

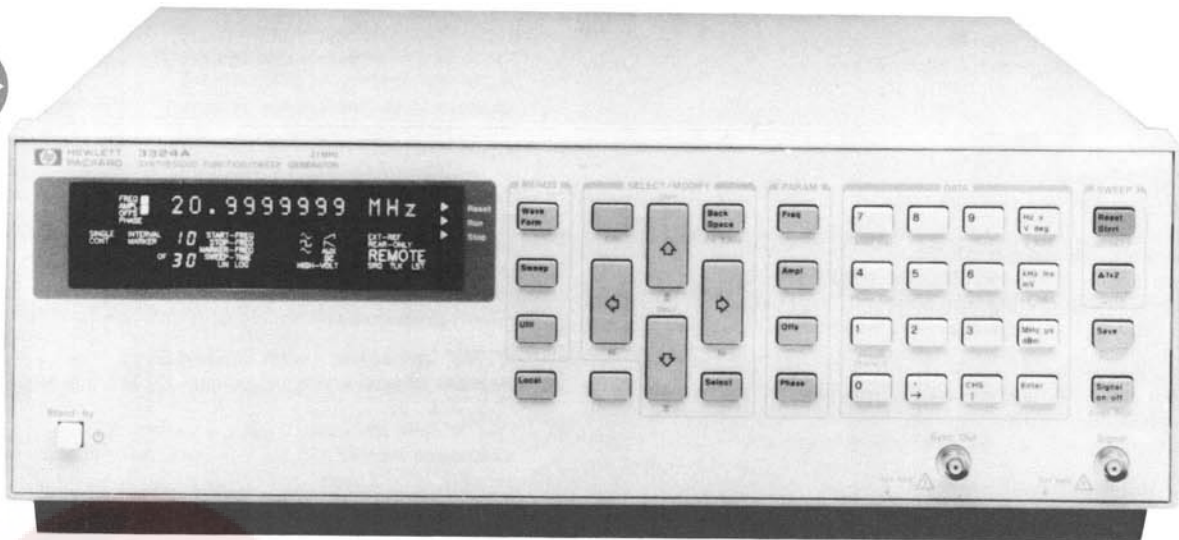
# FREQUENCY, FUNCTION & WAVEFORM SYNTHESIZERS

## 1 MHz to 21 MHz Synthesized Function/Sweep Generator

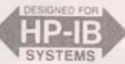
### Model 3324A

- Reference Source
- Function Generator
- Programmable

- Multi-Interval Sweeper
- Two-Phase Signals
- 60 MHz TTL clock



HP 3324A



### The HP 3324A Synthesized Function/Sweep Generator

The HP 3324A complements HP's family of synthesized function generators. It combines good synthesizer quality with extended sweep capabilities, at a low price.

### The Reference Source

Many applications, like PLL testing and calibration of measurement instruments, require a frequency reference which can be accurately tuned and which is stable over a long period of time. The accuracy and stability of the HP 3324A fulfills this requirement.

For those applications which require a better stability than 5 ppm/year, a high stability frequency reference oven provides a stability of 0.05 ppm/week (optional).

### Good Spectral Purity

In addition to the highly stable frequency the HP 3324A provides good sine wave spectral purity with  $-50$  dBc phase noise and  $-55$  dBc spurious signals.

### The Clock Generator (1 MHz to 60 MHz)

Complex test set-ups can be built only if a reliable clock generator minimizes jitter or timing uncertainties. The HP 3324A provides clock frequencies from 1 MHz up to 60 MHz - synthesized over the full frequency range.

### The Variety of Waveforms

Sine, square, triangle and ramp are the waveforms which make the HP 3324A a function generator, therefore it can compete with other versatile function generators but with the advantage that all waveforms are generated with the accuracy of a synthesizer. The linearity of triangle and ramp waveforms (up to 11 kHz) is 0.05% of full p-p output, thus making it, for example, the ideal generator for the fast evaluation of linearities of Analog to Digital Converters.

### Multi-Interval Sweeping

At this time linear and logarithmic sweeps are standard for a generator, like the HP 3324A, but interval sweep capabilities are new.

