

# RIGOL

## Data Sheet

### DG1000 Series Dual-Channel Function/Arbitrary Waveform Generator

#### Product Overview

DG1000 series Dual-Channel Function/Arbitrary Waveform Generators adopt Direct Digital Synthesis (DDS) technology, which enables to generate stable, high-precision, pure and low distortion signals.

#### Applications

- Analog Sensor
- Practical Environment Signals
- Circuit Function Test
- IC Chip Test

#### Easy to Use Design

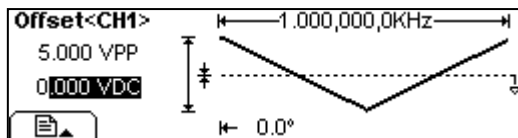
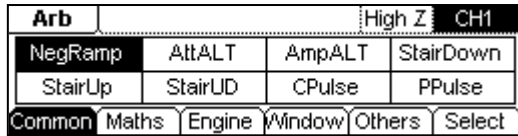
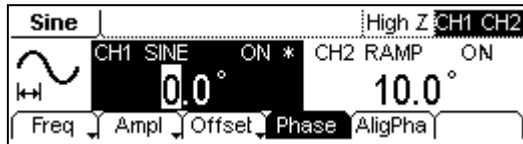
- A variety of display modes
- Clear graphical interface
- Provide Chinese and English menu and input
- Built-in help system makes help information acquisition more convenient.
- File management (store file in USB flash storage device or the internal memory)



#### Main Features

- Adopt advanced DDS technology; dual channel output; 100 MSa/s sampling rate; 14 bits vertical resolution
- Output 5 standard waveforms; built-in 48 arbitrary waveforms
- Abundant modulation functions: AM, FM, PM and FSK
- Provide linear/logarithm sweep and burst
- Abundant output and input interfaces: waveform output; synchronous signal output, external modulation source, external clock reference (10 MHz) input, external trigger input
- Channel coupling and channel copy
- Built-in high precision and wide band counter, the measurement range: 100 mHz to 200 MHz (single channel)
- Standard configuration interfaces: USB Device & USB Host
- Seamlessly interconnect with DS1000 series digital oscilloscope
- Powerful arbitrary waveform editing software (UltraWave)
- Support remote control by commands

## ➤ Dual-channel Output, Built-in and Editable Arb Waveform



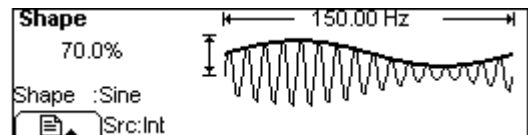
**Dual Channel Output:** Separately setup the waveform and parameter as well as the output state of two channels. The phases from two channels could be synchronous while outputting based on the “AligPha” function from operation menu.

**Built-in Waveform Output:** The instrument has 48 built-in arbitrary waveforms (contains DC) which including common, math, engineering, window function and other common waveforms.

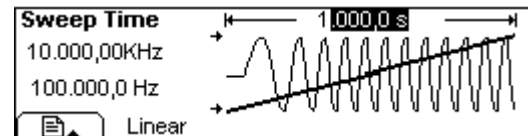
**Editable Arb Waveform:** Enable to edit and output an arbitrary waveform with 14bits, 4kpts. In addition, the instrument provides 10 nonvolatile memories for storing custom arbitrary waveforms. According to Ultrawave, more waveforms could be edited and saved.

## ➤ Abundant Modulation Functions, Sweep, Burst

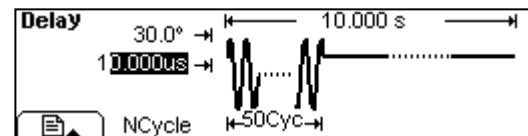
**Abundant Modulation Functions:** Support AM, FM, PM and FSK, the modulated waveforms are intuitively shown on the screen. It can be used in Education & Training area proverbially.



**Sweep:** It can generate “sweep” from the start frequency to the stop frequency during appointed sweep time (1 ms to 500 s) you specify. Sweeping can be generated by Sine, Square, Ramp or Arbitrary waveform.



