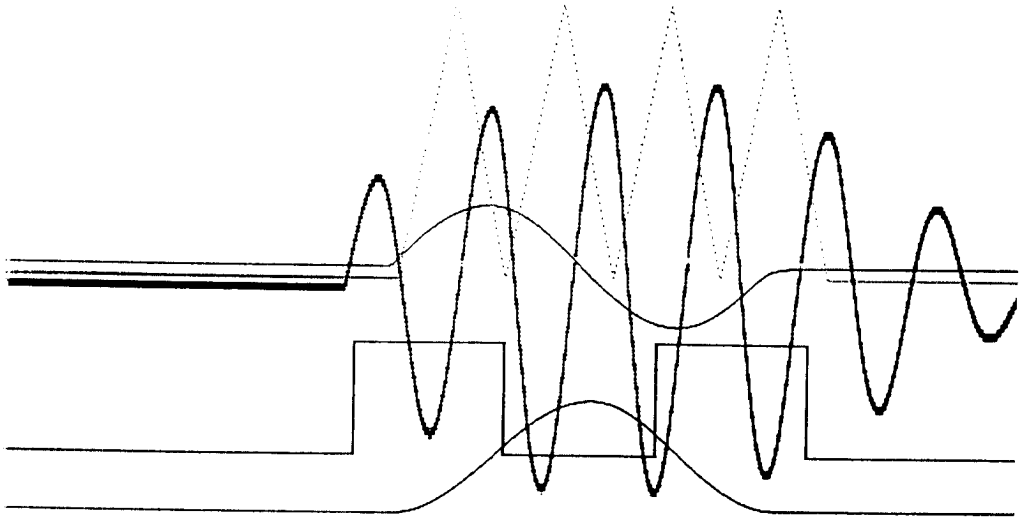
AEMK

HEWLETT PACKARD

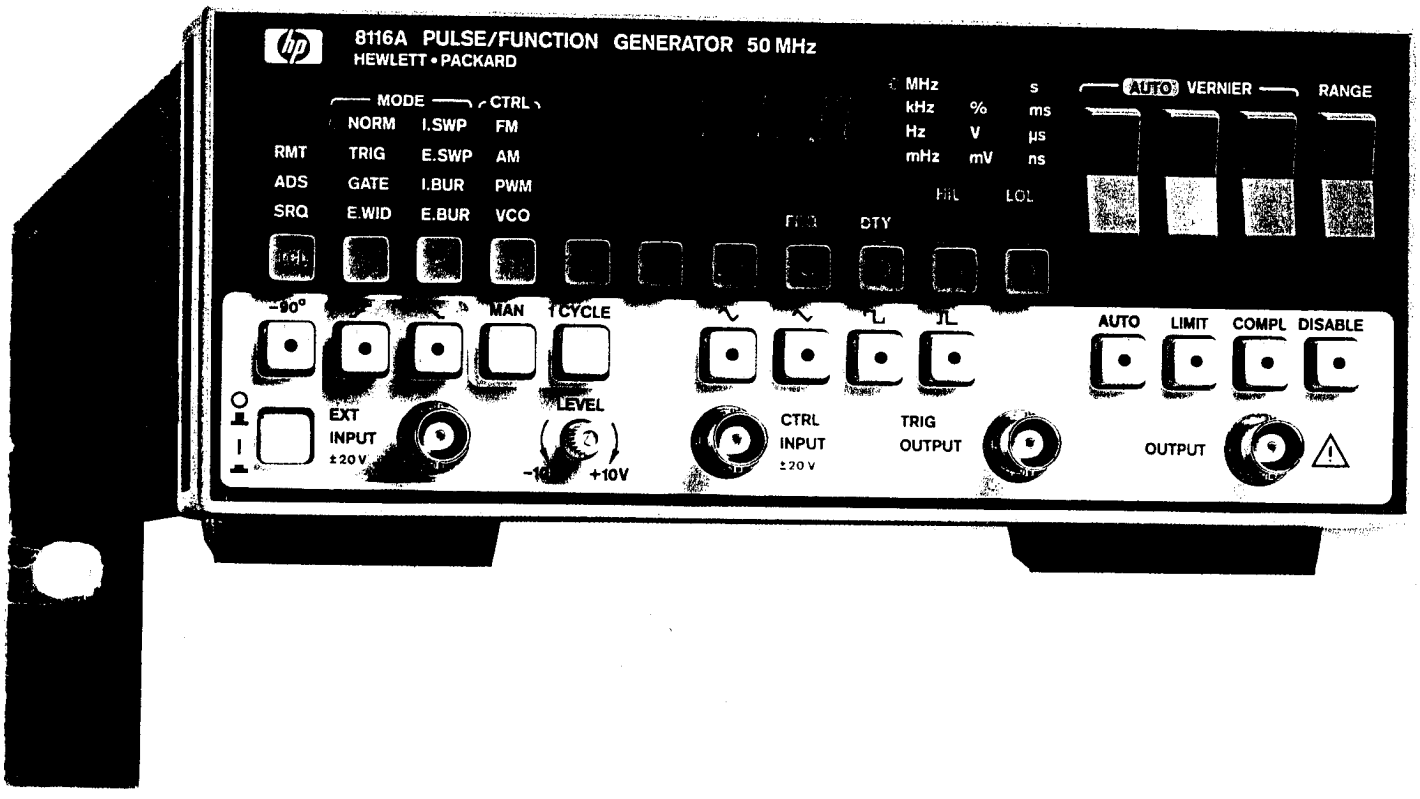
50 MHz Pulse/Function Generator Solves More than Everyday Analog Needs



