

# TM 500 / 5000

MODULAR TEST INSTRUMENTS

- FG 501A 2 MHz Function Generator
- FG 502 11 MHz Function Generator
- FG 503 3 MHz Function Generator
- FG 5010 Programmable 20 MHz Function Generator

## Plug-in Function Generators to 20 MHz for Waveform Generation

TEGAM TM 500/TM 5000 Function Generators are compact plug-in modules you can use singly or in combination with one another to fill all your waveform generation requirements. Several levels of performance make it possible to configure a versatile cost-effective solution for use in either manual or automated systems.

The FG 5010 provides full GPIB programmability, accuracy within 0.1% of reading to 20 MHz, variable symmetry, complementary output and a host of other features.

The FG 502, FG 502 and FG 501A are lower frequency generators that provide a low-cost alternative for straightforward applications in biological, geophysical and mechanical simulations.

TM 500/TM 5000 Function Generators can be rear interfaced easily with other plug-in instruments.

The two-wide FG 501 fits in a TM 5006A or TM 5003 mainframe, and the four manual plug-ins can be used in any TM 500/TM 5000 mainframe. All modules, manual and programmable, are interchangeable with the TM 5000 mainframe.

Finally, whether it's a single unit or complete package, you can count on TEGAM to offer more in support of your purchase, including comprehensive manuals, applications assistance and immediate worldwide service network access.

### Function Generator Comparison Of Characteristics

	FG 501	FG 502	FG 503	FG 5010
Signal: Square, Triangle, Waveforms		•	•	•
Pulse				•
Ramp	•	•		•
Frequency Range	2 mHz to 2 MHz	0.1 Hz to 11 MHz	1 Hz to 3 MHz	2 mHz to 20 MHz
Amplitude (V p-p) Open Circuit	30	10	20	20
Integr. 50 Ω	15	5	10	10
IEEE Interface	No	No	No	Yes
Module Width	1	1	1	2



THE GLOBAL SOURCE FOR PROVEN TEST AND MEASUREMENT TECHNOLOGY.

## FG 501A 2 MHz Function Generator

- 0.002 Hz to 2 MHz
- 30 V p-p Output,  $\pm 13$  V Offset
- 5% to 95% Variable Symmetry
- Trigger or Gate, Slope
- 60 dB Step Attenuator
- < 0.25% Sine Wave Distortion
- < 25 ns Rise/Fall

The FG 501A Function Generator provides low-distortion outputs from 0.002 Hz to 2 MHz. It can generate five basic waveforms — sine, square, triangle, ramp and pulse — at output levels up to 30 V peak-to-peak, with up to  $\pm 13$  V of offset into an open circuit.

Waveform triggering and gating are provided with a variable phase control to permit up to  $\pm 90^\circ$  of phase shift for generating haversines, sine pulses and haversine triangles. A step attenuator provides 60 dB of output signal attenuation in 20 dB steps with an additional 20 dB of variable attenuation. Variable symmetry from 5% to 95% makes possible ramps and pulses. Pulse rise time is  $\leq 25$  ns. Audio sine wave distortion is  $\leq 0.25\%$ , and audio amplitude flatness is within 0.1 dB.

### Specifications

**Frequency Range** — 0.002 Hz to 2 MHz.

**Symmetry Range** —  $\leq 5\%$  to  $\geq 95\%$  variable. Limited to 200 kHz.

**Dial Accuracy** —  $\leq 3\%$ , 20 to 2 on dial.

**Frequency Stability** —  $\leq 0.05\%$  for 10 min.,  $\leq 0.1\%$  for 1 hour,  $\leq 0.5\%$  for 24 hours, constant temperature.

