HDG2000B SCPI Programming Reference

◆ **Introduction to the SCPI Language**

◆ **Alphabetical List of SCPI Commands and Queries**

◆ **Programming Examples**

1 Introduction to the SCPI Language

The following four symbols are not the content of SCPI commands and will not be sent with the commands, but are usually used to describe the parameters in the commands.

Braces { }

The parameters enclosed in braces are optional and can be ignored.

Vertical Bar |

The vertical bar is used to separate multiple parameters and one of the parameters must be selected when sending the command.

Triangle Brackets < >

The parameter enclosed in the triangle brackets must be replaced by an effective value.

Square Brackets [ ]

The content (parameter or keyword) enclosed in the square brackets can be omitted. When the parameter is omitted, the instrument will set the parameter to its default.

SCPI (Standard Commands for Programmable Instruments) is an ASCII-based instrument command language designed for test and measurement instruments. SCPI commands are based on a hierarchical structure, also known as a *tree system*. In this system, associated commands are grouped together under a common node or root, thus forming *subsystems*. A portion of the OUTPut subsystem is shown below to illustrate the tree system.

Syntax Conventions

The format used to show commands is illustrated below:

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

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

The command syntax shows most commands (and some parameters) as a mixture of upper- and lower-case letters. The upper-case letters indicate the abbreviated spelling for the command. For shorter program lines, you can send the abbreviated form. For better program readability, you can send the long form.

For example, in the above syntax statement, VOLT and VOLTAGE are both acceptable forms. You can use upper- or lower-case letters. Therefore, VOLTAGE, volt, and Volt are all acceptable. Other forms, such as VOL and VOLTAG, are not valid and will generate an error.

◆ Braces (**{ }**) enclose the parameter choices for a given command string. The braces are not sent with the command string.

◆ A vertical bar (**|**) separates multiple parameter choices for a given command string. The bar is not sent with the command string.

◆ Triangle brackets in the second example (**< >**) indicate that you must specify a value for the enclosed parameter. For example, the above syntax statement shows the *<frequency>* parameter enclosed in triangle brackets. The brackets are not sent with the command string. You must specify a value for the parameter (for example "FREQ:CENT 1000") unless you select another option shown in the syntax (for example "FREQ:CENT MIN").

◆ Some syntax elements (for example nodes and parameters) are enclosed in square brackets (**[ ]**). This indicates that the element is optional and can be omitted. The brackets are not sent with the command string. If you do not specify a value for an optional parameter, the

instrument chooses a default value.

Command Separators

A colon (**:**) is used to separate a command keyword from a lower-level keyword. You must insert a blank space to separate a parameter from a command keyword.

Using the MIN andMAX   Parameters

For many commands, you can substitute "MIN" or "MAX" in place of a parameter. For example, consider the following command:
SOURce<n>:VOLTage:OFFSet <offset>|MINimum|MAXimum
Instead of selecting a specific value for the *<offset>* parameter, you can substitute MIN to set the offset to its minimum value, MAX to set the offset to its maximum value.

SCPI Command Terminators

A command string sent to the instrument must terminate with a <new line> (<NL>) character. The IEEE-488 EOI(End-Or-Identify) message is interpreted as a <NL> character and can be used to terminate a command string in place of a <NL> character. A <carriage return> followed by a <NL> is also accepted. Command string termination will always reset the current SCPI command path to the root level.

IEEE-488.2 Common Commands

The IEEE-488.2 standard defines a set of common commands that perform functions such as reset, self-test, and status operations. Common commands always begin with an asterisk (*****), are three characters in length, and may include one or more parameters. The command keyword is separated from the first parameter by a blank space. Use a semicolon (**;**) to separate multiple commands as shown below:
*RST**;** *CLS**;** *ESE 32**;** *OPC?

SCPI Parameter Types

The SCPI language defines several data formats to be used in program messages and response messages.

Numeric Parameters

Commands that require numeric parameters will accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation. Special values for numeric parameters such as MIN and MAX are also accepted. You can also send engineering unit suffixes with numeric parameters (e.g., M, k, m, or u). If a command accepts only certain specific values, the instrument will automatically round the input numeric parameters to the accepted values. The following command requires a numeric parameter for the frequency value:
SOURce<n>:FREQuency:CENTer <frequency>|MINimum|MAXimum

Discrete Parameters

Discrete parameters are used to program settings that have a limited number of values (like IMMediate, EXTernal). They may have a short form and a long form just like command keywords. You can mix upper- and lower-case letters.

Boolean Parameters

Boolean parameters represent a single binary condition that is either true or false. For a false condition, the instrumentwill accept "OFF". For a true condition, the instrument will accept "ON".

ASCII String Parameters

String parameters can contain virtually any set of ASCII characters. A string must begin and end with matching quotes; either with a single quote or a double quote. You can include the quote delimiter as part of the string by typing it twice without any characters in between.

2 Alphabetical List of SCPI Commands and Queries

2.1 AM Subsystem

The AM subsystem allows you to add amplitude modulation (AM) to a carrier waveform.

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

Parameter	Typical Return
0% to 120%, default 50%	+5.000000000000000E+01
Set the modulation of CH1 to 50%: SOURce1:MOD:AM:DEPTh 50	

◆　　To achieve modulation depth greater than 100%, output carrier amplitude may be reduced.

◆　　With AM:SOURce EXTernal, carrier waveform is modulated with an external waveform.

SOURce<n>:MOD:AM:INTernal:FREQuency <frequency>|MINimum|MAXimum
SOURce<n>:MOD:AM:INTernal:FREQuency? [MINimum|MAXimum]
Set frequency of modulating waveform. The waveform chosen as modulating source will operate at that frequency, within waveform frequency limits.

Parameter	Typical Return
2 mHz to 500 kHz	+1.000000000000000E+02
Set the modulation frequency of CH1 100Hz：SOURce1:MOD:AM:INTernal:FREQuency 100	

◆　When you select an arbitrary waveform as the modulating source, the frequency changes to the frequency of the arbitrary waveform, which is based on the sample rate and the number of points in the arbitrary waveform.

◆　This command should be used only with the internal modulation source (AM:SOURce INTernal).

SOURce<n>:MOD:AM:INTernal:FUNCtion SINusoid|SQUare|RAMP
SOURce<n>:MOD:AM:INTernal:FUNCtion?
Selects shape of modulating waveform.

Parameter	Typical Return
SINusoid|SQUare|RAMP, default SINusoid	SINusoid, SQUare, or RAMP
Select a square wave as the modulating waveform of CH1: SOURce1:MOD:AM:INTernal:FUNCtion SQUare	

◆　This command should be used only with the internal modulation source (AM:SOURce INTernal).

◆　　Pulse and DC cannot be carrier waveform for AM.

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?
Select the source of the modulating signal.

Parameter	Typical Return
INTernal|EXTernal, default INTernal	INTernal, or EXTernal
Select external modulation source of CH1: SOURce1:MOD:AM:SOURce EXTernal (could also substituteASK, FM, BPSK, FSK, PM, PSAK or PWM for AM)	

SOURce<n>:MOD ON|OFF
SOURce<n>:MOD?
Enables or disables modulation.

Parameter	Typical Return
ON|OFF, default OFF	ON, or OFF
Enable modulation: SOURce1:MOD ON	

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

Parameter	Typical Return
TYPe AM|FM|PM|ASK|FSK|PSK|PWM|BPSK, default AM	AM, FM, PM, ASK, FSK, PSK, PWM or BPSK
Set FM modulation: SOURce<n>:MOD:TYPe FM	

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

◆ Only one modulation mode may be enabled at a time.

◆ The instrument will not enable modulation with sweep or burst enabled. When you enable modulation, the sweep or burst mode is turned off.

◆ PWM is allowed only when pulse is the selected function.

2.2 ASK Subsystem

ASK(Amplitude Shift Keying) is a form of amplitude modulation that represents digital data as variations in the amplitude of a carrier wave.

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

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

Sets amplitude of the modulating waveform

Parameter	Typical Return
0 Vpp to20 Vpp, default 2Vpp	+1.000000000000000E+00
Set the modulating amplitude to 1Vp-p for CH1: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 carrier frequency and frequency hopping rate of "mobile".

Parameter	Typical Return
2 mHz to 1 MHz, default 100Hz	+2.000000000000000E+02
Set the modulating rate to 200Hz on CH1: SOURce1:MOD:ASKey:INTernal:RATE 200	

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

SOURce<n>:MOD:ASKey:SOURce?

Select the source of the modulating signal (INTernal or EXTernal).

Parameter	Typical Return
INTernal|EXTernal, default INTernal	INTernal, or EXTernal
Select external modulation source on CH1: SOURce<n>:MOD:ASKey:SOURce EXTernal	

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

SOURce<n>:MOD:ASKey:POLarity?

Select **POSitive or NEGative** of the modulating signal to control waveform output.

Parameter	Typical Return
POSitive|NEGative, default POSitive	POSitive, or NEGative
Select NEGative of the modulating signal to control waveform output: SOURce1:MOD:ASKey:POLarity NEGative	

2.3 BPSK Subsystem

The BPSK subsystem allows you to modulate a wave form with Binary Phase Shift Keying (BPSK), a digital modulation format. In BPSK, the carrier waveform is phase shifted between two phase settings using an on/off keying. The source may be internal, using a square wave at a specified frequency, or external, using the external trigger input.

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

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

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

Parameter	Typical Return
2 mHz to 1 MHz, default 100Hz	+2.000000000000000E+02
Set BPSK rate to 200Hz: SOURce1:MOD:BPSKey:INTernal:RATE 200	

◆ The BPSK rate is used *only* when the *INTernal* source is selected (BPSK:SOURce INTernal)

and is ignored when the EXTernal source is selected (BPSK:SOURce EXTernal).

◆ The internal modulating waveform is a square wave with a 50% duty cycle.

SOURce\<n\>:MOD:BPSKey:PHASe \<phase\>|MINimum|MAXimum
SOURce\<n\>:MOD:BPSKey:PHASe ? [MINimum|MAXimum]
Sets the Binary Phase Shift Keying phase shift in degrees.

