# Progrmming Guide

## CSG Series Microwave Signal Generator


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## Document Overview

Chapter 1. Programming Overview

This chapter outlines how to build the remote communication between the signal generator and PC, the methods and remote control the signal generator, and brief introduction of the SCPI commands.

Chapter 2. Command Systems

This Chapter introduces the syntax, function, parameter in alphabetical order (from A to Z).

Chapter 3. Application Examples

This chapter provides the application examples of the main function of the signal generator. These examples are combined with a series of commands to realize the basic functions of the signal generator.

# Chapter 1： Programming Overview

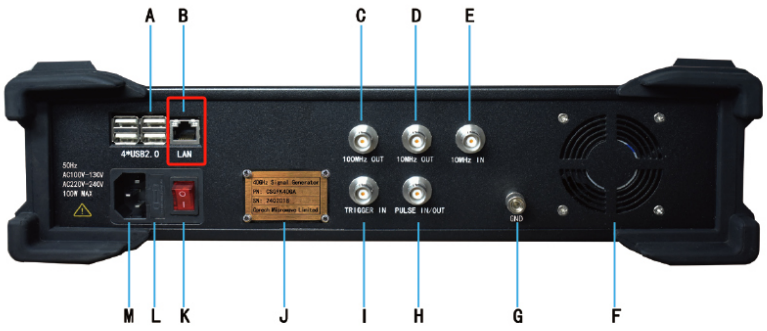
This chapter introduces the remote communication between the instrument and PC and illustrates the syntax, abbreviation rules and status systems of the SCPI commands.

Main Topics of This Chapter:

- Remote Communication Building
- Remote Control Methods
- SCPI Command Overview

## 1. Remote Communication Building

Remote communication between the signal generator and PC can be built over LAN interface.



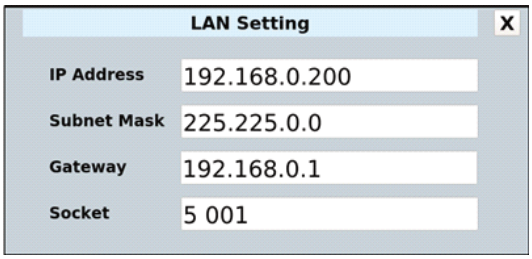

| Ref. | Function | Description |
|---|---|---|
| A | USB Ports | 4×USB2.0 |
| B | Ethernet Port | RJ45 |
| C | 100MHz Output | BNC-Female |
| D | 10MHz Output | BNC-Female |
| E | 10MHz Input | BNC-Female |
| F | Fan | Exhaust |
| G | GND Terminal | GND |
| H | Pulse Signal Input/Output | BNC-Female |
| I | Trigger Signal In | BNC-Female |
| J | Name Plate | |
| K | AC ON/OFF | |
| L | Fuse Holder | Replaceable |
| M | AC Power Port | AC110-240V |

