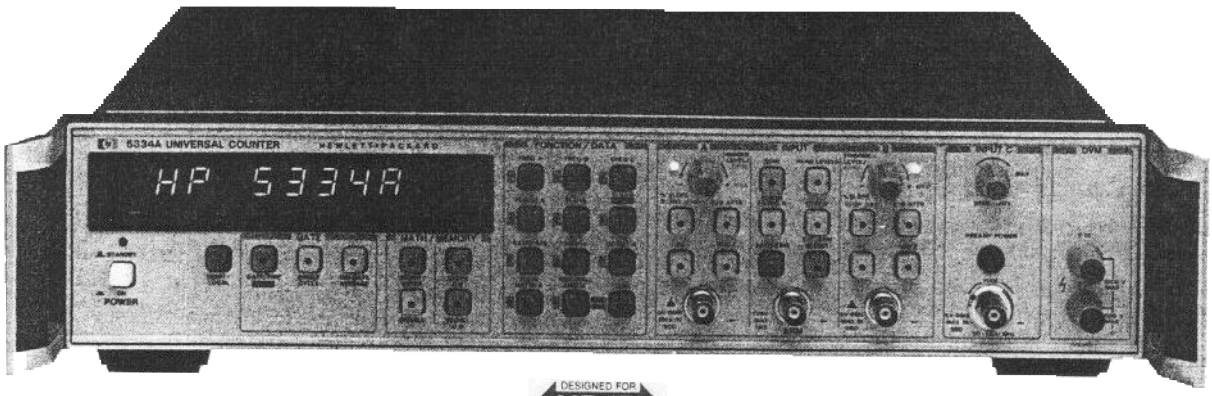
ELECTRONIC COUNTERS

100 MHz Universal Counters

Model 5334A

- Two matched 100 MHz channels; optional 1.3 GHz channel C
- 9 digits per second resolution over the entire frequency range in one second
- 2 ns single shot time interval resolution
- Automatic rise/fall time, pulse width and peak amplitude measurements
- Store/recall of up to 10 front panel setups
- Complete HP-IB programmability including trigger levels



HP 5334A

DESIGNED FOR HP-IB SYSTEMS

The HP 5334A is a two-channel, 100 MHz Universal Counter with 9 digits in one second resolution and 2 ns single shot time interval resolution. Frequency, period, rise time, fall time, pulse width and peak amplitude may be measured automatically—all at the touch of a button. Options include a high-stability oven oscillator, a +/− 1000 V DVM and a 1.3 GHz C-Channel.

Fully Programmable

Complete HP-IB capability standard is a first for counters in this class, opening up new possibilities for ATE applications. All front panel controls are programmable including input signal conditioning and trigger levels. Optional rear terminal inputs simplify cabling in rack-mounted systems.

Peak Amplitudes

The peak amplitude function adds a new dimension to universal counter applications. For any waveshape up to 20 MHz, the HP 5334A measures not only time and frequency, but also the maximum and minimum peak amplitudes of Channel A or B input signals. Often this function reduces the need for additional test equipment and gives a more complete picture of the input signal.

Input Signal Conditioning

In addition to automatic capability, independent selection of input signal conditioning provides flexibility for any application. Accurate triggering is ensured by selection of trigger slope, coupling, input impedance, attenuation, low pass filter, and variable sensitivity. Variable sensitivity may be used to widen the hysteresis band for measurements on noisy input signals.

Triggering Alternatives

The HP 5334A offers four alternatives for trigger level selection. Auto Trigger offers maximum convenience. The maximum and minimum peaks of the input signal are found automatically, and the optimum trigger point calculated. Auto Attenuator is enabled with Auto Trigger, ensuring correct counting by selecting the X10 attenuator when the input signal amplitude is greater than the input signal operating range.

The trigger levels may also be set manually over the range of −5.10 V to +5.10 V (−51.0 V to +51.0 V in X10 attenuation). Read Levels may be used to display the current trigger level control settings. -Storing trigger levels from the front panel and programming trigger levels over HP-IB complete the alternatives for reliable and accurate -triggering.

Store/Recall

Up to ten instrument setups including trigger levels may be stored in a nonvolatile memory and conveniently recalled. Sequencing through several complicated setups requires much less time and results in repeatable, exact measurement setups.

Math

Math functions let you view results in measurement units of your choice such as velocity, flow, or ppm. Normalize divides the measured value by a constant. Offset adds or subtracts the measured value by a constant.

