

SECTION 1

GENERAL DESCRIPTION

1.1 MODEL 166

The Model 166 Pulse/Function Generator is a combination sweep, function and pulse generator with a full complement of features in all modes of operation. The frequency range is from 0.0001 Hz (2.8 hours per cycle) to 50 MHz. Waveforms are sine, triangle, ramp, square, pulse, positive pulse and negative pulse. The waveforms may be amplitude controlled, dc offset and inverted (complemented).

Pulse versatility includes variable width and independently variable leading and trailing edge transition times. The generator can be used to generate an output pulse whose width and frequency are dependent upon an external signal input.

Sweep can be logarithmic, as well as linear. The output can be stopped at the start and stop frequencies for accurate setting. Besides continuous sweep, a sweep may be triggered from the quiescent start frequency. The frequency can sweep to the upper (stop) frequency, then return to start frequency, or it can be held at the upper frequency. The duration of the sweep can be set to be from 100 seconds to 100 micro-seconds.

The generator can give a continuous output, be triggered for one cycle, or a double cycle, or gated for many cycles. The output waveform can be presented in haverwave mode; i.e., the selected waveform starts and stops at a positive or negative peak voltage.

The signal being generated may be frequency or amplitude modulated by external signals.





1.2 SPECIFICATIONS

1.2.1 Versatility

Instrument operates as a sweep/function generator or a pulse generator.

1.2.2 Sweep/Function Generator

Selectable Waveforms

Sine , triangle , ramp  and square . All can be inverted 180°. Ramp up-down ratio can be as large as 1:1000. All can be amplitude and frequency modulated.

Operational Modes

Continuous: Generator oscillates continuously at selected frequency.

Triggered: Generator quiescent until triggered by external signal or manually, then generates one cycle.

Double Triggered: As triggered mode, except two cycles are generated.

Triggered Haverwave: As triggered mode. Output is one cycle starting at -90° (or $+90^\circ$).

Gated: As triggered, except output continues for duration of gate.

Gated Haverwave: As gated. Output is a burst of cycles starting at -90° (or $+90^\circ$).

Continuous Sweep: Generator frequency continuously sweeps up from start to stop frequency.

Triggered Sweep: Generator oscillates at sweep start frequency until triggered, then generates one sweep to the stop frequency and returns to the start frequency.

Sweep and Hold: As triggered sweep mode, except the generator remains at stop frequency until the trigger signal falls, then returns to start frequency.

Frequency Range

0.0001 Hz to 50 MHz in 11 ranges. Maximum sweep 1000:1 in linear or logarithmic mode.

Sweep Time Range

100s to 100 μ s in 6 ranges.

Function Output

Variable to 30V p-p into open circuit (15V p-p into 50 Ω). DC offset of waveform is adjustable to ± 10 V open circuit (± 5 V into 50 Ω). Voltage attenuation 0 to 80 dB: to 60 dB in 20 dB steps, plus 20 dB continuous vernier.

Low Frequency Hold

Function output will hold at the instantaneous voltage level when the hold switch is depressed. Effective in the X 0.001 Hz to X 10 Hz ranges.

Amplitude Drift: Less than 0.2% of amplitude per minute.

DC Offset

DC offset of all waveforms is adjustable to $\pm 10\text{V}$ open circuit ($\pm 5\text{V}$ into 50Ω). Waveform plus offset is limited to $\pm 15\text{V}$ open circuit ($\pm 7.5\text{V}$ into 50Ω).

GCV Output

0 to 5V (nominal, open circuit) proportional to the frequency of the main generator. Output impedance is 600Ω .

Sweep Output

0 to +5V (nominal, open circuit) ramp. Output impedance is 600Ω . Sweep time is 100s to 100 μs .

VCG (FM) – Voltage Controlled Generator

Up to 1000:1 frequency change with external 0 to +5V signal.

Mode: Linear or logarithmic.

Slew Rate: 2% of range per μs .

VCG Linearity: 0.0005 Hz to 50 kHz $\pm 0.5\%$ of range.

Voltage Controlled Amplitude (AM)

0 to $\pm 5\text{V}$ gives 0 to 30V amplitude change. AC input allows 0 to 200% modulation (suppressed carrier).

AC Input Range: 5V minimum for 100%, 10V minimum for 200% AM.

Input Impedance: 4.99 to 10 k Ω , depending on gain control.

Input Bandwidth: 10 kHz.

Trigger Input

Trigger Signal: 1V p-p minimum.

Trigger Level: $\pm 5\text{V}$.

Input Impedance: 1.5 k Ω , 30 pF.

Maximum Repetition Rate: 25 MHz.

1.2.3 Frequency Precision

Dial Accuracy (For \sim , \wedge , \sqcap and linear dial settings of 0.5 to 5)

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

+ 15%, – 6% of full scale for 5 to 50 MHz.

1.2.4 Amplitude Precision

Amplitude Change With Frequency

Sine and square variations less than:

± 0.1 dB to 100 kHz;

± 0.2 dB to 1 MHz;

± 3 dB to 50 MHz.

Step Attenuator Accuracy

± 0.3 dB per 20 dB step to 100 kHz.

1.2.5 Waveform Characteristics

Sine Distortion (Test at 10V p-p normal sine wave)

Less than 0.5% for 10 Hz to 100 kHz.

All harmonics greater than:

30 dB down for 100 kHz to 5 MHz;

20 dB down for 5 to 50 MHz.

Triangle Linearity



Greater than 99% for 0.005 Hz to 100 kHz.

Square Wave Aberrations (Test at 10Vp-p)

Less than 5% of p-p voltage.

1.2.6 Pulse Generator

Pulses

Variable amplitude positive or complementary pulses , . Pulse amplitude, width and rise/fall times are independently adjustable and independent of frequency. TTL and TTL pulse widths are simultaneous with main pulse. AM and FM modulation. All pulses can drive 50Ω terminations.

Operational Modes

Continuous, Triggered, Double Triggered, Gated and Continuous Sweep. (See Sweep/Function Generator.)

External Width: An external signal at the trigger input determines the output pulse width and frequency.

Pulse Period Range

Pulse period is selectable from 20 ns to 10,000s (50 MHz to 0.0001 Hz) with approximately 1% vernier.

Pulse Width

10 ns to 100 ms in 7 ranges. Maximum duty cycle is 70% for periods to 200 ns, decreasing to 50% for 20 ns periods. Control has nominal 50% duty cycle detent.

Transition Time

7 ns to 50 ms in 7 ranges, independently variable for leading and trailing edges.

Function Output

0 to $\pm 15\text{V}$ into open circuit and 0 to $\pm 7.5\text{V}$ into 50Ω . Voltage attenuation 0 to 80 dB: to 60 dB in 20 dB steps, plus 20 dB continuous vernier.

TTL and TTL Pulses

Transition times less than 4 ns into 50Ω termination.

1.2.7 General

Stability

Amplitude, dc offset and frequency in linear mode to 500 kHz.

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

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

Environmental

Specifications apply at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ after 30 minute warm-up.

Instrument will operate from 0°C to $+50^{\circ}\text{C}$.

Dimensions

36.2 cm (14¼ in.) wide; 13.3 cm (5¼ in.) high; 38.1 cm (15 in.) deep.

Weight

9.8 kg (21½ lb) net; 12.5 kg (27½ lb) shipping.

Power

108 to 132V or 216 to 250V; 50 to 400 Hz; 50 watts nominal.