

## MODEL 186

## FUNCTION GENERATORS

**VERSATILITY****Waveforms**

Sine  $\sim$ , triangle  $\wedge$ , square  $\square$ , positive pulse  $\text{┐}$ , negative pulse  $\text{┌}$ , haversine  $\text{⌒}$ , ramp  $\text{↗}$ , waveform inversions, symmetry variations, AM  $\text{⊖}$ , FM  $\text{Ⓜ}$ , TTL pulse  $\text{⏏}$  and dc.

**Operational Modes**

Continuous: Generator oscillates continuously at selected frequency.

Triggered: Generator quiescent until triggered by an external signal, then generates one cycle at selected frequency.

Gated: As triggered mode, except generator oscillates for the duration of the external signal.

Phase Lock: Generator will frequency lock to an external signal and generator waveforms will lead or lag input signal by amount selected.

1 kHz AM: Selected generator output amplitude modulated at 1 kHz sine wave rate; the amount, zero thru suppressed carrier, is adjustable.

1 kHz FM: Selected generator output frequency modulated at 1 kHz sine wave rate; the amount of deviation from center frequency is adjustable.

**Frequency Range**

0.0001 Hz to 5 MHz in 10 overlapping decade ranges with dial and frequency vernier.

**Main Output**

$\sim$ ,  $\wedge$ ,  $\square$ ,  $\text{⊖}$ ,  $\text{Ⓜ}$  selectable and variable to 30V p-p (15V p-p into 50 $\Omega$ ).  $\text{┐}$ ,  $\text{┌}$  selectable and variable to  $\pm 15$ V max (7.5V into 50 $\Omega$ ).  $\text{⌒}$  based at 0 volts and amplitude control varies peak to +15V max. Waveforms may be inverted. Voltage attenuation 0 to 80 dB: to 60 dB in 20 dB steps plus 20 dB vernier. Output impedance 50 $\Omega$ .

**DC Offset and DC Output**

Waveform offset and dc output selectable thru 50 $\Omega$  output. Adjustable between  $\pm 15$ V max ( $\pm 7.5$ V into 50 $\Omega$  load) as offset or Vdc output. Signal peak plus dc offset limited to  $\pm 15$ V ( $\pm 7.5$ V into 50 $\Omega$ ). DC offset and output waveform are attenuated proportionately by the attenuator.

**TTL Pulse Output**

TTL pulse at generator frequency; rise and fall times typically 15 ns. Symmetry variable by symmetry control. Drives up to 20 TTL loads.

**VCG — Voltage Controlled Generator**

Up to 1000:1 frequency change with external 0 to  $\pm 5$ V signal. Upper frequency is limited to maximum of selected range.

Slew Rate: 2% of range per  $\mu$ s.

Linearity: 0.5% for 0.0001 Hz to 50 kHz.

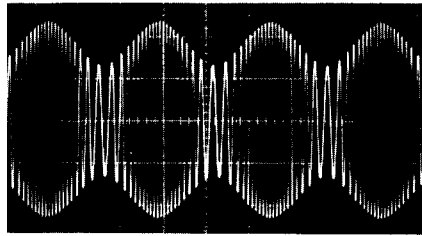
**VCA — Voltage Controlled Amplitude**

Zero to 30V amplitude change with external 0 to  $\pm 5$ V signal. AC output

allows zero to suppressed carrier modulation.

Input Impedance: 3 k $\Omega$ .

Input Bandwidth: 5 MHz.



Voltage Controlled Amplitude and Frequency

**Phase Lock**

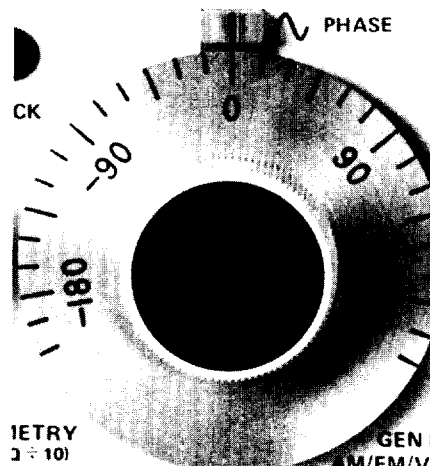
Input Frequency Range: 10 Hz to 5 MHz.

