

AX-DG105

1. Use of Operation Manual

Please read through and understand this Operation Manual before operating the product. After reading, always keep the manual nearby so that you may refer to it as needed. When moving the product to another location, be sure to bring the manual as well.

2. Safety instructions

2.1. Safety Terms and Symbols

This chapter contains important safety instructions that you must follow when operating the instrument and when keeping it in storage. Read the following before any operation to insure your safety and to keep the best condition for the instrument. The following safety symbols may appear in this manual or on the instrument:

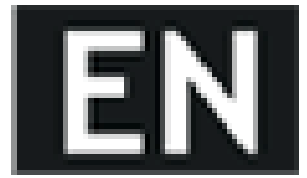


WARNING - Identifies conditions or practices that could result in injury or loss of life.



CAUTION - Identifies conditions or practices that could result in damage to the instrument or to other properties.

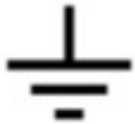




DANGER - High voltage



ATTENTION - Refer to the manual



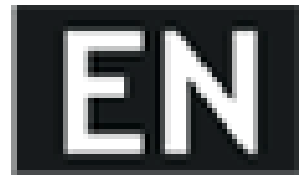
Earth (ground) terminal

2.2. Safety Guidelines



- Before plugging into local AC mains, check and make sure that the output voltage is compatible to the load. (It is suggested to disconnect a load before plugging into local AC mains.
- Do not use this instrument near water.
- Do not operate or touch this instrument with wet hands.
- Do not open the casing of the instrument when it is connected to AC mains.
- Do not use the instrument in an atmosphere which contains sulfuric acid mist or other substances which cause corrosion to metal.
- Do not use the instrument in a dusty place or a highly humid place as such will cause instrument reliability degradation and instrument failures.
- Install the instrument in a place where is free from vibration.
- Install the instrument in a place where the ambient temperature is in range of 10~70°C. Note that the instrument operation may become unstable if it is operated in an ambient temperature exceeding the range of 0~40°C





2.3. Power Supply



AC Input voltage: 110V~120V/220~240V \pm 10%, 50/60Hz.

Connect the protective grounding conductor of the AC power cord to an earth ground to avoid electrical shock.

2.4. Fuse



- Fuse type: 110~120V: T2A /250V, or 220~240V: T1A/250V.
- Make sure the correct type of fuse is installed before power up.
- Replace the AC fuse with the same type and rating as the original fuse.
- Disconnect the power cord before fuse replacement.
- Make sure the cause of fuse blowout is fixed before fuse replacement.

2.5. Maintenance Inspection

- Inspect the instrument at regular intervals so that it maintains its initial performance for a long time.
- Check the input power cord for damage of the vinyl cover and overheating of the plug and cord stopper. Check the terminal screws and binding posts for loosening.
- Remove dust from the inside of the casing and ventilation holes of the cover by using a compressed air of the exhaust air of a vacuum cleaner.

2.6. Cleaning

- Before cleaning, disconnect the AC mains.
- To clean the power supply, use a soft cloth dampened in a solution of mild detergent and water. Do not spray cleaner directly onto the instrument, since it may leak into the cabinet and cause damage.
- Do not use chemicals containing benzene, benzene, toluene, xylene, acetone, or similar solvents.
- Do not use abrasive cleaners on any portion of the instrument.





3. Introduction

This user's guide is used for all models of this series of DDS function generator. This series of DDS function generator uses Direct Digital Synthesis (DDS) technology. Its outstanding performance and system features make this function generator a perfect solution for your testing requirement. The simplified and optimized design of the front panel and dual-language (English/Chinese) LCD display interface make your testing much easier for operation and observation. Additionally, the extendable optional functions can also improve your system characteristics.

