



User's manual

**Arbitrary Waveform Generator
HDG 2000**

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General Safety Summary

Please read the following safety precautions to avoid personal injury and want to connect to the product or other damage to the product, in order to avoid possible injury and danger, this product can only be used within the specified range.

- ◆ **Only authorized personnel should perform service professional.**
- ◆ **Avoid fire and personal injury**
- ◆ **Use the correct power cord.** Only use this product certified for the country-specific power cord.
- ◆ **Ground the product.** This product has a protective ground terminal. To minimize the risk of electric shock, grounding power cord must be connected to AC power equipment, the ground wire firmly connected to the power outlet ground (**safety ground**) terminal. Interruption protection or protective earth conductor connection terminal (**ground**), will cause a potential shock hazard that could cause injury.
- ◆ **View all terminal ratings.** To prevent fire or shock hazard high current, see all ratings and markings on the product. Consult the product manual for further ratings before connecting the product details.
- ◆ **Do not open lid operation.** Do not operate this product with covers or panels removed.
- ◆ **Avoid exposed circuitry.** Do not touch exposed connections and components when power is present.
- ◆ **Suspected malfunction, do not operate.** If you suspect that this product has been damaged by qualified service personnel.
- ◆ **Maintain proper ventilation.**
- ◆ **Do not operate in wet environments.**
- ◆ **Do not operate in an explosive atmosphere.**
- ◆ **Please keep it clean and dry surface of the product.**

Model

This section describes the HDG2000 series instrument models.

Instrument Model

| Model | Explanation |
|-----------|---|
| HDG2 002B | 5MHz 14-bit resolution Arbitrary Waveform 64M memory depth |
| HDG2012B | 10MHz 16-bit resolution Arbitrary Waveform 64M memory depth |
| HDG2022B | 20MHz 16-bit resolution Arbitrary Waveform 64M memory depth |
| HDG2032B | 30 MHz 16-bit resolution Arbitrary Waveform 64M memory depth |
| HDG2062B | 60MHz 16-bit resolution Arbitrary Waveform 64M memory depth |
| HDG2082B | 80MHz 16-bit resolution Arbitrary Waveform 64M memory depth |
| HDG2102B | 100MHz 16-bit resolution Arbitrary Waveform 64M memory depth |
| HDG2032C | 30MHz 16-bit resolution Arbitrary Waveform 64M memory depth 2GB Memory |
| HDG2052C | 50MHz 16-bit resolution Arbitrary Waveform 64M memory depth 2GB Memory |
| HDG2072C | 70MHz 16-bit resolution Arbitrary Waveform 64M memory depth 2GB Memory |
| HDG2102C | 100MHz 16-bit resolution Arbitrary Waveform 64M memory depth |

| | |
|--|------------|
| | 2GB Memory |
|--|------------|

The first chapter Getting Started

- ◆ [Instrument Introduction](#)
- ◆ [The front panel functions introduced](#)
- ◆ [Rear Panel Features](#)
- ◆ [Ready to use instruments](#)

1.1 Instrument Introduction

HDG2000 series is a series of built-in arbitrary waveforms and pulse function of the composite waveform generator.

Features:

- ◆ 16-bit resolution, 250MSa / s sampling rate;
- ◆ Maximum 64M memory depth;
- ◆ 100 MHz, 80 MHz, 70 MHz, 60 MHz, 50MHz, 30 MHz, 20MHz, 10 MHz or 5 MHz maximum sine wave frequency output;
- ◆ 7-inch 16K color TFT LCD screen, WVGA (800X480);
- ◆ 16-channel digital output and analog channel output five standard waveforms and multiple arbitrary waveform;
- ◆ Standard TCXO time base, optional high stability OCXO;
- ◆ Multiple interfaces: USB Host and USB Device, LAN optional;
- ◆ Extensive modulation capabilities, support for AM, FM, PM, ASK, FSK, PSK BPSK And PWM, etc.;
- ◆ USB and LAN remote interface (in LAN Optional)
- ◆ SCPI (Standard Commands for Programmable Instruments) compatible
- ◆ Online help function
- ◆ Built-in SD card

1.2 Front Panel Description:

The signal generator's front panel contains F0 to F6 menu software area, the numeric keypad keypad, function waveform keypad, shortcut keys area, mode keypad, function keys trigger zone, output keypad buttons and knobs area, and input and output interfaces areas. You can control the signal generator, the input and output signals via the front panel.



- 1 Menu soft key **F0-F6**
- 2 wave function keys
3. **CH1** and **CH2** switch key
- 4 function menu button
5. Knob and cursor arrow
- 6 Numeric Keypad
7. Channel output key
- 8 trigger button
9. **CH1** and **CH2** connectors
10. **Sync** Connector
11. Modulation signal input terminal
- 12 **high** frequency counter (24MHz to 2.7GHz)
- 13 low-frequency counter/external trigger
- 14 digital channels
15. **USB** port
16. **SD** card port
- 17 Power Switch

Note: Press any front panel key or softkey context-sensitive help is available.

Front panel digital inputs

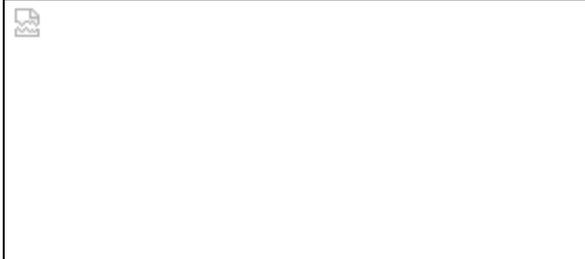
◆ You can enter numbers from the front panel by the following two methods:

Use the knob and cursor keys to change the number. Turn the knob to change the number. Knob below the arrow to the left or right to move

the cursor.



◆ Use the numeric keypad to enter numbers, use the soft keys to select units. +/-Keys to change the sign of a number.



CE: Delete key

BASP: backspace, backspace and clear the last digit

ENT: Enter key

WARNING: To prevent electrical shock, the power cord ground must be canceled. If only two contacts a power outlet, the instrument should be connected to a good chassis ground screw ground lines.

Online Help

Signal generator online help provides two views. One is the content view, the other is an indexed view.

1 indexed view is a view in ascending order after the online help topic content. You can select a different index by turning the knob, press the **ENTER** key to **enter** the appropriate subject matter.

2 is a description of a specific topic content view contents view, you can select the content view by rotating the knob conjunctions, into a different subject matter.

3 To exit the online help, online help under the main menu, press the **F5** key to exit;

Screen area

The entire signal generator screen can be divided into three major areas: the status panel top of the screen, the screen area of the right side of the window menu panel and the bottom left of the screen.



Instructions on the status panel external **usb** device is plugged in, the rear panel **usbdev** interface is connected, the Ethernet interface is connected and the current time.

Menu panel and software is the corresponding label. Contents can be modified via software label menu panel. There are three main styles menu panel: one is executed directly, click Run performance of an act, or perform a function or enter the sub-menu, or enter the next menu.

One is selective and selective provide several parameters and a theme, the theme is displayed at the top of the menu items, parameters are displayed at the bottom, press the corresponding function key was to select the specified parameters;

An alternate style, alternating appearance and selective about the same, indicating that there is no interactive theme, the top menu item displays the currently selected, the bottom is optional, flip key is defined as **the F6** key to return to previous level menu by **F0**.

1.3 Rear Panel Features

Rear panel has the following connectors:

- 1 External reference input 10Mhz
- 2 external 10MHZ reference output
- 3 **usb** device side connector

1.4 ready to use instruments

This section describes the help you quickly start using the basic process of this instrument.

Ready to use instruments

If necessary, connect the power cord. By pressing the lower left corner of the front panel power switch, turn on the instrument.

The default function of the instrument is 1 kHz, 2 00 mVpp sine wave. When powered on, disables the channel output connector. To enable the output channel connector, press the channel connector at the top of "Output" button.

If the instrument is not open, check the power cord is connected securely (at power supply automatically senses line voltage), should also ensure that the instrument is connected to the electricity supply.



Power switch:

To power off the instrument, press the power switch.

Chapter II Basic operation

- ◆ [Front Panel Menu Reference](#)
- ◆ [Accessibility](#)

- ◆ [Save and Recall](#)
- ◆ [Remote Control](#)

2.1 Front Panel Menu Reference

The front panel menu overview. The remainder of this chapter describes some examples of using the front panel menu.

Select the waveform



Shortcuts



Configuration parameters specific to the waveform

- ◆ Cycle/frequency
- ◆ Amplitude or high voltage and low voltage
- ◆ Offset
- ◆ Phase
- ◆ Duty Cycle
- ◆ Symmetry
- ◆ Pulse Width
- ◆ Edge Time

- ◆ Arbitrary Waveform
- ◆ Bandwidth

Designated units and parameters Preferences

- ◆ Frequency or period
- ◆ Configure the voltage amplitude/offset or high/low
- ◆ Voltage Unit
- ◆ The pulse width or duty cycle
- ◆ The frequency scan configuration as the center/span or start/stop



Mode:

Configure the modulation parameters

- ◆ Turn on or off modulation
- ◆ Modulation Type: AM, FM, PM, 2ASK, 2FSK, 2PSK, BPSK, PWM
- ◆ Modulation source
- ◆ Modulation parameters



Sweep:

Configure the frequency scanning parameters

- ◆ Open or closed scan
- ◆ Linear
- ◆ Scan time
- ◆ Initial cutoff frequency, center frequency, symbol frequency, frequency span
- ◆ Sweep time, hold time and return time



Burst:

Configuration parameters bursts

- ◆ Burst open or close
- ◆ Burst Mode: Trigger (multi-cycle, infinite cycles) or gated
- ◆ The number of cycles per burst
- ◆ Burst period



Save / Recall:



Help:

- ◆ Display a list of help topics
- ◆ Displays help index list
- ◆ Get help on any key



Accessibility:



1 System Settings

- ◆ Language Settings: Select the front panel messages and help text of the local language
- ◆ Security Settings
- ◆ Display settings: Set the screen brightness; enable or disable the screen saver
- ◆ Sound settings: Enable or disable the beeper
- ◆ Network Settings
- ◆ Time Settings
- ◆ Set the clock source

2 System Information

- ◆ Device Information
- ◆ Hardware Information
- ◆ Software Information
- ◆ Legal Information

3 System Status

- ◆ View system status
- ◆ Save or recall system status

4 Upgrade

Firmware upgrades

5. Counter

Open counter or frequency meter

6. Perform a self-test

Before starting any other adjustments, run a self-test to ensure the normal operation of the instrument

7 Calibration Instruments

Closed electronic instrument calibration function, no internal mechanical adjustments. The instrument will be set according to the input reference value to calculate the correction factor, and until the next calibration adjustment, the correction factor has been stored in

the nonvolatile memory. This data will not turn the power off and then on again, or *RST May change.



Trigger:

Trigger settings

- ◆ Perform a manual trigger when lit.
- ◆ Specify the scan, or arbitrary waveform forward burst trigger source.
- ◆ External trigger source specified slope (**rising** or **falling**).
- ◆ Enable/disable the specified channel is its synchronization signal output



Factory setting:

The current state of the machine is configured to factory condition.

Before pressing the signal generator panel **Default** button, the machine will be configured to factory condition.

2.2 Accessibility

Auxiliary functions: <System Settings>, <System Information>, <System Status>, <upgrade>, <counter>, <a self-test> <calibration> function.

Can be selected by the knob and move around the corresponding function key, press the **enter** key to confirm; also by pressing the **F1** and **F2** keys to select the desired function, press **Enter** or **F4** key to confirm; exit auxiliary function, press the **F5** key to exit.

2.2 1. System Settings

System settings can modify various features of the signal generator;

Can <language settings>

Can <Security Settings>

Can <Display>

Can <Sound Settings>

Can <Network Settings>

Can <time setting>

Can <reference source settings>

Asked the following steps to enter the appropriate settings:

1 according to <Accessibility> the description into the auxiliary function, select System Settings;

2 Select the appropriate settings in the softkey menu **F1** to **F5**, enter the appropriate settings;

3 can also dial to select the desired function, press **enter** to confirm.

◆ Language Settings

The current language support in English and Chinese, modify the following steps:

1 according to <Accessibility> the description into the auxiliary function, select System Settings;

2 in accordance with the "<System Settings> the description into the language settings;

3 Press the F1 key to select a different language

4 Press the F2 key to exit

◆ Security Settings

Visit some of the features of a signal generator, requires administrator authorization, the input keys, such as "Upgrading> features and <calibration> function.

In the security settings, the administrator can maintain the security key;

Please modify the machine key in the following steps:

1 according to <Accessibility> the description into the auxiliary function, select System Settings;

2 in accordance with the "System Settings> Security Settings entered in the description;

3 Press the F1 key, the machine will eject the current key input window, enter the correct key, and then press F1 again, this time by the front panel

Numeric keypad area to change the password;

4 Press the F2 key to enter the password again;

5 Press the F3 key to confirm, if the password is entered in line twice, then automatically exit the "System Settings> years, if not, then emptied once entered,

Waiting for the next input;

6 If you want to change your password, then press the F4 key to exit

Note: In the default state machine key is 88888888, the machine can be set up eight key, key input via the numeric keypad on the front panel, or may contain numbers. ". "

◆ Display Settings

Display settings where you can set the brightness settings of the current screen and screen savers:

Change the brightness of the screen:

1 according to <Accessibility> the description into the auxiliary function, select System Settings;

2 in accordance with the "System Settings> Display Settings to enter the description;

3 Press the F1 key to change screen brightness, this time to modify the parameters highlighted.

4 Modify the current value using the numeric keypad or the knob

Set the screen saver switch

A. In accordance with <Accessibility> the description into the auxiliary function, select System Settings;

2 in accordance with the "System Settings> Display Settings to enter the description;

3 Press the F2 key to turn on or off the screen saver

(4) If the screensaver is on, press the F3 key to set the screen saver in the system long after no operation is started.

5 Press the F4 key to exit

◆ Sound Settings

If you turn on the sound, then press the button, the signal generator will be issued to specify the frequency of the sound signal and the delay time:

Open and close the sound, follow these steps:

- 1 according to <Accessibility> the description into the auxiliary function, select System Settings;
- 2 in accordance with the "System Settings> the description into the sound settings;
- 3 Press the F1 key to open and close the sound;
- 4 Press the F2 key to exit

◆ Network Settings

Signal generator can be <Remote Control> client pc via Ethernet interface.
Set the correct <IP>, <subnet mask>, <gateway>, <Mac> can guarantee connection establishment;

Please follow these steps to modify network parameters:

- 1 according to <Accessibility> the description into the auxiliary function, select System Settings;
- 2 in accordance with the "System Settings> Network Settings to enter the description;
- 3 Press the F1 key to modify ip, in the correct format ip address, using the front panel keypad to enter
- 4 Press the F2 key to change the subnet mask, in the correct format ip address, using the front panel keypad to enter
- 5 Press the F3 key to change the gateway ip address in the correct format, and using the front panel keypad to enter
- 6 Press the F4 key to modify the Mac, using the front panel keypad to enter
- 7 Press the F5 key to exit

Note: Not all models are Ethernet interfaces machines

◆ Time Settings

Signal generator contains a real time clock. You can set the current time.

Please follow these steps to modify the time parameters:

- 1 according to <Accessibility> the description into the auxiliary function, select System Settings;
- 2 in accordance with the "System Settings> enter time settings as described in;
- 3 Press F1 to amend the
- 4 Press the F2 key to modify the month
- 5 Press the F3 key to change date
- 6 Press the F4 key to modify
- 7 Press the F5 key to modify the points
- 8 Press the F6 key to enter the time setting of the second page of the menu, press the F1 key modifications seconds
- 9 Press the F6 key to enter the time setting of the second page of the menu, press the F2 key to exit repair

◆ Set reference source

The default signal generator uses an internal clock 10M, 10M order to synchronize the external oscillator can choose between different machines as a signal generator clock source.

Please modify the system clock source by following these steps:

- 1 according to <Accessibility> the description into the auxiliary function, select System Settings;
- 2 in accordance with the "System Settings> the description into the clock reference set;
- 3 If you select the internal clock as the system clock source, press the F1 key to select the internal clock source
- 4 If you choose an external clock source, after the input signal source 10M entrance panel external clock input, press the F1 key to select the external clock
- 5 Press the F2 key to exit

2.2 2. System Information

System contains information about the device, hardware, software, and law-related information

2.2 3. System Status

In systems where you can view the current status of the major states of the system, and you can save and recall system status;

Follow these steps to check the system's current main state

- 1 according to <Accessibility> the description into the auxiliary function, select System Status;
- 2 In the main window area to see the current state of the system

Please save the current state of the system, follow these steps:

- 1 according to <Accessibility> the description into the auxiliary function, select System Status;
- 2 Press the F1 key to enter the <File Browser> select the file directory, rename files;
- 3 In the file browser, press the F3 key to save the file, then enter the file name must first go
- 4 After entering the correct file name, file browser, press the F3 key to save the file again
- 5 The system returns the system status window
- 6 Press the F5 key to exit

Please follow these steps to adjust the system to save the state:

- 1 according to <Accessibility> the description into the auxiliary function, select System Status;
- 2 Press the F1 key to enter the <File Browser> select the file specific path;
- 3 In the file browser menu, press F4 (Recall key) to bring up the system state
- 4 The system returns the system status window
- 5 Press the F5 key to exit

2.2 4. Upgrade

Upgrade

Update the system needs to have administrator privileges, you need to enter the administrator password, the password input operation please refer to the topic "password authentication".

Please update your system, follow these steps:

- 1 Insert the firmware upgrade usb or sd storage devices;
- (2) according to <Accessibility> the description into the auxiliary function, choose to upgrade;

- 3 Press the **F1** function key, enter the password authentication window, enter the administrator password;
- 4 Press the **F1** key, <file browser> window, select the firmware upgrade
- 5 The system returns upgrade window, press the **F2** key to automatically start the upgrade
- 6 Upgrade to restart the system after power failure
- 7 upgrade process, you may get an error

2.2 5. Counter

Signal generator built-in counter function; including low frequency counter, frequency meter low frequency, high frequency counter, frequency meter high frequency of four types:

To measure the frequency of the signal at **100Khz** below, please use the frequency counter, frequency meter LF

To measure the frequency of the signal at **10Mhz** below, please use the high-frequency counter, frequency meter high frequency

Please count the low frequency signal measurement by following these steps

1. The measured signal is triggered by an external signal generator input ports on the front panel
- 1 according to <Accessibility> the description into the auxiliary function, select the counter;
- 2 Select the type of low-frequency counter,
- 3 Press the **F3** key to start counting
- 4 Press the **F3** key to stop counting

Please measure the frequency of low frequency signals follow the steps below

1. The measured signal is triggered by an external signal generator input ports on the front panel
- 1 according to <Accessibility> the description into the auxiliary function, select the counter;
- 2 Select the type of low frequency meter,
- 3 Press the **F3** key to start the measurement
- 4 Press the **F3** key to stop the measurement
5. Frequency meter default gate time is **1s**, To modify the gate time, press the **F4** key to modify the parameters highlighted using the knob and numeric keypad to enter the correct parameter values

Please measure the high-frequency signal count by following these steps

1. The measurement signal through the front panel of the **counter-port** input signal generator
- 1 according to <Accessibility> the description into the auxiliary function, select the counter;
- 2 Select the type of high-frequency counter,
- 3 Press the **F3** key to start counting
- 4 Press the **F3** key to stop counting

Please measure the frequency of the RF signal in accordance with the following procedure

1. The measurement signal through the front panel of the **counter-port** input signal generator
- 1 according to <Accessibility> the description into the auxiliary function, select the counter;
- 2 Select the type of high frequency meter,
- 3 Press the **F3** key to start the measurement

4 Press the **F3** key to stop the measurement

5. Frequency meter default gate time is **1s**, To modify the gate time, press the **F4** key to modify the parameters highlighted using the knob and numeric keypad to enter the correct parameter values

2.2 6. Self

Self-test signal generator to determine the current signal generators can be used normally;

Real-time system clock signal generator will, the internal **adc, fpga**, analog front-end circuit for testing;

Please follow these steps to perform a self-test:

1 according to **<Accessibility>** the description into the auxiliary function, choose self-test;

2 Press the **F1** key to start the self-test

3 system automatically output current self-test and self-test of content

4. The whole process of self lasts about **15s**

2.2 7. Calibration

Under the premise of the system self-test, the signal generator can be manually calibrated, calibration requires administrator

privileges; calibration system based on user input, calculate the correction factor to correct errors related parameters; current system mainly the following correction:

1 Frequency

2. **Adc** offset coefficient

3. **Dc** voltage offset coefficient

To calibrate the system, please follow the steps below

1 according to **<Accessibility>** the description into the auxiliary function, select the calibration;

2 Press the **F1** key, the system appears **<password authentication>** window, enter the correct administrator password, you can start the calibration

3 Press the **F1** key to start the calibration, follow the prompts to enter the calibration of the instrument measurements, the input measurement results, you can enter

Next Calibration

4 Press the number keys to enter the measurement results, press the **F2** key.

5 After the calibration is complete, to save the calibration parameters, press **F3**;

6 Press **F4** to exit

Virtual Keyboard

Virtual Keyboard main character input operation is completed, the virtual keyboard provides the following features:

1. Provide both English and Chinese input method support

2 by the knob to select a different button, press the **enter** key to enter the key corresponding to the character

3 can be corrected after the input string

Please use the virtual keyboard, follow these steps:

1 **Select** Input Method

- 2 Enter the specified character
- 3 Modify character
- 4 OK to return

Election input method:

- 1 In the virtual keyboard main menu, press the **F1** key until the select input method specified

Enter the specified character:

- 1 If you choose to select the desired character input method in English, moving knobs, hit **enter** to confirm the text box, enter the window you can see the character input area after
- 2 If you select the input method for the Chinese, pinyin move the knob to select the desired character, and the display area pinyin input text window, while the first line of the window area of the keyboard will appear candidate Man character, press the number keys **1-9** to select or move to a forward or backward through the knob softkey to view a candidate for more than **nine** characters;

3 Modify character

- 1 In the virtual keyboard main menu, press the **F3** key to select the focus to a text box
- 2 by the direction keys to move the cursor, press the **backspace** key to delete or modify operations **ce** key executive
- 3 To return to the keyboard to continue to enter, then the virtual keyboard the main menu, press the **F3** key to select the keyboard focus

OK to return:

After modifying confirm press **F4** to return to the previous parent window

Password Authentication

System functions such as "**Security Settings**", **<calibration>**, **<upgrade>** requires administrator privileges, you need to verify the administrator password; password authentication provides this functionality;
The default system password is **88888888**

Please verify the password according to the following

- 1 Enter the administrator password via the numeric keypad area
- 2 Click the **F1** key to confirm the input, if the input the same, then enter the corresponding functions; If the input is inconsistent, clear the previous input password, continue to wait for user input;
- 3 If you do not continue with password authentication operation, press the **F3** key to **cancel** direct exit

Usb storage device

Signal generator can access external **usb** storage device. Signal generator recognizable format **fat32** equipment; maximum device size is **32G**;
Can **<Waveform Generators>** generated wave file or file system status signal generator into the device; and can be transferred from the device.

