Arbitrary Function Generator

AFG-3000 Series

QUICK START GUIDE

GW INSTEK PART NO. 82FG-30820MA1

ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

October 2010 edition

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SAFETY INSTRUCTIONS

This chapter contains important safety instructions that should be followed when operating and storing the function generator. Read the following before any operation to ensure your safety and to keep the function generator in the best condition.

Safety Symbols

These safety symbols may appear in this manual or on the instrument.

 WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
 CAUTION	Caution: Identifies conditions or practices that could result in damage to the function generator or to other objects or property.
	DANGER High Voltage
	Attention: Refer to the Manual
	Protective Conductor Terminal
	Earth (Ground) Terminal
	DANGER Hot Surface

Double Insulated

Do not dispose electronic equipment as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased.

Safety Guidelines

General Guideline CAUTION	• Do not place heavy objects on the instrument. • Do not place flammable objects on the instrument. • Avoid severe impact or rough handling that may damage the function generator. • Avoid discharges of static electricity on or near the function generator. • Use only mating connectors, not bare wires, for the terminals. • The instrument should only be disassembled by a qualified technician. (Measurement categories) EN 61010-1:2001 specifies the measurement categories and their requirements as follows. The AFG-3000 falls under category II. • Measurement category IV is for measurement performed at the source of a low-voltage installation. • Measurement category III is for measurement performed in a building installation. • Measurement category II is for measurement performed on circuits directly connected to a low voltage installation. • Measurement category I is for measurements performed on circuits not directly connected to Mains.
Power Supply WARNING	• AC Input voltage: 100 ~ 240V AC, 50 ~ 60Hz. • Connect the protective grounding conductor of the AC power cord to an earth ground to prevent electric shock.

Fuse ⚠ WARNING	• Fuse type: T0.63A/250V. • Only qualified technicians should replace the fuse. • To ensure fire protection, replace the fuse only with the specified type and rating. • Disconnect the power cord and all test leads before replacing the fuse. • Make sure the cause of fuse blowout is fixed before replacing the fuse.
Cleaning the function generator	• Disconnect the power cord before cleaning the function generator. • Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid into the function generator. • Do not use chemicals containing harsh products such as benzene, toluene, xylene, and acetone.
Operation Environment	• Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below) and avoid strong magnetic fields. • Relative Humidity: < 80% • Altitude: < 2000m • Temperature: 0°C to 40°C (Pollution Degree) EN 61010-1:2001 specifies pollution degrees and their requirements as follows. The function generator falls under degree 2. Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity". • Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. • Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected. • Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight,

	precipitation, and full wind pressure, but neither temperature nor humidity is controlled.
Storage environment	• Location: Indoor • Relative Humidity: < 70% • Temperature: -10°C to 70°C
Disposal 	Do not dispose this instrument as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environmental impact.

Power cord for the United Kingdom

When using the function generator in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead/appliance must only be wired by competent persons

WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)

As the colours of the wires in main leads may not correspond with the coloured marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with either the letter E, the earth symbol ⏚ or coloured Green/Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, a cable of 0.75mm² should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any exposed wiring from a cable, plug or connection that is engaged in a live socket is extremely hazardous. If a cable or plug is deemed hazardous, turn off the mains power and remove the cable, any fuses and fuse assemblies. All hazardous wiring must be immediately destroyed and replaced in accordance to the above standard.

GETTING STARTED

The Getting started chapter introduces the function generator's main features, appearance and introduces a quick instructional summary of some of the basic functions. For comprehensive operation instructions, please see the user manual.

