

NOW!

Constant output level
Constant modulation level
3 volt output into 50 ohms
Low envelope distortion

50 kc to 65 MC



NEW *-hp-* 606A HF Signal Generator

Here at last is a compact, convenient, moderately-priced signal generator providing constant output and constant modulation level plus high output from 50 kc to 65 MC. Tedious, error-producing resetting of output level and % modulation are eliminated.

Covering the high frequency spectrum, (which includes the 30 and 60 MC radar IF bands) the new *-hp-* 606A is exceptionally useful in driving bridges, antennas and filters, and measuring gain, selectivity and image rejection of receivers and IF circuits.

Output is constant within ± 1 db over the full frequency range, and is adjustable from +20 dbm (3 volts rms) to -110 dbm (0.1 μ v rms). No level adjustments are required during operation; the instrument has a minimum of con-

trols and high accuracy results are assured due to the constant internal impedance. The generator can be provided with a 10:1 voltage divider and dummy antenna lowering minimum output to 0.01 μ v (from 5 ohms) and simulating IRE standards for precision receiver measurements. (See Accessories Available in Specifications.)

The new *-hp-* 606A may be modulated by sine waves and complex waveforms from dc to 20 KC. A meter indicates percent modulation. Distortion in sine waves is extremely low due to use of a feedback circuit.

To insure maximum accuracy of frequency setting, the 606A includes an internal crystal calibrator providing check points at 100 kc and 1 MC intervals with error less than 0.01%.



offers the world's most complete

APPLICATIONS:

- Drive bridges, antennas; investigate filters
- Measure gain, selectivity, and image rejection of receivers, IF amps
- Simulate signals for equipment test under actual modulation conditions



606A

- Wide frequency range includes 60 MHz IF band
- Constant output impedance—wide modulation capabilities
- Crystal calibrator for precision frequencies
- 50×10^{-6} frequency stability per 10 minutes

FEATURES:

- Phase-lock for 2×10^{-7} stability with HP 8708A
- Frequency or phase modulation through HP 8708A
- Auxiliary RF output

606B



DESCRIPTION

The Hewlett-Packard 606 Series Signal Generators provide you with high quality, versatile performance with distinctive ease of operation in the important and widely used 50 kHz to 65 MHz frequency range. Output signals are stable and accurately known, output amplitude can be precisely established over a very wide dynamic range, and versatile modulation capabilities are incorporated to satisfy virtually all measurement requirements. Convenient size and form factor, together with a simple, straightforward control panel layout, make the 606 well suited for production line usage as well as for laboratory or field applications.

The 606 is of master oscillator-power amplifier (MOPA) design with a broadband buffer amplifier stage between the oscillator and power amplifier circuits for isolation. The MOPA design permits optimization of the oscillator circuit for highest stability including low drift, minimum residual FM, low harmonics, etc., without restricting the modulation characteristics. Modulation is applied to the power amplifier circuit with negligible effect on the oscillator frequency (because of the buffer stage).

The 606B, while retaining all the excellent features of the 606A, has in addition an auxiliary RF output for phase locking or counting purposes, and an external frequency control input for synchronization and modulation. The 606B also incorporates a ΔF control which provides better than 10 ppm resolution for very fine frequency stability.

HIGHEST FREQUENCY STABILITY

While the basic frequency stability of the 606 is excellent (less than 0.005% drift over a 10-minute period after warmup), the inclusion of frequency control circuitry in the 606B makes it possible to achieve 250 times greater stability by phase-locking the 606B with the HP 8708A Synchronizer. The 8708A, which is fully compatible with the 606B in every respect, can stabilize the 606B at any frequency (not just at discrete points) with a resultant stability of 2×10^{-7} /10 minutes and with a very high degree of spectral purity. The combination of the 606B and 8708A also permits you to perform narrow band frequency- or phase-modulation of the 606B carrier with very low modulation distortion.