SD card

Signal generators can access the external **SD** card devices. Signal generator recognizable format **fat32** equipment; maximum device size is **32G**;

Can <Waveform Generators> generated wave file or file system status signal generator into the device; and can be transferred from the device.

SD cards are small cards.

2.3 Save and Recall

File Browser

File browser for browsing and maintain signal generator storage devices, including internal and external **usb flash** device, and **sd** card. Its main functions are:

1 storage device file browser

2. Delete files and new storage devices

3 New Folder

4 **Turn** on the signal generator can identify the type of file.

Browse to select the storage device file:

1 **Select** a different storage device. Press **F1** to select storage devices area of focus, move the knob to change the current storage media, click the **enter** button to confirm, the signal generator automatically file list area as a focal point. Use the knob and **enter** key to select the current file

(2) maintain the device file:

1 Referring **to** browse and select the file and select the file storage device, press **F5** deleted To delete a folder, you need to delete its subfolders.

3 New Folder love

1 **In** the file browser main menu, press the **F4** key to create a new folder in the specified folder.

Open to identify the type of file

1 **Select** the file specified by the file browser to select the storage device is described.

2 **In** the file browser main menu, press the **F5** key to bring up the selected file, if the signal generator can identify the type of file, the file directly rendered, if not recognition, saved in the file browser window

2.4 Remote Control Software

Pc-source software can be remotely controlled machine state. Connector to communicate with a remote connection through the rear panel **usb** device side.

Remote control software to create waveforms and waveform computation.

Chapter III Features and functions

This section contains detailed information on the instrument characteristics, including the front panel and remote interface operation. You may need to read the [front-panel menu reference](#). For more information about **SCPI** commands and queries, please refer to the [SCPI programming reference](#). This section includes:

- ◆ [Output Configuration](#)
- ◆ [Pulse waveform](#)
- ◆ [Amplitude modulation \(AM\) and frequency modulation \(FM\)](#)
- ◆ [Phase modulation \(P M\)](#)
- ◆ [Frequency shift keying \(FSK\) modulation](#)
- ◆ [Pulse width modulation \(PWM\)](#)
- ◆ [Frequency Sweep](#)
- ◆ [Burst Mode](#)
- ◆ [Trigger](#)

3.1 Output Configuration

This section describes the output channel configuration. Most are associated with the output configuration commands are **SOURce1:** or **SOURce2:** beginning to indicate a particular channel. Can not be omitted.

Output function

Instruments include **6** Standard waveforms: sine, square, triangle, pulse, noise and harmonics. There are still **nine** kinds of built-in arbitrary waveform, and can create custom waveforms using the built-in waveform editor.

The following table shows the modulation, sweep and burst allowed (•) function. Function Select mode does not allow the use of modulation or modulation or mode is disabled.

| Carrier | AM | FM | PM | ASK | FSK | PSK | BPSK | PWM | Burst | Sweep |
|----------------------------|----|----|----|-----|-----|-----|------|-----|-------|-------|
| Sine wave | • | • | • | • | • | • | • | | • | • |
| Square wave | • | • | • | • | • | • | • | • | • | • |
| Triangular wave / Sawtooth | • | • | • | • | • | • | • | • | • | • |
| Pulse wave | • | • | • | • | • | • | • | | • | • |
| Gaussian noise | • | | | | | | | | • A | |
| Arbitrary Waveform | • | • | | | | | | | • | • |

(A) only gated burst

- ◆ Frequency limit: Change function to change the frequency to meet the frequency limits of the new function.
- ◆ Combination of amplitude and offset value can not exceed the capabilities of the instrument. Your last set of items may change to remain within limits.
- ◆ Specified by the output voltage limit value and the lower limit value, to protect the device under test (DUT).
- ◆ Front panel:



◆ SCPI:

SOURce <n>: FUNCtion <SINusoid | SQUa re | RAMP | PULSe | NOISe | DC | SINC | EXPFall |

HAVErsine | LOREntz | DUALtone | GAUSE | ECG | USER | HARMonic |>**Output frequency**

As shown below, the output frequency range depends on the function (the default frequency for all functions are 1 kHz)

| Function | Frequency Range | |
|---------------|--|------------------------------------|
| Sine wave | 1 μ Hz ~ maximum frequency | |
| Square wave | HDG2102B, HDG2082B, HDG2062B, HDG2032B, HDG2102C, HDG2072C, HDG2052C, HDG2032C | 1 μ Hz ~ 30MHz |
| | HDG2022B, HDG2012B, HDG2002B | 1 μ Hz ~ maximum frequency |
| Triangle wave | HDG2102B, HDG2082B, HDG2062B, HDG2032B, HDG2102C, HDG2072C, HDG2052C, HDG2032C | 1 μ Hz ~ 30MHz |
| | HDG2022B, HDG2012B, HDG2002B | 1 μ Hz ~ The maximum frequency |
| Pulse | HDG2102B, HDG2082B, HDG2062B, HDG2032B, HDG2102C, HDG2072C, HDG205 2C, HDG2032C | 1 μ Hz ~ 30MHz |
| | HDG2022B, HDG2012B, HDG2002B | 1 μ Hz ~ maximum frequency |
| White Noise | HDG2102B, HDG2082B, HDG2062B, HDG2032B, HDG2102C, HDG2072C, HDG2052C, HDG2032C | 1 μ Hz ~ 30MHz |
| | HDG2022B, HDG2012B, HDG2002B | 1 μ Hz ~ maximum frequency |

- ◆ Frequency limit: Change function to change the frequency to meet the frequency limits of the new function.
- ◆ Burst Limit: For internal trigger bursts, the minimum frequency of 1 Hz.

- ◆ Duty Cycle Limitations: For square waves and pulses, duty cycle by a minimum pulse width of **16 ns** technical parameter limits. For example, when a frequency of **1 kHz**, the duty cycle can be set to a low value of **0.01%**, as this may generate a pulse width of **100 ns**. When **1 MHz**, the minimum duty cycle is **1.6 percent**, while in the **10 MHz** to **16%**. If you change the frequency can not produce the current duty cycle, the duty cycle will be adjusted to meet the minimum pulse width of the technical parameters of the request.

- ◆ **SCPI:**

SOURce <n>: FREQUency <frequency> | MINimum | MAXimum

SOURce <n>: FUNCtion: ARBitra ry: PTPeak <voltage> | MINimum | MAXimum

Output amplitude

For all functions, the default amplitude is **2 00 mVpp**.

- ◆ Offset Voltage Limitations: The following shows the relationship between the amplitude and offset.
 $V_{pp} < 2 (V_{max} - |V_{offset}|)$
- ◆ Set high and low will set the waveform amplitude and offset. For example, if you set the high level to **+2 V**, a low level is set to **-1 V**, the resulting amplitude of **3 Vpp**, offset is **-500 mV**.
- ◆ The output level of the control signal from the **DC offset voltage (DC offset voltage)**. DC level can be **- 10 V** to **+ 10 V**.
- ◆ **SCPI:**
SOURce <n>: VO LTage <amplitude> | MINimum | MAXimum

DC offset voltage

For all functions, default offset is **0 V**.

- ◆ Amplitude Limitations: The following shows the relationship between offset voltage and the output amplitude. Peak output voltage (**DC plus AC**) must not exceed the rated output of the instrument.
- ◆ Set high and low will set the waveform amplitude and offset. For example, if you set the high level to **+2 V**, the low level to **-3 V**, the resulting amplitude is **5 Vpp**, offset is **-500 mV**.
- ◆ **SCPI:**
SOURce <n>: VOLTage: OFFSet <offset> | MINimum | MAXimum
SOURce <n>: VO LTage: OFFSet [MINimum | MAXimum]?

Duty cycle (square wave)

The duty cycle of the square wave waveform in each cycle represents the amount of time a high level. (For more information about the pulse duty cycle, see the pulse waveform.)



20% duty cycle 80% duty cycle

- ◆ Duty cycle: at low frequencies of **0.0%** to **99.99 01 6%** range will be reduced at higher frequencies. Stored in volatile memory, the

default value of 50%.

◆ **Front panel:**



If you use the keyboard, press the **ENT** key to complete:

◆ **SCPI:**

SOURce <n>: FUNCtion: SQUare: DCYClE <percent> | MINimum | MAXimum

Symmetry (triangular wave)

Only the triangular wave. Symmetry means that each cycle of the triangular wave is the amount of time increases.



0% to 100% symmetrical symmetry

- ◆ Symmetry (the default is 50%) stored in volatile memory when you change to another waveform or waveform changes from the other, remember this setting.
- ◆ Triangle wave is AM, when FM, PM, or PWM modulation waveform symmetry setting does not apply.
- ◆ **Front panel:**



You can specify the value using the knob or keyboard. If you use the keyboard, press the **ENT** key To complete:

◆ **SCPI:**

SOURce <n>: FUNCtion: RAMP: SYMMetry <symmetry> | MINimum | MAXimum, SOURce <n>: FUNCtion: RAMP: SYMMetry [MINimum | MAXimum]?

For example: a symmetry of the channel is set to 30%: SOURce1: FUNCtion: RAMP: SYMMetry 30

Automatic voltage adjustment range

Autoranging is enabled by default, and the instrument will select the best attenuator setting.

Output Control

By default, the channel output at power disabled to protect other equipment. To enable the channel output, see below. When enabled channel output, the corresponding channel button lights up.

- ◆ The front panel



- ◆ SCPI:

OUTPut <n> ON | OFF,
OUTPut <n>?

Sync Output Signal

Provide **Sync Sync** output connector on the front panel. All standard output functions (except DC and Noise) has an associated **Sync** signal. You may not want to use **Sync** signal output can be disabled **Sync** connector (Trig Menu->Sync->Off). **Sync** signal can be obtained either from the output channel.

General behavior

- ◆ By default, the **Sync** signal can be obtained from the channel 1, and transmits it to the connector **Sy nc (enabled)**.
- ◆ **Sync** is disabled when the signal output level on the **Sync** connector is a logic "low" level.
- ◆ For a sine wave, pulse, sawtooth, square wave and triangular wave, **Sync** signal is in the first half of the cycle is "high" in the second half of the "low" square wave.
- ◆ Front panel:



- ◆ SCPI:

OUTPut: SYNC: SOURce CH1 | CH2

3.2 pulse waveform

As shown, comprises a square wave or pulse period, pulse width, the rising and falling edges.



1 Frequency

◆ Frequency: the number of completed material changes periodically within **one** second is called frequency. Hertz (Hz), and <period> a reciprocal relationship;

◆ Front panel:

Select pulse waveform:



Select the frequency, instead of the **cycle**.

Set frequency:



◆ **SCPI :**

SOURce <n>: FUNCtion PULSe

SOURce <n>: FREQUency <frequency> | MINimum | MAXimum

2 pulse width

The rising edge of the pulse from the pulse width of **50%** to the next falling edge of the threshold **of 50%** of the time threshold.

◆ Pulse width: **16 ns** to **1,000,000 s** (see the following restrictions). The default pulse width is **00 μs 5** .

◆ by "minimum pulse width (**16ns** limit) "and" pulse cycle ".

Minimum pulse width pulse width \geq

Pulse width \leq pulse period - $2 \times$ minimum pulse width

◆ The instrument will adjust the pulse width to accommodate the specified period.

◆ front panel:



◆ SCPI :

SOURCE <n>: FUNCTION: PULSE: WIDTH <seconds> | MINimum | MAXimum

SOURCE <n>: FUNCTION: PULSE: WIDTH [MINimum | MAXimum]?

For example: Channel 1 pulse width is set to 5ms : SOURCE1: FUNCTION: PULSE: WIDTH 0.005

3. pulse duty cycle

Pulse duty cycle is defined as follows:

Duty Cycle = $100 \times (\text{pulse width}) / \text{cycle}$

The rising edge of the pulse from the pulse width of 50% to the next falling edge of the threshold of 50% of the time threshold.

◆ pulse duty cycle: 0.01% to 99.99% (please refer to the following restrictions). The default value is 50%.

◆ pulse duty cycle must meet the minimum pulse width (W_{min}) following limitations decision. The instrument will be adjusted to meet the specified pulse duty cycle. Pulse duty by "minimum pulse width (16 ns)" and "pulse cycle" restrictions:

Duty cycle $\geq 100 \times \text{minimum pulse width} / \text{cycle}$

Duty cycle $\leq 100 \times (1 - (2 \times \text{minimum pulse width} / \text{cycle}))$

◆ front panel:

Select the pulse function:



Switch to the duty cycle:



Input Duty Cycle:



◆ SCPI :

SOURCE <n>: PULSE: DCYCLE <percent> | MINimum | MAXimum

For example: Channel 1 duty cycle is set to 30% : SOURCE1: FUNCTION: PULSE: DCYCLE 30

4. edge time

Edge time can be set individually or simultaneously transition time leading and trailing edges of the pulse. Edge time represents 10% threshold and 90% of the time threshold value.

- ◆ edge time: The default value is 1 μ s.
- ◆ specified edge time must be within the specified pulse width. The instrument will adjust the edge time to meet the specified pulse width.
- ◆ front panel:



◆ SCPI:

SOURCE <n>: FUNCTION: PULSE: TRANSITION: LEADING <seconds> | MINIMUM | MAXIMUM

SOURCE <n>: FUNCTION: PULSE: TRANSITION: TRAILING <seconds> | MINIMUM | MAXIMUM

For example: Channel 1 pulse rise time is set to 10ns, SOURCE1: FUNCTION: PULSE: TRANSITION: LEADING 0.0000001

The channel 1 pulse rise time is set to 10ns, SOURCE1: FUNCTION: PULSE: TRANSITION: TRAILING 0.0000001

3.3 amplitude modulation (AM) and frequency modulation (FM)

A modulated waveform consists of a carrier waveform and a modulating waveform. In AM, the amplitude of the carrier waveform is modulated with the voltage level is changed. In FM, the frequency of the carrier wave modulated waveform with the voltage level is changed.

Instruments subject to internal or external modulation source.

Please select AM or FM, and then set any other modulation parameters.

Select **AM** or **FM**

- ◆ instruments allow only one modulation mode is enabled on a channel. Enabled AM or FM, all other modulation are closed. Modulation of both channels independent of each other, the instrument can add modulation waveforms from two channels.
- ◆ enabled devices are not allowed in the sweep or burst mode is AM or FM. Enable AM or FM will close sweep and burst.
- ◆ To avoid multiple waveform changes, enable modulation after configuring other modulation parameters.
- ◆ front panel:



◆ SCPI :

SOURCE <n>: MOD ON | OFF

SOURCE <n>: MOD: TYPE AM | FM

Carrier waveform shape

- ◆ AM or FM carrier shape: Sine (default), square, ramp, pulse, triangle, noise, or arbitrary waveforms. You can not use DC as the carrier waveform.
- ◆ For FM, the carrier frequency must always be greater than or equal to the frequency deviation. Attempt to set the deviation is greater than the carrier frequency will cause the instrument will be set equal to the carrier frequency deviation.
- ◆ plus carrier frequency deviation can not exceed the maximum frequency of the selected function plus 100 kHz.

Note: You can not use noise modulation waveform modulation noise or use any arbitrary waveform.

Carrier Frequency

Maximum carrier frequency as a function change, as shown below. The default value for all functions are 1 kHz.

| Function | The minimum frequency | The maximum frequency |
|---------------|--|------------------------------------|
| Sine wave | 1 μ Hz | The maximum frequency |
| Square wave | HDG2102B, HDG2082B, HDG2062B, HDG2032B, HDG2102C, HDG2072C, HDG2052C, HDG2032C | 1 μ Hz ~ 30MHz |
| | HDG2022B, HDG2012B, HDG2002B | 1 μ Hz ~ The maximum frequency |
| Triangle wave | HDG210 2B, HDG2082B, HDG2062B, HDG2032B, HDG2102C, HDG2072C, HDG2052C, HDG2032C | 1 μ Hz ~ 30MHz |
| | HDG2022B, HDG2012B, HDG2002B | 1 μ Hz ~ maximum frequency |
| Pulse wave | HDG2102B, HDG2082B, HDG2062B, HDG2032B, HDG2102C, HDG2072C, HDG2052C, HDG2032C | 1 μ Hz ~ 30MHz |
| | HDG2022B, HDG2012B, HDG2002 B | 1 μ Hz ~ maximum frequency |
| Noise | HDG2102B, HDG2082B, HDG2062B, HDG2032B, HDG2102C, HDG2072C, HDG2052C, HDG2032C | - |

| | | |
|--|---------------------------------|---|
| | HDG2022B, HDG2012B, HDG2002B | - |
|--|---------------------------------|---|

◆ **SCPI :**

SOURce <n>: FREQuency <frequency> | MINimum | MAXimum

Modulation waveform shape

The instrument will accept an internal or external AM or FM modulation source.

Note: You can not use noise modulation noise, or arbitrary waveforms using an arbitrary waveform modulation.

Modulation waveform shape (internal source) may be:

- ◆ Sine wave
- ◆ duty cycle of 50% of the square wave
- ◆ symmetry 50% of the triangular wave
- ◆ noise - white Gaussian noise
- ◆ Arb - Arbitrary Waveform
- ◆ sampling wave
- ◆ index fell
- ◆ half being lost
- ◆ Lorentz
- ◆ Dual Tone Multi-Frequency
- ◆ ECG

◆ **SCPI :**

SOURce <n>: MOD: AM: INTernal: FUNction SINusoid | SQUare | RAMP

SOURce <n>: MOD: FM: INTernal: FUNction SINusoid | SQUare | RAMP

Frequency modulation waveform

Instruments subject to internal or external modulation source.