Technical characteristics and system features:

- High-accurate Frequency: up to the 10^{-5} order of magnitude
- High Frequency Resolution: full-range resolution is $1\mu\text{Hz}$
- No Range Limitation: no frequency level switch, frequency set directly by digit keypad
- No Frequency Transition: momentarily switch to the stable value on phase and amplitude without transition and distortion
- Precise Output Waveform: output waveform is synthesized by the preset function calculation values, very accurate and less distortion
- Multiple Waveforms: output 32 kinds of the pre-stored waveforms
- Pulse Characteristics: set accurate pulse duty cycle
- Output Characteristics: two independent output channel, precisely set the phase of the two channel
- Sweep Characteristics: frequency sweep and amplitude sweep, free to set the start and stop points
- Modulation Characteristics: output FM signals
- Shift Keying Characteristics: output FSK, ASK, and PSK signals
- Burst Characteristics: output pulse waveform with burst count
- Store Characteristics: store 40 sets of the user parameters and recall
- Counter Characteristics: count the frequency, period, amplitude RMS value or peak-to-peak value
- Operation Mode: key operation for all functions, English/Chinese menu selectable, parameters settings by numeric keypad or rotary dial
- High Reliability: use VLSI components and surface mount technology
- Protection: over voltage protection, over current protection, output short circuit protection (for a few minutes), reverse voltage protection
- Remote Control: optional RS232 interface

4. Quick Starting

4.1.

This chapter describes the front and rear panels of the DDS function generator. The brief introduction of the function generator helps you get familiar with the fundamental operations and functions. The main contents in this chapter are as following.



4.2. Preparation

4.2.1. Check the Function Generator and Accessories

Check the function generator and accessory parts and verify all items in the good shape. If the box is broken, please keep the box until the function generator passes function test.

4.2.2. Connect the Function Generator to Power

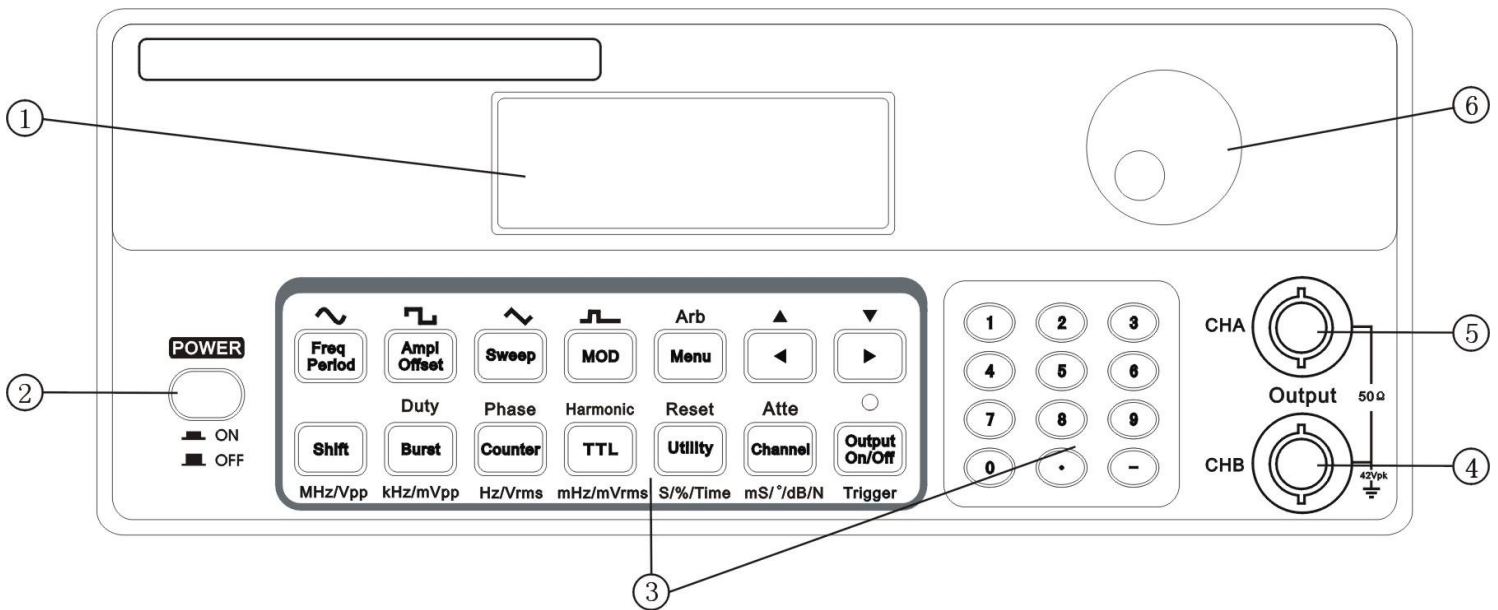
Only under the conditions below, users can connect power cable and turn on the power switch. Voltage: AC220V (1±10%), AC110V (1±10%) (Pay attention to the position of voltage selection switch), Frequency: 50Hz (1±5%), Watts: <45VA, Temperature: 0~40°C, Humidity: <80%.

