Hantek

HDG3000B series

Arbitrary waveform signal generator

Programming Manual

2022.05

Warranties and Declarations

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Hantek certified HDG3000B series arbitrary waveform signal generator to meet China's national industry standards and has passed the CE certification.

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Contents

Table

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1   <u>Document overview</u>

This document is intended to guide the user to quickly understand how to programmatically control the HDG3000B series digital oscilloscope through a remote interface using the SCPI commands. The HDG3000B series can communicate with a computer through a USB interface.

Tip:

The latest version of this manual can be downloaded at (http://www.hantek.com).

Document number:

 202205

Software version:

Software upgrade may change or increase product functionalities, please pay attention to Hantek website for the latest version.

Document format conventions:

1   Keys

Use "square brackets + text (bold)" to represent front panel keys, such as **[Utility]** for the "Utility" key.

2   Menu

Use blue menu text (bold) to represent a menu option, for instance, **Basic Settings** indicates clicking the "Basic Settings" option on the current operation interface to enter the configuration menu of "Basic Settings".

3   Operation flow

Use ">" to indicate the next operation, for instance, **[Utility]** > **Store** indicates clicking **[Utility]** and then click the **Store** function key.

4   Knob

Symbol	Knob
	Multi-function knob

Table 1.1 Knob

Document content conventions:

The HDG3000B signal generator contains the following models.

Model	Number of channels	Maximum frequency	CH1/CH2 sampling rate
HDG3012B	2	15MHz	300MS/s
HDG3022B	2	25MHz	300MS/s
HDG3042B	2	40MHz	300MS/s
HDG3062B	2	60MHz	300MS/s
HDG3082B	2	80MHz	300MS/s
HDG3102B	2	100MHz	300MS/s

Table 1.2 Model

2   SCPI profile

SCPI (Standard Commands for Programmable Instruments is a standard instrument programming language based on the existing standards IEEE 488.1 and IEEE 488.2, and follows the IEEE 754 floating point arithmetic rules, ISO 646 information exchange 7-bit coding symbols (equivalent to ASCII programming) and other standards. The SCPI command is a tree-like hierarchical structure, including multiple subsystems, each subsystem is composed of a root keyword and one or several hierarchical keywords.

Command symbol

The following four symbols are not part of the SCPI command and are not sent with the command but are commonly used to illustrate the arguments in the command.

1. **Curly braces {}**

   Arguments in braces are optional and can be left unset.

2. **Vertical bar |**

   Vertical bars are used to separate multiple arguments options. One of the arguments must be chosen when sending commands.

3. **Triangular parentheses < >**

   Arguments in triangular brackets must be replaced with a valid value.

4. **Square brackets []**

   The content in square brackets (arguments or keywords) can be omitted. If omitted, the content is set to its default value.

Syntax conventions

The format used to display commands is as follows:
SOURce<n>:VOLTage <amplitude>|MINimum|MAXimum
SOURce<n>:FREQuency:CENTer {<frequency>|MINimum|MAXimum}

According to the command syntax, most commands (and some arguments) are represented as a mixture of upper- and lower-case letters. For short program lines, commands in abbreviated format are acceptable. For better program readability, send commands in long format.

For example, VOLT and VOLTage are both acceptable in the statement above. Upper- or lower-case letters are both acceptable, therefore, VOLTage, volt, and Volt all can be used. Other formats (such as VOL and VOLTAG) are invalid and can produce errors.

- The curly braces (**{ }**) contain the argument options for the given command string. Braces are not sent with the command string.
- The vertical bar (**|**) separates multiple argument options for a given command string. Bar is not sent with the command string.
- The triangular brackets (**< >**) in the second example indicate that a value must be specified for the argument inside the brackets. For example, in the statement above, the argument inside the triangular brackets is <frequency>. The triangular brackets are not sent with the command string. You must specify a value for the argument (for example "FREQ:CENT 1000")
- Some syntactic elements (such as nodes and arguments) are contained within

square brackets (**[ ]**). This means that the element is optional and can be omitted. The square brackets are not sent with the command string. If no value is specified for an optional argument, the instrument will select the default value.

Command separator

The colon (**:**) is used to separate the command keyword from the keyword at the next level. A space must be inserted to separate the argument from the command keyword.

Use MIN, MAX arguments

For many commands, you can use "MIN" or "MAX" instead of arguments. For example, consider the following command:
SOURce<n>:VOLTage:OFFSet <offset>|MINimum|MAXimum
If no specific value is selected for the <offset> argument, MIN can be replaced to set the offset to the minimum, and MAX can be replaced to set the offset to the maximum.

SCPI command terminator

The command string sent to the instrument must end with a (<NL>). The IEEE-488 EOI (end or recognition) message can be interpreted as an <NL> character to terminate the command string. <Return> followed by an <NL> is also acceptable. Command string termination always resets the current SCPI command path to the root level.

General command

General commands can perform functions such as reset, self-test, and status operations. General commands, which always start with an asterisk (*) and are 3 characters long, can include one or more arguments. The command keyword is separated from the first argument by a space. Use a semicolon (;) to separate multiple commands as follows:
*RST; *CLS; *ESE 32; *OPC?

SCPI argument type

The SCPI language defines several data formats used by program messages and response messages.

Numerical arguments

Commands that require the use of numerical arguments, support all common decimal number representations, including optional symbols, decimal point, and scientific notation, etc. Special values for numerical arguments, such as MIN, MAX are also acceptable. In addition, it is possible to send engineering unit suffixes (for example, M, k, m, or u) along with numerical arguments. If the command only accepts certain values, the instrument will automatically round the input numerical arguments to acceptable values. The following commands require numerical arguments for frequency:
SOURce<n>:FREQuency:CENTer <frequency>|MINimum|MAXimum

Due to the SCPI parser is case-insensitive, the letter "M" (or "m") have some confusion. For convenience, the instrument interprets "mV" (or "MV") as millivolts but interprets "MHZ" (or "mhz") as megahertz. Also, interpret "MΩ" (or "mΩ") as megaohm. You can

use the prefix "MA" for megohm. For example, "MAV" is interpreted as megavolt.

Boolean arguments

Boolean arguments represent a true or false binary condition. For a false condition, the instrument will receive "OFF". For a true condition, the instrument will receive "ON."

ASCII string arguments

String arguments can contain virtually all ASCII character sets. Strings must begin and end with paired quotes. You can use single or double quotes. Quote delimiters can also be part of a string by typing them twice and not adding any characters in between.

3   Command system

This chapter describes the format, functions, arguments, and usage instructions of each command in the HDG3000B command set.

Note:

For argument setting commands (such as time, frequency, amplitude, etc.), the oscilloscope will not recognize the unit sent with the argument but only the number, and set the argument in the default unit. For the default unit of each argument, see the function description in the specific commands below.

3.1   General command

General commands are used to query basic information about an instrument or perform common basic operations. These commands usually start with an asterisk (*). The length of the keyword is 3 characters.

3.1.1   *IDN?

Command format

*IDN?

Function description

Query the ID string of the instrument.

Argument

None

Instructions

None

Return format

The query returns HANTEK,<model>,<serial number>,<software version>.
Among them,
<model>: instrument model;
<serial number>: instrument serial number;
<software version>: software version of the instrument.

Example

IDN?   / Returns the identity string of the instrument */

3.1.2   *RST?

Command format

*RST?

Function description

Restore the instrument to factory default.

Argument

None

Instructions

None

Return format

None

Example

RST   / Restore the instrument to factory default */

3.2   AM subsystem

The AM subsystem enables you to add amplitude modulation (AM) to the carrier waveform.

3.2.1   SOURce<n>:MOD:AM:DEPTh

Command format

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

Function description

Set the modulation depth of the channel.

Argument

Name	Range	Default value
<depth>	0% to 120%	50%

Instructions

- To achieve a modulation depth of more than 100%, the output carrier amplitude can be reduced.
- If using AM:SOURce EXTernal, the carrier waveform will be modulated through the external waveform.

Return format

Return as a scientific count.

Example

SOURce1:MOD:AM:DEPTh 100   /* Set the modulation depth of channel 1 to 100%*/

3.2.2   SOURce<n>:MOD:AM:INTernal:FREQuency

Command format

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

Function description

Set the modulation waveform frequency. The waveform selected as the modulation source will operate at that frequency (within the waveform frequency limit).

Argument

Name	Range	Default value
<frequency>	2 mHz to 500 kHz	--

Instructions

- When selecting an arbitrary waveform as the modulation source, the frequency will change to the frequency of the arbitrary waveform (based on the sampling rate and the number of points in the arbitrary waveform).
- This command can only be used for iternal modulation sources (AM:SOURce INTernal).

Return format

Return as a scientific count.

Example

SOURce1:MOD:AM:INTernal:FREQuency 500   /* set the modulated wave frequency of channel 1 to 500Hz */

3.2.3 SOURce\<n\>:MOD:AM:INTernal:FUNCtion

Command format

SOURce\<n\>:MOD:AM:INTernal:FUNCtion SINusoid|SQUare|RAMP
SOURce\<n\>:MOD:AM:INTernal:FUNCtion?

Function description

Select the modulated waveform shape.

Argument

Name	Range	Default value
FUNCtion	SINusoid|SQUare|RAMP	SINusoid

Instructions

- This command can only be used for internal modulation sources (AM:SOURce INTernal).
- The pulse and DC cannot be the carrier waveform of the AM.

Return format

Return the current modulated wave shape, SINusoid, SQUare, or RAMP.