**Amplitude** — 30 V p-p into open circuit, 15 V p-p into 50  $\Omega$ .

**Offset** —  $\pm 13$  V into open circuit,  $\pm 6.5$  V into 50  $\Omega$ .

**Peak Signal and Offset** —  $\pm 15$  V into an open circuit,  $\pm 7.5$  V into 50  $\Omega$ .

**Attenuator (dB) in 20 dB Steps** — 0 to -60.

**Attenuator with AMPL Control** —  $> 20$  dB additional.

**Output Impedance** — 50  $\Omega$ .

**Amplitude Flatness** — Sine wave:  $\pm 0.1$  dB, 20 Hz to 20 kHz;  $\pm 0.5$  dB to 1 MHz;  $\pm 1$  dB to 2 MHz. Triangle:  $\pm 0.5$  dB, 20 Hz to 200 kHz,  $\pm 2$  dB to 2 MHz. Square wave:  $\pm 0.5$  dB, 20 Hz to 2 MHz.

**Sine Wave Distortion** —  $\leq 0.25\%$ , 20 Hz to 20 kHz;  $\leq 0.5\%$  to 100 kHz; Harmonics,  $\leq -30$  dB to 2 MHz.

**Square Wave Response** —  $\leq 25$  ns rise/fall;  $< 3\%$  p-p aberrations.

**Triangle Linearity** —  $\geq 99\%$ , 20 Hz to 200 kHz,  $\geq 97\%$  to 2 MHz.

**Trigger Output** —  $\geq +4$  V from 50  $\Omega$ .

**External Input** — Impedance  $\approx 2$  k $\Omega$ ; +1 V  $\pm 20\%$  gate signal required.

**Trigger and Gate** —  $\pm 90^\circ$  variable start phase control.

**VCF** — Up to 1000:1 frequency change with 10 V external signal. Slew rate  $\geq 0.5$  V/ $\mu$ s.

**Environmental** — Operating: 0 to 50°C. Non-operating: -55 to +75°C.

## FG 502 11 MHz Function Generator

- 0.1 Hz to 11 MHz
- Five Waveforms
- VCF and Gated Burst
- Up to 10 V p-p Output
- Up to  $\pm 5$  V Offset

The FG 502 Function Generator provides low-distortion sine, square and triangle waveforms, along with positive or negative ramps and pulses. Output frequency is continuously variable from 0.1 Hz to 11 MHz. With a high-frequency range from 1 to 11 MHz, the FG 502 has the versatility to be extended into the medium radio-frequency range. VCF input also allows it to be used as a sweep generator or as a FM generator. External-gate input permits output in any mode to be controlled by an externally supplied pulse to generate bursts of various output waveforms.

### Specifications

**Frequency Range** — 0.1 Hz to 11 MHz.

**Symmetry Range** — 5%, 50%, 95% fixed. Limited to 1.1 MHz.

**Dial Accuracy** —  $\leq 3\%$  to 1 MHz,  $\leq 5\%$  to 10 MHz.

**Frequency Stability** —  $\leq 0.05\%$  for 10 min.,  $\leq 0.1\%$  for 1 hour,  $\leq 0.5\%$  for 24 hours, constant temperature.

**Amplitude** — 10 V p-p into open circuit, 5 V p-p into 50  $\Omega$ .

**Offset** —  $\pm 5$  V into open circuit,  $\pm 2.5$  V into 50  $\Omega$ .

**Peak Signal and Offset** —  $\pm 10$  V into open circuit,  $\pm 5$  V into 50  $\Omega$ .

**Output Impedance** — 50  $\Omega$ .

**Amplitude Flatness** — Sine Wave:  $\leq \pm 1.5$  dB referenced at 10 kHz; Triangle and Square Wave:  $\pm 3$  dB referenced to Sine Wave.

**Sine Wave Distortion** —  $\leq 0.5\%$  to 50 kHz; Harmonics  $\leq -27$  dB at all other frequencies.

**Square Wave Response** —  $\leq 20$  ns rise/fall;  $\leq 3\%$  p-p aberrations.

**Triangle Linearity** — Typically  $\geq 99\%$ , 0.1 Hz to 100 kHz,  $\geq 97\%$ , 100 kHz to 1.1 MHz;  $\geq 95\%$ , 1 to 11 MHz.