Input Impedance: 1 M $\Omega$ .

Input Voltage Range: 1 to 10V p-p.

Dynamic Range: 10:1 (0.5 to 5 on dial in any range except  $\times 10$ ).

Phase Accuracy:  $\pm 7.5^\circ$  of setting to 50 kHz. Phase dial calibrated for  $\sim$  and  $\wedge$ ;  $90^\circ$  shift for  $\square$  and  $\text{┐}$ .



Phase Control

Capture Range: Approx  $\pm 2\%$  of input frequency.

Hold Range: Approx  $\pm 5\%$  of input frequency.

**Symmetry Control**

Symmetry of all waveform outputs is continuously adjustable from 1:19 to 19:1. Varying symmetry provides variable duty cycle pulses, sawtooth ramps and nonsymmetrical sine waves.

NOTE: When SYMMETRY control is used, indicated frequency is divided by approximately 10.

**Trigger and Gate**

Input Range: 1 to 10V p-p ( $\pm 25$ V max). Impedance: 1 M $\Omega$ .

Pulse Width: 50 ns min.

Repetition Rate: 5 MHz max.

**1 kHz  $\sim$  Output**

Level: 10V p-p.

Impedance: 1 k $\Omega$ .

**FREQUENCY PRECISION****Dial Accuracy**

$\pm 2\%$  of full scale for 0.0005 Hz to 5 MHz.

$\pm 4\%$  of reading and  $\pm 2\%$  of full scale for 0.0005 to 0.005 Hz.

**Time Symmetry**

$\pm 1\%$  for 0.005 to 500 kHz.

**AMPLITUDE PRECISION****Amplitude Change With Frequency**

Sine variation less than:

$\pm 0.1$  dB for 0 to 100 kHz.

$\pm 0.2$  dB for 100 kHz to 1 MHz.

$\pm 1.5$  dB for 1 to 5 MHz.

**Amplitude Symmetry**

1% of amplitude range to 1 MHz.

**Step Attenuator Accuracy**

$\pm 0.3$  dB per 20 dB step.

**WAVEFORM CHARACTERISTICS****Sine Distortion (Continuous Mode)**

Less than:

0.5% for 10 Hz to 50 kHz.

1.0% for 0.005 Hz to 500 kHz.

All harmonics at least 25 dB down for  $\times 1$  MHz range.

**Triangle Linearity**

Greater than 99% for 0.0005 Hz to 100 kHz.

**Square Wave Rise and Fall Time**

Less than 50 ns terminated into 50  $\Omega$  load.

**GENERAL****Stability**

Amplitude, dc offset and frequency.

Short Term:  $\pm 0.05\%$  for 10 minutes.

Long Term:  $\pm 0.25\%$  for 24 hours.

**Environmental**

Specifications apply at  $25^\circ\text{C} \pm 5^\circ\text{C}$ . Instrument will operate from  $0^\circ\text{C}$  to  $+50^\circ\text{C}$ .

**Dimensions**

28.6 cm (11  $\frac{1}{4}$  in.) wide; 13.3 cm (5  $\frac{1}{4}$  in.) high; 27.3 cm (10  $\frac{3}{4}$  in.) deep.

**Weight**

3.9 kg (8.5 lb) net; 5.5 kg (12 lb) shipping.

**Power**

90 to 110V, 105 to 125V, 180 to 220V or 210 to 250V; 50 to 400 Hz; less than 35 watts.

NOTE: Specifications apply from 10 to 100% of a selected frequency range, with SYMMETRY control to NORMAL and WAVEFORM pushbutton to NORM. Symmetry and vernier affect frequency calibration. Maximum possible asymmetry is a function of frequency setting.

**PRICE (FOB San Diego)**

Model 186

\$795