Example

SOURce1:MOD:AM:INTernal:FUNCtion SQUare   /* Set the modulated wave shape of channel 1 to square wave */

3.2.4 SOURce\<n\>:MOD:AM:SOURce

Command format

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

Function description

Select the modulation signal source.

Argument

Name	Range	Default value
SOURce	INTernal|EXTernal	INTernal

Instructions

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

● Pulse and DC cannot be the carrier waveform of the AM.

Return format

INTernal or EXTernal.

For example,

SOURce1:MOD:AM:SOURce EXTernal   /* Set the modulation source of channel 1 to external */

Supplementary instructions

AM can be replaced with DSBAM, FM, PM, ASKey, FSKey, PSKey, OSKey or PWM.

1. SOURce<n>:MOD:DSBAM:SOURce INTernal|EXTernal
   SOURce<n>:MOD:DSBAM:SOURce?
2. SOURce<n>:MOD:FM:SOURce INTernal|EXTernal
   SOURce<n>:MOD:FM:SOURce?
3. SOURce<n>:MOD:PM:SOURce INTernal|EXTernal
   SOURce<n>:MOD:PM:SOURce?
4. SOURce<n>:MOD:ASKey:SOURce INTernal|EXTernal
   SOURce<n>:MOD:ASKey:SOURce?
5. SOURce<n>:MOD:FSKey:SOURce INTernal|EXTernal
   SOURce<n>:MOD:FSKey:SOURce?
6. SOURce<n>:MOD:PSKey:SOURce INTernal|EXTernal
   SOURce<n>:MOD:PSKey:SOURce?
7. SOURce<n>:MOD:OSKey:SOURce INTernal|EXTernal
   SOURce<n>:MOD:OSKey:SOURce?
8. SOURce<n>:MOD:PWM:SOURce INTernal|EXTernal
   SOURce<n>:MOD:PWM:SOURce?

3.2.5   SOURce<n>:MOD

Command format

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

Function description

Enable or disable modulation.

argument

Name	Range	Default value
MOD	ON|OFF	ON

Instructions

None

Return format

ON or OFF.

For example,

SOURce1:MOD ON   /* Turn the modulation function of channel 1 on */

3.2.6 SOURce\<n>:MOD:TYPe

Command format

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

Function description

Select modulation mode.

argument

Name	Range	Default value
TYPe	AM|FM|PM|ASK|FSK|PSK|PWM|BPSK	AM

Instructions

- To avoid multiple waveform changes, enable modulation after configuring other modulation arguments.
- Only one modulation mode can be enabled at a time.
- With scan or burst enabled, the instrument will not enable modulation. When modulation is enabled, the scan or burst mode will be turned off.
- PWM can only be enabled when the impulse function is selected.

Return format

Return the keyword of current modulation type, AM, FM | PM, ASK, FSK, PSK, PWM or BPSK.

Example

SOURce\<n>:MOD:TYPe FM   /* Set the modulation mode of channel 1 to FM */

3.3 ASK subsystem

Amplitude Shift Keying (ASK) adjusts the amplitude of the sine wave according to the different signals.

3.3.1 <u>SOURce<n>:MOD:ASKey:AMPLitude</u>

Command format

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

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

Function description

Set the amplitude of the ASK modulated wave.

argument

Name	Range	Default value
TYPe	0 Vpp to 20 Vpp	2Vpp

Instructions

None

Return format

Return the amplitude value as a scientific count.

Example

SOURce1:MOD:ASKey:AMPLitude 1   /* Set the modulated wave amplitude for channel 1ASK modulation to 1Vpp */

3.3.2 <u>SOURce<n>:MOD:ASKey:INTernal:RATE</u>

Command format

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

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

Function description

Set the rate at which the output frequency "moves" between the carrier frequency and the jump frequency.

Argument

Name	Range	Default value
TYPe	2 mHz to 1 MHz	100Hz

Instructions

None

Return format

Return the rate value as a scientific count.

Example

SOURce1:MOD:ASKey:INTernal:RATE 200   /* set the modulation rate for channel 1ASK modulation to 200Hz */

3.3.3 SOURce\<n>:MOD:ASKey:SOURce

Command format

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

Function description

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

Argument

Name	Range	Default value
SOURce	INTernal|EXTernal	INTernal

instructions

None

Return format

INTernal or EXTernal.

For example,

SOURce\<n>:MOD:ASKey:SOURce EXTernal   /* Set the modulation source for channel 1ASK modulation to external */

3.3.4 SOURce\<n>:MOD:ASKey:POLarity

Command format

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

Function description

Select the positive or negative polarity of the modulated wave to control the amplitude output.

Argument

Name	Range	Default value
POLarity	POSitive|NEGative	POSitive

Instructions

None

Return format

POSitive or NEGative.

Example

SOURce1:MOD:ASKey:POLarity NEGative   /* Set the modulation polarity of channel 1ASK to negative*/

3.4   BPSK subsystem

The BPSK subsystem enables you to modulate waveforms via Binary Phase Shift Keying (BPSK), a digital modulation format. In BPSK, the carrier waveform moves the phase between two phase settings using the ON/OFF keys. It can be an internal source, using a square wave at a specified frequency, or an external source, using an external trigger input.

3.4.1   SOURce<n>:MOD:BPSKey:INTernal:RATE

Command format

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

Function description

Set the rate at which the output phase "moves" between the carrier and offset phase.

Argument

Name	Range	Default value
RATE	2 mHz to 1 MHz	100Hz

Instructions

The internal modulated waveform is a square wave with a duty period of 50%.

Return format

Return as a scientific count.

Example

SOURce1:MOD:BPSKey:INTernal:RATE 200   /* set the modulation rate for

channel 1BPSK modulation to 200Hz */

3.4.2 SOURce<n>:MOD:BPSKey:PHASe

Command format

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

Function description

Set the phase (in degrees) of the BPSK modulated wave.

Argument

Name	Range	Default value
PHASe	0 to 360 degrees	180 degrees

Instructions

None

Return format

Return as a scientific count.

For example,

SOURce1:MOD:BPSKey:PHASe 90   /* Set the modulation phase for channel 1BPSK modulation to 90 degrees */

3.4.3 SOURce<n>:MOD:BPSKey:DATA

Command format

SOURce<n>:MOD:BPSKey:DATA PN15|PN21|01|10
SOURce<n>:MOD:BPSKey:DATA?

Function description

Select the data for the BPSK modulated wave.

Argument

Name	Range	Default value
DATA	PN15|PN21|01|10	01

Instructions

None

Return format

PN15, PN21, 01, or 10.

Example

SOURce1:MOD:BPSKey:DATA PN15   /* Set the data for channel 1 BPSK
modulation to PN15 */

3.5   BURSt subsystem

This section introduces the BURSt subsystem.
Burst mode has two burst modes, which are described below. The instrument enables
one burst mode at a time.

● Multi-period burst mode (default): Each time a trigger is received, the instrument will
  output a waveform for several periods (burst count). After outputting the specified
  number of periods, the instrument will stop and wait for the next trigger. You can
  configure the instrument to initiate burst using internal triggers, or apply a trigger
  signal to Trig connector on the rear panel by pressing the [Trig Menu] key on the
  front panel, or send a software trigger command from a remote interface to provide
  an external trigger source.

● External gate controlled burst mode: The instrument output is in either the "on" or
  "off" state depending on the external signal level applied to the TRIG connector on
  the rear panel. When this signal is true, the instrument will output a continuous
  waveform. When this signal is false, the instrument will complete the current
  waveform period first and then stop and remain at the voltage corresponding to the
  initial burst phase of the waveform.

3.5.1   SOURce<n>:BURSt:GATE:POLarity

Command format

SOURce<n>:BURSt:GATE:POLarity NORMal|INVerted
SOURce<n>:BURSt:GATE:POLarity?

Function description

For external gate-controlled burst, select to output the burst when the gating signal on
the rear panel [TRIG] connector is high or low.

Argument

Name	Range	Default value
POLarity	NORMal|INVerted	NORMal

Instructions

None

Return format

NORMal or INVerted.

Example

SOURce1:BURSt:GATE:POLarity INVerted   /* Set gate polarity of channel 1 to negative polarity */

3.5.2   SOURce<n>:BURSt:MODE

Command format

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

Function description

Select burst mode.

argument

Name	Range	Default value
MODE	TRIGgered|GATed|INFinity	TRIGgered

Instructions

- TRIGgered: Each time a trigger is received from the trigger source (SOURce<n>:BURSt:TRIGger:SOURce), the instrument will output a waveform for several periods (burst count).
- Under GATed burst mode, turn the output waveform on or off based on the signal on the TRIG connector on the rear panel. Use SOURce<n>:BURSt:TRIGger:SLOPe POSitive|NEGative to select the polarity of the signal. When the gated signal is true, the instrument will output the continuous waveform. When the gated signal is false, the instrument will first complete the current waveform period and then stop and remain at the voltage level corresponding to the onset burst phase of the waveform.
- GATed: Ignore burst count, burst period, and trigger source (which are only applicable for multi-period burst modes).

Return format

TRIGgered, GATed, or INFinity.

For example,

SOURce<n>:BURSt:MODE INFinity   /* Set the burst output mode of channel 1 to infinite */

3.5.3   SOURce<n>:BURSt:NPeriods

Command format

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

Function description

Set the number of output period for a burst (multi-period burst mode only).

Argument

Name	Range	Default value
<periods>	1 to 1 000 000 (external or manual triggered) 1 to 500 000 (internal trigger)	1

Instructions

None

Return format

Returns the current period number.

