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# 6060A SERIES SYNTHESIZED RF SIGNAL GENERATORS

The accuracy of your test system starts with the quality of your signal generator.

That's the reason the Giga-tronics 6061A and 6062A RF Signal Generators use indirect synthesis to deliver the spectral purity, accuracy and stability to test sophisticated components and systems.

## THE 6061A: OUTSTANDING VALUE

The Giga-tronics 6061A Synthesized RF Signal Generator is an ideal choice for general purpose RF testing from 10 kHz to 1.05 GHz.

The 6061A is programmable from -147 to above +13 dBm with 0.1 dB resolution. And accuracy is  $\pm 1.0$  dB from -127 to +13 dBm.

Built-in AM and FM are provided along with a number of amplitude features, including Relative Amplitude, RF On/Off and Fixed Range.

## THE 6062A: OUTSTANDING CAPABILITY

The Giga-tronics 6062A Synthesized Signal Generator adds the modulation capability to generate complex signals from 100 kHz to 2.1GHz.

In addition to AM and FM, the 6062A offers fast-rise pulse modulation as a standard feature, so you can test pulsed communication and radar systems. And the 6062A features phase modulation for communications applications, such as receiver testing.

## PROVEN PERFORMANCE AND RELIABILITY

Low phase noise, low harmonics, low spurious noise and low residual FM ensure that the measurements you make are from the system under test, and not your signal generator.

You can store up to 50 instrument set-ups and recall frequently used test points directly with the keypad, or use the sequence key to step through a series of set-ups.

The low profile, standard rack size and IEEE-488 interface make either instrument ideal for ATE applications.

Just choose the frequency range and modulation capability that meets your specific test application.



The Giga-tronics 6060A Series Synthesized RF Signal Generators are an ideal choice for general purpose RF testing.

## FREQUENCY

**Range:** 0.01 to 1050 MHz (6061A); 0.1 to 2100 MHz (6062A)

**Resolution:** 10 Hz to 1050 MHz; 20 Hz from 1050 to 2100 MHz (6062A)

**Accuracy & Stability:** Same as Reference Oscillator.

### SUPPLEMENTAL CHARACTERISTICS<sup>1</sup>

*Switching speed: 100 ms to be within 100 Hz of final frequency.*

## REFERENCE OSCILLATOR

### Internal Reference Oscillator Characteristics

Characteristic	Standard Free-Air Crystal	Option 132 Medium Stability Oven	Option 130 High Stability Oven
Frequency	10 MHz	10 MHz	10 MHz
Temperature	$\leq \pm 10 \times 10^{-6}$ total, 0-50°C	$\leq \pm 1 \times 10^{-7}$ total, 0-50°C	$\leq \pm 2 \times 10^{-10}/^{\circ}\text{C}$ 0-50°C
Aging Rate	$\leq \pm 5 \times 10^{-7}/\text{mo}$	$\leq \pm 1 \times 10^{-7}/\text{mo}$	$\leq \pm 5 \times 10^{-10}/\text{day}$ $\leq \pm 1.5 \times 10^{-9}/\text{mo}$
Warm-up (typical)	1 hr to within 1 ppm of final frequency	20 min to within $\pm 3 \times 10^{-8}$ of final frequency	30 min to within $\pm 1 \times 10^{-8}$ of final frequency

### Reference Output

**Frequency:** 10 MHz, sinewave

**Level:** 0 dBm minimum into 50  $\Omega$

**Source Impedance:** 50  $\Omega$ , nominal

### External Reference

**Input Frequency:** 1, 2, 2.5, 5, 10 MHz

**Input Level:** 0.3 to 4 V<sub>p-p</sub>, sinewave or squarewave

**Input Impedance:** 50  $\Omega$ , nominal

## SPECTRAL PURITY

### Harmonics:

Amplitude	6061A	6062A
+13 to +16 dBm	N/A	-25 dBc
<+13 dBm	-30 dBc (freq >100 kHz) -26 dBc (10-100 kHz)	-30 dBc (freq >1 MHz) -25 dBc (0.1-1 MHz)

### Subharmonics:

Carrier Frequency	6061A	6062B
Below 1050 MHz	None	None
1050 to 2100 MHz	N/A	-45 dBc

