## Arbitrary Function Generators



## Features \& Benefits

- $10 \mathrm{MHz}, 25 \mathrm{MHz}, 50 \mathrm{MHz}, 100 \mathrm{MHz}$, or 240 MHz Sine Waveforms
- 14 bits, $250 \mathrm{MS} / \mathrm{s}, 1 \mathrm{GS} / \mathrm{s}$, or $2 \mathrm{GS} / \mathrm{s}$ Arbitrary Waveforms
- Amplitude up to $20 \mathrm{~V}_{\mathrm{p}-\mathrm{p}}$ into $50 \Omega$ Loads
- 5.6 in. Color TFT LCD Display for Full Confidence in Settings and Waveform Shape
- Multilanguage and Intuitive Operation Saves Setup Time
- Pulse Waveform with Variable Edge Times
- AM, FM, PM, FSK, PWM
- Sweep and Burst
- Dual-channel Models Save Cost and Bench Space
- USB Connector on Front Panel for Waveform Storage on Memory Device
- USB, GPIB, and LAN
- LabVIEW and LabWindows/IVI-C Drivers


## Applications

- Electronic Test and Design
- Sensor Simulation
- Functional Test
- Education and Training


## Product Description

Unmatched performance, versatility, intuitive operation, and affordability make the AFG3000C Series of Function, Arbitrary Waveform, and Pulse Generators the most useful instruments in the industry.

## Superior Performance and Versatility

Users can choose from 12 different standard waveforms. Arbitrary waveforms can be generated up to 128 K in length at high sampling rates. On pulse waveforms, leading and trailing edge time can be set independently. External signals can be connected and added to the output signal. Dual-channel models can generate two identical or completely different signals. All instruments feature a highly stable time base with only $\pm 1$ ppm drift per year.

## Intuitive User Interface Shows More Information at a Single Glance

Color TFT LCD screen on all models shows all relevant waveform parameters and graphical wave shape at a single glance. This gives full confidence in the signal settings and lets you focus on the task at hand. Shortcut keys provide direct access to frequently used functions and parameters. Others can be selected conveniently through clearly structured menus. This reduces the time needed for learning and relearning how to use the instrument. Look and feel are identical to the world's most popular TDS3000 Oscilloscopes.

## ArbExpress ${ }^{\text {TM }}$ Software Included for Creating Waveforms with Ease

With this PC software waveforms can be seamlessly imported from any Tektronix oscilloscope, or defined by standard functions, equation editor, and waveform math.

