Arbitrary Function Generator

AFG-2225

Quick Start Guide

ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

Table of Contents

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 61010-1:2010 specifies the measurement categories and their requirements as follows. The AFG-2225 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: F1A/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 61010-1:2010 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, set up procedure and power-up.

Main Features

| Model	Bandwidth
AFG-2225	25MHz
Performance	• DDS function generator series
	• 1µHz high frequency resolution maintained at full range
	• 20ppm frequency stability
	• Arbitrary waveform capability
	• 120 MSa/S sample rate
	• 60 MSa/S repetition rate
	• 4k point waveform length
	• 10 groups of 4k waveform memories
	• True waveform output to display
	• User defined output section
	• DWR (Direction Waveform Reconstruction)
	• Waveform editing via PC.
Features	• Sine, Square, Ramp, Pulse, Noise, standard waveforms
	• Internal and external LIN/LOG sweep with marker output
	• Int/Ext AM, FM, PM, FSK, SUM modulation

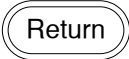|	• Burst function with internal and external triggers without marker output
	• Store/recall 10 groups of setting memories
	• Output overload protection
Interface	• USB interface as standard
	• 3.5″ color TFT LCD (320× 240) graphical user interface.
	• AWES (Arbitrary Waveform Editing Software) PC software

Panel Over view

Front Panel
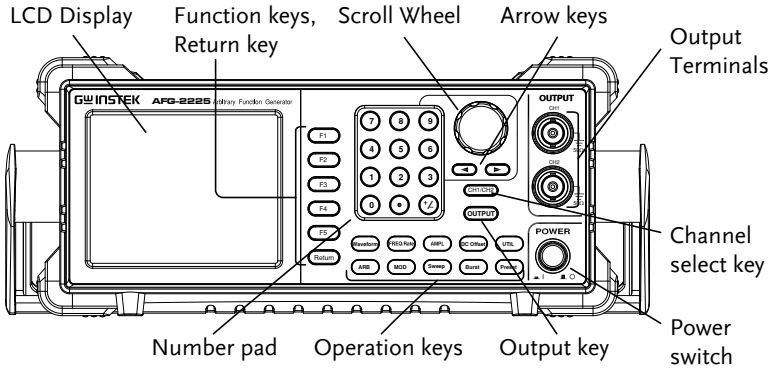
LCD Display | TFT color display, 320 x 240 resolution.

Function Keys F1~F5	F1	Activates functions which appear on the right-hand side of the LCD display.
Return Key	Return	Goes back to the previous menu level.
Operation Keys	Waveform	The waveform key is used to select a type of waveform.
	FREQ/Rate	The FREQ/Rate key is used to set the frequency or sample rate.
	AMP	AMPL sets the waveform amplitude.
	DC Offset	Sets the DC offset.

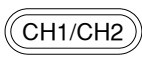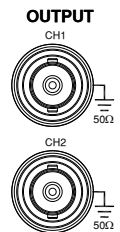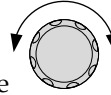|		
	UTIL	The UTIL key is used to access the save and recall options, update and view the firmware version, access the calibration options, dual channel settings and frequency meter.
	ARB	ARB is used to set the arbitrary waveform parameters.
	MOD Sweep Burst	The MOD, Sweep and Burst keys are used to set the modulation, sweep and burst settings and parameters.
Preset Key	Preset	The preset key is used to recall a preset state.
Output Key	OUTPUT	The Output key is used to turn on or off the waveform output.
Channel Select Key	CH1/CH2	The channel select key is used to switch between the two output channels.
Output ports	OUTPUT CH1 50Ω CH2 50Ω	CH1: Channel 1 output port CH2: Channel 2 output port
Power Button	POWER	Turns the power on or off.
Arrow Keys	◀ ▶	Used to select digits when editing parameters.
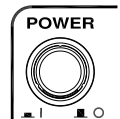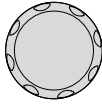
Scroll Wheel		The scroll wheel is used to edit values and parameters.
		Decrease Increase
Keypad		The digital keypad is used to enter values and parameters. The keypad is often used in conjunction with the selection keys and variable knob.
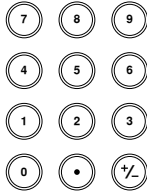
Rear Panel

Power socket input   Fan   Input Terminals

USB A port   USB B port   Trigger output
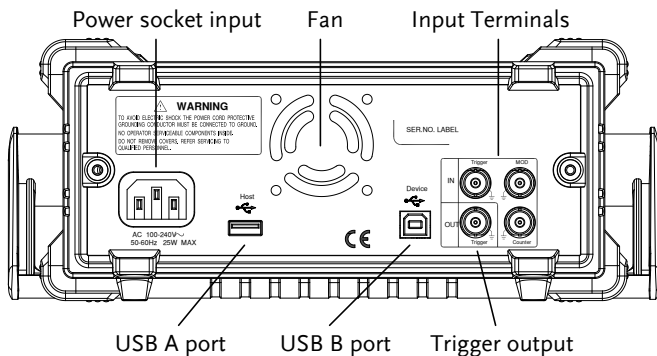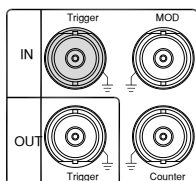
Trigger Input		External trigger input. Used to receive external trigger signals.
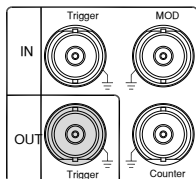
Trigger Output		Marker output signal. Used for Sweep, Burst and ARB mode only.
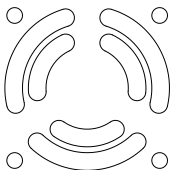
Fan		Fan.
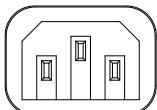
Power Input Socket		Power input: 100~240V AC 50~60Hz.

