G51

SPECIFICATIONS
(G5100A / G5110A)

Display & Capability

Display:	(G5100A) Graphic Mode for Visual Verification of Signal Settings (G5110) Text Mode LCD[8]
Standard Waveforms:	Sine, Square, Ramp, Triangle, Pulse, Noice, DC / Sine, Square, Ramp, Triangle, Pulse, DC
Built-In Arbitrary Waveforms	Exponential Rise & Fall, Negative Ramp, Sin(x)/x, Cardiac

Waveform Characteristics

	Frequency: 1 µHz ~ 50 MHz / 1 mHz ~ 15 MHz	
	Amplitude Flatness[1,2] (Relative to 1 KHz)	0.1 dB (< 100 KHz), 0.15 dB (< 5 MHz), 0.3 dB (< 20 MHz), 0.5 dB (< 50 MHz)
Sine:	**Harmonic**[2,3] **Distortion** (Unit: dBc)	DC ~ 20 KHz, -70 (< 1 Vpp) -70 (≥ 1 Vpp) -65 (< 1 Vpp) -65 (> 1 Vpp) 20 KHz ~ 100 KHz, -65 (< 1 Vpp) -60 (≥ 1 Vpp) 100 KHz ~ 1 MHz, -50 (< 1 Vpp) -45 (≥ 1 Vpp) 1 MHz ~ 20 MHz, -40 (< 1 Vpp) -35 (≥ 1 Vpp) 20 MHz ~ 50 MHz, -35 (< 1 Vpp) -30 (≥ 1 Vpp)
	Total Harmonic Distortion[5]	DC ~ 20 KHz, Out put ≥ 0.5 Vpp (THD + N ≤ 0.06 %)
	Spurious[2,4] **(Non-Harmonic)**	DC ~ 1 MHz, -70 dBc 1 MHz ~ 50 MHz, -70 dBc + 6 dB/octave DC ~ 1 MHz, -60 dBc 1 MHz ~ 15 MHz, -60 dBc + 6 dB/octave
	Phase Noise (10 KHz Offset)	-115 dBc/Hz (Typical), when f ≥ 1 MHz, V ≥ 0.1 Vpp -100 dBc/Hz (Typical), when f ≥ 1 MHz, V ≥ 0.1 Vpp

	Frequency:	1 µHz ~ 25 MHz / 1 mHz ~ 15 MHz
	Rise/Fall Time:	< 10 ns / < 15 ns
	Overshoot:	< 2 %
Square:	**Variable Duty Cycle**	20 % ~ 80 % (to 10 MHz) 20 % ~ 80 % (to 5 MHz) 40 % ~ 60 % (to 25 MHz) 40 % ~ 60 % (to 15 MHz)
	Asymmetry:	1 % of Period + 5 ns (@ 50 % Duty)
	Jitter (RMS):	200 ps, when f ≥ 1 MHz, V ≥ 0.1 Vpp 1 ns + 100 ppm of Period

Ramp, Triangle :	**Frequency:**	1 µHz ~ 200 KHz / 1 mHz ~ 200 KHz
	Linearity:	< 0.1 % of Peak Output / < 0.2 % of Peak Output
	Symmetry:	0.0 % ~ 100.0 % / 5.0 % ~ 95.0 %

Pulse:	**Frequency:**	500 µHz ~ 10 MHz / 1 mHz ~ 5 MHz
	Width:	20 ns Minimum / 40 ns Minimum
	Variable Edge Time	< 10 ns ~ 100 ns / < 15 ns
	Overshoot:	< 2 %
	Jitter (Rms):	200 ps, when f ≥ 50 kHz, V ≥ 0.1 Vpp 300 ps + 0.1 ppm of Period

Noise:	**Bandwidth:**	20 MHz (Typical) / Not Support

Arb.:	**Frequency:**	1 µHz ~ 10 MHz / 1 mHz ~ 3 MHz
	Length:	2 ~ 256 K / 2 ~ 8 K
	Resolution:	14 Bits (Including Sign)
	Sample Rate:	125 MSa/s / 50 MSa/s
	Rise/Fall Time (Min)	30 ns (Typical) / 50 ns (Typical)
	Linearity:	< 0.1 % of Peak Output / < 0.5 % of Peak Output
	Setting Time:	< 250 ns ~ 0.5 % of Final Value < 250 ns ~ 2 % of Final Value
	Jitter (RMS):	6 ns + 30 ppm / 12 ns + 60 ppm
	Non-Volatile Memory	4 Waveforms x 265 K Points 8 Waveforms x 8 K Points

