



## **Programming Guide**

# **DG1000 Series Dual-Channel Function/Arbitrary Waveform Generator**

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**RIGOL Technologies, Inc.**



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## **Structure of this Document**

### **Chapter 1 Programming Overview**

This chapter introduces how to programme DG1000 generator using commands and how to input the commands in right format.

### **Chapter 2 DG1000 Command System**

This chapter gives detailed information of each command supported by DG1000, including command syntax, function description, considerations when using command as well as some application examples.

### **Chapter 3 Application Examples**

This chapter shows you how to realize the examples in DG1000 User's Guide via commands.

### **Appendix: Commands Reference A-Z**

The Appendix lists all the commands alphabetically in favor of quick reference.

#### **Note:**

DG1000 series Dual-channel Function/Arbitrary Waveform Generator includes DG1022 and DG1022A. In this manual, DG1022 is taken as an example to illustrate the command system and its using method.

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# Chapter 1 Programming Overview

This chapter introduces how to programme DG1000 series Dual-channel function/arbitrary waveform generator using commands and how to input commands in right format.

This chapter contains the following sections:

- Communication Interfaces
- Commands Introduction
  - Command Syntax*
  - Symbol Description*
  - Parameter Type*
  - Command Abbreviation*

## Communication Interfaces

Computers communicate with the generator by sending and receiving commands over USB interface. Command is sent and identified in the form of ASCII character strings for users to easily control the generator and do user-defined development.

Operations that you can do with a computer and a generator include:

- Set the generator.
- Output waveforms from the generator.

Connection:

Please connect the USB Device port at the rear panel of DG1000 with the corresponding USB interface on the computer using an USB cable.



## Commands Introduction

### Command Syntax

The command systems of DG1000 present a hierarchy structure (tree system) and each command consists of a "Root" keyword and one or multiple sub-keywords. The keywords are separated by ":" and are followed by the parameter settings available, "?" is added at the end of the command string to indicate query and the command and parameter are separated by "space".

For example,

```
FUNCTION:SQUare:DCYCLE {<percent>|MINimum|MAXimum}
```

```
FUNCTION:SQUare:DCYCLE? [MINimum|MAXimum]
```

**FUNCTION** is the root keyword of the command, **SQUare** and **DCYCLE** are the second-level and third-level keywords respectively, all the keywords are separated by ":". <percent> denotes the parameter that users can set; "?" denotes query; the command **FUNCTION:SQUare:DCYCLE** and parameter are separated by "space".

"," is usually used to compare multiple parameters existed in one command, for example,

```
DATA VOLATILE,<value>,<value>,...
```

## Symbol Description

Following symbols are usually used to assist to explain the parameters contained in a command.

### 1. Braces { }

The options enclosed in a { } are parameters available in the command. Only one option could be selected every time, and all the options are separated by "|".

For example, {ON|OFF} indicates that **ON** or **OFF** can be selected.

### 2. Square Brackets [ ]

The content in square brackets is optional and could be omitted, but could be executed regardless whether it is omitted. For example,

DATA:COPY <destination arb name>[,VOLATILE]

This command copies the wave from volatile memory to the specified nonvolatile memory. Wherein, [,VOLATILE] could be omitted.

### 3. Triangle Brackets < >

The parameter enclosed in < > must be replaced by an effective value.

For example,

DISPlay:CONTRAST <value>

wherein, <value> must be a numerical value, such as:

DISPlay:CONTRAST 25

# Parameter Type

The commands contain 5 kinds of parameters, different parameters have different setting methods.

## 1. Boolean Parameters

The parameters could be "OFF" or "ON" ("0" or "1"), for example,

AM:STATE {OFF|ON}

"OFF" denotes disabling AM function. "On" denotes enabling AM function.

## 2. Consecutive Integer Parameters

The parameters could be a consecutive integer, for example,

DISPlay:CONTRAST <value>

<value> could be any integer between 0 and 31(including 0 and 31).

## 3. Consecutive Real Number Parameters

The parameters could be any value within the effective range and with the required precision, for example,

FREQuency {<frequency>|MINimum|MAXimum}

For sine wave, <frequency> could be any real number between 1uHz and 20MHz.

## 4. Discrete Parameters

The parameters could be a cited value, for example,

MEMory:STATe:NAME? {0|1|2|3|4|5|6|7|8|9|10}

The parameter could only be 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10.

## 5. ASCII Character String

The parameters should be the combinations of ASCII characters, for example,

DATA:COPY <destination arb name>[,VOLATILE]

<destination arb name> is a character string defined by user.

## Command Abbreviation

All the commands are case-insensitive, so you can use any kind of them. But if abbreviation is used, all the capital letters specified in commands must be written completely. For example,

FUNCTION:SQUare:DCYCLE? also can be:

FUNC:SQU:DCYC? or func:squ:dcyc?

## Chapter 2 DG1000 Command System

This chapter gives detailed information of each command supported by DG1000, including command syntax, function description, using considerations as well as some application examples.

DG1000 contains following command sub-systems:

- IEEE 488.2
- APPLy
- FUNCtion
- FREQuency
- VOLTage
- OUTPut
- PULSe
- AM
- FM
- PM
- FSKey
- SWEep
- TRIGger
- BURSt
- DATA
- MEMory
- SYSTem
- PHASe
- DISPlay
- COUPLing
- COUNter

## IEEE 488.2

IEEE standard defines some common commands for querying basic instrument information or executing basic operations. These commands usually begin with "\*" and hold 3-character long command keyword.

DG1000 supports following IEEE488.2 commands:

### 1. \*IDN?

1. *IDN?	
Syntax	*IDN?
Function	Query ID character string of instrument.
Return Value	The query returns 4 character segments separated by commas ",": manufacterer, model, serial number and the edition number that consists of numbers separated by "." . For example, RIGOL TECHNOLOGIES,DG1022,DG1D100,00.02.00.06.00.02.06

## APPLy

**APPLy** commands are used to quickly set the output waveforms of DG1000 and provide the most straightforward method to program the generator over remote interface.

DG1000 supports following **APPLy** commands:

1. APPLy:SINusoid
2. APPLy:SQUare
3. APPLy:RAMP
4. APPLy:PULSe
5. APPLy:NOISe
6. APPLy:DC
7. APPLy:USER
8. APPLy?
9. APPLy:SINusoid:CH2
10. APPLy:SQUare:CH2
11. APPLy:RAMP:CH2
12. APPLy:PULSe:CH2
13. APPLy:NOISe:CH2
14. APPLy:DC:CH2
15. APPLy:USER:CH2
16. APPLy:CH2?

Detailed information of each command:

<b>1. APPLy:SINusoid</b>	
Syntax	APPLy:SINusoid [<frequency>[,<amplitude>[,<offset>]]]
Function	Generate a sine wave with specific frequency, amplitude and DC offset via CH1.
Explanations	<ul style="list-style-type: none"> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:SIN 1000,5.0,-1.5
<b>2. APPLy:SQUare</b>	
Syntax	APPLy:SQUare [<frequency>[,<amplitude>[,<offset>]]]
Function	Generate a square wave with specific frequency, amplitude and DC offset via CH1. This command would overwrite the current duty cycle setting and select 50% automatically.
Explanations	<ul style="list-style-type: none"> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:SQU 1000,5.0,-1.5
<b>3. APPLy:RAMP</b>	
Syntax	APPLy:RAMP [<frequency>[,<amplitude>[,<offset>]]]
Function	Generate a ramp wave with specific frequency, amplitude and DC offset via CH1. This command would overwrite the current symmetry setting and select 50% automatically.
Explanations	<ul style="list-style-type: none"> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:RAMP 1000,5.0,-1.5
<b>4. APPLy:PULSe</b>	
Syntax	APPLy:PULSe [<frequency>[,<amplitude>[,<offset>]]]
Function	Generate a pulse wave with specific frequency, amplitude and DC



	offset via CH1.
Explanations	<ul style="list-style-type: none"> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:PULS 1000,5.0,-1.5
<b>5. APPLy:NOISe</b>	
Syntax	APPLy:NOISe [<frequency  DEFAult>[,<amplitude>[,<offset>]]]
Function	Generate a Gaussian noise with specific amplitude and DC offset via CH1.
Explanations	<ul style="list-style-type: none"> <li>● Although the frequency parameter makes no impression on this command, a value or "DEFAult" must be specified. (noise function has a 5MHz bandwidth)</li> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:NOIS DEF,5.0,2.0
<b>6. APPLy:DC</b>	
Syntax	APPLy:DC [<frequency DEFAult>[,<amplitude> DEFAult>[,<offset>]]]
Function	Generate a DC signal with electrical level specified by < offset > via CH1.
Explanations	<ul style="list-style-type: none"> <li>● Although the frequency and amplitude parameters make no impression on this command, a value or "DEFAult" must be specified.</li> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:DC DEF,DEF,-2.5
<b>7. APPLy:USER</b>	
Syntax	APPLy:USER [<frequency>[,<amplitude>[,<offset>]]]
Function	Generate an arbitrary wave (with specific frequency, amplitude and

	DC offset) selected by the <b>FUNCTION:USER</b> command via CH1.
Explanations	<ul style="list-style-type: none"> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:USER 1000,5.0,-1.5
<b>8. APPLy?</b>	
Syntax	APPLy?
Function	Query the current configuration of CH1 and the type of wave outputted.
Return Value	The query returns a character string enclosed in double quotation marks, including function, frequency, amplitude and offset. Such as, CH1:"SIN,1.000000e+03,5.000000e+00,-1.500000e+00"
<b>9. APPLy:SINusoid:CH2</b>	
Syntax	APPLy:SINusoid:CH2 [<frequency>[,<amplitude>[,<offset>]]]
Function	Generate a sine wave with specific frequency, amplitude and DC offset via CH2.
Explanations	<ul style="list-style-type: none"> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:SIN:CH2 1000,5.0,-1
<b>10. APPLy:SQUare:CH2</b>	
Syntax	APPLy:SQUare:CH2 [<frequency>[,<amplitude>[,<offset>]]]
Function	Generate a square wave with specific frequency, amplitude and DC offset via CH2. This command would overwrite the current duty cycle setting and select 50% automatically.
Explanations	<ul style="list-style-type: none"> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:SQU:CH2 1000,5.0,-1
<b>11. APPLy:RAMP:CH2</b>	

Syntax	APPLy:RAMP:CH2 [<frequency>[,<amplitude>[,<offset>]]]
Function	Generate a ramp wave with specific frequency, amplitude and DC offset via CH2. This command would overwrite the current symmetry setting and select 50% automatically.
Explanations	<ul style="list-style-type: none"> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:RAMP:CH2 1000,5.0,0.5

## 12. APPLy:PULSe:CH2

Syntax	APPLy:PULSe:CH2 [<frequency>[,<amplitude>[,<offset>]]]
Function	Generate a pulse wave with specific frequency, amplitude and DC offset via CH2.
Explanations	<ul style="list-style-type: none"> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:PULS:CH2 1000,5.0,0.5

## 13. APPLy:NOISe:CH2

Syntax	APPLy:NOISe:CH2[<frequency DEFault>[,<amplitude>[,<offset>]]]
Function	Generate a Gaussian noise with specific amplitude and DC offset via CH2.
Explanations	<ul style="list-style-type: none"> <li>● Although the frequency parameter makes no impression on this command, a value or "DEFault" must be specified. (noise function has a 5MHz bandwidth)</li> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:NOIS:CH2 DEF, 5.0, 0.5

## 14. APPLy:DC:CH2

Syntax	APPLy:DC:CH2[<frequency DEFault>[,<amplitude> DEFault>[,<offset>]]]
Function	Generate a DC signal with electrical level specified by <offset> via

	CH2.
Explanations	<ul style="list-style-type: none"> <li>● Although the frequency and amplitude parameters make no impression on this command, a value or "DEFault" must be specified.</li> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:DC:CH2 DEF,DEF,1.5
<b>15. APPLy:USER:CH2</b>	
Syntax	APPLy:USER:CH2 [<frequency>[,<amplitude>[,<offset>]]]
Function	Generate an arbitrary wave (with specific frequency, amplitude and DC offset) selected by the <b>FUNCTION:USER:CH2</b> command via CH2.
Explanations	<ul style="list-style-type: none"> <li>● If the parameters you set are less than three, the sequence would be: &lt;frequency&gt;, &lt;amplitude&gt;, &lt;offset&gt;.</li> <li>● The default units of &lt;frequency&gt;, &lt;amplitude&gt; and &lt;offset&gt; are Hz, V<sub>pp</sub> and V<sub>DC</sub> respectively.</li> </ul>
Example	APPL:USER:CH2 1000,5.0,-1.5
<b>16. APPLy:CH2?</b>	
Syntax	APPLy:CH2?
Function	Query the current configuration of CH2 and the type of wave outputted.
Return Value	The query returns a character string enclosed in double quotation marks, including function, frequency, amplitude and offset. Such as, CH2:"SIN,1.000000e+03,5.000000e+00,-1.500000e+00".