USB Host	Host	USB A Host port.
USB B Port	Device	The type-B USB connector is used to connect the function generator to a PC for remote control.
Counter Input	Trigger MOD IN OUT Trigger Counter	Frequency counter input.
MOD Input	Trigger MOD IN OUT Trigger Counter	Modulation input terminal.
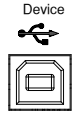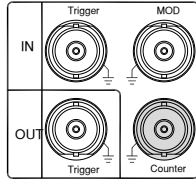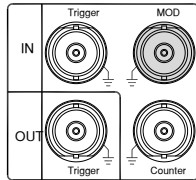
Display

Status Tabs

Parameter
Windows

Waveform
Display

Soft Menu
Keys

Parameter Windows	The Parameter display and edit window.
Status Tabs	Displays the current channel and setting status.
Waveform Display	Used to display the waveform
Soft Menu Keys	The function keys (F1~F5) beside the Soft Menu keys correspond to the soft keys.

Setting Up the function Generator

Background   This section describes how adjust the handle and
                  power up the function generator.

Adjusting the   Pull out the handle
Handle   sideways and rotate
                  it.
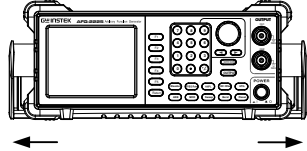
                  Place the AFG-2225
                  horizontally,
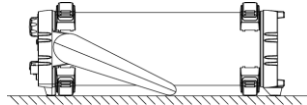
                  Or tilt the stand.
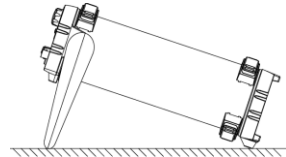
                  Place the handle
                  vertically to hand
                  carry.
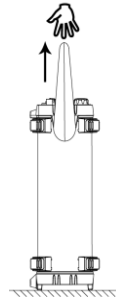
Power Up   1. Connect the power cord to
                     the socket on the rear panel.
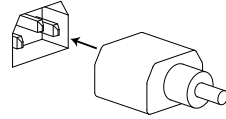
                  2. Turn on the power switch
                     on the front panel.
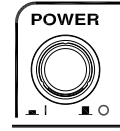
                  3. When the power switch is turned on the screen
                     displays the loading screen.

The function generator is now ready to be used.

QUICK REFERENCE

This chapter describes the operation shortcuts, built-in help and factory default settings. This chapter is to be used as a quick reference, for detailed explanations on parameters, settings and limitations, please see the user manual.

How to use the Digital Inputs

Background   The AFG-2225 has three main types of digital inputs: the number pad, arrow keys and scroll wheel.   The following instructions will show you how to use the digital inputs to edit parameters.

1. To select a menu item, press the corresponding function keys below (F1~F5). For example the function key F1 corresponds to the Soft key "Sine".

2. To edit a digital value, use the selector key to move the cursor to the digit that needs to be edited.

3. Use the scroll wheel to edit the parameter. Clockwise increases the value, counter clockwise decreases the value.
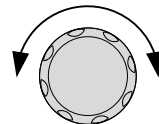
4. Alternatively, the number
   pad can be used to set the
   value of a highlighted
   parameter.
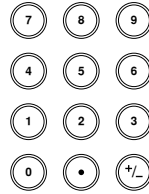
How to use the Help Menu

Background   Every key and function has a detailed description
                    in the help menu.

                    1. Press UTIL.   (UTIL)

                    2.   Press System (F3).   [System] (F3)

                    3. Press Help (F2).   [Help] (F2)
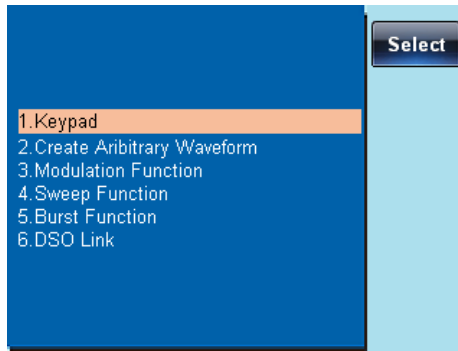
                    4. Use the scroll wheel to
                        navigate to a help item. Press
                        Select to choose the item.
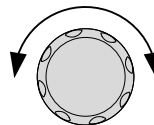
                    Keypad   Provides help on any front panel
                                        key that is pressed.

                    Create Arbitrary   Provides help on creating
                    Waveform   arbitrary waveforms.

                    Modulation   Explains how to create
                    Function   Modulated waveforms.

                    Sweep Function   Provides help on the Sweep
                                        function.

Burst Function   Provides help on the Burst
                    function.

DSO Link   Provides help on DSO link.

5. For example, select item 4 to see help on the
    sweep function.
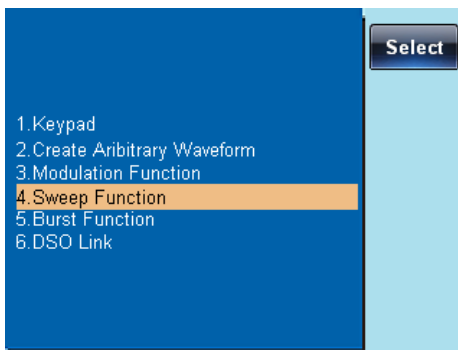
6. Use the scroll wheel to navigate the help
    information.
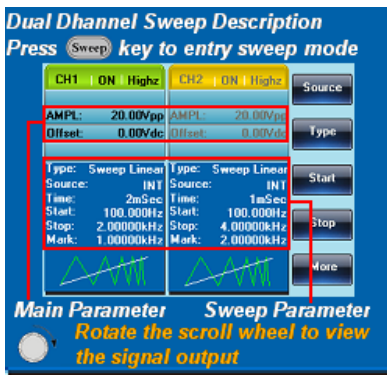
7. Press Return to return to the   Return
    previous menu.

Selecting a Waveform

Square Wave

Example: Square wave, 3Vpp, 75% duty cycle, 1kHz.

Output:

CH1

50Ω
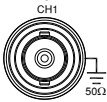
1. Press Waveform and select Square (F2).

`Waveform` `Square`

2. Press Duty (F1), 7 + 5 + %(F2).

`Duty` `7` `5` `%`

Input: N/A

3. Press Freq/Rate, 1 + kHz (F4).

`FREQ/Rate` `1` `kHz`

4. Press AMPL followed by, 3 + VPP (F5).

`AMPL` `3` `VPP`

5. Press the Output key.

`OUTPUT`

Ramp Wave

Example: Ramp Wave, 5Vpp, 10kHz, 50% Symmetry

Output:

CH1

50Ω
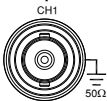
1. Press the Waveform key, and select Ramp (F4).

