ps using MEAN)

Resolution: $\pm (2 \times \text{LSD}) \pm (\text{START trigger error}) \pm (\text{STOP trigger error})$

Accuracy: $\pm (\text{resolution}) \pm (\text{timebase error}) \times \text{TI} \pm (\text{trigger level timing error}) \pm (2 \text{ ns})$

Gate Mode: MIN only

Time Interval Average: Select MEAN function, and $n = 100$ or 1000

Time Interval Delay (Holdoff)

Front panel Gate Adjust control inserts a variable delay between START and enabling of STOP. Electrical inputs during delay are ignored. Delay ranges are same as gate time ranges (100 μ s to 4 s, nominal) for gate modes of Fast, Norm, and Manual.

Inverse Time Interval A \rightarrow B

Range: 10^{-7} to 10^9 units/second

LSD Displayed, Resolution, and Accuracy are inverse of Time Interval A \rightarrow B specifications.

Rise and Fall Time A

Range: 20 ns to 10 ms transition with 50 Hz to 25 MHz repetition rates (50% duty cycle)

Minimum Pulse Height: 500 mV peak-to-peak

Minimum Pulse Width: 20 ns

Duty Cycle Range: 20% to 80%

LSD Displayed, Resolution: See Time Interval A \rightarrow B specifications.

Pulse Width A

Range: 5 ns to 10^7 s

Trigger Point Range: 40% to 60% of pulse height

LSD Displayed, Resolution: See Time Interval A \rightarrow B specifications.

Duty Cycle A (Constant Duty Cycle Required)

Range: 1% to 99%, 0 to 100 MHz
Trigger Point Range: 40% to 60% of pulse height

LSD Displayed: $\frac{1 \text{ ns}}{\text{period}} \times 100\%$

Slew Rate A

Range: 50 V/s to 10⁸ V/s slew rate with 50 Hz to 25 MHz repetition rates (50% duty cycle). Minimum pulse height, width, and duty cycle range are same as Rise and Fall Time A

Input Mode: Automatically set to COMMON A with 10% and 90% trigger levels

Ratio A/B

Range: Channel A: 0 to 200 MHz (prescaled by 2);
Channel B: 0 to 100 MHz.

LSD Displayed: $\frac{\text{Ratio}}{\text{Freq} \times \text{Gate Time}}$ where Freq is higher

frequency after prescaling

Totalize A

Range: 0 to 100 MHz
LSD Displayed: 1 count of input
HP-IB Output: At end of gate

Manual

Count reset: Via RESET key
HP-IB output: Totalize data on-the-fly sent if Cycle mode set to Single. Input frequency range in this mode is 0 to 50 Hz nominal.

Gated

Count reset: Automatic after measurement

Phase A Rel B

Range: -180° to 360° (Range Hold OFF) or 0° to 360° (Range Hold ON) with signal repetition rates of 30 Hz to 1 MHz.

Minimum Signal: 100 mV rms

LSD Displayed: 0.1°

Gate Time

Range: 100 μs to 10⁷ s
LSD Displayed: Up to 3 digits with Ext. Arm Enable OFF, 100 ns when ON. MIN Gate Mode display zero.

Trigger Level

Range: ×1, +5 to -5 V; ×10, +50 to -50 V

Resolution: ×1, 10 mV; ×10, 100 mV

Accuracy (×1): ±20 mV, ±0.5% of reading

Timebase

Standard Crystal (see page 198)

Frequency: 10 MHz

Aging rate: < 3 × 10⁻⁷/month

Temperature: < 5 × 10⁻⁶, 0 to 50° C

Line voltage: < 1 × 10⁻⁷ for 10% change

High-Stability Crystal: See Option 010

External Timebase Input: Rear-panel BNC accepts 5 or 10 MHz, 200 mV rms into 1 kΩ; 5 V rms maximum

Timebase Out: 10 MHz, > 1 V peak-to-peak into 50 Ω via rear panel

Statistics

Sample Size: Selectable, n = 100 to 1000 samples

Functions: Std. dev., mean, and smooth (weighted running average)

Math

All measurement functions, except GATE TIME, Totalize in Scale Mode, and TRIG LVL, may be operated upon by Math functions. Offset, Normalize, and Scale may be used independently or together:

$$\text{Display} = \frac{\text{measurement} + \text{offset}}{\text{normalize}} \times \text{scale.}$$

Number Value Range: ±1 × 10⁻⁹ to ±9 × 10⁹

Last Display: Causes value of previous display to Offset (negative value), Normalize, or Scale all subsequent measurements

Measurement t-1: Causes each new measurement to be Offset, Normalized, or Scaled by immediately preceding measurement

Hewlett-Packard Interface Bus (See Option 040)