- ◆ modulation frequency (internal source) : varies with the type of signal
- ◆ modulation frequency (external source) : 0 to 100 kHz
- ◆ **SCPI :**

SOURce <n>: MOD: AM: INTernal: FREQuency <frequency> | MINimum | MAXimum

SOURce <n>: MOD: FM: INTernal: FREQuency <frequency> | MINimum | MAXimum

For example:

The channel a frequency modulated wave is set to 500Hz : SOURCE1: MOD: FM: INTernal: FREQuency 500

The channel 1 waveform shape of the modulation wave is set to square wave: SOURCE1: MOD: FM: INTernal: FUNction SQUare

Modulation depth (AM)

The modulation depth is a percentage of the amplitude change. At 0% when the depth is half the amplitude of the carrier amplitude settings. At 100% when the depth of the modulation waveform with amplitude change of the amplitude of the carrier from 0% to 100%.

- ◆ Modulation depth: 0% to 120%. The default value is 50%.
- ◆ front panel:



◆ **SCPI :**

SOURce <n>: MOD: AM: DEPTh <depth> | MINimum | MAXimum

Frequency deviation (FM)

Frequency deviation setting represents the carrier frequency of the modulated waveform frequency peak variation.

When the carrier is PRBS, the frequency deviation will cause changes in the amount of half the bit rate is equal to the set frequency.

For example, 10 kHz deviation equal to the bit rate of 5 KBPS amount of change.

◆ Frequency deviation: 1 μ Hz to (carrier frequency) / 2, the default is 100 Hz.

◆ For FM, the carrier frequency must always be greater than or equal to the frequency deviation. Attempt to set the deviation is greater than the carrier frequency will cause the instrument will be set equal to the carrier frequency deviation.

Frequency deviation + carrier frequency \leq current carrier frequency limit + 1 kHz

◆ front panel



◆ **SCPI :**

SOURce <n>: MOD: FM: DEVIation <deviation> | MINimum | MAXimum

Modulation source

Instruments subject to internal or external modulation source.

◆ Modulation Source: Internal (default), the other channel or external. External modulation source may be up to 100 kHz.

◆ by an external source, the external waveform can be modulated carrier waveform. Modulation depth (AM) or frequency deviation (FM) on the front panel by the MOD connector on ± 5 V signal level control.

◆ front panel

Enable AM or FM after select the modulation source shown below



◆ **SCPI :**

SOURce <n>: MOD: AM: SOURce INTernal | EXTernal

SOURce <n>: MOD: FM: SOURce INTERNAL | EXTERNAL

For example: Channel 1 set for external modulation source: SOURCE1: MOD: AM: SOURce EXTERNAL

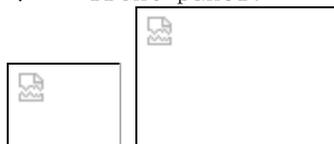
The Channel 1 set for external modulation source: SOURCE1: MOD: FM: SOURce EXTERNAL

3.4 Phase Modulation (PM)

A modulated waveform consists of a carrier waveform and a modulating waveform. PM and FM are very similar, but in the PM, the phase is changed by the instantaneous voltage of the modulating waveform is modulated waveform.

1 Select the phase modulation

- ◆ only once to enable a modulation mode. Enabling PM disabled before modulation mode.
- ◆ enable the PM will close sweep and burst.
- ◆ front panel:



Using the current carrier and modulating waveform set the output waveform.

- ◆ To avoid multiple waveform changes, enable modulation after configuring other modulation parameters.

- ◆ **SCPI:**

SOURce <n>: MOD ON | OFF

SOURce <n>: MOD: TYPE AM | FM | PM | ASK | FSK | PSK | PWM | BPSK

2 carrier waveform shape

- ◆ PM carrier shape: Sine (default), square wave, sawtooth, triangle, pulse, or arbitrary waveforms. You can not use noise or DC as the carrier waveform.

- ◆ **SCPI:**

SOURce <n>: FUNCTION <SINusoid | SQUare | RAMP | PULSe | SINC | ARB | HARMonic |>

3 Carrier Frequency

Maximum carrier frequency as a function change, as shown below. The default value for all functions are 1 kHz.

- ◆ **SCPI:**

SOUR ce <n>: FREQUency <frequency> | MINimum | MAXimum

For example ; the channel 1 output frequency is set to 100Hz: SOURCE1: FREQUency 100

4 modulation waveform shape

Instruments subject to internal or external modulation source.

- ◆ modulation waveform shape (internal source) may be:
 - ◆ Sine wave

- ◆ duty cycle of 50% of the square wave
- ◆ symmetry 100% up sawtooth
- ◆ symmetry 50% of the triangular wave
- ◆ symmetry 0% down sawtooth
- ◆ noise -white Gaussian noise
- ◆ Arbitrary Waveform
- ◆ You can use noise as the modulating waveform, but can not use noise or DC as the carrier waveform.

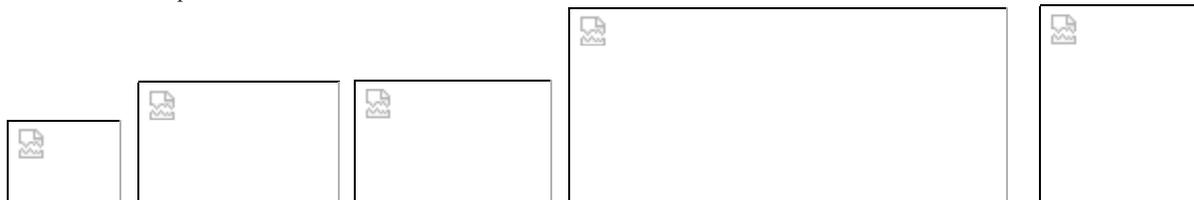
◆ **SCPI :**

SOURce <n>: MOD: PM: I Nternal: FUNction SINusoid | SQUare | RAMP

5 frequency modulation waveform

Instruments subject to internal or external modulation source.

- ◆ modulation frequency (internal) : 2 mHz to 500 kHz , the default value is 10 0 Hz .
- ◆ front panel:



◆ **SCPI:**

SOURce <n>: MOD: PM: I Nternal: FREQuency <frequency> | M I Nimum | M A Ximum

For example: Channel 1 wave frequency modulation is set to 500Hz : SOURCE1: MOD: PM: I Nternal: FREQuency 500

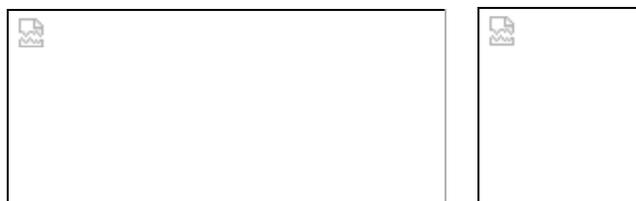
6 phase deviation

Phase deviation setting represents the peak variation is modulated waveform with the phase of the carrier wave. Phase deviation can be 0 to 360 degrees within the range set (default is 180).

- ◆ front panel:



Then set the phase deviation:



◆ **SCPI :**

SOURce <n>: MOD: PM: DEVIation <deviation> | MINimum | MAXimum

7. modulation source

Instruments subject to internal or external modulation source.

◆ Modulation Source: Internal (default), the other channel or external. External modulation source may be up to 100 kHz.

◆ If you choose an external source, then use an external waveform modulated carrier wave. Phase deviation from the front panel **MOD** connector shown ± 5 V signal level control.

◆ **front panel:**



◆ **SCPI :**

SOURce <n>: MOD: PM: SOURce INTernal | EXTernal

3.5 Frequency Shift Keying (FSK) modulation

Instrument can be configured to use **FSK** modulation between two preset values "move" its output frequency. Output at two frequencies (called the "carrier frequency" and "frequency hopping") between the rate move by the internal rate generator or the front panel **TRIG** signal level is determined on the connector.

Select the FSK modulation

SOURce <n>: MOD ON | OFF

SOURce <n>: MOD: TYPE FSK

◆ only once to enable a modulation mode. Enable **FSK** modulation mode is turned off before.

◆ In the case of the sweep or burst is enabled, you can not enable **FSK**. Enable **FSK** will close sweep and burst.

◆ To avoid multiple waveform changes, enable modulation after configuring other modulation parameters.

FSK carrier frequency

SOURce <n>: FREQuency <frequency> | MINimum | MAXimum

Different waveforms corresponding to different frequency ranges:

Sine wave: ≥ 1 μ H to 160 MHz

Square wave: 1 μ Hz to 50 MHz

Sawtooth: 1 μ Hz to 4 MHz

Pulse: 1 μ Hz to 40 MHz

Arbitrary waveform: 1 μ Hz to 40 MHz

Harmonic: 1 μ Hz to 80 MHz

- ◆ When selecting an external source, the output frequency from the front panel **TRIG** signal level decision on the connector. If there is a logic low, the output carrier frequency. If there is logic high, the output frequency hopping.

FSK " jump " frequency

SOURCE <n>: MOD: FSKey: FREQUENCY <frequency> | MINimum | MAXimum

Maximum alternate (or " jump ") frequency depends on the function. The default value for all functions are 100 Hz. Internal modulation waveform duty cycle of 50% of the square wave.

Sine wave: 1 μ Hz to 160 MHz

Square wave: 1 μ Hz to 50 MHz

Sawtooth: 1 μ Hz to 4 MHz

Arbitrary waveform: 1 μ Hz to 40 MHz (Built-wave DC except)

FSK rate

SOURCE <n>: MOD: FSKey: INTERNAL: RATE <frequency> | MINimum | MAXimum

FSK rate is using the internal FSK source, the output frequency between the carrier frequency and frequency hopping "mobile " rate.

- ◆ FSK rate (internal source): 2 mHz to 1 MHz, the default value is 10 0 Hz.
- ◆ If you choose an external FSK source is ignored FSK rate.

FSK source

SOURCE <n>: MOD: FSKey: SOURCE INTERNAL | EXTERNAL

Can be Internal (the default value) or EXTERNAL .

- ◆ When you select an internal source, the output frequency between the carrier frequency and frequency hopping "mobile " rate by the FSK rate decision.
- ◆ When selecting an external source, the output frequency from the rear panel **TRIG** signal level decision on the connector. If there is a logic low, the output carrier frequency. If there is logic high, the output frequency hopping.

3.6 Pulse Width Modulation (PWM)

This section represents a pulse width modulation PWM. PWM pulse waveform only for a pulse width modulated signal with change. Called pulse width variation width deviation, which can be specified as a percentage of the waveform period (ie duty cycle), or designated as a unit of time. For example, if the duty cycle is 20% of the pulses and enable the deviation of 5% of the PWM, then under the control of the modulation signal, the duty ratio of 15% to 25% variation between.

Instruments subject to internal or external modulation source.

Select PWM

- ◆ In the case of the sweep or burst is enabled, you can not enable PWM.
- ◆ To avoid multiple waveform changes, enable modulation after configuring other modulation parameters.
- ◆ front panel:

Using the current carrier and modulating waveform set the output waveform.

◆ **SCPI :**

SOURce <n>: MOD ON | OFF

SOURce <n>: MOD: TYPE PWM

Modulation waveform shape

Instruments subject to internal or external modulation source.

◆ modulation waveform shape (internal source) may be:

◆ Sine wave

◆ duty cycle of **50%** of the square wave

◆ symmetry **100%** up sawtooth

◆ symmetry **50%** of the triangular wave

◆ symmetry **0%** down sawtooth

◆ noise - white Gaussian noise

◆ Arbitrary Waveform

◆ You can use noise as the modulating waveform, but can not use noise, arbitrary waveform or **DC** as the carrier waveform.

◆ **front panel:**



◆ **SCPI :**

SOURce <n>: MOD: PWM: INTernal: FUNCtion SINusoid | SQUare | RAMP

Frequency modulation waveform

Instruments subject to internal or external modulation source.

◆ modulation frequency (internal source) : **2M Hz** to **500K Hz**. The default value is **10 0 Hz**.

◆ front panel:



◆ **SCPI :**

SOURce <n>: MOD: PWM: INTernal: FREQuency <fr equency> | MINimum | MAXimum

Width deviation

0 ns to **500 ks**, pulse width deviation can not exceed the current pulse width.

Pulse width limited by the minimum pulse width deviation and the current edge time setting.

◆ **SCPI :**

SOURce <n>: MOD: PWM: DEVIation <deviation> | MINimum | MAXimum

Modulation source

Instruments subject to internal or external modulation source.

◆ Modulation Source: Internal (default) or external. External modulation source may be up to **100 kHz**.

- ◆ If you choose *External* modulation source, the deviation from the front panel **MOD** connector ± 5 V signal level control. For example, if the deviation has been set to $1 \mu\text{s}$, then the $+5$ V signal corresponding to the width increases $1 \mu\text{s}$. Lower signal levels produce less deviation.

- ◆ **front panel**



- ◆ **SCPI :**

SOURce <n>: MOD: PWM: SOURce INTernal | EXTernal

3.7 Frequency Sweep

In the frequency sweep mode, the instrument will scan rate specified from the start frequency to move the stop frequency. You can order from high to low frequency linear scanning, or from low to high frequency scanning. You can also be configured as an instrument by applying an external or manual trigger to output a scan (from start frequency to stop frequency). The instrument can scan sine, square, pulse, sawtooth, triangle, or arbitrary waveform (not allowed PRBS, noise and DC).

You can specify the holding time (holding the stop frequency scan duration) and the return time (frequency in a linear manner from the start frequency to stop frequency is changed last time).

Select Scan

Instruments are not allowed in the burst enabled or arbitrary modulation mode is enabled while scanning or list mode. When scanning is enabled, will turn off the burst or modulation mode.

- ◆ To avoid multiple waveform changes, enable the sweep mode after you configure other parameters.

- ◆ front panel:

Using the current amplitude, frequency offset and the output scan:





Then press the " Sweep "button will close the sweep mode.

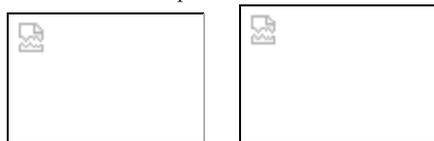
◆ **SCPI:**

SOURce <n>: SWEep ON | OFF

Start frequency and cutoff frequency

Start frequency and the cutoff frequency set upper and lower frequency scanning. Sweep from the start frequency, has been scanned into the stop frequency, and then reset back to the starting frequency.

- ◆ start frequency and cut-off frequency: **1 μ Hz** to the highest frequency. The default start frequency is **100 Hz**. The default stop frequency of **1 kHz**.
- ◆ scan from low frequency to high frequency, set the start frequency is set to be less than the stop frequency.
- ◆ sweep output and pulse train output of each channel is through the channel output terminals.
- ◆ front panel:



Center frequency and frequency span

You can also use the center frequency and frequency range to set the frequency boundary scan.

- ◆ center frequency: **1 μ Hz** to **30 MHz** (for sawtooth, limited to **200 kHz**). The default is **550 Hz**.
- ◆ frequency span: **-30 μ Hz** to **30 MHz** (for sawtooth, limited to **200 kHz**). The default is **900 Hz**.
- ◆ To perform the scan from low to high frequency, set a positive frequency range; want to perform the scan from high to low, set a

negative frequency range.

- ◆ sign off for scanning, **Sync** signal is a duty cycle of **50%** of the square wave. When scanning starts, **Sync** signal is a TTL "high " level, the midpoint of the scan becomes "Low " level. **Sync** waveform specified frequency equal to the scan time. The front panel **Sync** signal output connector.
- ◆ For frequency sweeps sign open when the scan start **Sync** signal is a TTL "high " level, the mark frequency is "low " level.

Scan time

Scan time specified from the start frequency to the stop frequency desired scan of seconds. The instrument calculates points based on scanning the scan time.

- ◆ scan time: **1 ms** to **300 s**, the default value is **1 s**.
- ◆ front panel:



- ◆ **SCPI :**
SOURce <n>: SWEep: TIME <seconds> | MINimum | MAXimum

Return time and hold time

Hold time specified stop frequency to keep time (in seconds), and the return time to return from the stop frequency to a specified number of seconds required start frequency.

- ◆ hold time and return time: **1ms** to **300 seconds** (default value **1S**).
- ◆ front panel:



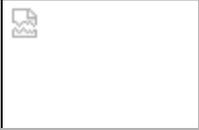
- ◆ **SCPI :**
SOURce <n>: SWEep: HTIM e <seconds> | MINimum | MAXimum
SOURce <n>: SWEep: RTIME <seconds> | MINimum | MAXimum

Flag frequency

If necessary, you can set the front panel **Sync** connector on the signal during the scan goes to a logic low frequencies. At the beginning of the scan, **Sync** signal is always from low to high.

If you enable the "flag" feature, the sync signal will reach the specified marker frequency at the output frequency becomes low.

- ◆ symbol frequency: between "Start frequency" and "End frequency", the default value is **5 5 0 Hz**.
- ◆ When the scan mode is enabled, the flag must be between the frequency specified in the start frequency and stop frequency.
- ◆ **front panel:**



- ◆ **SCPI :**
SOURce <n>: MARKer ON | OFF
SOURce <n>: MARKer: FREQuency <frequency> | MINimum | MAXimum

Sweep trigger source

In scan mode, the scanning device outputs a trigger signal when it receives. After a frequency from the start to the stop frequency scan, the instrument once the initial trigger output frequency will also wait for the next.

- ◆ sweep trigger source: Internal (default), external or manual.
- ◆ In using the internal (immediate) source, the instrument outputs a continuous sweep at a rate of retention time, scan time and return time joint decision.
- ◆ When using an external source, the instrument front panel will accept **TRIG** hardware connector on the trigger, and each **TRIG** receiver with the specified polarity **TTL** pulse, the instrument will start a scan.
- ◆ trigger period must be greater than or equal to the specified sweep time.
- ◆ When selecting the source manually, each time you press the front panel **[Trig Menu]** key is pressed, the instrument will output a scan.
- ◆ **SCPI :**
SOURce <n>: SWEep: TRIGger: SOURce INTernal | EXTernal

3.8 Burst Mode

Instrument can output waveform with a specified number of cycles, called a burst. For bursts, you can use sine, square, triangle, ramp, pulse, or arbitrary waveforms.

Select bursts

Enable scanning or modulation in case you can not enable bursts. Enable burst closes scanning and modulation.

- ◆ To avoid multiple waveform changes, enable the burst mode after you configure other parameters.
- ◆ front panel:



- ◆ **SCPI:**
SOURce <n>: BURSt ON | OFF

Burst Mode

Burst has two modes, as described below. The selected mode will allow the trigger source control, and what other burst parameters apply.

- ◆ triggered burst mode (default): The instrument can be received each time the trigger output with a specified number of cycles (trigger count) waveforms. After the output of the specified number of cycles, the instrument will stop and wait for the next trigger. Instrument can be used to start an internal trigger bursts, or by pressing the front panel **[Trig Menu]** button on the front panel **TRIG** trigger connector applications trigger signal.
- ◆ External Gated Burst Mode: According added to the front panel **TRIG** level of the external signal connector to open or close the output waveform. When the gate signal is true, the instrument outputs a continuous waveform. When the gate signal is false, the current waveform cycle is completed first, then the instrument stops, while maintaining the initial burst phase of the selected waveform corresponding to the voltage level. When the gate signal goes false, the noise waveform output will stop immediately.

| Parameter | Burst Mode (BURS : MODE) | Burst count (BURS : N CYC) | Burst cycle (BURS : INT: PER) | Burst phase (BURS : PHAS) | Trigger source (BURS : SOUR) |
|--|----------------------------|------------------------------|---------------------------------|-----------------------------|--------------------------------|
| Triggered Burst Mode: Internal trigger | TRIGgered | Available | Unavailable | Available | IMMediate |
| Triggered Burst Mode: External Trigger | TRIGgered | Available | Unused | Available | EXternal |
| Gated Burst Mode: External Trigger | GATed | Unused | Unused | Available | Unused |

In gated mode, burst count, burst period and trigger source are ignored.

In gated mode, you can specify the front panel **TRIG** polarity of the signal on the connector , (SOURce <n>: BURSt: TRIGger: SLOPe POSitive | NEGative). default is Positive.

- ◆ **SCPI :**
SOURce <n>: BURS t: TRIGger: SLOPe POSitive | NEGative
SOURce <n>: BURSt: TRIGger: SLOPe?
The default is Positive

Burst count

The number of cycles to be output per burst:

1 to 1,000,000 (external or manual trigger)

1 to 500,000 (internal trigger), the command only **N** cyclic mode is active

- ◆ When using the internal trigger source, in order to determine the rate of burst period specified number of cycles of continuous output. Continuous burst period is the time between the start of the burst.

