Keysight
N5166B CXG
N5171B/72B/73B EXG
N5181B/82B/83B MXG
X-Series Signal Generators
Notices

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Getting Started Guide
- Safety Information
- Receiving the Instrument
- Environmental & Electrical Requirements
- Basic Setup
- Accessories
- Operation Verification
- Regulatory Information

User's Guide
- Signal Generator Overview
- Preferences & Enabling Options
- Basic Operation
- Optimize Performance
- Avionics VOR/ILS (Option N5180302B)
- Analog Modulation (Option UNT)
- Pulse Modulation (Options UNW or N5180320B)
- Basic Digital Operation—No BBG Option
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- Digital Signal Interface Module (Option 003 /004)
- Baseband Operating Mode—Primary, BERT, or N5102A
- BERT (Option N5180UN7B)
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- Real-Time Fading (Option 660)
- Custom Digital Modulation (Option N5180431B)
- Multitone and Two-Tone Waveforms (Option N5180430B)
- Troubleshooting
- Working in a Secure Environment

Programming Guide
- Getting Started with Remote Operation
- Using IO Interfaces
- Programming Examples
- Programming the Status Register System
- Creating and Downloading Files
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SCPI Reference
- SCPI Basics
- Basic Function Commands
- System Commands
- Analog Modulation Commands
- Arb Commands
- Avionics VOR/ILS Commands
- Bit Error Rate Test (BERT) Commands
- Digital Signal Interface Module Commands
- Real-Time Commands
Programming Compatibility Guide — Provides a listing of SCPI commands and programming codes for signal generator models that are supported by the Keysight CXG, EXG, and MXG X- Series signal generators.

Service Guide — Troubleshooting
— Replaceable Parts
— Assembly Replacement
— Post–Repair Procedures
— Safety and Regulatory Information
— Instrument History

Error Messages Guide — Error Messages
— Error Message Format
— Error Message Type
— List of Error Messages

Key Help\(^a\) — Key function description
— Related SCPI commands

a. Press the **Help** key, and then the key for which you wish help.
1 SCPI Basics

This chapter describes how SCPI information is organized and presented in this reference. An overview of the SCPI language is also provided.

This chapter contains the following sections:

- Command Reference Information on page 32
- SCPI Basics on page 33
Command Reference Information

SCPI Command Listings

The Table of Contents lists the Standard Commands for Programmable Instruments (SCPI) without the parameters. The SCPI subsystem name will generally have the first part of the command in parenthesis that is repeated in all commands within the subsystem. The title(s) beneath the subsystem name is the remaining command syntax. The following example demonstrates this listing:

Communication Subsystem (:SYSTem:COMMunicate)
   :LAN:IP
   :LAN:SUBNet

The following examples show the complete commands from the above Table of Contents listing:

:SYSTem:COMMunicate:LAN:IP
:SYSTem:COMMunicate:LAN:SUBNet

Key and Data Field Cross Reference

The index is set up so applicable key and data field names can be cross-referenced to the appropriate SCPI command. There are two headings in the index where the key and data field names can be found:

- individual softkey, or data field name (i.e. To look up the communication subsystem topic on Default Gateway softkey refer to Default Gateway softkey.)
- subsystem name (i.e. To look for the Default Gateway softkey (in the Communication Subsystem), refer to the heading labeled: “communication subsystem keys”.)

Supported Field

Within each command section, the “Supported” heading describes which signal generator configurations are supported by the SCPI command. When “All Models” is shown next to this heading, all signal generator configurations are supported by the SCPI command. When “All with Option xxx” is shown next to this heading, only the stated option(s) is supported.
SCPI Basics

This section describes the general use of the SCPI language for Keysight X-Series signal generators. It is not intended to teach you everything about the SCPI language; the SCPI Consortium or IEEE can provide that level of detailed information. For a list of the specific commands available for the signal generator, refer to the table of contents.

For additional information, refer to the following publications:


Common Terms

The following terms are used throughout the remainder of this section:

Command  A command is an instruction in SCPI consisting of mnemonics (keywords), parameters (arguments), and punctuation. You combine commands to form messages that control instruments.

Controller  A controller is any device used to control the signal generator, for example a computer or another instrument.

Event Command  Some commands are events and cannot be queried. An event has no corresponding setting; it initiates an action at a particular time.

Program Message  A program message is a combination of one or more properly formatted commands. Program messages are sent by the controller to the signal generator.

Query  A query is a special type of command used to instruct the signal generator to make response data available to the controller. A query ends with a question mark. Generally you can query any command value that you set.

Response Message  A response message is a collection of data in specific SCPI formats sent from the signal generator to the controller. Response messages tell the controller about the internal state of the signal generator.
Command Syntax

A typical command is made up of keywords prefixed with colons (:). The keywords are followed by parameters. The following is an example syntax statement:

[:SOURce]:PULM:INTernal:FREQuency <frequency>|MAXimum|MINimum|UP|DOWN

In the example above, the :INTernal:FREQuency portion of the command immediately follows the :PULM portion with no separating space. The portion following the :INTernal, <frequency>|MAXimum|MINimum|UP|DOWN, are the parameters (argument for the command statement). There is a separating space (white space) between the command and its parameter.

Additional conventions in syntax statements are shown in Table 1-1 and Table 1-2.

Table 1-1 Special Characters in Command Syntax

<table>
<thead>
<tr>
<th>Characters</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
</table>
| | A vertical stroke between keywords or parameters indicates alternative choices. For parameters, the effect of the command varies depending on the choice. | [:SOURce]:AM:MOD DEEP|NORMal
DEEP or NORMal are the choices. |
| [] | Square brackets indicate that the enclosed keywords or parameters are optional when composing the command. These implied keywords or parameters will be executed even if they are omitted. | [:SOURce]:FREQuency[:CW]?
SOURce and CW are optional items. |
| <> | Angle brackets around a word (or words) indicate they are not to be used literally in the command. They represent the needed item. | [:SOURce]:FREQuency:STARt <value><unit>
In this command, the words <value> and <unit> should be replaced by the actual frequency and unit. |

:SOURce:FREQuency:STARt 2.5GHz |
### SCPI Basics

#### Table 1-2 Command Syntax

<table>
<thead>
<tr>
<th>Characters, Keywords, and Syntax</th>
<th>Example</th>
</tr>
</thead>
</table>
| Upper-case lettering indicates the minimum set of characters required to execute the command. But, each mode of the command must be in either short form or the complete long form (no in-between). Example: Correct: | [:SOURce]:FREQuency[:CW]?,
| :FREQ                                                                                         | FREQ is the minimum requirement.            |
| :FREQuency                                                                                     |                                              |
| Incorrect:                                                                                      |                                              |
| :FREQuenc                                                                                      |                                              |
| Lower-case lettering indicates the portion of the command that is optional; it can either be included with the upper-case portion of the command or omitted. This is the flexible format principle called forgiving listening. Refer to "Command Parameters and Responses" on page 37 for more information. | :FREQuency                                  |
| Either :FREQ, :FREQuency, or :FREQUENCY is correct.                                             |                                              |
| When a colon is placed between two command mnemonics, it moves the current path down one level in the command tree. Refer to “Command Tree” on page 36 more information on command paths. | :TRIGger:OUTPut:POLarity?                    |
| TRIGger is the root level keyword for this command.                                             |                                              |
| If a command requires more than one parameter, you must separate adjacent parameters using a comma. Parameters are not part of the command path, so commas do not affect the path level. | [:SOURce]:LIST:
| DWELL <value>,<value>                                                                          |                                              |
| A semicolon separates two commands in the same program message without changing the current path. | :FREQ 2.5GHz;:POW 10dBm                      |
| White space characters, such as <tab> and <space>, are generally ignored as long as they do not occur within or between keywords. However, you must use white space to separate the command from the parameter, but this does not affect the current path. | :FREQ uency or :POWer :LEVel are not allowed.
| A <space> between :LEVel and 6.2 is mandatory.                                                  |                                              |
| :POWer:LEVel 6.2                                                                               |                                              |
Command Types

Commands can be separated into two groups: common commands and subsystem commands. Figure 1-1, shows the separation of the two command groups.

Common commands are used to manage status registers, synchronization, and data storage and are defined by IEEE 488.2. They are easy to recognize because they all begin with an asterisk. For example *IDN?, *OPC, and *RST are common commands. Common commands are not part of any subsystem and the signal generator interprets them in the same way, regardless of the current path setting.

Subsystem commands are distinguished by the colon (:). The colon is used at the beginning of a command statement and between keywords, as in :FREQuency[:CW?]. Each command subsystem is a set of commands that roughly correspond to a functional block inside the signal generator. For example, the power subsystem (:POWer) contains commands for power generation, while the status subsystem (:STATus) contains commands for controlling status registers.

![Command Types Diagram](Figure 1-1)

Command Tree

Most programming tasks involve subsystem commands. SCPI uses a structure for subsystem commands similar to the file systems on most computers. In SCPI, this command structure is called a command tree and is shown in Figure 1-2.
Figure 1-2  Simplified Command Tree

The command closest to the top is the root command, or simply “the root.” Notice that you must follow a particular path to reach lower level commands. In the following example, :POWer represents AA, :ALC represents BB, :SOURce represents GG. The complete command path is :POWer:ALC:SOURce? (:AA:BB:GG).

Paths Through the Command Tree

To access commands from different paths in the command tree, you must understand how the signal generator interprets commands. The parser, a part of the signal generator firmware, decodes each message sent to the signal generator. The parser breaks up the message into component commands using a set of rules to determine the command tree path used. The parser keeps track of the current path (the level in the command tree) and where it expects to find the next command statement. This is important because the same keyword may appear in different paths. The particular path is determined by the keyword(s) in the command statement.

A message terminator, such as a <new line> character, sets the current path to the root. Many programming languages have output statements that automatically send message terminators.

NOTE

The current path is set to the root after the line-power is cycled or when *RST is sent.

Command Parameters and Responses

SCPI defines different data formats for use in program and response messages. It does this to accommodate the principle of forgiving listening and precise talking. For more information on program data types refer to IEEE 488.2.

Forgiving listening means the command and parameter formats are flexible.

For example, with the :FREQuency:REference:STATe ON|OFF|1|0 command, the signal generator accepts :FREQuency:REference:STATe ON, :FREQuency:REference:STATe 1, :FREQ:REF:STAT ON, :FREQ:REF:STAT 1 to turn on the frequency reference mode.
Each parameter type has one or more corresponding response data types. A setting that you program using a numeric parameter returns either real or integer response data when queried. Response data (data returned to the controller) is more concise and restricted, and is called precise talking.

Precise talking means that the response format for a particular query is always the same.

For example, if you query the power state (:POWer:ALC:STATE?) when it is on, the response is always 1, regardless of whether you previously sent :POWer:ALC:STATE 1 or :POWer:ALC:STATE ON. Table shows the response for a given parameter type.

<table>
<thead>
<tr>
<th>Parameter Types</th>
<th>Response Data Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numeric</td>
<td>Real, Integer</td>
</tr>
<tr>
<td>Extended Numeric</td>
<td>Real, Integer</td>
</tr>
<tr>
<td>Discrete</td>
<td>Discrete</td>
</tr>
<tr>
<td>Boolean</td>
<td>Numeric Boolean</td>
</tr>
<tr>
<td>String</td>
<td>String</td>
</tr>
<tr>
<td>Definite Block</td>
<td>Arbitrary byte dataa</td>
</tr>
</tbody>
</table>

a. (i.e. text, binary, discrete, real, integer, etc.-).

### Numeric Parameters

Numeric parameters are used in both common and subsystem commands. They accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation.

If a signal generator setting is programmed with a numeric parameter which can only assume a finite value, it automatically rounds any entered parameter which is greater or less than the finite value. For example, if a signal generator has a programmable output impedance of 50 or 75 ohms, and you specified 76.1 for the output impedance, the value is rounded to 75. The following are examples of numeric parameters:

- 100                          no decimal point required
- 100.                         fractional digits optional
- –1.23                        leading signs allowed
- 4.56E<space>03               space allowed after the E in exponential
- –7.89E<001                   use either E or e in exponential
- +256                         leading + allowed
- .5                           digits left of decimal point optional
Extended Numeric Parameters

Most subsystems use extended numeric parameters to specify physical quantities. Extended numeric parameters accept all numeric parameter values and other special values as well.

The following are examples of extended numeric parameters:

- 100 any simple numeric value
- 1.2GHz GHz can be used for exponential (E009)
- 200MHz MHz can be used for exponential (E006)
- −100mV negative 100 millivolts
- 10DEG 10 degrees

Extended numeric parameters also include the following special parameters:

- DEFault resets the parameter to its default value
- UP increments the parameter
- DOWN decrements the parameter
- MINimum sets the parameter to the smallest possible value
- MAXimum sets the parameter to the largest possible value

Discrete Parameters

Discrete parameters use mnemonics to represent each valid setting. They have a long and a short form, just like command mnemonics. You can mix upper and lower case letters for discrete parameters.

The following examples of discrete parameters are used with the command :TRIGger[:SEQuence]:SOURce BUS|IMMediate|EXTernal.

- BUS GPIB, LAN, or USB triggering
- IMMediate immediate trigger (free run)
- EXTernal external triggering

Although discrete parameters look like command keywords, do not confuse the two. In particular, be sure to use colons and spaces properly. Use a colon to separate command mnemonics from each other and a space to separate parameters from command mnemonics.

The following are examples of discrete parameters in commands:

- TRIGger:SOURce BUS
- TRIGger:SOURce IMMediate
- TRIGger:SOURce EXTernal
Boolean Parameters

Boolean parameters represent a single binary condition that is either true or false. The two-state boolean parameter has four arguments. The following list shows the arguments for the two-state boolean parameter:

- **ON** boolean true, upper/lower case allowed
- **OFF** boolean false, upper/lower case allowed
- **1** boolean true
- **0** boolean false

String Parameters

String parameters allow ASCII strings to be sent as parameters. Single or double quotes are used as delimiters.

The following are examples of string parameters:

- 'This is valid'
- "This is also valid"
- 'SO IS THIS'

Real Response Data

Real response data represent decimal numbers in either fixed decimal or scientific notation. Most high-level programming languages that support signal generator input/output (I/O) handle either decimal or scientific notation transparently.

The following are examples of real response data:

- +4.000000E+010, −9.990000E+002
- −9.990000E+002
- +4.0000000000000E+010
- +1
- 0
Integer Response Data

Integer response data are decimal representations of integer values including optional signs. Most status register related queries return integer response data.

The following are examples of integer response data:

- 0  signs are optional
- +100 leading + allowed
- −100 leading – allowed
- 256 never any decimal point

Discrete Response Data

Discrete response data are similar to discrete parameters. The main difference is that discrete response data only returns the short form of a particular mnemonic, in all upper case letters.

The following are examples of discrete response data:

- IMM
- EXT
- INT
- NEG

Numeric Boolean Response Data

Boolean response data returns a binary numeric value of one or zero.

String Response Data

String response data are similar to string parameters. The main difference is that string response data returns double quotes, rather than single quotes. Embedded double quotes may be present in string response data. Embedded quotes appear as two adjacent double quotes with no characters between them.

The following are examples of string response data:

- "This is a string"
- "one double quote inside brackets: [""]
- "Hello!"
Program Messages

The following commands will be used to demonstrate the creation of program messages:

\[
[:SOURce]:FREQuency:STARt \quad [:SOURce]:FREQuency:STOP

[:SOURce]:FREQuency[:CW] \quad [:SOURce]:POWer[:LEVel]:OFFSet
\]

Example 1

`:FREQuency:STARt 500MHz;STOP 1000MHz`

This program message is correct and will not cause errors; \texttt{START} and \texttt{STOP} are at the same path level. It is equivalent to sending the following message:

\texttt{FREQuency:STARt 500MHz;FREQuency:STOP 1000MHz}

Example 2

`:POWer 10DBM;:OFFSet 5DB`

This program message will result in an error. The message makes use of the default \texttt{POWer[:LEVel]} node (root command). When using a default node, there is no change to the current path position. Since there is no command \texttt{OFFSET} at the root level, an error results.

The following example shows the correct syntax for this program message:

`:POWer 10DBM;:POWer:OFFSet 5DB`

Example 3

`:POWer:OFFSet 5DB;POWer 10DBM`

This program message results in a command error. The path is dropped one level at each colon. The first half of the message drops the command path to the lower level command \texttt{OFFSET}; \texttt{POWER} does not exist at this level.

The \texttt{POWER 10DBM} command is missing the leading colon and when sent, it causes confusion because the signal generator cannot find \texttt{POWER} at the \texttt{POWER:OFFSet} level. By adding the leading colon, the current path is reset to the root. The following shows the correct program message:

`:POWer:OFFSet 5DB;:POWer 10DBM`

Example 4

\texttt{FREQ 500MHz;POW 4DBM}

In this example, the keyword short form is used. The program message is correct because it utilizes the default nodes of \texttt{FREQ[:CW]} and \texttt{POW[:LEVel]}. Since default nodes do not affect the current path, it is not necessary to use a leading colon before \texttt{FREQ} or \texttt{POW}. 
File Name Variables

File name variables designate a data file and file path. File name variables are used in the SCPI command syntax whenever files are accessed. The name of the file is always required, but the file path can sometimes be optional or be designated using different formats. The following table shows these different file path formats:

<table>
<thead>
<tr>
<th>Format</th>
<th>File Name Variable</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format 1</td>
<td>&quot;&lt;file name&gt;&quot;</td>
<td>&quot;Test_Data&quot;</td>
</tr>
<tr>
<td>Format 2</td>
<td>&quot;&lt;file name@msus&gt;&quot;</td>
<td>&quot;Test_Data@SEQ&quot;a</td>
</tr>
<tr>
<td>Format 3</td>
<td>&quot;&lt;msus:file name&gt;&quot;</td>
<td>&quot;SEQ:Test_Data&quot;</td>
</tr>
<tr>
<td>Format 4</td>
<td>&quot;&lt;/user/directory/file name&gt;&quot;</td>
<td>&quot;/USER/SEQ/Test_Data&quot;</td>
</tr>
</tbody>
</table>

a. Included for backwards compatibility. Not the recommended syntax.

Formats 2–4 offer programming flexibility and are equivalent. Format 1 can only be used with SCPI commands that imply the path name as part of the command syntax. Typically, SCPI load commands that access user-data files do not need to have a file path designated.

See Table 1-3 on page 45 for information on file types and directories.

The maximum length for a file name is 23 characters, excluding the file path.

**Example** Using Format 1

:CORR:FLAT:LOAD "FLAT_DATA"

The preceding example loads user-flatness data from a file called FLAT_DATA located in the USERFLAT directory. No file path is needed as the command syntax implies the directory where the file is located.

**Example** Using Format 2

:MEM:COPY "IQ_DATA@SNVWFM","Test_DATA@WFM1"

The preceding example copies a file named IQ_DATA located in the WAVEFORM directory to a file named Test_DATA in volatile waveform memory (BBG).

**Example** Using Format 3

:MEM:COPY "SNVWFM:IQ_DATA","WFM1:Test_DATA"

The preceding example copies a file named IQ_DATA located in the WAVEFORM directory to a file named Test_DATA in volatile waveform memory (BBG).
Example Using Format 4

:MEM:COPY
"/USER/WAVEFORM/IQ_DATA","/USER/BBG1/WAVEFORM/IQ_DATA"

The preceding example copies a file named IQ_DATA located in the WAVEFORM directory to a file named IQ_DATA in volatile waveform memory (BBG).

The following examples show commands, with different formats, that can be used to download a waveform file named Test_Data into the signal generator’s volatile waveform memory (BBG):

Command Syntax Format 3

:MEM:ORY:DATA "WFM1:Test_Data",#ABC

Command Syntax Format 4

:MEM:ORY:DATA "/USER/BBG1/WAVEFORM/Test_Data",#ABC

These commands are equivalent. The data block, #ABC, is described as follows:

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
<td>This character indicates the beginning of the data block</td>
</tr>
<tr>
<td>A</td>
<td>Number of digits in the byte count B</td>
</tr>
<tr>
<td>B</td>
<td>Byte count in C</td>
</tr>
<tr>
<td>C</td>
<td>Waveform data</td>
</tr>
</tbody>
</table>

Refer to “:DATA” on page 165 and the Programming Guide for more information on data blocks and downloading waveform data.

File Types and Directory Structure

The signal generator uses a computer directory model structure for file storage. The top level directory is called the USER directory. All other directories are subdirectories located under the USER directory. Each subdirectory is dedicated to the type of data stored. For example, the BIN directory is used to store binary data whereas the MARKERS directory is used to store marker data.
NOTE

When the USB media is used, the files on the USB media are stored in a single directory (i.e. USER/). Each file has an extension (i.e. .waveform, .list, .markers, .state, etc.-). The SCPI commands use the paths shown in Table 1-3 on page 45 and the associated examples. But when viewed, the USB media, will not display these directories. Instead the file extensions will be displayed. For more information on the USB media capability refer to the Programming Guide and to the Users Guide.

The instrument’s directory /USER/NONVOLATILE contains either the internal storage and USB media non-volatile files stored with the filename extensions: .waveform, .list, .markers, .state, etc.-. This directory is useful when ftp is used.

The following table lists signal generator the subdirectories and file paths where file types are stored.

Table 1-3 File Types and Directory Structures

<table>
<thead>
<tr>
<th>File System</th>
<th>File Type</th>
<th>File Path</th>
<th>MSUS Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>BINARYa</td>
<td>BIN</td>
<td>/USER/BIN</td>
<td>BINARY:</td>
</tr>
<tr>
<td>HDR1 - volatile arbitrary waveform header filea</td>
<td>HDR1</td>
<td>/USER/BBG1/HEADER</td>
<td>HDR1:</td>
</tr>
<tr>
<td>LIST - sweep list file</td>
<td>LIST</td>
<td>/USER/LIST</td>
<td>LIST:</td>
</tr>
<tr>
<td>MKR1 - volatile arbitrary waveform marker filea</td>
<td>MKR1</td>
<td>/USER/BBG1/MARKERS</td>
<td>MKR1:</td>
</tr>
<tr>
<td>NVHDR - non-volatile arbitrary waveform header filea</td>
<td>NVHDR</td>
<td>/USER/HEADER</td>
<td>NVHDR:</td>
</tr>
<tr>
<td>NVMKR - non-volatile arbitrary waveform marker filea</td>
<td>NVMKR</td>
<td>/USER/MARKERS</td>
<td>NVMKR:</td>
</tr>
<tr>
<td>NVWFOM - non-volatile arbitrary waveform filea</td>
<td>NVWFOM</td>
<td>/USER/WAVEFORM</td>
<td>NVWFOM:</td>
</tr>
<tr>
<td>SEQ - ARB sequence filea</td>
<td>SEQ</td>
<td>/USER/SEQ</td>
<td>SEQ:</td>
</tr>
<tr>
<td>STATE</td>
<td>STATE</td>
<td>/USER/STATE</td>
<td>STATE:</td>
</tr>
<tr>
<td>USERFLAT - user-flatness file</td>
<td>UFLT</td>
<td>/USER/USERFLAT</td>
<td>USERFLAT:</td>
</tr>
<tr>
<td>WFM1 - volatile waveform filea</td>
<td>WAVEFORM</td>
<td>/USER/BBG1/WAVEFORM</td>
<td>WFM1:</td>
</tr>
</tbody>
</table>

a. This feature does not apply to analog signal generator models.

MSUS (Mass Storage Unit Specifier) Variable

The variable "<msus>" enables a command to be file type specific when working with user files. Some commands use it as the only command parameter, while others can use it in conjunction with a file name when a command is not file type specific. When used with a file name, it is similar to
SCPI Basics

Format 2 in the File Name Variables section on page 43. The difference is the file type specifier (msus) occupies its own variable and is not part of the file name syntax.

The following examples illustrate the usage of the variable "<msus>" when it is the only command parameter:

**Command Syntax with the msus variable**

:MMEMory:CATalog? "<msus>"

**Command Syntax with the file system**

:MMEMory:CATalog? "LIST:" 

The variable "<msus>" is replaced with "LIST:". When the command is executed, the output displays only the files from the List file system. The following examples illustrate the usage of the variable "<file name>" with the variable "<msus>":

**Command Syntax with the file name and msus variables**

:MMEMory:DELete[:NAME] "<file name>",["<msus>]"

**Command Syntax with the file name and file system**

:MMEMory:DELete:NAME "LIST_1","LIST:" 

The command from the above example cannot discern which file system LIST_1 belongs to without a file system specifier and will not work without it. When the command is properly executed, LIST_1 is deleted from the List file system.

The following example shows the same command, but using Format 2 from the File Name Variables section on page 43:

:MMEMory:DELete:NAME "LIST_1@LIST"

When a file name is a parameter for a command that is not file system specific, either format ("<file name>";"<msus>" or "<file name@msus>") will work.

Refer to Table 1-3 on page 45 for a listing of the file systems and types.

**Quote Usage with SCPI Commands**

As a general rule, programming languages require that SCPI commands be enclosed in double quotes as shown in the following example:

"FM:EXTernal:IMPedance 600"

However when a string is the parameter for a SCPI command, additional quotes or other delimiters may be required to identify the string. Your programming language may use two sets of doublequotes, one set of single quotes, or back slashes with quotes to signify the string parameter. The following examples illustrate these different formats:
SCPI Basics

"MEMory:LOAD:LIST ""myfile""" used in BASIC programming languages

"MEMory:LOAD:LIST "myfile"" used in C, C++, Java, and PERL

"MEMory:LOAD:LIST 'myfile'" accepted by most programming languages

Consult your programming language reference manual to determine the correct format.

Binary, Decimal, Hexadecimal, and Octal Formats

Command values may be entered using a binary, decimal, hexadecimal, or octal format. When the binary, hexadecimal, or octal format is used, their values must be preceded with the proper identifier. The decimal format (default format) requires no identifier and the signal generator assumes this format when a numeric value is entered without one. The following list shows the identifiers for the formats that require them:

- #B identifies the number as a binary numeric value (base-2).
- #H identifies the number as a hexadecimal alphanumeric value (base-16).
- #Q identifies the number as a octal alphanumeric value (base-8).

The following are examples of SCPI command values and identifiers for the decimal value 45:

#B101101 binary equivalent
#H2D hexadecimal equivalent
#Q55 octal equivalent

The following example sets the RF output power to 10 dBm (or the equivalent value for the currently selected power unit, such as DBUV or DBUVEFM) using the hexadecimal value 000A:

:POW #H000A

A unit of measure, such as dBm or mV, will not work with the values when using a format other than decimal.
2 Basic Function Commands

With firmware version B.01.75 or later, the following options have changed to a new eight-digit format:

- Option 302 to Option N5180302B
- Option 320 to Option N5180320B
- Option 403 to Option N5180403B
- Option 430 to Option N5180430B
- Option 431 to Option N5180432B
- Option 432 to Option N5180431B
- Option UN7 to Option N5180UN7B

Only software options are changed to the eight-digit format. Hardware options remain with three-digits.

This chapter describes SCPI commands for subsystems dedicated to signal generator operations common to most CXG, MXG, and EXG X-Series signal generators.

This chapter contains the following sections:

- Correction Subsystem ([SOURce]:CORRection) on page 50
- Digital Modulation Subsystem—N5166B/72B/82B ([SOURce]) on page 56
- Frequency Subsystem ([SOURce]) on page 70
- List/Sweep Subsystem ([SOURce]) on page 83
- Marker Subsystem—N5173B/83B ([SOURce]) on page 96
- Power Subsystem ([SOURce]:POWer) on page 99
- Vector Modulation Subsystem—N5166B/72B/82B ([SOURce]:IQ) on page 118
Correction Subsystem ([SOURce]:CORRection)

:FLATness:FREQuency

**Supported** All Models

[:SOURce]:CORRection:FLATness:FREQuency? <point>

This command returns the frequency value of the <point> queried.

**Range** 1 to 3,201
**Key Entry** # Points

:FLATness:INITialize:FSTep

**Supported** All Models

**CAUTION**

The current flatness data will be overwritten once this command is executed. If needed, save the current data. Refer to the :FLATness:STORe command for storing user flatness files.

[:SOURce]:CORRection:FLATness:INITialize:FSTep

This command replaces the loaded user flatness data with the settings from the current step array data points.

The maximum number of user flatness points is 3,201. When copying the step array settings over to a user flatness file, ensure that the number of points in the step array do not exceed the maximum user flatness points.

See also “:FLATness:STEP:POINTs” on page 51.

**Range** 1 to 3,201
**Key Entry** Load Cal Array From Step Array

:FLATness:LOAD

**Supported** All Models

[:SOURce]:CORRection:FLATness:LOAD "<file name>"

This command loads a user–flatness correction file. The "<file name>" variable is the name of the file located in the Catalog of USERFLAT Files. The directory path is implied in the command and need not be specified in the file name parameter. For more information on file name syntax, refer to “File Name Variables” on page 43.

**Key Entry** Load From Selected File
Basic Function Commands
Correction Subsystem ([SOURce]:CORRection)

:FLATness:PAIR

Supported All Models

[:SOURce]:CORRection:FLATness:PAIR <freq.>[<freq suffix>], <corr.>[<corr suffix>]

This command sets a frequency and amplitude correction pair.

The maximum number of points that can be entered is 3,201.

<corr.> This variable is the power correction.

Range Frequency range varies and is model dependent. Refer to the instrument’s Data Sheet.

Key Entry Configure Cal Array

:FLATness:POINts

Supported All Models

[:SOURce]:CORRection:FLATness:POINts?

This query returns the number of points in the user-flatness correction file.

:FLATness:PRESet

Supported All Models

The current correction data will be overwritten once this command is executed. Save the current data if needed. Refer to :FLATness:STORe command for storing user-flatness files.

[:SOURce]:CORRection:FLATness:PRESet

This command presets the user-flatness correction to a factory-defined setting that consists of one point.

Key Entry Preset List

:FLATness:STEP:POINts

Supported All Models

[:SOURce]:CORRection:FLATness:STEP:POINts <points> |MAXimum|MINimum|DEFault|

[:SOURce]:CORRection:FLATness:STEP:POINts?[MAXimum|MINimum]

This command is used to define the number of points in the user flatness calibration step array.

See also :FLATness:STEP:STARt and :FLATness:STEP:STOP commands.

*RST 2
Basic Function Commands
Correction Subsystem ([:SOURce]:CORRection)

**Range** 2 to 3,201

**Key Entry** 

<table>
<thead>
<tr>
<th>:FLATness:STEP:STARt</th>
</tr>
</thead>
</table>

**Supported** All Models

[:SOURce]:CORRection:FLATness:STEP:START <freq><unit> | MAXimum| MINimum| DEFault |
[:SOURce]:CORRection:FLATness:STEP:START? [MAXimum|MINimum]

This command sets the start frequency for the user flatness calibration step array. See also, :FLATness:STEP:POINts and :FLATness:STEP:STOP commands.

*RST The preset value is model/option dependent. Refer to the instrument’s Data Sheet.

**Range** The range is model/option dependent. Refer to the instrument’s Data Sheet.

**Key Entry** Freq Start

<table>
<thead>
<tr>
<th>:FLATness:STEP:STOP</th>
</tr>
</thead>
</table>

**Supported** All Models

[:SOURce]:CORRection:FLATness:STEP:STOP <freq><unit> | MAXimum| MINimum| DEFault |
[:SOURce]:CORRection:FLATness:STEP:STOP? [MAXimum|MINimum]

This command sets the stop frequency for the user flatness calibration step array. See also, :FLATness:STEP:POINts and :FLATness:STEP:STARt commands.

*RST The preset value is model/option dependent. Refer to the instrument’s Data Sheet.

**Range** The range is model/option dependent. Refer to the instrument’s Data Sheet.

**Key Entry** Freq Stop

<table>
<thead>
<tr>
<th>:FLATness:STORE</th>
</tr>
</thead>
</table>

**Supported** All Models

[:SOURce]:CORRection:FLATness:STORE "<file name>"

This command stores the current user-flatness correction data to a file named by the :CORRection:FLATness:STORE command. The directory path is implied in the command and need not be specified in the "<file name>" variable.

**Key Entry** Store To File
Basic Function Commands
Correction Subsystem ([SOURce]:CORRection)

Remarks
For information on file name syntax, refer to “File Name Variables” on page 43.

:SPOWer:CHANnel

Supported  All Models
[:SOURce]:CORRection:SPOWer:CHANnel A|B
[:SOURce]:CORRection:SPOWer:CHANnel?
This command selects the channel setting on the external power meter for user flatness calibration.

Default  Channel A
Key Entry  Power Meter Channel A B
Remarks  The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:SPOWer:COMMunicate:LAN:DEVice

Supported  All Models
[:SOURce]:CORRection:SPOWer:COMMunicate:LAN:DEVice <deviceName>
[:SOURce]:CORRection:SPOWer:COMMunicate:LAN:DEVice?
This command enters a VXI–11 device name for a power meter that is being controlled by the signal generator for user flatness calibration. If connecting directly to the power meter, enter the name as specified on your power meter documentation. If connecting through a LAN–GPIB gateway, enter the SICL address of the power meter.

Key Entry  PM VXI–11 Device Name
Remarks  The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:SPOWer:COMMunicate:LAN:IP

Supported  All Models
[:SOURce]:CORRection:SPOWer:COMMunicate:LAN:IP <ipAddress>
[:SOURce]:CORRection:SPOWer:COMMunicate:LAN:IP?
This command sets the internet protocol (IP) address for a power meter that is controlled by the signal generator for user flatness calibration. If connecting to a GPIB power meter through a LAN–GPIB gateway, this command sets the IP address of the gateway.

Key Entry  Power Meter IP Address
Basic Function Commands
Correction Subsystem ([SOURce]:CORRection)

**Remarks**
The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.
Ensure that the power meter IP address is different from the signal generator address.

**:PMETer:COMMunicate:LAN:PORT**

**Supported**
All Models

[:SOURce]:CORRection:PMETer:COMMunicate:LAN:PORT
<portNumber>
[:SOURce]:CORRection:PMETer:COMMunicate:LAN:PORT?

This command sets the IP port number on the power meter that is controlled by the signal generator for users flatness calibration.

**Key Entry**

<table>
<thead>
<tr>
<th>Power Meter IP Port</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5025</td>
<td>Standard mode. The command enables standard mode for simple programming.</td>
</tr>
<tr>
<td>5024</td>
<td>Telnet mode. The command enables the telnet SCPI service for programming.</td>
</tr>
</tbody>
</table>

**NOTE**
For firmware versions <A.01.51, the default telnet mode is 5023. For firmware versions A.01.51 and greater, telnet port 5023 is still available for backwards compatibility.

**Remarks**
The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.
For more information on standard mode and telnet SCPI mode, refer to the Programming Guide.

**:PMETer:COMMunicate:TYPE**

**Supported**
All Models

[:SOURce]:CORRection:PMETer:COMMunicate:TYPE
SOCKets|SOCKETS|VXI11|USB
[:SOURce]:CORRection:PMETer:COMMunicate:TYPE?

This command sets the type of control connection for communication with the external power meter for user flatness calibration.

**Default**
Sockets

**Key Entry**

<table>
<thead>
<tr>
<th>Connection Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOCKets or SOCKETS</td>
<td>The command enables the power meter for sockets LAN control through the signal generator.</td>
</tr>
</tbody>
</table>
Basic Function Commands
Correction Subsystem ([SOURce]:CORRection)

VXI11

The command enables the power meter for VXI-11 control through the signal generator. A power meter with GPIB can be controlled through VXI-11 using a LAN–GPIB gateway.

USB

The command enables the power meter for USB control through the signal generator.

Remarks

The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:PMETer:COMMunicate:USB:DEVice

Supported All Models

[SOURce]:CORRection:PMETer:COMMunicate:USB:DEVice <device>

This command selects the USB device to be used for user flatness calibration. The query returns the USB device identification.

Key Entry USB Device

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:PMETer:COMMunicate:USB:LIST?

Supported All Models

[SOURce]:CORRection:PMETer:COMMunicate:USB:LIST?

The query returns a listing of all connected USB devices.

Key Entry USB Device

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

[:STATe]

Supported All Models

[SOURce]:CORRection[:STATe] ON|OFF|1|0

This command enables or disables the user–flatness corrections.

*RST 0

Key Entry Flatness Off On
Basic Function Commands
Digital Modulation Subsystem—N5166B/72B/82B ([:SOURce])

Digital Modulation Subsystem—N5166B/72B/82B ([:SOURce])

:BURSt:STATe

Supported  N5166B/72B/82B

[:SOURce]:BURSt:STATe  ON|OFF|1|0
[:SOURce]:BURSt:STATe?

This command enables or disables the burst envelope function.

*RST  0

Key Entry  Burst Envelope Off On

:DM:CORRection:OPTimization

Supported  N5166B/72B/82B

[:SOURce]:DM:CORRection:OPTimization  RFOut|EXTernal
[:SOURce]:DM:CORRection:OPTimization?

This command enables the internal optimized path to accommodate I/Q signals.

EXT  This choice applies correction terms to provide a calibrated signal at the IQ output. When the I/Q Output is selected, the RF signals at the RF Output are uncalibrated.

RFO  This choice applies correction terms to provide a calibrated signal at the RF output. When the RF Output is selected, the I/Q signals at the I/Q Output are uncalibrated.

*RST  RFO

Key Entry  Correction Optimized Path

:DM:EXTernal:INPut:ATTen

Supported  N5166B/72B/82B

[:SOURce]:DM:EXTernal:INPut:ATTen  <val><unit>
[:SOURce]:DM:EXTernal:INPut:ATTen?

This command sets the attenuation level for the external I/Q signals being modulated through the signal generator RF path. The variable <val> is expressed in decibels (dB).

Example

:DM:EXT:INP:ATT 10

The preceding example sets the modulator attenuator to 10 dB.
Basic Function Commands
Digital Modulation Subsystem—N5166B/72B/82B ([:SOURce])

*:RST +2.00000000E+000
Range 0 to 40 dB
Key Entry Modulator Atten Manual Auto

:DM:EXTernal:INPut:ATTen:AUTO

Supported N5166B/72B/82B

[:SOURce]:DM:EXTernal:INPut:ATTen:AUTO ON|OFF|1|0
[:SOURce]:DM:EXTernal:INPut:ATTen:AUTO?

This command enables or disables the external I/Q attenuator auto mode. The auto mode will be switched to manual if the signal generator receives a AUTO OFF or AUTO 0 command.

ON (1) This choice sets the external I/Q attenuator to auto mode which optimizes the attenuation setting for the current signal generator settings.

OFF (0) This choice sets the attenuator to manual mode and holds the attenuator at its current setting.

Example
:DM:EXT:INP:ATT:AUTO OFF

The preceding example sets the external I/Q attenuator to manual mode.

*:RST 1
Key Entry Modulator Atten Manual Auto

:DM:EXTernal:INPut:ATTen:LEVel

Supported N5166B/72B/82B

[:SOURce]:DM:EXTernal:INPut:ATTen:LEVel <val><volt_units>
[:SOURce]:DM:EXTernal:INPut:ATTen:LEVel?

This command sets the I/Q signal voltage level at the external I/Q inputs. The voltage level set with this command is used as the input level setting for automatic attenuation.

Example
:DM:EXT:INP:ATT:LEV 100MV

The preceding example sets the voltage level for the I and Q inputs to 100 millivolts.

*:RST +4.00000000E–001
Range .05 to 1 Volt
Key Entry I/Q Output Atten
Basic Function Commands
Digital Modulation Subsystem—N5166B/72B/82B ([:SOURce])

:DM:EXTernal:INPut:ATTen:LEVel:MEASurement

**Supported** N5166B/72B/82B

[[:SOURce]:DM:EXTernal:INPut:ATTen:LEVel:MEASurement]

This command measures the RMS value of the external I/Q signal. The external input level must be set to Measure.

**Key Entry** Do External Input Level Measurement


**Supported** N5166B/72B/82B

[[:SOURce]:DM:EXTernal:INPut:ATTen:MODE]

DEFault|MANual|MEASure

[[:SOURce]:DM:EXTernal:INPut:ATTen:MODE?]

This command selects the external measurement used to set the attenuator level. The modulation attenuation must be in Auto mode and is enabled by the :DM:EXTernal:INPut:ATTen:AUTO command.

**Example**

:DM:EXT:INP:ATT:MODE MAN

The preceding example sets manual as the method for setting the external I/Q input level.

*RST** DEFault

**Key Entry** Ext Input Level (nnn mV) Default Man Meas

:DM:EXTernal:POLarity

**Supported** N5166B/72B/82B

[[:SOURce]:DM:EXTernal:POLarity NORMAL|INVert|INVerted

[[:SOURce]:DM:EXTernal:POLarity?]
Basic Function Commands  
Digital Modulation Subsystem—N5166B/72B/82B [:SOURce]

This command, for backward compatibility with older signal generator models, selects normal or inverted I/Q routing of signals going out of the rear-panel I and Q output connectors. In the inverted mode, the Q input is routed to the I modulator and the I input is routed to the Q modulator.

Example

:DM:EXT:POL INV

The preceding example inverts I and Q signal routing.

*RST NORM

Key Entry Int Phase Polarity Normal Invert

:DM:INTernal:CHANnel:CORRection[:STATE]

Supported N5166B/72B/82B

[:SOURce]:DM:INTernal:CHANnel:CORRection[:STATE] ON|OFF|1|0

[:SOURce]:DM:INTernal:CHANnel:CORRection[:STATE]?

This command enables and disables the RF and baseband magnitude and phase corrections across the 160 MHz baseband bandwidth, at the current frequency.

When this feature is on, arbitrary frequency switching while the baseband is on will take up to an additional 3.3ms (typical) to 6.8ms the first time that frequency is specified. After that, switching to that frequency will take up to an additional 1.3ms. Up to 1024 unique frequencies can be cached before the oldest cache will be forgotten. If a frequency sweep is activated, then the calculation and caching will occur up front for the first 1024 unique frequencies, and all further unique frequencies will have the characteristics of arbitrary frequency switching.

If the I/Q correction optimized path is set to Ext I/Q Output, then only the baseband corrections are applied and the frequency switching is unaffected.

This correction is convolved with the ACP internal I/Q channel optimization filter and the equalization filter, if they are active. The resulting filter is truncated to 256 taps.

Example

:DM:INT:CHAN:CORR ON

The preceding example enables the internal channel correction calibration.

Key Entry Int Channel Correction Off On

:DM:INTernal:CHANnel:OPTimization

Supported N5166B/72B/82B

[:SOURce]:DM:INTernal:CHANnel:OPTimization EVM|ACP

[:SOURce]:DM:INTernal:CHANnel:OPTimization?
Basic Function Commands
Digital Modulation Subsystem—N5166B/72B/82B ([SOURce])

This command selects between optimizing the internal I/Q channel for EVM (in channel performance) at the expense of ACP (out of channel performance) or optimizing for ACP at the expense of EVM.

EVM is an 80% Nyquist filter (160 MHz wide) with a wide transition band. When an equalization filter is active, this filter is not active.

ACP is an 80% Nyquist filter (160 MHz wide) with a narrow transition band, thus reducing images for wide-band signals. This filter will be convolved with the active equalization filter, the result of which will be truncated to the center 256 taps.

*RST EVM
Key Entry Optimize Int I/Q Channel EVM ACP


Supported N5166B/72B/82B

[:SOURce]:DM:INTernal:EQUalization:FILTer:SElec "Filter"
[:SOURce]:DM:INTernal:EQUalization:FILTer:SElec?

This command selects the FIR file to use as the equalization filter. Equalization filters are typically complex and must have an oversample ratio of 1. The filter must not have more than 256 taps (512 coefficients for a complex filter). The equalization filter operates at 200 MHz, so all equalization filters must be resampled to 200 MHz if they are sampled at some other rate.

*RST No file selected
Key Entry Select Filter

:DM:INTernal:EQUalization:FILTer:STATe

Supported N5166B/72B/82B

[:SOURce]:DM:INTernal:EQUalization:FILTer:STATe ON|OFF|1|0
[:SOURce]:DM:INTernal:EQUalization:FILTer:STATe?

This command enables or disables the I/Q internal equalization filter. This filter can be used to correct and/or impair the RF and external I/Q outputs for the internal I/Q source. This filter will be convolved with the ACP internal I/Q Channel Optimization filter if that filter is selected, the result of which will be truncated to the center 256 taps. The equalization filter operates at 200 MHz, so all equalization filters must be resampled to 200 MHz if they are sampled at some other rate.

Applying I/Q Delay or I/Q Timing Skew will reduce the actual number of coefficients available in the hardware by 2 taps for every integral step of 5ns of delay or 10 ns of skew.

*RST Off
Basic Function Commands
Digital Modulation Subsystem—N5166B/72B/82B ([:SOURce])

Key Entry       Int Equalization Off On

:DM:IQADjustment:DELay

Supported       N5166B/72B/82B

[:SOURce]:DM:IQADjustment:DELay <value><unit>
[:SOURce]:DM:IQADjustment:DELay?

This command enables you to change the absolute phase of both I and Q with respect to triggers and markers. A positive value delays I and Q. This value affects both the external I/Q out signals and the baseband signal modulated on the RF output. This adjustment does not affect external I/Q inputs.

The variable <value> is expressed in seconds.

*RST         +0.00000000E+000
Range         −400 το 400 νανοσεξονδσ (νσ)

Key Entry     I/Q Delay
Remarks        This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:EXTernal:CMRange

Supported       N5166B/72B/82B

[:SOURce]:DM:IQADjustment:EXTernal:CMRange COARse|FINE
[:SOURce]:DM:IQADjustment:EXTernal:CMRange?

This command sets the common mode offset range voltage (COARse or FINE) for both the in–phase (I) and quadrature–phase (Q) signals going out of the rear panel I and Q output connectors.

The common mode offset range is expressed in units of volts (mV–V). The COARse range corresponds to a pre–existing adjustment range of ±2.5 V. When the FINE range is enabled, the common mode offset is limited to ±100 mV.

*RST         COAR
Range         −2.5 to 2.5 V (Coarse), −100 to 100 mV (Fine)

Key Entry     Common Mode I/Q Offset Range
Remarks        This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:EXTernal:COFFset

Supported       N5166B/72B/82B
Basic Function Commands
Digital Modulation Subsystem—N5166B/72B/82B ([:SOURce])

[:SOURce]:DM:IQADjustment:EXTernal:COFFset <value>
[:SOURce]:DM:IQADjustment:EXTernal:COFFset?

This command sets the common mode offset voltage for both the in–phase (I) and quadrature–phase (Q) signals going to the rear panel I and Q output connectors.

The variable <value> is expressed in units of volts (mV–V).

* RST +0.00000000E+000
Range –2.5 to 2.5 V
Key Entry Common Mode I/Q Offset
Remarks This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:EXTernal:DIOFfset

Supported N5166B/72B/82B

[:SOURce]:DM:IQADjustment:EXTernal:DIOFfset <value>
[:SOURce]:DM:IQADjustment:EXTernal:DIOFfset?

This command sets the differential offset voltage for an in–phase (I) signal routed to the I output connectors.

The variable <value> is expressed in units of volts (mV–V).

* RST +0.00000000E+000
Range –25 to 25 mV
Key Entry Diff. Mode I Offset
Remarks This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:EXTernal:DQOFfset

Supported N5166B/72B/82B

[:SOURce]:DM:IQADjustment:EXTernal:DQOFfset <value>
[:SOURce]:DM:IQADjustment:EXTernal:DQOFfset?

This command sets the differential offset voltage for a quadrature–phase (Q) signal routed to the Q output connectors.

* RST +0.00000000E+000
Range –25 to 25 mV
Key Entry Diff. Mode Q Offset
Basic Function Commands
Digital Modulation Subsystem—N5166B/72B/82B ([:SOURce])

Remarks
This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.


Supported N5166B/72B/82B

[:SOURce]:DM:IQADjustment:EXTernal:INPut:GAIN <val>
[:SOURce]:DM:IQADjustment:EXTernal:INPut:GAIN?

This command adjusts the External Input I/Q Gain Balance.

The variable <val> is expressed in units of decibels (dB), and the minimum increment is 0.001 dB.

*RST +0.00000000E+000
Range −1 to 1
Key Entry External Input I/Q Gain Balance

:DM:IQADjustment:EXTernal:IOFFset

Supported N5166B/72B/82B

[:SOURce]:DM:IQADjustment:EXTernal:IOFFset <value>
[:SOURce]:DM:IQADjustment:EXTernal:IOFFset?

This command sets the offset voltage for a signal applied to the external I Input connector.

The variable <value> is expressed in units of volts (mV–V).

*RST +0.00000000E+000
Key Entry External Input I Offset
Range −100 to 100 mV
Remarks This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:EXTernal:QOFFset

Supported N5166B/72B/82B

[:SOURce]:DM:IQADjustment:EXTernal:QOFFset <value>
[:SOURce]:DM:IQADjustment:EXTernal:QOFFset?

This command sets the offset voltage for a signal applied to the External Q Input connector.

The variable <value> is expressed in units of volts (mV–V).

*RST +0.00000000E+000
### Basic Function Commands

**Digital Modulation Subsystem—N5166B/72B/82B [:SOURce]**

<table>
<thead>
<tr>
<th><strong>Range</strong></th>
<th>−100 to 100 mV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key Entry</strong></td>
<td><strong>External Input Q Offset</strong></td>
</tr>
<tr>
<td><strong>Remarks</strong></td>
<td>This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.</td>
</tr>
</tbody>
</table>

:DM:IQADjustment:EXTernal:QSKew

<table>
<thead>
<tr>
<th><strong>Supported</strong></th>
<th>N5166B/72B/82B</th>
</tr>
</thead>
<tbody>
<tr>
<td>[:SOURce]:DM:IQADjustment:EXTernal:QSKew &lt;value&gt;</td>
<td></td>
</tr>
<tr>
<td>[:SOURce]:DM:IQADjustment:EXTernal:QSKew?</td>
<td></td>
</tr>
</tbody>
</table>

**CAUTION**

This Q phase angle adjustment is uncalibrated.

This command adjusts the phase angle (quadrature skew) between the I and Q vectors by increasing or decreasing the Q phase angle. This command adjusts the signals externally input to the signal generator’s front-panel Q input connector. For more information on this connector, refer to the User’s Guide.

The <value> variable is expressed in degrees with a minimum resolution of 0.1.

If the signal generator is operating at frequencies greater than 3.3 GHz, quadrature skew settings greater than ±5 degrees will not be within specifications.

Positive skew increases the angle from 90 degrees while negative skew decreases the angle from 90 degrees. When the quadrature skew is zero, the phase angle between the I and Q vectors is 90 degrees.

This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

**Example**

:DM:IQAD:EXT:QSK 4.5

The preceding example increases the phase angle by 4.5 degrees.

<table>
<thead>
<tr>
<th><strong>RST</strong></th>
<th>+0.00000000E+000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range</strong></td>
<td>−200 to +200</td>
</tr>
<tr>
<td><strong>Key Entry</strong></td>
<td><strong>Quadrature Angle Adjustment</strong></td>
</tr>
</tbody>
</table>
Basic Function Commands

Digital Modulation Subsystem—N5166B/72B/82B ([SOURce])

:DM:IQADjustment:GAIN

Supported
N5166B/72B/82B

[:SOURce]:DM:IQADjustment:GAIN <value><unit>
[:SOURce]:DM:IQADjustment:GAIN?

This command adjusts the ratio of I to Q while preserving the composite, vector magnitude. Adding gain (+x dB) to the signal increases the I component and decreases the Q component proportionally. Reducing gain (–x dB) decreases the I component and increases the Q component proportionally.

The variable <value> is expressed in units of decibels (dB).

*RST +0.00000000E+000
Range −1 to 1
Key Entry I/Q Gain Balance
Remarks This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATE] command.

:DM:IQADjustment:IOFFset

Supported
N5166B/72B/82B

[:SOURce]:DM:IQADjustment:IOFFset <value><unit>
[:SOURce]:DM:IQADjustment:IOFFset?

This command adjusts the I channel offset value.

When using this command to minimize the LO feedthrough signal, optimum performance is achieved when the command is sent after all other I/Q path commands are executed, such as those that change the internal phase polarity or adjust the modulator attenuator. If other adjustments are made after minimizing is performed, the LO feedthrough signal may increase.

The variable <value> is expressed in units of percent with a minimum resolution of 0.025.

*RST +0.00000000E+000
Range −20.000 to 20.000
Key Entry I Offset
Remarks This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATE] command.
Basic Function Commands

Digital Modulation Subsystem—N5166B/72B/82B [:SOURce]

:DM:IQADjustment:PHASe

**Supported**
N5166B/72B/82B

[:SOURce]:DM:IQADjustment:PHASe <value><unit>
[:SOURce]:DM:IQADjustment:PHASe?

This feature allows adjustment of the absolute phase of the internal I/Q channel by rotating both I and Q, and so adjusting the relative phase of the RF carrier. For MXGs with Option 012, this is the only way to adjust the phase for a unit with an external LO.

The I/Q signal will be scaled down by 0.7071 for all phase offsets except 0. Use -360 or +360, if it is desirable to maintain a constant power level with the ALC off while adjusting the I/Q phase.

The variable <value> is expressed in units of degrees with a resolution of 0.01 degrees. <unit> can be nothing or DEG for degrees.

- **RST**
  +0.00000000E+000
- **Range**
  −360.000 to 360.000
- **Key Entry**
  I/Q Phase

**Remarks**
This command is effective only if the state of the I/Q adjustment function is set to on. Refer to the .:DM:IQADjustment[:STATe] command.

:DM:IQADjustment:QOFFset

**Supported**
N5166B/72B/82B

[:SOURce]:DM:IQADjustment:QOFFset

[:SOURce]:DM:IQADjustment:QOFFset?

This command adjusts the Q channel offset value.

When using this command to minimize the LO feedthrough signal, optimum performance is achieved when the command is sent after all other I/Q path commands are executed, such as those that change the internal phase polarity or adjust the modulator attenuator. If other adjustments are made after minimizing is performed, the LO feedthrough signal may increase.

The variable <value> is expressed in units of percent with a minimum resolution of 0.025.

- **RST**
  +0.00000000E+000
- **Range**
  −20.000 to 20.000
- **Key Entry**
  Q Offset

**Remarks**
This command is effective only if the state of the I/Q adjustment function is set to on. Refer to the .:DM:IQADjustment[:STATe] command.
Basic Function Commands
Digital Modulation Subsystem—N5166B/72B/82B ([:SOURce])

:DM:IQADjustment:QSKew

**Supported** N5166B/72B/82B

[:SOURce]:DM:IQADjustment:QSKew <value>

This command adjusts the phase angle (quadrature skew) between the I and Q vectors by increasing or decreasing the Q phase angle.

The <value> variable is expressed in degrees with a minimum resolution of 0.1.

If the signal generator is operating at frequencies greater than 3.3 GHz, quadrature skew settings greater than ±5 degrees will not be within specifications.

Positive skew increases the angle from 90 degrees while negative skew decreases the angle from 90 degrees. When the quadrature skew is zero, the phase angle between the I and Q vectors is 90 degrees.

This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

**Example**

:DM:IQAD:QSK 4.5

The preceding example increases the phase angle by 4.5 degrees.

* RST +0.00000000E+000

Range −1E1 to +1E1

Key Entry Quadrature Angle Adjustment

:DM:IQADjustment:SKEW

**Supported** N5166B/72B/82B

[:SOURce]:DM:IQADjustment:SKEW <value>

This command changes the I/Q skew which is a time delay difference between the I and Q signals. Equal and opposite skew is applied to both I and Q and affects the RF Output and I/Q output paths simultaneously. A positive value delays the I signal relative to the Q signal, and a negative value delays the Q signal relative to the I signal.

**Example**

:DM:IQAD:SKEW 5E–9

The preceding example sets the time delay difference between the I and Q signals to 5 nanoseconds.

* RST +0.00000000E+000

Range −800 to +800 ns
**Basic Function Commands**

**Digital Modulation Subsystem—N5166B/72B/82B ([:SOURce])**

**Key Entry**

**I/Q Skew**

:DM:IQADjustment[:STATe]

**Supported**

N5166B/72B/82B

[:SOURce]:DM:IQADjustment[:STATe] ON|OFF|1|0

[:SOURce]:DM:IQADjustment[:STATe]?

This command enables or disables the I/Q adjustments.

**Example**

:DM:IQAD 1

The preceding example enables I/Q adjustments.

*RST 0

**Key Entry**

I/Q Adjustments Off On

**Key Path**

I/Q > I/Q Adjustments Off On

:DM:POLarity[:ALL]

**Supported**

N5166B/72B/82B

[:SOURce]:DM:POLarity[:ALL] NORMal|INVert

[:SOURce]:DM:POLarity?

This command sets the digital phase polarity.

NORMal This choice selects normal phase polarity for the I and Q signals.

INVert This choice inverts the Q channel signal.

*RST NORM

**Key Entry**

Int Phase Polarity Normal Invert

:DM:SOURce

**Supported**

N5166B/72B/82B

[:SOURce]:DM:SOURce EXTernal|INTernal|SUM

[:SOURce]:DM:SOURce?

This command selects the I/Q modulator source.

This softkey is found under the I/Q menu.

EXTernal This choice selects a 50 ohm impedance for the I and Q input connectors and routes the applied signals to the I/Q modulator.
Basic Function Commands
Digital Modulation Subsystem—N5166B/72B/82B [:SOURce]

INTernal
This choice selects the internal baseband generator as the source for the I/Q modulator and requires Option 65x.

Sum
This choice selects the internal baseband generator and combines that signal with an external source and routes the applied signals to the I/Q modulator and requires Option 65x.

*RST
INT

:DM:STATe
Supported N5166B/72B/82B
[:SOURce]:DM:STATe ON|OFF|1|0
[:SOURce]:DM:STATe?
This command enables or disables the I/Q modulator.

The I/Q modulator is enabled whenever a digital format is turned on.
The I/Q annunciator will be shown on the signal generator display whenever the I/Q modulator is on.

ON (1) This choice enables the internal I/Q modulator.
OFF (0) This choice disables the internal I/Q modulator. You can turn off the I/Q with this choice even though a digital format is enabled. With this configuration, the RF output signal will not be modulated, but the I/Q signals may be present at the rear panel I and Q outputs depending on the rear panel output selection.

*RST
0
Key Entry I/Q Off On

:DM:SRATio
Supported N5166B/72B/82B
[:SOURce]:DM:SRATio <val><unit>
[:SOURce]:DM:SRATio?
This command sets the power level difference (ratio) between the source one and source two signals when the two signals are summed together. A positive ratio value reduces the amplitude for source two, while a negative ratio value reduces the amplitude for source one.

*RST +0.00000000E+000
Range ± 50 dB
Key Entry Summing Ratio (SRC1/SRC2) x.xx dB
Frequency Subsystem ([:SOURce])

:FREQuency:CENTer

**Supported**  All Models

[:SOURce]:FREQuency:CENTer <num>[<freq_suffix>] | UP | DOWN

[:SOURce]:FREQuency:CENTer? [MAXimum|MINimum]

This command sets the center frequency for a step sweep. The center frequency symmetrically divides the selected frequency span and is coupled to the start and stop frequency settings. The frequency range and reset values are dependent on the signal generator model and option number.

The query returns the start and stop frequencies if the optional MAXimum or MINimum are used.

*RST  The preset value is model/option dependent. Refer to the instrument's Data Sheet.

**Range**  The range is model/option dependent. Refer to the instrument's Data Sheet.

**Example**

:FREQ:CENT .5 GHz

The preceding example sets the center frequency for a sweep to .5 GHz.

**Key Entry**  Freq Center

:FREQuency:CHANnels:BAND

**Supported**  All Models

[:SOURce]:FREQuency:CHANnels:BAND
NBASe|NMOBile|BPGSm|MPGSm|BEGSm|MEGSm|
BRGSm|MRGSm|BDCS|MDCS|BPCS|MPCS|B450|GM450|B480|B850BDCS|M480|B850|M850|B8|M8|B15|M15|B390|B420|B460|B915|M380|M410|M450|M870|PHS|DECT

[:SOURce]:FREQuency:CHANnels:BAND?

This command sets the frequency of the signal generator by specifying a frequency channel band. The frequency channel state must be enabled for this command to work.

Refer to the :FREQuency:CHANnels[:STATE] command.

<table>
<thead>
<tr>
<th>SCPI Parameter</th>
<th>Frequency Channel Band Selected</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBASe</td>
<td>Standard Base</td>
<td>NADC</td>
</tr>
<tr>
<td>NMOBile</td>
<td>Standard Mobile</td>
<td>NADC</td>
</tr>
</tbody>
</table>
## Basic Function Commands

### Frequency Subsystem ([:SOURce])

<table>
<thead>
<tr>
<th>SCPI Parameter</th>
<th>Frequency Channel Band Selected</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPGSm</td>
<td>P-Gsm 900 Base</td>
<td>GSM</td>
</tr>
<tr>
<td>MPGSm</td>
<td>P-Gsm 900 Mobile</td>
<td>GSM</td>
</tr>
<tr>
<td>BEGSm</td>
<td>E-Gsm 900 Base</td>
<td>GSM</td>
</tr>
<tr>
<td>MEGSm</td>
<td>E-Gsm 900 Mobile</td>
<td>GSM</td>
</tr>
<tr>
<td>BRGSm</td>
<td>R-Gsm 900 Base</td>
<td>GSM</td>
</tr>
<tr>
<td>MRGSm</td>
<td>R-Gsm 900 Mobile</td>
<td>GSM</td>
</tr>
<tr>
<td>BDCS</td>
<td>DCS 1800 Base</td>
<td>GSM</td>
</tr>
<tr>
<td>MDCS</td>
<td>DCS 1800 Mobile</td>
<td>GSM</td>
</tr>
<tr>
<td>BPCS</td>
<td>PCS 1900 Base</td>
<td>GSM</td>
</tr>
<tr>
<td>MPCS</td>
<td>PCS 1900 Mobile</td>
<td>GSM</td>
</tr>
<tr>
<td>B450</td>
<td>Gsm 450 Base</td>
<td>GSM</td>
</tr>
<tr>
<td>GM450</td>
<td>Gsm 450 Mobile</td>
<td>GSM</td>
</tr>
<tr>
<td>B480</td>
<td>Gsm 480 Base</td>
<td>GSM</td>
</tr>
<tr>
<td>M480</td>
<td>Gsm 480 Mobile</td>
<td>GSM</td>
</tr>
<tr>
<td>B850</td>
<td>Gsm 850 Base</td>
<td>GSM</td>
</tr>
<tr>
<td>M850</td>
<td>Gsm 850 Mobile</td>
<td>GSM</td>
</tr>
<tr>
<td>B8</td>
<td>800MHz Base</td>
<td>PDC</td>
</tr>
<tr>
<td>M8</td>
<td>800MHz Mobile</td>
<td>PDC</td>
</tr>
<tr>
<td>B15</td>
<td>1500MHz Base</td>
<td>PDC</td>
</tr>
<tr>
<td>M15</td>
<td>1500MHz Mobile</td>
<td>PDC</td>
</tr>
<tr>
<td>B390</td>
<td>Base 390-400</td>
<td>TETRA</td>
</tr>
<tr>
<td>B420</td>
<td>Base 420-430</td>
<td>TETRA</td>
</tr>
<tr>
<td>B460</td>
<td>Base 460-470</td>
<td>TETRA</td>
</tr>
<tr>
<td>B915</td>
<td>Base 915-921</td>
<td>TETRA</td>
</tr>
<tr>
<td>M380</td>
<td>Mobile 380-390</td>
<td>TETRA</td>
</tr>
<tr>
<td>M410</td>
<td>Mobile 410-420</td>
<td>TETRA</td>
</tr>
<tr>
<td>M450</td>
<td>Mobile 450-460</td>
<td>TETRA</td>
</tr>
<tr>
<td>M870</td>
<td>Mobile 870-876</td>
<td>TETRA</td>
</tr>
<tr>
<td>PHS</td>
<td>Standard PHS</td>
<td>PHS</td>
</tr>
<tr>
<td>DECT</td>
<td>Standard DECT</td>
<td>DECT</td>
</tr>
</tbody>
</table>
**Example**

```plaintext
:FREQ:CHAN:BAND DECT
```

The preceding example sets the frequency band to standard DECT.

```
*RST
BPGS
```

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>P-GSM Base</th>
<th>E-GSM Base</th>
<th>R-GSM Base</th>
<th>DCS Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCS Base</td>
<td>GSM 450 Base</td>
<td>GSM 480 Base</td>
<td>GSM 850 Base</td>
<td></td>
</tr>
<tr>
<td>NADC Base</td>
<td>800MHz Base</td>
<td>1500MHz Base</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tetra Base</td>
<td>Tetra Base</td>
<td>Tetra Base</td>
<td>Tetra Base</td>
<td></td>
</tr>
<tr>
<td>390/400</td>
<td>420/430</td>
<td>460/470</td>
<td></td>
<td></td>
</tr>
<tr>
<td>915/921</td>
<td>PHS Standard</td>
<td>DECT Standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tetra Mobile</td>
<td>380/390</td>
<td>Tetra Mobile</td>
<td>Tetra Mobile</td>
<td></td>
</tr>
<tr>
<td>870/876</td>
<td>410/420</td>
<td>450/460</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

:FRQuency:CHANnels:NUMBer

**Supported**  All Models

```
[:SOURce]:FREQuency:CHANnels:NUMBer <number>
[:SOURce]:FREQuency:CHANnels:NUMBer?
```

This command sets the frequency of the signal generator by specifying a channel number of a given frequency band.