Datasheet

## Characteristics

AFG3000C Series Characteristics

| Characteristic | AFG3011C | $\begin{aligned} & \text { AFG3021C } \\ & \text { AFG3022C } \end{aligned}$ | $\begin{aligned} & \text { AFG3051C } \\ & \text { AFG3052C } \end{aligned}$ | AFG3101C <br> AFG3102C | $\begin{aligned} & \text { AFG3251C } \\ & \text { AFG3252C } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Channels | 1 | $1 / 2$ | $1 / 2$ | $1 / 2$ | $1 / 2$ |
| Waveforms | Sine, Square, Pulse, Ramp, Triangle, Sin(x)/x, Exponential Rise and Decay, Gaussian, Lorentz, Haversine, DC, Noise |  |  |  |  |
| Sine Wave | $1 \mu \mathrm{~Hz}$ to 10 MHz | $1 \mu \mathrm{~Hz}$ to 25 MHz | $1 \mu \mathrm{~Hz}$ to 50 MHz | $1 \mu \mathrm{~Hz}$ to 100 MHz | $1 \mu \mathrm{~Hz}$ to 240 MHz |
| Sine wave in Burst Mode | $1 \mu \mathrm{~Hz}$ to 5 MHz | $1 \mu \mathrm{~Hz}$ to 12.5 MHz | $1 \mu \mathrm{~Hz}$ to 25 MHz | $1 \mu \mathrm{~Hz}$ to 50 MHz | $1 \mu \mathrm{~Hz}$ to 120 MHz |
| Effective maximum frequency out | 10 MHz | 25 MHz | 50 MHz | 100 MHz | 240 MHz |
| Amplitude Flatness ( $\mathrm{V}_{\text {p-p }}$ ) | $<5 \mathrm{MHz}: \pm 0.15 \mathrm{~dB}$ $\geq 5 \mathrm{MHz}$ to 10 MHz : $\pm 0.3 \mathrm{~dB}$ | $\begin{gathered} <5 \mathrm{MHz}: \pm 0.15 \mathrm{~dB} \\ \geq 5 \mathrm{MHz} \text { to } 20 \mathrm{MHz}: \\ \pm 0.3 \mathrm{~dB} \\ \geq 20 \mathrm{MHz} \text { to } 25 \mathrm{MHz}: \\ \pm 0.5 \mathrm{~dB} \end{gathered}$ | $\begin{gathered} <5 \mathrm{MHz}: \pm 0.15 \mathrm{~dB} \\ \geq 5 \mathrm{MHz} \text { to } 45 \mathrm{MHz}: \\ \pm 0.3 \mathrm{~dB} \\ \geq 45 \mathrm{MHz} \text { to } 50 \mathrm{MHz}: \\ \pm 0.5 \mathrm{~dB} \end{gathered}$ | $<5 \mathrm{MHz}: \pm 0.15 \mathrm{~dB}$ $\geq 5 \mathrm{MHz}$ to 25 MHz : $\pm 0.3 \mathrm{~dB}$ $\geq 25 \mathrm{MHz}$ to 100 MHz : $\pm 0.5 \mathrm{~dB}$ | $<5 \mathrm{MHz}: \pm 0.15 \mathrm{~dB}$ <br> $\geq 5 \mathrm{MHz}$ to 25 MHz : <br> $\pm 0.3 \mathrm{~dB}$ <br> $\geq 25 \mathrm{MHz}$ to 100 MHz : <br> $\pm 0.5 \mathrm{~dB}$ <br> $\geq 100 \mathrm{MHz}$ to 200 MHz : <br> $\pm 1.0 \mathrm{~dB}$ <br> $\geq 200 \mathrm{MHz}$ to 240 MHz : <br> $\pm 2.0 \mathrm{~dB}$ |
| Harmonic Distortion ( $1 \mathrm{~V}_{\text {p-p }}$ ) | 10 Hz to 20 kHz : <-60 dBc $\geq 20 \mathrm{kHz}$ to 1 MHz : $-55 \mathrm{dBC}$ $\geq 1 \mathrm{MHz}$ to $5 \mathrm{MHz}:<$ $-45 \mathrm{dBC}$ $\geq 5 \mathrm{MHz}$ to 10 MHz : $<-45 \mathrm{dBC}$ | $\begin{gathered} 10 \mathrm{~Hz} \text { to } 20 \mathrm{kHz}:<-70 \mathrm{dBc} \\ \geq 20 \mathrm{kHz} \text { to } 1 \mathrm{MHz}:< \\ -60 \mathrm{dBc} \\ \geq 1 \mathrm{MHz} \text { to } 10 \mathrm{MHz}:< \\ -50 \mathrm{dBc} \\ \geq 10 \mathrm{MHz} \text { to } 25 \mathrm{MHz}: \\ <-40 \mathrm{dBc} \end{gathered}$ | 10 Hz to 20 kHz : <-70 dBc $\geq 20 \mathrm{kHz}$ to 1 MHz : $-60 \mathrm{dBc}$ $\geq 1 \mathrm{MHz}$ to $5 \mathrm{MHz}:<$ $-50 \mathrm{dBC}$ $\geq 5 \mathrm{MHz}$ to 50 MHz : $<-40 \mathrm{dBC}$ | ```10 Hz to 1 MHz: <-60 dBc \geq1 MHz to 5MHz:< -50 dBc \geq5 MHz to 100 MHz: <-37 dBc``` | 10 Hz to 1 MHz : -60 dBc $\geq 1 \mathrm{MHz}$ to 5 MHz : $-50 \mathrm{dBC}$ $\geq 5 \mathrm{MHz}$ to 25 MHz : < $-37 \mathrm{dBC}$ $\geq 25 \mathrm{MHz}$ to 240 MHz : $<-30 \mathrm{dBC}$ |