- ◆ In gated burst mode, burst count is ignored.

- ◆ SCPI:

SOURce <n>: BURSt: NCYCles <cycle s> | MINimum | MAXimum

Burst period

Burst period is from one start to the next burst burst start time (default is 10 ms). Only for internal burst mode. Burst period and the "wave frequency" different wave frequencies for the frequency specified burst signal.

- ◆ enabled only "immediate trigger" (refers to Internal trigger manual or external triggering is enabled (or select gated burst mode), the burst period is ignored.

- ◆ not specify the burst period is too short, otherwise the instrument will not be at the specified burst count and frequency output. If the burst period is too short, the instrument will be continuously re-trigger the burst cycle based on the need to increase.

Starting phase

Burst starting phase, from 0 to +360 degrees (default is 0).

Burst trigger source

In the triggered burst mode:

- ◆ When a trigger is received, the instrument outputs a specified number of cycles (burst count) waveform. After the specified number of cycles has been output, the instrument stops and waits for the next trigger.

- ◆ **Internal (inside)**: When the trigger mode is enabled, the instrument will continuously output.

- ◆ **EXTERNAL**: before accepting the instrument panel **TRIG** connector hardware trigger. Every **TRIG** received with the correct polarity **SOURce <n>: BURSt: TRIGger: SLOPe POSitive | NEGative** the TTL pulse, the instrument will output pulse train with a specified number of cycles. External trigger signal is ignored during the burst.

- ◆ **EXTERNAL**: burst count and burst phase remain in effect, but ignores the burst cycle.

- ◆ SCPI:

SOURce <n>: BURSt: TRIGger: SOURce INTernal | EXTernal

Gating signal polarity

The current selection panel [external trigger] gating signal connector on the high or low when the output pulse train

- ◆ SCPI:

SOURce <n>: BURSt: GATE: POLarity NORMAl | INVerted

SOURce <n>: BURSt: GATE: POLarity?

Set channel 1 gate polarity is negative: **SOURCE1: BURSt: GATE: Polarity INVerted**

3.9 Trigger

This section describes the instrument's trigger system.

Trigger Overview

The trigger information applies only to sweep and burst. You can use the internal trigger, external or manual trigger is issued for the sweep or burst trigger.

- ◆ inside: When you select the sweep or burst mode, the instrument will continuously output.
- ◆ External: using the front panel **TRIG** connector to control the sweep or burst. Every **TRIG** received TTL pulse, the instrument will start a scan or outputs one burst. You can choose the instrument is triggered at the rising or falling.
- ◆ Manual: Each time you press the front panel **[Trig Menu]** key trigger will start a scan or outputs one burst.

Trigger Source

The trigger information applies only to sweep and burst. You must specify the instrument to accept its trigger trigger source.

- ◆ sweep and burst trigger source: Internal (default), external or manual.
- ◆ instrument will receive a manual trigger, from the front panel **TRIG** connector hardware trigger or continuous output using the internal trigger sweep or burst.
- ◆ trigger source with volatile;
- ◆ front panel:

Enable the sweep or burst. Then:



- ◆ **SCPI :**
SOURce <n>: SWEEp: TRIGger: SOURce INTernal | EXTernal
SOURce <n>: BURSt: TRIGger: SOURce INTernal | EXTernal

Internal trigger (immediate trigger)

Internal trigger mode (default): The instrument will continuously output the sweep or burst (designated by the scan time or burst cycle).

- ◆ **SCPI :**
SOURce <n>: BURSt: TRIGger
SOURce <n>: SWEEp: TRIGger

Manual trigger

Manual trigger mode: by pressing the **[Trig Menu]** button to manually trigger the instrument. Each time you press **[Trig Menu]**, the instrument will start a sweep or burst. In the trigger menu and the instrument is waiting for a manual trigger, this button indicator lights. When the instrument is waiting for a manual trigger, but you are not in the trigger menu, this button lights will flash.

External Trigger

In the external trigger mode, the instrument front panel will accept **TRIG** connector on the hardware trigger. Every **TRIG** has received a specified edge TTL pulse, the instrument will start a scan or burst. External trigger mode is similar to the manual trigger mode, the difference is applied to the trigger **Ext Trig** connector.

- ◆ **SCPI :**
SOURce <n>: SWEEp: TRIGger: SOURce EXTernal

SOURce <n>: SWEEp: TRIGger: SLOPe POSitive | NEGative
SOURce <n>: BURSt: TRIGger: SOURce EXTernal
SOURce <n>: BURSt: TRIGger: SLOPe POSit ive | NEGative

Chapter IV waveform generation tutorial

- ◆ [sine wave generator](#)
- ◆ [square wave generation](#)
- ◆ [triangle wave generation](#)
- ◆ [pulse generator](#)
- ◆ [noise generation](#)
- ◆ [arbitrary waveform generator](#)
- ◆ [harmonic generation](#)
- ◆ [worth method input parameters](#)

◆ modulation wave

Frequency: substance 1 cyclical changes in the number of completed within seconds, called frequency. Hertz (Hz), and <period > a reciprocal relationship;

Cycle: motion signal, change process ,some characteristics appear repeatedly ,there are two consecutive time elapsed is called "cycle", the unit cycle has ns, U.S., ms, s etc.

Range: distance signal development of the highest and lowest points between, the size of the signal changes, the unit is Vpp, mVpp, uVpp etc.

Offset: offset up or down from the intermediate position signal from the upward. Units of V, mv, uv, etc.

High and low: the letter the maximum number of high-level signal value, minimum is low, the unit is V, mv, uv, etc.

Phase: phase signal reflects the physical state at any time. The magnitude and direction of the signal change with time; unit is degree . Starting phase of the available range is 0 ° to 360 ° . The default value is 0 ° .

Duty cycle: the ratio of the total duration of the positive pulse and pulse period. Units of % , the default value is 50% .

Symmetry: Symmetry is defined as the percentage of the triangular waveform is rising during the period. Symmetry can be set in the range of 0% to 100% . The default value is 50% .

Pulse width: Pulse width is defined as the rising edge of the pulse amplitude of 50% threshold of the next falling edge of the amplitude of the 50% threshold of the time interval between.

Pulse duty cycle is defined as the percentage of the pulse width period accounted for. Symmetry can be set in the range of 0% to 100% . The default value is 50%

Rise time: The rise time is defined as the steady state response curve values from 10% up to the steady state value of 90% of the desired

time.

Fall Time: response time is defined as the curve drops from the steady state value of **90% of the steady-state value decreases by 10%** the time required.

4.1 sine wave generator

The sine wave is a single frequency component of the signal most, because such a signal waveform is sinusoidal mathematical name. Any complex signal can be seen as composed of many different frequencies, the sine wave of varying sizes composite.

Please follow the steps below sine wave output.

- 1 Push the front-panel **Sine** (sine wave) button, if the waveform is <modulation mode >, <sweep mode > or <burst mode > Turn off these types of models;
- 2 Press the front panel **Ouptput** (channel output button) to open the channel waveform output switch ,open the button lights;
- 3 shows the oscilloscope sine wave;
- 4 If you need to modify the waveform <frequency >, you can press the front panel **F/T** (frequency /period shortcut) button or the main menu when the current is sinusoidal, press **F1** button; then the selected parameter is high Highlight
- 5 If you need to modify the waveform <magnitude >, you can press the front panel **AMP** (amplitude shortcut) button or the main menu when the current is sinusoidal, press **F2** button; then selected parameter is highlighted
- 6 If you need to modify the waveform <dc offset >, you can press the front panel **Offset** (DC offset shortcut) button or the main menu when the current is sinusoidal, press **F3** button; then the selected parameter is high bright display,
- 7 If you need modify waveforms <phase>, then you can sinusoidal current menu, press the **F4** button; then selected parameter is highlighted
- 8 If the need to make the channel and the other phase alignment, you can sinusoidal current main menu, press the **F5** button (same phase softkey).
- 9 When the parameter you want to change the highlighted display, parameter values can be entered via the front panel knob and numeric keypad, see < input parameter value method > ;

4.2 square wave generation

Square wave is a non-sinusoidal waveform. Ideal square wave only "high" and "low" of these two values.

Please output square wave follow the steps below.

- 1 Press the front panel **Square** (square wave) button, if the waveform is <modulation mode >, <sweep mode > or <burst mode > Turn off the;
- 2 Press the front panel **Ouptput** (channel output button) to open the channel waveform output switch, open the button lights;
- 3 oscilloscope will show a square wave;
- 4 If you need to modify the waveform <duty cycle >when you can is a square wave in the current menu, press the **F5** button; then selected parameter is highlighted.
- 5 To modify other waveform parameters, see <sine wave generator > ;
- 6 When the parameter you want to change the highlighted display, parameter values can be entered via the front panel knob and numeric keypad, see < input parameter value method > ;
- 7 If you need to make the channel and the other phase alignment, you can in the main menu of the current sine wave, press **F6** button to

enter the second page of the main menu, press **F1** key.

4.3 triangular wave generating

Triangle wave is an non-sinusoidal waveform by adjusting < symmetry > it can be modified to a sawtooth wave.

Please triangular waveform output in accordance with the following procedure.

- 1 Press the front panel **Ramp** (triangle) button, if the waveform is < modulation mode >, < sweep mode > or < burst mode > Turn off the;
- 2 Press the front panel **Oupput** (channel output button) to open the channel waveform output switch , open the button lights;
- 3 oscilloscope shows a triangular wave;
- 4 If you need to modify the waveform < symmetry >, then the triangular wave current menu, press the **F5** button; then selected parameter is highlighted.
- 5 To modify other waveform parameters, see < sine wave generator >;
- 6 When the parameter you want to change the display to highlight, through the knob and numeric keypad to enter the parameter values of the front panel, see < method input parameter value >
- 7 If you need to make the channel and the other phase alignment, you can in the main menu of the current sine wave, press **F6** button to enter the second page of the main menu, press **F1** key.

4.4 pulse generator

Please follow the steps below output pulse waveform.

- 1 Push the front-panel **Pulse** (pulse wave) button, if the waveform is < modulation mode >, < sweep mode > or < burst mode > Turn off the;
- 2 Press the front panel **Oupput** (channel output button) to open the channel waveform output switch, open the button lights;
- 3 shows the oscilloscope pulse;
- 4 If you need to modify the waveform < rise time >, then the pulse wave when the current menu, press the **F6** button to enter the second page of the menu, Press the **F2** key, then the selected parameter is highlighted.
- 5 If you need to modify the waveform < fall time >, then the pulse wave when the current menu, press the **F6** button to enter the second page of the menu, Press the **F2** key twice, then the selected parameter is highlighted.
- 6 If you need to modify the waveform < pulse width >, then the pulse wave when the current menu, press the **F6** button to enter the second page of the menu, Press the **F1** key, then the selected parameter is highlighted.
- 7 If you need to modify the waveform < Duty Cycle >, then the pulse wave when the current menu, press the **F6** button to enter the second page of the menu, Press the **F1** key twice, then the selected parameter is highlighted
- 8 When the parameter you want to change the display to highlight, through the knob and numeric keypad to enter the parameter values of the

front panel, see <method input parameter value >

9 If the need to make the channel and the other phase alignment, you can pulse wave in the current main menu, press the **F5** button (same phase softkey).

10 To modify the other waveform parameters, see <sine wave generator >;

4.5 Noise generated

Noise can be in continuous wave mode;

Please follow these steps to output noise waveform.

1 Press the front panel of **Noise** (noise wave) button;

2 Press the front panel **Ouptput** (channel output button) to open the channel waveform output switch, open the button lights;

3 shows the oscilloscope noise wave;

4 To change the current parameter values, see <input parameter value method >;

5 To modify other waveform parameters, see <sine wave generator >;

Note: You can not wave modulation noise or sweep

4.6 arbitrary waveform generator

Arbitrary sampling frequency waves

Arbitrary wave is characterized by arbitrary waveform data is stored to the internal **ram** in the output. You can control the signal generator from the internal **ram** read rate of any wave, different rates making any waves exhibit the same data at different frequencies, this rate is called the sampling frequency of any wave.

Arbitrary waveform magnification

Arbitrary wave is characterized by arbitrary waveform data is stored to the internal **ram** in the output. In the **ram** voltage range of the stored value is **-32768** to **32768**. If from the **ram** for the data output from the enlargement processing, the corresponding output voltage range is **-1** to **1**, the signal generator allows the user to zoom **ram** output signal, the amplified multiple was **4,5, 20**;

Please arbitrary waveform output in accordance with the following procedure.

1 Press the front panel **ARb** (arbitrary waveform) button, if the waveform is <modulation mode >, <sweep mode > or <burst mode > Turn off the;

2 Pommer recognize any current waveform to be DC, to modify the current arbitrary waveform type, then the main menu at any wave, Press the **F6** key to enter the second page of the menu, press the **F2** key to enter any wave type sub-menu, use **F1** to **F6** function keys to select the desired output waveform, return to the main menu, press **F0** key;

3 Press the front panel **Ouptput** (channel output button) to open the channel waveform output switch, open the button lights;

4 shows the arbitrary waveform oscilloscope specified;

5 To modify the waveform parameters, see <sine wave generator >;

6 To change the current parameter values, see <input parameter value method >;

7 If you select <user-defined waveforms >, you can browse inside the machine (FLASH device) or an external storage device (<Usb storage devices > or <SD card >) ,select the suffix **hwf** waveform files.

8 If you select a user-defined waveforms can be modified as needed <arbitrary waveform sampling frequency > and <arbitrary waveform magnification > This is not even a waveform parameters.

Note:

1 user-defined waveform files can be generated machine itself or other tools;

2 user-defined waveforms are user-specified number of points for each point in the waveform and voltage waveform; through <Waveform Editor > produce; Users arbitrary waveform selection, selectable output.

4.7 harmonic generation

According to the principle of Fourier series, periodic function can be expanded with a constant sine and cosine functions of having a common cycle.

Its expansion, the constant part of the expression is called a DC component of each frequency component is typically an integer multiple of the fundamental frequency, called harmonics, the minimum being equal to the cycle period of the original function is called fundamental or first portion section called several times higher harmonics harmonics, the smallest positive period equal to the period of the original function.

Therefore, the higher harmonic frequency must also be equal to several times the fundamental frequency, the fundamental frequency of **three** times the third harmonic wave is called the fundamental wave frequency of **five** times the fifth harmonic wave is called, so . Regardless of a few harmonics, they are a sine wave. Frequency of an odd multiple of the fundamental frequency component is called the odd harmonics of the fundamental frequency is an even multiple of the frequency components are called even-order harmonics.

Please follow these steps to output <harmonics > waveforms.

1 Press the front panel **Harmonic** (harmonic) button, if the waveform is <modulation mode >, <sweep mode > or <burst mode > Turn off the;

2 Press the front panel **Ouptput** (channel output button) to open the channel waveform output switch; open button lights;

3 To modify <harmonics > number of times, when the harmonic menu, press the **F4** key, then the selected parameter is highlighted. Use the knob and numeric keypad to modify the parameter values;

4 Select the specified number of harmonics to be modified harmonic amplitude and phase, press the **F1** key, then the selected parameter is highlighted. Use the knob and numeric keypad to modify the parameter values;

5 To modify the amplitude corresponding to a harmonic, after selecting the harmonics, harmonic in the menu, press the **F2** key, then the selected parameter is highlighted.

6 To modify a harmonic corresponding phase, after selecting the harmonics, harmonic in the menu, press the **F3** key, then the selected parameter is highlighted.

7 To modify the effective harmonic harmonic harmonic at the time of the menu, press the **F5** key until the desired effective harmonics.

8 oscilloscope will show the specified harmonics;

9 Change the current parameter values, see <input parameter value method > ;

4.8 Method input parameter value

There are two types of waveform parameters input methods:

1 via the front panel keypad, a dialog box will pop up units and associated parameters related to the menu. Dialog, you can enter a numeric value, then select the appropriate units;

2 through the knob and left arrow keys to modify the front panel, use the left and right arrow keys to select the number of bits, use the knob to change the value of this bit. Signal generator will automatically adjust the value of the unit for easy display.

4.9 modulation wave

AM

AM, English is the **Amplitude Modulation (AM)**. AM is the amplitude of a high frequency carrier signal modulated with the instantaneous change of the signal varies. That is, the amplitude of the modulation signal to change the size of the high frequency signal, so that the information signal comprises a high-frequency modulated signal being.

FM

FM, English is the **Frequency Modulation**. Frequency modulation is a change in the instantaneous frequency of a carrier wave modulation mode information is represented by using different frequency carriers to convey different information.

PM

PM, English is the **Phase Modulation**. Phase of the carrier for its deviation from the reference phase with the instantaneous value of the modulating signal varies in proportion to the modulation is called phase modulation, phase modulation or said. Phase modulation and FM have a close relationship. When phase modulation, while FM accompanied occurred; When FM, phase modulation is accompanied also have occurred.

ASK

ASK: amplitude shift keying **ASK (Amplitude Shift Keying)**, ASK refers amplitude shift keying mode. This modulation method is different according to the signal, adjusting the amplitude of the sine wave.

FSK

FSK (**Frequency-shift Keying**) - Frequency shift keying is a frequency change using the carrier wave to transmit the digital information. It is the use of discrete values of the baseband digital signal to the characteristics of the carrier frequency shift keying modulation technique to transmit a digital information.

PSK

PSK **phase shift keying** modulation represents a carrier phase with the input signal information technology.

BPSK

BPSK full name: **Binary Phase Shift Keying**. Check symbol is " 1 ", the modulated and unmodulated carrier wave with the carrier phase; check symbol is " 0 ", the modulated carrier and the modulated carrier is not inverted; " 1 " and " 0 " when the carrier phase "modulation 180°".

Signal wave

Signal wave is <modulation mode >, the modulated carrier wave signal is used, the information carried by the modulated wave. Can be used for the signal wave from a signal generator may be an external input. When the internal input, optional Wave shape signal. As a function of the signal wave is in addition to other waveforms and DC signal that the noise

Carrier

Is the carrier waveform is modulated transmission signal, typically a sine wave. General requirements sinusoidal carrier frequency is much higher than the bandwidth of the modulated signal, otherwise aliasing occurs, the transmission signal distortion. Function as a carrier is in addition to other waveforms and DC signal that the noise.

Modulation depth

Modulation depth, also called modulation, **modulation Depth** extent of said amplitude variation, commonly expressed as a percentage. **AM** modulation depth can be set in the range of **0%** to **120%**.

FM wave frequency offset is the magnitude of the swing, the general said the greatest deviation. It refers to the fixed offset to the side of the FM wave frequency.

Frequency deviation must be less than or equal to the carrier frequency. Frequency deviation of the carrier frequency must be less than or equal to the current limit and the carrier frequency **10kHz** sum.

Phase Offset

Offset is the magnitude of the swing phase modulation wave phase, the general said that the maximum phase deviation. Phase shift setting range is **0** to **360** degrees.

Duty Cycle Offset

Offset is the duty cycle **PWM** duty cycle wave amplitude swing, the general said, is the maximum duty cycle offset.

Width modulated waveform of the deviation with respect to said change of the original pulse waveform pulse width (expressed in seconds).

Width deviation range: **0s** to **500ks**. Width deviation can not exceed the current pulse width. Width is limited by the minimum pulse width deviation and the current edge time setting

PWM

Pulse width modulation (**PWM**), the English " **Pulse Width Modulation** "acronym, pulse width modulation. Means depending on the signal, adjusting the duty cycle of the square wave. Modulation of **PWM**, the carrier can be used as

Function only as a square wave or a triangle wave, triangle wave if the output of the **PWM** wave means depending on the signal, adjust the symmetry of the triangle;

Keying rate

Keying rate, i.e. the code rate, which can be transmitted per second is the binary symbols (**bit**) number.

Hopping

It refers to the frequency shift keying, the carrier frequency is continuously changed in another frequency hopping.

Chapter V **SCPI** programming reference

- ◆ [SCPI language Introduction](#)
- ◆ [alphabetical order of **SCPI** commands and queries list](#)
- ◆ [programming examples](#)

5.1 SCPI language Introduction

In this manual, the programming interface for remote **SCPI** command syntax uses the following conventions:

- Square brackets (`[]`) the contents of the optional keywords or parameters.
- braces (`{ }`) the contents of the command string parameter.
- angle brackets (`< >`) in the content must be replaced with another value of the parameter.
- vertical line (`|`) to separate multiple parameter options.

