MFG-1000 series

User's Manual

MATRIX TECHNOLOGY INC.

Preface

Dear users:

Thank you for choosing a new MATRIX electronic equipment. In order to use this instrument correctly, please read the full text of this manual carefully before using this instrument, especially about the "safety precautions" part.

If you have read the full text of this manual, it is recommended that you keep it properly together with the instrument or where you can read it for future use.

Copyright information

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● Products are protected by patents in China or other countries, including patents obtained or under application.

● MATRIX TECHNOLOGY INC. reserves the right to change the product specifications and prices.

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Check and correction statement

In particular, the company declares that the equipment listed in this manual fully complies with the nominal specifications and characteristics of the company's technical specifications. The instrument has passed the factory calibration of the company before leaving the factory, and the verification procedures and steps are in line with the specifications and standards of the electronic inspection center.

Product quality assurance

The company guarantees that the new instruments manufactured have been subject to strict quality confirmation, and in case of construction defects or parts faults, the company is responsible for free repair. However, if the user has changed the circuit, function, or repaired the instrument and parts or external box damage, the company will not provide free warranty service. No free warranty is provided for any abnormal failure to complete all the ground lines or to operate the machine according to the safety specifications.
This warranty does not include the auxiliary equipment and other accessories not produced by our company.
During the one-year warranty period, please return the faulty unit to the company's maintenance center or the dealer designated by the company, and the company will repair it properly.
If the unit is under abnormal use, or human negligence, or under human control, such as earthquake, flood, riots, or fire and other factors under human control, the company will not free warranty services.

(The Company follows the sustainable development strategy and reserves the right not to improve the contents of this specification.)

Safety precautions

The following general safety precautions must be followed during all stages of this instrument operation. Failure to follow these precautions or the specific warnings described in other parts of this manual violates safety standards for the design, manufacture, and use of the instrument. The Company assumes no responsibility for the users' failure to comply with these precautions.

Warning

- Do not use damaged equipment, before using the equipment. Do not operate this equipment in an environment containing explosive gas, steam or dust.
- The power supply is supplied with a three-core power cord, and your power supply device should be connected to the three-core junction box. Before operating the power supply, you should first determine that the power supply is well grounded to avoid accidental injuries!
- Observe all the markers on the device before connecting to it.
- Always use the cables provided at the factory to avoid accidental injuries.
- Using wires with appropriately rated loads, the capacity of all load wires must be able to withstand the maximum short-circuit output current of the power supply without overheating. If there are multiple loads, each pair of load wires must be able to safely carry the full load rated short circuit output current of the power supply.
- To reduce the risk of fire and shock, make sure that the voltage fluctuation of the mains supply does not exceed 10% of the operating voltage range.
- If you use the power supply to charge the battery, to confirm the positive and negative polarity of the battery when wiring, otherwise it will burn out the power supply!
- Do not use the device when the cover is removed or is loose.
- Do not install substitute parts on the instrument, or perform any unauthorized modifications.
- We are not liable for any direct or indirect financial losses that may occur during the use of this product.
- Never use the equipment on the life support system or any other equipment with safety requirements.
- Not being used in the manner specified by the manufacturer may damage the protection provided by the equipment.
- Always clean the equipment enclosure with a dry cloth. Do not clean the instrument interior.

Contents

1. Basic introduction

MFG-1000 series two-channel function/arbitrary wave generator (hereinafter referred to as MFG-1000 series) adopts direct digital frequency synthesis technology, which can output signals with high accuracy, stability and low distortion.

MFG-1000 series has five models: MFG-1220, MFG-1230, MFG-1240, MFG-1250, MFG-1260, the highest output frequency is 20MHz, 30MHz, 40MHz, 50MHz and 60MHz respectively.

