## **Multi-Channel Function Generator**

MFG-2000 Series

QUICK START GUIDE GW INSTEK PART NO. 82MF-2K000MA1



ISO-9001 CERTIFIED MANUFACTURER

**G**<sup>W</sup>**INSTEK** 

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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: Identifies conditions or practices that could result in injury or loss of life.
	Caution: Identifies conditions or practices that could result in damage to the function generator or to other objects or property.
<u>Å</u>	DANGER High Voltage
Ĺ	Attention: Refer to the Manual
	Protective Conductor Terminal
<u> </u>	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	• Do not place heavy objects on the instrument.
	<ul> <li>Do not place flammable objects on the instrument.</li> </ul>
	<ul> <li>Avoid severe impact or rough handling that may damage the function generator.</li> </ul>
	• 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 (Third Edition)specifies the measurement categories and their requirements as follows. The MFG-2000 falls under category II.
	• Measurement category IV is for measurement performed at the source of a low-voltage installation.
	<ul> <li>Measurement category III is for measurement performed in a building installation.</li> </ul>
	<ul> <li>Measurement category II is for measurement performed on circuits directly connected to a low voltage installation.</li> </ul>
	<ul> <li>Measurement category I is for measurements performed on circuits not directly connected to Mains.</li> </ul>

Power Supply	<ul> <li>AC Input voltage: 100 ~ 240V AC, 50 ~ 60Hz. Or 100 ~ 120V AC, 220 ~ 240V AC, 50 ~ 60Hz (With power amplifier)</li> <li>Connect the protective grounding conductor of the AC power cord to an earth ground to prevent electric shock.</li> </ul>			
	Fuse type: T0.5A/250V. T1A/250V(With power amplifier).			
	<ul> <li>Only qualified technicians should replace the fuse.</li> </ul>			
	• 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	• Disconnect the power cord before cleaning the function generator.			
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	<ul> <li>Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below) and avoid strong magnetic fields.</li> </ul>			
	• Relative Humidity: < 80%			
	• Altitude: < 2000m			
	• Temperature: 0°C to 40°C			

	(Pollution Degree) EN 61010-1:2010(Third Edition)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	
	<ul> <li>Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.</li> </ul>	
	<ul> <li>Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.</li> </ul>	
	<ul> <li>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.</li> </ul>	
Storage	Location: Indoor	
environment	• 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

 $\sim$  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 0.75mm<sup>2</sup> 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.

## **G**ETTING STARTED

The Getting started chapter introduces the function generator's main features, appearance, set up procedure and power-up.

### Main Features

Model

wouch						
MFG-2000 series specific functions						
	CH1	CH2	25MHz	RF		Modulation
	Function With 200MSa/sARB	Function With 200MSa/sARB	Pulse Generator	Generator (function with ARB)	Power Amplifier	/Sweep/Burst/ Frequency.Counter
MFG-2110	●10MHZ		•			
MFG-2120	●20MHZ		•			
MFG-2120MA	●20MHZ		•		•	•
MFG-2130M	•30MHZ		•			•
MFG-2160MF	●60MHZ		•	•160MHZ		•
MFG-2160MR	●60MHZ		•	•320MHZ		•
MFG-2230M	•30MHZ	•30MHZ	•			•
MFG-2260M	●60MHZ	●60MHZ	•			•
MFG-2260MFA	●60MHZ	●60MHZ	•	•160MHZ	•	•
MFG-2260MRA	•60MHZ	●60MHZ	•	•320MHZ	•	•

Performance

- DDS Function Generator series
- $1\mu Hz$  high frequency resolution maintained at full range
- 20ppm frequency stability
- Arbitrary Waveform Capability
- 200 MSa/s sample rate
- 100 MSa/s repetition rate
- 16k-point waveform length
- 10 groups of 16k waveform memories
- True waveform output to display

	<ul> <li>User-defined output section</li> </ul>
	User-defined marker output section
	<ul> <li>DWR (Direct Waveform Reconstruction) capability</li> </ul>
	• Ability to edit waveforms without a PC
	<ul> <li>-60dBc low distortion sine wave</li> </ul>
Features	• Sine, Square, Ramp, Pulse, Noise waveforms
	<ul> <li>Internal and external LIN/LOG sweep with marker output</li> </ul>
	• Int/Ext AM, FM, PM, FSK, SUM, PWM modulation
	<ul> <li>Burst function with internal and external triggers</li> </ul>
	• 42Vpk signal ground chassis isolation
	<ul> <li>Pulse waveform with configurable rise times &amp; fall times</li> </ul>
	• Store/recall 10 groups of setting memories
	Output overload protection
Interface	<ul> <li>USB interface as standard, LAN interface(MFG- 22XX only)</li> </ul>
	• 4 inch Color TFT LCD (480 X 272) graphical user interface
	<ul> <li>AWES (Arbitrary Waveform Editing Software) PC software</li> </ul>