HP 8116A
Pulse/Function Generator

Trigger Modes
Modulation Modes
Sweep, Burst optional

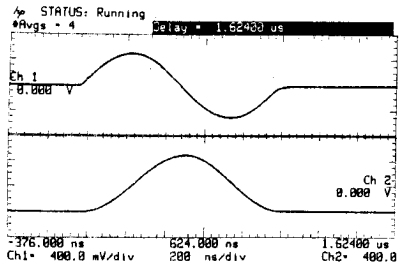
DESIGNED FOR HP-IB SYSTEMS



Meet Tough Analog Challenges

Triggered and Continuous Waveforms

Most function generators provide continuous sine, sawtooth and square waveforms. With the HP 8116 A you get all these up to 50 MHz — plus many others. For example, what if you need discontinuous signals? Easy with the HP 8116 A because single cycles, gated sequences and counted bursts are available on all waveforms.



Press a key to change from sine to haversine

Signals for Radar and Mechanics

Perhaps you may need to simulate band-limited signals like radar pulses, or you may want a signal to drive a mechanical actuator. Just press the HP 8116A's — 90° start-phase key to get the haversine or triangle you require.

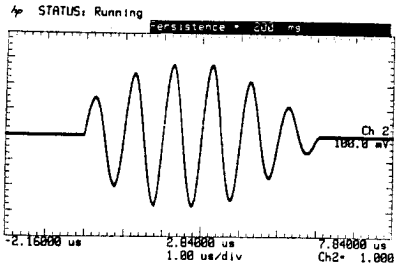
External Modulation

If you have sonar or ultrasonic applications, or need to test PLLs, you will certainly need modulated signals, and the HP 8116A's control modes provide AM, FM and pulse-width modulation as well as VCO capability.

When these signals are specified with an exact number of carrier cycles, the necessary modulating voltage can be quite difficult to set up. This difficulty is avoided by the HP 8116A because trigger, gate and especially burst mode can be used in conjunction with the modulation modes.

Sweep

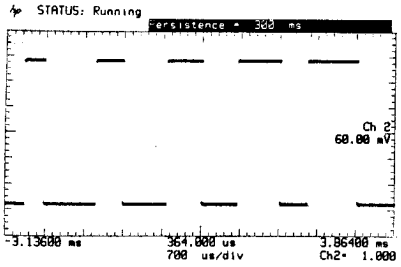
Use the HP 8116 A's VCO or logarithmic sweep modes for your frequency response measurements. Sweep mode can cover the HP 8116 A's 1 mHZ – 50 MHz range in a single band, and provides X- and pen-lift outputs for XYrecorders.