### 1.1 Install NI-VISA Driver

Acquire the NI-VISA Driver from **www.ni.com/visa**

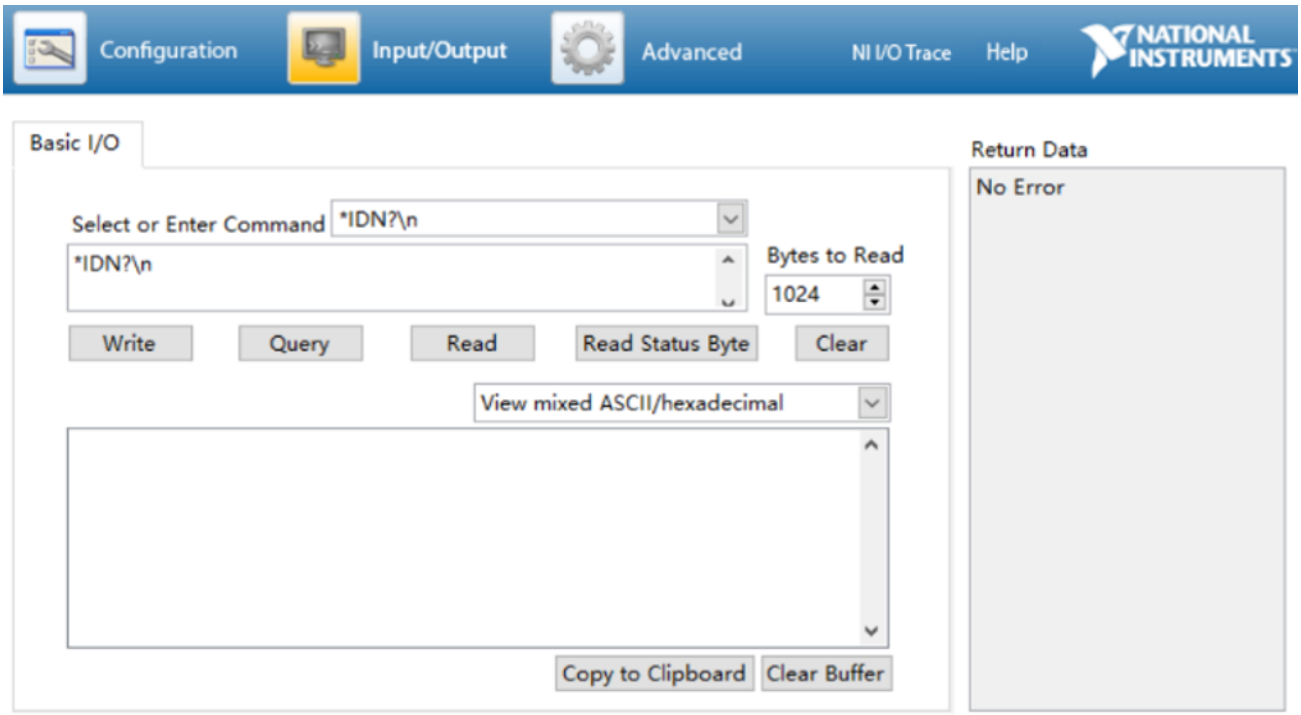
### 1.2 Use LAN Interface

- Make sure that the PC is connected to the local network.
- Check whether your local network supports DHCP or auto IP mode. If not, you need to acquire the available network interface parameters, including the IP address, subnet mask, gateway and DNS.
- Connect the signal generator to the local network by using network cable.
- After turning on the signal generator, press Press [Menu] → [LAN Setting] to set the IP address, subnet mask, gateway.



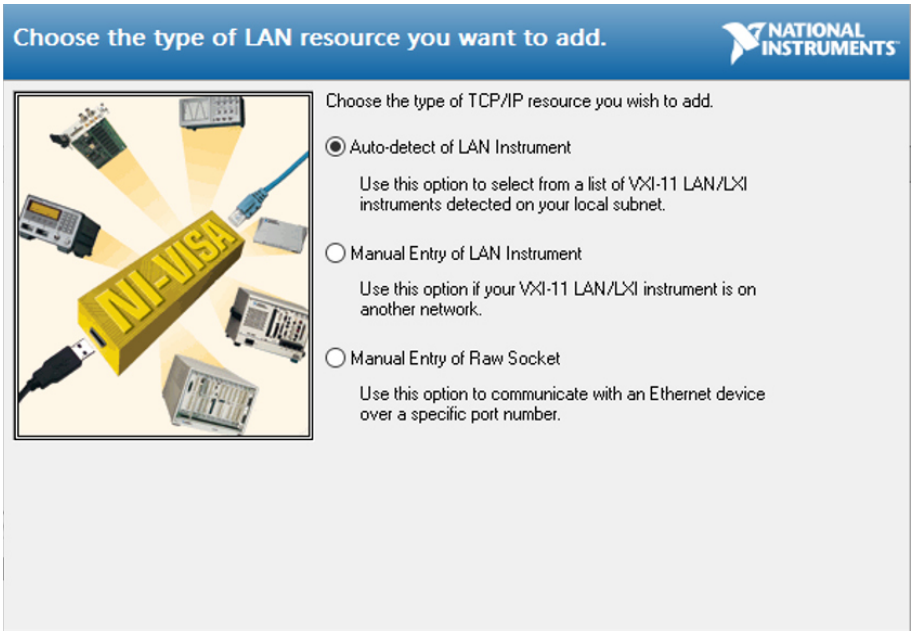

### 1.3 Run NI MAX

- Left Side: My System → Instruments and Connectors → Network Instruments: Find the auto-detected instruments and select the corresponding one;
- Right Side: Open VISA testing board → Enter the SCPI commands in the pop-up window to perform remote control.



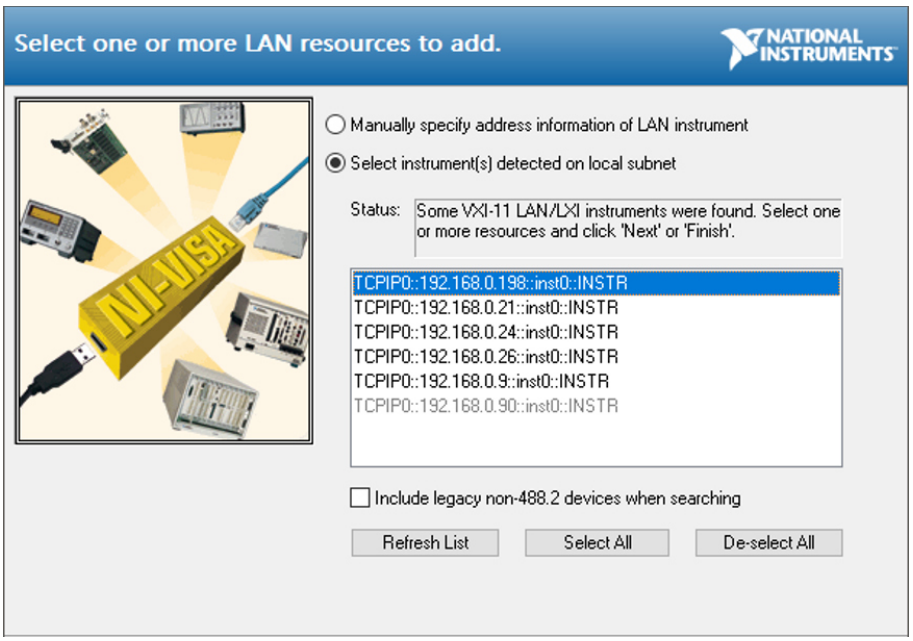
**1.4 If the instrument couldn't be automatically detected in Step 3, you need to manually add the network instrument**

1.4.1 Run NI MAX: My System → Instruments and Connectors → Network Instruments → Select Add Network Instruments → VISA TCP/IP Resource




1.4.2 Select Auto-detect of LAN Instrument in the pop-up window and select Next.

1.4.3 Select the detected instrument and finish this step.



## 2. Remote Control Methods

2.1 User-Defined Programming

Use the SCPI (Standard Commands for Programmable Instruments) commands listed in chapter 2 to program and control the signal generator in various development environments (such as Visual C++, Visual Basic and LabVIEW).