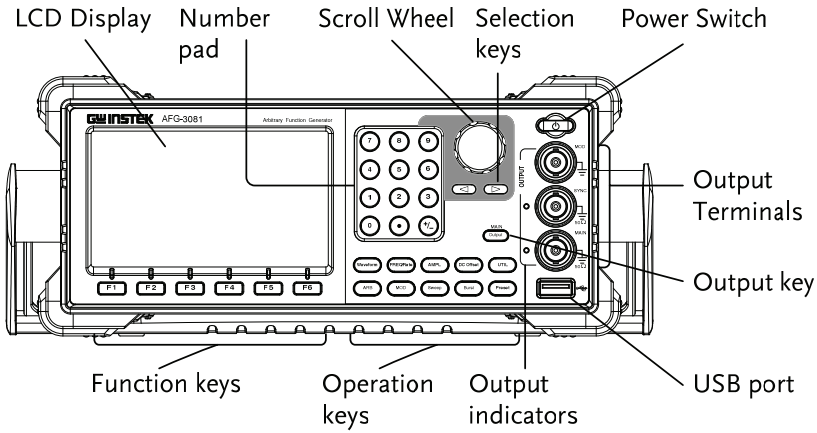
Main Features

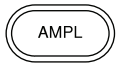
Model name	Frequency bandwidth
AFG-3081	80MHz
AFG-3051	50MHz
Performance	• DDS Function Generator series • 1μHz high frequency resolution maintained at full range • 1ppm frequency stability • Full Function Arbitrary Waveform Capability 200 MSa/s sample rate 100 MSa/s repetition rate 1 M-point waveform length 16-bit amplitude resolution Ten 1M waveform memories True waveform output to display User define output section User defined marker output section DWR (Direct Waveform Reconstruction) capability

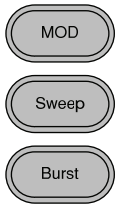
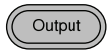
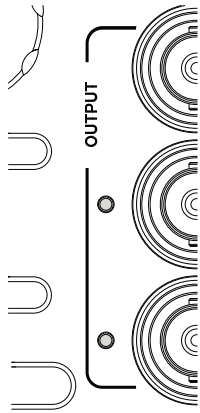
	Waveform editing capability sans PC N Cycle and Infinite output mode selectable • -60dBc low distortion sine wave
Features	• Sine, Square, Ramp, Pulse, Noise, Sinc standard waveforms • Internal and external LIN/LOG sweep with marker output • Int/Ext AM, FM, PWM, FSK modulation • Modulation/sweep signal output • Burst function with internal and external triggers without marker output • Store/recall 10 groups of setting memories • Output overload protection
Interface	• GPIB, RS232, USB standard interfaces • 4.3 inch Color TFT LCD (480 × 272) Graphical User Interface. • AWES (Arbitrary Waveform Editing Software) PC software

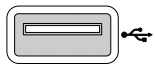
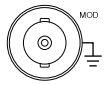
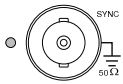
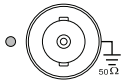
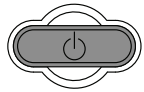
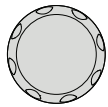
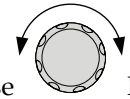
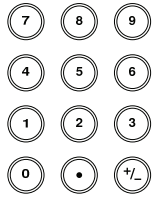
Panel Overview

Front Panel

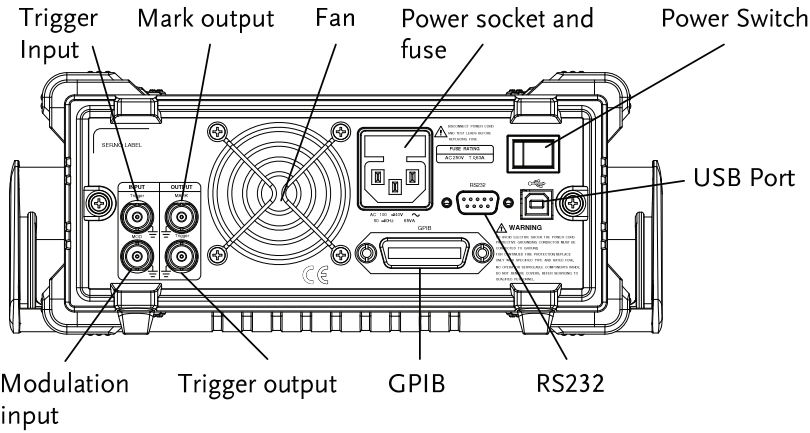


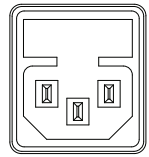
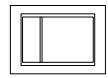
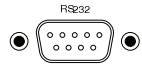
LCD display	TFT color LCD display, 480 x 272 resolution.	
Function keys: F1~F6		Activates the functions which appear in the bottom of the LCD display.
Operation keys		Waveform is used to select a waveform type.
		The FREQ/Rate key is used to set the frequency or sample rate
		AMPL sets the waveform amplitude.
		Sets the DC offset.

