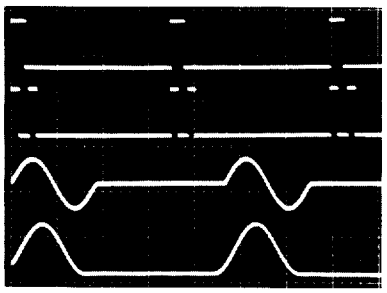
20 MHz Pulse/Function Generators



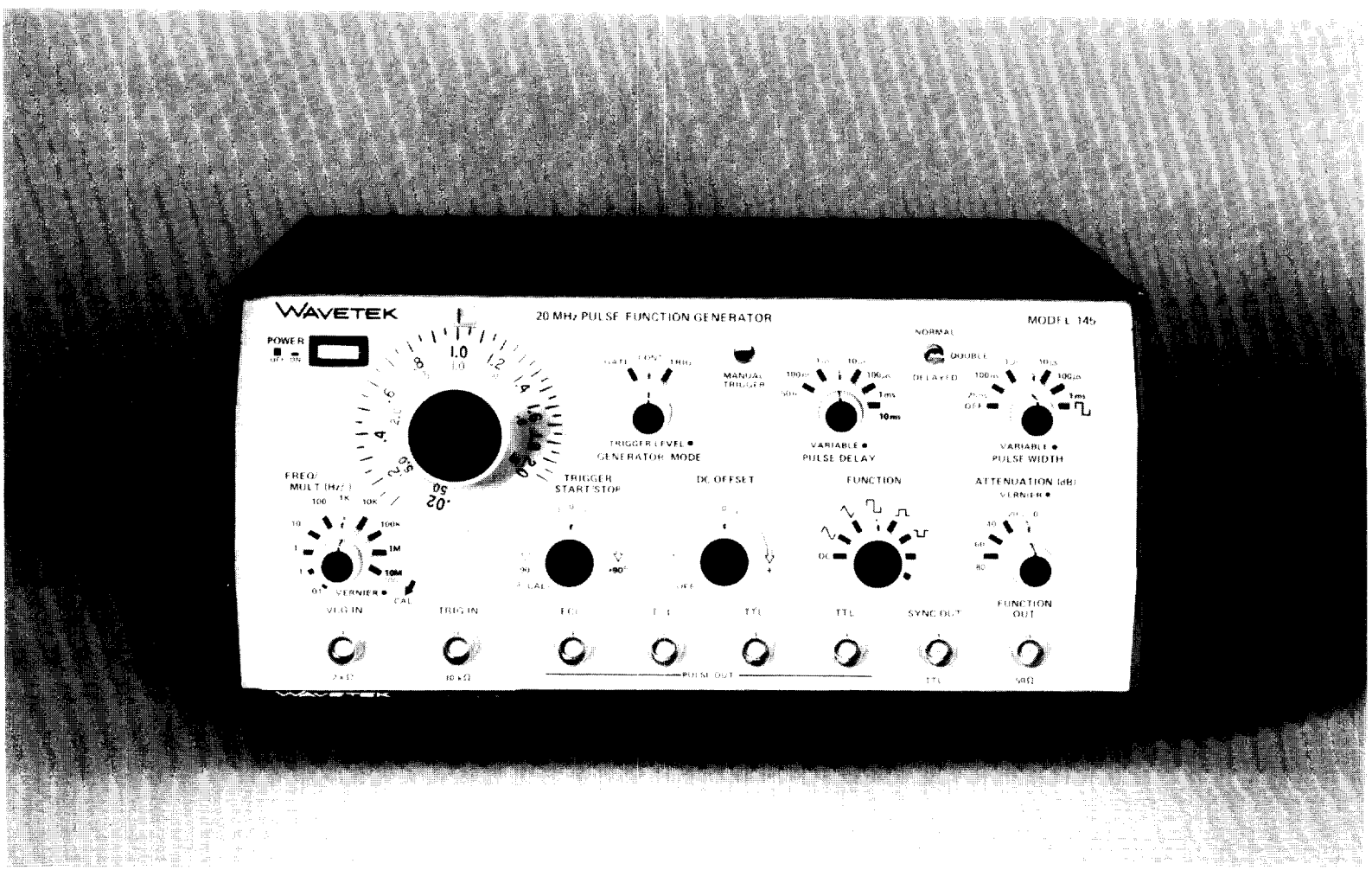
- **Frequency From 0.0001 Hz to 20 MHz**
- **Full 30 Volt Peak-to-Peak Output**
- **Continuous, Triggered and Gated Operation**
- **Fixed TTL and ECL Outputs (145)**
- **Delayed and Double Pulse Outputs (145)**