1. 1. Functional characteristic

- 2.4-inch 320X240 TFT LCD with clear graphic interface
- Chinese / English menu available
- Both channels are independent of each other and have phase synchronization function.
- Sampling rate: 200MSa/S, vertical resolution: 13 bit and storage depth: 8k
- 5 basic waveforms and 32 arbitrary waveforms in-built
- waveform storage; Support internal storage of 50 groups of user-defined edited waveforms;
- Pulse wave output set in edge time
- Internal AM, FM, PM modulation function （External AM, FM, PM modulation is optional）
- Internal/external ASK, FSK, PSK modulation function;
- Dual channel output, maximum output frequency 60M;
- Output of linear/logarithmic sweep and burst (pulse train) waveforms;
- With 100MHz high precision frequency meter and 32 bit counter;
- Standard USB Device interface; Optional external analog modulation interface;
- Equipped with multifunctional arbitrary waveform editing software.

1. 2. Matters needing attention

- Ensure that the port voltage is within the rated range before access signal.
- Please do not operate the instrument in the humid environment.
- Ensure reliable grounding of instrument.
- In order to ensure the accuracy of the index, the instrument must work continuously in a specified operating temperature (18 ℃ - 28 ℃) for more than 30 minutes.

2. Introduction to Front and Rear panels

This section first briefly introduces the front and rear panels of the MFG-1000 series, so that you can quickly familiarize yourself with the function Settings and use.

Front Panel

The front panel includes the LCD, buttons, knobs, CH1 output for channel 1, CH2 output for channel 2, and external input terminal ext. IN.

Figure 2-1 Front panel of the switch

Power Key: Long press to power on, long press to power off.

WAVE key: Enter the basic waveform output screen or selects a channel waveform on the basic waveform output screen.

MOD key: Enter the modulation function screen.

SYS key: Enter the system setting screen.

MEAS key: enter the interface of frequency meter and counter measurement.

◄ ► key: Left and right keys, used to toggle on when editing parameters.

OK Key: On the basic waveform output screen, disable or enable channel output at the same time. In the modulation related interface, as a manual trigger signal key.

CH1 Key: Select channel 1 to enable or disable output from channel 1.

CH2 Key: CH2: Select channel 2 to enable or disable output from channel 2.

F1 to F5 Key: Soft keys for setting functions on a specific screen.

Knob: allows you to change or shift values or options while editing parameters

Real Panel

The rear panel includes a power socket, power switch, USB square port, 10P communication expansion port, and external analog modulation input terminal (optional).

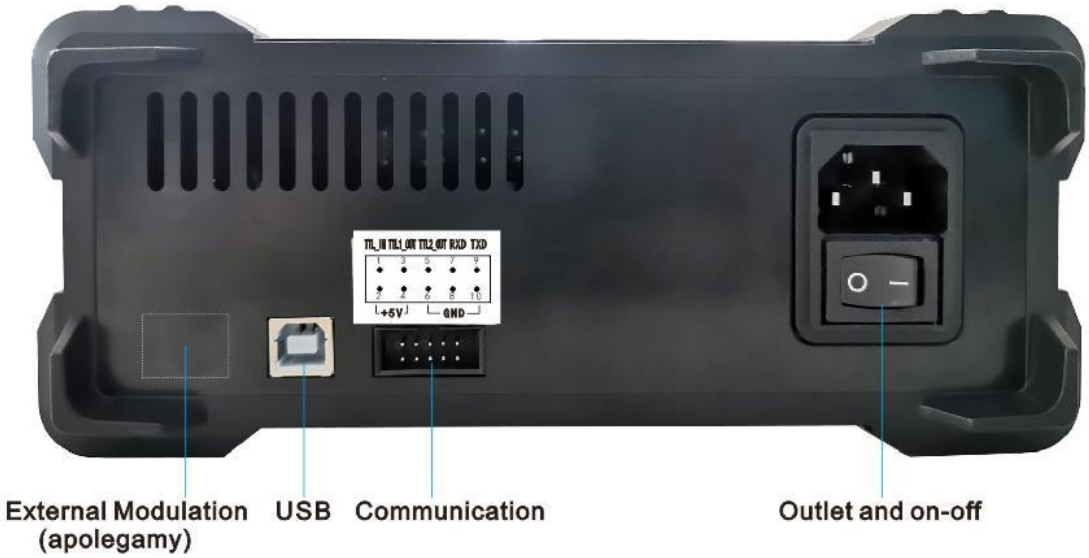

Figure 2-2 Rear panel (Standard configuration, no optional)

3. Device Connection

3. 1. Power connection

- Please connect one end of the auxiliary power cord with the power supply socket of the instrument back panel, and the other end is connected to the AC.
- Turn on the power switch at the bottom of the power supply socket to charge the instrument.
- The power switch is powered on directly. Long press the power button on the front panel to enter standby or start up.