## Panel Overview

#### MFG-2260MRA/2260MFA Front Panel



#### MFG-2160MR/2160MF Front Panel



#### MFG- 2120MA/2130M Front Panel



#### MFG- 2110/2120 Front Panel



#### MFG- 2260M/2230M Front Panel



#### LCD Display TFT color display, 480 x 272 resolution.

Function Keys F1~F6	<b>F</b> 1	Activates functions that appear on the bottom of the LCD screen.
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.
	AMPL	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, system setting, Dual channel functions 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	$\bigcirc$	The Output key is used to turn on or off the waveform output.
Channel Select Keys	(CH1/CH2) (Pulse/RF)	The channel select key is used to switch between the four output channels.
Output		CH1: Channel 1 output port
ports		CH2: Channel 2 output port
		Pulse: Pulse output port
		RF: RF output port

Power Button	Turns the power on or off.
USB Host	USB type-A host port.
Arrow Keys	Used to select digits when editing parameters.
Scroll Wheel	The scroll wheel is used to edit values and parameters. Decrease Increase

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Keypad	The digital keypad is used to enter values and parameters. The keypad is often used in conjunction with the arrow keys and variable knob.

#### MFG-2260MRA/2260MFA Rear Panel



#### MFG-2120MA Rear Panel



#### MFG-2160MR/2160MF/2130M Rear Panel



#### MFG-2260M/2230M Rear Panel



#### MFG-2110/2120 Rear Panel



Power Input Socket	AC 100/120V AC 220/240V 50/60Hz BOW MAX	Power input: 100~240V AC 50~60Hz. Or 100~120V AC 220~240V AC
		50~60Hz.
Power Switch	AC Selector 220V 100V 240V 120V	Selects AC voltage: 100V~120V Or 220V~240V.
LAN Port		The LAN port is used for remote control over a network (MFG-22XX only)
USB Device Port	***	USB type-B device port is used to connect the function generator to a PC for remote control.
Counter Input	Counter IN <42 Vpk	Frequency counter input.
MOD Input	MOD IN	Modulation input terminal.
Power Amplifier in		Power Amplifier input port

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Status Tabs	Displays the current channel and setting status.		
Waveform Display	Used to display the waveform		
Soft Menu Keys	The function keys (F1~F6) under the LCD display correspond directly to the soft menu keys.		

## Setting Up the function Generator

Background	This section describes how to adjust the handle and power up the function generator.		
Adjusting the Handle	Pull out the handle sideways and rotate it.		
	Place the MFG-2000 horizontally,	The second secon	
	Or tilt the stand.		
	Place the handle vertically to hand carry.		



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.

# 

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 operation chapters.

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### How to use the Digital Inputs

Background The MFG-2000 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.

> To select a menu item, press the corresponding function keys below (F1~F6). For example the function key F1 corresponds to the Soft key "Sine".



2. To edit a digital value, use the arrow keys 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 (F	4) System F4	
	3. Press Help (F3)	Help F3	
	<ol> <li>Keypad</li> <li>Create Aribitrary Wavefor</li> <li>Modulation Function</li> <li>Sweep Function</li> <li>Burst Function</li> <li>DSO Link</li> <li>Hardcopy</li> </ol>	m	
	Select	Return	
	4. Use the scroll wl navigate to a hel Select to choose	neel to p item. Press the item.	
	Keypad	Provides help on any front panel key that is pressed.	
	Create Arbitrary Waveform	Provides help on creating arbitrary waveforms.	
	Modulation Function	Explains how to create 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.
Hardcopy	Explains how to use the Hardcopy function.

5. For example, select item 4 to see help on the sweep functions.



6. Use the scroll wheel to navigate the help information.



7. Press Return to return to the previous menu.



## Selecting a Waveform

#### Square Wave

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

Output: 1. Press Waveform and ( Wave Square select Square (F2). 2. Press Duty (F1), 7 + 5 Duty 5 + %(F5). 3. Press Freq/Rate, 1 + Input: N/A kHz FREQ/Ra kHz (F5). 4. Press AMPL followed VPF AMPI by, 3 + VPP (F6). 5. Press the Output key.