## **FUNCTION**

**FUNCTION** commands are used for setting the output function and their parameters; selecting carrier wave function in modulation mode; choosing any one from 48 built-in arbitrary waveforms and 10 user-defined waveforms, or the waveform downloaded to volatile memory currently.

DG1000 supports following **FUNCTION** commands:

1. FUNCTION
2. FUNCTION?
3. FUNCTION:USER
4. FUNCTION:USER?
5. FUNCTION:SQUare:DCYClE
6. FUNCTION:SQUare:DCYClE?
7. FUNCTION:RAMP:SYMMetry
8. FUNCTION:RAMP:SYMMetry?
9. FUNCTION:CH2
10. FUNCTION:CH2?
11. FUNCTION:USER:CH2
12. FUNCTION:USER:CH2?
13. FUNCTION:SQUare:DCYClE:CH2
14. FUNCTION:SQUare:DCYClE:CH2?
15. FUNCTION:RAMP:SYMMetry:CH2
16. FUNCTION:RAMP:SYMMetry:CH2?

Detailed information of each command:

1. FUNCtion	
Syntax	FUNCtion {SINusoid SQUare RAMP PULSe NOISe DC USER}
Function	Select the output function for CH1.
Explanation	If <b>FUNC DC</b> is sent first and then <b>FUNC USER</b> , the output is still DC.
Example	FUNC SIN
2. FUNCtion?	
Syntax	FUNCtion?
Function	Query the output function of CH1.
Explanation	The query always returns CH1:ARB after sending <b>FUNC DC</b> or <b>FUNC USER</b> .
Example	The query returns CH1:SIN, CH1:SQU, CH1:RAMP, CH1:PULS, CH1:NOIS or CH1:ARB, the default is CH1:SIN.
3. FUNCtion:USER	
Syntax	FUNCtion:USER {<name of arbitrary wave> VOLATILE}
Function	Select any wave from built-in arbitrary waves,10 user-defined waves or waves that have been downloaded into volatile memory for CH1.
Explanations	<ul style="list-style-type: none"> <li>The built-in waves contain:  Common:  NegRamp/AttALT/AmpALT/StairDown/StairUp/StairUD/Cpulse/PPulse/NPulse/Trapezia/RoundHalf/AbsSine/AbsSineHalf/SINE_TRA/SINE_VER  Math:  Exp_Rise/Exp_Fall/Tan/Cot/Sqrt/X^2/Sinc/Gauss/HaverSine/Lorentz/Dirichlet/GaussPulse/Airy  Project:  Cardiac/Quake/Gamma/Voice/TV/Combin/BandLimited/Stepresponse/Butterworth/Chebyshev1/ Chebyshev2  Window Function:  Boxcar/Barlett/triang/Blackman/Hamming/Hanning/Kaiser  Others:  Roundpm/DC </li> </ul>

	<ul style="list-style-type: none"> <li>Send the <b>FUNC DC</b> command to select DC.</li> </ul>
Example	FUNC:USER VOLATILE
<b>4. FUNCTION:USER?</b>	
Syntax	FUNCTION:USER?
Function	Query the name of arbitrary wave generated from CH1.
Explanation	This command is invalid when DC is selected.
Return Value	The query returns the name of built-in arbitrary wave selected (such as EXP_RISE), VOLATILE or the name of any of the user-defined waves in nonvolatile memory. The default is EXP_RISE.
<b>5. FUNCTION:SQUare:DCYCLE</b>	
Syntax	FUNCTION:SQUare:DCYCLE {<percent> MINimum MAXimum}
Function	Set the duty cycle of square wave for CH1.
Explanation	<percent> is the percent of duty cycle selected, MIN is the minimum duty cycle of the selected frequency and MAX is the maximum.
Example	FUNC:SQU:DCYC 50
<b>6. FUNCTION:SQUare:DCYCLE?</b>	
Syntax	FUNCTION:SQUare:DCYCLE? [MINimum MAXimum]
Function	Query the duty cycle of square wave from CH1.
Return Value	The query returns the current duty cycle setting, such as 50.000000.
<b>7. FUNCTION:RAMP:SYMMetry</b>	
Syntax	FUNCTION:RAMP:SYMMetry {<percent> MINimum MAXimum}
Function	Set the symmetry of ramp wave output from CH1.
Explanation	<percent> is the selected percent of symmetry; MIN=0, MAX=100.
Example	FUNC:RAMP:SYMM 50
<b>8. FUNCTION:RAMP:SYMMetry?</b>	
Syntax	FUNCTION:RAMP:SYMMetry? [MINimum MAXimum]
Function	Query the symmetry of ramp wave output from CH1.
Return	The query returns the current symmetry setting, such as

Value	50.000000.
<b>9. FUNCTION:CH2</b>	
Syntax	FUNCTION:CH2 {SINusoid SQUare RAMP PULSe NOISe DC USER}
Function	Select the output function of CH2.
Explanation	If <b>FUNC:CH2 DC</b> is sent first and then <b>FUNC:CH2 USER</b> , the output is still DC.
Example	FUNC:CH2 SIN
<b>10. FUNCTION:CH2?</b>	
Syntax	FUNCTION:CH2?
Function	Query the output function of CH2.
Explanation	The query always returns CH2:ARB after sending <b>FUNC:CH2 DC</b> or <b>FUNC:CH2 USER</b> .
Example	The query returns CH2:SIN, CH2:SQU, CH2:RAMP, CH2:PULS, CH2:NOIS or CH2:ARB, the default is CH2:SIN.
<b>11. FUNCTION:USER:CH2</b>	
Syntax	FUNCTION:USER:CH2 {< name of arbitrary wave > VOLATILE}
Function	Select any owave from built-in arbitrary waves, 10 user-defined waves or waves that have been loaded into volatile memory for CH2.
Explanations	<ul style="list-style-type: none"> <li>The built-in waves contain:           <p>Common: NegRamp/AttALT/AmpALT/StairDown/StairUp/StairUD/Cpulse/PPulse/NPulse/Trapezia/RoundHalf/AbsSine/AbsSineHalf/SINE_TRA/SINE_VER</p> <p>Math: Exp_Rise/Exp_Fall/Tan/Cot/Sqrt/X^2/Sinc/Gauss/HaverSine/Lorentz/Dirichlet/GaussPulse/Airy</p> <p>Project: Cardiac/Quake/Gamma/Voice/TV/Combin/BandLimited/Stepresponse/Butterworth/Chebyshev1/ Chebyshev2</p> <p>Window Function: Boxcar/Barlett/triang/Blackman/Hamming/Hanning/Kaiser</p> <p>Others: Roundpm/DC</p> </li> </ul>



	<ul style="list-style-type: none"> <li>Send the <b>FUNC:CH2 DC</b> command when DC is used.</li> </ul>
Example	FUNC:USER:CH2 SINC
<b>12. FUNCtion:USER:CH2?</b>	
Syntax	FUNCtion:USER:CH2?
Function	Query the name of arbitrary wave generated from CH2.
Explanation	This command is invalid when DC is selected.
Return Value	The query returns the name of built-in arbitrary wave selected (such as EXP_RISE), VOLATILE or the name of any of the user-defined waves in nonvolatile memory. The default is EXP_RISE.
<b>13. FUNCtion:SQUare:DCYCLE:CH2</b>	
Syntax	FUNCtion:SQUare:DCYCLE:CH2 {<percent> MINimum MAXimum}
Function	Set the duty cycle of square wave for CH2.
Explanation	<percent> is the percent of duty cycle selected, MIN is the minimum duty cycle of the selected frequency and MAX is the maximum.
Example	FUNC:SQU:DCYC:CH2 50
<b>14. FUNCtion:SQUare:DCYCLE:CH2?</b>	
Syntax	FUNCtion:SQUare:DCYCLE:CH2? [MINimum   MAXimum]
Function	Query the duty cycle of square wave output from CH2.
Return Value	The query returns the current duty cycle setting, such as: 50.000000.
<b>15. FUNCtion:RAMP:SYMMetry:CH2</b>	
Syntax	FUNCtion:RAMP:SYMMetry:CH2 {<percent> MINimum MAXimum}
Function	Set the symmetry of ramp wave output from CH2.
Explanation	<percent> is the percent of symmetry selected; MIN=0, MAX=100.
Example	FUNC:RAMP:SYMM:CH2 50
<b>16. FUNCtion:RAMP:SYMMetry:CH2?</b>	
Syntax	FUNCtion:RAMP:SYMMetry:CH2? [MINimum MAXimum]
Function	Query the symmetry of ramp wave output from CH2.
Return	The query returns the current symmetry setting, such as:

Value	50.000000.
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## FREQuency

**FREQuency** commands are used for setting the frequencies of output functions of dual channels; the start/stop frequency, the center/span frequency in sweep mode, the carrier frequency in modulation. Sweep and modulation are only valid for CH1.

DG1000 supports following **FREQuency** commands:

1. FREQuency
2. FREQuency?
3. FREQuency:CH2
4. FREQuency:CH2?
5. FREQuency:START
6. FREQuency:START?
7. FREQuency:STOP
8. FREQuency:STOP?
9. FREQuency:CENTer
10. FREQuency:CENTer?
11. FREQuency:SPAN
12. FREQuency:SPAN?

Detailed information of each command:

<b>1. FREQuency</b>	
Syntax	FREQuency {<frequency> MINimum MAXimum}
Function	Set the frequency of output function for CH1.
Explanation	<frequency> is the frequency set by user, the default unit is Hz. MIN is the minimum frequency available for the specified function, MAX is the maximum.
Example	FREQ MIN
<b>2. FREQuency?</b>	
Syntax	FREQuency? [MINimum MAXimum]
Function	Query the frequency of output function of CH1.
Return Value	The query returns the frequency set in scientific notation and in Hz, such as: 1.000000e-06.
<b>3. FREQuency:CH2</b>	
Syntax	FREQuency:CH2 {<frequency> MINimum MAXimum}
Function	Set the frequency of output function for CH2.
Explanation	<frequency> is the frequency set by user, the default unit is Hz. MIN is the minimum frequency available for the specified function, MAX is the maximum.
Example	FREQ:CH2 MIN
<b>4. FREQuency:CH2?</b>	
Syntax	FREQuency:CH2? [MINimum MAXimum]
Function	Query the frequency of output function of CH2.
Return Value	The query returns the frequency set in scientific notation and in Hz, such as: CH2:1.000000e-06.
<b>5. FREQuency:STARt</b>	
Syntax	FREQuency:STARt {<frequency> MINimum MAXimum}
Function	Set the start frequency (used in conjunction with the stop frequency) in sweep mode.
Example	FREQ:STAR MIN
<b>6. FREQuency:STARt?</b>	

Syntax	FREQuency:START? [MINimum MAXimum]
Function	Query the start frequency in sweep mode.
Return Value	The query returns the start frequency set in scientific notation and in Hz, such as: 1.000000e-06.
<b>7. FREQuency:STOP</b>	
Syntax	FREQuency:STOP {<frequency> MINimum MAXimum}
Function	Set the stop frequency (used in conjunction with start frequency) in sweep mode.
Example	FREQ:STOP MAX
<b>8. FREQuency:STOP?</b>	
Syntax	FREQuency:STOP? [MINimum MAXimum]
Function	Query the stop frequency in sweep mode.
Return Value	The query returns the stop frequency set in scientific notation and in Hz, such as: 2.000000e+07.
<b>9. FREQuency:CENTer</b>	
Syntax	FREQuency:CENTer {<frequency> MINimum MAXimum}
Function	Set the center frequency (used in conjunction with frequency span) in sweep mode.
Example	FREQ:CEN 10000000
<b>10. FREQuency:CENTer?</b>	
Syntax	FREQuency:CENTer? [MINimum MAXimum]
Function	Query the center frequency in sweep mode.
Return Value	The query returns the center frequency set in scientific notation and in Hz, such as: 1.000000e+07.
<b>11. FREQuency:SPAN</b>	
Syntax	FREQuency:SPAN {<frequency> MINimum MAXimum}
Function	Set the frequency span (used in conjunction with center frequency) in sweep mode.
Example	FREQ:SPAN MAX
<b>12. FREQuency:SPAN?</b>	
Syntax	FREQuency:SPAN? [MINimum MAXimum]

Function	Query the frequency span in sweep mode.
Return Value	The query returns the frequency span set in scientific notation and in Hz, such as: 2.000000e+07.