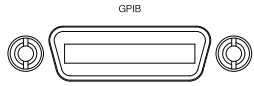
		The UTIL key is used to access the save and recall options, set the remote interface (USB, GPIB, RS232), use DSO link, update and view the firmware version, access the calibration options, output impedance settings, set the language and access the help menu.
		ARB is used to set the arbitrary waveform parameters.
		The MOD, Sweep and Burst keys are used to set the modulation, sweep and burst settings and parameters.
Preset		The preset key is used to recall a preset state.
Output key		The Output key is used to turn on or off the waveform output.
Output indicators		When an Output indicator is green, it indicates that the output is active.

USB host connector		The USB Host connector is used to save and restore waveform data and images, as well as update the firmware.
Output terminals		Modulation output terminal.
		The SYNC output terminal. 50Ω output impedance.
		The primary output terminal. 50Ω output impedance.
Standby key		The standby key is used to turn the function generator on (green) or to put the function generator into standby mode (red).
Selection keys		Used to select digits when editing parameters.
Scroll Wheel		The scroll wheel is used to edit values and parameters.  Decrease Increase
Keypad		The digital keypad is used to enter values and parameters. The keypad is often used in conjunction with the selection keys and variable knob.

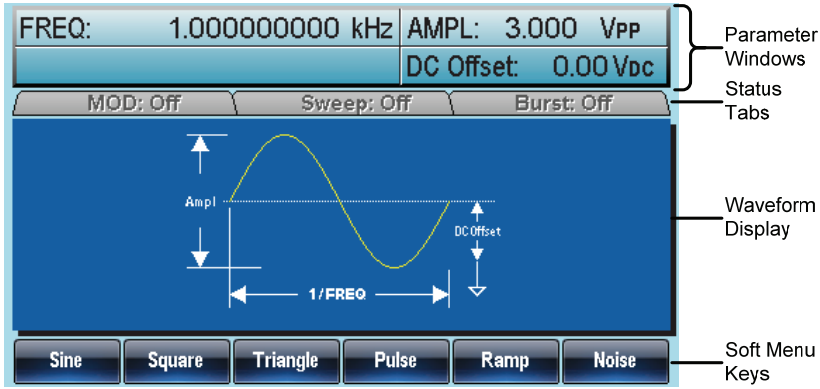
Rear Panel



Trigger input		External trigger input. Used to receive external trigger signals.
MARK output		Mark output signal. Used for Sweep and ARB mode only.
Fan		
Power Socket Input and fuse		Power input: 100~240V AC 50~60Hz. Fuse: T0.63A/250V
Power Switch		Main power switch.
USB port		The Mini-B type USB connector is used to connect the function generator to a PC for remote control.
RS232 port		9 pin female RS232 socket used for PC remote control.

GPIB		24 pin female GPIB connector for PC remote control.
Trigger output		Trigger output terminal.
MOD input		Modulation input terminal.

Display



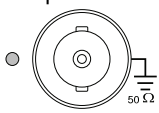
Parameter Windows	The Parameter display and edit window.
Status Tabs	Shows the status of MOD, Sweep and Burst modes.
Waveform Display	The Waveform Display is used to output the waveform on the display.
Soft Menu Keys	The function keys (F1~F6) below the Soft Menu keys correspond to the soft keys.

Selecting a Waveform

Square Wave

Example: Square Wave, 3Vpp, 75%Duty, 1 kHz

Output



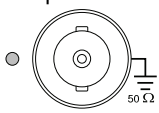
Input: N/A

1. Press **Waveform> Square (F2).**
2. Press **Duty(F1)>7>5>%(F5).**
3. Press **Freq/Rate>1>kHz (F5).**
4. Press **AMPL>3>VPP (F6).**
5. Press **Output**.

Triangle Wave

Example: Triangle Wave, 5Vpp,10kHz

Output



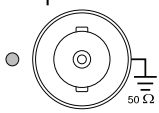
Input: N/A

1. Press **Waveform>Triangle (F3)**.
2. Press **Freq/Rate>1>0>kHz (F5)**.
3. Press **AMPL>5>VPP (F6)**.
4. Press **Output**.

Sine Wave

Example: Sine Wave, 10Vpp,100kHz

Output



Input: N/A

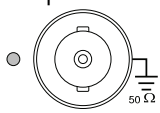
1. Press **Waveform >Sine (F1)**.
2. Press **Freq/Rate>1> 0>0> kHz (F5)**.
3. Press **AMPL >1> 0>VPP (F6)**.
4. Press **Output**.

Modulation

AM

Example: AM modulation. 100Hz modulating square wave. 1kHz Sine wave carrier. 80% modulation depth.

