

Table 3-1. Specifications

**FREQUENCY**

**Range:**

Sine: 1  $\mu$ Hz to 20.999 999 999 MHz

Square: 1  $\mu$ Hz to 10.999 999 999 MHz

Triangle/Ramps: 1  $\mu$ Hz to 10.999 999 999 kHz

**Resolution:**

1  $\mu$ Hz, <100 kHz

1 MHz  $\geq$  100 kHz (1  $\mu$ Hz available, not displayed)

**Accuracy:**

$\pm 5 \times 10^{-6}$  of selected value, 20°C to 30°C, at time of calibration (Standard Instrument)

**Stability:**

$\pm 5 \times 10^{-6}$ /year, 20°C to 30°C, standard (See also option 001, high stability frequency reference)

**Warm-up Time:**

20 minutes to within specified accuracy.

**MAIN SIGNAL OUTPUT**

(all waveforms)

**Impedance:**

50  $\Omega \pm 1\Omega$ , 0-10 kHz

**Return Loss:**

> 20 dB, 10 kHz to 20 MHz, except > 10 dB for > 3 V, 5 MHz to 20 MHz

**Connector:**

BNC; switchable to front or rear panel, non-switchable with option 002 except by internal cable change.

**Floating:**

Output may be floated up to 42V peak (AC + DC)

**AMPLITUDE (all waveforms)**

**Resolution:**

0.03% of full range or 0.01 dB (4 digits).

**Range:**

1 mV to 10 Vp-p in 8 amplitude ranges, 1-3-10 sequence. Ranges are 1 mV-2.999 mV, 3 mV-9.999 mV, 10 mV-29.99 mV, 30 mV-99.99 mV, 1 V- 2999 V, 3 V- 9999 V, 1V-2.999 V, 3 V-10V, (without DC offset).

Function	peak to peak	rms	dBm(50 $\Omega$ )
Sine	min.	0.354 mV	-56.02
	max.	3.536 V	+23.98
Square	min.	0.500 mV	-53.01
	max.	5.000 V	+26.99
Triangle/Ramps	min.	0.289 mV	-57.78
	max.	2.887 V	+22.22

**Accuracy: (with 0 Vdc offset)**

**Sine:**

	.001 Hz	100 kHz	10 MHz	20 MHz
+ 23.98 dBm	$\pm .1$ dB	+ .4 dB		
+ 13.52 dBm				$\pm .6$ dB
-16.02 dBm	$\pm .2$ dB	$\pm .6$ dB		
-56.02 dBm				$\pm .9$ dB

**Square Wave:**

	.001 Hz	100 kHz	10 MHz
10 Vp-p	$\pm 1.0\%$	$\pm 11.1\%$	
3 Vp-p			
1 mVp-p	$\pm 2.2\%$	$\pm 13.6\%$	

**Triangle:**

	.001 Hz	2 kHz	10 kHz
10 Vp-p	$\pm 1.5\%$	$\pm 5.0\%$	
3 Vp-p			
1 mVp-p	$\pm 2.7\%$	$\pm 6.2\%$	

**Ramps:**

	.001 Hz	500 kHz	10 kHz
10 Vp-p	$\pm 1.5\%$	$\pm 10\%$	
3 Vp-p			
1 mVp-p	$\pm 2.7\%$	$\pm 11.2\%$	

With DC offset, increase all sinewave tolerances by .2 dB and all function tolerances by 2%.

**SINEWAVE SPECTRAL PURITY**

**Phase Noise:**

- 60 dBc for a 30 kHz band centered on a 20 MHz carrier (excluding  $\pm 1$  Hz about the carrier) with option 001 installed.

**Spurious:**

✓ All non-harmonically related output signals will be more than 70 dB below the carrier (- 60 dBc with DC offset), or less than -90 dBm, whichever is greater.

**WAVEFORM CHARACTERISTICS**

**Sinewave Harmonic Distortion:**

Harmonically related signals will be less than the following levels relative to the fundamental:

Frequency Range	Harmonic Level
.1 Hz to 50 kHz	- 65 dBc
50 kHz to 200 kHz	- 60 dBc
200 kHz to 2 MHz	- 40dBc
2 MHz to 15 MHz	- 30 dBc
15 MHz to 20 MHz	- 25 dBc

**Squarewave Characteristics:**

Rise/fall time:  $\leq 20$  ns 10% to 90%, at full output.

Overshoot:  $\leq 5\%$  of peak to peak amplitude, at full output at 1MHz.

Settling time: <1  $\mu$ s to settle to within .05% of final value, tested at full output with no load, 10 Hz to 500 kHz.