### Non-Harmonic Spurious:

Output Frequency	6061A	6062A
10 to 100 kHz	-55 dBc	N/A
100 kHz to 1050 MHz	-60 dBc	-60 dBc
1050 to 2100 MHz	N/A	-54 dBc

*For offsets > 10 kHz from carrier, CW mode*

### Residual FM\* (Hz rms) in 0.5 to 3 kHz BW:

Frequency Range	6061A		6062A	
	(Spec)	(typ.)	(Spec)	(typ.)
Below 245 MHz	12	8	12	8
245 to 512 MHz	6	4	6	4
512 to 1050 MHz	12	8	12	8
1050 to 2100 MHz	N/A	N/A	24	16

### Residual FM\* (Hz rms) in 0.05 to 15 kHz BW:

Frequency Range	6061A		6062A	
	(Spec)	(typ.)	(Spec)	(typ.)
Below 245 MHz	18	12	18	12
245 to 512 MHz	9	6	9	6
512 to 1050 MHz	18	12	18	12
1050 to 2100 MHz	N/A	N/A	36	24

*\*Residual FM specifications apply for full 0 to 50°C range.*

### Residual FM (Hz rms) CCITT:

Frequency Range	6061A		6062A	
	(Spec)	(typ.)	(Spec)	(typ.)
Below 245 MHz	10	7	10	7
245 to 512 MHz	5	3.5	5	3.5
512 to 1050 MHz	10	7	10	7
1050 to 2100 MHz	N/A	N/A	20	14

**Residual AM** in 0.05 to 15 kHz BW: <0.1% rms (-60 dBc), <0.18% rms

## OUTPUT

**Amplitude Range:** 6061A: -127 to +13 dBm (+13 dBm peak on AM), with overrange to +19 dBm and underrange to -147 dBm.

6062A: -127 to +16 dBm (+16 dBm peak on AM) to 1050 MHz, to +13 dBm (+13 dBm peak on AM) above 1050 MHz.

Overrange to +17 dBm and underrange to -147 dBm.

**Resolution:** 0.1 dB

**Annunciators:** 6061A: dB, dBm, V, mV,  $\mu\text{V}$ ; 6062A: dB, dBm, V, mV,  $\mu\text{V}$ , dB  $\mu\text{V}$ , dB mV

**Amplitude Accuracy:** 25°C  $\pm 5^{\circ}\text{C}$

### 6061A

Amplitude Range	10 to 400 kHz	400 kHz to 1050 MHz
+13 to -100 dBm	$\pm 2$ dB	$\pm 1$ dB
-100 to -127 dBm	$\pm 3$ dB	$\pm 1$ dB

### 6062A

Amplitude Range	1 to 1050 MHz	1050 to 2100 MHz
+16 to +13 dBm	$\pm 1.0$ dB	N/A
+13 to -127 dBm	$\pm 1.0$ dB	$\pm 1.5$ dB

**Amplitude Accuracy:** 0 to 50°C

### 6061A

Amplitude Range	400 kHz to 1050 MHz
+13 to -127 dBm	$\pm 1.5$ dB

### 6062A

Amplitude Range	100 kHz to 1 MHz	1 to 1050 MHz	1050 to 2100 MHz
+16 to +13 dBm	$\pm 2$ dB	$\pm 1.5$ dB	N/A
+13 to -127 dBm	$\pm 2$ dB	$\pm 1.5$ dB	$\pm 1.5$ dB

**Output Impedance:** 50  $\Omega$ , nominal

### Output VSWR:

<1.5:1 for amplitude <+1 dBm

<2.0:1 for amplitude >+1 dBm

**Reverse Power Protection:** 6061A: 50 W RF from a 50  $\Omega$  source, 10 kHz to 1050 MHz. Will withstand up to 50 Vdc.  
6062A: 25 W RF from a 50  $\Omega$  source, 100 kHz to 2100 MHz; up to 25 Vdc.

