

Arbitrary Function Generator

AFG1022 Datasheet



The AFG1022 Arbitrary Function Generator provides a waveform generation tool with the best price performance ratio. It includes dual channel, 25 MHz bandwidth and up-to 10 V_{p-p} output amplitude. The four run modes, 50 built-in frequently-used waveforms and the built-in 200 MHz frequency counter cover most waveform generation needs in your experiment and test jobs. The 3.95-inch TFT LCD, short-cut buttons, USB interface and PC software provide the most intuitive ways to configure the instrument.

Features and benefits

- Dual-channel, 25 MHz sine wave, and 12.5 MHz square/pulse wave provides a cost effective solution for basic education and other applications
- 125 MS/s sampling rate and 14-bit vertical resolution enable great signal fidelity
- 1 mV_{p-p} to 10 V_{p-p} output amplitude over the whole frequency range
- The intuitive user interface shortens the learning curve for students and other users
- 2 to 8,192-point length of memory for user-defined arbitrary waveforms
- 64-MByte internal non-volatile memory for arbitrary waveform storage
- Standard USB host/device for memory expansion and remote control
- Continuous, sweeping, burst, and modulation modes covers most requirements for students and other users to get the experiments/test job done
- Built-in 200 MHz counter with 6-digit resolution offers an easy and precise way of frequency/period/pulse width/duty cycle measurement
- Menu and online help are in English and Simplified Chinese

- Compact form factor for stacking on other bench instruments to save valuable bench space
- Free ArbExpress makes user defined waveforms editing extremely easy
- Compatible with TekSmartLab™ for easy teaching and learning

Applications

- Electric and electronics experiments
- Communications experiments
- Sensor simulation
- Functional test

Performance and features

1 μHz to 25 MHz sine waveform range, with 12-digit or 1 μHz resolution and a ±1 ppm drift high stability time base, provides great signal fidelity in the frequency domain. With 1 mV_{p-p} to 10 V_{p-p} output amplitude range, and 14-bit or 1 mV_{p-p} resolution over the whole frequency range, there is no need to compromise between output amplitude and frequency any more.

Four different run modes and four modulation modes cover most use cases with a cost effective solution. 50 most-frequently used standard and arbitrary waveforms are built-in for easy access. Up to 8,192 points arbitrary waveforms memory enables users to replicate real world signals captured with a Tektronix oscilloscope or defined with ArbExpress. The built-in 200 MHz and 6 digit resolution frequency counter is an easy and precise way to measure frequencies/periods/pulse widths/duty cycles.

Ease of use

The high-resolution 3.95-inch color TFT display shows relevant settings and parameters in both text and graphic formats, which give users full confidence in their settings, and let them focus on the task at hand. The front panel shortcut buttons and rotary knob make accesses to most frequently used functions and settings with minimum effort and time. The built-in 64-MByte non-volatile memory together with USB stick memory interface, provide unlimited space for user-defined waveform storage.

Software and solutions

Compatible with ArbExpress, the user-defined arbitrary waveforms generated by the free software can be loaded on the AFG1022 easily with a USB memory stick.

As a building block of Tektronix educational solution, the AFG1022 can be embedded into TekSmartLab and enable a cost efficient and effective way of teaching, learning, and lab management.

Specifications

Channels

| | |
|--------------------|---|
| Number of channels | 2 |
|--------------------|---|

Built-in waveforms

| | |
|--------------------|--|
| Built-in waveforms | Sine, Square, Pulse, Ramp, Noise, and 45 frequently used arbitrary waveforms |
|--------------------|--|

Sine wave

| | |
|-------|----------------------|
| Range | 1 μ Hz to 25 MHz |
|-------|----------------------|

| | |
|-------------------------|-----------------|
| Sine wave in burst mode | 2 mHz to 25 MHz |
|-------------------------|-----------------|

| | |
|---------------------------------|--------|
| Effective maximum frequency out | 25 MHz |
|---------------------------------|--------|

