

**RIGOL**



# DG4000 Series Function/Arbitrary Waveform Generator

- Maximum output frequency: 200MHz, 160MHz, 100MHz, 60MHz
- 500MSa/s sample rate, 14 bit vertical resolution
- Dual channel outputs with identical performance
- 2ppm high-frequency stability
- -115dBc/Hz low phase noise
- Versatile analog and digital modulation functions
- 150 built-in waveforms
- 7digits/s, 200MHz built-in Counter
- Harmonic generator that can generate up to 16th order of harmonic (Std.)
- Powerful waveform editing PC software
- Connectivity: USB Host & Device, LAN
- 7 inch LCD display (800 × 480)

DG4000 series is a multifunctional generator that combines many functions in one, including Function Generator, Arbitrary Waveform Generator, Pulse Generator, Harmonic Generator, Analog/Digital Modulator and Counter. All the models have two channels with complete equivalent functions and precisely adjustable phases.

RIGOL TECHNOLOGIES, INC.

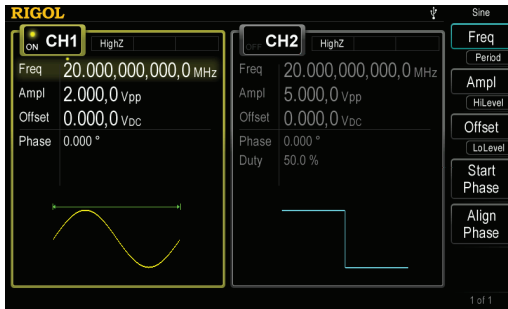


## ► Product Overview

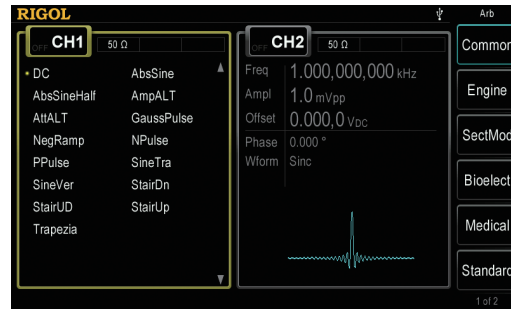


Product Dimensions: Width × Height × Depth = 313mm × 160.7mm × 116.7mm Weight: 3.2kg (Without Package)

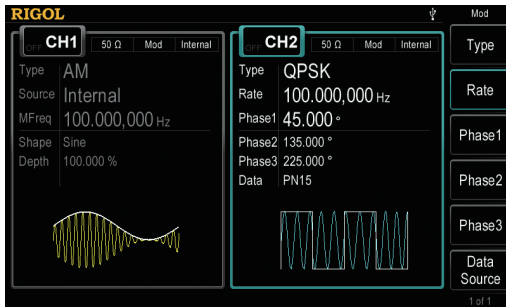
## ► Function Interfaces



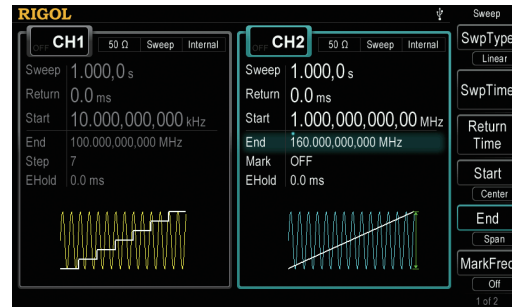
Two channels with complete equivalent functions and precisely adjustable phases (standard)



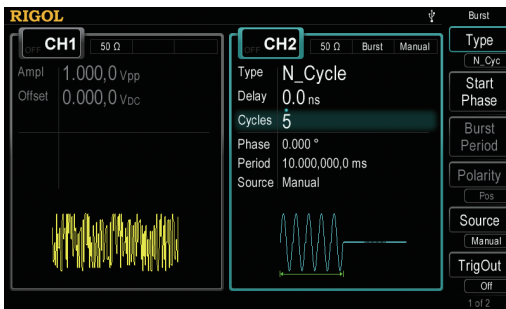
Standard arbitrary waveform function and 150 built-in arbitrary waveforms