2.2 Send SCPI Commands via PC SoftwareUse

VISA Test Panel by NI to send SCPI commands to remote control the signal generator.

## 3. SCPI Command Overview

SCPI (Standard Commands for Programmable Instrument) is standardized instrument programming language that is based on the standard IEEE488.1 and IEEE 488.2 and conforms to various standard (such as the floating point operation rule in IEEE754 standard, ISO646 7-bit coded character for information interchange (equivalent to ASCII programming). This chapter describes the syntax, symbol, parameter and abbreviation rules of the SCPI commands.

3.1 Syntax

SCPI commands present a hierarchical tree structure and have multiple sub-systems, each of which contains a root keyword and one or more sub-keywords. The command string usually begins with ":"; 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; space is used to separate the command and parameter.

For example,

:SYSTem:COMMunication:LAN:IP:ADDress <value>

:SYSTem:COMMunication:LAN:IP:ADDress?

SYSTem is the root keyword of the command above. COMMunication, LAN, IP and ADDress are the second-level, third-level, forth-level and fifth-level keywords separately. The command string begins with ":" which is also used to separate the multi-level keywords. <value> denotes the parameter available for setting. "?" denotes query and DSG3000 returns the response information (the output value or internal setting value of the instrument) when recieving a query command. The command :SYSTem:COMMunication:LAN:IP:ADDress and parameter <value> are separated by a space. "," is generally used for separating different parameters contained in the same command.

For example,

[:SOURce]:SWEep:LIST:LIST? <Start>,<Count>

## 3.2 Symbol Description

The following 4 symbols are not included in SCPI commands, usually used to describe the parameters in the commands.

- Braces { }

Multiple optional parameters are enclosed in the braces and one of the parameters must be selected when sending the command.

- Vertical Bar |

The vertical bar is used to separate multiple parameters. When you send a command, one of the parameters should be selected.

For example: SYSTem:LANGuage CHINese|ENGLish.

- Square Brackets [ ]

The content (such as keywords) enclosed in the square brackets could be omitted. If the content is omitted, the instrument would set it to the default.

For example: [:SOURce]:AM[:DEPTh]? Sending any of the four commands below generate the same effect.

:AM?

:AM:DEPTh?

:SOURce:AM?

:SOURce:AM:DEPTh?

- Triangle Brackets < >

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

For example, send the [:SOURce]:FREQuency <value> command in :FREQuency 4MHz form.

## 3.3 Parameter Type

Parameters in this guide book includes 5 types: bool, integer, real number, discrete and ASCII character string.

- Bool

The parameter could be OFF, ON, 0 or 1. For example：[:SOURce]:AM:STATe ON|OFF|1|0.

- Integer

  Integer Unless otherwise noted, the parameter can be any integer within the effective value range. Note that do not set the parameter to a decimal; otherwise, errors will occur.

  For example: SYSTem:BRIGhtness <value>, <value> can be any integer from 1 to 8.3.

- Real Number

  Unless otherwise noted, the parameter can be any real number within the effective value range.

  For example：[:SOURce]:AM:FREQuency <value>, <value> is from the range of 10Hz to100kHz.

- Discrete

  The parameter could only be one of the specified values or characters.

  For example：[:SOURce]:AM:WAVEform SINE|SQUA, the parameter can only be SINE or SQUA.

- ASCII Character String

  The parameter should be the combinations of ASCII characters.

  For example：MMEMory:SAVe <file_name>, <file_name> is a file name of of the file to be saved and can include Chinese characters (A Chinese character occupies 2 bytes), English characters and numbers (up to 28 bytes).

## 3.4 Command Abbreviation

All the commands are case-insensitive and you can use any of them. If abbreviation is used, all the capital letters in the command must be written completely.

For example: MMEMory:DISK:FORMat, can be abbreviated to: :MMEM:DISK:FORM.

# Chapter 2： Command System

This chapter introduces the syntax, function, parameter and using instruction of each DSG3000 command in A - Z order.

Main Topics of This Chapter:

- IEEE488.2 Common Commands
- SYSTem Commands
- OUTPut Commands
- SOURce Commands
- TRIGger Commands

## 1. IEEE488.2 Common Commands

The IEEE488.2 common commands are used to query the basic information about the instrument or execute common operations. These commands usually begin with "*", contain a 3-character keyword and relate to the The structure of the status register

Command List：

- *IDN?
- *RST

| ***IDN?** | |
|---|---|
| Syntax | *IDN? |
| Description | Query the ID character string of the instrument. |
| Return Format | Manufacturer Name+Part No.+Serial No.+Software Version No. |
| For example："CRMW,CSG9K20GA,202302001,v7.41" | |

| ***RST** | |
|---|---|
| Syntax | *RST |
| Description | Restore the RF signal generator to the preset state (factory or user). |
| Explanation | **[Press]** button on the front panel. |

### 2. :SYSTem Command

The :SYSTem commands are used to set a series of parameters relating to the system and the settings of these parameters do not affect the output signal of the RF signal generator.

