

**0.001 Hz to 40 MHz**

Three Basic Waveforms,  
Plus a Wide Range of Shaping  
with Variable Rise and Fall  
and Symmetry Controls

Logarithmic or Linear Sweep

Separate Frequency Dials  
Set Lower (START) and  
Upper (STOP) Limits of Sweep

Up to 30 V p-p Output

Built-in Attenuator

Am and Fm

Phase Lock Mode

External and Manual Trigger  
or Gate

Counted Burst with DDS01

The output of the FG 504 may be phase locked, gated, or triggered by a reference signal, letting you convert from one waveform to another, such as pulses to sine waves, as well as adjust phase relationships. Post attenuator offset enables use of the full  $\pm 7.5$  V offset range with small signals. And the FG 504 output can be amplitude or frequency modulated by external signals.

The FG 504 also provides trigger output, external voltage control input, and sweep output. (Contact your Tektronix Field Engineer for a data sheet discussing FG 504 applications in detail.)

**Frequency Range** — Sine, Triangle and Square Waveforms: 0.001 Hz to 40 MHz calibrated range. Ramps, pulses or waveforms requiring use of VARIABLE SYMMETRY control: 0.001 Hz to nominally 4 MHz. Multiplier switch has position for user-determined range by capacitor selection. Maximum frequency on this range is 400 kHz. A 5 pF capacitor provides a full scale frequency of 400 Hz. Instrument shipped from factory with capacitor installed for 20 Hz to 20 kHz range in 0.5 x 10<sup>3</sup> position.

**Frequency Resolution** — 1 part in 10<sup>6</sup> of full scale setting using the FREQUENCY VERNIER control.

**Frequency Stability** —  $\leq 0.05\%$  for 10 minutes,  $\leq 0.1\%$  for 1 hour,  $\leq 0.5\%$  for 24 hours. The FREQUENCY Hz dial must be on the calibrated portion. The instrument must be at a constant ambient temperature between 0°C and +50°C and checked after a 1 hour warmup.

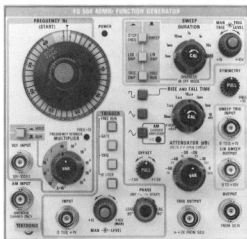
**Dial Calibration** — 1 to 40 Hz calibrated, 0.1 to 1 Hz uncalibrated.

**Dial Accuracy** — (+15°C to 35°C) Start Dial: Within  $\pm 3\%$  of full scale from 0.001 Hz to 4 MHz. Within  $\pm 8\%$  of full scale from 4 MHz to 40 MHz. Measurements made at  $\pm 25^\circ\text{C} \pm 10^\circ\text{C}$ . Stop Frequency Dial: 5% of the difference between the start and stop frequencies plus the FREQUENCY Hz (START) dial error. Stop Dial uncalibrated on the 10<sup>6</sup> MULTIPLIER range.

**Maximum Dial, VCF, and Sweep Range** —

MULTIPLIER	FREQUENCY RATIO
10 <sup>6</sup>	500:1
10 <sup>5</sup> -10 <sup>4</sup>	1000:1
10 <sup>3</sup> -10 <sup>2</sup> , 1, 10 <sup>-1</sup> , 10 <sup>-2</sup>	100:1
10 <sup>-3</sup>	40:1

**Internal Sweep** — Linear or Logarithmic. Accuracy: Limited by Start and Stop Frequency dial specifications. Can be set more accurately using an external


**FG 504**
**40 MHz FUNCTION GENERATOR**

frequency monitor. Sweep Duration: 100 s to 0.1 ms in six decades. Variable control overlaps decades. Stop Frequency to Swept Stop Frequency Error: Within 2% maximum from 100 s to 1 ms sweep duration. Within 10% maximum from 1 ms to 0.1 ms sweep duration. Linear Sweep Output: Amplitude: 0 V to +10 V from 1 kHz. Amplitude Accuracy: Within  $\pm 5\%$  from 100 s to 1 ms, within  $\pm 10\%$  from 1 ms to 0.1 ms. Sweep Trigger Input: Input Sensitivity: 1 V p-p. Trigger Level: 1 V through 10 V. Maximum Input: +20 V. Manual Trigger: Front panel control.

**Voltage Controlled Frequency Input** — Nominal sensitivity (Hz/volt) = X 4 MULTIPLIER setting per volt. A positive-going voltage increases frequency. Maximum Frequency: X 40 MULTIPLIER setting. Minimum Frequency: Maximum frequency divided by vcf of range of MULTIPLIER setting (see DIAL, VCF, and SWEEP RANGE). Slow Rate: 0.3 V/μs maximum. Input impedance: 10 kΩ.

**Output Amplitude** — 30 V p-p into an open circuit, 15 V p-p into 50 Ω.

**Amplitude Flatness** — Sinewave (reference at 10 kHz): Within  $\pm 0.5$  dB from 0.001 Hz to 40 kHz. Within  $\pm 2$  dB from 40 kHz to 40 MHz. Typically within  $\pm 0.5$  dB to 40 MHz. Triangle (reference at 10 kHz): Within  $\pm 0.5$  dB from 0.001 Hz to 40 kHz. Within  $\pm 2$  dB from 40 kHz to 40 MHz. Squarewave (reference at 10 kHz): Within  $\pm 0.5$  dB from 0.001 Hz to 20 MHz. Within  $\pm 2$  dB from 20 MHz to 40 MHz. Sine, Triangle and Squarewave Amplitude Match: Within  $\pm 1$  dB at 10 kHz.

