*Table 1-1. Model 5335A Specifications*

## INPUT CHARACTERISTICS (Channel A and B)

**Range:**
DC coupled, 0 to 100 MHz.
AC 1 MΩ, 30 Hz to 100 MHz.
AC 50 Ω, 200 KHz to 100 MHz.
**NOTE:** Channel A range 200 MHz when in Frequency A and Ratio modes.

**Sensitivity (X1):**
25 mV rms sine wave.
75 mV peak-to-peak pulse at minimum pulse width of 5 ns.

**Dynamic Range (X1):**
75 mV to 5V peak-to-peak, to 100 MHz.
75 mV to 2.5V peak-to-peak, > 100 MHz.

**Signal Operating Range (X1, DC):**
-5V dc to +5V dc.

**Crosstalk (X1):** <500 mV rms, 0 to 100 MHz, or <250 mV rms, 100 to 200 MHz, sine wave in either channel will not affect other channel.

**Trigger Level Range (X1):**
**Auto Trigger OFF:**
**Preset:** Set to 0V dc NOMINAL.
**Adjustable:** -5V dc to +5V dc.
**Auto Trigger ON:**
**Preset:** Set to NOMINAL 50% point of input signal.
**Adjustable:** NOMINALLY between + and - peaks of input signal.

**Auto Trigger (X1):**
**Range (50% duty cycle):**
DC coupled, 30 Hz to 200 MHz.
AC 1 MΩ, 30 Hz to 200 MHz.
AC 50 Ω, 200 kHz to 200 MHz.
**Minimum Signal:** 100 mV rms.
**Duty Cycle Range:** 10% to 90%.
**Response Time:** 3 seconds TYPICAL.
**NOTE:** Auto Trigger requires a repetitive signal.

**Coupling:** AC or DC, switchable.

**Impedance:** 1 MΩ NOMINAL shunted by <35 pf, or 50 Ω NOMINAL, switchable. In COMMON A, 1 MΩ is shunted by <50 pf.

**Attenuator:** X1 or X10 NOMINAL, switchable.

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

**Channel Input:** SEPARATE or COMMON A, switchable.

**Damage Level** (AC or DC):
**1 MΩ X 1:**
DC to 2 kHz .... 250V (DC + AC rms)
2 to 100 kHz (5 X $10^5$V rms Hz) /FREQ
>100 kHz ..... 5V rms
**1 MΩ X 10:**
DC to 20 kHz ... 250V (DC + AC rms)
20 to 100 kHz (5 X $10^6$V rms Hz) /FREQ
>100 kHz ..... 50V rms
**50Ω:**
DC to 200 MHz ..... 5V rms

## FREQUENCY A

**Range:** 0 to 200 MHz, prescaled by 2.

**LSD** Displayed:**

$\frac{1\text{ ns}}{\text{Gate Time}}$ X FREQ. (e.g., 9 digits in a second)

**Resolution:**

$\pm$ (2 X LSD) $\pm$ 1.4 X $\frac{\text{Trigger Error }^{**}}{\text{Gate Time}}$ X FREQ.

**Accuracy:** $\pm$ (Resolution ) $\pm$ (Time Base Error) X FREQ.

## PERIOD A

**Range:** 10 ns to $10^7$s.

**LSD** Displayed:**

$\frac{1\text{ ns}}{\text{Gate Time}}$ X PER. (e.g., 9 digits in a second)

**Resolution:**

$\pm$ (2 X LSD) $\pm$ 1.4 X $\frac{\text{Trigger Error }^{**}}{\text{Gate Time}}$ X PER.

**Accuracy:** $\pm$ (Resolution) $\pm$ (Time Base Error) X PER.

**Period Average:** User selects MEAN function, and n = 100, or n = 1,000.

## TIME INTERVAL A→B

**Range:** 0 ns to $10^7$s.

**LSD** Displayed:** 1 ns (100 ps using MEAN).

**Resolution:** $\pm$ (2XLSD) $\pm$ (START Trigger Error**) $\pm$ (STOP Trigger Error**).

**Accuracy:** $\pm$ (Resolution) $\pm$ (Time Base Error) X TI $\pm$ (Trigger Level Timing Error**) $\pm$ (2 ns).

**Gate Mode:** MIN only.

**Time Interval Average:** User selects MEAN function, n = 100 or n = 1,000.

## TIME INTERVAL DELAY (Holdoff)

For Time A→B, 1/Time A→B, Pulse A, (Time B→A, Pulse B), 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 μs to 4s NOMINAL) for gate modes of Fast, Norm, and Manual. Delay measured by pressing Gate Time key. All other specifications are same as Time Interval A→B.