3. 2. USB Device Interface

When the MFG-1000 functions as the slave device to connect to an external USB device, this port is used. The serial port baud rate is 115200.

3.3. Communication extension interface

The 10P communication extension interface of MFG-1000 extends TTL digital signal and serial signal.

4. Basic operation

4. 1. Main Interface Operation

The basic waveform interface, namely the main interface, is entered after each startup, as shown below.

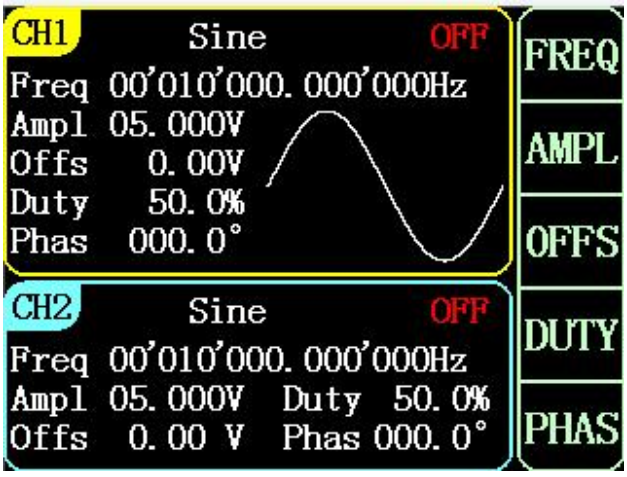

Figure 4-1-1 screen (main screen)

Press the OK key, close or open the channel output at the same time, and perform a phase operation.

Press CH1 or CH2 to select a channel as the primary channel. When the channel is open, press this key to

close the channel. When the channel is closed, press this key to open the channel.

On the main screen, press the WAVE key to select a waveform. knob or press ◄ ► to shift the waveform. In the non-home screen, press the WAVE key to switch to the home screen.

Press the soft key F1 to F5 to edit the frequency, amplitude, bias, duty cycle, and phase of the currently selected channel. Once the object is selected, move the cursor by press ◄ ►, long press the "◄ ►" key to move the cursor quickly. Change the value by turning the knob.

Press F5 to select the phase object, an in-phase operation will be performed.

4. 2. Modulation mode operation

Press the MOD key to enter the Settings for pulse/sweep/burst/modulated output.

Every time you enter the modulation interface, "Control" is set to off. Only when "Control" is turned on, the corresponding channel will output the corresponding modulation function.

Pulse wave belongs to the basic waveform, two channels can output at the same time.

Frequency sweep/pulse train (burst)/ modulation at the same time, can only be output by one channel, the other one output basic waveform.

After pressing the MOD key, enter the pulse wave setting interface, as shown in Figure 4-2-1.

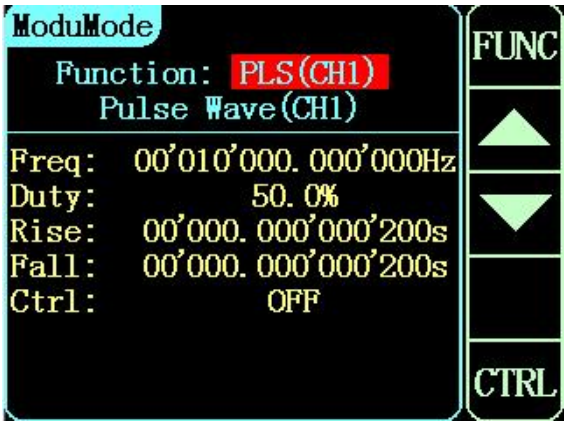

Figure 4-2-1 modulation mode - pulse wave

Pulse interface is mainly used to set the edge time of pulse wave.