Abundant analog and digital modulation functions



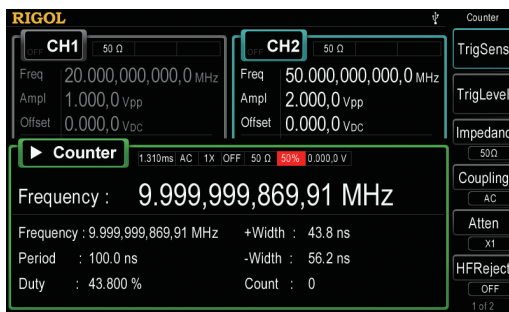
Various sweep modes



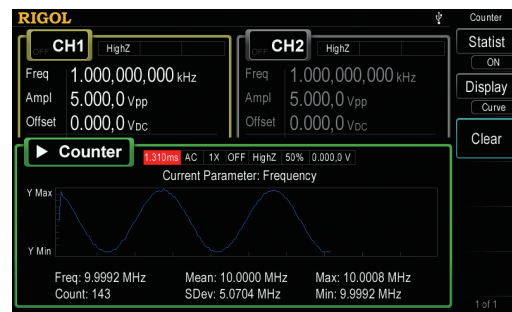
Noise and burst modes



Up to 16 orders customized harmonic generation function



Standard high resolution counter function



Statistic analysis function of counter

## ► Specifications

All the specifications can be guaranteed if the following two conditions are met unless where noted.

- The generator is within the calibration period and has performed self-calibration.
- The generator has been working continuously for at least 30 minutes under the specified temperature (18°C to 28°C).

All the specifications are guaranteed unless those marked with "typical".

Model	DG4202	DG4162	DG4102	DG4062
Number of Channels	2	2	2	2
Maximum Frequency	200MHz	160MHz	100MHz	60MHz
Sample Rate	500MSa/s			

Waveforms	
Standard Waveform	Sine, Square, Ramp, Pulse, Noise, Harmonics
Arbitrary Waveform	150 kinds, including Sinc, Exponential Rise, Exponential Fall, ECG, Gauss, HaverSine, Lorentz, Dual-Tone, DC, etc.

Frequency Characteristics				
Sine	1μHz to 200MHz	1μHz to 160MHz	1μHz to 100MHz	1μHz to 60MHz
Square	1μHz to 60MHz	1μHz to 50MHz	1μHz to 40MHz	1μHz to 25MHz
Ramp	1μHz to 5MHz	1μHz to 4MHz	1μHz to 3MHz	1μHz to 1MHz
Pulse	1μHz to 50MHz	1μHz to 40MHz	1μHz to 25MHz	1μHz to 15MHz
Harmonic	1μHz to 100MHz	1μHz to 80MHz	1μHz to 50MHz	1μHz to 30MHz
Noise (-3dB)	120MHz bandwidth	120MHz bandwidth	80MHz bandwidth	60MHz bandwidth
Arbitrary Waveform	1μHz to 50MHz	1μHz to 40MHz	1μHz to 25MHz	1μHz to 15MHz
Resolution	1μHz			
Accuracy	±2ppm, 18°C to 28°C			

Sine Wave Spectrum Purity	
Harmonic Distortion	Typical (0dBm) DC to 1MHz: <-60dBc 1MHz to 10MHz: <-55dBc 10MHz to 100MHz: <-50dBc 100MHz to 200MHz: <-40dBc
Total Harmonic Distortion	<0.1% (10Hz to 20kHz, 0dBm)
Spurious (non-harmonic)	Typical (0dBm) ≤10MHz: <-65dBc >10MHz: <-65dBc + 6dB/octave
Phase Noise	Typical (0dBm, 10kHz deviation) 10MHz: ≤-115dBc/Hz

Signal Characteristics			
<b>Square</b>			
Rise/Fall Time	Typical (1Vpp) <8ns	Typical (1Vpp) <10ns	Typical (1Vpp) <12ns
Overshoot	Typical (100kHz, 1Vpp) <3%		
Duty Cycle	≤10MHz: 20.0% to 80.0% 10MHz to 40MHz: 40.0% to 60.0% >40MHz: 50.0% (fixed)		
Non-symmetry	1% of period + 5ns		
Jitter (rms)	Typical (1MHz, 1Vpp, 50Ω) ≤5MHz: 2ppm + 500ps >5MHz: 500ps		
<b>Ramp</b>			