Programmable Controls: All measurement functions, Math, Statistics, Reset, Range Hold, Ext. Arm Enable/Slope, Check, Gate Adj. (~1 ms to 1 s), Gate Open/Close (gate times to ∞), Gate Mode, Cycle, Preset, Slope, Common A, Auto Trigger

Special Functions: FREQ B, PULSE B, TIME B → A, TOT A-B, LEARN, MIN, MAX, all internal diagnostic routines

Interface Functions: SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0 (see page 85)

Data Output: Fixed format consisting of 19 characters plus CR and LF output typically in 8 ms

General

Gate: Minimum, manual, or continuously variable (NORM/FAST) via Gate Adj. control

NORM: 20 ms to 4 s nominal

FAST: 100 μs to 20 ms nominal

MIN: Minimum gate time. Actual time depends on function.

MANUAL: Each press opens or closes gate.

Cycle: Determines delay between measurements

NORM: No more than a 4 readings per second, nominal

MIN: Updates display as rapidly as possible (~15 readings per second, depending on function)

SINGLE: One measurement taken with each press of button.

Arming: Ext. Arm Enable key allows rear-panel input to determine Start and/or Stop point of a measurement. External gate defined by both Start and Stop armed. All measurements are armable except Manual Totalize, Phase, and Trigger Level.

Start arm: + or - slope of arm input signal starts measurement.

Stop arm: + or - slope of arm input signal stops measurement.

When used, Start Arm must occur before Stop Arm.

Ext. arm input: Rear-panel BNC accepts TTL into 20 kΩ. Minimum Start to Stop Time: 200 ns.

Trigger Level Out: dc output into 1 MΩ via rear panel BNCs for Channel A and B; not adjusted for attenuators.

Accuracy at dc (×1): ±15 mV ±0.5% of TRIG LVL reading

Gate Out: TTL level into 50 Ω; goes low when gate open; rear panel BNC

Range Hold: Freezes decimal point and exponent of display.

Display: 12-digit LED; exponent range of +18 to -18

Operating Temperature: 0° to 50° C

Power Requirements: 100, 120, 220, 240 Vac (+5%, -10%), 48 to 66 Hz; 130 VA max

Weight: Net, 8.8 kg (19 lb 8 oz); shipping, 13.6 kg (30 lb)

Size: 425.5 mm W × 132.6 mm H × 345.4 mm D (16 1/4 in × 5 1/4 in × 13 1/2 in), not including removable handles

Options

Opt 010: High Stability Timebase Oven (see page 198)

Frequency: 10 MHz.

Aging rate: < 5 × 10⁻¹⁰/day after 24-hour warmup

Short term: < 1 × 10⁻¹⁰ rms for 1s average

Temperature: < 7 × 10⁻⁹, 0° to 50° C

Line voltage: < 1 × 10⁻¹⁰ for 10% change

Warmup: Within 5 × 10⁻⁹ of final value in 20 minutes

Opt 020: dc Digital Voltmeter

Range: 4 digits, autoranging, autopolarity, in ±10, ±100, ±1000 V ranges

Sensitivity: 100 μV, 1 mV, 10 mV, 100 mV for ±1 V, ±10 V, ±100 V, ±1000 V readings

LSD displayed: Same as sensitivity

Input type: Floating pair

Input frequency impedance: 10 MΩ ± 1%

Opt 030: 1.3 GHz C Channel

Input range: 150 MHz to 1.3 GHz prescaled by 20

Input sensitivity: 10 mV rms sinewave (-27 dBm) to 1 GHz; 100 mV rms sine wave (-7 dBm) to 1.3 GHz

LSD displayed, resolution, accuracy: Same as Frequency A

Ratio C/A Range: Channel A, 0 to 200 MHz

Channel C, 150 to 1300 MHz

Opt 040: Complete Systems Programmability

Adds remote selection of low-pass filter, ac/dc coupling, attenuator, dc trigger level, and input impedance for Channels A and B

Ordering Information

	Price
HP 5335A Universal Counter (with front handles)	\$5,775
Opt 010 Oven Oscillator	+ \$1,100
Opt 020 DVM	+ \$825
Opt 030 C Channel	+ \$1,015
Opt 040 Expanded HP-IB Control	+ \$950
Opt 908 Rack Flange Kit for Use Without Handles	+ \$75
Opt 913 Rack Flange Kit for Use With Supplied Front Handles	+ \$70
Opt W30 Extended Repair Service (see page 624)	\$110
Opt W32 Calibration Service (see page 624)	\$525
HP 10855A 2 MHz to 1300 MHz Preamplifier	\$1,450

For the most current prices and product information, contact your local Hewlett-Packard sales office—see page 654.