



# Agilent 5345A Universal Counter, 500 MHz

Data Sheet

## Product Specifications

Input Specifications (pulse and CW mode) 5356C

### Frequency Range 1.5 - 40 GHz

Sensitivity (0-50 deg. C):

0.4-1.5 GHz --

1.5-12.4 GHz -25 dBm

12.4-18 GHz -20 dBm

18-26.5 GHz -20 dBm

26.5-34 GHz -15 dBm

34-40 GHz -10 dBm

### Maximum Input:

0.4-1.5 GHz --

1.5-12.4 GHz +5 dBm

12.4-18 GHz +15 dBm

18-26.5 GHz +15 dBm

26.5-40 GHz +15 dBm

36-110 GHz --

**Damage Level:** +25 dBm peak

**Impedance:** 50 ohm NOMINAL

### SWR: (typical)

0.4-1.5 GHz --

1.5-10 GHz <2:1

10-18 GHz <3:1

18-26.5 GHz <3:1

26.5-34 GHz <3:1

34-40 GHz <5:1

36-110 GHz --

**Connector:** APC 3.5 male with collar

HP 5345A/55A

**Frequency Range:** 0.4-1.5 GHz

Sensitivity (0-50 deg. C):

0.4-1.5 GHz -15 dBm

1.5-12.4 GHz --

12.4-18 GHz --

18-26.5 GHz --

26.5-34 GHz --

34-40 GHz --

**Maximum Input:**

**Damage Level:** +24 dBm peak (use in BNC Connector)

**Impedance:** 50 ohm NOMINAL

**SWR: (typical)**

0.4-1.5 GHz <2:5:1

**Connector:** BNC

CW Mode HP 5356C

**FM Tolerance:**

**Auto Mode:** 60 MHz p-p, rate: dc - 10 MHz

**Man Mode:** 80 MHz p-p, rate: dc - 10 MHz

**AM Tolerance:** Any modulation index provided the minimum signal level is greater than the counter sensitivity.

**Acquisition Time (typical):**

**Auto Mode:** 1.4s (Option 001: 1.1s)

**Man Mode:** 15 ms

**Measurement Time (typical):**

**GATE TIME <= 100 ms:**

Acquisition time + 4 x HP 5345A GATE TIME + HP 5345A Sample Rate + 125 ms

**GATE TIME > 100 ms:**

Acquisition Time + HP 5345A GATE TIME + HP 5345A Sample Rate + 35 ms

**LSD:** 1 divided by 5345A GATE TIME

**Resolution:** +/- 2 x LSD +/- 10e-10 RMS x FREQ

**Accuracy (after 1 min. warmup):** Resolution +/- Timebase error x FREQ

**FM Tolerance:**

**Auto Mode:** 60 MHz p-p, rate dc - 10 MHz

**Man Mode:** 80 MHz p-p, rate: dc - 10 MHz

**AM Tolerance:** Any modulation index provided the minimum signal level is greater than the counter sensitivity.

**Acquisition Time (typical):**

**Auto Mode:** 1.4s (Option 001: 1.1s)

**Man Mode:** 15 ms

**Measurement Time (typical):**

**GATE TIME <= 100 ms:**

Acquisition time + 4 x HP 5345A GATE TIME + HP 5345A Sample Rate + 125 ms

**GATE TIME > 100 ms:**

Acquisition Time + HP 5345A GATE TIME + HP 5345A Sample Rate + 35 ms

**LSD:** 1 divided by 5345A GATE TIME

**Resolution:** +/-2 x LSD +/- 10e-10 RMS x FREQ

**Accuracy (after 1 min. warmup):** Resolution +/- Timebase error x FREQ 5345A/55A

**FM Tolerance:** Instantaneous frequency must not exceed 0.4-1.5 GHz range

**AM Tolerance:** Any modulation index provided the minimum signal level is greater than the counter sensitivity.

**Acquisition Time (typical):**

**FREQ >= 800 MHz:** <1 ms

**FREQ <800 MHz:** HP 5345A Sample rate + 35 ms

**Measurement Time (typical):**

Acquisition time + HP 5345A GATE TIME + HP 5345A Sample Rate + 35 ms