Parameter	Typical Return
0to 360 degrees, default 180 degrees	+0.000000000000000E-00
Set phase shift to 90 degrees: SOURce1:MOD:BPSKey:PHASe 90	

2.4 BURSt Subsystem

This section describes the BURSt subsystem.
Burst Modes
There are two burst modes, described below. The instrument enables one burst mode at a time.
◆**Triggered Burst Mode (default):** The instrument outputs a waveform for a number of cycles
(burst count) each time a trigger is received. After outputting the specified number of cycles, the
instrument stops and waits for the next trigger. You can configure the instrument to use an
internal trigger to initiate the burst or you can provide an external trigger by pressing the
front-panel **[Trig Menu]** key, by applying a trigger signal to the front-panel **TRIG** connector, or
by sending a software trigger command from the remote interface.
◆**External Gated Burst Mode:** The instrument output is either "on" or "off" based on the level of
the external signal applied to the front-panel **TRIG** connector. When this signal is true, the
instrument outputs a continuous waveform. When this signal goes false, the current waveform
cycle is completed and then the instrument stops while remaining at the voltage corresponding
to the starting burst phase of the waveform.
The following table shows which modes are associated with which burst features.

SOURce\<n\>:BURSt:GATE:POLarity NORMal|INVerted
SOURce\<n\>:BURSt:GATE:POLarity?
Selects NORMal or INVerted logic levels on the front-panel **TRIG** connector for an externally gated
burst.

Parameter	Typical Return
NORMal|INVerted, default NORMal	NORMal, or INVerted
Select INVerted for an externally gated burst: SOURce1:BURSt:GATE:POLarity INVerted	

SOURce\<n\>:BURSt:MODE TRIGgered|GATed|INFinity
SOURce\<n\>:BURSt:MODE?
Selects the burst mode.

Parameter	Typical Return
TRIGgered|GATed|INFinity, default TRIGgered	TRIGgered, GATed, or INFinity

Set gated burst mode: SOURce<n>:BURSt:MODE GATed

◆ **TRIGgered**: the instrument outputs a waveform for a number of cycles (burst count) each time a trigger is received from the trigger source (SOURce<n>:BURSt:TRIGger:SOURce).

◆ In **GATed** burst mode, the output waveform is on or off, based on the signal at the rear-panel **TRIG** connector. Select this signal's polarity using SOURce<n>:BURSt:TRIGger:SLOPe POSitive|NEGative. When the gate signal is true, the instrument outputs a continuous waveform.

◆ **GATed**: burst count, burst period, and trigger source are ignored (these are used for the triggered burst mode only). I

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

Sets the number of cycles to be output per burst (triggered burst mode only).

Parameter	Typical Return
1 to 1 000 000(External or manual trigger); 1 to 500 000(Internal), only for N cycle; Default 1	+5.000000000000000E+00
Return number of cycles per burst: SOURce1:BURSt:NCYCles 5	

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

Enables or disables burst mode.

Parameter	Typical Return
ON|OFF, default OFF	ON or OFF
Enable burst mode: SOURce1:BURSt ON	

◆Output phase is set to 0 when burst is enabled.

◆To avoid multiple waveform changes, enable the burst mode after configuring the other burst parameters.

◆The instrument will not allow the burst mode to be enabled at the same time that sweep or any modulation mode is enabled. When you enable burst, the sweep or modulation mode is turned off.

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

Select **POSitive or NEGative** of the external trigger signal to start sweep output.

Parameter	Typical Return
POSitive|NEGative, default POSitive	POSitive or NEGative
Select NEGative of the external trigger signal to start sweep output: SOURce<n>:BURSt:TRIGger:SLOPe NEGative	

2.5 COUNter Subsystem

COUNter:STATe

| COUNter:STATe ON|OFF | Enable or disable frequency meter. |
| COUNter:STATe? | Query the state of frequency meter. |

Parameter	Default	Typical Return
ON|OFF	OFF	ON , or OFF

For example

Enable frequency meter:

COUNter:STATe ON

Query the state of frequency meter and returns ON:

COUNter:STATe?

COUNter:GATEtime

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

Set the gate time.

COUNter:GATEtime?

Query the gate time.

Parameter		Default	Typical Return
AUTO AUTO		USER1	AUTO, USER1, USER2,
USER1 1 ms			USER3, USER4, USER5, or
USER2 10 ms			USER6
USER3 100 ms			
USER4 1 s			
USER5 10 s			
USER6 >10 s			

For example

Set the gate time to 10 ms:

COUNter:GATEtime USER2

Query and return to USER2:

COUNter:GATEtime?

COUNter:SENSitive

| **COUNter:SENSitive |MINimum|MAXimum** | Set trigger sensitivity |
| **COUNter:SENSitive? [MINimum|MAXimum]** | Query trigger sensitivity |

Parameter	Default	Typical Return
0% to 100%	50%	Scientific counting form

For example

Set the trigger sensitivity to 60%:

COUNter:SENSitive 60

Query and return to 6.000000E+01:

COUNter:SENSitive?

COUNter:LEVE

| **COUNter:LEVE |MINimum|MAXimum** | Set the trigger level |
| **COUNter:LEVE? [MINimum|MAXimum]** | Query the trigger level |

Parameter	Default	Typical Return

-2.5V to +2.5V	0V	Scientific counting form

For example

Set the trigger LEVEL to 2V:

COUNter:LEVE 2

Query and return to 2.000000E+00:

COUNter:LEVE?

COUNter:MEASure?

Get current counter measurement value.

Parameter	Typical Return
--	The parameters of Frequency, Period, Duty, +Width, -Width

For example

Query and return to

'1.000099993E+03,9.999000134E-04,1.422600068E+01,1.422537019E-04,8.576463115E-04' :

COUNter:MEASure?

2.6 DATA Subsystem

SOURce<n>:DATA:DOWNload iStartPoint, iPointLen
Functional Description:

Tell the machine that the data will be downloaded to the specified storage location inside the machine.

For example, SOURce1:DATA:DOWNload 512 1024

It indicates that 1024 points will be downloaded to the machine storage device, and the download first address of the storage device is 512 points. Figures as follow:

0--512-----1536---64M

0--64M

Explain

If the FPGA version of the machine is less than 40, then iStartPoint and iPointLen need to be a multiple of 8.

If the FPGA version of the machine is greater than or equal to 40, then iStartPoint and iPointLen need to be a multiple of 2.

SOURce1:DATA:OUTPut iStartPoint, iPointLen
Functional Description:

Tell the machine that the data in the specified location of the internal storage will be output

For example, SOURce1:DATA:OUTPut 512 1024

It indicates that the data from 512nd points to 1536th point will be output from the storage device. Figures as follow:

0--512-----1536---64M

0--64M

Explain

If the FPGA version of the machine is less than 40, then iStartPoint and iPointLen need to be a multiple of 8.

If the FPGA version of the machine is greater than or equal to 40, then iStartPoint and iPointLen need to be a multiple of 2.

SOURce1:DATA:DAC16:BIN iAllDotNum, iSumDotNum, iNowDotNum, #xy...yz...z

Functional Description:

Download the data to the storage device.

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

iAllDotNum=1024, indicates that the total number of points to be downloaded is 1024.

iNowDotNum=512, indicates that the number of points for this download is 512.

iSumDotNum=512, indicates the total number of downloaded points, including the number this time downloaded.

#3512z...z

# indicates the starting position of binary blocks.

3 indicates the length of the last three bytes for binary data, that is, the total length of binary data is 512.

The Z... Z behind 512 is the binary data for the data points we downloaded.

Explain

iAllDotNum, iSumDotNum, iNowDotNum, the purpose of them is to upload packets.

The maximum length of the instruction for each transmission is 8192 bytes.

Each point is represented by 16 bit signed numbers, such as int16.

If the FPGA version of the machine is less than 40, iAllDotNum, iSumDotNum, iNowDotNum need to be multiples of 8.

If the FPGA version of the machine is greater than or equal to 40, iAllDotNum, iSumDotNum, iNowDotNum need to be multiples of 2.

SOURce1:DATA:DAC16 iAllDotNum, iSumDotNum, iNowDotNum, {,value, value, ..., value}

Functional Description:

Download data points to the storage device

For example, SOURce1:DATA:DAC16 1024, 512, 512, 32767...32767

iAllDotNum=1024, indicates that the total number of points to be downloaded is 1024.

iNowDotNum=512, indicated that the number of downloaded data is 512.

iSumDotNum=512, represents the total number of downloaded data, including the download number.

32767...32767, represents the value of each point.

Explain

iAllDotNum, iSumDotNum, iNowDotNum, the purpose of them is to upload packets.

The maximum length of the instruction for each transmission is 8192 bytes.

Each point is represented by 16 bit signed numbers, such as int16. The range of value is from -32768 to 32767.

If the FPGA version of the machine is less than 40, iAllDotNum, iSumDotNum, iNowDotNum need to be multiples of 8.

If the FPGA version of the machine is greater than or equal to 40, iAllDotNum, iSumDotNum, iNowDotNum need to be multiples of 2.

SOURce1:DATA iAllDotNum, iSumDotNum, iNowDotNum, {,value, value, ..., value}
Functional Description:
Download data points to the storage device
For example, SOURce1:DATA 1024, 512, 512, 1...1
iAllDotNum=1024, indicates that the total number of points to be downloaded is 1024.
iNowDotNum=512, indicated that the number of downloaded data is 512.
iSumDotNum=512, represents the total number of downloaded data, including the download number.
1...1, represents the value of each point.
Explain
iAllDotNum, iSumDotNum, iNowDotNum, the purpose of them is to upload packets.
The maximum length of the instruction for each transmission is 8192 bytes.
Each point is a normalized data point, with a range of -1 to 1.
If the FPGA version of the machine is less than 40, iAllDotNum, iSumDotNum, iNowDotNum need to be multiples of 8.
If the FPGA version of the machine is greater than or equal to 40, iAllDotNum, iSumDotNum, iNowDotNum need to be multiples of 2.

SOURce1:DATA:FREQ:SPS sps
Functional Description:
Setting the sampling rate of the machine.
Explain
The maximum sampling rate (fs) of the machine is 125MHz, and the minimum is 1uHz.
If the FPGA version of the machine is less than 90, this command does not support.
The period of the waveform T= 1/fs*number of waveform data.
The amplitude of the waveform can be set by the SCPI instruction of the waveform amplitude.

SOURce1:DATA:FREQ:SPS? [MINimum|MAXimum]
Functional Description:
Get the maximum, minimum sampling rate or current sampling rate supported by the machine.