**Trigger Output into 50  $\Omega$**  —  $\geq +2.5$  V to 1 MHz  $\geq +1.5$  V to 11 MHz.

**External Input** — Impedance  $\approx 1$  k $\Omega$ ;  $\geq +2$  V gate signal required.

**VCF** — Up to 1000:1 frequency change with 10 V external signal. Slew rate  $\geq 0.5$  V/ $\mu$ s.

**Environmental** — Operating: 0° to 50°C. Non-operating: -40° to +75°C.

## FG 503 3 MHz Function Generator

- 1.0 Hz to 3 MHz
- Three waveforms
- Up to 20 V p-p Output
- Up to  $\pm 7.5$  V Offset
- VCF

The FG 503 Function Generator provides high-quality, low-distortion sine, square

and triangle waveforms. Six decade frequency multiplier steps, a custom position for user-determined frequency multiplication, a dial calibrated from 1.0 to 30 (uncalibrated from 0.1 to 1.0), and a frequency vernier control all work together to select frequencies in overlapping ranges from 1 Hz to 3 MHz.

The FG 503's output frequency can be swept over a 1000:1 ratio by an external voltage. Output amplitude and offset controls are provided. A trigger output is available for controlling external devices or equipment. Amplitude up to 10 V peak-to-peak can be developed across a 50  $\Omega$  load (20 V peak-to-peak open circuit). Selectable offset up to 3.75 V dc across 50  $\Omega$  load (7.5 V dc open circuit) is also included.

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## Specifications

**Frequency Range** — 1 Hz to 3 MHz (0.01 Hz to 5 MHz usable).

**Dial Accuracy** —  $\pm 5\%$ .

**Custom Frequency Range** — With user installed capacitor.

**Frequency Stability** —  $\leq 0.05\%$  to 10 mins.,  $\leq 0.1\%$  for 1 hour,  $\leq 0.5\%$  for 24 hours, constant temperature.

**Amplitude** — 20 V p-p into open circuit, 10 V p-p into 50  $\Omega$ .

**Offset** —  $\pm 7.5$  V into open circuit,  $\pm 3.75$  V into 50  $\Omega$ .

**Output Impedance** — 50  $\Omega$ .

**Amplitude Flatness** — Sine Wave  $\leq 2$  dB referenced at 10 kHz. Triangle and Square Wave;  $\pm 1$  dB referenced to sine wave.

**Sine Wave Distortion** —  $\leq 0.5\%$  to 30 kHz,  $\leq 1\%$  to 300 kHz,  $\leq 2.5\%$  to 3 MHz.

**Square Wave Response** —  $\leq 60$  ns rise/fall;  $\leq 3\%$  p-p aberrations.

**Triangle Linearity** — Typically  $\geq 99\%$ , 1 Hz to 100 kHz;  $\geq 95\%$ , 100 kHz to 3 MHz.

**Trigger Output** —  $+2.5$  V to 600  $\Omega$  load.

**VCF** — Up to 1000:1 frequency change with 10 V external signal. Slew rate  $\geq 0.5$  V/ $\mu$ s nominal.

**Environmental** — Operating:  $0^\circ$  to  $50^\circ$ C. Non-operating:  $-55^\circ$  to  $+75^\circ$ C.

## FG 5010 Programmable 20 MHz Function Generator

- 0.002 Hz to 20 MHz
- Up to 20 V p-p from 50  $\Omega$
- Sine, Square, Triangle, Pulse and Ramp Waveforms
- 10 ns Rise/Fall
- 10% to 90% Variable Symmetry in 1% Steps
- Trigger, Gate, Counted Burst
- Phase Lock with Autocan
- AM, FM, VCF
- Waveform Complement

The FG 5010 Programmable Function Generator provides waveform generation from 0.002 Hz to 20 MHz with 0.1% frequency accuracy. In addition to conventional sine, square and triangle waveforms, you get variable symmetry which is usable throughout the frequency range and extends pulse and ramp capabilities beyond what conventional generators offer. The FG 5010 also includes trigger, gate, counted burst, phase lock, AM, FM and VCF modes. Variable phase enhances the trigger, gate, burst and phase lock modes.