Plug the power cord into an 110V or 220V power outlet with ground connection and turn on the function generator. The function generator starts to initialize - display the instrument name, load the default parameters, display menu of Channel A frequency, start channel A and B output signal. After initialization, the function generator is in the normal working mode.

WARNING: For protection from electrical shock, the three-hole power cord with protective earth ground has to be used.

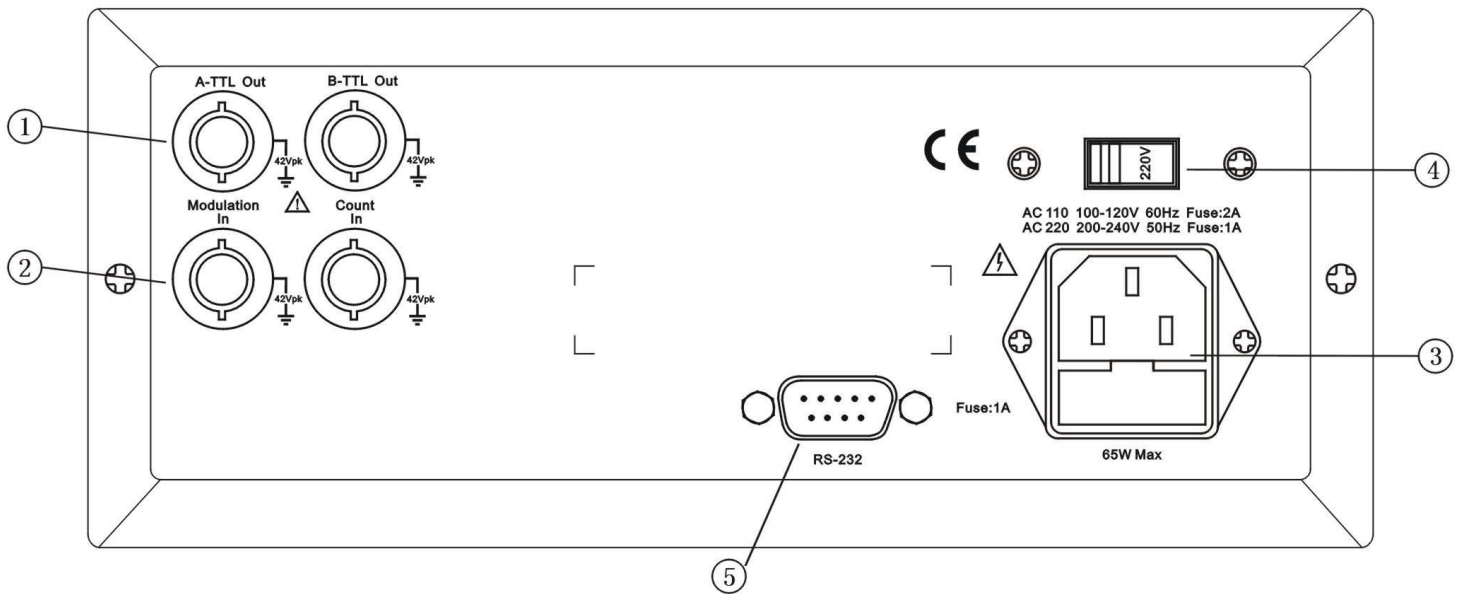
4.3. Front Panel and Rear Panel

Front Panel



1. LCD display
2. Power switch
3. Keypad
4. Channel B output

- 5. Channel A output
 - 6. Rotary knob
- Rear Panel



- 1. A-TTL/B-TTL output (BNC)
- 2. Modulation/External signal input (BNC)
- 3. Power connector with fuse
- 4. AC110V/220V power selection switch
- 5. RS232 connector

4.4. Key Description

4.4.1.

There are 26 keys on the front panel. The black word on each key represents the basic function. Simply press the key to use the basic function. The green word at the upper of key represents the second function of the key. Press key [Shift], the sign “↑” will be displayed at the lower-right of the LCD. Then press the function key, you can select the second function.

4.4.2. Function Key

Key name / Main function / Second function

Key [Freq/Period]: Frequency /period selection / Sine selection

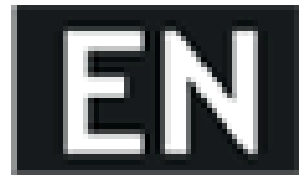
Key [Ampl/Offset]: Amplitude/offset selection / Square selection

Key [Sweep]: Sweep selection / Triangle selection

Key [MOD]: Modulation selection / Ramp selection

Key [Menu]: Menu selection / Waveform selection





Key [Burst]: Burst selection / Duty cycle selection

Key [Counter]: Frequency counter selection / Phase selection

Key [TTL]: TTL selection / Harmonic wave selection

Key [Utility]: System setup selection / Reset selection