SIMPLIFIED OPERATION

An outstanding feature of the 606 is the employment of feedback in the RF power amplifier section which results in superior performance characteristics and true ease of operation. The feedback circuit maintains both the output level and the percentage of modulation essentially constant over the entire frequency range, thus making it unnecessary to readjust controls when changing the operating frequency. The use of feedback also enables you to change the output level without affecting the degree of modulation. The constant output, constant modulation feature results in significant time saving as well as operator convenience, making the 606 an ideal choice for production line operations where semi-skilled personnel can make meaningful measurements.

VERSATILE AMPLITUDE MODULATION

The use of feedback in the power amplifier section also yields excellent amplitude modulation characteristics. Up to 100% modulation can be achieved with modulating fre-

quencies ranging from dc to 20 kHz. Envelope distortion is very low, less than 1% at 30% AM and less than 3% at 70% AM; this allows you to make more accurate measurements of the distortion characteristics on receivers or detectors. Internal modulation oscillators of 400 Hz and 1000 Hz are provided, and the modulation percentage can be set and read directly on the accurate front panel modulation meter. The wide modulation bandwidth (dc to 20 kHz) means the 606 may be modulated with squarewaves or other complex signals including tone-burst modulation, or you can remotely program the output amplitude. The buffer amplifier stage between the master oscillator and power amplifier holds incidental FM with AM to a minimum, assuring accurate measurements.

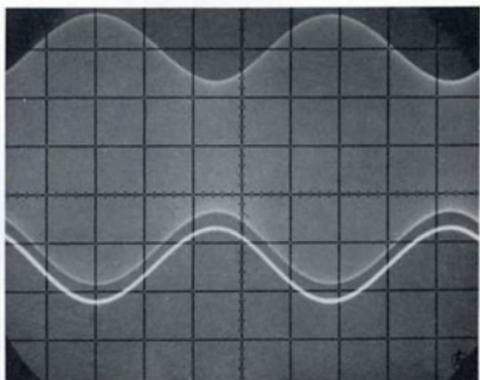


Figure 1. Dual-trace presentation comparing modulated output from 606B with internal 1-kHz modulating waveforms.

ACCURATE OUTPUT LEVEL

The output level from the 606 is continuously adjustable from 3 volts to 0.1 microvolt rms into a 50-ohm load. Direct calibration is provided in both volts and dBm (+23 to -120 dBm) and the output calibration is accurate to within 1 dB at any frequency or level setting. The output system of the 606 is a well-matched 50-ohm circuit which minimizes mismatch ambiguities as a factor in overall measurement accuracy. The extremely wide range of output amplitude control makes the 606 very useful for driving bridges and filters as well as complete receiver measurements including sensitivity, selectivity, and image rejection.

The 606B provides an auxiliary RF output; this fixed level (100 millivolts rms minimum) CW signal is for use with the 8708A Synchronizer and can also be applied to an HP Counter for very accurate indication of carrier frequency. Using the auxiliary RF output does not place any restriction on the modulation capabilities nor on the main RF output level. The 606 also contains a crystal calibrator to provide accurate frequency checkpoints at every 100 kHz or 1 MHz throughout the frequency range of the instrument.

SPECIFICATIONS

FREQUENCY CHARACTERISTICS

Range: 50 kHz to 65 MHz in 6 bands (50 - 170 kHz, 165 - 560 kHz, 0.53 - 1.8 MHz, 1.76 - 6 MHz, 5.8 - 19.2 MHz, 19 - 65 MHz). Total scale length approximately 95 in.

Accuracy: $\pm 1\%$.

Drift: (Attenuator on 1-volt range and below.) Less than 50 parts in 10^6 (or 5 Hz, whichever is greater) per 10-minute period after 2-hour warmup. Less than 10 minutes to restabilize after changing frequency.

Frequency Control Input (606B only): The FREQ. CONTROL INPUT normally used with the 8708A Synchronizer can also be used for external frequency control. A voltage change from -2 volts to -32 volts will change the output frequency more than 0.2% at the low end of each band and more than 2% at the high end of each band. Impedance, nominal 4 K ohm, direct coupled. Applied voltage must be negative and no greater than -50 volts.