## VOLTage

**VOLTage** commands are used for setting the voltage amplitude, offset voltage, high level, low level, or the voltage unit for each channel.

DG1000 supports following **VOLTage** commands:

1. VOLTage
2. VOLTage?
3. VOLTage:HIGH
4. VOLTage:HIGH?
5. VOLTage:LOW
6. VOLTage:LOW?
7. VOLTage:OFFSet
8. VOLTage:OFFSet?
9. VOLTage:UNIT
10. VOLTage:UNIT?
11. VOLTage:CH2
12. VOLTage:CH2?
13. VOLTage:HIGH:CH2
14. VOLTage:HIGH:CH2?
15. VOLTage:LOW:CH2
16. VOLTage:LOW:CH2?
17. VOLTage:OFFSet:CH2
18. VOLTage:OFFSet:CH2?
19. VOLTage:UNIT:CH2
20. VOLTage:UNIT:CH2?

Detailed information of each command:

<b>1. VOLTage</b>	
Syntax	VOLTage {<amplitude> MINimum MAXimum}
Function	Set the output amplitude of CH1 and the default unit is Vpp.
Explanation	<amplitude> is the amplitude set by users. MIN selects the minimum amplitude of the selected function and MAX selects the maximum amplitude.
Unit	VPP, VRMS or DBM. Note that DBM could be used only in non-high resistance. The unit of voltage could be changed via sending <b>VOLTage:UNIT</b> .
Example	VOLT MIN
<b>2. VOLTage?</b>	
Syntax	VOLTage?
Function	Query the output amplitude of CH1.
Return Value	The query returns the amplitude of the function currently selected in scientific notation, such as: 4.000000e-03.
<b>3. VOLTage:HIGH</b>	
Syntax	VOLTage:HIGH {<voltage> MINimum MAXimum}
Function	Set the high level of waves output from CH1 and the default unit is V.
Explanation	<voltage> is the high level set by users. MIN selects the minimum high level available and MAX selects the maximum high level available.
Example	VOLT:HIGH MAX
<b>4. VOLTage:HIGH?</b>	
Syntax	VOLTage:HIGH?
Function	Query the high level of waves output from CH1.
Return Value	The query returns the high level set in scientific notation, such as: 1.000000e+01.
<b>5. VOLTage:LOW</b>	
Syntax	VOLTage:LOW {<voltage> MINimum MAXimum}
Function	Set the low level of waves output from CH1 and the default unit is



	V.
Explanation	<voltage>is the low level set by users. MIN selects the minimum low level available and MAX selects the maximum low level available.
Example	VOLT:LOW MIN
<b>6. VOLTage:LOW?</b>	
Syntax	VOLTage:LOW?
Function	Query the low level of waves output from CH1.
Return Value	The query returns the low level set in scientific notation, such as: -1.000000e+01.
<b>7. VOLTage:OFFSet</b>	
Syntax	VOLTage:OFFSet {<offset> MINimum MAXimum}
Function	Set the offset voltage of CH1 in $V_{DC}$ .
Explanation	< offset >is the offset voltage set by users. MIN selects the minimum DC offset voltage for specified function and amplitude. MAX selects the maximum value.
Example	VOLT:OFFS MIN
<b>8. VOLTage:OFFSet?</b>	
Syntax	VOLTage:OFFSet?
Function	Query the offset voltage of CH1.
Return Value	The query returns the offset voltage set in scientific notation, such as: -9.998000e+00.
<b>9. VOLTage:UNIT</b>	
Syntax	VOLTage:UNIT {VPP VRMS DBM}
Function	Set the unit of voltage output from CH1.
Explanation	DBM could be used only in non-high resistance.
Example	VOLT:UNIT VPP
<b>10. VOLTage:UNIT?</b>	
Syntax	VOLTage:UNIT?
Function	Query the unit of voltage output from CH1.
Return Value	The query returns VPP, VRMS or DBM.

11. VOLTage:CH2	
Syntax	VOLTage:CH2 {<amplitude> MINimum MAXimum}
Function	Set the output amplitude of CH2 and the default unit is Vpp.
Explanation	<amplitude> is the amplitude set by users. MIN selects the minimum amplitude of the specified function and MAX selects the maximum amplitude.
Unit	VPP, VRMS or DBM. Note that DBM could be used only in non-high resistance. The unit of voltage could be changed via sending <b>VOLTage:UNIT:CH2</b> .
Example	VOLT:CH2 MIN
12. VOLTage:CH2?	
Syntax	VOLTage:CH2?
Function	Query the output amplitude of CH2.
Return Value	The query returns the amplitude of the function currently selected in scientific notation, such as: CH2: 4.000000e-03.
13. VOLTage:HIGh:CH2	
Syntax	VOLTage:HIGh:CH2 {<voltage> MINimum MAXimum}
Function	Set the high level of waves output from CH2 and the default unit is V.
Explanation	<voltage> is the high level set by users. MIN selects the minimum high level available and MAX selects the maximum high level available.
Example	VOLT:HIGh:CH2 MAX
14. VOLTage:HIGh:CH2?	
Syntax	VOLTage:HIGh:CH2?
Function	Query the high level of waves output from CH2.
Return Value	The query returns the high level set in scientific notation such as: 1.500000e+00.
15. VOLTage:LOW:CH2	
Syntax	VOLTage:LOW:CH2 {<voltage> MINimum MAXimum}
Function	Set the low level of waves output from CH2 and the default unit is V.
Explanation	<voltage> is the low level set by users. MIN selects the minimum

	low level available and MAX selects the maximum low level available.
Example	VOLT:LOW:CH2 MIN
<b>16. VOLTage:LOW:CH2?</b>	
Syntax	VOLTage:LOW:CH2?
Function	Query the low level of waves output from CH2.
Return Value	The query returns the low level set in scientific notation such as: -1.500000e+00.
<b>17. VOLTage:OFFSet:CH2</b>	
Syntax	VOLTage:OFFSet:CH2 {<offset> MINimum MAXimum}
Function	Set the offset voltage of CH2 in $V_{DC}$ .
Explanation	<offset> is the offset voltage set by users. MIN selects the minimum DC offset voltage for specified function and amplitude. MAX selects the maximum value.
Example	VOLT:OFFS:CH2 MIN
<b>18. VOLTage:OFFSet:CH2?</b>	
Syntax	VOLTage:OFFSet:CH2?
Function	Query the offset voltage of CH2.
Return Value	The query returns the offset voltage set in scientific notation, such as: -0.000000e+00.
<b>19. VOLTage:UNIT:CH2</b>	
Syntax	VOLTage:UNIT:CH2 {VPP VRMS DBM}
Function	Set the unit of voltage output from CH2.
Explanation	DBM could be used only in non-high resistance.
Example	VOLT:UNIT:CH2 VPP
<b>20. VOLTage:UNIT:CH2?</b>	
Syntax	VOLTage:UNIT:CH2?
Function	Query the unit of voltage output from CH2.
Return Value	The query returns VPP, VRMS or DBM.

## OUTPut

**OUTPut** commands are used for setting the output parameters, such as: the output switch, the output loads, the polarity of the waveform, the sync output signal and the trigger output of CH1.

DG1000 supports following **OUTPut** commands:

1. OUTPut
2. OUTPut?
3. OUTPut:LOAD
4. OUTPut:LOAD?
5. OUTPut:POLarity
6. OUTPut:POLarity?
7. OUTPut:SYNC
8. OUTPut:SYNC?
9. OUTPut:TRIGger:SLOPe
10. OUTPut:TRIGger:SLOPe?
11. OUTPut:TRIGger
12. OUTPut:TRIGger?
13. OUTPut:CH2
14. OUTPut:CH2?
15. OUTPut:LOAD:CH2
16. OUTPut:LOAD:CH2?
17. OUTPut:POLarity:CH2
18. OUTPut:POLarity:CH2?

Detailed information of each command:

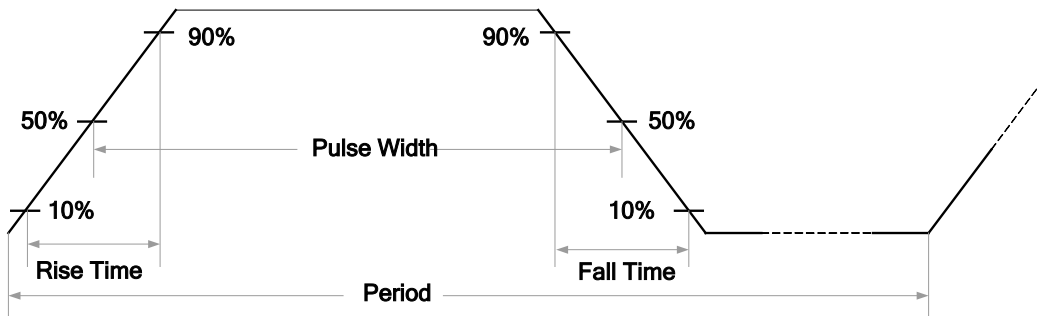
<b>1. OUTPut</b>	
Syntax	OUTPut {OFF ON}
Function	Disable or enable the [Output] connector of CH1 at the front panel. The default is "OFF".
Example	OUTP ON
<b>2. OUTPut?</b>	
Syntax	OUTPut?
Function	Query the state of the [Output] connector of CH1 at the front panel.
Return Value	The query returns OFF or ON.
<b>3. OUTPut:LOAD</b>	
Syntax	OUTPut:LOAD {<ohm> INFinity MINimum MAXimum}
Function	Select the desired output termination of CH1. The specified value is only used for amplitude and offset voltage.
Explanations	<ul style="list-style-type: none"> <li>● <math>\Omega</math> is the unit of &lt;ohm&gt;, the default is 50<math>\Omega</math>.</li> <li>● "INFinity" sets the output terminal as "High Z".</li> </ul>
Example	OUTP:LOAD 50
<b>4. OUTPut:LOAD?</b>	
Syntax	OUTPut:LOAD? [MINimum MAXimum]
Function	Query the current load setting of CH1.
Return Value	The query returns the current load setting in $\Omega$ or returns "Infinity".
<b>5. OUTPut:POLarity</b>	
Syntax	OUTPut:POLarity {NORMal INVerted}
Function	Set the polarity of waveform output from CH1.
Example	OUTP:POL NORM
<b>6. OUTPut:POLarity?</b>	
Syntax	OUTPut:POLarity?
Function	Query the polarity of waveform output from CH1.
Return Value	The query returns NORM or INV.