## INVERSE TIME INTERVAL A → B

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

**LSD Displayed, Resolution,** and **Accuracy** are inverse of Time Interval A → B specifications. If Time Interval A → B is zero, display will be zero.

## RISE AND FALL TIME A

**Range:** 20 ns to 10 ms

**Minimum Pulse Height:** 500 mV peak-to-peak.

**Minimum Width at Peak of Signal:** 20 ns.

**Duty Cycle Range:** 20% to 80%.

**LSD Displayed** and **Resolution** are same as Time Interval A→B specifications.

**Accuracy:** $\pm$ (TI Accuracy) $\pm$ (Trigger Level Setting Error** at 10% point) $\pm$ (Trigger Level Setting Error** at 90% point).

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

**Gate Mode:** MIN only.

## PULSE WIDTH A

**Range:** 5 ns to $10^7$s.

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

**LSD Displayed** and **Resolution** are same as Time Interval A → B specifications.

**Accuracy:** $\pm$ (Resolution) $\pm$ (Time Base Error) X PULSE $\pm$ (Trigger Level Timing Error**) $\pm$ 2ns.

## DUTY CYCLE** A

**Range:** 1% to 99%, 0 to 100 MHz.

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

**LSD** Displayed:**

$\frac{1\text{ ns}}{\text{PER}}$ X 100%.

**Resolution:**

$$\pm\left(\frac{\text{PULSE} + |\text{ PULSE Accuracy }|}{\text{PER} - |\text{ PER Resolution }|} \times 100\% - \text{DUTY CY}\right)$$

**Accuracy:**

$$\pm\left(\frac{\text{PULSE} + |\text{ PULSE Accuracy }|}{\text{PER} \times |\text{ PER Accuracy }|} \times 100\% - \text{DUTY CY}\right)$$

**Gate Mode:** MIN only.

**NOTE:** Constant duty cycle required during measurement.

## SLEW RATE** A

**Range:** 50 V/s to $10^8$ V/s slew rate

**Minimum Pulse Height, Width,** and **Duty Cycle Range** are same as Rise and Fall Time A.

**LSD** Displayed:**

$\frac{1\text{ ns}}{|\text{ RISE/FALL }|}$ X SLEW; three digits maximum.

**Resolution:**

$$\pm\left(\frac{|\text{ TRIG LVL B - TRIG LVL A }| + 20\text{ mV}}{|\text{ RISE/FALL }| - |\text{ RISE/FALL Resolution }|} - |\text{ SLEW }|\right).$$

**Accuracy:**

$$\pm\left(\frac{|\text{ TRIG LVL B - TRIG LVL A }| \text{ X } 1.003 + 40\text{ mV}}{|\text{ RISE/FALL }| - |\text{ RISE/FALL Accuracy }|} - |\text{ SLEW }|\right).$$

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

**Gate Mode:** MIN only.

## 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.

**Resolution:**

$\pm$ LSD $\pm$ $\frac{\text{Trigger Error}}{\text{Gate Time}}$ $\times$ RATIO,

where Trigger Error is on lower frequency after prescaling.