This means that up to 50 different sweep intervals can be programmed. Intervals can be swept linearly or logarithmically. Each interval

has its individual start and stop frequency, sweep time and if it is a "linear" interval it can contain a marker frequency. A user definable sequence which can contain up to 100 intervals allows the repetition of certain intervals and the mixture of "logarithmic" and "linear" intervals.

Sweeping in intervals is useful for applications such as Frequency Shift Keying or simulation of rotating signals. It also makes the operation with the HP 3324A more convenient than with standard sweep generators.

The HP 3324A operates in all sweep modes phase-continuous over the full frequency range (1 MHz to 21 MHz).

### Two-Phase-Signals

For devices which require phase dependent input signals the HP 3324A is the right stimulus.

For synchronisation two HP 3324A can be connected with BNC cables. With the Automatic Phase Calibration option the phase offset between both instruments is automatically calibrated to 0 degree. After calibration the phase offset can be adjusted at one or both instruments to between  $\pm 719.9^\circ$ .

### High Output Voltage

If more than 10 V (p-p) amplitude is required then the High Voltage Option enhances the amplitude range up to 40 V (p-p) (limited for frequencies up to 1 MHz).

### Structured Front Panel

The HP 3324A's front panel is clearly structured and is supported by an alphanumeric fluorescence display. The status of the instrument can be seen immediately, as all of the selected parameters and functions are displayed.

### Specifications

For complete specifications refer to the HP 3324A data sheet (Pub. No. 5952-9678).

### Waveforms

Sine, Square, Triangle, negative and positive Ramps, DC, TTL clock

## Frequency

### Range

Sine:	1 mHz - 21,000,000,0 MHz
Square:	1 mHz - 11,000,000,0 MHz
Triangle/Ramps:	1 mHz - 11,000,000,0 kHz
Auxiliary TTL clock:	1 mHz - 60,000,000,0 MHz

### Resolution

1 mHz for up to 999,999,999 kHz, 100 mHz for 1 MHz up to 21,000,000,0 MHz

**Accuracy:**  $\pm 5$  ppm of selected value, 20° to 30° C

### Stability

$\pm 5$  ppm/year, 20° to 30° C, standard (see also option 001)

## Main Signal Output

**Impedance:** 50 $\Omega$

### Amplitude (all waveforms except Auxiliary TTL clock)

**Range:** 1 mV to 10 V (p-p) in 8 amplitude ranges, 1-3-10 sequence.

**Resolution:** 4 digits (0.03% of full range)

**Accuracy** (without DC offset)

#### Sine

1mHz-100kHz:  $\geq 3$  V (p-p)  $\pm 0.2$  dB

>100kHz-21MHz:  $\geq 3$  V (p-p)  $\pm 0.4$  dB

#### Squarewave

1mHz-100kHz:  $\geq 3$  V (p-p)  $\pm 1.5\%$

100kHz-10MHz:  $\geq 3$  V (p-p)  $\pm 5\%$

#### Triangle

1mHz-2kHz:  $\geq 3$  V (p-p)  $\pm 1.5\%$

2kHz-10kHz:  $\geq 3$  V (p-p)  $\pm 5\%$

## Sinewave Spectral Purity

### Phase Noise

- 50 dBc for a 30 kHz band centered on a 20 MHz carrier (excluding  $\pm 1$  Hz about the carrier).

### Spurious

All non-harmonically related output signals will be more than 55 dB below the carrier.

### Sinewave harmonic distortion

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

Frequency Range	Harmonic Level
.1 Hz - 199 kHz	- 60 dBc
200 kHz - 1.99 MHz	- 40 dBc
2 MHz - 14.9 MHz	- 30 dBc
15 MHz - 20 MHz	- 25 dBc

## Waveform Characteristics

### Squarewave characteristics

Rise/Fall time: (10% to 90% at full output)  $\leq 20$  ns

Overshoot: 5% of peak to peak amplitude at full output

### Triangle/Ramp characteristics

Linearity (10%-90%, 10 kHz):  $\pm 0.05\%$  of full p-p output voltage

## DC Offset

**Range:** DC only (no AC signal): 0 to  $\pm 5$  V/50 Ohm

**Resolution:** 4 digits

## Phase Offset

### Range

$\pm 719.9^\circ$  with respect to arbitrary starting phase or assigned zero phase. See also option 003 and 004.