All functions are fully programmable, either from the front panel or over the GPIB. The ability to store up to ten complete front-panel settings reduces programming requirements and enhances stand-alone capability.

The FG 5010 makes possible automatic phase lock to an external signal from 20 Hz to 20 MHz. Waveform complement and  $\pm$  trigger slope allow interfacing to circuits with the proper waveform phase, especially important in pulse and digital applications. Waveform hold can freeze the output voltage of any waveform  $\leq 200$  Hz at its instantaneous value. With the output amplitude set to 0 V, the dc offset can be programmed to provide a dc voltage source of 0 to  $\pm 7.5$  V in 10 mV steps.

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## Specifications

**Frequency Range** — 0.002 Hz to 20 MHz.

**Frequency Accuracy** — Continuous mode,  $\pm 0.1\%$ ; Trigger, Gate, Burst Modes, frequency  $\leq 200$  Hz,  $\pm 0.1\%$ ; frequency  $> 200$  Hz,  $\pm 5.0\%$ .

**Frequency Resolution** — Continuous mode, 4 digits; Trigger, Gate, Burst Modes, frequency  $\leq 200$  Hz, 4 digits; frequency  $> 200$  Hz, 3 digits.

**Frequency Stability** —  $\leq 0.05\%$  of full scale for 1 hour,  $\leq 0.05\%$  of full scale for 24 hours  $\leq 200$  Hz, 0.1 % for  $> 200$  Hz.

**Amplitude** — Range: 20 mV to 20 V p-p into open circuit; 10 mV to 10 V p-p into 50  $\Omega$ .

**Sine Wave Amplitude Flatness** —  $\pm 3\%$ , 0.002 Hz to 1 kHz;  $\pm 3.5\%$ , 1 kHz to 1 MHz;  $\pm 5\%$ , 1 to 5 MHz;  $+5\%$ ,  $-10\%$ , 5 to 20 MHz.

**Triangle Amplitude Flatness** —  $\pm 2\%$ , 0.002 Hz to 1 kHz;  $\pm 3.5\%$ , 1 kHz to 100 kHz;  $\pm 4\%$ ,  $+100$  kHz to 1 MHz;  $+4\%$ ,  $-5\%$ , 1 to 5 MHz;  $+4\%$ ,  $-20\%$ , 5 to 20 MHz.

**Square Amplitude Flatness** —  $\pm 2\%$ , 0.002 Hz to 1 kHz;  $\pm 3.5\%$ , 1 kHz to 1 MHz;  $\pm 5\%$ , 1 to 10 MHz;  $\pm 10\%$ , 10 to 20 MHz.

**Offset Range** —  $\pm 10$  mV to  $\pm 7.5$  V open circuit;  $\pm 5$  mV to  $\pm 3.75$  V into 50  $\Omega$  load.

**Peak Signal Plus Offset** —  $\pm 15$  V open circuit,  $\pm 7.5$  V into 50  $\Omega$  load.

**Offset Accuracy** —  $< \pm 1\%$  of selected offset,  $+2\%$  of signal p-p amplitude,  $+20$  mV),  $< \pm 1\%$  of selected offset  $+5\%$  of signal p-p amplitude  $+20$  mV) for square-waves above 2 MHz.

**Offset Resolution** — 10 mV open circuit, 5 mV into 50  $\Omega$  load.

**Output Impedance** — 50  $\Omega$ .

**Sine Wave Distortion** — 20 Hz to 19.99 kHz,  $\leq 0.5\%$ ; 20.0 kHz to 99.99 kHz,  $\leq 1.0\%$ ; 100 kHz to 20.0 MHz, harmonics  $> 30$  dB down. Valid from  $+15^\circ$ C to  $+35^\circ$ C into 50  $\Omega$  load with 0 V offset, continuous mode, 50% symmetry, and AM, FM, VCF and Complement off.