**Burst:** It can generate pulse sequence for a variety of waveform function, and the waveform could continuously cycle within specific time or apply external gating signal.



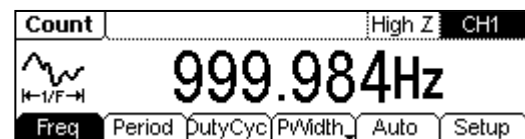
## ➤ Channel Coupling and Copy



**Channel Coupling:** Once you setup the base channel and the Frequency/Phase deviation of the two channels, the Frequency/Phase of the other one will vary with the base channel and will still keep the deviation you have selected.

**Channel Copy:** According to this function, the parameters from one channel could be copied to another channel with no change of the waveform shape.

## ➤ Built-in Frequency Counter



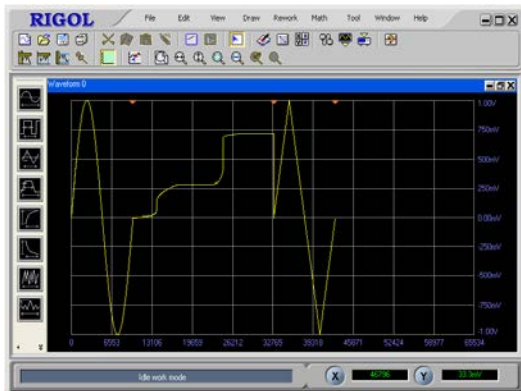
The counter could be used to measure these parameters: frequency, period, duty cycle, positive pulse width and negative pulse width within the range of 100 mHz to 200 MHz.

Two modes of counter are available:

**Auto mode:** The coupling mode, sensitivity, trigger level and the switch of high frequency reject could be set automatically.

**Manual mode:** DC/AC, sensitivity (low, mid, high), trigger level, the switch of high frequency reject could be set manually.

## ➤ Powerful Waveform Editing Software “UltraWave”



In order to meet the most basic needs of users, UltraWave provides 9 standard waveforms: Sine, Square, Ramp, Pulse, ExpRise, ExpFall, Sinc, Noise and DC. In addition, hand drawing, line (point by point) drawing and arbitrary points drawing are also offered to make it easier to create complex waveforms and to edit multiple waves simultaneously through the multi-file management interface.

Either, UltraWave has following utilitarian functions:

- Windows operation: enable to perform math operations such as “+”, “-”, “×” for the waves in two windows.
- Absolute operation: enable to perform absolute operation for the selected waves.
- Filter: enable to perform low pass filtering or smoothing for the whole wave.
- Save the arbitrary wave that has been created as the format of .txt (text file), .csv (CSV file) and .rdf (arbitrary waveform file).
- Read the wave files stored as the format of .Wfm from DS series Digital Oscilloscope.
- Print waveforms.
- Download the waves have been created to the internal storage of DG1000.

## Specifications

All the specifications below apply to DG1000 series Dual-Channel Function/ Arbitrary Waveform Generator unless where noted. To come up to these specifications, two conditions must be met firstly:

- The instrument must have been operated continuously for 30 minutes under the specified operating temperature (18°C to 28°C).
- Variation of the operating temperature should be within 5 °C.

**Note:** All specifications are guaranteed unless where marked “typical”.

## Specifications

| Frequency               |  |                       |
|-------------------------|--|-----------------------|
| Waveforms               | Sine, Square, Ramp, Pulse, Noise, Arb                    |                       |
|                         | <b>DG1022</b>  | <b>DG1022A</b>        |
| Sine                    | 1 μHz to 20 MHz  | 1μHz to 25MHz         |
| Square                  | 1 μHz to 5 MHz   | 1μHz to 5MHz          |
| Pulse                   | 500 μHz to 3 MHz   | 500μHz to 5MHz        |
| Ramp/Triangle           | 1 μHz to 150 kHz   | 1μHz to 500kHz        |
| White Noise             | 5 MHz bandwidth (-3 dB)                                  | 5MHz bandwidth (-3dB) |
| Arb.                    | 1 μHz to 5 MHz   | 1μHz to 5MHz          |
| Resolution              | 1 μHz  |                       |
| Accuracy                | ±50 ppm in 90 days<br>±100 ppm in 1 year<br>18°C to 28°C |                       |
| Temperature Coefficient | < 5 ppm/°C   |                       |