Output



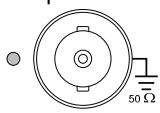
Input: N/A

1. Press **MOD>AM (F1)**.
2. Press **Waveform>Sine (F1)**.
3. Press **Freq/Rate>1>kHz (F5)**.
4. Press **MOD>AM (F1)>Shape (F4)>Square (F2)**.
5. Press **MOD>AM (F1)>AM Freq (F3)**.
6. Press **1>0>0>Hz (F2)**.
7. Press **MOD>AM (F1)>Depth (F2)**.
8. Press **8>0>% (F1)**.
9. Press **MOD>AM (F1)>Source (F1)>INT (F1)**.
10. Press **Output**.

FM

Example: FM modulation. 100Hz modulating square wave. 1kHz Sine wave carrier. 100 Hz frequency deviation. Internal Source.

Output



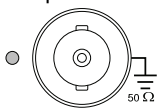
Input: N/A

1. Press **MOD>FM (F2)**.
2. Press **Waveform>Sine (F1)**.
3. Press **Freq/Rate>1>kHz (F5)**.
4. Press **MOD>FM (F2)>Shape (F4)>Square (F2)**.
5. Press **MOD>FM (F2)>FM Freq (F3)**.
6. Press **1>0>0>Hz (F2)**.
7. Press **MOD>FM (F2)>Freq Dev (F2)**.
8. Press **1>0>0>Hz (F3)**.
9. Press **MOD>FM (F2)>Source (F1)>INT (F1)**.
10. Press **Output**.

FSK Modulation

Example: FSK modulation. 100Hz Hop frequency. 1kHz Carrier wave. Triangle wave. 10 Hz Rate. Internal Source.

Output



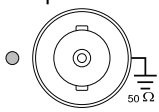
Input: N/A

1. Press **MOD>FSK (F3)**.
2. **Press Waveform>Triangle (F3)**.
3. Press **Freq/Rate>1>kHz (F5)**.
4. Press **MOD>FSK (F3)>FSK Rate (F3)**.
5. Press **1>0>Hz (F2)**.
6. Press **MOD>FSK (F3)>Hop Freq (F2)**.
7. Press **1>0>0>Hz (F3)**.
8. Press **MOD>FSK (F3)>Source (F1)>INT (F1)**.
9. Press **Output**.

PWM Modulation

Example: PWM modulation. 800Hz Carrier wave. 15 kHz modulating sine wave. 50% Duty Cycle. Internal Source.

Output



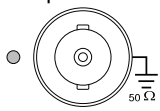
Input: N/A

1. Press **Waveform>Square (F2)**.
2. Press **MOD>PWM (F4)**.
3. Press **Freq/Rate>8>0>0>Hz (F4)**.
4. Press **MOD>PWM (F4)>Shape (F4)>Sine (F1)**.
5. Press **MOD>PWM (F4)>PWM Freq (F3)**.
6. Press **1>5>kHz (F3)**.
7. Press **MOD>PWM (F4)>Duty (F2)**.
8. Press **5>0>% (F1)**.
9. Press **MOD>PWM (F4)>Source (F1)>INT (F1)**.
10. Press **Output**.

Sweep

Example: Frequency Sweep. Start Frequency 10mHz, Stop frequency 1MHz. Log sweep, 1 second sweep, Marker Frequency 550 Hz, Manual Trigger, Trigger out, rising edge.

Output



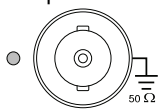
Input: N/A

1. Press **Sweep>Start (F3)**.
2. Press **1>0>mHz (F2)**.
3. **Press Sweep>Stop (F4)**.
4. Press **1>MHz (F5)**.
5. Press **Sweep>Type (F2)>Log (F2)**.
6. Press **Sweep>SWP Time (F5)**.
7. Press **1>SEC (F2)**.
8. Press **Sweep>More (F6)>Marker (F3)>ON/OFF (F2)>Freq (F1)**.
9. Press **5>5>0>Hz (F3)**.
10. Press **Sweep>More (F6)>TRIG out (F4)>ON/OFF (F3)>Rise (F1)**.
11. Press **Output**.
12. Press **Sweep>Source (F1)>Manual (F3)>Trigger (F1)**.

