OPERATOR'S & MAINTENANCE MANUAL

Model 288

20 MHz Synthesized Function Generator

WAVETEK

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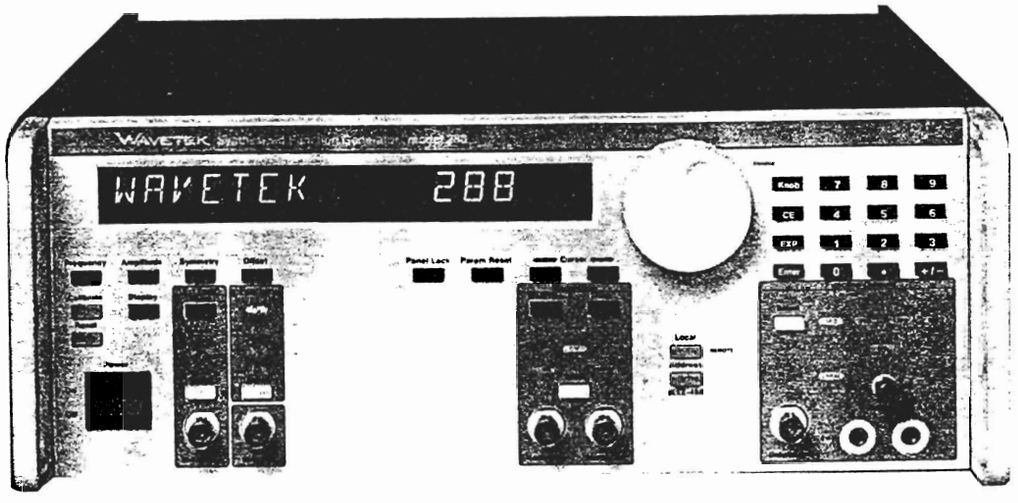

Model 288 20 MHz Synthesized Function Generator

SECTION 1
GENERAL

1.1 INTRODUCTION

The Model 288 Signal Generator is a precision source of sine, triangle, and variable symmetry (ramp and pulse) waveforms for use in the installation and maintenance of radio receivers, transmitters, and other electronic equipment.

- Push button control for easy operation.
- Indicator lights give constant equipment status.
- Large, 16 character (fourteen segments/ character), display for all parameters.
- Programmed interface for remote operation.
- Programmable sine, triangle, square, and dc outputs.
- Variable symmetry provides pulse and ramp waveforms.
- Balanced and unbalanced outputs.
- Built-in calibration and fault analysis programs with extensive self-adjustment.
- Battery backup for saving system setups.

1.1.1 List of Abbreviations

This list identifies abbreviations and descriptions used in this manual that are not contained in MIL-STD-12. For abbreviations used in this manual but not contained in this list refer to MIL-STD-12.

Abbreviation	Term
dBc	dB relative to carrier
dBm	dB relative to 1 milliwatt
fc	carrier frequency
fm	modulating frequency
GPIB	General Purpose Interface Bus
VCF	Voltage Controlled Frequency
VFD	Vacuum Fluorescent Display

1.2 OPTIONS

001: Special 24-pin extender card when used in conjunction with Option 002 permits user access to test points and components on the various circuit cards with or without power being applied.

002: 40-pin Extender Card – Special 40-pin extender card when used in conjunction with Option 001 permits user access to test points and components on the various circuit cards with or without power being applied.

003: Rack Mounting Kit

1.3 SPECIFICATIONS

1.3.1 Waveforms (Functions)

Sine, triangle and square; variable symmetry for pulse and ramp waveforms; and dc.

1.3.2 Operational Modes

Continuous (CW): Synthesized frequency output with selected parameters.

Amplitude Modulation (AM): Same as CW except that maximum amplitude limited to 15 Vp–p (open circuit) and external signal modulates the amplitude of the selected output.

Frequency Modulation (FM and VCF): External input modulates the frequency output.