The channel band and channel state must be enabled for this command to work. Refer to the :FREQuency:CHANnels[:STATe] command.
Basic Function Commands
Frequency Subsystem [:SOURce])

**Example**

`:FREQ:CHAN:NUMB 24`

The preceding example sets the channel number to 24 for the current band.

```
*RST
```

**Range**

<table>
<thead>
<tr>
<th>Base/Mode</th>
<th>Channel Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-GSM Base/Mobile</td>
<td>1–24</td>
</tr>
<tr>
<td>E-GSM and R-GSM Base/Mobile</td>
<td>1–1023</td>
</tr>
<tr>
<td>DCS Base/Mobile</td>
<td>512–885</td>
</tr>
<tr>
<td>PCS Base/Mobile</td>
<td>512–900</td>
</tr>
<tr>
<td>GSM-450 Base/Mobile</td>
<td>259–293</td>
</tr>
<tr>
<td>GSM-480 Base/Mobile</td>
<td>306–340</td>
</tr>
<tr>
<td>GSM-850 Base/Mobile</td>
<td>128–251</td>
</tr>
<tr>
<td>NADC Base/Mobile</td>
<td>1–1023</td>
</tr>
<tr>
<td>800MHz Base/Mobile</td>
<td>0–640</td>
</tr>
<tr>
<td>1500MHz Base/Mobile</td>
<td>0–960</td>
</tr>
<tr>
<td>TETRA 380/390 Mobile</td>
<td>3600–4000</td>
</tr>
<tr>
<td>TETRA 390/4000 Base</td>
<td>3600–4000</td>
</tr>
<tr>
<td>TETRA 410/420 Mobile</td>
<td>800–1200</td>
</tr>
<tr>
<td>TETRA 420/430 Base</td>
<td>800–1200</td>
</tr>
<tr>
<td>TETRA 460/470: 2400 through 2800</td>
<td>2400–2800</td>
</tr>
<tr>
<td>TETRA 870/876 Mobile</td>
<td>600–640</td>
</tr>
<tr>
<td>TETRA 915/921 Base</td>
<td>600–940</td>
</tr>
<tr>
<td>PHS Standard</td>
<td>1–255</td>
</tr>
<tr>
<td>DECT Standard</td>
<td>0–9</td>
</tr>
</tbody>
</table>

**Key Entry**

<table>
<thead>
<tr>
<th>Channel Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>:FREQuency:CHANnels[:STATe]</td>
</tr>
</tbody>
</table>

**Supported**

<table>
<thead>
<tr>
<th>Base/Mode</th>
<th>Channel Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Models</td>
<td></td>
</tr>
</tbody>
</table>

```
[:SOURce]:FREQuency:CHANnels[:STATe] ON|OFF|1|0
[:SOURce]:FREQuency:CHANnels[:STATe]?
```

This command enables or disables the frequency channel and band selection. The signal generator frequency will be set to the channel frequency when the state is on. To set frequency channel bands refer to the :

```
:FREQuency:CHANnels:BAND command.
```
Basic Function Commands
Frequency Subsystem ([:SOURce])

**Example**

`:FREQ:CHAN ON`

The preceding example turns on the frequency channel.

*RST 0

**Key Entry** Freq Channels Off On

`:FREQuency[:CW]`

**Supported** All Models

[:SOURce]:FREQuency[:CW] <value><unit>

[:SOURce]:FREQuency[:CW]?

This command sets the signal generator output frequency.

*RST The preset value is model/option dependent. Refer to the instrument's Data Sheet.

**Range** The range is model/option dependent. Refer to the instrument's Data Sheet.

**Remarks** A frequency change may affect the current output power. Refer to the [:LEVEL][:IMMediate][:AMPLitude] command for the correct specified frequency and amplitude settings. To set the frequency mode refer to the :FREQuency:MODE command.

`:FREQuency:FIXed`

**Supported** All Models

[:SOURce]:FREQuency:FIXed <val><unit>|UP|DOWN

[:SOURce]:FREQuency:FIXed?

This command sets the signal generator output frequency, or increments or decrements the current RF frequency setting.

*<val> A frequency value.

*UP Increases the current frequency setting by the value set with the front-panel up-arrow key.

*DOWN Decreases the current frequency setting by the value set with the front-panel down-arrow key.

*RST 0

Option 501: +10000000000000E+09

Option 503: +30000000000000E+09

Option 506: +60000000000000E+09
Basic Function Commands
Frequency Subsystem ([:SOURce])

Range

Option 501: 9kHz–1GHz
Option 503: 9kHz–3GHz
Option 506: 9kHz–6GHz

Remarks
To set the frequency mode to FIXed, refer to [:FREQuency:MODE].
A frequency change may affect the current output power. Refer to [:LEVel][:IMMediate][:AMPLitude] for the correct specified frequency and amplitude settings.

:FREQuency:LSPurs:STATe

Supported All Models

[:SOURce]:FREQuency:LSPurs:STATe ON|OFF|1|0
[:SOURce]:FREQuency:LSPurs:STATe?

This command enables the mode to improve non-harmonics performance (low spurs mode). Enabling this mode affects switching speed.

1 This choice enables the mode to improve non-harmonics.
0 This choice disables the mode to improve non-harmonics.
*RST 0

Key Entry Improve non-harmonics

:FREQuency:MODE

Supported All Models

[:SOURce]:FREQuency:MODE CW|FIXed|LIST
[:SOURce]:FREQuency:MODE?

This command sets the frequency mode of the signal generator to CW or swept.

CW and FIXed These choices are synonymous with one another and stops a frequency sweep, allowing the Keysight MXG to operate at a set frequency. Refer to the :FREQuency[:CW] command for setting the frequency in the CW mode and to the :FREQuency:FIXed command for setting the frequency in the FIXed mode.
Basic Function Commands
Frequency Subsystem ([SOURce])

LIST

This choice selects the swept frequency mode. If sweep triggering is set to immediate along with continuous sweep mode, executing the command starts the LIST or STEP frequency sweep.

To perform a frequency and amplitude sweep, you must also select LIST as the power mode. See the :MODE command for selecting the list mode for an amplitude sweep.

<table>
<thead>
<tr>
<th>*RST</th>
<th>CW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Entry</td>
<td>Freq</td>
</tr>
</tbody>
</table>

:FREQuency:MULTiplier

Supported All Models

[:SOURce]:FREQuency:MULTiplier <value>
[:SOURce]:FREQuency:MULTiplier?

This command sets the multiplier for the signal generator carrier frequency. This displayed frequency equals the actual frequency times the multiplier.

| *RST | +1.00000000E+000 |
| Range | Negative values: -1000 to -0.001 |
|       | Positive values: 0.001 to 1000 |
| Key Entry | Freq Multiplier |
| Remarks | For any multiplier other than one, the MULT indicator is shown in the frequency area of the display. |

:FREQuency:OFFSet

Supported All Models

[:SOURce]:FREQuency:OFFSet <value><unit>
[:SOURce]:FREQuency:OFFSet?

This command sets the frequency offset.

The query of this command returns a value equal to the original output frequency times the multiplier value, plus the frequency offset value. This displayed frequency equals the actual frequency times the multiplier.

When an offset has been entered, the OFFS indicator is turned on in the frequency area of the display.

The frequency offset state is turned on when any non–zero value is entered; entering zero will turn it off. Refer to the :FREQuency:OFFSet:STATe command for setting the offset state independent of entering offset values.
Basic Function Commands
Frequency Subsystem ([:SOURce])

*RST +0.0000000000000E+00

Range −200 to 200 GHz

Key Entry Freq Offset

:FREQuency:OFFSet:STATe

Supported All Models

[:SOURce]:FREQuency:OFFSet:STATe ON|OFF|1|0

[:SOURce]:FREQuency:OFFSet:STATe?

This command enables or disables the offset frequency.

*RST 0

Key Entry Freq Offset

Remarks Entering OFF (0) will set the frequency offset to 0 Hz.

:FREQuency:REFerence

Supported All Models

[:SOURce]:FREQuency:REFerence <value><unit>

[:SOURce]:FREQuency:REFerence?

This command sets the output reference frequency.

*RST +0.0000000000000E+00

Range The range is model/option dependent. Refer to the instrument's Data Sheet.

Key Entry Freq Ref Set

:FREQuency:REFerence:SET

Supported All Models

[:SOURce]:FREQuency:REFerence:Set

This command sets the current CW output frequency, along with any offset, as a 0 hertz reference value.

*RST +0.0000000000000E+00

Key Entry Freq Ref Set

:FREQuency:REFerence:STATe

Supported All Models

[:SOURce]:FREQuency:REFerence:STATe ON|OFF|1|0

[:SOURce]:FREQuency:REFerence:STATe?
Basic Function Commands
Frequency Subsystem ([:SOURce])

This command enables or disables the frequency reference mode.
When the frequency reference mode is on, subsequent frequency parameters are set relative to the reference value.

```
*RST 0
Key Entry Freq Ref Off On
```

`:FREQuency:SPAN

Supported All Models

```
[:SOURce]:FREQuency:SPAN <num>[<freq_suffix>] |UP|DOWN
[:SOURce]:FREQuency:SPAN? [MAXimum|MINimum]
```

This command sets the length of the frequency range for a step sweep. Span setting is symmetrically divided by the selected center frequency and is coupled to the start and stop frequency settings. The span range is dependent on the signal generator model and option number.

Example

`:FREQ:SPAN 100MHz`

The preceding example sets the frequency span to 100 megahertz.

```
*RST +0.0000000000000E+00
Key Entry Freq Span
```

`:FREQuency:STARt

Supported All Models

```
[:SOURce]:FREQuency:STARt <value><unit>
[:SOURce]:FREQuency:STARt?
```

This command sets the first frequency point in a step sweep.

```
*RST The preset value is model/option dependent. Refer to the instrument's Data Sheet.
Range The range is model/option dependent. Refer to the instrument's Data Sheet.
Key Entry Freq Start
```

`:FREQuency:STOP

Supported All Models

```
[:SOURce]:FREQuency:STOP <value><unit>
[:SOURce]:FREQuency:STOP?
```

This command sets the last frequency point in a step sweep.
Basic Function Commands
Frequency Subsystem ([SOURce])

*RST
The preset value is model/option dependent. Refer to the instrument’s Data Sheet.

Range
The range is model/option dependent. Refer to the instrument’s Data Sheet.

Key Entry
Freq Stop

:PHASe:REFerence

Supported
All Models

[:SOURce]:PHASe:REFerence
This command sets the current output phase as a zero reference. Subsequent phase adjustments are set relative to the new reference.

Key Entry
Phase Ref Set

:PHASe[:ADJust]

Supported
All Models

[:SOURce]:PHASe[:ADJust] <value><unit>
[:SOURce]:PHASe[:ADJust]?
This command adjusts the phase of the modulating signal. The query will only return values in radians.

*RST
+0.00000000E+000

Range

Key Entry
Adjust Phase

:ROSCillator:BANDwidth:EXTernal

Supported
All Models

[:SOURce]:ROSCillator:BANDwidth:EXTernal <value>[<units>]|NARRow|WIDE|MINimum|MAXimum|DEFault
[:SOURce]:ROSCillator:BANDwidth:EXTernal? |MINimum|MAXimum|
This command selects the external frequency bandwidth as the source for the measurement.
For values greater than 9.5 Hz, 73 Hz is used.

*RST
+9.50000000E+000

Range
.5 or 73 Hz

Key Entry
Ref Oscillator Ext Bandwidth
Basic Function Commands
Frequency Subsystem ([:SOURce])

:ROSCillator:FREQuency:BBG

Supported  All Models

[:SOURce]:ROSCillator:FREQuency:EXTernal <value>
[:SOURce]:ROSCillator:FREQuency:EXTernal?

This command sets the frequency of the internal baseband generator reference oscillator.

*RST  +1.0000000000000E+07 Hz
Range  +1.0000000000000E+06 to +5.0000000000000E+07 Hz

Key Entry  Ref Oscillator Ext Freq

:ROSCillator:FREQuency:EXTernal

Supported  All Models

[:SOURce]:ROSCillator:FREQuency:EXTernal <value>
[:SOURce]:ROSCillator:FREQuency:EXTernal?

This command makes External Ref Frequency the active function. The value that you enter sets the frequency of the external reference oscillator.

*RST  +1.0000000000000E+07 Hz
Range  +1.0000000000000E+06 to +5.0000000000000E+07 Hz

Key Entry  Ref Oscillator Ext Freq

Remarks  If the entered frequency does not match the frequency of the entered reference, an unlocked condition will occur and an error message will appear.

:ROSCillator:OVEN:STATe

Supported  All Models

[:SOURce]:ROSCillator:OVEN:STATe ON|OFF|1|0
[:SOURce]:ROSCillator:OVEN:STATe?

This command turns the 10 MHz oven oscillator on or off.

*RST  1

Key Entry  Oven Oscillator On Off
Basic Function Commands
Frequency Subsystem ([:SOURce])

:ROSCillator:OVEN:TUNE

Supported All Models
[:SOURce]:ROSCillator:OVEN:TUNE <value>
[:SOURce]:ROSCillator:OVEN:TUNE?

This command tunes the internal oven oscillator frequency.
The user value offsets the factory tuned value (the value is added to the factory calibrated DAC value). The tune value of 0 sets the factory calibrated value.

*RST +0.00000000E+000
Range −4096 to +4096
Key Entry Oven Oscillator Tune

:ROSCillator:SOURce

Supported All Models
[:SOURce]:ROSCillator:SOURce INTernal|EXTernal|BBG
[:SOURce]:ROSCillator:SOURce?

This command sets the current reference oscillator source: INT (internal), EXT (external), or BBG (internal baseband generator).

:ROSCillator:SOURce:AUTO

Supported All Models
[:SOURce]:ROSCillator:SOURce:AUTO ON|OFF|1|0
[:SOURce]:ROSCillator:SOURce:AUTO?

This command enables or disables the ability of the signal generator to automatically select between the internal and an external reference oscillator.

ON (1) This choice enables the signal generator to detect when a valid reference signal is present at the 10 MHz IN connector and automatically switches from internal to external frequency reference.

OFF (0) This choice selects the internal reference oscillator and disables the automatic switching capability between the internal and an external frequency reference.

*RST 1
Key Entry Ref Oscillator Source Auto Off On
**:ROSCillator:OVEN:TUNE**

**Supported** All Models

```
[:SOURce]:ROSCillator:OVEN:TUNE <value>
[:SOURce]:ROSCillator:OVEN:TUNE?
```

This command tunes the internal VCTXCO oscillator frequency.

The user value offsets the factory tuned value (the value is added to the factory calibrated DAC value). The tune value of 0 sets the factory calibrated value.

- **RST** +0.00000000E+000
- **Range** -8192 to +8191
- **Key Entry** Ref Oscillator Tune
Basic Function Commands
List/Sweep Subsystem ([SOURce])

List/Sweep Subsystem ([SOURce])

A complete sweep setup requires commands from other subsystems. Table 2-1 shows the function and location of these other commands.

Table 2-1: Location of Commands from the other Subsystems

<table>
<thead>
<tr>
<th>Sweep Type</th>
<th>Function</th>
<th>Command Location</th>
<th>Key Entry under Sweep/List key</th>
</tr>
</thead>
<tbody>
<tr>
<td>List and Step</td>
<td>Configuring frequency sweep</td>
<td>page 75</td>
<td>Freq Off On</td>
</tr>
<tr>
<td></td>
<td>Configuring amplitude sweep</td>
<td>page 114</td>
<td>Amptd Off On</td>
</tr>
<tr>
<td></td>
<td>Configuring frequency and amplitude sweepa</td>
<td>page 75</td>
<td>Freq &amp; Amptd Off On</td>
</tr>
<tr>
<td></td>
<td></td>
<td>page 114</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enables or Disables the waveform sweep</td>
<td>page 390</td>
<td>Waveform Off On</td>
</tr>
<tr>
<td></td>
<td>Set up and control sweep triggeringb</td>
<td>page 242</td>
<td>See the “Trigger Subsystem”</td>
</tr>
<tr>
<td>List</td>
<td>Load a list sweep file</td>
<td>page 186</td>
<td>Load From Selected File</td>
</tr>
<tr>
<td></td>
<td>Store list sweep data to a file</td>
<td>page 182</td>
<td>Store To File</td>
</tr>
<tr>
<td></td>
<td>Selects the waveform for the current waveform sequence</td>
<td>page 75</td>
<td>no softkey</td>
</tr>
<tr>
<td></td>
<td></td>
<td>page 84</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>page 91</td>
<td></td>
</tr>
<tr>
<td>List Sweep Options</td>
<td>This command enables specific options during a list sweep.</td>
<td>page 86</td>
<td>no softkey. Refer to Table 2-2 on page 87</td>
</tr>
<tr>
<td>Options Flags</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>Start frequency sweep</td>
<td>page 78</td>
<td>Freq Start</td>
</tr>
<tr>
<td></td>
<td>Store list sweep data to a file</td>
<td>page 182</td>
<td>Store To File</td>
</tr>
<tr>
<td></td>
<td>Start amplitude sweep</td>
<td>page 116</td>
<td>Amptd Start</td>
</tr>
<tr>
<td></td>
<td>Stop amplitude sweep</td>
<td>page 116</td>
<td>Amptd Stop</td>
</tr>
</tbody>
</table>

a. Execute both commands to start or stop a frequency and amplitude sweep.
b. For point to point triggering, see “:LIST:TRIGger:SOURce” on page 90.

:LIST:CPOint?

Supported: All Models

[[SOURce]]:LIST:CPOint?

This query returns the current sweep point.
Basic Function Commands
List/Sweep Subsystem ([:SOURce])

:LIST:DIREc tion

Supported: All Models

[:SOURce]:LIST:DIREc tion UP|DOWN
[:SOURce]:LIST:DIREc tion?

This command sets the direction of a list or step sweep.

UP: This choice enables a sweep in an ascending order:
– first to last point for a list sweep
– start to stop for a step sweep

DOWN: This choice reverses the direction of the sweep.

*RST: UP
Key Entry: Sweep Direction Down Up

:LIST:DWEL1

Supported: All Models

[:SOURce]:LIST:DWEL1 <value>,<value>
[:SOURce]:LIST:DWEL1?

This command sets the dwell time for the current list sweep points.

Dwell time is used when IMMEDIATE is the trigger source. Refer to the
:LIST:TRIGger:SOURce command for the trigger setting.

The dwell time is the amount of time the sweep is guaranteed to pause after
setting the frequency and/or power for the current point.

The setting enabled by this command is not affected by signal generator
power-on, preset, or *RST.

The variable <value> is expressed in units of seconds with a 0.000001 (mS).

**NOTE**

The dwell time (<value>) does not begin until the signal generator has
settled for the current frequency and/or amplitude change.

Range: 100E–6

:LIST:DWEL1:POINts?

Supported: All Models

[:SOURce]:LIST:DWEL1:POINts?

This command queries the signal generator for the number of dwell points in
the current list sweep file.
Basic Function Commands
List/Sweep Subsystem ([:SOURce])

:LIST:DWELL:TYPE

Supported  All Models

[:SOURce]:LIST:DWELL:TYPE  LIST|STEP
[:SOURce]:LIST:DWELL:TYPE?

This command toggles the dwell time for the list sweep points between the values defined in the list sweep and the value for the step sweep.

LIST  This choice selects the dwell times from the list sweep. Refer to the :LIST:DWELL command for setting the list dwell points.

STEP  This choice selects the dwell time from the step sweep. Refer to the :SWEep:DWELL command for setting the step dwell.

*RST  LIST

Key Entry  Dwell Type List Step

:LIST:FREQuency

Supported  All Models

[:SOURce]:LIST:FREQuency  <value>,<value>
[:SOURce]:LIST:FREQuency?

This command sets the frequency values for the current list sweep points.
The maximum number of list sweep points is 3,201.
The variable <value> is expressed in units of hertz (Hz).
The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

Range  The range is model/option dependent. Refer to the instrument’s Data Sheet.

:LIST:FREQuency:POINts

Supported  All Models

[:SOURce]:LIST:FREQuency:POINts?

This command queries the current list sweep file for the number of frequency points.

:LIST:MANual

Supported  All Models

[:SOURce]:LIST:MANual  <value>|UP|DOWN
[:SOURce]:LIST:MANual?

Key Entry  Dwell Type List Step
Basic Function Commands
List/Sweep Subsystem ([SOURce])

This command sets a list or step sweep point as the current sweep point controlling the frequency and power output.

If list or step mode is controlling frequency or power, or both, then the indexed point in the respective list(s) will be used.

Entering a value with this command will have no effect, unless MANual is the selected mode. Refer to the :LIST:MODE command for setting the proper mode.

If the point selected is beyond the length of the longest enabled list, then the point will be set to the maximum possible point, and an error will be generated.

<table>
<thead>
<tr>
<th>Range</th>
<th>List Sweep: 1 to 3,201</th>
<th>Step Sweep: 2 to 65535</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Entry</td>
<td>Manual Point</td>
<td></td>
</tr>
</tbody>
</table>

:LIST:MODE

Supported All Models

[:SOURce]:LIST:MODE AUTO|MANual
[:SOURce]:LIST:MODE?

This command sets the operating mode for the current list or step sweep.

AUTO  This choice enables the selected sweep type to perform a sweep of all points.

MANual This choice enables you to select a single sweep point. The selected point controls the frequency and/or amplitude according to the sweep type. Refer to the :LIST:MANual command for selecting a sweep point.

*RST AUTO

Key Entry Manual Mode Off On

:LIST:OPTions

Supported All Models

[:SOURce]:LIST:OPTions <val>,<val>
[:SOURce]:LIST:OPTions?
[:SOURce]:LIST:OPTions:POINts?

This command enables specific options during a list sweep. The command adds the capability to suppress FM, fM, and AM on any list sweep point. Additionally, frequency, power, and/or a waveform transition can be suppressed resulting in no synthesizer, no output, or no waveform playing interruption during a transition.
Basic Function Commands
List/Sweep Subsystem ([:SOURce])

This is a SCPI command only feature. There is no signal generator user interface displayed indication that these option flags are in use. The option flag list is preset to empty when list sweep is preset with the defaults. Otherwise, the option flag changes are persistent.

See also “:LIST:TYPE:LIST:INITialize:PRESet” on page 91.

Table 2-2 List Sweep Options Flag.

<table>
<thead>
<tr>
<th>Bit #</th>
<th>Bit Value</th>
<th>Option if set</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>Suppress Frequency Change</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Suppress Power Change</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>Suppress Waveform Change</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>Suppress FM and fM</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>Suppress AM</td>
</tr>
</tbody>
</table>

The table represents the value of a bit flag.
If a bit is not set, then the option is ignored (not applied).
If FM, fM is not turned on, the FM, fM suppression does nothing.
The FM, fM should be typically as in CW mode.
The AM suppressing is accomplished by grounding the input to the AM modulator, no other reconfiguration of HW is performed.
The AM should be set up in CW mode.

Example
FM:DEV 1E6
FM:STAT ON
LIST:FREQ 1E9,2E9,3E9,4E9
LIST:OPT 8,0,8,0

The preceding example sets up FM then a frequency list of 1, 2, 3, 4 GHz and suppresses FM on every other list sweep point (points 1 and 3 will have FM suppressed, points 2 & 4 will have FM enabled).

:LIST:POWer

Supported All Models

[:SOURce]:LIST:POWer <value>,<value>
[:SOURce]:LIST:POWer?

This command sets the amplitude for the current list sweep points.
The maximum number of list sweep points is 3,201.
Basic Function Commands
List/Sweep Subsystem ([SOURce])

Range
See also [:LEVel][:IMMediate][:AMPLitude] command for output power ranges.

Remarks
The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

[:LIST:POWer:POINts]

Supported All Models

[:SOURce]:LIST:POWer:POINts?
This command queries the number of power points in the current list sweep file.

[:LIST:RETRace]

Supported All Models

[:SOURce]:LIST:RETRace ON|OFF|1|0
[:SOURce]:LIST:RETRace?
This command configures the sweep to retrace to the first sweep point, or stop at the last sweep point upon completion of each sweep.

ON (1) The sweep retraces to the first sweep point.

OFF (0) The sweep stays at the last sweep point of the completed sweep and stays there until sweep is initiated and triggered again. When sweep is initiated and triggered again, the sweep point moves to the first point of the sweep.

*RST 1

Key Entry Sweep Retrace Off On

[:LIST:TRIGger:EXTernal:SOURce]

Supported All Models

:LIST:TRIGger:EXTernal:SOURce?
This command selects the external trigger source. With external triggering, the selected bi-directional BNC is configured as an input.

TRIGger1 This choice selects the TRIG 1 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

TRIGger2 This choice selects the TRIG 2 BNC as the external trigger source for triggering sweep, point and function generator sweeps.
Basic Function Commands
List/Sweep Subsystem ([SOURce])

**PULSe**
This choice selects the PULSE BNC as the external trigger source for triggering sweep, point and function generator sweeps.

*Example*

:LIST:TRIG:EXT:SOUR PULS
The preceding example sets the external trigger source to the PULSE BNC.

*RST* TRIGger1

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Trigger 1</th>
<th>Trigger 2</th>
<th>Pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**:LIST:TRIGger:INTernal:SOURce**

Supported All Models

:LIST:TRIGger:INTernal:SOURce PVIDeo|PSYNc
:LIST:TRIGger:INTernal:SOURce?

This command selects the internal trigger source.

**PVIDeo**
This choice selects Pulse Video as the internal trigger source for triggering sweep, point and function generator sweeps.

**PSYNc**
This choice selects Pulse Sync as the internal trigger source for triggering sweep, point and function generator sweeps.

*Example*

:LIST:TRIG:INT:SOUR PVID
The preceding example sets the internal trigger source to Pulse Video.

*RST* PSYN

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Pulse Video</th>
<th>Pulse Sync</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pulse Video</td>
<td>Pulse Sync</td>
</tr>
</tbody>
</table>

**:LIST:TRIGger:SLOPe**

Supported All Models

:LIST:TRIGger:SLOPe POSitive|NEGative
:LIST:TRIGger:SLOPe?

This command sets the polarity of an external signal at the TRIG 1, TRIG 2, or PULSE BNC (see :LIST:TRIGger:EXTernal:SOURce) or internal Pulse Video or Pulse Sync signal (see :LIST:TRIGger:INTernal:SOURce) that will trigger a list or step sweep.

**POSitive**
The signal generator triggers an event when it detects a rising edge on the source signal
Basic Function Commands
List/Sweep Subsystem ([SOURce])

NEGative  The signal generator triggers an event when it detects a falling edge on the source signal

*RST POS

Key Entry  Int/Ext Trigger Polarity Neg Pos

:LIST:TRIGger:SOURce

Supported  All Models

[SOURce]:LIST:TRIGger:SOURce BUS|IMMediate|EXTernal|INTernal|KEY|TIMer|MANual
[:SOURce]:LIST:TRIGger:SOURce?

This command sets the point trigger source for a list or step sweep event.

BUS  This choice enables GPIB triggering using the *TRG or GET command, or LAN and USB triggering using the *TRG command.

IMMediate  This choice enables immediate triggering of the sweep event.

EXTernal  This choice enables the triggering of a sweep event by an externally applied signal at the TRIGGER IN connector.

INTernal  This choice enables the triggering of a sweep event by an internal Pulse Video or Pulse Sync signal.

KEY  This choice enables triggering by pressing the front-panel Trigger key.

TIMer  This choice enables the trigger timer.

Example

:LIST:TRIG:SOUR BUS

The preceding example sets the trigger source to the instrument BUS.

*RST IMM

Key Entry  Bus Free Ext Int Trigger Timer
Run

:LIST:TYPE

Supported  All Models

[SOURce]:LIST:TYPE LIST|STEP
[:SOURce]:LIST:TYPE?

This command toggles between the two types of sweep.
Basic Function Commands
List/Sweep Subsystem ([SOURce])

LIST  This type of sweep has arbitrary frequencies and amplitudes.
STEP  This type of sweep has equally spaced frequencies and amplitudes.

*RST  STEP
Key Entry  Sweep Type List Step

:LIST:TYPE:LIST:INITialize:FSTep
Supported  All Models

CAUTION  The current list sweep data will be overwritten once this command is executed. If needed, save the current data. Refer to the ":STORe:LIST" command for storing list sweep files.

[:SOURce]:LIST:TYPE:LIST:INITialize:FSTep
This command replaces the loaded list sweep data with the settings from the current step sweep data points.
You can load only one sweep list at a time.
The maximum number of list sweep points is 3,201. When copying the step sweep settings over to a list sweep, ensure that the number of points in the step sweep do not exceed the maximum list sweep points.

Key Entry  Load List From Step Sweep

:LIST:TYPE:LIST:INITialize:PRESet
Supported  All Models

CAUTION  The current list sweep data will be overwritten once this command is executed. If needed, save the current data. Refer to the ":STORe:LIST" command for storing list sweep files.

[:SOURce]:LIST:TYPE:LIST:INITialize:PRESet
This command replaces the current list sweep data with a factory–defined file consisting of one point at a frequency, amplitude, and dwell time.

Key Entry  Preset List

:LIST:WAVeform
Supported  N5166B/72B/82B

CAUTION  The current list sweep data will be overwritten once this command is executed. If needed, save the current data. Refer to the ":STORe:LIST" command for storing list sweep files.
Basic Function Commands
List/Sweep Subsystem ([:SOURce])

```plaintext
[:SOURce]:LIST:WAVeform <name>,<name>
[:SOURce]:LIST:WAVeform?
```

This command sets the waveform values for the current list waveform sequence.

**NOTE**

Except for the sample clock rate, unspecified fields in the header result in the default settings of the dual arb's settings being used (i.e. not the current arb's settings). The sample clock rate must be specified for the file header of the waveform file being played. If the sample clock rate is unspecified in the file header, the instrument generates a header error.

**Example**

```plaintext
:LIST:WAV "WFM1:RAMP_TEST_WFM","WFM1:SINE_TEST_WFM"
```

The preceding example loads the waveforms RAMP_TEST_WFM and SINE_TEST_WFM into the waveform section of the List Table.

**Remarks**

The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

```plaintext
:LIST:WAVeform:POINts
```

**Supported**

N5166B/72B/82B

```plaintext
[:SOURce]:LIST:WAVeform:POINts?
```

This query returns the number of waveform points in the current list sweep file.

```plaintext
:SWEep:ATTen:PROTection[:STATe]
```

**Supported**

All Models

```plaintext
[:SOURce]:SWEep:ATTen:PROTection[:STATe] ON|OFF|1|0
[:SOURce]:SWEep:ATTen:PROTection[:STATe]?
```

This command enables protection for the mechanical attenuator by automatically turning on Atten Hold during frequency and/or power step sweeps.

This may cause unleveled RF output to occur for certain sweep configurations. Disabling this attenuator protection will allow the sweep to optimally set both the automatic leveling control (ALC) and output attenuation at each sweep point.

- **ON (1)** This choice enables attenuator protection.
- **OFF (0)** This choice disables attenuator protection. When the attenuator protection is disabled, the step dwell time will be set to a minimum of 50 ms as a precaution.

**Example**

```plaintext
:SWE:ATT:PROT 0
```
Basic Function Commands
List/Sweep Subsystem ([:SOURce])

The preceding example disables attenuator protection.

*RST

Key Entry Step Atten Protection On Off

:SWEep:CPOINt?

Supported All Models

[:SOURce]:SWEep:CPOINt?

This query returns the current sweep point in any mode.

:SWEep:DWELl

Supported All Models

[:SOURce]:SWEep:DWELl <value>

[:SOURce]:SWEep:DWELl?

This command enables you to set the dwell time for a step sweep.

The variable <value> is expressed in units of seconds with a 0.001 resolution.

The dwell time is the amount of time the sweep is guaranteed to pause after setting the frequency and/or power for the current point.

The dwell time (<value>) does not begin until the signal generator has settled for the current frequency and/or amplitude change.

*RST +2.00000000E–003

Range 0.0001 to 100

Key Entry Step Dwell

Remarks Dwell time is used when the trigger source is set to IMMEDIATE. Refer to the :LIST:TRIGger:SOURce command for the trigger setting.

:SWEep[:FREQuency]:STEP[:LINear]

Supported All Models

[:SOURce]:SWEep[:FREQuency]:STEP[:LINear] <value><unit>

[:SOURce]:SWEep[:FREQuency]:STEP[:LINear]?

This command sets the step size for a linear step sweep in frequency (difference between frequency points).

The variable <value> is expressed in units of frequency, specifies by the variable <unit> (as Hz, kHz, MHz, or GHz).
Basic Function Commands
List/Sweep Subsystem ([SOURce])

NOTE: Setting the step size will determine the number of points in the step sweep based on the current start and stop frequencies. Due to the integer number of step points, the step size may be adjusted in order to yield a true linear sweep between the start and stop frequencies.

*RST 0.00 Hz
Key Entry LIN Freq Step

:SWEep[:FREQuency]:STEP:LOGarithmic

Supported All Models

[:SOURce]:SWEep[:FREQuency]:STEP:LOGarithmic <value>
[:SOURce]:SWEep[:FREQuency]:STEP:LOGarithmic?

This command sets the step size for a logarithmic step sweep in frequency (ratio between frequency points).

The variable <value> is expressed as a percentage (%).

NOTE: Setting the step size will determine the number of points in the step sweep based on the current start and stop frequencies. Due to the integer number of step points, the step size may be adjusted in order to yield a true linear sweep between the start and stop frequencies.

*RST 0.00 Hz
Key Entry LOG Freq Step

:SWEep:POINts

Supported All Models

[:SOURce]:SWEep:POINts <value>
[:SOURce]:SWEep:POINts?

This command defines the number of step sweep points.

*RST 101
Range 2 to 65535
Key Entry # Points

:SWEep:SPACing

Supported All Models

[:SOURce]:SWEep:SPACing LINear|LOGarithmic
[:SOURce]:SWEep:SPACing?

This command enables the signal generator linear or logarithmic sweep modes. These commands require the signal generator to be in step mode.
Basic Function Commands
List/Sweep Subsystem ([SOURce])

The instrument uses the specified start frequency, stop frequency, and number of points for both linear and log sweeps.

*RST LIN

Key Entry Step Spacing LIN LOG
**Marker Subsystem–N5173B/83B ([:SOURce])**

**:MARKer:AMPLitude[:STATe]**

**Supported** N5173B/83B

[[:SOURce]:MARKer:AMPLitude[:STATe] ON|OFF|1|0

[[:SOURce]:MARKer:AMPLitude[:STATe]?]

This command sets the amplitude marker state for the currently activated markers. When the state is switched on, the RF output signal exhibits a spike with a magnitude relative to the power level at each marker’s set frequency. (To set the magnitude of the spike, refer to the :MARKer:AMPLitude:VALue command.)

**Example**

**:MARK:AMPL ON**

The preceding example enables amplitude markers.

*RST 0

**Key Entry** Amplitude Markers Off On

**:MARKer:AMPLitude:VALue**

**Supported** N5173B/83B

[[:SOURce]:MARKer:AMPLitude:VALue <num>[DB]

[[:SOURce]:MARKer:AMPLitude:VALue?]

This command sets the relative power for the amplitude spikes at each marker’s set frequency when the amplitude marker mode is activated. (To activate the amplitude markers, refer to the :MARKer:AMPLitude[:STATe] command.)

**Example**

**:MARK:AMPL:VAL 4DB**

The preceding example sets the relative marker power to 4 dB for all markers.

*RST 2 dB

**Range** –10 to +10 dB

**Key Entry** Marker Value

**:MARKer:AOFF**

**Supported** N5173B/83B

[[:SOURce]:MARKer:AOFF]

This command turns off all active markers.
Basic Function Commands
Marker Subsystem–N5173B/83B ([:SOURce])

Key Entry Turn Off Markers

:MARKer:DELTa

Supported N5173B/83B

[:SOURce]:MARKer:DELTa? <num>,<num>

This query returns the frequency difference between two amplitude markers. The variables <num> are used to designate the marker numbers.

Example

:MARK:DELT? 1,2

The preceding example returns the frequency difference between amplitude markers 1 and 2.

Range 0 to 19

:MARKer:MODE

Supported N5173B/83B

[:SOURce]:MARKer:MODE FREQuency|DELTa
[:SOURce]:MARKer:MODE?

This command sets the frequency mode for all markers.

FREQuency The frequency values for the markers are absolute.
DELTa The frequency values for the markers are relative to the designated reference marker. The reference marker must be designated before this mode is selected. (See the :MARKer:REFerence command to select a reference marker.)

Example

:MARK:MODE DELT

The preceding example sets the marker mode to delta.

*RST FREQuency

Key Entry Marker Delta Off On

:MARKer:REFerence

Supported N5173B/83B

[:SOURce]:MARKer:REFerence <marker>
[:SOURce]:MARKer:REFerence?

This command designates the reference marker when using markers in delta mode. The variable <marker> designates the marker number.
Basic Function Commands
Marker Subsystem–N5173B/83B [:SOURce]

Example
:MARK:REF 6
The preceding example sets marker 6 as the reference marker.

*RST 0
Range 0 to 19
Key Entry Delta Ref Set

:MARKer[0]|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|17|18|19:FREQuency
Supported N5173B/83B
[:SOURce]:MARKer[0]|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|17|18|19:FREQuency <freq>|MAXimum|MINimum
[:SOURce]:MARKer[0]|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|17|18|19:FREQuency? [MAXimum|MINimum]
This command sets the marker frequency. The frequency value must be between the start and stop frequencies set for the sweep.

Example
:MARK6 ON
The preceding example turns marker 6 on.

*RST 0
Key Entry Marker On Off

:MARKer[0]|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|17|18|19[:STATe]
Supported N5173B/83B
[:SOURce]:MARKer[0]|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|17|18|19[:STATe] ON|OFF|1|0
[:SOURce]:MARKer[0]|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|17|18|19[:STATe]?
This command turns a marker on or off. Marker 0 is the default if the marker designator [n] is not specified.

Example
:MARK6 ON
The preceding example turns marker 6 on.

*RST 0
Key Entry Marker On Off
Power Subsystem ([:SOURce]:POWer)

:ALC:BANDwidth

**Supported**  All Models

[:SOURce]:POWer:ALC:BANDwidth|BWIDth <num>freq suffix]
[:SOURce]:POWer:ALC:BANDwidth|BWIDth?

This command overrides the signal generator’s automatic ALC bandwidth selection with the user’s specific selection. For waveforms with varying amplitudes, high crest factors, or both, the recommended ALC loop bandwidth is the low bandwidth setting of the generator. Limiting the loop bandwidth of the ALC circuit will prevent the ALC from sampling the fast rising edges of pulsed waveforms. A limited, or narrow bandwidth will result in a longer ALC sample time and a more accurate representation of the signal’s level.

*RST  200 (2kHz when ALC:BAND:BWID is set to AUTO)

Key Entry  Auto  200 Hz  2 kHz  20 kHz

Remarks  Use this command when the ALC state is set to On. This command will override the automatic ALC bandwidth selection set by the :ALC:BANDwidth|BWIDth:AUTO command.

:ALC:BANDwidth|BWIDth:AUTO

**Supported**  All Models

[:SOURce]:POWer:ALC:BANDwidth|BWIDth:AUTO ON|OFF|1|0
[:SOURce]:POWer:ALC:BANDwidth|BWIDth:AUTO?

This command turns the bandwidth (BW) auto state on or off.

The bandwidth auto function allows the signal generator to automatically select a bandwidth for the automatic leveling control (ALC) circuit.

ON (1)  This choice allows the signal generator to automatically select an ALC BW. The selection of the ALC BW depends on the signal generator modulation type.

OFF (0)  This choice disables automatic selection of the ALC BW.

*RST  1

Key Entry  Auto

Remarks  For more information on ALC bandwidth, refer to the User’s Guide.
Basic Function Commands
Power Subsystem ([SOURce]:POWer)

:ALC:LEVel

**Supported** All Models

[:SOURce]:POWer:ALC:LEVel <value><unit>
[:SOURce]:POWer:ALC:LEVel?

This command sets the automatic leveling control (ALC) level. Use this command after setting the attenuation auto mode to On. Refer to :ATTenuation:AUTO command for setting the attenuation auto mode.

The ALC is used to maintain the signal generator’s output power level by compensating for power fluctuations due to drift, band changes, or load variations. After you set the ALC level, the signal generator’s output power is monitored and corrected so that the power level setting is maintained.

**Example**

:POW:ALC:LEV 10DB

The preceding example sets the ALC to 10 dB.

*RST +1.00000000E+000
Range –20 to 20
Key Entry Set ALC Level

:ALC:SEARch

**Supported** All Models

[:SOURce]:POWer:ALC:SEARch ON|OFF|1|0|ONCE
[:SOURce]:POWer:ALC:SEARch?

This command executes a power search routine that temporarily activates the ALC, calibrates the power of the current RF output, and then disconnects the ALC circuitry. The power search mode is active only when the ALC state is Off, and the RF output is On.

ON (1) This choice sets the power search mode to automatic (Auto). In automatic mode, the power search calibration routine is executed whenever an instrument setting is modified that affects RF output power. This includes changes to frequency, amplitude and modulation.

OFF (0) This choice sets the power search mode to Manual and disables the automatic power search calibration routine. The power level must be calibrated by explicitly sending the ONCE command. If there is a change in frequency or amplitude the ONCE command must be sent again.
Basic Function Commands
Power Subsystem ([SOURce]:POWer)

**ONCE**

This choice executes a single power search calibration at the current RF output frequency and amplitude setting. This command can be used when the power search mode is in automatic or manual.

*RST 1

Remarks

If power search fails, the output power of the instrument will be set to minimum and must be recovered with an instrument preset.

Refer to the :ALC[:STATe] command for setting the ALC state.

:ALC:SEARch:REFerence

Supported All Models

[:SOURce]:POWer:ALC:SEARch:REFerence

RMS|FIXed|MANual|MODulated

[:SOURce]:POWer:ALC:SEARch:REFerence?

This command sets the reference source used by the power search calibration routine. The reference source provides a steady state signal during the power search calibration.

**RMS**

This choice uses the I/Q system as the reference source for the power search calibration. When the power search calibration routine is executing, the I/Q system provides a DC bias on the I/Q modulator equivalent to the rms value of the current I/Q data. The rms value is derived from the waveform file header or calculated using the current I/Q data.

**FIXed**

This choice uses the I/Q system as the reference source for the power search calibration. When FIXed is active, the I/Q system uses a fixed level of 1.0 volt to provide a DC bias on the I/Q modulator during the power search calibration.

**MANual**

This choice uses the I/Q system as the reference source for the power search calibration. When MANual is selected, the user can specify the DC bias on the I/Q modulator during the power search calibration. The level is chosen using the :ALC:SEARch:REFerence:LEVel command.
**Basic Function Commands**

**Power Subsystem ([:SOURce]:POWer)**

**MODulated** This choice disables the power search reference source. During the power search calibration, the current RF output signal is measured to calibrate the output level. If the output signal is amplitude modulated at a slow rate or is bursted, power errors can be introduced at the RF output. For CW signals the power search reference is disabled.

*RST* FIXED (With BBG License only.)

**Key Entry** Power Search Reference Fixed Mode

**Remarks** MXG without the BBG license are defaulted to MOD mode.

**:ALC:SEARch:REFerence:LEVel**

**Supported** All Models

[:SOURce]:POWer:ALC:SEARch:REFerence:LEVel <value>
[:SOURce]:POWer:ALC:SEARch:REFerence:LEVel?

This command sets the DC bias voltage value for a manual power search.

*RST* +1.00000000+000

**Range** 0 to 1.414 V

**Key Entry** Power Search Manual Level

**:ALC:SEARch:SPAN:START**

**Supported** All Models

[:SOURce]:POWer:ALC:SEARch:SPAN:START <value><units>
[:SOURce]:POWer:ALC:SEARch:SPAN:START?

This command sets the start frequency for a span power search over a user specified range.

The start frequency has no default value. The start frequency value will be the last value set before powering off the instrument.

**Key Entry** Start Frequency

**:ALC:SEARch:SPAN:STOP**

**Supported** All Models

[:SOURce]:POWer:ALC:SEARch:SPAN:STOP <value><units>
[:SOURce]:POWer:ALC:SEARch:SPAN:STOP?

This command sets the stop frequency for a span power search over a user specified range.
Basic Function Commands
Power Subsystem ([SOURce]:POWer)

The stop frequency has no default value. The stop frequency value will be the last value set before powering off the instrument.

**Key Entry** Stop Frequency

:ALC:SEARch:SPAN:TYPE

**Supported** All Models

[:SOURce]:POWer:ALC:SEARch:SPAN:TYPE FULL|USER
[:SOURce]:POWer:ALC:SEARch:SPAN:TYPE?

This command enables you to select the frequency range for a span power search. You can specify the range (USER) or you can select the full range (FULL) of the signal generator.

**Key Entry** Span Type User Full

:ALC:SEARch:SPAN[:STATe]

**Supported** All Models

[:SOURce]:POWer:ALC:SEARch:SPAN[:STATe] ON|OFF|1|0
[:SOURce]:POWer:ALC:SEARch:SPAN[:STATe]?

This command enables (1) or disables (0) the span mode, allowing you to perform power searches over a selected range of frequencies. The power search corrections are then stored and used whenever the signal generator is tuned within the selected range.

**Key Entry** Span

:ALC:SOURce

**Supported** All Models

[:SOURce]:POWer:ALC:SOURce INTernal|DIODe
[:SOURce]:POWer:ALC:SOURce?

This command enables you to select an automatic level control (ALC) source. You can select the internal ALC source, an external detector source, or a millimeter–wave source module. Refer to the User’s Guide for more information on ALC leveling, bandwidth, and the power search function.

**Example**

:POW:ALC:SOUR DIOD

The preceding example selects an external detector as the source (the unit must be connected to the signal generator).

*RST INT

**Key Entry** Leveling Mode
Basic Function Commands
Power Subsystem ([SOURce]:POWer)

:[SOURce]:POWer:ALC:SOUR:EXT:COUPling

**Supported** All Models

[:SOURce]:POWer:ALC:SOUR:EXT:COUPling <value>DB
[:SOURce]:POWer:ALC:SOUR:EXT:COUPling?

This command sets the external detector coupling factor. Use this command when DIODe is the selected ALC source (Refer to the :ALC:SOURce command.)

**Example**

:POW:ALC:SOUR:EXT:COUP 20DB

The preceding example sets the external coupling factor to 20 dB.

*RST            +1.60000000E+001
Range           –200 to 200 dB.
Key Entry       Ext Detector Coupling Factor

:[SOURce]:POWer:ALC:SOUR:PM:CHANnel

**Supported** All Models

[:SOURce]:POWer:ALC:SOUR:PM:CHANnel A|B
[:SOURce]:POWer:ALC:SOUR:PM:CHANnel?

This command sets the power meter channel used for servo mode

**Example**

:POW:ALC:SOUR:PM:CHAN A

*RST            A
Range           A/B
Key Entry       Power Meter Channel (A|B)

:[SOURce]:POWer:ALC:SOUR:PM:INCRement

**Supported** All Models

[:SOURce]:POWer:ALC:SOUR:PM:INCRement <value>
[:SOURce]:POWer:ALC:SOUR:PM:INCRement?

This command sets the increment percentage of a measured power delta in the Power Meter Servo mode. By default this value is 100%, meaning that the system output power is adjusted by the measured value. This percentage can be lowered to assure that no overshoot takes place – at the cost of additional measurement/adjustment cycles. This command works in conjunction with the START and STOP commands.

**Example**

:POW:ALC:SOUR:PM:INCR 75
Basic Function Commands
Power Subsystem ([:SOURce]:POWer)

The preceding example sets the power increment to 75% of the measured delta.

*RST

Range: 10 to 100 in %

Key Entry: Power Meter Servo overshoot protection power increment

:ALC:SOURce:PMServo:MAXimum

Supported: All Models

[:SOURce]:POWer:ALC:SOURce:PMServo:MAXimum <value>
[:SOURce]:POWer:ALC:SOURce:PMServo:MAXimum?

This command adds device power protection by setting an RF output power protection limit while using the Power Meter Servo mode. The system restricts the actual RF output power to this value and will show UNLEVELED if the desired output power exceeds the value.

Example

:POW:ALC:SOUR:PMS:MAX 10 dBm

The preceding example limits the RF output power to a maximum of 10 dBm when in Power Meter Servo mode.

*RST: 30 dBm

Range: MIN to MAX RF output power of the system (option dependent)

Key Entry: Power Meter Servo mode RF Output power limit

:ALC:SOURce:PMServo:SERRor

Supported: All Models

[:SOURce]:POWer:ALC:SOURce:PMServo:SERRor <value>
[:SOURce]:POWer:ALC:SOURce:PMServo:SERRor?

This command sets the allowed settling error for the power meter servo mode. Measurement/adjustment cycles will be executed until this power delta is achieved.

Example

:POW:ALC:SOUR:PMS:SERR 0.2 dB

*RST: 0.2 dB

Range: 0.02 dB - 10 dB

Key Entry: Settling Error
Basic Function Commands
Power Subsystem ([:SOURce]:POWer)

:ALC:SOURce:PMServo:STARt

Supported All Models

[:SOURce]:POWer:ALC:SOURce:PMServo:STARt <value>
[:SOURce]:POWer:ALC:SOURce:PMServo:STARt?

This command sets the relative initial power when leveling with the Power Meter Servo mode. The default of 0 dB means that the system starts with the power it thinks is needed (based on output power, offset and reference) but this might lead to power overshoots in certain cases (especially when the offset is not set up correctly). This value allows to specify an additional safe-margin to start the measure/adjust cycles lower than the target power to protect the device from power overshoots. This command works in conjunction with the INCrement and STOP commands.

Example


The preceding example sets the relative initial power for power meter servo approach to -3 dB.

*RST 0 dB
Range -50 to 0 dB.

Key Entry Power Meter Servo overshoot protection relative start power

:ALC:SOURce:PMServo:STOP

Supported All Models

[:SOURce]:POWer:ALC:SOURce:PMServo:STOP <value>
[:SOURce]:POWer:ALC:SOURce:PMServo:STOP?

This command sets the final threshold for when the remaining measured power delta from the Power Meter Servo mode will be applied in full (100%) instead of the specified increment. This command works in conjunction with the STARt and INCrement commands.

Example

:POW:ALC:SOUR:PMS:STOP 3 dB

The preceding example sets the threshold from when on Power Meter Servo mode incremental iterations stop and the remaining power is adjusted in one jump to the size of the 3 dB.

*RST 1 dB
Range 0 to 50 dB.

Key Entry Power Meter Servo mode overshoot protection increment threshold
Basic Function Commands
Power Subsystem [:SOURce]:POWer

:ALC[:STATe]

**Supported**
All Models

[:SOURce]:POWer:ALC[:STATe] ON|OFF|1|0
[:SOURce]:POWer:ALC[:STATe]?

This command enables or disables the automatic leveling control (ALC) circuit. The query returns the current state of the ALC.

*RST
1

**Key Entry**
ALC Off On

**Remarks**
The purpose of the ALC circuit is to hold output power at a desired level by adjusting the signal generator’s power circuits to compensate for power drift. Power drift occurs over time and changes in temperature. Refer to the User’s Guide for more information on the ALC.

:ALC:TRANsition:REFe rence

**Supported**
N5166B/72B/82B

[:SOURce]:POWer:ALC:TRANsition:REFe rence RMS|MODulated|NBModulated
[:SOURce]:POWer:ALC:TRANsition:REFe rence?

This command determines the ALC settling mode during frequency transitions when the IQ modulator is on.

**RMS**
This choice is the default behavior. The IQ is set to an idle state and a CW only signal plays during frequency transitions.

**Mod**
This choice leaves the IQ on during frequency transition and also leaves the ALC in the default wide bandwidth mode for fast switching.

Although this choice results in switching times that are equivalent to RMS mode, there is the possibility of leveling at the wrong power level.

**NBMod**
This choice leaves the IQ on during frequency transitions but sets the ALC bandwidth to a narrow bandwidth. Doing this increases the switching time but allows for a more accurate amplitude level.

*RST
RMS

**Key Entry**
ALC Transition Reference RMS Mod NBMod

**Remarks**
RMS is the default behavior and in most cases is the best choice for this setting. Refer to the User’s Guide for more information on the ALC.
Basic Function Commands
Power Subsystem ([:SOURce]:POWer)

:ALCHold:EXTernal:SOURce

Supported All Models

[:SOURce]:POWer:ALCHold:EXTernal:SOURce TRIGger[1]|TRIGger2|PULSe

This command selects the external ALC Hold source. The ALC is held when the signal line is low (0V) and is not held (i.e. leveling) when the voltage is a TTL high (5V).

With external triggering, the selected bi-directional BNC is configured as an input.

TRIGger1 This choice selects the TRIG 1 BNC as the external source for the ALC Hold signal.
TRIGger2 This choice selects the TRIG 2 BNC as the external source for the ALC Hold signal.
PULSe This choice selects the PULSE BNC as the external source for the ALC Hold signal.

Example

:ALCH:EXT:SOUR PULS

The preceding example sets the external ALC Hold source to the PULSE BNC.

*RST TRIGger1

Key Entry Trigger 1 Trigger 2 Pulse

:ALCHold:EXTernal[:STATe]

Supported All Models

[:SOURce]:POWer:ALCHold:EXTernal[:STATe] ON|OFF|1|0

This command enables (1) or disables (0) the External ALC Hold control. If Ext ALC Hold is on, the external BNC input is selected using the :ALCHold:EXTernal:SOURce command.

*RST 0

Key Entry Ext ALC Hold Off On

:ALTernate:AMPLitude

Supported N5166B/72B/82B

[:SOURce]:POWer:ALTernate:AMPLitude <val><units>

This command sets the delta value for the alternate amplitude.
Basic Function Commands
Power Subsystem ([:SOURce]:POWer)

The variable <val> is expressed in units of decibels (dB).

*RST +0.00000000E+000
Range −174 to 174

Key Entry Desired Delta

Remarks The actual RF output amplitude is equal to the Alternate Amplitude Delta value plus the RF output amplitude; this sum cannot exceed the minimum and maximum amplitude limits of the signal generator. For example, if the Alternate Amplitude Delta is set to −174 dB and the RF output amplitude is set to 20 dB, the sum is equal to −154 dB.

:ALTerminate:TRIGger:EXTernal[[:SOURce]]

Supported N5166B/72B/82B

[:SOURce]:POWer:ALTerminate:TRIGger:EXTernal[[:SOURce]]
BBTRigger1|BBTRigger2|PTRig|EVENT1
[:SOURce]:POWer:ALTerminate:TRIGger:EXTernal[[:SOURce]]?

This command sets the external trigger source for the alternate amplitude signal when :ALTerminate:TRIGger[[:SOURce]] is set to External.

BBTRigger1 This choice requires an external trigger to the selected rear panel BB TRIG 1 BNC to toggle the RF output power between main and alternate amplitudes.

BBTRigger2 This choice requires an external trigger to the selected rear panel BB TRIG 2 BNC to toggle the RF output power between main and alternate amplitudes.

PTRig This choice requires an external trigger to the selected rear panel PAT TRIG BNC to toggle the RF output power between main and alternate amplitudes.

EVENT1 This choice requires an external trigger to the selected rear panel EVENT 1 BNC to toggle the RF output power between main and alternate amplitudes.

*RST BBTR1

Key Entry BB TRIG 1 BB TRIG 2 EVENT 1 PAT TRIG
BNC BNC BNC BNC

:ALTerminate:TRIGger[[:SOURce]]

Supported N5166B/72B/82B
Basic Function Commands
Power Subsystem ([:SOURce]:POWer)

`:SOURce]:POWer:ALTernate:TRIGger[:SOURce] INTernal|EXTernal
`:SOURce]:POWer:ALTernate:TRIGger[:SOURce]?

This command sets the trigger source for the alternate amplitude signal.

**INTernal**
The baseband generator triggers each timeslot to output a power level set with either the user-selected main or alternate amplitude parameter.

This choice requires a baseband generator option. Each timeslot is allowed to output power with a user-selected main or alternate amplitude.

**EXTernal**
This choice requires an external trigger to the selected rear panel connector (see :ALTernate:TRIGger:EXTernal[:SOURce]) to toggle the RF output power between main and alternate amplitudes.

*RST
MAN

**Key Entry**
Alt Ampl Trigger

`:ALTernate[:STATE]

**Supported**
N5166B/72B/82B

`:SOURce]:POWer:ALTernate:STATE ON|OFF|1|0
`:SOURce]:POWer:ALTernate:STATE?

This command enables or disables the alternate amplitude.

**NOTE:** Alternate amplitude should not be selected for more than 100ms at a time or the power may drift.

*RST
0

**Key Entry**
Alt Ampl Off On

`:ATTenuation

**Supported**
All Models

`:SOURce]:POWer:ATTenuation <value><unit>
`:SOURce]:POWer:ATTenuation?

This command sets the signal generator’s attenuator level. Before setting the attenuator level, set the “:ATTenuation:AUTO” function to Off which will disable ALC control.

In normal operation the attenuator level is selected by the signal generator’s automatic loop control (ALC) which maintains the output power by adjusting internal circuits to compensate for any power fluctuations due to drift, band
changes, or load variations. In some applications, such as fast pulse, the ALC may not respond quickly enough to compensate for the pulse rise times. In this case you can set the attenuator and override any ALC adjustments.

The output power is the ALC level minus the attenuator setting. The attenuator is set in increments of 5 dB.

Example

:POW:ATT 10DB

The preceding example sets the attenuator to 10 dB.

*RST  +115
Range  0 to 130 dB
Key Entry  Set Atten

:ATTenuation:AUTO

Supported  All Models

[:SOURce]:POWer:ATTenuation:AUTO ON|OFF|1|0
[:SOURce]:POWer:ATTenuation:AUTO?

This command sets the state of the attenuator auto mode function.

ON (1)  This selection allows the signal generator’s automatic level control (ALC) to adjust the attenuator so that a specified RF power level, at the Keysight MXG’s RF output connector, is maintained.

OFF (0)  This choice allows for a user–selected attenuator setting that is not affected by the signal generator’s ALC circuitry. Other settings become available, see Remarks.

The OFF (0) selection can be used to eliminate power discontinuity normally associated with attenuator switching during power adjustments.

*RST  1
Key Entry  Atten Hold Off On
Remarks  When OFF is the command setting, refer to:
– “:ALC:LEVel” on page 100
– “:ATTenuation” on page 110
– “:ATTenuation:BYPass” on page 111

The SPCI is the inverse logic of the front-panel. For example, when the front panel is set to On, user-selected attenuator settings are allowed. In this state, the query above returns 0, and vice versa.
Basic Function Commands
Power Subsystem ([SOURce]:POWer)

:ATTenuation:BYPass

**Supported** All Models

[:SOURce]:POWer:ATTenuation:BYPass ON|OFF|1|0
[:SOURce]:POWer:ATTenuation:BYPass?

This command enables or disables the attenuator bypass setting. The attenuator hold mode must be enabled to use this command.

**ON (1)** This selection allows the signal generator’s automatic level control (ALC) to adjust the attenuator hold mode. Output power is controlled solely by the ALC setting.

**OFF (0)** This choice allows for a user-selected attenuator setting combined with the ALC setting.

*RST 0

**Key Entry** Atten Bypass Off On

:HARMonics

**Supported** All Models

[:SOURce]:POWer:HARMonics[:STATe] ON|OFF|1|0
[:SOURce]:POWer:HARMonics?

This command enables or disables the optimize harmonics setting. The optimize harmonics mode modifies the attenuator and automatic level control (ALC) settings to give optimal harmonics performance. Optimize harmonics mode does not change the RF output power. The attenuator hold mode cannot be enabled while this mode is active, and modulations cannot be enabled while this mode is active.

**ON (1)** This selection allows the signal generator to optimize harmonics by modifying the attenuator and automatic level control settings.

**OFF (0)** This selection disables the optimize harmonics mode.

*RST 0

**Key Entry** Optimize Harmonics

[:LEVel][:IMMediate]:OFFSet

**Supported** All Models

[:SOURce]:POWer[:LEVel][:IMMediate]:OFFSet <value><unit>
[:SOURce]:POWer[:LEVel][:IMMediate]:OFFSet?

This command sets the power offset value.

*RST +0.00000000E+000

**Range** −200 to 200 dB
Basic Function Commands
Power Subsystem ([:SOURce]:POWer)

**Key Entry**  
Amptd Offset

**Remarks**  
This simulates a power level at a test point beyond the RF OUTPUT connector without changing the actual RF output power. The offset value only affects the displayed amplitude setting.

You can enter an amplitude offset any time in either normal operation or amplitude reference mode.

### [:LEVel][:IMMediate][:AMPLitude]

**Supported**  
All Models


This command sets the RF output power.

*RST  
-1.10000000E+002 (Standard) or -1.44000000E+002 (Option 1EQ)

**Key Entry**  
AMPTD

**Remarks**  
For information on the ranges for this command and the specified values, refer to the instrument’s Data Sheet.

### [:LEVel]:MINimum:LIMit

**Supported**  
All Models w/Option HAL

[ :SOURce ] :POWer [:LEVel] :MINimum:LIMit LOW|HIGH
[ :SOURce ] :POWer [:LEVel] :MINimum:LIMit ?

This command selects the RF Off power minimum level to LOW or HIGH. When set to HIGH, the RF Output Attenuator is set for maximum attenuation. When set to LOW, the internal RF modulators are biased off further reducing the output signal level.

**Key Entry**  
Minimum Power

**Remarks**  
Option HAL is a special operating mode that does not use the ALC modulator to shut off the RF output when the RF is off. When option HAL is active the pulse and ALC modulators are left on. The RF output attenuator is used to shut off the output level. The result being the output power will not decrease as much when the RF is off. Command reports undefined header error if option is not enabled.
Basic Function Commands
Power Subsystem [:SOURce]:POWer

:MODE

**Supported** All Models

[:SOURce]:POWer:MODE FIXed|LIST
[:SOURce]:POWer:MODE?

This command sets the signal generator power mode to fixed or swept.

**FIXed** This choice stops a power sweep, allowing the signal generator to operate at a fixed power level. Refer to the [:LEVEL][:IMMediate][:AMPLitude] command for setting the output power level.

**LIST** This choice selects the swept power mode. If sweep triggering is set to immediate along with continuous sweep mode, executing the command starts the LIST or STEP power sweep.

**NOTE** To perform a frequency and amplitude sweep, you must also select LIST as the frequency mode. See also the :FREQuency:MODE command for selecting the list mode for a frequency sweep.

*RST

**FIX**

**Key Entry** SWEEP Amptd Off On

NOISe:[STATe]

**Supported** All Models

[:SOURce]:POWer:NOISe:[STATe] ON|OFF|1|0
[:SOURce]:POWer:NOISe:[STATe]?