SCPI (Standard Commands for Programmable Instruments) is based on **ASCII** instrument command language for test and measurement instrumentation. **SCPI** command hierarchy (also known as a tree system)basis. In this system, the relevant commands are grouped in a common node or root, thus forming subsystems.

Syntax Conventions

Format used to display the command as follows:

SOURce <n>: **VOLTage** <amplitude> | **MINimum** | **MAXimum**

SOURce <n>: **FREQuency**: **CEN Ter** {<frequency> | **MINimum** | **MAXimum**}

According to the command syntax, most commands (and some parameters) indicated by lowercase letters mixed approach. Uppercase letters indicate the abbreviated command. For shorter program lines, you can send the abbreviated form of the command. If you want to get a better program readability, you can send the long form of the command.

For example, in the above syntax statement, **VOLT**, and **VOLT age** is acceptable format. You can use uppercase or lowercase letters. Therefore, **VOLT Age**, **volt**, and **Volt** are acceptable formats. Other formats (such as **VOL** and **VOLTAG**) are invalid and will generate an error.

- ◆ curly braces (**{ }**) contains the parameter options for a given command string. The braces are not sent with the command string together.
- ◆ vertical bar (**|**) separated by a number of parameters to select a given command string. Bars are not sent along with the command string.
- ◆ The second example in angle brackets (**< >**) indicate that you must specify a value for the parameter in brackets. For example, the above syntax statement, the parameters are within angle brackets **< Frequency >**. The brackets are not sent with the command string together. You must specify a value for the parameter (eg "FREQ: CENT 1000")
- ◆ some grammatical elements (such as nodes and parameters) enclosed in square brackets (**[]**) inside. This means that the element is optional and may be omitted. The brackets are not sent with the command string together. If you do not specify a value for the optional parameter, the instrument will select the default value.

Command separator

Colon (**:**) for the next level of command keywords and keywords separated. You must insert a space parameters and commands keywords separated.

IEEE-488.2 Common Commands

IEEE-488.2 standard defines a set of common commands, perform reset, self-test, and status operations and other functions. Common commands always with an asterisk (*****) start, **three** characters in length, and may include one or more parameters. Between the command and the first parameter keywords separated by a space. Use a semicolon (**;**) to separate multiple commands, as follows:

*** RST ; * CLS ; * ESE 32 ; * OPC ?**

SCPI parameter type

SCPI language defines the program messages and response messages using several data formats.

Numerical parameters requires numerical parameters command supports all commonly used decimal notation, including optional signs, decimal points, and scientific notation, etc.. You can also accept the value

Special values of the parameters, such as **MIN**, **MAX**, and **DEF**. In addition, you can also send engineering unit suffixes along with the numerical parameters (eg, **M**, **k**, **m** or **u**). If the command only accept certain values, the instrument will automatically enter the value parameter is rounded to an acceptable value. The following command requires a numeric parameter frequency values:

[SOURce [1 | 2]:] FREQuency: CENTer { < Frequency > | MINimum | MAXimum }

Since SCPI parser is not case sensitive, so the letter "M" (or "m") have some confusion. For convenience, the instrument will "mV" (or "MV") interpreted as millivolts, but the "MHZ" (or "mhz") interpreted as MHz. Similarly, the "MΩ" (or "mΩ") interpreted as megohms. You can use the prefix "MA" said Zhao. For example, "MAV" interpreted as a trillion volts.

Discrete Parameters

Discrete parameter values for a limited number of program settings (for example, **IMMediate**, **EXTernal** or **BUS**). Like, like command keywords, they can also have a short form and long form. Can be mixed uppercase and lowercase letters. Query response always return the short form uppercase letters. The following command requires a voltage discrete units

Parameters:

[SOURce [1 | 2]:] VOLTage: UNIT {VPP | VRMS | DBM}

Boolean parameter

Boolean parameter represents a true or false binary condition. For a false condition, the instrument will accept "OFF" or "0." For a true condition, the instrument will accept "ON" or "1." When the query boolean setting, the instrument always returns "0" or "1." The following command requires a boolean parameter:

DISPlay {OFF | 0 | ON | 1}

ASCII string parameter

String parameter can contain virtually any ASCII character set. String must begin and end quotes paired; may be single or double quotes. Quote delimiters can be used as part of the string, just type it twice without any characters. The following command uses a string parameter:

DISPlay: TEXT < *quoted String* >

For example, the following command displays a message on the instrument front panel "WAITING ..." (do not display quotes).

DISP: TEXT "WAITING ..." You can also use single quotes to display the same message.

5.2 alphabetical list of SCPI commands and queries list

[AM subsystem](#)

[ASK subsystem](#)

[BPSK subsystem](#)

[BURSt subsystem](#)

[CALibration subsystem](#)
[DATA subsystem](#)
[DISPlay subsystem](#)
[FM subsystem](#)
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[MARKer subsystem](#)
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[PWM subsystem](#)
[SOURce subsystem](#)
[SWEep subsystem](#)
[SYSTem subsystem](#)
[VOLTage subsystem](#)

5.2.1 AM subsystem

AM amplitude modulation subsystem supports you (AM) added to the carrier waveform.

SOURce <n>: MOD: AM: DEPTH <depth> | MINimum | MAXimum

SOURce <n>: MOD: AM: DEPTH [MINimum | MAXimum]?

| Parameter | General Returns |
|---|--------------------------------|
| 0% to 120%, the default is 50% | Returns in scientific notation |
| The channel 1 is set as the modulation depth 100% : SOURCE1: MOD: AM: 100 DEPTH | |

◆ to reach more than 100% modulation depth, reduces the output amplitude of the carrier.

- ◆ If using **AM: SOURce EXTERNAL**, the modulated carrier wave by an external waveform.

SOURce <n>: MOD: AM: INTernal: FREQuency <frequency> | MINimum | MAXimum

SOURce <n>: MOD: AM: INTernal: FREQuency [MINimum | MAXimum]?

Set the modulating waveform frequency. Selected as the modulation source waveform will run at the frequency (in the waveform frequency limit).

| Parameter | General Returns |
|---|--------------------------------|
| 2 mHz to 500 kHz | Returns in scientific notation |
| The channel a frequency modulated wave is set to 500Hz: SOURCE1: MOD: AM: INTernal: FREQuency 500 | |

- ◆ When you select an arbitrary waveform as the modulation source, the frequency will change the frequency arbitrary waveform (based arbitrary waveform sampling rate and number of points).
- ◆ This command can only be used for internal modulation source ([AM: SOURce INTernal](#)).

SOURce <n>: MOD: AM: INTernal: FUNction SINusoid | SQUare | RAMP

SOURce <n>: MOD: AM: INTernal: FUNction?

Select the modulation waveform shape

| Parameter | General Returns |
|--|---|
| SINusoid SQUare RAMP, the default is SINusoid | Returns the current modulation waveform shape, SINusoid , SQUare or RAMP |
| The channel 1 waveform shape of the modulation wave is set to square wave: SOURCE1: MOD: AM: INTernal: FUNction SQUare | |

- ◆ This command can only be used for internal modulation source ([AM: SOURce INTernal](#)).
- ◆ pulse and DC can not be AM carrier waveform.

SOURce <n>: MOD: AM: SOURce INTernal | EXTERNAL SOURce <n>: MOD: AM: SOURce?

SOURce <n>: MOD: FM: SOURce INTernal | EXTERNAL

SOURce <n>: MOD: FM: SOURce?

SOURce <n>: MOD: PM: SOURce INTernal | EXTERNAL

SOURce <n>: MOD: PM: SOURce?

SOURce <n>: MOD: ASKey: SOURce INTernal | EXTERNAL

SOURce <n>: MOD: ASKey: SOURce?

SOURce <n>: MOD: FSKey: SOURce INTernal | EXTERNAL

SOURce <n>: MOD: FSKey: SOURce?

SOURce <n>: MOD: PSKey: SOURce INTernal | EXTERNAL

SOURce <n>: MOD: PSKey: SOURce?

SOURce <n>: MOD: BPSKey: INTernal: RATE <frequency> | MINimum | MAXimum

SOURce <n>: MOD: PWM: SOURce INTERNAL | EXTERNAL**SOURce <n>: MOD: PWM: SOURce?**

Modulation signal source selection

| Parameter | General Returns |
|---|----------------------|
| INTERNAL EXTERNAL, the default is INTERNAL | INTERNAL or EXTERNAL |
| The Channel 1 set for external modulation source: SOURCE1: MOD: AM: SOURce EXTERNAL (you can also use FM, BPSK, FSK, PM, or PWM replace AM) | |

SOURce <n>: MOD ON | OFF**SOURce <n>: MOD?**

Enable or disable the modulation.

| Parameter | General Returns |
|---|-----------------|
| ON OFF, default is OFF | ON or OFF |
| The channel a modulation function open: SOURCE1: MOD ON | |

SOURce <n>: MOD: TYPE AM | FM | PM | ASK | FSK | PSK | PWM | BPSK**SOURce <n>: MOD: TYPE?**

Select Modulation

| Parameter | General Returns |
|---|--|
| Type AM FM PM ASK FSK PSK PWM BPSK, the default is AM | Returns the current modulation type keyword, AM, FM PM, ASK, FSK, PSK, PWM or BPSK |
| The Channel 1 modulation is set to FM: SOURce <n>: MOD: type FM | |

- ◆ To avoid multiple waveform changes, enable modulation after configuring other modulation parameters.
- ◆ only once to enable a modulation mode.
- ◆ In the case of the sweep or burst is enabled, the instrument is not enabled modulation. When enabled modulation, will close the sweep or burst mode.
- ◆ Only when selecting the pulse function, it allows the use of PWM.

5.2.2 ASK subsystem

Amplitude shift keying ASK (Amplitude Shift Keying), ASK amplitude keying means. This modulation method is different according to the signal, adjusting the amplitude of the sine wave.

SOURce <n>: MOD: ASKey: AMPLitude <amplitude> | MINimum | MAXimum

SOURce <n>: MOD: ASKey: AMPLitude [MINimum | MAXimum]?

Provided ASK modulation wave amplitude

| Parameter | General Returns |
|-----------|-----------------|
|-----------|-----------------|

| | |
|---|--|
| 0 Vpp to 20 Vpp, the default is 2Vpp | In scientific notation return amplitude values |
| The channel 1ASK modulated wave amplitude modulation is set to 1Vpp: SOURce1: MOD: ASKey: AMPLitude 1 | |

SOURce <n>: MOD: ASKey: INTernal: RATE <frequency> | MINimum | MAXimum

SOURce <n>: MOD: ASKey: INTernal: RATE [MINimum | MAXimum]?

Set the output frequency between the carrier frequency and frequency hopping "mobile" rate

| Parameter | General Returns |
|--|--|
| 2 mHz to 1 MHz, the default is 2 mHz to 100Hz | In scientific notation return rate value |
| The channel 1ASK modulation rate modulation is set to 200Hz, SOURCE1: MOD: ASkey: INTernal: RATE 200 | |

SOURce <n>: MOD: ASKey: SOURce INTernal | EXTernal

SOURce <n>: MOD: ASKey: SOURce?

Select ASK modulation source type is internal (INTernal) or external (EXTernal).

| Parameter | General Returns |
|--|----------------------|
| INTernal EXTernal, the default is INTernal | INTernal or EXTernal |
| The channel 1ASK modulation source for the external modulation settings, SOURce <n>: MOD: ASkey: SOURce EXTernal | |

SOURce <n>: MOD: ASKey: POLarity POSitive | NEGative

SOURce <n>: MOD: ASKey: POLarity?

Selects the output from the positive polarity or negative amplitude modulation wave control

| Parameter | General Returns |
|---|----------------------|
| POSitive NEGative, the default is POSitive | POSitive or NEGative |
| The channel 1ASK polar modulation modulation is set to negative: SOURCE1: MOD: ASkey: Polarity NEGative | |

5.2.3 BPSK subsystem

BPSK subsystem supports you via a digital modulation format binary phase shift keying (BPSK) modulated waveforms. In BPSK, the carrier waveform using the on/off button to move between the two phases in the phase setting. Can be an internal source, using the specified frequency square wave, it can be an external source, use an external trigger input.

SOURce <n>: MOD: BPSKey: INTernal: RATE <frequency> | MINimum | MAXimum

SOURce <n>: MOD: BPSKey: INTernal: RATE [MINimum | MAXimum]?

Set the output phase of the phase shift between the carrier and the "mobile" rate

| Parameter | General Returns |
|--|--------------------------------|
| 2 mHz to 1 MHz, the default is 100Hz | Returns in scientific notation |
| The channel 1BPSK modulation rate modulation is set to 200Hz, SOURCE1: MOD: BPSKey: INTERNAL: RATE 200 | |

- ◆ only when you select *INTERNAL* source (BPSK: SOURCE INTERNAL) only when using BPSK rate; When selecting *EXTERNAL* source (BPSK: SOURCEEXTERNAL) ignored when BPSK rate.
- ◆ internal modulation waveform duty cycle of 50% of the square wave.

SOURCE <n>: MOD: BPSKey: PHASe <phase> | MINimum | MAXimum

SOURCE <n>: MOD: BPSKey: PHASe [MINimum | MAXimum]?

Set BPSK modulation wave phase (in degrees)

| Parameter | General Returns |
|---|--------------------------------|
| 0 to 360 degrees, the default is 180 degrees | Returns in scientific notation |
| The channel 1BPSK modulation phase modulation is set to 90 degrees : SOURCE1: MOD: BPSKey: PHASe 90 | |

5.2. 4 BURSt subsystem

This section describes the BURSt subsystem.

Burst Mode

There are two burst mode, the following will be introduced. Instrument enables one burst mode.

- ◆ triggered burst mode (default): Each time a trigger is received, the instrument will output the number of cycles (burst count) waveform. Output after a specified number of cycles, the instrument will stop and wait for the next trigger. You can configure the instrument to use the internal trigger to start the burst, or by pressing the front panel **[Trig Menu]** button on the front panel **TRIG** connector applications trigger signal or trigger commands sent from the remote interface software to provide a external trigger source.
- ◆ External Gated Burst Mode: In accordance with the applied panel **TRIG** connector for an external signal level, the instrument output is "on" or "off" state. When this signal is true, the instrument outputs a continuous waveform. When this signal is false, the current waveform cycle is completed first, then the instrument is stopped, while maintaining the initial burst phase waveform corresponding voltage.

SOURCE <n>: BURSt: GATE: POLarity NORMal | INVerted

SOURCE <n>: BURSt: GATE: POLarity?

For external gated burst, select the current panel **[TRIG]** gating signal connector on the high or low when the output pulse train

| Parameter | General Returns |
|--|--------------------|
| NORMal INVerted, the default is NORMal | NORMal or INVerted |
| Set channel 1 gate polarity is negative: SOURCE1: BURSt: GATE: Polarity INVerted | |

SOURce <n>: BURSt: MODE TRIGgered | GATed | INFinity

SOURce <n>: BURSt: MODE?

Select the burst mode.

| Parameter | General Returns |
|--|-------------------------------|
| TRIGgered GATed INFinity , the default is TRIGgered | TRIGgered , GATed or INFinity |
| Set the channel 1 output mode for unlimited burst: SOURce <n>: BURSt: MODE INFinity | |

- ◆ **TRIGgered** : time from the trigger source (**SOURce <n>: BURSt: TRIGger: SOURce**) when a trigger is received, the instrument will output the number of cycles (burst count) waveform.
- ◆ In **GATed** next burst mode, according to the front panel **TRIG** signal connectors on the opening or closing of the output waveform. Use **SOURce <n>: BURSt: TRIGger: SLOPe POSitive | NEGative** select the signal polarity. When the gate signal is true, the instrument outputs a continuous waveform. When the gate signal goes false, the current waveform cycle is completed, then the instrument will stop and remain in the starting burst phase of the waveform corresponding to the voltage level.
- ◆ **GATed** : Ignore burst count, burst period and trigger source (which is only used to trigger the burst mode).

SOURce <n>: BURSt: NCYCles <cycles> | MINimum | MAXimum

SOURce <n>: BURSt: NCYCles [MINimum | MAXimum]?

Set the output of the number of cycles per burst (triggered burst mode only).

| Parameter | General Returns |
|--|--------------------------------------|
| 1 to 1,000,000 (external or manual trigger); 1 to 500,000 (internal trigger), the command is only N effective cyclic mode; The default is 1 | Returns the current number of cycles |
| Set the channel a number of burst period is 5 : SOURCE1: BURSt: NCYCles 5 | |

SOURce <n>: BURSt ON | OFF

SOURce <n>: BURSt?

Enable or disable burst mode.

| Parameter | General Returns |
|---|-----------------|
| ON OFF , default OFF | ON or OFF |
| Open channel a burst output functions: SOURCE1: BURSt ON | |

- ◆ After enabling bursts, the output phase is set to 0.
- ◆ In order to avoid a large number of waveform changes, please re-enable the burst mode after you configure other burst parameters.
- ◆ instrument does not allow scanning or any modulation mode is enabled at the same time enable the burst mode. When you enable the burst, the sweep or modulation mode is turned off.

SOURce <n>: BURSt: TRIGger: SLOPe POSitive | NEGative

SOURce <n>: BURSt: TRIGger: SLOPe?

Select the rising edge of the external trigger signal generator signal (**POSitive**) or falling (**NEGative** start sweep output)

| Parameter | General Returns |
|-----------|-----------------|
|-----------|-----------------|

| | |
|--|--|
| POSitive NEGative , the default is POSitive | Returns the current trigger source slope keyword |
| Set Channel 1 trigger source for the falling edge of the scan mode when the output from the sweep: SOURce <n>: BURSt: TRIGger: SLOPe NEGative | |

SOURce <n>: BURSt: TRIGger

Trigger the instrument immediately

Set channel 1 immediately trigger: **SOURCE1: BURSt: TRIGger**

SOURce <n>: BURSt: TRIGger: SOURce INTernal | EXTernal**SOURce <n>: BURSt: TRIGger: SOURce?**

Select the type of sweep trigger source for the internal (**INTernal**), external (**EXTernal**)

| Parameter | General Returns |
|--|------------------------------------|
| INTernal EXTernal , the default is INTernal | Returns the current trigger source |
| Set Channel 1 trigger source for the external scan mode: SOURCE1: BURSt: TRIGger: SOURce EXTernal | |

5.2. 5 CALibration subsystem

CALibration subsystem is used to calibrate the instrument.

CALibration: SETup <step>**CALibration?****CALibration: VALue <value>****CALibration: STORe****CALibration?**

Using the calibration values (**CALibration: VALue**) to perform the calibration.

| Parameter | Average return value |
|--|----------------------------|
| No | 0 (by) or +1 (failure) |
| CALibration? , using current values for calibration | |

◆ **CALibration: SetUP** should always be located **CALibration?** front of the query.

◆ modify the temporary version of the calibration constants. At the end of the calibration, use **CALibration: STORe** save these constants in non-volatile memory.

CALibration: SETup <step>

Configured to perform the calibration procedure

| Parameter | Average return value |
|---|----------------------|
| Integer 1 to 8 | No |
| Prepare a calibration step 5 : CALibration: SETup 5 | |

◆ The setting is non-volatile; close and reopen the power does not change the settings

CALibration: STORe

Extracting volatile memory calibration constants (CALibration?), and then placed in non-volatile memory so that it will not turn off and on the power to change .

| Parameter | General Returns |
|--|-----------------|
| No | No |
| The calibration constants stored in the nonvolatile memory: CAL: STOR | |

CALibration: VALue <value>

Specify a known calibration signal value.

| Parameter | General Returns |
|---------------------------|-----------------|
| Numbers, the default is 0 | No |
| - | |

◆ The setting is non-volatile; close and reopen the power does not change the settings

5.2. 6 COUNter subsystem

COUNter ON | OFF
COUNter: MEASure?
COUNter: GATETIME
COUNter: GATETIME?
COUNter: TYPE

COUNter ON | OFF

Turn on or off frequency meter function

| Parameter | General Returns |
|--------------------------|-----------------|
| ON OFF, default is OFF | ON or OFF |
| COUNter ON | |

COUNter: MEASure?

Query frequency meter current measurement results

| Parameter | General Returns |
|-----------|--|
| | Returns the current frequency or count |

COUNter: GATETIME AUTO | USER1 | USER2 | USER3 | USER4 | USER5 | USER6

COUNter: GATETIME?