Press the function key, the cursor will move to the function bar, and the function can be switched by pressing the function key, or by pressing ◄ ► keys and the knob.

In addition to pulse wave, frequency sweep, burst, AM, FM, PM, ASK, FSK, PSK and other modulation functions are available. Press F1 key to select function bar and enter modulation function of specific channel.

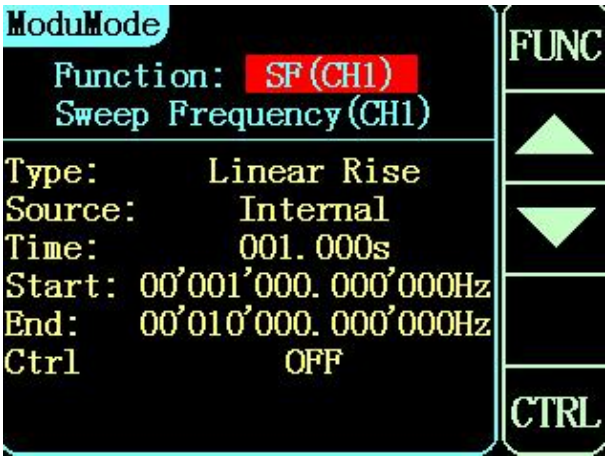

Figure 4-2-2 Modulation mode - frequency sweep

Among them, burst, AM, FM, PM, ASK, FSK and PSK can be selected to edit the carrier. Press the carrier

soft key of F4 to enter the carrier interface.

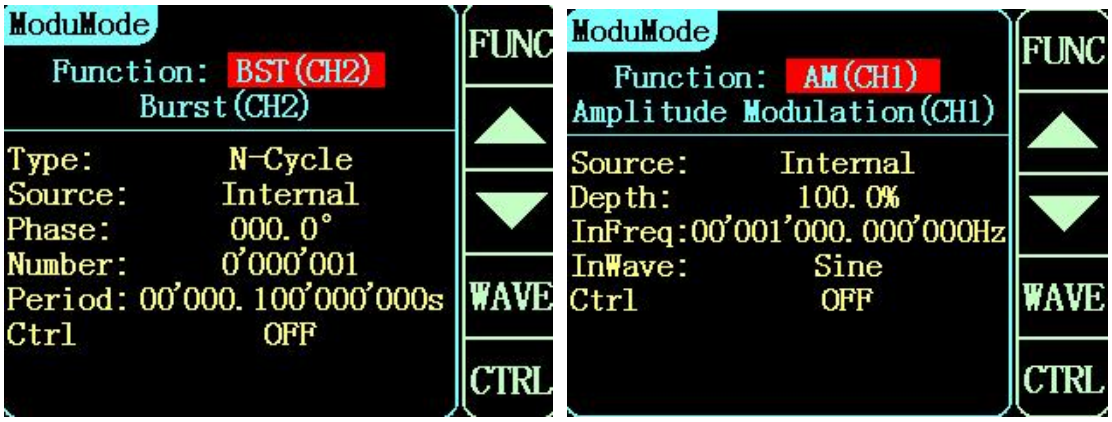

Figure 4-2-3 Modulation mode - burst, AM

The carrier interface is shown in FIG. 4-2-4. The carrier interface is the same as the waveform interface, and the related operations are the same, but the channel as the carrier output will show the word "MOD".

Pressing the MOD key to return to the modulation screen.

If press the SYS or MEAS key at the modulated carrier interface, it will enter the system setup or measurement mode accordingly and exit the modulated output.