Burst

Example: Burst Mode, N-Cycle (Internally triggered), 1kHz burst frequency, Burst count = 5, 10 ms Burst period, 0˚ burst phase, Internal trigger, 10 us delay, rising edge trigger out

Output



Input: N/A

1. Press **FREQ/Rate>1> kHz (F5)**.
2. Press **Burst>N Cycle (F1)>Cycles (F1)**.
3. Press **5>Cyc (F5)**.
4. Press **Burst>N Cycle (F1)>Period (F4)**.
5. Press **1>0>msec (F2)**.
6. Press **Burst>N Cycle (F1)>Phase (F3)**.
7. Press **0>Degree (F5)**.

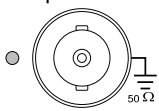
8. Press **Burst>N Cycle (F1)>TRIG Setup (F5)>INT (F1)**.
9. Press **Burst>N Cycle (F1)>TRIG Setup (F5)>Delay (F4)**.
10. Press **1>0>uSEC (F2)**.
11. Press **Burst>N Cycle (F1)>TRIG Setup (F5)>TRIG out (F5)>ON/OFF (F3)>Rise (F1)**.
12. Press **Output**.

ARB

ARB – Add Built-In Waveform

Example: ARB Mode, Exponential Rise. Start 0, Length 100, Scale 32767.

Output

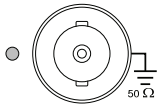


1. Press **ARB>Built in (F3)>More (F5)>Exp Rise (F1)**.
2. Press **Start (F1)>0>Enter (F5)>Return (F6)**.
3. Press **Length (F2)>100>Enter (F5)>Return (F6)**.
4. Press **Scale (F3)>32767>Enter (F5)>Return (F6)>Done (F4)**.

ARB - Add Point

Example: ARB Mode, Add point, Address 40, data 300.

Output

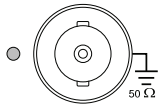


1. Press **ARB>Edit (F2)>Point (F1)>Address (F1)**.
2. Press **4>0>Enter (F5)>Return (F6)**.
3. Press **Data (F2)>3>0>0>Enter (F5)**.

ARB - Add Line

Example: ARB Mode, Add line, Address:Data (10:30, 50:100)

Output

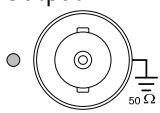


1. Press **ARB>Edit (F2)>Line (F2)>Start ADD (F1)**.
2. Press **1>0>Enter (F5)>Return (F6)**.
3. Press **Start Data (F2)>3>0>Enter (F5)>Return (F6)**.
4. Press **Stop ADD (F3)>5>0>Enter (F5)>Return (F6)**.
5. Press **Stop Data (F4)>1>0>0>Enter (F5)>Return (F6)>Done (F5)**.

ARB – Output Section

Example: ARB Mode, Output ARB Waveform, Start 0, Length 100.

Output

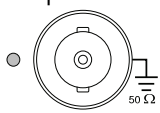


1. Press **ARB>Output (F6)**.
2. Press **Start (F1)>0>Enter (F5)>Return (F6)**.
3. Press **Length (F2)>100>Enter (F5)>Return (F6)**.

ARB – Output N Cycle

Example: ARB Mode, Output N Cycle, Start 0, Length 100, Cycles 10.

Output

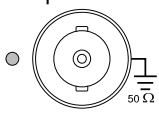


1. Press **ARB>Output (F6)**.
2. Press **Start (F1)>0>Enter (F5)>Return (F6)**.
3. Press **Length (F2)>100>Enter (F5)>Return (F6).**
4. Press **N Cycle (F4)>Cycles(F1)>10>Enter (F5)>Return (F6)**.
5. Press **Trigger (F6)** to output once.

ARB – Output Infinite

Example: ARB Mode, Output Infinite, Start 0, Length 100.

Output

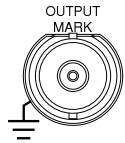


6. Press **ARB>Output (F6)**.
7. Press **Start (F1)>0>Enter (F5)>Return (F6)**.
8. Press **Length (F2)>100>Enter (F5)>Return (F6).**
9. Press **Infinite (F5).**

ARB – Output Markers

Example: ARB Mode, Output Markers, Start 0, Length 80.

Output

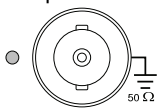


1. Press **ARB>Output (F6)>Marker (F3)**.
2. Press **Start (F1)>30, Enter (F5)>Return (F6)**.
3. Press **Length (F2)>80>Enter (F5)>Return (F6)**.

ARB – Save

Example: ARB Mode, Save ARB waveform, Start 0, Length 100.