Key [Channel]: Channel selection / Attenuation selection

4.4.3. Numeric Keypad

Key [0] [1] [2] [3] [4] [5] [6] [7] [8] [9]: for numeric input.

Key [.] : decimal point.

Key [-] : negative sign.

4.4.4. Direction Key

Key [LEFT] and [RIGHT]: cursor keys, used to add or subtract the digit on the cursor when tuning the rotary knob.

4.4.5. Other keys

Key name / Main function / Second function

Output On/Off: Signal output on/off / Single trigger for sweep and burst function

Shift: Shift to 2'nd function with other keys and exit remote control / Unit MHz/Vpp

4.5. Fundamental Operation

4.5.1. Function of Channel A

- Press key [Channel] to select “CHA Frequency” function.
- Set the frequency of channel A: set frequency at 3.5kHz
- Press [Freq] and select “Frequency”, then press keys [3] [.] [5] and the soft key corresponding to [kHz].
- Adjust the frequency of channel A: press key [LEFT] or [RIGHT] to move the cursor left or right, and rotate the knob left or right to decrease or increase the digits continuously for the coarse or fine adjustment of frequency. Apply the same procedures for adjustments of other parameters.
- Set period of channel A: set a period of 25ms. Press key [Period] and select “Period”, then press keys [2] [5] and the soft key corresponding to [ms].
- Set amplitude of channel A: set amplitude peak value at 3.2Vpp. Press key [Ampl], select “Amplitude”, then press keys [3] [.] [2] and the soft key corresponding to [Vpp].
- Set the amplitude format of the channel A: Vrms or Vpp
Press key [Menu] to change the format from Vrms to Vpp;
Press key [Ampl] to change the format from Vpp to Vrms.
- Select the channel A common waveform: select the sine, square, triangle and ramp wave.
- Press keys [Shift] [~] to select sine wave.
Press keys [Shift] [⌘] to select square wave.
Press keys [Shift] [~] to select triangle wave.
Press keys [Shift] [✓] to select ramp wave.