`Waveform` `Ramp`

2. Press SYM(F1), 5 + 0 +%(F2).

`SYM` `5` `0` `%`

Input: N/A

3. Press the Freq/Rate key then 1 + 0 + kHz (F4).

`FREQ/Rate` `1` `0` `kHz`

4. Press the AMPL key
    then 5 +VPP (F5).

    AMPL 5 VPP

5. Press the Output key.

    OUTPUT

Sine Wave

Example: Sine Wave, 10Vpp,100kHz

Output:

CH1

50Ω
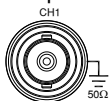
Input: N/A

1. Press the Waveform
    key and select Sine
    (F1).

    Waveform Sine

2. Press the Freq/Rate
    key, followed by 1 + 0
    +0 + kHz (F4).

    FREQ/Rate 1 0 0 kHz

3. Press the AMPL key,
    followed by 1 + 0
    +VPP (F5).

    AMPL 1 0 VPP

4. Press the output key.

    OUTPUT

Modulation

AM

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

Output:
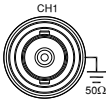
CH1

50Ω

1. Press the MOD key and select AM (F1).

[MOD] [AM]

2. Press Waveform and select Sine (F1).

[Waveform] [Sine]

Input: N/A

3. Press the Freq/Rate key, followed by 1 + kHz (F4).

[FREQ/Rate] [1] [kHz]

4. Press the MOD key, select AM (F1), Shape (F4), Square (F2).

[MOD] [AM] [Shape]
[Square]

5. Press the MOD key, select AM (F1), AM Freq (F3).

[MOD] [AM] [AM Freq]
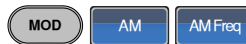
6. Press 1 + 0 + 0 + Hz (F2).

[1] [0] [0] [Hz]

7. Press the MOD key, select AM (F1), Depth (F2).

[MOD] [AM] [Depth]

8. Press 8 + 0 + % (F1).

[8] [0] [%]

9. Press MOD, AM (F1), Source (F1), INT (F1).

[MOD] [AM] [Source]
[INT]

10. Press the output key.   [**OUTPUT**]

FM

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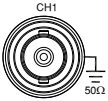
Output:

CH1
50Ω

1. Press the MOD key
   and select FM (F2).

   [MOD] [FM]

2. Press Waveform and
   select Sine (F1).

   [Waveform] [Sine]

Input: N/A

3. Press the Freq/Rate
   key, followed by 1 +
   kHz (F4).

   [FREQ/Rate] (1) [kHz]

4. Press the MOD key,
   select FM (F2), Shape
   (F4), Square (F2).

   [MOD] [FM] [Shape]
   [Square]

5. Press the MOD key,
   select FM (F2), FM
   Freq (F3).

   [MOD] [FM] [FM Freq]

6. Press 1 + 0 + 0 + Hz
   (F2).

   (1)(0)(0) [Hz]

7. Press the MOD key,
   select FM (F2), Freq
   Dev (F2).

   [MOD] [FM] [Freq Dev]

8. Press 1 + 0 + 0 + Hz
   (F3).

   (1)(0)(0) [Hz]

9. Press MOD, FM (F2), Source (F1), INT (F1).

| MOD | FM | Source |
| INT |

10. Press the Output key.   (OUTPUT)

FSK Modulation

Example: FSK modulation. 100Hz Hop frequency. 1kHz Carrier wave. Sine wave. 10 Hz Rate. Internal Source.
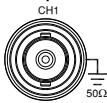
Output: 1. Press the MOD key
                    and select FSK (F3).

| MOD | FSK |

                 2. Press Waveform and
                    select Sine (F1).

| Waveform | Sine |

Input: N/A   3. Press the Freq/Rate
                    key, followed by 1 +
                    kHz (F4).

| FREQ/Rate | 1 | kHz |

                 4. Press the MOD key,
                    select FSK (F3), FSK
                    Rate (F3).

| MOD | FSK | FSK Rate |

                 5. Press 1 + 0 + Hz (F2).

| 1 | 0 | Hz |

                 6. Press the MOD key,
                    select FSK (F3), Hop
                    Freq (F2).

| MOD | FSK | Hop Freq |

                 7. Press 1 + 0 + 0 + Hz
                    (F3).

| 1 | 0 | 0 | Hz |

8. Press MOD, FSK (F3), Source (F1), INT (F1).

MOD FSK Source

INT

9. Press the output key.

OUTPUT

PM Modulation

Example: PM modulation. 800Hz sinusoidal carrier wave. 15 kHz modulating sine wave. 50° phase deviation. Internal Source.

Output:

CH1

50Ω
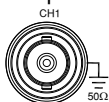
1. Press Waveform and select Sine (F1).

Waveform Sine

2. Press the MOD key and select PM (F4).

MOD PM

Input: N/A

3. Press the Freq/Rate key, followed by 8 + 0 + 0 + Hz (F3).

FREQ/Rate 8 0 0 Hz

4. Press the MOD key, select PM (F4), Shape (F4), Sine (F1).

MOD PM Shape

Sine

5. Press MOD, then PM (F4), PM Freq (F3).

MOD PM PM Freq

6. Press 1 + 5 + kHz (F3).

1 5 kHz

7. Press MOD, PM (F4), PM Dev (F2).

MOD PM PM Dev

8. Press 5 + 0 + Degree (F1).

5 0 Degree

9. Press MOD, PM (F4), Source (F1), INT (F1).

[MOD] [PM] [Source]
[INT]

10. Press the Output key.

[OUTPUT]

SUM Modulation

Example: SUM modulation. 100Hz modulating square wave, 1kHz sinusoidal carrier wave, 50% SUM amplitude, internal source.

Output:

CH1

50Ω
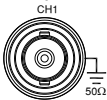
1. Press the MOD key, then SUM (F5).