Set frequency counter gate time

| Parameter | General Returns |
|--|--|
| AUTO AUTO USER1 1 ms USER2 10 ms USER3 100 ms | AUTO , USER1 , USER2 , USER3 , USER4 , USER5 or USER6 |

| | |
|--------------|--|
| USER4 1 s | |
| USER5 10 s | |
| USER6 > 10 s | |

COUNTER: TYPE LFCOUNTER | LFFREQ | HFCOUNTER | HFFREQ

Set frequency meter type

| Parameter | General Returns |
|--|--|
| LF_COUNTER LF_FREQ HF_COUNTER HF_FREQ, the default is LF_COUNTER | Returns the current frequency meter type LF_COUNTER, LF_FREQ HF_COUNTER or HF_FREQ |

5.2.7 DATA subsystem

DATA subsystem to manage user-defined arbitrary waveforms:

SOURCE <n>: DATA: DAC16 <addr>, <dots_num>, <binary_block> | <value>, <value>, ...

To dac data format to download data to ddr2

SOURCE <n>: DATA: <addr>, <dots_num>, <binary_block> | <value>, <value>, ...

Floating-point data format to download data to ddr2

SOURCE <n>: DATA: OUTPUT <start_addr>, <end_addr>

The output at the specified address ddr data

SOURCE <n>: DATA: DAC16 <addr>, <dots_num>, <binary_block> | <value>, <value>, ...

| Parameter | General Returns |
|---|-----------------|
| <addr> hexadecimal number, in the range of 0x00 to 64M address, 4 -byte aligned | No |
| <dots_num> decimal number, the case of two binary block maximum 4k points must be 4 multiples | |
| <binary_block> binary number, size dots_num * 2 bytes to # beginning | |
| <value> integers, negative 32767-32767 | |

SOURCE <n>: DATA: <addr>, <dots_num>, <binary_block> | <value>, <value>, ...

| Parameter | General Returns |
|---|-----------------|
| <addr> hexadecimal number, in the range of 0x00 to 64M address, 4 -byte aligned | No |
| <dots_num> decimal number, if it is two blocks biggest band 2k points must be 4 multiples | |
| <binary_block> binary number, size dots_num * 4 bytes to # beginning | |

| | |
|--------------------------------|--|
| <value> integers, negative 1-1 | |
|--------------------------------|--|

SOURce <n>: DATA: OUTPut <start_addr>, <end_addr>

| Parameter | General Returns |
|--|-----------------|
| <start_addr> hexadecimal number, in the range of 0x00 to 64M address, 4-byte aligned | |
| <end_addr> hexadecimal number, in the range of 0x00 to 64M address, 4-byte aligned | |

5.2. 8 DISPlay subsystem

DISPlay subsystem control the instrument display.

DISPlay: BRIGhtness <brightness> | MINimum | MAXimum
DISPlay: BRIGhtness [MINimum | MAXimum]?

Set the screen brightness

| Parameter | Average return value |
|-----------------------------|------------------------|
| 1% to 100%, the default 50% | As a percentage return |
| DISPlay: BRIGhtness 80 | |

DISPlay: SAVer ON | OFF
DISPlay: SAVer?

Enable or disable the screen saver mode

| Parameter | Average return value |
|---|----------------------|
| ON OFF, default is ON | ON or OFF |
| Open screensavers: DISPlay: Saver: STATE ON | |

5.2. 9 FM subsystem

SOURce <n>: MOD: FM: DEViation <deviation> | MINimum | MAXimum
SOURce <n>: MOD: FM: DEViation [MINimum | MAXimum]?

Set FM modulation frequency deviation difference (in Hz units)

| Parameter | General Returns |
|--|--------------------------------|
| The default is 500Hz | Returns in scientific notation |
| The Channel 1 offset set for 900Hz : SOURCE1: MOD: FM: DEViation 900 | |

- ◆ deviation can not exceed the carrier frequency. If you attempt to set the deviation to a value in excess of the carrier frequency (enabled FM under conditions), the instrument will adjust the maximum deviation allowed for the carrier frequency.

- ◆ plus carrier frequency deviation can not exceed the maximum frequency of the selected function plus 100 kHz. If you attempt to set the deviation to an invalid value, the instrument will be adjusted to the current carrier frequency of the maximum allowed.
- ◆ If the deviation will cause the duty cycle of the carrier wave frequency beyond the current boundaries (only square wave), the instrument will be adjusted to the maximum duty cycle of the current carrier frequency allowed.
- ◆ If you choose *External* modulation source, the deviation from the front panel **MOD** connector ± 5 V signal level control. For example, if the frequency deviation of 100 kHz, the +5 V signal level corresponds to the increasing frequency 100 kHz. Lower external signal levels produce less deviation and negative signal levels reduce the frequency below the carrier frequency.

Frequency deviation <deviation> should meet the following conditions:

Frequency Deviation \leq carrier frequency.

Frequency deviation + carrier frequency \leq current carrier frequency limit + 1 kHz

SOURce <n>: MOD: FM: INTernal: FREQUENCY <frequency> | MINimum | MAXimum

SOURce <n>: MOD: FM: INTernal: FREQUENCY [MINimum | MAXimum]?

Set frequency modulation waveform. The modulation source waveform frequencies within the frequency limits of the waveform.

| Parameter | General Returns |
|---|--------------------------------|
| 2 mHz to 500 kHz, the default is 100Hz | Returns in scientific notation |
| The channel a frequency modulated wave is set to 500Hz: SOURCE1: MOD: FM: INTernal: FREQUENCY 500 | |

- ◆ When you select an arbitrary waveform as the modulation source, the frequency will change the frequency arbitrary waveform (based arbitrary waveform sampling rate and number of points).
- ◆ This command can only be used for internal modulation source (FM: SOURce INTernal).

SOURce <n>: MOD: FM: INTernal: FUNCtion SINusoid | SQUare | RAMP

SOURce <n>: MOD: FM: INTernal: FUNCtion?

The command to select the shape of the modulating waveform.

| Parameter | General Returns |
|--|--------------------------|
| SINusoid SQUare RAMP, the default is SINusoid | SINusoid, SQUare or RAMP |
| The channel 1 waveform shape of the modulation wave is set to square wave: SOURCE1: MOD: FM: INTernal: FUNCtion SQUare | |

- ◆ This command can only be used for internal modulation source (FM: SOURce INTernal).

5.2. 10 FREQUENCY subsystem

FREQUENCY subsystem to set the output frequency of the instrument.

SOURce <n>: FREQUENCY <frequency> | MINimum | MAXimum

SOURce <n>: FREQUENCY [MINimum | MAXimum]?

Set the output frequency

| Parameter | General Returns |
|-----------|-----------------|
|-----------|-----------------|

| | |
|---|---|
| Different waveforms corresponding to different frequency ranges: Sine wave: 1 μHz to 160 MHz Square wave: 1 μHz to 50 MHz Sawtooth: 1 μHz to 4 MHz Pulse: 1 μHz to 40 MHz Arbitrary waveform: 1 μHz to 40 MHz Harmonic: 1 μHz to 80 MHz | In scientific notation return frequency value +1.0000000000000000 E +03 |
| The channel 1 output frequency is set to 100Hz : SOURCE1:FREQUENCY 100 | |

SOURCE <n>: FREQUENCY: CENTER <frequency> | MINimum | MAXimum

SOURCE <n>: FREQUENCY: CENTER [MINimum | MAXimum]?

Set the center frequency. Used in conjunction with a frequency range frequency scanning.

| Parameter | General Returns |
|---|---|
| Sweep waveform corresponding to different frequency ranges different starting: Sine wave: 1 μHz to 160 MHz Square wave: 1 μHz to 50 MHz Sawtooth: 1 μHz to 4 MHz Arbitrary waveform: 1 μHz to 40 MHz (Built-wave DC except the default is 550Hz) | In scientific notation returns center frequency value +1.0000000000000000 E +03 |
| The channel 1 of the center frequency is set to 1KHz : SOURCE1:FREQUENCY: CENTER 1000 | |

◆ next sweep mode, the start frequency, stop frequency, center frequency and frequency span interrelated, satisfy the following relationship:

$$\text{Center frequency} = (\text{Start Frequency} + \text{End Frequency}) / 2$$

$$\text{Frequency span} = \text{stop frequency} - \text{start frequency}$$

5.2.1 1 F SKey subsystem

FSKey subsystem is configured to frequency shift keying (FSK) waveform.

SOURCE <n>: MOD: FSKey: FREQUENCY <frequency> | MINimum | MAXimum

SOURCE <n>: MOD: FSKey: FREQUENCY [MINimum | MAXimum]?

Set FSK alternate (or " jump ") frequency.

| Parameter | General Returns |
|---|---|
| Sine wave: 1 μHz to 160 MHz Square wave: 1 μHz to 50 MHz | In scientific notation return frequency value |

| | |
|---|--|
| Sawtooth: 1 μ Hz to 4 MHz Arbitrary waveform: 1 μ Hz to 40 MHz (Built-wave DC excluded), the default 100Hz | |
| The channel 1FSK jump frequency modulation is set to 200Hz: SOURce1: MOD: FSKey: FREQUency 200 | |

SOURce <n>: MOD: FSKey: INTernal: RATE <frequency> | MINimum | MAXimum
SOURce <n>: MOD: FSKey: INTernal: RATE [MINimum | MAXimum]?

Set the output frequency between the carrier frequency and the hop frequency "mobile" rate.

| Parameter | General Returns |
|---|---|
| 2 mHz to 1 MHz, the default 100Hz | In scientific notation return rate value |
| The channel 1FSK modulation rate modulation is set to 200Hz, SOURCE1: MOD: FSKey: INTernal: RATE 200 | |

FSK rate is only for internal sources (FSK: SOURce INTernal) .

5.2.1 2 FUNCTION subsystem

FUNCTION subsystem configuration of the instrument output functions:

SOURce <n>: FUNCTION <wave>

Set the current waveform type

SOURce <n>: FUNCTION: ARBitrary <filename>

Set the current arbitrary waveform output file

SOURce <1 | 2>: FUNCTION: ARBitrary: PTPeak

Set an arbitrary two-wave peak voltage

SOURce <1 | 2>: FUNCTION: ARBitrary: SRATe

Set arbitrary waveform sampling rate

SOURce <n>: FUNCTION: SQUare: DCYClE

Set the duty cycle of the square wave

SOURce <n>: FUNCTION: RAMP: SYMMetry

Set the percentage of the triangular-wave symmetry

SOURce <n>: FUNCTION: PULSe: DCYClE

Set the duty cycle of the pulse wave

SOURce <n>: FUNCTION: PULSe: WIDTH

Set pulse width

SOURce <n>: FUNCTION: PULSe: TRANSition: LEADIng

Set the pulse rise time

SOURce <n>: FUNCTION: PULSe: TRANSition: TRAIling

Set the pulse fall time

SOURCE <n>: FUNCTION <wave>**SOURCE <n>: FUNCTION?**

Select the output function type.

| Parameter | General Returns |
|--|--|
| SINusoid SQUare RAMP PULSe NOISe DC SINC EXPFall HAVersine LOREntz DUALtone GAUSE ECG USER HARMONIC , the default is SINusoid | SINusoid , SQUare RAMP , PULSe , NOISe , DC , SINC , EXPFall , Haversine , LORENTZ DUALtone , GAUSE , ECG , USER or HARMonic |
| The channel 1 waveform output is set to sine: SOURCE1: FUNCTION SINusoid , successful return SINusoid | |

- ◆ Noise will generate white Gaussian noise
- ◆ ARB generates current through FUNCTION: ARBITrary arbitrary waveform selected.

SOURCE <n>: FUNCTION: ARBITrary <filename>, SOURCE <n>: FUNCTION: ARBITrary?

| Parameter | General Returns |
|--|-----------------|
| Valid filename: file into user-defined and built-in waveform file; common use mainly " Builtin INT :// SINC.hwf " , "INT :// Mywave.hwf" , "SD :// mywave.hwf" , "USB :// mywave.hwf " | Waveform file |
| The channel 1 is set arbitrary waveform output file is: Builtin INT :// SINC.hwf SOURCE1: FUNCTION: Arbitrary "Builtin INT :// SINC.hwf", the correct return Int :// Builtin / SINC.hwf | |

SOURCE <1 | 2>: FUNCTION: ARBITrary: PTPeak <voltage> | MINimum | MAXimum, SOURCE <1 | 2>: FUNCTION: ARBITrary: PTPeak {MINimum | MAXimum}?

Set peak - peak voltage.

| Parameter | General Returns |
|--|--------------------------------|
| Discrete values 1,4,5,20 , the default value is 1V | Returns in scientific notation |
| The Channel 1 peak - peak voltage is set to 4V : SOURCE1: FUNCTION: ARBITrary: PTPeak 4 | |

SOURCE <1 | 2>: FUNCTION: Arbitrary: srate {<sample_rate> | MINimum | MAXimum} , SOURCE <1 | 2>: FUNCTION: Arbitrary: srate {MINimum | MAXimum}?

Set arbitrary waveform sampling rate

| Parameter | General Returns |
|---|--|
| 1 to 255 between the number, the default is 1 | In scientific notation returns the current sampling rate |
| The channel 1 will sample rate is set to 25MSa/s : SOURCE1: FUNCTION: Arbitrary: srate 10 | |

Returns the value of the current sampling rate formula $250M / (4 * n)$, n is a value set by the user, especially when the user is set to 0 ,

the sampling rate of 250M

SOURce <n>: FUNCtion: SQUare: DCYCLE <percent> | MINimum | MAXimum , SOURce <n>: FUNCtion: SQUare: DCYCLE [MINimum | MAXimum]?

Set the duty cycle of the square wave

| Parameter | General Returns |
|---|---|
| 0.001% to 99.996% , by 16 ns minimum pulse width, the default is 50% | In scientific notation returns the current duty cycle |
| The channel a duty cycle is set to 30% : SOURCE1: FUNCtion: SQUare: DCYCLE 30 | |

SOURce <n>: FUNCtion: RAMP: Symmetry <symmetry> | MINimum | MAXimum , SOURce <n> : FUNCtion: RAMP: Symmetry [MINimum | MAXimum]?

Set the percentage of the triangular-wave symmetry

| Parameter | General Returns |
|---|--|
| 0% to 100% , the default is 50% | Returns the current form of scientific notation symmetry |
| The Channel 1 symmetry set 30% : SOURCE1: FUNCtion: RAMP: Symmetry 30 | |

SOURce <n>: FUNCtion: PULSe: DCYCLE <percent> | MINimum | MAXimum

SOURce <n>: PULSe: DCYCLE [MINimum | MAXimum]?

Set the duty cycle of the pulse wave

| Parameter | General Returns |
|--|---|
| 0% to 100% , restrictions described below; default is 50% | In scientific notation returns the current duty cycle |
| The channel a duty cycle is set to 30% : SOURCE1: FUNCtion: PULSe: DCYCLE 30 | |

◆ **FUNCtion: PULSe: DCYCLE** and **FUNCtion: PULSe: WIDTH** command the same impact parameter

◆ pulse duty cycle is defined as:

$$\text{Duty Cycle} = 100 \times \text{pulse width} \div \text{cycle}$$

The rising edge of the pulse from the pulse width of 50% to the next falling edge of the threshold of 50% of the time threshold.

◆ pulse duty cycle ranges from 0% to 100%. However, the pulse duty cycle restricted minimum pulse width and edge time can be set to prevent exactly 0% or 100% duty cycle. For example, for a 1 kHz pulse waveform, pulse duty cycle is usually limited to 0.002% to 99.998% in the range, subject to 16ns minimum pulse width restrictions.

◆ restrictions based on pulse width: The specified pulse duty cycle must meet the minimum pulse width (W_{min}) identified the following limitations. The instrument will need to be adjusted to meet the specified period in accordance with the duty cycle

$$\text{Pulse duty cycle} \geq 100 \times (\text{minimum pulse width} / \text{pulse cycle})$$

$$\text{Pulse duty cycle} \leq 100 \times (1 - 2 \times \text{minimum pulse width} / \text{pulse cycle})$$

SOURce <n>: FUNCtion: PULSe: WIDTH <seconds> | MINimum | MAXimum

SOURce <n>: FUNCtion: PULSe: WIDTH [MINimum | MAXimum]?

Set pulse width

| Parameter | General Returns |
|---|--|
| 16ns to 1000 μ s , default is 500 μ s | In scientific notation return pulse value. |
| The channel 1 pulse width is set to 5ms : SOURCE1: FUNCtion: PULSe: WIDTH 0.005 | |

FUNCTION: PULSe: DCYCLe and FUNCTION: PULSe: WIDTH command the same impact parameter.

- ◆ rising edge of the pulse from the pulse width of 50% to the next falling threshold value of 50% of the time threshold.
- ◆ minimum pulse width of the pulse width \geq
Pulse width \leq pulse period - $2 \times$ minimum pulse width

SOURce <n>: FUNCTION: PULSe: TRANSition: LEADing <seconds> | MINimum | MAXimum
SOURce <n>: PULSe: TRANSition: LEADing [MINimum | MAXimum]?

SOURce <n>: FUNCTION: PULSe: TRANSition: TRAILing <seconds> | MINimum | MAXimum
SOURce <n>: PULSe: TRANSition: TRAILing [MINimum | MAXimum]?

In the forefront of the pulse, the trailing edge of the pulse edge or set the time on both edges.

| Parameter | General Returns |
|--|--|
| The default is 1 μ s | Return time in scientific notation value |
| The channel 1 pulse rise time is set to 10ns , SOURCE1: FUNCTION: PULSe: TRANSITION: LEADING 0.00000001 | |
| The channel 1 pulse rise time is set to 10ns , SOURCE1: FUNCTION: PULSe: TRANSITION: TRAILING 0.00000001 | |

- ◆ frontier time applies to the rising edge , said edge from the 10% threshold to 90% of the time between the thresholds; falling edge represents from 90% of the value of the threshold to 10% of the time between the thresholds.
- ◆ specified edge time must be within the specified pulse width and period. The instrument will limit the edge of time in order to meet the specified pulse width or duty cycle.

5.2.1 3 HARMONIC subsystem

SOURce <n>: HARMonic: AMPL - Set harmonic amplitudes

SOURce <n>: HARMONIC: PHASe - Set harmonic phase

SOURce <n>: HARMONIC: Order - Set the number of harmonics

SOURce <n>: HARMonic: TYPE - choose Harmonic Type

SOURce <n>: HARMonic: AMPL <sn>, <value> | MINimum | MAXimum

SOURce <n>: HARMonic: AMPL?

Sets the specified harmonic amplitude

| Parameter | General Returns |
|--|-----------------|
| <sn> integer, 2 to 16 , default is 2 ; <value> continuous real | No |
| The channel 1 first of two harmonic amplitude is set to 1Vpp : SOURCE1: HARMONIC: AMPL 2,1 | |

SOURce <n>: HARMonic: PHASe <sn>, <value> | MINimum | MAXimum
? SOURce <n>: HARMonic: PHASe <sn> [, MINimum | MAXimum]

Set the specified harmonic phase

| Parameter | General Returns |
|--|--|
| <sn> integer, 2 to 16, default is 2 ; <value> continuous real, 0 to 360 degrees, the default is 0 | Returns the specified form of scientific notation harmonic phase value |
| The channel 1 of the first two harmonics of the phase is set to 90 degrees: SOURCE1: HARMONIC: PHASe 2,90 | |

SOURce <n>: HARMonic: ORDER <value> | MINimum | MAXimum

SOURce <n>: HARMonic: ORDER [MINimum | MAXimum]?

Set the number of harmonics

| Parameter | General Returns |
|---|--|
| 2 ÷ maximum output frequency of the instrument to the fundamental frequency, and is an integer, the maximum value is 16, the default is 2 | In scientific notation returns the number of harmonics |
| The channel a harmonic number is set to 8 : SOURCE1: HARMONIC: Order 8 | |

SOURce <n>: HARMonic: TYPE EVEN | ODD | ALL | USER

SOURce <n>: HARMonic: TYPE?

Select the type of even-order harmonics, odd, all

| Parameter | General Returns |
|--|-------------------|
| EVEN ODD ALL, the default is ALL | EVEN, ODD, or ALL |
| The channel a harmonic type set for odd: SOURCE1: HARMONIC: HARMONIC: type ODD | |

5.2.1 4 IEEE-488 General Commands

This subsystem contains the IEEE-488 standard commands and queries associated with:

- * IDN-? instrument identification
- * RCL /* SAV - call /save the instrument state
- * RST - Reset the instrument to the factory default settings
- * TRG - Trigger command
- * TST-? self-test

* IDN?