Example

SOURce1:BURSt:NPeriods 5   /* Set the number of burst periods for channel 1 to 5*/

3.5.4   SOURce<n>:BURSt

Command format

SOURce<n>:BURSt ON|OFF
SOURce<n>:BURSt?

Function description

Enable or disable burst mode.

Argument

Name	Range	Default value
BURSt	ON|OFF	OFF

Instructions

● With burst enabled, the output phase is set to 0.
● To avoid numerous waveform changes, wait until you have configured other burst arguments before enabling burst mode.

- The burst mode cannot be enabled when scan or arbitrary modulation mode is enabled. When burst is enabled, scan or modulation mode will be turned off.

Return format

ON or OFF.

For example,

SOURce1:BURSt ON   /* Turn on the burst output function of channel 1 */

3.5.5   SOURce<n>:BURSt:TRIGger:SLOPe

Command format

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

Function description

Select the signal generator to start the sweep output when the rising edge (POSitive) or falling edge (NEGative) of the signal is triggered externally.

Argument

Name	Range	Default value
SLOPe	POSitive|NEGative	POSitive

Instructions

None

Return format

Returns the keyword of the current triggered source slope.

Example

SOURce<n>:BURSt:TRIGger:SLOPe NEGative   /* Set the sweep output from the time when the trigger source of channel 1 in scan mode is falling edge */

3.5.6   SOURce<n>:BURSt:TRIGger

Command format

SOURce<n>:BURSt:TRIGger

Function description

Make the instrument trigger immediately.

Argument

None

Instructions

None

Return format

None

Example

SOURce1:BURSt:TRIGger   /* Set channel 1 to trigger immediately*/

3.5.7   SOURce\<n\>:BURSt:TRIGger:SOURce

Command format

SOURce\<n\>:BURSt:TRIGger:SOURce INTernal|EXTernal|MANU
SOURce\<n\>:BURSt:TRIGger:SOURce?

Function description

Select the type of sweep trigger source as internal (INTernal), external (EXTernal), manual (MANU).

Argument

Name	Range	Default value
SOURce	INTernal|EXTernal|MANU	INTernal

instructions

None

Return format

Return the current trigger source.

Example

SOURce1:BURSt:TRIGger:SOURce EXTernal   /* Set the trigger source of channel 1 in scan mode to external */

3.5.8   SOURce\<n\>:BURSt:INTernal:PERIod

Command format

SOURce\<n\>:BURSt:INTernal:PERIod

SOURce<n>:BURSt:INTernal:PERIod?

Function description

Set the output period of the burst (multi-period burst mode only)

Argument

Name	Range	Default value
PERIod	Burst period ≥ 1µs + carrier waveform period × burst count	10ms

Instructions

None

Return format

None

Example of returning the current period

SOURce1: BURSt: INTernal: PERIod of 0.05   /* Set the burst period of channel 1 to 50ms */

3.5.9   SOURce<n>:BURSt:PHASe

Command format

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

Function description

Set the onset phase of the burst.

Argument

Name	Range	Default value
PHASe	0 ° to 360 °	0 °

Instructions

None

Return format

Return the current phase.

Example

SOURce1:BURSt:PHASe 100   /* Set the burst phase of channel 1 to 100°*/

3.6   COUNter subsystem

3.6.1   COUNter:STATe

Command format

COUNter:STATe ON|OFF
COUNter:STATe?

Function description

Turn the frequency meter function on or off to query the status of the frequency meter function.

Argument

Name	Range	Default value
STATe	ON|OFF	OFF

Instructions

None

Return format

ON or OFF.

Example

COUNter:STATe ON   /* Turn on the frequency meter function */
COUNter:STATe?   /* Query returns ON*/

3.6.2   COUNter:GATEtime

Command format

COUNter:GATEtime
COUNter:GATEtime?

Function description

Set the gate time of a frequency meter. Query the gate time of a power meter.

Argument

Name	Range	Default value
GATEtime	10ms~16s	1s

Instructions

None

Return format

Return the current gate time.

Example

:COUNter:GATEtime 0.01/* set the gate time of the frequency meter to 10 ms*/
:COUNter:GATEtime?/* Query returns 10ms*/

3.6.3 COUNter:MEASure

Command format

COUNter: MEASure?

Function description

Query the current measurement results of the frequency meter.

Argument

None

Instructions

None

Return format

Return the measurement results of each argument in the form of "frequency, period, duty period, positive pulse width, negative pulse width", where each argument is represented as a scientific count.

Example

COUNter:MEASure?   /* Query returns
1.000099993E+03,9.999000134E-04,1.422600068E+01,1.422537019E-04,8.576463115E-04*/

3.7 DATA subsystem

3.7.1 SOURce<n>:DATA:DAC16:BIN

Command format

SOURce<n>:DATA:DAC16:BIN iAllDotNum, iSumDotNum, iNowDotNum, #xy...yz...z

Function description

Download data points to your storage device.

For example, SOURce1:DATA:DAC16:BIN 1024, 128, 512, #3512z...z

IAllDotNum =1024 means that the total number of points to be downloaded is 1024.

INowDotNum =128 indicates the number of points for this download is 128.

ISumDotNum =512 indicates the cumulative number of downloaded points, including the number of points for this download.

#3512z...z

# indicates the starting position of the binary block. 3 indicates that the next three bytes are the length of the binary data, that is, the total length of the binary data is 512. z...z followed by 512 is the binary data of the downloaded data point.

Argument

None

Instructions

n represents the channel, which can be set to 1 or 2.

iAllDotNum, iSumDotNum, iNowDotNum is used to subcontract upload.

The maximum length of each instruction transmitted is 128 bytes.

Each dot is represented by a 16-bit signed number such as int16.

After downloading the data, the instructions of setting amplitude, offset, frequency and phase can be used to change the corresponding parameters of the waveform.

Return format

None

Example

None

3.7.2　SOURce<n>:DATA:FREQ:SPS

Command format

SOURce<n>:DATA:FREQ:SPS sps

Function description

Set the sampling rate of the machine.

Argument

None

Instructions

n represents the channel, which can be set to 1 or 2.

The maximum sampling rate (fs) of the machine is 75MSa/s and the minimum is 1uSa/s.

The period of the waveform T=1/fs * number of waveform points.

The amplitude of the waveform can be set by the SCPI instruction.

Return format

None

Example

None

3.7.3 SOURce<n>:DATA:FREQ:SPS?

Command format

SOURce<n>:DATA:FREQ:SPS? [MINimum|MAXimum]

Function description

Get the maximum or minimum sampling rate supported by the machine or the current sampling rate.

Argument

None

Instructions

n represents the channel, which can be set to 1 or 2.

Return format

None

Example

None

3.7.4 SOURce<n>:DATA:RAM:DAC16:BIN

Command format

SOURce<n>:DATA:RAM:DAC16:BIN iAllDotNum, iSumDotNum, iNowDotNum, #xy...yz...z

Function description

Download data points to your storage device.

For example, SOURce1: DATA: RAM: DAC16: BIN 16384, 128, 512, # 3512 z...z

IAllDotNum =4096 indicates that the total number of points to be downloaded is 16384. The total number of points of CH1 and CH2 are 16384 and that of CH3 is 8192. INowDotNum =128 indicates that the total number of points for this download is 128; ISumDotNum =512 indicates the cumulative number of downloaded points, including the number of points for this download.

#3512z...z

# indicates the starting position of the binary block. 3 indicates that the next three bytes are the length of the binary data, that is, the total length of the binary data is 512. z...z followed by 512 is the binary data of the downloaded data point.

Argument

None

Instructions

N represents the channel, which can be set to 1, 2, or 3.
The purpose of iAllDotNum, iSumDotNum, iNowDotNum is to subcontract upload.
The maximum length of each transmission instruction is 128 bytes.
Each dot is represented by a 16-bit signed number such as INT16.
After downloading the data, the instructions of setting amplitude, offset, frequency and phase can be used to change the corresponding parameters of the waveform.

Return format

None

Example

None

3.8 The DISPlay subsystem

The DISPlay subsystem controls the display screen of the instrument.

3.8.1 DISPlay:BRIGhtness

Command format

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

Function description

Set the screen brightness.

Argument

Name	Range	Default value
BRIGhtness	1% to 100%	50%

Instructions

None

Return format

Return it as a percentage.

For example,

DISPlay:BRIGhtness 80   /* Set the screen brightness to 80%*/

3.8.2   DISPlay:SAVer

Command format

DISPlay:SAVer ON|OFF
DISPlay:SAVer?

Function description

Enable or disable screen saver mode.

Argument

Name	Range	Default value
SAVer	ON|OFF	ON

Instructions

None

Return format

ON or OFF.

Example

DISPlay:SAVer:STATe ON   /* Open screensaver */

3.9   DSB - AM subsystem

3.9.1   SOURce<n>:MOD:DSBAM:DEPTh

Command format

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

SOURce<n>:MOD:DSBAM:DEPTh? [MINimum|MAXimum]

Function description

Set the modulation depth.

Argument

Name	Range	Default value
DEPTh	0% to 120%	50%

Instructions

- To achieve a modulation depth of more than 100%, the output carrier amplitude can be reduced.
- If using DSBAM:SOURce EXTernal, the carrier waveform will be modulated through the external waveform.

Return format

Return as a scientific count.

Example

SOURce1:MOD:DSBAM:DEPTh 100   /* Set the modulation depth of channel 1 to 100%*/

3.9.2   SOURce<n>:MOD:DSBAM:INTernal:FREQuency

Command format

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

Function description

Set the modulated waveform frequency. The waveform selected as the modulation source will operate at that frequency (within the waveform frequency limit).