<b>7. OUTPut:SYNC</b>	
Syntax	OUTPut:SYNC {OFF ON}
Function	Disable or enable the rear panel [Sync Output] connector of CH1.
Explanation	Only CH1 provides sync signal output.
Example	OUTP:SYNC OFF
<b>8. OUTPut:SYNC?</b>	
Syntax	OUTPut:SYNC?
Function	Query the state of the [Sync Out] connector of CH1 on the rear panel.
Return Value	The query returns SYNC OFF or SYNC ON.
<b>9. OUTPut:TRIGger:SLOPe</b>	
Syntax	OUTPut:TRIGger:SLOPe {POSitive NEGative}
Function	Select the edge of "tirgger output". If the <b>OUTPut:TRIGger</b> command is enabled, TTL-compatible square wave with specified edge will be generated from [Ext Trig/FSK/Burst] connccetor on the rear panel when the sweep starts.
Explanations	<ul style="list-style-type: none"> <li>● The command is used in <b>Burst</b> and <b>Sweep</b> operation.</li> <li>● Select "POS" to output a pulse with a rising edge.</li> <li>● Select "NEG" to output a pulse with a falling edge.</li> </ul>
Example	OUTP:TRIG:SLOP POS
<b>10. OUTPut:TRIGger:SLOPe?</b>	
Syntax	OUTPut:TRIGger:SLOPe?
Function	Query the edge of "tirgger output".
Return Value	The query returns POSITIVE or NEGATIVE.
<b>11. OUTPut:TRIGger</b>	
Syntax	OUTPut:TRIGger {OFF ON}
Function	Disable or enable the [Ext Trig/FSK/Burst] connector on rear panel.
Example	OUTP:TRIG OFF
<b>12. OUTPut:TRIGger?</b>	
Syntax	OUTPut: TRIGger?
Function	Query the state of the [Ext Trig/FSK/Burst] connector on rear

	panel.
Return Value	The query returns OFF or ON.
<b>13. OUTPut:CH2</b>	
Syntax	OUTPut:CH2 {OFF ON}
Function	Disable or enable the front-panel [Output] connector of CH2. The default is OFF.
Example	OUTP:CH2 ON
<b>14. OUTPut:CH2?</b>	
Syntax	OUTPut:CH2?
Function	Query the state of front-panel [Output] connector of CH2.
Return Value	The query returns OFF or ON.
<b>15. OUTPut:LOAD:CH2</b>	
Syntax	OUTPut:LOAD:CH2 {<ohm> INFinity MINimum MAXimum}
Function	Select the desired output termination of CH2. The specified value is only used for amplitude and offset voltage.
Explanations	<ul style="list-style-type: none"> <li>● <math>\Omega</math> is the unit of &lt;ohm&gt;, the default is 50<math>\Omega</math>.</li> <li>● "INFinity" sets the output terminal as "High Z".</li> </ul>
Example	OUTP:LOAD:CH2 MIN
<b>16. OUTPut:LOAD:CH2?</b>	
Syntax	OUTPut:LOAD:CH2? [MINimum MAXimum]
Function	Query the current load setting of CH2.
Return Value	The query returns the current load setting in $\Omega$ or returns "Infinity".
<b>17. OUTPut:POLarity:CH2</b>	
Syntax	OUTPut:POLarity:CH2 {NORMal INVerted}
Function	Set the polarity of waveform output from CH2.
Example	OUTP:POL:CH2 NORM
<b>18. OUTPut:POLarity:CH2?</b>	
Syntax	OUTPut:POLarity:CH2?
Function	Query the polarity of waveform output from CH2.
Return Value	The query returns NORM or INV.

## PULSe

**PULSe** commands are used for configuring the parameters of pulse waves from dual channels, such as: period, pulse width, duty cycle and others. Following figure is going to help you comprehend the parameters about pulse wave.



DG1000 supports following **PULSe** commands:

1. PULSe:PERiod
2. PULSe:PERiod?
3. PULSe:WIDTh
4. PULSe:WIDTh?
5. PULSe:DCYClE
6. PULSe:DCYClE?
7. PULSe:PERiod:CH2
8. PULSe:PERiod:CH2?
9. PULSe:WIDTh:CH2
10. PULSe:WIDTh:CH2?
11. PULSe:DCYC:CH2
12. PULSe:DCYC:CH2?



Detailed information of each command:

<b>1. PULSe:PERiod</b>	
Syntax	PULSe:PERiod {<seconds> MINimum MAXimum}
Function	Set the period of pulse output from CH1 in seconds.
Example	PULS:PER 0.01
<b>2. PULSe:PERiod?</b>	
Syntax	PULSe:PERiod? [MINimum MAXimum]
Function	Query the period of pulse output from CH1.
Return Value	The query returns the pulse period in scientific notation and in seconds, such as: 1.000000e-02.
<b>3. PULSe:WIDTh</b>	
Syntax	PULSe:WIDTh {<seconds> MINimum MAXimum}
Function	Set the width of pulse for CH1 in seconds.
Example	PULS:WIDT 0.005
<b>4. PULSe:WIDTh?</b>	
Syntax	PULSe:WIDTh? [MINimum MAXimum]
Function	Query the width of pulse output from CH1.
Return Value	The query returns the pulse width in scientific notation and in seconds, such as: 5.000000e-03.
<b>5. PULSe:DCYClE</b>	
Syntax	PULSe:DCYClE {<percent> MINimum MAXimum}
Function	Set the duty cycle of pulse for CH1.
Example	PULS:DCYC 50
<b>6. PULSe:DCYClE?</b>	
Syntax	PULSe:DCYClE? [MINimum MAXimum]
Function	Query the duty cycle of pulse output from CH1.
Return Value	The query returns the percent of duty cycle of pulse in scientific notation, such as: 5.000000e+01.
<b>7. PULSe:PERiod:CH2</b>	
Syntax	PULSe:PERiod:CH2 {<seconds> MINimum MAXimum}

Function	Set the period of pulse for CH2 in seconds.
Example	PULS:PER:CH2 0.01
<b>8. PULSe:PERiod:CH2?</b>	
Syntax	PULSe:PERiod:CH2? [MINimum MAXimum]
Function	Query the period of pulse output from CH2.
Return Value	The query returns the period of pulse in scientific notation and in seconds, such as: 1.000000e-02.
<b>9. PULSe:WIDTh:CH2</b>	
Syntax	PULSe:WIDTh:CH2 {<seconds> MINimum MAXimum}
Function	Set the pulse width for CH2 in seconds.
Example	PULS:WIDT:CH2 0.005
<b>10. PULSe:WIDTh:CH2?</b>	
Syntax	PULSe:WIDTh:CH2? [MINimum MAXimum]
Function	Query the pulse width of CH2.
Return Value	The query returns the pulse width in scientific notation and in seconds, such as: 5.000000e-03.
<b>11. PULSe:DCYC:CH2</b>	
Syntax	PULSe:DCYC:CH2 {<percent> MINimum MAXimum}
Function	Set the duty cycle of pulse output from CH2.
Example	PULS:DCYC:CH2 50
<b>12. PULSe:DCYC:CH2?</b>	
Syntax	PULSe:DCYC:CH2? [MINimum MAXimum]
Function	Query the duty cycle of pulse output from CH2.
Return Value	The query returns the percent of duty cycle in scientific notation, such as: 5.000000e+01.

## AM

In AM, the amplitude of carrier varies with the instantaneous voltage of the modulating waveform. For DG1000, CH1 can output AM modulated waveform. **AM** commands could be used for these settings: modulation source, modulating waveform, modulating frequency, modulation depth and AM modulation state.

DG1000 supports following **AM** commands:

1. AM:SOURce
2. AM:SOURce?
3. AM:INTernal:FUNctIon
4. AM:INTernal:FUNctIon?
5. AM:INTernal:FREQuency
6. AM:INTernal:FREQuency?
7. AM:DEPTh
8. AM:DEPTH?
9. AM:STATe
10. AM:STATe?

Detailed information of each command:

<b>1. AM:SOURce</b>	
Syntax	AM:SOURce {INTernal EXTernal}
Function	Select internal or external modulation source, the default is INT.
Example	AM:SOUR EXT
<b>2. AM:SOURce?</b>	
Syntax	AM:SOURce?
Function	Query the modulation source of AM.
Return Value	The query returns INT or EXT.
<b>3. AM:INTernal:FUNCTION</b>	
Syntax	AM:INTernal:FUNCTION {SINusoid SQUare RAMP NRAMP TRIangle NOISe USER}
Function	Select the internal modulating wave of AM.
Explanation	In internal modulation mode, the modulating wave could be sine, square, ramp, negative ramp, triangle, noise or arbitrary wave, the default is sine.
Example	AM:INT:FUNC SQU
<b>4. AM:INTernal:FUNCTION?</b>	
Syntax	AM:INTernal:FUNCTION?
Function	Query the internal modulating wave selected .
Return Value	The query returns SIN, SQU, RAMP, NRAMP, TRI, NOIS or USER.
<b>5. AM:INTernal:FREQuency</b>	
Syntax	AM:INTernal:FREQuency {<frequency> MINimum MAXimum}
Function	Set the frequency of AM internal modulation in Hz.
Explanation	Frequency range: 2mHz to 20kHz
Example	AM:INT:FREQ 200
<b>6. AM:INTernal:FREQuency?</b>	
Syntax	AM:INTernal:FREQuency?
Function	Query the frequency of AM internal modulation.
Return Value	The query returns the frequency of AM internal modulation in scientific notation and the default unit is Hz, such as:

	2.000000e+02.
<b>7. AM:DEPT<sub>h</sub></b>	
Syntax	AM:DEPT <sub>h</sub> {<depth percent> MINimum MAXimum}
Function	Set the depth of AM internal modulation in percent.
Explanation	Depth range: 0% to 120%
Example	AM:DEPT 70
<b>8. AM:DEPT<sub>h</sub>?</b>	
Syntax	AM:DEPT <sub>h</sub> ? [MINimum MAXimum]
Function	Query the depth of AM internal modulation.
Return Value	The query returns the percent of the depth of AM internal modulation in scientific notation, such as: 7.000000e+01.
<b>9. AM:STAT<sub>e</sub></b>	
Syntax	AM:STAT <sub>e</sub> {OFF ON}
Function	Disable or enable AM function.
Example	AM:STAT OFF
<b>10. AM:STAT<sub>e</sub>?</b>	
Syntax	AM:STAT <sub>e</sub> ?
Function	Query the modulation state of AM.
Return Value	The query returns OFF or ON.

## FM

In FM, the frequency of carrier varies with the instantaneous voltage of the modulating waveform. For DG1000, CH1 can output FM modulated waveform. **FM** commands could be used for these settings: modulation source, modulating waveform, modulating frequency, frequency deviation and FM modulation state.

DG1000 supports following **FM** commands:

1. FM:SOURce
2. FM:SOURce?
3. FM:INTernal:FUNction
4. FM:INTernal:FUNction?
5. FM:INTernal:FREQuency
6. FM:INTernal:FREQuency?
7. FM:DEViation
8. FM:DEViation?
9. FM:STATe
10. FM:STATe?