Amplitude flatness (1 V_{p-p})

| | |
|------------------|--------------|
| <10 MHz | ± 0.2 dB |
| 10 MHz to 25 MHz | ± 0.3 dB |

| | |
|---------------------|---|
| Harmonic distortion | < -50 dBc, 1 V_{p-p} , 1 μ Hz to 25 MHz |
|---------------------|---|

| | |
|---------------------------|--|
| Total harmonic distortion | < 0.2% (10 Hz to 20 kHz, 1 V_{p-p}) |
|---------------------------|--|

| | |
|----------|---|
| Spurious | < -45 dBc, 1 V_{p-p} , 1 μ Hz to 25 MHz |
|----------|---|

| | |
|-------------|--|
| Phase noise | 1 MHz: < -110 dBc/Hz at 10 kHz offset, 1 V_{p-p} (typical) |
|-------------|--|

| | |
|----------------------|-------------------|
| Residual clock noise | -57 dBm (typical) |
|----------------------|-------------------|

Square wave

| | |
|-------|------------------------|
| Range | 1 μ Hz to 12.5 MHz |
|-------|------------------------|

| | |
|----------------|---------|
| Rise/fall time | < 12 ns |
|----------------|---------|

| | |
|--------------|------------------|
| Jitter (rms) | < 1 ns (typical) |
|--------------|------------------|

| | |
|-----------|-----|
| Overshoot | <5% |
|-----------|-----|

Ramp wave

| | |
|-------|---------------------|
| Range | 1 μ Hz to 1 MHz |
|-------|---------------------|

| | |
|-----------|--|
| Linearity | \leq 0.1% of peak output at 10% - 90% of amplitude range, at 1 kHz, 1 V_{p-p} , 50% symmetry (typical) |
|-----------|--|

| | |
|----------|----------------|
| Symmetry | 0.0% to 100.0% |
|----------|----------------|

Pulse wave

| | |
|-------|-------------------|
| Range | 1 MHz to 12.5 MHz |
|-------|-------------------|

| | |
|-------------------|-----------------------|
| Pulse width range | 40.00 ns to 999,000 s |
|-------------------|-----------------------|

| | |
|------------------------|-------------------|
| Pulse width resolution | 10 ps or 5 digits |
|------------------------|-------------------|

| | |
|------------|---|
| Pulse duty | <1 MHz, 0.001% to 99.999% (limitations of pulse duty width apply) 1 MHz to 12.5 MHz, 50% fixed |
|------------|---|

| | |
|----------------------|----------------|
| Edge transition time | < 12 ns, fixed |
|----------------------|----------------|

| | |
|-----------|----------------|
| Overshoot | < 5% (typical) |
|-----------|----------------|

| | |
|--------------|------------------|
| Jitter (rms) | < 1 ns (typical) |
|--------------|------------------|

Noise

| | |
|-------------------------|--------|
| Noise bandwidth (-3 dB) | 25 MHz |
|-------------------------|--------|

| | |
|------------|----------------|
| Noise type | White Gaussian |
|------------|----------------|

DC

| | |
|-------|---|
| Range | -5 V to +5 V, 50 Ω load 10 V to + 10 V, open circuit or high Z load |
|-------|---|

Arbitrary waveform

| | |
|------------------------------------|----------------------|
| Range | 1 μ Hz to 10 MHz |
| Arbitrary waveform in burst mode | 2 mHz to 10 MHz |
| Effective analog bandwidth (-3 dB) | 30 MHz |
| Non-volatile memory | 64 MByte |
| Memory | |
| Length | 2 to 8,192: 125 MS/s |
| Sampling rate | 125 MS/s |
| Vertical resolution | 14 bits |
| Rise and fall time | < 10 ns |
| Jitter (rms) | < 6 ns (typical) |

Frequency

| | |
|------------------------------|--------------------------|
| Resolution | 1 μ Hz or 12 digits |
| Internal reference stability | ± 1 ppm at 0 - 40 °C |
| Internal reference aging | ± 1 ppm per year |