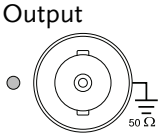
Output



4. Press **ARB>Save (F4)**.
5. Press **Start (F1)>0>Enter (F5)>Return (F6)**.
6. Press **Length (F2)>100>Enter (F5)>Return (F6)**.
7. Press either **Memory(F3) or USB(F4)**.
8. Choose a file using the scroll wheel and press **Select (F1)**.

ARB – Load

Example: ARB Mode, Load ARB waveform.



1. Press **ARB>Load (F5)**.
2. Press either **Memory(F1) or USB(F2)**.
3. Choose a file using the scroll wheel and press **Select (F1)**.
4. Press **To (F3)>0>Enter (F5)>Return (F6)**.
5. Press **Done (F5).**

Utility Menu

Save

Example: Save to Memory file #5.

1. Press **UTIL>Memory (F1)>Store (F1)**.
2. Choose a file using the scroll wheel and press **Select (F1)>Done (F5)**.

Recall

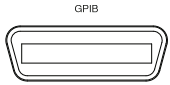
Example: Recall Memory file #5.

1. Press **UTIL>Memory (F1)>Recall (F2)**.
2. Choose a file using the scroll wheel and press **Select (F1)>Done (F5)**.

Interface GPIB

Example: GPIB interface, Address 10.

GPIB

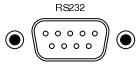


1. Press **UTIL>Interface (F2)>GPIB (F1)>Address (F1)**.
2. Press **10>Done (F5)**.

Interface RS232

Example: RS232 interface, Baud 115200, Parity None, Bits 8.

RS232



1. Press **UTIL>Interface (F2)>RS232 (F2)**.
2. Press **Baud Rate (F1)>115k (F5)**.
3. Press **UTIL>Interface (F2)>RS232 (F2)**.
4. Press **Parity/Bits (F2)>None/8Bits (F1)**.

Interface USB

Example: USB interface.

USB B 

1. Press **UTIL>Interface (F2)>USB (F3)**.

AFG-3000 Series Specifications

The specifications apply when the function generator is powered on for at least 30 minutes under +20°C~+30°C.

Waveforms		AFG-3051	AFG-3081
		Sine, Square, Ramp, Pluse, Noise, DC, Sin(x)/x, Exponential Rise, Exponential Fall, Negative Ramp	
Arbitrary Waveforms			
	ARB Function	Built in	
	Sample Rate	200 MSa/s	
	Repetition Rate	100MHz	
	Waveform Length	1M points	
	Amplitude Resolution	16 bits	
	Non-Volatile Memory	Ten 1M waveforms(1)	
	User defined Output Section	Any section from 2 to 1M points	
	User define Mark Output	Any section from 2 to 1M points	
	Output mode	1 to 1048575 cycles or Infinite mode selectable	

Frequency Characteristics			
Range	Sine	50MHz	80MHz
	Square	50MHz	80MHz
	Triangle, Ramp	1MHz	
Resolution		1μHz	
Accuracy	Stability	±1 ppm 0 to 50˚C ±0.3 ppm 18 to 28˚C	
	Aging	±1 ppm, per 1 year	
	Tolerance	≤ 1 μHz	
Output Characteristics(2)			
Amplitude	Range	10 mVpp to 10 Vpp(into 50Ω) 20 mVpp to 20 Vpp(open-circuit)	
	Accuracy	± 1% of setting ±1 mVpp (at 1 kHz,>10 mVpp)	
	Resolution	0.1 mV or 4 digits	