This example of a modulated burst illustrates the flexibility of combining modulation and trigger modes

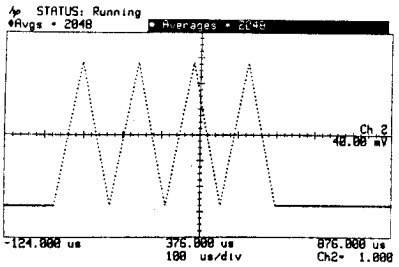
Enter the Digital Arena

Clean Pulses, accurate Bursts
Digital ICs like gates and counters occur frequently in analog circuits to provide control functions. If this is the case in your application, the HP 8116 A will still provide solutions: a clean pulse with 7 ns transitions, ideal for TTL and CMOS devices, is available in Pulse mode with widths down to 10 ns. Combine this with Burst mode for rapid counter testing or reliable initialization.



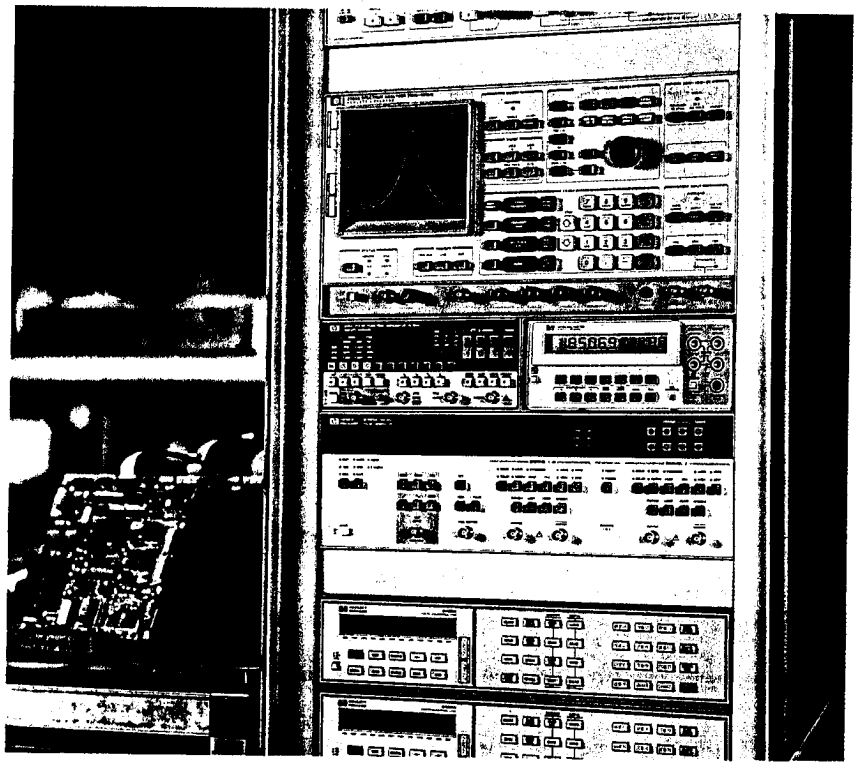
Pulse width modulation

Pulse Recovery
If your device requires serial data, and the external source is noisy or degraded, the HP 8116 A's External Width mode will recover clean pulses for certain triggering.