**Accuracy:** Same as Resolution.

## 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.
**Resolution:** $\pm$ LSD
**Accuracy:** Same as Resolution.

**See Definitions section for further information.

*Table 1-1. Model 5335A Specifications (Continued)*

## PHASE** A rel B

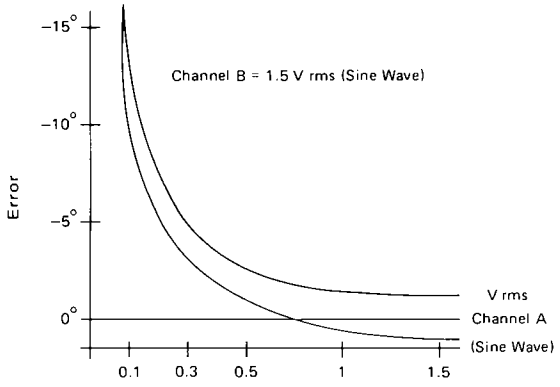
**Range:** -180° to 360°, Range Hold off, or 0° to 360°, Range Hold on, with signal repetition rates of 30 Hz to 1 MHz.
**Minimum Signal:** 100 mV rms.
**LSD** Displayed:** 0.1°.
**Resolution:**

$$\left[\pm \frac{TI_1 + |\ TI_1\ \text{Resolution}\ | + TI_2 + |\ TI_2\ \text{Resolution}\ |}{2\ [\ \text{PER A} - |\ \text{PER A Resolution}\ |\ ]} \times 360° - \text{PHASE (expressed in + degrees)}\right]$$

**Accuracy:**

$$\left[\pm\text{Resolution} + \frac{TI_1 \pm TI_1\ \text{error}) + (TI_2 \pm TI_2\ \text{error})}{2\ (\text{PER A} + \text{PER error})} \times 360° - \text{PHASE (expressed in + degrees)}\right]$$

**Input Mode:** Automatically set to 50% trigger level in A and B channels.
**Gate Mode:** MIN only.
**NOTE:** Constant phase required during measurement.




Typical phase uncertainty for PHASE A rel B measurements where channel B is 1.5 V RMS and channel A is varied in amplitude

NOTE: When signal B is **smaller** than signal A phase measurement uncertainty tends to be positive. $TI_1$ and $TI_2$ are times between 50% points of A and B as illustrated in the DEFINITIONS section.

$TI_1$ error and $TI_2$ error are the errors due to: 1) Trigger Level Timing Error, 2) Trigger Level Setting Error, and 3) Trigger Error due to noise.

## GATE TIME

**Range:** 100 ns to $10^7$s.
**LSD** Displayed:** Up to three digits with Ext. Arm Enable OFF, 100 ns when ON. MIN Gate Mode display zero.
NOTE: Time displayed and actual gate time may differ due to input signal synchronization of gate.

## TRIGGER LEVEL

**Range:** X1, +5 to -5 volts.
X10, +50 to -50 volts.
**Resolution:** X1, 10 mV; X10, 100 mV.
**Accuracy (X1):** ±20 mV, ±0.5% of reading.
**NOTE:** Reading is center point of hysteresis band. When in X10, reading is multiplied by 10.

## TIME BASE

**Standard Crystal:**
**Frequency:** 10 MHz.
**Aging Rate:** $<3 \times 10^{-7}$/month.
**Temperature:** $<4 \times 10^{-6}$, 0 to 50°C.
**Line Voltage:** $<1 \times 10^{-7}$ for 10% change.
**High Stability Crystal:** See Option 010.
**External Time Base Input:** Rear panel BNC accepts 5 or 10 MHz, 200 mV rms into 1 kΩ; 5V rms maximum.
**Time Base Out:** 10 MHz, >1V p-p into 50 Ω via rear panel.

## STATISTICS

**Sample Size:** Selectable between either N = 100 or N = 1000 samples.
**Std. Dev.:** Displays a standard deviation of selected sample size.
**Mean:** Displays mean estimate of selected sample size.
**Smooth:** Performs a weighted running average and truncates unstable least significant digits from display.
**NOTE:** Statistics functions performed after Math functions.

## MATH

All measurement functions with exception of 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 as follows:

$$\text{Display} = \frac{\text{Measurement} + \text{Offset}}{\text{Normalize}} \times \text{Scale}.$$

Numbers are entered via blue labeled keys.
DISABLE key will toggle off and on all active math keys.
**Number Value Range:** $\pm 1 \times 10^{-9}$ to $\pm 9 \times 10^{9}$.
**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 (negative value), Normalized, or Scaled by each immediately preceding measurement.