| THD | $<0.2 \%$ ( $10 \mathrm{~Hz}-20 \mathrm{kHz}, 1 \mathrm{~V}_{\mathrm{p} \cdot}$ ) |  |  |  |  |
| Spurious ( $\mathrm{V}_{\text {p-p }}$ ) | 10 Hz to $1 \mathrm{MHz}:<-60 \mathrm{dBc}$ $\geq 1 \mathrm{MHz}$ to 10 MHz : $<-50 \mathrm{dBC}$ | 10 Hz to 1 MHz < -60 dBc $\geq 1 \mathrm{MHz}$ to 25 MHz : $<-50 \mathrm{dBC}$ | 10 Hz to 1 MHz : <-60 dBc $\geq 1 \mathrm{MHz}$ to 50 MHz : $<-50 \mathrm{dBc}$ | $\begin{gathered} 10 \mathrm{~Hz} \text { to } 1 \mathrm{MHz}:<-60 \mathrm{dBc} \\ \geq 1 \mathrm{MHz} \text { to } 25 \mathrm{MHz}: \\ <-50 \mathrm{dBc} \\ \geq 25 \mathrm{MHz} \text { to } 100 \mathrm{MHz} \\ <-50 \mathrm{dBc}+6 \mathrm{dBc} / \text { octave } \end{gathered}$ | $\begin{gathered} 10 \mathrm{~Hz} \text { to } 1 \mathrm{MHz}:<-50 \mathrm{dBC} \\ \geq 1 \mathrm{MHz} \text { to } 25 \mathrm{MHz}: \\ <-47 \mathrm{dBc} \\ \geq 25 \mathrm{MHz} \text { to } 240 \mathrm{MHz}: \\ <-47 \mathrm{dBc}+6 \mathrm{dBc} \text { octave } \end{gathered}$ |
| Phase noise, typical | $<-110 \mathrm{dBc} / \mathrm{Hz}$ at 10 MHz , 10 kHz offset, $1 \mathrm{~V}_{\text {p-p }}$ | $<-110 \mathrm{dBc} / \mathrm{Hz}$ at $20 \mathrm{MHz}, 10 \mathrm{kHz}$ offset, $1 \mathrm{~V}_{\text {p-p }}$ |  |  |  |
| Residual clock noise | -63 dBm | -63 dBm | -63 dBm | -57 dBm | -57 dBm |
| Square Wave | $1 \mu \mathrm{~Hz}$ to 5 MHz | $1 \mu \mathrm{~Hz}$ to 25 MHz | $1 \mu \mathrm{~Hz}$ to 40 MHz | $1 \mu \mathrm{~Hz}$ to 50 MHz | $1 \mu \mathrm{~Hz}$ to 120 MHz |
| Rise/Fall time | $\leq 50 \mathrm{~ns}$ | $\leq 9 \mathrm{~ns}$ | $\leq 7 \mathrm{~ns}$ | $\leq 5 \mathrm{~ns}$ | $\leq 2.5$ ns |
| Jitter (RMS), typical | 500 ps | 500 ps | 300 ps | 200 ps | 100 ps |
| Ramp Wave | $1 \mu \mathrm{~Hz}$ to 100 kHz | $1 \mu \mathrm{~Hz}$ to 500 kHz | $1 \mu \mathrm{~Hz}$ to 800 kHz | $1 \mu \mathrm{~Hz}$ to 1 MHz | $1 \mu \mathrm{~Hz}$ to 2.4 MHz |
| Linearity, typical | $\leq 0.2 \%$ of peak output | $\leq 0.1 \%$ of peak output | $\leq 0.1 \%$ of peak output | $\leq 0.15 \%$ of peak output | $\leq 0.2 \%$ of peak output |
| Symmetry | 0.0\% to 100.0\% |  |  |  |  |
| Pulse Wave | 1 mHz to 5 MHz | 1 mHz to 25 MHz | 1 mHz to 40 MHz | 1 mHz to 50 MHz | 1 mHz to 120 MHz |
| Pulse width | 80.00 ns to 999.99 s | 16.00 ns to 999.99 s | 12 ns to 999.99 s | 8.00 ns to 999.99 s | 4.00 ns to 999.99 s |
| Resolution | 10 ps or 5 digits |  |  |  |  |
| Pulse duty | 0.001\% to 99.999\% (Limitations of pulse width apply) |  |  |  |  |
| Edge transition time | 50 ns to 625 s | 9 ns to 625 s | 7 ns to 625 s | 5 ns to 625 s | 2.5 ns to 625 s |
| Resolution | 10 ps or 4 digits |  |  |  |  |
| Lead delay |  |  |  |  |  |
| Range | (Continuous Mode): 0 ps to Period(Triggered/Gated Burst Mode): 0 ps to Period - [Pulse Width +0.8 * (Leading Edge Time + Trailing Edge Time)] |  |  |  |  |
| Resolution | 10 ps or 8 digits |  |  |  |  |
| Overshoot, typical | <5\% |  |  |  |  |
| Jitter (RMS), typical | 500 ps | 500 ps | 300 ps | 200 ps | 100 ps |