#### Ramp Wave

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

Output:



Input: N/A

- 1. Press the Waveform key, and select Ramp (F5).
- 2. Press SYM(F1), 5 + 0 +%(F5).
- 3. Press the Freq/Rate key then 1 + 0 + kHz (F5).





- 4. Press the AMPL key then 5 +VPP (F6).
- AMPL 5 Vpp
- 5. Press the Output key.

#### Sine Wave

Example: Sine Wave, 10Vpp,100kHz

Output:



Input: N/A

- Press the Waveform key and select Sine (F1).
- Press the Freq/Rate key, followed by 1 + 0 +0 + kHz (F5).
- Press the AMPL key, followed by 1 + 0 +VPP (F6).
- 4. Press the output key.



0

0

kHz

Sine

Wavefo

(FREQ/Ra

1



## Modulation

#### AM

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



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

#### ASK

Example: ASK modulation. 50% duty cycle. 1kHz sine carrier wave. 10Hz rate . Internal source.

Output:	1.	Press MOD and then select ASK(F2).	MOD ASK
	2.	Press Waveform and select Sine(F1).	Waveform
Input: N/A	3.	Press the Freq/Rate key, followed by 1 + kHz (F5).	(FREORBARE) 1 KHz
	4.	Press the MOD key, select ASK(F2), ASK Rate (F3).	ASK ASK Rate
	5.	Press 1+ 0 + Hz (F2)	1 0 Hz
	6.	Press the MOD key, select ASK(F5), ASK Ampl(F2).	MOD ASK Ampl
	7.	Press 5+0+0+mVpp(F5).	5 0 0 mvpp



#### FΜ

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

O	u	tp	u	t:	
		~	_		



Input:	N/A
--------	-----

- 1. Press the MOD key and select FM (F2).
- 2. Press Waveform and select Sine (F1).
- 3. Press the Freq/Rate key, followed by 1 + kHz (F5).
- 4. Press the MOD key, select FM (F2), Shape (F4), Square (F2).
- 5. Press the MOD key, select FM (F2), FM Freq (F3).
- 6. Press 1 + 0 + 0 + Hz (F2).
- 7. Press the MOD key, select FM (F2), Freq Dev (F2).





ΕM

Freq Dev

MOD

8. Press 1 + 0 + 0 + Hz (F3).
9. Press MOD, FM (F2), Source (F1), INT (F1).
10. Press the Output key.

#### FSK

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
Input: N/A	3.	Press the Freq/Rate key, followed by 1 + kHz (F5).	(FREO/Rate) 1 KHz
	4.	Press the MOD key, select FSK (F3), FSK Rate (F5).	MOD FSK FSK Rate
	5.	Press 1 + 0 + Hz (F5).	1 0 Hz
	6.	Press the MOD key, select FSK (F3), Hop Freq (F5).	MOD FSK Hop Freq



#### ΡM

Example: PM modulation. 800Hz sinusoidal carrier wave. 15 kHz modulating sine wave. 180° phase deviation. Internal Source.




#### PSK

Example: PSK modulation. 50% phase deviation. 1kHz sine carrier wave. 10Hz PSK rate. Internal source.



7. Press 5+ 0 + %(F3)



- 8. Press MOD, PSK(F6), Source (F1), INT (F1)
- 9. Press the Output key

#### PWM

Example: PWM modulation. 800Hz carrier, 15kHz modulated sine wave. 50% duty cycle. Internal source.

Output:	1.	Press Waveform and select Square (F2)	Waveform
	2.	Press MOD and select PWM(F6)	(MOD) PWM
Input: N/A	3.	Press the Freq/Rate key, followed by 8+0+0 Hz (F4).	(FREQRAte) (8) (0) (0) Hz
	4.	Press the MOD key, select PWM (F6), Shape (F4), Sine(F1).	MOD PWM Shape Sine
	5.	Press MOD, select PWM(F6),PWM Freq(F3)	MOD PWM PWM Freq
	6.	Press 1 + 5+ kHz (F3).	1 5 kHz



### SUM

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

Output:	1.	Press the MOD key, then SUM (F5).	MOD SUM
	2.	Press Waveform, and select Sine (F1).	Waveform
Input: N/A	3.	Press Freq/Rate followed by 1 + kHz (F5).	(FREQ/Rate) 1 kHz
	4.	Press the MOD key, SUM (F5), Shape (F4), Square (F2).	MCD SUM Shape Square
	5.	Press the MOD key and select SUM (F5), SUM Freq (F3).	SUM SUM Freq

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0

SUM

SUM

Hz

SUM Ampl

Source

- 6. Press 1 + 0 + 0 + Hz (F2).
- 7. Press the MOD key and select SUM (F5), SUM Ampl (F2).
- 8. Press 5 + 0 + % (F1).
- Press MOD, SUM (F5), Source (F1), INT (F1).
- 10. Press the Output key.