Command List:

- :SYSTem:PRESet

| **:SYSTem:PRESet** | |
|---|---|
| Syntax | :SYSTem:PRESet |
| Description | Reset the instrument to the preset state. |
| Explanation | **[Press]** button on the front panel. |

### 3. :OUTPut Command

Command List:

- :OUTPut

| **:OUTPut:ALL[:STATe]** | |
|---|---|
| Syntax | :OUTPut:ALL[:STATe] <value> |
| Description | Turn on or off the RF output. |
| Parameter | <table><tr><th>Name</th><th>Type</th><th>Range</th><th>Default</th></tr><tr><td><value></td><td>Bool</td><td>1\|ON\|0\|OFF</td><td>0\|OFF</td></tr></table> |
| Explanation | ON\|1: turn on the RF output. At this point, the [RF ON] green light goes on, the interface shows "RF ON". |
| | OFF\|0: turn off the RF output. At this point, the [RF ON] yellow light goes on, the interface shows "RF OFF". |

<table>
<tr><td colspan="2">:OUTPut1[:STATe]</td></tr>
<tr><td rowspan="2">Syntax</td><td>:OUTPut1[:STATe] <value></td></tr>
<tr><td>:OUTPut1 ?</td></tr>
<tr><td>Description</td><td>Turn on or off the RF output of Channel 1.</td></tr>
<tr><td>Parameter</td><td>
<table>
<tr><th>Name</th><th>Type</th><th>Range</th><th>Default</th></tr>
<tr><td><value></td><td>Bool</td><td>1|ON|0|OFF</td><td>0|OFF</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Explanation</td><td>ON|1: turn on the RF output of channel 1. At this point, the enable checkbox for Channel 1 is checked to indicate that it is enabled.</td></tr>
<tr><td>OFF|0: turn off the RF output of channel 1.  At this point, the enable checkbox for Channel 1is unchecked to indicate that it is disabled.</td></tr>
<tr><td>Return Format</td><td>Return ON or OFF.</td></tr>
<tr><td rowspan="2">Example</td><td>:OUTPut1 1  /*turn on the RF output of channel 1*/</td></tr>
<tr><td>:OUTPut1 ? /*query RF output status of Channel 1, return ON or OFF*/</td></tr>
</table>

**4. :SOURce Commands**

The :SOURce commands are used to set the related parameters of the main functions of the RF signal generator including the frequency, level, pluse, sweep etc.

Command List：

- [:SOURce<hw>]: FREQuency Command Subsystem
- [:SOURce<hw>]: POWer Command Subsystem
- [:SOURce<hw>]: MODulation Command Subsystem
- [:SOURce<hw>]: PULM Command Subsystem
- [:SOURce<hw>]: PGENerator Command Subsystem
- [:SOURce<hw>]: SWEep Command Subsystem

### 4.1 [:SOURce<hw>]:FREQuency Command Subsystem

Command List:

- [:SOURce<hw>]: FREQuency:CW
- [:SOURce<hw>]: FREQuency:STARt
- [:SOURce<hw>]: FREQuency:STOP

| **[:SOURce<hw>]:FREQuency:CW** | |
|---|---|
| Syntax | [:SOURce1]:FREQuency:CW <value> |
| | [:SOURce1]:FREQuency:CW ? |
| Description | Set the RF output frequency. |
| Parameter | Name: <value> / Type: Real / Range: 9kHz to 40GHz / Default: 10GHz |
| Explanation | When <value> is set in "Number" form, the default unit is Hz, for example, 6000000000. |
| | <value> can also be set as "Number+Unit" form, for example, 6GHz. |
| Return Format | The query returns the RF frequency, for example, 6.000000000GHz. |
| Example | :SOURce1:FREQuency:CW 6000000000 */*Set the frequency as 6GHz*/* |
| | :SOURce1:FREQuency:CW ? */*Return frequency as 6.000000000000GHz\n*/* |

| **[:SOURce<hw>]:FREQuency:STARt** | |
|---|---|
| Syntax | [:SOURce<hw>]:FREQuency:STARt <value> |
| | [:SOURce<hw>]:FREQuency:STARt ? |
| Description | Set the start frequency of sweep. |
| | Query the start frequency of sweep |
| Parameter | Name: <value> / Type: Real / Range: 9kHz to 40GHz / Default: 10GHz |
| Explanation | When <value> is set in "Number" form, the default unit is Hz, for example, 6000000000. |
| | <value> can also be set as "Number+Unit" form, for example, 6GHz. |
| Return Format | Return the start frequency of sweep. |
| Example | [:SOURce<hw>]:FREQuency:STARt 6 |
| | [:SOURce<hw>]:FREQuency:STARt ? |

| [:SOURce<hw>]:FREQuency:STOP | |
|---|---|
| Syntax | [:SOURce<hw>]:FREQuency:STOP <value> |
| | [:SOURce<hw>]:FREQuency:STOP ? |
| Description | Set the stop frequency of sweep. |
| | Query the stop frequency of sweep. |
| Parameter | <table><tr><th>Name</th><th>Type</th><th>Range</th><th>Default</th></tr><tr><td><value></td><td>Real</td><td>9kHz to 40GHz</td><td>10GHz</td></tr></table> |
| Explanation | When <value> is set in "Number" form, the default unit is Hz, for example, 6000000000. |
| | <value> can also be set as "Number+Unit" form, for example, 6GHz. |
| Return Format | Return the stop frequency of sweep. |
| Example | [:SOURce<hw>]:FREQuency:STOP 6 |
| | [:SOURce<hw>]:FREQuency:STOP ? |

### 4.2 [:SOURce<hw>]:POWer Command Subsystem

Command List:

- [:SOURce<hw>]:POWer:POWer

| [:SOURce<hw>]:POWer:POWer | |
|---|---|
| Syntax | [:SOURce1]:POWer:POWer <value> |
| | [:SOURce1]:POWer:POWer ? |
| Description | Set the power level of RF channels. |
| Parameter | <table><tr><th>Name</th><th>Type</th><th>Range</th><th>Default</th></tr><tr><td><value></td><td>Real</td><td>-120dBm to 17dBm</td><td>-10dBm</td></tr></table> |
| Explanation | When <value> is set in "Number" form, the default unit is dBm, for example, 10. |
| | <value> can also be set in "Number + Unit" form, for example, 10dBm. At this point, the amplitude displayed in the interface is related to the setting of Level Unit:<br>• When the level unit is "dBm", 2.00dBm is displayed;<br>• When the level unit is "dBmV", 56.99dBmV is displayed;<br>• When the level unit is "dBuV", 116.99dBuV is displayed;<br>• When the level unit is "mV", 707.11mV is displayed;<br>• When the level unit is "uV", 707107uV is displayed;<br>• When the level unit is "mW", 10.0000mW is displayed;¬<br>• The default unit of the return value is dBm. |

| [:SOURce<hw>]:POWer:POWer | |
|---|---|
| Return Format | Return power level of RF channel, 10dBm |
| Example | :SOURce1:POWer:POWer 10 */*Set power level as 10dBm*/* |
| | :SOURce1:POWer:POWer ? /*Return frequency10dBm\n*/ |

### 4.3 [:SOURce<hw>]: MODulation Command Subsystem

Command List:

- [:SOURce<hw>]: MODulation

| [:SOURce<hw>]:MODulation:STATe | |
|---|---|
| Syntax | [:SOURce1]:MODulation:STATe <value> |
| Description | Turn on or off all the modulation outputs. |
| Parameter | Name: <value> / Type: Bool / Range: 1\|ON\|0\|OFF / Default: 0\|OFF |
| Explanation | ON\|1: turn on all the modulation outputs. The enable checkbox for [MOD SW] on the interface is checked to indicate that it is enabled. |
| | OFF\|0: turn off all the modulation outputs. The enable checkbox for [MOD SW] on the interface is not checked to indicate that it is disabled. |

### 4.4 [:SOURce<hw>]:Command Subsystem

Command List:

- [:SOURce<hw>]: PULM:STATe
- [:SOURce<hw>]: PULM:TRIGger:MODE
- [:SOURce<hw>]: PULM:SOURce
- [:SOURce<hw>]: PULM:POLarity
- [:SOURce<hw>]: PULM:MODE
- [:SOURce<hw>]: PULM:DELay
- [:SOURce<hw>]: PULM:PERiod
- [:SOURce<hw>]: PULM:WIDth
- [:SOURce<hw>]: PULM:DOUBle:WIDTh
- [:SOURce<hw>]: PULM:DOUBle:DELay
- [:SOURce<hw>]: PULM:TRIGger:EXTernal:SLOPe

| [:SOURce<hw>]:PULM:State | |
|---|---|
| Syntax | [:SOURce1]:PULM:STATe <value> |
| | [:SOURce1]:PULM:STATe ? |
| Description | Set the state of the pulse modulation. |
| | Query the state of the pulse modulation |
| Parameter | Name \| Type \| Range \| Default<br><value> \| Bool \| 1\|ON\|0\|OFF \| 0\|OFF |
| Explanation | ON\|1：turn on the pulse modulation switch to enable the pulse modulation function. Current PM period and pulse width parameter displayed. |
| | OFF\|0: turn off the pulse modulation switch to disable the pulse modulation function. |
| Return Format | Return ON or OFF |
| Example | [:SOURce1]:PULM:STATe 1 */*Turn on pulse modulation switch*/* |
| | [:SOURce1]:PULM:STATe ? */*Query pulse modulation status, return ON or OFF*/* |

| [:SOURce<hw>]:PULM:TRIGger:MODE | |
|---|---|
| Syntax | [:SOURce1]:PULM:TRIGger:MODE <value> |
| | [:SOURce1]:PULM:TRIGger:MODE ? |
| Description | Set the trigger mode of pulse modulation. |
| | Query the trigger mode of pulse modulation. |
| Parameter | Name \| Type \| Range \| Default<br><value> \| Discrete \| AUTO\|EXTernal \| AUTO |
| Explanation | AUTO: select "Auto" trigger mode. At this point, the RF signal generator meets the trigger condition at any time and can perform pulse modulation continuously. |
| | EXTernal: select "Ext Trig" mode. At this point, the RF signal generator receives the external trigger signal input from the [TRIGGER IN] connector at the rear panel. The instrument starts a pulse modulation each time a TTL pulse with the specified polarity is received. |
| | To specify the slope of the TTL pulse, use the [:SOURce]:PULM:TRIGger:EXTernal:SLOPe command to select the "Pos" or "Neg" |
| Return Format | The query returns the trigger mode of pulse modulation, for example, AUTO. |
| Example | [:SOURce1]:PULM:TRIGger:MODE AUTO |
| | [:SOURce1]:PULM:TRIGger:MODE ? |