	Flatness	± 1% (0.1dB) <10 MHz ± 2% (0.2 dB) 10 MHz to 50 MHz ± 10% (0.9 dB) 50 MHz to 70 MHz ± 20% (1.9 dB) 70 MHz to 80 MHz (sine wave relative to 1 kHz)
	Units	Vpp, Vrms, dBm,
Offset	Range	±5 Vpk ac +dc (into 50Ω) ±10Vpk ac +dc (Open circuit)
	Accuracy	1% of setting + 2 mV + 0.5% Amplitude
Waveform Output	Impedance	50Ω typical (fixed) > 10MΩ (output disabled)
	Protection	Short-circuit protected Overload relay automatically disables main output
Sync Output	Level	TTL-compatible into>1kΩ
	Impedance	50Ω nominal
Sine wave Characteristics		
	Harmonic distortion(5)	–60 dBc DC～1 MHz, Ampl＜3 Vpp –55 dBc DC～1 MHz, Ampl＞3 Vpp –45 dBc 1MHz～5 MHz, Ampl＞3 Vpp –30 dBc 5MHz～80 MHz, Ampl＞3 Vpp
	Total Harmonic Distortion	< 0.2%+0.1mVrms DC to 20 kHz
	Spurious (non-harmonic)(5)	–60 dBc DC～1 MHz –50 dBc 1MHz～20MHz –50 dBc+ 6 dBc/octave 1MHz～80MHz
	Phase Noise	＜-65dBc typical 10MHz, 30 kHz band ＜-47dBc typical 80MHz, 30 kHz band
Square wave Characteristics		
	Rise/Fall Time	<8 ns(3)
	Overshoot	<5%
	Asymmetry	1% of period +1 ns
	Variable duty Cycle	20.0% to 80.0% ≤25 MHz 40.0% to 60.0% 25～50MHz 50.0%(Fixed) 50～80MHz
	Jitter	0.01%+525ps ＜ 2 MHz 0.1%+75ps ＞ 2 MHz
Ramp Characteristics		
	Linearity	＜ 0.1% of peak output
	Variable Symmetry	0% to 100%
Pulse Characteristics		
	Period	20ns～ 2000s

	Pulse Width	8ns～ 1999.9s Minimum Pulse Width: 8nS when FREQ≦50MHz 5% of setting period when FREQ≦6.5MHz Resolution: 1nS when FREQ≦50MHz 1% of setting period when FREQ≦6.5MHz
	Overshoot	<5%
	Jitter	100 ppm +50 ps
AM Modulation		
	Carrier Waveforms	Sine, Square, Triangle, Ramp, Pulse, Arb
	Modulating Waveforms	Sine, Square, Triangle, Up/Dn Ramp
	Modulating Frequency	2 mHz to 20 kHz
	Depth	0% to 120.0%
	Source	Internal / External
FM Modulation		
	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating Waveforms	Sine, Square, Triangle, Up/Dn Ramp
	Modulating Frequency	2 mHz to 20 kHz
	Peak Deviation	DC to 50 MHz DC to 80 MHz
	Source	Internal / External
PWM		
	Carrier Waveforms	Square
	Modulating Waveforms	Sine, Square, Triangle, Up/Dn Ramp
	Modulating Frequency	2 mHz to 20 kHz
	Deviation	0% ～ 100.0% of pulse width
	Source	Internal / External
FSK		
	Carrier Waveforms	Sine, Square, Triangle, Ramp, Pulse
	Modulating Waveforms	50% duty cycle square
	Internal Rate	2 mHz to 100 kHz
	Frequency Range	DC to 50 MHz DC to 80 MHz
	Source	Internal / External
Sweep		
	Waveforms	Sine, Square, Triangle, Ramp
	Type	Linear or Logarithmic

	Direction	Up or Down
	Start/Stop Freq	100 µHz to 50 MHz 100 µHz to 80 MHz
	Sweep Time	1 ms to 500 s
	Trigger	Single, External, Internal
	Marker	Falling edge of Mark signal (Programmable frequency)
	Source	Internal / External
Burst		
	Waveforms	Sine, Square, Triangle, Ramp
	Frequency	1 µHz to 50 MHz(4) 1 µHz to 80 MHz(4)
	Burst Count	1 to 1000000 cycles or Infinite
	Start/Stop Phase	-360.0° to +360.0°
	Internal Period	1 ms to 500 s
	Gate Source	External Trigger
	Trigger Source	Single, External or Internal Rate
Trigger Delay	N-Cycle, Infinite	0s to 85 s
External Modulation Input		
	Type	For AM, FM, Sweep, PWM
	Voltage Range	± 5V full scale
	Input Impedance	10kΩ
	Frequency	DC to 20kHz
External Trigger Input		
	Type	For FSK, Burst, Sweep
	Input Level	TTL Compatibility
	Slope	Rising or Falling (Selectable)
	Pulse Width	>100ns
	Input Impedance	10kΩ, DC coupled
Latency	Sweep	<10us (typical)
	Burst	<100ns (typical)
Jitter	Sweep	2.5 us
	Burst	1 ns; except pulse, 300 ps
Modulation Output		
	Type	For AM, FM, Sweep, PWM
Amplitude	Range	≥1Vpp
	Impedance	>10kΩ typical (fixed)
Trigger Output		
	Type	For Burst, Sweep
	Level	TTL Compatible into 50Ω
	Pulse Width	>450 ns
	Maximum Rate	1 MHz
	Fan-out	≥4 TTL load
	Impedance	50Ω Typical
Marker Output		
	Type	For ARB, Sweep