[MOD] [SUM]

2. Press Waveform, and select Sine (F1).

[Waveform] [Sine]

Input: N/A

3. Press Freq/Rate followed by 1 + kHz (F4).

[FREQ/Rate] [1] [kHz]

4. Press the MOD key, SUM (F5), Shape (F4), Square (F2).

[MOD] [SUM] [Shape]
[Square]

5. Press the MOD key and select SUM (F5), SUM Freq (F3).

[MOD] [SUM] [SUM Freq]

6. Press 1 + 0 + 0 + Hz (F2).

[1] [0] [0] [Hz]

7. Press the MOD key and select SUM (F5), SUM Ampl (F2).

[MOD] [SUM] [SUM Ampl]

8. Press 5 + 0 + % (F1).

[5] [0] [%]

9. Press MOD, SUM (F5), Source (F1), INT (F1).
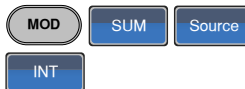
10. Press the Output key.

Sweep

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

Output:

CH1

50Ω

1. Press Sweep, Start (F3).

`MOD` `START`
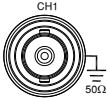
2. Press 1 + 0 + mHz (F2).

`1` `0` `mHz`

3. Press Sweep, Stop (F4).

`Sweep` `Stop`

Input: N/A

4. Press 1 + MHz (F5).

`1` `MHz`

5. Press Sweep, Type (F2), Log (F2).

`Sweep` `Type` `Log`
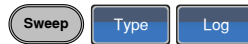
6. Press Sweep, More (F5), SWP Time (F1).

`Sweep` `More` `SWP Time`

7. Press 1 + SEC (F2).

`1` `SEC`

8. Press Sweep, More (F5), Marker (F4), ON/OFF (F2), Freq (F1).

`Sweep` `More` `Marker` `ON/OFF` `Freq`

9. Press 5 + 5 + 0 + Hz (F3).

`5` `5` `0` `Hz`

10. Press the Output key.

`OUTPUT`

11. Press Sweep, Source (F1), Manual (F3), Trigger (F1).
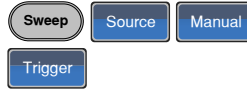
Burst

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:
CH1

50Ω
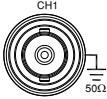
Input: N/A

1. Press FREQ/Rate 1
   kHz (F4).

   [FREQ/Rate] [1] [kHz]

2. Press Burst, N Cycle
   (F1), Cycles (F1).

   [Burst] [N Cycle] [Cycles]

3. Press 5 + Cyc (F2).

   [5] [Cyc]

4. Press Burst, N Cycle
   (F1), Period (F4).

   [Burst] [N Cycle] [Period]
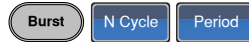
5. Press 1 +0 + msec
   (F2).

   [1] [0] [mSEC]

6. Press Burst, N Cycle
   (F1), Phase (F3).

   [Burst] [N Cycle] [Phase]
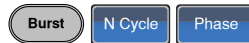
7. Press 0 + Degree (F2).

   [0] [Degree]

8. Press Burst, N Cycle
   (F1), TRIG set (F5),
   INT (F1).

   [Burst] [N Cycle] [TRIG set]
   [INT]

9. Press Burst, N Cycle
   (F1), TRIG set (F5),
   Delay (F4).

   [Burst] [N Cycle] [TRIG set]
   [Delay]
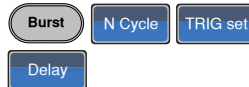
10. Press 1 + 0 + uSEC
    (F2).

    [1] [0] [uSEC]

11. Press Burst, N Cycle (F1), TRIG set (F5), TRIG out (F5), ON/OFF (F3), Rise (F1).

Burst	N Cycle	TRIG set
TRIG out	ON/OFF	Rise

12. Press the Output key.   OUTPUT

ARB

ARB–Add Built-In Waveform

Example: ARB Mode, Exponential Rise. Start 0, Length 100, Scale 327.

Output:

CH1

50Ω
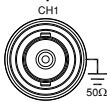
1. Press ARB, Built in (F3), Wave (F4), Math(F2), use the scroll wheel to select Exporise and then press Select(F5).

ARB	Built in	Wave
Math	Select	

2. Press Start (F1), 0 + Enter (F2), Return.

Start | 0 | Enter
(Return)

3. Press Length (F2), 100, Enter (F2), Return.
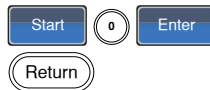
Length | 1 | 0 | 0 | Enter
(Return)
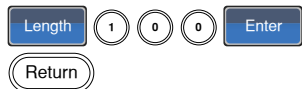
4. Press Scale (F3), 327, Enter (F2), Return, Done (F5).

Scale | 3 | 2 | 7 | Enter
(Return) | Done

ARB- Add Point

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

Output:

CH1

50Ω
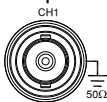
1. Press ARB, Edit (F2), Point (F1), Address (F1)

ARB	Edit	Point
Adress		
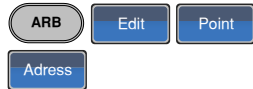
2. Press 4 + 0 + Enter (F2), Return
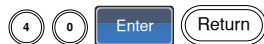
4 | 0 | Enter | (Return)

3. Press Data (F2), 3+0+0, Enter (F2).

| Data | 3 | 0 | 0 | Enter |

ARB- Add Line

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

Output:

CH1

50Ω
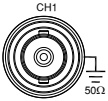
1. Press ARB, Edit (F2), Line (F2), Start ADD (F1).

| ARB | Edit | Line |
| Start ADD |

2. Press 1 + 0 + Enter (F2), Return.

| 1 | 0 | Enter | Return |

3. Press Start Data (F2), 3 + 0, Enter (F2), Return.

| Start Data | 3 | 0 | Enter |
| Return |
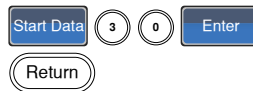
4. Press Stop ADD (F3), 5 + 0, Enter (F2), Return.

| Stop ADD | 5 | 0 | Enter |
| Return |
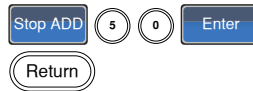
5. Press Stop Data (F4), 1 + 0 + 0, Enter (F2), Return, Done (F5).

| Stop Data | 1 | 0 | 0 |
| Enter | Return | Done |
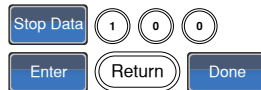
ARB– Output Section

Example: ARB Mode, Output ARB Waveform, Start 0, Length 1000.