| Characteristic | AFG3011C | $\begin{aligned} & \text { AFG3021C } \\ & \text { AFG3022C } \end{aligned}$ | $\begin{aligned} & \text { AFG3051C } \\ & \text { AFG3052C } \end{aligned}$ | $\begin{aligned} & \text { AFG3101C } \\ & \text { AFG3102C } \end{aligned}$ | $\begin{aligned} & \text { AFG3251C } \\ & \text { AFG3252C } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Other Waveforms | $1 \mu \mathrm{~Hz}$ to 100 kHz | $1 \mu \mathrm{~Hz}$ to 500 kHz | $1 \mu \mathrm{~Hz}$ to 800 kHz | $1 \mu \mathrm{~Hz}$ to 1 MHz | $1 \mu \mathrm{~Hz}$ to 2.4 MHz |
| Noise Bandwidth (-3 dB) | 10 MHz | 25 MHz | 50 MHz | 100 MHz | 240 MHz |
| Noise type | White Gaussian |  |  |  |  |
| Internal Noise Add | When activated, output signal amplitude is reduced to 50\% |  |  |  |  |
| Level | 0.0\% to 50\% of amplitude ( $\mathrm{V}_{\text {p-p }}$ ) setting |  |  |  |  |
| Resolution | 1\% |  |  |  |  |
| DC (into $50 \Omega$ ) | -10 V to +10 V | -5 V to +5 V | -5 V to +5 V | -5 V to +5 V | -2.5 V to +2.5 V |
| Arbitrary Waveforms | 1 mHz to 5 MHz | 1 mHz to 12.5 MHz | 1 mHz to 25 MHz | 1 mHz to 50 MHz | 1 mHz to 120 MHz |
| Arbitrary waveforms in Burst Mode | 1 mHz to 2.5 MHz | 1 mHz to 6.25 MHz | 1 mHz to 12.5 MHz | 1 mHz to 25 MHz | 1 mHz to 60 MHz |
| Effective analog bandwidth ( -3 dB ) | 8 MHz |  |  | 100 MHz | 225 MHz |
| Nonvolatile memory | 4 waveforms |  |  |  |  |
| Memory: Sample rate ( $1 \mathrm{~K}=1024$ points) | 2 to $128 \mathrm{~K}: 250 \mathrm{MS} / \mathrm{s}$ | 2 to $128 \mathrm{~K}: 250 \mathrm{MS} / \mathrm{s}$ | $\begin{gathered} 2 \text { to } 16 \mathrm{~K}: 1 \mathrm{GS} / \mathrm{s} \\ >16 \mathrm{~K} \text { to } 128 \mathrm{~K}: 250 \mathrm{MS} / \mathrm{s} \\ \hline \end{gathered}$ | $\begin{gathered} 2 \text { to } 16 \mathrm{~K}: 1 \mathrm{GS} / \mathrm{s} \\ >16 \mathrm{~K} \text { to } 128 \mathrm{~K}: 250 \mathrm{MS} / \mathrm{s} \\ \hline \end{gathered}$ | $\begin{gathered} 2 \text { to } 16 \mathrm{~K}: 2 \mathrm{GS} / \mathrm{s} \\ >16 \mathrm{~K} \text { to } 128 \mathrm{~K}: 250 \mathrm{MS} / \mathrm{s} \end{gathered}$ |
| Vertical resolution | 14 bits |  |  |  |  |
| Rise/Fall time | $\leq 80 \mathrm{~ns}$ | $\leq 14 \mathrm{~ns}$ | $\leq 10 \mathrm{~ns}$ | $\leq 8 \mathrm{~ns}$ | $\leq 3 \mathrm{~ns}$ |
| Jitter (RMS), typical | 4 ns | 4 ns | 1 ns at $1 \mathrm{GS} / \mathrm{s}$ 4 ns at $250 \mathrm{MS} / \mathrm{s}$ | 1 ns at $1 \mathrm{GS} / \mathrm{s}$ 4 ns at $250 \mathrm{MS} / \mathrm{s}$ | 500 ps at $2 \mathrm{GS} / \mathrm{s}$ 4 ns at $250 \mathrm{MS} / \mathrm{s}$ |
| Amplitude |  |  |  |  |  |
| Range ( $50 \Omega$ load) | $20 \mathrm{mV}_{\text {p-p }}$ to $20 \mathrm{~V}_{p-p}$ | $10 \mathrm{mV} \mathrm{p}_{\text {-p }}$ to $10 \mathrm{~V}_{p-p}$ | $10 \mathrm{mV} \mathrm{p}_{\text {-p }}$ to $10 \mathrm{~V}_{p-p}$ | $20 \mathrm{mV} \mathrm{p}_{\text {pp }}$ to $10 \mathrm{~V}_{p-p}$ | $\begin{aligned} & \leq 200 \mathrm{MHz}: 50 \mathrm{mV} \mathrm{~V}_{\text {p-p }} \\ & \text { to } 5 \mathrm{~V}_{\text {p-p }} \\ & >200 \mathrm{MHz}: 50 \mathrm{mV}_{p-p} \\ & \text { to } 4 \mathrm{~V}_{\text {p-p }} \end{aligned}$ |