	Level	TTL Compatible into 50Ω
	Fan-out	≥4 TTL load
	Impedance	50Ω Typical
Store/Recall		10 Groups of Setting Memories
Interface		GPIB, RS232, USB
Display		4.3 inch TFT LCD 480 × 3 (RGB) × 272

System Characteristics				
	Configuration Times (typical)	Function Change: Standard---->102ms Pulse-------->660ms Built-In Arb->240ms Frequency Change: 24ms Amplitude Change: 50ms Offset Change: 50ms Select User Arb: < 2s for 1M points Modulation Change: < 200ms		
	Arb Download Times (typical)	Binary Code GPIB/RS232 (115 Kbps)	Binary Code USB Device	ASCII Code USB Host
	1M points	189 sec	34 sec	70 sec
	512K points	95 sec	18sec	35 sec
	256K points	49 sec	9 sec	18 sec
	64K points	16 sec	3 sec	6 sec
	16K points	7 sec	830 ms	1340 ms
	8K points	6 sec	490 ms	780 ms
	4K points	6 sec	365 ms	520 ms
	2K points	5 sec	300 ms	390 ms

General Specifications		
	Power Source	AC100~240V, 50~60Hz
	Power Consumption	65 VA
	Operating Environment	Temperature to satisfy the specification : 18 ~ 28˚C Operating temperature : 0 ~ 40˚C Relative Humidity: ≤ 80%, 0 ~ 40˚C ≤ 70%, 35 ~ 40˚C Installation category : CAT Ⅱ
	Operating Altitude	2000 Meters

	Pollution Degree	IEC 61010 Degree 2, Indoor Use
	Storage Temperature	-10~70°C, Humidity: ≤70%
Dimensions (WxHxD)	Bench Top	265 (W) x 107 (H) x 374 (D)
	Weight	Approx. 4kg
	Safety Designed to	EN61010-1
	EMC Tested to	EN 55011, IEC-61326
	Accessories	Test cable(GTL-110× 1), User Manual Compact Disk × 1, Quick Start Guide × 1, Power cord × 1

(1). A total of ten waveforms can be stored. (Every waveform can be composed of 1M points maximum.)
(2). Add 1/10th of output amplitude and offset specification per ∘C for operation outside of 0 ∘C to 28 ∘C range (1-year specification).
(3). Edge time decreased at higher frequency.
(4). Sine and square waveforms above 25 MHz are allowed only with an “Infinite” burst count.
(5). Harmonic distortion and Spurious noise at low amplitudes is limited by a -70 dBm floor.

EC Declaration of Conformity

We

GOOD WILL INSTRUMENT CO., LTD.
No.7-1, Jhongsing Rd., Tucheng City, Taipei County 236, Taiwan

GOOD WILL INSTRUMENT (SUZHOU) CO., LTD.
No. 69, Lushan Road, Suzhou New District Jiangsu, China

declares that the below mentioned product

AFG-3081, AFG-3051

Are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (2004/108/EC) and Low Voltage Equipment Directive (2006/95/EC). For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Equipment Directive, the following standards were applied:

◎ **EMC**

EN 61326-1 : **EN 61326-2-1:**	Electrical equipment for measurement, control and laboratory use — EMC requirements (2006)
Conducted and Radiated Emissions EN 55011: 2007+A2: 2007	Electrostatic Discharge EN 61000-4-2: 2009
Current Harmonic EN 61000-3-2: 2006+A1: 2009+A2: 2009	Radiated Immunity EN 61000-4-3: 2006+A1: 2008
Voltage Fluctuation EN 61000-3-3: 2008	Electrical Fast Transients IEC 61000-4-4: 2004+Corr.1 : 2006+Corr.2 : 2007
----------	Surge Immunity EN 61000-4-5: 2006
----------	Conducted Susceptibility EN 61000-4-6: 2009
----------	Power Frequency Magnetic Field EN 61000-4-8: 1993+A1: 2001
----------	Voltage Dips/ Interrupts EN 61000-4-11: 2004

◎ **Safety**

Low Voltage Equipment Directive 2006/95/EC
Safety Requirements **IEC/EN 61010-1: 2001**