## HEWLETT-PACKARD INTERFACE BUS

**Programmable Controls:** All measurement functions, Math, Statistics, Reset, Range Hold, Ext. Arm Enable/Slope, Check, Gate Adj. (~1 ms to 1s), Gate Open/Close (gate time 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.
**HP-IB Commands:** Trigger, Clear, Remote, Local, Local Lockout, Require Service.
**Data Output Rate:** Fixed output format consisting of 19 characters plus CR and LF output in TYPICALLY 8 ms. Number of readings/second dependent on function, gate, and cycle used (~15 readings/second maximum).

## GENERAL

**Function Memory:** Front panel settings for Math, Statistics, Range Hold, Ext. Arm Enable, Gate, and Cycle stored for current function and immediately preceding function. GATE TIME and TRIG LVL do not affect memory.
**Gate:** Minimum, manual, or continuously variable (NORM/FAST) via Gate Adj. control.
**NORM:** 20 ms to 4s NOMINAL.
**FAST:** 100 μs to 20 ms NOMINAL.
**MIN:** Minimum gate time. Actual time depends on function. For FREQ A, (FREQ B), FREQ C, and PER A, minimum gate = (one period of input) × (prescale factor).
**MANUAL:** Each press opens or closes gate.
**Cycle:** Determines delay between measurements.
**NORM:** No more than 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 BNC's for Channel A and B; not adjusted for attenuators.
**Accuracy at DC (X1):** ±15 mV ± 0.5% of TRIG LVL reading.
**Gate Out:** TTL level into 1 KΩ goes low when gate open; rear panel BNC.
**Range Hold:** Freezes decimal point and exponent of display.
**Reset:** Starts a new measurement cycle when pressed.
**Check:** Performs internal self test and lamp test.
**Display:** 12 digit LED display in engineering format; exponent range of +18 to -18.
**Overflow:** All measurements which would theoretically cause a display of more than 12 digits will display 12 most significant digits.
**Operating Temperature:** 0 to 50°C.
**Power Requirements:** 100, 120, 220, 240 VAC (+5%, -10%), 48-66 Hz; 130 VA max.
**Weight:** Net, 8.8 kg (19 lbs. 8 oz.); shipping, 13.6 kg (30 lbs.).
**Dimensions:** 425.5 mm W × 132.6 mm H × 345.4 mm D (16¾" × 5¼" × 13½"), not including removable handles.

**See Definitions section for further information.

*Table 1-1. Model 5335A Specifications (Continued)*

## OPTIONS

**Option 010:** High Stability Time Base (Oven)
**Frequency:** 10 MHz.
**Aging Rate:** $< 5 \times 10^{-10}$/day after 24 hr. warm up.
**Short Term:** $< 1 \times 10^{-10}$rms for 1s average.
**Temperature:** $\leq 7 \times 10^{-9}$, 0 to 50°C.
**Line Voltage:** $< 1 \times 10^{-10}$ for 10% change.
**Warm-Up:** Within $5 \times 10^{-9}$ of final value in 20 min.

**Option 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 ± 1V, ± 10V, ± 100V, ± 1000V readings.
**LSD** Displayed:** Same as sensitivity.
**Accuracy** (10 min. warm-up): ±0.045% of reading ± 0.02% of range; for 1000V range, ± 0.06% of reading ± 0.02% of range. For 60 days at 24°C ± 5°C, RH < 80%, and gate > 100 ms.
**Temperature Coefficient:** ± (0.0055% of reading + 0.005% of range)/°C; for 1000V range, ± (0.008% of reading + 0.0005% of range)/°C.
**Input Type:** Floating pair.
**Input Impedance:** 10 MΩ ± 1%.
**Maximum Input:** Hi to Lo, ± 1000V all ranges. Low to chassis ground, ± 500V.
**Response Time:** 100 ms to within 1% of final value, within one range.
**Normal Mode Rejection:** 30 dB at 50/60 Hz.
**Effective Common Mode Rejection** (1 kΩ unbalanced): ≥ 110 dB at 50/60 Hz.
**Filter:** Single pole from 10 Hz NOMINAL.

