

# SIGNAL GENERATORS

Synthesized Signal Generators

Model 8660D

373

- 10 kHz to 2600 MHz
- Synthesizer stability and accuracy
- 1 Hz resolution (2 Hz above 1300 MHz)

- Ten digit display
- Calibrated output over > 140 dB range
- AM, FM,  $\Phi$ M, or pulse modulation



HP 8660D (with HP 86633A and HP 86603A plug-ins)

## HP 8660D Synthesized Signal Generator

### System Concept

The HP 8660 is a modular, solid-state, plug-in system. Each system includes: 1) a programmable, synthesized signal generator mainframe, 2) an RF section plug-in, and 3) a modulation section. Synthesized accuracy and stability, along with complete programmability, make the HP 8660 ideal for automated receiver, subsystem and component testing.

### Mainframes

The HP 8660D offers front panel and HP-IB or BCD control of center frequency and frequency sweep. An external reference may be used to replace the internal, high stability reference oscillator.

### Plug-In RF Sections

The HP 86601A (0.01 - 110 MHz), HP 86602B (1 - 1300 MHz), and HP 86603A (1 - 2600 MHz) are the three RF section choices. The HP 11661B Frequency Extension Module (mainframe Option 100) must be used with the HP 86602B and HP 86603A and is installed internally to an HP 8660 mainframe. (When using the HP 8660A mainframe, the HP 86603A plug-in must be ordered with Option 003.)

### Plug-In Modulation

There are five modulation sections from which to choose. The HP 86631B Auxiliary Section provides external AM and pulse modulation. The HP 86632B offers AM and FM and utilizes a free-running VCO to provide high FM deviations and rates while the HP 86633B provides AM and phase locked FM. The HP 86634A offers high performance phase modulation with rates to 10 MHz while the HP 86635A provides both FM and phase modulation. (The HP 86634A and HP 86635A must be used with Option 002 RF Section.)

## HP 8660D Mainframe Specifications

**Frequency accuracy and stability:** CW frequency accuracy and long term stability are determined by internal reference oscillator, or by external reference.

### Reference Oscillator

**Internal:** 10 MHz quartz oscillator. Aging rate less than  $\pm 3$  parts in  $10^9$  per 24 hours.

**External:** rear panel switch allows operation from 5 MHz or 10 MHz frequency standard at a level between 0.5 and 2.5 Vrms into 170 ohms.

**Reference output:** rear panel BNC connector provides output of reference signal selected at level of at least 0.75 Vrms into 170 ohms.

**Digital sweep:** auto, single, or manual. Selectable speeds 0.1, 1, or 50 seconds.

### Remote Programming Functions

**Connector type:** CW frequency, frequency stepping (STEP), STEP I), output level, and most modulation functions are programmable.

### Programming Input

**Connector type:** 36-pin Cinch type 57 (mating connector supplied). 24-pin Cinch type 57 for HP-IB control. BCD and HP-IB control internal jumper selectable.

**Logic:** TTL compatible (negative true).

**Switching time:** less than 10 ms to be within 100 Hz of any new frequency selected. (Less than 175 ms to be within 10 Hz.)

### General

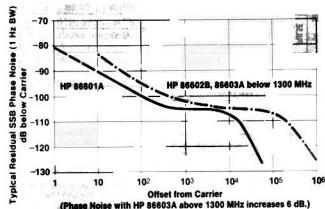
**Operating temperature range:** 0° to +55°C.

**Power:** 100, 120 (+5%, -10%), 48-400 Hz; 220, 240V (+5%, -10%), 48-66 Hz; approximately 350 watts.

**Weight (mainframe only):** net, 23.8 kg (53 lb). Shipping, 29.6 kg (65 lb).

### Supplemental Characteristics

#### Typical Single Sideband Phase Noise



# SIGNAL GENERATORS

## Synthesized Signal Generators

Models 86601A-86603A

10 kHz to 110 MHz



HP 86601A

1 MHz to 1300 MHz



HP 86602B (HP 11661B required)

1 MHz to 2600 MHz



HP 86603A (HP 11661B required)