Output:

CH1

50Ω

1. Press ARB, Output (F4).
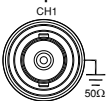
| ARB | Output |

2. Press Start (F1), 0 + Enter (F2), Return.

| Start | 0 | Enter |
| Return |
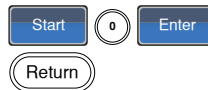
3. Press Length (F2), 1 + 0 + 0, Enter (F2), Return.

Utility Menu

Save

Example: Save to Memory file #5.

1. Press UTIL, Memory
    (F1), Store (F1).

    UTIL   Memory   Store

2. Choose a setting
    using the scroll wheel
    and press Done (F5).

    Done

Recall

Example: Recall Memory file #5.

1. Press UTIL, Memory
    (F1), Recall (F2).

    UTIL   Memory   Recall

2. Choose a setting
    using the scroll wheel
    and press Done (F5).

    Done

Frequency Counter

Frequency Counter

Example: Turn on the frequency counter. Gate time: 1 second.

Output: N/A

Input:

1. Press UTIL, Counter (F5).
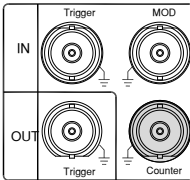
2. Press Gate Time (F1), and press 1 Sec (F3) to choose a gate time of 1 second.

3. Connect the signal of interest to the Frequency counter input on the rear panel.

coupling

Frequency Coupling

Example: Frequency Coupling

1. Press UTIL, Dual Chan (F4) to enter the coupling function.

   UTIL   Dual Chan

2. Press Freq Cpl (F1) to select the frequency coupling function.

   Freq Cpl

3. Press Offset (F2). The offset is the frequency difference between CH1 and CH2. Use the number keys or scroll wheel to enter the offset.

   Offset

Amplitude Coupling

Example: Amplitude Coupling

1. Press UTIL, Dual Chan (F4) to enter the coupling function.

   UTIL   Dual Chan

2. Press Ampl Cpl (F2), ON (F1) to select the amplitude coupling function.

   Ampl Cpl   On

3. Couples the amplitude and offset between both channels. Any changes in amplitude in the current channel are reflected in the other channel.

Tracking

Example: Tracking

1. Press UTIL, Dual Chan (F4) to enter the coupling function.

   `UTIL` `Dual Chan`

2. Press Tracking (F3), ON (F2) to turn on the tracking function.

   `Tracking` `On`

3. When tracking is turned on, parameters such as amplitude and frequency from the current channel are mirrored on the other channel.

Menu Tree

Conventions   Use the menu trees as a handy reference for the
                   function generator functions and properties. The
                   AFG-2225 menu system is arranged in a hierarchical
                   tree. Each hierarchical level can be navigated with the
                   operation or soft menu keys. Pressing the Return key
                   will return you to the previous menu level.

Waveform

ARB-Display

```
                          ┌─────────┐
                          │   ARB   │
                          └────┬────┘
                               │
                        ┌──────┴──────┐
                        │   Display   │
                        └──────┬──────┘
     ┌──────────┬──────────────┼──────────────┬──────────┐
┌─────────┐ ┌─────────┐ ┌───────────┐ ┌───────────┐ ┌──────────┐
│ Horizon │ │ Vertical│ │ Next Page │ │ Back Page │ │ Overview │
└────┬────┘ └────┬────┘ └───────────┘ └───────────┘ └──────────┘
     │           │
┌─────────┐ ┌─────────┐
│  Start  │ │   Low   │
└─────────┘ └─────────┘
   Clear       Clear
   Enter       Enter
┌─────────┐ ┌─────────┐
│ Length  │ │  High   │
└─────────┘ └─────────┘
   Clear       Clear
   Enter       Enter
┌─────────┐ ┌─────────┐
│ Center  │ │ Center  │
└─────────┘ └─────────┘
   Clear       Clear
   Enter       Enter
┌─────────┐ ┌─────────┐
│ Zoom in │ │ Zoom in │
│Zoom out │ │Zoom out │
└─────────┘ └─────────┘
```

ARB-Edit

```
                          ┌─────┐
                          │ ARB │
                          └─────┘
                             │
                        ┌─────────┐
                        │  Edit   │
                        └─────────┘
                             │
   ┌─────────┬─────────┬─────────┬─────────┬─────────┐
┌───────┐ ┌───────┐ ┌───────┐ ┌───────┐ ┌───────┐
│ Point │ │ Line  │ │ Copy  │ │ Clear │ │Protect│
└───────┘ └───────┘ └───────┘ └───────┘ └───────┘
┌─────────┐ ┌──────────┐ ┌───────┐ ┌───────┐ ┌───────┐
│ Address │ │Start ADD │ │ Start │ │ Start │ │  All  │
└─────────┘ └──────────┘ └───────┘ └───────┘ └───────┘
  Clear       Clear        Clear     Clear     Done
  Enter       Enter        Enter     Enter
┌─────────┐ ┌──────────┐ ┌────────┐ ┌────────┐ ┌───────┐
│  Data   │ │Start Data│ │ Length │ │ Length │ │ Start │
└─────────┘ └──────────┘ └────────┘ └────────┘ └───────┘
  Clear       Clear        Clear     Clear      Clear
  Enter       Enter        Enter     Enter      Enter
            ┌──────────┐ ┌──────────┐ ┌───────┐ ┌────────┐
            │ Stop ADD │ │ Paste To │ │ Done  │ │ Length │
            └──────────┘ └──────────┘ └───────┘ └────────┘
              Clear        Clear                  Clear
              Enter        Enter      ┌───────┐   Enter
            ┌──────────┐ ┌──────────┐ │  All  │ ┌────────┐
            │ Stop Data│ │   Done   │ └───────┘ │  Done  │
            └──────────┘ └──────────┘   Done    └────────┘
              Clear                            ┌──────────┐
              Enter                            │ Unprotect│
            ┌──────────┐                       └──────────┘
            │   Done   │                          Done
            └──────────┘
```

