

SPECIFICATIONS

WAVEFORM OUTPUT

Output channels	FG220/FG320: 2 channels FG210/FG310: 1 channel
Output waveforms	Sine, Square (fixed 50% duty cycle), Triangle (variable symmetry), Pulse (variable duty cycle), or Arbitrary waveform (FG310/FG320)
Output signal	Continuous output(CONT): Waveform output continuously FG220/FG320: Switchable between phase-continuous and internal-channel synchronized output FG210/FG310: Phase-continuous only Triggered output (TRIG) Output preset number (integer) of burst waveforms on trigger sync Gated output (GATE) Output integer number of burst waveforms while enabled by gate DC output (DC) Output DC voltage

FREQUENCY

Frequency range	Sine or Square waveform Triangle or Pulse waveform Arbitrary waveform (FG310/FG320)	1 μ Hz to 15 MHz 1 μ Hz to 200 kHz 1 μ Hz to 200 kHz
Resolution	1 μ Hz or 9 digits max.	
Frequency accuracy	± 20 ppm	
Frequency stability	± 20 ppm (at ambient temperature of 5 to 40°C)	
Reference clock	40.2107 MHz	

OUTPUT CHARACTERISTICS

Maximum output voltage***	± 10 V
Amplitude setting range***	± 20 Vpp (setting resolution 1 mVpp) (negative amplitude represents inverted waveform)
Amplitude accuracy*** (1 kHz sine wave)	$\pm (0.8\% \text{ of setting} + 14 \text{ mVrms})$
Amplitude frequency characteristics*	Sine waveform ≤ 100 kHz ± 0.1 dB ≤ 1 MHz ± 0.2 dB ≤ 10 MHz ± 0.5 dB ≤ 15 MHz ± 1 dB Square/Pulse waveform (50% duty cycle) ≤ 10 kHz $\pm 2\%$ Triangle waveform (50% symmetry) ≤ 10 kHz $\pm 3\%$
Offset voltage setting range***	± 10 V (setting resolution 1 mV)
Offset voltage accuracy***	$\pm (0.3\% \text{ of setting} + 0.5\% \text{ of amplitude setting} + 40 \text{ mV})$
Output impedance	50 $\Omega \pm 1\%$ (open when output OFF)
DC output setting range***	± 10 V (setting resolution 1mV)
DC output accuracy***	$\pm (0.3\% \text{ of setting} + 20 \text{ mV})$
Output attenuator setting range	1/1, 1/10, 1/100
Output attenuator accuracy***	0.2%
Interchannel crosstalk**(FG220/FG320)	-65 dB max.

* Rms measurements referenced to output at 1 kHz into 50 Ω load, amplitude setting 20 Vpp, offset voltage 0V

** Crosstalk between channels 1 and 2 with 50 Ω load, amplitude setting 20 Vpp, offset voltage 0V, Ch1 set for 15 MHz sine wave, Ch2 set for 10 MHz sine wave.

*** High-impedance load

SINE WAVEFORM PURITY

Harmonics* (maximum of 2nd to 5th harmonic components)	100 kHz -55 dBc max. 1 MHz -45 dBc max. 10 MHz -35 dBc max. 15 MHz -25 dBc max.
Harmonic distortion* (rms value of 2nd to 5th harmonic components)	100 kHz 0.3% max.
Spurious* (1 kHz to 100 MHz frequency range)	100 kHz -55 dBc max.

* Measured with amplitude setting 20 Vpp, offset voltage 0V, into 50 Ω load

SQUARE, PULSE AND TRIANGLE WAVEFORM CHARACTERISTICS

Rise time*	Square waveform 30 ns max. (10% to 90%) Pulse waveform 100 ns max. (10% to 90%)
Overshoot*	$\pm 5\%$ max. of output peak-to-peak value
Duty cycle setting* (pulse waveform)	Setting range 0% to 100% (setting resolution 0.01% or 25 ns) Time accuracy ≤ 10 kHz $\pm 0.2\%$ of (1/frequency setting) Jitter 1 clock period
Symmetry* (Triangle waveform)	Setting range 0% to 100% (setting resolution 0.01% or 25 ns) Jitter 1 clock period

* Measured with amplitude setting 20 Vpp, offset voltage 0V, into 50 Ω load

PHASE

Utilization	Starting/stopping phase of triggered or gated output. Channel-to-channel phase difference setting during 2-channel output
Setting range	-10000 deg to + 10000 deg (setting resolution 0.01 deg)

SWEEP CHARACTERISTICS

Sweep types	Linear, Log, Linear step, Log step, or Arbitrary pattern (FG310/FG320)
Sweepable parameters	Frequency, phase, amplitude, offset voltage, duty cycle, or simultaneous frequency and amplitude (sweepable range for each parameter is same as setting range during normal output)
Sweep time setting range	1 ms to 10000 s (setting resolution 10 μ s or 5 digits max.)
Sweep ratio	0% to 100% (setting resolution 0.01% or 1.6 μ s)
Sweep modes	Continuous mode (REP) Perform continuously repeating sweep of each parameter Single sweep (SINGLE) Perform single sweep synchronized to trigger Single & hold sweep (SGL&HLD) Perform single sweep synchronized to trigger, continuing when finished to output waveform with final parameter values