Argument

Name	Range	Default value
FREQuency	2 mHz to 500 kHz	--

Instructions

- When selecting an arbitrary waveform as the modulation source, the frequency will change to the frequency of the arbitrary waveform (based on the sampling rate and the number of points in the arbitrary waveform).
- This command can only be used with internal modulation sources (DSBAM:SOURce INTernal).

Return format

Return as a scientific count.

Example

SOURce1:MOD:DSBAM:INTernal:FREQuency 500   /* set the modulated wave
frequency of channel 1 to 500Hz*/

3.9.3 SOURce<n>:MOD:DSBAM:INTernal:FUNCtion

Command format

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

Function description

Select the modulated waveform shape.

Argument

Name	Range	Default value
FUNCtion	SINusoid|SQUare|RAMP	SINusoid

Instructions

- This command can only be used with internal modulation sources
  (DSBAM:SOURce INTernal).
- The pulse and DC cannot be the carrier waveform of DSB-AM.

Return format

Return the current modulated waveform shape, SINusoid, SQUare, or RAMP.

Example

SOURce1:MOD:DSBAM:INTernal:FUNCtion SQUare   /* Set the waveform
shape of Channel 1 modulated wave to square wave */

3.10 FM subsystem

3.10.1 SOURce<n>:MOD:FM:DEViation

Command format

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

Function description

Set the frequency deviation difference (in Hz) for FM modulation.

Argument

None

Instructions

● The deviation must not exceed the carrier frequency. If the deviation is set to a value that exceeds the carrier frequency (with FM enabled), the instrument will adjust the deviation to the maximum value allowed for that carrier frequency.

● The carrier frequency plus bias must not exceed the maximum frequency of the selected function plus 100 kHz. If the deviation is set to an invalid value, the instrument will adjust it to the maximum value allowed by the current carrier frequency.

● If the deviation would cause the carrier waveform to exceed the frequency limit of the current duty cycle (square wave only), the instrument will adjust the duty cycle to the maximum value allowed for the current carrier frequency.

● If the External modulation source is selected, the deviation is controlled by the ± 5 V signal level of the MOD connector on the front panel. For example, if the frequency deviation is 100 kHz, a +5 V signal level is equivalent to a 100 kHz increase in frequency. A lower external signal level produces less deviation, and a negative signal level reduces the frequency below the carrier frequency.

The frequency deviation <deviation> should meet the following conditions:

Frequency deviation $\leqslant$ carrier frequency.

Frequency deviation + carrier frequency $\leqslant$ the upper limit of current carrier frequency + 1 kHz

Return format

Return as a scientific count.

Example

SOURce1:MOD:FM:DEViation 900   /* set the frequency offset of channel 1 to 900Hz */

3.10.2   SOURce<n>:MOD:FM:INTernal:FREQuency

Command format

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

Function description

Set the frequency of the modulated waveform. The modulated source waveform

operates at this frequency, within the frequency limit of this waveform.

Argument

Name	Range	Default value
FREQuency	2 mHz to 500 kHz	100Hz

Instructions

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

Return format

Return as a scientific count.

Example

SOURce1:MOD:FM:INTernal:FREQuency 500   /* set the modulated wave frequency of channel 1 to 500Hz */

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

Command format

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

Function description

This command selects the shape of the modulated waveform.

Argument

Name	Range	Default value
FUNCtion	SINusoid|SQUare|RAMP	SINusoid

Instructions

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

Return format

SINusoid, SQUare, or RAMP.

For example,

SOURce1:MOD:FM:INTernal:FUNCtion SQUare   /* Set the waveform shape of Channel 1 modulated wave to square wave */

3.11 FREQuency subsystem

The FREQuency subsystem sets the output FREQuency of the instrument.

3.11.1 SOURce<n>:FREQuency

Command format

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

Function description

Set the output frequency.

Argument

Name	Range	Default value
<frequency>	Different waveforms correspond to different frequency ranges, refer to the relevant content in the user manual for details.	--

Instructions

None

Return format

Return the frequency value +1.000000000000000E+03 as a scientific count.

Example

SOURce1:FREQuency 100   /* set the channel 1 output frequency to 100Hz */

3.12 FSKey subsystem

The FSKey subsystem is configured with Frequency Shift Keying (FSK) waveforms.

3.12.1 SOURce<n>:MOD:FSKey:FREQuency

Command format

SOURce<n>:MOD:FSKey:FREQuency <frequency>|MINimum|MAXimum
SOURce<n>:MOD:FSKey:FREQuency? [MINimum|MAXimum]
SOURce<n>:MOD:3FSKey:FREQuency1 <frequency>|MINimum|MAXimum

SOURce<n>:MOD:3FSKey:FREQuency1? [MINimum|MAXimum]
SOURce<n>:MOD:3FSKey:FREQuency2 <frequency>|MINimum|MAXimum
SOURce<n>:MOD:3FSKey:FREQuency2? [MINimum|MAXimum]
SOURce<n>:MOD:4FSKey:FREQuency1 <frequency>|MINimum|MAXimum
SOURce<n>:MOD:4FSKey:FREQuency1? [MINimum|MAXimum]
SOURce<n>:MOD:4FSKey:FREQuency2 <frequency>|MINimum|MAXimum
SOURce<n>:MOD:4FSKey:FREQuency2? [MINimum|MAXimum]
SOURce<n>:MOD:4FSKey:FREQuency3 <frequency>|MINimum|MAXimum
SOURce<n>:MOD:4FSKey:FREQuency3? [MINimum|MAXimum]

Function description

Set the FSK alternate (or "jump") frequency.

Argument

Name	Range	Default value
<frequency>	Sine wave: 1 µHz to highest frequency Square wave: 1 µHz to the highest frequency Sawtooth wave: 1 µHz to the highest frequency Arbitrary wave: 1 µHz to the highest frequency (except built-in waveform DC) Refer to the relevant content in the user manual for details.	100Hz

Instructions

None

Return format

Return the frequency value as a scientific count.

Example

SOURce1:MOD:FSKey:FREQuency 200   /* set the jump frequency for channel 1
FSK modulation to 200Hz */
SOURce1:MOD:3FSKey:FREQuency1 500   /* set jump frequency 1 for channel
1 3FSK modulation to 500Hz */

3.12.2 SOURce<n>:MOD:FSKey:INTernal:RATE

Command format

SOURce<n>:MOD:FSKey:INTernal:RATE <frequency>|MINimum|MAXimum
SOURce<n>:MOD:FSKey:INTernal:RATE? [MINimum|MAXimum]
SOURce<n>:MOD:3FSKey:INTernal:RATE <frequency>|MINimum|MAXimum

SOURce<n>:MOD:3FSKey:INTernal:RATE? [MINimum|MAXimum]
SOURce<n>:MOD:4FSKey:INTernal:RATE <frequency>|MINimum|MAXimum
SOURce<n>:MOD:4FSKey:INTernal:RATE? [MINimum|MAXimum]

Function description

Set the rate at which the output frequency "moves" between the carrier frequency and the jump frequency.

Argument

Name	Range	Default value
RATE	2 mHz to 1 MHz	100Hz

Instructions

FSK rates are only for internal sources (FSK:SOURce INTernal).

Return format

Return the rate value as a scientific count.

Example

SOURce1:MOD:FSKey:INTernal:RATE 200   /* set the modulation rate for channel 1 FSK modulation to 200Hz */
SOURce1:MOD:4FSKey:INTernal:RATE 500   /* set the modulation rate for channel 1 4FSK modulation to 500Hz */

3.13　The FUNCtion subsystem

3.13.1　SOURce<n>:FUNCtion <wave>

Command format

SOURce<n>:FUNCtion <wave>
SOURce<n>:FUNCtion?

Function description

Select the output function type.

Argument

Name	Range	Default value
FUNCtion	SINusoid|SQUare|RAMP| PULSe|NOISe|DC|SINC|EXPFall|HAVErsine|LORentz| DUALtone|GAUSe| ECG| USER| HARMonic|	SINusoid

Instructions

- NOISe will generate white Gaussian noise.
- ARB generates an arbitrary waveform currently selected via FUNCtion:ARBitrary.

Return format

SINusoid, SQUare, RAMP, PULSe, NOISe, DC, SINC, EXPFall, HAVErsine, LOREntz, DUALtone, GAUSe, ECG, USER, or HARMonic.

For example,

SOURce1:FUNCtion SINusoid   /* Set the waveform output in channel 1 to sine */
SOURce<n>:FUNCtion?   /* Return SINusoid if succeeding*/

3.13.2   <u>SOURce\<n>:FUNCtion:ARBitrary</u>

Command format

SOURce<n>:FUNCtion:ARBitrary <filename>
SOURce<n>:FUNCtion:ARBitrary?

Function description

Set the current arbitrary wave output file.