| <b>Sine Waveform Spectrum Purity</b>                                   |  |                 |   |                 |  |
|--|--|-----------------|---|-----------------|--|
| Harmonic Distortion  | CH1  |                 | CH2   |                 |  |
|  | ≤1 Vpp   | >1 Vpp          | ≤1 Vpp  | >1 Vpp          |  |
| DC-1 MHz   | -45 dBc  | -45 dBc         | -45 dBc   | -45 dBc         |  |
| 1 MHz - 5 MHz  | -45 dBc  | -40 dBc         | -45 dBc   | -40 dBc         |  |
| 5 MHz - 25 MHz   | -45 dBc  | -35 dBc         | -45 dBc   | -35 dBc         |  |
| Total Harmonic Distortion  | DC to 20 kHz, 1 Vpp <0.2%  |                 |   |                 |  |
| Spurious Signal (non-harmonic)   | DC to 1 MHz < -70 dBc<br>1 MHz to 10 MHz < -70 dBc + 6 dB/octave |                 |   |                 |  |
| Phase Noise  | 10kHz Offset, -108 dBc / Hz (typical)                            |                 |   |                 |  |
| <b>Square</b>  |  |                 |   |                 |  |
| Rise/Fall Time   | < 20 ns (10% to 90%), (typical, 1 kHz, 1 Vpp)                    |                 |   |                 |  |
| Overshoot  | < 7.5% (Typical, 1 kHz, 1 Vpp)                                   |                 |   |                 |  |
| Duty Cycle   | 1 μHz to 3 MHz: 20% to 80%                                       |                 |   |                 |  |
|  | 3 MHz (not contain) to 4 MHz: 40% to 60%                         |                 |   |                 |  |
|  | 4 MHz (not contain) to 5 MHz: 50%                                |                 |   |                 |  |
| Asymmetry (below 50% Duty Cycle)                                       | 1% of period + 20 ns (typical, 1 kHz, 1 Vpp)                     |                 |   |                 |  |
| Jitter   | 6 ns + 0.1% of period (typical, 1 kHz, 1 Vpp)                    |                 |   |                 |  |
| <b>Ramp</b>  |  |                 |   |                 |  |
| Linearity  | < 0.1% of peak output (typical, 1 kHz, 1 Vpp, 100% Symmetry)     |                 |   |                 |  |
| Symmetry   | 0% to 100%   |                 |   |                 |  |
| <b>Pulse</b>   |  |                 |   |                 |  |
| Pulse Width  | 2000 s max period; 20 ns min period; 1 ns resolution             |                 |   |                 |  |
| Overshoot  | < 7.5%   |                 |   |                 |  |
| Jitter   | 6 ns + 100 ppm of period   |                 |   |                 |  |
| <b>Arb</b>   |  | CH1             | CH2   |                 |  |
| Waveform Length  | 4k points  |                 | 1k points   |                 |  |
| Vertical Resolution  | 14 bits (including sign)   |                 | 14 bits (including sign)                              |                 |  |
| Sampling Rate  | 100 MSa/s  |                 | 100 MSa/s   |                 |  |
| Minimum Rising /Falling Time   | 35 ns (Typical)  |                 | 35 ns (typical)                                       |                 |  |
| Jitter (RMS)   | 6 ns + 30 ppm (typical)  |                 | 6 ns + 30 ppm (typical)                               |                 |  |
| Nonvolatile Storage (Total:10 Waveforms)                               | 10 waveforms   |                 | 10 waveforms  |                 |  |
| <b>Output Characteristics</b>  |  | DG1022          |   | DG1022A         |  |
| Amplitude (50 Ω)   | CH1  | CH2             | CH1   | CH2             |  |
|  | 2 mVpp to 10 Vpp   | 2 mVpp to 3 Vpp | ≤20MHz: 2 mVpp to 10 Vpp;<br>>20MHz: 2 mVpp to 5 Vpp; | 2 mVpp to 3 Vpp |  |
| Accuracy (1 kHz Sine) <sup>[1]</sup>                                   | ±(2% of setting + 2 mVpp)  |                 |   |                 |  |
| Amplitude Flatness (relative to 1 kHz, 5 Vpp Sine wave) <sup>[1]</sup> | <100 kHz: 0.1 dB   |                 | <100 kHz: 0.1 dB                                      |                 |  |
|  | 100 kHz to 5 MHz: 0.15 dB  |                 | 100 kHz to 5 MHz: 0.15 dB                             |                 |  |
|  | 5 MHz to 20 MHz: 0.3 dB  |                 | 5 MHz to 25 MHz: 0.3 dB                               |                 |  |
| DC Offset  | CH1  |                 | CH2   |                 |  |