### RF Section Specifications (installed in HP 8660D mainframe)

		HP 86601A	HP 86602B (requires HP 11661B)	HP 86603A (requires HP 11661B)	
FREQUENCY CHARACTERISTICS	Frequency Range	0.01–110 MHz (109.999999 MHz)	1–1300 MHz (1299.999999 MHz)	1–2600 MHz (2599.999998 MHz)	
	Frequency Resolution	1 Hz	1 Hz	2 Hz	
	Harmonics	≤-40 dBc	≤-30 dBc (≤-25 dBc above +3 dBm)	≤-20 dBc <sup>1</sup>	
	Spurious Non Harmonically Related (greater than 10 kHz offsets)	≤-76 dBc	≤-80 dBc below 700 MHz ≤-80 dBc above 700 MHz within 45 MHz of carrier ≤-70 dBc above 700 MHz >45 MHz from carrier	≤-74 dBc within 45 MHz of carrier <sup>1</sup> ≤-64 dBc >45 MHz from carrier ≤-60 dBc	
	Power Line Related (CW, AM, FM only) <sup>2</sup>	≤-60 dBc	≤-50 dBc on +10 dBm range ≤-60 dBc	≤-60 dBc	
Signal To Phase Noise Ratio (CW, AM, FM only, offsets >300 Hz)	>50 dB	>45 dB	>39 dB		
OUTPUT CHARACTERISTICS	Output Level (into 50Ω)	+13 dBm to -146 dBm	+10 to -146 dBm	+10 to -136 dBm +7 to -136 dBm <sup>3</sup>	
	Output Accuracy (local and remote)	±1 dB +13 to -66 dBm ±2 dB -66 to -146 dBm	±1.5 to -76 dBm ±2.0 to -146 dBm	±2.5 dB to -76 dBm <sup>3</sup> ±3.5 dB to -136 dBm	
	Flatness (output level variation with frequency)	<±0.75 dB	<±1.0 dB	<±2.0 dB	
Impedance		50Ω			
MODULATION CHARACTERISTICS	AM	AM Modulation Depth	0 to 95%	0 to 90% <sup>4</sup>	0 to 50% <sup>4</sup>
		3 dB Bandwidth:	0–30% 200 Hz, CF<0.4 MHz 10 kHz, 0.4<CF<4 MHz 100 kHz, CF>4 MHz	0–30% 10 kHz, CF<10 MHz 100 kHz, CF>10 MHz	5 kHz
		0–70% 125 Hz, CF<0.4 MHz 6 kHz, 0.4<CF<4 MHz 60 kHz, CF>4 MHz	0–70% 6 kHz, CF<10 MHz 60 kHz, CF>10 MHz	N/A	
	0–90% 100 Hz, CF<0.4 MHz 5 kHz, 0.4<CF<4 MHz 50 kHz, CF>4 MHz	0–90% 5 kHz, CF<10 MHz 50 kHz, CF>10 MHz	N/A		
	Distortion, <sup>5</sup> THD at 30% AM at 70% AM at 90% AM	<1%, 0.4–110 MHz <3%, 0.4–110 MHz <5%, 0.4–110 MHz	<1% <3% <5%	<5% N/A N/A	
	FM	FM Rate	dc to 1 MHz with HP 86632B and HP 86635A 20 Hz to 100 kHz with HP 86633B	dc to 200 kHz with HP 86632B and HP 86635A 20 Hz to 100 kHz with HP 86633B	dc to 200 kHz with HP 86632B and HP 86635A 200 kHz w/HP 86632B, 86635A 200 kHz w/HP 86633B
Maximum Deviation (peak)		1 MHz with HP 86632B and HP 86635A 100 kHz with HP 86633B	200 kHz with HP 86632B and HP 86635A 100 kHz with HP 86633B	400 kHz w/HP 86632B, 86635A 200 kHz w/HP 86633B	
PULSE	Distortion, THD (at rates up to 20 kHz)	<1% up to 200 kHz dev. <3% up to 1 MHz dev.	<1% up to 200 kHz dev.	<1% up to 400 kHz dev.	
	Pulse Rise/Fall Time	200 ns	50 ns		
4MHz	ON/OFF Ratio (with pulse level control at max.)	>50 dB	>40 dB	>60 dB	
	µM Rate	N/A	dc to 1 MHz with HP 86635A dc to 1 MHz for CF <100 MHz dc to 10 MHz for CF ≥100 MHz	dc to 1 MHz with HP 86635A with HP 86634A	
	Maximum Peak Deviation	N/A	0 to 100 degrees	0 to 200 degrees	
GENERAL	Distortion, THD	N/A	<5% up to 1 MHz rates <7% up to 5 MHz rates <15% up to 10 MHz rates		
	Weight	Net 5 kg (11 lb) Shipping 6.8 kg (15 lb)	Net 4.1 kg (9 lb) Shipping 5.5 kg (12 lb)	Net 5 kg (11 lb) Shipping 6.4 kg (14 lb)	

<sup>1</sup>For output levels +3 dBm and below; slightly higher +3 to +7 dBm.

<sup>2</sup>Measured in a 30 kHz band centered on the carrier excluding a 1 Hz band centered on the carrier.

<sup>3</sup>For +3 to +7 dBm output levels, output accuracy and flatness will be slightly degraded (above 1300 MHz only)

<sup>4</sup>For RF output level meter readings from +3 dB to -6 dB and only at +3 dBm and below.

<sup>5</sup>Applies only at 400 Hz and 1 kHz rates with output meter set between 0 and +3 dB. At -6 dB meter setting the distortion approximately doubles.

<sup>6</sup>Phase modulation is only possible with Option 002 RF Sections.