Sweep Modulation: All symmetrical waveforms swept over 3 decades from Start to Stop frequency (up or down) at programmed rate.

Rate: 100 ms to 100s.

Start/Stop Accuracy: $< \pm$ 3%.

Phase Lock: Frequency, stability and purity controlled by external reference. In all modes except FM and Sweep, generator will lock to applied external 20 Hz to 20 MHz sine wave.

Lock Phase Angle: $\pm$ 180° ($\pm \pi$ radians).

Resolution: 1°.

Accuracy: 50 Hz to 10 MHz, ± (4° + 20 ns).

1.3.3 Waveform Quality

Sine Distortion: Unbalanced output, Total Harmonic Distortion.

2 mHz to 20 Hz: – 40 dB.
20 Hz to 100 kHz: – 46 dB.
100 kHz to 1 MHz: – 40 dB.
1 MHz to 6 MHz: – 34 dB.
6 MHz to 20 MHz: – 26 dB.

Time Symmetry: Programmable from 5% to 95% in 1% steps to 2 MHz, linearly decreasing to 50% fixed at 20 MHz.

Accuracy: <± (2% + 20 ns). At 50%, <± (0.1% + 20 ns).

Square Wave Transition Time: < 13 ns, 10% to 90%, full output, from 50Ω source into 50Ω load.

Square Wave Aberrations: Overshoot and ringing < (5% + 20 mV) of p–p amplitude.

Triangle Linearity: From 10% to 90% points:
2 mHz to 100 kHz: ± 1%.
100 kHz to 2 MHz: ± 2%.
2 MHz to 5 MHz: ± 10%.

1.3.4 Frequency

Range: 2 mHz to 20 MHz.
Synthesized: 20 Hz to 20 MHz.
600Ω or Balanced Output: 2 mHz to 1 MHz.
Amplitude Modulation: 0.1 Hz to 20 MHz.

Resolution: 3 1/2 digits (200 to 2000 counts in the display).

Accuracy: Percent of setting:
2 mHz to 20 Hz and FM or Sweep Modes: ± 3%.
20 Hz to 20 MHz: ± 0.05%.

Stability
Within 10 Minutes:
≤ 20 Hz and FM or Sweep Modes: ± 0.1%
> 20 Hz: ±0.001%.
Within 24 Hours:
≤ 20 Hz and FM or Sweep Modes: ± 0.5%
> 20 Hz: ± 0.002%.
Line Voltage Variation:
For ± 10% line variation and ≤ 20 Hz and all frequencies in FM and Sweep Modes: ± 0.1%.
> 20 Hz: ± 0.001%.
Temperature:
≤ 20 Hz and all frequencies in FM and Sweep Modes: < 100 ppm/°C.
> 20 Hz: < 2 ppm/°C

Output level Variation:
≤ 20 Hz and all frequencies in FM and Sweep Modes: ± 0.1%
> 20 Hz: ± 0.001%.

1.3.5 Amplitude

Range:
Open Circuit: 2 mVp-p to 30 Vp-p.
Impedance Terminated: 1 mVp-p to 15 Vp-p.

Resolution: With no offset:
2 mVp-p to 20 Vp-p Open Circuit, (1 mVp–p to 10 Vp–p Terminated): 3 digits.
To 30 Vp-p (15 Vp-p Terminated): 3 1/2 digits.

Accuracy: % of Setting:

Sine :
To 999 mVp-p: ± 2% + 2 mV.
To 30 Vp-p: ± 2% + 10 mV.
Triangle and Square :
To 999 mVp-p: ± 3% + 4 mV.
To 30 Vp-p: ± 3% + 20 mV.

Flatness: To accuracy percent of setting:
For 100 kHz to 1 MHz: Additional ± 2%.
To 5 MHz: Additional ± 3%.
To 20 MHz: Additional ± 10%.