| Range (open circuit or High Z) | $40 \mathrm{mV} \mathrm{p}_{\text {pp }}$ to $40 \mathrm{~V}_{p-p}$ | $20 \mathrm{mV} \mathrm{p}_{\text {-p }}$ to $20 \mathrm{~V}_{p-p}$ | $20 \mathrm{mV} \mathrm{p}_{\text {pp }}$ to $20 \mathrm{~V}_{p-p}$ | 40 mV p-p to $20 \mathrm{~V}_{p-p}$ | $\begin{aligned} & \leq 200 \mathrm{MHz}: 100 \mathrm{mV}_{p-p} \\ & \text { to } 10 \mathrm{~V}_{p-p} \\ & >200 \mathrm{MHz}: 100 \mathrm{mV}_{p-p} \\ & \text { to } 8 \mathrm{~V}_{p-p} \end{aligned}$ |
| Accuracy | $\pm(2 \%$ of setting +2 mV ) <br> ( 1 kHz sine wave, 0 V offset, $>20 \mathrm{mV}_{\text {p-p }}$ amplitude) | $\pm(1 \%$ of setting $+1 \mathrm{mV})\left(1 \mathrm{kHz}\right.$ sine wave, 0 V offset, $>10 \mathrm{mV} \mathrm{p}_{\mathrm{p} \text {, }}$ amplitude $)$ |  |  |  |
| Resolution | $0.1 \mathrm{mV}_{\text {p-p }}, 0.1 \mathrm{mV}_{\mathrm{RMS}}, 1 \mathrm{mV}, 0.1 \mathrm{dBm}$ or 4 digits |  |  |  |  |
| Units | $\mathrm{V}_{\text {p-p }}, \mathrm{V}_{\text {RMS }}, \mathrm{dBm}$ (sine wave only) and Volt (high/low setting) |  |  |  |  |
| Output impedance | $50 \Omega$ |  |  |  |  |
| Load impedance setting | Selectable: $50 \Omega, 1 \Omega$ to $10.0 \mathrm{k} \Omega$, High Z (Adjusts displayed amplitude according to selected load impedance) |  |  |  |  |
| Isolation | $<42 \mathrm{~V}_{\mathrm{pk}}$ maximum to earth |  |  |  |  |
| Short-circuit protection | Signal outputs are robust against permanent shorts against floating ground |  |  |  |  |
| External voltage protection | To protect signal outputs against external voltages use fuse adapter 013-0345-xx |  |  |  |  |
| DC Offset |  |  |  |  |  |
| Range ( $50 \Omega$ load) | $\pm\left(10 \mathrm{~V}_{\mathrm{pk}}-\right.$ Amplitude $\left._{\mathrm{pp}} / 2\right)$ | $\pm\left(5 \mathrm{~V}_{\mathrm{pk}}-\right.$ Amplitude $\left._{\text {pp }} / 2\right)$ | $\pm\left(5 \mathrm{~V}_{\mathrm{pk}}-\right.$ Amplitude $\left._{\text {pp }} / 2\right)$ | $\pm 5 \mathrm{~V}_{\mathrm{pk}} \mathrm{DC}$ | $\pm 2.5 \mathrm{~V}_{\mathrm{pk}}$ DC |
| Range (open circuit or High Z) | $\pm\left(20 \mathrm{~V}_{\mathrm{pk}}-\right.$ Amplitude $\left._{\text {pp }} / 2\right)$ | $\pm\left(10 \mathrm{~V}_{\mathrm{pk}}-\right.$ Amplitude $\left._{\text {pp }} / 2\right)$ | $\pm\left(10 \mathrm{~V}_{\mathrm{pk}}-\right.$ Amplitude $\left._{\text {pp }} / 2\right)$ | $\pm 10 \mathrm{~V}_{\mathrm{pk}} \mathrm{DC}$ | $\pm 5 \mathrm{~V}_{\mathrm{pk}}$ DC |
| Accuracy | $\pm(2 \%$ of $\mid$ setting $\mid+10 \mathrm{mV}+$ <br> $1 \%$ of amplitude $\left(\mathrm{V}_{\text {p-p }}\right)$ ) | $\pm\left(1 \%\right.$ of $\mid$ setting $\mid+5 \mathrm{mV}+0.5 \%$ of amplitude $\left(\mathrm{V}_{\mathrm{p}-\mathrm{p}}\right)$ ) |  |  |  |
| Resolution | 1 mV |  |  |  |  |