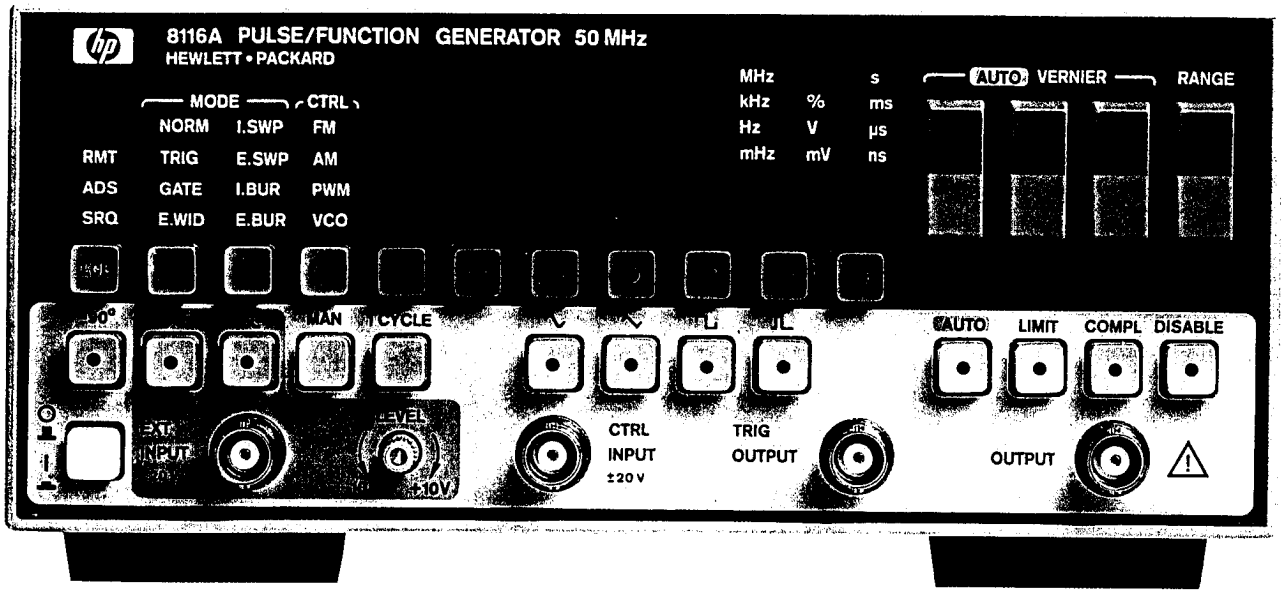


Counted bursts up to 1999 pulses.

Save Rack and Bench Space
All this capability comes in an astoundingly small space: a half-width unit, less than a hand's breadth in height! Nevertheless, the instrument has a wide operating temperature range, and the HP-IB interface allows parameters to be uploaded as well as programmed.



Flexibility and Convenience



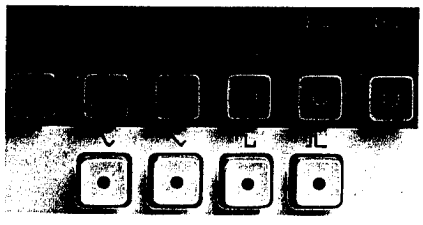
HP 8116 A with Option 001 sweep and burst.

Whether your device needs a sine-wave, sawtooth, rectangle or even dc, you'll be impressed by the HP 8116 A's flexibility and convenience:

Intuitive, Self-prompting Operation

Illuminated key labels make sure you're confronted only with the parameters appropriate to your application. For example, the large photograph shows the situation in Normal mode. If you now select Internal Burst, the burst repetition rate (RPT) and burst length (BUR) labels will light. This invites you to enter these parameters in the three-digit display.

Note also the easy parameter entry, each display digit has its own vernier key so you can close in very quickly to a value.



Easy, Safe Connection to Device

Interfacing to the device is easy because the output can be set up in terms of amplitude and offset or high-level and low-level. Also, the 16 Vpp output (into 50 ohms, voltage doubles into high impedance) means that most devices can be connected directly.

Connection is safe because you can set a maximum voltage limit, and program a constant duty-cycle. The HP 8116 A's 50-ohm output is proof against short circuit and so also lends itself for driving low-impedance devices.

Manual and Auto-Vernier

Critical or limiting values can be found rapidly with the help of the vernier keys that work on all parameters. You can save yourself — or your system controller — even more time if you use the auto-vernier. This requires no software loop, and LF functions can be stopped by a signal from the device-under-test.

Specifications

Specifications describe the instrument's warranted performance under the following conditions: Normal mode, 15 minutes warm-up, 50-ohm load, 15° to 35° C ambient temperature. Refer to the "General" section of the specifications for performance at 0° to 55° C ambient temperature.

Timing Parameters
(measurement point: 50 % of amplitude).