Argument

Name	Range	Default value
ARBitrary	Valid file name: can be divided into custom file and built-in waveform file.The common usage is mainly "INT:/Builtin/ sinc.hwf","USB:/mywave.hwf".	Waveform file

Instructions

Built-in waveform files: "ACOS"，"ACOSH"，"ACOTCON"，"ACOTHCON"，"ACOTHPRO"，"ACOTPRO","ACSCCON","ACSCHCON","ACSCHPRO","ACSCPRO","ASECCON","ASECH","ASECPRO","ASIN","ASINH","ATAN","ATANH","CARDIAC","EEG","EMG","EOG","PULSEILOGRAM","RESSPEED","ABSSINE","ABSSINEHALF","AMPALT","ATTALT","GAUSSPULSE",
 "NPULSE","NEGRAMP","PPULSE","SINETRA","SINEVER","STAIRDN","STAIRUD","STAIRUP","TRAPEZIA","ARB_2","AIRY","BESSELJ","BESSELY","CAUCHY","CUBIC","DIRICHLET","ERF","ERFINV","ERFC","ERFCINV","EXPFALL","EXPRISE","GAUSS","HANERSINE","HAVERSINE","LAPLACE","LEGEND","LOG","LOGNORMAL","LORENTZ","MAXWELL","RAYLEIGH","VERSIERA","WEIBULL","LFPLUSE","TENS1","TENS2","TENS3","AM","FM","PFM","PM","PWM","BANDLIMITED","BLASEIWAVE","BUTTERWORTH","CWPULSE","CHEBYSHEV1","CHEBYSHEV2","COMBIN","CPULSE","DAMP

EDOSC","DISCHARGE","DUALTONE","GAMMA","GATEVIBR","LFMPULSE","MCNOI SE","PAHCUR","QUAKE","RADAR","RIPPLE","ROUNDHALF","ROUNDPM","STEPRE SP","SWINGOSC","TV","VOICE","ISO16750_2SP","ISO16750_2VR","ISO7637_2TP1" ,"ISO7637_2TP2A","ISO7637_2TP2B","ISO7637_2TP3A","ISO7637_2TP3B","ISO763 7_2TP4","ISO7637_2TP5A","ISO7637_2TP5B","LOGINTION","SCR","SURGE","COSH ","COSINT","COT","COTHCON","COTHPRO","CSCCON","CSCHCON","CSCHPRO"," CSCPRO","RECIPCON","RECIPPRO","SECCON","SECH","SECPRO","SINH","SININT ","SINC","SQRT","TAN","TANH","BARLETT","BARTHANNWIN","BLACKMAN","BOHM ANWIN","BOXCAR","CHEBWIN","FLATTOPWIN","HAMMING","HANNING","KAISER"," MUTTALLWIN","PARZENWIN","TAYLORWIN","TRIANG","TUKEYWIN","BLACKMANH" ,"A1","A1H","B1","C1","C1H","D1","D1H","E1","F1","F1H","G1","G1H"。

Return format

None

Example

SOURce1:FUNCtion:ARBitrary "INT:/Builtin/SINC.hwf"   /* Set the arbitrary wave output file of channel 1 to INT:/Builtin/ sinc.hwf */
SOURce<n>:FUNCtion:ARBitrary?   /* Return Int:/Builtin/ sinc.hwf if succeeding */

3.13.3   SOURce<1|2>:FUNCtion:ARBitrary:PTPeak

Command format

SOURce<1|2>:FUNCtion:ARBitrary:PTPeak <voltage>|MINimum|MAXimum,
SOURce<1|2>:FUNCtion:ARBitrary:PTPeak?{MINimum|MAXimum}

Function description

Set the dual peak voltage for an arbitrary wave.

Argument

Name	Range	Default value
PTPeak	1,4,5,20 discrete values	1V

Instructions

None

Return format

Return as a scientific count.

Example

SOURce1:FUNCtion:ARBitrary:PTPeak 4   /* Set channel 1 peak-to-peak voltage

to 4V */

3.13.4 SOURce<1|2>:FUNCtion:ARBitrary:SRATe

Command format

SOURce < 1 | 2 >: FUNCtion: ARBitrary: SRATe {< sample_rate > | MINimum | MAXimum}, SOURce |< 1 | 2 >: FUNCtion: ARBitrary: SRATe? {MINimum|MAXimum}

Function description

Set the sampling rate for arbitrary wave.

Argument

Name	Range	Default value
SRATe	A number between 1 and 255	1

Instructions

Return the set value, the current sampling rate formula is 250M/(4*n), where n is the user set value. When the user set it to 0, the sampling rate is 250M.

Return format

Return the current sampling rate as a scientific count.

Example

SOURce1:FUNCtion:ARBitrary:SRATe 10   /* Set Channel 1 sampling rate to 25MSa/s */

3.13.5 SOURce<n>:FUNCtion:SQUare:DPeriod

Command format

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

Function description

Set the duty period of square wave.

Argument

Name	Range	Default value
DPeriod	0.001% to 99.996%, limited by a minimum pulse width of 16 ns	50%

Instructions

None

Return format

Returns the current duty cycle as a scientific count.

Example

SOURce1:FUNCtion:SQUare:DPeriod 30   /* Set channel 1 duty cycle to 30%*/

3.13.6   SOURce<n>:FUNCtion:RAMP:SYMMetry

Command format

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

Function description

Set the symmetry percentage of triangle wave.

Argument

Name	Range	Default value
SYMMetry	0% to 100%	50%

Instructions

None

Return format

Return the current symmetry as a scientific count.

Example

SOURce1:FUNCtion:RAMP:SYMMetry 30   /* Set channel 1 symmetry to 30%*/

3.13.7   SOURce<n>:FUNCtion:PULSe:DPeriod

Command format

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

Function description

Set the duty period of pulse wave.

Argument

Name	Range	Default value
DPeriod	0% to 100%	50%

Instructions

- FUNCtion:PULSe:DPeriod and FUNCtion:PULSe:WIDTh commands affect the same arguments.
- The pulse duty cycle is defined as:
  Duty cycle = 100 x pulse width ÷ period
  Pulse width is the time from the 50% threshold on the rising edge to the 50% threshold on the next falling edge.
- The pulse duty period ranges from 0% to 100%. The pulse duty cycle is limited by the minimum pulse width and edge time, though, which prevents setting a duty period to 0% or 100%. For example, for a 1 kHz pulse waveform, the pulse duty cycle is usually limited to a range of 0.002% to 99.998%, limited by a minimum pulse width of 16ns.
- Pulse width limits: The specified pulse duty period must meet the following limits determined by the minimum pulse width (Wmin). The instrument will adjust the duty cycle as needed to meet the specified period.
  Pulse duty period ≥ 100 × (minimum pulse width/pulse cycle)
  Pulse duty period ≥ 100 × (1-2 × minimum pulse width/pulse cycle)

Return format

Return the current duty cycle as a scientific count.

Example

SOURce1:FUNCtion:PULSe:DPeriod 30   /* Set channel 1 duty cycle to 30%*/

3.13.8   SOURce<n>:FUNCtion:PULSe:WIDTh

Command format

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

Function description

Set the pulse width of the pulse.

Argument

Name	Range	Default value
WIDTh	16ns to 1000μs	500μs

Instructions

FUNCtion:PULSe:DPeriod and FUNCtion:PULSe:WIDTh commands affect the same arguments.

- Pulse width is the time from the 50% threshold on the rising edge to the 50% threshold on the next falling edge.
- Pulse width ≥ minimum pulse width

 Pulse width ≤ pulse period - 2 x minimum pulse width

Return format

Return the pulse width value as a scientific count.

For example,

SOURce1: FUNCtion: PULSe, WIDTh of 0.005   /* Set channel 1 pulse width to 5ms */

3.13.9 SOURce<n>:FUNCtion:PULSe:TRANsition:LEADing

Command format

SOURce<n>:FUNCtion:PULSe:TRANsition:LEADing<seconds>|MINimum|MAXimum
SOURce<n>:PULSe:TRANsition:LEADing? [MINimum|MAXimum]

Function description

Set pulse rising edge time.

Argument

None

Instructions

- The leading edge time applies to the rising edge and represents the time between the 10% threshold and the 90% threshold of the edge.
- The specified edge time must be within the specified pulse width and period. The instrument will limit the edge time to meet the specified pulse width or duty cycle.

Return format

Return the time value as a scientific count.

Example

SOURce1: FUNCtion: PULSe: the TRANsition: LEADing 0.00000001   /* Set Channel 1 pulse rising time to 10ns */

3.13.10 SOURce<n>:FUNCtion:PULSe:TRANsition:TRAiling

Command format

SOURce<n>:FUNCtion:PULSe:TRANsition:TRAiling <seconds>|MINimum|MAXimum
SOURce<n>:PULSe:TRANsition:TRAiling? [MINimum|MAXimum]

Function description

Set pulse falling edge time.

Argument

None

Instructions

- The falling edge indicates the time between the 90% threshold and the 10% threshold.
- The specified edge time must be within the specified pulse width and period. The instrument will limit the edge time to meet the specified pulse width or duty cycle.

Return format

Return the time value as a scientific count.

Example

SOURce1: FUNCtion: PULSe: the TRANsition: TRAiling 0.00000001
/* Set the pulse falling time of channel 1 to 10ns */

3.14 HARMonic subsystem

3.14.1 SOURce<n>:HARMonic:AMPL

Command format

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

Function description

Set the amplitude of a specified subharmonic.

Argument

Name	Range	Default value
<sn> integer	1 to 16	1
<value> continuous real type	--	--

Instructions

None

Return format

None

Example

SOURce1: HARMonic: AMPL 1, 1   /* Set the amplitude of the 1st subharmonic of channel 1 to 1Vpp */

3.14.2 SOURce<n>:HARMonic:PHASe

Command format

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

Function description

Set the phase of a specified subharmonic.

Argument

Name	Range	Default value
<sn> integer	1 to 16	1
<value> continuous real type	0 to 360 degrees	0

Instructions

None

Return format

Return the phase value of the specified subharmonic as a scientific count.

Example

SOURce1: HARMonic: PHASe 1, living   /* Set the phase of the 1st subharmonic of channel 1 to 90 degrees */

3.14.3 SOURce<n>:HARMonic:ORDEr

Command format

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

Function description

Set the number of harmonics.