This command enables the optimize signal to noise (S/N) ratio state. The command optimizes the attenuator and ALC setting to give the optimal signal to noise performance. It does not change the RF output power. The query returns an integer.

**Default** S/N Off

**Key Entry** Optimize S/N Off On

**Remarks** An example of this feature is when the S/N is off, and the output power is set to –10 dBm, the ALC rises to 0 dBm. The resulting attenuation is 10 dB.

When the Optimize S/N is enabled (on), and the output power is set to –10 dBm, the ALC increases to maximum (i.e. 20 dBm). The attenuator increases to 30 dB, resulting in a 20 dB increased S/N for better dynamic range.

Can not go beyond maximum ALC.

It is limited to CW operation.
Basic Function Commands
Power Subsystem ([:SOURCE]:POWER)

This mode is mutually exclusive with Attenuator Hold, and any modulation type. A settings conflict error will be generated if Attenuator Hold or any modulation is activated when Optimize S/N is enabled.

:SOURce:POWER

This command enables or disables the power search protection function. The power search protection function sets the attenuator to its maximum level whenever a power search is initiated. This can be used to protect devices that are sensitive to high average power or high power changes. The trade off on using the power protection function is decreased attenuator life, as the attenuator will switch to its maximum setting during a power search.

**NOTE**

Continual or excessive use of the power search protection function can decrease attenuator life.

- **ON (1)** Causes the attenuator to switch to and hold its maximum level setting during a power search.
- **OFF (0)** Sets the attenuator to normal mode. The attenuator is not used during power search.

**Example**

:POWER:PROT ON

The preceding example enables the power inhibit function.

**RST**

:POWER

This command sets the power level for the signal generator RF output reference.

The RF output power is referenced to the value entered in this command.

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>RF During Power Search Normal Minimum</th>
</tr>
</thead>
</table>

**:REference**

This command sets the power level for the signal generator RF output reference.

The RF output power is referenced to the value entered in this command.

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>AmpTd Ref Set</th>
</tr>
</thead>
</table>
Basic Function Commands
Power Subsystem ([:SOURce]:POWer)

:**REFerence:**STATe

**Supported** All Models

[:SOURce]:POWer:**REFerence:**STATe ON|OFF|1|0
[:SOURce]:POWer:**REFerence:**STATe?

This command enables or disables the RF output reference.

Once the reference state is ON, all subsequent output power settings are set relative to the reference value.

- **ON** (1) This choice will set the power reference state to ON. The unit displayed for commands, ":ANNotation:AMPLitude:UNIT" and ":POWer" will be expressed in dB.

- **OFF** (0) This choice will set the power reference state to OFF.

  **RST** 0

**Key Entry** Amptd Ref Off On

**Remarks** Amplitude offsets can be used with the amplitude reference mode.

:**STAIt**

**Supported** All Models

[:SOURce]:POWer:**STAIt** <value><unit>
[:SOURce]:POWer:**STAIt**?

This command sets the first amplitude point in a step sweep.

- **RST** \(-1.10000000E+002\) (Standard) and \(-1.44000000E+002\) (Option 1EQ)

**Range** Refer to the [:LEVel][:IMMediate][:AMPLitude] command for the output power ranges.

**Key Entry** Amptd Start

:**STOP**

**Supported** All Models

[:SOURce]:POWer:**STOP** <value><unit>
[:SOURce]:POWer:**STOP**?

This command sets the last amplitude point in a step sweep.

- **RST** \(-1.10000000E+002\) (Standard) and \(-1.44000000E+002\) (Option 1EQ)

**Range** Refer to the [:LEVel][:IMMediate][:AMPLitude] command for the output power ranges.
Basic Function Commands  
Power Subsystem ([SOURce]:POWer)

Key Entry  Amptd Stop

:USER:MAX

Supported All Models

[ :SOURce ] :POWer :USER :MAX ?

This command enables the user to specify a maximum output power level that is lower than the instrument’s normal maximum output power. This affects all modes of power operation. The query returns the value of the output power level.

Key Entry User Power Max  

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:USER:ENABLe

Supported All Models

[ :SOURce ] :POWer :USER :ENABLe ON|OFF|1|0  
[ :SOURce ] :POWer :USER :ENABLe ?

This command enables or disables the user settable maximum output power limit.

Key Entry User Power Max Enable:
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B ([:SOURce]:IQ)

Vector Modulation Subsystem—N5166B/72B/82B ([:SOURce]:IQ)

:AUX:INPut:STRobe[:MODE]

This command sets the mode that is used for latching AUX port input data.
If the signal generator is in serial (vs. parallel) mode, the input strobe mode will always be free-run. If parallel mode is selected, user can choose either free-run or user-input-strobe mode.

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:AUX:INPut:STRobe[:MODE] FREE|USER
[:SOURce]:IQ:AUX:INPut:STRobe[:MODE]? *

FREE  Input data to AUX port is in free-run mode (the signal generator latches new input data on its own internal schedule).

USER  Input data to AUX port is in user external input strobe mode (user supplies some strobe signal to let the signal generator know when to latch data).

*RST  FREE

Key Entry  Input Strobe Free Run User

:AUX:INPut:STRobe:SLOPe

This command controls the polarity of the user external input strobe signal.
The external-input-strobe signal must be at least 200ns wide, and user must hold assert 16 input data bits stable 20ns before the active edge of the user input strobe and hold the data stable for at least 100ns after the active edge of the user input strobe.

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:AUX:INPut:STRobe:SLOPe POSitive|NEGative
[:SOURce]:IQ:AUX:INPut:STRobe:SLOPe?

POSitive  The signal generator looks for a rising edge of the external strobe signal to latch the data.

NEGative  The signal generator looks for a falling edge of the external strobe signal to latch the data.

*RST  POS

Key Entry  Input Strobe Polarity Neg Pos
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B ([:SOURce]:IQ)

:AUX:OPERating:MODE

**Supported** N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:AUX:OPERating:MODE DEDicated|MULTiplexed

This command sets the operating mode for real-time applications.

**NOTE:** This command is not supported by all real-time applications

DEDicated  Configures the AUX I/O port operating mode to Dedicated for real-time applications.

MULTiplexed  Configures the AUX I/O port operating mode to Multiplexed for real-time applications.

*RST  DED

**Key Entry**

Operating Mode  Dedicated  Multiplexed

:AUX:OUTPut:STRobe:SLOPe

**Supported** N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:AUX:OUTPut:STRobe:SLOPe POSitive|NEGative

[:SOURce]:IQ:AUX:OUTPut:STRobe:SLOPe?

This command controls the polarity of the AUX output sample clock.

The output sample clock indicates that the signal generator has latched the 16 input data bits. The signal generator will output this signal in either free-run or external-input-strobe mode. The user can select the polarity of the output-strobe signal using this command.

POSitive  The signal generator will assert a pulse with a rising edge to indicate when it has latched the 16 input data bits.

NEGative  The signal generator will assert a pulse with a falling edge to indicate when it has latched the 16 input bits. The output pulse will be at least 200 ns wide.

*RST  POS

**Key Entry**

Output Strobe Polarity Neg Pos
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B ([SOURce]:IQ)

:SOURce:OPERating:MODE

**Supported** N5172B or N5182B with Option N5180UN7B or 003 or 004

When the Baseband Operating Mode is changed, the current contents of volatile waveform memory are erased

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIMary</td>
<td>All signal generator features are available in this mode except BERT and N5102A functionality. This choice selects the PXB Input ARB FPGA image. For backwards compatibility, selecting the Primary Baseband Operating Mode sets the I/Q Digital Bus Connectivity to PXB.</td>
</tr>
<tr>
<td>BERT</td>
<td>Requires Keysight N5172B EXG or N5182B MXG X-Series signal generators with Option N5180UN7B. All signal generator features are available in this mode; all BERT features are also available, but N5102A is not available in this mode. This choice selects the BERT ARB FPGA image and contains all functionality and features from the B.01.65 PXB Input FPGA image. For backwards compatibility, selecting the BERT Baseband Operating Mode sets the I/Q Digital Bus Connectivity to PXB.</td>
</tr>
<tr>
<td>N5102A</td>
<td>Requires Keysight N5172B EXG or N5182B MXG X-Series signal generators with Option 003 or 004 or both. All signal generator features are available in this mode; all N5102A features are also available, but BERT is not available in this mode. For backwards compatibility, selecting the N5102A Baseband Operating Mode sets the I/Q Digital Bus Connectivity to N5102A.</td>
</tr>
</tbody>
</table>

*RST* N/A
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B ([SOURce]:IQ)

Remarks
The selected Baseband Operating Mode is a persistent instrument setting and its value is maintained through power cycles, Preset, or *RST.

[:OUTPut:IMPairments:AWGN:BANDwidth|BWIDth]

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:BANDwidth|BWIDth <value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:BANDwidth|BWIDth?

This command sets the flat noise bandwidth, which is typically set wider than the signal bandwidth. There will be roll-off of the noise outside of this bandwidth.

*RST 1 Hz

Range
Option 653: 1 Hz–60 MHz
Option 655: 1 Hz–120 MHz
Option 656: 1 Hz–80 MHz
Option 657: 1 Hz–160 MHz

Key Entry
Flat Noise Bandwidth

[:OUTPut:IMPairments:AWGN:EBNO]

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:EBNO <value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:EBNO?

This command allows the signal to noise ratio to be set using the Eb/No (energy per bit over noise power density at the receiver) form. This requires the signal bit rate to be set properly.

\[(\text{SNR})_{\text{dB}} = (\text{Eb}/\text{No})_{\text{dB}} + 10\log(\text{bitRate}/\text{signalBandwidth})\]

*RST 0 dBm

Range
–100 to 100 dBm

Key Entry
Eb/No
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B ([:SOURce]:IQ)

:OUTPut:IMPairments:AWGN:IBWidth

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:IBWidth <value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:IBWidth?

This value determines the non-AUTO value of the noise integration bandwidth. This is the bandwidth over which to sum the noise for the purposes of SNR (or Eb/No). Often, it is the symbol rate or chip rate of the signal in question.

*RST  1 Hz
Range  1 Hz–200 MHz
Key Entry  Integration Bandwidth

:OUTPut:IMPairments:AWGN:IBWidth:AUTO

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:IBWidth:AUTO ON|OFF|1|0
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:IBWidth:AUTO?

This is a new feature that allows the currently ON application to control the noise integration bandwidth. For applications that have no clear noise integration bandwidth, such as Dual Arb, the auto mode is effectively OFF.

*RST  1
Key Entry  Integration Bandwidth Manual Auto

:OUTPut:IMPairments:AWGN:MUX SUM|SIGNal|NOISe

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:MUX SUM|SIGNal|NOISe
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:MUX?

This value allows diagnostic control of additive noise. The intended purpose of this feature is to allow direct measurement of just the signal or noise contribution to the total power (assuming that the ALC is off). The system will still behave as if both the noise and the signal are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

SUM  The sum of both the noise and the signal will be output from the internal baseband generator.
SIGNal  Only the signal will be output from the internal baseband generator.
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B ([:SOURce]:IQ)

**NOISE**

Only noise will be output from the internal baseband generator.

**:*RST**

SUM

**Key Entry**

Output Mux

**:OUTPut:IMPairments:AWGN:POWer:CONTrol[:MODE]**

**Supported**

N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

**:OUTPut:IMPairments:AWGN:POWer:CONTrol[:MODE]**

TOTal|SIGNal|NOISe|NCHannel

**:OUTPut:IMPairments:AWGN:POWer:CONTrol[:MODE]?**

Sets the mode of power control while noise is on.

**TOTal**

The total power and SNR are independent variables and the signal power, channel noise power, and total noise power are dependent variables set by the total power, SNR and the rest of the noise settings. The signal power, channel noise power, and total noise power will change as any noise parameter is adjusted to keep the total power and the SNR at their last specified values.

**SIGNal**

The signal power and SNR are independent variables and the total power, channel noise power, and total noise power are dependent variables set by the signal power, SNR and the rest of the noise settings. The total power, channel noise power, and total noise power will change as any noise parameter is adjusted to keep the signal power and the SNR at their last specified values.

**NOISe**

The total noise power and SNR are independent variables and the total power, channel noise power, and signal power are dependent variables set by the total noise power, SNR and the rest of the noise settings. The total power, channel noise power, and signal power will change as any noise parameter is adjusted to keep the total noise power and the SNR at their last specified values.

**NCHannel**

The channel noise power and SNR are independent variables and the total power, total noise power, and signal power are dependent variables set by the channel noise power, SNR and the rest of the noise settings. The total power, total noise power, and signal power will change as any noise parameter is adjusted to keep the channel noise power and the SNR at their last specified values.

**:*RST**

TOT
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B ([SOURce]:IQ)

**Key Entry** Power Control Mode
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B ([SOURce]:IQ)

:OUTPut:IMPairments:AWGN:POWer:NOISe:CHANnel

**Supported**
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:NOISe:CHANnel <value>

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:NOISe:CHANnel?

Set the current channel noise power level if noise is on. In the "Channel Noise" control mode, the total power will be adjusted to achieve the specified channel noise power and the channel noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the channel noise power setting appropriately to maintain the SNR.

In the other control modes, this will adjust the total power once for the specified channel noise power level, after which the channel noise power could change if any noise parameters are adjusted.

The range varies based on the bounds of the total power that results from the noise settings.

*RST -110 dBm

Range Varies based on the bounds of the total power that results from the noise settings

Key Entry Noise Power In Channel

:OUTPut:IMPairments:AWGN:POWer:NOISe:TOTal

**Supported**
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:NOISe:TOTal <value>

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:NOISe:TOTal?

Set the current channel noise power level if noise is on. In the "Channel Noise" control mode, the total power will be adjusted to achieve the specified channel noise power and the channel noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the channel noise power setting appropriately to maintain the SNR.

In the other control modes, this will adjust the total power once for the specified channel noise power level, after which the channel noise power could change if any noise parameters are adjusted.

The range varies based on the bounds of the total power that results from the noise settings.

*RST -169.03 dBm

Range Varies based on the bounds of the total power that results from the noise settings
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B [:SOURce]:IQ

Key Entry
Total Noise Power

:OUTPut:IMPairments:AWGN:POWer:SIGNal

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:SIGNal <value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:SIGNal?

Sets the current signal power level if noise is on. In the "Signal" control mode, the total power will be adjusted to achieve the specified signal power and the signal power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the signal power setting appropriately to maintain the S/N ratio.

In the other control modes, this will adjust the total power once for the specified signal power level, after which the signal power could change if any noise parameters are adjusted.

The range varies based on the bounds of the total power that results from the noise settings.

Range
Varies based on the bounds of the total power that results from the noise settings

Key Entry
Signal Power

:OUTPut:IMPairments:AWGN:SBRate

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:SBRate <value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:SBRate?

This value adjusts the signal bit rate (gross bit rate) for purposes of calculating the Eb/No (energy per bit over noise power density at the receiver). Adjusting this parameter will have an immediate impact on the SNR as appropriate for the last specified Eb/No. The signal bit rate is a saved instrument state that is recorded in the waveform header for Arb waveforms.

This value is only used if [:SOURce]:IQ:OUTPut:IMPairments:AWGN:SNRFormat is EBNO and the application currently on does not define a reference channel for Eb/No.

Range
1 bps to 999 Mbps

Key Entry
Reference Signal Bit Rate
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B (:SOURce):IQ

:OUTPut:IMPairments:AWGN:SNR

**Supported**
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:SNR <value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:SNR?

This command sets the Signal to Noise Ratio (SNR). This is the value of the noise power as a ratio of signal power to noise power. Signal power equals the total modulated signal power before noise is added. When noise is added, the power output from the signal generator may not change; it is the sum of signal power and the added noise power. This value can be changed in real time while the waveform is playing.

*RST 0 dB

**Range**
-100 dB to 100 dB

**Key Entry**
Signal to Noise Ratio

:OUTPut:IMPairments:AWGN:SNRFormat

**Supported**
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:AWGN:SNRFormat SNR|EBNO
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:SNRFormat?

This command sets the variable controlling the ratio of signal power to noise power in the noise integration bandwidth.

SNR Selects Signal to Noise Ratio (SNR) to control the ratio of signal power to noise power in the noise integration bandwidth.

EBNO Selects energy per chip over noise power density at the receiver (Ec/No) to control the ratio of signal power to noise power in the noise integration bandwidth.

*RST SNR

**Key Entry**
Signal to Noise Ratio Format

:OUTPut:IMPairments:AWGN[:STATe]

**Supported**
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:AWGN[:STATe] ON|OFF|1|0
[:SOURce]:IQ:OUTPut:IMPairments:AWGN[:STATe]?

This command enables or disables the additive white Gaussian noise.

*RST 0
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B ([:SOURce]:IQ)

**Key Entry**
Real-Time AWGN On Off

:OUTPut:IMPairments:PHASe:NOISe:F1

**Supported**
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISe:F1 <value>
[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISe:F1?

This command sets the desired start frequency offset of the flat phase noise. The actual value of f1 varies logarithmically depending on the value of the stop frequency (f2). As f2 increases in value, the adjustment becomes coarser. The effect of this value can only be determined by examining the graphic on the front panel or the actual output.

**NOTE:** This phase noise is added to the base phase noise of the instrument.

f1 must always be less than or equal to f2. Setting f1 higher than f2 will cause f2 to be set to the value of f1.

*RST 1 kHz
Range 0 Hz to 77.50052449 MHz
**Key Entry** Desired Start Freq(F1)

:OUTPut:IMPairments:PHASe:NOISe:F2

**Supported**
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISe:F2 <value>
[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISe:F2?

This command sets the desired stop frequency offset of the flat phase noise. The actual value of f2 varies logarithmically. As f2 increases in value, the adjustment becomes coarser. The effect of this value can only be determined by examining the graphic on the front panel or the actual output.

**NOTE:** This phase noise is added to the base phase noise of the instrument.

f2 must always be greater than or equal to f1. Setting f2 less than f1 will cause f1 to be set to the value of f2.

*RST 30 kHz
Range 0 Hz to 77.50052449 MHz
**Key Entry** Desired Start Freq(F2)
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B ([:SOURce]:IQ)

:OUTPut:IMPairments:PHASe:NOISE:LMID

Supported  
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISE:LMID <value>
[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISE:LMID?

This command sets the desired flat phase noise power (Lmid). The actual value can vary by approximately 0.28 dBc/Hz. The effect of this value can only be determined by examining the graphic on the front panel or the actual output.

NOTE: This phase noise is added to the base phase noise of the instrument.

*RST  
-70 dBc/Hz

Range  
-300 dBc/Hz to 100 dBc/Hz
The range of Lmid varies depending on the value of the stop frequency (f2). The range decreases as f2 increases.

Key Entry  
Desired Flat Amplitude(Lmid)

:OUTPut:IMPairments:PHASe:NOISE[:STATe]

Supported  
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISE[:STATe] ON|OFF|1|0
[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISE[:STATe]?

This command enables or disables the real-time phase noise impairment.

NOTE: This phase noise is added to the base phase noise of the instrument.

The actual performance of the phase noise can only be determined by examining the graphic on the front panel or the actual output, as the parameters simply guide the phase noise response.

*RST  
0

Key Entry  
Phase Noise On Off

:OUTPut[1]:TRIGger:CONTinuous[:TYPE] FREE|TRIGger

Supported  
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut[1]:TRIGger:CONTinuous[:TYPE] FREE|TRIGger
[:SOURce]:IQ:OUTPut[1]:TRIGger:CONTinuous[:TYPE]?

This SCPI command sets the behavior of the per output channel triggering.
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B [:SOURce]:IQ

FREE  With this choice, the signal will flow freely through the output channel.

TRIGger  With this choice, the output will start after a trigger is received.

*RST  FREE

:OUTPut[1]:TRIGger:EXTernal:DELay

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut[1]:TRIGger:EXTernal:DELay <value>
[:SOURce]:IQ:OUTPut[1]:TRIGger:EXTernal:DELay?

This command adds an external trigger delay (in seconds). The value you enter sets a delay time between when an external trigger is received and when it is applied to the signal.

This key is active only if you select external (Ext) as the trigger source.

*RST  0 ns

Range  0 ns to 41 s

Key Entry  Ext Delay Time

:OUTPut[1]:TRIGger:EXTernal:POLarity

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut[1]:TRIGger:EXTernal:POLarity POSitive|NEGative
[:SOURce]:IQ:OUTPut[1]:TRIGger:EXTernal:POLarity?

This command sets the polarity of the external trigger source to trigger on a positive edge or negative edge.

*RST  POS

Key Entry  Ext Polarity Neg Pos

:OUTPut[1]:TRIGger:EXTernal:SOURce

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut[1]:TRIGger:EXTernal:SOURce EPTrigger[1]|EPTrigger2
[:SOURce]:IQ:OUTPut[1]:TRIGger:EXTernal:SOURce?
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B ([:SOURce]:IQ)

Selects the trigger source for the external trigger.

**EPTRigger1**
This choice selects the PATT TRIG IN 1 rear panel connector (AUX I/O) as the external trigger source.

**EPTRigger2**
This choice selects the PATT TRIG IN 2 rear panel connector (AUX I/O) as the external trigger source.

*RST*

**Key Entry**

:OUTPut[1]:TRIGger:SOURce

**Supported**
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut[1]:TRIGger:SOURce KEY|BUS|EXTernal

[:SOURce]:IQ:OUTPut[1]:TRIGger:SOURce?

This command sets the source of a trigger to allow this output channel to play.

**Key Entry**

<table>
<thead>
<tr>
<th>Trigger Key</th>
<th>Bus</th>
<th>Ext</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BUS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXTernal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*RST*

**Key Entry**

:OUTPut[1]:TRIGger:STATus

**Supported**
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

[:SOURce]:IQ:OUTPut[1]:TRIGger:STATus?

This query reports the current play status of the output channel.

**Table 2-3 Trigger Status Bit Description**

<table>
<thead>
<tr>
<th>Bit 0 - Output is ON</th>
<th>Bit 1 - Output is waiting for a trigger</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Output is off, triggering is inactive</td>
<td>Output is not waiting for a trigger (playing or stopped)</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Output is on, triggering is active</td>
<td></td>
</tr>
</tbody>
</table>
Basic Function Commands
Vector Modulation Subsystem—N5166B/72B/82B ([SOURce]:IQ)

Table 2-3 Trigger Status Bit Description

<table>
<thead>
<tr>
<th>Bit</th>
<th>Output Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Output is waiting for a trigger (shown as &quot;ARMED&quot; indicator where normally the name of the application is shown)</td>
</tr>
<tr>
<td>0</td>
<td>Output is currently paused or stopped</td>
</tr>
<tr>
<td>1</td>
<td>Output is currently playing</td>
</tr>
<tr>
<td>2</td>
<td>Output has received a trigger since last trigger setup</td>
</tr>
<tr>
<td>0</td>
<td>No trigger ever received</td>
</tr>
<tr>
<td>1</td>
<td>A trigger has been set in the past</td>
</tr>
<tr>
<td>3</td>
<td>External input clock is phase locked</td>
</tr>
<tr>
<td>0</td>
<td>Not phase locked</td>
</tr>
<tr>
<td>1</td>
<td>Phase locked</td>
</tr>
<tr>
<td>4</td>
<td>Synchronization (realignment) trigger</td>
</tr>
<tr>
<td>0</td>
<td>Out of Sync (shown as &quot;NO SYNC&quot; indicator where normally &quot;UNLOCK&quot; and &quot;DAC OVER&quot; is shown)</td>
</tr>
<tr>
<td>1</td>
<td>In Sync</td>
</tr>
<tr>
<td>5</td>
<td>MultiBoxSync waiting</td>
</tr>
<tr>
<td>0</td>
<td>Not awaiting sync</td>
</tr>
<tr>
<td>1</td>
<td>Awaiting sync</td>
</tr>
<tr>
<td>6</td>
<td>MultiBoxSync is synchronized</td>
</tr>
<tr>
<td>0</td>
<td>Out of sync</td>
</tr>
<tr>
<td>1</td>
<td>In sync</td>
</tr>
</tbody>
</table>
With firmware version B.01.75 or later, the following options have changed to a new eight-digit format:

- Option 302 to Option N5180302B
- Option 320 to Option N5180320B
- Option 403 to Option N5180403B
- Option 430 to Option N5180430B
- Option 431 to Option N5180432B
- Option 432 to Option N5180431B
- Option UN7 to Option N5180UN7B

Only software options are changed to the eight-digit format. Hardware options remain with three-digits.

This chapter describes SCPI commands for subsystems dedicated to peripheral signal generator operations common to all Keysight X-Series signal generators.

This chapter contains the following sections:

- Calibration Subsystem (:CALibration) on page 134
- Communication Subsystem (:SYSTem:COMMunicate) on page 138
- Diagnostic Subsystem (:DIAGnostic[:CPU]:INFormation) on page 144
- Display Subsystem (:DISPlay) on page 148
- IEEE 488.2 Common Commands on page 152
- Memory Subsystem (:MEMory) on page 158
- Output Subsystem (:OUTPut) on page 188
- Route Subsystem (:ROUTe) on page 190
- Status Subsystem (:STATus) on page 200
- System Subsystem (:SYSTem) on page 213
- Trigger Subsystem on page 242
- Unit Subsystem (:UNIT) on page 247
Calibration Subsystem (:CALibration)

:ALC:MODulator:BIAS

**Supported**  All Models

:CALibration:ALC:MODulator:BIAS

This command performs the ALC modulator bias calibration. The adjustment compensates for ALC open loop power drift due to temperature and humidity.

**Key Entry**  Execute ALC Modulator Bias Adjustment

**Remarks**  Use this calibration when the instrument is being used in the ALC open loop mode.

:BBG:SKEW RFOut|EXTernal

**Supported**  N5166B, N5172B, N5182B

:CALibration:BBG:SKEW EXTernal, <value in pS>

:CALibration:BBG:SKEW? EXTernal

This command enters a calibration value that will correct the inherent External Output I/Q skew due to differences in the I/Q physical paths.

EXTernal[1]|2:DC

**Supported**  All Models

:CALibration:EXTernal[1]|2:DC

This command initiates a DC offset calibration for the external source specified.

**NOTE**  If the calibration is performed with a DC signal applied, any deviation provided by the DC signal will be removed and the new zero reference point will be at the applied DC level.

**Key Entry**  External DC Cal

**Remarks**  Use this calibration for externally applied DC signals.

:IQ:DC

**Supported**  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:CALibration:IQ:DC

This command performs a one to two second adjustment that is not traceable to a standard. However, it will minimize errors associated with IQ gain, quadrature, and offset voltages. This adjustment minimizes errors for the current signal generator setting and at a single frequency. The DC adjustment
System Commands  
Calibration Subsystem (:CALibration)

is volatile and must be repeated with each signal generator setting change. This command can be sent while the RF On/Off is set to Off and the adjustment will still be valid when the RF is enabled. IQ must be on to perform this adjustment.

The I/Q DC adjustment is dependent upon a number of instrument settings. If any of the instrument settings change, the adjustment will become invalid. The dependent instrument settings are:

- RF frequency
- I/Q attenuation level
- Baseband generator settings
- I/Q polarity settings
- Baseband filter settings
- I/Q calibration (the I/Q DC calibration will be invalidated if any other I/Q calibration is executed or if the Revert to Factory Default key is pressed)
- Temperature (±5 degrees Celsius)
- I/Q Off On set to On
- I/Q Correction Optimized Path (must be set to RF Output). Refer to ":DM:CORRection:OPTimization" on page 56.
- I/Q Source (must be set to Internal). Refer to ":DM:SOURce" on page 68.

The following instrument states will not invalidate the I/Q DC calibration:

- Power level changes
- I/Q Impairments

Key Entry  
Execute Cal (with Calibration Type User Full set to DC)

:IQ:DEFault

Supported  
N5166B/72B/82B

:IQ:DEFault

Supported  
N5166B/72B/82B

:IQ:FULL

Supported  
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:IQ:FULL

Key Entry  
Revert to Default Cal Settings
System Commands

Calibration Subsystem (:CALibration)

This command performs an adjustment to the I/Q offset, gain and quadrature for the full–frequency range (regardless of the start and stop frequency settings) and stores the results in the signal generator's firmware.

This calibration should be run when the ambient temperature has varied by at least ±5 degrees Celsius from the ambient temperature at which the previous calibration was run.

**Key Entry**
- Execute Cal (with Calibration Type User Full set to Full)

**Remarks**
Start and stop frequencies will default to the full frequency range of the signal generator.

`:IQ:STARt`

**Supported**
- N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

`:CALibration:IQ:STARt <value><unit>`
`:CALibration:IQ:STARt?`

This command sets the start frequency and automatically sets the calibration type to User for an I/Q calibration.

The start frequency must be less than the current value of the stop frequency.

**Range**
- Option 503: 5 MHz to 3 GHz
- Option 506: 5 MHz to 6 GHz

**Key Entry**
- Start Frequency

**Remarks**
The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

`:IQ:STOP`

**Supported**
- N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

`:CALibration:IQ:STOP <value><unit>`
`:CALibration:IQ:STOP?`

This command sets the stop frequency and automatically sets the calibration type to User for an I/Q calibration.

The stop frequency must be greater than the current value of the start frequency.

**Range**
- Option 503: 5 MHz to 3 GHz
- Option 506: 5 MHz to 6 GHz
### System Commands
### Calibration Subsystem (:CALibration)

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Stop Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remarks</td>
<td>The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.</td>
</tr>
</tbody>
</table>

#### IQ:TYPE

<table>
<thead>
<tr>
<th>Supported</th>
<th>N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657</th>
</tr>
</thead>
</table>

The command sets the IQ calibration type.

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Calibration Type DC User Full</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remarks</td>
<td>The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.</td>
</tr>
</tbody>
</table>

#### IQ[:USER]

<table>
<thead>
<tr>
<th>Supported</th>
<th>N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657</th>
</tr>
</thead>
</table>

This command performs an IQ calibration according to the IQ calibration type. For information on selecting the type of IQ calibration, refer to “:IQ:TYPE” on page 137.

This calibration should be run when the ambient temperature has varied by at least ±5 degrees Celsius from the ambient temperature at which the previous calibration was run.

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Execute Cal</th>
</tr>
</thead>
</table>
System Commands
Communication Subsystem (:SYSTem:COMMunicate)

Communication Subsystem (:SYSTem:COMMunicate)

**NOTE**

The settings enabled by the LAN commands are not affected by signal generator power–on, preset, or *RST.

:**GPIB:ADDReSS**

**Supported**  All Models

:SYSTem:COMMunicate:GPIB:ADDReSS <number>
:SYSTem:COMMunicate:GPIB:ADDReSS?

This command sets the signal generator’s GPIB address.

**Range**  0 to 30

**Key Entry**  GPIB Address

:**GTLocal**

**Supported**  All Models

:SYSTem:COMMunicate:GTLocal

This command sets the signal generator to local mode which enables front panel operation.

**Key Entry**  Local

:**LAN:CONFig**

**Supported**  All Models

:SYSTem:COMMunicate:LAN:CONFig MANual|AUTO
:SYSTem:COMMunicate:LAN:CONFig?

**NOTE**

The SCPI query for the LAN setup returns the last power on state setting, which may or may not be the currently displayed setting.

This command sets the signal generator’s Internet protocol (IP) address.

**MANual**  The user assigns an IP address to the signal generator.

**AUTO**  The network assigns an IP address to the signal generator with a fall back to Auto–IP if DHCP fails. If both DHCP and Auto–IP fail, manual configuration will be used.

**Example**

:SYST:COMM:LAN:CONF DHCP
System Commands
Communication Subsystem (:SYSTem:COMMunicate)

The preceding example sets up the signal generator LAN configuration to use a DHCP IP address.

**Key Entry**  
LAN Config

**Remarks**  
The SCPI query returns the current setting, not the saved setting.

### :LAN:DEFaults

**Supported**  
All Models

**:SYSTem:COMMunicate:LAN:DEFaults**

This command restores the instrument’s LAN settings to their factory default values.

**Key Entry**  
Restore LAN Settings to Default Values

**Key Path**  
Utility > I/O Config > Lan Setup > Advanced Settings > More 2 of 2 > Restore LAN Settings to Default Values

### :LAN:DESCription

**Supported**  
All Models

**:SYSTem:COMMunicate:LAN:DESCription <string>**  
**:SYSTem:COMMunicate:LAN:DESCription?**

This command defines the instrument’s web description. The query returns the current saved setting.

**Remarks**  
If queried and there is no current LAN description the default web description value is returned.

LAN description is displayed on the homepage for the Keysight MXG.

### :LAN:DHCP:EXPires

**Supported**  
All Models

**:SYSTem:COMMunicate:LAN:DHCP:EXPires**

This command returns a string indicating the time at which the current DHCP lease expires or an empty string if no DHCP lease was acquired.

**Remarks**  
Only relevant when the instrument’s LAN configuration type has been set to Auto.
System Commands
Communication Subsystem (:SYStem:COMMunicate)

:SYStem:COMMunicate:LAN:DHCP:OBTained
This command returns a string indicating the time at which the current DHCP lease was obtained or an empty string if no DHCP lease was acquired.

Remarks Only relevant when the instrument’s LAN configuration type has been set to Auto.

:LAN:DHCP:SERVer
Supported All Models.

:SYStem:COMMunicate:LAN:DHCP:SERVer
This command returns a string containing the IP address of the DHCP server that has provided the current lease or an empty string if no DHCP lease was acquired.

Remarks Only relevant when the instrument’s LAN configuration type has been set to Auto.

:LAN:DNS:DYNamic
Supported All Models

:SYStem:COMMunicate:LAN:DNS:DYNamic ON|OFF|1|0
:SYStem:COMMunicate:LAN:DNS:DYNamic?
This command turns dynamic Domain Name System (DNS) on/off. The query returns the current setting, not the saved setting.

Default On

Key Entry Dynamic DNS On
Key Path Utility > I/O Config > LAN Setup > Advanced Settings > Dynamic Hostname Services > Dynamic DNS Off On

:LAN:DNS[::SERVer]
Supported All Models

:SYStem:COMMunicate:LAN:DNS[::SERVer] <ipstring>
:SYStem:COMMunicate:LAN:DNS[::SERVer]?
This command defines the IP address of the signal generator DNS server. This entry defines the DNS server for the signal generator LAN connection. The query returns the current setting, not the saved setting.

Key Entry DNS Server

:LAN:DOMain
Supported All Models
System Commands
Communication Subsystem (:SYSTem:COMMunicate)

:SYSTem:COMMunicate:LAN:DOMain <string>
:SYSTem:COMMunicate:LAN:DOMain?

This command defines the domain name of the signal generator's DNS server. This entry defines the DNS server for the signal generator LAN connection. The query returns the current setting, not the saved setting.

Key Entry          Domain Name

:LAN:GATeway

Supported     All Models

:SYSTem:COMMunicate:LAN:GATeway "<ipstring>"
:SYSTem:COMMunicate:LAN:GATeway?

This command sets the gateway for local area network (LAN) access to the signal generator from outside the current sub-network. The query returns the current setting, not the saved setting.

Key Entry          Default Gateway
Remarks           Using an empty string restricts access to the signal generator to local hosts on the LAN.

:LAN:HOSTname

Supported     All Models

:SYSTem:COMMunicate:LAN:HOSTname "<string>"
:SYSTem:COMMunicate:LAN:HOSTname?

This command sets the signal generator's local area network (LAN) connection hostname. The query returns the current setting, not the saved setting.

Key Entry          Hostname

:LAN:IDENtify

Supported     All Models

:SYSTem:COMMunicate:LAN:IDENtify ON|OFF|1|0

This command controls the LAN identify feature.

ON (1)     The command enables device identification by displaying the full-screen message "Identify: <IP Address>" on the signal generator's front panel; the LAN Status indicator will also show "IDENTIFY". For more information, refer to the Programming Guide.
System Commands
Communication Subsystem (:SYSTem:COMMunicate)

OFF (0) This command disables device identification by clearing the message on the signal generator's front panel and returning the LAN Status indicator to display the current network state. For more information, refer to the Programming Guide.

:LAN:IP

Supported All Models

:SYSTem:COMMunicate:LAN:IP "<ipstring>"
:SYSTem:COMMunicate:LAN:IP?

This command sets the signal generator's local area network (LAN) internet protocol (IP) address for your IP network connection.

Key Entry IP Address

:LAN:MDNS

Supported All Models

:SYSTem:COMMunicate:LAN:MDNS ON|OFF|1|0
:SYSTem:COMMunicate:LAN:MDNS?

This command enables or disables the multicast (mDNS) and DNS service discovery (DNS-SD) services. The query returns the current setting.

Default On

Key Entry mDNS/DNS-SD Off On

Key Path Utility > I/O Config > LAN Setup > Advanced Settings > Dynamic Hostname Services > mDNS/DNS-SD Off On
System Commands
Communication Subsystem (:SYStem:COMMunicate)

:LAN:RESTart

Supported All Models
:SYStem:COMMunicate:LAN:RESTart

This command restarts the network to enable changes that have been made to the LAN setup.

Key Entry Proceed With Reconfiguration
Key Path Utility > I/O Config > Lan Setup > Proceed With Reconfiguration

:LAN:SUBNet

Supported All Models
:SYStem:COMMunicate:LAN:SUBNet "<ipstring>"
:SYStem:COMMunicate:LAN:SUBNet?

This command sets the signal generator’s local area network (LAN) subnet mask address for your internet protocol (IP) network connection.

NOTE
An error will occur if the IP address, Gateway, and subnet mask have conflicting settings.

Key Entry Subnet Mask
Remarks The SCPI query returns the current setting, not the saved setting.
Diagnostic Subsystem (:DIAGnostic[:CPU]:INFormation)

:CCOunt:ATTenuator

Supported All Models

:DIAGnostic[:CPU]:INFormation:CCOunt:ATTenuator?

This query returns the cumulative number of times that the attenuator has been switched.

Key Entry Diagnostic Info

:CCOunt:PON

Supported All Models

:DIAGnostic[:CPU]:INFormation:CCOunt:PON?

This query returns the cumulative number of times the signal generator has been powered–on.

Key Entry Diagnostic Info

:CCOunt:PROTection

Supported All Models

:DIAGnostic[:CPU]:INFormation:CCOunt:PROTection?

This query returns the cumulative number of times the reverse power protection has been cycled.

Key Entry Diagnostic Info

:DISPlay:OTIMe

Supported All Models

:DIAGnostic[:CPU]:INFormation:DISPlay:OTIMe?

This query returns the cumulative number of hours the display has been on.

Key Entry Diagnostic Info

:LICense:AUXiliary

Supported All Models

:DIAGnostic[:CPU]:INFormation:LICense:AUXiliary?
This query returns a list of licenses for software applications associated with the signal generator that have the software license file installed on the PC, as opposed to a license key installed on the signal generator. This query includes calibration software licenses but does not return demo licenses for Arb–based applications.

**Key Entry**   Auxiliary Software Options

**Remarks** If you use the signal generator with a PC that has a copy of a software application for which a license shows with this query, the software automatically accesses and installs the license on the PC.

To access Arb–based demo software licenses, see :LICense:WAVEform. To view option numbers for software applications that use license keys, see “:OPTions” on page 146.

**:LICense:WAVEform**

**Supported**

N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

**:DIAGnostic[:CPU]:INFormation:LICense:WAVEform?**

This query returns a list of Arb–based licenses (including demo) for software applications associated with the signal generator that have the software license file installed on the PC, as opposed to a license key installed on the signal generator. These waveform licenses are created by the software application in a license file on the PC. Refer to “:WLIocene[:VALue]” on page 147 for more information.

The response format is a series of comma separated entries enclosed in quotation marks. The first field is the waveform type number and the second is a text description of the license.

**Key Entry**   Waveform Licenses

**Remarks** If a license appears in this list, this means that you can transfer waveform files, created with the associated Arb–based software application to another signal generator if the other signal generator has the same license.

For a list of option numbers for software applications that use license keys, see “:OPTions”.
System Commands
Diagnostic Subsystem (:DIAGnostic[:CPU]:INFormation)

:OPTions

Supported All Models

:DIAGnostic[:CPU]:INFormation:OPTions?

This query returns a comma separated list of internally installed signal generator options.

Key Entry Instrument Options

:OPTions:DETail

Supported All Models

:DIAGnostic[:CPU]:INFormation:OPTions:DETail?

This query returns the options that are installed along with the option revision and DSP version if applicable.

Key Entry Options Info

:OTIMe

Supported All Models

:DIAGnostic[:CPU]:INFormation:OTIMe?

This query returns the cumulative number of hours that the signal generator has been on.

Key Entry Diagnostic Info

:REVision

Supported All Models

:DIAGnostic[:CPU]:INFormation:REVision?

This query returns the CPU bootstrap read only memory (boot ROM) revision date. In addition, the query returns the revision, creation date, and creation time of the main firmware.

Key Entry Diagnostic Info

:SDATe?

Supported All Models

:DIAGnostic[:CPU]:INFormation:SDATe?

This query returns the date and time of the firmware revision.

Key Entry Diagnostic Info
System Commands
Diagnostic Subsystem (:DIAGnostic[:CPU]:INFormation)

:WLICence[:VA]ue

**Supported**
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:DIAGnostic[:CPU]:INFormation:WLICense[:VALue]? <type_num>

This query returns the number of seconds remaining on the waveform license for the type of waveform designated by the `<type_num>` variable number. The type variable number is obtained using the :LiCense:WAveform command shown on page 145. Zero is returned for non-existent and expired licenses. The value 2^32 – 1 (4,294,967,295) is returned for licenses that do not expire.
Display Subsystem (:DISPlay)

:ANNotation:AMPLitude[:STATe]

Supported All Models

:DISplay:ANNotation:AMPLitude[:STATe] ON|OFF|1|0
:DISplay:ANNotation:AMPLitude[:STATe]?

This command enables or disables the amplitude annotation secure display mode. See also, “:ANNotation:FREQuency[:STATe]” on page 148 and “:SECurity:DISplay:RESTricted” on page 238.

ON(1) This selection turns off the displayed amplitude security, and the amplitude annotation is visible.

OFF(0) This selection turns on the displayed amplitude security and the amplitude annotation is blanked on the signal generator's display. Also, the keys that access the amplitude, sweep, and user flatness information are disabled.

For more information about security functions, refer to the User's Guide.

:ANNotation:AMPLitude:UNIT

Supported All Models

:DISplay:ANNotation:AMPLitude:UNIT
DBM|DBUV|DBUVEMF|V|VEMF|DB
:DISplay:ANNotation:AMPLitude:UNIT?

This command sets the displayed front-panel amplitude units.

If the amplitude reference state is set to on, the query returns units expressed in dB. Setting any other unit will cause a setting conflict error stating that the amplitude reference state must be set to off. Refer to, “:REFerence:STATe” on page 116 for more information.

*RST DBM

:ANNotation:FREQuency[:STATe]

Supported All Models

:DISplay:ANNotation:FREQuency[:STATe] ON|OFF|1|0
:DISplay:ANNotation:FREQuency[:STATe]?

This command enables or disables the frequency annotation secure display mode. See also, “:ANNotation:AMPLitude[:STATe]” on page 148 and “:SECurity:DISplay:RESTricted” on page 238.

ON (1) This selection turns off the displayed frequency security, and the frequency annotation is visible.
System Commands
Display Subsystem (:DISPlay)

OFF (0)  This selection turns on the displayed frequency security and the frequency annotation is blanked on the signal generator’s display. Also, the keys that access the frequency, sweep, and user flatness information are disabled.

For more information about security functions, refer to the User's Guide.

*RST  Activate Restricted Display

:ANNotation:CLOCk:DATE:FORMat

Supported  All Models

:DISPlay:ANNotation:CLOCk:DATE:FORMat  MDY|DMY
:DISPlay:ANNotation:CLOCk:DATE:FORMat?

This command enables the selection of the date format. The choices are month–day–year (MDY) or day–month–year (DMY) format.

Remarks  The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:ANNotation:CLOCk[:STATe]

Supported  All Models

:DISPlay:ANNotation:CLOCk[:STATe]  ON|OFF|1|0
:DISPlay:ANNotation:CLOCk[:STATe]?

This command enables or disables the digital clock view in the lower right side of the front-panel display.

Remarks  The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:BRIghtness

Supported  All Models

:DISPlay:BRIghtness  <value>
:DISPlay:BRIghtness?

This command sets the display brightness (intensity). The brightness can be set to the minimum level (0.02), maximum level (1), or in between by using fractional numeric values (0.03–0.99).

Range  0.02 to 1
Key Entry  Brightness
Remarks  The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.
System Commands
Display Subsystem (:DISPlay)

:CAPTure

**Supported** All Models

**:DISPlay:CAPTure**

This event command enables the user to capture the current display and store it in the signal generator’s memory.

**Remarks** The display capture is stored as DISPLAY.BMP in the Binary Directory file system. This file is overwritten with each subsequent display capture. The file can be downloaded in the following manner:

1. Log on to the signal generator using ftp.
2. Change (cd) to the BIN directory.
3. Retrieve the file by using the **GET** command or by using the :MEM:DATA query on page 165.

:CMAP:DEFault

**Supported** All Models

**:DISPlay:CMAP:DEFault** [<palette:BRIGht|DARK|MONOchrome>]

This command selects the color palette for the instrument display.

**Key Entry** Bright Color Dark Color Monochrome

**Remarks** The setting enabled by this command is not affected by signal generator power–on, preset, or \*RST.

:REMoTe

**Supported** All Models

**:DISPlay:REMoTe** ON|OFF|1|0

**:DISPlay:REMoTe?**

This command enables or disables the display updating when the signal generator is remotely controlled.

ON (1) This choice updates the signal generator display (Text Area) so you can see the settings as the commands are executed, however, this will degrade the signal generator speed. Frequency Area, Amplitude Area, and status LEDs continue to update. For more information on the front-panel display description, refer to the **User’s Guide**.
Keysight CXG, EXG, and MXG X-Series Signal Generators SCPI Command Reference

System Commands
Display Subsystem (:DISPlay)

OFF (0) This choice turns off the display (Text Area) updating while further optimizing the signal generator for speed. No Text Area updates occur but the Frequency Area, Amplitude Area, and status LEDs continue to update. For more information on the front-panel display description, refer to the User's Guide.

Key Entry Update in Remote Off On

Remarks The setting enabled by this command is not affected by signal generator preset or *RST. However, cycling the signal generator power will reset it to zero.

[:WINDow][:STATe]

Supported All Models

:DISPlay[:WINDow][:STATe] ON|OFF|1|0
:DISPlay[:WINDow][:STATe]?

This command is used to either blank out (OFF or 0) the display screen or turn it on (ON or 1).

Remarks *RST and presetting the signal generator or cycling the power will turn the display on.
IEEE 488.2 Common Commands

*CLS

**Supported** All Models

The Clear Status (CLS) command clears the status byte by emptying the error queue and clearing all the event registers including the Data Questionable Event Register, the Standard Event Status Register, the Standard Operation Status Register and any other registers that are summarized in the status byte.

*ESE

**Supported** All Models

*ESE <data>

The Standard Event Status Enable (ESE) command sets the Standard Event Status Enable Register.

The variable <data> represents the sum of the bits that will be enabled.

**Range** 0 to 255

**Remarks** The setting enabled by this command is not affected by signal generator preset or *RST. However, cycling the signal generator power will reset this register to zero.

Refer to the Programming Guide for more information.

*ESE?

**Supported** All Models

*ESE?

The Standard Event Status Enable (ESE) query returns the value of the Standard Event Status Enable Register.

**Remarks** Refer to the Programming Guide for more information.

*ESR?

**Supported** All Models

This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.

*ESR?

The Standard Event Status Register (ESR) query returns the value of the Standard Event Status Status Register.
System Commands
IEEE 488.2 Common Commands

Remarks Refer to the Programming Guide for more information.

*IDN?

Supported All Models

*IDN?
The Identification (IDN) query outputs an identifying string. The response will show the following information:

<company name>, <model number>, <serial number>, <firmware revision>

Key Entry Diagnostic Info
Remarks The identification information can be modified. Refer to :SYST:IDN on page 216 for more information.

*OPC

Supported All Models

*OPC?
The Operation Complete (OPC) command sets bit 0 in the Standard Event Status Register when all pending operations have finished.

*OPC?

Supported All Models

*OPC?
The Operation Complete (OPC) query returns the ASCII character 1 in the Standard Event Status register indicating completion of all pending operations.

This query stops any new commands from being processed until the current processing is complete. This command blocks the controller until all operations are complete (i.e. the timeout setting should be longer than the longest sweep).

CAUTION

The *OPC? query is not recommended for checking if a previous command has been completed by the SCPI parser. (e.g. If the *OPC? query is waiting for a sweep or arb generation that is pending, it could potentially hang the *OPC? query for an undefined extended or even indefinite period of time.)

*OPT?

Supported All Models

*OPT?
System Commands
IEEE 488.2 Common Commands

The options (OPT) query returns a comma separated list of all of the instrument options currently installed on the signal generator.

| Key Entry | Instrument Options |

**PSC**

**Supported** All Models

**PSC ON|OFF|1|0**

The Power–On Status Clear (PSC) command controls the automatic power–on clearing of the Service Request Enable Register, the Standard Event Status Enable Register, and device–specific event enable registers.

- **ON (1)** This choice enables the power–on clearing of the listed registers.
- **OFF (0)** This choice disables the clearing of the listed registers and they retain their status when a power–on condition occurs.

**Remarks** The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.*

**PSC?**

**Supported** All Models

**PSC?**

The Power–On Status Clear (PSC) query returns the flag setting as enabled by the **PSC** command.

**RCL**

**Supported** All Models

**RCL <reg>,<seq>**

The Recall (RCL) command recalls the state from the specified memory register <reg> of the specified sequence <seq>.

**Range**

Registers: 0 to 99
Sequences: 0 to 9

**Key Entry** **RECALL Reg** **Select Seq:**

**RST**

**Supported** All Models

**RST**
The Reset (RST) command resets most signal generator functions to factory-defined conditions.

**Remarks**

Each command shows the *RST value if the setting is affected.

The settings enabled by this command is not affected by a signal generator power-on, preset, or *RST.

*RST uses the factory preset state which is better for automated testing, for example sweep mode is set to single.

For a comparison of the SCPI preset commands, refer to Table, “The defined conditions are either factory- or user-defined.,” on page 231.

**SAV**

**Supported** All Models

*S<reg>,<seq>*

The Save (SAV) command saves signal generator settings to the specified memory register <reg> of the specified sequence <seq>.

**Range**

Registers: 0 to 99

Sequences: 0 to 9

**Key Entry**

Save Reg

Save Seq[n] Reg[nn]

**Remarks**
The save function does not save all signal generator settings. Refer to the User's Guide for more information on the save function. Refer to “*RCL” on page 154 for information on recalling saved signal generator settings.

**SRE**

**Supported** All Models

*S<data>*

The Service Request Enable (SRE) command sets the value of the Service Request Enable Register.

The variable <data> is the decimal sum of the bits that will be enabled. Bit 6 (value 64) is ignored and cannot be set by this command.

**Range**

0 to 255

**Remarks**

Refer to the Programming Guide for more information.

Entering values from 64 to 127 is equivalent to entering values from 0 to 63.
The setting enabled by this command is not affected by signal generator preset or *RST. However, cycling the signal generator power will reset it to zero.

*SRE?

**Supported**
All Models

*SRE?

The Service Request Enable (SRE) query returns the value of the Service Request Enable Register.

**Range**
0 to 63 or 128 to 191

**Remarks**
Refer to the Programming Guide for more information.

*STB?

**Supported**
All Models

*STB?

The Read Status Byte (STB) query returns the value of the status byte including the master summary status (MSS) bit.

**Range**
0 to 255

**Remarks**
Refer to the Programming Guide for more information.

*TRG

**Supported**
All Models

*TRG

The Trigger (TRG) command triggers the device if BUS is the selected trigger source, otherwise, *TRG is ignored.
**System Commands**

**IEEE 488.2 Common Commands**

**TST?**

**Supported** All Models

TST?

The Self-Test (TST) query initiates the internal self-test and returns one of the following results:

- 0 This shows that all tests passed.
- 1 This shows that one or more tests failed.

**Key Entry** Run Complete Self Test

**WAI**

**Supported** All Models

WAI

The Wait-to-Continue (WAI) command causes the signal generator to wait until all pending commands are completed, before executing any other commands.
Memory Subsystem (:MEMory)

:CATalog:BINary?

Supported All Models

This query outputs a list of the binary files. The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name>,<file type>,<file size>"

Example Output

1818624,519962624,"GEN_FILE11,BIN,5"

Key Entry Binary
Remarks Refer to "File Name Variables" on page 43 for information on the file name syntax.

:CATalog:BIT

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

This command outputs a list of the bit files. The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name,file type,file size>"

Key Entry Bit
Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.
System Commands
Memory Subsystem (:MEMory)

:CATalog:DMOD

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:CATalog:DMOD?

This command outputs a list of the arbitrary waveform digital modulation files. The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name, file type, file size>"

Key Entry DMOD
Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.

:CATalog:FIR

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:CATalog:FIR?

This command outputs a list of the finite impulse response filter (FIR) files. The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name, file type, file size>"

Key Entry FIR
Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.

:CATalog:FSK?

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:CATalog:FSK?

This command outputs a list of the frequency shift keying (FSK) files. The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"
System Commands
Memory Subsystem (:MEMory)

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name, file type, file size>"

Key Entry  FSK
Remarks  Refer to “File Name Variables” on page 43 for information on the file name syntax.

:CATalog:IQ?

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:CATalog:IQ?

This query outputs a list of the Inphase and Quadrature (I/Q) files. The return data will be in the following form:

<mem used>, <mem free>, "<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name>, <file type>, <file size>"

Key Entry  I/Q
Remarks  Refer to File Name Variables for information on the file name syntax.

:CATalog:LIST?

Supported  All Models

:MEMory:CATalog:LIST?

This query outputs a list of the list sweep files. The return data will be in the following form:

<mem used>, <mem free>, "<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name>, <file type>, <file size>"

Example Output

1818624, 519962624, "LAST, LIST, 122", "LIST10, LIST, 69"

Key Entry  List
System Commands
Memory Subsystem (:MEMory)

Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.

:CATalog:MDMod

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:CATalog:MDMod?

This command outputs a list of the arbitrary waveform multi carrier digital modulation files. The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name,file type,file size>"

Key Entry MDMOD
Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.

:CATalog:MTONE

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:CATalog:MTONE?

This command outputs a list of the arbitrary waveform multitone files. The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name,file type,file size>"

Key Entry MTONE
Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.
System Commands
Memory Subsystem (:MEMory)

:CATalog:PTRain?

Supported: All with Options UNW and N5180320B

:MEMory:CATalog:PTRain?

This command lists all files of the pulse train files stored in the non-volatile storage.

:CATalog:SEQ?

Supported: N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:CATalog:SEQ?

This query outputs a list of the arbitrary waveform sequence files. The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name>,<file type>,<file size>"

Example Output
1818624,519962624,"SEQ1_TEST,SEQ,206","SEQ_TEST,SEQ,169"

Key Entry: SEQ
Remarks: Refer to “File Name Variables” on page 43 for information on the file name syntax.

:CATalog:SHAPE?

Supported: N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:CATalog:SHAPE?

This command outputs a list of the burst shape files. The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name,file type,file size>"

Key Entry: SHAPE
System Commands
Memory Subsystem (:MEMory)

Remarks
Refer to “File Name Variables” on page 43 for information on the file name syntax.

:CATalog:STATe?

Supported All Models

:MEMory:CATalog:STATe?

This query outputs a list of the state files. The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name,file type,file size>"

Example Output

1818624,519962624,"0_00,STAT,641"

Key Entry

State

Remarks
Refer to File Name Variables for information on the file name syntax.

The :MEM:CAT:STAT command requires the use of registry number and sequence number variables. The ranges are 0 to 99 for <reg_num> and 0 to 9 for <seq_num>.

:CATalog:UFLT?

Supported All Models

:MEMory:CATalog:UFLT?

This query outputs a list of the user-flatness correction files. The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

"<file name,file type,file size>"

Example Output

1818624,519962624,"FLAT_1,UFLT,16","LAST,UFLT,16"

Key Entry

User Flatness
System Commands
Memory Subsystem (:MEMory)

Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.

:CATalog[:ALL]?

Supported All Models

:MEMory:CATalog[:ALL]?

This query outputs a list of all the files in the memory subsystem. However it does not include files stored on the Option 653, 655, 656, or 657 baseband generator. The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"

The signal generator will return the two memory usage parameters and as many file listings as there are files in the memory subsystem. Each file listing parameter will be in the following form:

"<file name,file type,file size>"

Example Output

1818624,519962624,0_00@STATE,STAT,641","0_01@STATE,STAT,669","A@NVHDR,NVHDR,132","A@NVMKR,NVMKR,0","A@NVWFM,NVWFM,9","COPY12@STATE,STAT,669","FLAT_1@USERFLAT,UFLT,16","GEN_FILE11@BINARY,BIN,5","LAST@LIST,LIST,122","LAST@USERFLAT,UFLT,16","PERSISTENT@STATE,STAT,1056","SEQ1_TEST@SEQ,SEQ,206

Key Entry All
Remarks Refer to the Table 1-3 on page 45 for a listing of the file types and the table on page 46 for information on the "<file name>" syntax.

:COPY[:NAME]

Supported All Models

:MEMory:COPY[:NAME] "<file name>" ,"<file name>"

This command makes a duplicate of the requested file.

Key Entry Copy File
Remarks Refer to File Name Variables for information on the file name syntax.

When copying a waveform file from volatile to non–volatile memory, the marker file and file header, associated with the waveform file, will automatically be copied at the same time.
:DATA

Supported All Models

:MEMory:DATA "<file_name>"",<data_block>
:MEMory:DATA? "<file_name>"

This command loads data into signal generator memory using the <data_block> parameter and saves the data to a file designated by the "<file_name>" variable. The query returns the file contents of the file as a datablock.

A waveform file must be located in volatile waveform memory (WFM1) before it can be played by the signal generator’s dual ARB player.

For downloads directly into volatile waveform memory (WFM1) use the path "WFM1:<file_name>". For downloads to non–volatile waveform memory, use the path "NVWFM:<file_name>".

"<file_name>" This variable names the destination file, including the directory path.

<data_block> This parameter represents the data and file length parameters. The data in the file is represented by the <data_block> variable.

Refer to the Programming Guide for more information on programming the status registers.

Example

:MEM:DATA "NVWFM:IQ_Data",#210Qaz37pY9oL

The preceding example downloads 10 bytes of data to a file, IQ_Data, in the signal generator’s non–volatile memory. The table shown below describes the command parameters.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;NVWFM:IQ_Data&quot;</td>
<td>IQ_Data is the file name. The directory path is not needed. The path <em>/USER/WAVEFORM/</em> is implied.</td>
</tr>
<tr>
<td>#210Qaz37pY9oL</td>
<td>Data block</td>
</tr>
<tr>
<td>#</td>
<td>This character indicates the beginning of the data block</td>
</tr>
<tr>
<td>2</td>
<td>Number of digits in the byte count</td>
</tr>
<tr>
<td>10</td>
<td>Byte count</td>
</tr>
<tr>
<td>Qaz37pY9oL</td>
<td>10 bytes of data</td>
</tr>
</tbody>
</table>

The data, Qaz37pY9oL, in the above command are not valid and are shown for example purposes only. Typically, ASCII characters representing data are unprintable.

Remarks See File Name Variables for information on the file name syntax.
:DATA:APPend

**Supported**  All Models

```
:APPend "<file_name>";<data_block>
```

This command appends data to an existing file stored in signal generator memory.

- `<file_name>`: This variable names the destination file and directory path.
- `<data_block>`: This parameter represents the data and file length parameters. The data in the file is represented by the `<data_block>` variable. The file length parameters are used by the signal generator for allocating memory.

Refer to the Programming Guide for more information on downloading and using files.

**Example**

```
:MEM:DATA:APPend "NVWFM:IQ_Data",#14Y9oL
```

The preceding example downloads and appends the data, Y9oL, to an existing file named IQ_Data stored in the signal generator's non-volatile memory (NVWFM).

- "NVWFM:IQ_Data"  IQ_Data the file name. The directory path is not needed. The path "*/USER/WAVEFORM/*" is implied.
- #14Y9oL  Data block
  
<table>
<thead>
<tr>
<th>#</th>
<th>1</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Byte count</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4 bytes of data</td>
<td></td>
</tr>
</tbody>
</table>

**Remarks**  Refer to File Name Variables for information on the file name syntax.

:DATA:BIT

**Supported**  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

```
:MEM:DATA:BIT "<filename>";<bit_count>;<datablock>
:MEM:DATA:BIT? "<filename>
```

This command loads bit data into signal generator memory using the `<bit_count>` and `<datablock>` parameters and saves the data to a file designated by the `<filename>` variable. The query returns the bit count, file length information, and the data.
System Commands
Memory Subsystem (:MEMory)

"filename"  This variable names the destination file and the
directory path.

<bit_count>  This number represents the number of bits in the data
block.

<datablock>  This parameter represents the data and file length
parameters. The data in the file is represented by the
<datablock> variable. The file length parameters are
used
by the signal generator for allocating memory.

Refer to the Programming Guide for more information on downloading and
using files.

Example

:MEM:DATA:BIT "Test_Data",16,#12Qz

The preceding example downloads bit data to the file, Test_Data. The table
below describes the command parameters.

- "Test_Data"  Test_Data is the file name. The directory path is not needed.
The path "/USER/BIT/" is implied.
- 16  Number of bits in the data block
- #12Qz  Data block
  #  This character indicates the beginning of the data block
  1  Number of digits in the byte count
  2  Byte count
  Qz  16 bits of data (ascii representation of bit data)

Remarks  Refer to "File Name Variables" on page 43 for
information on the file name syntax.
System Commands
Memory Subsystem (:MEMory)

:DATA:BIT:INSert

**Supported**
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

**:MEMory:DATA:BIT:INSert**

"<filename>",<bitOffset>,<bitCount>,<datablock>

This command inserts a specified number of bits at a specified bit offset in a bit file.

"<filename>"  This variable names the destination file and the directory path.

<bitOffset>  This number represents a value between 0 and a value that will fill all of the available memory. This is where the <bitCount> bits of the data in the <datablock> will be inserted. If the <bitOffset> is greater than the current file length, then zero bits will fill the file from the current length in bits to the <bitOffset>.

<bitCount>  This number represents the number of bits in the data block.

<datablock>  This parameter represents the data to be inserted into the file.

Refer to the Programming Guide for more information on downloading and using files.

**Example**

:MEM:DATA:BIT:INS "Test_Data",7,16,#12Qz

The preceding example inserts bit data at the 7th bit of the file, Test_Data. The table below describes the command parameters.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Test_Data&quot;</td>
<td>Test_Data is the file name. The directory path is not needed. The path <em>/USER/BIT/</em> is implied.</td>
</tr>
<tr>
<td>7</td>
<td>The offset in bits to insert the data in the data block</td>
</tr>
<tr>
<td>16</td>
<td>Number of bits in the data block</td>
</tr>
<tr>
<td>#12Qz</td>
<td>Data block</td>
</tr>
<tr>
<td>#</td>
<td>This character indicates the beginning of the data block</td>
</tr>
<tr>
<td>1</td>
<td>Number of digits in the byte count</td>
</tr>
<tr>
<td>2</td>
<td>Byte count</td>
</tr>
<tr>
<td>Qz</td>
<td>16 bits of data (ascii representation of bit data)</td>
</tr>
</tbody>
</table>

**Remarks**
Refer to “File Name Variables” on page 43 for information on the file name syntax.
**System Commands**

**Memory Subsystem (MEMory)**

**:DATA:FIR**

**Supported**

N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

**:MEMory:DATA:FIR**

"<file_name">,[REAL|COMplex],osr,coefficients

**:MEMory:DATA:FIR?"<file_name>"

This command loads user–defined finite impulse response (FIR) coefficient data, with a given oversample ratio (OSR), into a file in the signal generator’s non–volatile memory. The query returns the oversample ratio and coefficient data.

"<file_name>"  This variable is the file name of the destination file. The directory path, /USER/FIR is not required as it is implied by the command.