Detailed information of each command:

<b>1. FM:SOURce</b>	
Syntax	FM:SOURce {INTernal EXTernal}
Function	Select internal or external modulation source, the default is INT.
Example	FM:SOUR EXT
<b>2. FM:SOURce?</b>	
Syntax	FM:SOURce?
Function	Query the modulation source of FM.
Return Value	The query returns INT or EXT.
<b>3. FM:INTernal:FUNCtion</b>	
Syntax	FM:INTernal:FUNCtion {SINusoid SQUare RAMP NRAMP TRIangle NOISe USER}
Function	Select the internal modulating wave of FM.
Explanation	In internal modulation mode, the modulating wave could be sine, square, ramp, negative ramp, triangle, noise or arbitrary wave, the default is sine.
Example	FM:INT:FUNC SQU
<b>4. FM:INTernal:FUNCtion?</b>	
Syntax	FM:INTernal:FUNCtion?
Function	Query the internal modulating wave selected .
Return Value	The query returns SIN, SQU, RAMP, NRAM, TRI, NOIS or USER.
<b>5. FM:INTernal:FREQuency</b>	
Syntax	FM:INTernal:FREQuency {<frequency> MINimum MAXimum}
Function	Set the frequency of FM internal modulation in Hz.
Explanation	Frequency range: 2mHz to 20kHz
Example	FM:INT:FREQ 200
<b>6. FM:INTernal:FREQuency?</b>	
Syntax	FM:INTernal:FREQuency?
Function	Query the frequency of FM internal modulation.
Return Value	The query returns the frequency of FM internal modulation in the scientific notation and the default unit is Hz, such as:

	2.000000e+02.
<b>7. FM:DEVIation</b>	
Syntax	FM:DEVIation{<frequency deviation>  MINimum MAXimum}
Function	Set the frequency deviation of FM in Hz.
Example	FM:DEV 100
<b>8. FM:DEVIation?</b>	
Syntax	FM:DEVIation? [MINimum MAXimum]
Function	Query the frequency deviation of FM.
Return Value	The query returns the frequency deviation of FM in the scientific notation and in Hz, such as: 1.000000e+02
<b>9. FM:STATe</b>	
Syntax	FM:STATe {OFF ON}
Function	Disable or enable FM function.
Example	FM:STAT OFF
<b>10. FM:STATe?</b>	
Syntax	FM:STATe?
Function	Query the modulation state of FM.
Return Value	The query returns OFF or ON.



## PM

In PM, the phase of carrier varies with the instantaneous voltage of the modulating waveform. For DG1000, CH1 can output PM modulated waveform. **PM** commands could be used for these settings: modulation source, modulating waveform, modulating frequency, phase deviation and PM modulation state.

DG1000 supports following **PM** commands:

1. PM:SOURce
2. PM:SOURce?
3. PM:INTernal:FUNctIon
4. PM:INTernal:FUNctIon?
5. PM:INTernal:FREQuency
6. PM:INTernal:FREQuency?
7. PM:DEViation
8. PM:DEViation?
9. PM:STATe
10. PM:STATe?

Detailed information of each command:

<b>1. PM:SOURce</b>	
Syntax	PM:SOURce {INTernal EXTernal}
Function	Select internal or external modulation source, the default is INT.
Example	PM:SOUR EXT
<b>2. PM:SOURce?</b>	
Syntax	PM:SOURce?
Function	Query the modulation source of PM.
Return Value	The query returns INT or EXT.
<b>3. PM:INTernal:FUNCTION</b>	
Syntax	PM:INTernal:FUNCTION {SINusoid SQUare RAMP NRAMP TRIangle NOISe USER}
Function	Select the internal modulating wave of PM.
Explanation	In internal modulation mode, the modulating wave could be sine, square, ramp, negative ramp, triangle, noise or arbitrary wave, the default is sine.
Example	PM:INT:FUNC SQU
<b>4. PM:INTernal:FUNCTION?</b>	
Syntax	PM:INTernal:FUNCTION?
Function	Query the internal modulating wave selected .
Return Value	The query returns SIN, SQU, RAMP, NRAMP, TRI, NOIS or USER.
<b>5. PM:INTernal:FREQuency</b>	
Syntax	PM:INTernal:FREQuency {<frequency> MINimum MAXimum}
Function	Set the frequency of PM internal modulation in Hz.
Explanation	Frequency range: 2mHz to 20kHz
Example	PM:INT:FREQ 200
<b>6. PM:INTernal:FREQuency?</b>	
Syntax	PM:INTernal:FREQuency?
Function	Query the frequency of PM internal modulation.
Return Value	The query returns the frequency of PM internal modulation in scientific notation and the default unit is Hz, such as:

	2.000000e+02.
<b>7. PM:DEVIation</b>	
Syntax	PM:DEVIation {<phase deviation> MINimum MAXimum}
Function	Set the phase deviation of PM in degree.
Explanation	Phase deviation range: 0° to 360°
Example	PM:DEV 180
<b>8. PM:DEVIation?</b>	
Syntax	PM:DEVIation? [MINimum MAXimum]
Function	Query the phase deviation of PM.
Return Value	The query returns the phase deviation of PM in scientific notation and in degree, such as: 1.800000e+02.
<b>9. PM:STATe</b>	
Syntax	PM:STATe {OFF ON}
Function	Disable or enable PM function.
Example	PM:STAT OFF
<b>10. PM:STATe?</b>	
Syntax	PM:STATe?
Function	Query the modulation state of PM.
Return Value	The query returns OFF or ON.

## FSKey

In FSK modulation, you can configure the generator to “shift” its output frequency between two preset frequencies (called the “carrier frequency” and the “hop frequency”). The frequency at which the output frequency shifts between the carrier frequency and the hop frequency is called “FSK rate”. FSK rate is determined by internal modulating frequency or signal level at the [Ext Trig/FSK/Burst] connector on the rear panel.

For DG1000, CH1 can output FSK modulated waveform. **FSK** commands could be used for these settings: modulation source, hop frequency, FSK rate and FSK modulation state. DG1000 supports following **FSK** commands:

1. FSK:SOURce
2. FSK:SOURce?
3. FSK:FREQuency
4. FSK:FREQuency?
5. FSK:INTernal:RATE
6. FSK:INTernal:RATE?
7. FSK:STATe
8. FSK:STATe?

Detailed information of each command:

<b>1. FSK:SOURce</b>	
Syntax	FSK:SOURce {INTernal EXTernal}
Function	Select internal or external modulation source, the default is INT.
Example	FSK:SOUR EXT
<b>2. FSK:SOURce?</b>	
Syntax	FSK:SOURce?
Function	Query the modulation source of FSK.
Return Value	The query returns INT or EXT.
<b>3. FSK:FREQuency</b>	
Syntax	FSK:FREQuency {<frequency> MINimum MAXimum}
Function	Set the hop frequency of FSK in Hz.
Example	FSK:FREQ 10
<b>4. FSK:FREQuency?</b>	
Syntax	FSK:FREQuency?
Function	Query the hop frequency of FSK.
Return Value	The query returns the hop frequency of FSK in scientific notation and in Hz, such as: 1.000000e+01.
<b>5. FSK:INTernal:RATE</b>	
Syntax	FSK:INTernal:RATE {<rate> MINimum MAXimum}
Function	Set the rate at which the output frequency “shifts” between the carrier and hop frequencies, the unit is Hz.
Explanation	Rate range: 2mHz to 50kHz
Example	FSK:INT:RATE 100
<b>6. FSK:INTernal:RATE?</b>	
Syntax	FSK:INTernal:RATE?
Function	Query the FSK rate.
Return Value	The query returns the FSK rate in scientific notation, such as: 1.000000e+02.
<b>7. FSK:STATe</b>	

Syntax	FSK:STATe {OFF ON}
Function	Disable or enable FSK function.
Example	FSK:STAT OFF
<b>8. FSK:STATe?</b>	
Syntax	FSK:STATe?
Function	Query the modulation state of FSK.
Return Value	The query returns OFF or ON.

## SWEep

In frequency sweep mode, the generator “steps” from the start frequency to the stop frequency at the specified sweep rate. You can sweep up or down in frequency with either linear or logarithmic spacing.

In addition, you can configure the generator to output a single sweep (sweep from start frequency to stop frequency) by applying an external or manual trigger. The generator can produce a frequency sweep for sine, square, ramp or arbitrary waveforms (pulse, noise, and DC are not allowed) from CH1.

DG1000 supports following **SWEep** commands:

1. SWEep:SPACing
2. SWEep:SPACing?
3. SWEep:TIME
4. SWEep:TIME?
5. SWEep:STATe
6. SWEep:STATe?

Detailed information of each command:

<b>1. SWEep:SPACing</b>	
Syntax	SWEep:SPACing {LINear LOGarithmic}
Function	Select linear or logarithmic spacing for the sweep, the default is Linear.
Example	SWE:SPAC LIN
<b>2. SWEep:SPACing?</b>	
Syntax	SWEep:SPACing?
Function	Query the current sweep mode.
Return Value	The query returns LINEAR or LOG.
<b>3. SWEep:TIME</b>	
Syntax	SWEep:TIME {<seconds> MINimum MAXimum}
Function	Set the sweep time needed for the generator to sweep from the start frequency to the stop frequency, the default time is 1s.
Explanation	<seconds> is the sweep time set by users, the unit is s. MIN=1ms, MAX=500s.
Example	SWE:TIME 10
<b>4. SWEep:TIME?</b>	
Syntax	SWEep:TIME?
Function	Query the sweep time needed for the generator to sweep from the start frequency to the stop frequency.
Return Value	The query returns the sweep time in scientific notation and in seconds, such as: 1.000000e+01.
<b>5. SWEep:STATe</b>	
Syntax	SWEep:STATe {OFF ON}
Function	Disable or enable the sweep mode.
Example	SWE:STAT OFF
<b>6. SWEep:STATe?</b>	
Syntax	SWEep:STATe?
Function	Query the sweep state.
Return Value	The query returns OFF or ON.



## TRIGger

**TRIGger** commands are only available in **Sweep** and **Burst** mode. As only CH1 supports sweep and burst modes, **TRIGger** commands are only applicable to CH1.

DG1000 supports following **TRIGger** commands:

1. TRIGger:SOURce
2. TRIGger:SOURce?
3. TRIGger:SLOPe
4. TRIGger:SLOPe?
5. TRIGger:DELaY
6. TRIGger:DELaY?

Detailed information of each command:

<b>1. TRIGger:SOURce</b>	
Syntax	TRIGger:SOURce {IMMEDIATE EXternal BUS}
Function	Select the trigger source for generator, including internal trigger (IMM), external trigger (EXT) from the [Ext Trig/FSK/Burst] connector on the rear panel and manual trigger (BUS). The default is IMM.
Example	TRIG:SOUR EXT
<b>2. TRIGger:SOURce?</b>	
Syntax	TRIGger:SOURce?
Function	Query the trigger source of generator.
Return Value	The query returns IMM, EXT or BUS.
<b>3. TRIGger:SLOPe</b>	
Syntax	TRIGger:SLOPe {POSitive NEGative}
Function	Set the generator to use the rising edge (POS) or falling edge (NEG) of the trigger signal from the [Ext Trig/FSK/Burst] connector on the rear panel. The default is POS (rising edge).
Explanation	This command could be used only when <b>OUTPut:TRIGger</b> is enabled.
Example	TRIG:SLOP POS
<b>4. TRIGger:SLOPe?</b>	
Syntax	TRIGger:SLOPe?
Function	Query the edge selected for trigger signal .
Return Value	The query returns POS or NEG.
<b>5. TRIGger:DELay</b>	
Syntax	TRIGger:DELay {<second> MINimum MAXimum}
Function	Set the trigger delay in seconds. Note: this command is only applicable to Burst mode.
Example	TRIG:DEL 0.000005
<b>6. TRIGger:DELay?</b>	
Syntax	TRIGger:DELay?

Function	Query the trigger delay.
Return Value	The query returns the selected delay time in scientific notation and in seconds, such as: 5.000000e-06.

## BURSt

**BURSt** commands are used for setting the generator to output waveforms (called burst) with specified cycles. DG1000 can generate burst using sine, square, ramp, pulse or arbitrary waveform and output it from CH1.

DG1000 supports following **BURSt** commands:

1. BURSt:MODE
2. BURSt:MODE?
3. BURSt:NCYCles
4. BURSt:NCYCles?
5. BURSt:INTernal:PERiod
6. BURSt:INTernal:PERiod?
7. BURSt:PHASe
8. BURSt:PHASe?
9. BURSt:STATe
10. BURSt:STATe?
11. BURSt:GATE:POLarity
12. BURSt:GATE:POLarity?