Argument

Name	Range	Default value
ORDEr	1 to maximum output frequency ÷ fundamental frequency (integer, maximum:16)	1

Instructions

None

Return format

Return the number of harmonics as a scientific count.

For example,

SOURce1:HARMonic:ORDEr 8   /* Sets the harmonic count of channel 1 to 8*/

3.14.4   SOURce<n>:HARMonic:TYPe

Command format

SOURce<n>:HARMonic:TYPe EVEN|ODD|ALL
SOURce<n>:HARMonic:TYPe?

Function description

Select the harmonic type as even, odd, all.

argument

Name	Range	Default value
TYPe	EVEN|ODD|ALL	ALL

Instructions

None

Return format

EVEN, ODD, or ALL.

Example

SOURce1:HARMonic:HARMonic:TYPe ODD   /* Set the harmonic type of channel 1 to odd */

3.15 MARKer subsystem

3.15.1 SOURce<n>:MARKer

Command format

SOURce<n>:MARKer ON|OFF
SOURce<n>:MARKer?

Function description

Turn on or off the frequency marker function of the sweep.

Argument

Name	Range	Default value
MARKer	ON|OFF	OFF

Instructions

None

Return format

ON or OFF.

Example

SOURce1:MARKer ON   /* Turn on the frequency marker function for channel 1 sweep */

3.15.2 SOURce<n>:MARKer:FREQuency

Command format

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

Function description

Set marking frequency.

Argument

Name	Range	Default value
<frequency>	Between "start frequency" and "stop frequency"	550 Hz

Instructions

None

Return format

+ 1.000000000000000E+03.

Example

SOURce2:MARKer:FREQuency 1000   /* set the marker frequency for channel 1 to 1000hz */

3.16   OSK subsystem

3.16.1   SOURce<n>:MOD:OSKey:INTernal:RATE

Command format

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

Function description

Set the rate of OSK modulation.

Argument

Name	Range	Default value
RATE	2 mHz to 1 MHz	100Hz

Instructions

None

Return format

Return the rate value as a scientific count.

Example

SOURce1:MOD:OSKey:INTernal:RATE 200   /* set the modulation rate for channel 1 OSK modulation to 200Hz */

3.16.2   SOURce<n>:MOD:OSKey:TIME

Command format

SOURce<n>:MOD:OSKey:TIME
SOURce<n>:MOD:OSKey:TIME?

Function description

Set the oscillation time for OSK modulation.

Argument

Name	Range	Default value
TIME	8ns to 4.99975ms	100us

Instructions

None

Return format

Return the rate value as a scientific count.

Example

SOURce1: MOD: OSKey: 0.0002 TIME   /* Set the oscillation time for channel 1 OSK modulation to 200us */

3.17   OUTPut subsystem

The OUTPut subsystem controls the front panel channel output.
OUTPut<n> The front panel channel outputs the connector status.

3.17.1   OUTPut<n>

Command format

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

Function description

Enable or disable the output of the front panel [Output1] or [Output2] connectors.

Argument

Name	Range	Default value
<n>	ON|OFF	OFF

Instructions

- The front panel channel output key will light up when output is enabled.
- OUTPut changes the status of the channel output connector by switching the output relay.

Return format

Return ON or OFF.

For example,

OUTPut1 ON   /* Enable the [Output1] connector */
OUTPut<n>?   / * Returns ON if enabled*/

3.18   PHASe subsystem

The PHASe subsystem enables you to adjust the phase of the waveform. This is very useful in channel-channel and channel-sync applications. The subsystem also enables you to synchronize multiple instruments using 10 MHz Out and 10 MHz In rear panel connectors.

3.18.1   SOURce<n>:PHASe

Command format

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

Function description

Sets the starting phase of the waveform.

Argument

Name	Range	Default value
<phase>	0 to 360 degrees	0

Instructions

You can synchronize the phases of the two internal channels using PHASe:SYNChronize.

Return format

Return the phase value as a scientific count.

Example

SOURce1:PHASe 90   /* Set the starting phase of channel 1 to 90 degrees */

3.18.2   SOURce<n>:PHASe:SYNChronize

Command format

SOURce<n>:PHASe:SYNChronize

Function description

Reset all phase generators in the instrument to establish a zero-reference point of universal internal phases.

Argument

None

Instructions

- SOURce1 and SOURce2 are meaningliess for this command.
- This setting is not valid when either of the two channels is in modulation mode.

Return format

None

Example

PHAS:SYNC   /* Reset all phase generators */

3.19   PM subsystem

PM subsystem enables you to modulate waveforms via phase.

3.19.1   SOURce\<n\>:MOD:PM:DEViation

Command format

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

Function description

Set the phase deviation in degrees. This value represents the peak phase change of the modulated waveform with respect to the carrier waveform.

Argument

Name	Range	Default value
\<deviation\>	0 to 360 degrees	180 degrees

Instructions

With an external modulation source, the deviation is controlled by the ±5 V signal level displayed on the MOD connector on the front panel. For example, if you have set the frequency deviation to 180 degrees, a +5 V signal level is equivalent to a +180 phase deviation. A lower external signal level produces a smaller deviation, and a negative signal level produces a negative deviation.

Return format

Return the phase deviation as a scientific count +9.000000000000000E+01.

Example

SOURce1:MOD:PM:DEViation 90   /* Set the phase of channel 1 to 90 degrees */

3.19.2   SOURce\<n\>:MOD:PM:INTernal:FREQuency

Command format

SOURce\<n\>:MOD:PM:INTernal:FREQuency \<frequency\>|MINimum|MAXimum
SOURce\<n\>:MOD:PM:INTernal:FREQuency? [MINimum|MAXimum]

Function description

Set the frequency of the modulated waveform. The waveform selected as the modulation source will operate at that frequency (within that waveform frequency limit).

Argument

Name	Range	Default value
\<frequency\>	2 mHz to 500 kHz	100Hz

Instructions

This command can only be used with internal modulation sources (PM:SOURce INTernal).

Return format

Return the frequency value as a scientific count.

Example

SOURce1:MOD:PM:INTernal:FREQuency 1000   /* Set the modulated wave frequency of channel 1 to 1000Hz */

3.19.3   SOURce\<n\>:MOD:PM:INTernal:FUNCtion

Command format

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

Function description

Select the modulated waveform shape.

Argument

Name	Range	Default value
FUNCtion	SINusoid|SQUare|RAMP	SINusoid

Instructions

This command can only be used with internal modulation sources (PM:SOURce INTernal).

Return format

SINusoid, SQUare, or RAMP.

Example

SOURce1:MOD:PM:INTernal:FUNCtion SQUare   /* Set the waveform shape of Channel 1 modulated wave to square wave */

3.19.4   SOURce<n>:MOD:PM:SOURce

Command format

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

Function description

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

Argument

Name	Range	Default value
SOURce	INTernal|EXTernal	INTernal

Instructions

None

Return format

INTernal or EXTernal.

Example

SOURce1:MOD:FM:SOURce EXTernal   /* Set the modulation source of channel 1 to external */

3.20   PSK subsystem

PSK (Phase Shift keying) A modulation technique in which the input signal information is represented by the carrier phase.

3.20.1 SOURce<n>:MOD:PSKey:PHASe

Command format

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

Function description

Set the phase of the PSK modulated wave.

Argument

Name	Range	Default value
<phase>	0 to 360 degrees	180 degrees

Instructions

None

Return format

Return the phase value as a scientific count.

Example

:SOURce1:MOD:PSKey:PHASe 90   /* Set the modulation phase of channel
1PSK modulation to 90 degrees */

3.20.2 SOURce<n>:MOD:PSKey:INTernal:RATE

Command format

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

Function description

Set the rate at which the output frequency "moves" between the carrier frequency and
the jump frequency.

argument

Name	Range	Default value
<frequency>	2 mHz to 1 MHz	100Hz

Instructions

None

Return format

Return the rate value as a scientific count.

Example

SOURce1:MOD:FSKey:INTernal:RATE 200   /* set the modulation rate for channel 1FSK modulation to 200Hz */

3.20.3   SOURce<n>:MOD:PSKey:SOURce

Command format

SOURce<n>:MOD:PSKey:SOURce INTernal|EXTernal
SOURce<n>:MOD:PSKey:SOURce?

Function description

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

Argument

Name	Range	Default value
SOURce	INTernal|EXTernal	INTernal

Instructions

None

Return format

Return the current modulation source.

Example

SOURce<n>:MOD:FSKey:SOURce EXTernal   /* Set the modulation source for channel 1ASK modulation to external */

3.20.4   SOURce<n>:MOD:PSKey:POLarity

Command format

SOURce<n>:MOD:PSKey:POLarity POSitive|NEGative
SOURce<n>:MOD:PSKey:POLarity?

Function description

Select the amplitude output to be controlled by the either the positive or the negative polarity of the modulated wave.

Argument

Name	Range	Default value
POLarity	POSitive|NEGative	POSitive

Instructions

None

Return format

POSitive or NEGative.

Example

SOURce1:MOD:PSKey:POLarity NEGative   /* Set the modulation polarity of channel 1ASK to negative polarity */

3.21   PWM subsystem

The PWM subsystem enables you to perform pulse width modulation (PWM) on the pulse waveform.

3.21.1   SOURce<n>:MOD:PWM:DEViation

Command format

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

Function description

Set pulse width deviation. Relative to the pulse width of the carrier pulse waveform $\pm$ deviation (in seconds).