REAL  Filter with real coefficients which are applied to I and Q equally. These coefficients are in the time domain and are supplied by the user. This type of filter is selectable as either a modulation filter or an equalization filter.

COMPLEX  Filter with complex I and Q samples (I + jQ) that are applied to the I/Q signal in a complex manner, as in (I + jQ)*(I + jQ). These coefficients are in the time domain and are supplied by the user. This type of filter is only selectable by the equalization filter feature.

osr  The OSR is the number of filter taps per symbol. For an equalization filter, the OSR must always be 1 and the filter coefficients must be sampled at 200MHz. For a modulation filter, the OSR must be ≥2 and the filter rate must be sampled at 2 times the OSR.

coefficients  This variable is the set of FIR coefficients. The maximum number of taps is 1024. For COMPLEX filters, the coefficients alternate between the real and imaginary values. There can be 2048 coefficients for COMPLEX filters. The equalization filter is limited to 256 taps.

Refer to the Programming Guide for more information on downloading and using files.

**Example**

`:MEM:DATA:FIR
"FIR_1",4,0,0,0,0,0.000001,0.000012,0.000132,0.001101,0.006743,0.030588,0.103676,0.265790,0.523849,0.809508,1,1,0.809508,0.523849,0.265790,0.103676,0.030588,0.006743,0.001101,0.000132,0.000012,0.000001,0,0,0,0
System Commands
Memory Subsystem (:MEMory)

The preceding example downloads real FIR coefficients with an oversampling ratio of 4 to the signal generator's non-volatile memory in a file named FIR_1. Notice that the signal generator directory path, /USER/FIR, is not needed as it is implied by the command. Refer to File Name Variables for information on the file name syntax.

Example 2

:MEM:DATA:FIR "EQ_1",COMP,1,0,0.000001,0.000145,0.000035,1,0,-0.000256,0.000016,0.000001,0

The preceding example downloads complex FIR coefficients with an OSR 1 as file "EQ_1". This file is suitable for use as an equalization filter.

Range osr: 1 to 32

Coefficient: -1000 to 1000

Key Entry Oversample Ratio

:DATA:FSK

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEM:DATA:FSK
"<file_name>";<num_states>;<f0>;<f1>,...;<f(n)>[,<diff_state>;<num_diff_states>;<diff1>,...;<diff(n)>]

:MEM:DATA:FSK? "<file_name>"

This command loads custom frequency shift keying (FSK) data into a file in the signal generator's non-volatile memory.

The query returns data in the following form:

<num_states>;<f0>;<f1>,...;<f(n)>;<diff_state>;<num_diff_states>;<diff1>,...;<diff(n)>

"<file_name>" This variable string identifies the name of the FSK file. The filename must be enclosed with quotation marks.

<num_states> This variable identifies the number of frequency states.

<f0> This variable identifies the value of the first frequency state.

<f1>,...;<f(n)> This variable identifies the value of the second and subsequent frequency states with a frequency resolution of 0.1Hz.

<diff_state> This variable enables or disables differential encoding.

<num_diff_states> This variable identifies the number of differential states.
System Commands
Memory Subsystem (:MEMory)

<diff0> This variable identifies the value of the first differential state.
<diff1>,...,<diff(n)> This variable identifies the value of the second and subsequent differential states.

Refer to the Programming Guide for more information on downloading and using files.

Example

:MEM:DATA:FSK "4FSK",4,−2kHz,−1kHz,2kHz,1kHz,ON,2,1,0

The preceding example downloads a four-level FSK data to a file named 4FSK. There are four states (frequencies): -2kHz, -1kHz, 2kHz, 1kHz; differential encoding is toggled ON, and there are two differential states 1 and 0. The table shown below describes the command parameters.

- "4FSK" 4FSK is the FSK file name. The directory path is not needed. The path "USER/FSK" is implied.
- 4 Number of states
- -2kHz First frequency state
- -1kHz Second frequency state
- 2kHz Third frequency state
- 1kHz Fourth frequency state
- ON Differential encoding is on
- 2 Number of differential states
- 1 Value of the first differential state.
- 0 Value of the second differential state.

Range num_diff_states: 0–256
num_states: 2–16
f0–f(n): -20MHz to 20MHz (For ARB custom modulation, the range values vary with the symbol rate values.)
diff0–diff(n): -128 to 127

Remarks Refer to File Name Variables for information on the file name syntax.

:DATA:IQ

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657
System Commands
Memory Subsystem (:MEMory)

:MEMory:DATA:IQ
"<file_name>"","<offsetQ>,<num_states>,<i0>,<q0>,<i1>,
<i1>,...<i(n)>,<q(n)>,[,"<diff_state>,<num_diff_states>,<diff0
>,<diff1>,...<diff(n)>]
:MEMory:DATA:IQ? "<file_name>"

This command loads custom I/Q data into a file in the signal generator's non-volatile memory.

The query returns data in the following form:

"<offsetQ>,<num_states>,<i0>,<q0>,<i1>,<q1>,...<i(n)>,<q(n)>
,<diff_state>,<num_diff_states>,<diff0>,<diff1>,...<diff(n)>

"<file_name>"  This variable string identifies the name of the I/Q file. The filename must be enclosed with quotation marks.
[offsetQ]  This variable enables (1) or disables (0) the Q output delay by 1/2 symbol from the I output.
[num_states]  This is the number of symbols.
<i0>...<i(n)>  This is the I value of the first and subsequent I symbols.
<i0>...<i(n)>  This is the Q value of the first and subsequent Q symbols.
[diff_state]  This variable enables and disables differential encoding.
[num_diff_states]  This variable identifies the number of differential states.
[diff0]  This variable identifies the value of the first differential state.
[diff1,...diff(n)]  This variable identifies the value of the second and subsequent differential states.

Refer to the Programming Guide for more information on downloading and using files.

Example

:MEM:DATA:IQ "Test_BPSK",1,2,1,0,0,0

The preceding example loads and stores a two-symbol I/Q file named Test_BPSK that has a Q offset. The table shown below describes the command parameters.

- "Test_BPSK"  Test_BPSK is the file name. The directory path is not needed. The path "/USER/IQ" is implied.
- 1  Q Offset. The Q output delay is enabled.
- 2  Number of symbols
- 1  Value of the first I symbol
- 0  Value of the first Q symbol.
System Commands
Memory Subsystem (:MEMory)

- "Test_BPSK"
  Test_BPSK is the file name. The directory path is not needed. The path "/USER/IQ" is implied.
- 0
  Value of the second I symbol
- 0
  Value of the second Q symbol

Range

<table>
<thead>
<tr>
<th>num_states:</th>
<th>2–1024</th>
</tr>
</thead>
<tbody>
<tr>
<td>i0–i(n):</td>
<td>-1 to 1</td>
</tr>
<tr>
<td>q0–q(n):</td>
<td>-1 to 1</td>
</tr>
<tr>
<td>num_diff_states:</td>
<td>0–256</td>
</tr>
<tr>
<td>diff0–diff(n):</td>
<td>-128 to 127</td>
</tr>
</tbody>
</table>

Remarks
Refer to "File Name Variables" on page 43 for information on the file name syntax.

:DATA:PRAM:FILE:BLOCk

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657


This command loads block-formatted data directly into pattern RAM volatile memory (WFM1). Pattern RAM memory describes how memory (WFM1) is used and is not a distinct piece of memory. A PRAM file is specified as an array of bytes.

"<file_name>" This variable names the destination file. No directory path name is needed.

<data_block> This parameter represents the data and file length parameters. The data in the file is represented by the <data_block> variable. The file length parameters are used by the signal generator for allocating memory.

Pattern Ram files are binary files downloaded directly into waveform memory as an array of bytes. Each byte specifies a data bit (LSB 0), a burst bit (BIT 2), and an Event 1 output bit (BIT 6). Refer to the Programming Guide for more information on pattern RAM downloading.

Example

:MEM:DATA:PRAM:FILE:BLOC "PRAM_Data", #14Yq8L
System Commands
Memory Subsystem (:MEMory)

The preceding example downloads PRAM data to a file named PRAM_Data into the signal generator’s volatile memory (WFM1).

- "PRAM_Data"  
  PRAM_Data is the file name. PRAM files are saved to the signal generator's volatile memory (WFM1).
- #14Yq8L  
  Data block
  
  #  
  This character indicates the beginning of the data block
  
  1  
  Number of digits in the byte count
  
  4  
  Byte count
  
  Yq8L  
  4 bytes of data

NOTE

The data, Yq8L, in the above command is not valid and is used for example purposes only. Typically, ASCII characters representing data are unprintable.

Remarks  Refer to “File Name Variables” on page 43 for information on the file name syntax.

:DATA:PRAM:FILE:LIST

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

MEMory:DATA:PRAM:FILE:LIST
"<file_name>",<uint8>[,<uint8>,<...>]

This command loads list-formatted data directly into pattern RAM volatile memory (WFM1). Pattern RAM memory describes how memory (WFM1) is used and is not a distinct piece of memory. A PRAM file is specified as an array of bytes.

This command should be preceded by a *WAI (Wait-to-Continue) command to ensure that all pending operations are completed, before loading the list.

"<file_name>"  This variable names the destination file.

<uint8>  This variable is any of the valid 8-bit, unsigned integer values between 0 and 255.

[,<uint8>,<...>]  This variable identifies the value of the second and subsequent 8-bit unsigned integer variables.

Pattern Ram files are binary files downloaded directly into waveform memory as an array of bytes. Each byte specifies a data bit (LSB 0), a burst bit (BIT 2), and an Event 1 output bit (BIT 6). Refer to the Programming Guide for more information on pattern RAM downloading.

Example

System Commands
Memory Subsystem (:MEMory)

The preceding example downloads PRAM data, in list format, to a file named Pram_Data in the signal generator’s volatile memory (WFM1).

- "Pram_Data"  Pram_Data is the file name. PRAM files are saved to the signal generator’s volatile memory (WFM1).
- 85  The first 8-bit integer value
- 21,21,20,20,100  Subsequent 8-bit integer values.

Range  0–255
Remarks  Refer to “File Name Variables” on page 43 for information on the file name syntax.

:DATA:SHAPE

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEM:DATA:SHAPE
"<file_name>",<rise_pnts>,<rp0>,<rp1>,...<fall_points>,<fp0>,
,<fp1>,...<fp(n)>
:MEM:DATA:SHAPE? "<file_name>"

This command loads a burst shape file into the signal generator’s non–volatile memory (NVWFM).

"<file_name>"  This variable names the destination file and directory path.
rise_pnts  This variable indicates the number of rise points used to describe the burst shape rising slope.
rp0,...rp(n)  This variable defines each successive rise point, where 0 is no power and 1 is full power.
fall_points  This variable indicates the number of fall points used to describe the burst shape falling slope.
fp0,...fp(n)  This variable defines each successive fall point, where 1 is full power and 0 is no power.

Refer to the Programming Guide for more information on downloading and using files.

Example

:MEM:DATA:SHAPE "Shape_File",6,0,0.2,0.4,0.6,0.8,1.0,2,0.5,0
System Commands
Memory Subsystem (:MEMory)

The preceding example loads shape data to a file named Shape_File in the signal generator’s non-volatile memory.

- "Shape_File"  
  Shape_File is the shape data filename. The directory path is not needed. The path "/USER/SHAPE/" is implied.

- 6  
  Number of rise points describing the burst shape.
- 0.0, 0.4, 0.6, 0.8, 1.0  
  Rise point values.
- 2  
  Number of fall points describing the burst shape.
- 0.5, 0  
  Fall point values.

Range
num_rise_points: 2–256
num_fall_points: 2–256
rp0–rp(n): 0.0–1.0
fp0–fp(n): 0.0–1.0

:DELe:ALL

Supported All Models

Using this command deletes all non-volatile user files including binary, list, state, and flatness correction files, and any saved setups which use the front-panel table editor. However, this does not include files stored on the Option 653, 655, 656, or 657 ARB generator. You cannot recover the files after executing this command.

:MEM:DELe:ALL

This command clears the file system of all non-volatile user files.

Key Entry Delete All Files

:DELe:BINary

Supported All Models

:MEM:DELe:BINary

This command deletes all binary files.

Key Entry Delete All Binary Files

:DELe:BIT

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657
System Commands
Memory Subsystem (:MEMory)

:MEMory:DELete:BIT
This command deletes all bit files.

Key Entry Delete All Bit Files

:DELete:DMOD
Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:DELete:DMOD
This command deletes all arbitrary waveform digital modulation files.

Key Entry Delete All ARB DMOD Files

:DELete:FIR
Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:DELete:FIR
This command deletes all finite impulse response filter files.

Key Entry Delete All FIR Files

:DELete:FSK
Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:DELete:FSK
This command deletes all FSK files.

Key Entry Delete All FSK Files

:DELete:IQ
Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:DELete:IQ
This command deletes all I/Q files.

Key Entry Delete All I/Q Files

:DELete:LIST
Supported All Models

:MEMory:DELete:LIST
System Commands
Memory Subsystem (:MEMory)

This command deletes all List files.

Key Entry                   Delete All List Files

:DELete:MDMod

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:DELete:MDMod

This command deletes all arbitrary waveform multicarrier digital modulation files.

Key Entry                   Delete All ARB MDMOD Files

:DELete:MTONE

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:DELete:MTONE

This command deletes all arbitrary waveform multitone files.

Key Entry                   Delete All ARB MTONE Files

:DELete:PTRain

Supported  All with Options UNW and N5180320B

:MEMory:DELete:PTRain

This command deletes all pulse train files.

:DELete:SEQ

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:DELete:SEQ

This command deletes all sequence files.

Key Entry                   Delete All Sequence Files

:DELete:SHAPE

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:DELete:SHAPE

This command deletes all burst shape files.

Key Entry                   Delete All Shape Files
System Commands
Memory Subsystem (:MEMory)

:DELeTe:STATe

Supported All Models

:MEMory:DELeTe:STATe
This command deletes all state files.

Key Entry Delete All State Files

:DELeTe:UFLT

Supported All Models

:MEMory:DELeTe:UFLT
This command deletes all user–flatness correction files.

Key Entry Delete All UFLT Files

:DELeTe[:NAME]

Supported All Models

:MEMory:DELeTe[:NAME] "<file name>"
This command clears the user file system of "<file name>".

Key Entry Delete File
Remarks Refer to File Name Variables for information on the file name syntax.
When deleting a waveform (WFM1) file from memory, the marker file and file header, associated with the waveform file, will also be deleted.

:EXPOrt[:ASCii]:PTRAin

Supported All with Options UNW and N5180320B

:MEMory:EXPOrt[:ASCii]:PTRAin "<filename>"
This command writes out a CSV/ASCII file to the BINARY directory. User may supply their own extender as part of the filename. Refer to :EXPOrt[:ASCii]:SEParator:COLumn and :EXPOrt[:ASCii]:SEParator:DECimal.

Example
:MEM:EXP:PTR "myfile.csv"
The preceding example saves a power train file to “myfile.csv”.

Key Entry Export To File
### System Commands

#### Memory Subsystem (:MEMory)

:EXPort[:ASCii]:SEPArator:COLumn

**Supported** All with Options UNW and N5180320B

:MEMory:EXPort[:ASCii]:SEPArator:COLumn

**TAB|Semicolon|COMma|SPACE**

:MEMory:EXPort[:ASCii]:SEPArator:COLumn?

This command selects whether the column separator is a tab, ",", "," or a " " during export of CSV/ASCII files.

This value is persistent across preset/recall and power cycles. (At the factory the MXG is set to **COMma** (",").) Refer to :EXPort[:ASCii]:SEPArator:DECimal.

**Key Entry** Export Column Separator

:EXPort[:ASCii]:SEPArator:DECimal

**Supported** All with Options UNW and N5180320B

:MEMory:EXPort[:ASCii]:SEPArator:DECimal

**DOT|COMma**

:MEMory:EXPort[:ASCii]:SEPArator:DECimal?

This command selects whether the decimal point is a "." or a "," during export of CSV/ASCII files.

This value is persistent across preset/recall and power cycles. (At the factory the MXG is set to **DOT** (".").) Refer to :EXPort[:ASCii]:SEPArator:COLumn.

**Key Entry** Export Decimal Separator

:FREE[:ALL]

**Supported** All Models

:MEMory:FREE[:ALL]?

This command returns the number of bytes left in the non-volatile user file system.

**Key Entry** All

:IMPort[:ASCii]:PTRain

**Supported** All with Options UNW and N5180320B

:MEMory:IMPort[:ASCii]:PTRain <"filename">

This command reads a CSV/ASCII file from the BINARY directory. The user must specify any extender (such as .csv or .txt) used when placing the file into the instrument. Note that the form of these files must be **On Time<column separator>Off Time<column separator>Repetitions<newline>** or **On Time<column separator>Off Time<newline>** with repetition count assumed to always be 1 in the second case. Refer to :IMPort[:ASCii]:SEPArator:DECimal.
System Commands
Memory Subsystem (:MEMory)

Key Entry Import From Selected File

:IMPort[:ASCii]:SEPArator:DECimal

Supported All with Options UNW and N5180320B

:MEMory:IMPort[:ASCii]:SEPArator:DECimal DOT|COMMa
:MEMory:IMPort[:ASCii]:SEPArator:DECimal?

This command selects whether the decimal point is a "." or a ",," during import of CSV/ASCII files.

This value is persistent across preset/recall and power cycles. (At the factory the MXG is set to DOT (".").) Refer to :IMPort[:ASCii]:PTRain.

Key Entry Import Decimal Separator

:LOAD:LIST

Supported All Models

:MEMory:LOAD:LIST "<file name>"

This command loads a list sweep file.

Key Entry Load From Selected File

:LOAD:PTRain

Supported All with Options UNW and N5180320B

:MEMory:LOAD:PTRain <"filename">

This command reads the pulse train file specified. Refer to :STORe:PTRain.

Key Entry Confirm Load from File

:MOVE

Supported All Models

:MEMory:MOVE "<src_file>","<dest_file>"

This command renames the requested file in the memory catalog.

Key Entry Rename File

Remarks Refer to File Name Variables for information on the file name syntax.

:SIZE

Supported All Models

:MEMory:SIZE? <"filename">
System Commands
Memory Subsystem (:MEMory)

This command returns the size of the file named "filename" in bytes or a -1, if the file does not exist. If the MSUS or directory is invalid, an "ERROR: -257, File name error" will be reported.

:STATe:COMMent

Supported All Models
:MEMory:STATe:COMMent <reg_num>,<seq_num>,"<comment>"
:MEMory:STATe:COMMent? <reg_num>,<seq_num>

This command lets you to add a descriptive comment to the saved state <reg_num>,<seq_num>. Comments can be up to 55 characters long.

Key Entry Add Comment To Seq[n] Reg[nn]

:STORe:LIST

Supported All Models
:MEMory:STORe:LIST "<file name>"

This command stores the current list sweep data to a file.

Key Entry Store To File

:STORe:PTRain

Supported All with Options UNW and N5180320B
:MEMory:STORe:PTRain "<filename>"

Writes out the current pulse train list to the PTRAIN file specified. This operation will overwrite any existing file of the same name in the PTRAIN directory with a binary file. Refer to :LOAD:PTRain.

Key Entry Store To File

:CATalog

Supported All Models
:MMEMory:CATalog? "<msus>"

This command outputs a list of the files from the specified file system.

The variable "<msus>" (mass storage unit specifier) represents "<file system>".
The file systems and types are shown in Table 1-3 on page 45.
The return data will be in the following form:

<mem used>,<mem free>,"<file listing>"
The signal generator will return the two memory usage parameters and as many file listings as there are files in the specified file system. Each file listing will be in the following format:
System Commands
Memory Subsystem (:MEMory)

"<file name,file type,file size>"

Key Entry | Binary | List | State | User Flatness
Seq | BBG Segments | NVM | NVW
| KR | FM |

Remarks Refer to MSUS (Mass Storage Unit Specifier) Variable for information on the use of the "<msus>" variable.

:COPY

Supported All Models

:MMEMory:COPY "<file name>"","<file name>"

This command makes a duplicate of the requested file.

Key Entry Copy File

Remarks Refer to File Name Variables for information on the file name syntax.

When copying a waveform file from volatile to non–volatile memory, the marker file and file header, associated with the waveform file, will automatically be copied at the same time.

:DATA

Supported All Models

:MMEMory:DATA "<file name>",<datablock>
:MMEMory:DATA? "<file name>"

This command loads <datablock> into the memory location "<file name>".

The query returns the <datablock> associated with the "<file name>".

Remarks Refer to File Name Variables for information on the file name syntax.

:DELete:NVWFm

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MMEMory:DELete:NVWFm

This command clears the user file system of all non–volatile arbitrary waveform files.

Key Entry Delete All NVWFM Files
System Commands
Memory Subsystem (:MEMory)

:DELete:WFM

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MMEMory:DELete:WFM

This command clears the user file system of all volatile arbitrary waveform files stored on the WFM1.

Key Entry  Delete All BBG Segments

:DELete[:NAME]

Supported  All Models

On the

:MMEMory:DELete[:NAME] "<file name>",["<msus>"]

This command clears the user file system of "<file name>" with the option of specifying the file system separately. For a list of file systems refer to Table on page 45.

The variable "<msus>" (mass storage unit specifier) represents the file system.

Key Entry  Delete File

Remarks  If the optional variable "<msus>" is omitted, the file name needs to include the file system extension. Refer to File Name Variables and MSUS (Mass Storage Unit Specifier) Variable for information on the use of the file variables.

When deleting a waveform file from memory, the marker file and file header, associated with the waveform file, will also be deleted.
System Commands
Memory Subsystem (:MEMory)

:HEADer:CLEar

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MMEMory:HEADer:CLEar "<file name>"

This command sets the file header field settings to unspecified for the "<file name>" variable.

Key Entry  Clear Header
Remarks   In addition to waveforms currently running in the signal generator, it is possible to change or delete file header information on files that are not currently running but are stored in either the internal storage or USB media non–volatile memory (Example: :MMEMory:HEADer:CLEar "NVWFM:file_name").

Refer to File Name Variables for information on the file name syntax.

:HEADer:DESCription

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MMEMory:HEADer:DESCription "<file name>","<description>"
:MMEMory:HEADer:DESCription? "<file name>"

This command inserts a description for the file header.

Key Entry  Edit Description
Remarks   In addition to waveforms currently running in the signal generator, it is possible to change or delete file header information on files that are not currently running but are stored in either the internal storage or USB media non–volatile memory (Example: :MMEMory:HEADer:DESCription "NVWFM:file_name","example_file_name").

The header description is limited to 32 characters. Refer to File Name Variables for information on the file name syntax.
System Commands
Memory Subsystem (:MEMory)

:HEADer:ID?

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MMEMory:HEADer:ID? "<file name>"
This query returns the unique waveform ID of file "<file name>".
The command is ignored if the file name does not exist.

:LOAD:LIST

Supported All Models

:MMEMory:LOAD:LIST "<file name>"
This command loads a List sweep file.

Key Entry Load From Selected File

:LOAD:PTRain

Supported All with Options UNW and N5180320B

:MMEMory:LOAD:PTRain <"filename">
This command reads the pulse train file specified. Refer to :STORe:PTRain.

Key Entry Confirm Load from File

:LOAD:WFM:ALL

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:MMEMory:LOAD:WFM:ALL
This command loads all of the waveforms in the active media to the internal BBG memory. The active media is either internal non-volatile memory storage media or an external storage media connected to the front-panel USB port.

Key Entry Load All From Int Media

:MOVE

Supported All Models

:MMEMory:MOVE "<src_file>","<dest_file>"
This command renames the requested file in the memory catalog.

Key Entry Rename File

Remarks Refer to File Name Variables for information on the file name syntax.
System Commands
Memory Subsystem (:MEMory)

:STOR:LIST

Supported All Models
:MMEM:STOR:LIST "<file name>"
This command stores the current list sweep data to a file.

Key Entry Store To File

:STOR:PTRain

Supported All with Options UNW and N5180320B
:MMEM:STOR:PTRain "<filename>">
Writes out the current pulse train list to the PTRAIN file specified. This operation will overwrite any existing file of the same name in the PTRAIN directory with a binary file. Refer to :LOAD:PTRain.

Key Entry Store To File

:STOR:WFM:ALL

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657
:MMEM:STOR:WFM:ALL
This command stores from the internal BBG memory to the active media. The active media is either internal non-volatile memory storage media or an external storage media connected to the front-panel USB port.

Key Entry Store All To Int Media
Output Subsystem (:OUTPut)

:BLANking:AUTO

Supported All Models

:OUTPut:BLANking:AUTO ON|OFF|1|0

:OUTPut:BLANKing:AUTO?

This command turns the RF output on or off during frequency band changes. Frequency band changes can cause the signal generator’s RF output to fluctuate. The output blanking function, when active, turns off the RF output until the frequency and power settles.

ON (1) The RF output turns off when crossing a frequency band.

OFF (0) The RF output stays on, if possible, when crossing a frequency band. Refer to the Data sheet.

*RST 1

Key Entry Output Blanking Off On Auto

Remarks Refer to the signal generator’s data sheet for information on frequency switching speeds, settling times, and frequency band information.

:BLANking:STATe

Supported All Models

:OUTPut:BLANking:STATe ON|OFF|1|0

:OUTPut:BLANKing:STATe?

This command enables or disables the RF output blanking state.

ON (1) The RF output turns off during frequency changes.

OFF (0) The RF output stays on, if possible, during frequency changes. Refer to the Data sheet.

*RST 0

Remarks Refer to the signal generator’s data sheet for information on frequency switching speeds, settling times, and frequency band information.
**System Commands**
**Output Subsystem (:OUTPut)**

:MODulation[:STATe]

**Supported** All Models

:OUTPut:MODulation[:STATe] ON|OFF|1|0
:OUTPut:MODulation[:STATe]?

This command enables or disables the modulation of the RF output with the currently active modulation type(s).

*RST 1

**Key Entry** Mod On/Off

**Remarks** Some modulation types can be simultaneously enabled such as pulse and AM.

An annunciator on the signal generator is always displayed to indicate whether modulation is switched on or off.

[:STATe]

**Supported** All Models

:OUTPut [:STATe] ON|OFF|1|0
:OUTPut [:STATe]?

This command enables or disables the RF output.

*RST 0

**Key Entry** RF On/Off

**Remarks** Although you can configure and engage various modulations, no signal is available at the RF OUTPUT connector until this command is executed.

An annunciator is always displayed on the signal generator to indicate whether the RF output is switched on or off.
Route Subsystem (:ROUTe)

[:CONNectors]:EVENt[:OUTPut]

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe[:CONNectors]:EVENt[:OUTPut] M1|M2|M3|M4|AUX29|NONE

:ROUTe[:CONNectors]:EVENt[:OUTPut]?

This command selects a marker (M1–M4) signal to be routed to the rear panel EVENT 1 connector. AUX29 selects Aux I/O Pin 29. NONE indicates that the BNC connector is, or can be, input.

*RST  M1

Key Entry  Route to Event 1 BNC

HARDware:DGENerator:INPut:BPOLarity

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe:HARDware:DGENerator:INPut:BPOLarity POSitive|NEGative

:ROUTe:HARDware:DGENerator:INPut:BPOLarity?

This command configures the polarity of the TTL input signal at the BURST GATE IN connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

*RST  POS

Key Entry  Burst Gate In Polarity Neg Pos

Remarks  This command performs the same function as “HARDware:DGENerator:IPOLarity:BGATe” on page 191.

HARDware:DGENerator:INPut:CPOLarity

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe:HARDware:DGENerator:INPut:CPOLarity POSitive|NEGative

:ROUTe:HARDware:DGENerator:INPut:CPOLarity?

This command configures the polarity of the TTL input signal at the DATA CLOCK connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

*RST  POS

Key Entry  Data Clock Polarity Neg Pos
System Commands
Route Subsystem (:ROUTe)

Remarks
This command performs the same function as
“HARDware:DGENerator:IPOLarity:CLOCk” on page
192.

HARDware:DGENerator:INPut:DPOLarity

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe:HARDware:DGENerator:INPut:DPOLarity POSitive|NEGative
:ROUTe:HARDware:DGENerator:INPut:DPOLarity?

This command configures the polarity of the TTL input signal at the DATA connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

*RST POS

Key Entry Data Polarity Neg Pos

Remarks This command performs the same function as

HARDware:DGENerator:INPut:SPOLarity

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe:HARDware:DGENerator:INPut:SPOLarity POSitive|NEGative
:ROUTe:HARDware:DGENerator:INPut:SPOLarity?

This command configures the polarity of the TTL input signal at the SYMBOL SYNC connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

*RST POS

Key Entry Symbol Sync Polarity Neg Pos

Remarks This command performs the same function as
“HARDware:DGENerator:IPOLarity:SSYNc” on page 193.

HARDware:DGENerator:IPOLarity:BGATe

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe:HARDware:DGENerator:IPOLarity:BGATe POSitive|NEGative
:ROUTe:HARDware:DGENerator:IPOLarity:BGATe?

This command configures the polarity of the input signal at the BURST GATE IN connector. POSitive refers to normal logic, while NEGative refers to inverted logic.
System Commands
Route Subsystem (:ROUTe)

*RST

Key Entry
Burst Gate In Polarity Neg Pos

Remarks
This command performs the same function as “HARDware:DGENerator:INPut:BPOLarity” on page 190.

HARDware:DGENerator:IPOLarity:CLOCk

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:*ROUTe:HARDware:DGENerator:IPOLarity:CLOCk POSitive|NEGative
:*ROUTe:HARDware:DGENerator:IPOLarity:CLOCk?

This command configures the polarity of the TTL input signal at the DATA CLOCK connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

*RST

Key Entry
Data Clock Polarity Neg Pos

Remarks
This command performs the same function as “HARDware:DGENerator:INPut:CPOLarity” on page 190.

HARDware:DGENerator:IPOLarity:DATA

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:*ROUTe:HARDware:DGENerator:IPOLarity:DATA POSitive|NEGative
:*ROUTe:HARDware:DGENerator:IPOLarity:DATA?

This command configures the polarity of the TTL input signal at the DATA connector. POSitive refers to normal logic, while NEGative refers the inverted logic.

*RST

Key Entry
Data Polarity Neg Pos

Remarks
This command performs the same function as “HARDware:DGENerator:INPut:DPOLarity” on page 191.
System Commands
Route Subsystem (:ROUTE)

HARDware:DGENerator:IPOLarity:SSYNc

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTE:HARDware:DGENerator:IPOLarity:SSYNc  POSitive|NEGative
:ROUTE:HARDware:DGENerator:IPOLarity:SSYNc?

This command configures the polarity of the TTL input signal at the SYMBOL SYNC connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

*RST  POS
Key Entry  Symbol Sync Polarity Neg Pos
Remarks  This command performs the same function as “HARDware:DGENerator:INPut:SPOLarity” on page 191.

HARDware:DGENerator:OPOLarity:CLOCk

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTE:HARDware:DGENerator:OPOLarity:CLOCk  POSitive|NEGative
:ROUTE:HARDware:DGENerator:OPOLarity:CLOCk?

This command configures the polarity of the TTL output Data Clock Out signal at the DATA CLK OUT pin on the rear panel AUX I/O connector. POSitive refers to normal logic, while the NEGative refers to inverted logic.

*RST  POS
Key Entry  Data Clock Out Neg Pos
Remarks  This command performs the same function as “HARDware:DGENerator:OUTPut:CPOLarity” on page 194.

HARDware:DGENerator:OPOLarity:DATA

Supported  N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTE:HARDware:DGENerator:OPOLarity:DATA  POSitive|NEGative
:ROUTE:HARDware:DGENerator:OPOLarity:DATA?

This command configures the polarity of the TTL output DATA OUT signal at the DATA OUT pin on the rear panel AUX I/O connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

*RST  POS
Key Entry  Data Out Polarity Neg Pos
System Commands
Route Subsystem (:ROUTe)

Remarks
This command performs the same function as "HARDware:DGENerator:OUTPut:DPOLarity" on page 195.

HARDware:DGENerator:OPOLarity:SSYNc

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe:HARDware:DGENerator:OPOLarity:SSYNc POSitive|NEGative
:ROUTe:HARDware:DGENerator:OPOLarity:SSYNc?

This command configures the polarity of the TTL output SYMBOL SYNC signal at the SYM SYNC OUT pin on the rear panel AUX I/O connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

*RST
POS

Key Entry
Symbol Sync Out Polarity Neg Pos

Remarks
This command performs the same function as “HARDware:DGENerator:OUTPut:SPOLarity” on page 195.

HARDware:DGENerator:OUTPut:CPOLarity

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe:HARDware:DGENerator:OUTPut:CPOLarity POSitive|NEGative
:ROUTe:HARDware:DGENerator:OUTPut:CPOLarity?

This command configures the polarity of the TTL output DATA CLOCK OUT signal at the DATA CLK OUT pin on the rear panel AUX I/O connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

*RST
POS

Key Entry
Data Clock Polarity Neg Pos

Remarks
This command performs the same function as “HARDware:DGENerator:OPOLarity:CLOCK” on page 193.

HARDware:DGENerator:OUTPut:DCS[:STATe]

Supported
N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe:HARDware:DGENerator:OUTPut:DCS[:STATe] ON|OFF|1|0
:ROUTe:HARDware:DGENerator:OUTPut:DCS[:STATe]?
System Commands
Route Subsystem (:ROUTe)

This command is used to enable or disable the output DATA OUT, DATA CLK OUT, and SYM SYNC OUT signals from the rear panel AUX I/O connector. Normally, these output signals should be enabled (On). However, disabling these outputs will decrease the spurs that are sometimes present when operating at high symbol rates.

*RST 1

Key Entry DATA/CLK/SYNC Rear Outputs Off On

HARDware:DGENerator:OUTPut:DPOLarity

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe:HARDware:DGENerator:OUTPut:DPOLarity
POSitive|NEGative
:ROUTe:HARDware:DGENerator:OUTPut:DPOLarity?

This command configures the polarity of the TTL output signal at the DATA OUT connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

*RST POS

Key Entry Data Out Polarity Neg Pos

Remarks This command performs the same function as “HARDware:DGENerator:OPOLarity:DATA” on page 193.

HARDware:DGENerator:OUTPut:SPOLarity

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe:HARDware:DGENerator:OUTPut:SPOLarity
POSitive|NEGative
:ROUTe:HARDware:DGENerator:OUTPut:SPOLarity?

This command configures the polarity of the TTL input signal at the SYMBOL SYNC connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

*RST POS

Key Entry Symbol Sync Out Polarity Neg Pos

LINE:PTRigger[1]|2:BNC:SOURce

Supported N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657
System Commands
Route Subsystem (:ROUTE)


This command selects a BNC connector to use as an input for the Pattern Trigger In source.

- **BBTRigger1**
  - This choice sets the BB TRIG 1 connector as the Pattern Trigger In source.
- **BBTRigger2**
  - This choice sets the BB TRIG 2 connector as the Pattern Trigger In source.
- **EVENT1**
  - This choice sets the EVENT 1 connector as the Pattern Trigger In source.
- **PTRigger**
  - This choice sets the PAT TRIG connector as the Pattern Trigger In source.
- **NONE**
  - This choice selects no Pattern Trigger In source.
- **:*RST**
  - PTR

**Key Entry**

Patt Trig Source

[:CONNectors]:BBTRigger[1]|2[:OUTPut]

**Supported**

N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTE[:CONNectors]:BBTRigger[1]|2[:OUTPut]?

This command selects a marker (M1–M4) signal to be routed to the specified rear panel BB TRIG 1 or BB TRIG 2 connector. AUX29 selects Aux I/O Pin 29. NONE indicates that the BNC connector is, or can be, an input.

- **:*RST**
  - BBTRigger1 - M2
  - BBTRigger2 - None

**Key Entry**

Route to BB TRIG 1, 2 BNC

[:CONNectors]:PTRig[:OUTPut]

**Supported**

N5166B/72B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTE[:CONNectors]:PTRig[:OUTPut] M1|M2|M3|M4|AUX29|NONE
:ROUTE[:CONNectors]:PTRig[:OUTPut]?

This command selects a marker (M1–M4) signal to be routed to the rear panel PAT TRIG connector. AUX29 selects Aux I/O Pin 29. NONE indicates that the BNC connector is, or can be, an input.
System Commands
Route Subsystem (:ROUTe)

*RST None
Key Entry Route to PATT TRIG BNC

[:CONNectors]:SOUT

Supported All Models

:ROUTe[:CONNectors]:SOUT
SWEep|SETTled|PVIDeo|PSYNc|SW8757|SRUN|SFDone
:ROUTe:CONNectors:SOUT?

This command selects a signal to be routed to the rear panel SWEEP OUT connector.

SWEep This choice routes the sweep out signal to the SWEEP OUT connector.
SETTled This choice routes the source settled signal to the SWEEP OUT connector.
PVIDeo This choice routes the pulse video signal to the SWEEP OUT connector.
PSYNc This choice routes the pulse sync signal to the SWEEP OUT connector.
SW8757 This choice routes the sweep out signal to the SWEEP OUT connector for compatibility with the 8757D.
SRUN This choice routes the sweep run signal (the pulse at the start of each full sweep) to the SWEEP OUT connector.
SFDone This choice routes the swept function done signal (the pulse at the end of each full swept function) to the SWEEP OUT connector.

*RST SWE
Key Entry Route to Sweep Out BNC

[:CONNectors]:TRIGger1:OUTPut

Supported As indicated

:ROUTe[:CONNectors]:TRIGger1:OUTPut
SWEep|SRUN|SETTled|PVIDeo|PSYNc|LXI|PULSe|TRIGger2|SFDone|NONE
:ROUTe[:CONNectors]:TRIGger1:OUTPut?

This command selects a signal to be routed to the rear panel TRIG 1 connector.

SWEep This choice routes the sweep trigger out signal to the TRIG 1 connector.
System Commands
Route Subsystem (:ROUTE)

**SETTled**
This choice routes the source settled signal to the TRIG 1 connector.

**PVIDeo**
This choice routes the pulse video signal to the TRIG 1 connector.

**PSYNC**
This choice routes the pulse sync signal to the TRIG 1 connector.

**LXI**
This choice routes the LXI signal to the TRIG 1 connector.

**PULSE**
This choice routes the pulse sync signal to the TRIG 1 connector.

**TRIGger2**
This choice routes the TRIG 2 BNC signal to the TRIG 1 connector.

**SFDone**
This choice routes the swept function done signal (the pulse at the end of each full swept function) to the TRIG 1 connector.

**NONE**
This choice routes no signal to the <connector> connector, which allows the BNC to be an input.

**RST**
NONE

**Key Entry**
**Route to Trig 1 BNC**

[:CONNectors]:TRIGger[2]:OUTPut

**Supported**
**As indicated**

:ROUTE[:CONNectors]:TRIGger[2]:OUTPut
SWEep|SRUN|SETTled|PVIDeo|PSYNC|LXI|PULSe|TRIGger1|SFDone|NONE
:ROUTE[:CONNectors]:TRIGger[2]:OUTPut?

This command selects a signal to be routed to the rear panel TRIG 2 connector.

**SWEep**
This choice routes the sweep trigger out signal to the TRIG 2 connector.

**SETTled**
This choice routes the source settled signal to the TRIG 2 connector.

**PVIDeo**
This choice routes the pulse video signal to the TRIG 2 connector.

**PSYNC**
This choice routes the pulse sync signal to the TRIG 2 connector.

**LXI**
This choice routes the LXI signal to the TRIG2 connector.

**PULSe**
This choice routes the pulse sync signal to the TRIG 2 connector.
### System Commands

#### Route Subsystem (:ROUTe)

<table>
<thead>
<tr>
<th>TRIGger1</th>
<th>This choice routes the TRIG 1 BNC signal to the TRIG 2 connector.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFDone</td>
<td>This choice routes the swept function done signal (the pulse at the end of each full swept function) to the TRIG 2 connector.</td>
</tr>
<tr>
<td>NONE</td>
<td>This choice routes no signal to the &lt;connector&gt; connector, which allows the BNC to be an input.</td>
</tr>
<tr>
<td>*RST</td>
<td>SWE</td>
</tr>
<tr>
<td>Key Entry</td>
<td>Route to Trig 2 BNC</td>
</tr>
</tbody>
</table>
Status Subsystem (:STATus)

**:OPERation:CONDition?**

**Supported** All Models

**:STATus:OPERation:CONDition?**

This query returns the decimal sum of the bits for the registers that are set to one and are part of the Standard Operation Status Group. For example, if a sweep is in progress (bit 3), the value 8 is returned.

**Range** 0 to 32767

**Remarks** The data in this register is continuously updated and reflects current conditions.

Refer to the **Programming Guide** for more information.

**:OPERation:ENABle**

**Supported** All Models

**:STATus:OPERation:ENABle <value>**

**:STATus:OPERation:ENABle?**

This command determines which bits in the Standard Operation Event Register will set the Standard Operation Status Summary bit (bit 7) in the Status Byte Register.

The variable `<value>` is the sum of the decimal values of the bits that you want to enable.

**Range** 0 to 32767

**Remarks** Refer to the **Programming Guide** for more information.

**:OPERation:NTRansition**

**Supported** All Models

**:STATus:OPERation:NTRansition <value>**

**:STATus:OPERation:NTRansition?**

This command determines which bits in the Standard Operation Condition Register will set the corresponding bit in the Standard Operation Event Register when that bit has a negative transition (1 to 0).

The variable `<value>` is the sum of the decimal values of the bits that you want to enable.

**Range** 0 to 32767

**Remarks** Refer to the **Programming Guide** for more information.
System Commands
Status Subsystem (:STATus)

:OPERation:PTRansition

Supported All Models

:STATus:OPERation:PTRansition <value>
:STATus:OPERation:PTRansition?

This command determines which bits in the Standard Operation Condition Register will set the corresponding bit in the Standard Operation Event Register when that bit has a positive transition (0 to 1).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767
Remarks Refer to the Programming Guide for more information.

:OPERation:SUPPress

Supported All Models

:STATus:OPERation:SUPPress 0|1|ON|OFF
:STATus:OPERation:SUPPress?

This command disables the instrument’s management of the Standard Operation Condition Register and saves 50 us of switching time.

*RST OFF
Remarks Refer to the Programming Guide for more information.

:OPERation[:EVENt]

Supported All Models

CAUTION This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.

:STATus:OPERation[:EVENt]?

This query returns the decimal sum of the bits in the Standard Operation Event Register.

Range 0 to 32767
Remarks The equivalent PTR or NTR filters must be set before the condition register can set the corresponding bit in the event register.

Refer to the Programming Guide for more information.

:PRESet

Supported All Models
System Commands
Status Subsystem (:STATus)

:STATus:PRESet
This command presets all transition filters, enable registers, and error/event queue enable registers.

Remarks Refer to the Programming Guide for more information.

:QUEStionable:BERT:CONDition

Supported N5172B/82B with Option N5180UN7B

:STATus:QUEStionable:BERT:CONDition?
This query returns the decimal sum of the bits in the Data Questionable BERT Condition Register. For example, if no clock signal has been input for more than three seconds during the bit error rate measurement (bit 0), then a value of 1 is returned.

Range 0–32767
Remarks The data in this register is continuously updated and reflects the current conditions.

Refer to the X-Series Signal Generators Programming Guide for more information.

:QUEStionable:BERT:ENABle

Supported N5172B/82B with Option N5180UN7B

:STATus:QUEStionable:BERT:ENABle <value>
:STATus:QUEStionable:BERT:ENABle?
This command determines which bits in the Data Questionable BERT Event Register will set the Data Questionable BERT Summary bit (bit 12) in the Data Questionable Condition Register.

The variable <value> is the sum of the decimal values of the bits you want to enable.

Range 0–32767
Remarks Refer to the X-Series Signal Generators Programming Guide for more information.

:QUEStionable:BERT:NTRansition

Supported N5172B/82B with Option N5180UN7B

:STATus:QUEStionable:BERT:NTRansition <value>
:STATus:QUEStionable:BERT:NTRansition?
This command determines which bits in the Data Questionable BERT Condition Register will set the corresponding bit in the Data Questionable BERT Event Register when that bit has a negative transition (1 to 0).
System Commands
Status Subsystem (:STATus)

The variable <value> is the sum of the decimal values of the bits that you want to enable.

<table>
<thead>
<tr>
<th>Range</th>
<th>0–32767</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remarks</td>
<td>The data in this register is continuously updated and reflects the current conditions.</td>
</tr>
</tbody>
</table>

Refer to the X-Series Signal Generators Programming Guide for more information.

:QUESTionable:BERT:PTRansition

Supported  N5172B/82B with Option N5180UN7B

:STATus:QUESTionable:BERT:PTRansition <value>
:STATus:QUESTionable:BERT:PTRansition?

This command determines which bits in the Data Questionable BERT Condition Register will set the corresponding bit in the Data Questionable BERT Event Register when that bit has a positive transition (0 to 1).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

<table>
<thead>
<tr>
<th>Range</th>
<th>0–32767</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remarks</td>
<td>Refer to the X-Series Signal Generators Programming Guide for more information.</td>
</tr>
</tbody>
</table>

:QUESTionable:BERT[:EVENt]

Supported  N5172B/82B with Option N5180UN7B

CAUTION

This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.

:STATus:QUESTionable:BERT[:EVENt]?

This command returns the decimal value of the sum of the bits in the Data Questionable BERT Event Register.

<table>
<thead>
<tr>
<th>Range</th>
<th>0–32767</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remarks</td>
<td>Note that the register requires that the equivalent PTR or NTR filters be set before a condition register bit can set a bit in the Event register. Refer to the X-Series Signal Generators Programming Guide for more information.</td>
</tr>
</tbody>
</table>

:QUESTionable:CALibration:CONDition?

Supported  All Models
System Commands
Status Subsystem (:STATus)

:STATus:QUEStionable:CALibration:CONDition?
This query returns the decimal sum of the bits in the Data Questionable Calibration Condition Register.

Range 0 to 32767
Remarks The data in this register is continuously updated and reflects the current conditions.
Refer to the Programming Guide for more information.

:QUEStionable:CALibration:ENABle

Supported All Models
:STATus:QUEStionable:CALibration:ENABle <value>
:STATus:QUEStionable:CALibration:ENABle?
This command determines which bits in the Data Questionable Calibration Event Register will set the calibration summary bit (bit 8) in the Data Questionable Condition Register.

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767
Remarks Refer to the Programming Guide for more information.

:QUEStionable:CALibration:NTRansition

Supported All Models
:STATus:QUEStionable:CALibration:NTRansition <value>
:STATus:QUEStionable:CALibration:NTRansition?
This command determines which bits in the Data Questionable Calibration Condition Register will set the corresponding bit in the Data Questionable Calibration Event Register when that bit has a negative transition (1 to 0).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767
Remarks Refer to the Programming Guide for more information.
System Commands
Status Subsystem (:STATus)

:QUESTionable:CALibration:PTRansition

Supported All Models

:STATus:QUESTionable:CALibration:PTRansition <value>
:STATus:QUESTionable:CALibration:PTRansition?

This command determines which bits in the Data Questionable Calibration Condition Register will set the corresponding bit in the Data Questionable Calibration Event Register when that bit has a positive transition (0 to 1).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767
Remarks Refer to the Programming Guide for more information.

:QUESTionable:CALibration[:EVENT]?

Supported All Models

CAUTION

This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.

:STATus:QUESTionable:CALibration[:EVENT]?

This command returns the decimal sum of the bits in the Data Questionable Calibration Event Register.

Range 0 to 32767
Remarks The equivalent PTR or NTR filters must be set before the condition register can set the corresponding bit in the event register.
Refer to the Programming Guide for more information.

:QUESTionable:CONDition?

Supported All Models

:STATus:QUESTionable:CONDition?

This query returns the decimal sum of the bits in the Data Questionable Condition Register. For example, if the ALC Heater Detector is cold (bit 4), a value of 16 is returned.

Range 0 to 32767
Remarks The data in this register is continuously updated and reflects current conditions.
Refer to the Programming Guide for more information.
System Commands
Status Subsystem (:STATus)

:QUESTIONable:ENABle

**Supported**  All Models

:STATus:QUESTIONable:ENABle <value>
:STATus:QUESTIONable:ENABle?

This command determines which bits in the Data Questionable Event Register will set the Data Questionable Status Group Summary bit (bit 3) in the Status Byte Register.

The variable <value> is the sum of the decimal values of the bits that you want to enable.

**Range**  0 to 32767

**Remarks**  Refer to the *Programming Guide* for more information.

:QUESTIONable:FREQuency:CONDition?

**Supported**  All Models

:STATus:QUESTIONable:FREQuency:CONDition?

This query returns the decimal sum of the bits in the Data Questionable Frequency Condition Register. For example, if the 1 GHz internal reference clock is unlocked (bit 2), a value of 4 is returned.

**Range**  0 to 32767

**Remarks**  The data in this register is continuously updated and reflects current conditions.

Refer to the *Programming Guide* for more information.

:QUESTIONable:FREQuency:ENABle

**Supported**  All Models

:STATus:QUESTIONable:FREQuency:ENABle <value>
:STATus:QUESTIONable:FREQuency:ENABle?

This command determines which bits in the Data Questionable Frequency Event Register will set the frequency summary bit (bit 5) in the Data Questionable Condition Register.

The variable <value> is the sum of the decimal values of the bits that you want to enable.

**Range**  0 to 32767

**Remarks**  Refer to the *Programming Guide* for more information.
System Commands
Status Subsystem (:STATus)

:QUESTionable:FREQuency:NTRansition

Supported  All Models

:STATus:QUESTionable:FREQuency:NTRansition <value>
:STATus:QUESTionable:FREQuency:NTRansition?

This command determines which bits in the Data Questionable Frequency Condition Register will set the corresponding bit in the Data Questionable Frequency Event Register when that bit has a negative transition (1 to 0).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range  0 to 32767
Remarks  Refer to the Programming Guide for more information.

:QUESTionable:FREQuency:PTRansition

Supported  All Models

:STATus:QUESTionable:FREQuency:PTRansition <value>
:STATus:QUESTionable:FREQuency:PTRansition?

This command determines which bits in the Data Questionable Frequency Condition Register will set the corresponding bit in the Data Questionable Frequency Event Register when that bit has a positive transition (0 to 1).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range  0 to 32767
Remarks  Refer to the Programming Guide for more information.

:QUESTionable:FREQuency[:EVENt]?

Supported  All Models

**CAUTION**

This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.

:STATus:QUESTionable:FREQuency[:EVENt]?

This query returns the decimal sum of the bits in the Data Questionable Frequency Event Register.

Range  0 to 32767
Remarks  The equivalent PTR or NTR filters must be set before the condition register can set the corresponding bit in the event register.

Refer to the Programming Guide for more information.
System Commands
Status Subsystem (:STATus)

:QUEStionable:MODulation:CONDition?

Supported All Models

:STATus:QUEStionable:MODulation:CONDition?

This command returns the decimal sum of the bits in the Data Questionable Modulation Condition Register. For example, if the modulation is uncalibrated (bit 4), a value of 16 is returned.

Range 0 to 32767
Remarks The data in this register is continuously updated and reflects current conditions.

Refer to the Programming Guide for more information.

:QUEStionable:MODulation:ENABle

Supported All Models

:STATus:QUEStionable:MODulation:ENABle <val>
:STATus:QUEStionable:MODulation:ENABle?

This command determines which bits in the Data Questionable Modulation Event Register will set the modulation summary bit (bit 7) in the Data Questionable Condition Register.

The variable <val> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767
Remarks Refer to the Programming Guide for more information.

:QUEStionable:MODulation:NTRansition

Supported All Models

:STATus:QUEStionable:MODulation:NTRansition <val>
:STATus:QUEStionable:MODulation:NTRansition?

This command determines which bits in the Data Questionable Modulation Condition Register will set the corresponding bit in the Data Questionable Modulation Event Register when that bit has a negative transition (1 to 0).

The variable <val> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767
Remarks Refer to the Programming Guide for more information.
System Commands
Status Subsystem (:STATus)

:QUEStionable:MODulation:PTRansition

**Supported**  All Models

:STATus:QUEStionable:MODulation:PTRansition <val>
:STATus:QUEStionable:MODulation:PTRansition?

This command determines which bits in the Data Questionable Modulation Condition Register will set the corresponding bit in the Data Questionable Modulation Event Register when that bit has a positive transition (0 to 1).

The variable <val> is the sum of the decimal values of the bits that you want to enable.

- **Range**  0 to 32767
- **Remarks**  Refer to the *Programming Guide* for more information.

:QUEStionable:MODulation[:EVENt]?

**Supported**  All Models

---

**CAUTION**

This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.

:STATus:QUEStionable:MODulation[:EVENt]?

This query returns the decimal sum of the bits in the Data Questionable Modulation Event Register.

- **Range**  0 to 32767
- **Remarks**  The equivalent PTR or NTR filters must be set before the condition register can set the corresponding bit in the event register.
  
  Refer to the *Programming Guide* for more information.

:QUEStionable:NTRansition

**Supported**  All Models

:STATus:QUEStionable:NTRansition <value>
:STATus:QUEStionable:NTRansition?

This command determines which bits in the Data Questionable Condition Register will set the corresponding bit in the Data Questionable Event Register when that bit has a negative transition (1 to 0).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

- **Range**  0 to 32767
- **Remarks**  Refer to the *Programming Guide* for more information.
System Commands
Status Subsystem (:STATus)

:QUEStionable:POWer:CONDition?

Supported All Models

:STATus:QUEStionable:POWer:CONDition?

This query returns the decimal sum of the bits in the Data Questionable Power Condition Register. For example, if the RF output signal is unleveled (bit 1), a value of 2 is returned.

Range 0 to 32767

Remarks The data in this register is continuously updated and reflects current conditions.

Refer to the Programming Guide for more information.

:QUEStionable:POWer:ENABle

Supported All Models

:STATus:QUEStionable:POWer:ENABle <value>
:STATus:QUEStionable:POWer:ENABle?

This command determines which bits in the Data Questionable Power Event Register will set the power summary bit (bit 3) in the Data Questionable Condition Register.

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the Programming Guide for more information.

:QUEStionable:POWer:NTRansition

Supported All Models

:STATus:QUEStionable:POWer:NTRansition <value>
:STATus:QUEStionable:POWer:NTRansition?

This command determines which bits in the Data Questionable Power Event Register will set the corresponding bit in the Data Questionable Power Event Register when that bit has a negative transition (1 to 0).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the Programming Guide for more information.
System Commands
Status Subsystem (:STATus)

:QUEStionable:POWer:PTRansition

**Supported** All Models

:STATus:QUEStionable:POWer:PTRansition <value>
:STATus:QUEStionable:POWer:PTRansition?

This command determines which bits in the Data Questionable Power Condition Register will set the corresponding bit in the Data Questionable Power Event Register when that bit has a positive transition (0 to 1).

The variable `<value>` is the sum of the decimal values of the bits that you want to enable.

**Range** 0 to 32767

**Remarks** Refer to the *Programming Guide* for more information.

:QUEStionable:POWer[:EVENT]?

**Supported** All Models

This query returns the decimal sum of the bits in the Data Questionable Power Event Register.

**Range** 0 to 32767

**Remarks** The equivalent PTR or NTR filters must be set before the condition register can set the corresponding bit in the event register.

Refer to the *Programming Guide* for more information.

:QUEStionable:PTRansition

**Supported** All Models

:STATus:QUEStionable:PTRansition <value>
:STATus:QUEStionable:PTRansition?

This command determines which bits in the Data Questionable Condition Register will set the corresponding bit in the Data Questionable Event Register when that bit has a positive transition (0 to 1).

The variable `<value>` is the sum of the decimal values of the bits that you want to enable.

**Range** 0 to 32767

**Remarks** Refer to the *Programming Guide* for more information.
:QUESTionable[:EVENT]?

**Supported**

All Models

**CAUTION**

This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.

:STATus:QUESTionable[:EVENT]?

This query returns the decimal sum of the bits in the Data Questionable Event Register.

<table>
<thead>
<tr>
<th>Range</th>
<th>0 to 32767</th>
</tr>
</thead>
</table>

**Remarks**

The equivalent PTR or NTR filters must be set before the condition register can set the corresponding bit in the event register.

Refer to the Programming Guide for more information.
System Subsystem (:SYSTem)

:CAPability

Supported All Models

:SYSTem:CAPability?

This query returns the signal generator’s capabilities and outputs the appropriate specifiers:

(RFSOURCE
WITH((AM|FM|PULM|PM)&(FSSWEEP|FLIST)&(PSSWEEP|PLIST)
&TRIGGER&REFERENCE))

This is a list of the SCPI–defined basic functionality of the signal generator and the additional capabilities it has in parallel (a&b) and singularly (a|b).

:DATE

Supported All Models

:SYSTem:DATE <year>,<month>,<day>

:SYSTem:DATE?

This command sets the date as shown in the lower right area of the signal generator display.

<year> This variable requires a four digit integer.

The query returns the date in the following format:

<+year>, <+month>, <+day>

Range <month>: 1 to 12 <day>: 1 to 31

Key Entry Time/Date

:ERRor:CODE[:NEXt]

Supported All Models

:SYSTem:ERRor:CODE[:NEXt]?

This query returns the next error message number from the signal generator SCPI error queue. If there are no error messages, the query returns the following output:

+0

When there is more than one error message, the query will need to be sent for each message.
System Commands
System Subsystem (:SYSTem)

The Keysight MXG deletes the error messages from the front-panel error queue after viewing the last message.

Key Entry | Error Info | View Next Error Message
--- | --- | ---
:ERRor[:NEXt]

**Supported** All Models

:SYSTem:ERRor[:NEXt]?

This query returns the next error message from the signal generator SCPI error queue. If there are no error messages, the query returns the following output:

```
+0,"No error"
```

When there is more than one error message, the query will need to be sent for each message.

The Keysight MXG deletes the error messages from the front-panel error queue after viewing the last message.

Key Entry | Error Info | View Next Error Message
--- | --- | ---
:ERRor:SCPI[:SYNTax]

**Supported** All Models

:SYSTem:ERRor:SCPI[:SYNTax] ON|OFF|1|0

:SYSTem:ERRor:SCPI[:SYNTax]?

This command enables or disables the reporting of SCPI syntax errors to the error queue.

The setting ON/1 is persistent through Preset and *RST. It is cleared to OFF/0 by sending SYST:PRES:ALL or cycling the power of the signal generator.

:FILesystem:STORage:EXTernal

**Supported** All Models

:SYSTem:FILesystem:STORage:EXTernal?

This query checks to see if the external USB port is actively being used for data storage and retrieval on the signal generator. A returned value of 1 means the external USB media is being used for data storage and retrieval. For more information on non–volatile storage media settings, refer to :FILesystem:STORage:EXTernal:PATH, :FILesystem:STORage:TYPE and :FILesystem:STORage:TYPE:AUTO commands.
System Commands
System Subsystem (:SYSTem)

:FIlesystem:STORage:EXTernal:PATH

**Supported** All Models

:SYSTem:FIlesystem:STORage:EXTernal:PATH <"USB media root path">
:SYSTem:FIlesystem:STORage:EXTernal:PATH?

This command selects the directory storage path on the USB media. For more information, refer to the signal generator’s softkey Help. For more information on non–volatile storage media settings, refer to :FIlesystem:STORage:EXTernal, :FIlesystem:STORage:TYPE and :FIlesystem:STORage:TYPE:AUTO commands.

**Remarks** When reading and writing files from or to the USB media, different memory subsystem file types are marked by having a particular extender on the filename. Refer to Table USB Media Path Options on page 215.

Files with unrecognized extenders are treated as binary (.bin) files.

<table>
<thead>
<tr>
<th>USB Media Path Options</th>
<th>Extender</th>
<th>File Type</th>
<th>Memory Subsystem</th>
</tr>
</thead>
<tbody>
<tr>
<td>.waveform</td>
<td>waveform</td>
<td>waveform</td>
<td>NVWFM</td>
</tr>
<tr>
<td>.markers</td>
<td>waveform marker</td>
<td>waveform marker</td>
<td>NVMKR</td>
</tr>
<tr>
<td>.header</td>
<td>waveform header</td>
<td>waveform header</td>
<td>NVHDR</td>
</tr>
<tr>
<td>.state</td>
<td>instrument state</td>
<td>instrument state</td>
<td>STATE</td>
</tr>
<tr>
<td>.list</td>
<td>list sweep</td>
<td>list sweep</td>
<td>LIST</td>
</tr>
<tr>
<td>.userflat</td>
<td>user flatness</td>
<td>user flatness</td>
<td>USERFLAT</td>
</tr>
<tr>
<td>.seq</td>
<td>waveform sequence</td>
<td>waveform sequence</td>
<td>SEQ</td>
</tr>
</tbody>
</table>

**All others** All others BIN
System Commands
System Subsystem (:SYSTem)

:FIleSystem:STORage:TYPE

Supported All Models

:SYSTem:FIleSystem:STORage:TYPE INTernal|EXTernal
:SYSTem:FIleSystem:STORage:TYPE?

This command selects the non–volatile storage location on the signal generator. For more information on non–volatile storage media settings, refer to :FIleSystem:STORage:EXTernal, :FIleSystem:STORage:EXTernal:PATH and :FIleSystem:STORage:TYPE:AUto commands.

Key Entry Storage Type Int Ext Auto

Example

:SYST:FIL:STOR:TYPE EXT

The preceding example selects the external USB port as the location for non-volatile file storage on the signal generator.

:FIleSystem:STORage:TYPE:AUTO

Supported All Models

:SYSTem:FIleSystem:STORage:TYPE:AUTO ON|OFF|1|0
:SYSTem:FIleSystem:STORage:TYPE:AUTO?

This command enables the signal generator to auto–detect when the USB media is connected. When AUTO (ON|1) is selected, the file system uses the USB media, if available. When the USB media is removed, the file system uses the internal media. For more information, refer to the signal generator’s softkey Help. For more information on non–volatile storage media settings, refer to :FIleSystem:STORage:EXTernal, :FIleSystem:STORage:EXTernal:PATH and :FIleSystem:STORage:TYPE commands.

*RST 1

Key Entry Storage Type Int Ext Auto

Example

:SYST:FIL:STOR:TYPE:AUTO ON

The preceding example selects AUTOmatic as the non–volatile storage setting and the signal generator will detect if the external USB port has a memory storage device connected.

Remarks When the USB media is removed, the USB non–volatile user file system effectively does not exist.

:IDN

Supported All Models

:SYSTem:IDN "string"
System Commands
System Subsystem (:SYSTem)

This command modifies the identification string that the *IDN? query returns. Sending an empty string sets the query output of *IDN? to its factory shipped setting. The maximum string length is 72 characters.

**Remarks**
Modification of the *IDN? query output enables the signal generator to identify itself as another signal generator when used as a replacement.

The display diagnostic information, shown by pressing the **Diagnostic Info** softkey, is not affected by this command.

**:LANGuage**

**Supported**
All

**:SYSTem:LANGuage
"SCPI" | "COMP" | "8648" | "E4428C" | "E4438C" | "E8257D" | "E8267D" | "E8663B" | "E8247C" | "E8257C" | "E8267C" | "N5181A" | "N5182A" | "E442XB" | "E443XB" | "E8241A" | "E8244A" | "E8251A" | "E8254A" | "SMU200A" | "SMA100A" | "SML" | "SMV" | "SMR" | "SMF100A" | "MG3691B" | "MG3692B" | "MG3693B" | "MG3694B" | "3410" | "8360" | "8371" | "83732" | "83752" | "8340" | "8644" | "8662" | "8663" | "8664" | "8665"

**:SYSTem:LANGuage?**
This command sets the remote language for the signal generator.

- **SCPI**
  This choice provides compatibility for SCPI commands.

- **COMP**
  This choice provides compatibility for the 8656B, 8657A/B signal generator which is supported only through the GPIB interface.

- **8648**
  This choice provides compatibility for the 8648A/B/C/D signal generator which is supported only through a GPIB interface.

- **E4428C** or **E4438C**
  This choice provides compatibility for the E4428C or E4438C signal generators which are supported through a GPIB, LAN, or USB interface.

- **E8257D**, **E8267D**, or **E8663B**
  This choice provides compatibility for the E8257D, E8267D, or E8663B signal generators which are supported through a GPIB, LAN, or USB interface.