5

MOD

INT

0

## Sweep

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

Output:	1.	Press Sweep, Start (F3).	Sweep Start
	2.	Press 1 + 0 + mHz (F2).	1 0 mHz
	3.	Press Sweep, Stop (F4).	Sweep
Input: N/A	4.	Press 1 + MHz (F5).	1 MHz
	5.	Press Sweep, Type (F2), Log (F2).	Sweep Type Log
	6.	Press Sweep, SWP Time (F5).	Sweep SWP Time
	7.	Press 1 + SEC (F2).	1 SEC
	8.	Press Sweep, More (F6), Marker (F3), ON/OFF (F2), Freq (F1).	Sweep More Marker
	9.	Press 5 + 5 + 0 + Hz (F3).	5 5 0 Hz
	10	Press the Output key.	$\bigcirc$

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



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



12. Press the Output key.

# ARB

### ARB-Add Built-In Waveform

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

Output: 42  Vpk $50\Omega$	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
	2.	Press Start (F1), 0 + Enter (F2), Return.	Start Return	0 Enter
	3.	Press Length (F2), 100, Enter (F2), Return.	Length	1 0 0 Return
	4.	Press Scale (F3), 327, Enter (F2), Return, Done (F5).	Scale Enter	3 2 7 Return Done

### 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.



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.
- 3. Press Start Data (F2), 3 + 0, Enter (F5), Return.
- 4. Press Stop ADD (F3), 5 + 0, Enter (F5), Return.
- 5. Press Stop Data (F4), 1 + 0 + 0, Enter (F5), Return, Done (F5).



### **ARB-Output Section**

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

Output:



- 1. Press ARB, Output (F6).
- 2. Press Start (F1), 0 + Enter (F5), Return.



3. Press Length (F2), 1 + 0 + 0, Enter (F5), Return.



## ARB-Output N Cycle

Example: ARB Mode, Output N Cycle, Start 0, Length 1000, N Cycle 10.

Output:	1.	Press ARB, Output(F6).	ARBOUTput
	2.	Press Start(F1), 0+Enter (F5), Return(F6).	Start 0 Enter
	3.	Press Length(F5), 1+0+0, Enter(F5), Return(F6).	Length 1 0 0
	4.	Press N Cycle (F4).	N Cycle
	5.	Press Cycle(F1), 1+0.	Cycles 1 0
	6.	Press Trigger(F5) to trigger the output once.	Trigger

### ARB-Output Infinite Cycles

Example: ARB Mode, output N cycle, start 0, length 1000, cycles infinite.

Output: 1. Press ARB, Output ARB Output(F6). 2. Press Start (F1), 0 + Start Enter 0 Enter (F5), Return Return(F6). 3. Press Length (F2), Length 1+0+0+0, Enter (F5), Return (F6). Return 4. Press Infinite(F5), Infinite Return Return(F6).

#### **ARB–Output Marker**

Example: ARB mode, output marker, Start 30, Length.

Output:1. Press ARB, Output<br/>(F6), Marker (F3).OutputMarker<br/>Marker42 Vpk2. Press Start (F1), 3+0,<br/>Enter (F5), Return.Start303. Press Length (F2), 8 + <br/>0, Enter (F5), Return.Start80EnterReturnReturn80

# Utility Menu

### Save

Example: Save to Memory file #5.

- 1. Press UTIL, Memory (F1), Store (F1).
- 2. Choose a setting using the scroll wheel and press Done (F5).



Memory

UTIL

Store

### Recall

Example: Recall Memory file #5.