**Output Attenuator** — Open Circuit Voltages:

ATTENUATOR STEP	MAXIMUM OUTPUT VOLTAGE (p-p)
0 dB	30 V
-10 dB	3 V
-20 dB	300 mV
-30 dB	30 mV
-40 dB	3 mV
-50 dB	300 μV

Variable — 20 dB extends minimum signal amplitude to 10 mV. See square wave aberrations specification. Accuracy:  $\pm 0.5$  dB/decade.

**Offset Range** —  $\pm 7.5$  V into an open circuit,  $\pm 3.75$  V into 50 Ω. Maximum signal plus offset peak output amplitude of  $\pm 20$  V into an open circuit or  $\pm 11.25$  V into 50 Ω. Offset defeatable by front panel control.

**Waveforms** — Sine, Triangle and Square: Ramps and Pulses by use of the VARIABLE SYMMETRY control.

**Variable Symmetry** — Duty Cycle Range: 7% to 93%; 20% to 80% on triangle and sine waveforms above 1 MHz. Action of VARIABLE SYMMETRY control divides output frequency by approximately ten.

**Triangle Symmetry** — Within 1% from 10 Hz to 400 kHz within 5% from 400 kHz to 40 MHz on calibrated portion of FREQUENCY Hz dial. Typically within 2% from 0.001 Hz to 10 Hz.

**Triangle Linearity** — Within 1% from 10 Hz to 400 kHz, within 2% from 400 kHz to 4 MHz, within 10% from 4 MHz to 40 MHz measured from the 20% to 80% points on the waveform. Typically within 2% from 0.001 Hz to 10 Hz.

**Sine-wave Distortion (Total Harmonic Distortion)** —  $\leq 0.5\%$  from 20 Hz to 40 kHz. Greatest harmonic at least 30 dB down from 40 kHz to 1 MHz and 20 dB down from 1 MHz to 40 MHz. Typically  $\leq 1\%$  from 0.001 Hz to 20 Hz. Measured under the following conditions: terminated in 50 Ω, at  $25^\circ\text{C} \pm 10^\circ\text{C}$  ambient, with zero offset,  $\leq 30$  dB attenuation and with FREQUENCY Hz (START) dial set between 4 and 40.

**Square wave** — Rise and fall time (FIXED):  $\leq 6$  ns. Aberrations:  $\leq 5\%$  p-p + 30 mV into a 50 Ω load.

**Variable Rise and Fall Time (Square and Pulse Waveforms)** — Range: 10 ns to 100 ms in 7 steps measured from 10% to 90% points on waveform. Variable control has  $\geq 10$  x range. Period of waveform must exceed combined rise and fall times by  $\geq 20\%$ .

**Amplitude Modulation Input** — A 5 V p-p signal produces 100% modulation of a sine wave carrier from dc to 4 MHz with  $< 5\%$  distortion at 70% modulation when driven from a source impedance of  $\leq 500$  Ω. From 4 MHz to 40 MHz there is  $< 10\%$  distortion at 65% modulation. Distortion specifications valid for modulating frequencies from 20 Hz to 100 kHz. Modulation frequency bandwidth is dc to 200 kHz. A modulating source impedance of  $\leq 10$  kΩ ensures proper modulation and divides the output amplitude by 2. Input impedance:  $> 1$  MΩ.

**External Trigger/Gate/Phase Lock Input** — Input impedance  $\geq 10$  kΩ. Sensitivity: 1 V p-p. Maximum input Amplitude:  $\pm 20$  V. Trigger Mode: (for triggering a single cycle of generator waveform). Trigger Level: 1 to 10 V. Minimum Period: 75 ns. Maximum Triggered Frequency:  $\geq 20$  MHz. Gate Mode: (for gating multiple-cycle bursts of main generator waveform). Minimum Period: 75 ns. Maximum Gated Frequency:  $\geq 20$  MHz. Duration of gate determines number of output cycles with integral number of cycles completed. Phase Lock Mode: Frequency Range: 100 Hz to 40 MHz. Capture Range:  $\geq 10$  major dial divisions from 100 Hz to 4 MHz.  $\pm 8$  major dial divisions from 4 MHz to 40 MHz. Lock Range: Generator will lock to a changing external signal, without readjusting the PHASE control, within  $\pm 10$  major dial divisions from 100 Hz to 4 MHz and within  $\pm 1$  MHz from 4 MHz to 40 MHz. Phase Adjustment Range:  $\pm 80^\circ$  from 100 Hz to 4 MHz.

**Gate and Trigger Phase Control** — Phase Adjustment Range: Triangle and sine waveforms only,  $\pm 80^\circ$  from 0.001 Hz to 4 MHz.

**Manual Trigger/Gate** — Available at front panel.

**Trigger Output** — 0 V to  $\geq +2$  V from 50 Ω.

**Hold Mode** — Drift:  $\leq 10\%$  of p-p output amplitude/hour. Range: 0.001 Hz to 400 Hz.

**Power Consumption** — 48 W from power line.

**Power Dissipation** — 24 W maximum in plug-in.

**Performance Conditions** — The electrical characteristics are valid if the FG 504 is calibrated at an ambient temperature between  $-20^\circ\text{C}$  and  $+30^\circ\text{C}$ , and operated between  $0^\circ\text{C}$  and  $+50^\circ\text{C}$ , unless otherwise noted. Forced air circulation is required above  $+40^\circ\text{C}$  (TM 515, TM 506, RTM 506 or equivalent).

**FG 504 40 MHz Function Generator**

**FG 504T 40 MHz Function Generator**  
(Includes FG 504, TM 503 Mainframe, and 016-0195-01 blank panel)

**DD501 Digital Delay**