Linearity	≤1% of peak output (Typical, 1kHz, 1VPP, 100% Symmetry)		
Symmetry	0% to 100%		

<b>Pulse</b>			
Period	25ns to 1000000s	40ns to 1000000s	66.7ns to 1000000s
Pulse Width	≥10ns	≥12ns	≥18ns
Leading/Trailing Edge Time	≥5ns	≥7ns	≥11ns
Overshoot	Typical (1Vpp) <3%		
Jitter (rms)	Typical (1Vpp) ≤5MHz: 2ppm + 500ps >5MHz: 500ps		

<b>Arb</b>	
Waveform Length	16k points
Vertical Resolution	14bits
Sample Rate	500MSa/s
Minimum Rise/Fall Time	Typical (1Vpp) <5ns
Jitter (rms)	Typical (1Vpp) ≤5MHz: 2ppm + 500ps >5MHz: 500ps
Interpolation Method	Off, Linear
Edit Method	Edit Points, Edit Block

<b>Harmonic</b>	
Harmonic Order	≤16
Harmonic Type	Even, Odd, All, User
Harmonic Amplitude	Can be set for all the orders of harmonics
Harmonic Phase	Can be set for all the orders of harmonics

### Output Characteristics

<b>Amplitude (into 50 Ω)</b>				
Range	≤20MHz: 1mVpp to 10Vpp ≤70MHz: 1mVpp to 5Vpp ≤120MHz: 1mVpp to 2.5Vpp ≤200MHz: 1mVpp to 1Vpp	≤20MHz: 1mVpp to 10Vpp ≤70MHz: 1mVpp to 5Vpp ≤120MHz: 1mVpp to 2.5Vpp ≤160MHz: 1mVpp to 1Vpp	≤20MHz: 1mVpp to 10Vpp ≤70MHz: 1mVpp to 5Vpp ≤100MHz: 1mVpp to 2.5Vpp	≤20MHz: 1mVpp to 10Vpp ≤60MHz: 1mVpp to 5Vpp
Accuracy	Typical (1kHz Sine, 0V Offset, >10mVpp, Auto) ± 1% of setting ± 2mVpp			
Flatness	Typical (relative to 1kHz Sine, 500mVpp, 50Ω)			
	≤10MHz: ±0.1dB ≤60MHz: ±0.2dB ≤100MHz: ±0.4dB ≤160MHz: ±0.8dB ≤200MHz: ±1dB	≤10MHz: ±0.1dB ≤60MHz: ±0.2dB ≤100MHz: ±0.4dB ≤160MHz: ±0.8dB	≤10MHz: ±0.1dB ≤60MHz: ±0.2dB ≤100MHz: ±0.4dB	≤10MHz: ±0.1dB ≤60MHz: ±0.2dB
Unit	Vpp, Vrms, dBm			
Resolution	1mV or 3bits			
<b>Offset (into 50 Ω)</b>				
Range	±5Vpk ac + dc			
Accuracy	±(1% of setting + 5mV + 0.5% of amplitude)			
<b>Waveform Output</b>				
Impedance	50Ω (Typical)			
Protection	Short-circuit protection, automatically disable waveform output when overload occurs			

<b>Modulation Characteristics</b>	
Modulation Type	AM, FM, PM, ASK, FSK, PSK, BPSK, QPSK, 3FSK, 4FSK, OSK, PWM
<b>AM</b>	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Depth	0% to 120%
Modulating Frequency	2mHz to 50KHz
<b>FM</b>	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Modulating Frequency	2mHz to 50KHz
<b>PM</b>	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Phase Deviation	0° to 360°
Modulating Frequency	2mHz to 50KHz
<b>ASK</b>	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal/External
Modulating Waveform	Square with 50% duty cycle
Key Frequency	2mHz to 1MHz
<b>FSK</b>	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal/External
Modulating Waveform	Square with 50% duty cycle
Key Frequency	2mHz to 1MHz
<b>3FSK</b>	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal
Modulating Waveform	Square with 50% duty cycle
Key Frequency	2mHz to 1MHz
<b>4FSK</b>	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal
Modulating Waveform	Square with 50% duty cycle
Key Frequency	2mHz to 1MHz
<b>PSK</b>	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal/External
Modulating Waveform	Square with 50% duty cycle
Key Frequency	2mHz to 1MHz
<b>BPSK</b>	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)
Source	Internal
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Key Frequency	2mHz to 1MHz
<b>QPSK</b>	
Carrier Waveform	Sine, Square, Ramp, Arb (except DC)