Amplitude

| | |
|--------------------------|---|
| Range | 1 mV _{p-p} to 10 V _{p-p} , 50 Ω load 2 mV _{p-p} to 20 V _{p-p} , open circuit or high Z load |
| Accuracy | $\pm(1\%$ of setting + 1 mV _{p-p}), (1 kHz sine waveform, 0 V offset) |
| Resolution | 1 mV _{p-p} , 1 mV _{rms} or 4 digits |
| Units | V _{p-p} , V _{rms} |
| Output impedance | 50 Ω (typical) |
| Local impedance setting | Selectable: 50 Ω , 1 Ω to 10.000 k Ω , High Z (adjusts displayed amplitude according to selected load impedance) |
| Isolation | No floating ground, signal ground connected to chassis ground |
| Signal output protection | Short-circuit tolerance, main output automatically disabled when over current |

DC offset

| | |
|-------------------|--|
| Range | $\pm(5 V_{pk} - \text{Amplitude}_{pp}/2)$, 50 Ω load $\pm(10 V_{pk} - \text{Amplitude}_{pp}/2)$, open circuit or high Z load |
| Accuracy | $\pm(1\% \text{ of } \text{setting} + 1 \text{ mV} + 0.5\% \text{ of amplitude } (V_{p-p}))$ |
| Resolution | 1 mV or 4 digits |

Modulation

Modulation, sweeping, and burst modes are only available in channel 1.

Amplitude modulation

| | |
|--------------------------------------|--|
| Carrier waveforms | Sine, square, ramp, arbitrary, except DC and noise |
| Source | Internal / external |
| Internal modulating waveforms | Sine, square, ramp, noise, arbitrary |
| Internal AM frequency | 2 mHz to 20 kHz |
| Depth | 0.0% to 100.0% |

Frequency modulation

| | |
|--------------------------------------|--|
| Carrier waveforms | Sine, square, ramp, arbitrary, except DC and noise |
| Source | Internal / external |
| Internal modulating waveforms | Sine, square, ramp, noise, arbitrary |
| Internal modulating frequency | 2 mHz to 20 kHz |
| Frequency deviation | 2 mHz to 12.5 MHz |

Phase modulation

| | |
|--------------------------------------|--|
| Carrier waveforms | Sine, square, ramp, arbitrary, except DC and noise |
| Source | Internal / external |
| Internal modulating waveforms | Sine, square, ramp, noise, arbitrary |
| Internal PM frequency | 2 mHz to 20 kHz |
| Phase Deviation | 0° to 180° |

Frequency shift keying

| | |
|--------------------------------------|--|
| Carrier waveforms | Sine, square, ramp, arbitrary, except DC and noise |
| Source | Internal / external |
| Internal modulating waveforms | 50% duty cycle square |
| FSK rate | 2 mHz to 100 kHz |

Sweeping

Modulation, sweeping, and burst modes are only available in channel 1.

| | |
|-------------------------------------|---|
| Carrier waveforms | Sine, square, ramp |
| Minimum start-stop frequency | 1 μ Hz |
| Maximum start-stop frequency | Sine: 25 MHz Square: 12.5 MHz Ramp: 1 MHz |
| Type | Linear, logarithmic |
| Direction | Up / down |
| Sweep time | 1 ms to 500 s \pm 0.1% |
| Trigger sources | Internal, external, or manual |

Burst

Modulation, sweeping, and burst modes are only available in channel 1.

| | |
|----------------------------------|--|
| Waveforms | Sine, square, ramp, pulse, arbitrary except DC and noise |
| Types | Count (1 to 50,000 cycles), infinite, gated |
| Start phase | -360° to +360° |
| Trigger sources | Internal, external, or manual |
| Internal trigger interval | (40 ns or (cycles x period) to 500 s) \pm 1% |
| Gate source | External trigger |