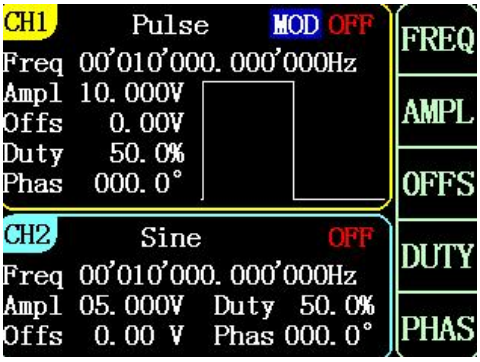

Figure 4-2-4 Modulation - carrier Edit

4.3. Measurement mode operation

Press the MEAS key to enter the measurement mode, as shown in Figure 4-3-1.

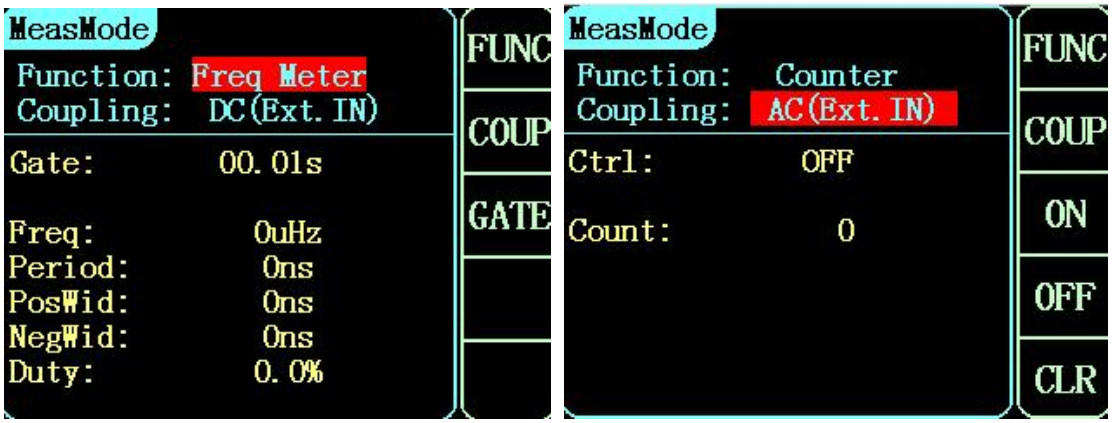

Figure 4-3-1 Measurement mode - Frequency meter and counter

The measurement mode has 2 functions, one is a frequency meter, the other is a counter. They measure digital signals from the external input port.

The frequency meter is used to measure the frequency. The frequency is measured by equal precision measurement. The coupling and gate time can be set.

The counter is used to count the number of pulses, and can be set to turn on the coupling and function, as well as the number of zeroes.

4.4. System Interface operations

Press the SYS key to enter system Settings, as shown in Figure 4-4-1.

Figure 4-4-1 System Settings

The system Settings page displays the current software version.

It can load and save the system parameters, set the buzzer to open and close, the brightness of the screen, the English and Chinese language switching, and edit, save and load any wave, calibrate, and restore factory Settings.

Press soft keys F1 to F5 to select and operate objects.

Load and save operation can save and load the current various parameter Settings. After the sound and brightness are changed, you need to press the save soft key F1 to save the Settings. The setting value will be maintained after the power is off and the instrument is restarted, otherwise the original setting value will be restored.

Any wave can save the waveform data of the current main channel to any set wave position. Clear or load the waveform data at any wave position currently set

5. Accessories

5.1. Standard accessories

1. One three-core power cable
2. Two pc BNC coaxial cables
3. A USB data cable
4. One straight signal cable
5. Instruction Manual