Identify the query. Queries the instrument identification string.

| Parameter | General Returns |
|-----------|-----------------|
|-----------|-----------------|

| | |
|--|---|
| No | Returns a string manufacturer, model, serial number and version number, all the information separated by commas |
| Returns instrument identification string: * IDN? | |

* RST

The instrument is reset to the factory default state.

| Parameter | General Returns |
|--------------------------|-----------------|
| No | No |
| Reset instrument: ST * R | |

- ◆ not affect the instrument state is stored in non-volatile memory, arbitrary waveform or I/O settings.

5.2.15 MARKer subsystem

SOURCE <n>: MARKer - open or close the sweep frequency tagging

SOURCE <n>: MARKer: FREQUENCY - Set the marker frequency

SOURCE <n>: MARKer ON | OFF

SOURCE <n>: MARKer?

Turn on or off the sweep frequency tagging

| Parameter | General Returns |
|--|-----------------|
| ON OFF, default is OFF | ON or OFF |
| Open channel a frequency sweep marker functions: SOURCE1: MARKer ON | |

SOURCE <n>: MARKer: FREQUENCY <frequency> | MINimum | MAXimum

SOURCE <n>: MARKer: FREQUENCY [MINimum | MAXimum]?

Set the marker frequency

| Parameter | General Returns |
|--|-----------------------------|
| Between "Start frequency" and "End frequency", the default is 550 Hz | + 1 .0000000000000000 E +03 |
| Set channel 1 marked the frequency of 1000hz : SOURCE2: MARKer: FREQUENCY 1000 | |

5.2.1 6 MEMory subsystem

MEMory: STATE: DELETE USER1 | USER2 | USER3 | USER4 | USER5

Delete state storage location.

| Parameter | General Returns |
|-----------|-----------------|
|-----------|-----------------|

| | |
|---|----|
| USER1 USER2 USER3 USER4 USER5 | No |
| Delete storage location 1 content: MEM: STAT: DEL USER1? | |

5.2.1 7 MMEemory subsystem

MMEemory instrument or an external subsystem **USB** manage file system file system. The file system can store and load a variety of file formats.

Commands and queries

MMEemory subsystem consists of the following commands and queries:

MMEemory: **CATalog** -? lists mass storage devices available and used space and file

MMEemory: **CDIRectory** - Change to the directory

MMEemory: **COPY** - Copy mass storage device files

MMEemory: **DELeTe** - remove files from the mass storage device

MMEemory: **LOAD: STATe** - loaded from a file saved instrument state

MMEemory: **MDIRectory** - Create a new directory (folder)

MMEemory: **RDIRectory** - delete directory

MMEemory: **STORE: STATe** - the instrument state storage to a file

M MEmory: **CATalog**?

Under current path check all files and folders

Returns the current large-capacity storage directory (including the built-in memory and **USB** drives) a list of all the files.

MMEemory: **CDIRectory** <folder>

MMEemory: **CDIRectory**?

The current path is amended as <directory_name> specified path

<folder> ASCII character type, with a string of double quotes, the length is limited to 256 characters in the

| Parameter | General Returns |
|---|---|
| String with double quotes, the length is limited to 256 characters in the | Return 0 negative statement failed Table success |
| MMEemory: CDIRectory "SD :/ tmp | |

MMEemory: **COPY** <folder>, <file_name>

The current path from the <file_name> copy specified files to <directory_name> specified path (non-current path) down.

<folder> ASCII character type, with a string of double quotes, the length is limited to 256 characters in the

<file_name> string with double quotes (including suffix), limit the length of 40 characters in the

| Parameter | General Returns |
|---|-----------------|
| Both documents can be any valid file name | No |
| MMEemory: COPY "SD :/ tmp", "tmp1.hsf" | |

MMEMory: DElete <file_name>

Delete the file. To delete a folder, use **MMEMory: RDIrectory** .

| Parameter | General Returns |
|--|-----------------|
| Any valid file name, including the file extension | No |
| Delete the file from the root directory indicates internal flash file system: MMEMory: DElete "Int :/ tmp.hsf" | |

MMEMory: LOAD: STATE <file_name>**MMEMory: STORE: STATE <file_name>**

Load state file;

The current instrument state to state file storage

| Parameter | General Returns |
|--|-----------------|
| String with double quotes , any valid file name, including the file extension | No |
| Instrument status from the internal memory to load the root directory: MMEMory: LOAD: STATE "Int :/ tmp.hsf" The current instrument state stored in the internal flash file system state file in the root directory: MMEMory: STORE: STATE "Int :/ tmp.hsf" | |

MMEMory: RDIrectory <folder>**MMEMory: MDIrectory <folder>**

Delete directories large-capacity storage medium;

Create a new directory on a large-capacity storage media

| Parameter | General Returns |
|--|---|
| Any directory name, including large-capacity storage unit specifier, the default is INT:\string with double quotes, the length is limited to 256 characters in the | Return 0 negative statement failed Table success |
| MMEMory: RDIrectory MMEMory: MDIrectory "test" | |

5.2.1 8 OUTPut subsystem

OUTPut subsystem control channel outputs and front panel **Sync** connector:

OUTPut <n> - channel output connector on the front panel status

OUTPut: SYNC - Front panel **Sync** connector status

OUTPut <n> ON | OFF ,

OUTPut <n>?

Enable or disable the front panel [Output1] or [Output2] connector output

| Parameter | General Returns |
|---|---------------------|
| ON OFF, default is OFF | Return to ON or OFF |
| Enable [Output1] connector: Output1 ON, if the return value is opened ON | |

- ◆ When the output is enabled, the front panel channel output button will be lit.
- ◆ OUTPut to change the channel output connector by switching the output relay status

OUTPut: SYNC: SOURce CH1 | CH2

Set Sync output connector source

| Parameter | General Returns |
|---|-------------------------------------|
| CH1 CH2, default is CH1 | Return to set the channel ON or OFF |
| The sync source is set to channel 1: OUTPut: SYNC: SOURce CH1, set successfully return ON | |

5.2.1 9 PHASe subsystem

PHASe subsystem supports you to adjust the waveform phase; This channel - channel and the channel - very useful for synchronous applications. The subsystem also allows you to use **10 MHz Out** and **10 MHz In** the rear panel connector to synchronize multiple instruments.

SOURce <n>: PHASe - phase shift setting of the output waveform (does not apply to an arbitrary waveform or noise)

SOURce <n>: PHASe: SYNChronize - phase synchronous two internal channels.

SOURce <n>: PHASe <phase> | MINimum | MAXimum

SOURce <n>: PHASe [MINimum | MAXimum]?

Set the initial phase of the waveform

| Parameter | General Returns |
|--|---|
| 0 to 360 degrees, the default is 0 | In scientific notation return phase value |
| The Channel 1 starting phase is set to 90 degrees: SOURCE1: PHASe 90 | |

- ◆ Use PHASe: SYNChronize sync phase two internal channels.

S OURce <n>: PHASe: SYN Chronize

Reset all phases instrument builder to build a common internal phase zero reference point

| Parameter | General Returns |
|---|-----------------|
| No | No |
| Reset all phases Builder: PHAS: SYNC | |

- ◆ SOURCE1 and SOURce2 no meaning for the command.
- ◆ in both channels, any time a channel is modulated mode, this setting is invalid.

5.2. 20 PM subsystem

PM subsystem supports your phase modulation waveform.

SOURce <n>: MOD: PM: DEVIation <deviation> | MINimum | MAXimum

SOURce <n>: MOD: PM: DEVIation [MINimum | MAXimum]?

In degrees to set the phase deviation. This value represents the peak phase modulation waveform with respect to changes in the carrier waveform.

| Parameter | General Returns |
|--|--|
| 0 to 360 degrees, the default is 180 degrees | In scientific notation return phase deviation +9.0000000000000000 E +01 |
| The Channel 1 phase is set to 90 degrees: SOURCE1: MOD: PM: DEVIation 90 | |

◆ by external modulation source, the deviation from the front panel **MOD** displayed on the connector ± 5 V signal level control. For example, if you have the frequency deviation is set to 180 degrees, the +5 V signal level corresponds to +180 phase deviation. Lower external signal levels produce less deviation and negative signal levels produce a negative bias.

SOURce <n>: MOD: PM: INTernal: FREQUency <frequency> | MINimum | MAXimum

SOURce <n>: MOD: PM: INTernal: FREQUency [MINimum | MAXimum]?

Set frequency modulation waveform. Selected as the modulation source waveform will run at this frequency (within the waveform frequency limit).

| Parameter | General Returns |
|---|---|
| 2 mHz to 500 kHz, the default is 100Hz | In scientific notation return frequency value |
| The channel a frequency modulated wave is set to 10 00Hz: SOURCE1: MOD: PM: INTernal: FREQUency 10 00 | |

◆ This command can only be used for internal modulation source ([PM: SOURce INTernal](#)).

SOURce <n>: MOD: PM: INTernal: FUNCtion SINusoid | SQUare | RAMP

SOURce <n>: MOD: PM: INTernal: FUNCtion?

Select the modulating waveform shape.

| Parameter | General Returns |
|---|--------------------------|
| SINusoid SQUare RAMP, the default is SINusoid | SINusoid, SQUare or RAMP |
| The channel 1 waveform shape of the modulation wave is set to square wave: SOURCE1: MOD: PM: INTernal: FUNCtion SQUare | |

◆ This command can only be used for internal modulation source ([PM: SOURce INTernal](#)).

SOURce <n>: MOD: PM: SOURce INTernal | EXTernal

SOURce <n>: MOD: PM: SOURce?

Select AM modulation source type is internal ([INTernal](#)) or external ([EXTernal](#)).

| Parameter | General Returns |
|---|----------------------|
| INTernal EXTernal, the default is INTernal | INTernal or EXTernal |
| The Channel 1 set for external modulation source: SOURCE1:MOD:FM:SOURCE1:EXTernal | |

5.2. 2 1 P SK subsystem

PSK (PSK phase shift Keying) with a carrier phase modulation technique in which the input signal information.

SOURCE <n>: MOD: PSKey: PHASE <phase> | MINimum | MAXimum

SOURCE <n>: MOD: PSKey: PHASE [MINimum | MAXimum]?

Setting PSK modulation wave phase

| Parameter | General Returns |
|--|---|
| 0 to 360 degrees, the default is 180 degrees | In scientific notation return phase value |
| The channel 1PSK modulation phase modulation is set to 90 degrees : SOURCE1:MOD:PSKey:PHASE 90 | |

SOURCE <n>: MOD: PSKey: INTernal: RATE <frequency> | MINimum | MAXimum

SOURCE <n>: MOD: PSKey: INTernal: RATE [MINimum | MAXimum]?

Set the output frequency between the carrier frequency and frequency hopping "mobile" rate

| Parameter | General Returns |
|--|--|
| 2 mHz to 1 MHz, the default is 100Hz | In scientific notation return rate value |
| The channel 1FSK modulation rate modulation is set to 200Hz, SOURCE1:MOD:FSKey:INTernal:RATE 200 | |

SOURCE <n>: MOD: PSKey: SOURCE INTernal | EXTernal

SOURCE <n>: MOD: PSKey: SOURCE?

Select the FSK modulation source type is internal (INTernal) or external (EXTernal).

| Parameter | General Returns |
|--|---------------------------------------|
| INTernal EXTernal, the default is INTernal | Returns the current modulation source |
| The channel 1ASK modulation source for the external modulation settings, SOURCE <n>: MOD: FSKey: SOURCE EXTernal | |

SOURCE <n>: MOD: PSKey: POLarity POSitive | NEGative

SOURCE <n>: MOD: PSKey: POLarity?

Selects the output from the positive polarity or negative amplitude modulation wave control

| Parameter | General Returns |
|--|----------------------|
| POSitive NEGative, the default is POSitive | POSitive or NEGative |

The channel 1ASK polar modulation modulation is set to negative: SOURCE1: MOD: PSKey: Polarity NEGative

5.2. 2 2 PWM subsystem

PWM subsystem supports you to perform pulse width modulation on pulse waveforms (PWM).

SOURCE <n>: MOD: PWM: DEVIation <deviation> | MINimum | MAXimum

SOURCE <n>: MOD: PWM: DEVIation [MINimum | MAXimum]?

Set the pulse width deviation; relative to the pulse width carrier pulse waveform width \pm deviation (in seconds).

| Parameter | General Returns |
|---|---------------------------|
| 0 ns to 500 ks, the default is 200 μ s | +1.0000000000000000 E +00 |
| The channel 1 is set to the pulse width deviation 1S : SOURCE1: MOD: PWM: DEVIation 1 | |

- ◆ width deviation can not exceed the current pulse width.
- ◆ pulse width limited by the minimum pulse width deviation and the current edge time setting.

SOURCE <n>: MOD: PWM: INTERNAL: FREQUENCY <frequency> | MINimum | MAXimum

SOURCE <n>: MOD: PWM: INTERNAL: FREQUENCY [MINimum | MAXimum]?

Select the output pulse frequency according to their displacement pulse width deviation. Used as a modulation source waveform will run at this frequency (within the waveform frequency limit).

| Parameter | General Returns |
|--|--|
| 2 mHz to 500 kHz, the default is 100Hz | In scientific notation return frequency value +1.0000000000000000 E +02 |
| The channel a frequency modulated wave is set to 100Hz : SOURCE1: MOD: PM: INTERNAL: FREQUENCY 100 | |

- ◆ When you select an arbitrary waveform as the modulation source, the frequency will change the frequency arbitrary waveform (based arbitrary waveform sampling rate and number of points).
- ◆ This command can only be used for internal modulation source (PWM: SOURCE INTERNAL).

SOURCE <n>: MOD: PWM: INTERNAL: FUNCTION SINusoid | SQUARE | RAMP

SOURCE <n>: MOD: PWM: INTERNAL: FUNCTION?

Select internal modulation waveform shape.

| Parameter | General Returns |
|--|---|
| SINusoid SQUARE RAMP , the default is SINusoid | Returns the current modulation waveform shape SINusoid, SQUARE or RAMP |
| The channel 1 waveform shape of the modulation wave is set to square wave: SOURCE1: MOD: PM: INTERNAL: FUNCTION SQUARE | |

- ◆ This command can only be used for internal modulation source (PWM: SOURCE INTERNAL)

SOURce <n>: MOD: PWM: SOURce INTernal | EXTernal

SOURce <n>: MOD: PWM: SOURce?

Select AM modulation source type is internal (INTernal) or external (EXTernal).

| Parameter | General Returns |
|--|----------------------|
| INTernal EXTernal, the default is INTernal | INTernal or EXTernal |
| The Channel 1 set for external modulation source: SOURCE1: MOD: FM: SOURce EXTernal | |

5.2.2 3 ROSCillator subsystem

ROSCillator subsystem control 10 MHz reference oscillator uses an external reference oscillator input. Reference oscillator waveform synthesis of all the master clock. All waveforms are phase locked to the reference oscillator to control the output signal frequency and phase.

ROSCillator: SOURce - Select internal or external reference oscillator source

SYSTEM: ROSCillator: SOURce INTernal | EXTernal

SYSTEM: ROSCillator: SOURce?

| System | General Returns |
|--|----------------------|
| INTernal EXTernal, the default is INTernal | INTernal or EXTernal |
| Returns the current system reference clock source Set the system clock source is external: SYSTEM: ROSCillator: SOURce EXTernal | |

- ◆ **External** : the instrument panel **10 MHz In** connector of the signal as a reference, if the signal is missing or if the instrument can not be locked to the signal, the error message is generated. In such an error, the instrument will continue to output, but the frequency will be unstable.
- ◆ **Internal** : instrument using the internal reference oscillator and ignores the **10 MHz In** connector signal.

5.2.2 4 SOURce subsystem

Use the optional **SOURce** subsystem keyword

Because **SOURce** subsystem command is usually not with the **SOURce** used with keywords, so according to their sub-lists these commands, as follows:

[AM](#)

[ASK](#)

[BPSK](#)

[BURSt](#)

[DATA](#)

[FM](#)
[FREQuency](#)
[FSKey](#)
[FUNction](#)
[MARKer](#)
[PHASe](#)
[PM](#)
[ROSCillator](#)
[SWEep](#)
[VOLTage](#)

5.2.2 5 SWEep subsystem

SOURCE <n>: SWEep: HTIME <seconds> | MINimum | MAXimum

SOURCE <n>: SWEep: HTIME [MINimum | MAXimum]?

Sweep time is set to maintain the termination

| Parameter | General Returns |
|--|---------------------------|
| 1 ms to 300 s , the default is 1s | + 5.0 00000000000000E +00 |
| Set the channel a sweep of a hold time of 5S : SOURCE1: SWEep: HTIME 5 | |

SOURCE <n>: SWEep: RTIME <seconds> | MINimum | MAXimum

SOURCE <n>: SWEep: RTIME [MINimum | MAXimum]?

Set the scan returns the number of seconds it takes from the start frequency to stop frequency.

| Parameter | General Returns |
|--|---------------------------|
| 1 ms to 300 s , the default is 1s | + 5.0 00000000000000E +00 |
| Set the channel a sweep of the return time is 5S : SOURCE1: SWEep: RTIME 5 | |

SOURCE <n>: SWEep ON | OFF

SOURCE <n>: SWEep?

Open or closed sweep function

| Parameter | General Returns |
|--|-----------------|
| ON OFF , default is OFF | ON or OFF |
| Open channel a sweep function: SOURCE1: SWEep ON | |

SOURCE <n>: SWEep: TIME <seconds> | MINimum | MAXimum

SOURCE <n>: SWEep: TIME [MINimum | MAXimum]?

Set sweep from the start frequency to the stop frequency of the time (in seconds).

| Parameter | General Returns |
|-----------------------------------|--|
| 1 ms to 300 s , the default is 1s | Return time in scientific notation value |

| |
|---|
| + 5.0 00000000000000E +0 0 |
| Set the channel a sweep time of 5S : SOURCE1: SWEep: TIME 5 |

5.2.2 6 SYST em subsystem

SYSTem subsystem management instrument state storage, power call, error conditions, self-test, the front panel display and remote control interface configuration.

SYSTem: BEEPer - immediately produce a beep buzzer

SYSTem: BEEPer: STAtE - open or close the buzzer

SYSTem: COMMunicate: LAN: GATEway - set the default gateway to the signal generator

SYSTem: COMMunicate: LAN: IPADdress - set the signal generator IP address

SYSTem: COMMunicate: LAN: MAC - check MAC address

SYSTem: COMMunicate: LAN: SMASK - Set the subnet mask for the signal generator

SYSTem: ERRor -? Query Error event queue

SYSTem: LANGuage - set the system language

SYSTem: KLOCK - remotely lock or unlock the front panel keypad

SYSTem: VERSion -? query and returns the SCPI version

SYSTem: BEEPer

Immediately generate a beep buzzer

| Parameter | General Returns |
|----------------|-----------------|
| No | No |
| SYSTem: BEEPer | |

- ◆ This command will overwrite the current buzzer status (SYSTem: BEEPer: STAtE). This means that even if the buzzer is off, you can still beep.

SYSTem: BEEPer: STAtE ON | OFF

Turn on or off the buzzer

| Parameter | General Returns |
|--|-----------------|
| ON OFF, default is ON | ON or OFF |
| Open System Buzzer: SYSTem: BEEPer: STAtE ON | |

- ◆ Close the front panel buttons to disable the beeper will sound.
- ◆ send SYSTem: BEEPer, it will always beep (beep even if the status is OFF).
- ◆ The setting is non-volatile; close and reopen the supply or *RST does not change this setting.

SYSTem: COMMunicate: LAN: GATEway <address>

SYSTem: COMMunicate: LAN: GATEway?

Set the default gateway to the signal generator

| Parameter | General Returns |
|-----------|-----------------|
|-----------|-----------------|

| | |
|--|---|
| 0.0.0.0 to 223.255.255.255 and the first paragraph of the value can not be 127 | Returns the current default gateway, the format nnn.nnn.nnn.nnn |
| Set the gateway to 192.168.1.1 : SYSTem: COMMUnicate: LAN: 192.168.1.1 GATEway | |

SYSTem: COMMUnicate: LAN: IPADdress <ip_addr>

SYSTem: COMMUnicate: LAN: IPADdress?