Frequency counter

| | |
|--|---|
| Function | Frequency, period, positive pulse width, duty cycle |
| Frequency range | 100 MHz to 200 MHz |
| Frequency resolution | 6 digits |
| Coupling mode | AC, DC |
| Voltage Range and Sensitivity, DC coupled (non-modulation signal) | |
| 100 MHz to 100 MHz | 250 mV _{p-p} to 5 V _{p-p} (AC + DC) |
| 100 MHz to 200 MHz | 450 mV _{p-p} to 3 V _{p-p} (AC + DC) |
| Voltage range and sensitivity, AC coupled (non-modulation signal) | |
| 1 Hz to 100 MHz | 250 mV _{p-p} to 5 V _{p-p} |
| 100 MHz to 200 MHz | 450 mV _{p-p} to 4 V _{p-p} |

Frequency counter

| | |
|--------------------------------------|--------------------------------------|
| Pulse width and duty cycle measure | 1 Hz to 10 MHz |
| Input impedance | 1 M Ω in parallel with 100 pF |
| High frequency noise restraint (HFR) | On / Off (HFR frequency = 500 kHz) |
| Sensitivity | Low, middle, or high |
| Trigger level range | -2.5 V to +2.5 V |

Auxiliary inputs and outputs

External modulation input

| | |
|-----------------------|--|
| Input frequency range | DC to 20 kHz |
| Input voltage range | All except FSK: ± 1 V full scale, FSK: 3.3 V logic level |
| Input impedance | 12 k Ω (typical) |

External trigger input

| | |
|-------------|--------------------------------|
| Level | TTL-compatible |
| Slope | Rising or falling (selectable) |
| Pulse Width | >100 ns |

External reference clock input

| | |
|-------------------------------|---|
| Impedance | 400 Ω , AC coupled |
| Requested Input voltage swing | 100 mV _{p-p} to 5 V _{p-p} |
| Locking range | 10 MHz \pm 9 kHz |

External reference clock output

| | |
|-----------|--|
| Frequency | 10 MHz |
| Impedance | 50 Ω , DC coupled |
| Amplitude | 1.6 V _{p-p} into 50 Ω load |

Communication interface

| | |
|-----|-------------------------------------|
| USB | Host and device, USB TMC compliance |
|-----|-------------------------------------|

Display

| | |
|--------------------|------------|
| Display type | 3.95-inch |
| Display resolution | 480 by 320 |
| Display colors | 65,536 |

Menu and online help languages

Menu and online help languages English and Simplified Chinese

Power source

Supply 220-240 VAC, 100-120 VAC, 50/60 Hz, CAT II

Consumption Less than 28 W

Fuse 110 V: 250 V, F4AL
220 V: 250 V, F2AL

Warm-up time 30 minutes (typical)

Physical characteristics

Dimensions (W, H, D) 235 × 110 × 295 mm (9.2 × 4.33 × 11.61 in)

Weight

Net 3.4 kg (7.4 lbs)

Shipping 4.7 kg (10.3 lbs)

EMC environment and safety

Temperature

Working 0 °C to 40 °C (32 °F to 104 °F)

Storage -20 °C to 60 °C (-4 °F to 144 °F)

Relative humidity

Operating: ≤ 80%, +0 °C to +40 °C (+32 °F to +104 °F)

Non-operating: 5% to 90%, < +40 °C (+104 °F), non-condensing

Non-operating: 5% to 80%, ≥ +40 °C (+104 °F) to ≤ +60 °C (+140 °F), non-condensing

Altitude

Operating: up to 3,000 m (9842 ft.)

Non-operating: up to 12,000 m (39,368 ft)

Cooling method

Fan cooling

EMC compliance

European Union EN 61326-1

Australia/NZ CISPR 11, Class A

Safety compliance

UL 61010-1

CAN/CSA-C22.2 No. 61010-1

EN 61010-1

IEC 61010-1

Ordering information

Models

| | |
|---------|------------------------------|
| AFG1022 | Arbitrary Function Generator |
|---------|------------------------------|

Instrument options

Power plug options

| | |
|----------|--|
| Opt. A0 | North America power plug (115 V, 60 Hz) |
| Opt. A1 | Universal Euro power plug (220 V, 50 Hz) |
| Opt. A2 | United Kingdom power plug (240 V, 50 Hz) |
| Opt. A3 | Australia power plug (240 V, 50 Hz) |
| Opt. A5 | Switzerland power plug (220 V, 50 Hz) |
| Opt. A6 | Japan power plug (100 V, 50/60 Hz) |
| Opt. A10 | China power plug (50 Hz) |
| Opt. A11 | India power plug (50 Hz) |
| Opt. A12 | Brazil power plug (60 Hz) |
| Opt. A99 | No power cord |