Detailed information of each command:

<b>1. BURSt:MODE</b>	
Syntax	BURSt:MODE {TRIGgered GATed}
Function	Set the burst mode to trigger (TRIGgered) or gated (GATed).
Explanations	<ul style="list-style-type: none"> <li>● In trigger mode, the generator outputs a wave with specified number of cycles once it receives a trigger from the specified trigger source (via sending <b>TRIGger:SOURce</b>).</li> <li>● In gated mode, the output state of waves ("ON" or "OFF") depends on the external signal level at the [Ext Trig/FSK/Burst] connector on the rear panel.</li> <li>● The default burst mode is trigger.</li> </ul>
Example	BURSt:MODE GAT
<b>2. BURSt:MODE?</b>	
Syntax	BURSt:MODE?
Function	Query the burst mode.
Return Value	The query returns TRIG or GAT.
<b>3. BURSt:NCYCles</b>	
Syntax	BURSt:NCYCles {<cycle> INFinity MINimum MAXimum}
Function	Set the cycle number of burst (only used in triggermode).
Explanations	<ul style="list-style-type: none"> <li>● &lt;cycle&gt; is the cycle number set by users.</li> <li>● MIN=1, MAX=50,000, INF is infinite.</li> </ul>
Example	BURSt:NCYC 100
<b>4. BURSt:NCYCles?</b>	
Syntax	BURSt:NCYCles?
Function	Query the cycle number of burst.
Return Value	The query returns the burst counting in scientific notation (such as 1.000000e+02) or returns "Infinite".
<b>5. BURSt:INTernal:PERiod</b>	
Syntax	BURSt:INTernal:PERiod {<second> MINimum MAXimum}
Function	Set the period of burst in internal trigger mode.
Explanations	<ul style="list-style-type: none"> <li>● &lt;second&gt; is the burst period set by users, the default unit is s.</li> </ul>

	<ul style="list-style-type: none"> <li>● MIN=0.000001, MAX=500.</li> </ul>
Example	BURS:INT:PER 10
<b>6. BURSt:INteRnal:PERiod?</b>	
Syntax	BURSt:INteRnal:PERiod? [MINimum MAXimum]
Function	Query the period of burst in internal trigger mode.
Return Value	The query returns the burst period in scientific notation and the default unit is s, such as: 1.000000e+01.
<b>7. BURSt:PHASe</b>	
Syntax	BURSt:PHASe {<angle> MINimum MAXimum}
Function	Set the initial phase of burst.
Explanations	<ul style="list-style-type: none"> <li>● &lt;angle&gt; is the phase set by users, the default unit is degree.</li> <li>● MIN=-180, MAX=180.</li> </ul>
Example	BURS:PHAS 150
<b>8. BURSt:PHASe?</b>	
Syntax	BURSt:PHASe? [MINimum MAXimum]
Function	Query the initial phase of burst.
Return Value	The query returns the initial phase of burst in scientific notation and the default unit is degree, such as: 1.500000e+02.
<b>9. BURSt:STATe</b>	
Syntax	BURSt:STATe {OFF ON}
Function	Enable or disable burst mode.
Example	BURS:STAT OFF
<b>10. BURSt:STATe?</b>	
Syntax	BURSt:STATe?
Function	Query the state of burst mode.
Return Value	The query returns OFF or ON.
<b>11. BURSt:GATE:POLarity</b>	
Syntax	BURSt:GATE:POLarity {NORMal INVerted}
Function	Set the polarity of external gated signal at the [Ext Trig/FSK/Burst] connector on the rear panel, the default is NORMal.

Example	BURSt:GATE:POL INV
<b>12. BURSt:GATE:POLarity?</b>	
Syntax	BURSt:GATE:POLarity?
Function	Query the polarity of external gated signal from the rear panel.
Return Value	The query returns NORM or INV.

## DATA

**DATA** commands are used for editing or saving arbitrary waves and outputting those waves via CH1. You can store ten user-defined waveforms at most in non-volatile memory in addition to one in volatile memory. Each waveform can contain 1 to 524,288 data points.

DG1000 supports following **DATA** commands:

1. DATA
2. DATA:DAC
3. DATA:COPY
4. DATA:DELeTe
5. DATA:CATalog?
6. DATA:RENAME
7. DATA:NVOLatile:CATalog?
8. DATA:NVOLatile:FREE?
9. DATA:ATTRibute:POINts?
10. DATA:LOAD



Detailed information of each command:

1. DATA	
Syntax	DATA VOLATILE,<value>, <value>, . . .
Function	Load the floating point numbers between -1 and 1 into volatile memory.
Explanations	<ul style="list-style-type: none"> <li>● The <b>DATA</b> command would overwrite the previous waveform in volatile memory (does not generate error).</li> <li>● Use the <b>DATA:COPY</b> command to copy the waveform to non-volatile memory.</li> <li>● Use the <b>DATA:DELe</b> command to delete the waveform in volatile memory or any of the ten user-defined waveforms in nonvolatile memory.</li> <li>● Use the <b>DATA:CATalog?</b> command to list all waveforms currently stored in volatile and non-volatile memories.</li> <li>● Use the <b>FUNCTion:USER</b> command to output the waves that have been edited and stored after downloading the waveform data to memory.</li> </ul>
Example	DATA VOLATILE,1,0.67,0.33,0,-0.33,-0.67,-1
2. DATA:DAC	
Syntax	DATA:DAC VOLATILE,<value>, <value>, . . .
Function	Download decimal integer values from 0 to 16383 into volatile memory. Wherein, 0 and 16383 correspond to the minimum amplitude and maximum amplitude respectively.
Explanations	<ul style="list-style-type: none"> <li>● The <b>DATA:DAC</b> command would overwrite the previous waveform in volatile memory ( does not generate error).</li> <li>● Use the <b>DATA:COPY</b> command to copy the waveform to non-volatile memory.</li> <li>● Use the <b>DATA:DELe</b> command to delete the waveform in volatile memory or any of the ten user-defined waveforms in nonvolatile memory.</li> <li>● Use the <b>DATA:CATalog?</b> command to list all waveforms currently stored in volatile and non-volatile memories.</li> <li>● Use the <b>FUNCTion:USER</b> command to output the waves that have been edited and stored after downloading the waveform data to memory.</li> </ul>

Example	DATA:DAC VOLATILE,8192,16383,8192,0
<b>3. DATA:COPY</b>	
Syntax	DATA:COPY < destination arb name >[,VOLATILE]
Function	Copy the waveform from volatile memory to the specified non-volatile memory.
Explanations	<ul style="list-style-type: none"> <li>● The arb name may contain up to 12 characters. The first character must be a letter (A-Z or a-z), the remaining characters can be numbers (0-9) or the underscore character ("_"). Blank space is invalid.</li> <li>● The VOLATILE parameter is optional and can be omitted. Note that the keyword "VOLATILE" does not have abbreviation.</li> <li>● Use the <b>DATA:DELeTe</b> command to delete the waveform in volatile memory or any of the ten user-defined waveforms in non-volatile memory.</li> <li>● Use the <b>DATA:CATalog?</b> command to list all waveforms currently stored in volatile and non-volatile memories.</li> </ul>
Example	DATA:COPY a1,VOLATILE
<b>4. DATA:DELeTe</b>	
Syntax	DATA:DELeTe <arb name>
Function	Delete the specified arbitrary waveform from either volatile memory or non-volatile memory.
Example	DATA:DEL a1
<b>5. DATA:CATalog?</b>	
Syntax	DATA:CATalog?
Function	Query the names of all waveforms currently available for selection.
Return Value	<p>The query returns the names of the five built-in waveforms (non-volatile memory), "VOLATILE" (if a waveform is currently downloaded to volatile memory), and all user-defined waveforms downloaded to non-volatile memory, such as:</p> <p>"VOLATILE","EXP_RISE","EXP_FALL","NEG_RAMP","SINC", "CARDIAC","A","B","C","D","E","F","G","H","I","J".</p>
<b>6. DATA:RENAME</b>	
Syntax	DATA:RENAME <destination arb name>,<new arb name>

Function	Rename user-defined arbitrary waves in non-volatile memory.
Example	DATA:RENAME A, new
<b>7. DATA:NVOLatile:CATalog?</b>	
Syntax	DATA:NVOLatile:CATalog?
Function	Query the names of all user-defined arbitrary waveforms downloaded to non-volatile memory.
Return Value	The query returns the names (enclosed in quotation marks) of up to 10 waveforms, such as: "A","B","C","D","E","F","G","H","I","J".
<b>8. DATA:NVOLatile:FREE?</b>	
Syntax	DATA:NVOLatile:FREE?
Function	Query the number of locations available for saving user-defined waveforms in non-volatile memory.
Return Value	The query returns 0 (the memory is full), 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10.
<b>9. DATA:ATTRibute:POINts?</b>	
Syntax	DATA:ATTRibute:POINts? <destination arb name>
Function	Query the number of points in the specified arbitrary waveform.
Return Value	The query returns a value within 0 and 524,288, such as: 4096.
<b>10. DATA:LOAD</b>	
Syntax	DATA:LOAD [<destination arb name>]
Function	Upload the specified arbitrary wave to the application software.

## MEMory

The generator has 10 storage locations (STATE1 to STATE10) in non-volatile memory to store instrument states. The locations are numbered from 1 to 10. Location 0 is volatile memory and the generator automatically uses location "0" to hold the state of the instrument at power-down. MEMory commands can be used to read the location names, delete the stored instrument states, automatically recall instrument state and query the available storage locations. You can also assign a user-defined name to each of the locations (1 to 10) from the front panel.

DG1000 supports following **MEMory** commands:

1. MEMory:STAtE:NAME
2. MEMory:STAtE:NAME?
3. MEMory:STAtE:DELEte
4. MEMory:STAtE:RECall:AUTO
5. MEMory:STAtE:RECall:AUTO?
6. MEMory:STAtE:VALId?
7. MEMory:NSTates?

Detailed information of each command:

<b>1. MEMory:STATe:NAME</b>	
Syntax	MEMory:STATe:NAME {0 1 2 3 4 5 6 7 8 9 10} [,<name>]
Function	Assign a user-defined name for specified memory location.
Example	MEM:STAT:NAME 1,A1
<b>2. MEMory:STATe:NAME?</b>	
Syntax	MEMory:STATe:NAME? {0 1 2 3 4 5 6 7 8 9 10}
Function	Query the name of specified memory location.
Return Value	The query returns the name of specified memory location such as A1. If no name was assigned, the return is empty.
<b>3. MEMory:STATe:DELeTe</b>	
Syntax	MEMory:STATe:DELeTe {0 1 2 3 4 5 6 7 8 9 10}
Function	Delete the contents in specified memory location.
Example	MEM:STAT:DEL 1
<b>4. MEMory:STATe:RECall:AUTO</b>	
Syntax	MEMory:STATe:RECall:AUTO {OFF  ON}
Function	Disable or enable the automatic recall of the power-down state from storage location "0" at power-on. Select "ON" to automatically recall power-down state at power-on and select "OFF" (default) to execute a reset.
Example	MEM:STAT:REC:AUTO OFF
<b>5. MEMory:STATe:RECall:AUTO?</b>	
Syntax	MEMory:STATe:RECall:AUTO?
Function	Query the power-down recall state
Return Value	The query returns OFF or ON.
<b>6. MEMory:STATe:VALId?</b>	
Syntax	MEMory:STATe:VALId? {0 1 2 3 4 5 6 7 8 9 10}
Function	Query the specified storage location to determine if a valid state has already been stored in that location.
Return Value	Return "0" if no state has been stored or if it has been deleted. or else return "1".

<b>7. MEMory:NStates?</b>	
Syntax	MEMory:NStates?
Function	Query the total number of memory locations available for state storage.
Return Value	Always return "11" (including memory location "0").

## SYSTem

**SYSTem** commands provide information about state storage, power-down recall, error state and screen control of the front panel as well as other information about the instrument.