ARB- Built In

```
                      ┌─────┐
                      │ ARB │
                      └─────┘
                         │
                   ┌──────────┐
                   │ Built in │
                   └──────────┘
                         │
   ┌─────────┬─────────┬─────────┬─────────┬─────────┐
┌───────┐ ┌────────┐ ┌───────┐ ┌───────┐ ┌───────┐
│ Start │ │ Length │ │ Scale │ │ Wave  │ │ Done  │
└───────┘ └────────┘ └───────┘ └───────┘ └───────┘
  Clear      Clear      Clear
  Enter      Enter      Enter    ┌──────────┐
                                 │  Common  │
                                 │   Math   │
                                 │  Window  │
                                 │ Engineer │
                                 │  Select  │
                                 └──────────┘
```

ARB-Save

```
                    ARB
                     │
                   More
                     │
                   Save
                     │
  ┌──────────┬─────────┬─────────┬──────────┐
Start     Length    Memory     USB        Done
Clear     Clear        │         │
Enter     Enter     Select    Select
                              New Folder
                              Enter Char
                              Back Space
                              Save
                              New File
                              Enter Char
                              Back Space
                              Save
```

ARB-Load

```
                    ARB
                     │
                   More
                     │
                   Load
                     │
  ┌──────────┬─────────┬─────────┬──────────┐
Memory     USB        To        Done
  │          │         │
Select    Select    Clear
                    Enter
```

ARB-Output

```
              ARB

             Output

        Start      Length

        Clear       Clear
        Enter       Enter
```

MOD

```
                    MOD

    AM      FM      FSK      PM      SUM

  Source  Source  Source  Source  Source
   Int     Int     Int     Int     Int
   EXT     EXT     EXT     EXT     EXT

  Depth   Freq Dev  Hop Freq  Phase Dev  SUM Ampl
    %      uHz      uHz      Degree      %
  AM Freq  mHz      mHz                PM Freq  SUM Freq
           Hz       Hz
   mHz     kHz      kHz                  mHz     mHz
   Hz      MHz      MHz                  Hz      Hz
   kHz                                   kHz     kHz

  Shape   FM Freq  FSK Rate            Shape   Shape
   Sine    mHz      mHz                 Sine    Sine
  Square   Hz       Hz                 Square  Square
 Triangle  kHz      kHz               Triangle Triangle
  UpRamp            MHz                UpRamp  UpRamp
  DnRamp                               DnRamp  DnRamp
          Shape
           Sine
          Square
         Triangle
          UpRamp
          DnRamp
```

SWEEP

```
                    ┌─────────┐
                    │  SWEEP  │
                    └─────────┘
       ┌─────────┬─────────┬─────────┬─────────┬─────────┐
  ┌─────────┬─────────┬─────────┬─────────┬──────────────┐
  │ Source  │  Type   │  Start  │  Stop   │    More      │
  └─────────┴─────────┴─────────┴─────────┴──────────────┘
  ┌─────────┬─────────┬─────────┬─────────┬──────────────┐
  │   Int   │ Linear  │   uHz   │   uHz   │ Go to the    │
  │   EXT   │  Log    │   mHz   │   mHz   │ Sweep -      │
  ├─────────┤         │   Hz    │   Hz    │ More menu    │
  │ Manual  │         │   kHz   │   kHz   │              │
  └─────────┘         │   MHz   │   MHz   │              │
   Trigger            └─────────┴─────────┴──────────────┘
```

SWEEP- More

```
                    ┌─────────┐
                    │  Sweep  │
                    └─────────┘
                    ┌─────────┐
                    │  More   │
                    └─────────┘
       ┌───────────┬─────────┬─────────┬─────────┐
  ┌───────────┬─────────┬─────────┬─────────┐
  │ SWP Time  │  Span   │ Center  │ Marker  │
  └───────────┴─────────┴─────────┴─────────┘
  ┌───────────┬─────────┬─────────┬─────────┐
  │   mSEC    │   uHz   │   uHz   │  Freq   │
  │   SEC     │   mHz   │   mHz   │   uHz   │
  └───────────┤   Hz    │   Hz    │   mHz   │
              │   kHz   │   kHz   │   Hz    │
              │   MHz   │   MHz   │   kHz   │
              └─────────┴─────────┤   MHz   │
                                  └─────────┘
                                  ┌─────────┐
                                  │ ON/OFF  │
                                  └─────────┘
```

Burst- N Cycle

```
                      ┌────────┐
                      │ Burst  │
                      └────────┘
                          │
                    ┌───────────┐
                    │  N Cycle  │
                    └───────────┘
                          │
   ┌──────────┬───────────┼───────────┬────────────┐
┌────────┐┌─────────┐┌────────┐┌─────────┐┌────────────┐
│ Cycles ││ Infinite││ Phase  ││ Period  ││ TRIG Setup │
└────────┘└─────────┘└────────┘└─────────┘└────────────┘
    │                    │         │            │
┌────────┐          ┌────────┐┌────────┐┌────────────┐
│ Clear  │          │ Clear  ││ uSEC   ││    Int     │
│  Cyc   │          │ Degree ││ mSEC   │├────────────┤
└────────┘          └────────┘│  SEC   ││    EXT     │
                              └────────┘└────────────┘
                                          Rise
                                          Fall
                                        ┌────────────┐
                                        │   Manual   │
                                        └────────────┘
                                          Trigger
                                        ┌────────────┐
                                        │   Delay    │
                                        └────────────┘
                                          nSEC
                                          uSEC
                                          mSEC
                                          SEC
                                        ┌────────────┐
                                        │  TRIG out  │
                                        └────────────┘
                                          Rise
                                          Fall
                                          ON/OFF
```

Burst – Gate

```
              ┌────────┐
              │ Burst  │
              └────────┘
                   │
              ┌────────┐
              │  Gate  │
              └────────┘
                   │
           ┌───────────────┐
      ┌──────────┐   ┌────────┐
      │ Polarity │   │ Phase  │
      └──────────┘   └────────┘
           │              │
      ┌──────────┐   ┌────────┐
      │   Pos    │   │ Clear  │
      │   Neg    │   │ Degree │
      └──────────┘   └────────┘
```

UTIL

UTIL

| Memory | Cal. | System | Dual Chan | Counter |

| Store | Self Test | Language | Freq Cpl | Gate Time |

Store
Done

Self Test
Software

Language
English
中文

Freq Cpl
Off
Offset
Ratio

Gate Time
0.01 Sec
0.1 Sec
1 Sec
10 Sec

Recall
Done

Software
Version
Upgrade

Help
Select

Ampl Cpl
Off
On

Delete
Done

Beep
On
Off

Tracking
Off
On
Inverted

Delete All
Done

S_Phase

CH1/CH2

| Load | Phase | DSO Link |

Load
50 OHM
High Z

Phase
Phase
S_Phase
Degree

DSO Link
CH1
CH2
CH3
CH4
Search

Default Settings

The Preset key is used to restore the default panel
settings.