SOURce1:DATA:RAM:DAC16:BIN iAllDotNum, iSumDotNum, iNowDotNum, #xy...yz...z
Functional Description:
Download data points to the storage device.
For example, SOURce1:DATA:RAM:DAC16:BIN 4096, 512, 512, #3512z...z
iAllDotNum=4096, indicates that the total number of points to be downloaded is 4096, The value of iAllDotNum can only be 4096;
iNowDotNum=512, indicated that the number of downloaded data is 512.
iSumDotNum=512, represents the total number of downloaded data, including the download number.
#3512z...z

# indicates the starting position of binary blocks.

3 indicates the length of the last three bytes for binary data, that is, the total length of binary data is 512.

The Z... Z behind 512 is the binary data for the data points we downloaded.

Explain

iAllDotNum, iSumDotNum, iNowDotNum, the purpose of them is to upload packets.

The maximum length of the instruction for each transmission is 8192 bytes.

Each point is represented by 16 bit signed numbers, such as int16.

If the FPGA version of the machine is greater than or equal to 40, iAllDotNum, iSumDotNum, iNowDotNum need to be multiples of 2.

After using this command to download data, you can set the amplitude, offset, frequency and phase instructions to change the parameters corresponding to the waveform.

SOURce1:DATA:RAM:DAC16 iAllDotNum, iSumDotNum, iNowDotNum, {,value, value, ..., value}

Functional Description:

Download data points to the storage device.

For example, SOURce1:DATA:RAM:DAC16 4096, 512, 512, 32767...32767

iAllDotNum=4096, indicates that the total number of points to be downloaded is 4096, The value of iAllDotNum can only be 4096;

iNowDotNum=512, indicated that the number of downloaded data is 512.

iSumDotNum=512, represents the total number of downloaded data, including the download number.

32767...32767, represents the value of each point.

Explain

iAllDotNum, iSumDotNum, iNowDotNum, the purpose of them is to upload packets.

The maximum length of the instruction for each transmission is 8192 bytes.

If the FPGA version of the machine is greater than or equal to 40, iAllDotNum, iSumDotNum, iNowDotNum need to be multiples of 2.

After using this command to download data, you can set the amplitude, offset, frequency and phase instructions to change the parameters corresponding to the waveform.

SOURce1:RAM:DATA iAllDotNum, iSumDotNum, iNowDotNum, {,value, value, ..., value}

Functional Description:

Download data points to the storage device.

For example, SOURce1:RAM:DATA 4096, 512, 512, 1...1

iAllDotNum=4096, indicates that the total number of points to be downloaded is 4096, The value of iAllDotNum can only be 4096;

iNowDotNum=512, indicated that the number of downloaded data is 512.

iSumDotNum=512, represents the total number of downloaded data, including the download number.

1...1, represents the value of each point.

Explain

iAllDotNum, iSumDotNum, iNowDotNum, the purpose of them is to upload packets.

The maximum length of the instruction for each transmission is 8192 bytes.

Each point is a normalized data point, with a range of -1 to 1.

If the FPGA version of the machine is greater than or equal to 40, iAllDotNum, iSumDotNum, iNowDotNum need to be multiples of 2.

After using this command to download data, you can set the amplitude, offset, frequency and phase instructions to change the parameters corresponding to the waveform.

2.7 DISPlay Subsystem

The DISPlay subsystem controls the instrument's display.

DISPlay:BRIGhtness <brightness>|MINimum|MAXimum

DISPlay:BRIGhtness? [MINimum|MAXimum]

Set the display bringhtness.

Parameter	Typical Return
1%至 100%, default 50%	80%
DISPlay:BRIGhtness 80	

DISPlay:SAVer ON|OFF

DISPlay:SAVer ?

Enable or disable display saver.

Parameter	Typical Return
ON|OFF, default ON	ON, or OFF
Enable display saver: DISPlay:SAVer:STATe ON	

2.8 FM Subsystem

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

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

Sets the peak frequency deviation in Hz.

Parameter	Typical Return
Default 500Hz	+1.000000000000000E+03
Set peak frequency deviation to 1 kHz: SOURce1:MOD:FM:DEViation 1000	

◆ The deviation cannot exceed the carrier frequency. If you attempt to set a deviation 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 the deviation cannot exceed the selected function's maximum frequency plus 100 kHz. If you attempt to set the deviation to an invalid value, the instrument adjusts it to the maximum value allowed with the present carrier frequency.

◆ If the deviation causes the carrier waveform to exceed a frequency boundary for the current duty cycle (square waveform only), the instrument will adjust the duty cycle to the maximum value allowed with the present carrier frequency.

◆ If you select the *External* modulating source, the deviation is controlled by the ±5 V signal level on the rear-panel **Modulation In** connector.For example, if the frequency deviation is 100 kHz, then a +5 V signal level corresponds to a 100 kHz increase in frequency.Lower external signal levels produce less deviation and negative signal levels reduce the frequency below the carrier frequency.

Deviation is valid under these conditions:
deviation≤carrier frequency
deviation + carrier frequency≤ carrier upper frequency limit + 1 kHz

SOURce\<n\>:MOD:FM:INTernal:FREQuency \<frequency\>|MINimum|MAXimum
SOURce\<n\>:MOD:FM:INTernal:FREQuency? [MINimum|MAXimum]
Sets the frequency of the modulating waveform. The modulating source waveform operates at that frequency, within the frequency limits of that waveform.

Parameter	Typical Return
2 mHz to 500 kHz, default 100Hz	+5.000000000000000E+02
Set the modulating frequency to 500Hz: SOURce1:MOD:FM:INTernal:FREQuency 500	

◆ When you select an arbitrary waveform as the modulating source, the frequency changes to the frequency of thearbitrary waveform, which is based on the sample rate and the number of points in the arbitrary waveform.

◆ This command should be used only with the internal modulation source (FM:SOURce INTernal).

SOURce\<n\>:MOD:FM:INTernal:FUNCtion SINusoid|SQUare|RAMP
SOURce\<n\>:MOD:FM:INTernal:FUNCtion?
This command selects the shape of the modulating waveform.

Parameter	Typical Return
SINusoid|SQUare|RAMP, default SINusoid	SINusoid, SQUare, or RAMP
Select a squarewave as the modulating waveform: SOURce1:MOD:FM:INTernal:FUNCtion SQUare	

◆ This command should be used only with the internal modulation source (FM:SOURce INTernal).

2.9 FREQuency Subsystem

The FREQuency subsystem sets the instrument's output frequency
SOURce\<n\>:FREQuency\<frequency\>|MINimum|MAXimum
SOURce\<n\>:FREQuency? [MINimum|MAXimum]
Sets the output frequency

Parameter	Typical Return
Different waveform has diffenent frequency	+1.000000000000000E+03

range, please refer to [Output Configuration](#) and [Appendix B](#)

Set output frequency to 100 Hz: SOURce1:FREQuency 100

SOURce<n>:FREQuency:CENTer <frequency>|MINimum|MAXimum
SOURce<n>:FREQuency:CENTer? [MINimum|MAXimum]
Sets the center frequency. Used with frequency span for a frequency sweep.

Parameter	Typical Return
Different waveform has diffenent frequency range, please refer to [Output Configuration](#) and [Appendix B](#) Default 550Hz	+1.000000000000000E+03

Set sweep center frequency to 1 kHz: SOURce1:FREQuency:CENTer   1000

◆   The following equation shows how span relates to start and stop frequencies.

Frequency Span = Stop Frequency + Start Frequency

◆   The following equation shows how center frequency relates to start and stop frequencies.

Center Frequency = (|Stop Frequency + Start Frequency|)/2

2.10 FSKey Subsystem

FSKey subsystem sets the FSK waveform.

SOURce<n>:MOD:FSKey:FREQuency <frequency>|MINimum|MAXimum
SOURce<n>:MOD:FSKey:FREQuency? [MINimum|MAXimum]
Set the FSK alternating frequency (or "hopping").

Parameter	Typical Return
please refer to [Output Configuration](#) and [Appendix B](#) Default 100Hz	+2.000000000000000E+02

Set "hopping" rate to 200Hz on CH1: SOURce1:MOD:FSKey:FREQuency 200

SOURce<n>:MOD:FSKey:INTernal:RATE <frequency>|MINimum|MAXimum
SOURce<n>:MOD:FSKey:INTernal:RATE? [MINimum|MAXimum]
Set the 'moving' rate of output frequency between carrier frequency and hopping frequency.

Parameter	Typical Return
2 mHz to 1 MHz, default 100Hz	+2.000000000000000E+02

Set moding rate to 200Hz on CH1: SOURce1:MOD:FSKey:INTernal:RATE 200

FSK rate should be used only with the internal modulation source(FSK:SOURce INTernal).

2.11 FUNCtion Subsystem

The FUNCtion subsystem configures the instrument's output function:
SOURce<n>:FUNCtion <wave>
output waveform
SOURce<n>:FUNCtion:ARBitrary <filename>

Output arbitrary waveform file

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

peak-to-peak voltage for an arbitrary waveform

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

sample rate for arbitrary waveform

SOURce<n>:FUNCtion:SQUare:DCYCle

pulse duty cycle for pulse

SOURce<n>:FUNCtion:RAMP:SYMMetry

symmetry percentage for ramp

SOURce<n>:FUNCtion:PULSe:DCYCle

pulse duty cycle for pulse

SOURce<n>:FUNCtion:PULSe:WIDTh

pulse width

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

Leading edge time for pulse

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

Trailing edge time for pulse

SOURce<n>:FUNCtion <wave>

SOURce<n>:FUNCtion?

Selects output function

Parameter	Typical Return
SINusoid|SQUare|RAMP| PULSe|NOISe|DC|SINC|EXPFall|HAVErsine |LOREntz| DUALtone|GAUSe| ECG| USER| HARMonic|, default SINusoid	SINusoid, SQUare, RAMP, PULSe, NOISe, DC, SINC, EXPFall、HAVErsine, LOREntz, DUALtone, GAUSe, ECG, USER, or HARMonic|
Set output on channel 1 to sine: SOURce1:FUNCtion SINusoid	

◆ NOISe generates white gaussian noise

◆ ARB generates the arbitrary waveform currently selected by FUNCtion:ARBitrary.