- Select the channel A other waveform: select exponent wave.
Press keys [Shift] [Arb], then press keys [1] [6] and the soft key corresponding to [No.].
- Set duty cycle of channel A: set pulse duty cycle at 25%. Press keys [Shift][Duty] select “Duty” next press keys [2] [5] and the soft key corresponding to [%].
- Set the channel A attenuation: select the fixed attenuation 0dB (after power on or reset, the instrument is default as AUTO attenuation).
Press keys [Shift] [Atte], then press key [1] and the soft key corresponding to [dB].
- Set offset of channel A: set DC offset at -1Vdc. Press key [Offset] and select “Offset” , then press keys [-] [1] and the soft key corresponding to [Vdc] .

4.5.2. Function of Channel B

- Press key [Channel] to select “CHB Frequency”.
- Set frequency and amplitude of channel B: apply the same procedure of setting frequency and amplitude of channel B as explained earlier.
- Select the channel B common waveform: select the sine, square, triangle and ramp wave.
- Press keys [Shift] [~] to select sine wave.
Press keys [Shift] [⌘] to select square wave.
Press keys [Shift] [^] to select triangle wave.
Press keys [Shift] [✓] to select ramp wave.
- Select the channel B other waveform: select exponent wave, same as channel A.
Press keys [Shift] [Arb], then press keys [1] [6] and the soft key corresponding to [No.].
- Set the channel B harmonic wave: set the frequency of channel B as a 3-time harmonic wave of channel A.
Press keys [Shift] [Harmonic] [3] [TIME].
- Set phase of channel B: set phase of channel B at 90°.
Press key [Channel] and select channel B, then press keys [Shift] [Phase] [9] [0] [°].

4.5.3. Frequency Sweep

- Press key [Sweep] and select “Sweep Freq” function. The instrument will output the frequency sweep signal with the default parameters at CHA output.
- Set sweep direction: set sweep direction Up-Down. Press key [Menu] and select “Sweep direction”, then press keys [2] [No.]
- Sweep frequency display: Press key [Menu] and select “CHA frequency”, the displayed frequency data varies with the sweep process simultaneously.

4.5.4. Amplitude Sweep

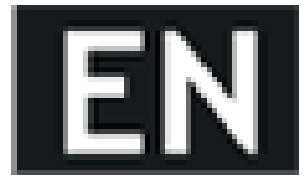
Press key [Sweep] and select “CHA Sw Am” function. The instrument will output the amplitude sweep signal with the default parameters at CHA output.

Set the interval time: set the interval time as 0.5s.

Press key [Menu] and select “Interval time”, then press keys [0] [.] [5] [s].

Sweep amplitude display: Press key [Menu] and select “CHA amplitude”, the displayed amplitude data varies with the sweep process simultaneously.





4.5.5. Frequency Modulation (FM)

- Press key [MOD] to select “FM”.
- Set modulation deviation: set modulation deviation at 5.2%. Press key [Menu] and select “FM Deviation”, then press keys [5] [.] [2] and the key corresponding to [%].

4.5.6. FSK Modulation of the Channel A

- Press key [MOD] and select “FSK”. The instrument will output the FSK signal with the default parameters at CHA output.
Set the hop frequency: set the hop frequency at 1 kHz.
Press key [Menu] and select “Hop Freq”, next press keys [1] [kHz].

4.5.7. ASK Modulation of the Channel A

- Press key [MOD] and select “ASK”. The instrument will output the ASK signal with the default parameters at CHA output.
Set the carrier amplitude: set the carrier amplitude at 2 Vpp.
Press key [Menu] and select “Carrier Ampl”, next press keys [2] [Vpp].

4.5.8. PSK Modulation of the Channel A

- Press key [MOD] and select “PSK”. The instrument will output the PSK signal with the default parameters at CHA output.
Set the hop phase: set the hop phase at 180°.
Press key [Menu] and select “Hop Phase”, next press keys [1] [8] [0] [°].

4.5.9. Burst Output of Channel A

- Press key [Channel] to select “CHA Alone”. Next press key [Burst] to go to “CHA Burst”. Apply the same setting procedures as described in section “Function of Channel A” for frequency and amplitude setup.
- Set burst count: set burst count as 5 cycles. Press key [Menu] and select “Cycles”, then press key [5] and the key corresponding to [CYCL].