Preset

Output Settings	Function	Sine Wave
	Frequency	1kHz
	Amplitude	3.000 Vpp
	Offset	0.00V dc
	Output units	Vpp
	Output terminal	50Ω

Modulation (AM/FM/FSK/ PM/SUM)	Carrier wave	1kHz sine wave
	Modulation wave	100Hz sine wave
	AM depth	100%
	FM deviation	100Hz
	FSK hop frequency	100Hz
	FSK frequency	10Hz
	PM phase deviation	180°
	SUM amplitude	50%
	Modem status	Off

Sweep	Start/Stop frequency	100Hz/1kHz
	Sweep time	1s
	Sweep type	Linear
	Sweep status	Off

Burst	Burst frequency	1kHz
	Ncycle	1
	Burst period	10ms
	Burst starting phase	0˚
	Burst status	Off

System Settings	Power off signal	On
	Display mode	On
	Error queue	Cleared
	Memory settings	No change
	Output	Off

Trigger	Trigger source	Internal (immediate)

Calibration	Calibration Menu	Restricted

AFG-2225 Specifications

The specifications apply when the function generator is powered on for at least 30 minutes under +18°C~+28°C.

AFG-2225 models		CH1	CH2
Waveforms		Sine, Square, Ramp, Pulse, Noise, ARB	
Arbitrary Functions (1)			
	Sample Rate	120 MSa/s	
	Repetition Rate	60MHz	
	Waveform Length	4k points	
	Amplitude Resolution	10 bits	
	Non-Volatile Memory	4k points	
Frequency Characteristics			
Range	Sine	1uHz~25MHz	
	Square	1uHz~25MHz	
	Ramp	1MHz	
Resolution		1uHz	
Accuracy	Stability	±20 ppm	
	Aging	±1 ppm, per 1 year	
	Tolerance	≤1 mHz	
Output Characteristics			
Amplitude	Range	1mVpp to 10 Vpp (into 50Ω)	
		2mVpp to 20 Vpp (open-circuit)	
		1mVpp to 5 Vpp (into 50Ω) for 20MHz-25MHz	
		2mVpp to 10 Vpp (open-circuit) for 20MHz-25MHz	
	Accuracy	±2% of setting ±1 mVpp (at 1 kHz/into 50Ω without DC offset)	
	Resolution	1mV or 3 digits	
	Flatness	±1% (0.1dB) ≤100kHz	
		±3% (0.3 dB) ≤5MHz	
		±5% (0.4 dB) ≤12MHz	
		±10%(0.9dB) ≤25MHz	
		(sine wave relative to 1kHz/into 50Ω)	
	Units	Vpp, Vrms, dBm	
Offset	Range	±5 Vpk ac +dc (into 50Ω)	
		±10Vpk ac +dc (Open circuit)	
		±2.5 Vpk ac +dc (into 50Ω) for 20MHz-25MHz	
		±5Vpk ac +dc (Open circuit) for 20MHz-25MHz	
	Accuracy	2% of setting + 10mV+ 0.5% of amplitude	
Waveform Output	Impedance	50Ω typical (fixed)	
		> 10MΩ (output disabled)	
	Protection	Short-circuit protected	
		Overload relay automatically disables main output	

Sine wave Characteristics			
	Harmonic distortion	≤-55 dBc	DC ~ 200kHz, Ampl > 0.1Vpp
		≤-50 dBc	200kHz ~ 1MHz, Ampl > 0.1Vpp
		≤-35 dBc	1MHz ~ 5MHz, Ampl > 0.1Vpp
		≤-30 dBc	5MHz ~ 25MHz, Ampl > 0.1Vpp
Square wave Characteristics			
	Rise/Fall Time	≤25ns at maximum output. (into 50 Ω load)	
	Overshoot	5%	
	Asymmetry	1% of period +5 ns	
	Variable duty Cycle	1.0% to 99.0% ≤100kHz 10% to 90% ≤ 1MHz 50% ≤ 25MHz	
Ramp Characteristics			
	Linearity	< 0.1% of peak output	
	Variable Symmetry	0% to 100% (0.1% Resolution)	
Pulse Characteristics			
	Period	40ns~2000s	
	Pulse Width（2）	20ns~1999.9s	
	Overshoot Accuracy Jitter	<5% 0.1%+20ns 20ppm +10ns	
AM Modulation			
	Carrier Waveforms	Sine, Square, Ramp, Pulse,Arb	Sine, Square, Ramp, Pulse,Arb
	Modulating Waveforms	Sine, Square, Triangle, Upramp, Dnramp	Sine, Square, Triangle, Upramp, Dnramp
	Modulating Frequency	2mHz to 20kHz (Int) DC to 20kHz (Ext)	2mHz to 20kHz (Int) DC to 20kHz (Ext)
	Depth	0% to 120.0%	0% to 120.0%
	Source	Internal / External	Internal / External
FM Modulation			
	Carrier Waveforms	Sine, Square, Ramp,	Sine, Square, Ramp,
	Modulating Waveforms	Sine, Square, Triangle, Upramp, Dnramp	Sine, Square, Triangle, Upramp, Dnramp
	Modulating Frequency	2mHz to 20kHz (Int) DC to 20kHz (Ext)	2mHz to 20kHz (Int) DC to 20kHz (Ext)
	Peak Deviation	DC to Max Frequency	DC to Max Frequency
	Source	Internal / External	Internal / External
Sweep			
	Waveforms	Sine, Square, Ramp,	Sine, Square, Ramp,
	Type	Linear or Logarithmic	Linear or Logarithmic
	Start/Stop Freq	1uHz to Max Frequency	1uHz to Max Frequency