**Square Wave Response** —  $\leq 10$  ns rise/fall;  $\leq \pm(5\% + 20$  mV) aberrations.



**Symmetry** — 10 to 90%, 1% steps,  $\pm 2\%$  accuracy for frequencies below 2 MHz. Range above 4 MHz is limited by 25 ns minimum triangle transition time (decreases to 50% at 20 MHz).

**Triangle Linearity** —  $>99\%$  to 100 kHz;  $>98\%$  to 2 MHz;  $>90\%$  to 20 MHz.

**Trigger Output** —  $0 \pm 100$  mV to  $\geq 2$  V from 50  $\Omega$  into an open circuit.

**Trig, Gate, Burst and Phase Lock Input**

**Trigger Input** — 1 M $\Omega$ /50 $\Omega$  selectable; 0 V/0.5 V selectable.

**Amplitude Sensitivity** —  $\leq 250$  mV p-p.

**Maximum Input Amplitude** —  $\pm 5$  V peak into 50  $\Omega$ ,  $\pm 20$  V peak into 1 M $\Omega$ .

**Minimum Pulse Width** — 25 ns.

**Burst Range** — 1 to 9999 cycles.

**Amplitude Modulation** — 100% with 5 V p-p, dc to  $\geq 100$  kHz,  $<2\%$  distortion to 2 MHz at 70%,  $<4\%$  to 20 MHz at 70%, Max. Amp.  $\pm 20$  V.

**Frequency Modulation** — Dc to  $\geq 100$  kHz,  $\leq 2\%$  distortion, Max. Amp.  $\pm 20$  V.

**VCF Modulation** — 0 to 10 V produces  $\leq 1000$ : 1 frequency change, dc to  $\geq 100$  kHz,  $\geq 0.063$  V/ $\mu$ s slew rate, Max. Amp.  $\pm 20$  V.

**Output Hold Mode** — 0.002 to 200 Hz.

**Phase Range** —  $\pm 90^\circ$  to 1 MHz,  $\pm 47^\circ$  to 20 MHz. Resolution  $1^\circ$ .

**Phase Lock Range** —  $\pm 90^\circ$  to 10 MHz,  $\pm 50^\circ$  to 20 MHz. Resolution  $1^\circ$ .

### Other Specifications

**Environmental** — Operating:  $0^\circ$  to  $50^\circ$ C. Non-operating:  $-55^\circ$  to  $+75^\circ$ C.

**Power Module Compatibility** — A TM 5000 mainframe is required to operate the FG 5010.

### Ordering Information

FG 501A 2 MHz Function Generator  
Includes: Instruction Manual (070-2957-00)

FG 502 11 MHz Function Generator  
Includes: Instruction Manual (070-1706-01)

FG 503 3 MHz Function Generator  
Includes: Instruction Manual (070-1727-01)

FG 5010 Prgm. 20 MHz Function Generator  
Includes: Instruction Manual (070-3467-01), Instrument Interfacing Guide (070-4613-00), Reference Guide (070-3561-00)

TM 502A 2 Wide Power Module Mainframe

TM 502A/TB TM 502A w/Tool Box Plug-In  
TM 5003 3 Wide Power Module

Mainframe, GPIB  
TM 5003/RI TM 5003 w/Rear Interface

TM 5006A 6 Wide Power Module Mainframe, GPIB

TM 5006A/R TM 5006A w/Rack Mount  
TM 5006A/RI TM 5006A w/Rear Interface

TM 5006A/R/RI TM 5006A w/Rack Mt & Rear Interface

TM 5006A/EMC TM 5006A w/EMC Shielding

### Mainframe Power Plug Options

Standard 120V North American  
UE220 220V Universal Euro & Switzerland  
UK240 240V United Kingdom  
A240 240V Australian  
NA240 240V North American  
S220 220V Switzerland

### Warranty

One year on materials and workmanship.

### Calibration Documentation

Contact TEGAM for OPTION Z540 NIST Traceable Compliance Certificate and Test Data.

### Calibration & Technical Services

For warranty and remedial repair, calibration services and spare parts, or for additional information on TEGAM sales and service offices around the world, contact us at 440-466-6100 (ph) or 440-466-6110 (fx).



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