1.3.6 Offset

Range
± 10V (± 5V terminated).
Resolution
3 digits; may be reduced if both offset and waveform amplitude are programmed.
Accuracy
0.5V to 10V: ± 1% of setting + 20 mV.
1 mV to 500 mV: ± 1% of setting + 5 mV.

1.3.7 Outputs

Sync (Trigger) Output
Pulse at frequency of and in phase with square wave.
Low Level: < 0.4V.
High level: > 1.8V into 50Ω.
10-90% Transition Times: < 13 ns.

Horizontal Output
Ramp indicates sweep position.
Level: Fixed 0V to approx. + 5V (open circuit).
Source Impedance: 600Ω.

Unbalanced Output
Source Impedance:
To 1 MHz: 600Ω ± 1%.
To 20 MHz: 50Ω ± 1% or 75Ω ± 1%.

Balanced Output
Banana jacks for differential output of sine wave; universal binding post for common.
Source Impedance:
To 1 MHz: 135Ω ± 0.5% or 600Ω ± 1%
Output Unbalance:
10 Hz to 1 MHz: < 1% referenced to 1 kHz.

1.3.8 Inputs

External Trigger/Freq In
Input Impedance: 10 kΩ ± 2%.
Range (Sine Wave): 600 mVp-p to 30 Vp-p (into 10 kΩ), 20 Hz to 20 MHz.

Modulation In
Input Impedance: 10 kΩ ± 2%.
Bandwidth: DC to 100 kHz
Max Level: ± 20 Vp-p (into 10 kΩ).
FM Mode: ± 10V gives 1000:1 change. Apply as DC for VCF or AC for FM.
AM Mode: 4 Vp-p into 10 kΩ gives 100% AM.

1.3.9 Displays

Amplitude: V or mV peak-to-peak or peak. For symmetrical waveforms with no offset, displays amplitude in RMS or dBm.
Resolution: 100 to 999 counts or 0.1 dBm.
Offset: V or mV.
Resolution: 100 to 999 counts.
Frequency Including Sweep Start/Stop): mHz, Hz, kHz or MHz.
Resolution: 3 1/2 digits.
Period: sec, ms, µs or ns.
Resolution: 4 digits.
Symmetry: In %.
Resolution: ≥ 10 counts.
Resolution: resolves in 1° (deg) increments, displays radians in 4 digits.
Sweep Time: sec or ms with ≥ 100 counts.

1.3.10 GPIB Programming

Address: 0-30 selectable, battery backed.

Subsets: SH1, AH1, SR1, RL1, PP0, DC1, DT0, C0, T6, L4, TE0,LE0 and E1.

1.3.11 General

MIL-T-28800 Class 5 qualified.
Temperature Range: 0 to +50°C, - 40 to +70°C for storage.
Warm-up Time: 20 minutes for specified operation at 25 ± 10°C ambient temperature.
Humidity: 0 to +25°C at 95% RH, 0 to +40°C at 75% RH, and 0 to 50°C at 45% RH.
Altitude: 3050m (10,000 ft.); non-operating to 12,000m (40,000 ft.).
Vibration: 0.013 in. from 5 to 55 Hz (2g acceleration at 55 Hz).
Shock: Non-operating; 30g, 11 ms half-sine.
Electromagnetic Compatibility: MIL-STD-461A Notice 4 (EL). Emission and susceptibility requirements of CE02, CE04, CS02, CS06, RE02, RE02.1 and RS03.
Dimensions: 35.6 cm (14.00 in.) wide, 13.3 cm (5.219 in.) high and 43.2 cm (17.00 in.) deep.
Weight: Approximately 11.4 kg (25 lb) net; 13.6 kg (30 lb) shipping.
Power: 90 to 108, 108 to 126, 198 to 231, or 216 to 252 Vrms; 48 to 440 Hz; 1 phase; < 60 VA.

1.4 EQUIPMENT SUPPLIED

The Model 288 is supplied with a shielded power cord, spare fuse, and manual.

1.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED

All items required for the Model 288 are supplied.