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

Parameter	Typical Return
Effective filename: including user-defined file and built-in waveform file; Common use: "INT:/Builtin/SINC.hwf","INT:/Mywave.hwf"," SD:/mywave.hwf","USB:/mywave.hwf"	File name
Set arbitrary filename output: INT:/Builtin/SINC.hwf SOURce1:FUNCtion:ARBitrary "INT:/Builtin/SINC.hwf", return Int:/Builtin/SINC.hwf	

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

Sets peak to peak voltage.

Parameter	Typical Return
Discrete values 1,4,5,20, default 1V	+4.000000000000000E+00
Set peak to peak voltage to 4 V: SOURce1:FUNCtion:ARBitrary:PTPeak 4	

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

Sets the sample rate for the arbitrary waveform.

Parameter	Typical Return
From 1 to 255, default 1	+2.500000000000000E+07
Set sample rate on CH1 to25MSa/s: SOURce1:FUNCtion:ARBitrary:SRATe 10	

sample rate = 250M/(4*n)

n: the setting value by user

When n is 0, the sample rate is 250M.

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

Sets pulse duty cycle.

Parameter	Typical Return
0.001% to 99.996%，limited as described below, default 50%	+3.000000000000000E+01
Set duty cycle to 30%: SOURce1:FUNCtion:SQUare:DCYCle 30	

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

Sets the symmetry percentage for ramp waves.

Parameter	Typical Return
0% to 100%, default 50%	+3.000000000000000E+01
Set symmetry on CH1 to 30%: SOURce1:FUNCtion:RAMP:SYMMetry 30	

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

Sets pulse duty cycle.

Parameter	Typical Return
0 % to 100%, default 50%	+3.000000000000000E+01
Set duty cycle on CH1 to 30%: SOURce1:FUNCtion:PULSe:DCYCle 30	

◆The FUNCtion:PULSe:DCYCle and FUNCtion:PULSe:WIDTh commands affect the same
parameter.

◆The pulse duty cycle is defined as:

Duty Cycle = 100 x Pulse Width ÷ Period

Pulse width is the time from the 50% threshold of a pulse's rising edge to the 50% threshold of
the next falling edge.

◆The pulse duty cycle range is 0 percent to 100 percent. However, the pulse duty cycle is limited
by *minimum pulse width* and *edge time* restrictions, which prevent you from setting exactly 0
percent or 100 percent. For example, for a 1 kHz pulse waveform, you are typically restricted to
pulse duty cycles in the range 0.002 percent to 99.998 percent, limited by the minimum pulse
width of 16 ns.

◆*Restrictions Based on Pulse Width:* The specified pulse duty cycle must conform to the following restrictions determined by the *minimum pulse width* (Wmin).

Duty Cycle ≥ (Wmin / Period) X 100

Duty Cycle ≤ (1 – Wmin / Period) X 100

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

Sets pulse width.

Parameter	Typical Return
16ns to 1000µs, default 500µs	+5.000000000000000E-03
Set pulse width on CH1 to 5 ms: SOURce1:FUNCtion:PULSe:WIDTh 0.005	

◆ The FUNCtion:PULSe:DCYCle and FUNCtion:PULSe:WIDTh commands affect the same parameter.

◆ Pulse width is the time from the 50% threshold of a pulse's rising edge to the 50% threshold of the next falling edge.

◆ Pulse Width ≥ Wmin

Pulse Width ≤ Period   - 2 x Wmin

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]

Sets the pulse edge time on the leading, trailing, or both edges of a pulse.

Parameter	Typical Return
Default 1µs	+1.000000000000000E-08
Set leading edge time on CH1 to 10 ns: SOURce1:FUNCtion:PULSe:TRANsition:LEADing 0.00000001	
Set trailing edge time on CH1 to 10 ns: SOURce1:FUNCtion:PULSe:TRANsition:TRAiling 0.00000001	

◆ The leading edge time applies to rising edge, and represents the time from the 10% threshold to the 90% threshold of the edge; the trailing edge represents the time from the 90% threshold to the 10% threshold.

◆ The specified edge time must fit within the specified pulse width and period. The instrument will limit the edge time to accommodate the specified pulse width or duty cycle.

2.12 HARMonicSubsystem

SOURce<n>:HARMonic:AMPL –Harmonic amplitude
SOURce<n>:HARMonic:PHASe –Harmonic phase
SOURce<n>:HARMonic:ORDEr –Harmonic order
SOURce<n>:HARMonic:TYPe –Harmonic type

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

SOURce\<n>:HARMonic:AMPL?

Set Harmonic amplitude

Parameter	Typical Return
\<sn> integer, 2 to 16, default 2; \<value>Continuous real Numbers	none
Sets the amplitude of the second harmonic to 1Vpp on CH1: SOURce1:HARMonic:AMPL 2,1	

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

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

Set Harmonic phase.

Parameter	Typical Return
\<sn> integer, 2 to 16, default 2; \<value>Continuous real Numbers, 0 to 360degrees, default 0	+9.000000000000000E+01
Set the second Harmonic phase on CH1 to 90 degrees: SOURce1:HARMonic:PHASe 2,90	

SOURce\<n>:HARMonic:ORDEr \<value>|MINimum|MAXimum

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

Set Harmonic order.

Parameter	Typical Return
2 to the highest frequency ÷fundamental frequency, ,integer, Max 16, default 2	+8.000000000000000E+00
Set Harmonic order on CH1 to 8: SOURce1:HARMonic:ORDEr 8	

SOURce\<n>:HARMonic:TYPe EVEN|ODD|ALL|USER

SOURce\<n>:HARMonic:TYPe?

Select Harmonic type even, odd or all.

Parameter	Typical Return
EVEN|ODD|ALL, default ALL	EVEN, ODD, or ALL
Set harmonic type on CH1 to odd: SOURce1:HARMonic:HARMonic:TYPe ODD	

2.13 IEEE-488 Common Commands

*IDN? - Instrument identification

*RCL/*SAV - Recall/save instrument state

*RST - Reset instrument to factory defaults

*TRG - Trigger command, command is valid under sweep mode and burst mode

*TST? - Self-test

*IDN?

Identification Query. Returns instrument's identification string.

Parameter	Typical Return
none	Return factory, model, series number andvesion

Return the instrument's identification string: *IDN?

*RST

Resets instrument to factory default state.

Parameter	Typical Return
none	none

Reset the instrument: *RST

◆ Does not affect stored instrument states, stored arbitrary waveforms, or I/O settings; these are stored in non-volatile memory.

2.14 MARKer Subsytem

SOURce<n>:MARKer –Enable or disable sweep marker function
SOURce<n>:MARKer:FREQuency -Sets the marker frequency

SOURce<n>:MARKer ON|OFF
SOURce<n>:MARKer?
Enable or disable sweep marker function.

Parameter	Typical Return
ON|OFF, default OFF	ON, or OFF

Enable sweep marker on CH1: SOURce1:MARKer ON

SOURce<n>:MARKer:FREQuency <frequency>|MINimum|MAXimum
SOURce<n>:MARKer:FREQuency? [MINimum|MAXimum]
Sets the marker frequency.

Parameter	Typical Return
Any frequency between start and stop frequency, default 550 Hz	+1.000000000000000E+03

Set marker frequency to 1000Hz：SOURce2:MARKer:FREQuency 1000

2.15 MMEMory Subsystem

The MMEMory subsystem manages the file system in the instrument or on an external USB file system. The file system can store and load several file formats.

Commands and Queries
The MMEMory subsystem includes the following commands and queries.
MMEMory:CATalog? - lists available and used space and files on Mass Memory device
MMEMory:CDIRectory - changes to a directory
MMEMory:COPY -copies a file on Mass Memory device
MMEMory:DELete -removes files from Mass Memory device

MMEMory:LOAD:STATe-loads saved instrument state from file

MMEMory:MDIRectory -makes a new directory (folder)

MMEMory:RDIRectory - query currently available storage devices

MMEMory:STORe:STATe -stores instrument state to file

MMEMory:DATA - Upload the file to the device

MMEMory:CATalog?

Returns a list of all files in the current mass storage directory, including internal storage and the USB drive.

MMEMory:CDIRectory <folder>

MMEMory:CDIRectory?

Amend the current path to < directory_name > specified path

ASCII type, String with a string of double quotes, limited to 256 characters

Parameter	Typical Return
String with a string of double quotes, limited to 256 characters.	(none)
MMEMory:CDIRectory "SD:/tmp	

MMEMory:COPY <folder>,<file_name>

Copies a file from < folder > to < file_name >(not current path).

<folder> ASCII type, String with a string of double quotes, limited to 256 characters.

<file_name> String with double quotation (including suffix), limited to 40 characters.

Parameter	Typical Return
Both files can be any valid file name	(none)
MMEMory:COPY "SD:/tmp","tmp1.hsf"	

MMEMory:DELete <file_name>

Deletes a file. To delete a folder, use MMEMory:RDIRectory.

Parameter	Typical Return
Any valid file name, including file extension.	(none)
Delete the indicated file from the root directory of the internal flash file system:	
MMEMory:DELete "Int:/tmp.hsf"	

MMEMory:LOAD:STATe <file_name>

MMEMory:STORe:STATe <file_name>

Loads or saves a complete instrument setup, using a named file on the mass storage.

Parameter	Typical Return
Any valid file name on current mass storage directory, including file extension.	no
Load a complete instrument setup from the file in internal mass memory:	
MMEMory:LOAD:STATe "Int:/tmp.hsf"	
Store instrument setup to the root directory of the internal flash file system:	
MMEMory:STORe:STATe "Int:/tmp.hsf"	

MMEMory:RDIRectory?

Query currently available storage devices (excluding internal flash memory)

Return format

Format: "1," "USB:" "" (currently inserted the USB device)

Format: "0", "" (no external storage device is currently inserted).

MMEMory:MDIRectory <folder>

MMEMory:MDIRectory makes a new directory (folder) on the mass storage medium.

MMEMory:RDIRectory removes a directory (folder) on the mass storage medium.

Parameter	Typical Return
Any directory name, including the mass storage unit specifier, default INT:\ String with a string of double quotes, limited to 256 characters.	"INT:\"
MMEMory:RDIRectory MMEMory:MDIRectory "test"	

MMEMory:DATA

MMEMory:DATA <filename>, <all_file_len>, <sum_file_len>, <now_file_len> , <data>

Upload the file to the device

MMEMory:DATA?<filename><flag>

Download the file to PC

Parameter		Typical Return
<filename>		The string returned contains 5 paragraphs separated by commas.:
<all_file_len>		
<sum_file_len>		<filename>, <all_file_len>, <sum_file_len> ,
<now_file_len>,	[1-4096]	<now_file_len> ,<data>
<data>		If there is error, all_file_len, sum_file_len,
<flag>,	STA|CON	now_file_len field is 0.