Symmetry:  $\leq .02\%$  of period + 3 ns.

**Triangle/Ramp Characteristics:**

Triangle/ramp linearity (10% to 90%, 10 kHz):  $\pm .05\%$  of full p-p output for each range.

Ramp retrace time:  $\leq 3 \mu$ s, 90% to 10%.

Period variation for alternate ramp cycles:  $\leq 1\%$  of period.

**DC OFFSET**

**Range:**

DC only (no AC signal): 0 to  $\pm 5.0$  V/500

DC + AC: Maximum DC offset  $\pm 4.5$  V on highest range; decreasing to  $\pm 4.5$  mV on lowest range.

**Resolution:** 4 digits

**Accuracy:**

DC only:  $\pm .02$  mV to  $\pm 20$  mV, depends on offset chosen.

DC + AC, to 1MHz:  $\pm .06$  mV to  $\pm 60$  mV, depends on AC output level,  $\pm .2$  mV to  $\pm 120$  mV for ramps to 10 kHz.

DC + AC, 1 MHz to 20 MHz:  $\pm 15$  mV to  $\pm 150$  mV, depends on AC output level.

Table 3-1. Specifications (Cont'd)

**PHASE OFFSET**

**Range:**  
± 719.9° with respect to arbitrary starting phase, or assigned zero phase.  
**Resolution:** 0.1°  
**Increment Accuracy:** ± 0.2°  
**Stability:** ± 1.0 degree of phase/°C

**SINEWAVE AMPLITUDE MODULATION**

**Modulation Depth (at full output for each range):**  
0-100%  
**Modulation Frequency Range:**  
DC to 400 kHz (0-21 MHz carrier frequency)  
**Envelope Distortion:**  
- 30 dB to 80% modulation at 1 kHz, 0 VDC offset  
**Sensitivity:**  
± 5 V peak for 100% modulation  
**Input Impedance:** 10 kΩ  
**Connector:** Rear panel BNC

**PHASE MODULATION**

**Sine Function Range:**  
± 850°, ± 5V input  
**Sine Function-Linearity:**  
± 0.5%, best fit straight line  
**Squarewave Range:** ± 425°  
**Triangle Range:** ± 42.5°  
**Positive and Negative Ramps:**  
± 85°  
**Modulation Frequency Range:**  
DC - 5 kHz  
**Input Impedance:** >40 kΩ  
**Connector:** Rear panel BNC

**FREQUENCY SWEEP**

**Sweep Time:**  
Linear: 0.01s to 1000s  
Logarithmic: 1s to 1000s single, 0.1s to 1000s continuous  
**Maximum Sweep Width:**  
Full frequency range of the main signal output for the waveform in use except minimum log start frequency is 1 Hz.  
**Minimum Sweep Width:**

Function	Minimum sweep width	
	Sweep time .01 sec.	Sweep time 99.9 sec.
Sine:	.1 mHz	999.9 mHz
Square:	.05 mHz	499.5 mHz
Triangle:	.005 mHz	49.95 mHz
Ramps:	.01 mHz	99.99 mHz

Minimum log sweep width is 1 decade.  
**Phase Continuity:**  
Sweep is phase continuous over the full frequency range of the main output.  
**Discrete Sweep:**  
Number of segments: 100 maximum (Start and stop frequencies settable for each segment)  
Time/segment: 0.01s to 1000s, 0.01s resolution

**MODULATION SOURCE:**

Frequency Range: Sine 0.1 Hz-10 kHz, Square 0.1 Hz-2 kHz  
Frequency Resolution: 2 digits  
Frequency Accuracy: Typically 0.1% (Sinewave)  
Amplitude Range: 0.1 Vp-p to 12 Vp-p  
Amplitude Resolution: 0.1 V  
Amplitude Accuracy: Typically ± 200 mV  
Impedance: Designed to drive ≥ 10 kΩ loads  
Sinewave Purity: Typically better than - 34 dBc  
Standard Waveforms: Sine, Square  
Arbitrary Waveforms: Vertical resolution 256 points, horizontal resolution 4096 points, 300,000 samples/sec, 10 kHz maximum.  
Output Location: Rear Panel BNC