Frequency (FRQ)
Range: 1.00 mHz to 50.00 MHz
Resolution: 3 digits, best case 10 uHz
Accuracy (FRQ < 100 kHz): ±3% ± 0.3 mHz (Pulse mode*), ±3% ± 0.6 mHz (other waveforms).
Accuracy (FRQ ≧ 100 kHz): ±5% (Pulse mode*), ±10% (other waveforms).
Jitter: <0.1% + 100 ps (Pulse mode*), <0.2% + 100 ps (other waveforms).
Stability: ±0.2% (1 h), ±0.5% (24 h)

Duty Cycle (DTY):
Range: 10 - 90% (20 - 80% for FRQ ≧ 1 MHz, 50% fixed for FRQ ≧ 10 MHz)
Resolution: 1 digit
Accuracy: ±0.5 (±3.0 for FRQ ≧ 1 MHz)

Pulse Width (WID)
Range: 10.0 ns to 999 ms, max: 1/FRQ - 10 ns.
Resolution: 3 digits, best case 0.1 ns.
Accuracy: ±5% of programmed value ±2 ns.
Jitter: <0.1% (0.2% +200 ps for width <10 us).
Repeatability: factor 4 better than accuracy.

Output Parameters
(the following voltages double into high impedance)

Amplitude (AMP)
Range: 10.0 mVpp to 16.0 Vpp.
Resolution: 3 digits, best case 0.1 mV.
Accuracy: ±5% (0.45 dB)
Applies to pulse and square wave at all frequencies and to sines and triangles at 1 kHz.
Flatness (at 50% duty cycle):

Sine	Triangle	FRQ
±3%	±3%	< 1 MHz
±5%	±5%	≧ 1 MHz
5/-15%	5/-25%	≧ 10 MHz

DC or Offset (OFS)
Range: 0.0 mV to ±7.95 V (0.0 to ±795 mV when AMP <100 mV).
Resolution: best case 0.1 mV.
Accuracy: ±1% setting ±1% AMP ±40 mV (±0.5% ±1% ±4 mV when AMP <100 mV).
Repeatability: factor 4 better than accuracy.

Sinewave (DTY = 50%)
Total harmonic distortion, FRQ 10 Hz - 50 kHz: <1% (-40 dB).
Harmonic components, FRQ 50 kHz - 1 MHz: <2% (-34 dB).
Harmonic components, FRQ >1 MHz, AMP <8 Vpp: <7% (-23 dB).

Sawtooth (100 mHz to 1 MHz), Non-linearity (10% to 90% amplitude):
<±3%.

Square and pulse performance:
Transitions (10% to 90% amplitude): <7 ns.
Perturbations: <±5% amplitude ±2 mV

General
Environmental
Storage temperature: -40° to +70° C.
Operating temperature: 0° to 55° C
Derating factor: 0.05 per degree C outside specified range 15°C to 35°C
Humidity: up to 95% RH between 0° and 40° C
Power: 100/120/220/240 Vrms +5% -10%, 48 - 440 Hz, 120 VA max.
Weight: Net 5.9 kg (13 lbs) shipping 8.0 kg (18 lbs).
Dimensions (H,W,D): 89 x 213 x 450 mm (3.5 x 8.4 x 17.7 in.).
Recalibration period: 1 year.

* applies also for functions with 50% DTY.

Operating Characteristics

Operating characteristics describe typical, non-warranted performance

Waveforms:
variable-duty-cycle sine, sawtooth, square, haversine and triangle. Also pulse (variable width) and dc modes.

Trigger Modes
(Period and duty cycle of first cycle may deviate 10% from subsequent cycles).
Normal: continuous signal. Auto: selected digit of selected parameter increments at 1 digit/s. Can be halted by Ext Input signal.
Trigger: each active input edge at Ext Input triggers a single cycle.
Gate: active Ext. Input level enables signal; synchronous start, last cycle is always complete.
External Width (E WID, Pulse mode only): input edges toggle output (pulse recovery).
"1 Cycle" key (Option 001): gives additional cycle in Gate and Burst modes.
"–90" key: advances start phase for generating haversines and triangles. Applies only to Trigger, Gate and Burst modes.