<table>
<tr><th colspan="2">[:SOURce<hw>]:PULM:SOURce</th></tr>
<tr><td rowspan="2">Syntax</td><td>[:SOURce1]:PULM:SOURce <value></td></tr>
<tr><td>[:SOURce1]:PULM:SOURce ?</td></tr>
<tr><td rowspan="2">Description</td><td>Set the pulse modulation source.</td></tr>
<tr><td>Query the pulse modulation source.</td></tr>
<tr><td>Parameter</td><td>
<table>
<tr><th>Name</th><th>Type</th><th>Range</th><th>Default</th></tr>
<tr><td><value></td><td>Discrete</td><td>INTernal|EXTernal</td><td>INTernal</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Explanation</td><td>NTernal: select “Int” modulation source. At this point, the modulating signal is provided by the internal pulse generator. When the “Pulse Out” is turned on, the pulse signal generated by the internal pulse generator can be output via the [PULSE IN/OUT] connector at the rear panel.</td></tr>
<tr><td>EXTernal: select “Ext” modulation source. At this point, the RF signal genenraot recieves the external pulse modulating signal input from the [PULSE IN/OUT] connector at the rear panel.</td></tr>
<tr><td>Return Format</td><td>The query returns the pulse modulation source (INT or EXT).</td></tr>
<tr><td rowspan="2">Example</td><td>[:SOURce1]:PULM:SOURce INTernal</td></tr>
<tr><td>[:SOURce1]:PULM:SOURce ?</td></tr>
</table>

<table>
<tr><th colspan="2">[:SOURce<hw>]:PULM:POLarity</th></tr>
<tr><td rowspan="2">Syntax</td><td>[:SOURce1]:PULM:POLarity <value></td></tr>
<tr><td>[:SOURce1]:PULM:POLarity ?</td></tr>
<tr><td rowspan="2">Description</td><td>Set the polarity of the pulse modulation.</td></tr>
<tr><td>Query the polarity of the pulse modulation.</td></tr>
<tr><td>Parameter</td><td>
<table>
<tr><th>Name</th><th>Type</th><th>Range</th><th>Default</th></tr>
<tr><td><value></td><td>Discrete</td><td>NORMal|INVerse</td><td>NORMal</td></tr>
</table>
</td></tr>
<tr><td>Explanation</td><td>The parameter NORMal|INVerse can set the polarity of the current pulse modulating signal to “Normal” or “Inverse”.</td></tr>
<tr><td>Return Format</td><td>The query returns NORMAL or INVERSE.</td></tr>
<tr><td rowspan="2">Example</td><td>[:SOURce1]:PULM:POLarity NORMal</td></tr>
<tr><td>[:SOURce1]:PULM:POLarity ?</td></tr>
</table>

| [:SOURce<hw>]:PULM:MODE | |
|---|---|
| Syntax | [:SOURce1]:PULM:MODE <value> |
| | [:SOURce1]:PULM:MODE ? |
| Description | Set the mode of pulse modulation. |
| | Query the mode of pulse modulation |
| Parameter | Name: <value> \| Type: Discrete \| Range: SINGle\|DOUBle \| Default: SINGle |
| Explanation | SINGle: set the pulse mode to "Single" to enable the single pulse modulation mode. |
| | TRAIn: set the pulse mode to "Train" to enable the train modulation mode. |
| Return Format | The query returns to pulse mode. |
| Example | [:SOURce1]:PULM:MODE SINGle |
| | [:SOURce1]:PULM:MODE ? |

| [:SOURce<hw>]:PULM:DELay | |
|---|---|
| Syntax | [:SOURce1]:PULM:DELay <value> |
| | [:SOURce1]:PULM:DELay ? |
| Description | Set pulse modulation trigger delay. |
| | Query pulse modulation trigger delay. |
| Parameter | Name: <value> \| Type: Real \| Range: 0.02us - 100.00s \| Default: 0.02us |
| Explanation | You can use this command to set the pulse delay when select "Int" modulation source and "Ext Trig" mode. |
| | When <value> is set in "Number" form, the default unit is ms, for example, 2. |
| | <value> can also be set in "Number + Unit" form, for example, 2ms. |
| Return Format | The query returns the trigger delay of pulse modulation. |
| Example | [:SOURce1]:PULM:DELay 2 |
| | [:SOURce1]:PULM:DELay ? |

| [:SOURce<hw>]:PULM:PERiod | |
|---|---|
| Syntax | [:SOURce1]:PULM:PERiod <value> |
| | [:SOURce1]:PULM:PERiod ? |
| Description | Set the period of pulse modulation. |
| | Query the period of pulse modulation. |
| Parameter | Name: <value> / Type: Real / Range: 0.11us～100.00s / Default: 20.00us |
| Explanation | When <value> is set in "Number" form, the default unit is ms, for example, 2. |
| | <value> can also be set in "Number + Unit" form, for example, 2ms. |
| | This command is invalid when "Ext" modulation source is selected. |
| Return Format | The query returns the period of pulse modulation. |
| Example | [:SOURce1]:PULM:PERiod 2 |
| | [:SOURce1]:PULM:PERiod ? |

| [:SOURce<hw>]:PULM: WIDTh | |
|---|---|
| Syntax | [:SOURce1]:PULM:WIDTh <value> |
| | [:SOURce1]:PULM:WIDTh ? |
| Description | Set the width of the pulse modulating signal. |
| | Query the width of the pulse modulating signal. |
| Parameter | Name: <value> / Type: Real / Range: 0.10us～99.999 999 99s / Default: 5.00us |
| Explanation | When <value> is set in "Number" form, the default unit is ms, for example, 2. |
| | <value> can also be set in "Number + Unit" form, for example, 2ms. |
| | This command is invalid when "Ext" modulation source is selected. |
| | The single pulse width is limited by the minimum pulse width and pulse period and the three fulfill the following relation:<br>Pulse Width ≥ Minimum Pulse<br>Width Pulse Width ≤ Pulse Period-10ns |
| Return Format | The query returns the width of the pulse modulating signal. |
| Example | [:SOURce1]:PULM:WIDTh 2 |
| | [:SOURce1]:PULM:WIDTh ? |