## System Characteristics

| Characteristic Description |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Frequency Resolution | $1 \mu \mathrm{~Hz}$ or 12 digits |  |  |  |
| Internal Frequency Reference |  |  |  |  |
| Stability | All except ARB: $\pm 1 \mathrm{ppm}, 0^{\circ} \mathrm{C}$ to $50^{\circ} \mathrm{C}$ ARB: $\pm 1 \mathrm{ppm} \pm 1 \mu \mathrm{~Hz}, 0^{\circ} \mathrm{C}$ to $50^{\circ} \mathrm{C}$ |  |  |  |
| Aging | $\pm 1 \mathrm{ppm}$ per year |  |  |  |
| Phase (except DC, Noise, Pulse) |  |  |  |  |
| Range | $-180^{\circ}$ to $+180^{\circ}$ |  |  |  |
| Resolution | $0.01^{\circ}$ (sine), $0.1^{\circ}$ (other waveforms) |  |  |  |
| When activated, output signal amplitude is reduced to $50 \%$ |  |  |  |  |
| Level | $0.0 \%$ to $50 \%$ of amplitude ( $\mathrm{V}_{\text {p.p }}$ ) setting |  |  |  |
| Resolution | 1\% |  |  |  |
| Main Output | $50 \Omega$ |  |  |  |
| Remote Programming | GPIB, LAN 10BASE-T / 100BASE-TX, USB 1.1 <br> Compatible with SCPI-1999.0 and IEEE 488-2 standards |  |  |  |
| Configuration times, max typical | USB | LAN |  | IB |
| Function change | 81 ms | 81 ms |  | ms |
| Frequency change (except Pulse) | 2.5 ms | 6 ms |  | ms |
| Frequency change (Pulse) | 40 ms | 37 ms |  | ms |
| Amplitude change | 90 ms | 97 ms |  | ms |
| Select user ARB (4k points from USB Memory) | 48 ms | 50 ms |  | ms |
| Select user ARB ( 128 k points from USB Memory) | 260 ms | 266 ms |  | ms |
| Data download time for 4000 point waveform data, typical | 47 ms | 78 ms |  | ms |
| Power Source $\quad 100-240 \mathrm{~V}, 47-63 \mathrm{~Hz}$, or $115 \mathrm{~V}, 360-440 \mathrm{~Hz}$ |  |  |  |  |
| Power Consumption | Less than 120 W |  |  |  |
| Warm-up Time, typical | 20 minutes |  |  |  |
| Power-on Self Diagnostics, typical | $<10 \mathrm{~s}$ |  |  |  |
| Acoustic Noise, typical | $<50 \mathrm{dBA}$ |  |  |  |
| Display | 5.6 in. Color TFT LCD |  |  |  |
| User Interface and Help Languages | English, French, German, Japanese, Korean, Portuguese, Simplified and Traditional Chinese, Russian (user selectable) |  |  |  |
| Modulation |  | Pulse Width Modulation |  |  |
| AM, FM, PM |  | Characteristic Description |  |  |
| Characteristic Description |  | Carrier Waveform | Pulse |  |
| Carrier Waveforms All, except Pulse, Noise, and DC |  | Source | /External |  |
| Source Internal/External |  | Internal Modulating Waveform | Sine, square, ramp, noise, ARB (maximum waveform length 2,048) |  |
| Internal Modulating Sine, square, ramp, noise, ARB <br> (AM: maximum waveform length 4,096; <br>  FM/PM: maximum waveform length 2,048) |  | Internal Modulating Frequency | 2 mHz to 50.00 kHz |  |
| Internal Modulating 2 mHz to 50.00 kHz Frequency | 2 mHz to 50.00 kHz | Deviation | 50.0\% of pulse par |  |
| AM Modulation Depth $0.0 \%$ to $+120.0 \%$ |  |  |  |  |
| Min FM Peak Deviation DC |  |  |  |  |
| Max FM Peak See following table, Modulation: Max FM Peak DeviationDeviation |  |  |  |  |
| PM Phase Deviation $-360.0^{\circ}$ to $+360.0^{\circ}$ |  |  |  |  |
| Modulation: Max FM Peak Deviation |  |  |  |  |
| Characteristic AFG3 | 011CAFG3021C <br> AFG3022C | $\begin{aligned} & \text { AFG3051C } \\ & \text { AFG3052C } \end{aligned}$ | $\begin{aligned} & \text { AFG3101C } \\ & \text { AFG3102C } \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { AFG3251C } \\ & \text { AFG3252C } \end{aligned}$ |
| Sine 5 | MHz 12.5 MHz | 25 MHz | 50 MHz | 120 MHz |
| Square 2.5 | MHz $\quad 12.5 \mathrm{MHz}$ | 20 MHz | 25 MHz | 60 MHz |
| ARB 2.5 | MHz 6.25 MHz | 12.5 MHz | 25 MHz | 60 MHz |
| Others 50 | kHz 250 kHz | 400 kHz | 500 kHz | 1.2 MHz |