Logarithmic Sweep (Option 001)
Band: Up sweep programmable from 1 mHz (min) to 50 MHz (max) in one range.
Sweep time: 10 ms – 500 s per decade, selectable in 1–2–5 sequence.
Sweep repetition: continuous (I SWP) or external trigger (E SWP), phase discontinuous (sweep always starts at 0°).
Marker frequency: programmable, see Marker (pen up-down) Output.
Sweep ramp voltage: see X Output.

Counted burst (Option 001)
Burst length: 1 to 1999 cycles.
Burst repetition time: Internal Burst (I BUR, not in Pulse mode): 100 ns to 999 ms.
External Burst (E BUR): external trigger. Min 100 ns between end of one burst and start of next.
Max. FRQ: 40 MHz.

Control (CTRL) Modes
External voltage at Ctrl input modulates the output signal:
FM
Deviation: max. ±5% with ±5 V input.
Modulation bandwidth: dc to 20 kHz (dc to 3 kHz for FRQ >= 10 MHz).
AM
Modulation: 100% with ±2.5 V input. DSBSC with +2.5/–7.5 V input.
Modulation bandwidth: dc to 1 MHz.
Envelope distortion: <1% (modulation <90%, dc to 50 kHz).
PWM
Pulse width ratio: max 10:1 or 1:10 with ±6 V input.
Ranges: 8 non-overlapping decades. Display shows midrange (zero volt) value in current range.
VCO
Frequency ratio: max 1:100 for 0.1 to 10 V input.
Ranges: 11 overlapping ranges from 1 mHz to 50 MHz. 2 decades per range. Display shows max value in current range.
Modulation bandwidth: dc to 1 kHz.

Output Modes
Complement: selectable.
Disable: disconnects output, automatic on power-up.
Limit: declares present levels as limits.
Hold mode (Option 001): external signal stops output at instantaneous voltage. Applies to FRQ <10 Hz. Droop: 0.01% per second.

Inputs and Outputs

External Input
Threshold: adjustable ±10 V.
Trigger slope: positive, negative, Off.
Min amplitude: 0.5 Vpp.
Max input voltage: ±20 V
Min pulse width: 10 ns.
Input impedance: 10 kohm.

Control Input
Max input voltage: ±20 V
Input impedance: 10 kohm.
Hold Input (Option 001)
Hold level: >2.5 V (or open).
Run level: <2.5 V
Max input voltage: ±20 V
Input impedance: 10 kohm.

Trigger Output
High level: + 2.4 V into 50 ohm, + 4.8 V into high impedance.
Low level: 0 V.
Active edge: positive.
Duty cycle: 50 %.
Output impedance: 50 ohm.
Propagation delay (Ext In to Trig Out): 60 ns.
Max external voltage: –0 V/+5 V.

Marker (pen up/down) Output (Option 001)
High level: +2.4 V into 50 ohm, + 4.8 V into high impedance.
Low level: 0 V.
Edges: positive at sweep marker frequency, negative at sweep start.
Output impedance: 50 ohm.
Max external voltage: –0 V/+5 V

X Output (Option 001)
Output: 0 V to max 10 V ramp, 1.5 V per sweep decade.
Output impedance: 50 ohm.
Max external voltage: –0 V/+5 V.

Main Output (into 50 ohm)
Window: ±8 V (± 800 mV for amplitudes <100 mVpp), values double into high impedance.
Reflections: <12 % for amplitudes >100 mVpp.
Source impedance: 50 ohm.
Short-circuit protected (Imax = 150 mA).
Max external voltage: ±5 V

Additional Features

HP-IB: fully programmable except Ext Input Level.
Capability codes: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1.
Learn mode: all or individual parameters can be uploaded, up to 10 (Option 001, 16) strings of max. 14 characters.
Service request: initiated by syntax or operating error; returns error number.
Status byte: returns text of operating-error message.
Time to receive and verify message: modes 30 ms, timing parameters 50 ms, voltages 250 ms.
Time to execute a message: 5 ms (offset: 30 ms).
Time to transmit a message: 15 ms per status byte or learn string.
Self-test: executed at power-up and on HP-IB command.
Memory: current settings saved on power-down.
Operating-error detection: visual and status byte indication of incompatible settings.