Modulation

Type	Carrier	Source/Trig	Internal Modulation	
			Shape/Type	**Freq/Time**
AM	Sine, **Square**[9]	Source: Internal/**External**	Sine, Square, Ramp, Triangle, Noise, Arb	2 mHz ~ 20 KHz
FM, PM	Sine, Square, Ramp, Arb			
PWM	Pulse			
FSK	Sine, Square, Ramp, Arb	Trig: Internal/**External**/ Manual	50 % Duty Square	2 mHz ~ 100 KHz
Sweep			Linear/Log/Arb	1 ms ~ 500 s
Burst	Sine, Square, Ramp, **Noise**, Arb		Counted Infinite **Gated**	1µs ~ 500 s 1 ~ 50 K (Cycles)

Common Characteristics

Freq.:	**Resolution:**	1 µHz / 1 mHz
Ampl.:	**Range:**	10 mVpp ~ 10 Vpp in 50 Ω 20 mVpp ~ 20 Vpp in Hi-Z
	Accuracy[1,2] **(at 1 KHz)**	±1 % of Setting ±1 mVpp / ±2 % of Setting ±2 mVpp
	Units:	Vpp, Vrms, dBm
	Resolution:	4 Digits / 3 Digits
DC Offset	**Peak Range** (AC + DC)	±5 V in 50 Ω ±10 V in Hi-Z
	Accuracy[1,2]	±2 % of Offset Setting ±0.5 % of Amplitude Setting ±2 mV ±2 % of Offset Setting ±1 % of Amplitude Setting ±3 mV
	Resolution:	4 Digits / 3 Digits
Main Output	**Impedance:**	50 Ω (Typical)
	Isolation:	42 Vpk Maximum
	Protection:	Short-Circuit Protected; Overload Automatically Disables Main Output
Internal Frequency Reference Accuracy[6]		±10 ppm in 90 Days ±20 ppm in 1 Year
Ext. Freq. Reference		Standard / Optional
Ext. Freq.: Input	**Lock Range:**	10 MHz ± 500 Hz
	Level:	100 mVpp ~ 5 Vpp
	Impedance:	1 KΩ (Typical), AC Coupled
	Lock Time:	< 2 Sec
Ext. Freq. Output	**Lock Range:**	10 MHz
	Level:	632 mVpp (0 dBm), Typical
	Impedance:	50 Ω (Typical), AC Coupled
Phase Offset	**Range:**	-360° ~ +360°
	Resolution:	0.001
	Accuracy:	8 ns / 20 ns
External[7] **Modulation Input**	**Voltage Range:**	±5V Full Scale / NS
	Input Resistance:	8KΩ Typical / NS
	Bandwidth:	DC ~ 20 KHz / NS
Trigger Input	**Level:**	TTL Compatible / NS
	Slope:	Rising or Falling (Selectable) / NS
	Pulse Width:	> 100 ns / NS
	Impedance:	> 100 KΩ, DC Coupled / NS
	Latency:	< 500 ns / NS
Trigger Output	**Level:**	TTL Compatible into ≥ 1 KΩ / NS
	Pulse Width:	> 400 ns / NS
	Output Impedance:	50 Ω Typical / NS
	Maximum Rate:	1 MHz / NS
	Fan-Out:	≤ 4 Picotest G5100As / NS

Pattern Mode Characteristics

Clock:	**Maximum Rate:**	50 MHz / NS
Output:	**Level:**	TTL Compatible into ≥ 2 KΩ / NS
	Impedance:	110 Ω Typical / NS
Pattern:	**Length :**	2 ~ 256 / NS