Stability When Used with 8708A Synchronizer (606B only): 5×10^{-8} /minute, 2×10^{-7} /10 minutes, 2×10^{-6} /day; $2 \times 10^{-7}/^{\circ}\text{C}$, 0° to 55°C ; $2 \times 10^{-7}/10\%$ line voltage change.

Resettability (606B only): VERNIER control resettability better than 0.15% after initial warmup.

ΔF Control (606B only): Ultra-fine frequency vernier provides better than 10 parts in 10^6 resettability; total range of ΔF control approximately 0.1%.

Crystal Calibrator: Provides frequency checkpoints every 100 kHz and 1 MHz. Headphone jack provided for audio frequency output (headphone not included). Crystal frequency accuracy better than 0.01% from 0° to 50°C . Cursor on frequency dial adjustable over small range to aid in interpolation adjustment. Calibrator may be turned off when not in use.

Residual FM: Less than ± 1 part in 10^6 or ± 20 Hz, whichever is greater.

OUTPUT CHARACTERISTICS

Output Level: Continuously adjustable from 0.1 microvolt to 3 volts into 50-ohm resistive load. Output ATTENUATOR calibrated in 10 dB steps from 3 volts full scale to 1.0 microvolt full scale (into 50 ohms), also calibrated in dBm (0 dBm = 1 milliwatt in 50 ohms). VERNIER control provides continuous adjustment of voltage between full scale ranges. Output level indicated on RF Output Meter calibrated in volts (0 to 1 and 0 to 3 volts) and dBm (-10 to +3 dBm).

Frequency Response and Output Accuracy (50-ohm resistive load): At 1 volt range and below, output variation with frequency change is less than 2 dB, total, across entire frequency range. Output accuracy better than ± 1 dB at any frequency.

Impedance: 50 ohms, SWR less than 1.2 on 0.3 volt attenuator range and below.

RFI: Meets all conditions specified in MIL-I-6181D; permits receiver sensitivity measurements down to at least 0.1 microvolt.

Harmonic Output: At least 30 dB below the carrier.

Spurious AM: Hum and noise sidebands are 70 dB below carrier down to thermal level of 50-ohm output system.

Auxiliary RF Output (606B only): Fixed level CW signal from RF oscillator provided at front panel BNC female connector for use with HP 8708A Synchronizer or other external equipment (e.g., frequency counter). Minimum output 100 mV rms bands 1 - 5 (50 kHz - 19.2 MHz), 200 mV rms band 6 (19 - 65 MHz).

MODULATION CHARACTERISTICS

Internal AM

Frequency: 400 and 1000 Hz, $\pm 5\%$. Modulation signal available at front panel BNC female connector for synchronization of external equipment.

Incidental Frequency Modulation (attenuator on 1-volt range and below, 30% modulation): 606A: less than $\pm 25 \times 10^{-6}$ or 100 Hz, whichever is greater. 606B: less than $\pm 5 \times 10^{-6} + 100$ Hz.

External AM

Frequency: DC to 20 kHz maximum, dependent on carrier frequency (f_c) and percent modulation as tabulated:

Maximum Modulation Frequency:

30%	70% Mod	Squarewave Mod
$0.06 f_c$	$0.02 f_c$	$0.003 f_c$ (3 kHz max.)

Input Required: 606A: 4.5 volts peak produces 100% modulation, input impedance 600 ohms. 606B: 4.5 volts peak produces 95% modulation (maximum input 50 volts), input impedance 1000 ohms.

Modulation Meter: Accuracy: $\pm 5\%$ of full scale, 0 to 90%, for modulation frequencies to 10 kHz, $\pm 10\%$ of full scale for frequencies from 10 kHz to 20 kHz.

Modulation Level Constancy (internal or external AM)

Modulation Level: 606A: 0 to 100% $\pm 5\%$ on 1-volt range (for both 400 and 1000 Hz rates); 0 to 70% on 3-volt range. 606B: 0 to 95% on 1-volt attenuator range and below; 0 to at least 30% on 3-volt range. Modulation level stays constant within $\pm 1/2$ dB regardless of carrier frequency and output level changes.