Marker Output:
Located on Z axis rear panel connector

Sync Output:
Low during the return-to-start vector

Gate Mode:
Allows external gating of ARB output-complete ARB waveforms only

Symmetry
Symmetry Range: 5% to 95% of period
Symmetry Resolution: 1% steps
Frequency Range: 2 Hz to 2 MHz ranges
Symmetry Accuracy, Fixed: 50% ±0.2%
Fixed Symmetry = 50% (SYM light OFF)
Frequency = 1 Hz to 100 kHz
Function = square wave

Symmetry Accuracy, Variable:
±0.5% of period
Frequency = 1 Hz to 100 kHz
Function = square wave

Phase
Phase Offset - Phase lock Modes:
Resolution: 0.1°
Range: ±199.9°
Accuracy: ±2° (50 Hz to 25 kHz)
Phase Offset is referenced to:
signal output for Fin÷N
trigger input for Fin x N

Start / Stop Phase - Burst Modes:
Resolution: 0.1°
Range: ±90.0° for frequencies to 19.99 MHz
Accuracy: ±3° (applies from .001 Hz to 1 kHz)

OPTION 001
Simultaneous x3 Output
(For Option 001 Retrofit Kit, order 3314A Special Option K-04).

Frequency Range: DC to 1MHz

Amplitude Range:
ac only - - ±30 Vp-p (60 mAp-p)
ac + dc - - ±15 Vpeak (±30 mApeak)

Specifications apply with the x3 Output into >500 Ω and <500 pF, and the main output into 50 Ω

Output Resistance: < 2 Ω at 10 kHz

x3 Gain / Accuracy:
x3 Output Amplitude = (3 ±1%) x Main Output Amplitude

Sine Power Flatness:
Relative to full output at 10 kHz.

20 Hz	50 kHz	500 kHz	1 MHz
±.1 dB	±.5 dB	1.5 dB	

Sine Harmonic Distortion:
Add 2 dB to standard instrument specifications to 1MHz.

Square Wave Rise / Fall Time:
200 ns, 10% to 90% at 30 Vp-p output

Residual DC Offset: 40 mVdc

General
Specifications apply when:
Main signal output terminated into 50 ±0.1 Ω
Warm-up ≥ 30 min
Within ±5°C and 24 hours of last internal calibration
Temperature: 0 to 55°C
Relative Humidity: ≤95% at 40°C
Altitude: ≤15,000 ft

Storage:
Temperature: -40 to +75°C
Altitude: ≤50,000 ft

Power:
100/120/220/240 V +5% -10%, 48 to 66 Hz
90 VA maximum

Weight:
7.3 kg (16 lbs) net
10.5 kg (23 lbs) shipping

Dimensions:
132.6 mm (5.22 in) high
212.3 mm (8.36 in) wide
419.0 mm (16.50 in) deep

HP-IB:
IEEE Standard 488-1978 abbreviated definition SH1 AH1 T6 TE0 L3 LE0 SR1 RL1 PP0 DC1 DT1 C0 E2

Accessories:
Transit case for one 3314A HP #9211-2677

Ordering Information
HP 3314A Function Generator
Opt. 001 x3 output
Opt. 907 Front Handle Kit
Opt. 908 Rack Adapter Kit
Opt. 910 Extra Op. and Svc. Manuals

Ordering Information

HP 8116 A Pulse/ Function Generator

Options:

001 burst, sweep and hold (not retro-fitable)
910 additional operating and service manual
W30 three-year repair service
W32 three-year calibration service

Accessories:

1251-0405 telephone jack (for Hold In connector)
5062-4001 bail handle kit

For rack-mounting a single HP 8116 A:
5062-3972 flange and filler panel kit

For rack-mounting two HP 8116 As:
5062-3974 flange kit
5062-3994 lock link kit
1494-0059 non-tilt slide kit (if required)

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Printed in the
Federal Republic of Germany 8/89
5953-6325