General Specifications

Item	Description	Item	Description
Power Supply	CAT II 110 ~ 240 V AC ±10 %	**Warm-Up Time**	1 Hour
Power Cord Freq.	50 Hz ~ 60 Hz ±10%	**Language**	SCPI-1993, IEEE-488.2
Power Consumption	80 VA Max. 35 VA Max.	**Dimension**	214.6(W) x 88.6(H) x 346.9(D) mm 214.6(W) x 88.6(H) x 280.7(D) mm
Operating Environment	0 ~ 55°C	**Weight**	3100 g / 2120g
Storage Environment	-30°C ~ 70°C	**Safety**	IEC61010-1 EN61010-1
Operating Altitude	Up to 2000 m	**EMC**	EN61326
Operating Humidity	Max. Rel. Humidity 80 % for Temp. up to 31°C Decreasing Linearly to 50 % Rel. Humidity at 40°C	**Interface**	STD. USB & LAN OPT. GPIB or RS-232 STD. USB / OPT. GPIB or RS-232
		Warranty	1 Year
		Recycle Level	

1. Add 1/10th of output amplitude and offset spec per °C to operation outside the range of 18°C ~ 28°C.
2. The autorange is enabled.
3. DC offset is set to 0 V.
4. The spurious output at low amplitude is typical -75 / (-70) dBm.
5. Add 1 ppm / °C average to operation outside the range of 18°C ~ 28°C.
6. The sine and square waveforms above 10 MHz / (3 MHz) are allowed only with an "infinite" burst count.
7. The FSK uses trigger input (1 MHz Max.)
8. The words in gray are for the model G5100A. No gray description represents "the same as G5100A."
9. The words in red and "NS" in gray stand for the functions which are "Not Supported" by G5110A.

For more information, please refer to the user's manuals.

G51 Series
Function/Arbitrary Generator

Interface:
STD. USB & (LAN: LXI for G5100A)
OPT. GPIB / RS-232
(Conform to USBTMC&IEEE-488.2)

G5100A 50 MHz Function/Arbitrary Waveform Generator

- **Features:** Sine (50 MHz), Square (25 MHz), Arbitrary (10 MHz)
- **Freq. Resolution:** 1 µHz
- **Arbitrary:** 14-Bit, 125 MSa/s, 256 K-Point
- **Capability:** Sine, Square, Ramp, Triangle, Pulse, Noise, DC, Exponential Rise and Fall, Negative Ramp, Sin(x)/x, Cardiac
- **Modulation:**
  - **AM/FM/PM/PWM:** 2 mHz ~ 20 KHz
  - **FSK:** 2 mHz ~ 100 KHz
  - **External Modulation Input:** ±5V full scale, 8.7 KΩ Typical, DC to 20 KHz
  - **Sweep:** Linear/Logarithmic/Arb. Time (1 ms ~ 500 Sec.) Marker (Falling Edge of Sync Signal - Freq.: Programmable)
  - **Burst:** Counted (1 ~ 50 K Cycles), Infinite, Gated. Phase (-360° to + 360°). Internal Period (1µs ~ 500 Sec.)
  - **Trigger Input:** TTL Compatible, Rising or Falling, Pulse Width (> 100ns), Impedance (>10 KΩ, DC Coupled), Latency (<500 ns)
  - **Trigger Output:** TTL Compatible into ≥1 KΩ. Output Impedance (50 Ω Typical). Max. Rate (1 MHz).
- **Amplitude Range:** 20 mVpp to 20 Vpp into Open Circuit
- **Display:** Graphic Mode (Visual Verification of Signal Settings)
- **Pattern Out:** 16-Bit Data Output + Clock
- **Time Base:** 10 MHz Input/Output
- **Free Software:** WavePatt
- **Dimension & Weight:** (for Rack) 214.6(W) x 88.6(H) x 346.9(D) mm, 3100 g
- **Optional Accessories:**
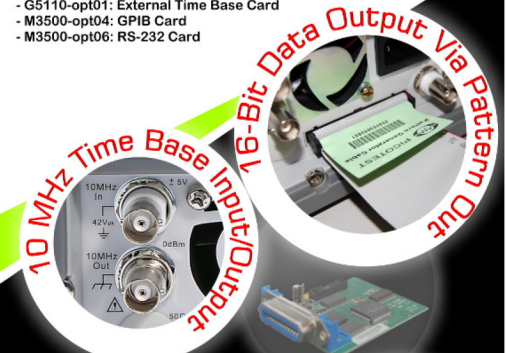 - M3500-opt04: GPIB Card
  - M3500-opt06: RS-232 Card