## Sweep: Max Start/Stop Frequency

| Characteristic | AFG3011C | AFG3021C <br> AFG3022C | AFG3051C <br> AFG3052C | AFG3101C <br> AFG3102C | AFG3251C <br> AFG3252C |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Sine | 10 MHz | 25 MHz | 50 MHz | 100 MHz | 240 MHz |
| Square | 5 MHz | 25 MHz | 40 MHz | 50 MHz | 120 MHz |
| ARB | 5 MHz | 12.5 MHz | 25 MHz | 50 MHz | 120 MHz |
| Others | 100 kHz | 500 kHz | 800 kHz | 1 MHz | 2.4 MHz |

## Frequency Shift Keying

| Characteristic | Description |
| :--- | :--- |
| Carrier Waveforms | All, except Pulse, Noise, and DC |
| Source | Internal/External |
| Internal Modulating <br> Frequency | 2 mHz to 1.000 MHz |
| Number of Keys | 2 |
| Sweep |  |
| Characteristic Description <br> Waveforms All, except Pulse, Noise, and DC <br> Type Linear, logarithmic <br> Sweep Time 1 ms to 300 s <br> Hold/Return Time 0 ms to 300 s <br> Max Total Sweep Time 300 s <br> Resolution 1 ms or 4 digits <br> Total Sweep Time $\leq 0.4 \%$ <br> Accuracy, typical Min Start/StopAll except ARB: $1 \mu \mathrm{~Hz}$ <br> Frequency <br> Max Start/Stop <br> Frequency | See chart, below |

## Burst

| Characteristic | Description |
| :--- | :--- |
| Waveforms | All, except Noise and DC |
| Type | Triggered, gated (1 to 1,000,000 cycles or Infinite) |
| Internal Trigger Rate | $1 \mu \mathrm{~s}$ to 500.0 s |
| Gate and Trigger <br> Sources | Internal, external, remote interface |

Auxiliary Inputs
Characteristic Description

| Modulation Inputs Channel 1, Channel 2 |  |
| :---: | :---: |
| Input range | All except FSK: $\pm 1 \mathrm{~V}$ <br> FSK: 3.3 V logic level |
| Impedance | $10 \mathrm{k} \Omega$ |
| Frequency range | DC to $25 \mathrm{kHz}(122 \mathrm{kS} / \mathrm{s})$ |
| External Triggered/Gated Burst Input |  |
| Level | TTL compatible |
| Impedance | $10 \mathrm{k} \Omega$ |
| Pulse width | 100 ns minimum |
| Slope | Positive/Negative, selectable |
| Trigger delay | 0.0 ns to 85.000 s |
| Resolution | 100 ps or 5 digits |
| Jitter (RMS), typical | Burst: <500 ps (Trigger input to signal output) |
| 10 MHz Reference Input |  |
| Impedance | $1 \mathrm{k} \Omega$, AC coupled |
| Required Input Voltage Swing | $100 \mathrm{mV}_{\text {p-p }}$ to $5 \mathrm{~V}_{\text {p-p }}$ |
| Lock Range | $10 \mathrm{MHz} \pm 35 \mathrm{kHz}$ |
| External Add Input (CH1) | AFG3101C, AFG3102C, AFG3251C, AFG3252C only |
| Impedance | $50 \Omega$ |
| Input range | -1 V to +1 V (DC + peak AC) |
| Bandwidth | DC to $10 \mathrm{MHz}(-3 \mathrm{~dB})$ at $1 \mathrm{~V}_{\mathrm{p} \text { - }}$ |

## Auxiliary Outputs

Characteristic Description

| Trigger Output (Channel 1) |  |
| :---: | :---: |
| Level | Positive TTL level pulse into $1 \mathrm{k} \Omega$ |
| Impedance | $50 \Omega$ |
| Jitter (RMS), typical | $\begin{aligned} & \text { AFG3011C/21C/22C: } 500 \mathrm{ps} \\ & \text { AFG3051C/52C: } 300 \mathrm{ps} \\ & \text { AFG3101C/02C: } 200 \mathrm{ps} \\ & \text { AFG3251C/52C: } 100 \mathrm{ps} \\ & \hline \end{aligned}$ |
| Max Frequency | 4.9 MHz <br> (4.9 MHz to 50 MHz : A fraction of the frequency is output; <br> $>50 \mathrm{MHz}$ : no signal is output) |
| Clock Reference Out ( 10 MHz ) | AFG3101C, AFG3102C, AFG3251C, AFG3252C only |
| Impedance | $50 \Omega$, AC coupled |
| Amplitude | $1.2 \mathrm{~V}_{\text {p-p }}$ into $50 \Omega$ load |