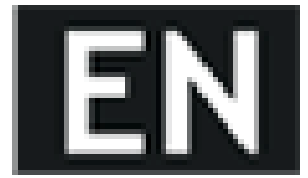
4.5.10. Burst Output of Channel B

Press key [Channel] to select “CHB Alone”. Next press key [Burst] to go to “CHB Burst”. Apply the same setting procedure as explained in section above for setting burst of channel B.

4.5.11. CHA/CHB Output On/Off

Press key [Channel], channel A is shown on the LCD display, press [Output], the output lamp turns to green, the signal of channel A outputs. Press [Output] again, the output lamp turns off, the instrument closes the signal output of channel A. Press key [Channel], channel B is shown on the LCD display, press [Output], the output lamp turns to red, the signal of channel A outputs. Press [Output] again, the output lamp turns off, the instrument closes the signal output of channel A. After power on, the default state is not having signal output, with the lamp being off. When the output lamp turns to orange, there are signals output both in channel A and channel B.





4.5.12. System Initialization

After power on, the system initialization of the instrument displays the following parameters:

CHA and CHB waveform: Sine

CHA and CHB frequency: 1kHz

CHA and CHB amplitude: 2Vpp

CHA and CHB duty cycle: 50%

CHA attenuation: AUTO

CHA offset: 0V

CHB harmonic: 1.0 Time

CHB phase offset: 0°

Sweep time: 10s

Gate time: 100ms

Start frequency: 500Hz

Stop frequency: 5kHz

Interval time: 10ms

Sweep direction: UP

Carrier frequency: 50kHz

Carrier amplitude: 2Vpp

Modulation frequency: 1kHz

Modulation waveform: Sine

Modulation deviation: 5%

Hop frequency: 1kHz

Hop amplitude: 1Vpp

Hop phase: 180°

Burst count: 3 CYCL

Burst frequency: 100Hz

5. Technical specifications

5.1. Output Characteristics of Channel A

5.1.1. Waveform Characteristics

Waveform type: 32 pre-stored waveforms including: Sine, Square, Triangle, Ramp, Pulse etc.

Waveform length: 1024 points Sample rate: 100MSa/s

Waveform amplitude resolution: 8bits

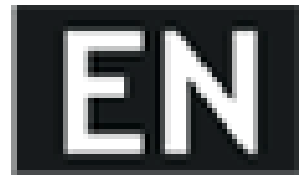
Sinusoidal harmonic rejection: $\geq 40\text{dBc}$ (<1MHz), $\geq 35\text{dBc}$ (1MHz~20MHz)

Sine wave total distortion: $\leq 1\%$ (20Hz~200kHz)

Square rise/fall edge time: $\leq 35\text{ ns}$ Overshoot: $\leq 10\%$

Square wave duty cycle: 1%~99%





5.1.2. Frequency Characteristics

Frequency range: Sine: $1\mu\text{Hz}\sim\text{Max.frequency (MHz)}$; Square : $1\mu\text{Hz}\sim 5\text{MHz}$;

Other waveforms: $1\mu\text{Hz}\sim 1\text{MHz}$

Frequency resolution: $1\mu\text{Hz}$

Frequency accuracy: $\pm(5\times 10^{-5})$

Frequency stability: $\pm 5\times 10^{-6}/3$ hours

5.1.3. Amplitude Characteristics

Amplitude range: $2\text{mVpp}\sim 20\text{Vpp}$ $1\mu\text{Hz}\sim 10\text{MHz}$ (high impedance)

$2\text{mVpp}\sim 15\text{Vpp}$ $10\text{MHz}\sim 15\text{MHz}$ (high impedance)

$2\text{mVpp}\sim 8\text{Vpp}$ $15\text{MHz}\sim 20\text{MHz}$ (high impedance)