**Trip/Reset:** Flashing RF OFF annunciator indicates when Reverse Power Protection circuit is tripped.

**Leakage:**

RF Leakage	6061A	6062A
At Carrier Frequency	0.5 $\mu$ V	1 $\mu$ V

**SUPPLEMENTAL CHARACTERISTICS<sup>1</sup>**

Amplitude Switching Speed: <100 ms typical (within 0.1 dB of selected value)  
Level Flatness:  $\pm 0.5$  dB at +10 dBm

**AMPLITUDE MODULATION**

**AM Depth:** 0 to 99% in 1% steps.

**AM Accuracy:** (6061A)  $\pm(2\% + 4\%$  of setting)

(6062A)

$\pm(3\% + 5\%$  of setting), 0.1 to 1 MHz, to +16 dBm pk

$\pm(2\% + 4\%$  of setting), 1 to 1050 MHz, to +16 dBm pk

$\pm(2\% + 4\%$  of setting), 1050 to 2100 MHz, to +13 dBm pk

**AM Distortion:**

**6061A**

AM Depth	10 kHz to 1050 MHz
0 to 30% AM	<1.5% THD
30 to 70% AM	<3% THD
70 to 90% AM	<5% THD

**6062A**

AM Depth	100 kHz to 1 MHz	1 to 1050 MHz	1050 to 2100 MHz
0 to 30% AM	<3% THD	<1.5% THD	<3% THD
30 to 70% AM	<5% THD	<3% THD	<3% THD
70 to 90% AM	<7% THD	<5% THD	<5% THD

**Incidental FM:** <0.3  $f_m$  at internal rates and <30% AM to 1050 MHz, <0.6  $f_m$  above 1050 MHz (6062A).

**Internal Rates:** 400 Hz and 1 kHz (see Modulation Source)

**External BW (3 dB):**

	6061A	6062A
ac-coupled	.02 to 30 kHz	.02 to 50 kHz
dc-coupled	N/A	dc to 50 kHz

**FREQUENCY MODULATION**

**Deviation Ranges:** 100 to 999 Hz, 1 to 9.99 kHz,

10 to 99.9 kHz, 100 to 400 kHz (6062A only).

**Maximum Peak Deviation:** The following table applies for modulating frequencies of 200 Hz and above.

Output Frequency	6061A	6062A
Below 245 MHz	100 kHz	200 kHz
245 to 512 MHz	100 kHz	100 kHz
512 to 1050 MHz	100 kHz	200 kHz
1050 to 2100 MHz	N/A	400 kHz

**Maximum Deviation for Low Modulating Frequencies:**

At low audio frequencies, maximum FM deviation is modulation-index limited. Use the following formulas to compute maximum allowable deviation.

	6061A	6062A
Below 245 MHz	dev. = $2f_m(f_c+800)$	dev. = $2f_m(f_c+800)$
245 to 1050 MHz	dev. = $2f_m f_c$	dev. = $2f_m f_c$
245 to 2100 MHz	N/A	dev. = $2f_m f_c$

$f_o$  = RF frequency in MHz.

$f_m$  = modulation frequency in Hz.

dev. = max peak deviation in Hz.

Example: If  $f_o$  = 300 MHz and  $f_m$  = 50 Hz, the maximum allowable deviation is 30 kHz. i.e.,  $(2)(50)(300)$  = 30,000 Hz or 30 kHz.

**FM Deviation Accuracy:**  $\pm 7\%$  for rates of 0.3 to 20 kHz for carrier frequency greater than 400 kHz, FM deviation >100 Hz.

**Distortion:** Less than 1% THD for 0.3 to 20 kHz rates, FM deviation >100 Hz.

**Incidental AM:** Less than 1% AM at 1 kHz rate and less than 50 kHz deviation.

**Internal Rates:** 400 Hz and 1 kHz (see Modulation Source)

**External BW (3 dB):** 20 Hz to 100 kHz.

**PULSE MODULATION, 10 TO 2100 MHZ\*\* (6062A ONLY)**

**ON/OFF Ratio:** 80 dB min

**Rise and Fall Times:** 15 ns max

**Level Error:** For pulse width >50 ns, power in pulse within  $\pm 0.5$  dB of CW level.

**Duty Cycle:** 0-100%

**Rep Rate:** dc-16 MHz

**Internal Modulation:** 400 Hz, 1000 Hz rates, 50% duty cycle.

**Pulse Modulator Input (External):** Nominal 50  $\Omega$  impedance with internal pull-up. Can be driven directly by TTL.