Source	Internal
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Key Frequency	2mHz to 1MHz

#### OSK

Carrier Waveform	Sine
Source	Internal/External
Oscillation Time	8ns to 499.75 $\mu$ s
Key Frequency	2mHz to 1MHz

#### PWM

Carrier Waveform	Pulse
Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Width Deviation	0% to 100% of pulse width
Modulating Frequency	2mHz to 50KHz

#### External Modulation Input

Maximum Input Range	75mVRMS to $\pm 2.5V_{ac+dc}$
Input Bandwidth	5MHz
Input Impedance	1k $\Omega$

#### Burst Characteristics

Carrier Waveform	Sine, Square, Ramp, Pulse, Noise, Arb (except DC)		
Carrier Frequency	2mHz to 100MHz	2mHz to 100MHz	2mHz to 60MHz
Burst Count	1 to 1000000 or Infinite		
Start/Stop Phase	0° to 360°		
Internal Period	2 $\mu$ s to 500s		
Gated Source	External Trigger		
Trigger Source	Internal, External or Manual		
Trigger Delay	0ns to 85s		

#### Sweep Characteristics

Carrier Waveform	Sine, Square, Ramp, Arb (except DC)			
Type	Linear, Log or Step			
Direction	Up or Down			
Start/Stop Frequency	1 $\mu$ Hz to 200MHz	1 $\mu$ Hz to 160MHz	1 $\mu$ Hz to 100MHz	1 $\mu$ Hz to 60MHz
Sweep Time	1ms to 300s			
Hold/Return Time	0ms to 300s			
Trigger Source	Internal, External or Manual			
Mark	Falling edge of Sync signal (programmable)			

#### Counter

Function	Frequency, Period, Positive/Negative Pulse Width, Duty Cycle		
Frequency Resolution	7 digits/second (Gate Time =1s)		
Frequency Range	1 $\mu$ Hz to 200MHz		
Period Measurement	5ns to 16 days		

#### Voltage Range and Sensitivity (Non-modulating signal)

DC Coupling	DC Offset Range	$\pm 1.5V_{DC}$	Input Attenuation: OFF
	1 $\mu$ Hz to 100MHz	50mVRMS to $\pm 2.5V_{ac+dc}$	
	100MHz to 200MHz	100mVRMS to $\pm 2.5V_{ac+dc}$	
AC Coupling	1 $\mu$ Hz to 100MHz	50mVRMS to $\pm 2.5V_{pp}$	
	100MHz to 200MHz	100mVRMS to $\pm 2.5V_{pp}$	



## Pulse Width and Duty Cycle Measurements

Frequency/Amplitude Range	1 $\mu$ Hz to 25MHz	50mVRMS to $\pm$ 2.5Vac + dc	DC Coupling, Input Attenuation: OFF
Pulse Width	Minimum	$\geq$ 20ns	
	Resolution	2ns	
Duty Cycle	Range (Display)	0% to 100%	

## Input Characteristics

Input Range	Breakdown Voltage	$\pm$ 7Vac + dc (Attenuation: OFF)	Input Impedance = 1M $\Omega$
		$\pm$ 70Vac + dc (Attenuation: OFF)	
		5Vrms	Input Impedance = 50 $\Omega$
Input Adjustment	Input Attenuation	ON: $\times$ 10; OFF: $\times$ 1	
	Input Impedance	50 $\Omega$	1M $\Omega$
	Coupling Mode	AC	DC
	HF Reject	ON: input bandwidth = 250kHz; OFF: input bandwidth = 225MHz	
Input Trigger	Trigger Level Range	-2.5V to +2.5V	
	Trigger Sensitivity Range	0% (140mV hysteresis voltage) to 100% (2mV hysteresis voltage)	
Gate Time	GateTime1	1ms	
	GateTime2	10ms	
	GateTime3	100ms	
	GateTime4	1s	
	GateTime5	10s	
	GateTime6	>10s	

## Trigger Characteristics

### Trigger Input

Level	TTL-compatible
Slope	Rising or falling (selectable)
Pulse Width	>50ns
Latency	Sweep: <100ns (typical) Burst: <300ns (typical)