Introductions

The format of filename is: disk: / directory / file. The effective string of the disk is INT, USB, SD.

Filename is wrapped up with double quotes

All_file_len is the total length of the file;

Sum_file_len is the total length of the total transmission (including this transmission);

Data is binary block, format: #9?????? XXXX... XXX. For example, Transfer the 512 byte data to #9000000512xxxx.....xxxx. X represents a byte binary number, which has 512 bytes in this example.

Flag is used to transfer files to PC, and when flag is "STA", it begins to transmit from the first position of the file. When flag is "CON", it means continues to transmit, PC sends query instruction "MMEMory:DATA?" until sum_file_len=all_file_len.

For example

Upload the file "1.txt" to USB device:

MMEMory:DATA "USB:/1.txt", 9, 9, 9, #9000000009xxxxxxxxx

Download the file "1.txt" and return this data:"USB:/1.txt", 9, 9, 9, #9000000009xxxxxxxxx :

MMEMory:DATA ? "USB:/1.txt", STA

2.16 OUTPut Subsystem

The OUTPut subsystem controls the front-panel channel output and **Sync** connectors:
OUTPut<n> - front-panel channel output connector state
OUTPut:SYNC - front-panel **Sync** connector state

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

Enables or disables the front-panel output connector.

Parameter	Typical Return
ON|OFF, default OFF	ON, or OFF
Enable output connector for channel 1: OUTPut1 ON	

◆ When output is enabled, the front-panel channel output key is illuminated.

◆ OUTPut changes the state of the channel output connector by switching the output relay, without zeroing output voltage.

OUTPut:SYNC:SOURce CH1|CH2

Disables or enables the front-panel **Sync** connector.

Parameter	Typical Return
CH1|CH2, default CH1	ON or OFF
Disable front panel **Sync** connector for CH1: OUTPut:SYNC:SOURce CH1	

2.17 PHASeSubsystem

The PHASe subsystem allows you to adjust the waveform phase; this is useful in channel-to-channel and channel-to- ync applications. This subsystem also allows you to use the **10 MHz Out** and **10 MHz In** rear-panel connectors to synchronize multiple instruments.

SOURce<n>:PHASe -sets phase offset of output waveform (not available for arbitrary waveforms or noise)
SOURce<n>:PHASe:SYNChronize -synchronizes phase of both internal channels on a two-channel instrument.

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

Sets waveform's phase offset angle.

Parameter	Typical Return
0 to 360degrees, default 0	+9.0000000000000E+01
Set channel 1 phase offset to 90 degrees: SOURce1:PHASe 90	

◆ Use PHASe:SYNChronize to synchronize the phases of the two internal channels.

SOURce<n>:PHASe:SYNChronize

Simultaneously resets all phase generators in the instrument to establish a common, internal phase zero reference point.

Parameter	Typical Return

none	none
Reset all phase generators: PHAS:SYNC	

◆ SOURce1 and SOURce2 mean nothing for this command.

◆ The setting is invalid when any channel is in a modulation mode in two channels.

2.18 PM Subsystem

The PM subsystem allows you to phase modulate a waveform.

SOURce<n>:MOD:PM:DEViation <deviation>|MINimum|MAXimum
SOURce<n>:MOD:PM:DEViation? [MINimum|MAXimum]
Sets the phase deviation in degrees. This value represents the peak variation in phase of the modulated waveform from the carrier waveform.

Parameter	Typical Return
0 to 360degrees, default 180degrees	+9.000000000000000E+01
Set phase deviation to 90 degrees: SOURce1:MOD:PM:DEViation 90	

With the External modulating source, deviation is controlled by the ±5 V signal level on the front-panel **MOD** connector. For example, if you have set the frequency deviation to 180 degrees, then a +5 V signal level corresponds to a +180 degree phase deviation. Lower external signal levels produce less deviation, and negative signal levels produce negative deviation.

SOURce<n>:MOD:PM:INTernal:FREQuency <frequency>|MINimum|MAXimum
SOURce<n>:MOD:PM:INTernal:FREQuency? [MINimum|MAXimum]
Sets the frequency of the modulating waveform. The waveform chosen as the modulating source will operate at that frequency, within the frequency limits of that waveform.

Parameter	Typical Return
2 mHz to 500 kHz, default 100Hz	+1.000000000000000E+04
Set modulating frequency to 10 kHz: SOURce1:MOD:PM:INTernal:FREQuency 10000	

◆ This command should be used only with the internal modulation source (PM:SOURce INTernal).

SOURce<n>:MOD:PM:INTernal:FUNCtion SINusoid|SQUare|RAMP
SOURce<n>:MOD:PM:INTernal:FUNCtion?
Selects shape of modulating waveform.

Parameter	Typical Return
SINusoid|SQUare|RAMP, default SINusoid	SINusoid, SQUare, or RAMP
Select a square wave as the modulating waveform: SOURce1:MOD:PM:INTernal:FUNCtion SQUare	

◆ This command should be used only with the internal modulation source (PM:SOURce INTernal).

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

SOURce\<n>:MOD:PM:SOURce?

Select the source(INTrnal or EXTenal) of the modulating signal.

Parameter	Typical Return
INTernal|EXTernal, default INTernal	INTernal, or EXTernal
Select external modulation source for CH1: SOURce1:MOD:FM:SOURce EXTernal	

2.19 PSK Subsystem

PSK phase shift keying.is a digital modulation scheme that conveys data by changing, or modulating, the phase of a reference signal (the carrier wave).
Any digital modulation scheme uses a finite number of distinct signals to represent digital data.
PSK uses a finite number of phases, each assigned a unique pattern of binary digits.

SOURce\<n>:MOD:PSKey:PHASe \<phase>|MINimum|MAXimum

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

Sets the phase in degrees.

Parameter	Typical Return
0 to 360 degrees, default 180 degree	+9.000000000000000E+01
Sets the phaseon CH1 to 90degrees: SOURce1:MOD:PSKey:PHASe 90	

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

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

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

Parameter	Typical Return
2 mHz to 1 MHz, default 100Hz	+2.000000000000000E+02
Set PSK rate on CH1 to 200Hz: SOURce1:MOD:PSKey:INTernal:RATE 200	

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

SOURce\<n>:MOD:PSKey:SOURce?

Select the source(INTrnal or EXTenal) of the modulating signal.

Parameter	Typical Return
INTernal|EXTernal, default INTernal	INTernal, or EXTernal,
Select external modulation source for CH1: SOURce\<n>:MOD:FSKey:SOURce EXTernal	

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

SOURce\<n>:MOD:PSKey:POLarity?

Select **POSitive or NEGative** of the modulating signal to control waveform output.

Parameter	Typical Return
POSitive|NEGative, default POSitive	POSitive, or NEGative
Set NEGative of ASK modulating signal on CH1: SOURce1:MOD:PSKey:POLarity NEGative	

2.20 PWM Subsystem

The PWM subsystem allows you to perform pulse width modulation (PWM) on a pulse waveform.

SOURce\<n\>:MOD:PWM:DEViation \<deviation\>|MINimum|MAXimum

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

Sets pulse width deviation; the ± variation in width (in seconds) from the pulse width of the carrier pulse waveform.

Parameter	Typical Return
0 ns to 500 ks, default 200μs	+1.000000000000000E+00
Set pulse width deviation to1s: SOURce1:MOD:PWM:DEViation 1	

◆ The pulse width deviation cannot exceed the current pulse width

◆ The pulse width deviation is limited by the current edge time setting.

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

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

Selects frequency at which output pulse width shifts through its pulse width deviation. The waveform used as the modulating source will operate at that frequency, within frequency limits of that waveform.

Parameter	Typical Return
2 mHz to 500 kHz, default 100Hz	+1.000000000000000E+02
Set internal PWM frequency to 100Hz: SOURce1:MOD:PM:INTernal:FREQuency 100	

◆ When you select an arbitrary waveform as the modulating source, the frequency changes to the frequency of the arbitrary waveform, which is based on the sample rate and the number of points in the arbitrary waveform.

◆ This command should be used only with the internal modulation source (PWM:SOURce INTernal).

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

SOURce\<n\>:MOD:PWM:INTernal:FUNCtion?

Selects shape of the internal modulating waveform.

Parameter	Typical Return
SINusoid|SQUare|RAMP, default SINusoid	SINusoid, SQUare, or RAMP
Select a square wave as the modulating waveform shape: SOURce1:MOD:PM:INTernal:FUNCtion SQUare	

◆ This command should be used only with the internal modulation source (PWM:SOURce INTernal).

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

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

Select the source of the modulating signal.

Parameter	Typical Return

INTernal|EXTernal, default INTernal	INTernal, default EXTernal
Select external modulation source:: SOURce1:MOD:FM:SOURce EXTernal	

2.21 ROSCillatorSubsystem

The ROSCillator subsystem controls use of the 10 MHz reference oscillator and external reference oscillator input. The reference oscillator is the primary clock for all waveform synthesis. All waveforms are phase-locked to the reference oscillator, which therefore controls output signal frequency and phase.
ROSCillator:SOURce - selects internal or external reference oscillator source

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

Parameter	Typical Return
INTernal|EXTernal, default INTernal	INTernal, or EXTernal
Use the external reference oscillator source: SYSTem:ROSCillator:SOURce EXTernal	

◆ **EXTernal:** instrument uses signal on the rear-panel **10 MHz In** connector as reference, and generates an error if this signal is absent or the instrument cannot lock to it. In such error cases, instrument output continues, but the frequency will be unstable.

◆ **INTernal:** instrument uses the internal reference oscillator and ignores the signal at the **10 MHz In** connector.

2.22 SOURce Subsystem

Subsystems Using the Optional SOURce Keyword
Because SOURce subsystem commands are often used without the SOURce keyword, these commands are listed by their individual subsystems, below:
AM
ASK
BPSK
BURSt
DATA
FM
FREQuency
FSKey
FUNCtion
MARKer
PHASe
PM
ROSCillator
SWEep
VOLTage

2.23 SWEepSubsystem

SOURce\<n>:SWEep:HTIMe \<seconds>|MINimum|MAXimum
SOURce\<n>:SWEep:HTIMe? [MINimum|MAXimum]
Sets number of seconds the sweep holds (pauses) at the stop frequency before returning to the start frequency.