Input Voltage	Modulator State*
<0.9 Volts	RF OFF
>1.1 Volts	RF ON
Open Circuit	RF ON

\* EXT PULSE enabled

\*\* Pulse available below 10 MHz, specifications dependent on RF frequency

**PHASE MODULATION (6062A ONLY)**

**Deviation Ranges:** 0.01-0.099 rad, 0.100-0.999 rad, 1.00-9.99 rad, and 10.0-40.0 rad.

**Maximum Phase Deviation:**

	Peak Deviation
Below 245 MHz	20 Radians
245 to 512 MHz	10 Radians
512 to 1050 MHz	20 Radians
1050 to 2100 MHz	40 Radians

**Accuracy:**  $\pm 7\%$  for rates of 0.3 to 5 kHz and greater than 0.01 rad deviation.

**Distortion:** Less than 1% THD at 1 kHz rate and >0.01 rad deviation.

**Bandwidth (3 dB):** 20 Hz to 10 kHz

**Incidental AM:** Less than 1% AM at 1 kHz rate and less than 40 rad deviation

## MODULATION SOURCE

**Internal:** 400 Hz or 1 kHz,  $\pm 3\%$  for 20-30°C; add  $\pm 0.1\%/^{\circ}\text{C}$  outside this range.

**External:** 1 V peak causes indicated modulation index. Internal and External modulation sources may be enabled simultaneously, and combined linearly.

**Input Impedance:** 600  $\Omega$ , nominal (560  $\Omega$ , nominal, when EXT AM and EXT FM enabled simultaneously).

### SUPPLEMENTAL CHARACTERISTICS<sup>1</sup>

External Modulation Annunciator: EXT HI EXT LO indicator when 1V peak,  $\pm 2\%$  is applied at MOD IN connector .02 to 100 kHz BW.

## ORDERING INFORMATION

### MODELS

**6061A** (0.01-1050 MHz)

**6062A** (0.1-2100 MHz)

### OPTIONS

**130:** High stability oven reference.

**132:** Medium stability oven reference.

**830:** Rear only RF output and modulation inputs. Type N RF output connector on rear panel.

## GENERAL SPECIFICATIONS

**Operating Temperature:** 0 to 50°C.

**Storing Temperature:** -40 to +75°C.

**Humidity (operating):** 0-95%, up to 30°C; 0-75%, 30 to 40°C; 0-45%, 40 to 50°C.

**Altitude (operating):** <10,000 feet

**Power:** 100, 120, 220, 240 Vac  $\pm 10\%$ , 47-63 Hz (for 400 Hz consult the factory); <180 VA (<15 VA standby with option 130).

**Weight:** <16 kg (35 lb)

**Size:** 13.3 cm H x 43.2 cm W x 50.8 cm D (5.25 in x 17 in x 20 in)

**EMI:** Meets MIL-STD 461B REO2, CEO3, FCC Part 15 (j), Class A

## MEMORY

**Type:** Non-volatile. Data is stored 2 years (typical) with power off.

**Size:** 50 complete front panel settings.

**Features:** Store, recall, sequence

## REAR PANEL CONNECTORS AND CONTROLS

**10 MHz OUT:** Connector to monitor internal

10 MHz reference

**REF INT/EXT:** Control to enable REF IN connector and disable internal reference.

**REF IN:** Connector to input external reference (see Reference Oscillator).

### IEEE-488 INTERFACE:

**Functions Controlled:** All front panel controls except line power switch.

**Data Output:** Instrument status, stored memory contents, instrument settled, instrument ID, option complement, uncal/reject entry status, operating time.

**Indicators:** Remote, Addressed, SRQ

**Interface Functions:** SHI, AHI, T5, TE0, L3, LE0, SRI, LRI, PP0, DCI, DTI, C0, EI

**MOD IN, RF OUT:** Present only if option 830 is installed.

**PULSE IN (6062A):** Present only if option 830 is installed.

<sup>1</sup>Supplemental Characteristics are provided to assist in the application of the instrument and describe the TYPICAL performance that can be expected.



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