Models 143 and 145
Both 20 MHz function generators are precision sources of sine, square and triangle waveforms, and positive and negative pulses. The frequency range is variable from 0.0001 Hz (2.78 hour period) to 20 MHz, and the frequency can be modulated, swept or dc controlled over a 1000:1 range by an external voltage. Output can be continuous or the generator can be triggered or gated by an external control signal or front panel switch.

30 Volts Peak-to-Peak
A calibrated 20 dB per step attenuator and 20 dB vernier give 80 dB control for a 1.5 mV p-p to 30 Vp-p output signal.

Variable DC and Start/Stop Point
Other key features of both models are DC offset, triggered waveform start/stop point control and an X-Y recorder frequency axis drive.

Model 145
In addition to the features described above, Model 145 provides pulse outputs with calibrated repetition rates up to 20 MHz. Convenient fixed amplitude outputs are available for TTL and ECL. The variable pulse output gives pulses up to a full 30V peak-to-peak. For further utility you can select delayed or double pulses and continuous, triggered or gated output. Pulse width and delay are independently controllable.



MODELS 143 & 145 FUNCTION GENERATORS

VERSATILITY

Waveforms
Selectable sine ∿, square ⊓, triangle △, positive square ⎍, negative square ⎎, TTL sync pulse and dc.
(143 only.) Symmetry of waveforms may be varied for sawtooth and variable duty cycle pulses.
(145 only.) Fixed amplitude pulses of TTL, $\overline{\text{TTL}}$, ECL and $\overline{\text{ECL}}$, all simultaneously available with function output.

Operational Modes
Continuous: Generator oscillates continuously at selected frequency.
Triggered: Generator is quiescent until triggered by an external signal or manual trigger, then generates one cycle at selected frequency.
Gated: As triggered mode, except generator oscillates for the duration of the gate signal. Last cycle started is completed.

Frequency Range
0.0001 Hz to 20 MHz in 10 overlapping ranges with approximately 1% vernier control.

Function Output
∿, ⊓, △ selectable and variable to 30 Vp-p (15 Vp-p into 50Ω). ⎍, ⎎, to 15 Vp (7.5 Vp into 50Ω). All waveforms and dc can supply 150 mA peak current and may be attenuated to 60 dB in 20 dB steps with an additional 20 dB vernier.

DC Output and DC Offset
Selectable through FUNCTION OUT output. Controlled by front panel control or by applying an external voltage. Adjustable between ±15 Vdc (±7.5 Vdc into 50Ω) with signal peak plus offset limited to ±15 Vdc (±7.5 into 50Ω). External offset sensitivity approximately −1 V/V with output into open circuit. DC offset and output waveform attenuated proportionately by the 60 dB output attenuator.

Sync Output
A TTL level pulse. Will drive 50Ω termination.

GCV—Generator Controlled Voltage
At GCV OUT connector, a 0 to +2V signal proportional to generator frequency. 600Ω source impedance.

VCG—Voltage Controlled Generator
Up to 1000:1 frequency change with external 0 to 2 volt signal to VCG IN connector. Upper and lower frequencies limited to maximum and minimum of selected range.
Slew Rate: 2% of range per μs.
Linearity:
±0.2% for 10 Hz to 200 kHz;
±0.75% for 0.001 Hz to 2 MHz.
Impedance: 2 kΩ.