DG1000 supports following **SYSTem** commands:

1. SYSTem:ERRor?
2. SYSTem:VERSion?
3. SYSTem:BEEPer:STATe
4. SYSTem:BEEPer:STATe?
5. SYSTem:LOCal
6. SYSTem:RWLock
7. SYSTem:REMOte
8. SYSTem:CLKSRC
9. SYSTem:LANGuage

Detailed information of each command:

<b>1. SYSTem:ERRor?</b>	
Syntax	SYSTem:ERRor?
Function	Read and clear an error from error queue.
Return Value	The query returns an error information in following format: -118,"Invalid parameter"
<b>2. SYSTem:VERSion?</b>	
Syntax	SYSTem:VERSion?
Function	Query the current edition number of the instrument.
Return Value	The query returns a character string in following format: 00.02.00.06.00.02.06
<b>3. SYSTem:BEEPer:STATe</b>	
Syntax	SYSTem:BEEPer:STATe {OFF ON}
Function	Enable or disable the beep when error occurs on front panel or remote interface.
Example	SYST:BEEP:STAT OFF
<b>4. SYSTem:BEEPer:STATe?</b>	
Syntax	SYSTem:BEEPer:STATe?
Function	Query the state of beeper.
Return Value	The query returns 0 (OFF) or 1 (ON).
<b>5. SYSTem:LOCal</b>	
Syntax	SYSTem:LOCal
Function	Activate local state, delete RMT indicator and unlock the front panel.
<b>6. SYSTem:RWLock</b>	
Syntax	SYSTem:RWLock
Function	Activate remote state with locking function, display R-LOCK indicator and lock the front panel (including the Local button)
<b>7. SYSTem:REMOte</b>	
Syntax	SYSTem:REMOte



Function	Activate remote state, display RMT indicator and lock the front panel (except the Local button) .
<b>8. SYSTem:CLKSRC</b>	
Syntax	SYSTem:CLKSRC {EXT INT}
Function	Select the system clock source as internal or external, the default is INT.
Explanation	When external clock source is activated, the system accepts the clock source from [10 MHz In] connector on the rear panel.
Example	SYST:CLKSRC EXT
<b>9. SYSTem:LANGuage</b>	
Syntax	SYSTem:LANGuage {CHINESE ENGLISH}
Function	Select the system language as Chinese or English.
Example	SYST:LANG CHINESE

## PHASe

**PHASe** commands are used for setting the initial phase of signals from each channel and setting the align phase output of dual channels.

DG1000 supports following **PHASe** commands:

1. PHASe
2. PHASe?
3. PHASe:CH2
4. PHASe:CH2?
5. PHASe:ALIGN

Detailed information of each command:

<b>1. PHASe</b>	
Syntax	PHASe {<angle> MINimum MAXimum}
Function	Set the initial phase of signals output from CH1.
Explanation	<angle> is the phase set by users, the default unit is degree. MIN=-180°, MAX=180°.
Return Value	PHAS 90
<b>2. PHASe?</b>	
Syntax	PHASe? [MINimum MAXimum]
Function	Query the initial phase of signals output from CH1.
Return Value	The query returns any numerical value between -180 and 180, such as: 90.000.
<b>3. PHASe:CH2</b>	
Syntax	PHASe:CH2 {<angle> MINimum MAXimum}
Function	Set the initial phase of signals output from CH2.
Explanation	<angle> is the phase set by users, the default unit is degree. MIN=-180, MAX=180.
Return Value	PHAS:CH2 90
<b>4. PHASe:CH2?</b>	
Syntax	PHASe:CH2? [MINimum MAXimum]
Function	Query the initial phase of signals output from CH2.
Return Value	The query returns any numerical value between -180 and 180, such as: 90.000.
<b>5. PHASe:ALIGN</b>	
Syntax	PHASe:ALIGN
Function	Enable the align phase output of dual channels.

## DISPlay

**DISPlay** commands are used for controlling the display of front panel.

DG1000 supports following **DISPlay** commands:

1. DISPlay
2. DISPlay:CONTRAST
3. DISPlay:LUMINANCE**DISPlay:LUMINANCE**

Detailed information of each command:

1. DISPlay	
Syntax	DISPlay {OFF ON}
Function	Enable or disable the display function of front panel.
Example	DISP OFF
2. DISPlay:CONTRAST	
Syntax	DISPlay:CONTRAST <value>
Function	Set the contrast of display within 0 and 31.
Example	DISP:CONTRAST 25
3. DISPlay:LUMINANCE	
Syntax	DISPlay:LUMINANCE <value>
Function	Set the luminance of display within 0 and 31.
Example	DISP:LUMINANCE 25

## COUPling

**COUPling** commands are used for channel coupling or copying.

DG1000 supports following **COUPling** commands:

1. COUPling
2. COUPling?
3. COUPling:BASEdchannel
4. COUPling:BASEdchannel?
5. COUPling:PHASEDEVIation
6. COUPling:PHASEDEVIation?
7. COUPling:FREQDEVIation
8. COUPling:FREQDEVIation?
9. COUPling:CHANNCopy

Detailed information of each command:

<b>1. COUPling</b>	
Syntax	COUPling {OFF ON}
Function	Enable or disable coupling function.
Example	COUP OFF
<b>2. COUPling?</b>	
Syntax	COUPling?
Function	Query the coupling state.
Return Value	The query returns OFF or ON.
<b>3. COUPling:BASEdchannel</b>	
Syntax	COUPling:BASEdchannel{:CH1 :CH2}
Function	Select the base channel of channel coupling.
Example	COUP:BASE:CH1
<b>4. COUPling:BASEdchannel?</b>	
Syntax	COUPling:BASEdchannel?
Function	Query the base channel selected.
Return Value	The query returns CH1 or CH2.
<b>5. COUPling:PHASEDEVIation</b>	
Syntax	COUPling:PHASEDEVIation <value>
Function	Set the phase deviation of channel coupling, the default unit is degree.
Explanation	<value>: -180° to 180
Example	COUP:PHASEDEV 10
<b>6. COUPling:PHASEDEVIation?</b>	
Syntax	COUPling:PHASEDEVIation?
Function	Query the phase deviation.
Return Value	The query returns the phase deviation in scientific notation and the default unit is degree, such as: 1.000000e+01.
<b>7. COUPling:FREQDEVIation</b>	
Syntax	COUPling:FREQDEVIation <value>

Function	Set the frequency deviation of channel coupling and the default unit is Hz.
Explanation	<value>: 0Hz to 20MHz
Example	COUP:FREQDEV 100
<b>8. COUPling:FREQDEViation?</b>	
Syntax	COUPling:FREQDEViation?
Function	Query the frequency deviation.
Return Value	The query returns the frequency deviation in scientific notation and the default unit is Hz, such as: 1.000000e+02.
<b>9. COUPling:CHANNCopy</b>	
Syntax	COUPling:CHANNCopy {1>2 2>1}
Function	Copy CH1 to CH2 or copy CH2 to CH1.
Example	COUP:CHANNC 1>2

## COUNter

**COUNter** commands are used to enable the counter and set or query related parameters.

DG1000 supports following **COUNter** commands:

1. COUNter
2. COUNter:COUPling
3. COUNter:COUPling?
4. COUNter:SENSitivity
5. COUNter:SENSitivity?
6. COUNter:TLEVel
7. COUNter:TLEVel?
8. COUNter:HFRS
9. COUNter:HFRS?
10. COUNter:FREQuency?
11. COUNter:PERiod?
12. COUNter:DCYClE?
13. COUNter:POSWidth?
14. COUNter:NEGWidth?



Detailed information of each command:

<b>1. COUNter</b>	
Syntax	COUNter {OFF ON}
Function	Disable or enable the counter.
Example	COUN ON
<b>2. COUNter:COUPling</b>	
Syntax	COUNter:COUPling {AC DC}
Function	Set the coupling mode to AC or DC.
Example	COUN:COUP AC
<b>3. COUNter:COUPling?</b>	
Syntax	COUNter:COUPling?
Function	Query the coupling mode selected.
Return Value	The query returns AC or DC.
<b>4. COUNter:SENSitivity</b>	
Syntax	COUNter:SENSitivity {LOW MEDIUM HIGH}
Function	Set the trigger sensitivity to High, Medium or Low.
Example	COUN:SENS HIGH
<b>5. COUNter:SENSitivity?</b>	
Syntax	COUNter:SENSitivity?
Function	Query the trigger sensitivity selected.
Return Value	The query returns LOW, MEDIUM or HIGH.
<b>6. COUNter:TLEVel</b>	
Syntax	COUNter:TLEVel {MIN MAX <value>}
Function	Set the trigger level.
Explanations	<ul style="list-style-type: none"> <li>• &lt;value&gt; is a consecutive real number parameter and its range is from 0.0 to 99.9, wherein MIN=0.0 and MAX=99.9.</li> <li>• The trigger level (-3V to +3V) is equally divided into 1000 (0.0 to 99.9) segments and each segment is 6mV, namely the regulation interval is 6mV. For example, if the input value is "62.0", the trigger level is <math>-3V + (62.0 / 0.1) \times 6mV = 0.72V</math>.</li> </ul>
Example	COUNter:TLEVel 62

<b>7. COUNTER:TLeVel?</b>	
Syntax	COUNTER:TLeVel?
Function	Query the trigger level set.
Return Value	The query returns the trigger level currently set in decimal format, such as: 62.000000.
<b>8. COUNTER:HFRS</b>	
Syntax	COUNTER:HFRS {ON OFF}
Function	Enable or disable high-frequency reject.
Explanation	When measuring low-frequency signal with frequency lower than 1kHz, enable high-frequency reject to filter out the high-frequency noise; disable high-frequency reject when measuring high-frequency signal with frequency greater than 1kHz.
Example	COUNTER:HFRS ON
<b>9. COUNTER:HFRS?</b>	
Syntax	COUNTER:HFRS?
Function	Query the state of high-frequency reject.
Explanation	When measuring low-frequency signal with frequency lower than 1kHz, enable high-frequency reject to filter out the high-frequency noise; disable high-frequency reject when measuring high-frequency signal with frequency greater than 1kHz.
Return Value	The query returns ON or OFF.
<b>10. COUNTER:FREQuency?</b>	
Syntax	COUNTER:FREQuency?
Function	Query the frequency measurement value of the counter.
Return Value	The query returns the frequency in decimal format and the default unit is Hz, such as: 999.989319.
<b>11. COUNTER:PERiod?</b>	
Syntax	COUNTER:PERiod?
Function	Query the period measurement value of the counter.
Return Value	The query returns the period in decimal format and the default unit is s, such as: 0.001000.

12. COUNTER:DCYCLE?	
Syntax	COUNTER:DCYCLE?
Function	Query the duty cycle measurement value of the counter.
Return Value	The query returns the duty cycle in percentage, such as: 50.0%.
13. COUNTER:POSWIDTH?	
Syntax	COUNTER:POSWIDTH?
Function	Query the positive pulse width measurement value of the counter.
Return Value	The query returns the positive pulse width in scientific notation and in seconds, such as: 5.00358e-04.
14. COUNTER:NEGWIDTH?	
Syntax	COUNTER:NEGWIDTH?
Function	Query the negative pulse width measurement value of the counter.
Return Value	The query returns the negative pulse width in scientific notation and in seconds, such as: 5.00000e-04.



## Chapter 3 Application Examples

This chapter shows you how to realize the examples in DG1000 User's Guide via commands, you can compare it with the introduction in User's Guide to get deeper understanding of the usage of commands.

The number before every command in these examples is not the content of command. The content enclosed in " / \* " and " \* / " behind every command is note (not a part of the command) which is used to assist user to understand the command well.

Before executing every example, please make sure that all the corresponding devices have been connected correctly.

## Example 1: To Generate a Sine Wave

**Target:** Generate a sine wave with 20 kHz frequency, 2.5 Vpp amplitude, 500mV<sub>DC</sub> offset and 10° phase via CH1.