**LSD:** 1 divided by 5345A GATE TIME

**Resolution:** +/-5 x LSD

**Accuracy (after 1 min. warmup):** Resolution +/- Timebase error x FREQ Pulse Mode 5356C

**FM Tolerance:**

Input Auto Mode: 50 MHz p-p, Chirp

Input Man Mode: 80 MHz p-p, Chirp

**Measurement Time (typical):****Input Auto Mode: Input Man Mode:**

Acquisition Time + Calibration Time + HP 5345A SAMPLE RATE +  
60 ms + ((1 us + HP 5345A GATE TIME) / (EXT GATE WIDTH x PRF))

**Pulse Width:****Input Auto Mode:**

Min: 100 ns

Max: 20 ms

**Input Man Mode:**

Min: 75 ns

Max: 20 ms

**Pulse Repetition Frequency:****Input Auto Mode:**

Min: 50 Hz

Max: 2 MHz

**Input Man Mode:**

Min: 50 Hz

Max: 2 MHz

**Maximum Video Feed-Through:** 15 mV p-p typical for RF burst rise and fall times >10 ns.

**Accuracy (after 1 min. warmup):**

+/-2 x LSD +/- rms Jitter +/- Gate Error +/- Timebase Uncertainty 5345A/55A

**FM Tolerance:** Instantaneous frequency must not exceed

0.4-1.5 GHz range

**Measurement Time (typical):**

Acquisition Time + Calibration Time + HP 5345A SAMPLE RATE + 60 ms +  
((1 us + HP 5345A GATE TIME) / (EXT GATE WIDTH x PRF))

**Pulse Width:**

Min: 150 ns

Max: 1 s

**Pulse Repetition Frequency:**

Min: 100 Hz

Max: 1 MHz

**Maximum Video Feed-Through:** 15 mV p-p typical for rf burst rise and fall times >10 ns.

**Accuracy (after 1 min. warmup):**

+/- (16 x LSD) +/- (5 x rms Jitter) +/- Gate Error +/-  
Timebase Uncertainty

5345A Inputs, Separate Inputs:

**Range:**

(dc coupled): 0 to 500 MHz

(ac coupled, 50 ohm): 4 MHz to 500 MHz

(ac coupled, 1 Mohm): 200 Hz to 500 MHz

**Impedance:** selectable, 1 Mohm (nominal) shunted by approximately 45 pF or 50 ohm (nominal).

**Sensitivity:**

X1: 25 mV rms sine wave and 75 mV peak-to-peak

X10: 300 mV sine wave and 900 mV peak-to-peak pulse

**Dynamic Range (50 ohm and 1 Mohm):**

X1: 25 mV to 300 mV rms sine wave and 75 mV to 900 mV p-p pulse

X10: 300 mV to 2.0 V rms sine wave and 900 mV to 6.0V p-p pulse

**Linear Operating Range:** -2.0 to +2.0V dc (nominal)

**Trigger Level:** Adjustable over +/- 2.0V dc

Preset: centers trigger level to 0V dc (nominal) at 25 degrees C

Drift: +/-10 mV dc max, 0 degrees C to 50 degrees C

Output: Channel A and B trigger voltages (x ATTEN) available at rear panel BNC connectors

Accuracy:

X1: +/-15 mV

X10: +/-150 mV (nominal)

**Slope:** independent selection of positive or negative slope

**Maximum Input:**

50 ohm, X1: +/-7V dc, 7V rms below 5 MHz, 3.5 Vrms (+24 dBm)  
5 MHz and above

1 Mohm, X1: +/-350V dc, 250V rms to 20 kHz, decreasing to 3.5V rms above 5 MHz

1 Mohm, X10: +/- 350V dc, 250V rms to 20 kHz, decreasing to 35V rms above 5 MHz  
5345A Inputs, Common Input

**Range:**

dc coupled: 0-400 MHz  
ac coupled, 50 ohm: 4-400 MHz  
ac coupled, 1 Mohm: 300 Hz-400 MHz