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



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



# Menu Tree

Conventions Use the menu trees as a handy reference for the function generator functions and properties. The MFG-2000 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–Edit



ARB–Built In



### ARB-Save



ARB-Load



ARB-Output



MOD



#### SWEEP



### SWEEP- More



Burst-N Cycle



Burst–Gate



UTIL



## CH1/CH2



### CH3/RF



Preset

# **Default Settings**

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

Output Settings	Function	Sine Wave
	Frequency	1kHz
	Amplitude	3.000 Vpp
	Offset	0.00V dc
	Output units	Vpp
	Output terminal	50Ω
Modulation		
(AM/ASK/FM/FS K/PM/PSK/SUM)	Carrier wave	1kHz sine wave
	Modulation wave	100Hz sine wave
	AM depth	100%
	ASK amplitude	500mVpp
	ASK frequency	10Hz
	FM deviation	100Hz
	FSK hop frequency	100Hz
	FSK frequency	10Hz
	PM phase deviation	180°
	PSK phase	180°
	PSK frequency	10Hz
	SUM amplitude	50%
	Modem status	Off
PWM Modulation	Carrier wave	1kHz Square wave
	Modulation wave	20kHz sine wave

	PWM duty cycle	50%
	Modem status	Off
Sweep	Start/Stop frequency	100Hz/1kHz
	Sweep time	1ms
	Sweep type	Linear
	Sweep status	Off
Burst	Burst frequency	1kHz
	Ncycle	1
	Burst period	10ms
	Burst starting phase	0°
	Burst status	Off
	D (( ) 1	2
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

# MFG-2000 Series Specifications

The specifications apply when the function generator is powered on for at least 30 minutes under  $+18^{\circ}C^{+28}$ °C.

MFG-2000 series specific functions						
	CH1 Function With 200MSa/sARB	CH2 Function With 200MSa/sARB	25MHz Pulse Generator	RF Generator (function with ARB)	Power Amplifier	Modulation /Sweep/Burst/Fr equency.Counter
MFG-2110	•10MHZ		•			
MFG-2120	●20MHZ		•			
MFG-2120MA	●20MHZ		•		•	•
MFG-2130M	•30MHZ		•			•
MFG-2160MF	●60MHZ		•	•160MHZ		•
MFG-2160MR	●60MHZ		•	•320MHZ		•
MFG-2230M	•30MHZ	•30MHZ	•			•
MFG-2260M	●60MHZ	●60MHZ	•			•
MFG-2260MFA	●60MHZ	●60MHZ	•	•160MHZ	•	•
MFG-2260MRA	●60MHZ	●60MHZ	•	•320MHZ	•	•

#### CH1/CH2

-			
Arbitrary Functions	ARB function	Built-in	
	Sample Rate	200 MSa/s	
	Repetition Rate	100MHz	
	Waveform Length	16k points	
	Amplitude Resolution	14 bits	
	Non-Volatile Memory	10sets 16k poin	ts(1)
	User-defined output section	From point 2~10	6384 (optional)
	User-defined output marker section	er From point 2 ~ 16384(option	
	Output mode	1~1048575 cycle mode	es or infinite
Frequency Characteristics			
	Range	Sine 60	MHz(max)
		Square 25	MHz(max)
		Triangle, Ramp	1MHz
	Resolution	Triangle, Ramp	1MHz 1µHz
	Resolution Accuracy Stability	Triangle, Ramp ±20 ppm	1MHz 1μHz
	Resolution Accuracy Stability Aging	Triangle, Ramp ±20 ppm ±1 ppm, per 1 y	1MHz 1μHz ear

	Tolerance	≤1µHz
Output Characteristics(2)		
	Amplitude Range	1mVpp to 10 Vpp (into 50Ω) 2mVpp to 20 Vpp (open-circuit)
	Accuracy	±2% of setting ±1 mVpp (at 1 kHz/into 50Ω without DC offset))
	Resolution	0.1mV or 4 digits
	Flatness	$\pm$ 1% (0.1dB) ≤1MHz $\pm$ 3% (0.3dB) ≤50 MHz $\pm$ 10% (0.9dB) ≤160MHz $\pm$ 30% (3dB) ≤320MHz (sinewave relative to 1 kHz/into 50Ω)
	Units	Vpp, Vrms, dBm
Offset	Range	±5 Vpk ac +dc (into 50Ω) ±10Vpk ac +dc (Open circuit)
	Accuracy	1% of setting + 5mV+ 0.5% of amplitude
Waveform Output		
	Impedance	50Ω typical (fixed) >10MΩ (output disabled)
	Protection	Short-circuit protected Overload relay automatically disables main output
	Ground Isolation	42Vpk max
Sync Output	Range	TTL-compatible into>1k $\Omega$
	Impedance	50 $\Omega$ standard
	Ground Isolation	42Vpk max
Sine wave Characteristics(3)		
	Harmonic distortion Total harmonic distortion	-60 dBc DC~200kHz, Ampl>0.1 Vpp -55 dBc 200kHz~1 MHz, Ampl>0.1 Vpp -45 dBc 1MHz~10 MHz, Ampl>0.1Vpp -30 dBc 10MHz~320MHz, Ampl>0.1Vpp < 0.1% (Ampl>1)(cp)DC 100
	I otal flarmonic distortion	< 0.1% (Ampi>1Vpp)DC~100