Trigger and Gate
Input Range: 1 Vp-p to ±10V.
Impedance: 10 kΩ, 33 pF.
Pulse Width: 25 ns min.
Repetition Rate: 10 MHz max.
Adjustable Triggered Signal Start/Stop Point: Approximately −90° to +90° to 2 MHz.

Symmetry
(143 only.) Symmetry of all waveform outputs is continuously adjustable from 1:19 to 19:1 for variable duty-cycle pulses, sawtooth ramps and distorted sine waves.
NOTE: When SYMMETRY control is used, indicated frequency is divided by approximately 10.

FREQUENCY PRECISION

Dial Accuracy
From ×.01 Hz to ×1 MHz: ±3% of full range.
×10 MHz: ±5% of full range.

Time Symmetry
Square wave variation:
0.001 Hz to 200 kHz: <±1%.
20 Hz to 20 kHz: <±0.5%.

AMPLITUDE PRECISION

Amplitude Change With Frequency
Sine variation:
0.001 Hz to 200 kHz: <±0.1 dB.
200 kHz to 2 MHz: <±0.5 dB.
2 to 20 MHz: <±3.0 dB.

Step Attenuator Accuracy
±0.3 dB per 20 dB step at 2 kHz.

WAVEFORM CHARACTERISTICS

Sine Distortion
×100 Hz to ×10 kHz: <0.5%.
×.01 to ×10 Hz and ×100 kHz: <1.0%.
×1 MHz: All harmonics 34 dB below fundamental.
×10 MHz: All harmonics 26 dB below fundamental.

Square Wave Rise/Fall Time
At FUNCTION OUT <20 ns for 15 Vp-p output into 50 Ω load.

PULSE GENERATOR

(145 only.)

Pulse Outputs
Variable amplitude pulse, and simultaneous fixed ECL, $\overline{\text{ECL}}$, TTL and $\overline{\text{TTL}}$ pulses and TTL sync pulse. All outputs can drive 50Ω terminations.

Operational Modes
Continuous, triggered and gated plus the following.
Normal Pulse: Adjustable width pulse in phase with sync signal.
Delayed Pulse: Pulse delayed with respect to normal pulse. Pulse delay and pulse width adjustable.
Double Pulse: Two pulses for every period. Time between pulses and pulse width adjustable. Minimum period 100 ns.

Pulse Period Range
50 ns to 10,000s in 10 overlapping ranges with approximately 1% vernier control.

Pulse Width
25 ns to 1 ms in 5 overlapping ranges with vernier control. Includes OFF and square wave.

Pulse Delay
50 ns to 10 ms in 6 overlapping ranges with vernier control.

Duty Cycle
Duty cycles to 70% for periods >100 ns (<10 MHz); for periods <100 ns (>10 MHz) duty cycles are approximately 50%.

Function Output
Variable to 30 Vp-p into 50Ω). DC offset and attenuation are same as for function generator.

Pulse Rise/Fall Times
At FUNCTION OUT, <20 ns for 15 Vp-p output into 50Ω load.

GENERAL

Stability
Short Term: ±0.05% for 10 min.
Long Term: ±0.25% for 24 hours.
Percentages apply to amplitude, frequency and dc offset.

Environment
Specifications apply at 23° ±5°C. Instrument will operate from 0° to +50°C ambient temperatures.

Dimensions
28.6 cm (11¼ in.) wide; 13.3 cm (5¼ in.) high; 27.3 cm (10¼ in.) deep.

Weight
Model 143: 4.2 kg (9.3 lb) net; 5.5 kg (12 lb) shipping.
Model 145: 4.5 kg (10 lb) net; 5.9 kg (13 lb) shipping.

Power
90 to 105V, 108 to 126V, 198 to 231V and 216 to 252V selectable; 48 to 400 Hz; less than 30 VA.

NOTE: All specifications apply from 0.1 to 2.0 on frequency dial, when FUNCTION OUT is at maximum and 50Ω terminated, and (143 only) with SYMMETRY control at OFF. Symmetry and vernier affect frequency calibration. Maximum possible asymmetry is a function of frequency setting. Model 145 function generator specifications apply when PULSE WIDTH control is OFF.

FACTORY/FOB

San Diego, CA