Parameter	Typical Return
1 ms to 300 s, default 1s	+5.000000000000000E+00
Set sweep hold time to 5 seconds: SOURce1:SWEep:HTIMe 5	

SOURce\<n>:SWEep:RTIMe   \<seconds>|MINimum|MAXimum
SOURce\<n>:SWEep:RTIMe ? [MINimum|MAXimum]
Sets number of seconds the sweep takes to return from stop frequency to start frequency.

Parameter	Typical Return
1 ms to 300 s, default 1s	+5.000000000000000E+00
Set sweep return time to 5s: SOURce1:SWEep:RTIMe 5	

SOURce\<n>:SWEep ON|OFF
SOURce\<n>:SWEep?
Enables or disables the sweep.

Parameter	Typical Return
ON|OFF, default OFF	ON or OFF
Enable sweep: SOURce1:SWEep ON	

SOURce\<n>:SWEep:TIME \<seconds>|MINimum|MAXimum
SOURce\<n>:SWEep:TIME? [MINimum|MAXimum]
Sets time (seconds) to sweep from start frequency to stop frequency.

Parameter	Typical Return
1 ms to 300 s, default 1s	+5.000000000000000E+00
Set sweep time to 5s: SOURce1:SWEep:TIME 5	

2.24 SYSTem Subsystem

The SYSTem subsystem manages instrument state storage, power-down recall, error conditions, self test, front-panel display control and remote interface configuration.

SYSTem:BEEPer -issues a single beep

SYSTem:BEEPer:STATe -disables or enables beeper

SYSTem:ERRor? - reads and clears one error from error queue

SYSTem:LANGuage - Select language

SYSTem:KLOCk - Remote keyboard Lock or unlock keyboard of the front panel

SYSTem:VERSion? -returns version of SCPI used by instrument

SYSTem:ROSCillator:SOURce –set the clock source

SYSTem:DATE –set the system data

SYSTem:TIME –set the system time

SYSTem:BEEPer

Issues a single beep

Parameter	Typical Return
none	none
SYSTem:BEEPer	

◆This command overrides the current beeper state (the SYSTem:BEEPer:STATe). This means

that you can issue asingle beep even if the beeper is turned off.

SYSTem:BEEPer:STATe ON|OFF

Disables or enables the beeper.

Parameter	Typical Return
ON|OFF, on ON	ON, or OFF
Enable beeper: SYSTem:BEEPer:STATe ON	

◆ Turning off the beeper does not disable the front-panel key click.

◆ A beep is always emitted (even with beep state OFF) when SYSTem:BEEPer is sent.

◆ This setting is non-volatile; it will not be changed by power cycling or *RST.

SYSTem:ERRor?

Reads and clears one error from error queue.

Parameter	Typical Return
none	-113, "Undefined header; keyword cannot be found"; No error: 0, "No Error"。
Read and clear first error in error queue: SYST:ERR?	

SYSTem:LANGuage ENGLish|SCHinese，SYSTem:LANGuage?

Set language to English or SCHinese.

Parameter	Typical Return
ENGLish|SCHinese, default ENGLish	ENGLish, or SCHinese
Set language to SChinese: SYSTem:LANGuage SCHinese	

SYSTem:KLOCk ON|OFF
SYSTem:KLOCk?

Remotely enable or disable front-panel keyboard.

Parameter	Typical Return
ON|OFF, default OFF	ON, or OFF
Disable front-panel keyboard: SYSTem:KLOCk ON	

SYSTem:VERSion?

Find and return SCP version information

Parameter	Typical Return

none	Return SCPI information
Find and return SCP version information: SYSTem:VERSion?	

SYSTem:ROSCillator:SOURce

SYSTem:ROSCillator:SOURce INTernal|EXTernal

Setting the clock source is internal (INTernal) or external (EXTernal).

SYSTem:ROSCillator:SOURce?

Query the clock source

Parameter	Typical Return
none	Return INTernal or EXTernal

Introductions

After setting the reference clock, it will take at least 2 seconds to delay the time to query the reference clock source.

For example

Set the clock source to external (This setting will take effect after the system detects the correct external clock.):

SYSTem:ROSCillator:SOURce EXTernal

Query and return to EXTernal:

SYSTem:ROSCillator:SOURce?

SYSTem:DATE

SYSTem:DATE <year>, <month>, <day>   Set the system date

SYSTem:DATE?   Query the system date

Parameter	Default	Typical Return
<year>	2018	The string returned contains 3 paragraphs
<month>, [1-12]	1	separated by commas.
<day>, [1-31]	1	<year>, <month>, <day>

For example

Set the system date to August 9, 2018:

SYSTem:DATE 2018, 8, 9

Query and return to 2018, 8, 9:

SYSTem:DATE?

SYSTem:TIME

SYSTem:TIME <hour>, <minute>, <second>   Set the system time

SYSTem:TIME?   Query the system time

Parameter	Default	Typical Return
<hour>, [0-23]	6	The string returned contains 3 paragraphs
<minute>, [0-59]	6	separated by commas.
<second>, [0-59]	6	<hour>, <minute>, <second>

For example

Set the system time to 10 hours, 25 minutes and 32 seconds:

SYSTem:TIME 10, 25, 32

Query and return to 10, 25, 32:

SYSTem:TIME?

2.25 SYSTem COMMunicate

SYSTem:COMMunicate
SYSTem:COMMunicate:<W>LAN:AUTOip[:STATe] ON|OFF
Enable or disable the AutoIP mode
SYSTem:COMMunicate:<W>LAN:AUTOip[:STATe]?
Query the state of the AutoIP

Parameter	Default	Typical Return
--, ON|OFF	OFF	ON or OFF

For example,
Enable AutoIP:
SYSTem:COMMunicate:LAN:AUTOip ON
Quary and return to ON:
SYSTem:COMMunicate:LAN:AUTOip?

SYSTem:COMMunicate:<W>LAN:DHCP[:STATe]
SYSTem:COMMunicate:<W>LAN:DHCP[:STATe] ON|OFF
Enable or disable the dynamic IP mode (DHCP).
SYSTem:COMMunicate:<W>LAN:DHCP[:STATe]?
Query the state of DHCP

Parameter	Default	Typical Return
--, ON|OFF	OFF	ON or OFF

For example,
Enable DHCP:
SYSTem:COMMunicate:LAN:DHCP ON
Quary and return to ON:
SYSTem:COMMunicate:LAN:DHCP?

SYSTem:COMMunicate:<W>LAN:DNS
SYSTem:COMMunicate:<W>LAN:DNS <address>
Set the DNS address of the cable network card
SYSTem:COMMunicate:<W>LAN:DNS?
Query the DNS address

Parameter	Default	Typical Return
<address>, 0.0.0.0 to 255.255.255.255	--	Return the current domain name server address, the form is nnn.nnn.nnn.nnn

For example,
Set the DNS address to 202.106.46.151:
SYSTem:COMMunicate:LAN:DNS 202.106.46.151
Query and return to 202.106.46.151:
SYSTem:COMMunicate:LAN:DNS?

SYSTem:COMMunicate:<W>LAN:GATEway
SYSTem:COMMunicate:<W>LAN:GATEway <address>
Setting the default gateway.
SYSTem:COMMunicate:<W>LAN:GATEway?
Query the default gateway.

Parameter	Default	Typical Return
<address>, 0.0.0.0 to 255.255.255.255	--	Return the current default gateway, the form is nnn.nnn.nnn.nnn

For example,
Ste the gateway to 172.16.3.1:
SYSTem:COMMunicate:LAN:GATEway 172.16.3.1
Query and return to 172.16.3.1:
SYSTem:COMMunicate:<W>LAN:GATEway?

SYSTem:COMMunicate:<W>LAN:IPADdress
SYSTem:COMMunicate:<W>LAN:IPADdress <address>
Set the IP address.
SYSTem:COMMunicate:<W>LAN:IPADdress?
Query the IP address.

Parameter	Default	Typical Return
<address>, 0.0.0.0 to 255.255.255.255	--	Return the default IP address, the form is nnn.nnn.nnn.nnn

For example,
Set the IP address to 172.16.3.145:
SYSTem:COMMunicate:LAN:IPADdress 172.16.3.145
Query and return to 172.16.3.145:
SYSTem:COMMunicate:LAN:IPADdress?

SYSTem:COMMunicate:<W>LAN:SMASk
SYSTem:COMMunicate:<W>LAN:SMASk <mask>
Set the subnet mask.
SYSTem:COMMunicate:<W>LAN:SMASk?
Query the subnet mask.

Parameter	Default	Typical Return
<mask>, 0.0.0.0 to 255.255.255.255	--	Return the subnet mask, the form is nnn.nnn.nnn.nnn

For example,
Set the subnet mask to 255.255.255.0:
SYSTem:COMMunicate:LAN:SMASk 255.255.255.0
Query and return to 255.255.255.0:
SYSTem:COMMunicate:LAN:SMASk?

SYSTem:COMMunicate:<W>LAN:STATic[:STATe]

SYSTem:COMMunicate:<W>LAN:STATic[:STATe] ON|OFF

Open or close the manual IP mode.

SYSTem:COMMunicate:<W>LAN:STATic[:STATe]?

Query the state of the manual IP mode.

Parameter	Default	Typical Return
--, ON|OFF	OFF	ON or OFF

For example,

Open the manual IP mode:

SYSTem:COMMunicate:LAN:STATic ON

Query and return to ON:

SYSTem:COMMunicate:LAN:STATic?

SYSTem:COMMunicate:<W>LAN:MAC?

Query the MAC address.

Return format: 00-11-22-33-44-55

SYSTem:COMMunicate:<W>LAN[:STATe]

SYSTem:COMMunicate:<W>LAN[:STATe] ON|OFF

Open or close the network card.

SYSTem:COMMunicate:<W>LAN[:STATe]?

Query network card status.

Parameter	Default	Typical Return
--, ON|OFF	OFF	ON or OFF

For example,

Open or close the network card

SYSTem:COMMunicate:LAN:STATe ON

Query and return to ON:

SYSTem:COMMunicate:LAN:STATe?