Argument

Name	Range	Default value
<deviation>	0 ns to 500 ks	200μs

Instructions

- The pulse width deviation must not exceed the current pulse width.
- The pulse-width deviation is limited by the minimum pulse width and the current edge time setting.

Return format

+ 1.000000000000000E+00.

Example

SOURce1:MOD:PWM:DEViation 1/* Set the pulse-width deviation of channel 1 to 1s */

3.21.2   SOURce<n>:MOD:PWM:INTernal:FREQuency

Command format

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

Function description

Select the frequency at which the output pulse is displaced according to its pulse width deviation. The waveform used as the modulation source will operate at that frequency (within that waveform frequency limit).

Argument

Name	Range	Default value
<frequency>	2 mHz to 500 kHz	100Hz

Instructions

- When selecting an arbitrary waveform as the modulation source, the frequency will change to the frequency of the arbitrary waveform (based on the sampling rate and the number of points in the arbitrary waveform).
- This command can only be used with internal modulation sources (PWM:SOURce INTernal).

Return format

Return the frequency value +1.000000000000000E+02 as a scientific count.

Example

SOURce1:MOD:PM:INTernal:FREQuency 100   /* set the modulated wave frequency of channel 1 to 100Hz */

3.21.3   SOURce<n>:MOD:PWM:INTernal:FUNCtion

Command format

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

Function description

Select the internal modulated waveform shape.

Argument

Name	Range	Default value
FUNCtion	SINusoid|SQUare|RAMP	SINusoid

Instructions

This command can only be used with internal modulation sources (PWM:SOURce INTernal).

Return format

Return the current modulated wave shape SINusoid, SQUare, or RAMP.

Example

SOURce1:MOD:PM:INTernal:FUNCtion SQUare   /* Set the waveform shape of Channel 1 modulated wave to square wave */

3.21.4   SOURce\<n>:MOD:PWM:SOURce

Command format

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

Function description

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

Argument

Name	Range	Default value
SOURce	INTernal|EXTernal	INTernal

Instructions

None

Return format

INTernal or EXTernal.

Example

SOURce1:MOD:FM:SOURce EXTernal   /* Set the modulation source of channel 1 to external */

3.22   QPSK subsystem

3.22.1   SOURce\<n>:MOD:QPSKey:INTernal:RATE

Command format

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

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

Function description

Sets the rate at which the output phase "moves" between the carrier and offset phase.

Argument

Name	Range	Default value
<frequency>	2 mHz to 1 MHz	100Hz

Instructions

The internal modulated waveform is a square wave with a duty cycle of 50%.

Return format

Return as a scientific count.

Example

SOURce1:MOD:QPSKey:INTernal:RATE 200   /* Set the modulation rate for channel 1 QPSK modulation to 200Hz */

3.22.2   <u>SOURce<n>:MOD:QPSKey:PHASe</u>

Command format

SOURce<n>:MOD:QPSKey:PHASe1 <phase>|MINimum|MAXimum

SOURce<n>:MOD:QPSKey:PHASe1? [MINimum|MAXimum]

SOURce<n>:MOD:QPSKey:PHASe2 <phase>|MINimum|MAXimum

SOURce<n>:MOD:QPSKey:PHASe2? [MINimum|MAXimum]

SOURce<n>:MOD:QPSKey:PHASe3 <phase>|MINimum|MAXimum

SOURce<n>:MOD:QPSKey:PHASe3? [MINimum|MAXimum]

Function description

Set the phase (in degrees) of the QPSK modulated wave.

Argument

Name	Range	Default value
<phase>	0 to 360 degrees	180 degrees

Instructions

None

Return format

Return as a scientific count.

For example,

SOURce1:MOD:QPSKey:PHASe1 90   /* Set modulation phase 1 to 90 degrees during channel 1 QPSK modulation*/

3.22.3 SOURce<n>:MOD:QPSKey:DATA

Command format

SOURce<n>:MOD:QPSKey:DATA PN15|PN21
SOURce<n>:MOD:QPSKey:DATA?

Function description

Select the data of the BPSK modulated wave.

Argument

Name	Range	Default value
DATA	PN15|PN21	PN15

Instructions

None

Return format

PN15 or PN21.

Example

SOURce1:MOD:QPSKey:DATA PN21   /* Set the data for channel 1 QPSK modulation to PN21*/

3.23 ROSCillator subsystem

The ROSCillator subsystem controls the use of the 10 MHz reference oscillator and the input of thr external reference oscillator. The reference oscillator is the master clock for all waveform synthesis. All waveforms are phase-locked to the reference oscillator, thus controlling the output signal frequency and phase.

3.23.1 SYSTem:ROSCillator:SOURce

Command format

SYSTem:ROSCillator:SOURce INTernal|EXTernal
SYSTem:ROSCillator:SOURce?

Function description

Select an internal or external reference oscillator source.

Argument

Name	Range	Default value
SOURce	INTernal|EXTernal	INTernal

Instructions

- EXTernal: The instrument uses the signal in the 10 MHz In connector on the rear panel as a reference and generates an error message if this signal is missing or the instrument cannot lock to it. In such error cases, the instrument will continue to output, but at an erratic frequency.
- INTernal: The instrument uses the internal reference oscillator and ignores the signal in the 10 MHz In connector.

Return format

INTernal or EXTernal.

For example,

SYSTem:ROSCillator:SOURce EXTernal   /* Set the system clock source to external */

3.24   The SOURce subsystem

Subsystem using the optional SOURce keywords.
SOURce subsystem commands are not usually used with the SOURce keywords, hence, these are listed by respective subsystem as follows:

AM

ASK

BPSK

BURSt

DATA

FM

FREQuency

FSKey

FUNCtion

MARKer

PHASe

PM

ROSCillator

SWEep

VOLTage

3.25   SWEep subsystem

3.25.1   SOURce\<n>:SWEep:HTIMe

Command format

SOURce\<n>:SWEep:HTIMe \<seconds>|MINimum|MAXimum
SOURce\<n>:SWEep:HTIMe? [MINimum|MAXimum]

Function description

Set the termination hold time for the sweep.

Argument

Name	Range	Default value
\<seconds>	1 ms to 300 s	1s

Instructions

None

Return format

+ 5.000000000000000E+00.

Example

SOURce1:SWEep:HTIMe 5   /* Set the sweep hold time for channel 1 to 5s */

3.25.2 SOURce<n>:SWEep:RTIMe

Command format

SOURce<n>:SWEep:RTIMe   <seconds>|MINimum|MAXimum
SOURce<n>:SWEep:RTIMe ? [MINimum|MAXimum]

Function description

Sets the number of seconds for the scan to return from the stop frequency to the start frequency.

Argument

Name	Range	Default value
<seconds>	1 ms to 300 s	1s

Instructions

None

Return format

+ 5.000000000000000 E+00.

Example

SOURce1:SWEep:RTIMe 5   /* Set the sweep return time for channel 1 to 5s*/

3.25.3 SOURce<n>:SWEep

Command format

SOURce<n>:SWEep ON|OFF
SOURce<n>:SWEep?

Function description

Turn the frequency sweep function on or off.

Argument

Name	Range	Default value
SWEep	ON|OFF	OFF

Instructions

None

Return format

ON or OFF.

Example

SOURce1:SWEep ON   /* Turn on Channel 1 sweep function */

3.25.4   SOURce<n>:SWEep:TIME

Command format

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

Function description

Set the time (in seconds) for the scan to go from the start frequency to the stop frequency.

Argument

Name	Range	Default value
<seconds>	1 ms to 300 s	1s

Instructions

None

Return format

Return the time value +5.000000000000000E+00 as a scientific count.

Example

SOURce1:SWEep:TIME 5   /* Set the sweep time for channel 1 to 5s */

3.25.5   SOURce<n>:FREQuency:STARt

Command format

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

Function description

Set the start frequency of the sweep.

Argument

Name	Range	Default value
<frequency>	Different sweep waveforms correspond to different start frequency ranges. Refer to the user manual for details.	100Hz

Instructions

None

Return format

Return the center frequency value +1.000000000000000E+03 as a scientific count.

Example

SOURce1:FREQuency:STARt 1000   /* Set the start frequency of channel 1 to 1KHz */

3.25.6   SOURce<n>:FREQuency:STOP

Command format

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

Function description

Set the cutoff frequency for the sweep.

Argument

Name	Range	Default value
<frequency>	Different sweep waveforms correspond to different cutoff frequency ranges, please refer to the relevant content of the user manual for details.	1KHz

Instructions

None

Return format

Return the center frequency value +1.000000000000000E+03 as a scientific count.

Example

SOURce1:FREQuency:STOP 10000   /* Set the cutoff frequency of channel 1 to 10KHz */

3.25.7   SOURce<n>:FREQuency:CENTer

Command format

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

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

Function description

Set the center frequency of the sweep.

Argument

Name	Range	Default value
<frequency>	Different sweep waveforms correspond to different center frequency ranges, please refer to the relevant content of user manual for details.	550Hz

Instructions

None

Return format

Return the center frequency value +1.000000000000000E+03 as a scientific count.

For example,

SOURce1:FREQuency:CENTer 1000   /* Set the center frequency of channel 1 to 1 KHZ */

3.25.8 SOURce<n>:FREQuency:SPAN

Command format

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

Function description

Set the frequency span of the sweep.