MODULATION CHARACTERISTICS

Carrier	Sine, Square (fixed 50% duty cycle), Triangle (variable symmetry), Pulse (variable duty cycle), or Arbitray waveform (FG310/FG320), Output characteristics same as during continuous output
Modulation types	AM Modulation setting range 0% to 100% (setting resolution 0.01%) DSB-AM FM Max. deviation setting range 0 Hz to 7.5 MHz (setting resolution 1 μ Hz or 9 digits) Phase modulation (PM) Max. deviation setting range 0 deg to 360 deg (setting resolution 0.01 deg) Offset modulation Max. deviation setting range 0 V to 10 V (setting resolution 1 mV) PWM Max. deviation setting range 0% to 50% (setting resolution 0.01%)
Modulation waveform	Sine, Triangle (variable symmetry), Pulse (variable duty cycle), or Arbitrary waveforms (FG310/FG320)
Modulation frequency	1 mHz to 50 kHz (setting resolution 1 mHz)

SEQUENCE (FG310/FG320)

Sequence mode	Sequential switching of output waveform sets of parameters under trigger control
Affected parameters	Can set frequency, phase, amplitude, offset voltage, and duty cycle for each step
Number of steps	1 to 256 (returns to step 1 after last step)

ARBITRARY WAVEFORM (FG310/FG320)

Output amplitude resolution	12 bits
Memory length	8192 points (not all points will be output if frequency exceeds 4.9 kHz)
Waveform definition functions	Definable waveforms Number of settings 8 Interpolation Output waveform, sweep pattern Linear, step, or spline

TRIGGER/GATE

Trigger source	External trigger, Internal trigger, Manual trigger, or GP-IB command
Internal trigger frequency setting range	1 mHz to 50 kHz (setting resolution 1 mHz)
Burst cycle setting range	1 to 65535 cycles (in 1-cycle steps)
Gate source	External gate, or Manual gate

SYNCHRONIZED OPERATION

Number of units	Up to eight units can be operated in synchronization
Output delay	70 ns (typ.) for each unit [25 ns (typ.) for each unit when triggered]

OTHER FUNCTIONS

Setup data retention	10 sets of parameters can be saved to and recalled from non-volatile memory
Preset TTL	Sets amplitude 5 V, offset voltage 2.5 V (with high-impedance load)
Waveform output ON/OFF	Output can be switched ON/OFF independently for each channel
Parameter copy (FG220/FG320)	Copies setup parameters between channels (CH1→CH2/CH2→CH1)
Dual setup (FG220/FG320)	Setup parameters can be changed simultaneously on both channels

BUILT-IN FLOPPY DISK DRIVE (FG310/FG320)

Drive type	3.5" floppy disk drive
Number of drives	1
Formats	MS-DOS: 640 KB, 720 KB, 1.2 MB, and 1.44 MB

GP-IB COMMUNICATION INTERFACE

Electrical & mechanical specifications	Conforms to IEEE St'd 488-1978
Functional specifications	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0
Protocol	Conforms to IEEE St'd 488.2-1987

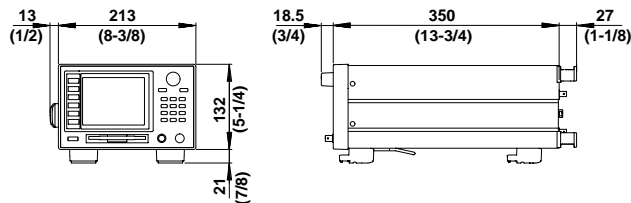
GENERAL SPECIFICATIONS

Warm-up time	30 minutes minimum
Operating temperature range	5°C to 40°C
Operating humidity range	20% RH to 80% RH (max. wet bulb temperature 29°C, non-condensing)
Storage temperature range	-20°C to 60°C
Rated power voltage range	100 V AC to 240 V AC
Allowable range of power voltage variation	90 V AC to 264 V AC
Rated power frequency	50 Hz to 60 Hz
Allowable range of power frequency variation	48 Hz to 63 Hz
Power consumption	125 VA max.
Signal grounding	Ground sides of all I/O connectors are connected to case ground
Dimensions	Approx. 213(W) × 132(H) × 350(D) mm (not including projections)
Weight	Approx. 5 kg (main unit only)

The above performance is obtained at reference operating conditions after the specified warm-up time has elapsed.
Reference operating conditions: Ambient temperature 23°C±2°C, ambient humidity 50% RH±10% RH, power voltage 100 V±1%.

DIMENSIONS

Unit: mm(inch)



AVAILABLE MODELS

Model	Suffix Code	Description
706111		FG210: 1-channel model
706112		FG220: 2-channel model
706121		FG310: 1-channel model (with arbitrary sweep and simple arbitrary waveform generator functions)
706122		FG320: 2-channel model (with arbitrary sweep and simple arbitrary waveform generator functions)
Power Cord	-D	UL, CSA Standard
	-F	VDE Standard
	-R	SAA Standard
	-J	BS Standard
Option	/R1	External sweep control

OPTIONAL ACCESSORIES

Name	Model	Description
Parallel connection cable	705926	26-pin (1 m)
BNC cable	366924	BNC-BNC (1 m)
BNC cable	366925	BNC-BNC (2 m)
BNC-alligator cable	366926	BNC-alligator clip (1 m)
Adapter	366921	BNC plug to banana jack
Adapter	366927	BNC plug to RCA jack
Adapter	366928	BNC plug to RCA plug