6. Product Technical Indicators

Frequency Characteristics					
Model	MFG-1220	MFG-1230	MFG-1240	MFG-1250	MFG-1260
Sine	1μHz~ 20MHz	1μHz ~ 30MHz	1μHz ~ 40MHz	1μHz ~ 50MHz	1μHz ~ 60MHz
Square	1μHz ~ 15MHz	1μHz ~ 15MHz	1μHz ~ 15MHz	1μHz ~ 15MHz	1μHz ~ 15MHz
Triangle	1μHz ~ 15MHz	1μHz ~ 15MHz	1μHz ~ 15MHz	1μHz ~ 15MHz	1μHz ~ 15MHz
Pulse	100μHz ~	100μHz ~	100μHz ~	100μHz ~	100μHz ~
Arbitrary	1μHz ~ 6MHz	1μHz ~ 6MHz	1μHz ~ 6MHz	1μHz ~ 6MHz	1μHz ~ 6MHz
Frequency Resolution	1μHz				
Frequency Accuracy	±20ppm				
Frequency Stability	±1ppm/3 hour				

Waveform Characteristics	
Waveform Types	Sine, square, triangle, pulse, noise and arbitrary waves (including DC). There are 32 kinds of arbitrary waves and 50 kinds of user-defined waves.
Waveform Length	8192 points
Waveform Sampling Rate	200MSa/s
Waveform vertical resolution	13bits

Sine Wave Characteristics		
Sine Wave	Harmonic suppression degree	⩾45dBc(<1MHz); ⩾40dBc(1MHz~20MHz)
	Total harmonic distortion	<0.8%(20Hz ~ 20kHz, 0dBm)

Square Wave Signal Characteristics		
Square Wave	Rise/Fall	<20ns
	Overshoot	<5%
	Duty Cycle	freq<100kHz: 1%~99%; 100kHz⩽freq<5MHz: 20% ~ 80%; 5MHz⩽freq: 40% ~ 60%(0.1% resolution)

Pulse Wave Characteristics		
Pulse Wave	Pulse Width	Min 20ns; 1ns resolution
	Edge jump time	Min 20ns;
	Overshoot	<5%
	Jitter	6ns+0.1%Period

Sawtooth wave Characteristics		
Sawtooth wave	Linearity Degree	⩾98%(0.01Hz~10kHz)
	Symmetry	0.0 ~ 100.0%(resolution0.1%)

Output Characteristics

Amplitude			
Amplitude Range	freq < 10MHz	10MHz≤freq < 30MHz	30MHz≤freq
	2mVpp ~ 20Vpp	2mVpp ~10Vpp	2mVpp ~5Vpp
Amplitude Resolution	1mV		
Accuracy of amplitude	1% of set value +2mVpp（1kHz Sine，0 offset，>10mVpp）		
Amplitude accuracy Amplitude flatness (Relative to 1K sine wave, 1Vpp)	±0.4dB <10MHz ； ±1.0dB ≥10MHz。		
Output Impedance	50Ω±10%（Typical）		
Protection	All signal output terminals can work within 60s under load short circuit		
Offset			
	Output Amplitude>0.1V	2mV<Output Amplitude≤0.1V	
Output range	±10Vpk，ac + dc	±0.250Vpk，ac + dc	
Offset Resolution	1mV		
Phase characteristics			
Phase Adjusting Range	0~359.9°		
Phase Resolution	0.1°		
External Measurement Function			
Frequency Meter Function	range	1Hz ~ 100MHz	
	Gate time	0.01s ~ 10s continuously adjusted	
Counter Function	Counting region	0 ~ 4294967295	
	Counting method	Manual operation	
Input Signal Voltage Range	2Vpp~20Vpp		
Coupled Mode	AC or DC		
Pulse Width Measurement	1ns(resolution，MAX measuring time 20s		
Period	1nsresolution，MAX measuring time 20s		
AM Modulation			
Output Channel	CH1 or CH2		
Carrier Wave	Sine, square, sawtooth wave, pulse and arbitrary waveforms (excluding DC)		
Source	Internal/External VCO(external optional)		
Modulation Wave	Sine wave, square wave, triangle wave, upper oblique wave, lower oblique wave		
Modulation Frequency	2mHz~20kHz		
Modulation depth	0%~120%		
FM Modulation			
Output Channel	CH1 or CH2		
Carrier Wave	Sine, square, sawtooth wave, pulse and arbitrary waveforms (excluding DC)		
Source	Internal/External VCO(external optional)		