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		kHz
Square wave Characteristics		
	Rise/Fall Time	<15ns
	Overshoot	<5%
	Asymmetry	1% of period +5 ns
	Variable duty Cycle	0.01% to 99.99%(limited by the current frequency setting)
	Jitter	20ppm+500ps(4)
Ramp Characteristics		
	Linearity	< 0.1% of peak output
	Variable Symmetry	0% to 100%
Pulse Characteristics		
	Frequency	1uHz~25MHz
	Pulse Width	≧20nS(limited by the current frequency setting)
	Variable duty Cycle	0.01%~99.99%(limited by the current frequency setting)
	Overshoot	<5%
	Jitter	20ppm+500ps(4)
Pulse Generator		
	Amplitude	1mVpp to 2.5 Vpp (into 50Ω) 2mVpp to 5 Vpp (open-circuit)
	Offset	±1 Vpk ac +dc (into 50Ω) ±2Vpk ac +dc (Open circuit)
	Frequency	1uHz~25MHz
	Pulse Width	20nS~999.9ks(limited by the current frequency setting)
	Variable duty Cycle	0.01%~99.99%(limited by the current frequency setting)
	Leading and Trailing Edge Time(5)	10nS~20S(1ns resolution) (limited by the current frequency and pulse width settings)
	Overshoot	<5%
	Jitter	100ppm+500ps(4)
RF Generator		
Arbitrary Functions		

	ARB function	Built-in
	Sample Rate	200 MSa/s
	Repetition Rate	100MHz
	Waveform Length	16k points
	Amplitude Resolution	14 bits
	User-defined output section	From point 2~16384 (optional)
	Jitter	20ppm+5ns
Frequency Characteristics		
	Range	Sine 1uHz~160MHz (MFG-2XXXMF) 1uHz~320MHz (MFG-2XXXMR)
		Square 25MHz(max)
		Triangle, Ramp 1MHz
	Resolutio	lμHz
	Accuracy Stability	±20 ppm
	Aging	±1 ppm, per 1 year
	Tolerance	≤1µHz
Output Characteristics(2)		
	Amplitude(into 50Ω)	1mVpp to 2 Vpp (MFG-2XXXMF) 1mVpp to 1 Vpp (MFG-2XXXMR)
	Accuracy	$\pm 2\%$ of setting $\pm 1$ mVpp (at 1 kHz/into 50 $\Omega$ without DC offset))
	Resolution	0.1mV or 4 digits
	Flatness	$\begin{array}{ll} \pm 1\% & (0.1dB) \\ \pm 1\% & (0.3dB) \\ \leq 50 \text{ MHz} \\ \pm 10\% & (0.9dB) \\ \pm 30\% & (3dB) \\ \leq 320 \text{ MHz} \\ (\text{sinewave relative to 1 kHz/into} \\ 50\Omega) \end{array}$
Offset		±1 Vpk ac +dc (into 50Ω) ±2Vpk ac +dc (Open circuit)
Waveform Output	Impedance	50Ω typical (fixed) >10MΩ (output disabled)
Sine wave Characteristics (3)		