### How to realize via commands?

#### Method1:

0	*IDN?	/* Query ID to check the operating state */
1	VOLT:UNIT VPP	/* Set the unit of amplitude */
2	APPL:SIN 20000,2.5,0.5	/*Set the frequency, amplitude and offset of the sine wave*/
3	PHAS 10	/* Set the initial phase */
4	OUTP ON	/*Enable the [Output] connector of CH1 at front panel */

#### Method2:

0	*IDN?	/* Query ID to check the operating state */
1	FUNC SIN	/*Select sine function*/
2	FREQ 20000	/* Set the output frequency*/
3	VOLT:UNIT VPP	/* Set the unit of amplitude*/
4	VOLT 2.5	/* Set the output amplitude */
5	VOLT:OFFS 0.5	/* Set the offset*/
6	PHAS 10	/* Set the initial phase */
7	OUTP ON	/*Enable the [Output] connector of CH1 at front panel */

#### Note:

The function of the "VOLT:UNIT VPP" and "APPL:SIN 20000,2.5,0.5" commands is the same with that of the "FUNC SIN, FREQ 20000", "VOLT:UNIT VPP", "VOLT 2.5" and "VOLT:OFFS 0.5" commands.

## Example 2: To Generate a Built-in Arbitrary Wave

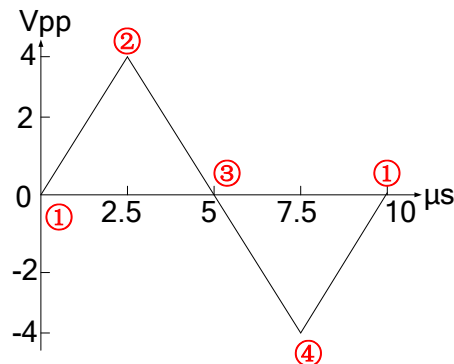
**Target:** Generate an ExpRise wave with 2MHz frequency, 5V<sub>RMS</sub> amplitude, 10mV<sub>DC</sub> offset and 60°phase via CH1.

### How to realize via commands?

0	*IDN?	/*Query ID to check the operating state */
1	FUNC:USER EXP_RISE	/* Select built-in wave function */
2	FREQ 2000000	/* Set the output frequency */
3	VOLT:UNIT VRMS	/* Set the unit of amplitude */
4	VOLT 5	/*Set the output amplitude */
5	VOLT:OFFS 0.01	/* Set the offset */
6	PHAS 60	/*Set the initial phase */
7	OUTP ON	/*Enable the [Output] connector of CH1 at the front panel */

## Example 3: To Generate an User-defined Arbitrary Wave

**Target:** Generate a user-defined arbitrary ramp wave with  $10\mu\text{s}$  period, 4V high level and -4V low level.



The vertical resolution of user-defined arbitrary wave is 14 bits, 0 and 16383 separately correspond to the minimum and maximum amplitudes, that is: -4 V corresponds to 0 and 4 V corresponds to 16383. So, edit the points in following table to generate the specified ramp wave..

Point	Time Value	(voltage) Value
1	0s	(0V) 8192
2	$2.5\mu\text{s}$	(4V) 16383
3	$5\mu\text{s}$	(0V) 8192
4	$7.5\mu\text{s}$	(-4V) 0

### How to realize via commands?

```

0  *IDN? /*Query ID to check the operating state */
1  FUNC USER /*Select user-defined arbitrary wave*/
2  FREQ 100000 /* Set the frequency as 100kHz (period:  $10\mu\text{s}$ )/
3  VOLT:UNIT VPP /* Set the unit of voltage*/
4  VOLT:HIGH 4 /* Set the high level*/
5  VOLTage:LOW -4 /*Set the low level*/
6  DATA:DAC VOLATILE,8192,16383,8192,0

```



```
/*Load the 4 decimal numbers to volatile
memory */
7  FUNC:USER VOLATILE /*Output the waves in volatile memory */
8  OUTP ON /* Enable the [Output] connector of CH1 at the
front panel */
```

## Example 4: To Generate a FSK Wave

**Target:** Generate a FSK wave with 10 kHz, 5 V<sub>pp</sub>, 0 V<sub>DC</sub> carrier wave (Sine), internal modulation source, 800 Hz hop frequency and 200 Hz FSK rate.

### How to realize via commands?

0	*IDN?	/* Query ID to check the operating state */
1	FUNC SIN	/*Select carrier function*/
2	FREQ 10000	/* Set the frequency of carrier*/
3	VOLT:UNIT VPP	/* Set the amplitude unit of carrier */
4	VOLT 5	/*Set the amplitude of carrier */
5	VOLT:OFFS 0	/* Set the offset of carrier */
6	FSK:STAT ON	/* Enable FSK function*/
7	FSK:SOUR INT	/* Select internal modulation source */
8	FSK:FREQ 800	/* Set the hop frequency */
9	FSK:INT:RATE 200	/* Set the FSK rate*/
10	OUTP ON	/* Enable the [Output] connector of CH1 at the front panel */

## Example 5: To Generate a Linear Sweep Wave

**Target:** Generate a sweep sine wave with 100 Hz to 10 kHz frequency, internal trigger, linear mode and 1 s sweep time.

### How to realize via commands?

0	*IDN?	/* Query ID to check the operating state */
1	FUNC SIN	/* Select the sweep function */
2	SWE:STAT ON	/* Enable frequency sweep */
3	SWE:SPAC LIN	/* Select linear sweep mode */
4	FREQ:STAR 100	/* Set the start frequency */
5	FREQ:STOP 10000	/* Set the stop frequency */
6	SWE:TIME 1	/* Set the sweep time */
7	TRIG:SOUR IMM	/* Select internal trigger source */
8	OUTP ON	/* Enable the [Output] connector of CH1 at the front panel */

## Example 6: To Generate a Burst Wave

**Target:** Generate a burst: 3-cycle square, 0°initial phase, 10 ms burst period and internal trigger.

### How to realize via commands?

0	*IDN?	/* Query ID to check the operating state */
1	FUNC SQU	/* Select burst function */
2	BURS:STAT ON	/* Enable burst output */
3	BURS:MODE TRIG	/* Select the burst mode */
4	BURS:NCYC 3	/* Set the cycle number */
5	BURS:PHAS 0	/* Set the initial phase*/
6	BURS:INT:PER 0.01	/* Set the period */
7	TRIG:SOUR IMM	/* Select internal trigger source */
8	OUTP ON	/* Enable the [Output] connector of CH1 at the front panel */

## Example 7: To Output Waves via Dual Channels

**Target:** Output a 1kHz, 2.5Vpp, 500mV<sub>DC</sub>, 10° sine wave, via CH1 and a 1.5kHz, 5Vpp, 1 V<sub>DC</sub>, 20° ramp wave via CH2.

### How to realize via commands?

<b>0</b>	<b>*IDN?</b>	<b>/* Query ID to check the operating state */</b>
<b>1</b>	<b>VOLT:UNIT VPP</b>	<b>/* Set the amplitude unit of CH1 */</b>
<b>2</b>	<b>APPL:SIN 1000,2.5,0.5</b>	<b>/* Set the frequency, amplitude and offset of sine wave output from CH1 */</b>
<b>3</b>	<b>PHAS 10</b>	<b>/* Set the initial phase of wave output from CH1 */</b>
<b>4</b>	<b>OUTP ON</b>	<b>/* Enable the [Output] connector of CH1 at the front panel */</b>
<b>5</b>	<b>VOLT:UNIT:CH2 VPP</b>	<b>/* Set the amplitude unit of CH2*/</b>
<b>6</b>	<b>APPL:RAMP:CH2 1500,5,1</b>	<b>/*Set the frequency, amplitude and offset of ramp wave output from CH2*/</b>
<b>7</b>	<b>PHAS:CH2 20</b>	<b>/*Set the initial phase of wave output from CH2*/</b>
<b>8</b>	<b>OUTP:CH2 ON</b>	<b>/* Enable the [Output] connector of CH2 at the front panel */</b>
<b>9</b>	<b>PHAS:ALIGN</b>	<b>/*Enable align phase output of dual channels*/</b>

## Example 8: Channel Coupling

**Target:** Output a 1kHz, 5Vpp, 0V<sub>DC</sub>, 0° sine wave via CH1 and a 1.5kHz, 5Vpp, 0 V<sub>DC</sub>, 0° ramp wave via CH2, and then, take CH1 as the base channel and set the phase deviation as 10°, finally, observe the phase of wave output from CH2 after coupling.

### How to realize via commands?

<b>0</b>	<b>*IDN?</b>	<b>/* Query ID to check the operating state */</b>
<b>1</b>	<b>VOLT:UNIT VPP</b>	<b>/* Set the amplitude unit of CH1 */</b>
<b>2</b>	<b>APPL:SIN 1000,5,0</b>	<b>/*Set the frequency, amplitude and offset of sine wave output from CH1 */</b>
<b>3</b>	<b>PHAS 0</b>	<b>/* Set the initial phase of wave output from CH1*/</b>
<b>4</b>	<b>VOLT:UNIT:CH2 VPP</b>	<b>/* Set the amplitude unit of CH2*/</b>
<b>5</b>	<b>APPL:RAMP:CH2 1500,5,0</b>	<b>/*Set the frequency, amplitude and offset of ramp wave output from CH2*/</b>
<b>6</b>	<b>PHAS:CH2 0</b>	<b>/*Set the initial phase of wave output from CH2*/</b>
<b>7</b>	<b>COUP ON</b>	<b>/* Enable channel coupling function */</b>
<b>8</b>	<b>COUP:BASE:CH1</b>	<b>/* Select CH1 as the base channel */</b>
<b>9</b>	<b>COUP:PHASEDEV 10</b>	<b>/* Set the phase deviation */</b>
<b>10</b>	<b>PHAS 2</b>	<b>/*Change the phase of wave output from CH1*/</b>
<b>11</b>	<b>PHAS:CH2?</b>	<b>/*Query the phase of wave output from CH2 and the query returns 12 */</b>

### Notes:

- 1 The return value of **PHAS:CH2?** is 12, which indicates that the phase of CH2 varies with the phase of CH1 and keeps a 10°phase deviation.
- 2 The setting method of frequency coupling is the same with that of phase coupling.

## Example 9: Channel Copy

**Target:** Output a 1kHz, 5Vpp, 500mV<sub>DC</sub>, 10° sine wave via CH1 and a 1.5kHz, 2Vpp, 0 V<sub>DC</sub>, 0° ramp wave via CH2, and then observe the parameters of wave from CH2 after copying CH1 to CH2.

### How to realize via commands?

0	*IDN?	/* Query ID to check the operating state */
1	VOLT:UNIT VPP	/* Set the amplitude unit of CH1 */
2	APPL:SIN 1000,5,0.5	/* Set the frequency, amplitude and offset of sine wave from CH1 */
3	PHAS 10	/* Set the initial phase of wave from CH1 */
4	VOLT:UNIT:CH2 VPP	/* Set the amplitude unit of CH2 */
5	APPL:RAMP:CH2 1500,2,0	/* Set the frequency, amplitude and offset of ramp wave from CH2 */
6	PHAS:CH2 0	/* Set the initial phase of wave from CH2 */
7	COUP OFF	/* Disable channel coupling */
8	COUP:CHANNC 1>2	/* Copy the wave parameters of CH1 to CH2 */
		/* Query the wave parameters of CH2 after copying */
9	FREQuency:CH2?	/* Return 1.000000e+03 (1kHz) */
10	VOLTage:CH2?	/* Return 5.000000e+00 (5Vpp) */
11	VOLTage:OFFSet:CH2?	/* Return 5.000000e-01 (500mV <sub>DC</sub> ) */
12	PHAS:CH2?	/* Return 10.000 (10°) */

### Notes:

- 1 Channel Copy function is only valid for wave parameters but not for wave shapes.
- 2 Channel Copy function could only be enabled after Channel Coupling is disabled.
- 3 Channel Copy function is limited by parameter verification, for the details please refer to DG1000 User's Guide.





## Appendix: Commands Reference A-Z

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