- **E8247C**, **E8257C**, or **E8267C**
  This choice provides compatibility for the E8247C, E8257C, or E8267C signal generators which are supported through a GPIB, LAN, or USB interface.
System Subsystem (:SYSTem)

N5181A or N5182A  This choice provides compatibility for the N5181A or N5182A signal generators which are supported through a GPIB, LAN, or USB interface.

E442XB or E443XB  This choice provides compatibility for the E442XB or E443XB signal generators which are supported through a GPIB, LAN, or USB interface.

E8241A or E8244A  This choice provides compatibility for the 8648A/B/C/D signal generator which is supported through a GPIB, LAN, or USB interface.

E8251A or E8254A  This choice provides compatibility for the E8251A or E8254A signal generators which are supported through a GPIB, LAN or USB interface.

SMU200A, or SMATE200A, or SMJ100A, or SMIQ, or SML, or SMV, or SMR, or SMF100A  This choice provides compatibility for the Rohde and Schwarz SMU200A, SMATE200A, SMJ100A, SMIQ, SML, SMV, SMR, or SMF100A signal generators which are supported through a GPIB, LAN or USB interface.

MG3691B, or MG3692B, or MG3693B, or MG3694B  This choice provides compatibility for the Anritsu MG3691B, MG3692B, MG3693B, or MG3694B signal generators which are supported through a GPIB, LAN or USB interface.

3410  This choice provides compatibility for the Aeroflex 3410 series signal generator, which is supported through a GPIB, LAN, or USB interface.

8360  This choice provides compatibility for 8360 series signal generators.

83712, or 83732, or 83752  This choice provides compatibility for the 83712A/B, 83732A/B, or 83752A/B signal generator.
### System Commands

#### System Subsystem (:SYSTem)

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>SCPI</th>
<th>SMJ100A</th>
<th>8648A/B/C/D</th>
<th>E8257D, E8267D, E8663B</th>
</tr>
</thead>
<tbody>
<tr>
<td>SML</td>
<td>3410 Series</td>
<td>8656B, 8657A/B</td>
<td>E8241A, E8244A, E8251A, E8264A</td>
<td></td>
</tr>
<tr>
<td>SMV</td>
<td>E4428C, E4438C</td>
<td>SMU200A, SMATE200A</td>
<td>8662A</td>
<td></td>
</tr>
<tr>
<td>SMIQ</td>
<td>E442xB, E443xB</td>
<td>E8247C, E8257C, E8267C</td>
<td>8663A</td>
<td></td>
</tr>
</tbody>
</table>

**Remarks**
The setting enabled by this command is not affected by signal generator power-on, preset, or *RST.*
System Commands
System Subsystem (:SYStem)

:LICense:AUS[:DATE]?

Supported All Models

This query retrieves the latest expiration date of the Keysight Upgrade Service license.

:LICense:[FPACK]:WAVeform:ADD

: SYSTem:LICense:[FPACK]:WAVeform:ADD "filename"

This command assigns a “filename” to the next available waveform slot. Filename should be just the filename, no path information. The file must reside in a non–volatile waveform memory (NVWFM) before it can be licensed.

Key Entry Add Waveform
Key Path Mode > Dual ARB > More 2 of 2 > Waveform Licensing > Add Waveform To Next Available Slot > Add Waveform

:LICense:[FPACK]:WAVeform:CLEar

Supported All Models

:SYSTem:LICense[:FPACK]:WAVeform:CLEar <slot_number>

This command clears the file currently assigned to the license waveform license slot. The specified slot cannot be locked.

Key Entry Clear Waveform From Slot
Key Path Mode > Dual ARB > More 2 of 2 > Waveform Licensing > Clear Waveform From Slot

:LICense:[FPACK]:WAVeform:FREE?

Supported All Models

:SYSTem:LICense[:FPACK]:WAVeform:FREE?

This queries the number of available slots open for waveforms to be licensed.

:LICense:[FPACK]:WAVeform:IDList?

Supported All Models

:SYSTem:LICense[:FPACK]:WAVeform:IDList?

This query returns a comma separated list of the licensed waveform IDs. The ID of a waveform in the instrument can be compared to this list to see if it is licensed.
System Commands
System Subsystem (:SYSTem)

:LICense:[FPACk]:WAVEform:LOCK

**Supported** All Models

:`SYSTem:LICense[:FPACk]:WAVEform:LOCK slot_number`

This command locks the file currently assigned to the waveform license slot specified by slot number. Once the slot is locked it can no longer be modified.

**Key Entry** Lock Waveform In Slot

**Key Path** Mode > Dual ARB > More 2 of 2 > Waveform Licensing > Lock Waveform In Slot >

:LICense:[FPACk]:WAVEform:REPLace

**Supported** All Models

:`SYSTem:LICense[:FPACk]:WAVEform:REPLace slot_number, "filename"

This command will overwrite the contents of the selected slot with the “filename”, providing the slot is in the trial period. If the slot is locked the command returns an error.

**Key Entry** Replace Waveform In Slot

**Key Path** Mode > Dual ARB > More 2 of 2 > Waveform Licensing > Replace Waveform In Slot >

:LICense:[FPACk]:WAVEform:STATus?

**Supported** All Models

:`SYSTem:LICense[:FPACk]:WAVEform:STATus? slot_number`

This query returns the same values that are indicated in the Status column display.

:LICense:[FPACk]:WAVEform:USED?

**Supported** All Models

:`SYSTem:LICense:FPACk:WAVEform:USED?`

This query returns the number of slots used by licensed waveforms.

:LICense:INSTall

**Supported** All Models

:`SYSTem:LICense:INSTall
<license_line>|<block_of_license_lines>`
System Commands
System Subsystem (:SYSTem)

This command installs the licenses into the signal generator.

<table>
<thead>
<tr>
<th>&lt;license_line&gt;</th>
<th>This choice installs a license line.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;block_of_license_lines&gt;</td>
<td>This choice installs a block of license lines.</td>
</tr>
</tbody>
</table>

Example

:SYST:LIC:INST "FEATURE 403 aspk 0 permanent 0 389D66FB107E9B02 HOSTID=N5182B,US00000068"

The preceding example installs license "FEATURE 403 aspk 0 permanent 0 389D66FB107E9B02 HOSTID=N5182B,US00000068", into the signal generator.

Example

:SYST:LIC:INST #210Qaz37pY9oL

The preceding is an example of the syntax for installing a block of licenses into the signal generator. For more on handling block data, refer to the Programming Guide.

NOTE

With firmware version ≥ B.01.75, the actual 'FEATURE' number (option number) may vary from three-digits to eight-digits.

NOTE

The data, Qaz37pY9oL, in the above command are not valid and are shown for example purposes only. Typically, ASCII characters representing data are unprintable.

For additional information on downloading and installing licenses for applications, refer to the Keysight License Manager at http://www.keysight.com/find/LicenseManager.

:LICense:LIST

Supported All Models

:SYSTem:LICense:LIST?

This query provides a listing of the current licenses installed on the signal generator.

:LICense:REMove

Supported All Models

:SYSTem:LICense:REMove <license_line>

This command removes a single license line.

Example

To remove a license line:
System Commands
System Subsystem (:SYSTem)

:SYST:LIC:REM "FEATURE 403 aspk 0 permanent 0 389D66FB107E9B02 HOSTID=N5182B,US00000068"

The preceding example removes a license "FEATURE 403 aspk 0 permanent 0 389D66FB107E9B02 HOSTID=N5182B,US00000068", from the signal generator.

**NOTE**

With firmware version ≥ B.01.75, the actual 'FEATURE' number (option number) may vary from three-digits to eight-digits.

Remarks
To remove multiple license lines: Repeat the process for removing a single license for each license line to be removed.

:LOG:SCPI ON/OFF/1/0

Supported All Models

:SYSTem:LOG:SCPI ON|OFF|1|0

This command toggles the state of SCPI logging. When toggled ON, a copy of every subsequent SCPI command executed will be placed in the log. Toggling the state to OFF suspends the logging, and toggling back to ON resumes the logging. Pressing the front-panel **Clear SCPI Log** softkey will clear the log.

Remarks
This log information is stored in a file the BIN directory called SCPI_LOG.TXT. You can use FTP to download the file from the instrument.

:OPT

Supported All Models

:SYSTem:OPT "string"

This command modifies the option string that the *OPT? query returns. Sending an empty string sets the query output of *OPT? to its factory shipped setting. The maximum string length is 72 characters.

Remarks
Modification of the *OPT? query output enables the signal generator, with a set of options, to identify itself as another signal generator when used as a replacement. The display diagnostic information, shown by pressing the **Diagnostic Info** softkey, is not affected by this command.
System Commands
System Subsystem (:SYSTem)

:PDOWn

Supported All Models

:SYSTem:PDOWn

This command turns off the instrument.

:PMETer[1]|2:CHANnel

Supported All Models

:SYSTem:PMETer[1]|2:CHANnel A|B

:SYSTem:PMETer[1]|2:CHANnel?

This command selects the external power meter channel that will be used by each channel’s power meter measurement. The query returns the selected channel.

Key Entry External Power Meter Channel A B

Default Channel A


Supported All Models


This command enters a VXI–11 name for a power meter that is being controlled by the signal generator for power meter measurements. If connecting directly to the power meter enter the name as specified on your power meter documentation. If connecting through a LAN–GPIB gateway, enter the SICL address of the power meter.

Key Entry PM VXI–11 Device Name

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.


Supported All Models


This command sets the internet protocol (IP) address for a power meter that is controlled by the signal generator for power meter measurements. If connecting to a GPIB power meter through a LAN–GPIB gateway, this command sets the IP address of the gateway.
System Commands
System Subsystem (:SYSTem)

Key Entry | Power Meter IP Address
Remarks

The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.
Ensure that the power meter IP address is different from the signal generator address.


Supported All Models


This command sets the IP port on the power meter that is controlled by the signal generator.

Key Entry | Power Meter IP Port

5025 Standard mode. The command enables standard mode for simple programming.

5024 Telnet mode. The command enables the telnet SCPI service for programming.

For firmware versions <A.01.51, the default telnet mode is 5023. For firmware versions A.01.51 and greater, telnet port 5023 is still available for backwards compatibility.

Remarks

The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.
For more information on standard mode and telnet SCPI mode, refer to the Programming Guide.


Supported All Models


SOCKets|SOCKETS|VXI11|USB


This command sets the type of control connection for communication with the external power meter for power meter measurements. The query returns the connection type.

Key Entry | Connection Type

SOCK or SOCKETS The command enables the power meter for sockets LAN control through the signal generator.
System Commands
System Subsystem (:SYSTem)

VXI11  The command enables the power meter for VXI–11 control through the signal generator. A power meter with GPIB can be controlled through VXI–11 using a LAN–GPIB gateway.

USB   The command enables the power meter for USB control through the signal generator.

Remarks  The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:PMETer[1]|2:COMMunicate:USB:DEVice

Supported   All Models


This command selects the USB device to be used for power meter measurements for Channel A or B. The query returns the USB device identification.

Key Entry       Connection Type  >  USB Devise


Supported   All Models


This queries for the list of all connected USB devices.

:PMETer[1]|2:MEASure?

Supported   All Models

:SYSTem:PMETer[1]|2:MEASure?

This query starts the measurement and returns the result for Channel A or B.

:PMETer[1]|2:SENSe:AVERage:COUNt

Supported   All Models


This command sets the averaging count value for Channel A or B when automatic averaging is disabled (i.e. manual mode.) The query returns an integer.

Range:  1 to 2048

Key Entry       Averaging Count
System Commands
System Subsystem (:SYSTem)

Default: 1024

:PMETer[1]|2:SENSe:AVERage:COUNt:AUTO

Supported All Models
:SYSTem:PMETer[1]|2:SENSe:AVERage:COUNt:AUTO ON|OFF|1|0

This command enables or disables the automatic averaging mode for Channel A or B. The query returns the state of the automatic averaging mode.

Key Entry Averaging Mode
Default: Auto

:PMETer[1]|2:SENSe:AVERage[:STATe]

Supported All Models
:SYSTem:PMETer[1]|2:SENSe:AVERage[:STATe] ON|OFF|1|0
:SYSTem:PMETer[1]|2:SENSe:AVERage[:STATe]?

This command enables or disables averaging for Channel A or B. The query returns the state of averaging.

Key Entry Averaging Mode


Supported All Models

This command sets channel frequency for channel A or B. The query returns the value.

Key Entry Channel Frequency
Default 50 MHz
System Commands
System Subsystem (:SYSTem)

:PMETer[1]|2:UNIT:POWer

Supported All Models

This command selects the power measurement units for Channel A or B. The query returns that value.

Key Entry Measurement Units dBm W

:PMETer[1]|2[:STATe]

Supported All Models
:SYSTem:PMETer[1]|2[:STATe] ON|OFF|1|0
:SYSTem:PMETer[1]|2[:STATe]?

This command enables or disables the power meter measurements for channel A or B.

Key Entry Averaging Mode > Off

:PMETer:PASSthrough

Supported All Models
:SYSTem:PMETer[1]|2:PASSthrough <"scpiCommand">

Provides a SCPI pass-through method of accessing attached power meters. In this mode, the MXG exposes commands that encapsulate power meter commands, allowing commands and query responses to pass through the MXG.

Remarks It is not possible to use the Power Meter Display and pass-through on the same channel at the same time.

:PMETer:PASSthrough:ENABle

Supported All Models
:SYSTem:PMETer[1]|2:PASSthrough:ENABle 0|1

This command enables/disables the pass-through feature.

Example
SYST:PMET1:PASS:ENAB

The preceding example enables the pass-through feature.
System Commands
System Subsystem (:SYSTem)

Remarks
It is not possible to use the Power Meter Display and pass-through on the same channel at the same time.

:PMETer:PASSt through:TI Meout

Supported All Models
:SYSTem:PMETer[1]|2:PASSt through:TI Meout <value>
:SYSTem:PMETer[1]|2:PASSt through:TI Meout?
This command sets the communication timeout value (seconds = S, milliseconds = MS, microseconds = US).

Example
SYST:PMET1:PASS:TIMEOUT 60S
The preceding example sets the timeout to 60 seconds.

Remarks
It is not possible to use the Power Meter Display and pass-through on the same channel at the same time.

:PMETer:SENSe:CORRection:GAIN2[:INPut][:MAGNitude]

Supported All Models
:SYSTem:PMETer:SENSe:CORRection:GAIN2[:INPut][:MAGNitude]
This command sets gain for channel A or B. The query returns the value.
*RST 0
Range -100 to 100 dB, but ultimately depends the range supported by the power meter/sensor

:PMETer:SENSe:FREQuency[:CW]:COUPling[:STATe]

Supported All Models
:SYSTem:PMETer:SENSe:FREQuency[:CW]:COUPling[:STATe]
This command sets the channel frequency for channel A or B. The channel frequency can be set explicitly (fixed frequency) or coupled to the front panel displayed frequency.
The coupling to the displayed frequency can be expressed as
FreqCh = FreqDisplayed * Multiplier + Offset
*RST OFF|0
Range ON|1 and OFF|0
System Commands
System Subsystem (:SYSTem)

:PMETer:SENSe:FREQuency[:CW]:MULTiplier

Supported   All Models

:SYSTem:PMETer:SENSe:FREQuency[:CW]:MULTiplier

Sets the channel frequency for channel A or B.

The channel frequency can be set explicitly (fixed frequency) or coupled to the front panel displayed frequency.

The coupling to the displayed frequency can be expressed as

\[ FreqCh = FreqDisplayed \times Multiplier + Offset \]

*RST   1.0

Range   -1000 to 1000

:PMETer:SENSe:FREQuency[:CW]:OFFSet

Supported   All Models

:SYSTem:PMETer:SENSe:FREQuency[:CW]:OFFSet

Sets the channel frequency for channel A or B.

The channel frequency can be set explicitly (fixed frequency) or coupled to the front panel displayed frequency.

The coupling to the displayed frequency can be expressed as

\[ FreqCh = FreqDisplayed \times Multiplier + Offset \]

*RST   0

Range   -200 GHz to 200 GHz

:PON:TYPE

Supported   All

:SYSTem:PON:TYPE PRESet|LAST|USER

:SYSTem:PON:TYPE?

This command sets the defined conditions for the signal generator at power on.

PRESet   This choice sets the conditions to factory- or user-defined as determined by the choice for the preset type.

LAST    This choice retains the settings at the time the signal generator was last powered down.

USER    This choice sets the power on state to be the user preset value.
System Commands
System Subsystem (:SYSTem)

**Key Entry**

**Power On Last Preset**

**Remarks**
The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

`:PRESet`

**NOTE**
If this SCPI command is not responding as expected, use the E4428C/38C compatibility command: :SYST:PRESet:TYPE:NORMal to return the front-panel Preset key to its factory default functionality.

**Supported**

All

SYSTem:PRESet

This command returns the signal generator to a set of defined conditions. It is equivalent to pressing the front-panel Preset key.

**Key Entry**

Preset

**Remarks**
The defined conditions are either factory– or user-defined.

Table 3-1  Preset SCPI Commands Overview

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>*RST</td>
<td>This IEEE 488.2 Common Command uses the factory preset settings for the instrument preset.</td>
<td>Optimized for automated testing</td>
</tr>
<tr>
<td>:SYSTem:PRESet:PERSistent</td>
<td>Only the instrument's persistent parameters are returned to factory default value.</td>
<td></td>
</tr>
<tr>
<td>:SYSTem:PON:TYPE:PRESet</td>
<td>Sets the power on state (PON) to be the same as the front-panel green Preset key, or the last state, or to the user state.</td>
<td></td>
</tr>
<tr>
<td>:SYSTem:PRESet</td>
<td>Performs the same preset as currently set for the front-panel green Preset key.</td>
<td></td>
</tr>
<tr>
<td>:SYSTem:PRESet:USER:SAVE</td>
<td>Saves the current instrument state as the user preset state.</td>
<td></td>
</tr>
</tbody>
</table>

`:PRESet:ALL`

**Supported**

All
System Commands
System Subsystem (:SYSTem)

:SYSTem:PRESet:ALL

This command sets all states of the signal generator back to their factory default settings, including states that are not normally affected by signal generator power–on, preset, or *RST.

:PRESet:LANGuage

Supported All

:SYSTem:PRESet:LANGuage

"SCPI" | "COMP" | "8648" | "E4428C" | "E4438C" | "E8257D" | "E8267D" | "E8663B" | "E8247C" | "E8257C" | "E8267C" | "N5181A" | "N5182A" | "E442XB" | "E443XB" | "E8241A" | "E8244A" | "E8251A" | "E8254A" | "SMU200A" | "SMAT E200A" | "SMJ100A" | "SMIQ" | "SML" | "SMV" | "SMR" | "SMF100A" | "MG3691B" | "MG3692B" | "MG3693B" | "MG3694B" | "3410" | "8360" | "8372" | "83732" | "83752" | "8340" | "8644" | "8662" | "8663" | "8664" | "8665"

:SYSTem:PRESet:LANGuage?

This command sets the remote language that is available when the signal generator is preset.

SCPI This choice provides compatibility for SCPI commands.
COMP This choice provides compatibility for the 8656B, 8657A/B signal generator which is supported only through the GPIB interface.
8648 This choice provides compatibility for the 8648A/B/C/D signal generator which is supported only through a GPIB interface.
E4428C or E4438C This choice provides compatibility for the E4428C or E4438C signal generators which are supported through a GPIB, LAN, or USB interface.
E8257D, or E8267D, or E88663B This choice provides compatibility for the E8257D, or E8267D or E8663B signal generators which are supported through a GPIB, LAN, or USB interface.
E8247C, or E8257C, or E8267C This choice provides compatibility for the E8247C, E257C, or E8267C signal generators which are supported through a GPIB, LAN, or USB interface.
N5181A or N5182A This choice provides compatibility for the N5181A or N5182A signal generators which are supported through a GPIB, LAN, or USB interface.
System Commands
System Subsystem (:SYSTem)

E442XB or E443XB
This choice provides compatibility for the E442XB or E443XB signal generators which are supported through a GPIB, LAN, or USB interface.

E8241A or E8244A
This choice provides compatibility for the 8648A/B/C/D signal generator which is supported through a GPIB, LAN, or USB interface.

E8251A or E8254A
This choice provides compatibility for the E8251A or E8254A signal generators which are supported through a GPIB, LAN, or USB interface.

SMU200A, or SMATE200A, or SMJ100A, or SMIQ, or SML, or SMV, or SMR, or SMF100A
This choice provides compatibility for the Rohde and Schwartz SMU200A, SMATE200A, SMJ100A, SMIQ, SML, SMV, SMR, or SMF100A signal generators which are supported through a GPIB, LAN, or USB interface.

MG3691B, or MG3692B, or MG3693B, or MG3694B
This choice provides compatibility for the Anritsu MG3691B, MG3692B, MG3693B, or MG3694B signal generators which are supported through a GPIB, LAN, or USB interface.

3410
This choice provides compatibility for the Aeroflex 3410 signal generator which are supported through a GPIB, LAN, or USB interface.

8360
This choice provides compatibility for 8360 series signal generators.

83712, or 83732, or 83752
This choice provides compatibility for the 83712A/B, 83732A/B, or 83752A/B signal generator.

8340
This choice provides compatibility for the 8340A/B signal generator.

8644
This choice provides compatibility for the 8644A/B signal generator.
System Commands
System Subsystem (:SYSTem)

8662, or
8663, or
8664, or
8665
This choice provides compatibility for the 8662A, 8663A, 8664A, or 8665A signal generator.

*RST
"SCPI"

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>SCPI</th>
<th>SMJ100A</th>
<th>8648A/B/C/D</th>
<th>E8257D, E8267D, E8663B</th>
</tr>
</thead>
<tbody>
<tr>
<td>SML</td>
<td>3410 Series</td>
<td>8656B, 8657A/B</td>
<td>E8241A, E8244A, E8251A, E8264A</td>
<td></td>
</tr>
<tr>
<td>SMV</td>
<td>E4428C, E4438C</td>
<td>SMU200A, SMATE200A</td>
<td>8662A</td>
<td></td>
</tr>
<tr>
<td>SMIQ</td>
<td>E442xB, E443xB</td>
<td>E8247C, E8257C, E8267C</td>
<td>8663A</td>
<td></td>
</tr>
</tbody>
</table>

Remarks
After setting a new preset language and presetting the instrument, some defaults may change to the preset values of the instrument indicated by the remote language.

:PRESet:PERSistent
Supported All

This command sets the states that are not affected by signal generator power–on, preset, or *RST to their factory default settings.

Key Entry Restore System Settings to Default Values
Remarks For a list of the persistent instrument factory default values refer to the Programming Guide.

:PRESet:TYPE
Supported All

This command defines the Preset key as either factory preset or as the user preset saved in memory.

NORMal This choice uses the factory–defined defaults when Preset is pressed.
System Commands
System Subsystem (:SYSTem)

COMP
This choice uses the user–defined preset saved in the instrument when Preset is pressed. Refer to :PRESet:USER and :PRESet:USER:SAVE commands.

Key Entry Preset

Remarks This command will return an error, if the USER parameter is sent without a user preset saved in the instrument.

:PRESet:USER

Supported All

:SYSTem:PRESet:USER
This command presets the signal generator to the user’s saved state.

Key Entry Execute User Preset

Remarks This command presets the signal generator to the saved user–defined state.

:PRESet:USER:SAVE

Supported All

This command saves your user–defined preset conditions to a state file.

Key Entry Save User Preset

Remarks Only one user–defined preset file can be saved. Subsequent saved user–defined preset files will overwrite the previously saved file.

:SANalyzer:COMMunicate:LAN:DEVice

Supported All Models

:SYSTem:SANalyzer:COMMunicate:LAN:DEVice <deviceName>
:SYSTem:SANalyzer:COMMunicate:LAN:DEVice?
This command enters a VXI–11 name for a signal analyzer that is being controlled by the signal generator for making spectral measurements. If connecting directly to the signal analyzer, enter the name as specified on your signal analyzer documentation. If connecting through a LAN–GPIB gateway, enter the SICL address of the signal analyzer.

Key Entry SA VXI–11 Device Name
Remarks

The setting enabled by this command is not affected by signal generator power-on, preset, or *RST.

:SAnalyze:COMMunicate:LAN:IP

Supported

All Models

:SYSTem:SAnalyze:COMMunicate:LAN:IP?

This command sets the internet protocol (IP) address for the spectrum analyzer that is controlled by the signal generator for making spectral measurements. If connecting to a GPIB signal analyzer through a LAN–GPIB gateway, this command sets the IP address of the gateway.

Key Entry

Signal Analyzer IP Address

Remarks

The setting enabled by this command is not affected by signal generator power-on, preset, or *RST.

Ensure that the signal analyzer IP address is different from the signal generator address.
System Commands
System Subsystem (:SYSTem)

:SANalyzer:COMMunicate:LAN:PORT

Supported All Models

:SYSTem:SANalyzer:COMMunicate:LAN:PORT <portNum>
:SYSTem:SANalyzer:COMMunicate:LAN:PORT?

This command...
This command sets the IP port on the signal analyzer that is controlled by the signal generator.

Key Entry Signal Analyzer IP Port
5025 Standard mode. The command enables standard mode for simple programming.
5024 Telnet mode. The command enables the telnet SCPI service for programming.

For firmware versions <A.01.51, the default telnet mode is 5023. For firmware versions A.01.51 and greater, telnet port 5023 is still available for backwards compatibility.

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.
For more information on standard mode and telnet SCPI mode, refer to the Programming Guide.

:SANalyzer:COMMunicate:TYPE

Supported All Models

:SYSTem:SANalyzer:COMMunicate:TYPE SOCKets|SOCKETS|VXI11
:SYSTem:SANalyzer:COMMunicate:TYPE?

This command sets the type of control connection for communication with the external signal analyzer for spectral measurements. The query returns the connection type.

Key Entry Connection Type
SOCK or SOCKETS The command enables the signal analyzer for sockets LAN control through the signal generator.
VXI11 The command enables the signal analyzer for VXI–11 control through the signal generator. A signal analyzer with GPIB can be controlled through VXI–11 using a LAN–GPIB gateway.
USB The command enables the signal analyzer for USB control through the signal generator.
System Commands
System Subsystem (:SYSTem)

Remarks
The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:SECurity:DISPlay

Supported
All Models with Option 006

:SYSTem:SECurity:DISPlay ON|OFF|1|0
:SYSTem:SECurity:DISPlay?

This command enables or disables the secure display mode.

ON (1) This selection turns the signal generator display back on, showing the current settings. Cycling the signal generator power also restores the display. Note that the current instrument state may be retained across reboots depending on the power-on configuration choice. See :PON:TYPE command for information on the power-on choices available.

OFF (0) This selection blanks the signal generator’s display, hiding the settings and disabling the front-panel keys. While in this mode, the display shows *** SECURE DISPLAY ACTIVATED ***.

For more information about security functions, refer to the User's Guide.

Example
:SYST:SEC:DISP OFF
The preceding example enables the secure display mode.

*RST 1

Range N/A

Key Entry Activate Security Display

:SECurity:DISPlay:RESTricted

Supported All Models

:SYSTem:SECurity:DISPlay:RESTricted ON|OFF|1|0
:SYSTem:SECurity:DISPlay:RESTricted?

This command enables or disables the secure restricted display mode. See also, :ANNotation:AMPLitude[:STATe] and :ANNotation:FREQuency[:STATe] commands.

ON (1) This selection turns on the secure restricted display, blanking the frequency. Also, the keys that access the frequency, sweep, and user flatness information are disabled.
System Commands
System Subsystem (:SYSTem)

OFF (0)  This selection turns off the secure restricted display mode, allowing the signal generator's display to show the current frequency.

For more information about security functions, refer to the User's Guide.

Example

:SYST:SEC:DISP:REST ON

The preceding example enables the security restricted display mode.

*RST  0

Key Entry  Activate Restricted Display

:SECurity:ERASeall

Supported  All Models with Option 006

:SYSTem:SECurity:ERASeall

This command removes all user files, flatness correction files, and baseband generator files. In addition, all table editor files are returned to their original factory values.

This command differs from the :DELete:ALL command, which does not reset table editors to factory values. For more information about security functions, refer to the User's Guide.

Key Entry  Erase All

:SECurity:SANitize

Supported  All Models with Option 006

:SYSTem:SECurity:SANitize

This command removes all user files, table editor files values, flatness correction files, and baseband generator files. The memory is then overwritten with a sequence of data as described below. For more information about security functions, refer the User's Guide.

SrAM  All addressable locations will be overwritten with random characters.

HARD DISK  All addressable locations will be overwritten with a single character and then a random character.

FLASH MEMORY  The flash blocks will be erased.

Key Entry  Erase and Sanitize All
System Commands
System Subsystem (:SYSTem)

:SSAVer:DELa_y

Supported All
:SYSTem:SSAVer:DELa_y <value>
:SYSTem:SSAVer:DELa_y?

This command sets the amount of time before the display light or display light and text is switched off. This will occur if there is no input through the front panel during the delay period.

The variable <value> is a whole number measured in hours.

Range 1 to 12
Key Entry Screen Saver Delay:
Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.
Refer to :SSAVer:MODE command for selecting the screen saver mode.

:SSAVer:MODE

Supported All
:SYSTem:SSAVer:MODE LIGHT TEXT
:SYSTem:SSAVer:MODE?

This command toggles the screen saver mode between light only or light and text.

LIGHT This choice enables only the light to turn off during the screen saver operation while leaving the text visible on the darkened screen.

TEXT This choice enables both the display light and text to turn off during the screen saver operation.

Key Entry Screen Saver Mode
Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:SSAVer:STATe

Supported All
:SYSTem:SSAVer:STATe ON OFF 1 0
:SYSTem:SSAVer:STATe?

This command enables or disables the display screen saver.

Key Entry Screen Saver Off On
System Commands
System Subsystem (:SYSTem)

Remarks
The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:TIME

Supported All

:SYSTem:TIME <hour>,<minute>,<second>
:SYSTem:TIME?

This command sets the time displayed in the lower right area of the signal generator's display.

Range
<hour>: 0 to 23  <minute>: 0 to 59  <second>: 0 to 59

Key Entry
Time/Date

:VERSion

Supported All

:SYSTem:VERSion?

This command returns the SCPI version number with which the signal generator complies.
Trigger Subsystem

:ABORt

**Supported**  All

:ABORt

This command causes the List or Step sweep in progress to abort. If INIT:CONT[:ALL] is set to on, the sweep will immediately re-initiate. The pending operation flag affecting *OPC, *OPC?, and *WAI will undergo a transition once the sweep has been reset.

:INITiate:CONTinuous[:ALL]

**Supported**  All

:INITiate:CONTinuous[:ALL]  ON|OFF|1|0

:INITiate:CONTinuous[:ALL]?

This command selects either a continuous or single list or step sweep. Execution of this command does not affect a sweep in progress.

**ON (1)**  This choice selects continuous sweep where, after the completion of the previous sweep, the current sweep will restart automatically or wait until the appropriate trigger source is received.

**OFF (0)**  This choice selects a single sweep. Refer to :INITiate[:IMMediate][:ALL] for single sweep triggering information.

**RST**  0

**Key Entry**  **Sweep Repeat Single Cont**

**Remarks**  Execution of this command will not affect a sweep in progress.

:INITiate[:IMMediate][:ALL]

**Supported**  All

:INITiate[:IMMediate][:ALL]

This command either sets or sets and starts a single List or Step sweep, depending on the trigger type. The command performs the following:

- arms a single sweep when BUS, EXternal, or KEY is the trigger source selection
- arms and starts a single sweep when IMMEDIATE is the trigger source selection
System Commands
Trigger Subsystem

This command is ignored if a sweep is in progress. See :INITiate:CONTinuous[:ALL] command for setting continuous or single sweep. See :TRIGger[:SEQUence]:SOURce command to select the trigger source.

### Key Entry

<table>
<thead>
<tr>
<th>Single Sweep</th>
</tr>
</thead>
</table>

:TRIGger:EXTernal:SOURce

**Supported**

All

:TRIGger:EXTernal:SOURce TRIGger[1]|TRIGger2|PULSe

:TRIGger:EXTernal:SOURce?

This command selects the external trigger source. With external triggering, the selected bi-directional BNC is configured as an input.

**TRIGger1**

This choice selects the TRIG 1 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

**TRIGger2**

This choice selects the TRIG 2 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

**PULSe**

This choice selects the PULSE BNC as the external trigger source for triggering sweep, point and function generator sweeps.

**Example**

:TRIG:EXT:SOUR PULS

The preceding example sets the external trigger source to the PULSE BNC.

*RST TRIGger1

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Trigger 1</th>
<th>Trigger 2</th>
<th>Pulse</th>
</tr>
</thead>
</table>

:TRIGger:INTernal:SOURce

**Supported**

All

:TRIGger:INTernal:SOURce PVIDeo|PSYNc

:TRIGger:INTernal:SOURce?

This command selects the internal trigger source.

**PVIDeo**

This choice selects Pulse Video as the internal trigger source for triggering sweep, point and function generator sweeps.

**PSYNc**

This choice selects Pulse Sync as the internal trigger source for triggering sweep, point and function generator sweeps.
**System Commands**

**Trigger Subsystem**

**Example**

:TRIG:INT:SOUR PVID

The preceding example sets the internal trigger source to Pulse Video.

*RST PSYN

**Key Entry** Pulse Video Pulse Sync


**Supported** All

:TRIGger:OUTPut[1]|2:POLarity POSitive|NEGative
:TRIGger:OUTPut[1]|2:POLarity?

Sets the polarity of the TTL signal output at the selected (TRIG 1 or TRIG 2) output BNC.

**Example**

:TRIG:OUTP2:POL NEG

The preceding example sets the signal polarity to be reversed at the TRIG 2 BNC when the trigger is present.

*RST POS

**Key Entry** Trigger Out 1 Polarity Trigger Out 2 Polarity

Neg Pos

:TRIGger[:SEQuence]:SLOPe

**Supported** All

:TRIGger[:SEQuence]:SLOPe POSitive|NEGative
:TRIGger[:SEQuence]:SLOPe?

This command sets the polarity of an external signal at the TRIG 1, TRIG 2, or PULSE BNC (see :TRIGger:EXTernal:SOURce) or internal Pulse Video or Pulse Sync signal (see :TRIGger:INTernal:SOURce) that will trigger a list or step sweep.

**Example**

:TRIGger[:SEQuence]:SLOPe POSitive

The signal generator triggers an event when it detects a rising edge on the source signal.
System Commands
Trigger Subsystem

NEGative  The signal generator triggers an event when it detects a falling edge on the source signal

*RST  POS

Key Entry  Int/Ext Trigger Polarity Neg Pos

:TRIGger[:SEQUence]:SOURce

Supported  All

:TRIGger[:SEQUence]:SOURce
BUS|IMMediate|EXTernal|INTernal|KEY|TIMer|MANual
:TRIGger[:SEQUence]:SOURce?

This command sets the sweep trigger source for a list or step sweep.

BUS  This choice enables GPIB triggering using the *TRG or GET command. The *TRG SCPI command can be used with any combination of GPIB, LAN, or USB. The GET command requires USB, GPIB, or LAN–VXI–11.

IMMediate  This choice enables immediate triggering of the sweep event.

EXTernal  This choice enables the triggering of a sweep event by an externally applied signal at the TRIG 1, TRIG 2 or PULSE connector (see :TRIGger:EXTernal:SOURce).

INTernal  This choice enables the triggering of a sweep event by an internal Pulse Video or Pulse Sync signal (see :TRIGger:INTernal:SOURce).

KEY  This choice enables triggering through front panel interaction by pressing the Trigger key.

TIMer  This choice enables the sweep trigger timer.

MANual  This choice enables manual sweep triggering.

*RST  IMM

Remarks  The wait for the BUS, EXTernal, or KEY trigger can be bypassed by sending the :TRIGger[:SEQUence][:IMMediate] command.

Example

:TRIG:SOUR BUS

The preceding example sets the sweep trigger source to BUS.

*RST  IMM

Key Entry  Bus  Free  EXT  INT  Trigger Key  Timer
Run

Keysight CXG, EXG, and MXG X-Series Signal Generators SCPI Command Reference  245
System Commands
Trigger Subsystem

:TRIGger[:SEQuence]:TIMer

Supported    All Models

:TRIGger[:SEQuence]:TIMer <period>
:TRIGger[:SEQuence]:TIMer?

This command sets the period of the timer trigger.

*RST    1 ms
Range    .5 ms to 1000 seconds
Key Entry    Trig Timer Period

:TRIGger[:SEQuence][:IMMediate]

Supported    All Models

:TRIGger[:SEQuence][:IMMediate]

This event command causes an armed List or Step sweep to immediately start without the selected trigger occurring.

:TSWeep

Supported    All Models

[:SOURce]:TSWeep

This command aborts the current sweep, then either arms or arms and starts a single list, depending on the trigger type.

The command performs the following:

– arms a single sweep when BUS, EXternal, or Trigger KEY is the trigger source selection

– arms and starts a single sweep when IMMediate is the trigger source selection

Key Entry    Single Sweep
System Commands
Unit Subsystem (:UNIT)

Unit Subsystem (:UNIT)

:POWer

**Supported**

All

:UNIT:POWer DBM|DBUV|DBUVEMF|V|VEMF|DB

:UNIT:POWer?

This command terminates an amplitude value in the selected unit of measure.

If the amplitude reference state is set to on, the query returns units expressed in dB and the dB choice will be displayed. Setting any other unit will cause a setting conflict error stating that the amplitude reference state must be set to off. Refer to, :REFerence:STATe command for more information.

*RST DBM

**Key Path**

AMPTD > keypad entry > Power Units

**Remarks**

All power values in this chapter are shown with dBm as the unit of measure. If a different unit of measure is selected, replace dBm with the newly selected unit whenever it is indicated for the value.

:VOLT:TYPE

**Supported**

All

:UNIT:VOLT:TYPE PD|EMF

:UNIT:VOLT:TYPE?

This command scales the voltage values to display potential differences or electromagnetic force.

**Potential Difference**

This choice sets the instrument to PD mode where the output voltage assumes that a 50 ohm load is connected. PD is the default mode of the instrument.

**Electro–motive Force**

This choice sets the instrument to EMF mode where the output voltage assumes no load is connected. The EMF value is twice the PD value.

*RST PD
System Commands
Unit Subsystem (:UNIT)
4  Analog Modulation Commands

With firmware version B.01.75 or later, the following options have changed to a new eight-digit format:

- Option 302 to Option N5180302B
- Option 320 to Option N5180320B
- Option 403 to Option N5180403B
- Option 430 to Option N5180430B
- Option 431 to Option N5180432B
- Option 432 to Option N5180431B
- Option UN7 to Option N5180UN7B

Only software options are changed to the eight-digit format. Hardware options remain with three-digits.

This chapter describes SCPI commands for subsystems dedicated to analog commands common to all Keysight X-Series signal generators.

This chapter contains the following sections:

- **Amplitude Modulation Subsystem–Option UNT ([SOURce])** on page 250
- **Frequency Modulation Subsystem–Option UNT ([SOURce])** on page 263
- **Low Frequency Output Subsystem ([SOURce]:LFOutput)** on page 274
- **Phase Modulation Subsystem–Option UNT ([SOURce])** on page 286
- **Pulse Modulation Subsystem–Options UNW and N5180320B ([SOURce])** on page 298
Amplitude Modulation Subsystem–Option UNT ([:SOURce])

:AM[1]|2[:DEPTh]:EXPonential

Supported
All Models with Option UNT

[:SOURce]:AM[1]|2 [:DEPTh]:EXPonential <value>

[:SOURce]:AM[1]|2 [:DEPTh]:EXPonential?

This commands sets the amplitude modulation depth in dB.

*RST +4.00000000E+001

Range 0 to 40 dB

Key Entry AM Depth

Remarks Refer to :AM[:DEPTh]:STEP[:INCRement] command for setting the value associated with UP and DOWN choices.

:AM[1]|2[:DEPTh][:LINear]

Supported
All Models with Option UNT

[:SOURce]:AM[1]|2 [:DEPTh] [:LINear] <value><unit>|UP|DOWN

[:SOURce]:AM[1]|2 [:DEPTh] [:LINear]?

This commands sets the amplitude modulation depth in percent.

*RST +1.00000000E–001

Range 0.0 to 100%

Key Entry AM Depth

Remarks Refer to :AM[:DEPTh]:STEP[:INCRement] command for setting the value associated with UP and DOWN choices.

:AM[1]|2[:DEPTh][:LINear]:TRACk

Supported
All models with Option UNT

[:SOURce]:AM[1]|2 [:DEPTh] [:LINear]:TRACk ON|OFF|1|0

[:SOURce]:AM[1]|2 [:DEPTh] [:LINear]:TRACk?

This command enables or disables AM depth value coupling between AM paths 1 and 2. When the depth values are coupled, a change made to one path is applied to both. LINear must be the AM type for this command to have any affect. To set the AM measurement type, use the :AM[1]|2:TYPE command.

ON (1) This choice will link the depth value of AM[1] with AM2; AM2 will assume the AM[1] depth value. For example, if AM[1] depth is set to 15% and AM2 is set to 11%,
Analog Modulation Commands

Amplitude Modulation Subsystem–Option UNT ([SOURce])

enabling the depth tracking will cause the AM2 depth value to change to 15%. This applies regardless of the path (AM[1] or AM2) selected in this command.

OFF (0) This choice disables coupling and both paths will have independent depth values.

Example

:AM1:TRAC ON
The preceding example enables AM depth coupling between AM path 1 and AM path 2.

*RST 0
Key Entry AM Depth Couple Off On

:AM[:DEPTh]:STEP[:INCRement]

Supported All Models with Option UNT

[:SOURce]:AM[:DEPTh]:STEP[:INCRement] <value><unit>
[:SOURce]:AM[:DEPTh]:STEP[:INCRement]?

This command sets the AM depth step increment.

Range 0.1–100%
Key Entry Incr Set
Remarks The value set by this command is used with the UP and DOWN choices for the AM depth setting. Refer to :AM[1]|2[:DEPTh][:LINear] command for more information.

The setting enabled by this command is not affected by signal generator power-on, preset, or *RST.


Supported All Models with Option UNT


This command sets the coupling for the amplitude modulation source through the selected external input connector.

AC This choice will only pass ac signal components.
DC This choice will pass both ac and dc signal components.
*RST DC
Key Entry Ext Coupling DC AC
Analog Modulation Commands
Amplitude Modulation Subsystem–Option UNT ([SOURce])

Remarks  The command does not change the currently active source or switch the current modulation on or off. The modulating signal may be the sum of several signals, either internal or external sources.

:AM[:SOURce]:AM[:SOURce]:EXTernal[:SOURce]:IMPedance

Supported  All Models with Option UNT

[:SOURce]:AM[:SOURce]:AM[:SOURce]:EXTernal[:SOURce]:IMPedance  50 | 600 | 1000000
[:SOURce]:AM[:SOURce]:AM[:SOURce]:EXTernal[:SOURce]:IMPedance?

This command sets the input impedance for the externally-applied AM input signal.

50  This choice selects 50 Ohm input impedance.
600  This choice selects 600 Ohm input impedance.
1000000  This choice selects 1 MOhm input impedance.
*RST  50 Ohm

Key Entry  Ext Impedance  50 Ohm  600 Ohm  1 MOhm

:AM[:SOURce]:AM[:SOURce]:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent

Supported  All Models with Options UNT and 303

[:SOURce]:AM[:SOURce]:AM[:SOURce]:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent <value><unit>
[:SOURce]:AM[:SOURce]:AM[:SOURce]:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent?

This command sets the amplitude of tone 2 of the internal dual function generator source as a percent of the peak analog modulation amplitude. Tone 1 of the internal dual function generator source will make up the remaining amplitude.

*RST  50.0

Range  0 to 100.0 percent

Key Entry  AM Tone 2 Ampl % of Peak

:AM[:SOURce]:AM[:SOURce]:INTernal:DUAL:FUNCtion2:POFFset

Supported  All Models with Options UNT and 303

[:SOURce]:AM[:SOURce]:AM[:SOURce]:INTernal:DUAL:FUNCtion2:POFFset <value><unit>
[:SOURce]:AM[:SOURce]:AM[:SOURce]:INTernal:DUAL:FUNCtion2:POFFset?
Analog Modulation Commands
Amplitude Modulation Subsystem–Option UNT ([:SOURce])

This command sets the phase offset in degrees or radians of tone 2 in relation to tone 1 of the internal dual function generator source.

*RST  0.000 rad

Range  -6.290 to 6.290 rad
         -360.4 to 360.4 deg

Key Entry  AM Tone 2 Phase Offset


Supported  All Models with Options UNT and 303


Sets the frequency of tone 1 (default) or tone 2 of the internal dual function generator source.

*RST  400.0 Hz

Range  100.0 mHz to 6.25 MHz

Key Entry  AM Tone 1 Freq   AM Tone 2 Freq


Supported  All Models with Options UNT and 303


This command sets the shape of tone 1 (default) or tone 2 of the internal dual function generator source.

*RST  SINE

Key Entry  AM Tone 1 Waveform   AM Tone 2 Waveform


Supported  All Models with Options UNT and 303

Analog Modulation Commands
Amplitude Modulation Subsystem–Option UNT ([SOURce])

This command sets the ramp direction of the selected tone (1 or 2) of the internal dual function generator source when :AM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe is set to RAMP.

*RST POS

Key Entry Pos Ramp Neg Ramp


Supported All Models with Option UNT


This command sets the internal amplitude modulation rate for the following applications:

– the start frequency for a swept-sine waveform
– the frequency rate for all other waveforms

*RST +4.00000000E+002

Range Swept-Sine & Sine: 0.1 Hz–20 MHz

Key Entry AM Rate


Supported All Models with Options UNT and 303


This command sets the phase offset in degrees or radians of internal function generator source.

*RST 0.000 rad

Range -6.290 to 6.290 rad
-360.4 to 360.4 deg

Key Entry AM Phase Offset


Supported All Models with Options UNT
Analog Modulation Commands
Amplitude Modulation Subsystem–Option UNT ([SOURce])

SINE|TRIangle|SQUare|RAMP|PULSe

This command sets the AM waveform type.

*RST SINE

Remarks SINE is the only shape available without Option 303.

Key Entry AM Waveform


Supported All Models with Options UNT and 303


This command sets the ramp direction when :AM[1]|2:INTernal:FUNCTION[1]|2:SHAPe is set to RAMP.

*RST POS

Key Entry Pos Ramp Neg Ramp


Supported All Models with Options UNT and 303


This command sets the noise type when :AM[1]|2:SOURce is set to NOISe[1] or NOISe2.

*RST POS

Key Entry Noise Gen 1 Noise Gen 2


Supported All Models with Options UNT and 303

[:SOURce]:AM[1]|2:INTernal:SWEep:FUNCTION:FREQuency:STARt <val><units>
[:SOURce]:AM[1]|2:INTernal:SWEep:FUNCTION:FREQuency:STARt?

This command sets the start frequency for the swept function generator.

*RST 400.0 Hz

Range 100 mHz to 6.250 MHz
Analog Modulation Commands
Amplitude Modulation Subsystem–Option UNT ([SOURce])

Key Entry AM Start Freq


Supported All Models with Options UNT and 303


This command sets the stop frequency for the swept function generator.

*RST 400.0 Hz

Range 100 mHz to 6.250 MHz

Key Entry AM Stop Freq


Supported All Models with Options UNT and 303

[:SOURce]:AM[1]|2:INTernal:SWEep:FUNCtion:SHAPe SINE|TRIangle|SQUare|RAMP

This command sets the AM waveform type for the swept function generator.

*RST SINE

Key Entry AM Sweep Waveform


Supported All Models with Options UNT and 303


This command sets the ramp direction for the swept function generator when :AM[1]|2:INTernal:SWEep:FUNCtion:SHAPe is set to RAMP.

*RST POS

Key Entry Pos Ramp Neg Ramp


Supported All Models with Options UNT and 303

Analog Modulation Commands
Amplitude Modulation Subsystem–Option UNT ([SOURce])

This command sets the sweep rate for the AM swept–sine waveform. The sweep rate function is only available for internal source 1.

*RST +4.00000000E+002
Range 0.5 Hz to 100 kHz
Key Entry AM Sweep Rate


Supported All Models with Options UNT and 303

[[:SOURce]:AM[1]|2:INTernal:SWEep:SHAPe SAWTooth|TRIangle
[[:SOURce]:AM[1]|2:INTernal:SWEep:SHAPe?

This command selects the sweep shape.

SAWTooth A sawtooth sweep shape only sweeps from start freq to stop freq.
TRIangle A triangle sweep sweeps from start freq to stop freq and back to start freq. With a triangle shape sweep you can choose a different sweep rate for start freq to stop freq and another sweep rate for stop freq to start freq.

*RST SAWTooth

Key Entry AM Sweep Shape


Supported All Models with Options UNT and 303

[[:SOURce]:AM[1]|2:INTernal:SWEep:TIME:COUPled ON|OFF|1|0

This command sets the couplings between start-to-stop values and stop-to-start values for AM sweep times and rates. The sweep times coupled to on.

Use this command when [:SOURce]:AM[1]|2:INTernal:SWEep:SHAPe is set to TRIangle.

ON|1 This choice uses the same sweep time for both start freq to stop freq and stop freq to start freq sweeps of a triangle shape sweep. If sweep times coupled is ON, sweep time and rate is only set by the Start -> Stop softkeys.
OFF|0 This choice disables sweep time couplings.

*RST OFF

Key Entry AM Sweep Times Coupled Off On
Analog Modulation Commands
Amplitude Modulation Subsystem–Option UNT ([SOURce])


**Supported** All Models with Options UNT and 303


This command sets the sweep rate for the amplitude-modulated, swept-sine waveform.

*RST +1.00000000E−001

Range 1mS–65.535S

**Key Entry** AM Sweep Time


**Supported** All Models with Options UNT and 303

[:SOURce]:AM[1]|2:INTernal:SWEep:TRIGger
BUS|IMMediate|EXTernal|INTernal|KEY
[:SOURce]:AM[1]|2:INTernal:SWEep:TRIGger?

This command sets the trigger source for the amplitude modulated swept-sine waveform.

**BUS** This choice enables GPIB triggering using the *TRG or GET command or LAN and RS-232 triggering using the *TRG command.

**IMMediate** This choice enables immediate triggering of the sweep event.

**EXTernal** This choice enables the triggering of a sweep event by an externally applied signal at the TRIG 1, TRIG 2, or PULSE BNC connector.

**INTernal** This choice enables the triggering of a sweep event by an internal Pulse Video or Pulse Sync signal.

**KEY** This choice enables triggering through front panel interaction by pressing the **Trigger** key.

*RST IMM

**Key Entry** Bus Free Run Ext Int Trigger Key


**Supported** All Models with Options SOURce
Analog Modulation Commands
Amplitude Modulation Subsystem–Option UNT ([SOURce])

TRIGger[1]|TRIGger2|PULSe

This command selects the external trigger source for the AM swept-sine waveform. With external triggering, the selected bi-directional BNC is configured as an input.

<table>
<thead>
<tr>
<th></th>
<th>Trigger 1</th>
<th>Trigger 2</th>
<th>Pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRIGger1</td>
<td>This choice selects the TRIG 1 BNC as the external trigger source for triggering sweep, point and function generator sweeps.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRIGger2</td>
<td>This choice selects the TRIG 2 BNC as the external trigger source for triggering sweep, point and function generator sweeps.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PULSe</td>
<td>This choice selects the PULSE BNC as the external trigger source for triggering sweep, point and function generator sweeps.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*RST</td>
<td>TRIGger1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key Entry Pulse Video Pulse Sync


Supported All Models with Options UNT and 303

PVIDeo|PSYNc

This command selects the internal trigger source for the AM swept-sine waveform.

<table>
<thead>
<tr>
<th></th>
<th>Trigger 1</th>
<th>Pulse Video</th>
<th>Pulse Sync</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVIDeo</td>
<td>This choice selects Pulse Video as the internal trigger source for triggering sweep, point and function generator sweeps.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSYNc</td>
<td>This choice selects Pulse Sync as the internal trigger source for triggering sweep, point and function generator sweeps.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*RST</td>
<td>PSYN</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key Entry Pulse Video Pulse Sync
Analog Modulation Commands
Amplitude Modulation Subsystem–Option UNT ([SOURce])


**Supported** All Models with Options UNT and 303

POSitive|NEGative
[:SOURce]:AM[1]|2:INTernal:SWEep:TRIGger:SLOPe?

This command sets the polarity of an external signal at the TRIG 1, TRIG 2, or PULSE BNC (see :AM[1]|2:INTernal:SWEep:TRIGger:EXTERNAL:SOURce) or internal Pulse Video or Pulse Sync signal (see :AM[1]|2:INTernal:SWEep:TRIGger:INTERNAL:SOURce) that will trigger a list or step sweep.

**POSitive** The signal generator triggers an event when it detects a rising edge on the source signal

**NEGative** The signal generator triggers an event when it detects a falling edge on the source signal

*RST

**Key Entry** Int/Ext Trigger Polarity Neg Pos

:AM:MODE

**Supported** All Models with Option UNT

[:SOURce]:AM:MODE DEEP|NORMAL

[:SOURce]:AM:MODE?

This command sets the amplitude modulation mode. **DEEP** provides an AM depth with greater dynamic range. **NORMAL** sets AM to standard operation.

**Default** DEEP

**Key Entry** AM Mode Normal Deep

**Remarks** The RF carrier is modulated when you have set the signal generator’s modulation state to ON, see :MODulation[:STATe] command for more information.

Whenever amplitude modulation is enabled, the AM annunciator is turned on in the display.

:AM[1]|2:SOURce

**Supported** All Models with Option UNT

[:SOURce]:AM[1]|2:SOURce

[:SOURce]:AM[1]|2:SOURce?

This command sets the source to generate the amplitude modulation.
Analog Modulation Commands
Amplitude Modulation Subsystem–Option UNT ([SOURce])

FUNCTION[1]  Selects function generator 1 as the modulation source.
FUNCTION[2]  Selects function generator 2 as the modulation source.
SWEep  Selects the swept function generator as the modulation source.
DUAL  Selects the dual function generator as the modulation source.
NOISe[1]  Selects noise generator 1 as the modulation source.
NOISe2  Selects noise generator 2 as the modulation source.
EXT[1]  Selects an externally applied signal as the modulation input. Connect the signal to the EXT 1 connector.
EXT2  Selects an externally applied signal as the modulation input. Connect the signal to the EXT 2 connector.

*RST  FUNCTION[1]

Key Entry  Ext1  Func Gen 1  Dual Func Gen  Noise Gen 1

Ext2  Func Gen 2  Swept Func Gen  Noise Gen 2

Remarks  A 1.0 Vp input is required for calibrated AM depth settings.

The externally applied, ac-coupled input signal is tested for a voltage level and a display annunciator will report a high or low condition if that voltage is > ±3% of 1 Vp.

Only FUNC1, FUNC2, EXT1 and EXT2 are available without Option 303.

:AM[1]|2:STATe

Supported  All Models with Option UNT

[:SOURce]:AM[1]|2:STATe ON|OFF|1|0
[:SOURce]:AM[1]|2:STATe?

This command enables or disables the amplitude modulation for the selected path.

*RST  0

Key Entry  AM Off On

Remarks  The RF carrier is modulated when you have set the signal generator’s modulation state to ON, see :MODulation[:STATe] command for more information.
Analog Modulation Commands
Amplitude Modulation Subsystem–Option UNT ([:SOURce])

Whenever amplitude modulation is enabled, the AM annunciator is turned on in the display.

:AM[1]|2:TYPE

**Supported**  All models with Option UNT

[:SOURce]:AM[1]|2:TYPE LINear|EXPonential

This command sets the AM type to linear or exponential AM.

**Example**

:AM2:TYPE EXP

The preceding example selects exponential type depth values for AM path 2.

*RST  LIN

**Key Entry**  AM Type LIN EXP

:AM:WIDeband:STATe

**Supported**  All Models with Option UNT

[:SOURce]:AM:WIDeband:STATe ON|OFF|1|0

This command toggles the state of wideband AM, which provides bandwidth beyond that of standard AM by utilizing an external modulating signal connected to the I Input.

*RST  0

**Key Entry**  AM Path 1 2 WB  AM Off On

**Remarks**  Instruments that have 9kHz as their lowest frequency cannot have wideband AM at frequencies from 9kHz up to 5MHz.
Frequency Modulation Subsystem–Option UNT ([:SOURce])


Supported All Models with Option UNT


This command sets the coupling for the frequency modulation source through the selected external input connector.

Use this command with the EXTernal[1]|2:DC command to remove the effects of DC and optimize the DCFM calibration.

AC  This choice only passes ac signal components.
DC  This choice passes both ac and dc signal components.
*RST DC

Key Entry Ext Coupling DC AC

Remarks The command does not change the currently active source or switch the current modulation on or off. The modulating signal may be the sum of several signals, either internal or external sources.


Supported All Models with Option UNT

[:SOURce]:FM:EXTernal[1]|2:IMPedance 50|600|1000000
[:SOURce]:FM:EXTernal[1]|2:IMPedance?

This command sets the input impedance for the externally-applied FM input signal.

50  This choice selects 50 Ohm input impedance.
600 This choice selects 600 Ohm input impedance.
1000000 This choice selects 1 MOhm input impedance.
*RST 50 Ohm

Key Entry Ext Impedance 50 Ohm 600 Ohm 1 MOhm


Supported All Models with Options UNT and 303

Analog Modulation Commands
Frequency Modulation Subsystem–Option UNT ([:SOURce])

This command sets the amplitude of tone 2 of the internal dual function generator source as a percent of the peak analog modulation amplitude. Tone 1 of the internal dual function generator source will make up the remaining amplitude.

*RST  50.0
Range  0 to 100.0%

Key Entry  FM Tone 2 Ampl % of Peak


Supported All Models with Options UNT and 303


This command sets the phase offset in degrees or radians of tone 2 in relation to tone 1 of the internal dual function generator source.

*RST  0.000 rad
Range  -6.290 to 6.290 rad
-360.4 to 360.4 deg

Key Entry  FM Tone 2 Phase Offset


Supported All Models with Options UNT and 303


This command sets the frequency of tone 1 (default) or tone 2 of the internal dual function generator source.

*RST  400.0 Hz
Range  100.0 mHz to 6.25 MHz

Key Entry  FM Tone 1 Freq  FM Tone 2 Freq
Analog Modulation Commands

Frequency Modulation Subsystem–Option UNT ([:SOURce])

SINE|TRIAngle|SQUARE|RAMP

This command sets the shape of tone 1 (default) or tone 2 of the internal dual function generator source.

*RST SINE

Key Entry FM Tone 1 Waveform FM Tone 2 Waveform


Supported All Models with Options UNT and 303

POSitive|NEGative

This command sets the ramp direction of the selected tone (1 or 2) of the internal dual function generator source when :FM[1]|2:INTERNAL:DUAL:FUNCTION[1]|2:SHAPE is set to RAMP.

*RST POS

Key Entry Pos Ramp Neg Ramp

:FM:INTERNAL:FREQuency:STEP[:INCRement]

Supported All Models with Option UNT


This command sets the step increment for the internal frequency modulation. The variable <num> sets the entered value in units of Hertz:

*RST +5.00000000E+002 (persistent value; use :PRESet:PERSistent to restore the factory preset value)

Range 0.1–6.25E6

Key Entry Incr Set

Remarks The value set by this command is used with the UP and DOWN choices for the FM frequency setting. Refer to :FM[1]|2:INTERNAL:FUNCTION[1]|2:FREQuency command for more information.

The setting enabled by this command is not affected by signal generator power-on, preset, or *RST.
Analog Modulation Commands

Frequency Modulation Subsystem–Option UNT ([SOURce])


**Supported** All Models with Option UNT

```
```

This command sets the internal frequency modulation rate for the following applications:

– the start frequency for a swept-sine waveform
– the frequency rate for all other waveforms

*RST +4.00000000E+002

Range All Waveforms: 0.1 Hz–2 MHz

**Key Entry** FM Rate


**Supported** All Models with Options UNT and 303

```
```

This command sets the phase offset in degrees or radians of internal function generator source.

*RST 0.000 rad

Range -6.290 to 6.290 rad
-360.4 to 360.4 deg

**Key Entry** FM Phase Offset


**Supported** All Models with Option UNT

```
```

This command sets the FM waveform type.

*RST SINE
Analog Modulation Commands
Frequency Modulation Subsystem–Option UNT [:SOURce]

Remarks
The waveform selection is only valid when INT is the source selection. Refer to “:FM[1]|2:SOURce” on page 272 for source type selection. SINE is the only shape available without Option 303.


Supported All Models with Options UNT and 303

POSitive|NEGative

This command sets the ramp direction when :FM[1]|2:INTernal:FUNCtion[1]|2:SHApe is set to RAMP.

*RST POS

Key Entry Pos Ramp Neg Ramp


Supported All Models with Options UNT and 303


This command sets the noise type when “:FM[1]|2:SOURce” on page 272 is set to NOISe[1] or NOISe2.

*RST POS

Key Entry Noise Gen 1 Noise Gen 2


Supported All Models with Options UNT and 303

<val><units>
[:SOURce]:FM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STARt?

This command sets the start frequency for the swept function generator.

*RST 400.0 Hz
Range 100 mHz to 6.250 MHz
Key Entry FM Start Freq


Supported All Models with Options UNT and 303
Analog Modulation Commands

Frequency Modulation Subsystem–Option UNT ([SOURce])

<val><units>

This command sets the stop frequency for the swept function generator.

*RST 400.0 Hz

Range 100 mHz to 6.250 MHz

Key Entry FM Stop Freq


Supported All Models with Options UNT and 303

SINE|TRIangle|SQUare|RAMP

This command sets the FM waveform type for the swept function generator.

*RST SINE

Key Entry FM Sweep Waveform


Supported All Models with Options UNT and 303

POSitive|NEGative

This command sets the ramp direction for the swept function generator when :FM[1]|2:INTernal:SWEep:FUNCtion:SHAPe is set to RAMP.

*RST POS

Key Entry Pos Ramp Neg Ramp


Supported All Models with Options UNT and 303


This command sets the sweep rate for the FM swept–sine waveform.

The sweep rate function is only available for internal source 1.

*RST +4.00000000E+002

Range 0.5 Hz to 100 kHz
Analog Modulation Commands
Frequency Modulation Subsystem–Option UNT ([:SOURce])

### Key Entry  
**FM Sweep Rate**


**Supported**  All Models with Options UNT and 303


This command selects the sweep shape.

- **SAWTooth**  A sawtooth sweep shape only sweeps from start freq to stop freq.
- **TRIangle**  A triangle sweep sweeps from start freq to stop freq and back to start freq. With a triangle shape sweep you can choose a different sweep rate for start freq to stop freq and another sweep rate for stop freq to start freq.

**RST**  SAWTooth

**Key Entry**  
**FM Sweep Shape**


**Supported**  All Models with Options UNT and 303

[:SOURce]:FM[1]|2:INTernal:SWEep:TIME:COUPled ON|OFF|1|0

This command sets the couplings between start-to-stop values and stop-to-start values for FM sweep times and rates. The sweep times coupled to on.


- **ON|1**  This choice uses the same sweep time for both start freq to stop freq and stop freq to start freq sweeps of a triangle shape sweep. If sweep times coupled is ON, sweep time and rate is only set by the Start -> Stop softkeys.
- **OFF|0**  This choice disables sweep time couplings.

**RST**  OFF

**Key Entry**  
**FM Sweep Times Coupled Off On**


**Supported**  All Models with Options UNT and 303


Analog Modulation Commands
Frequency Modulation Subsystem–Option UNT ([SOURce])

This command sets the sweep time for the swept-sine waveform.

*RST +1.00000000E−001
Range 1.0mS–65.535S
Key Entry FM Sweep Time


Supported All Models with Options UNT and 303

[:SOURce]:FM[1]|2:INTernal:SWEep:TRIGger
BUS|IMMediate|EXTernal|INTernal|KEY
[:SOURce]:FM[1]|2:INTernal:SWEep:TRIGger?

This command sets the trigger source for the frequency modulated swept-sine waveform.