Signal generator set IP address

| Parameter | General Returns |
|---|--|
| 0.0.0.0 to 223.255.255.255 and the first paragraph of the value can not be 127 | Returns the current IP , the format nnn.nnn.nnn.nn |
| Set ip address is 192.168.1.118 : SYSTem: COMMUnicate: LAN: IPADdress 192.168.1.118 | |

SYSTem: COMMUnicate: LAN: MAC?

Query MAC address

SYSTem: COMMUnicate: LAN: SMASk <mask>

SYSTem: COMMUnicate: LAN: SMASk?

Set the subnet mask for the signal generator

| Parameter | General Returns |
|---|---|
| 0.0.0.0 to 255.255.255.255 | Returns the current subnet mask, in the format nnn.nnn.nnn.nn |
| Set ip address is 192.168.1.118 : SYSTem: COMMUnicate: LAN: IPADdress 192.168.1.118 | |

SYSTem: ERRor?

Query Error event queue. Can you clear the error (read from the error queue and clear an error.)

| Parameter | General Returns |
|---|---|
| No | Returns an error event information, such as: -113, "Undefined header; keyword Can not be found" . If no error is returned: 0, "No Error" . |
| Read and clear the error queue first error: SYST: ERR? | |

SYSTem: LANGUage english | schinese , SYSTem: LANGUage?

Set the system language to English (english) or Simplified Chinese (schinese).

| Parameter | General Returns |
|---|---------------------|
| English schinese , the default is ENGLISH | ENGLISH or SCHinese |

Set the system to Simplified Chinese: **SYSTem: LANGUage** schinese

SYSTem: KLOCK ON | OFF

SYSTem: KLOCK?

Remotely lock or unlock the front panel keypad.

| Parameter | General Returns |
|--|-----------------|
| ON OFF, default is OFF | ON or OFF |
| Lock the front panel keypad: SYSTem: KLOCK ON | |

SYSTem: VERSion?

Query and returns the SCPI version

| Parameter | General Returns |
|---|---|
| No | Returns SCPI version information, such as: 1999.0 |
| Query and returns the SCPI version information: SYSTem: VERSion? | |

5.2.2 7 VOLTage Subsystem Profile

VOLTage subsystem and the output voltage can be set related parameters.

SOURce <n>: VOLTage <amplitude> | MINimum | MAXimum

SOURce <n>: VOLTage [{MINimum | MAXimum}]?

Set the output amplitude.

| Parameter | General Returns |
|--|----------------------------|
| 2 mVpp to 20 Vpp, the default is 200mVpp | + 10 .00000000000000 E +00 |
| The Channel 1 amplitude is set to 10Vpp : SOURCE1: VOLTage 10 | |

SOURce <n>: VOLTage: OFFSet <offset> | MINimum | MAXimum

SOURce <n>: VOLTage: OFFSet [MINimum | MAXimum]?

Set DC offset voltage.

| Parameter | General Returns |
|---|------------------------|
| -10 to +10 V, the default is 0V | +1.00000000000000 E-01 |
| The Channel 1 offset voltage is set to 100 mV : SOURCE1: VOLTage: OFFSet 0.1 | |

- ◆ The following shows the relationship between offset voltage and the output amplitude.

$$|V_{offset}| < V_{max} - V_{pp} / 2$$

- ◆ settings will be set high and low wave amplitude and offset. For example, if you set the high level to +2 V, the low level to -3 V, the resulting amplitude is 5 Vpp, offset is -500 mV.

5.3 Programming Examples

- ◆ [sine wave configuration](#)
- ◆ [square wave configuration](#)
- ◆ [sawtooth configuration](#)
- ◆ [pulse wave configuration](#)

5.3 a sine wave configuration

This section describes how to configure the sine function.

Explanation

Sine wave having an amplitude, and phase shift with respect to the sync pulse.

Example

The following waveform by **SCPI** command set series:



Following command to generate a sine wave as shown above.

```
SOURce1: FUNCtion SINusoid  
SOURce1: FREQuency 100 000  
SOURce1: VOLTage 2  
OUTPut1 ON  
SOURce1: PHASe 90
```

5.3.2 Configuration square wave

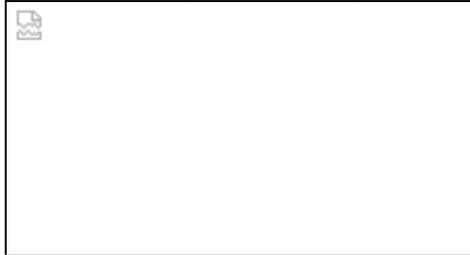
Explanation

The square wave amplitude and phase shift with respect to the sync pulse. It also has a duty cycle and period. May be used and a low

voltage high voltage amplitude and offset value.

Example

The following waveform by SCPI command set series:



The following command generates a square wave as shown above.

```
SOURce1: FUNCtion SQUare  
SOURce1: FUNCtion: SQUare: DCYCLE 20  
SOURce1: FREQuency 100 000  
SOURce1: VOLTage 4  
OUTPut1 ON
```

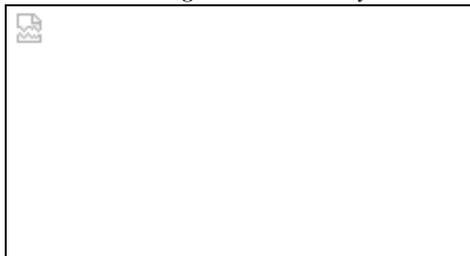
5.3.3 Configuration sawtooth

Explanation

A sawtooth wave having an amplitude, and phase shift with respect to the sync pulse. It is also used to create a triangular waveform symmetry and other similar waveforms.

Example

The following waveform by SCPI command set series



```
SOURce1: FUNCtion RAMP  
SOURce1: FUNCtion: RAMP: SYMMetry 25  
SOURce1: FREQuency 100 0  
SOURce1: VOLTage 2  
SOURce1: VOLTage: OFFSet 1.0  
OUTPut1 ON
```

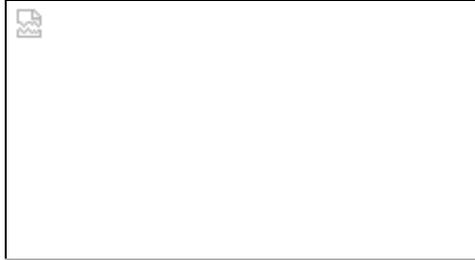
5.3.4 Configuration Pulse

Explanation

Pulse has an amplitude, and phase shift with respect to the sync pulse. It also adds an edge slope, period and duty cycle (or pulse width). May be used and a low voltage high voltage amplitude and offset value.

Example

The following waveform by **SCPI** command set series



As shown in the following command to generate a pulse wave.

```
SOURce1: FUNCtion P UL S
SOURce1: FUNCtion: PULSe: TRANSition: LEADing 0.0000000 4
SOURce1: FUNCtion: PULSe: TRANSition: TRAILing 0.000001
SOURce1: FUNCtion: PULSe: WIDTh 0.00 0003
SOURce1: FREQuency 200000
SOURce1: VOLTage 3
OUTPut1 ON
```

Appendix

HDG2000 Series Command Quick Reference

DATA command

SOURce <n>: DATA: DAC16 <addr>, <dots_num>, <binary_block> | <value>, <value>, ...

SOURce <n>: DATA: <addr>, <dots_num>, <binary_block> | <value>, <value>, ...

Output configuration commands

SOURce <n>: FUNCtion <wave> ,

SOURce <n>: FUNCtion?

Frequency Control

SOURce <n>: FREQuency <frequency> | MINimum | MAXimum

SOURce <n>: FREQuency [MINimum | MAXimum]?

SOURce <n>: FREQuency: STARt <frequency> | MINimum | MAXimum

SOURce <n>: FREQuency: STARt [MINimum | MAXimum]?

SOURce <n>: FREQuency: STOP <frequency> | MINimum | MAXimum

SOURce <n>: FREQuency: STOP [MINimum | MAXimum]?

SOURce <n>: FREQuency: CENTer <frequency> | MINimum | MAXimum

SOURce <n>: FREQuency: CENTer [MINimum | MAXimum]?

SOURce <n>: FREQUency: SPAN <frequency> | MINimum | MAXimum
SOURce <n>: FREQUency: SPAN [MINimum | MAXimum]?

Voltage

SOURce <n>: VOLTage <amplitude> | MINimum | MAXimum
SOURce <n>: VOLTage [{MINimum | MAXimum}]?
SOURce <n>: VOLTage: OFFSet <offset> | MINimum | MAXimum
SOURce <n>: VOLTage: OFFSet [MINimum | MAXimum]?

Square wave

SOURce <n>: FUNCtion: SQUare: DCYCLE <percent> | MINimum | MAXimum , SOURce <n>: FUNCtion: SQUare: DCYCLE [MINimum | MAXimum]?

Sawtooth

SOURce <n>: FUNCtion: RAMP: Symmetry <symmetry> | MINimum | MAXimum , SOURce <n> : FUNCtion: RAMP: Symmetry [MINimum | MAXimum]?

Pulse wave

SOURce <n>: FUNCtion: PULSe: DCYCLE <percent> | MINimum | MAXimum
SOURce <n>: PULSe: DCYCLE [MINimum | MAXimum]?
SOURce <n>: FUNCtion: PULSe: WIDTh <seconds> | MINimum | MAXimum
SOURce <n>: FUNCtion: PULSe: WIDTh [MINimum | MAXimum]?
SOURce <n>: FUNCtion: PULSe: TRANSition: LEADing <seconds> | MINimum | MAXimum
SOURce <n>: PULSe: TRANSition: LEADing [MINimum | MAXimum]?
SOURce <n>: FUNCtion: PULSe: TRANSition: TRAILing <seconds> | MINimum | MAXimum
SOURce <n>: PULSe: TRANSition: TRAILing [MINimum | MAXimum]?

Arbitrary Waveform

SOURce <n>: FUNCtion: ARBItrary <filename>, SOURce <n>: FUNCtion: ARBItrary?
SOURce <1 | 2>: FUNCtion: ARBItrary: PTPeak <voltage> | MINimum | MAXimum, SOURce <1 | 2>: FUNCtion: ARBItrary: PTPeak {MINimum | MAXimum}?
SOURce <1 | 2>: FUNCtion: ARBItrary: srate {<sample_rate> | MINimum | MAXimum} , SOURce <1 | 2>: FUNCtion: ARBItrary: srate {MINimum | MAXimum}?

OUTPUT

OUTPut <n> ON | OFF ,
OUTPut <n>?
OUTPut: SYNC: SOURce CH1 | CH2

Modulation command

SOURce <n>: MOD ON | OFF
SOURce <n>: MOD?
SOURce <n>: MOD: TYPE AM | FM | PM | ASK | FSK | PSK | PWM | BPSK
SOURce <n>: MOD: TYPE?
AM
SOURce <n>: MOD: AM: DEPTH <depth> | MINimum | MAXimum
SOURce <n>: MOD: AM: DEPTH [MINimum | MAXimum]?

SOURce <n>: MOD: AM: SOURce INTernal | EXTernal
 SOURce <n>: MOD: AM: SOURce?
 SOURce <n>: MOD: AM: INTernal: FREQuency <frequency> | MINimum | MAXimum
 SOURce <n>: MOD: AM: INTernal: FREQuency [MINimum | MAXimum]?
 SOURce <n>: MOD: AM: INTernal: FUNCtion SINusoid | SQUare | RAMP
 SOURce <n>: MOD: AM: INTernal: FUNCtion?

FM
 SOURce <n>: MOD: FM: DEVIation <deviation> | MINimum | MAXimum
 SOURce <n>: MOD: FM: DEVIation [MINimum | MAXimum]?
 SOURce <n>: MOD: FM: SOURce INTernal | EXTernal
 SOURce <n>: MOD: FM: SOURce?
 SOURce <n>: MOD: FM: INTernal: FREQuency <frequency> | MINimum | MAXimum
 SOURce <n>: MOD: FM: INTernal: FREQuency [MINimum | MAXimum]?
 SOURce <n>: MOD: FM: INTernal: FUNCtion SINusoid | SQUare | RAMP
 SOURce <n>: MOD: FM: INTernal: FUNCtion?

PM
 SOURce <n>: MOD: PM: DEVIation <deviation> | MINimum | MAXimum
 SOURce <n>: MOD: PM: DEVIation [MINimum | MAXimum]?
 SOURce <n>: MOD: PM: SOURce INTernal | EXTernal
 SOURce <n>: MOD: PM: SOURce?
 SOURce <n>: MOD: PM: INTernal: FREQuency <frequency> | MINimum | MAXimum
 SOURce <n>: MOD: PM: INTernal: FREQuency [MINimum | MAXimum]?
 SOURce <n>: MOD: PM: INTernal: FUNCtion SINusoid | SQUare | RAMP
 SOURce <n>: MOD: PM: INTernal: FUNCtion?

ASK
 SOURce <n>: MOD: ASKey: AMPLitude <amplitude> | MINimum | MAXimum
 SOURce <n>: MOD: ASKey: AMPLitude [MINimum | MAXimum]?
 SOURce <n>: MOD: ASKey: INTernal: RATE <frequency> | MINimum | MAXimum
 SOURce <n>: MOD: ASKey: INTernal: RATE [MINimum | MAXimum]?
 SOURce <n>: MOD: ASKey: SOURce INTernal | EXTernal
 SOURce <n>: MOD: ASKey: SOURce?
 SOURce <n>: MOD: ASKey: POLarity POSitive | NEGative
 SOURce <n>: MOD: ASKey: POLarity?

FSK
 SOURce <n>: MOD: FSKey: FREQuency <frequency> | MINimum | MAXimum
 SOURce <n>: MOD: FSKey: FREQuency [MINimum | MAXimum]?
 SOURce <n>: MOD: FSKey: INTernal: RATE <frequency> | MINimum | MAXimum
 SOURce <n>: MOD: FSKey: INTernal: RATE [MINimum | MAXimum]?
 SOURce <n>: MOD: FSKey: SOURce INTernal | EXTernal
 SOURce <n>: MOD: FSKey: SOURce?
 SOURce <n>: MOD: FSKey: POLarity POSitive | NEGative
 SOURce <n>: MOD: FSKey: POLarity?

PSK

SOURce <n>: MOD: PSKey: PHASe <phase> | MINimum | MAXimum
 SOURce <n>: MOD: PSKey: PHASe [MINimum | MAXimum]?
 SOURce <n>: MOD: PSKey: INTernal: RATE <frequency> | MINimum | MAXimum
 SOURce <n>: MOD: PSKey: INTernal: RATE [MINimum | MAXimum]?
 SOURce <n>: MOD: PSKey: SOURce INTernal | EXTernal
 SOURce <n>: MOD: PSKey: SOURce?
 SOURce <n>: MOD: PSKey: POLarity POSitive | NEGative
 SOURce <n>: MOD: PSKey: POLarity?
 BPSK
 SOURce <n>: MOD: BPSKey: PHASe <phase> | MINimum | MAXimum
 SOURce <n>: MOD: BPSKey: PHASe [MINimum | MAXimum]?
 SOURce <n>: MOD: BPSKey: INTernal: RATE <frequency> | MINimum | MAXimum
 SOURce <n>: MOD: BPSKey: INTernal: RATE [MINimum | MAXimum]?
 PWM
 SOURce <n>: MOD: PWM: DEVIation <deviation> | MINimum | MAXimum
 SOURce <n>: MOD: PWM: DEVIation [MINimum | MAXimum]?
 SOURce <n>: MOD: PWM: SOURce INTernal | EXTernal
 SOURce <n>: MOD: PWM: SOURce?
 SOURce <n>: MOD: PWM: INTernal: FREQuency <frequency> | MINimum | MAXimum
 SOURce <n>: MOD: PWM: INTernal: FREQuency [MINimum | MAXimum]?
 SOURce <n>: MOD: PWM: INTernal: FUNCtion SINusoid | SQUare | RAMP
 SOURce <n>: MOD: PWM: INTernal: FUNCtion?

Frequency Sweep

SOURce <n>: SWEEp ON | OFF
 SOURce <n>: SWEEp?
 SOURce <n>: SWEEp: TIME <seconds> | MINimum | MAXimum
 SOURce <n>: SWEEp: TIME [MINimum | MAXimum]?
 SOURce <n>: SWEEp: HTIME <seconds> | MINimum | MAXimum
 SOURce <n>: SWEEp: HTIME [MINimum | MAXimum]?
 SOURce <n>: SWEEp: RTIME <seconds> | MINimum | MAXimum
 SOURce <n>: SWEEp: RTIME [MINimum | MAXimum]?
 SOURce <n>: SWEEp: TRIGger: SOURce INTernal | EXTernal
 SOURce <n>: SWEEp: TRIGger: SOURce?
 SOURce <n>: SWEEp: TRIGger: SLOPe POSitive | NEGative
 SOURce <n>: SWEEp: TRIGger: SLOPe?
 SOURce <n>: SWEEp: TRIGger

Burst Mode

SOURce <n>: BURSt ON | OFF
 SOURce <n>: BURSt?
 SOURce <n>: BURSt: MODE TRIGgered | GATed | INFinity
 SOURce <n>: BURSt: MODE?

SOURce <n>: BURSt: NCYCles <cycles> | MINimum | MAXimum
SOURce <n>: BURSt: NCYCles [MINimum | MAXimum]?
SOURce <n>: BURSt: GATE: POLarity NORMal | INVerted
SOURce <n>: BURSt: GATE: POLarity?
SOURce <n>: BURSt: TRIGger: SOURce INTernal | EXTernal
SOURce <n>: BURSt: TRIGger: SOURce?
SOURce <n>: BURSt: TRIGger: SLOPe POSitive | NEGative
SOURce <n>: BURSt: TRIGger: SLOPe?
SOURce <n>: BURSt: TRIGger

State Storage

MEMory: STATe: VALid USER1 | USER2 | USER3 | USER4 | USER5?
MEMory: STATe: DELete USER1 | USER2 | USER3 | USER4 | USER5

Large capacity memory

MMEMory: CATalog?
MMEMory: CDIRectory <folder>
MMEMory: CDIRectory?
MMEMory: COPY <folder>, <file_name>
MMEMory: DELete <file_name>
MMEMory: RDIRectory <folder>
MMEMory: MDIRectory <folder>
MMEMory: LOAD: STATe <file_name>
MMEMory: STORE: STATe <file_name>

System

DISPlay: BRIGHtness <brightness> | MINimum | MAXimum
DISPlay: BRIGHtness [MINimum | MAXimum]?
DISPlay: SAVER ON | OFF
DISPlay: SAVER?

Remote Interface Configuration

SYSTem: BEEPPer: STATe ON | OFF
SYSTem: BEEPPer
SYSTem: LANGuage english | schinese , SYSTem: LANGuage?
SYSTem: KLOCK ON | OFF
SYSTem: KLOCK?
SYSTem: COMMunicate: LAN: GATEway <address>
SYSTem: COMMunicate: LAN: GATEway?
SYSTem: COMMunicate: LAN: IPADdress <ip_addr>
SYSTem: COMMunicate: LAN: IPADdress?
SYSTem: COMMunicate: LAN: SMASk <mask>
SYSTem: COMMunicate: LAN: SMASk?

SYSTem: COMMunicate: LAN: MAC?
SYSTem: ERRor?
SYSTem: ROSCillator: SOURce INTernal | EXTernal
SYSTem: ROSCillator: SOURce?
SYSTem: VERSion?
DISPlay: BRIGhtness <brightness> | MINimum | MAXimum
DISPlay: BRIGhtness [MINimum | MAXimum]?
DISPlay: SAVer ON | OFF
DISPlay: SAVer?

Phase-locked

SOURce <n>: PHASe <phase> | MINimum | MAXimum
SOURce <n>: PHASe [MINimum | MAXimum]?
SOURce <n>: PHASe: SYNChronize

Frequency Counter

COUNter ON | OFF
COUNter: MEASure?
COUNter: GATETIME UTO | USER1 | USER2 | USER3 | USER4 | USER5 | USER6
: COUNter: GATETIME?
COUNter: TYPE LFCOUNTER | LFFREQ | HFCOUNTER | HFFREQ

Calibration

CALibration: SETup <step>
CALibration?
CALibration: VALue <value>
CALibration: STORe

IEEE-488

* IDN?
* RCL
* SAV
* RST
* TRG
* TST?

Other

SOURce <n>: MARKer ON | OFF
SOURce <n>: MARKer?
SOURce <n>: MARKer: FREQuency <frequency> | MINimum | MAXimum
SOURce <n>: MARKer: FREQuency [MINimum | MAXimum]?