Modulation Wave	Sine wave, square wave, triangle wave, upper oblique wave, lower oblique wave
Modulation	2mHz~20kHz
Frequency Offset	0~Maximum carrier frequency
PM Modulation	
Output Channel	CH1 or CH2
Carrier Wave	Sine, square, sawtooth wave, pulse and arbitrary waveforms (excluding DC)
Source	Internal/External VCO(external optional)
Modulation Wave	Sine wave, square wave, triangle wave, upper oblique wave, lower oblique wave
Modulation freq.	2mHz~20kHz
Frequency Offset	0°~360°
ASK Modulation	
Output Channel	CH1 or CH2
Carrier Wave	Sine, square, sawtooth wave, pulse and arbitrary waveforms (excluding DC)
Source	Internal/External
Modulation Wave	A square wave with 50% duty cycle
Modulation freq.	2mHz~1MHz
Amplitude modulation	0~Carrier wave amplitude
FSK Modulation	
Output Channel	CH1 or CH2
Carrier Wave	Sine, square, sawtooth wave, pulse and arbitrary waveforms (excluding DC)
Source	Internal/External
Modulation Wave	A square wave with 50% duty cycle
Modulation rate	2mHz~1MHz
Frequency hopping	Carrier frequency range
PSK Modulation	
Output Channel	CH1 or CH2
Carrier Wave	Sine, square, sawtooth wave, pulse and arbitrary waveforms (excluding DC)
Source	nternal/External
Modulation Wave	A square wave with 50% duty cycle
Modulation rate	2mHz~1MHz
The phase modulation	0°~360°
Frequency sweep function	
Sweep frequency channel	CH1 or CH2
Frequency sweep type	Linear scan, logarithmic scan
Frequency sweep time	1ms ~ 999.999s
Setting range	Arbitrarily set the start and end points
Frequency sweep direction	Forward, reverse, round trip
Trigger source	Internal, external, manual

Burst Characteristic	
Output Channel	CH1 or CH2
Carrier Wave	Sine wave, square wave, sawtooth wave, pulse wave, noise, arbitrary wave (except DC)
Pulse count	1 to 1048575 or Unlimited or gated
Start/stop phase	0~360°
Intercycle	1μs~500s
Door control source	external
Trigger source	Internal, external, manual
Trigger input	
Input signal voltage range	2Vpp~20Vpp
Coupled mode	DC or AC
Pulse width	>100ns
Response time	<500ns（pulse train）
	<10μs（sweep frequency）
Analog modulation input (optional)	
Input inpedance	1MΩ
Singal range	±2.5V ac+dc

7. Outline specification

Power	
Power voltage	AC 110~240V，50~60Hz
Power consumer	<15W
Display	
Type	2.4 inch TFT LED
Resolution	320×240
Color	16M color
Condition	
Temperature	Operation：10℃~+40℃；Non-operation：-10℃~+60℃
Cooling method	Natural cooling
Humidity range	+35℃ below：≤90% relative humidity；+35℃ ~ +40℃：≤60% relative humidity
interface	USB Device

Appendics

Table 1 Comparison table of 32 arbitrary waves in Chinese and English

NegRamp	负斜波	Boxcar	矩形窗
AttALT	指数衰减振荡	Barlett	巴特利特窗
AmpALT	指数增加振荡	Triang	三角窗
StairUP	上阶梯	Blackman	布莱克曼窗
Halfsin	半波正弦	Hamming	海明窗
stairUD	上下阶梯波	Hanning	汉宁窗
stairDn	下阶梯波	Kaiser	凯塞窗
PPluse	冲激波	DC	直流
ExpRise	指数上升	Comp	复合函数

ExpFall	指数下降	Tanh	双曲正切
Tan	正切	Coth	双曲余切
Cot	余切	Gamma	伽马函数
Sqrt	二次根	Lerendre	勒让德多项式函数
X^2	二次方	Chebyshev	切比雪夫函数
Sinc	Sa 函数	Bessel	贝塞尔曲线
Gauss	高斯函数	StepResp	阶跃响应