BUS This choice enables GPIB triggering using the *TRG or GET command or LAN and RS-232 triggering using the *TRG command.
IMMediate This choice enables immediate triggering of the sweep event.
EXTernal This choice enables the triggering of a sweep event by an externally applied signal at the TRIG 1, TRIG 2, or PULSE BNC connector.
INTernal This choice enables the triggering of a sweep event by an internal Pulse Video or Pulse Sync signal.
KEY This choice enables triggering through front panel interaction by pressing the Trigger key.

*RST IMM

Key Entry Bus Free Run Ext Int Trigger Key


Supported All Models with Options UNT and 303

TRIGger[1]|TRIGger2|PULSe

This command selects the external trigger source for the FM swept-sine waveform. With external triggering, the selected bi-directional BNC is configured as an input.

TRIGger1 This choice selects the TRIG 1 BNC as the external trigger source for triggering sweep, point and function generator sweeps.
Analog Modulation Commands
Frequency Modulation Subsystem–Option UNT ([SOURce])

TRIGger2  This choice selects the TRIG 2 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

PULSe  This choice selects the PULSE BNC as the external trigger source for triggering sweep, point and function generator sweeps.

*RST  TRIGger1

Key Entry Trigger 1 Trigger 2 Pulse


Supported All Models with Options UNT and 303

PVIDeo|PSYNc


This command selects the internal trigger source for the FM swept-sine waveform.

PVIDeo  This choice selects Pulse Video as the internal trigger source for triggering sweep, point and function generator sweeps.

PSYNc  This choice selects Pulse Sync as the internal trigger source for triggering sweep, point and function generator sweeps.

*RST  PSYN

Key Entry Pulse Video Pulse Sync


Supported All Models with Options UNT and 303

POSitive|NEGative

[:SOURce]:FM[1]|2:INTernal:SWEep:TRIGger:SLOPe?

This command sets the polarity of an external signal at the TRIG 1, TRIG 2, or PULSE BNC (see :FM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce) or internal Pulse Video or Pulse Sync signal (see :FM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce) that will trigger a list or step sweep.

POSitive  The signal generator triggers an event when it detects a rising edge on the source signal.
Analog Modulation Commands

Frequency Modulation Subsystem–Option UNT ([:SOURce])

NEGative  The signal generator triggers an event when it detects a falling edge on the source signal

*RST  POS

Key Entry  Int/Ext Trigger Polarity Neg Pos

`:FM[1]|2:SOURce`

**Supported**  All Models with Option UNT

```
[:SOURce]:FM[1]|2:SOURce
[:SOURce]:FM[1]|2:SOURce?
```

This command sets the source to generate the frequency modulation.

- **FUNCTION[1]**  Selects function generator 1 as the modulation source.
- **FUNCTION[2]**  Selects function generator 2 as the modulation source.
- **SWEep**  Selects the swept function generator as the modulation source.
- **DUAL**  Selects the dual function generator as the modulation source.
- **NOISe[1]**  Selects noise generator 1 as the modulation source.
- **NOISe2**  Selects noise generator 2 as the modulation source.
- **EXT[1]**  Selects an externally applied signal as the modulation input. Connect the signal to the EXT 1 connector.
- **EXT2**  Selects an externally applied signal as the modulation input. Connect the signal to the EXT 2 connector.

```
*RST
```

**Key Entry**  Ext1  Func Gen 1  Dual Func Gen  Noise Gen 1

```
Ext2  Func Gen 2  Swept Func Gen  Noise Gen 2
```

**Remarks**  The externally applied, ac-coupled input signal is tested for a voltage level and a display annunciator will report a high or low condition if that voltage is > ±3% of 1 Vp.


**Supported**  All Models with Option UNT

```
[:SOURce]:FM[1]|2:STATe  ON|OFF|1|0
[:SOURce]:FM[1]|2:STATe?
```
Analog Modulation Commands
Frequency Modulation Subsystem–Option UNT ([SOURce])

This command enables or disables the frequency modulation for the selected path.

*RST 0
Key Entry FM Off On
Remarks The RF carrier is modulated when you set the signal generator’s modulation state to ON, see :MODulation[:STATE] command for more information. Whenever frequency modulation is enabled, the FM annunciator is turned on in the display.

:FM[1]|2[:DEViation]

Supported All Models with Option UNT

[:SOURce]:FM[1]|2[:DEViation] <value><unit>
[:SOURce]:FM[1]|2[:DEViation]?

This command sets the frequency modulation deviation. Please refer to Data Sheet for more information on FM deviation specifications.

*RST +1.00000000E+003
Key Entry FM DEV

:FM[:DEViation]:STEP[:INCRement]

Supported All Models with Option UNT

[:SOURce]:FM[:DEViation]:STEP[:INCRement] <value><unit>|GHz|MHz|kHz|Hz
[:SOURce]:FM[:DEViation]:STEP[:INCRement]?

This command sets the step increment for the FM deviation of the signal generator.

*RST +5.00000000E+003
Key Entry Incr Set
Remarks The setting enabled by this command is not affected by signal generator power-on, preset, or *RST.
Low Frequency Output Subsystem ([SOURce]:LFOutput)

:AMPLitude

**Supported**  All Models with Option UNT

[:SOURce]:LFOutput:AMPLitude <val><unit>
[:SOURce]:LFOutput:AMPLitude?

This command sets the amplitude for the signal at the LF OUTPUT connector.

*RST 0.00
Range 0.000VP–5.0VP
Key Entry LF Out Amplitude

:DUAL:FUNCtion2:AMPLitude:PERCent

**Supported**  All Models with Options UNT and 303

[:SOURce]:LFOutput:DUAL:FUNCtion2:AMPLitude:PERCent <value><unit>
[:SOURce]:LFOutput:DUAL:FUNCtion2:AMPLitude:PERCent?

This command sets the amplitude of tone 2 of the internal dual function generator source as a percent of the peak analog modulation amplitude. Tone 1 of the internal dual function generator source will make up the remaining amplitude.

*RST 50.0
Range 0 to 100.0%
Key Entry LFOut Tone 2 Ampl % of Peak

:DUAL:FUNCtion2:POFFset

**Supported**  All Models with Options UNT and 303

[:SOURce]:LFOutput:DUAL:FUNCtion2:POFFset <value><unit>
[:SOURce]:LFOutput:DUAL:FUNCtion2:POFFset?

This command sets the phase offset in degrees or radians of tone 2 in relation to tone 1 of the internal dual function generator source.

*RST 0.00 rad
Range -6.290 to 6.290 rad
-360.4 to 360.4 deg
Analog Modulation Commands
Low Frequency Output Subsystem [:SOURce]:LFOutput

Key Entry LF Out Tone 2 Phase Offset


**Supported** All Models with Options UNT and 303

[:SOURce]:LFOutput:DUAL:FUNCtion[1]|2:FREQuency
<value><unit>
[:SOURce]:LFOutput:DUAL:FUNCtion[1]|2:FREQuency?

This command sets the frequency of tone 1 (default) or tone 2 of the internal dual function generator source.

*RST 400.0 Hz

Range 100.0 mHz to 6.25 MHz

Key Entry LF Out Tone 1 Freq LF Out Tone 2 Freq


**Supported** All Models with Options UNT and 303

SINE|TRIangle|SQUARE|RAMP
[:SOURce]:LFOutput:DUAL:FUNCtion[1]|2:SHAPe?

This command sets the shape of tone 1 (default) or tone 2 of the internal dual function generator source.

*RST SINE

Key Entry LF Out Tone 1 Waveform LF Out Tone 2 Waveform


**Supported** All Models with Options UNT and 303

POSitive|NEGative

This command sets the ramp direction of the selected tone (1 or 2) of the internal dual function generator source when :DUAL:FUNCtion[1]|2:SHAPe is set to RAMP.

*RST POS

Key Entry Pos Ramp Neg Ramp
Analog Modulation Commands
Low Frequency Output Subsystem ([SOURce]:LFOutput)

:FUNCTION[1]|2:FREQuency

Supported All models with Option UNT

[:SOURce]:LFOutput:FUNCTION[1]|2:FREQuency <val><units>
[:SOURce]:LFOutput:FUNCTION[1]|2:FREQuency?

This command sets the frequency of function generator 1 or 2. The command sets:

– the frequency of the first tone of a dual–sine waveform
– the start frequency for a swept–sine waveform
– the frequency for all other waveform types

For selecting the waveform type, use the :FUNCTION[1]|2:SHAPE command.

*RST +4.00000000E+002

Range Sine and Dual–Sine: 0.5 Hz to 1 MHz

Range Swept–Sine: 1 Hz to 1 MHz

All Other Waveforms: 0.5 Hz to 100 kHz

Key Entry LF Out Tone 1 Freq LF Out Start Freq LF Out Freq

:FUNCTION[1]|2:PERiod

Supported All Models with Options UNT and 303

[:SOURce]:LFOutput:FUNCTION[1]|2:PERiod <val><unit>
[:SOURce]:LFOutput:FUNCTION[1]|2:PERiod?

This command sets the pulse period of the internally generated pulsed low frequency waveform.

*RST +8.00000000E−005

Range 16uS–30S

Key Entry LF Out Period

:FUNCTION[1]|2:POFFset

Supported All Models with Options UNT and 303

[:SOURce]:LFOutput:FUNCTION[1]|2:POFFset <val><unit>
[:SOURce]:LFOutput:FUNCTION[1]|2:POFFset?

This command sets the phase offset in degrees or radians of internal function generator source.
Analog Modulation Commands
Low Frequency Output Subsystem (::SOURce::LFOutput)

*RST 0.000 rad

Range -6.290 to 6.290 rad
-360.4 to 360.4 deg

Key Entry LF Out Phase Offset

:FUNCtion[1]|2:PWIDth

Supported All Models with Options UNT and 303

[:SOURce]:LFOutput:FUNCtion[1]|2:PWIDth <val><unit>
[:SOURce]:LFOutput:FUNCtion[1]|2:PWIDth?

This command sets the pulse width of the internally-generated pulsed low frequency waveform.

The upper limit range value is restricted by the current value of the pulse period. For example, if the pulse period value is set to 16 μS, the pulse width is limited to a maximum range value of 16 μS.

*RST +4.00000000E−005

Range 8μS–30S

Key Entry LF Out Width

Remarks To change the pulse period value, refer to the :FUNCtion[1]|2:PERiod command.

:FUNCtion[1]|2:SHAPe

Supported All models with Option UNT

[:SOURce]:LFOutput:FUNCtion[1]|2:SHAPe SINE|TRIangle|SQUARE|RAMP|PULSe|NOISe|DC
[:SOURce]:LFOutput:FUNCtion[1]|2:SHAPe?

This command selects the waveform type. Function Generator 1 must be the source for the dual–sine or the swept–sine waveform. Refer to the ::SOURce command for more information.

*RST SINE

Key Entry Sine Triangle Square Ramp Pulse

Noise DC
Analog Modulation Commands
Low Frequency Output Subsystem ([:SOURCE]:LFOutput)

:FUNCTION[1]|2:SHAPE:RAMP

Supported       All models with Option UNT


This command selects a positive or negative slope for the ramp modulation on the LF output.

For selecting the waveform type, use the :FUNCTION[1]|2:SHAPE command.

*RST               POS

Key Entry       Positive    Negative

:LOAD:IMPedance

Supported       All Models with Option UNT

[ :SOURCE ]:LFOutput:LOAD:IMPedance 50|1000000
[ :SOURCE ]:LFOutput:LOAD:IMPedance?

This command sets the impedance of the load that the LF Output is connected to. This changes the displayed LF Output amplitude based on the load impedance. Max LF Output amplitude is 5V into 50 Ohms and 10V into 1 MOhms.

50               This choice selects 50 Ohm load impedance.
1000000          This choice selects 1 MOhm load impedance.
*RST             50 Ohm

Key Entry       Load Impedance 50 Ohm 1 MOhm

:NOISE[1]|2:TYPe

Supported       All Models with Options UNT and 303


This command sets the noise type when :SOURCE is set to NOISE[1] or NOISE2.

*RST               POS

Key Entry       Uniform    Gaussian

:OFFSET

Supported       All Models with Option UNT
Analog Modulation Commands
Low Frequency Output Subsystem ([:SOURce]:LFOutput)

[:SOURce]:LFOutput:OFFset <value><unit>
[:SOURce]:LFOutput:OFFset?

This command sets the DC offset (in volts) of the signal at the LF Output connector.

*RST 0.000 V

Range -10.000 to 10.000 V

Key Entry LF Out DC Offset Into 50 Ohms
   LF Out DC Offset Into 1 MOhms

[:SOURce]

Supported All Models with Options UNT and 303

[:SOURce]:LFOutput:SOURce
MONitor|FUNCtion[1]|FUNCtion2|SWEep|DUAL|NOISe[1]|NOISe2|DC
[:SOURce]:LFOutput:SOURce?

This command selects the source for the LF output.

MONitor Selects monitoring on the LF output BNC. Select the monitoring source using the :SOURce:MONitor command.

FUNCtion[1] Selects function generator 1 as the modulation source.

FUNCtion[2] Selects function generator 2 as the modulation source.

SWEep Selects the swept function generator as the LF output BNC source. If AM or FM or PM is modulating the swept function generator then the LF output BNC will have the unmodulated signal if you choose to monitor the swept function generator.

DUAL Selects the dual function generator as the modulation source.

NOISe[1] Selects noise generator 1 as the modulation source.

NOISe2 Selects noise generator 2 as the modulation source.

DC Selects a DC voltage level as the LF output BNC source.

*RST MONitor

Key Entry Int Monitor Func Gen 1 Dual Func Gen
   DC Func Gen 2 Swept Func Gen
   Noise Gen 1 Noise Gen 1
Analog Modulation Commands
Low Frequency Output Subsystem ([:SOURCE]:LFOutput)

**Remarks**
Only MON, FUNC1 and DC are available without Option 303.

**:SOURCE:MONitor**

**Supported**
All models with Option UNT

[[:SOURCE]:LFOutput:SOURce:MONitor
FUNCtion[1]|FUNCtion2|SWEep|DUAL
[:SOURCE]:LFOutput:SOURce:MONitor?]

This command selects the source for the LF output.

**FUNCTION[1]|2**
These choices enable you to output a signal where the frequency and shape of the signal is set by internal function generator 1 or 2. For example, if the internal source is currently assigned to an AM path configuration and AM is turned on, the signal output at the LF OUTPUT connector will have the frequency and shape of the amplitude modulating signal.

**SWEep**
Selects the swept function generator as the modulation source to monitor. If AM or FM or PM is modulating the swept function generator then the LF output BNC will have the unmodulated signal if you choose to monitor the swept function generator.

**DUAL**
Selects the dual function generator as the modulation source to monitor. If AM or FM or PM is modulating the dual function generator then the LF output BNC will have the unmodulated signal if you choose to monitor the dual function generator.

**:*RST**
FUNC1

**Key Entry**
Func Gen 1 Dual Func Gen
Func Gen 2 Swept Func Gen

**Remarks**
Only FUNC1 is available without Option 303.

**:STATE**

**Supported**
All Models

[[:SOURCE]:LFOutput:STATE ON|OFF|1|0
[:SOURCE]:LFOutput:STATE?]

This command enables or disables the low frequency output.

**:*RST**
0

**Key Entry**
LF Out Off On
Analog Modulation Commands
Low Frequency Output Subsystem ([:SOURce]:LFOutput)

:SWEep:FUNCTION:FREQuency:STARt

Supported  All Models with Options UNT and 303

[:SOURce]:LFOutput:SWEep:FUNCTION:FREQuency:STARt <val><units>
[:SOURce]:LFOutput:SWEep:FUNCTION:FREQuency:STARt?

This command sets the start frequency for the swept function generator.

*RST  400.0 Hz
Range  100 mHz to 6.250 MHz
Key Entry LF Out Start Freq

:SWEep:FUNCTION:FREQuency:STOP

Supported  All Models with Options UNT and 303

[:SOURce]:LFOutput:SWEep:FUNCTION:FREQuency:STOP <val><units>
[:SOURce]:LFOutput:SWEep:FUNCTION:FREQuency:STOP?

This command sets the stop frequency for the swept function generator.

*RST  400.0 Hz
Range  100 mHz to 6.250 MHz
Key Entry LF Out Stop Freq

:SWEep:FUNCTION:SHAPe

Supported  All Models with Options UNT and 303

[:SOURce]:LFOutput:SWEep:FUNCTION:SHAPe SINE|TRIangle|SQUare|RAMP
[:SOURce]:LFOutput:SWEep:FUNCTION:SHAPe?

This command sets the waveform type for the swept function generator.

*RST  SINE
Key Entry LF Out Sweep Waveform

:SWEep:FUNCTION:SHAPe:RAMP

Supported  All Models with Options UNT and 303

[:SOURce]:LFOutput:SWEep:FUNCTION:SHAPe:RAMP POSitive|NEGative
[:SOURce]:LFOutput:SWEep:FUNCTION:SHAPe:RAMP?

This command sets the ramp direction for the swept function generator when :SWEep:FUNCTION:SHAPe is set to RAMP.
Analog Modulation Commands
Low Frequency Output Subsystem ([SOURce]:LFOutput)

*SRT  POS

Key Entry  Pos Ramp  Neg Ramp

:SWEep:RATE[1]|2

Supported  All Models with Options UNT and 303

[:SOURce]:LFOutput:SWEep:RATE[1]|2 <val><units>
[:SOURce]:LFOutput:SWEep:RATE[1]|2?

This command sets the sweep rate for the swept-sine waveform.
The sweep rate function is only available for internal source 1.

*RST  +4.00000000E+002

Range  0.5 Hz to 100 kHz

Key Entry  LF Out Sweep Rate

:SWEep:SHAPe

Supported  All Models with Options UNT and 303

[:SOURce]:LFOutput:SWEep:SHAPe SAWTooth|TRIangle
[:SOURce]:LFOutput:SWEep:SHAPe?

This command selects the sweep shape.

SAWTooth  A sawtooth sweep shape only sweeps from start freq to stop freq.

TRIangle  A triangle sweep sweeps from start freq to stop freq and back to start freq. With a triangle shape sweep you can choose a different sweep rate for start freq to stop freq and another sweep rate for stop freq to start freq.

*RST  SAWTooth

Key Entry  LF Out Sweep Shape

:SWEep:TIME:COUPled

Supported  All Models with Options UNT and 303

[:SOURce]:LFOutput:SWEep:TIME:COUPled ON|OFF|1|0
[:SOURce]:LFOutput:SWEep:TIME:COUPled?

This command sets the couplings between start-to-stop values and stop-to-start values for low-frequency output sweep times and rates. The sweep times coupled to on.

Use this command when :SWEep:SHAPe is set to TRIangle.
Analog Modulation Commands
Low Frequency Output Subsystem ([:SOURce]:LFOutput)

**ON|1**
This choice uses the same sweep time for both start freq to stop freq and stop freq to start freq sweeps of a triangle shape sweep. If sweep times coupled is ON, sweep time and rate is only set by the Start -> Stop softkeys.

**OFF|0**
This choice disables sweep time couplings.

\*RST

**Key Entry**
LF Out Sweep Times Coupled Off On

`:SWEep:TIME[1]|2`

**Supported**
All Models with Options UNT and 303

[:SOURce]:LFOutput:SWEep:TIME[1]|2 <val><unit>
[:SOURce]:LFOutput:SWEep:TIME[1]|2?

This command sets the sweep time for the swept-sine waveform.

\*RST

**Range**
1.0mS–65.535S

**Key Entry**
LF Out Sweep Time

`:SWEep:TRIGger`

**Supported**
All Models with Options UNT and 303

[:SOURce]:LFOutput:SWEep:TRIGger
IMMediate|KEY|EXTernal|INTernal|BUS
[:SOURce]:LFOutput:SWEep:TRIGger?

This command sets the trigger source for the frequency modulated swept-sine waveform.

IMMediate
This choice enables immediate triggering of the sweep event.

KEY
This choice enables triggering through front panel interaction by pressing the Trigger key.

EXTernal
This choice enables the triggering of a sweep event by an externally applied signal at the TRIG 1, TRIG 2, or PULSE BNC connector.

INTernal
This choice enables the triggering of a sweep event by an internal Pulse Video or Pulse Sync signal.

BUS
This choice enables GPIB triggering using the *TRG or GET command or LAN and RS-232 triggering using the *TRG command.
Analog Modulation Commands
Low Frequency Output Subsystem ([:SOURce]:LFOutput)

*RST IMM

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<tr>
<th>Key Entry</th>
<th>Bus</th>
<th>Free Run</th>
<th>Ext</th>
<th>Int</th>
<th>Trigger Key</th>
</tr>
</thead>
</table>

**:SWEep:TRIGger:EXTernal:SOURce**

Supported All Models with Options UNT and 303

[:SOURce]:LFOutput:SWEep:TRIGger:EXTernal:SOURce
TRIGger[1]|TRIGger2|PULSe
[:SOURce]:LFOutput:SWEep:TRIGger:EXTernal:SOURce?

This command selects the external trigger source for the sweep. With external triggering, the selected bi-directional BNC is configured as an input.

TRIGger1 This choice selects the TRIG 1 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

TRIGger2 This choice selects the TRIG 2 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

PULSe This choice selects the PULSE BNC as the external trigger source for triggering sweep, point and function generator sweeps.

*RST TRIGger1

<table>
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<tr>
<th>Key Entry</th>
<th>Trigger 1</th>
<th>Trigger 2</th>
<th>Pulse</th>
</tr>
</thead>
</table>

**:SWEep:TRIGger:INTernal:SOURce**

Supported All Models with Options UNT and 303

[:SOURce]:LFOutput:SWEep:TRIGger:INTernal:SOURce
PVIDeo|PSYNc
[:SOURce]:LFOutput:SWEep:TRIGger:INTernal:SOURce?

This command selects the internal trigger source for the sweep.

PVIDeo This choice selects Pulse Video as the internal trigger source for triggering sweep, point and function generator sweeps.

PSYNc This choice selects Pulse Sync as the internal trigger source for triggering sweep, point and function generator sweeps.

*RST PSYN

<table>
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<tr>
<th>Key Entry</th>
<th>Pulse Video</th>
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</tr>
</thead>
</table>
Analog Modulation Commands
Low Frequency Output Subsystem ([:SOURce]:LFOoutput)

:SWEep:TRIGger:SLOPe

**Supported** All Models with Options UNT and 303

[[:SOURce]:LFOoutput:SWEep:TRIGger:SLOPe] POSitive|NEGative

This command sets the polarity of an external signal at the TRIG 1, TRIG 2, or PULSE BNC (see :SWEep:TRIGger:EXTernal:SOURce) or internal Pulse Video or Pulse Sync signal (see :SWEep:TRIGger:INTernal:SOURce) that will trigger a list or step sweep.

- **POSitive** The signal generator triggers an event when it detects a rising edge on the source signal
- **NEGative** The signal generator triggers an event when it detects a falling edge on the source signal

*RST POS

**Key Entry** Int/Ext Trigger Polarity Neg Pos
Phase Modulation Subsystem–Option UNT ([SOURce])

:PM[1]|2:BANDwidth|BWIDth

**Supported**  All Models with Option UNT

[:SOURce]:PM[1]|2:BANDwidth|BWIDth NORMal|HIGH
[:SOURce]:PM[1]|2:BANDwidth|BWIDth?

This command toggles between normal phase modulation and high-bandwidth phase modulation mode.

*RST  NORM

**Key Entry**  FM ΦM Normal High BW


**Supported**  All Models with Option UNT


This command sets the coupling for the phase modulation source through the selected external input connector.

Use this command with the EXTernal[1]|2:DC command to remove the effects of DC and optimize the DCFM calibration.

AC  This choice will only pass ac signal components.
DC  This choice will pass both ac and dc signal components.
*RST  DC

**Key Entry**  Ext Coupling DC AC

**Remarks**  This command does not change the currently active source or switch the current modulation on or off. The modulating signal may be the sum of several signals, either internal or external sources.


**Supported**  All Models with Option UNT

[:SOURce]:PM[1]|2:EXTernal[1]|2:IMPedance 50|600|1000000

This command sets the input impedance for the externally-applied phase-modulated input signal.

50  This choice selects 50 Ohm input impedance.
600  This choice selects 600 Ohm input impedance.
Analog Modulation Commands

Phase Modulation Subsystem–Option UNT ([:SOURce])

1000000  This choice selects 1 MOhm input impedance.

*RST 50 Ohm

Key Entry  Ext Impedance  50 Ohm  600 Ohm  1 MOhm


Supported  All Models with Option UNT and 303

[:SOURce]:PM[1]|2:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent <value><unit>

This command sets the amplitude of tone 2 of the internal dual function generator source as a percent of the peak analog modulation amplitude. Tone 1 of the internal dual function generator source will make up the remaining amplitude.

*RST 50.0

Range  0 to 100.0%

Key Entry  Φ M Tone 2 Ampl % of Peak


Supported  All Models with Option UNT and 303


This command sets the phase offset in degrees or radians of tone 2 in relation to tone 1 of the internal dual function generator source.

*RST 0.000 rad

Range  -6.290 to 6.290 rad
       -360.4 to 360.4 deg

Key Entry  Φ M Tone 2 Phase Offset


Supported  All Models with Option UNT and 303

Analog Modulation Commands
Phase Modulation Subsystem–Option UNT ([:SOURce])

This command sets the frequency of tone 1 (default) or tone 2 of the internal dual function generator source.

*RST 400.0 Hz

Range 100.0 mHz to 6.25 MHz

Key Entry  ΦM Tone 1 Freq  ΦM Tone 2 Freq


     Supported All Models with Option UNTand 303


This command sets the shape of tone 1 (default) or tone 2 of the internal dual function generator source.

*RST SINE

Key Entry  ΦM Tone 1 Waveform  ΦM Tone 2 Waveform


     Supported All Models with Option UNT and 303


This command sets the ramp direction of the selected tone (1 or 2) of the internal dual function generator source when

*RST POS

Key Entry  Pos Ramp  Neg Ramp

:PM:INTernal:FREQuency:STEP[:INCRement]

     Supported All Models with Option UNT

[:SOURce]:PM:INTernal:FREQuency:STEP[:INCRement] <num>
[:SOURce]:PM:INTernal:FREQuency:STEP[:INCRement]?

This command sets the step increment of the phase modulation internal frequency.

The variable <num> sets the entered value in units of Hertz.
Analog Modulation Commands
Phase Modulation Subsystem—Option UNT ([:SOURce])

*RST +5.00000000E+002 (persistent value; use :PRESet:PERSistent to restore the factory preset value)

Range 0.1–6.25E6

Key Entry Incr Set

Remarks The value set by this command is used with the UP and DOWN choices for the PM frequency command. Refer to :PM[1]|2:INTernal:FUNCtion[1]|2:FREQuency command for more information.

The setting enabled by this command is not affected by signal generator power-on, preset, or *RST.


Supported All Models with Option UNT


This command sets the internal modulation frequency rate for the following applications:

– the start frequency for a swept-sine waveform
– the frequency rate for all other waveforms

*RST +4.00000000E+002

Range All Waveforms: 0.1 Hz–2 MHz (Wideband)

All Waveforms: 0.1 Hz–1 MHz (narrowband)

Key Entry ΦM Rate


Supported All Models with Option UNT and 303


This command sets the phase offset in degrees or radians of internal function generator source.

*RST 0.000 rad

Range -6.290 to 6.290 rad

-360.4 to 360.4 deg
Analog Modulation Commands
Phase Modulation Subsystem–Option UNT ([:SOURce])

**Key Entry**  
ΦM Phase Offset

**Supported**  All Models with Option UNT

SINE|SQUare|TRIangle|RAMP|PULSe  

This command sets the phase modulation waveform type.

*RST SINE  
Remarks  The waveform selection is only valid when INT is the source selection. Refer to ":PM[1]|2:SOURce" on page 295 for source type selection.  
SINE is the only shape available without Option 303.

**Supported**  All Models with Option UNT and 303

POSitive|NEGative  

This command sets the ramp direction when :PM[1]|2:INTernal:FUNCtion[1]|2:SHAPe is set to RAMP.

*RST POS  
Key Entry  
Pos Ramp  
Neg Ramp

**Supported**  All Models with Option UNT and 303

UNIForm|GAUSsian  

This command sets the noise type when ":PM[1]|2:SOURce" on page 295 is set to NOISe[1] or NOISe2.

*RST POS  
Key Entry  
Noise Gen 1  
Noise Gen 2

**Supported**  All models with Option UNT and 303

Key Entry  
ΦM Phase Offset
Analog Modulation Commands
Phase Modulation Subsystem–Option UNT ([:SOURce])

[:SOURce]:PM[1]|2:INTernal:SWEep:FUNCTION:FREQuency:STARt <val><units>
[:SOURce]:PM[1]|2:INTernal:SWEep:FUNCTION:FREQuency:STARt?

This command sets the start frequency for the swept function generator.

*RST 400.0 Hz
Range 100 mHz to 6.250 MHz
Key Entry ΦM Start Freq


Supported All models with Option UNT and 303

This command sets the stop frequency for the swept function generator.

*RST 400.0 Hz
Range 100 mHz to 6.250 MHz
Key Entry ΦM Stop Freq


Supported All Models with Option UNT and 303
[:SOURce]:PM[1]|2:INTernal:SWEep:FUNCTION:SHAPe SINE|TRIangle|SQUare|RAMP
[:SOURce]:PM[1]|2:INTernal:SWEep:FUNCTION:SHAPe?

This command sets the phase modulation waveform type for the swept function generator.

*RST SINE
Key Entry ΦM Sweep Waveform


Supported All Models with Option UNT and 303

This command sets the ramp direction for the swept function generator when [:PM[1]|2:INTernal:SWEep:FUNCTION:SHAPe is set to RAMP.
Analog Modulation Commands
Phase Modulation Subsystem–Option UNT ([:SOURCE])

*RST  POS

Key Entry  Pos Ramp  Neg Ramp


Supported  All models with Option UNT and 303


This command sets the sweep rate for a phase–modulated, swept–sine waveform.

To select the waveform, use the :PM[1]|2:INTernal:SWEep:FUNCTION:SHAPE command.

Example

:PM1:INT:SWE:RATE 30KHZ

The preceding example sets the sweep rate to 30 kHz.

*RST  +4.00000000E+002
Range  0.5 Hz to 100 kHz

Key Entry  FM Sweep Rate


Supported  All Models with Option UNT and 303


This command selects the sweep shape.

SAWTooth  A sawtooth sweep shape only sweeps from start freq to stop freq.

TRIangle  A triangle sweep sweeps from start freq to stop freq and back to start freq. With a triangle shape sweep you can choose a different sweep rate for start freq to stop freq and another sweep rate for stop freq to start freq.

*RST  SAWTooth

Key Entry  FM Sweep Shape


Supported  All Models with Option UNT and 303
Analog Modulation Commands
Phase Modulation Subsystem–Option UNT ([:SOURce])

[:SOURce]:PM[1]|2:INTernal:SWEep:TIME:COUPled ON|OFF|1|0
[:SOURce]:PM[1]|2:INTernal:SWEep:TIME:COUPled?

This command sets the couplings between start-to-stop values and stop-to-start values for phase modulation sweep times and rates. The sweep times coupled to on.

Use this command when :PM[1]|2:INTernal:SWEep:SHAPE is set to TRIangle.

ON|1  This choice uses the same sweep time for both start freq to stop freq and stop freq to start freq sweeps of a triangle shape sweep. If sweep times coupled is ON, sweep time and rate is only set by the Start -> Stop softkeys.

OFF|0  This choice disables sweep time couplings.

*RST

Key Entry  ΦM Sweep Times Coupled Off On


Supported  All Models with Option UNT and 303


This command sets the sweep time for a phase-modulated, swept-sine waveform.

*RST  +1.00000000E-001

Range  1.0mS–65.535S

Key Entry  ΦM Sweep Time


Supported  All Models with Option UNT and 303

[:SOURce]:PM[1]|2:INTernal:SWEep:TRIGger BUS|IMMediate|EXTernal|INTernal|KEY
[:SOURce]:PM[1]|2:INTernal:SWEep:TRIGger?

This command sets the trigger source for the phase-modulated, swept-sine waveform.

BUS  This choice enables GPIB triggering using the *TRG or GET command or LAN and RS-232 triggering using the *TRG command.

IMMediate  This choice enables immediate triggering of the sweep event.
Analog Modulation Commands

Phase Modulation Subsystem–Option UNT ([:SOURce])

**EXTernal**
This choice enables the triggering of a sweep event by an externally applied signal at the TRIG 1, TRIG 2, or PULSE BNC connector.

**INTernal**
This choice enables the triggering of a sweep event by an internal Pulse Video or Pulse Sync signal.

**KEY**
This choice enables triggering through front panel interaction by pressing the Trigger key.

*RST
IMM

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Bus</th>
<th>Free Run</th>
<th>Ext</th>
<th>Trigger Key</th>
</tr>
</thead>
</table>

**Supported**
All Models with Option UNT and 303

TRIGger1|TRIGger2|PULSe

This command selects the external trigger source for the phase-modulated swept-sine waveform. With external triggering, the selected bi-directional BNC is configured as an input.

**TRIGger1**
This choice selects the TRIG 1 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

**TRIGger2**
This choice selects the TRIG 2 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

**PULSe**
This choice selects the PULSE BNC as the external trigger source for triggering sweep, point and function generator sweeps.

*RST
TRIGger1

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Trigger 1</th>
<th>Trigger 2</th>
<th>Pulse</th>
</tr>
</thead>
</table>

**Supported**
All Models with Option UNT and 303

PVIDeo|PSYNc

This command selects the internal trigger source for the phase-modulated swept-sine waveform.
Analog Modulation Commands
Phase Modulation Subsystem–Option UNT ([:SOURce])

PVIDeo This choice selects Pulse Video as the internal trigger source for triggering sweep, point and function generator sweeps.

PSYNc This choice selects Pulse Sync as the internal trigger source for triggering sweep, point and function generator sweeps.

*RST PSYN

Key Entry Pulse Video Pulse Sync


Supported All Models with Option UNT and 303

POSitive|NEGative
[:SOURce]:PM[1]|2:INTernal:SWEep:TRIGger:SLOPe?

This command sets the polarity of an external signal at the TRIG 1, TRIG 2, or PULSE BNC (see :PM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce) or internal Pulse Video or Pulse Sync signal (see :PM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce) that will trigger a list or step sweep.

POSitive The signal generator triggers an event when it detects a rising edge on the source signal

NEGative The signal generator triggers an event when it detects a falling edge on the source signal

*RST POS

Key Entry Int/Ext Trigger Polarity Neg Pos

:PM[1]|2:SOURce

Supported All Models with Option UNT

[:SOURce]:PM[1]|2:SOURce
[:SOURce]:PM[1]|2:SOURce?

This command sets the source to generate the phase modulation.

FUNCTION[1] Selects function generator 1 as the modulation source.

FUNCTION[2] Selects function generator 2 as the modulation source.

SWEep Selects the swept function generator as the modulation source.

DUAL Selects the dual function generator as the modulation source.
Analog Modulation Commands

Phase Modulation Subsystem–Option UNT ([:SOURce])

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOISe[1]</td>
<td>Selects noise generator 1 as the modulation source.</td>
</tr>
<tr>
<td>NOISe2</td>
<td>Selects noise generator 2 as the modulation source.</td>
</tr>
<tr>
<td>EXT[1]</td>
<td>Selects an externally applied signal as the modulation input. Connect the signal to the EXT 1 connector.</td>
</tr>
<tr>
<td>EXT2</td>
<td>Selects an externally applied signal as the modulation input. Connect the signal to the EXT 2 connector.</td>
</tr>
<tr>
<td>*RST</td>
<td>Function[1]</td>
</tr>
</tbody>
</table>

**Key Entry**

<table>
<thead>
<tr>
<th>Ext1</th>
<th>Func Gen 1</th>
<th>Dual Func Gen</th>
<th>Noise Gen 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ext2</th>
<th>Func Gen 2</th>
<th>Swept Func Gen</th>
<th>Noise Gen 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks**

The externally applied, ac-coupled input signal is tested for a voltage level and a display annunciator will report a high or low condition if that voltage is $\pm 3\%$ of $1 \, V_p$.

**:PM[1]|2:STATe**

**Supported**

All Models with Option UNT

[:SOURce]:PM[1]|2:STATe ON\|OFF\|1\|0

This command enables or disables the phase modulation for the selected path.

**Key Entry**

ΦM Off On

**Remarks**

The RF carrier is modulated when you set the signal generator’s modulation state to ON, see :MODulation[:STATe] command for more information.

Whenever phase modulation is enabled, the ΦM annunciator is turned on in the display.
Analog Modulation Commands
Phase Modulation Subsystem–Option UNT ([SOURce])

:PM[1]|2[:DEViation]

Supported All Models with Option UNT

[:SOURce]:PM[1]|2[:DEViation] <value><unit>|UP|DOWN

This command sets the deviation of the phase modulation.

The variable <unit> will accept RAD (radians), PIRAD (pi-radians), and DEG (degrees); however, the query will only return values in radians.

*RST +0.00000000E+000

Range See the Data Sheet for range values

Key Entry ΦM Dev

Remarks Refer to :PM[:DEViation]:STEP[:INCRement] command for setting the value associated with the UP and DOWN choices.

:PM[:DEViation]:STEP[:INCRement]

Supported All Models with Option UNT

[:SOURce]:PM[:DEViation]:STEP[:INCRement] <value><unit>

This command sets the phase modulation deviation step increment.

Range 0.001–1E3RAD

Key Entry Incr Set

Remarks The value set by this command is used with the UP and DOWN choices for the FM deviation command. Refer to :PM[1]|2[:DEViation] command for more information.

The setting enabled by this command is not affected by signal generator power-on, preset, or *RST.
Pulse Modulation Subsystem–Options UNW and N5180320B ([:SOURce])

:PULM:EXTInternal:POLarity

**Supported**

All with Option UNW

[:SOURce]:PULM:EXTInternal:POLarity NORMal|INVerted

[:SOURce]:PULM:EXTInternal:POLarity?

This command selects the polarity of the TTL input signal at the TRIG IN rear panel connector. The signal generator can respond to either a normal (a TTL high) or an inverted (TTL low) signal.

**Example**

:PULM:EXT:POL NORM

The preceding example selects normal (TTL high) polarity.

*RST Normal

**Key Entry**

Ext Polarity Normal Invert

:PULM:INTernal:DELay:STEP

**Supported**

All with Option UNW

[:SOURce]:PULM:INTernal:DELay:STEP <value><unit>

[:SOURce]:PULM:INTernal:DELay:STEP?

This command sets the step increment for the pulse delay.

The step value, set by this command, is used with the UP and DOWN choices in the :PULM:INTernal:DELay[1]|2 command.

The step value set with this command is not affected by a signal generator power-on, preset, or *RST command.

**Example**

:PULM:INT:DEL:STEP 10NS

The preceding example sets the pulse delay step value to 10 nanoseconds.

**Range**

10nS to (pulse period – 20 nS)

**Key Entry**

Incr Set


**Supported**

All with Option UNW

[:SOURce]:PULM:INTernal:DELay[1]|2 <value><unit>|UP|DOWN

[:SOURce]:PULM:INTernal:DELay[1]|2
Analog Modulation Commands
Pulse Modulation Subsystem–Options UNW and N5180320B ([:SOURce])

This command sets the pulse delay for the internally-generated pulse modulation using the variable <value><unit>. The command, used with the UP|DOWN parameters, will change the delay by a user-defined step value. Refer to the :PULM:INTernal:DELa y:STEP command for setting the value associated with the UP and DOWN choices.

The optional variable <unit> accepts nS (nanoseconds) to S (seconds) with a resolution of 10 nS.

The range value is dependent on the pulse period (refer to the :PULM:INTernal:PERiod command).

Use DELay1 with the DOUBlet parameter and Delay1 and Delay2 with the ADOublet parameter (refer to the :PULM:SOURce:INTernal command).

When “TRIGgered” is the pulse train trigger mode, then this value specifies the time after a trigger is received before the first Pulse Train On Time starts (refer to the :PULM:INTernal:TRAI n:TRIGger command).

Example
:PULM:INT:DEL 200E-9
The preceding example sets the internal pulse delay to 200 nanoseconds.

*RST
0.00000000E000

Range

Internal Free Run: depends on pulse period and pulse width settings

Internal Triggered, Adjustable Doublet, & Triggered Doublet:
70nS to (42 S - 10 nS - pulse width)

Key Entry Pulse Delay

:PULM:INTernal:FREQuency

Supported All with Option UNW

[:SOURce]:PULM:INTernal:FREQuency
<frequency>|MAXimum|MINimum|UP|DOWN
[:SOURce]:PULM:INTernal:FREQuency?

This command sets the pulse rate for the internally-generated square wave using the variable <frequency>. The command, used with the UP|DOWN parameters, will change the frequency by a user-defined step value. Refer to the :PULM:INTernal:FREQuency:STEP command for setting the value associated with the UP and DOWN choices.

This command is used when SQUare is the pulse modulation type. Refer to :PULM:SOURce command for the pulse modulation type selection.

Example
:PULM:INT:FREQ 1MHz
Analog Modulation Commands
Pulse Modulation Subsystem–Options UNW and N5180320B [:SOURce]

The preceding example sets the square wave pulse rate to 1 megahertz.

*RST +4.00000000E+002
Range 0.1Hz–10MHz
Key Entry Pulse Rate

:PULM:INTernal:FREQuency:STEP

Supported All with Option UNW

[:SOURce]:PULM:INTernal:FREQuency:STEP[:INCRement]
<freq>|MAXimum|MINimum|DEFault
[:SOURce]:PULM:INTernal:FREQuency:STEP[:INCRement]?

This command sets the step value for the internally-generated square wave pulse rate.

This command is used when SQUare is the pulse modulation type. Refer to :PULM:SOURce command for the pulse modulation type selection. The step value, set with this command, is used with the UP and DOWN choices in the :PULM:INTernal:FREQuency command.

The step value set with this command is not affected by a power-on, preset, or *RST command.

Example

:PULM:INT:FREQ:STEP MIN

The preceding example sets the step value for the square wave pulse rate to 0.1 Hz, the minimum rate.

Range 0.1Hz–10MHz
Key Entry Incr Set

:PULM:INTernal:PERiod

Supported All with Option UNW

[:SOURce]:PULM:INTernal:PERiod
<period>|MAXimum|MINimum|UP|DOWN
[:SOURce]:PULM:INTernal:PERiod?

This command sets the pulse period for the internally generated pulse modulation using the variables <value><units>. The command, used with the UP|DOWN parameters, will change the pulse period by a user–defined step value. Refer to the :PULM:INTernal:PERiod:STEP[:INCRement] command for setting the value associated with the UP and DOWN choices.
Analog Modulation Commands
Pulse Modulation Subsystem–Options UNW and N5180320B ([:SOURce])

If the entered value for the pulse period is equal to or less than the value for the pulse width, the pulse width changes to a value that is less than the pulse period. Refer to :PULM:INTernal:PWIDth[1]|2 command for setting the pulse width.

Example

:PULM:INT:PER .5S

The preceding example sets the period of the internally generated pulse to 500 milliseconds.

*RST +4.00000000E−006

Range 30 nS – 42 S

Key Entry Pulse Period

:PULM:INTernal:PERiod:STEP[:INCRement]

Supported All with Option UNW

[:SOURce]:PULM:INTernal:PERiod:STEP[:INCRement]
<value><unit>|UP|DOWN
[:SOURce]:PULM:INTernal:PERiod:STEP[:INCRement]?

This command sets the step value for the internal pulse period using the variable <value><unit>.

The step value, set with this command, is used with the UP and DOWN choices available in the :PULM:INTernal:PERiod command.

The step value set with this command is not affected by a power-on, preset, or *RST command.

Example

:PULM:INT:PER:STEP .1S

The preceding example sets the square wave pulse period step value to 100 milliseconds.

Range 30 nS – 42S

Key Entry Incr Set

:PULM:INTernal:PWIDth:STEP

Supported All with Option UNW

[:SOURce]:PULM:INTernal:PWIDth:STEP
<value><unit>|MAXimum|MINimum|DEFault
[:SOURce]:PULM:INTernal:PWIDth:STEP?

This command sets the step increment for the pulse width using the variables <value><unit>.
Analog Modulation Commands
Pulse Modulation Subsystem—Options UNW and N5180320B ([[:SOURce]])

The step value, set by this command, is used with the **UP** and **DOWN** choices available in the :PULM:INternal:PWIDth[1]|2 command.

The step value, set with this command, is not affected by a power-on, preset, or *RST command.

**Example**

`:PULM:INT:PWID:STEP 100NS`

The preceding example sets the pulse width step to 100 nanoseconds.

**Range** 20nS to (pulse period - 10 nS)

**Key Entry** Incr Set

### :PULM:INternal:PWIDth[1]|2

**Supported** All with Option UNW

[*[:SOURce]]:*PULM:INternal:PWIDth[1]|2 <value><unit>|UP|DOWN

[*[:SOURce]]:*PULM:INternal:PWIDth[1]|2?

This command sets the pulse width for the internally generated pulse signal.

This command sets the pulse width for the internally-generated pulse modulation using the variables <value><unit>. The command, used with the **UP|DOWN** parameters, will change the pulse width by a user-defined step value. Refer to the :PULM:INternal:PWIDth:STEP command for setting the value associated with the **UP** and **DOWN** choices.

If the entered value for the pulse width is equal to or greater than the value for the pulse period, the pulse width changes to a value that is less than the pulse period. For more information, refer to the *PULM:INternal:PERiod command.

Use PWIDTH1 with the DOUBlet parameter and PWIDTH1 and PWIDTH2 with the ADOublet parameter (refer to :PULM:SOURce:INternal command).

**NOTE**

A power search is recommended for signals with pulse widths less than one microsecond. Refer to “:ALC:SEARch” on page 100.

**Example**

`:PULM:INT:PWIDth 100MS`

The preceding example sets the pulse width to 100 milliseconds.

*RST +2.00000000E–006

**Range** 20 nS to (pulse period - 10 nS)

**Key Entry** Pulse Width

### :PULM:INternal:TRAin:LIST:PRESet

**Supported** All with Options UNW and N5180320B
Analog Modulation Commands
Pulse Modulation Subsystem–Options UNW and N5180320B ([:SOURce])

[:SOURce]:PULM:INTernal:TRAin:LIST:PRESet

This command sets the list to a single row of 2us of On Time, 2us of Off Time, and a Repetition of 1. Refer to :PULM:INTernal:TRAin:ONTime and :PULM:INTernal:TRAin:OFFTime.

:PULM:INTernal:TRAin:OFFTime

Supported All with Options UNW and N5180320B

[:SOURce]:PULM:INTernal:TRAin:OFFTime <value>,<value>
[:SOURce]:PULM:INTernal:TRAin:OFFTime?

This command sets the pulse off values for the current list of pulse train off times (where the RF will be off). If this list is shorter than the other lists, then the last element will be repeated as necessary to match the length of the On Time or the Repetition list. The query returns the count of pulse cycle elements in the list of off times. Refer to :PULM:INTernal:TRAin:ONTime and :PULM:INTernal:TRAin:REPetition.

The resolution for this setting is 10nS.

Example

:PULM:INT:TRA:OFFT 100NS,200NS,400E–9

The preceding example sets the pulse train off cycles to 100 nanoseconds, 200 nanoseconds, and 400 nanoseconds.

Range 20nS to 42S

:PULM:INTernal:TRAin:OFFTime:POINts?

Supported All with Options UNW and N5180320B

[:SOURce]:PULM:INTernal:TRAin:OFFTime:POINts?

This query returns the count of elements in the list of off times.

:PULM:INTernal:TRAin:ONTime

Supported All with Options UNW and N5180320B

[:SOURce]:PULM:INTernal:TRAin:ONTime <value>,<value>
[:SOURce]:PULM:INTernal:TRAin:ONTime?

This command sets the pulse on values for the current list of pulse train on times. If this list is shorter than the other lists, then the last element will be repeated as necessary to match the length of the Off Time or the Repetition list. The query returns the count of pulse cycle elements in the list of on times. Refer to :PULM:INTernal:TRAin:OFFTime and :PULM:INTernal:TRAin:REPetition.

The resolution for this setting is 10 nS.
Analog Modulation Commands
Pulse Modulation Subsystem–Options UNW and N5180320B ([:SOURce])

Example

[:PULM:INT:TRA:ONT 100NS,200NS,400E–9]

The preceding example sets the pulse train on cycles to 100 nanoseconds, 200 nanoseconds, and 400 nanoseconds.

Range 20nS to 42S

[:PULM:INTernal:TRAin:ONTime:POINts?]

Supported All with Options UNW and N5180320B

[:SOURce]:PULM:INTernal:TRAin:ONTime:POINts?

This query returns the count of elements in the list of on times.

[:PULM:INTernal:TRAin:REPetition]

Supported All with Options UNW and N5180320B

[:SOURce]:PULM:INTernal:TRAin:REPetition <value>,<value>

[:SOURce]:PULM:INTernal:TRAin:REPetition?

This command generates a user-defined list of the pulse repetitions. The maximum is a total count of 2047, so a list of "2047,1" would be too long. Lists that are too long will generate an error and only the first 2047 pulses will be played. If this list is shorter than the other lists, then the last element will be repeated as necessary to match the length of the On Time or Off Time list, whichever is longer. Refer to [:PULM:INTernal:TRAin:ONTime and [:PULM:INTernal:TRAin:OFFTime.

Example

[:PULM:INT:TRA:REP 100,20,3]

The preceding example repeats the first pulse cycle 100 times, the second cycle to be repeated 20 times, and the third cycle 3 times.

Range 1 to 2047 total pulse repetitions
Analog Modulation Commands
Pulse Modulation Subsystem–Options UNW and N5180320B [:SOURce]]

[:SOURce]:PULM:INTernal:TRAIN:REPetition:POINts?

Supported All with Options UNW and N5180320B

This query returns the count of elements in the list of repetitions.

[:SOURce]:PULM:INTernal:TRAIN:TRIGger

This command sets the triggering mode for the Pulse Train feature.

- **FRUN**
  - Free Run triggering continuously plays the pulse train.

- **TRIGgered**
  - Trigger runs the pulse train (after waiting the Pulse Delay) each time an external trigger is supplied (edge triggered) to the PULSE BNC, the “Trigger Immediately” softkey is pressed, or the [:SOURce]:PULM:INTernal:TRAIN:TRIGger:IMMediate SCPI command is sent (when the pulse train playback is idle). Triggers received during playback are lost.

- **GATEd**
  - Gated triggering runs the pulse train while an external trigger is supplied (level triggered) to the PULSE BNC. The state of the GATEd trigger is detected only when the playback is transitioning to or in idle. This means that, once started, playback is always completed, even if the GATE trigger changes to the inactive state.

*:RST* TRIGgered

Key Entry Trigger Mode

[:SOURce]:PULM:INTernal:TRAIN:TRIGger:IMMediate

This command will cause the pulse train to run once. If the pulse train is already running or off, then this SCPI command has no effect.

Key Entry Trigger Immediately

[:SOURce]:PULM:INTernal:VIDeo:POLarity

Supported All with Option UNW

[:SOURce]:PULM:INTernal:VIDeo:POLarity NORMAL|INVerted

[:SOURce]:PULM:INTernal:VIDeo:POLarity?
Analog Modulation Commands
Pulse Modulation Subsystem–Options UNW and N5180320B ([:SOURce])

This command inverts the polarity on the internally generated pulse video signal.
If the entered value for Trig Out BNC Video Polarity is set to Invert, the pulse video signal at the Trig Out BNC is inverted.

**Example**

```
:PULM:INT:VID INV
```

The preceding example inverts the video signal polarity at the Trig Out BNC.

*RST Normal

**Key Entry** Trig Out BNC Video Polarity Normal Invert

**:PULM:SOURce**

Supported All with Option UNW

```
[:SOURce]:PULM:SOURce INTernal|EXTernal
[:SOURce]:PULM:SOURce?
```

This command sets the source of the pulse modulation.
The INTernal selection accesses one of the six internally generated modulation inputs while EXTernal selects an external pulse (rear panel connector) input. To select an internally generated modulation input, refer to

```
:PULM:SOURce:INTernal command.
```

**Key Entry** Pulse Source

**:PULM:SOURce:INTernal**

Supported All with Option UNW

```
[:SOURce]:PULM:SOURce:INTernal
SQUare|FRUN|TRIGgered|ADOublet|DOUBlet|GATEd|PTRain
[:SOURce]:PULM:SOURce:INTernal?
```

This command selects one of the seven internally generated modulation inputs. There is one external source: Ext Pulse selected by :PULM:SOURce command.

**NOTE**

The PTRain (Pulse Train) parameter requires Option N5180320B.

```
[:SOURce]:PULM:SOURce:INTernal
SQUare|FRUN|TRIGgered|ADOublet|DOUBlet|GATEd|PTRain
[:SOURce]:PULM:SOURce:INTernal?
```

This command selects one of the seven internally generated modulation inputs. There is one external source: Ext Pulse selected by :PULM:SOURce command.

**SQUare** This command sets Square as the pulse modulation source. This is an internal free-run pulse with a 50% duty cycle. The period is determined by the rate.

**FRUN** This command sets Free Run as the pulse modulation source. You can define the period, width, and delay.
Analog Modulation Commands
Pulse Modulation Subsystem–Options UNW and N5180320B ([SOURce])

TRIGgered
This command sets Triggered as the pulse modulation source. This selection produces an RF pulse with a user-defined width and delay at the RF OUTPUT connector when a valid trigger signal occurs at the PULSE connector.

ADOublet
This command sets Adjustable Doublet as the pulse modulation source. This selection produces two pulses at the RF OUTPUT connector for each trigger event at the PULSE connector. The first pulse has a user-defined width and delay (from the rising edge of the Pulse Sync Out signal). The second pulse has a user-defined width and delay (from the rising edge of the first pulse).

DOUBlet
This command sets Trigger Doublet as the pulse modulation source. This produces two pulses at the RF OUTPUT connector for each trigger event at the PULSE connector. The first pulse follows the external trigger signal. The second pulse has user-defined width and delay parameters.

GATEd
This command sets Gated as the pulse modulation source. A pulse train with user-defined period and width parameters occurs at the RF OUTPUT connector when a valid gate signal is applied to the PULSE connector.

PTRain
This selection produces an RF pulse train (up to 2047 distinct cycles) with user-defined widths and delays at the RF OUTPUT connector when a valid trigger signal occurs at the PULSE connector. The Pulse Train Trigger mode selection determines when the pulse train is output.

Example
:PULM:SOUR:INT SQU
The preceding example selects an internal free-run square wave with a 50% duty cycle, as the pulse modulation source.

*RST
FRUN (Int Free–Run)

Key Entry
Square Free-Run Triggered
Trigger Doublet Gated Pulse Train
Adjustable Doublet

:PULM:STATe

Supported
All with Option UNW

[:SOURce]:PULM:STATe ON|OFF|1|0
[:SOURce]:PULM:STATe?
Analog Modulation Commands
Pulse Modulation Subsystem—Options UNW and N5180320B ([:SOURce])

This command enables or disables pulse modulation for the selected path.
When pulse modulation is enabled, the PULSE annunciator appears on the signal generator's front-panel display.

**Example**

`:PULM:STAT ON`

The preceding example enables the pulse modulation.

```
*RST 0
Key Entry Pulse Off On
```
5 Arb Commands

With firmware version B.01.75 or later, the following options have changed to a new eight-digit format:

- Option 302 to Option N5180302B
- Option 320 to Option N5180320B
- Option 403 to Option N5180403B
- Option 430 to Option N5180430B
- Option 431 to Option N5180432B
- Option 432 to Option N5180431B
- Option UN7 to Option N5180UN7B

Only software options are changed to the eight-digit format. Hardware options remain with three-digits.

This chapter provides arb signal generation SCPI command descriptions for use in either component or receiver test using Keysight X-Series signal generators.

This chapter contains the following sections:

- **All Subsystem–N5166B/72B/82B [:SOURce]** on page 310
- **Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B [:SOURce]:RADio:DMODulation:ARB** on page 311
- **Dual ARB Subsystem–N5166B/72B/82B [:SOURce]:RADio:ARB** on page 344
- **LARB Subsystem–N5166B/72B/82B [:SOURce]:RADio:LARB** on page 390
- **Multitone Subsystem–N5166B/72B/82B with Option N5180430B [:SOURce]:RADio:MTONe:ARB** on page 391
- **Two Tone Subsystem–N5166B/72B/82B with Option N5180430B [:SOURce]:RADio:TTONe:ARB** on page 411
All Subsystem–N5166B/72B/82B ([:SOURce])

:RADio:ALL:OFF

**Supported**  N5166B/72B/82B

[:SOURce]:RADio:ALL:OFF

This command turns off all digital modulation formats.

**Remarks**  This command does not affect analog modulation.
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B ([:SOURce]:RADio:DMODulation:ARB)

Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B ([:SOURce]:RADio:DMODulation:ARB)

**:BASeband:FREQuency:OFFSet**

**Supported** N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:DMODulation:ARB:BASeband:FREQuency:OFFSet <value><unit>

[:SOURce]:RADio:DMODulation:ARB:BASeband:FREQuency:OFFSet?

This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed–through is not in the center.

The X-Series signal generator provides automatic DAC over–range protection when the offset value is something other than 0 Hz. It scales down the playing I/Q data by \(1/\sqrt{2}\).

*RST +0.00000000E+000

Range +5.0E7 to –5.0E7 Hz

**Key Entry** Baseband Frequency Offset

**:BASeband:FREQuency:OFFSet:PHASe:RESet**

**Supported** N5166B/72B/82B with Option N5180431B


This command clears the phase accumulation and so zero phase shift.

When the Baseband Frequency Offset is non–zero, the hardware rotator accumulates phase–shift of the baseband signal. This residual phase remains even after the offset value is returned to zero. While there is a non–zero residual phase present in the signal, the DAC Over–Range Protection feature will automatically prevent DAC overrange errors from occurring by scaling the signal down by \(1/\sqrt{2}\).

**Key Entry** Baseband Frequency Offset Phase Reset

**:FILTer**

**Supported** N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:DMODulation:ARB:FILTer

RNYQuist|NYQuist|GAUSSian|

RECTangle|IS95|IS95_EQ|IS95_MOD|IS95_MOD_EQ|EDGE|EWIDe|EHSR|

WCDMa|AC4Fm|"<user FIR>"

[:SOURce]:RADio:DMODulation:ARB:FILTer?
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURce:RADio:DMODulation:ARB])

This command specifies the pre–modulation filter type.

- **RNYQuist**: This choice selects a Root Nyquist (root raised cosine) filter. This filter is adjusted using Alpha.
- **NYQuist**: This choice selects a Nyquist (raised cosine) filter. This filter is adjusted using Alpha.
- **GAUSsian**: This choice selects a Gaussian filter which is adjusted using Bbt values.
- **RECTangle**: This choice selects a one symbol wide rectangular filter.
- **IS95**: This choice selects a filter that meets the criteria of the IS–95 standard.
- **IS95_EQ**: This choice selects a filter which is a combination of the IS–95 filter (above) and the equalizer filter described in the IS–95 standard. This filter is only used for IS–95 baseband filtering.
- **IS95_MOD**: This choice selects a filter that meets the criteria of the IS–95 error function (for improved adjacent channel performance) with lower passband rejection than the filter specified in the IS–95 standard.
- **IS95_MOD_EQ**: This choice selects a filter which is a combination of the equalizer filter described in the IS–95 standard and a filter that meets the criteria of the IS–95 error function (for improved adjacent channel performance), with lower passband rejection.
- **EDGE**: This choice selects a linearized Gaussian filter as defined in GSM 05.04.
- **EWIDe**: This choice selects an EDGE spectrally wide pulse shape filter as per 3GPP TS 45.004.
- **EDGE EHSR**: This choice selects an EDGE high symbol rate spectrally narrow pulse shape filter as per 3GPP TS 45.004.
- **WCDMa**: This choice selects a W–CDMA filter which is the equivalent of a Root Nyquist filter with an alpha of 0.22 optimized for ACP.
- **AC4Fm**: This choice selects a predefined Association of Public Safety Communications Officials (APCO) specified compatible 4–level frequency modulation (C4FM) filter.
- **"<user FIR>"**: This variable is any FIR filter file that you have stored in memory. The variable needs no directory path indicating the location of the file, such as FIR: or /USER/FIR. The command assumes the FIR directory. For more information on file names, refer to “File Name Variables” on page 43.
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURCE]:RADIO:DMODulation:ARB)

*RST Root Nyquist

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Nyquist</th>
<th>IS–95</th>
<th>EDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaussian</td>
<td>IS–95 Mod</td>
<td>WCDMA</td>
<td></td>
</tr>
<tr>
<td>User FIR</td>
<td>IS–95 w/EQ</td>
<td>Rectangle</td>
<td></td>
</tr>
<tr>
<td>Root Nyquist</td>
<td>IS–95 Mod w/EQ</td>
<td>EDGE Wide</td>
<td></td>
</tr>
<tr>
<td></td>
<td>APCO 25 C4FM</td>
<td>EDGE EHSR</td>
<td></td>
</tr>
</tbody>
</table>

:FILTER:ALPHA

Supported N5166B/72B/82B with Option N5180431B

[:SOURCE]:RADIO:DMODulation:ARB:FILTER:ALPHA <val>
[:SOURCE]:RADIO:DMODulation:ARB:FILTER:ALPHA?

This command changes the Nyquist or Root Nyquist filter alpha value.

The filter alpha value can be set to the minimum level (0), the maximum level (1), or in between by using fractional numeric values (0.001 to 0.999).

*RST +5.00000000E−001
Range 0.000 to 1.000
Key Entry Filter Alpha
Remarks To change the current filter type, refer to ":FILTER" on page 311.

:FILTER:BBT

Supported N5166B/72B/82B with Option N5180431B

[:SOURCE]:RADIO:DMODulation:ARB:FILTER:BBT <val>
[:SOURCE]:RADIO:DMODulation:ARB:FILTER:BBT?

This command changes the bandwidth–multiplied–by–bit–time (BbT) filter parameter.

The filter BbT value can be set to the minimum level (0.1), the maximum level (1), or in between by using fractional numeric values (0.100 to 0.999).

*RST +5.00000000E−001
Range 0.100 to 1.000
Key Entry Filter BbT
Remarks This command is effective only after choosing a Gaussian filter. It does not have an effect on other types of filters.
Arb Commands
Dmodulation Subsystem—N5166B/72B/82B with Option N5180431B
([SOURce]:RADio:DMODulation:ARB)

To change the current filter type, refer to “:FILTER” on page 311.

:FILTER:CHANnel

Supported N5166B/72B/82B with Option N5180431B
[SOURce]:RADio:DMODulation:ARB:FILTER:CHANnel EVM|ACP
[SOURce]:RADio:DMODulation:ARB:FILTER:CHANnel?

This command optimizes the Nyquist and Root Nyquist filters to minimize error vector magnitude (EVM) or to minimize adjacent channel power (ACP).

- **EVM**: This choice provides the most ideal passband.
- **ACP**: This choice improves stopband rejection.

*RST

Key Entry Optimize FIR For EVM ACP

Remarks To change the current filter type, refer to “:FILTER” on page 311.

:HEADER:CLEar

Supported N5166B/72B/82B with Option N5180431B
[SOURce]:RADio:DMODulation:ARB:HEADER:CLEar

This command clears the header information from the file header used by this modulation format.

Key Entry Clear Header

Remarks The Digital Modulation Off On softkey must be set to On for this command to function.

:HEADER:SAVE

Supported N5166B/72B/82B with Option N5180431B
[SOURce]:RADio:DMODulation:ARB:HEADER:SAVE

This command saves the header information to the file header used by this modulation format.

Key Entry Save Setup To Header

Remarks The Digital Modulation Off On softkey must be set to On for this command to function.

:IQ:MODulation:ATTen

Supported N5166B/72B/82B with Option N5180431B
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURCE]:RADio:DMODulation:ARB)

[:SOURCE]:RADio:DMODulation:ARB:IQ:MODulation:ATTen <val>
[:SOURCE]:RADio:DMODulation:ARB:IQ:MODulation:ATTen?