**Resolution:** 0.1°

## Frequency Sweep

**Sweep sequence modes:** single, continuous

### Sweep function modes:

**Multi-Interval:** Up to 50 different intervals can be sequenced and repeated in a sequence which can contain up to 100 intervals.

**Multi-Marker:** One marker frequency can be set in each interval or up to 9 marker frequencies can be set if only one interval is used.

**Sweep time (settable for each interval):** Linear, 10 ms to 10<sup>5</sup>s. Log. 100 ms to 10<sup>5</sup>s.

**Maximum sweep width (settable for each interval):** full frequency range of the main signal output for the waveform in use, except minimum log start frequency is 1 Hz.

**Phase continuity:** sweep is phase continuous over the full frequency range of the main output.

## Auxiliary Outputs

### SYNC output

Phasesynchronous squarewave with same frequency as main signal output, output impedance: 50 Ohm

**Auxiliary freq. output:** Square, freq. range: 21 MHz to 60 MHz

**X-Axis drive output:** Linear ramp proportional to sweep time

**Z-Axis blank output:** Output signal depending on sweep state.

**Sweep marker output:** Pulses (TTL and CMOS compatible) at selected marker frequencies

### 1 MHz reference output

1 MHz squarewave for phase locking additional instruments to the HP 3324A, output impedance: 50 Ohm, output amplitude: 0 dBm.

## Auxiliary Input

**Reference input:** For phase locking the HP 3324A to an external frequency reference. Signal from 0 dBm to 20 dBm into 50 Ohm.

## HPiB Interface Functions

**Interface functions:** SH1,AH1,T6,L3,SR1,RL1,PP0, DC1,DT0,C0,E2

## Option 001, High Stability Frequency Reference

### Aging rate

$\pm 5 \times 10^{-8}$ /week after 72 hours continuous operation.

$\pm 1 \times 10^{-7}$ /month after 15 days continuous operation.

### 10 MHz oven output

10 MHz squarewave for phaselocking additional instruments to the HP 3324A, output impedance: 50 Ohm, output level: > 4.5 dBm

## Option 002, High Voltage Output

**Frequency range:** 1 mHz to 1 MHz

### Amplitude

4 mV to 40 V (p-p) in 8 ranges, 4-12-40 sequence into 500 Ohm, < 500 pF load.

**Accuracy:**  $\pm 2\%$  of full output for each range at 2 kHz.

**Flatness:**  $\pm 10\%$  relative to programmed amplitude.

## Waveform characteristics

### Sinewave harmonic distortion

Harmonically related signals will be the same as the standard instrument up to 1 MHz.

**Squarewave characteristics** (500 Ohm, 500 pF load)

Rise/Fall Time: (10% to 90% of p-p output voltage)  $\leq 125$  ns

Overshoot:  $\leq 10\%$  of p-p output voltage

**Output impedance:** < 3 Ohm at DC, < 10 Ohm at 1 MHz

**DC Offset:** 4 times the specified range of the standard instrument

## Options 003 and 004, Automatic Phase Calibration

These options provide automatic phase calibration if two HP 3324As are connected to generate phase related signals. Option 003 has to be installed into one of the instruments and option 004 into the other.

Phase shifted signals can be achieved by selection of a certain phase offset.

## General

**Power:** 100/120/220/240 V, 48 to 66 Hz, max. 100 VA

**Weight:** 11 kg net

**Dimensions:** 132.6 mm high x 425.5 mm wide x 497.8 mm deep

## Ordering Information

	Price
HP 3324A Synthesized Function/Sweep Generator	\$3500
Opt 001 High Stability Frequency Reference	\$765
Opt 002 High Voltage Output	\$255
Opt 003 Automatic Phase Calibration, slave	\$450
Opt 004 Automatic Phase Calibration, master	\$270
Opt 907 Front Handle Kit	\$55
Opt 908 Rack Flange Kit	\$33.50
Opt 909 Rack Flange and Handle Combination Kit	\$82.50
W30 2 years additional hardware service	\$90

Fast-Ship product - see page 734