G5110A 15 MHz Function/Arbitrary Waveform Generator

- **Features:** Sine (15 MHz), Square (15 MHz), Arbitrary (3 MHz)
- **Freq. Resolution:** 1 mHz
- **Arbitrary:** 14-Bit, 50 MSa/s, 8 K-Point
- **Capability:** Sine, Square, Ramp, Triangle, Pulse, DC, Exponential Rise and Fall, Negative Ramp, Sin(x)/x, Cardiac
- **Modulation:**
  - AM/FM/PM/PWM: 2 mHz ~ 20 KHz
  - FSK: 2 mHz ~ 100 KHz
  - Sweep: Linear/Logarithmic/Arb. Time (1 ms ~ 500 Sec.) Marker (Falling Edge of Sync Signal - Freq.: Programmable)
  - Burst: Counted (1 ~ 50 K Cycles), Infinite. Phase (-360° to + 360°). Internal Period (1µs ~ 500 Sec.)
- **Amplitude Range:** 20 mVpp to 20 Vpp into Open Circuit
- **Display:** Text Mode LCD
- **Free Software:** WavePatt
- **Dimension & Weight:** (for Rack) 214.6(W) x 88.6(H) x 280.7(D) mm, 2120 g
- **Optional Accessories:**
  - G5110-opt01: External Time Base Card
  - M3500-opt04: GPIB Card
  - M3500-opt06: RS-232 Card

10 MHz Time Base Input/Output

16-Bit Data Output Via Pattern Out

Great Performance

The Picotest G5110A function/arbitrary waveform generator is the latest member of the G51XXA family in 2014. This model uses direct digital synthesis technology to create stable and precision low distortion sine & square waves with fast rise and fall times up to 15MHz and linear ramp waves up to 200KHz. The G5110A can also generate 14-bit, 50MSa/s 8K point arbitrary waveform. It's a standard function built in G5110A.

User-Defined Waveform Generation

The G5110A can generate complex user-defined waveforms via the built-in arbitrary function, and working with the free companion software "Wavepatt", it's easy to create specific waves you need. In addition, you can generate waveforms using previously saved files. If user-defined waveforms don't meet your needs, you can set frequency, length, and other parameters with "Sequencing Mode" on each waveform's segment.

Waveform Editor Wavepatt®

The Picotest Waveform Editor Software Wavepatt® allows you to create, edit, and download complex waveforms. This companion software is free of charge.

High Flexible Sequencing Arbitrary Waveform Mode

Using the Sequencing Arbitrary Mode to generate individual segments in different sampling intervals, you can construct any complex waveforms you need. The waveforms can then be transferred distortion free and finally generating the waveform for high-speed output. The process is simple. First of all, break down a complex wavefom into individual segments of basic waves using the sequencing mode. Connect the individual segments to form a desired waveform via the Wavepatt software, and transfer it to your G5110A. You can generate any waveforms you want. It's impressive, isn't it?
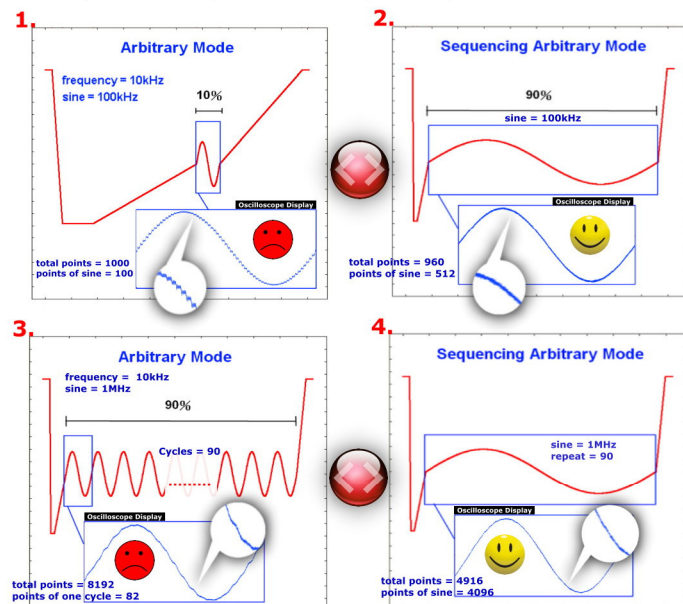
1.