This command sets the attenuation level of the I/Q signals being modulated through the signal generator RF path.

The variable <val> is expressed in units of decibels (dB).

*RST  +6.00000000E+000
Range  0 to 50
Key Entry I/Q Modulator Atten Manual Auto

:iQ:MODulation:ATTen:AUTO

Supported  N5166B/72B/82B with Option N5180431B

ON|OFF|1|0

This command enables or disables the I/Q attenuation auto mode.

ON (1)  This choice enables the attenuation auto mode which optimizes the modulator attenuation for the current conditions.

OFF (0)  This choice holds the attenuator at its current setting or at a selected value. Refer to the :iQ:MODulation:ATTen command for setting the attenuation value.

*RST  1
Key Entry I/Q Modulator Atten Manual Auto

:MDEStination:AAMPliitude

Supported  N5166B/72B/82B with Option N5180431B

[:SOURCE]:RADio:DMODulation:ARB:MDEStination:AAMPliitude
NONE|M1|M2|M3|M4
[:SOURCE]:RADio:DMODulation:ARB:MDEStination:AAMPliitude?

This command routes the selected marker to the Alternate Amplitude function. The NONE parameter clears the marker for the Alternate Amplitude function.

*RST  NONE

Key Entry  None  Marker  Marker  Marker  Marker
          1     2     3     4
CAUTION

Incorrect automatic level control (ALC) sampling can create a sudden unlevelled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.

NOTE

Do not use the ALC hold for more than 100 ms, because it can affect the waveform’s output amplitude.

NOTE

A waveform file that has unspecified settings in the file header uses the previous waveform’s routing settings.

For more information on the marker ALC hold function, see the User’s Guide.

Example
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([[:SOURce]:RADio:DMODulation:ARB])

:RAD:DMOD:ARB:MDES:ALCH M1

The preceding example routes marker 1 to the ALC Hold function.

*RST

None

**NOTE**

Key Entry

<table>
<thead>
<tr>
<th>Entry</th>
<th>Marker 1</th>
<th>Marker 2</th>
<th>Marker 3</th>
<th>Marker 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

:MDEStination:PULSe

**Supported** N5166B/72B/82B with Option N5180431B

**CAUTION**

The pulse function incorporates ALC hold. Incorrect automatic level control (ALC) sampling can create a sudden unleveled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.

[:SOURce]:RADio:DMODulation:ARB:MDEStination:PULSe

NONE|M1|M2|M3|M4

[:SOURce]:RADio:DMODulation:ARB:MDEStination:PULSe?

This command enables the marker pulse/RF blanking function for the selected marker.

This function automatically uses the ALC hold function, so there is no need to select both the ALC hold and pulse/RF blanking functions for the same marker.

**NOTE**

Do not use ALC hold for more than 100 ms, because it can affect the waveform’s output amplitude.

The signal generator blanks the RF output when the marker signal goes low. The marker polarity determines when the marker signal is low. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. For setting a marker's polarity, see

:MPOLarity:MARKer1|2|3|4.

**NOTE**

Set marker points prior to using this function. Enabling this function without setting marker points may create a continuous low or high marker signal, depending on the marker polarity. This causes either no RF output or a continuous RF output.

The marker signal has a minimum of a two–sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURce]:RADio:DMODulation:ARB)

the RF blanking to begin. The RF blanking setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

A waveform that has unspecified settings in the file header uses the previous waveform’s routing settings. This could create the situation where there is no RF output signal, because the previous waveform used RF blanking.

For more information on the marker RF blanking function, see the User’s Guide.

NONE  This terminates the marker RF blanking/pulse function.
M1–M4  These are the marker choices. The RF blanking/pulse feature uses only one marker at a time.

Example
The preceding example routes marker 2 to Pulse/RF Blanking.

*RST  NONE

Key Entry

<table>
<thead>
<tr>
<th>Marker</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marker</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

:MODulation:ASK[:DEPTh]

Supported  N5166B/72B/82B with Option N5180431B
[:SOURce]:RADio:DMODulation:ARB:MODulation:ASK[:DEPTh] <0% – 100%>
[:SOURce]:RADio:DMODulation:ARB:MODulation:ASK[:DEPTh]?
This command changes the depth for the amplitude shift keying (ASK) modulation. Depth is set as a percentage of the full power on level.

*RST  +1.00000000E+002
Range  0 to 100
Key Entry  ASK Depth 100%
Remarks  The modulation is applied to the I signal, the Q value is always kept at zero.

:MODulation:FSK[:DEViation]

Supported  N5166B/72B/82B with Option N5180431B
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURCE]:RADIO:DMODulation:ARB)

[[:SOURCE]:RADIO:DMODulation:ARB:MODulation:FSK[:DEViation]
<val>
[[:SOURCE]:RADIO:DMODulation:ARB:MODulation:FSK[:DEViation]?]

This command sets the symmetric FSK frequency deviation value.
The variable <val> is expressed in units of Hertz and the maximum range value equals the current symbol rate value multiplied by ten, limited to 20 MHz.

*RST +4.00000000E+002
Range 0 to 10 times the current symbol rate but never more than the lesser of maxSymbolRate*0.8 or 40 MHz.
Key Entry Freq Dev
Remarks To change the modulation type, refer to “:MODulation[:TYPE]” on page 319.
Refer to the :SRATe command for a list of the minimum and maximum symbol rate values.
To set an asymmetric FSK deviation value, refer to the User's Guide for more information.

:MODulation[:TYPE]

Supported N5166B/72B/82B with Option N5180431B

[[:SOURCE]:RADIO:DMODulation:ARB:MODulation[:TYPE]
ASK|BPSK|QPSK|QPSK|IS95QPSK|
GRAYQPSK|QPSK|IS95QPSK|PSK8|PSK16|D8PSK|EDGE|MSK|FSK2|FSK4|FSK8|FSK16|
C4FM|QAM4|QAM16|QAM32|QAM64|QAM128|QAM256|QAM1024|UIQ|UFSK|VSAQAM64|VSAQAM128|VSAQAM256|VSAQAM512|VSAQAM1024
[[:SOURCE]:RADIO:DMODulation:ARB:MODulation[:TYPE]?]

This command sets the modulation type for the digital modulation personality.

*RST QPSK
Key Entry AS BPS QPS Unbalanced IS–95
K K K QPSK QPSK

QPSK IS–95 π/4 8PS 16PS D8PS
K OQPSK DQPSK K K K

2–Lvl 4–Lvl 8–Lvl 16–Lvl C4F
FSK FSK FSK FSK M
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURce]:RADio:DMODulation:ARB)

32QA  64QA  128Q  256QA  1024Q  Select
M    M    AM    M    AM    User IQ

Select User  VSA  VSA  VSA
FSK        16QAM  32QAM  64QAM

VSA  VSA  VSA  4QAM
256QAM  512QAM  1024QAM

Gray Coded  EDG  MS  16QA  Select User
QPSK       E    K    M    IQ

VSA 128QAM

:MODulation:UFSK

Supported  N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:DMODulation:ARB:MODulation:UFSK <“filename”>
[:SOURce]:RADio:DMODulation:ARB:MODulation:UFSK?

This command selects the user FSK file to use when the :MODulation[:TYPE] is set to UFSK.
For more information on the file name syntax, see “File Name Variables” on page 43.

Key Entry  Select User FSK

:MODulation:UIQ

Supported  N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:DMODulation:ARB:MODulation:UIQ <“filename”>
[:SOURce]:RADio:DMODulation:ARB:MODulation:UIQ?

This command selects the user FSK file to use when the :MODulation[:TYPE] is set to UIQ.
For more information on the file name syntax, see “File Name Variables” on page 43.

Key Entry  Select User I/Q

:MODulation:UQPSk[:GAIN]

Supported  N5166B/72B/82B with Option N5180431B
Arb Commands
Dmodulation Subsystem—N5166B/72B/82B with Option N5180431B
([SOURce]:RADio:DMODulation:ARB)

[:SOURce]:RADio:DMODulation:ARB:MODulation:UQPSk[:GAIN] <val>
[:SOURce]:RADio:DMODulation:ARB:MODulation:UQPSk[:GAIN]?

This command sets the Unbalanced QPSK modulation I versus Q gain, which is the difference in amplitude between I and Q. UQPSK is a 2 bits per symbol modulation where the I constellation values are typically set to be larger or smaller than the Q constellation values. This factor is known as the I Gain. Use this command when the :MODulation[:TYPE] is set to UQPSK.

The variable <val> is expressed in units of dB and the resolution is 0.01 dB.

*RST 0 dB
Range -50 to 50 dB
Key Entry I Gain

:MPOLarity:MARKer1|2|3|4

Supported N5166B/72B/82B with Option N5180431B
[:SOURce]:RADio:DMODulation:ARB:MPOlarity:MARker1|2|3|4 NEGative|POSitive
[:SOURce]:RADio:DMODulation:ARB:MPOlarity:MARKer1|2|3|4?

This command sets the polarity for the selected marker. For a positive marker polarity, the marker signal is high during the marker points. For a negative marker polarity, the marker signal is high during the period of no marker points.

*RST POS
Key Entry Marker 1 Polarity Neg Pos Maker 2 Polarity Neg Pos Marker 3 Polarity Neg Pos Marker 4 Polarity Neg Pos

:NOISe:BANDwidth

Supported N5166B/72B/82B with Options N5180431B and N5180403B
[:SOURce]:RADio:DMODulation:ARB:NOISe:BANDwidth <value><unit>
[:SOURce]:RADio:DMODulation:ARB:NOISe:BANDwidth?

This command selects the flat noise bandwidth value of the real–time noise for an ARB waveform.

Typically, this value is set slightly wider than the carrier bandwidth.
Arb Commands

Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURce]:RADio:DMODulation:ARB)

*:RST +1.00000000E+000

**Range**

- Option 653: 1 sa to 75 Msa
- Option 655: 1 sa to 150 Msa
- Option 656: 1 sa to 100 Msa
- Option 657: 1 sa to 200 Msa

Key Entry Noise Bandwidth

**:NOISe:CBRate**

**Supported** N5166B/72B/82B with Options N5180431B and N5180403B

[:,SOURce]:RADio:DMODulation:ARB:NOISe:CBRate <1bps - 999Mbps> [:SOURce]:RADio:DMODulation:ARB:NOISe:CBRate?

This command sets a value of the carrier bit rate (gross bit rate) for purposes of calculating the Eb/N0 (energy per bit over noise power density at the receiver). When the carrier to noise ratio format is set to Eb/N0 (refer to the :NOISe:CNFormat command), the adjustment of the carrier bit rate will have an immediate impact on the carrier to noise ratio as specified by Eb/N0. For DMODulation (ARB Custom) the carrier bit rate is derived from the symbol rate and bits per symbol of the modulation. The carrier bit rate is a saved instrument state that is recorded in the waveform header.

The query returns the current carrier bit rate setting.

**Example**


The preceding example sets the carrier bit rate to 5 Mbps.

**Default** 2.000000000 Mbps

**Range** 1 bps to 999 Mbps

**Key Entry** Carrier Bit Rate

**:NOISe:CBWidth**

**Supported** N5166B/72B/82B with Options N5180431B and N5180403B

[:,SOURce]:RADio:DMODulation:ARB:NOISe:CBWidth <1Hz-125MHz>

[:,SOURce]:RADio:DMODulation:ARB:NOISe:CBWidth?
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURCE]:RADio:DMODulation:ARB)

This command selects the carrier bandwidth over which the AWGN (additive white gaussian noise) is applied. The noise power will be integrated over the selected bandwidth for the purposes of calculating C/N (carrier to noise ratio). The carrier bandwidth is typically the symbol rate. For more information refer to “:NOISE[:STATE]” on page 327.

*RST 1.000000000 MHz
Range 1 Hz to 125 MHz
Key Entry Carrier Bandwidth

:NOISE:CN

Supported N5166B/72B/82B with Options N5180431B and N5180403B

[:SOURCE]:RADio:DMODulation:ARB:NOISE:CN <-100dB - 100dB>
[:SOURCE]:RADio:DMODulation:ARB:NOISE:CN?

This command sets the carrier to noise ratio in dB. The carrier power is defined as the total modulated signal power without noise power added. The noise power is applied over the specified bandwidth of the carrier signal. For more information, refer to the “:NOISE:CBWidth” command.

Example
:RAD:ARB:NOIS:CN 50DB

The preceding example sets the carrier to noise ratio to 50 dB.

*RST +0.00000000E+000
Key Entry Carrier to Noise Ratio

:NOISE:CNFormat

Supported N5166B/72B/82B with Options N5180431B and N5180403B

[:SOURCE]:RADio:DMODulation:ARB:NOISE:CNFormat CN|EBNO
[:SOURCE]:RADio:DMODulation:ARB:NOISE:CNFormat?

This command selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (Eb/N0) as the variable controlling the ratio of carrier power to noise power in the carrier bandwidth.

Example
:RAD:DMOD:ARB:NOIS:CNF EBNO

The preceding example sets the carrier to noise ratio format to EbNo.

Default Carrier to Noise Ratio Format C/N
Key Entry Carrier to Noise Ratio Format C/N Eb/No
Arb Commands
DModulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURCE]:RADio:DMODulation:ARB)

:[NOISE]:EBNO

Supported N5166B/72B/82B with Options N5180431B and N5180403B

[:SOURCE]:RADio:DMODulation:ARB:NOISE:EBNO <ebno in dB>
[:SOURCE]:RADio:DMODulation:ARB:NOISE:EBNO?

This command allows the C/N to be set using the Eb/N0 (energy per bit over noise power density at the receiver) form. This requires that the carrier bit rate (:NOISE:CBRate) be set properly. The range of Eb/N0 is limited to the range that is equivalent to –100 to 100 dB of C/N. This value is only effective when Eb/N0 has been enabled by the :NOISE:CNFormat command.

The query returns the value of Eb/N0.

Default 0 dB
Range –100 to 100 dB
Key Entry Carrier to Noise Ratio Format Eb/No

:[NOISE]:MUX

Supported N5166B/72B/82B with Options N5180431B and N5180403B

[:SOURCE]:RADio[1]:DMODulation:ARB:NOISE:MUX
SUM|CARRier|NOISE
[:SOURCE]:RADio[1]:DMODulation:ARB:NOISE:MUX?

This command enables diagnostic control of additive noise, such that only the noise, only the carrier, or the sum of both the noise and the carrier are output from the internal baseband generator. With the ALC off, this feature enables direct measurement of just the carrier or the noise contributions to the total power. The system will still behave as if both the noise and the carrier are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

Example

:RAD:DMOD:ARB:NOIS:MUX CARR

The preceding example enables the direct measurement of the carrier contribution to the total power.

Default Carrier+Noise
Key Entry Carrier+Noise | Carrier | Noise

:[NOISE]:POWer:CARRier

Supported N5166B/72B/82B with Options N5180431B and N5180403B
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURce]:RADio:DMODulation:ARB)

[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:CARRier <carrierPower>
[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:CARRier?

This command sets the current carrier power level if noise is on.

In the CARRier control mode, the total power will be adjusted to achieve the specified carrier power and the carrier power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the carrier power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total power is adjusted.

In the NOISe control mode, this will adjust the total noise power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total noise power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] and :NOISe:POWer:NOISe:TOTal commands.

Range  The range varies based on the bounds of the total power that results from the noise settings.
Default  The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry  Carrier Power

:NOISe:POWer:CONTrol[:MODE]

Supported  N5166B/72B/82B with Options N5180431B and N5180403B

[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:CONTrol[:MODE]TO Tal|CARRier|NOISe
[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:CONTrol[:MODE]?

This command sets the power control to one of the three following modes:

Total  This is the default mode where the total power and C/N are independent variables and the carrier power and total noise power are dependent variables set by the total power, C/N and the rest of the noise settings. The carrier power and total noise power will change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values.

Carrier  In this mode the carrier power and C/N are independent variables and the total power and total noise power are dependent variables set by the carrier power, C/N and the rest of the noise settings. The total power and total...
noise power will change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values.

**Total Noise**
In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.

**Default**
TOTal

**Key Entry**
Total Carrier Total Noise

**:NOISe:POWer:NOISe:CHANnel?**

**Supported**
N5166B/72B/82B with Options N5180431B and N5180403B

[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:NOISe:CHANnel?
The query returns the current noise power across the carrier bandwidth in dBm.

**:NOISe:POWer:NOISe:TOTal**

**Supported**
N5166B/72B/82B with Options N5180431B and N5180403B

[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:NOISe:TOTal
<totalNoisePowerInDbm>
[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:NOISe:TOTal?

This command sets the current total noise power level if noise is on.

In the NOISe control mode, the total power will be adjusted to achieve the specified total noise power and the total noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the total noise power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the total power is adjusted.

In the CARRier control mode, this will adjust the carrier power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the carrier power is adjusted.

See also :NOISe:POWer:CONTrol[:MODE] command.

**Range**
The range varies based on the bounds of the total power that results from the noise settings.
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([::SOURce]:RADio:DMODulation:ARB)

Default
The appropriate value given the current total power and the current Carrier to Noise (C/N).

Key Entry
Total Noise Power

:NOISe[:STATe]

Supported
N5166B/72B/82B with Options N5180431B and N5180403B

[:SOURce]:RADio:DMODulation:ARB:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:DMODulation:ARB:NOISe[:STATe]?

This command enables or disables adding real–time, non–repeating additive white gaussian noise (AWGN) to the carrier modulated by the waveform being played by the Dual ARB waveform player.

For more information on AWGN, see the User’s Guide.

Example
:RAD:ARB:NOIS ON

The preceding example applies real–time AWGN to the carrier.

*RST 0

Key Entry
Real–Time AWGN Off On

:PHASe:NOISe:F1

Supported
N5172B/82B with Options N5180431B and N5180432B

[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:F1 <value><unit>
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:F1?

This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see :PHASe:NOISe:F2). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the User’s Guide.

*RST +1.00000000E+003

Range
0 Hz to 77.50052449 MHz

Key Entry
Desired Start Freq (f1)

:PHASe:NOISe:F1:ACTual?

Supported
N5172B/82B with Options N5180431B and N5180432B
Arb Commands

Dmodulation Subsystem—N5166B/72B/82B with Option N5180431B
([:SOURce]:RADio:DMODulation:ARB)

[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:F1:ACTual?

This query returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

:PHASe:NOISe:F2

  Supported  N5172B/82B with Options N5180431B and N5180432B

[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:F2 <value><unit>
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:F2?

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see :PHASe:NOISe:F1). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the User’s Guide.

*RST  +3.00000000E+004

Range  1 Hz to 77.50052449 MHz

Key Entry  Desired Stop Freq (f2)

:PHASe:NOISe:F2:ACTual?

  Supported  N5172B/82B with Options N5180431B and N5180432B

[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:F2:ACTual?

This query returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

:PHASe:NOISe:LMID

  Supported  N5172B/82B with Options N5180431B and N5180432B

[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:LMID <value>
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:LMID?

This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator.

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.
Arb Commands
Dmodulation Subsystem—N5166B/72B/82B with Option N5180431B
([:SOURCE]:RADio:DMODulation:ARB)

For more information on the phase noise impairment option, see the User’s Guide.

The amplitude range varies depending on the f2 value (“:PHASe:NOIsE:F2” on page 328). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.

The range values are expressed in units of dBc/Hz.

<table>
<thead>
<tr>
<th>Command</th>
<th>Range</th>
<th>Key Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>*RST</td>
<td>-7.00000000E+001</td>
<td>Desired Flat Amplitude (Lmid)</td>
</tr>
<tr>
<td>Range</td>
<td>-300 to 100 dBc/Hz</td>
<td></td>
</tr>
</tbody>
</table>

::PHASe:NOIsE:LMID:ACTual?

Supported N5172B/82B with Options N5180431B and N5180432B

This query returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

::PHASe:NOIsE[:STATe]

Supported N5172B/82B with Options N5180431B and N5180432B

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the User’s Guide.

*RST 0

Key Entry Phase Noise Off On

::PHASe:NOIsE:TRACe?

Supported N5172B/82B with Options N5180431B and N5180432B

This query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the impairment from
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([;SOURce]:RADio:DMODulation:ARB)

the phase noise feature. The output is over the start frequency to the stop
frequency for the number of samples specified. The samples are taken at
logarithmic frequency steps and the output is in dBc/Hz.

<table>
<thead>
<tr>
<th>Range</th>
<th>&lt;startFreq&gt;</th>
<th>1 Hz to 100 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;stopFreq&gt;</td>
<td>1 Hz to 100 MHz</td>
</tr>
<tr>
<td></td>
<td>&lt;numSamples&gt;</td>
<td>1 to 8192</td>
</tr>
</tbody>
</table>
Arb Commands
Dmodulation Subsystem—N5166B/72B/82B with Option N5180431B
([:SOURce]:RADio:DMODulation:ARB)

:PLAY:COMpleted?

Supported N5166B/72B/82B with Option N5180431B

This SCPI command returns whether the ARB waveform has completed since the last query or the last time the waveform was set up to play. The waveform is setup to play when various waveform parameters are adjusted, such as turning the mode off and on or changing the triggering mode. It returns a 0 if the waveform has not completed and a 1 if the waveform has completed at least one time. After this query, the value will be reset to 0 until another completion occurs.

:PLAY:WCOMpleted?

Supported N5166B/72B/82B with Option N5180431B

This SCPI command returns whether the ARB waveform has completed since the last query or the last time the waveform was setup up to play. This SCPI command will wait until the ARB waveform has completed. The completion is after repeat counts for single trigger. The waveform is set up to play when various waveform parameters are adjusted, such as turning the mode off and on or changing the triggering mode. It returns a 0 if the waveform has not completed and a DCAS has been sent to the instrument or the mode is not on, otherwise a 1 will be returned when the waveform has completed at least one time. After this query, the value will be reset to 0 until another completion occurs.

:RETRigger

Supported N5166B/72B/82B with Option N5180431B

This command enables or disables the ARB retriggering mode; the retrigger mode controls how the retriggering function performs while a waveform is playing.

ON (1) This choice specifies that if a trigger occurs while a waveform is playing, the waveform will retrigger at the end of the current waveform sequence and play once more.

OFF (0) This choice specifies that if a trigger occurs while a waveform is playing, the trigger will be ignored.
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURce]:RADio:DMODulation:ARB)

**IMMediate**
This choice specifies that if a trigger occurs while a waveform is playing, the waveform will reset and replay from the start immediately upon receiving a trigger.

**:*RST**
ON

**Key Entry**
On   Off   Immediate

**:SCLock:RATE**

**Supported**
N5166B/72B/82B with Option N5180431B

[[:SOURce]:RADio:DMODulation:ARB:SCLock:RATE <val>  
[:SOURce]:RADio:DMODulation:ARB:SCLock:RATE?

This command sets the sample clock rate.

The variable <val> is expressed in units of Hertz (kHz – MHz)

**:*RST**
+4.00000000E+006

**Range**
1E3 to 2E8

**Key Entry**
ARB Sample Clock

**Remarks**
The modulation format should be active before executing this command. If this command is executed before the modulation format is active, the entered value will be overridden by a calculated factory default value. Refer to the [:STATE] command to activate the modulation format.

**:SETup**

**Supported**
N5166B/72B/82B with Option N5180431B

[[:SOURce]:RADio:DMODulation:ARB:SETup  
GSM|NADC|PDC|PHS|DECT|AC4Fm|  
ACQPsk|CDPD|PWT|EDGE|TETRa|BLUetooth|DEFault|MCARrier|"<filename>"  
[:SOURce]:RADio:DMODulation:ARB:SETup?

This command selects the digital modulation format type or multicarrier, and turns multicarrier off or on (see the MCARrier choice description).

The **MCARrier** choice selects multicarrier and turns it on. Selecting any other setup such as GSM or CDPD turns multicarrier off. To select the multicarrier setup, see the “:SETup:MCARrier” on page 333.

**:*RST**
NADC

**Key Entry**
GS   NAD   PD   PH   DEC   APCO 25  
M    C    C    S    T    w/C4FM
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURce]:RADio:DMODulation:ARB)

[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier

Supported N5166B/72B/82B with Option N5180431B

GSM|NADC|PDC|PHS|DECT|
AC4Fm|ACQPSk|CDPD|PWT|EDGE|TETRa,<num carriers>,<freq spacing>)|<file name>

This command builds a table with the specified number of carriers and frequency spacing or retrieves the setup stored in the specified user file.

The carrier type, number of carriers, and frequency spacing value are returned when a query is initiated. The output format is as follows:

<carrier type>,<num carriers>,<freq spacing>

If a specific file is loaded and then queried, only the file name is returned.

The variable <freq spacing> is expressed in units of Hertz (kHz–MHz).

*RST

Carrier: NADC  <num carriers>: 2

<freq spacing>: +1.0000000000000E+06

Range

<num carriers>: 2–100

<freq spacing>: 2 ÷ (num carriers) – 1) ÷ 80 MHz

Key Entry

GSM NADC PDC PHS DECT

CDPD PWT EDGE TETRA # of Carriers

Remarks
For information on the file name syntax, refer to “File Name Variables” on page 43.
Arb Commands
Dmodulation Subsystem—N5166B/72B/82B with Option N5180431B
([:SOURce]:RADio:DMODulation:ARB)

Custom Digital Mod State  APCO w/CQPSK
APCO 25 w/C4FM  Freq Spacing

Remarks  For information on the file name syntax, refer to “File Name Variables” on page 43.

:SETup:MCARrier:PHASe

Supported  N5166B/72B/82B with Option N5180431B
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier:PHASe
FIXed|RANDom
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier:PHASe?

This command toggles the phase settings for multicarrier digital modulation.

FIXed  This choice sets the phase of all carriers to 0.
RANDom  This choice sets random phase values for all of the carriers.

*RST  FIX

Key Entry  Carrier Phases Fixed Random

:SETup:MCARrier:STORe

Supported  N5166B/72B/82B with Option N5180431B
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier:STORe "<filename>"

This command stores the current multicarrier setup information.
The stored file contains information that includes the digital modulation format, number of carriers, frequency spacing, and power settings for the multicarrier setup.

Key Entry  Load/Store
Remarks  The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

For information on the file name syntax, refer to “File Name Variables” on page 43.

:SETup:MCARrier:TABLe

Supported  N5166B/72B/82B with Option N5180431B
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier:TABLe
INIT|APPend|<carrier_num>,GSM|NADC|PDC|PHS|DECT|AC4Fm|ACQPsk|CDPD|PWT|ED

For information on the file name syntax, refer to “File Name Variables” on page 43.
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURce]:RADio:DMODulation:ARB)

GE|TETRa|
"<file name>"",<freq_offset>,<power>
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier:TABLE? <carrier_num>

This command modifies the parameters of one of the available multicarrier
digital modulation formats.

The variable <freq_offset> is expressed in units of Hertz (kHz–MHz).
The variable <power> is expressed in units of decibels (dB).

 INIT This choice clears the current information and creates a
new one–row table, allowing for further definition using
additional parameters.

 APPend This choice adds rows to an existing table.

 <carrier_num> This variable specifies the number of the carriers in the
multicarrier table that will be modified.
The value of the variable <carrier_num> must be
specified prior to selecting the digital modulation
format.

Carrier type, frequency offset, and power level are returned when a query is
initiated. The output format is as follows:

 <carrier type>,<freq_offset>,<power>

*RST carrier type: NADC  <freq_offset>: −5.00000000E+004
<power>: +0.00000000E+000

Range <freq_offset>: −8E7 to 8E7  <power>: −40 to 0

Key Entry Initialize Table   Insert Row   GSM

 NADC     PDC     PHS     DECT
APCO 25 w/C4FM   APCO w/CQPSK   TETRA
CDPD     PWT     EDGE   Custom Digital Mod State

Remarks For information on the file name syntax, refer to “File
Name Variables” on page 43.
Arb Commands

Dmodulation Subsystem—N5166B/72B/82B with Option N5180431B

([::SOURce]:RADio:DMODulation:ARB)

To store a multicarrier setup refer to “::SETup:MCARrier:STORe” on page 334.

::SETup:MCARrier:TABLE:NCARriers

**Supported**

N5166B/72B/82B with Option N5180431B

[::SOURce]:RADio:DMODulation:ARB::SETup:MCARrier:TABLE:NCARriers?

This query returns the number of carriers in the current multicarrier setup.

| *RST | +2 |
| **Range** | 1 to 100 |

**Key Entry**

# of Carriers

::SETup:STORe

**Supported**

N5166B/72B/82B with Option N5180431B

[::SOURce]:RADio:DMODulation:ARB::SETup:STORe "<file name>"

This command stores the current custom digital modulation state.

The saved file contains information that includes the modulation type, filter and symbol rate for the custom modulation setup.

**Key Entry**

Store Custom Dig Mod State

**Remarks**

For information on the file name syntax, refer to “File Name Variables” on page 43.

::SRATe

**Supported**

N5166B/72B/82B with Option N5180431B

[::SOURce]:RADio:DMODulation:ARB::SRATe <val>

[::SOURce]:RADio:DMODulation:ARB::SRATe?

This command sets the transmission symbol rate.

The variable <val> is expressed in units of symbols per second (sps–Msps) and the maximum range value is dependent upon the modulation type and filter.

| *RST | +1.00000000E+006 |
| **Range** | Option 653 | 50 sps to 37.5 Msps |
| | Option 655 | 50 sps to 75 Msps |
| | Option 656 | 50 sps to 50 Msps |
| | Option 657 | 50 sps to 100 Msps |

**Key Entry**

Symbol Rate
Arb Commands

Dmodulation Subsystem—N5166B/72B/82B with Option N5180431B
([:SOURce]:RADio:DMODulation:ARB)

[:TRIGger:TYPE]

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:DMODulation:ARB:TRIGger:TYPE
CONTinuous|SINGle|GATE

[:SOURce]:RADio:DMODulation:ARB:TRIGger:TYPE?

This command sets the trigger mode (type) that controls the waveform’s playback.

Triggers control the playback by telling the X-Series signal generator when to play the modulating signal (waveform). Depending on the trigger settings, the waveform playback can occur once, continuously, or the X-Series signal generator may start and stop playing the waveform repeatedly (GATE mode).

A trigger signal comprises both positive and negative signal transitions (states), which are also called high and low periods. You can configure the X-Series signal generator to trigger on either state of the trigger signal. It is common to have multiple triggers, also referred to as trigger occurrences or events, occur when the X-Series signal generator requires only a single trigger. In this situation, the X-Series signal generator recognizes the first trigger and ignores the rest.

When you select a trigger mode, you may lose the signal (carrier plus modulating) from the RF output until you trigger the waveform. This is because the X-Series signal generator sets the I and Q signals to zero volts prior to the first trigger event, which suppresses the carrier. After the first trigger event, the waveform’s final I and Q levels determine whether you will see the carrier signal or not (zero = no carrier, other values = carrier visible). At the end of most files, the final I and Q points are set to a value other than zero.

There are four parts to configuring the trigger:

− Choosing the trigger type, which controls the waveform’s transmission.

− Setting the waveform’s response to triggers:
  − CONTinuous, see “[:TRIGger:TYPE:CONTinuous[:TYPE]]” on page 339
  − SINGle, see “:RETRigger” on page 331
  − GATE, selecting the mode also sets the response

− Selecting the trigger source (see “[:TRIGger[:SOURce]]” on page 340), which determines how the X-Series signal generator receives its trigger signal, internally or externally. The GATE choice requires an external trigger.

− Setting the trigger polarity when using an external source:
  − CONTinuous and SINGle see “:TRIGger[:SOURce]:EXTernal:SLOPe” on page 342
  − GATE, see “:TRIGger:TYPE:GATE” on page 339

For more information on triggering, see the User’s Guide.

The following list describes the trigger type command choices:
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([SOURce]:RADio:DMODulation:ARB)

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Continuous</th>
<th>Single</th>
<th>Gated</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTInuous</td>
<td>Upon triggering, the waveform repeats continuously.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SINGle</td>
<td>Upon triggering, the waveform segment or sequence plays once.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GATE</td>
<td>An external trigger signal repeatedly starts and stops the waveform’s playback (transmission). The time duration for playback depends on the duty period of the trigger signal and the gate polarity selection (see “:TRIGger:TYPE:GATE” on page 339). The waveform plays during the inactive state and stops during the active polarity selection state. The active state can be set high or low. The gate mode works only with an external trigger source.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE**
The ARB gating behavior described above is opposite to the gating behavior for real-time custom mode.

*RST CONT*
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURce]:RADio:DMODulation:ARB)

:TRIGger:TYPE:CONTinuous[:TYPE]

Supported N5166B/72B/82B with Option N5180431B

TRIGger|RESet
[:SOURce]:RADio:DMODulation:ARB:TRIGger:TYPE:CONTinuous[:TYPE]?

This commands selects the waveform’s response to a trigger signal while using the continuous trigger mode.

For more information on triggering and to select the continuous trigger mode, see “:TRIGger:TYPE” on page 337.

The following list describes the waveform’s response to each of the command choices:

FREE Turning the ARB format on immediately triggers the waveform. The waveform repeats until you turn the format off, select another trigger, or choose another waveform file.

TRIGger The waveform waits for a trigger before play begins. When the waveform receives the trigger, it plays continuously until you turn the format off, select another trigger, or choose another waveform file.

RESet The waveform waits for a trigger before play begins. When the waveform receives the trigger, it plays continuously. Subsequent triggers reset the waveform to the beginning. For a waveform sequence, this means to the beginning of the first segment in the sequence.

*RST FREE

Key Entry Free Trigger & Reset &
Run Run Run

:TRIGger:TYPE:GATE

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:DMODulation:ARB:TRIGger:TYPE:GATE LOW|HIGH
[:SOURce]:RADio:DMODulation:ARB:TRIGger:TYPE:GATE?

This command selects the active state (gate polarity) of the gate while using the gating trigger mode.

The LOW and HIGH selections correspond to the low and high states of an external trigger signal. For example, when you select HIGH, the active state occurs during the high of the trigger signal. When the active state occurs, the X-Series signal generator starts the waveform playback at the last played
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURCE]:RAD:DMODulation:ARB)

Sample point, then stops the playback at the next sample point when the
inactive state occurs. For more information on triggering and to select gating
as the trigger mode, see “TRIgger:TYPE” on page 337.

The following list describes the X-Series signal generator’s gating behavior for
the polarity selections:

- **LOW**  The waveform playback starts when the trigger signal
goes low (active state) and stops when the trigger
signal goes high (inactive state).

- **HIGH** The waveform playback starts when the trigger signal
goes high (active state) and stops when the trigger
signal goes low (inactive state).

- **RST** HIGH

**Key Entry** Gate Active Low High

:TRIGger[:SOURCE]

Supported  N5166B/72B/82B with Option N5180431B

[:SOURCE]:RAD:DMODulation:ARB:TRIGger[:SOURCE] KEY|EXT|BUS

[:SOURCE]:RAD:DMODulation:ARB:TRIGger[:SOURCE]?

This command sets the trigger source.

For more information on triggering, see “TRIgger:TYPE” on page 337. The
following list describes the command choices:

- **KEY** This choice enables manual triggering by pressing the
  front panel Trigger.

- **EXT** An externally applied signal triggers the waveform. This
  is the only choice that works with gating. The following
  conditions affect an external trigger:

  - The input connector selected for the trigger signal.
  You have a choice between the rear panel PATTERN
  TRIG IN connector or the PATT TRIG IN 2 pin on the
  rear panel AUXILIARY I/O connector. To make the
  connector selection, see
  “TRIgger[:SOURCE]:EXTernal[:SOURCE]” on page
  342.

  For more information on the connectors and on
  connecting the cables, see the User’s Guide.

  - The trigger signal polarity:
    - gating mode, see “TRIgger:TYPE:GATE” on
      page 339
Arb Commands

Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([:SOURCE]:RADio:DMODulation:ARB)

— continuous and single modes, see
“:TRIGger[:SOURCE]:EXTernal:SLOPe” on page 342

— The time delay between when the X-Series signal
generator receives a trigger and when the waveform
responds to the trigger. There are two parts to
setting the delay:

— setting the amount of delay, see
“:TRIGger[:SOURCE]:EXTernal:DELay” on page 341

— turning the delay on, see
“:TRIGger[:SOURCE]:EXTernal:DELay:STATe” on page 342

BUS This choice enables triggering over the GPIB or LAN
using the *TRG or GET commands or the AUXILIARY
INTERFACE (RS–232) using the *TRG command.

*RST

Key Entry Trigger Key Ext Bus

:TRIGger[:SOURCE]:EXTernal:DELay

Supported N5166B/72B/82B with Option N5180431B

[:SOURCE]:RADio:DMODulation:ARB:TRIGger[:SOURCE]:EXTernal:DELay <val>
[:SOURCE]:RADio:DMODulation:ARB:TRIGger[:SOURCE]:EXTernal:DELay?

This command sets the amount of time to delay the X-Series signal generator’s
response to an external trigger.

The delay is a path (time) delay between when the X-Series signal generator
receives the trigger and when it responds to the trigger. For example,
configuring a trigger delay of two seconds, causes the X-Series signal
generator to wait two seconds after receipt of the trigger before the X-Series
signal generator plays the waveform.

The delay does not occur until you turn it on (see
“:TRIGger[:SOURCE]:EXTernal:DELay:STATe” on page 342). You can set the
delay value either before or after turning it on.

For more information on configuring an external trigger source and to select
external as the trigger source, see “:TRIGger[:SOURCE]” on page 340.

The unit of measurement for the variable <val> is in seconds (nsec–sec).

*RST +1.00000000E–003

Range 1E–8 to 4E1
Arb Commands
Dmodulation Subsystem—N5166B/72B/82B with Option N5180431B
([[:SOURce]:RADio:DMODulation:ARB])

**Key Entry**  **Ext Delay Time**

`:TRIGger[:SOURce]:EXTernal:DELay:STATe`

**Supported**  N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe ON|OFF|1|0
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe?

This command enables or disables the external trigger delay function.

For setting the delay time, see “`:TRIGger[:SOURce]:EXTernal:DELay`” on page 341, and for more information on configuring an external source, see “`:TRIGger[:SOURce]`” on page 340.

*RST 0

**Key Entry**  **Ext Delay Off On**

`:TRIGger[:SOURce]:EXTernal:SLOPe`

**Supported**  N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal:SLOPe POSitive|NEGative
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal:SLOPe?

This command sets the polarity for an external trigger signal while using the continuous, single triggering mode. To set the polarity for gating, see “`:TRIGger:TYPE:GATE`” on page 339.

The POSitive and NEGative selections correspond to the high (positive) and low (negative) states of the external trigger signal. For example, when you select POSitive, the waveform responds (plays) during the high state of the trigger signal. When the X-Series signal generator receives multiple trigger occurrences when only one is required, the signal generator uses the first trigger and ignores the rest.

For more information on configuring an external trigger source and to select external as the trigger source, see “`:TRIGger[:SOURce]`” on page 340.

*RST NEG

**Key Entry**  **Ext Polarity Neg Pos**

`:TRIGger[:SOURce]:EXTernal[:SOURce]`

**Supported**  N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal[:SOURce] EPT1|EPT2|EPTRIGGER1|EPTRIGGER2
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal[:SOURce]?
Arb Commands
Dmodulation Subsystem–N5166B/72B/82B with Option N5180431B
([[:SOURce]:RADio:DMODulation:ARB])

This command selects which PATTERN TRIG IN connection the X-Series signal
generator uses to accept an externally applied trigger signal when external is
the trigger source selection.

For more information on configuring an external trigger source and to select
external as the trigger source, see “:TRIGger[:SOURce]” on page 340. For more
information on the rear panel connectors, see the User’s Guide.

The following list describes the command choices:

- **EPT1** This choice is synonymous with EPTRIGGER1 and
  selects the PATTERN TRIG IN rear panel connector.

- **EPT2** This choice is synonymous with EPTRIGGER2 and
  selects the PATT TRIG IN 2 pin on the rear panel
  AUXILIARY I/O connector.

- **EPTRIGGER1** This choice is synonymous with EPT1 and selects the
  PATTERN TRIG IN rear panel connector.

- **EPTRIGGER2** This choice is synonymous with EPT2 and selects the
  PATT TRIG IN 2 pin on the rear panel AUXILIARY I/O
  connector.

- **:*RST** EPT1

**Key Entry** Patt Trig In 1 Patt Trig In 2

**[:STATe]**

**Supported** N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:DMODulation:ARB[:STATe] ON|OFF|1|0
[:SOURce]:RADio:DMODulation:ARB[:STATe]?

This command enables or disables the digital modulation capability.

- **ON (1)** This choice sets up the internal hardware to generate
  the currently selected digital modulation format signal
  selection.

- **OFF (0)** This choice disables the digital modulation capability.

- **:*RST** 0

**Key Entry** Digital Modulation Off On

**Key Path** Mode > ARB Custom Modulation > Digital Modulation
Off On

**Remarks** When On is selected, the I/Q state is activated and the
I/Q source is set to internal.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

:BASeband:FREQuency:OFFSet

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:BASeband:FREQuency:OFFSet <value><unit>
[:SOURce]:RADio:ARB:BASeband:FREQuency:OFFSet?

This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed-through is not in the center.

The X-Series signal generator provides an automatic DAC over-range protection feature, which can be turned off (factory default has it set to on). When turned on, the protection is active when the offset value is something other than 0 Hz. It scales down the playing I/Q data by \(1/\sqrt{2}\). To turn the protection off, see ":DOPRotection" on page 345.

*RST 0 Hz

Range –5.0E7 to +5.0E7 Hz

Key Entry Baseband Frequency Offset

:BASeband:FREQuency:OFFSet:PHASe:RESet

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:BASeband:FREQuency:OFFSet:PHASe:RESet

This command clears the phase accumulation and so zero phase shift.

When the Baseband Frequency Offset is non-zero, the hardware rotator accumulates phase-shift of the baseband signal. This residual phase remains even after the offset value is returned to zero. While there is a non-zero residual phase present in the signal, the DAC Over-Range Protection feature will automatically prevent DAC overrange errors from occurring by scaling the signal down by \(1/\sqrt{2}\).

Key Entry Baseband Frequency Offset Phase Reset

:CLIPping

Supported N5166B/72B/82B

Clipping cannot be undone (i.e. restoring clipping value to 100% will have no effect on a previously clipped waveform.)

[[:SOURce]:RADio:ARB:CLIPping "<file name>"|IJQ|IORQ,<value> [,<value>]]
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

This command sets the clipping level of the selected waveform segment to a percentage of its highest peak.

The variable <value> is expressed in units of percent.

- **I/Q**: This choice clips the composite I/Q waveform.
- **IORQ**: This choice clips I and Q separately. When this choice is enabled, percentage values for both I and Q must be specified.

*RST I/Q <value>: +100

**Range**

<value>: 10–100 (0.1% resolution)

**Key Entry**

Clipping Type |I+jQ| |I|,|Q|

**Remarks**

A value of 100 percent equates to no clipping.

For information on the file name syntax, refer to “File Name Variables” on page 43.

:DOPRtection

**Supported**

N5172B/82B with Option N5180432B

[ :SOURce]:RADio:ARB:DOPRtection ON|OFF|1|0

[ :SOURce]:RADio:ARB:DOPRtection?

This commands turns the DAC over–range protection feature off or on.

The over–range protection feature works only with the Baseband Frequency Offset feature and the Option N5180432B Phase Noise Impairment.

- **On**: Minimizes the occurrence of a DAC over–range condition. In doing so, it can also decrease the dynamic range of the waveform by scaling the data more than what is actually needed. For the Baseband Frequency Offset feature, this protection is active only when the offset parameter is a value other than 0 Hz.
- **Off**: The automatic protection feature is not enabled. To correct a DAC over–range condition, reduce the waveform runtime scaling value (see “:RSCaling” on page 376).

*RST ON

**Key Entry**

DAC Over–range Protection Off On

:FILTer:ALPHa

**Supported**

N5166B/72B/82B
Arb Commands

Dual ARB Subsystem–N5166B/72B/82B ([SOURce]:RADio:ARB)

[:SOURce]:RADio[1]:ARB:FILTER:ALPHA <value>

[:SOURce]:RADio[1]:ARB:FILTER:ALPHA?

This command changes the Nyquist or Root Nyquist Real-Time Modulation filter alpha value.

The filter alpha value can be set to the minimum level (0), the maximum level (1), or in between by using fractional numeric values (0.001 to 0.999).

*RST  +3.50000000E−001

Range  0.000 to 1.000

Key Entry  Filter Alpha

Remarks  To change the current filter type, refer to :FILTER:TYPE.

:FILTER:BBT

Supported  N5166B/72B/82B

[:SOURce]:RADio[1]:ARB:FILTER:BBT <value>

[:SOURce]:RADio[1]:ARB:FILTER:BBT?

This command changes the bandwidth-multiplied-by-bit-time (BbT) Real-Time Modulation filter parameter.

The filter BbT value can be set to the minimum level (0.1), the maximum level (1), or in between by using fractional numeric values (0.100 to 0.999).

*RST  +5.00000000E−001

Range  0.100 to 1.000

Key Entry  Filter BbT

Remarks  This command is effective only after choosing a Gaussian filter. It does not have an effect on other types of filters.

To change the current filter type, refer to :FILTER:TYPE.

:FILTER:CHANnel

Supported  N5166B/72B/82B

[:SOURce]:RADio[1]:ARB:FILTER:CHANnel EVM|ACP

[:SOURce]:RADio[1]:ARB:FILTER:CHANnel?

This command optimizes the Nyquist and Root Nyquist Real-Time Modulation filters to minimize error vector magnitude (EVM) or to minimize adjacent channel power (ACP).

EVM  This choice provides the most ideal passband.

ACP  This choice improves stopband rejection.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B [:SOURce]:RADio:ARB

*RST
Key Entry EVM
Remarks Optimize FIR For EVM ACP
Remarks To change the current filter type, refer to :FILTer:TYPE.

:FILTer:TYPE

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:FILTer:TYPE RNYQuist|NYQuist|GAUSsian|
RECTangle|IS95|IS95_EQ|IS95_MOD|IS95_MOD_EQ|EDGE|EWIDE|EHSR|
WCDMa|AC4Fm|"<user FIR>"
[:SOURce]:RADio:ARB:FILTer:TYPE?

This command specifies the Real-Time Modulation filter type.

RNYQuist This choice selects a Root Nyquist (root raised cosine) filter. This filter is adjusted using Alpha.

NYQuist This choice selects a Nyquist (raised cosine) filter. This filter is adjusted using Alpha.

GAUSsian This choice selects a Gaussian filter which is adjusted using Bbt values.

RECTangle This choice selects a one symbol wide rectangular filter.

IS95 This choice selects a filter that meets the criteria of the IS–95 standard.

IS95_EQ This choice selects a filter which is a combination of the IS–95 filter (above) and the equalizer filter described in the IS–95 standard. This filter is only used for IS–95 baseband filtering.

IS95_MOD This choice selects a filter that meets the criteria of the IS–95 error function (for improved adjacent channel performance) with lower passband rejection than the filter specified in the IS–95 standard.

IS95_MOD_EQ This choice selects a filter which is a combination of the equalizer filter described in the IS–95 standard and a filter that meets the criteria of the IS–95 error function (for improved adjacent channel performance), with lower passband rejection.

EDGE This choice selects a linearized Gaussian filter as defined in GSM 05.04.

EWIDE This choice selects an EDGE spectrally wide pulse shape filter as per 3GPP TS 45.004.

EDGE EHSR This choice selects an EDGE high symbol rate spectrally narrow pulse shape filter as per 3GPP TS 45.004.
Arb Commands

Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

**WCDMa**
This choice selects a W-CDMA filter which is the equivalent of a Root Nyquist filter with an alpha of 0.22 optimized for ACP.

**AC4Fm**
This choice selects a predefined Association of Public Safety Communications Officials (APCO) specified compatible 4-level frequency modulation (C4FM) filter.

"<user FIR>"
This variable is any FIR filter file that you have stored in memory. The variable needs no directory path indicating the location of the file, such as FIR: or /USER/FIR. The command assumes the FIR directory. For more information on file names, refer to “File Name Variables” on page 43.

**:*RST**
Root Nyquist

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Nyquist</th>
<th>IS–95</th>
<th>EDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaussian</td>
<td>IS–95 Mod</td>
<td>WCDMA</td>
<td></td>
</tr>
<tr>
<td>User FIR</td>
<td>IS–95 w/EQ</td>
<td>Rectangle</td>
<td></td>
</tr>
<tr>
<td>Root Nyquist</td>
<td>IS–95 Mod w/EQ</td>
<td>EDGE Wide</td>
<td>APCO 25 C4FM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EDGE EHSR</td>
</tr>
</tbody>
</table>

**:FILT[er][:STATe]**

**Supported**
N5166B/72B/82B

[:SOURce]:RADio[1]:ARB:FILTer[:STATe]ON|OFF|1|0

[:SOURce]:RADio[1]:ARB:FILTer[:STATe]?

This command enables or disables the Real-Time Modulation Filter. This filter is typically applied to an Arb waveform containing just the I/Q symbol decision points. The filter then defines the transitions between the symbol decision points. This means that the filter must have an oversample ratio of two or more. When this feature is active, the Sample Clock Rate is actually the Symbol Rate.

Default  Off

Key Entry  Modulation Filter Off On

**:GENerate:SINE**

**Supported**
N5166B/72B/82B

[:SOURce]:RADio:ARB:GENerate:SINE

["<file_name>",[<osr>],[<scale>],[I|Q|IQ][<phasedeg>]]
Arb Commands
Dual ARB Subsystem—N5166B/72B/82B ([SOURce]:RADio:ARB)

This command creates a sine wave waveform file and saves it in the signal generator's volatile waveform memory (WFM1).

"<file_name>"  This variable names the file used to save the generated sine wave data.

<osr>  This variable sets the oversample ratio, which must be an even number and \( \geq 4 \). The <osr> variable is expressed in samples. If the oversample ratio is \(< 60\) (the minimum number of samples or I/Q points required for a waveform), multiple waveform periods are generated to create a waveform file with \( \geq 60\) samples. The number of periods created is \( 60 + \frac{\text{osr}}{\text{osr}} \) (quotient will round up to an integer value). A waveform with an oversample ratio \( \geq 60\) has one period.

*scale>  This variable sets the scale factor for the waveform. The scale factor is a real number from zero to one.

I|Q|IQ  Selects I, Q, or I and Q paths for the waveform data. Sine wave data is generated and applied to the I path if the I path is selected; Q data are set to zeros. Sine data is generated and applied to the Q path if the Q path is selected; I data are set to zeros. If the I and Q paths are selected, sine wave data are applied to the I and Q paths.

<phasedeg>  Selects the phase angle of the waveform data. Sine wave data is generated and the phase angle in degrees is applied to the sine wave.

Example

:RAD:ARB:GEN:SINE "Sine_Wave",60,.5,IQ

The preceding example generates an I/Q sine wave and saves the data to a file named Sine_Wave. The oversampling ratio is 60, the scaling is set for 50%, and the data is applied to both the I and Q paths.

The signal generator's baseband option and available baseband memory determine the maximum number of samples for the waveform.

Range  

OSR Option 65x: 4E0 to 32E6

OSR Option 021: 4E0 to 256E6

OSR Option 022: 4E0 to 512E6

OSR Option 023: 4E0 to 1E9

Scale: 0 to 1

:GENERate:TEST:WAVeforms

Supported  

N5166B/72B/82B
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURCE]:RADio:ARB)

[:SOURCE]:RADio:ARB:GENERate:TEST:WAVEforms
This command recreates the arb waveform test files into BBG (waveform) memory (WFM1). When this command is sent to the instrument, the SINE_TEST_WFM and RAMP_TEST_WFM files are regenerated.

Example
:RAD:ARB:GEN:TEST:WAV

:HEADER:CLEar

Supported N5166B/72B/82B

[:SOURCE]:RADio:ARB:HEADER:CLEar
This command clears the header information from the file header used by this modulation format (i.e. all file header fields are set to unspecified).

Key Entry Clear Header

Remarks A waveform must be selected for this command to function.

:HEADER:NOISe:RMS[:OVERRide]

Supported N5166B/72B/82B

[:SOURCE]:RADio:ARB:HEADER:NOISe:RMS:OVERRide "<file_name>" ,<value>|UNSpecified
This command sets the value of the waveform’s I and Q RMS (root mean square) for noise.

The RMS is used strictly for calculating the relative power of the noise in the specified header. The RMS is specified in normalized linear units with |+1| or |–1| as full scale on I or Q, therefore the largest RMS that can be specified is the square root of 2 (1.414213562). If the value is unspecified, then the waveform file header’s RMS is used.

This value is useful if you wish to have the noise be relative to only a portion of the waveform, such as a pilot channel, or be relative to only a single carrier that is mixed with other carriers.

For setting the header’s RMS value, see “:HEADER:RMS” on page 351.

"<file_name>" This variable names the waveform file to which the RMS value will be applied. The file name variable can designate a file in the WFM1, NVWFWM, or SEQ directories. For information on file name syntax, refer to “File Name Variables” on page 43.

<value> This variable is the user–measured RMS noise value for the specified carrier.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

UNSPecified
Sets RMS as unspecified, which causes the general RMS value to be used for calculating the relative noise power.

Example
The preceding example sets the file header RMS noise override value for a file type WFM1, named Sine_Wave, to .835.
In the second example, the signal generator calculates the RMS, using the waveform file header’s RMS value. For setting the header’s RMS value, see “:HEADer:RMS” on page 351.
The RMS value is expressed in volts.

Key Entry Edit Noise RMS Override Unspecified Enter

:HEADer:RMS

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:HEADER:RMS "<file_name>" | SPECified
[:SOURce]:RADio:ARB:HEADER:RMS? "<file_name>"

This command sets the file header RMS value for the selected waveform file. The X-Series signal generator uses the RMS value with the dual ARB’s real–time noise function and to optimize the modulator drive level.
The signal generator reads the RMS value from the file header when a waveform is selected to play. If the value is unspecified, then it is calculated and stored in the header automatically.
When the waveform file is saved from volatile waveform memory (WFM1) to non–volatile waveform memory (NVWFM), the RMS value, auto–calculated or user–defined, is also saved.
For setting the header noise carrier RMS override value, see “:HEADer:NOISE:RMS[:OVERride]” on page 350.
"<file_name>" This variable names the waveform file to which the RMS value will be applied. The file name variable can designate a file in the WFM1, NVWFM, or SEQ directories. For information on the file name syntax, refer to “File Name Variables” on page 43.
<value> This variable is the user–measured RMS value for the specified waveform. The following figure shows the RMS calculation.

\[
\sqrt{\frac{1}{N} \sum_{n=1}^{N} (i_n^2 + q_n^2)}
\]

UNSPECified Using this variable in the command clears the RMS value and sets it to unspecified. An unspecified RMS value causes the signal generator to calculate the value when the ARB personality is turned on. The RMS calculation includes rise/fall times and does not include consecutive zero level samples. DC offsets and noise are also included in the RMS measurement. But, the Marker values are not included in these calculations. Because the signal generator calculation uses so many factors, you may achieve better results calculating your own RMS value.

Examples

[:SOURce]:RADio:ARB:HEADER:RMS "WFM1:Sine_Wave",.835

The first example shows a user–measured RMS value for the Sine_Wave waveform file in the waveform's file header.

[:RAD:ARB:HEADER:RMS "WFM1:Sine_Wave",UNSP]

In the second example, the signal generator calculates the RMS value when the ARB is turned on with this file selected or a sequence which contains the file selected.

The RMS value is expressed in volts.

Range 0 to 1.414213562373095

Key Entry Edit RMS Enter Unspecified Calculate

:HEADer:SAVE

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:HEADer:SAVE

This command saves the Dual ARB state information to the header of the currently selected waveform.

Key Entry Save Setup To Header

Remarks A waveform must be selected for this command to function.
:IQ:MODulation:ATTen

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:IQ:MODulation:ATTen <value>
[:SOURce]:RADio:ARB:IQ:MODulation:ATTen?

This command sets the attenuation level of the I/Q signals being modulated through the signal generator RF path.

The variable <value> is expressed in units of decibels (dB).

*RST Varies (instrument dependent)

Range 0 to 50

Key Entry Modulator Atten Manual Auto

:IQ:MODulation:ATTen:AUTO

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:IQ:MODulation:ATTen:AUTO ON|OFF|1|0
[:SOURce]:RADio:ARB:IQ:MODulation:ATTen:AUTO?

This command enables or disables the I/Q attenuation auto mode.

ON (1) This choice enables the attenuation auto mode which optimizes the modulator attenuation for the current conditions.

OFF (0) This choice holds the attenuator at its current setting or at a selected value. Refer to the :IQ:MODulation:ATTen command for setting the attenuation value.

*RST 1

Key Entry Modulator Atten Manual Auto

:MARKer:CLEar

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:MARKer:CLEar "<file_name>,<marker>,<first_point>,<last_point>

This command clears a single marker point or a range of marker points on a waveform segment for the selected marker (1–4). The dual ARB player and all of the ARB modulation formats use this command.

"<file_name>" This variable specifies the name of the waveform file in volatile waveform memory (WFM1). For information on the file name syntax, see “File Name Variables” on page 43.

<marker> This variable selects the marker number; an integer value from one to four.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

<first_point> This variable defines the first point in a range of points. The number must be greater than or equal to one, and less than or equal to the total number of waveform points.

If you enter a value for either the first marker point or the last marker point that would make the first marker point occur after the last, the last marker point automatically adjusts to match the first marker point.

<last_point> This variable defines the last point in a range of points. The number must be greater than or equal to the first point, and less than or equal to the total number of waveform points.

To clear a single marker point, use the same marker point for the first and last point variables. For more information on markers and ARB files, refer to the User’s Guide.

Example

:RAD:ARB:MARK:CLE "Test_Data",1,1,300

The preceding example clears marker 1 from the first point through the 300th point in the Test_Data file.

Range <marker>: 1–4

<first_Point>: 1–number of waveform points

<last_point>: <first_Point>–number of waveform points

Key Entry Set Marker Off Range Of Points Marker 1 2 3 4

Key Entry First Mkr Point Last Mkr Point
Arb Commands
Dual ARB Subsystem—N5166B/72B/82B ([SOURce]:RADio:ARB)

:MARKer:CLEar:ALL

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:MARKer:CLEar:ALL "<file_name>",<marker>

This command clears all marker points on a waveform segment for the selected marker (1–4). The dual ARB player and all of the ARB formats use this command. With all marker points cleared, the event output signal level is set low.

"<file_name>" This variable specifies the name of the waveform file in volatile waveform memory (WFM1). For information on the file name syntax, see “File Name Variables” on page 43.

<marker> This variable selects the marker number; an integer value from one to four.

Example

:RAD:ARB:MARK:CLE:ALL "Test_Data",1

The preceding example clears marker 1 from the all waveform points in the Test_Data file.

Range 1 to 4

Key Entry Marker 1 2 3 4 Set Marker Off All Points

:MARKer:ROTate

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:MARKer:ROTate "<file_name>",<rotate_count>

This command shifts the marker points for all markers in a waveform segment earlier or later by the value of the <rotate_count> variable. The dual ARB player and all of the ARB formats use this command.

You can use a positive or negative value. When a marker point is close to the end of the waveform and the <rotate_count> value is greater than the number of remaining marker points, but less than the total number of marker points, the marker points that would move beyond the end of the waveform wrap to the beginning of the waveform. For example, if a marker point resides at sample point 195 out of 200, and the <rotate_count> value is twenty-five, the marker point wraps to the beginning of the waveform and continues out to the twentieth waveform point.

To set the marker points in a waveform, refer to “:MARKer[:SET]” on page 356.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([[:SOURce]:RADio:ARB])

"<file_name>"  This variable specifies the name of the waveform file in volatile waveform memory (WFM1). For information on the file name syntax, see “File Name Variables” on page 43.

Example

:RAD:ARB:MARK:ROT "Test_Data",100

The preceding example shifts all markers set in the Test_Data file 100 points later. If the first set point in the file is at 50, then after sending this command, the first set point will be 150 (assuming the Test_Data file has at least 150 points and no later set points wrapped around to the beginning of the file).

Range  
– (n – 1) to (n – 1)

n = number of points in the waveform

:MARKer[:SET]

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:MARKer[:SET]
"<file_name">,<marker>,<first_point>,<last_point>,<skip_count>

This command sets a single marker point or a range of marker points on a waveform segment for the selected marker (1–4). The dual ARB player and all of the ARB formats use this command.

The Keysight X-Series signal generator provides four independent markers. Two of the markers route output signals to rear panel event connectors, Marker–1 to Event1 BNC and Marker–2 to Aux I/O. A marker consists of marker points placed at defined sample points in a waveform segment. This means that a marker point cannot be less than one or greater than the last sample point in the waveform. Marker points are cumulative, so multiple command executions with different range values, without first clearing the existing points, places additional marker points on the waveform. Because of this cumulative behavior, it is a good practice to clear existing marker points prior to setting new points. This will eliminate unexpected marker pulses. Refer to “:MARKer:CLEar” on page 353 and “:MARKer:CLEar:ALL” on page 355 for information on clearing marker points.

For waveforms generated on the signal generator (baseband generator), the Keysight X-Series signal generator automatically places a marker point at the first waveform sample for markers one and two.

NOTE

You can set markers for either positive or negative polarity. The following discussions for this command assume positive marker polarity. When using negative marker polarity, the marker pulses occur during the periods of no marker points.

There are three ways to place marker points using this command:
Arb Commands

Dual ARB Subsystem–N5166B/72B/82B ([SOURce]:RADio:ARB)

- consecutive marker points over a range that collectively create a single marker pulse that spans the range
- equally spaced marker points over a range, so that a marker pulse occurs at each sample point that coincides with a marker point (Using this method, you can configure a clock signal by setting the <skip_count> variable to one.)
- a single marker point placed at a specific sample point in the waveform, which outputs a single pulse relative to the marker point location (To configure a single marker point, set the first and last points to the same number.)

For more information on markers, refer to the User’s Guide.

The following list describes the command variables:

- "<file_name>" This variable specifies the name of the waveform file in volatile waveform memory (WFM1). For information on the file name syntax, see “File Name Variables” on page 43.

- <marker> This variable selects the marker number; an integer value from one to four.

- <first_point> This variable defines the first point in the range over which the marker is placed. This number must be greater than or equal to one, and less than or equal to the total number of waveform points.

  If you enter a value for either the first marker point or the last marker point that would make the first marker point occur after the last, the last marker point is automatically adjusted to match the first marker point.

- <last_point> This variable defines the last point in the range over which the marker will be placed. This value must be greater than or equal to the first point, and less than or equal to the total number of waveform points.

- <skip_count> This variable defines the marker point pattern across the range. A zero value means the marker points occur consecutively across the range. A value greater than zero creates a repeating marker point pattern across the range, where the gap between the marker points is equal to the <skip_count> value. The gaps begin after the first marker point. Each marker point in the pattern, which is only one point wide, produces a marker pulse.

**Example**

:RAD:ARB:MARK "Test_Data",1,40,100,2
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([[:SOURce]:RADio:ARB])

The preceding example sets marker 1 on the first point, 40, the last point, 100, and every third point (skip 2) between 40 and 100 (assuming the Test_Data file has at least 100 points).

<table>
<thead>
<tr>
<th>Range</th>
<th>&lt;marker&gt;: 1–4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;first_Point&gt;: 1–number of waveform points</td>
</tr>
<tr>
<td></td>
<td>&lt;last_point&gt;: &lt;first_point&gt;–number of waveform points</td>
</tr>
<tr>
<td></td>
<td>&lt;skip_count&gt;: 0–number of points in the range</td>
</tr>
</tbody>
</table>

Key Entry
Set Marker on Range Of Points       Marker 1 2 3 4
First Mkr Point        Last Mkr Point
# Skipped Points        Apply to Waveform

:MBSync

Supported   N5166B/72B/82B

[:SOURce]:RADio:ARB:MBSync OFF|MASTer|SLAVe
[:SOURce]:RADio:ARB:MBSync?