**Option 030:** 1.3 GHz C Channel
**Input Characteristics**
**Range:** 150 MHz to 1.3 GHz, prescaled by 20.
**Sensitivity:**
10 mV rms sine wave (-27 dBm) to 1 GHz.
100 mV rms sine wave (-7 dBm) to 1.3 GHz.
Sensitivity can be decreased continuously by up to 20 dB NOMINAL, 150 to 1000 MHz and 14 dB NOMINAL, 1 to 1.3 GHz via sensitivity control. Trigger level is fixed at OV NOMINAL.

**Dynamic Range:**
10 mV to 1 V rms (40 dB), to 1 GHz.
100 mV to 1 V rms (20 dB), to 1.3 GHz.

**Signal Operating Range:** +5V dc to -5V dc.

**Coupling:** AC.

**Impedance:** 50 Ω NOMINAL (VSWR, < 2.5:1 TYPICAL).
**Damage Level:** ± 8V (DC + AC peak), fuse protected. Fuse located in BNC connector.

**Frequency C**
**Range:** 150 MHz to 1.3 GHz, prescaled by 20.
**LSD** Displayed, Resolution,** and **Accuracy** are same as Frequency A.

**Ratio C/A**
**Range:**
Channel A, 0 to 200 MHz (prescaled by 2.)
Channel C, 150 to 1300 MHz (prescaled by 20).
**LSD** Displayed, Resolution,** and **Accuracy** are same as Ratio A/B.

**Option 040:** Expanded HP-IB Control
**Added Programmable Controls:** Trigger level, input coupling, filter, input impedance, attenuation:
**Trigger Level.**
**Range:** ± 5 Vdc in 10 mV steps.
**Accuracy:** ± 30 mV of programmed level in X1; ± 300 mV in X10 NOMINAL
**Setup Time:** < 50 ms from HP-IB command.

**NOTE:** Level programmed is center of hystersis band. When in X10, displayed level is 10 times entered value. Rear panel trigger level is not multiplied by 10 in X10 mode.

**Input Coupling:** AC or DC
**Low Pass Filter:** 150 kHz (Nom.), -30 dB down at 200 MHz (Nom.)
**Input Impedance:** 1M Ω NOMINAL shunted by < 45 pf, or 50 Ω NOMINAL. In Common A, 1 M Ω is shunted by < 55 pf.
**Attenuator:** X1 or X10 NOMINAL
**Auto-Trigger:** 50 mV ms sensitivity in PRESET, 30 Hz to 200 MHz (100 MHz in Channel B).

## DEFINITIONS

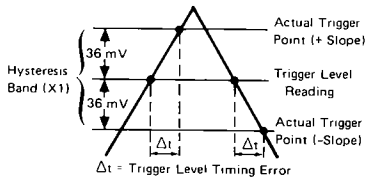
**LSD Displayed:** Unit value of Least Significant Digit displayed. Calculations should be rounded up to nearest decade, with a 12 digit mantissa maximum. If truncation required, most significant digits are kept.

**Trigger Error:**

$$\frac{\sqrt{(e_i^2 + e_n^2}}{\text{Input slew rate at trigger point}} \text{ sec rms}$$

where $e_i = 260\mu V$, typical, and is the effective rms noise of the 5335A input channel; $e_n$ is the rms noise voltage of the signal input for a 200 MHz bandwidth.

**Trigger Level and Trigger Point** (X1):




**Trigger Level Timing Error** (X1): Applies to Time Interval measurements;

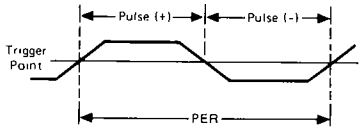
$$\frac{36 \text{ mV}}{|\text{Input slew rate at START trigger point}|} \text{ minus } \frac{36 \text{ mV}}{|\text{Input slew rate at STOP trigger point}|}$$

**Trigger Level Setting Error** (X1): Applies to Rise/Fall, Slew, and Phase measurements:

$$\frac{\pm 2\% \text{ of input p-p voltage} \pm 40 \text{ mV}}{\text{Input slew rate at trigger point}}$$