|   |  |                                      |
|---|--|--------------------------------------|
| Range (DC)                                | 5 V (50 $\Omega$ )<br>10 V (High Z)  | 1.5 V (50 $\Omega$ )<br>3 V (High Z) |
| Offset Accuracy                           | $\pm(2\%$ of the  Offset Setting  + 2 mV)  |                                      |
| <b>Waveform Output</b>                    | <b>CH1</b>   | <b>CH2</b>                           |
| Impedance                                 | 50 $\Omega$ (typical)  | 50 $\Omega$ (typical)                |
| Protection <sup>[2]</sup>                 | Short-circuit protected,<br>overload relay automatically<br>disables main output | Short-circuit protected              |
| <b>AM (CH1)</b>                           |  |                                      |
| Carrier Waveforms                         | Sine, Square, Ramp, Arb (except DC)  |                                      |
| Source                                    | Internal/ External   |                                      |
| Modulation Waveforms                      | Sine, Square, UpRamp, DnRamp, Triangle, Noise, Arb (2 mHz to 20 kHz)             |                                      |
| Depth                                     | 0% to 120%   |                                      |
| <b>FM (CH1)</b>                           |  |                                      |
| Carrier Waveforms                         | Sine, Square, Ramp, Arb (except DC)  |                                      |
| Source                                    | Internal/ External   |                                      |
| Modulation Waveforms                      | Sine, Square, UpRamp, DnRamp, Triangle, Noise, Arb (2 mHz to 20 kHz)             |                                      |
| Frequency Deviation                       | DC to 10 MHz   |                                      |
| <b>PM (CH1)</b>                           |  |                                      |
| Carrier Waveforms                         | Sine, Square, Ramp, Arb (except DC)  |                                      |
| Source                                    | Internal/ External   |                                      |
| Modulation waveforms                      | Sine, Square, UpRamp, DnRamp, Triangle, Noise, Arb (2 mHz to 20 kHz)             |                                      |
| Phase Deviation                           | 0 to 360°  |                                      |
| <b>FSK (CH1)</b>                          |  |                                      |
| Carrier Waveforms                         | Sine, Square, Ramp, Arb (except DC)  |                                      |
| Source                                    | Internal/ External   |                                      |
| Modulating Waveforms                      | square (2 mHz to 50 kHz) with 50% duty cycle                                     |                                      |
| <b>Sweep (CH1)</b>                        |  |                                      |
| Carrier Waveforms                         | Sine, Square, Ramp, Arb (except DC)  |                                      |
| Type                                      | Linear or Logarithmic  |                                      |
| Direction                                 | Up or Down   |                                      |
| Sweep Time                                | 1 ms to 500 s $\pm$ 0.1%   |                                      |
| Trigger Source                            | Internal/External/Manual   |                                      |
| <b>Burst (CH1)</b>                        |  |                                      |
| Waveforms                                 | Sine, Square, Ramp, Pulse, Noise, Arb (except DC)                                |                                      |
| Types                                     | Count (1 to 50,000 periods), infinite, gated                                     |                                      |
| Start Phase                               | -180° to +180°   |                                      |
| Internal Period                           | 1 $\mu$ s to 500 s $\pm$ 1%  |                                      |
| Gate Source                               | External Trigger   |                                      |
| Trigger Source                            | Internal/External/Manual   |                                      |
| <b>Rear Panel Connector<sup>[3]</sup></b> |  |                                      |
| External Modulation                       | $\pm$ 5 Vpk = 100% modulation<br>10 k $\Omega$ input impedance                   |                                      |
| External Trigger                          | TTL compatible   |                                      |
| <b>Trigger Input</b>                      |  |                                      |