Argument

Name	Range	Default value
<frequency>	Different frequency sweep waveforms correspond to different frequency span ranges, please refer to the relevant content of the user manual for details.	900Hz

Instructions

In the frequency sweep mode, the start frequency, stop frequency, center frequency and frequency span are correlated with each other, which satisfies the following relationship:
Center frequency = (| start frequency + stop frequency |) /2

Frequency span = stop frequency - start frequency

Return format

Return the center frequency value +1.000000000000000E+03 as a scientific count.

Example

SOURce1:FREQuency:SPAN 10000   /* Set the frequency span of channel 1 to 10KHz */

3.26   SYSTem subsystem

The SYSTem subsystem manages instrument status storage, power outage invocation, error conditions, self-test, front panel display control, and remote interface configuration.

3.26.1   SYSTem:BEEPer:STATe

Command format

SYSTem:BEEPer:STATe ON|OFF

Function description

Turn the buzzer on or off.

Argument

Name	Range	Default value
STATe	ON|OFF	ON

Instructions

Turning off the buzzer will disable the front panel key sound.
After sending the SYSTem:BEEPer, it will always beep (even if the beep is OFF).
This setting is set to non-volatile. Restart the power or *RST will not change this setting.

Return format

ON or OFF.

For example,

SYSTem:BEEPer:STATe ON   /* Turn on the system buzzer */

3.26.2   SYSTem:ERRor?

Command format

SYSTem:ERRor?

Function description

Query the error event queue. Can errors be cleared (read and clear an error from the error queue.)

Argument

None

Instructions

None

Return format

Return error event information, such as: -113, "Undefined header; keyword cannot be found".
If there are no errors, return: 0, "No Error".

Example

SYST:ERR?   /* Read and clear the first error in the error queue */

3.26.3   SYSTem:KLOCk

Command format

SYSTem:KLOCk ON|OFF
SYSTem:KLOCk?

Function description

Remotely lock or unlock the front panel keyboard.

Argument

Name	Range	Default value
KLOCk	ON|OFF	OFF

Instructions

None

Return format

ON or OFF.

Example

SYSTem:KLOCk ON   /* Lock the front panel keyboard */

3.26.4   SYSTem:VERSion?

Command format

SYSTem:VERSion?

Function description

Query and return SCPI version information.

Argument

None

Instructions

None

Return format

Return SCPI version information such as: 1999.0.

Example

SYSTem:VERSion?   /* Query and return SCPI version information */

3.26.5   SYSTem:ROSCillator:SOURce

Command format

SYSTem:ROSCillator:SOURce INTernal|EXTernal
SYSTem:ROSCillator:SOURce?

Function description

Set the type of the reference clock source to INTernal or EXTernal.
Query the type of the reference clock source.

Argument

Name	Range	Default value
SOURce	none	--

Instructions

● The instrument provides an internal 10MHz clock source, but also accepts an external clock source input from the front panel [10MHz IN/OUT], and can also output a clock source from the front panel [10MHz IN/OUT] connector.

● After setting the reference clock, you need to delay at least 2 seconds before querying the reference clock source.

Return format

Return INTernal or EXTernal.

For example,

 SYSTem:ROSCillator:SOURce EXTernal   /* Set the reference clock source to external */
SYSTem:ROSCillator:SOURce?   /* Query returns EXTernal */

3.27   **VOLTage subsystem**

The VOLTage subsystem allows you to set arguments related to the output voltage.

3.27.1   **SOURce<n>:VOLTage**

Command format

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

Function description

Set the output amplitude.

Argument

Name	Range	Default value
<amplitude>	2 mVpp to 20 Vpp	200mVpp

Instructions

None

Return format

+ 10.0000000000000E+00.

For example,

SOURce1:VOLTage 10   /* Set the amplitude of channel 1 to 10Vpp */

3.27.2   **SOURce<n>:VOLTage:OFFSet**

Command format

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

Function description

Set DC offset voltage.

Argument

Name	Range	Default value
<offset>	- 10 to + 10 v	0V

Instructions

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

  |Voffset| < Vmax - Vpp/2

- Set up high level and low level will also set the waveform amplitude and deviation. For example, if setting the high level to +2 V and the low level to -3 V, an amplitude of 5 Vpp and the offset of -500 mV will be produced.

Return format

+ 1.0000000000000E-01.

Example

SOURce1: VOLTage OFFSet of 0.1   /* Set the offset voltage of channel 1 to 100 mV */

4   <u>Programming instance</u>

4.1   <u>Configure the sine wave</u>

This section will illustrate how to configure the sine wave function.

Instructions

A sine wave has amplitude, offset, and phase with respect to a synchronous pulse.

Instance

The following waveforms can be set by the SCPI command series:
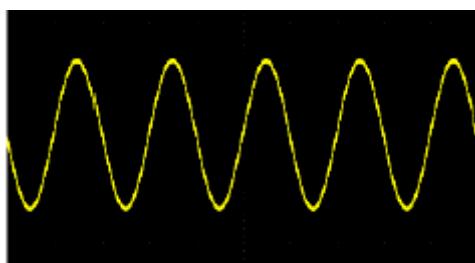
The following command will generate a sine wave as shown above:

SOURce1:FUNCtion SINusoid
SOURce1:FREQuency 100000
SOURce1:VOLTage 2
OUTPut1 ON
SOURce1:PHASe 90

4.2   <u>Configure the square wave</u>

Instructions

A square wave has amplitude, offset, and phase with respect to a synchronous pulse. It also has a duty cycle and a period. Its amplitude and offset can be set by   high and low voltage values.

Instance

The following waveforms can be set by the SCPI command series:
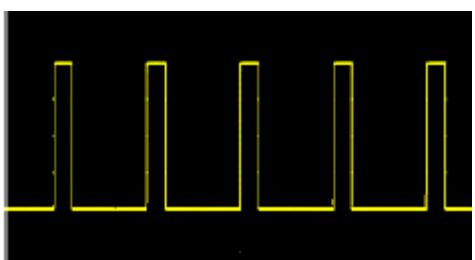
The following commands will generate a square wave as shown above:

SOURce1:FUNCtion SQUare
SOURce1:FUNCtion:SQUare:DPeriod 20
SOURce1:FREQuency 100000
SOURce1:VOLTage 4
OUTPut1 ON

4.3 Configure the sawtooth wave

Instructions

A sawtooth wave has amplitude, offset, and phase relative to a synchronous pulse. It also has the symmetry used to create triangular waveforms and other similar waveforms.

Instance

The following waveforms can be set by the SCPI command series
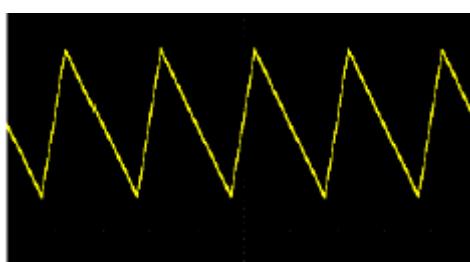
SOURce1:FUNCtion RAMP
SOURce1:FUNCtion:RAMP:SYMMetry 25
SOURce1:FREQuency 1000
SOURce1:VOLTage 2
SOURce1: VOLTage OFFSet of 1.0
OUTPut1 ON

4.4 Configure the pulse wave

Instructions

The pulse wave has amplitude, offset, and phase with respect to the synchronous pulse. It also has the edge slope, period, and duty cycle (or pulse width). Its amplitude and offset can be set by high and low voltage values.

Instance

The following waveforms can be set by the SCPI command series
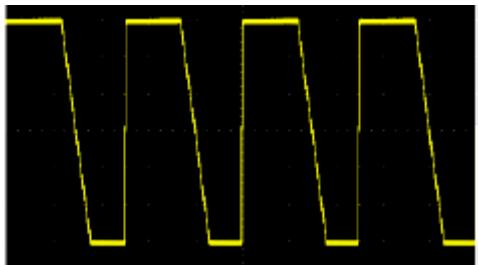
The following commands will generate pulse waves as shown above:

SOURce1:FUNCtion PULSe

SOURce1: FUNCtion: PULSe: the TRANsition: LEADing 0.00000004

SOURce1: FUNCtion: PULSe: the TRANsition: TRAiling 0.000001

SOURce1: FUNCtion: PULSe, WIDTh of 0.000003

SOURce1:FREQuency 200000

SOURce1:VOLTage 3

OUTPut1 ON

5   <u>Attachment: Command quick reference</u>

DATA command

SOURce1:DATA:DAC16:BIN iAllDotNum, iSumDotNum, iNowDotNum, #xy...yz...z
SOURce1:DATA:FREQ:SPS sps
SOURce1:DATA:FREQ:SPS? [MINimum|MAXimum]
SOURce1:DATA:RAM:DAC16:BIN iAllDotNum, iSumDotNum, iNowDotNum, #xy...yz...z

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

Sawtooth wave

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

Pulse wave

SOURce<n>:FUNCtion:PULSe:DPeriod <percent>|MINimum|MAXimum
SOURce<n>:PULSe:DPeriod? [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

The OUTPut of < n > ON | OFF,

OUTPut<n>?

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 scanning

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:NPeriods <periods>|MINimum|MAXimum

SOURce<n>:BURSt:NPeriods? [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

Remote interface configuration

SYSTem:BEEPer:STATe ON|OFF

SYSTem:BEEPer:STATe?

SYSTem:KLOCk ON|OFF

SYSTem:KLOCk?

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

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

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

SOURce<n>:PHASe:SYNChronize

Frequency meter

COUNter:STATe ON|OFF

COUNter:STATe?

COUNter:MEASure?

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

COUNter:GATEtime?

IEEE-488

*IDN?

*RST

Other

SOURce<n>:MARKer ON|OFF

SOURce<n>:MARKer?

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

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