**Impedance:** 50 ohms remains 50 ohms; 1 Mohm becomes 500 kohm (nominal)  
shunted by approximately 80 pF.

**Sensitivity:**

50 ohm, X1: 50 mV rms sine wave and 150 mV p-p pulse  
50 ohm, X10: 600 mV rms sine wave and 1.8V p-p pulse  
1 Mohm: <=50 MHz = 25 mV rms  
50-200 MHz = 75 mV rms  
200-400 MHz = 120 mV rms

**Dynamic Range:**

50 ohm, X1: 50 mV to 600 mV rms sine wave and 150 mV to 1.8V p-p pulse  
50 ohm, X10: 600 mV to 4.0V rms sine wave and 1.8V to 12V p-p pulse  
1 Mohm: same as Separate Inputs

**Maximum Input:**

50 ohm: +/-5.0V dc or 5V rms  
1 Mohm: same as Separate Inputs

**Trigger Level:** adjustable over the range +/-4.0V dc (X ATTEN) in 50 ohm or +/-2.0V dc in 1 Mohm (X ATTEN)

Output: Channel A and B trigger voltages times 2 (X ATTEN) available at rear panel BNC connectors

**Accuracy:**

50 ohm, X1: +/-30 mV nominal  
50 ohm, X10: +/-300 mV nominal  
1 Mohm: same as Separate Inputs

**Frequency**

**Range:** 0.00005 Hz to 500 MHz

**Resolution:** +/- LSD +/- ((Noise Trigger Error) / (Gate Time)) x Frequency

Least significant digit (LSD) is nine digits per second of measurement time.

With DISPLAY POSITION switch in AUTO, the LSD error is +/-1 count if the most significant digit (MSD) is 1 through 4, and +/-2 counts if the MSD is 5 through 9.

**Accuracy:** Resolution +/- Timebase Error x Frequency

**Measurement Time:** When in MIN the GATE TIME is 50 ns or one period of the input signal, whichever is greater. When the GATE TIME is set to one of the decade steps, the counter will reset if a stop trigger is not reached within 3.5 times the GATE TIME setting. Decade GATE TIME settings range from 100 ns to 1000s.

When using EXT GATE, the measurement cycle time consists of the GATE TIME divided by the duty cycle of the EXT GATE signal plus the time required to reach the next STOP trigger level after the end of the last EXT GATE pulse.

**General**

**Display:** 11-digit LED display and sign. Decimal point is positioned with DISPLAY POSITION control or positioned after the first, second or third most significant digit if DISPLAY POSITION is in AUTO.

**Sample rate:** rate continuously variable from <0.1s to <5s with front-panel control. In HOLD position the last reading is maintained until the counter is reset or an EXT ARM signal is applied.

**External arm input:** counter can be armed by a -1.0V (-5.0V max) signal applied to the rear panel 50 ohm input for greater than 500 ns. Minimum time between EXT ARM and acceptance of start pulse is <1 us (typical).

**Operating temperature:** 0 degrees C to 50 degrees C.

**Power requirements:** 100/120/220/240V rms +5% -10% 48 to 66 Hz, maximum power 250 VA.

**Size:** 132.6 mm H x 425 mm W x 495 mm D (5.22 in x 16.75 in x 19.95 in); 17kg (37 lb).

### **Output**

Programmable over the GPIB, the 5345A can transfer more than 9000 measurements per second over the bus. The fast throughput saves time and reduces cost for systems applications.

### **Flexible Gating**

For applications requiring more detailed information than the average frequency in a burst, the 5345A can accept your choice of measurement gates. External gates as short as 20 ns can be used for profiling the frequency content of a chirp radar, or characterizing the post-tuning drift of voltage-controlled oscillators.

### **Automatic Averaging**

The automatic averaging algorithm improves accuracy. By lengthening the gate time, you can reduce the effect of jitter and noise on your measurements.

### **High-Stability Timebase**

The built-in timebase ages at the rate of  $5 \times 10^{-10}$  per day, extending the calibration cycle to two years while maintaining kHz accuracy for a 20 GHz measurement.