|   |  |   |                            |
|---|--|---|----------------------------|
| Input Level   | TTL compatible   |   |                            |
| Slope   | Rising or falling (selectable)                               |   |                            |
| Pulse Width   | > 100 ns   |   |                            |
| Input Impedance                                       | > 10 k $\Omega$ , DC coupled                                 |   |                            |
| Latency   | Sweep: < 500 $\mu$ s (typical)                               |   |                            |
|   | Burst: < 500 ns (typical)                                    |   |                            |
| <b>Trigger Output</b>                                 |  |   |                            |
| Electrical Level                                      | TTL compatible   |   |                            |
| Pulse Width   | > 400 ns (typical)   |   |                            |
| Output Impedance                                      | 50 $\Omega$ (typical)  |   |                            |
| Maximum Rate  | 1 MHz  |   |                            |
| <b>Sync Output (CH1)</b>                              |  |   |                            |
| Electrical Level                                      | TTL compatible   |   |                            |
| Pulse Width   | > 50 ns (typical)  |   |                            |
| Output Impedance                                      | 50 $\Omega$ (typical)  |   |                            |
| Maximum Frequency                                     | 2 MHz  |   |                            |
| <b>External Reference Input</b>                       |  |   |                            |
| Lock Range  | 10 MHz $\pm$ 50 Hz   |   |                            |
| Level   | 1.5 Vpp to 5 Vpp   |   |                            |
| Lock Time   | <2 s   |   |                            |
| Input Impedance (Typical)                             | 1 k $\Omega$ , AC Coupling                                   |   |                            |
| <b>Counter Specification</b>                          |  |   |                            |
| Function  | Frequency, period, positive/negative Pulse width, Duty cycle |   |                            |
| Frequency Range                                       | Single channel: 100 mHz to 200 MHz                           |   |                            |
| Frequency Resolution                                  | 6 digits/second  |   |                            |
| Voltage Range and Sensitivity (non-modulation signal) |  |   |                            |
| Auto mode   | 1 Hz to 200 MHz  | 200 mVpp to 5 Vpp                             |                            |
| Manual mode   | DC coupled   | DC offset range                               | $\pm$ 1.5 VDC              |
|   |  | 100 mHz to 100 MHz                            | 20 mVRMS to $\pm$ 5 Vac+dc |
|   | 100 MHz to 200 MHz   | 40 mVRMS to $\pm$ 5 Vac+dc                    |                            |
|   | AC coupled   | 1 Hz to 100 MHz                               | 50 mVpp to $\pm$ 5 Vpp     |
| 100 MHz to 200 MHz                                    |  | 100 mVpp to $\pm$ 5 Vpp                       |                            |
| Pulse width and Duty cycle Measure                    | 1 Hz to 10 MHz (100 mVpp to 10 Vpp)                          |   |                            |
| Input adjust  | Input impedance  | 1 M $\Omega$                                  |                            |
|   | Coupling mode  | AC, DC  |                            |
|   | High frequency restrain                                      | High frequency noise restrain (HFR) On or Off |                            |
|   | Sensitivity  | Low, Medium, High                             |                            |
| Trigger mode  | The trigger level can adjust manually or automatically.      |   |                            |
|   | Trigger level range: $\pm$ 3 V (0.1% to 100%)                |   |                            |
|   | Resolution: 6 mV   |   |                            |

**Remark:**

[1] In atypical condition, the specification may have minor differences.