## Physical Characteristics

## Benchtop Configuration

| Dimensions | $\mathbf{m m}$ | $\mathbf{i n .}$ |
| :--- | :---: | :---: |
| Height | 156.3 | 6.2 |
| Width | 329.6 | 13.0 |
| Depth | 168.0 | 6.6 |
| Weight | $\mathbf{k g}$ | $\mathbf{l b}$. |
| Net | 4.5 | 9.9 |
| Shipping | 5.9 | 12.9 |

## Environmental and Safety Characteristics

| Characteristic | Description |
| :---: | :---: |
| Temperature |  |
| Operating | $0^{\circ} \mathrm{C}$ to $+50^{\circ} \mathrm{C}$ |
| Nonoperating | $-30^{\circ} \mathrm{C}$ to $+70^{\circ} \mathrm{C}$ |
| Humidity |  |
| Operating | $\begin{aligned} & \leq+40^{\circ} \mathrm{C}: \leq 80 \% \\ & >+40^{\circ} \mathrm{C} \text { to } 50{ }^{\circ} \mathrm{C}: \leq 60 \% \\ & \hline \end{aligned}$ |
| Altitude | Up to 10,000 ft./3,000 m |
| EMC Compliance |  |
| European Union | EU Council Directive 2004/108/EC |
| Safety | UL 61010-1:2004 <br> CAN/CSA C22.2 No. 61010-1:2004 IEC 61010-1:2001 |



BNC Fuse Adapter and 0.125 A Fuse

## Ordering Information

AFG3011C, AFG3021C, AFG3022C, AFG3051C, AFG3052C, AFG3101C, AFG3102C, AFG3251C, AFG3252C'
Arbitrary Function Generator
Includes: Quick-start user manual, power cord, USB cable, CD-ROM with specifications and performance verification manual, programmer manual, service manual, LabView and IVI drivers, CD-ROM with ArbExpress ${ }^{\text {TM }}$ software, and NIST-traceable calibration certificate. Please specify power plug when ordering.

International Power Plugs

| Option | Description |
| :--- | :--- |
| Opt. A0 | North America power |
| Opt. A1 | Universal EURO power |
| Opt. A2 | United Kingdom power |
| Opt. A3 | Australia power |
| Opt. A5 | Switzerland power |
| Opt. A6 | Japan power |
| Opt. A10 | China power |
| Opt. A11 | India power |
| Opt. A12 | Brazil power |
| Opt. A99 | No power cord or AC adapter |

Note: Includes front-panel overlay.

## Manual Options

| Option | Description |
| :--- | :--- |
| Opt. L0 | English (071-1631-xx) |
| Opt. L1 | French (071-1632-xx) |
| Opt. L2 | Italian (071-1669-xx) |
| Opt. L3 | German (071-1633-xx) |
| Opt. L4 | Spanish (071-1670-xx) |
| Opt. L5 | Japanese (071-1634-xx) |
| Opt. L6 | Portuguese (071-3042-xx) |
| Opt. L7 | Simple Chinese (071-1635-xx) |
| Opt. L8 | Traditional Chinese (071-1636-xx) |
| Opt. L9 | Korean (071-1637-xx) |
| Opt. L10 | Russian (071-1638-xx) |
| Opt. L99 | No manual |

## Service

| Option | Description |
| :--- | :--- |
| Opt. C3 | Calibration Service 3 Years |
| Opt. C5 | Calibration Service 5 Years |
| Opt. D1 | Calibration Data Report |
| Opt. D3 | Calibration Data Report 3 Years (with Opt. C3) |
| Opt. D5 | Calibration Data Report 5 Years (with Opt. C5) |
| Opt. R5 | Standard Warranty Extended to 5 Years |
| Opt. R5DW | Repair Service Coverage 5 Years |
| Opt. SLLV200 | Standard Warranty Extended to 5 Years (AFG3011C, <br> AFG3021C, AFG3022C, AFG3101C, and AFG3102C) |
| Opt. SILV400 | Standard Warranty Extended to 5 Years (AFG3251C and <br> AFG3252C) |

## Warranty

Three-year warranty on parts and labor.

## Recommended Accessories

| Accessory | Description |
| :---: | :---: |
| Rackmount Kit | RM3100 |
| Fuse adapter, BNC-P to BNC-R | 013-0345-xx |
| $\begin{aligned} & \text { Fuse set, } 3 \mathrm{pcs}, \\ & 0.125 \mathrm{~A} . \end{aligned}$ | 159-0454-xx |
| BNC cable shielded, $3 \mathrm{ft} .$ | 012-0482-xx |
| BNC cable shielded, 9 ft . | 012-1256-xx |
| GPIB cable, double shielded | 012-0991-xx |
| $50 \Omega$ BNC terminator | 011-0049-02 |

## C $\epsilon$

(SRI)
(SRi)
GPIB
Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.
Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

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

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