External Arming

Synchronize a measurement to a real time event or events. Start arm is used alone to enable the start of a measurement, stop arm to enable the stop of a measurement. External gating is accomplished by arming both the start and stop of a measurement. This capability facilitates applications such as measuring the frequency within a pulsed RF signal and averaging for increased resolution, selecting a specific time interval within a pulse train, and selecting a portion of a pulse train to totalize.

The arm input and slope selection are conveniently located on the front panel and are programmable over HP-IB. The trigger level at which the arm signal will arm a measurement may be selected from −4 V to +4 V via a rear panel control.

Condensed Specifications

Input Characteristics (channels A and B)

Range

DC coupled: 0 to 100 MHz.

AC coupled: 1 MΩ, 30 Hz to 100 MHz. 50Ω, 1 MHz to 100 MHz.

Sensitivity

15 mV rms sine wave to 20 MHz. 35 mV rms sine wave to 100 MHz. 100 mV peak-to-peak at a minimum pulse width of 5 ns.

Sensitivity can be continuously varied to 150 mV rms, (NOMINAL) using the TRIGGER LEVEL/SENS control in sensitivity mode. (Trigger levels set to 0 V NOMINAL.)

Dynamic Range (X1)

45 mV to 5 V peak-to-peak, to 20 MHz.

100 mV to 2.5 V peak-to-peak, to 100 MHz.

Signal operating range, dc: ±5 V DC (X ATTN).

Trigger Level Range

Manual (auto trigger off): continuously adjustable over ±5.1V, displayed in 20 mV steps. In X10, ±51 V displayed in 200 mV steps.

Preset: 0 V NOMINAL in Sensitivity Mode.

Auto Trigger
DC coupled: 100 Hz to 100 MHz.
AC coupled: 1MΩ, 100 Hz to 100 MHz. 50Ω, 1 MHz to 100 MHz.
Coupling: ac or dc, switch selectable.
Trigger slope: independent selection of + or − slope.
Impedance: 1 MΩ NOMINAL shunted by <60 pf or 50 Ω NOMINAL, switch selectable.
Attenuator
Manual: X1 or X10 NOMINAL, switch selectable.
Auto: attenuator automatically switched when in Auto Trigger.
Low pass filter: 100 kHz NOMINAL, switchable in or out of Channel A.

External Arm
Minimum width: 50 ns.
Maximum transition time: 1 μs.
Sensitivity: 500 mV peak-to-peak.
Signal operating range: −5 Vdc to +5 Vdc.
Slope: independent selection of START and STOP ARM slopes: +, −, or OFF.

Frequency A and Frequency B
Range: .001 Hz to 100 MHz.
LSD: (4ns/Gate Time) X FREQ.
Resolution

$$\pm \text{LSD} \pm \frac{(1.4 \times \text{Trigger Error} + 1 \text{ ns rms})}{\text{Gate Time}} \times \text{FREQ.}$$

Accuracy: ± Resolution ± Time Base Error × FREQ.

Period A
Range: 10 ns to 10^3 s, single shot. 10 ns to 10 s for 100 GATE AVERAGE.
LSD: (4 ns/Gate Time) × PER.
Resolution

$$\pm \text{LSD} \pm \frac{(1.4 \times \text{Trigger Error} + 1 \text{ ns rms})}{\text{Gate Time}} \times \text{PER.}$$

Accuracy: ± Resolution ± Time Base Error × PER.

Time Interval A to B
Range: −1 ns to 10^3 seconds, single shot. −1 ns to 10s for 100 GATE AVERAGE.
LSD: 1 ns (100 ps using 100 GATE AVERAGE).
Resolution: ± LSD ± Start Trigger Error ± Stop Trigger Error ± 1 ns rms.
Accuracy: ± Resolution ± (Time Base Error × TI) ± Trigger Level Timing Error ± Trigger Level Setting Error ± 2 ns.

Time Interval Delay
Used with Time Interval A to B, a selectable delay can be inserted between START (Channel A trigger) and STOP (Channel B trigger). Electrical inputs during delay are ignored. Delay Range is 1 ms to 99.999 s (1 ms steps).

Ratio A/B
Range: .001 Hz to 100 MHz both channels.
LSD: 4 × RATIO/(FREQ A × Gate Time).
Resolution and Accuracy
± LSD ± (B Trigger Error/Gate Time) × RATIO.