Carrier Envelope Distortion: Less than 1% at 30% AM, less than 3% at 70% AM (attenuator on 1-volt range and below).

GENERAL

Power: 115 or 230 volts $\pm 10\%$, 50 to 400 Hz, 135 watts.

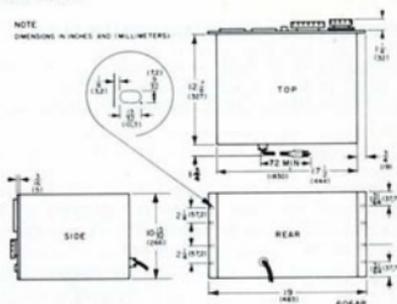
SPECIFICATIONS

Weight: Cabinet Mount: 606A: Net 54 lb (24,3 kg). Shipping, 64 lb (28,8 kg). 606B: Net, 55 lb (24,8 kg). Shipping, 65 lb (29,3 kg). Rack Mount: 606AR: Net, 44 lb (22,1 kg). Shipping, 63 lb (28,4 kg). 606BR: Net, 50 lb (24,5 kg). Shipping, 63 lb (28,4 kg).

Price: HP Model 606A High Frequency Signal Generator: Cabinet Mount, \$1,540.00; Rack Mount, \$1,525.00. Model 606B: Cabinet Mount, \$1,650.00; Rack Mount, \$1,635.00.

Dimensions:

Cabinet Mount: 20 $\frac{3}{4}$ in. wide, 12 $\frac{1}{2}$ in. high, 14 $\frac{3}{4}$ in. deep (527 x 318 x 370 mm).

Rack Mount:

HP 606B SIGNAL GENERATOR FREQUENCY STABILIZED BY HP 8708A SYNCHRONIZER



The 8708A Synchronizer is an easy-to-use frequency stabilizer that allows you to phase-lock the 606B Signal Generator at any frequency. The 8708A is fully compatible with the 606B, and you retain full flexibility of the 606B's amplitude-modulation capabilities and output level control.

Major Specifications 606B/8708A Combination

Frequency Range: 606B can be phase-locked at any carrier frequency, 50 kHz to 65 MHz with 2×10^{-7} settability. (8708A frequency range is 50 kHz to 500 MHz.)

8708A Input: Proper level automatically provided from 606B auxiliary RF output.

606B RF Output Characteristics:**Stability**

- 5 x 10⁻⁸/minute
- 2 x 10⁻⁷/10 minutes
- 2 x 10⁻⁶/day
- 2 x 10⁻⁷/°C, 0° to 55°C
- 2 x 10⁻⁷/10% line voltage change

Spectral Purity

- Non-harmonic signals: \geq 60 dB down
- Signal-to-AM Noise*: \geq 70 dB
- Signal-to-Phase Noise*: \geq 60 dB, 10 MHz and below;
 \geq 60 dB - 20 log $\frac{f}{f_{MC}}$, above 10 MHz.

RMS fractional frequency deviation*:
 $\leq 5 \times 10^{-8}$ averaged over 10 ms.

* 30 kHz band.

Modulation: 606B AM characteristics apply. 606B can be frequency- or phase-modulated through 8708A.

ACCESSORIES

11507A



11509A



The HP 11507A Output Termination is a multi-purpose termination which enhances the usefulness of the 606 by providing:

1. A matched 50-ohm termination to permit use into high impedance circuits.

2. A 20 dB (10:1) terminated voltage driver which reduces the source impedance to 5 ohms.
3. A dummy antenna having the IEEE standard characteristics for receiver measurements (driven from 10:1 divider).

Weight: Net, 4 oz (112 g). Shipping, 10 oz (283 g).

Price: 11507A, \$70.00.

Also available is the HP 11509A Fuseholder which protects the output circuit of the 606B against inadvertent transmitter keying when the signal generator is being used in transceiver tests.

For use as a nanosecond pulse generator the HP 10514A (0.2 - 500 MHz) and the HP 10534A (0.05 - 150 MHz) are available.