SYSTem:COMMunicate:<W>LAN:RX[:BYTEs]?

Query the total amount of data received by network card

Return format: Returns the cumulative received data, the unit is Byte.

SYSTem:COMMunicate:<W>LAN:TX[:BYTEs]?

Query the total amount of data sent by network card

Return format: Returns the cumulative sent data, the unit is Byte.

SYSTem:COMMunicate:WLAN:HOTPot[:STATe]

SYSTem:COMMunicate:WLAN:HOTPot[:STATe] ON|OFF

Enable or disable the WLAN hot feature.

SYSTem:COMMunicate:WLAN:HOTPot[:STATe]?

Query whether the current wireless network card is working in hot spot mode.

Parameter	Default	Typical Return
--, ON|OFF	ON	ON or OFF

For example,

Enable the WLAN hot:

SYSTem:COMMunicate:WLAN:HOTPot:STATe ON

Query and return to ON:

SYSTem:COMMunicate:WLAN:HOTPot:STATe?

SYSTem:COMMunicate:WLAN:HOTPot:KEYMgmt

SYSTem:COMMunicate:WLAN:HOTPot:KEYMgmt NONE|WPAPSK

Setting WiFi security.

SYSTem:COMMunicate:WLAN:HOTPot:KEYMgmt?

Query the current security configuration.

Parameter	Default	Typical Return
--, NONE|WPAPSK	WPAPSK	NONE or WPAPSK

For example,

Setting security to no (NONE)

SYSTem:COMMunicate:WLAN:HOTPot:KEYMgmt NONE

Query and return to NONE:

SYSTem:COMMunicate:WLAN:HOTPot:KEYMgmt?

SYSTem:COMMunicate:WLAN:HOTPot:SSID

SYSTem:COMMunicate:WLAN:HOTPot:SSID <name>

Setting the WiFi hot name.

SYSTem:COMMunicate:WLAN:HOTPot:SSID?

Query the current WiFi hot name.

Parameter	Default	Typical Return
<name>, Max. 128 characters	HDG2000B_xxx	Current WiFi hot name

XXX is a machine sequence number.

For example,

Set the WIFI hot name as: HELLO:

SYSTem:COMMunicate:WLAN:HOTPot:SSID HELLO

Query and return to HELLO:

SYSTem:COMMunicate:WLAN:HOTPot:SSID?

SYSTem:COMMunicate:WLAN:HOTPot:PSK

SYSTem:COMMunicate:WLAN:HOTPot:PSK <password>

Set the WiFi hot password, and it is effective when security is set to WPAPSK.

SYSTem:COMMunicate:WLAN:HOTPot:PSK?

Query the current WiFi hot password.

Parameter	Default	Typical Return
<password>, Max. 128 characters	88888888	Query and return the current WiFi hot password

For example,

Set the WIFI hot password as: HELLO:

SYSTem:COMMunicate:WLAN:HOTPot:PSK HELLO

Query and return to HELLO:

SYSTem:COMMunicate:WLAN:HOTPot:PSK?

SYSTem:COMMunicate:WLAN:HOTPot:CHANnel

SYSTem:COMMunicate:WLAN:HOTPot:CHANnel <channel>

Setting up the WiFi broadcast channel.

SYSTem:COMMunicate:WLAN:HOTPot:CHANnel?

Setting up the WiFi broadcast channel.

Parameter	Default	Typical Return
<channel>, 1 to 13	11	Query and return to the current WiFi broadcast channel

For example,

Set the WIFI hot broadcast channel to 10:

SYSTem:COMMunicate:WLAN:HOTPot:CHANnel 10

Query and return to 10:

SYSTem:COMMunicate:WLAN:HOTPot:CHANnel?

SYSTem:COMMunicate:WLAN:HOTPot:MAXStation

SYSTem:COMMunicate:WLAN:HOTPot:MAXStation <number>

Set the maximum connection number of WIFI hot spot.

SYSTem:COMMunicate:WLAN:HOTPot:MAXStation?

Query the maximum connection number of WIFI hot spot.

Parameter	Default	Typical Return
<number>, 1 to 8	8	Query and return to the current maximum connection number of WIFI hot spot

For example,

Set the maximum connection number of WIFI hot spot to 6:

SYSTem:COMMunicate:WLAN:HOTPot:MAXStation 6

Query and return to 6:

SYSTem:COMMunicate:WLAN:HOTPot:MAXStation?

SYSTem:COMMunicate:WLAN:HOTPot:DHCP:RANGe

SYSTem:COMMunicate:WLAN:HOTPot:DHCP:RANGe <begain>, <end>, <mask>

Set the IP address range of the hot spot assignment.

SYSTem:COMMunicate:WLAN:HOTPot:DHCP:RANGe?

Query the IP address range of the hot spot.

Parameter	Default	Typical Return
<begin>, 0.0.0.0 to 255.255.255.255	--	Query and return the current DHCP allocation address range, the format is nnn.nnn.nnn.nnn, nnn.nnn.nnn.nnn, nnn.nnn.nnn.nnn
<end>, 0.0.0.0 to 255.255.255.255	--	
<mask>, 0.0.0.0 to 255.255.255.255	--	

For example,

Set the DHCP address range from 192.168.1.127 to 192.168.1.251, and the subnet mask is

255.255.255.0:

SYSTem:COMMunicate:WLAN:HOTPot:DHCP:RANGe 192.168.1.127, 192.168.1.251,

255.255.255.0

Query and return to 192.168.1.127, 192.168.1.251, 255.255.255.0:

SYSTem:COMMunicate:WLAN:HOTPot:DHCP:RANGe?

SYSTem:COMMunicate:WLAN:HOTPot:STAtions?

Query the number of currently connected users.

Return format: return the integer number, and return 0 when there is no user connection.

SYSTem:COMMunicate:WLAN:NETWork:SCAN?

Query and return the scanned list of WiFi hot spots.

Return format:

"ssid1, keymag1,lvl1", "ssid2,keymag2,lvl2",......,"ssidn,keymagn,lvln"

ssid is a name for WiFi hot spot.

Keymag means whether or not to encrypt. If it is encrypted, the keymag is "Encrypted"; if no

encryption, the keymag is "Open".

lvl means the number of WiFi signals, ranging from 0 to 4

SYSTem:COMMunicate:WLAN:NETWork:LIST?

Return the saved list of WiFi hot spots.

Return format:

"ssid1, pw1,state1", "ssid2,pw2,state2",......,"ssidn,pwn,staten"

ssid is a name for WiFi hot spot

PW means the WiFi password

State means the current state, 0 indicates no connection, 1 indicates that IP is being acquired, and

2 indicates that it is connected.

SYSTem:COMMunicate:WLAN:NETWork:ADD <ssid>, <psk>

Add WiFi hot spots to the list of hot spots in the system saved

Parameter	Default	Typical Return
<ssid>, Max. 128 characters	--	Return 0 means success, Return other means failure
<psk>, Max. 128 characters	--	

For example:

Add the hotspot "hello" and the password "123456" to the WiFi list:

SYSTem:COMMunicate:WLAN:NETWork:ADD "hello", "123456"

SYSTem:COMMunicate:WLAN:NETWork:ENABle <ssid>

Connect the hotspot named "ssid".

Parameter	Default	Typical Return
<ssid>, Max. 128 characters	--	Return 0 means success, Return other means failure

For example:

Connect the hotspot named "hello":

SYSTem:COMMunicate:WLAN:NETWork:ENABle "hello"

SYSTem:COMMunicate:WLAN:NETWork:DISAble <ssid>

Disconnect the WiFi hot spot named "ssid".

Parameter	Default	Typical Return
<ssid>, Max. 128 characters	--	Return 0 means success, Return other means failure

For example,

Disconnect the WiFi hot spot named "hello":

SYSTem:COMMunicate:WLAN:NETWork:DISAble "hello"

SYSTem:COMMunicate:WLAN:NETWork:REMOve <ssid>

Remove the hotspot from the WiFi list saved in the system.

Parameter	Default	Typical Return
<ssid>, Max. 128 characters	--	Return 0 means success, Return other means failure

For example,

Remove the hotspots named "hello" from the WiFi list saved in the system:

SYSTem:COMMunicate:WLAN:NETWork:REMOve "hello"

2.26 VOLTage Subsystem

The VOLTage subsystem sets parameters related to output voltage.

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

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

Sets output amplitude.

Parameter	Typical Return
2 mVpp to 20 Vpp, default 200mVpp	+10.0000000000000E+00
Set output amplitude on CH1 to 10Vpp: SOURce1:VOLTage 10	

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

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

Sets DC offset voltage.

Parameter	Typical Return
-10 to +10V, default 0V	+1.0000000000000E-01
Set offset voltage to on CH1 100 mV: SOURce1:VOLTage:OFFSet 0.1	

◆ The relationship between offset voltage and output amplitude is shown below.

   $|Voffset| < Vmax - Vpp/2$

◆ Setting the high and low levels also sets the waveform amplitude and offset. For example, if you set the high level to +2 V and the low level to -3 V, the resulting amplitude is 5 Vpp, with a -500 mV offset.

2.27 Word Subsystem

OUTPutL1

OUTPutL1 ON|OFF   Open or close the word signal output
OUTPutL1?   Query the word signal state

Parameter	Default	Typical Return
--, ON|OFF	OFF	ON or OFF

For example,

Open the word signal output:

OUTPutL1 ON

Query and return to ON:

OUTPutL1?

OUTPutL1:SYNC:SOURce

OUTPutL1:SYNC:SOURce CH1|CH2

When the output waveform of the word generator is synchronous, set the synchronization channel.

OUTPutL1:SYNC:SOURce?

Query the current synchronization channel

Parameter	Default	Typical Return
--, CH1|CH2	CH1	CH1 or CH2

For example,

Set the synchronization channel to CH1:

OUTPutL1:SYNC:SOURce CH1

Query and return to CH1:

OUTPutL1:SYNC:SOURce?

SOURceL1:FUNCtion

SOURceL1:FUNCtion SYNC|DATA

Set the output type of word signal.

SOURceL1:FUNCtion?

Query the current output type of word signal.

Parameter	Default	Typical Return
--, SYNC|DATA	SYNC	SYNC or DATA

For example,

Set the output type of word signal to DATA:

SOURceL1:FUNCtion DATA

Query and return to DATA:

SOURceL1:FUNCtion?