	Sweep Time	1ms to 500s	1ms to 500s
	Source	Internal / External/Manual	Internal / External/Manual
FSK			
	Carrier Waveforms	Sine, Square, Ramp,Pulse	Sine, Square, Ramp,Pulse
	Modulating Waveforms	50% duty cycle square	50% duty cycle square
	Modulation Rate	2mHz to 100 kHz (INT) DC to 100 kHz(EXT)	2mHz to 100 kHz (INT) DC to 100 kHz(EXT)
	Frequency Range	1uHz to Max Frequency	1uHz to Max Frequency
	Source	Internal / External	Internal / External
PM			
	Carrier Waveforms	Sine, Square, Ramp	Sine, Square, Ramp
	Modulating Waveforms	Sine, Square, Triangle, Upramp, Dnramp	Sine, Square, Triangle, Upramp, Dnramp
	Modulation Frequency	2mHz to 20kHz (Int) DC to 20kHz (Ext)	2mHz to 20kHz (Int) DC to 20kHz (Ext)
	Phase deviation	0˚ to 360˚	0˚ to 360˚
	Source	Internal / External	Internal / External
SUM			
	Carrier Waveforms	Sine, Square, Ramp,Pulse,Noise	Sine, Square, Ramp,Pulse,Noise
	Modulating Waveforms	Sine, Square, Triangle, Upramp,Dnramp	Sine, Square, Triangle, Upramp,Dnramp
	Modulation Frequency	2mHz to 20kHz (Int) DC to 20kHz (Ext)	2mHz to 20kHz (Int) DC to 20kHz (Ext)
	SUM Depth	0% to 100.0%	0% to 100.0%
	Source	Internal / External	Internal / External
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	
External Modulation Input			
	Type	For AM, FM, PM, SUM	
	Voltage Range	±5V full scale	
	Input Impedance	10kΩ	
	Frequency	DC to 20kHz	
Trigger Output			
	Type	For Burst, Sweep, Arb	
	Level	TTL Compatible into 50Ω	
	Pulse Width	>450ns	
	Maximum Rate	1MHz	
	Fan-out	≥4 TTL Load	
	Impedance	50Ω Typical	
Dual Channel Function			

	Phase（3）	-180˚ ~180˚	-180˚ ~ 180˚
		Synchronize phase	Synchronize phase
	Track	CH2=CH1	CH1=CH2
	Coupling	Frequency(Ratio or Difference)	Frequency(Ratio or Difference)
		Amplitude & DC Offset	Amplitude & DC Offset
	Dsolink	√	√
Burst			
	Waveforms	Sine, Square, Ramp,Arb	Sine, Square, Ramp,Arb
	Frequency	1uHz~15 MHz(Sine) 1uHz~15 MHz (Squa) 1uHz~1 MHz (Ramp)	1uHz~15 MHz(Sine) 1uHz~15 MHz (Squa) 1uHz~1 MHz (Ramp)
	Burst Count	1 to 65535 cycles or Infinite	1 to 65535 cycles or Infinite
	Start/Stop Phase	-360 to +360	-360 to +360
	Internal Period	1ms to 500s	1ms to 500s
	Gate Source	External Trigger	External Trigger
	Trigger Source	Single, External or Internal Rate	Single, External or Internal Rate
Trigger Delay	N-Cycle, Infinite	0s to 655350ns	0s to 655350ns
Frequency Counter			
	Range	5Hz to 150MHz	
	Accuracy	Time Base accuracy±1count	
	Time Base	±20ppm (23˚C ±5˚C) after 30 minutes warm up	
	Resolution	The maximum resolution is: 100nHz for 1Hz, 0.1Hz for 100MHz.	
	Input Impedance	1kΩ/1pf	
	Sensitivity	35mVrms ~ 30Vms (5Hz to 150MHz)	
Save/Recall		10 Groups of Setting Memories	
Interface		USB (Host&Device)	
Display		TFT	
General Specifications			
	Power Source	AC100~240V, 50~60Hz	
	Power Consumption	25 W (Max)	
	Operating Environment	Temperature to satisfy the specification : 18 ~ 28˚C Operating temperature : 0 ~ 40˚C Relative Humidity: ＜ 80%, 0 ~ 40˚C Installation category : CAT II	
	Operating Altitude	2000 Meters	
	Storage Temperature	-10~70˚C, Humidity: ≤70%	
	Dimensions (WxHxD)	266(W) x 107(H) x 293(D) mm	
	Weight	Approx. 2.5kg	
	Accessories	GTL-101× 2	

Quick Start Guide ×1
CD (user manual + software) ×1
Power cord×1

(1)　Filter bandwidth 20MHz.-3dB

(2)　Pulse amplitude will decrease when pulse width is <50ns

(3)　Square and Pulse can not be change, Phase is 0°

EC Declaration of Conformity

We

GOOD WILL INSTRUMENT CO., LTD.
declare that the below mentioned product
Type of Product: 20MHz True Dual Channel Arbitrary Function
              Generator
Model Number: AFG-2225

is 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 (2014/30/EU) and Low Voltage Directive (2014/35/EU).

For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Directive, the following standards were applied:

◎ **EMC**	
EN 61326-1: Electrical equipment for measurement, control and EN 61326-2-1: laboratory use –– EMC requirements (2013)	
Conducted & Radiated Emission EN 55011: 2009+A1: 2010	Electrical Fast Transients EN 61000-4-4: 2012
Current Harmonics EN 61000-3-2: 2014	Surge Immunity EN 61000-4-5: 2006
Voltage Fluctuations EN 61000-3-3: 2013	Conducted Susceptibility EN 61000-4-6: 2014
Electrostatic Discharge EN 61000-4-2: 2009	Power Frequency Magnetic Field EN 61000-4-8: 2010
Radiated Immunity EN 61000-4-3: 2006+A1: 2008+A2: 2010	Voltage Dip/ Interruption EN 61000-4-11: 2004
Low Voltage Equipment Directive 2014/35/EU	
Safety Requirements	**IEC 61010-1: 2010 (Third Edition)**

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