**AUXILIARY OUTPUTS**

**Auxiliary Frequency Output:**  
Frequency Range: 21 MHz to 60.999 999 999 MHz, underrange coverage to 19.000 000 001 MHz, frequency selection from front panel.  
Amplitude: 0 dBm; output impedance: 50Ω  
Connector: Rear panel BNC  
**Sync Output:**  
Square wave with  $V_{high} \geq 1.2 V$ ,  $V_{low} \leq 0.2 V$  into 50Ω. Frequency range is the same as the main signal output for front panel sync and DC-60 MHz for rear panel sync.  
Output impedance: 50Ω  
Connector: BNC front and rear panels.  
**X-Axis Drive:**  
(0-100s sweeps only)  
0 to + 10 Vdc linear ramp proportional to sweep frequency; linearity, 10-90%, ± .1% of final value (applies for sweep widths which are integer multiples of the minimum sweep width).  
Connector: Rear panel BNC.  
**Sweep Marker Output:**  
High to low TTL compatible voltage transition at keyboard selected marker frequency. (Linear sweep only.)  
Connector: Rear panel BNC.  
**Z-Axis Blank Output:**  
TTL compatible voltage levels capable of sinking current from a positive source. Current 200 mA, voltage 45V, power dissipation 1 watt maximum.  
**1 MHz Reference Output:**  
0 dBm output for phase-locking additional instruments to the HP 3325B.  
Connector: Rear panel BNC.  
**10 MHz Oven Output:**  
0 dBm internal high stability frequency reference output for phase-locking HP 3325B or other instruments (option 001 only).  
Connector: Rear panel BNC.

Table 3-1. Specifications (Cont'd)

**AUXILIARY INPUTS**

**Reference Input:**

For phase-locking HP 3325B to an external frequency reference. Signal from 0 dBm to +20 dBm into 50Ω. Reference signal must be a subharmonic of 10 MHz from 1 MHz to 10 MHz.

Connector: Rear panel BNC. With option 001 this input may be jumpered to the 10 MHz reference output.

**Amplitude Modulation Input:**

See modulation specifications.

**Phase Modulation Input:**

See modulation specifications.

**REMOTE CONTROL**

**Frequency Switching Time (to within 1 Hz exclusive of programming time:**

≤10 ms for 100 kHz step; ≤25 msec for 1 MHz step; ≤70 msec for 20 MHz step.

**Phase Switching Time (to within 90° of phase lock exclusive of programming time:**

≤15 msec.

**Amplitude Switching Time (to within amplitude specifications, exclusive of programming time):** < 30 ms.

**HP-IB Interface Functions:**

SH1, AH1, T6, L3, SR1, RL1, PP0, DC1, DT1, C0, E1

**RS-232 Interface:**

Subset of ANSI/EIA-232D-1986, CCITT V.24

Type: DTE, 25 pin female "D" connector  
Baud Rate: 300-4800

**OPTION 001 HIGH STABILITY FREQUENCY REFERENCE**

**Aging Rate:**

± 5 × 10<sup>-8</sup>/week, after 72 hours continuous operation; ± 1 × 10<sup>-7</sup> mo., after 15 days continuous operation.

**Warm-up time:**

Reference will be within ± 1 × 10<sup>-7</sup> of final value 15 minutes after turn-on at 25°C for an off time of less than 24 hours.

**OPTION 002 HIGH VOLTAGE OUTPUT**

**Frequency Range:** 1 μHz to 1 MHz

**Amplitude:**

Range: 4.00 mV to 40.00 Vp-p in 8 ranges, 4-12-40 sequence, into 500Ω < 500 pF load. Ranges are four times the standard instrument ranges, without DC offset.

Accuracy: ± 2% of full output for each range at 2 kHz.

Flatness: ± 10% relative to programmed amplitude.

**Sinewave Distortion:**

Harmonically related signals will be less than the following levels (relative to the fundamental full output into 500Ω, load):

10 Hz-50 kHz: - 65 dB

50 kHz-200 kHz: - 60 dB

200 kHz-1 MHz: - 40 dB

**Square Wave Rise/Fall Time:**

± 125 ns, 10% to 90% at full output, with 500Ω, 500 pF load.

**Square Wave Overshoot:**

± 10% of peak to peak amplitude with 500Ω, 500 pF load.

**Output Impedance:**

< 2Ω at DC, < 10Ω at 1 MHz

**DC Offset:**

Range: 4 times the specified range of the standard instrument.

Accuracy: ± (1% of full output for each range + 25 mV).

**Maximum Output Current:**

± 20 mA peak

**GENERAL**

**Operating Environment:**

Temperature: 0°C to 55° C

Relative Humidity: 95%, 0°C to 40°C

Altitude: ≤15,000 ft.

**Power:**

100/120/220/240 V, +5%, -10%; 48 to

66 Hz; 90 VA, 120 VA with all options

**Weight:**

9 kg (20 lbs) net; 14.5 kg (32 lbs) shipping

**Dimensions:**

133.4 mm high × 425.5 mm wide × 498.5 mm deep (5¼" H × 16¾" W × 19¾" D)