Arbitrary Mode

frequency = 10kHz
sine = 100kHz

10%

Oscilloscope Display

total points = 1000
points of sine = 100

2.

Sequencing Arbitrary Mode

90%

sine = 100kHz

Oscilloscope Display

total points = 960
points of sine = 512

3.

Arbitrary Mode

frequency = 10kHz
sine = 1MHz

90%

Cycles = 90

Oscilloscope Display

total points = 8192
points of one cycle = 82

4.

Sequencing Arbitrary Mode

sine = 1MHz
repeat = 90

Oscilloscope Display

total points = 4916
points of sine = 4096

Figure 1. The length and frequency of the arbitrary waveform (AW) is based on 1000 points and 10kHz. To define the freq. of a specific sinewave, you have to calculate and adjust the point proportion in an AW. It's annoying and a waste of time.

Figure 2. By applying the sequencing mode, you do not need the same point proportion to create waveforms. Here is the sinewave created with 512 points. You can just set its output freq. as 100kHz under the same limited 1000 points. After that, the waveforms are generated without distortion. And you don't have to calculate and adjust the point proportion. It streamlines the process while generating complex waveforms in need.

Figure 3. Here is the typical AW with 8192 points. The high freq. parts, 90-cycle sinewaves, occupies 90% (eq. 7372 points) of the AW, and each cycle has 82 points. Therefore, the insufficient points cause the distortion on high freq. presentation when working with an oscilloscope.

Figure 4. Using the sequencing mode each waveform segment can be set separately, so you don't need the same point proportion to create waveforms. Here is the sinewave created with 4096 points, and its repeat time is set as 90. Comparing with any traditional AW, the resolution can be improved 50 times. Due to the sufficient number of points, the sinewave at 1MHz is produced perfectly without distortion.

Pulse Generation

The G5110A can generate pulses up to 5MHz. With variable period, pulse width and amplitude the G5110A is perfectly suited to applications requiring a flexible pulse signal.

Easy-to-Use Functions

You can easily use the following functions.
- Internal modulations of AM[1], FM, PM, FSK & PWM for waveform adjustment.
- Built-in linear and logarithmic sweeps from 1ms to 500s.
- Burst mode has a selectable number of cycles per period of time.
- Remote control via USB or Opt. GPIB interface.
- Programmability by SCPI commands under the remote control connection.
- Precise phase adjustments and calibrations can be performed from the front panel or via a PC.

High Contrast LCD Display

You can see the relative parameters of waveforms on a distinct LCD Display, via the auxiliary annunciator display, you can clearly see all of the required settings simultaneously, speed up the efficiency creating the desired waveforms.

External Time Base

The G5110A's external time base can synchronize to an external 10MHz clock, to another G5110A or G5100A or any other unit which can support 10-MHz-frequency-input function. You can made phase adjustments from the front panel or via a remote interface, allowing precise phase calibration and adjustment.

User Friendly Operation

The G5110A's front-panel operation is straight-forward and user friendly. With a single key or two, you can access major functions. The long-life optical knob and numeric carbon keypad can be used to precisely adjust frequency, amplitude, offset, and other parameters. Via the remote interface only you can enter voltage values directly in Vpp, Vrms, dBm, or high and low levels, as well as timing parameters in Hertz or seconds.

Standard USB & Optional GPIB

The G5110A is equipped with a standard USB interface. The driver is a free download and can be found by performing an internet search for "NI-VISA RUN-TIME ENGINE". This will direct you to the necessary file. Choose version 4.2 or higher. After downloading and installing the driver, connect this equipment and your PC with the attached USB cable. Your G5110A can be remotely controlled right away. In addition, GPIB connection is also supported. Please contact your local agency for more information.

[1] The carrier waveforms of AM mode includes Sine, Triangle and Arbitrary waveforms.