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	Harmonic distortion Total harmonic distortion	-60 dBc DC~200kHz, Ampl>0.1 Vpp -55 dBc 200kHz~1 MHz, Ampl>0.1 Vpp -45 dBc 1MHz~10 MHz, Ampl>0.1Vpp -30 dBc 10MHz~320MHz, Ampl>0.1Vpp < 0.1% (Ampl>1Vpp)DC~100 kHz
Square wave Characteristics		
	Rise/Fall Time	<15ns
	Overshoot	<5%
	Asymmetry	1% of period +5 ns
	Variable duty Cycle	0.01% to 99.99% (limited by the current frequency setting)
	Jitter	20ppm+500ps(4)
Ramp Characteristics		
	Linearity	< 0.1% of peak output
	Variable Symmetry	0% to 100%
Modulation/ Sweep		
	Modulation Type	AM,FM,PM,FSK,PWM (The detail same as CH1 modulation specification)
	Sweep type	Frequency
	Source	INT/EXT(INT only for AM,FM,PM, PWM)
PSK		
	Carrier Waveforms	Sine, Square, Triangle, Ramp,Pulse
	Modulating Waveforms	50% duty cycle square
	Internal Frequency	2mHz to 1 MHz
	Phase Range	0°~360.0°
	Source	Internal / External
ASK		
	Carrier Waveforms	Sine, Square, Triangle, Ramp,Pulse
	Modulating Waveforms	50% duty cycle square

### MFG-2000 Quick Start Guide

	Internal Frequency	2mHz to 1 MHz
	Amplitude Range	0%~100.0%
	Source	Internal / External
Power Amplifier		
	Input Impedance	10ΚΩ
	Input voltage	1.25Vpmax
	Working Mode	Constant Voltage
	Gain	20dB
	Output Power (RL=8Ω)	20W(Square)
	Output Voltage	12.5Vpmax
	Output Current	1.6Amax
	Rise/Fall Time	<2.5uS
	FullPower Bandwidth	DC-100KHz
	Overshoot	5%
	Total harmonic distortion	< 0.1% (Ampl>1Vpp) 20Hz~20 kHz
	Ground Isolation	42Vpk max
Advanced Functions		
AM Modulation		
	Carrier Waveforms	Sine, Square, Triangle, Ramp, Pulse,Arb
	Modulating Waveforms	Sine, Square, Triangle,Upramp, Dnramp
	Modulating Frequency	2mHz to 20kHz (Int)DC to 20kHz (Ext)
	Depth	0% to 120.0%
	Source	Internal / External
FM Modulation		
	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating Waveforms	Sine, Square, Triangle,Upramp, Dnramp
	Modulating Frequency	2mHz to20kHz (Int)DC to 20kHz (Ext)
	Peak Deviation	DC to max frequency
		1 /
	Source	Internal / External

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	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating	Sine, Square, Triangle,
	Waveforms	Upramp, Dnramp
	Modulation Frequency	2mHz to20kHz (Int)DC to 20kHz (Ext)
	Phase deviation	0°~360.0°
	Source	Internal / External
SUM Modulation		
	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating Waveforms	Sine, Square, Triangle, Upramp, Dnramp
	Modulation Frequency	2mHz to20kHz (Int)DC to 20kHz (Ext)
	SUM depth	0%~100.0%
_	Source	Internal / External
PWM Modulation		
	Carrier Waveforms	Sine, Square, Triangle, Ramp
	Modulating	Sine, Square, Triangle,
	Waveforms	Upramp, Dnramp
	Modulation Frequency	2mHz to20kHz (Int)DC to 20kHz (Ext)
	Phase deviation	0%~100.0% pulse width
_	Source	Internal / External
FSK		
	Carrier Waveforms	Sine, Square, Triangle, Ramp,Pulse
	Modulating Waveforms	50% duty cycle square
	Internal Frequency	2mHz to 1 MHz
	Frequency Range	$1\mu$ Hz to max frequency
	Source	Internal / External
Sweep		
	Waveforms	Sine, Square, Triangle, Ramp
	Туре	Linear or Logarithmic
	Sweep direction	Sweep up or sweep down
	Start/Stop Freq	1uHz to max frquency
	Sweep Time	1ms to 500s
	Source	Internal / External
	Trigger	Single, External, Internal.