Resolution: 20mVpp (amplitude $> 2\text{Vpp}$), 2mVpp (amplitude $< 2\text{Vpp}$)

Amplitude accuracy: $\pm(1\%+2\text{mVrms})$ (high impedance, true RMS, frequency at 1kHz)

Amplitude stability: $\pm 0.5\%/3$ hours

Amplitude flatness: $\pm 5\%$ (frequency $< 10\text{MHz}$), $\pm 10\%$ (frequency $> 10\text{MHz}$)

Output impedance: 50

5.1.4. DC Offset Characteristics

Offset range: $\pm 10\text{V}$ (high impedance, attenuation 0dB) Resolution: 20mVdc

Offset accuracy: $\pm(1\%+20\text{mVdc})$

5.1.5. Sweep Characteristics

Sweep type: frequency sweep, amplitude sweep

Sweep range: free to set the start and stop points

Sweep time: $100\text{ms}\sim 900\text{s}$

Sweep direction: Up, Down, Up-down

Sweep mode: linear, logarithmic

5.1.6. Modulation Characteristics

Carrier signal: channel A signal

Modulation signal: internal signal of channel B or external signal

FM deviation: $0\%\sim 20\%$

5.1.7. Shift Keying Characteristics

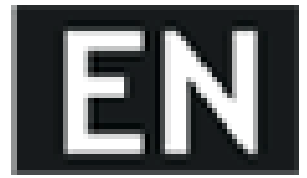
FSK: free to set carrier frequency and hop frequency

ASK: free to set carrier amplitude and hop amplitude

PSK: hop phase $0\sim 360^\circ$, max.resolution 1°

Alternative rate: $10\text{ms}\sim 60\text{s}$





5.1.8. Burst Characteristics

Carrier signal: channel A signal

Trigger signal: TTL_A signal

Burst count: 1~65000 cycles

Burst mode: Internal TTL, External, Single

5.2. Output Characteristics of Channel B

5.2.1. Waveform Characteristics

Waveform type: 32 pre-stored waveforms including: Sine, Square, Triangle, Ramp, Pulse etc.

Waveform length: 1024 points Sample rate: 12.5MSa/s

Waveform amplitude resolution: 8bits

Square duty cycle: 1%~99%

5.2.2. Frequency Characteristics

Frequency range: Sine: 1 μ Hz~1MHz Other waveforms: 1 μ Hz~100kHz

Frequency resolution: 1 μ Hz

Frequency accuracy: $\pm(1 \times 10^{-5})$

5.2.3. Amplitude Characteristics

Amplitude range: 50mVpp~20Vpp (high impedance) Resolution: 20mVpp

Output impedance: 50

5.2.4. Burst Characteristics

Carrier signal: channel B signal

Trigger signal: TTL_B signal

Burst count: 1~65000 cycles

Burst mode: Internal TTL, External, Single

5.3. TTL Output Characteristics

Waveform Characteristics: Square, rise/fall time \leq 20ns

Frequency Characteristics: 10mHz~1MHz

Amplitude Characteristics: TTL, CMOS compatible, low level $<$ 0.3V, high level $>$ 4V

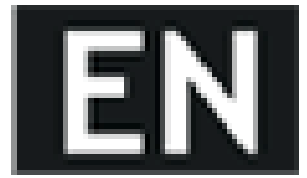
5.4. Common characteristics

5.4.1. Power Source

Voltage: AC220V (1 \pm 10%)

AC110V (1 \pm 10%) (Pay attention to the position of voltage selection switch)





Frequency: 50Hz (1±5%)

Power: <45VA

5.4.2. Environment

Temperature: 0~40°C

Humidity: <80%

5.4.3. Operation Characteristics

Keypad operation and rotary knob operation

5.4.4. Display

LCD display, English, Chinese (simplified), Chinese (traditional)

5.4.5. Dimension and Weight

Chassis dimensions: 415(D)×295(W)×195(H)mm

Weight: 3.5kg