| [:SOURce<hw>]:PULM:DOUBle:DELay | |
|---|---|
| Syntax | [:SOURce1]:PULM:DOUBle:DELay <value> |
| | [:SOURce1]:PULM:DOUBle: DELay? |
| Description | Set the delay of the double pulse modulating signal. |
| | Query the delay of the double pulse modulating signal. |
| Parameter | <table><tr><th>Name</th><th>Type</th><th>Range</th><th>Default</th></tr><tr><td><value></td><td>Real</td><td>0.11us～100.00s</td><td>5.00us</td></tr></table> |
| Explanation | When <value> is set in "Number" form, the default unit is s, for example, 2. |
| | <value> can also be set in "Number + Unit" form, for example, 2s. |
| | This command is invalid when "Single Pulse" mode is selected |
| Return Format | The query returns the delay of the double pulse modulating signal. |
| Example | [:SOURce1]:PULM:DOUBle: DELay 2 |
| | [:SOURce1]:PULM:DOUBle: DELay? |

| [:SOURce<hw>]:PULM:TRIGger:EXTernal:SLOPe | |
|---|---|
| Syntax | [:SOURce1]:PULM:TRIGger:EXTernal:SLOPe <value> |
| | [:SOURce1]:PULM:TRIGger:EXTernal:SLOPe ? |
| Description | Set the slope of the valid edge of the external trigger pulse. |
| | Query the slope of the valid edge of the external trigger pulse. |
| Parameter | <table><tr><th>Name</th><th>Type</th><th>Range</th><th>Default</th></tr><tr><td><value></td><td>Discrete</td><td>POSitive\|NEGative</td><td>POSitive</td></tr></table> |
| Explanation | When the trigger mode of pulse modulation is set to "Ext Trig", the RF signal generator receives the external trigger signal input from the [PULSE IN] connector at the rear panel. At this point, you can use this command to set the trigger edge of the external trigger signal. |
| | The parameter POSitive\|NEGative can set the slope of the valid edge of the external trigger pulse to "Pos" or "Neg". |
| Return Format | The query returns POSITIVE or NEGATIVE. |
| Example | [:SOURce1]:PULM:TRIGger:EXTernal:SLOPe POSitive |
| | [:SOURce1]:PULM:TRIGger:EXTernal:SLOPe ? |

### 4.5 [:SOURce<hw>]:PGENerator Command Subsystem

Command List:

- [:SOURce<hw>]:PGENerator:OUTPut

| [:SOURce<hw>]:PGENerator:OUTPut | |
|---|---|
| Syntax | [:SOURce<hw>]:PGENerator:OUTPut |
| Description | Set output enable of pulse modulation. |
| | Query output enable of pulse modulation. |
| Parameter | <table><tr><th>Name</th><th>Type</th><th>Range</th><th>Default</th></tr><tr><td><value></td><td>Bool</td><td>1\|ON\|0\|OFF</td><td>0\|OFF</td></tr></table> |
| Explanation | ON\|1: turn on output enable of pulse modulation. |
| | OFF\|0: turn off output enable of pulse modulation. |
| Return Format | The query returns output enable of pulse modulation. |
| Example | [:SOURce1]:PGENerator:OUTPut 1 |
| | [:SOURce1]:PGENerator:OUTPut ? |

### 4.6 [:SOURce<hw>]:SWEep Command Subsystem

Command List:

- [:SOURce<hw>]:SWEep:FREQuency:STEP:LINear
- [:SOURce<hw>]:SWEep:FREQuency:DWELl

| [:SOURce<hw>]:SWEep:FREQuency:STEP:LINear | |
|---|---|
| Syntax | [:SOURce<hw>]:SWEep:FREQuency:STEP:LINear <value> |
| | [:SOURce<hw>]:SWEep:FREQuency:STEP:LINear ? |
| Description | Set the frequency step of sweep |
| | Query the frequency step of sweep. |
| Parameter | <table><tr><th>Name</th><th>Type</th><th>Range</th><th>Default</th></tr><tr><td><value></td><td>Real</td><td>0.001Hz - 40GHz</td><td>0.1GHz</td></tr></table> |
| Explanation | When <value> is set in "Number" form, the default unit is Hz, for example, 6000000000. |
| | <value> can also be set in "Number + Unit" form, for example, 6GHz. |
| Return Format | The query returns frequency step of sweep. |
| Example | [:SOURce1]:SWEep:FREQuency:STEP:LINear 6 |
| | [:SOURce1]:SWEep:FREQuency:STEP:LINear ? |

| [:SOURce<hw>]:SWEep:FREQuency:DWELl | |
|---|---|
| Syntax | [:SOURce<hw>]:SWEep:FREQuency:DWELl <value> |
| | [:SOURce<hw>]:SWEep:FREQuency:DWELl ? |
| Description | Set the frequency dwell time of step sweep. |
| | Query the frequency dwell time of step sweep. |
| Parameter | <table><tr><th>Name</th><th>Type</th><th>Range</th><th>Default</th></tr><tr><td><value></td><td>Real</td><td>10ms～10s</td><td>10ms</td></tr></table> |
| Explanation | When <value> is set in "Number" form, the default unit is ms, for example, 2. |
| | <value> can also be set in "Number + Unit" form, for example, 2ms. |
| Return Format | The query returns frequency dwell time of step sweep. |
| Example | [:SOURce1]:SWEep:FREQuency:DWELl 2 |
| | [:SOURce1]:SWEep:FREQuency:DWELl ? |