### Trigger Output

Level	TTL-compatible
Pulse Width	>60ns (typical)
Maximum Rate	1MHz

## Clock Reference

### Phase Offset

Range	0 $^\circ$ to 360 $^\circ$
Resolution	0.03 $^\circ$

### External Reference Input

Lock Range	10MHz $\pm$ 50Hz
Level	250mVpp to 5Vpp
Lock Time	<2s
Input Impedance (Typical)	1k $\Omega$ , AC coupling

### Internal Reference Output

Frequency	10MHz $\pm$ 50Hz
Level	3.3Vpp
Input Impedance (Typical)	50 $\Omega$ , AC coupling



Sync Output	
Level	TTL-compatible
Impedance	50 Ω, nominal

Programming Time (Typical)		
	USB 2.0	LAN
Function Variation	500ms	510ms
Frequency Variation	50ms	50ms
Amplitude Variation	300ms	310ms
Select User Arbitrary Waveform	500ms	510ms

General Specifications	
<b>Power</b>	
Power Voltage	100V to 240V, 45Hz to 440Hz
Power Consumption	Less than 50W
Fuse	250V, T2A
<b>Display</b>	
Type	7-inch TFT LCD
Resolution	800 Horizontal × RGB × 480 Vertical Resolution
Color	16M color
<b>Environment</b>	
Temperature Range	Operating: 10°C to 40°C Non-Operating: -20°C to 60°C
Cooling Method	Cooling by fans compulsively
Humidity Range	Less than 35°C : ≤90% Relative Humidity 35°C to 40°C : ≤60% Relative Humidity
Altitude	Operating: Less than 3000 meters Non-Operating: Less than 15000 meters
<b>Mechanical</b>	
Dimensions (W × H × D)	313mm × 160.7mm × 116.7mm
Weight	Without package: 3.2kg With package: 4.5kg
<b>Interface</b>	
USB Host, USB Device, LAN	
<b>IP Protection</b>	
IP2X	
<b>Calibration Interval</b>	
Recommend 1 year for standard interval	

## ► Ordering Information

	Description	Order Number
Models	DG4202 (200MHz, dual-channel)	DG4202
	DG4162 (160MHz, dual-channel)	DG4162
	DG4102 (100MHz, dual-channel)	DG4102
	DG4062 (60MHz, dual-channel)	DG4062
Standard Accessories	Power Cord	-
	USB Cable	CB-USBA-USBB-FF-150
	BNC Cable (1 meter)	CB-BNC-BNC-MM-100
	Quick Guide	-
	Resource CD (including User's Guide and Application Software)	-
	Warranty	-
Optional Accessories	40dB Attenuator	RA5040K
	Rack Mount Kit	RM-DG4000
	10W Power Amplifier Module	PA1011
	DG4 PC Software (Advanced Function Software)	Ultra Station-adv
	Soft Carrying Bag	BAG-G1

## Warranty

Three-year warranty, excluding accessories.

# RIGOL

### HEADQUARTER

RIGOL TECHNOLOGIES, INC.  
No.156,Cai He Village,  
Sha He Town,  
Chang Ping District, Beijing,  
102206 P.R.China  
Tel:+86-10-80706688  
Fax:+86-10-80705070  
Electronic Measurement  
Instrument service and support  
email:EMD\_support@rigol.com  
Chemical Analysis Instrument  
service and support email:service.  
chem@rigol.com

### EUROPE

RIGOL TECHNOLOGIES GmbH  
Lindbergh str. 4  
82178 Puchheim  
Germany  
Tel: 0049- 89/89418950  
Email: info-europe@rigoltech.com

### NORTH AMERICA

RIGOL TECHNOLOGIES,  
USA INC.  
10200 SW Allen Blvd, Suite C  
Beaverton, OR 97005, USA  
Toll free: 877-4-RIGOL-1  
Office: (440) 232-4488  
Fax: (216)-754-8107  
Email: info@rigol.com

### JAPAN

RIGOL TECHNOLOGIES JAPAN G.K.  
Tonematsu Bldg. 5F, 2-33-8 Nihonbashi-  
Ningyocho, Chuo-ku,  
Tokyo 103-0013  
Japan  
Tel: +81-3-6264-9251  
Fax: +81-3-6264-9252  
Email: info-japan@rigol.com

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