HP 11661B: Net 2.3 kg (5 lb); shipping 2.7 kg (6 lb)

# SIGNAL GENERATORS

## Synthesized Signal Generators (Cont'd)

Models 86631B-86633B, 86634A-86635A

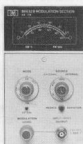
375

Pulse/AM

AM/High Deviation FM

AM/ $\phi$  Locked FMHigh rate  $\phi$ M $\phi$ M/FM

HP 86631B



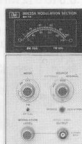
HP 86632B



HP 86633B



HP 86634A



HP 86635A

### Modulation Section Specifications

		HP 86631B	HP 86632B	HP 86633B	HP 86634A	HP 86635A
	Functions	Ext. Only	Int. and Ext.	Int. and Ext.	—	—
AM	Indicated Accuracy (at 400 and 1000 Hz rates)	—	±5% of full scale With HP 86601A RF Section: ±7%, center frequency ≥100 MHz. With HP 86603A RF Section: ±10%, center frequency ≥1300 MHz.		—	—
	Functions	—	Int. and Ext., FM CF CAL	Int. and Ext.	—	Int. and Ext., FM CF CAL
FM	Center Frequency Long Term Stability	—	Typically less than 200 Hz/hr	Same as in CW Mode (3 × 10 <sup>-9</sup> /day)	—	Typically less than 200 Hz/hr
	Indicated Accuracy (up to 20 kHz rates)	—	±5% of full scale		—	±5% of full scale
Pulse	Functions	Ext. Only	—	—	—	—
$\phi$ M	Functions	—	—	—	Int. and Ext.	Int. and Ext.
	Indicated Accuracy (15°C to 35°C)	—	—	—	±5% of full scale up to 100 kHz rates ±8% of full scale up to 2 MHz rates ±15% of full scale up to 10 MHz rates	
Meter		—	0–100% AM 0–10, 100, 1000 kHz FM Pk. Dev. (0–20, 200, 2000 kHz FM for CF ≥1300 MHz)	0–100% AM 0–10, 100 kHz FM Pk. dev. (0–20, 200 kHz FM for CF ≥1300 MHz)	0–100% Peak $\phi$ M (0–200° for CF <sub>2</sub> 1300 MHz)	0–10, 100, 1000 kHz FM, 0–100% Pk. $\phi$ M (0–20, 200, 2000 kHz FM, 0–200° Pk. $\phi$ M for CF ≥1300 MHz)
Internal Modulation Source Output		None	400 Hz and 1 kHz ±5% 200 mV minimum into 10 k $\Omega$ . Available at front panel BNC connector			
Input Impedance		500 Pulse 6000 AM	6000	6000	500	6000
Weight		Net, 1.4 kg (3 lb) Shipping, 2.3 kg (5 lb)	Net, 2.7 kg (6 lb) Shipping, 4.1 kg (9 lb)	Net, 2.7 kg (6 lb) Shipping, 4.1 kg (9 lb)	Net, 1.8 kg (4 lb) Shipping, 3.2 kg (7 lb)	Net, 2.7 kg (6 lb) Shipping, 4.1 kg (9 lb)

### Ordering Information

HP 8660D Synthesized Signal Generator mainframe<sup>1</sup>

Opt 001 ±3 × 10<sup>-3</sup>/day internal reference oscillator

Opt 002 No internal reference oscillator

Opt 003 Operation from 48 to 440 Hz line

Opt 005 Factory configured for HP-IB programming operation.

Opt 100 HP 11661B factory installed inside

main frame

Opt 908 Rack flange kit (08660-60347)

Opt 910 Provides an additional operation and calibration manual (08660-90103) and two service manuals

(08660-90104)

Opt 915 Add service manual (08660-90104)

Opt W30 Extended repair service. See page 725.

HP 86601A 0.01–110 MHz RF Section

HP cables not supplied. For description and price, see page 569.

### Price

\$15,700

\$0

– \$300

\$0

\$0

\$0

+

\$6,280

+

\$113

+

\$255

+

\$103

+

\$365

+

\$8,240

HP 86602B 1–1300 MHz RF Section<sup>2</sup>

HP 86603A 1–2600 MHz RF Section<sup>2</sup>

Opt 002 adds phase modulation capability

(HP 86602B, 86603A only)

Opt 003 allows operation of HP 86603A with

HP 8660A mainframe

HP 86607A field retrofit for HP 8660A/C to HP

8660D

HP 86631B AM/Pulse Auxiliary Section

HP 86632B AM/FM Modulation Section

HP 86633B AM/FM Modulation Section

HP 86634A  $\phi$ M Modulation Section

HP 86635A  $\phi$ M/FM Modulation Section

Note: Opt 910, 2 sets of operation and service manuals, is available for each modulation section. Contact your HP sales representative for part numbers and prices.

HP 11661B Frequency Extension Module

HP 11672A Service Accessory Kit

HP 11707A Test Plug-in

<sup>1</sup>HP 86602B and HP 86603A RF sections require an HP 11661B for operation.

\$9,275

\$11,500

+ \$2,500

+ \$255

\$4,800

\$800

\$3,850

\$3,850

\$3,050

\$4,200

\$6,650

\$1,450

\$2,850