**5. :TRIGger Command**

Command List:

- :TRIGger1:FSWeep:SOURce

| :TRIGger1:FSWeep:SOURce | |
|---|---|
| Syntax | :TRIGger1:FSWeep:SOURce <source> |
| | :TRIGger1:FSWeep:SOURce ? |
| Description | Set linear sweep mode. |
| | Query linear sweep mode. |
| Parameter | <table><tr><th>Name</th><th>Type</th><th>Range</th><th>Default</th></tr><tr><td><value></td><td>Discrete</td><td>AUTO\|IMMediate\|SINGle\|BUS</td><td>AUTO</td></tr></table> |
| Explanation | AUTO\|IMMediate: From the start frequency, the output RF frequency increments/decrements step by step according to the frequency sweep steps. After staying at each point for the dwell time, it switches to the next point. Once the final frequency is reached, the frequency turns back to the initial frequency and begins a new sweep cycle. |
| | SINGle\|BUS: turn on single linear sweep mode, from From the start frequency, the output RF frequency increments/decrements step by step according to the frequency sweep steps. After staying at each point for the dwell time, it switches to the next point till the final frequency reached. |
| Return Format | The query returns liner sweep mode. |
| Example | :TRIGger1:FSWeep:SOURce AUTO |
| | :TRIGger1:FSWeep:SOURce ? |

# Chapter 3： Application Examples

This Chapter provides some application examples of the main functions of the signal generator. These examples are composed of a series of commands to achieve the basic functions.

Main Topics of This Chapter:

- Output RF Signal
- Output RF Sweep Signal
- Output RF Modulation Signal

## 1. Output RF Signal

Use the SCPI commands to realize the following functions:

Output a RF signal with 12 GHz frequency and 10 dBm amplitude from the [RF OUTPUT 50Ω] connector.

Method

| No. | Commands | Description |
|---|---|---|
| 1 | *IDN? | */*Query the ID character string of the RF signal generator to check whether the remote communication is normal*/* |
| 2 | *RST | */*Restore the instrument*/* |
| 3 | [:SOURce1]:FREQuency:CW 12000000000 | */*Set the RF signal frequency to 12 GHz*/* |
| 4 | [:SOURce1]:POWer:POWer 10 | */*Set the RF signal power to 10dBm*/* |
| 5 | :OUTPut1 1 | */*Enable the RF output*/* |

## 2. Output RF Sweep Signal

Use the SCPI commands to realize the following functions:

Output a RF sweep signal from the [RF OUTPUT 50Ω] connector by configuring continuous linear step sweep. Set the frequency range to 1 GHz to 12 GHz, the amplitude to 10 dBm, sweep step to 1GHz and the dwell time to 500 ms.

| No. | Commands | Description |
|---|---|---|
| 1 | *IDN? | */*Query the ID character string of the RF signal generator to check whether the remote communication is normal*/* |
| 2 | *RST | */*Restore the instrument*/* |
| 3 | [:SOURce1]:FREQuency:STARt 1000000000 | */*Set the final frequency to 12 GHz*/* |
| 4 | [:SOURce1]:FREQuency:STOP 12000000000 | */*Set the sweep step to 1 GHz*/* |
| 5 | [:SOURce1]:SWEep:FREQuency:STEP:LINear 1GHz | */*Enable the RF output*/* |
| 6 | [:SOURce1]:SWEep:FREQuency:DWELl 10ms | */*Set the dwell time to 1 GHz*/* |

| No. | Commands | Description |
|---|---|---|
| 7 | [:SOURce1]:POWer:POWer 10 | */*Set the RF signal Power to 10 dBm*/* |
| 8 | :OUTPut1 1 | */*Enable the RF output*/* |
| 9 | :TRIGger1:FSWeep:SOURce AUTO | */*Turn on the automatic linear sweep cycle*/* |

**3. Output RF Modulation Signal**

Use the SCPI commands to realize the following functions:

Output an pulse modulated signal. Set the frequency to 12GHz, the pulse period to 1 ms, the pulse width to 50us, single pulse and internal trigger.

| No. | Commands | Description |
|---|---|---|
| 1 | *IDN? | */*Query the ID character string of the RF signal generator to check whether the remote communication is normal*/* |
| 2 | *RST | */*Restore the instrument*/* |
| 3 | [:SOURce1]:FREQuency:CW 12000000000 | */*Set the RF signal frequency to 12 GHz*/* |
| 4 | [:SOURce1]:POWer:POWer 10 | */*Set the RF signal Power to 10 dBm*/* |
| 5 | [:SOURce1]:PULM:PERiod 1 ms | */*Set the pulse modulation period to 1 ms*/* |
| 6 | [:SOURce1]:PULM:WIDth 50 us | */*Set the pulse modulation width to 1 50us*/* |
| 7 | [:SOURce1]:PULM:MODE SINGle | */*Set the pulse modulation mode to single mode*/* |
| 8 | :OUTPut1 1 | */*Enable the RF output*/* |
| 9 | :TRIGger1:FSWeep:SOURce AUTO | */*Turn on the automatic linear sweep cycle*/* |
| 10 | [:SOURce1]:PULM:STATe 1 | */*Enable the pulse modulation*/* |
| 11 | [:SOURce1]:MODulation:ALL:STATe 1\| | */*Turn on the pulse modulation switch*/* |