### MFG-2000 Quick Start Guide

	Marker	Marker signal or falling
	Warker	edge(programmable)
	Source	Internal / External
Burst		
	Waveforms	Sine, Square, Triangle, Ramp
	Frequency	1uHz~MaxFrequency
	Pulse count	1~1000000 Cycles or intfinite
	Start/ Stop Phase	-360.0° ~+360.0°
	Internal Frequency	1 us~500 s
	Gate source	External Trigger
	Trigger Source	Single, External, Internal.
Trigger Delay	NCycle, Infinite	0s~100 s
External Trigger Input		
	Туре	For FSK, Burst, Sweep
	Input Level	TTL Compatibility
	Slope	Rising or Falling(Selectable)
	Pulse Width	>100ns
	Input Impedance	10k $\Omega$ , DC coupled
External Modulation Input		
	Туре	For AM, FM, PM, SUM, PWM
	Voltage Range	±5V full scale
	Input Impedance	10kΩ
	Frequency	DC to 20kHz
	Ground Isolation	42Vpk max
Trigger Output		
	Туре	For FSK,Burst,Sweep
	Level	TTL Compatible into 50 $\Omega$
	Pulse Width	>450ns
	Maximum Rate	1MHz
	Fan-out	≥4 TTL Load
	Impedance	50Ω Typical
Frequency Counter		
	Range	5Hz to 150MHz
	Accuracy	Time Base accuracy±1count
	Time Base	±20ppm (23°C ±5°C)
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	Resolution	The maximum resolution is: 100nHz for 1Hz, 0.1Hz for 100MHz.
	Input Impedance	1kΩ/1pf
	Sensitivity	35mVrms ~ 30Vrms (5Hz to 150MHz)
	Ground Isolation	42Vpk max
Dual Channel Function (CH1/CH2)		
	Phase	-180° ~180°
		Synchronize phase
	Track	CH2=CH1
	Coupling	Frequency(Ratio or Difference)
		Amplitude & DC Offset
	Dsolink	$\checkmark$
Save/Recall		10 Groups of Setting Memories
Interface		LAN, USB
Diaplay		4.3" TFT LCD
Display		480 × 3 (RGB) × 272
General Specifications		
	Power Source	AC100~240V, 50~60Hz or AC100~120V, AC220~240V, 50~60Hz
	Power Consumption	30W or 80W (With power amplifier)
	Operating Environment	Temperature to satisfy the specification : $18 \sim 28$ °C Operating temperature : $0 \sim 40$ °C Relative Humidity: $\leq 80\%, 0 \sim 40$ °C $\leq 70\%, 35 \sim 40$ °C Installation category : CAT II
	Operating Altitude	2000 Meters
	Dellution Deene	IEC 61010 degree 2, Indoor

Storage Temperature	-10~70°C, Humidity: ≤70%
Dimensions (WxHxD)	266(W) x 107(H) x293(D)mm
Weight	Approx. 2.5kg
Safety designed to	EN61010-1
Accessories	GTL-101× 1 (MFG-21XX) GTL-101× 2 (MFG-22XX) Quick Start Guide ×1 CD (user manual + software) ×1
	Power cord×1

(1). A total of ten waveforms can be stored. (Every waveform can be composed of a maximum of 16k points.)

(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). DC offset set to zero,

(4). Jitter specification for RF Generator: 20ppm+5ns.

(5).Only Pluse channel support

# EC Declaration of Conformity

#### We

#### GOOD WILL INSTRUMENT CO., LTD.

No.7-1, Jhongsing Rd., Tucheng Dist., New Taipei City 236, Taiwan

#### GOOD WILL INSTRUMENT (SUZHOU) CO., LTD.

No. 69, Lushan Road, Suzhou New District Jiangsu, China

declares that the below mentioned product

# MFG-2110, MFG-2120, MFG-2120MA, MFG-2130M, MFG-2230M, MFG-2260M, MFG-2160MF, MFG-2260MFA, MFG-2160MR, MFG-2260MRA

Are here with 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&2014/30/EU) and Low Voltage Equipment Directive EMC: 2014/30/EU, LVD: 2014/35/EU, WEEE: 2012/19/EU and RoHS: 2011/65/EU. For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Equipment Directive, the following standards were applied:

O EMC

EN 61326-1:	Electrical equipment for measurement, control and	
EN 61326-2-1:	laboratory use — EMC requirements (2013)	
Conducted and Radiated Emissions EN 55011: 2009+A1:2010		Electrostatic Discharge EN 61000-4-2: 2009
Current Harmonic EN 61000-3-2: 2014		Radiated Immunity EN 61000-4-3: 2006+A1 : 2008+A2:2010
Voltage Fluctuation EN 61000-3-3: 2013		Electrical Fast Transients IEC 61000-4-4: 2012
		Surge Immunity EN 61000-4-5: 2006
		Conducted Susceptibility EN 61000-4-6: 2014
		Power Frequency Magnetic Field EN 61000-4-8: 2010
		Voltage Dips/ Interrupts IEC 61000-4-11: 2004

#### © Safety

#### Low Voltage Equipment Directive 2014/35/EU

Safety Requirements

IEC/EN 61010-1: 2010(Third Edition)

# GLOBL HEADAQARTERS

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