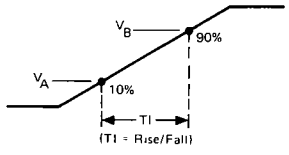
**Duty Cycle:** Percentage of time a signal is high or low, depending on Slope A setting. Trigger point is high/low dividing point.

$$\text{DUTY CY} = \frac{\text{PULSE}}{\text{PER}} \times 100\%;$$




**Slew Rate:** Effective slope between 10% and 90% points of rising or falling signal depending on Slope A setting.

$$\text{SLEW} = \frac{V_B - V_A}{TI};$$

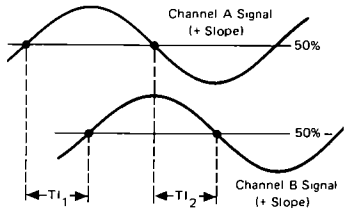



**Phase:** Angle, with respect to B signal, between 50% points of Channel A and B signals, trigger slopes selected by Channel A and B slope switches.

$$\text{PHASE} = \frac{\frac{TI_1 + TI_2}{2}}{\text{PER}} \times 360°,$$

$TI_1$ is time between 50% points of A then B signals using slopes defined during Phase measurement.

$TI_2$ is time between 50% points of A then B signals using complement slopes to $TI_1$.




*Specifications describe the instrument's warranted performance. Supplemental characteristics are intended to provide information useful in applying the instrument by giving TYPICAL or NOMINAL, but nonwarranted performance parameters. Definition of terms is provided at the end of the specification section. For a more detailed explanation, see Application Note 200-4 "Understanding Frequency Counter Specifications".

*Table 1-2. Equipment Supplied*

| DESCRIPTION | HP PART NUMBER |
|---|---|
| Detachable Power Cord 229 cm (7 1/2 feet long) | 8120-1378 |

*Table 1-3. Accessories Available*

| DESCRIPTION | HP PART NUMBER |
|---|---|
| Option 910<br>Additional Manual | |
| Rack Mounting Adapter Kits:<br>Rack Mount with Handles attached;<br>Option 913 | 5060-0171 |
| Rack Mount with Handles removed<br>Option 908 | 5061-0077 |
| Signature Analyzer | Model 5004A |
| 2–1300 MHz Preamplifier | Model HP 10855A |
| Time Interval Probes | Model 5363B |

## 1-13. DESCRIPTION

1-14. The HP Model 5335A is a Universal Counter capable of measuring signals in the 200 MHz range. The instrument's basic measurement functions include Frequency, Period, Time, Ratio, and Totalize. The resident microprocessor and multiple-register-counter expand the usefulness of the counter by allowing post-measurement data manipulation. This allows the additional power and convenience of user-defined measurement function keys for Statistical Data, Math Functions, Pulse Width, Rise/Fall Time, Slew Rate, Duty Cycle, and Phase Relationship. Interpolating oscillators, phaselocked to the instrument's time base, allow measurements to be resolved near a nanosecond.

1-15. The 5335A input provides two independent channels, featuring matched high performance 200 MHz input amplifiers. Each input channel includes a full complement of input signal conditioning controls. Additionally, the 5335A offers extensive control of trig-gerring and arming. Most measurements are displayed in scientific notation, with the digits grouped into three's for convenience. Four modes of gate selection are provided on the front panel.

1-16. HP-IB provides remote control of programming and data output.

## 1-17. OPTIONS

1-18. The following lists the options available for the 5335A. Specifications for the options are given in *Table 1-1*. If an option is included in the initial order, it will be installed at the factory and ready for operation upon receipt. For field installation of Options 010, 020, 030 and 040, refer to Section II for part numbers and instructions.

| Option | Description |
|---|---|
| 010 | High Stability Time Base (Oven Oscillator) |
| 020 | DC Voltmeter Module |
| 030 | C Channel Input Module A/B |
| 040 | Programmable Input Amplifiers |

## 1-19. RECOMMENDED TEST EQUIPMENT

1-20. The test equipment listed in *Table 1-4* is recommended for use during performance tests, adjustments, and troubleshooting. Substitute test equipment may be used if it meets the required characteristics listed in the table.