Service options

| | |
|-----------|---|
| Opt. C3 | Calibration Service 3 Years |
| Opt. C5 | Calibration Service 5 Years |
| Opt. R5 | Repair Service 5 Years (including warranty) |
| Opt. R5DW | Repair Service Coverage 5 Years (includes product warranty period). 5-year period starts at time of instrument purchase |

Probes and accessories are not covered by the warranty and Service Offerings. Refer to the datasheet of each probe and accessory model for its unique warranty and calibration terms.

Accessories

Standard Accessories

- AFG1022 Arbitrary/Function Generator Safety and Compliance Instructions; printed document
- AFG1022 Documentation CD containing the following PDF documents:
 - AFG1022 Arbitrary/Function Generators Quick Start User Manual, English
 - AFG1022 Arbitrary/Function Generators Quick Start User Manual, Simplified Chinese
 - AFG1022 Arbitrary/Function Generators Programmer Manual
 - AFG1022 Arbitrary/Function Generators Specifications and Performance Verification Manual
- Packing list
- Power cord, specified by country
- Certificate of calibration ; printed document
- USB cable x 1, Type A to Type B
- BNC cable x 2
- Tektronix Supplemental Information Sheet For the Peoples Republic of China: China RoHs; printed document
- Fuse, cartridge; 5 x 20 mm, 2 A, 250 V, time-delay
- Fuse, cartridge; 5 x 20 mm, 4 A, 250 V, time-delay

Warranty

- Three year warranty on parts and labor

Recommended accessories

- 174-4401-xx, USB cable, type A to type B cable – three feet
- 174-5194-xx, USB cable, type A to type B cable – six feet
- 012-1732-xx, BNC cable assembly, 0 to 1 GHz, shielded – three feet
- 159-0107-xx, Fuse, cartridge; 5 x 20 mm, 2 A, 250 V, time-delay
- 159-0397-xx, Fuse, cartridge; 5 x 20 mm, 4 A, 250 V, time-delay



Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.



Product Area Assessed: The planning, design/development and manufacture of electronic Test and Measurement instruments.

ASEAN / Australasia (65) 6356 3900
Belgium 00800 2255 4835*
Central East Europe and the Baltics +41 52 675 3777
Finland +41 52 675 3777
Hong Kong 400 820 5835
Japan 81 (3) 6714 3010
Middle East, Asia, and North Africa +41 52 675 3777
People's Republic of China 400 820 5835
Republic of Korea 001 800 8255 2835
Spain 00800 2255 4835*
Taiwan 886 (2) 2656 6688

Austria 00800 2255 4835*
Brazil +55 (11) 3759 7627
Central Europe & Greece +41 52 675 3777
France 00800 2255 4835*
India 000 800 650 1835
Luxembourg +41 52 675 3777
The Netherlands 00800 2255 4835*
Poland +41 52 675 3777
Russia & CIS +7 (495) 6647564
Sweden 00800 2255 4835*
United Kingdom & Ireland 00800 2255 4835*

Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777
Canada 1 800 833 9200
Denmark +45 80 88 1401
Germany 00800 2255 4835*
Italy 00800 2255 4835*
Mexico, Central/South America & Caribbean 52 (55) 56 04 50 90
Norway 800 16098
Portugal 80 08 12370
South Africa +41 52 675 3777
Switzerland 00800 2255 4835*
USA 1 800 833 9200

* European toll-free number. If not accessible, call: +41 52 675 3777

For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit www.tektronix.com.

Copyright © Tektronix, Inc. All rights reserved. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks of Tektronix, Inc. All other trade names referenced are the service marks, trademarks, or registered trademarks of their respective companies.



12 Feb 2015 75W-30936-1

www.tektronix.com



Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Tektronix:](#)

[AFG1022](#)