Totalize A
Range: 0 to $10^{12}-1$.
LSD: 1 count of input signal.
Resolution and accuracy: ± LSD.

Pulse Width A
Range: 5 ns to 10 ms.
LSD: 1 ns (100 ps using 100 GATE AVERAGE).
Resolution: ± LSD ± Start Trigger Error ± Stop Trigger Error ± 1 ns rms.

Rise/Fall Time A
Range: 30 ns to 10 ms.
Minimum amplitude: 500 mV peak-to-peak.
Dynamic range: 500 mV to 40 V peak-to-peak.
LSD: 1 ns (100 ps using 100 GATE AVERAGE).
Resolution: ± LSD ± Start Trigger Error ± Stop Trigger Error ± 1 ns rms.

Read Peak Amplitudes
Maximum and minimum peaks of Channel A or Channel B input are displayed.
Frequency range: DC, 100 Hz to 20 MHz.
Dynamic range: 0 V to 40 V peak-to-peak.
Resolution: ×1: 20 mV. ×10: 200 mV.

Time Base
Standard Crystal
Frequency: 10 MHz.
Aging rate: $<3 \times 10^{-7}$ per month.
Temperature: $<5 \times 10^{-6}$, 0° to 50°C.
Line voltage: $<1 \times 10^{-7}$ for 10 % change.
External input: rear panel BNC accepts 10 MHz, 500 mV to 5 V rms into 1 KΩ nominal shunted by < 20 pf.
Time base output: 10 MHz, >500 mV rms sine wave into 50Ω via rear panel.
Gate time range: 1 ms to 99.999 seconds in 1 ms increments.

Math
Display = (Measurement/Normalize) + Offset.
Entry range: $\pm 1 \times 10^{-10}$ to $\pm 9.99999999999 \times 10^{9}$.
Single cycle: when enabled, one measurement is taken with each push of RESET key.
100 gate average: 100 gates accumulated and average displayed. This adds an additional digit of resolution.
Gate output: rear panel BNC drives TTL levels into 1 kΩ.

Hewlett-Packard Interface Bus
Programmable controls: all front panel controls and functions, except Option 030 Channel C sensitivity and power on/stby switch.
Trigger level: set Channel A or B from −5.1 V to +5.1 V in 20 mV steps (× ATTN).
Other: Initialize, Transmit Error, High-Speed Output, Transmit Calibration Data, Device ID, and SRQ Mask.
Data Output
Normal operation: format: 19 characters plus CR and LF. Rate: Ten readings/second.
High speed output mode: format: 8 bytes of count data and Interpolator Start and Stop counts. Rate: up to 140 readings/second with 1 ms gate time.
Interface functions: SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP0, DC1, DC1, C0, E2.

Options
Option 010 High Stability Time Base (Oven)
Frequency: 10 MHz.
Aging rate: $<5 \times 10^{-10}$/day after 24-hour warm up.
Short term: $<5 \times 10^{-10}$ rms for a 1-second average.
Temperature: $<7 \times 10^{-9}$, 0 to 50°C.
Line voltage: $<5 \times 10^{-10}$ for 10% change (2 minutes after change).
Warm up: within 5×10^{-9} of final value in 20 minutes.
Option 020 DC Digital Voltmeter
Range: 4 digits, autoranging, and autopolarity in ±10 V, ±100 V, ±1000 V ranges.
Sensitivity and LSD: 100 μV for ±1 V reading. 1 mV for ±10 V reading. 10 mV for ±100 V reading. 100 mV for ±1000 V reading.
Input type: floating pair.
Input resistance: 10 MΩ ±1%.
Option 030 1300 MHz C Channel
Range: 90 MHz to 1300 MHz.
Sensitivity: 15 mV rms (−23.5 dBm) sine wave, 90 MHz to 1000 MHz. 75 mV rms (−9.5 dBm) sine wave, 1000 MHz to 1300 MHz.

Ordering Information
Option 010: Oven Oscillator
Option 020: DVM
Option 030: Channel C
Option 050: Both option 020 and 030, order instead of both options separately.
Option 060: Rear Terminals
Channel A, B and ARM in parallel with front inputs.
Options 020 and 030 at rear panel only.
Option 908: Rack Mount Kit for use without front handles.
Option 913: Rack Mount Kit for use with supplied front handles.

HP 5334A Universal Counter