SOURceL1:DATA:PIN\<n\>

SOURceL1:DATA:PIN\<n\> HIGH|LOW

Setting the level state corresponding to each pin of a word signal

SOURceL1:DATA:PIN\<n\>?

Query the level state corresponding to each pin of a word signal

Parameter	Default	Typical Return
--, HIGH|LOW	LOW	HIGH or LOW

For example,

Change the word signal waveform Pin1 to high level:

SOURceL1:DATA:PIN1 HIGH

Query the level of Pin1 and return to HIGH:

SOURceL1:DATA:PIN1?

3 Programming Examples

These programming examples help you get started with common tasks.

Configure a Sine Wave

Configure a Square Wave
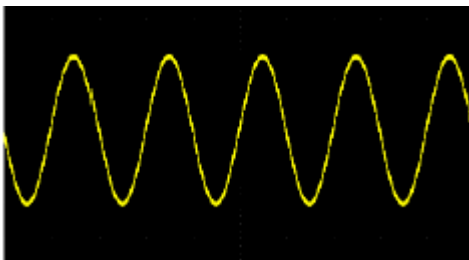
Configure a Ramp Wave

Configure a Pulse Wave

3.1 Configure a Sine Wave

This section describes the configuration of a sine wave function.

Description

A sine wave has amplitude, offset, and phase relative to sync pulse.

The following commands produce the sine wave shown above.

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

3.2 Configure a Square Wave

Description

A square wave has amplitude, offset, and phase relative to sync pulse. It also has duty cycle and period. Its amplitude and offset can also be set using high and low voltage values.

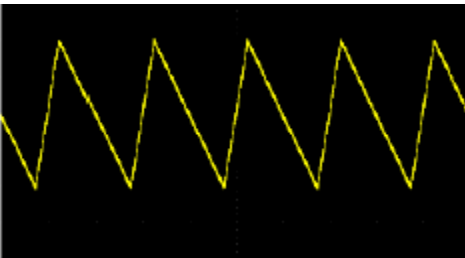The following commands produce the square wave shown above.
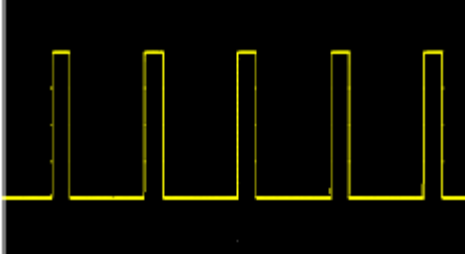
```
SOURce1:FUNCtion SQUare
SOURce1:FUNCtion:SQUare:DCYCle 20
SOURce1:FREQuency 100000
SOURce1:VOLTage 4
OUTPut1 ON
```

3.3 Configure a Ramp Wave

Description

A ramp wave has amplitude, offset, and phase relative to sync pulse. It also has symmetry for creating triangular and other similar waveforms.

The following commands produce the ramp wave shown above.


```
SOURce1:FUNCtion RAMP
SOURce1:FUNCtion:RAMP:SYMMetry 25
SOURce1:FREQuency 1000
SOURce1:VOLTage 2
SOURce1:VOLTage:OFFSet 1.0
OUTPut1 ON
```

3.4 Configure a Pulse Wave

Description

A pulse wave has amplitude, offset, and phase relative to sync pulse. It also adds edge slope, period, and duty cycle (orpulse width). Its amplitude and offset can also be set using high and low voltage values.

The following commands produce the pulse wave shown above.

SOURce1:FUNCtion PULS
SOURce1:FUNCtion:PULSe:TRANsition:LEADing 0.00000004
SOURce1:FUNCtion:PULSe:TRANsition:TRAiling 0.000001
SOURce1:FUNCtion:PULSe:WIDTh 0.000003
SOURce1:FREQuency 200000
SOURce1:VOLTage 3
OUTPut1 ON

Appendix SCPI command

HDG2000B Series Command Quick Reference

DATA Commands
SOURce<n>:DATA:DOWNload iStartPoint, iPointLen
SOURce1:DATA:OUTPut iStartPoint, iPointLen
SOURce1:DATA:DAC16:BIN iAllDotNum, iSumDotNum, iNowDotNum, #xy...yz...z
SOURce1:DATA:DAC16 iAllDotNum, iSumDotNum, iNowDotNum, {,value, value, ...,
value}
SOURce1:DATA iAllDotNum, iSumDotNum, iNowDotNum, {,value, value, ..., value}
SOURce1:DATA:FREQ:SPS sps
SOURce1:DATA:FREQ:SPS? [MINimum|MAXimum]
SOURce1:DATA:RAM:DAC16:BIN iAllDotNum, iSumDotNum, iNowDotNum, #xy...yz...z
SOURce1:DATA:RAM:DAC16 iAllDotNum, iSumDotNum, iNowDotNum, {,value, value, ...,
value}
SOURce1:RAM:DATA iAllDotNum, iSumDotNum, iNowDotNum, {,value, 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]

RAMP

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

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

PLUSE

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 Commands

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

Word signal
OUTPutL1 ON|OFF
OUTPutL1?
OUTPutL1:SYNC:SOURce CH1|CH2
OUTPutL1:SYNC:SOURce?
SOURceL1:FUNCtion SYNC|DATA
SOURceL1:FUNCtion?
SOURceL1:DATA:PIN<n> HIGH|LOW
SOURceL1:DATA:PIN<n>?

State Storage
MEMory:STATe:VALid? USER1|USER2|USER3|USER4|USER5
MEMory:STATe:DELete USER1|USER2|USER3|USER4|USER5

Mass 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>
MMEMory:DATA

System
DISPlay:BRIGhtness <brightness>|MINimum|MAXimum
DISPlay:BRIGhtness? [MINimum|MAXimum]
DISPlay:SAVer ON|OFF
DISPlay:SAVer ?

Remote Interface Configuration
SYSTem:BEEPer:STATe ON|OFF
SYSTem:BEEPer
SYSTem:LANGuage ENGLish|SCHinese，SYSTem:LANGuage?
SYSTem:KLOCk ON|OFF
SYSTem:KLOCk?

SYSTem:ERRor?
SYSTem:ROSCillator:SOURce INTernal|EXTernal
SYSTem:ROSCillator:SOURce?
SYSTem:VERSion?
SYSTem:DATE <year>, <month>, <day>
SYSTem:DATE?
SYSTem:TIME <hour>, <minute>, <second>
SYSTem:TIME?
DISPlay:BRIGhtness <brightness>|MINimum|MAXimum
DISPlay:BRIGhtness? [MINimum|MAXimum]
DISPlay:SAVer ON|OFF
DISPlay:SAVer ?
SYSTem:COMMunicate:<W>LAN:AUTOip[:STATe] ON|OFF
SYSTem:COMMunicate:<W>LAN:AUTOip[:STATe]?
SYSTem:COMMunicate:<W>LAN:DHCP[:STATe] ON|OFF
SYSTem:COMMunicate:<W>LAN:DHCP[:STATe]?
SYSTem:COMMunicate:<W>LAN:DNS <address>
SYSTem:COMMunicate:<W>LAN:DNS?
SYSTem:COMMunicate:LAN:GATEway <address>
SYSTem:COMMunicate:LAN:GATEway?
SYSTem:COMMunicate:LAN:IPADdress < address>
SYSTem:COMMunicate:LAN:IPADdress?
SYSTem:COMMunicate:LAN:SMASk <mask>
SYSTem:COMMunicate:LAN:SMASk?
SYSTem:COMMunicate:<W>LAN:STATic[:STATe] ON|OFF
SYSTem:COMMunicate:<W>LAN:STATic[:STATe]?
SYSTem:COMMunicate:LAN:MAC?
SYSTem:COMMunicate:<W>LAN[:STATe] ON|OFF
SYSTem:COMMunicate:<W>LAN[:STATe]?
SYSTem:COMMunicate:<W>LAN:RX[:BYTEs]?
SYSTem:COMMunicate:<W>LAN:TX[:BYTEs]?
SYSTem:COMMunicate:WLAN:HOTPot[:STATe] ON|OFF
SYSTem:COMMunicate:WLAN:HOTPot[:STATe]?
SYSTem:COMMunicate:WLAN:HOTPot:KEYMgmt NONE|WPAPSK
SYSTem:COMMunicate:WLAN:HOTPot:KEYMgmt?
SYSTem:COMMunicate:WLAN:HOTPot:SSID <name>
SYSTem:COMMunicate:WLAN:HOTPot:SSID?
SYSTem:COMMunicate:WLAN:HOTPot:PSK <password>
SYSTem:COMMunicate:WLAN:HOTPot:PSK?
SYSTem:COMMunicate:WLAN:HOTPot:CHANnel <channel>
SYSTem:COMMunicate:WLAN:HOTPot:CHANnel?
SYSTem:COMMunicate:WLAN:HOTPot:MAXStation <number>
SYSTem:COMMunicate:WLAN:HOTPot:MAXStation?
SYSTem:COMMunicate:WLAN:HOTPot:DHCP:RANGe <begain>, <end>, <mask>

SYSTem:COMMunicate:WLAN:HOTPot:DHCP:RANGe?
SYSTem:COMMunicate:WLAN:HOTPot:STAtions?
SYSTem:COMMunicate:WLAN:NETWork:SCAN?
SYSTem:COMMunicate:WLAN:NETWork:LIST?
SYSTem:COMMunicate:WLAN:NETWork:ADD <ssid>, <psk>
SYSTem:COMMunicate:WLAN:NETWork:ENABle <ssid>
SYSTem:COMMunicate:WLAN:NETWork:DISAble <ssid>
SYSTem:COMMunicate:WLAN:NETWork:REMOve <ssid>

Phase-Lock
SOURce<n>:PHASe <phase>|MINimum|MAXimum
SOURce<n>:PHASe? [MINimum|MAXimum]
SOURce<n>:PHASe:SYNChronize

Counter
COUNter:STATe ON|OFF
COUNter:STATe?
COUNter:MEASure?
COUNter:GATEtime AUTO|USER1|USER2|USER3|USER4|USER5|USER6
:COUNter:GATEtime?
COUNter:SENSitive |MINimum|MAXimum
COUNter:SENSitive?
COUNter:LEVE |MINimum|MAXimum
COUNter:LEVE?

IEEE-488
*IDN?
*RCL
*SAV
*RST
*TRG
*TST?

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