[2] In normal temperature, short circuit in less than half hour will be tolerable.

- CH1 is provided with **Overvoltage** function. When the output terminal is connected to an external circuit, the relationships between the output voltage "Vout" of generator and the voltage "Vin" possibly generated by external circuit are:

If  $V_{out} \leq 1V_{DC}$ , the protective range of  $V_{in}$  is  $\pm 3V$

If  $V_{out} > 1V_{DC}$ , the protective range of  $V_{in}$  is  $\pm 12.5V$

Therein,  $V_{out} = \text{Amplitude}/2 + |\text{Offset}|$ , the Amplitude and Offset are the parameters of the signal outputted from generator.

The generator will turn off the output automatically when  $V_{in}$  exceeds the specified range.

- The voltage inputted to the output connector of CH2 should be within  $\pm 3V$ .

[3] External input voltage should be within  $\pm 5V$ , or else the generator may be damaged.

## General Specifications

| <b>Display</b>                 |  |         |
|--------------------------------|--|---------|
| Display Type                   | Black and White LCD Screen                           |         |
| Display Resolution             | 256 Horizontal x 64 Vertical                         |         |
| Grey Degree                    | 4 Level Grey   |         |
| Display Contrast (typical)     | 150 : 1  |         |
| Backlight Brightness (typical) | 300 nit  |         |
| <b>Power Supply</b>            |  |         |
| Supply Voltage                 | 100 to 240 VAC <sub>RMS</sub> , 45 to 440 Hz, CAT II |         |
| Power Consumption              | Less than 40 W                                       |         |
| Fuse                           | 2 A, T Level, 250 V                                  |         |
| <b>Environment</b>             |  |         |
| Ambient Temperature            | Operation: 10°C to +40°C                             |         |
|                                | Non-operation: -20°C to +60°C                        |         |
| Cooling Method                 | Natural cooling                                      |         |
| Humidity Range                 | Below +35°C: ≤90% relative humidity                  |         |
|                                | +35°C to +40°C: ≤60% relative humidity               |         |
| Height above sea level         | Operation: below 3,000m                              |         |
|                                | Non-operation: below 15,000m                         |         |
| <b>Mechanism</b>               |  |         |
| Dimension                      | Width  | 232 mm  |
|                                | Height   | 108 mm  |
|                                | Depth  | 288 mm  |
| Weight                         | Net Weight   | 2.65 kg |
|                                | Gross Weight   | 4 kg    |
| <b>IP Protection</b>           |  |         |
| IP2X                           |  |         |
| <b>Calibration Interval</b>    |  |         |
| One year suggested             |  |         |

## Ordering Information

### Name of Product

**RIGOL** DG1000 series Dual-Channel Function/Arbitrary Waveform Generator

### Standard Accessories

- A Power Cord that fits the standard of destination country
- A CD (including User's Guide and application software)
- A Quick Guide
- A BNC Cable

### Optional Accessories

- BNC to Alligator Clip Cable
- USB Cable
- 40dB Attenuator
- Power Amplifier

## Contact Us

If you have any problem or requirement when using our products or this manual, please contact **RIGOL**.

E-mail: [service@rigol.com](mailto:service@rigol.com)

Website: [www.rigol.com](http://www.rigol.com)

## Warranty

Thank you for choosing **RIGOL** products!

**RIGOL** warrants that the product mainframe and product accessories will be free from defects in materials and workmanship within the warranty period.

If a product proves defective within the respective period, **RIGOL** guarantees free replacement or repair of any defective products within a reasonable period of time. To get repair service, please contact with your nearest **RIGOL** sales or service office.

There is no other warranty, expressed or implied, except such as is expressly set forth herein or other applicable warranty card. There is no implied warranty of merchantability or fitness for a particular purpose. Under no circumstances shall **RIGOL** be liable for any consequential, indirect, ensuing or special damages for any breach of warranty in any case.