This command disables or enables the multiple BBG synchronization setup for the current signal generator. Ensure that the Dual ARB play is off prior to executing this command.

| OFF       | Turns off multiple baseband synchronization for the signal generator. |
| MASTer    | Sets the signal generator as the master for the setup. When selected, the following trigger features are unavailable: |

**Trigger Type**
- Free Run, see page 381
- Gated, see page 380

Prior to selecting MASTer, ensure that the trigger type is something other than shown above. If not, the X-Series signal generator generates a settings conflict error and changes the trigger type to TRIGger (continuous play once triggered).
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([SOURce]:RADio:ARB)

<table>
<thead>
<tr>
<th>SLAVe</th>
<th>Sets the signal generator as a slave in the setup. When selected, the following trigger features are unavailable:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Trigger Type</strong></td>
</tr>
<tr>
<td></td>
<td>Free Run, see page 381</td>
</tr>
<tr>
<td></td>
<td>Gated, see page 380</td>
</tr>
<tr>
<td></td>
<td><strong>Trigger Source</strong></td>
</tr>
<tr>
<td></td>
<td>All selections, see page 384</td>
</tr>
</tbody>
</table>

Prior to selecting SLAVe, ensure that the trigger type is something other than shown above and that the trigger source is set according to the following list:

- EXT (external trigger signal, see page 384)
- EPT1 (PAT TRIG connector, see page 387)
- SLOPe POSitive (see page 386)
- EXT DELay to OFF (see page 386)

If not, the X-Series signal generator generates a settings conflict error and changes the trigger type to TRIGger (continuous play once triggered) and the trigger source to the above listed selections.

To set the slave position, see "MBSync:SREFERENCE" on page 361.

For more information on the multiple BBG synchronization feature, see the User's Guide.

**Example**

:RAD:ARB:MBS MAST

The preceding example sets the signal generator as the master in the master/slave setup.

*RST OFF

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Off</th>
<th>Master</th>
<th>Slave</th>
</tr>
</thead>
</table>

:MBSync:NASLaves

| Supported | N5166B/72B/82B |

[:SOURce]:RADio:ARB:MBSync:NASLaves <value>
[:SOURce]:RADio:ARB:MBSync:NASLaves?

This command enters the number of first-generation MXG (N51xxA) signal generators that are designated as slaves in a multiple BBG synchronization setup. This value is required for both the master and slave signal generators and is used to calculate the internal compensation values to minimize synchronization delay.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURCE]:RADio:ARB)

NOTE: All first-generation MXG slaves must be at the end of the synchronization chain.

The NASLaves value is a persistent setting that survives both preset and power cycling.

Example

:RAD:ARB:MBS:NASL 3

The preceding example enters three as the number of first-generation MXG slaves the current signal generator master/slave setup.

Range 0 to 15 (depends on the NSLaves setting)
Key Entry Number of MXG-A Slaves

:MBSync:NSLaves

Supported N5166B/72B/82B

[:SOURCE]:RADio:ARB:MBSync:NSLaves <value>
[:SOURCE]:RADio:ARB:MBSync:NSLaves?

This command enters the number of signal generators designated as slaves in a multiple BBG synchronization setup. This value is required for both the master and slave signal generators.

This command does not designate which slave position a signal generator occupies. To set the slave position, see “:MBSync:SREFERENCE” on page 361.

The NASLaves value is a persistent setting that survives both preset and power cycling.

Example

:RAD:ARB:MBS:NSL 7

The preceding example enters seven as the number of slaves the current signal generator master/slave setup.

Range 1 to 15
Key Entry Number of Slaves

:MBSync:SLISten

Supported N5166B/72B/82B

[:SOURCE]:RADio:ARB:MBSync:SLISten

For signal generators designated as slaves in the multiple BBG synchronization setup, this command enables them to receive a one–time baseband synchronization event trigger initiated by the master. The signal generator receives the trigger signal through the PAT TRIG connector.
Arb Commands
Dual ARB Subsystem—N5166B/72B/82B ([:SOURce]:RADio:ARB)

Prior to executing this command, ensure that the Dual ARB player and the trigger source for the master is off.

Since this command is for a one-time event, you must send this command each time there is a need to synchronize the master/slave setup and prior to initiating the synchronization trigger from the master signal generator. After executing this command, each signal generator should show a status register weighting of 256 (waiting for sync). To check the status, see “:REGister[:STATus]” on page 374. To initiate the synchronization signal, see “:MBSync:SSLaves” on page 361.

Example

[:RAD:ARB:MBS:SLIS]

The preceding example enables a slave signal generator to receive the synchronization trigger.

Key Entry       Listen for Sync

:MBSync:SREFerence

**Supported** N5166B/72B/82B

[:SOURce]:RADio:ARB:MBSync:SREFerence <value>
[:SOURce]:RADio:ARB:MBSync:SREFerence?

For signal generators designated as slaves in the multiple BBG synchronization setup, this command sets the slave position of the signal generator.

The SREFerence value is a persistent settings that survives both preset and power cycling.

Example

[:RAD:ARB:MBS:SREF 13]

The preceding example sets the signal generator to slave number 13.

**Range** 1 to 15

**Key Entry** Slave Position

:MBSync:SSLaves

**Supported** N5166B/72B/82B

[:SOURce]:RADio:ARB:MBSync:SSLaves

For the signal generator designated as the master in the multiple BBG synchronization setup, this command initiates the trigger to synchronize the baseband generators. The trigger signal is output through the **EVENT 1** connector.
Arb Commands
Dual ARB Subsystem—N5166B/72B/82B ([SOURce]:RADio:ARB)

As each slave receives the synchronization signal, it automatically sends a synchronization signal to the next slave in the chain. Prior to executing this command, all of the slaves must be set to listen for the trigger. For more information, see ":[MBSync:SLISten] on page 360. After executing this command, each signal generator should show a status register weighting of 512 (in sync). To check the status, see ":[REGister:[STATus]] on page 374.

If any changes are made to the synchronization parameters after executing this command, the master/slave system must be resynchronized. See the User’s Guide for more information and the process for resynchronizing a system.

**Example**

```
:RAD:ARB:MBS:SSL
```

The preceding example initiates the synchronization trigger signal.

**Key Entry**

<table>
<thead>
<tr>
<th>Sync Slaves</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

**:MDEStination:AAMPliitude**

**Supported**

N5166B/72B/82B

[ :SOURce]:RADio:ARB:MDEStination:AAMPliitude NONE|M1|M2|M3|M4

[ :SOURce]:RADio:ARB:MDEStination:AAMPliitude?

This command routes the selected marker to the Alternate Amplitude function. The **NONE** parameter clears the marker for the Alternate Amplitude function.

**:*RST**

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Marker 1</th>
<th>Marker 2</th>
<th>Marker 3</th>
<th>Marker 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**:MDEStination:ALCHold**

**Supported**

N5166B/72B/82B

Incorrect automatic level control (ALC) sampling can create a sudden unleveled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Marker 1</th>
<th>Marker 2</th>
<th>Marker 3</th>
<th>Marker 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[ :SOURce]:RADio:ARB:MDEStination:ALCHold NONE|M1|M2|M3|M4

[ :SOURce]:RADio:ARB:MDEStination:ALCHold?

This command enables the marker ALC hold function for the selected marker. For setting markers, see ":[MARKer:[SET]] on page 356."
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

Use the ALC hold function when you have a waveform signal that incorporates idle periods, or when the increased dynamic range encountered with RF blanking is not desired. The ALC leveling circuitry responds to the marker signal during the marker pulse (marker signal high), averaging the modulated signal level during this period.

The ALC hold function operates during the low periods of the marker signal. The marker polarity determines when the marker signal is high. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. For setting a marker’s polarity, see “:MPOLarity:MARKe1|2|3|4” on page 365.

Do not use the ALC hold for more than 100 ms, because it can affect the waveform’s output amplitude.

The marker signal has a minimum of a two-sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want the ALC sampling to begin.

The ALC hold setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

A waveform file that has unspecified settings in the file header uses the previous waveform’s routing settings.

For more information on the marker ALC hold function, see the User’s Guide. For setting the marker points, see “:MARKe[:SET]” on page 356.

NONE  This terminates the marker ALC hold function.
M1–M4  These are the marker choices. The ALC hold feature uses only one marker at a time.

Example

:RAD:ARB:MDES:ALCH M1

The preceding example routes marker 1 to the ALC Hold function.

*RST  NONE

Key Entry  None  Marker 1  Marker 2  Marker 3  Marker 4
Arb Commands
Dual ARB Subsystem—N5166B/72B/82B ([:SOURce]:RADio:ARB)

:MDestination:PULSe

Supported N5166B/72B/82B

**CAUTION**
The pulse function incorporates ALC hold. Incorrect automatic level control (ALC) sampling can create a sudden unleveled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.

[:SOURce]:RADio:ARB:MDestination:PULSe NONE|M1|M2|M3|M4
[:SOURce]:RADio:ARB:MDestination:PULSe?

This command enables the marker pulse/RF blanking function for the selected marker.

This function automatically uses the ALC hold function, so there is no need to select both the ALC hold and pulse/RF blanking functions for the same marker.

**NOTE**
Do not use ALC hold for more than 100 ms, because it can affect the waveform’s output amplitude.

The signal generator blanks the RF output when the marker signal goes low. The marker polarity determines when the marker signal is low. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. For setting a marker’s polarity, see “:MPolarity:MARKer1|2|3|4” on page 365.

Set marker points prior to using this function. Enabling this function without setting marker points may create a continuous low or high marker signal, depending on the marker polarity. This causes either no RF output or a continuous RF output. For setting the marker points, see “:MARKer[:SET]” on page 356.

The marker signal has a minimum of a two–sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want the RF blanking to begin. The RF blanking setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

**NOTE**
A waveform that has unspecified settings in the file header uses the previous waveform’s routing settings. This could create the situation where there is no RF output signal, because the previous waveform used RF blanking.

For more information on the marker RF blanking function, see the User’s Guide.

NONE This terminates the marker RF blanking/pulse function.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

M1–M4 These are the marker choices. The RF blanking/pulse feature uses only one marker at a time.

Example
:RAD:ARB:MDES:PULS M2
The preceding example routes marker 2 to Pulse/RF Blanking.

*RST NONE

:MPOLarity:MARKer1|2|3|4

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:MPOLarity:MARKer1|2|3|4 NEGative|POSitive
[:SOURce]:RADio:ARB:MPOLarity:MARKer1|2|3|4?

This command sets the polarity for the selected marker. For a positive marker polarity, the marker signal is high during the marker points. For a negative marker polarity, the marker signal is high during the period of no marker points.

Example
:RAD:ARB:MPOL:MARK3 NEG
The preceding example sets the polarity for marker 3 to negative.

*RST POS

:NOISe:BANDwidth

Supported N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:ARB:NOISe:BANDwidth <value><unit>
[:SOURce]:RADio:ARB:NOISe:BANDwidth?

This command selects the flat noise bandwidth value of the real–time noise for an ARB waveform. Typically, this value is set slightly wider than the signal bandwidth. The minimum increment value is 0.001 Hz.

*RST +1.00000000E+000

Range Option 653 1 sa to 75 Msa
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([::SOURce]:RADio:ARB)

Option 655 1 sa to 150 Msa
Option 656 1 sa to 100 Msa
Option 657 1 sa to 200 Msa

Key Entry  Noise Bandwidth

:NOISe:CBRate

Supported  N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:ARB:NOISe:CBRate <1bps - 999Mbps>
[:SOURce]:RADio:ARB:NOISe:CBRate?

This command sets a value of the carrier bit rate (gross bit rate) for purposes of calculating the Eb/N0 (energy per bit over noise power density at the receiver). When the carrier to noise ratio format is set to Eb/N0 (refer to the :NOISe:CNFormat command), the adjustment of the carrier bit rate will have an immediate impact on the carrier to noise ratio as specified by Eb/N0. The carrier bit rate is derived from the symbol rate and bits per symbol of the modulation. The carrier bit rate is a saved instrument state that is recorded in the waveform header.

The query returns the current carrier bit rate setting.

Example

:RAD:ARB:NOISe:CBR 5

The preceding example sets the carrier bit rate to 5 bps.

Default  1.000 bps
Range  1 bps to 999 Mbps

Key Entry  Carrier Bit Rate

:NOISe:CBWidth

Supported  N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:ARB:NOISe:CBWidth <value><unit>
[:SOURce]:RADio:ARB:NOISe:CBWidth?

This command selects the carrier bandwidth over which the additive white gaussian noise (AWGN) is applied. The carrier RMS power and the noise power will be integrated over the selected carrier–bandwidth for the purposes of calculating carrier to noise ratio (C/N). The minimum increment value is 0.001 Hz. For more information, refer to the “:NOISe[:STATe]” command and the “:NOISe:BANDwidth” command.

*RST  +1.00000000E+000
Range  1 Hz to 200 MHz
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

Key Entry    Carrier Bandwidth

:NOISe:CN

Supported    N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:ARB:NOISe:CN <value><unit>
[:SOURce]:RADio:ARB:NOISe:CN?

This command sets the carrier to noise ratio (C/N) in dB. The carrier power is defined as the total modulated signal power without noise power added. The noise power is applied over the specified bandwidth of the carrier signal. For more information, refer to “:NOISe:CBWidth” on page 366.

Example
:RAD:ARB:NOIS:CN 50DB
The preceding example sets the carrier to noise ratio to 50 dB.

*RST    +0.00000000E+000
Range    -100 to 100 dB

Key Entry    Carrier to Noise Ratio

:NOISe:CNFormat

Supported    N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:ARB:NOISe:CNFormat CN|EBNO
[:SOURce]:RADio:ARB:NOISe:CNFormat?

This command selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (E_b/N_0) as the variable controlling the ratio of carrier power to noise power in the carrier bandwidth.

Example
:RAD:ARB:NOIS:CNF EBNO
The preceding example sets the carrier to noise ratio format to EbNo.

Default    Carrier to Noise Ratio Format C/N

Key Entry    Carrier to Noise Ratio Format C/N   Eb/No

:NOISe:EBNO

Supported    N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:ARB:NOISe:EBNO <ebno in dB>
[:SOURce]:RADio:ARB:NOISe:EBNO?
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURCE]:RAD:ARB)

This command allows the C/N to be set using the Eb/N0 (energy per bit over noise power density at the receiver) form. This requires that the carrier bit rate (:NOIS:CBRate on page 366) be set properly. The range of Eb/N0 is limited to the range that is equivalent to –100 to 100 dB of C/N. This value is only effective when Eb/N0 has been enabled by the :NOIS:CNFormat command.

The query returns the value of EBNO.

Default 0 dB
Range –100 to 100 dB
Key Entry Carrier to Noise Ratio Format Eb/No

:NOIS:MUX

Supported N5166B/72B/82B with Option N5180403B
[:SOURCE]:RAD:ARB:NOIS:MUX SUM|CARRier|NOISe
[:SOURCE]:RAD:ARB:NOIS:MUX?

This command enables diagnostic control of additive noise, such that only the noise, only the carrier, or the sum of both the noise and the carrier are output from the internal baseband generator. With the ALC off, this feature enables direct measurement of just the carrier or the noise contributions to the total power. The system will still behave as if both the noise and the carrier are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

Example

:RAD:ARB:NOIS:MUX CARR

The preceding example enables the direct measurement of the carrier contribution to the total power.

Default Carrier+Noise
Key Entry Carrier+Noise | Carrier | Noise

:NOIS:POWer:CARRier

Supported N5166B/72B/82B with Option N5180403B
[:SOURCE]:RAD:ARB:NOIS:POWer:CARRier <carrierPower>
[:SOURCE]:RAD:ARB:NOIS:POWer:CARRier?

This command sets the current carrier power level if noise is on.

In the CARRier control mode, the total power will be adjusted to achieve the specified carrier power and the carrier power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the carrier power setting appropriately to maintain the C/N ratio.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

In the TOTal control mode, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total power is adjusted.

In the NOISe control mode, this will adjust the total noise power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total noise power is adjusted. See also :NOIsE:POWer:CONTrol[:MODE] and :NOIsE:POWr:NOIsE:TOTal commands.

Range  The range varies based on the bounds of the total power that results from the noise settings.

Default  The appropriate value given the current total power and the current Carrier to Noise (C/N).

Key Entry  Carrier Power

:NOIsE:POWer:CONTrol[:MODE]

Supported  N5166B/72B/82B with Option N5180403B


This command sets the power control to one of the three following modes:

Total  This is the default mode where the total power and C/N are independent variables and the carrier power and total noise power are dependent variables set by the total power, C/N and the rest of the noise settings. The carrier power and total noise power will change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values.

Carrier  In this mode the carrier power and C/N are independent variables and the total power and total noise power are dependent variables set by the carrier power, C/N and the rest of the noise settings. The total power and total noise power will change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values.

Total Noise  In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.

Default  Total

Key Entry  Total  Carrier  Total Noise
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([SOURce]:RADio:ARB)

:"NOISe*:POWer*:NOISe*:CHANnel?"

Supported
N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:ARB:NOISe*:POWer*:NOISe*:CHANnel?

The query returns the current noise power across the carrier bandwidth in dBm.

:"NOISe*:POWer*:NOISe*:TOTal"

Supported
N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:ARB:NOISe*:POWer*:NOISe*:TOTal
<totalNoisePowerInDbm>
[:SOURce]:RADio:ARB:NOISe*:POWer*:NOISe*:TOTal?

This command sets the current total noise power level if noise is on.

In the NOISe control mode, the total power will be adjusted to achieve the specified total noise power and the total noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the total noise power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the total power is adjusted.

In the CARRier control mode, this will adjust the carrier power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the carrier power is adjusted.

See also :NOISe*:POWer*:CONTrol[:MODE] command.

Range
The range varies based on the bounds of the total power that results from the noise settings.

Default
The appropriate value given the current total power and the current Carrier to Noise (C/N).

Key Entry
Total Noise Power

:"NOISe*:STATE"

Supported
N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:ARB:NOISe*:STATE ON|OFF|1|0
[:SOURce]:RADio:ARB:NOISe*:STATE?

This command enables or disables adding real-time additive white gaussian noise (AWGN) to the carrier modulated by the waveform being played by the dual ARB waveform player.

Example
:RAD:ARB:NOIS ON
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

The preceding example applies real-time AWGN to the carrier.

*RST 0
Key Entry Real-Time AWGN Off On

:PHASe:NOISe:F1

Supported N5172B/82B with Option N5180432B

[:SOURce]:RADio:ARB:PHASe:NOISe:F1 <value><unit>
[:SOURce]:RADio:ARB:PHASe:NOISe:F1?

This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :PHASe:NOISe:F2 command). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the User’s Guide.

*RST +1.00000000E+003
Range 0 Hz to 77.50052449 MHz
Key Entry Desired Start Freq (f1)

:PHASe:NOISe:F1:ACTual?

Supported N5172B/82BN5172B/82B with Option N5180432B

[:SOURce]:RADio:ARB:PHASe:NOISe:F1:ACTual?

This query returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

:PHASe:NOISe:F2

Supported N5172B/82B with Option N5180432B

[:SOURce]:RADio:ARB:PHASe:NOISe:F2 <value><unit>
[:SOURce]:RADio:ARB:PHASe:NOISe:F2?

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :PHASe:NOISe:F1 command). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the User’s Guide.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([SOURce]:RADio:ARB)

*RST  +3.00000000E+004
Range  1 Hz to 77.50052449 MHz
Key Entry  Desired Stop Freq (f2)

:PHASe:NOISe:F2:ACTual?
Supported N5172B/82B with Option N5180432B

[:SOURce]:RADio:ARB:PHASe:NOISe:F2:ACTual?
This query returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

:PHASe:NOISe:LMID
Supported N5172B/82B with Option N5180432B

[:SOURce]:RADio:ARB:PHASe:NOISe:LMID <value>
[:SOURce]:RADio:ARB:PHASe:NOISe:LMID?
This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator. The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.

For more information on the phase noise impairment option, see the User’s Guide.

NOTE
The amplitude range varies depending on the f2 value (see the “:PHASe:NOISe:F2” on page 371). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.

The range values are expressed in units of dBC/Hz.

*RST  −7.00000000E+001
Range  −300 to 100
Key Entry  Desired Flat Amplitude (Lmid)

:PHASe:NOISe:LMID:ACTual?
Supported N5172B/82B with Option N5180432B

[:SOURce]:RADio:ARB:PHASe:NOISe:LMID:ACTual?
This query returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.
Arb Commands
Double ARB Subsystem—N5166B/72B/82B ([SOURce]:RADio:ARB)

:[PHASE:NOISE][:STATE]  
**Supported** N5172B/82B with Option N5180432B  
[:SOURce]:RADio:ARB:[PHASE:NOISE][:STATE] ON|OFF|1|0  
[:SOURce]:RADio:ARB:[PHASE:NOISE][:STATE]?

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the *User's Guide*.

*RST*  
0  
**Key Entry**  
Phase Noise Off On

:[PHASE:NOISE]:TRACe?  
**Supported** N5172B/82B with Option N5180432B  
[:SOURce]:RADio:ARB:[PHASE:NOISE]:TRACe?  
<startFreq>,<stopFreq>,<numSamples>

This query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the impairment from the phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBC/Hz.

**Range**  
<startFreq> 1 Hz to 100 MHz  
<stopFreq> 1 Hz to 100 MHz  
<numSamples> 1 to 8192

:[PLAY:COMPleted]?  
**Supported** N5166B/72B/82B  
[:SOURce]:RADio:ARB:PLAY:COMPleted?

This SCPI command returns whether the ARB waveform has completed since the last query or the last time the waveform was setup up to play. The completion is after repeat counts for single trigger. The waveform is setup to play when various waveform parameters are adjusted, such as turning the mode off and on or changing the triggering mode. It returns a 0 if the waveform has not completed and a 1 if the waveform has completed at least one time. After this query, the value will be reset to 0 until another completion occurs.

:[PLAY:WCOMpleted]?  
**Supported** N5166B/72B/82B  
[:SOURce]:RADio:ARB:PLAY:WCOMpleted?
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([SOURce]:RADio:ARB)

This SCPI command returns whether the ARB waveform has completed since the last query or the last time the waveform was setup up to play. This SCPI command will wait until the ARB waveform has completed. The completion is after repeat counts for single trigger. The waveform is setup to play when various waveform parameters are adjusted, such as turning the mode off and on or changing the triggering mode. It returns a 0 if the waveform has not completed and a DCAS has been sent to the instrument or the mode is not on, otherwise a 1 will be returned when the waveform has completed at least one time. After this query, the value will be reset to 0 until another completion occurs.

[:REGister][:STATus]

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:REGister[:STATus]?

This query returns a weighted decimal value to indicate the status of the following Dual ARB settings:

- Dual ARB state (ARB)
- Triggering modes (ARM and Run)
- Multiple BBG synchronization (MBS1 and MBS2)

<table>
<thead>
<tr>
<th>Weighting</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>512</th>
<th>256</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>4</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit</td>
<td>15</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Position</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Status</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>MBS2</td>
<td>MBS1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Run</td>
<td>ARM</td>
</tr>
</tbody>
</table>

When the bit position is set high, the weighted position value equals $2^n$ where $n$ = bit position. When the bit position is set low, the weighting equals zero. The sum of the weighted values indicates the status of all monitored items.

Table 5-1 Low and High Bit Position Description

<table>
<thead>
<tr>
<th>ARB</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Dual ARB is off</td>
</tr>
<tr>
<td>1</td>
<td>Dual ARB is on</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ARMa</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Trigger is not armed</td>
</tr>
<tr>
<td>1</td>
<td>Trigger is armed and the Dual ARB is waiting for a trigger to start the play-back of the waveform</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RUNb</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The Dual ARB waveform is not playing</td>
</tr>
<tr>
<td>1</td>
<td>The Dual ARB waveform is playing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MBS1</th>
<th></th>
</tr>
</thead>
</table>

374 Keysight CXG, EXG, and MXG X-Series Signal Generators SCPI Command Reference
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

Table 5-1  Low and High Bit Position Description

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Multiple BBG synchronization is not waiting for a sync signal from the master</td>
</tr>
<tr>
<td>1</td>
<td>Multiple BBG synchronization is waiting for a sync signal from the master</td>
</tr>
</tbody>
</table>

MBS2

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Multiple BBG synchronization is out of sync</td>
</tr>
<tr>
<td>1</td>
<td>Multiple BBG synchronization is in sync</td>
</tr>
</tbody>
</table>

a. The ARM bit remains 0 for the following trigger type selections:

FREE (Free Run) see page 381
RESet (Reset and Run) see page 381
IMMediate (Restart on Trigger) see page 375
GATE see page 380

b. For GATE triggering, the bit remains high for both states of the trigger signal.

*RST 0

:RETRigger

Supported  N5166B/72B/82B

[:SOURce]:RADio:ARB:RETRigger  ON|OFF|1|0|IMMediate
[:SOURce]:RADio:ARB:RETRigger?

This command enables or disables the ARB retriggering mode. The retrigger mode controls how the retriggering function performs while a waveform is playing.

ON (1)  This choice (Buffered Trigger) specifies that if a trigger occurs while a waveform is playing, the waveform will retrigger at the end of the current waveform sequence and play once more.

OFF (0)  This choice (No Retrigger) specifies that if a trigger occurs while a waveform is playing, the trigger will be ignored.

IMMediate  This choice (Restart on Trigger) specifies that if a trigger occurs while a waveform is playing, the waveform will reset and replay from the start immediately upon receiving a trigger.

*RST ON

Key Entry  No Retrigger  Buffered Trigger  Restart on Trigger

Remarks  This command applies to the single trigger type only.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

:RSCaling

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:RSCaling <value>
[:SOURce]:RADio:ARB:RSCaling?

This command adjusts the scaling value in percent that is applied to a waveform while it is playing. The variable <value> is expressed as a percentage. Runtime scaling does not alter the waveform data file. This feature is used to avoid DAC overflow. The scaling is compensated for at the modulator (i.e. when the modulator is the optimized path). For more information about runtime scaling, refer to the User's Guide.

Example

:RAD:ARB:RSC 50

The preceding example applies a 50% scaling factor to the selected waveform. Runtime scaling does not alter the waveform data file.

*RST +7.00000000E+001

Range 1 to 100 percent

Key Entry Runtime Scaling

Remarks Saving the instrument state saves the currently-set Runtime Scaling in the instrument state file.

:SCALing

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:SCALing "<file_name>",<value>

This command scales the designated "<file_name>" waveform file while it is being played by the dual ARB player. The variable <value> is expressed as a percentage, 1–100%. The peak value of the waveform is disconnected and the whole waveform is scaled such that the peak value is at the specified percentage of full scale.

Unlike runtime scaling (:RSCaling), Scaling (:SCALing) has a permanent effect on the waveform data. Scaling up, after scaling down, typically results in a slightly different waveform from the original, as some data is lost in the scale–down process. For more information about waveform file scaling, refer to the User's Guide.

Example

:RAD:ARB:SCAL "Test_Data", 50

The preceding example applies a 50% scaling factor to the Test_Data waveform file.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

**Range**  
1 to 100 percent

**Key Entry**  
Scaling

**Remarks**  
For information on file name syntax, see “File Name Variables” on page 43.

:SCLock:RATE

**Supported**  
N5166B/72B/82B

[:SOURce]:RADio:ARB:SCLock:RATE <value>  
[:SOURce]:RADio:ARB:SCLock:RATE?

This command sets the sample clock rate for the dual ARB format. When the Modulation Filter is active, the Sample Clock Rate is actually the Symbol Rate and is limited from 100 Hz to half of the maximum sample rate as shown in the range table below.

The variable <value> is expressed in units of hertz.

* RST  
  +75.000000E+006 (with Option 653)  
  +150.000000E+006 (with Option 655)  
  +100.000000E+006 (with Option 656)  
  +200.000000E+006 (with Option 657)

**Range**  
Option 653: 1 Hz to 75MHz  
Option 655: 1 Hz to 150MHz  
Option 656: 1 Hz to 100 MHz  
Option 657: 1 Hz to 200 MHz

**Key Entry**  
ARB Sample Clock

:SEQuence[:MWAVeform]

**Supported**  
N5166B/72B/82B

[:SOURce]:RADio:ARB:SEQuence[:MWAVeform]  
<filename>,<waveform1>,<reps>,NONE|M1|M2|M3|M4|M1M2|M1M3|M1M4|M2M3|M2M4|M3M4|M1M2M3|M1M2M4|M1M3M4|M2M3M4|M1M2M3M4|ALL,,<waveform2>,<reps>,NONE|M1|M2|M3|M4|M1M2|M1M3|M1M4|M2M3|M2M4|M3M4|M1M2M3|M1M2M4|M1M3M4|M2M3M4|ALL,}

[:SOURce]:RADio:ARB:SEQuence[:MWAVeform]? <filename>
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([[:SOURce]:RADiO]:ARB)

This command creates a waveform sequence. A waveform sequence is made up of segments and other sequences. Any number of segments, up to a segment count limit of 1024, can be used to create a sequence. The count limit is determined by the number of segments in the waveform sequence. Repeated segments are included in the count limit.

For example, using the figure below, suppose a waveform is created using two sequences: Sequence_A and Sequence_B. Sequence_A consists of Sequence_B and Segment_Q with Sequence_B repeated four times. The total segment count for this waveform sequence would be eleven.

The query returns the contents and segment settings of the waveform sequence file.

The segments and sequences play in the same order as placed into the waveform sequence by the command. Once you create the file, you cannot edit the segment settings or add further waveform segments unless you use the signal generator’s front panel. Using the same waveform sequence name overwrites the existing file with that name. To use a segment’s marker settings, you must enable the segment’s markers within the segment or within the waveform sequence. A sequence is stored in the catalog of SEQ files USER/SEQ or SEQ: directory.

When you create a waveform sequence, the Keysight X-Series signal generator also creates a file header for the sequence. This file header takes priority over segment or nested sequence file headers. Refer to the User’s Guide for more information on file headers. To save the file header, see “:HEADer:SAVE” on page 352.

"<file_name>" This variable names the waveform sequence file. For information on the file name syntax, see “File Name Variables” on page 43.

"<waveform1>" This variable specifies the name of an existing waveform segment or sequence file. A waveform segment or the waveform segments in a specified sequence must reside in volatile memory, WFM1, before it can be played by the dual ARB player. For information on the file name...
Arb Commands

Dual ARB Subsystem–N5166B/72B/82B ([SOURce]:RADio:ARB)

syntax, see “File Name Variables” on page 43, and for more information on waveform segments, see the User’s Guide.

"<waveform2>"  This variable specifies the name of a second existing waveform segment or sequence file. The same conditions required for waveform1 apply for this segment or sequence. Additional segments and other sequences can be inserted into the file.

<reps>  This variable sets the number of times a segment or sequence plays (repeats) before the next segment or sequence plays.

NONE  This choice disables all four markers for the waveform. Disabling markers means that the waveform sequence ignores the segment’s or sequence’s marker settings.

M1, M2, M3, M4  These choices, either individually or a combination of them, enable the markers for the waveform segment or sequence. Markers not specified are ignored for that segment or sequence.

ALL  This choice enables all four markers in the waveform segment or sequence.

Example


The preceding example creates a waveform sequence file named Test_Data. This file consists of the factory–supplied waveform segments, ramp_test_wfm and sine_test_wfm. The waveform is stored in the signal generator’s SEQ: directory.

– The first segment, ramp_test_wfm, has 25 repetitions with markers 1 and 4 enabled.
– The second segment, sine_test_wfm, has 100 repetitions with all four markers enabled.

Range  <reps>: 1 to 65535

A carriage return or line feed is never included in a SCPI command. The example above contains a carriage return so that the text will fit on the page.

The preceding example creates a waveform sequence file named Test_Data. The example above contains a carriage return so that the text will fit on the page.

### NOTE

The example above contains a carriage return so that the text will fit on the page.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

:TRIGger:TYPE

Supported
N5166B/72B/82B

[:SOURce]:RADio:ARB:TRIGger:TYPE
CONTinuous|SINGle|GATE|SADVance
[:SOURce]:RADio:ARB:TRIGger:TYPE?

This command sets the trigger mode (type) that controls the waveform’s playback.

Triggers control the playback by telling the Keysight X-Series signal generator when to play the modulating signal (waveform). Depending on the trigger settings for the Keysight X-Series signal generator, the waveform playback can occur once, continuously, or the Keysight X-Series signal generator may start and stop playing the waveform repeatedly (GATE mode).

A trigger signal comprises both positive and negative signal transitions (states), which are also called high and low periods. You can configure the Keysight X-Series signal generator to trigger on either state of the trigger signal. It is common to have multiple triggers, also referred to as trigger occurrences or events, occur when the signal generator requires only a single trigger. In this situation, the Keysight X-Series signal generator recognizes the first trigger and ignores the rest.

When you select a trigger mode, you may lose the signal (carrier plus modulating) from the RF output until you trigger the waveform. This is because the Keysight X-Series signal generator sets the I and Q signals to zero volts prior to the first trigger event, which suppresses the carrier. After the first trigger event, the waveform’s final I and Q levels determine whether you will see the carrier signal or not (zero = no carrier, other values = carrier visible). At the end of most files, the final I and Q points are set to a value other than zero.

There are four parts to configuring the trigger:

– Choosing the trigger type, which controls the waveform’s transmission.

– Setting the waveform’s response to triggers:

  – CONTinuous, see “:TRIGger:TYPE:CONTinuous[:TYPE]” on page 381
  – SINGle, see “:RETrigger” on page 375
  – SADVance, see “:TRIGger:TYPE:SADVance[:TYPE]” on page 383
  – GATE, selecting the mode also sets the response
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

- Selecting the trigger source (see "`:TRIGger[:SOURce]` on page 384"), which determines how the Keysight X-Series signal generator receives its trigger signal, internally or externally. The GATE choice requires an external trigger.

- Setting the trigger polarity when using an external source:
  - CONTinuous, SINGle, and SADVance see "`:TRIGger[:SOURce]:EXTernal:SLOPe` on page 386
  - GATE, see "`:TRIGger:TYPE:GATE` on page 382

To check the trigger status, see "`:REGister[:STATus]` on page 374". For more information on triggering, see the User’s Guide.

The following list describes the trigger type command choices:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTinuous</td>
<td>Upon triggering, the waveform repeats continuously.</td>
</tr>
<tr>
<td>SINGle</td>
<td>Upon triggering, the waveform segment or sequence plays once.</td>
</tr>
<tr>
<td>SADVance</td>
<td>The trigger controls the segment advance within a waveform sequence. To use this choice, a waveform sequence must be the active waveform. Ensure that all segments in the sequence reside in volatile memory.</td>
</tr>
<tr>
<td>GATE</td>
<td>An external trigger signal repeatedly starts and stops the waveform’s playback (transmission). The time duration for playback depends on the duty period of the trigger signal and the gate polarity selection (see &quot;<code>:TRIGger:TYPE:GATE</code> on page 382&quot;). The waveform plays during the inactive state and stops during the active polarity selection state. The active state can be set high or low. The gate mode works only with an external trigger source.</td>
</tr>
</tbody>
</table>

With the multiple baseband generator synchronization feature active, GATE is unavailable (see page 358 for more information).

*RST CONT

Key Entry | Continuous | Single | Gate | Segment Advance
---|---|---|---|---

`::TRIGger:TYPE:CONTinuous[:TYPE]`

Supported N5166B/72B/82B

`[:SOURce]:RADio:ARB::TRIGger:TYPE:CONTinuous[:TYPE]`

FREE | TRIGger | RESET

`[:SOURce]:RADio:ARB::TRIGger:TYPE:CONTinuous[:TYPE]?`

This command selects the waveform’s response to a trigger signal while using the continuous trigger mode.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([SOURce]:RADio:ARB)

For more information on triggering and to select the continuous trigger mode, see “:TRIGger:TYPE” on page 380.

The following list describes the waveform’s response to each of the command choices:

FREE  Turning the ARB format on immediately triggers the waveform. The waveform repeats until you turn the format off, select another trigger, or choose another waveform file.

With the multiple baseband generator synchronization feature active, this selection is unavailable (see page 358 for more information).

TRIGger  The waveform waits for a trigger before play begins. When the waveform receives the trigger, it plays continuously until you turn the format off, select another trigger, or choose another waveform file.

RESet  The waveform waits for a trigger before play begins. When the waveform receives the trigger, it plays continuously. Subsequent triggers reset the waveform to the beginning. For a waveform sequence, this means to the beginning of the first segment in the sequence.

*RST  FREE

:TRIGger:TYPE:GATE

Supported  N5166B/72B/82B

[:SOURce]:RADio:ARB:TRIGger:TYPE:GATE LOW|HIGH
[:SOURce]:RADio:ARB:TRIGger:TYPE:GATE?

This command selects the active state (gate polarity) of the gate while using the gating trigger mode.

The LOW and HIGH selections correspond to the low and high states of an external trigger signal. For example, when you select HIGH, the active state occurs during the high of the trigger signal. When the inactive state occurs, the Keysight X-Series signal generator stops the waveform playback at the last played sample point, then restarts the playback at the next sample point when the active state occurs. For more information on triggering and to select gating as the trigger mode, see “:TRIGger:TYPE” on page 380.

The following list describes the Keysight X-Series signal generator’s gating behavior for the polarity selections:

LOW  The waveform playback stops when the trigger signal goes high and restarts when the trigger signal goes low.
**Arb Commands**

**Dual ARB Subsystem—N5166B/72B/82B ([;SOURce]:RADio:ARB)**

**HIGH** The waveform playback stops when the trigger signal goes low and restarts when the trigger signal goes high.

*RST* HIGH

**Key Entry**

<table>
<thead>
<tr>
<th>Active Low</th>
<th>Active High</th>
</tr>
</thead>
</table>

:TRIGger:TYPE:SADVance[:TYPE]

**Supported** N5166B/72B/82B

[:SOURce]:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE]

SINGLE|CONTInuous

[:SOURce]:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE]?

This command selects the waveform’s response to a trigger signal while using the segment advance (SADVance) trigger mode.

When the Keysight X-Series signal generator receives multiple trigger occurrences when only one is required, the signal generator uses the first trigger and ignores the rest. For more information on triggering and to select segment advance as the trigger mode, see “:TRIGger:TYPE” on page 380.

The following list describes the waveform’s response to each of the command choices:

**SINGLE** Each segment in the sequence requires a trigger to play, and a segment plays only once, ignoring a segment’s repetition value (see “:SEQuence[:MWAVeform]” on page 377 for repetition information). The following list describes a sequence’s playback behavior with this choice:

- After receiving the first trigger, the first segment plays to completion.

- When the waveform receives a trigger after a segment completes, the sequence advances to the next segment and plays that segment to completion.

- When the waveform receives a trigger during play, the current segment plays to completion. Then the sequence advances to the next segment, and it plays to completion.

- When the waveform receives a trigger either during or after the last segment in a sequence plays, the sequence resets and the first segment plays to completion.
CONTinuous Each segment in the sequence requires a trigger to play. After receiving a trigger, a segment plays continuously until the waveform receives another trigger. The following list describes a sequence’s playback behavior with this choice:

- After receiving the first trigger, the first segment plays continuously.
- A trigger during the current segment play causes the segment to play to the end of the segment file, then the sequence advances to the next segment, which plays continuously.
- When last segment in the sequence receives a trigger, the sequence resets and the first segment plays continuously.

Example

:RAD:ARB:TRIG:TYPE:SADV CONT

The preceding example selects the continuous segment advance mode.

*RST CONT

Key Entry Single Continuous

:TRIGger:TYPE:SINGle:REPeat

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:TRIGger:TYPE:SINGle:REPeat <count>

<count> is the number of times to repeat the waveform when a single trigger is received.

*RST 1

Range 1 to 65535

:TRIGger[:SOURce]

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:TRIGger[:SOURce] KEY|EXT|BUS

[:SOURce]:RADio:ARB:TRIGger[:SOURce]?

This command sets the trigger source. With the multi–baseband generator synchronization slave selection, this command is unavailable (see page 358 for more information).

For more information on triggering, see “:TRIGger:TYPE” on page 380. The following list describes the command choices:
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEY</td>
<td>Enables manual triggering by pressing the front-panel Trigger key.</td>
</tr>
<tr>
<td>EXT</td>
<td>An externally applied signal triggers the waveform. This is the only choice that works with gating. The following conditions affect an external trigger:</td>
</tr>
<tr>
<td></td>
<td>- The input connector selected for the trigger signal. You have a choice between the rear panel PATTERN TRIG IN connector or the PATT TRIG IN 2 pin on the rear panel AUXILIARY I/O connector. To make the connector selection, see “:TRIGger[:SOURce]:EXTernal[:SOURce]” on page 387. For more information on the connectors and on connecting the cables, see the User’s Guide.</td>
</tr>
<tr>
<td></td>
<td>- The trigger signal polarity:</td>
</tr>
<tr>
<td></td>
<td>- gating mode, see “:TRIGger:TYPE:GATE” on page 382</td>
</tr>
<tr>
<td></td>
<td>- continuous and single modes, see “:TRIGger[:SOURce]:EXTernal:SLOPe” on page 386</td>
</tr>
<tr>
<td></td>
<td>- The time delay between when the Keysight X-Series signal generator receives a trigger and when the waveform responds to the trigger. There are two parts to setting the delay:</td>
</tr>
<tr>
<td></td>
<td>- setting the amount of delay, see “:TRIGger[:SOURce]:EXTernal:DELay” on page 385</td>
</tr>
<tr>
<td></td>
<td>- turning the delay on, see “:TRIGger[:SOURce]:EXTernal:DELay:STATe” on page 386</td>
</tr>
<tr>
<td>BUS</td>
<td>Enables triggering over the GPIB or LAN using the *TRG or GET commands or the AUXILIARY INTERFACE (USB) using the *TRG command.</td>
</tr>
</tbody>
</table>

*RST* EXT

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Trigger Key</th>
<th>Ext</th>
<th>Bus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

:TRIGger[:SOURce]:EXTernal:DELay

**Supported** N5166B/72B/82B

[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay <value>

[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay?
Arb Commands
Dual ARB Subsystem—N5166B/72B/82B ([:SOURce]:RADio:ARB)

This command sets the amount of time to delay the Keysight X-Series signal generator’s response to an external trigger.

The delay is a path (time) delay between when the Keysight X-Series signal generator receives the trigger and when it responds to the trigger. For example, configuring a trigger delay of two seconds, causes the Keysight X-Series signal generator to wait two seconds after receipt of the trigger before the Keysight X-Series signal generator plays the waveform.

The delay does not occur until you turn it on (see “[:TRIGger[:SOURce]:EXTernal:DELay:STATe” on page 386). You can set the delay value either before or after turning it on.

For more information on configuring an external trigger source and to select external as the trigger source, see “[:TRIGger[:SOURce]” on page 384.

The unit of measurement for the variable <value> is in seconds (nsec–sec).

*RST +1.00000000E–003
Range 1E–8 to 3E1
Key Entry Ext Delay Time

[:TRIGger[:SOURce]:EXTernal:DELay:STATe

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB[:TRIGger[:SOURce]:EXTernal:DELay:STATe

ON|OFF|1|0

[:SOURce]:RADio:ARB[:TRIGger[:SOURce]:EXTernal:DELay:STATe?

This command enables or disables the operating state of the external trigger delay function.

For setting the delay time, see “[:TRIGger[:SOURce]:EXTernal:DELay” on page 385, and for more information on configuring an external source, see “[:TRIGger[:SOURce]” on page 384.

*RST 0

Key Entry Ext Delay Off On

[:TRIGger[:SOURce]:EXTernal:SLOPe

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB[:TRIGger[:SOURce]:EXTernal:SLOPe

POSitive|NEGative

[:SOURce]:RADio:ARB[:TRIGger[:SOURce]:EXTernal:SLOPe?

This command sets the polarity for an external trigger signal while using the continuous, single triggering mode. To set the polarity for gating, see “[:TRIGger:TYPE:GATE” on page 382.
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([:SOURce]:RADio:ARB)

The POSitive and NEGative selections correspond to the high (positive) and low (negative) states of the external trigger signal. For example, when you select POSitive, the waveform responds (plays) during the high state of the trigger signal. When the Keysight X-Series signal generator receives multiple trigger occurrences when only one is required, the signal generator uses the first trigger and ignores the rest.

For more information on configuring an external trigger source and to select external as the trigger source, see “:TRIGger[:SOURce]” on page 384.

*RST
Key Entry Ext Polarity Neg Pos

:TRIGger[:SOURce]:EXTernal[:SOURce]

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal[:SOURce]
EPT1|EPT2|
EPTRIGGER1|EPTRIGGER2
[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal[:SOURce]?

This command selects which PATTERN TRIG IN connection the Keysight X-Series signal generator uses to accept an externally applied trigger signal when external is the trigger source selection.

For more information on configuring an external trigger source and to select external as the trigger source, see “:TRIGger[:SOURce]” on page 384. For more information on the rear panel connectors, see the User’s Guide.

The following list describes the command choices:

- **EPT1** This choice is synonymous with EPTRIGGER1 and selects the PAT TRIG rear panel connector.
- **EPT2** This choice is synonymous with EPTRIGGER2 and selects the PATT TRIG IN 2 pin on the rear panel AUX I/O connector.
- **EPTRIGGER1** This choice is synonymous with EPT1 and selects the PAT TRIG rear panel connector.
- **EPTRIGGER2** This choice is synonymous with EPT2 and selects the PATT TRIG IN 2 pin on the rear panel AUXILIARY I/O connector.

*RST EPT1

Key Entry Patt Trig In 1 Patt Trig In 2

:WAVeform

Supported N5166B/72B/82B
Arb Commands
Dual ARB Subsystem–N5166B/72B/82B ([SOURce]:RADio:ARB)

[:SOURce]:RADio:ARB:WAVeform
"WFM1:file_name"|"SEQ:file_name"

[:SOURce]:RADio:ARB:WAVeform?

This command selects a waveform file or sequence, for the dual ARB player to play. The file must be present in volatile memory, WFM1, or in the SEQ directory. If a file is in non–volatile memory (NVWFM), use the command "COPY[:NAME]" on page 164 to copy the file to WFM1. Any specified values in the header are applied to the ABR upon selection. Unspecified fields in the header cause no change in the ARB state.

"WFM1:file_name" This variable names a waveform file residing in volatile memory (WFM1:). For information on the file name syntax, see “File Name Variables” on page 43.

"SEQ:filename" This variable names a sequence file residing in the catalog of sequence files. For more information on the file name syntax, see “File Name Variables” on page 43.

Example
:RAD:ARB:WAV "WFM1:Test_Data"

The preceding example selects the file Test_Data from the list of files in volatile waveform memory, WFM1, and applies its file header settings.

Key Entry Select Waveform

:WAVeform:NHEAders

Supported N5166B/72B/82B

[:SOURce]:RADio:ARB:WAVeform:NHEaders
"WFM1:file_name"|"SEQ:filename"

[:SOURce]:RADio:ARB:WAVeform:NHEaders?

This command, for the dual ARB mode, allows for a fast selection of a segment or sequence waveform file. No header information or settings are applied to the segment or sequence waveform file when this command is used. This will improve the access or loading speed of the waveform file. The file must be in volatile waveform memory (WFM1), or in the SEQ directory. If a file is in non–volatile waveform memory (NVWFM), use the command "COPY[:NAME]" on page 164 to copy files to WFM1.

"WFM1:file_name" This variable names a waveform file residing in volatile memory:WFM1. For information on the file name syntax, see "File Name Variables" on page 43.

"SEQ:filename" This variable names a sequence file residing in the catalog of sequence files. For more information on the file name syntax, see “File Name Variables” on page 43.

Example
:RAD:ARB:WAV:NHE "Test_Data"
Arb Commands
Dual ARB Subsystem—N5166B/72B/82B ([:SOURce]:RADIO:ARB)

The preceding example selects the file Test_Data, without applying header settings.

:WAVEform:SEGMents

Supported  N5166B/72B/82B

[:SOURce]:RADIO:ARB:WAVEform:SEGMents?

This command returns the segment count in the currently selected waveform sequence for Dual Arb.

[:STATE]

Supported  N5166B/72B/82B

[:SOURce]:RADIO:ARB[:STATE] ON|OFF|1|0

[:SOURce]:RADIO:ARB[:STATE]?

This command enables or disables the arbitrary waveform generator function.

The Dual ARB Player provides a status register to show the status of the following items:

– Dual ARB state (off or on)
– Trigger arming
– Waveform play–back
– Multiple BBG synchronization

To use the register, see “:REGister[:STATus]” on page 374.

*RST 0

Key Entry ARB Off On
Arb Commands
LARB Subsystem–N5166B/72B/82B ([::SOURce]:RADio:LARB)

LARB Subsystem–N5166B/72B/82B ([::SOURce]:RADio:LARB)

[::STATe]

**Supported**  N5166B/72B/82B

[::SOURce]:RADio:LARB[:STATe] ON|OFF|1|0

[::SOURce]:RADio:LARB[:STATe]?

This command enables or disables the waveform sweep function, when the signal generator is in list sweep mode.

*NOTE*

Except for the sample clock rate, unspecified fields in the header result in the default settings of the dual arb's settings being used (i.e. not the current arb's settings). The sample clock rate must be specified for the file header of the waveform file being played. If the sample clock rate is unspecified in the file header, the instrument generates a header error.

*RST  0

Key Entry  Waveform Off On

Remarks  The **Sweep Type** softkey must be set to **List** for this command to function.
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:MTONe:ARB)

Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:MTONe:ARB)

Creating a Multitone Waveform

Use the following steps to create a multitone waveform:

1. Initialize the phase for the multitone waveform. Refer to
   “:SETup:TABLE:PHASe:INITialize” on page 408.
2. Assign the frequency spacing between the tones. Refer to
   “:SETup:TABLE:FSPacing” on page 407.
3. Define the number of tones within the waveform. Refer to
   “:SETup:TABLE:NTONes” on page 408.
4. Modify the power level, phase, and state of any individual tones. Refer to
   “:SETup:TABLE:ROW” on page 409.

:ALIGnment

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTONe:ARB:ALIGnment LEFT|CENTer|RIGHT
[:SOURce]:RADio:MTONe:ARB:ALIGnment?

This command will align the multitones either left, center or right of the carrier frequency.

Example

:RAD:MTON:ARB:ALIG CENT

The preceding example aligns each of the multitones equidistant from the carrier frequency.

Key Entry Alignment Left Cent Right

:BASEband:FREQuency:OFFSet

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTONe:ARB:BASEband:FREQuency:OFFSet
<val><unit>
[:SOURce]:RADio:MTONe:ARB:BASEband:FREQuency:OFFSet?

This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed-through is not in the center.

The X-Series signal generator provides automatic DAC over-range protection when the offset value is something other than 0 Hz. It scales down the playing I/Q data by $1/\sqrt{2}$. 

Key Entry Alignment Left Cent Right

:BASEband:FREQuency:OFFSet

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTONe:ARB:BASEband:FREQuency:OFFSet
<val><unit>
[:SOURce]:RADio:MTONe:ARB:BASEband:FREQuency:OFFSet?

This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed-through is not in the center.

The X-Series signal generator provides automatic DAC over-range protection when the offset value is something other than 0 Hz. It scales down the playing I/Q data by $1/\sqrt{2}$. 

Key Entry Alignment Left Cent Right
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([[:SOURce]:RADio:MTOnE:ARB])

*RST

Range +5.0E7 to −5.0E7 Hz

Key Entry Baseband Frequency Offset

[:BASEband]:FREQuency:OFFSet:PHASE:RESet

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTOnE:ARB:BASEband:FREQuency:OFFSet:PHASE:RESet

This command clears the phase accumulation and so zero phase shift.

When the Baseband Frequency Offset is non-zero, the hardware rotator accumulates phase-shift of the baseband signal. This residual phase remains even after the offset value is returned to zero. While there is a non-zero residual phase present in the signal, the DAC Over-Range Protection feature will automatically prevent DAC overrange errors from occurring by scaling the signal down by $1/\sqrt{2}$.

Key Entry Baseband Frequency Offset Phase Reset

:HEADer:CLEar

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTOnE:ARB:HEADer:CLEar

This command clears the header information from the file header used by this modulation format.

Key Entry Clear Header

Remarks The Multitone Off On softkey must be set to On for this command to function.

:HEADer:SAVE

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTOnE:ARB:HEADer:SAVE

This command saves the header information to the file header used by this modulation format.

Key Entry Save Setup To Header

Remarks The Multitone Off On softkey must be set to On for this command to function.

:IQ:MODulation:ATTen

Supported N5166B/72B/82B with Option N5180430B
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:MTONe:ARB)

[:SOURce]:RADio:MTONe:ARB:IQ:MODulation:ATTen <val>
[:SOURce]:RADio:MTONe:ARB:IQ:MODulation:ATTen?

This command attenuates the I/Q signals being modulated through the signal generator RF path.

The variable <val> is expressed in units of decibels (dB).

*RST +2.00000000E+000
Range 0 to 50
Key Entry Modulator Atten Manual Auto

:IQ:MODulation:ATTen:AUTO

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTONe:ARB:IQ:MODulation:ATTen:AUTO ON|OFF|1|0
[:SOURce]:RADio:MTONe:ARB:IQ:MODulation:ATTen:AUTO?

This command enables or disables the I/Q attenuation auto mode.

ON (1) This choice enables the attenuation auto mode which optimizes the modulator attenuation for the current conditions.

OFF (0) This choice holds the attenuator at its current setting or at a selected value. Refer to the :IQ:MODulation:ATTen command for setting the attenuation value.

*RST 1
Key Entry Modulator Atten Manual Auto

:MDEStination:AAMPlitude

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTONe:ARB:MDEStination:AAMPlitude NONE|M1|M2|M3|M4
[:SOURce]:RADio:MTONe:ARB:MDEStination:AAMPlitude?

This command routes the selected marker to the Alternate Amplitude function. The NONE parameter clears the marker for the Alternate Amplitude function.

*RST NONE

Key Entry None Marker 1 Marker 2 Marker 3 Marker 4
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([SOURce]:RADIO:MTONe:ARB)

:MDEStination:ALCHold

Supported  N5166B/72B/82B with Option N5180430B

**CAUTION**
Incorrect automatic level control (ALC) sampling can create a sudden un leveled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.

[:SOURce]:RADIO:MTONe:ARB:MDEStination:ALCHold
NONE|M1|M2|M3|M4
[:SOURce]:RADIO:MTONe:ARB:MDEStination:ALCHold?

This command enables the marker ALC hold function for the selected marker. For setting markers, see “:MARKer:[SET]” on page 356.

Use the ALC hold function when you have a waveform signal that incorporates idle periods, or when the increased dynamic range encountered with RF blanking is not desired. The ALC leveling circuitry responds to the marker signal during the marker pulse (marker signal high), averaging the modulated signal level during this period.

The ALC hold function operates during the low periods of the marker signal. The marker polarity determines when the marker signal is high. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. For setting a marker’s polarity, see :MPOLarity:MARKer1|2|3|4.

Do not use the ALC hold for more than 100 ms, because it can affect the waveform’s output amplitude.

The marker signal has a minimum of a two–sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want the ALC sampling to begin.

The ALC hold setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

**NOTE**
A waveform file that has unspecified settings in the file header uses the previous waveform’s routing settings.

For more information on the marker ALC hold function, see the *User’s Guide*.

<table>
<thead>
<tr>
<th>NONE</th>
<th>This terminates the marker ALC hold function.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1–M4</td>
<td>These are the marker choices. The ALC hold feature uses only one marker at a time.</td>
</tr>
</tbody>
</table>
Arb Commands
Multitone Subsystem—N5166B/72B/82B with Option N5180430B
([:SOURCE]:RAD:MTON:ARB)

*RST NONE

Key Entry None Marker 1 Marker 2
Marker 3 Marker 4

:MDEStination:PULSe

Supported N5166B/72B/82B with Option N5180430B

CAUTION

The pulse function incorporates ALC hold. Incorrect automatic level control (ALC) sampling can create a sudden unlevelled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.

[:SOURCE]:RAD:MTON:ARB:MDEstination:PULSe
NONE|M1|M2|M3|M4
[:SOURCE]:RAD:MTON:ARB:MDEstination:PULSe?

This command enables the marker pulse/RF blanking function for the selected marker.

This function automatically incorporates the ALC hold function, so there is no need to select both the ALC hold and pulse/RF blanking functions for the same marker.

NOTE

Do not use ALC hold for more than 100 ms, because it can affect the waveform’s output amplitude.

The signal generator blanks the RF output when the marker signal goes low. The marker polarity determines when the marker signal is low. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. For setting a marker’s polarity, see “:MPOLarity:MARKer1|2|3|4” on page 396.

NOTE

Set marker points prior to using this function. Enabling this function without setting marker points may create a continuous low or high marker signal, depending on the marker polarity. This causes either no RF output or a continuous RF output. For setting the marker points, see “:MARKer:[SET]” on page 356.

The marker signal has a minimum of a two–sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([*SOURce*]:RADio:MTONe:ARB)

the RF blanking to begin. The RF blanking setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

A waveform file that has unspecified settings in the file header uses the previous waveform’s routing settings. This could create the situation where there is no RF output signal, because the previous waveform used RF blanking.

For more information on the marker RF blanking function, see the User’s Guide.

NONE  This terminates the marker RF blanking/pulse function.
M1–M4  These are the marker choices. The RF blanking/pulse feature uses only one marker at a time.
*RST  NONE

Key Entry

None     Marker 1     Marker 2
Marker 3     Marker 4

:MPOLarity:MARKer1|2|3|4

Supported     N5166B/72B/82B with Option N5180430B

[:SOURce*]:RADio:MTONe:ARB:MPOLarity:MARKer1|2|3|4
NEGative|POSitive
[:SOURce*]:RADio:MTONe:ARB:MPOLarity:MARKer1|2|3|4?

This command sets the polarity for the selected marker. For a positive marker polarity, the marker signal is high during the marker points. For a negative marker polarity, the marker signal is high during the period of no marker points.

*RST  POS

Key Entry

Marker 1 Polarity Neg Pos
Marker 2 Polarity Neg Pos
Marker 3 Polarity Neg Pos
Marker 4 Polarity Neg Pos

:NOISe:BANDwidth

Supported     N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce*]:RADio:MTONe:ARB:NOISe:BANDwidth <val><unit>
[:SOURce*]:RADio:MTONe:ARB:NOISe:BANDwidth?

This command sets the flat noise bandwidth value for the multitone waveform. This value is typically set wider than the carrier bandwidth.
Arb Commands
Multitone Subsystem—N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:MTONe:ARB)

To configure the AWGN, refer to the following sections located in the multitone subsystem:

- To set the bandwidth over which the noise power is integrated for calculating the carrier to noise ratio, refer to "[:NOISe:CBWidth]" on page 397.
- To set the carrier to noise ratio as the active function, refer to "[:NOISe:CN]" on page 398.
- To enable the AWGN, refer to "[:NOISe:[STATE]]" on page 402.

\*RST +1.00000000E+000

Key Entry Noise Bandwidth

:NOISe:CBRate

Supported N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce]:RADio:MTONe:ARB:NOISe:CBRate <val>
[:SOURce]:RADio:MTONe:ARB:NOISe:CBRate?

This command sets a value of the carrier bit rate (gross bit rate) for purposes of calculating the Eb/N0 (energy per bit over noise power density at the receiver). When the carrier to noise ratio format is set to Eb/N0 (refer to the :NOISe:CNFormat command), the adjustment of the carrier bit rate will have an immediate impact on the carrier to noise ratio as specified by Eb/N0. The carrier bit rate is derived from the symbol rate and bits per symbol of the modulation. The carrier bit rate is a saved instrument state that is recorded in the waveform header.

The query returns the current carrier bit rate setting.

Default 1.000 bps
Range 1 bps–999 Mbps
Key Entry Carrier Bit Rate

:NOISe:CBWidth

Supported N5166B/72B/82B with Options N5180430B and N5180403B
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:MTONe:ARB)

[:SOURce]:RADio:MTONe:ARB:NOISe:CBWidth <val>
[:SOURce]:RADio:MTONe:ARB:NOISe:CBWidth?

This command selects the carrier bandwidth over which the AWGN (additive white gaussian noise) is applied. The noise power will be integrated over the selected bandwidth for the purposes of calculating C/N (carrier to noise ratio). For more information refer to “:NOISe[:STATe]” on page 402.

*RST +1.00000000E+000

Range 1 Hz–200 MHz (Minimum increment is .001 Hz)

Key Entry Carrier Bandwidth

:NOISe:CN

Supported N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce]:RADio:MTONe:ARB:NOISe:CN <val>
[:SOURce]:RADio:MTONe:ARB:NOISe:CN?

This command sets the carrier to noise ratio in dB. The carrier power is defined as the total modulated signal power without noise power added. The noise power is applied over the specified bandwidth of the carrier signal. For more information, refer to :NOISe:CBWidth.

Example

:RAD:ARB:NOIS:CN 50DB

The preceding example sets the carrier to noise ratio to 50 dB.

*RST +0.00000000E+000

Range –100dB to 100dB

Key Entry Carrier to Noise Ratio

:NOISe:CNFormat

Supported N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce]:RADio:MTONe:ARB:NOISe:CNFormat CN|EBNO
[:SOURce]:RADio:MTONe:ARB:NOISe:CNFormat?

This command selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (Eb/N0) as the variable controlling the ratio of carrier power to noise power in the carrier bandwidth.

Example

:RAD:MTON:ARB:NOIS:CNF EBNO
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B ([:SOURCE]:RAD:MTONE:ARB)

The preceding example sets the carrier to noise ratio format to EbNo.

<table>
<thead>
<tr>
<th>Default</th>
<th>Carrier to Noise Ratio Format C/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Entry</td>
<td>Carrier to Noise Ratio Format C/N Eb/No</td>
</tr>
</tbody>
</table>

::NOISe:EBNO

Supported
N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURCE]:RAD:MTONE:ARB:NOISe:EBNO <ebno in dB>
[:SOURCE]:RAD:MTONE:ARB:NOISe:EBNO?

This command allows the C/N to be set using the Eb/N0 (energy per bit over noise power density at the receiver) form. This requires that the carrier bit rate (::NOISe:CBRate on page 397) be set properly. The range of Eb/N0 is limited to the range that is equivalent to –100 to 100 dB of C/N. This value is only effective when Eb/N0 has been enabled by the ::NOISe:CNFormat command.

The query returns the value of Eb/N0.

<table>
<thead>
<tr>
<th>Default</th>
<th>0 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>–100 to 100 dB</td>
</tr>
<tr>
<td>Key Entry</td>
<td>Carrier to Noise Ratio Format Eb/No</td>
</tr>
</tbody>
</table>

::NOISe:MUX

Supported
N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURCE]:RAD[1]:MTONE:ARB:NOISe:MUX SUM|CARRier|NOISe
[:SOURCE]:RAD[1]:MTONE:ARB:NOISe:MUX?

This command enables diagnostic control of additive noise, such that only the noise, only the carrier, or the sum of both the noise and the carrier are output from the internal baseband generator. With the ALC off, this feature enables direct measurement of just the carrier or the noise contributions to the total power. The system will still behave as if both the noise and the carrier are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

Example

:RAD:MTON:ARB:NOIS:MUX CARR

The preceding example enables the direct measurement of the carrier contribution to the total power.

<table>
<thead>
<tr>
<th>Default</th>
<th>Carrier+Noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Entry</td>
<td>Carrier+Noise</td>
</tr>
</tbody>
</table>
Arb Commands
Multitone Subsystem—N5166B/72B/82B with Option N5180430B
([SOURce]:RADio:MTONE:ARB)

:NOISE:POWER:CARRier

**Supported**
N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce]:RADio:MTONE:ARB:NOISE:POWER:CARRier <carrierPower>

[:SOURce]:RADio:MTONE:ARB:NOISE:POWER:CARRier?

This command sets the current carrier power level if noise is on.

In the CARRier control mode, the total power will be adjusted to achieve the specified carrier power and the carrier power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the carrier power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total power is adjusted.

In the NOISe control mode, this will adjust the total noise power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total noise power is adjusted. See also :NOISE:POWER:CONTrol[:MODE] and :NOISE:POWER:NOISe:TOTal commands.

**Range**
The range varies based on the bounds of the total power that results from the noise settings.

**Default**
The appropriate value given the current total power and the current Carrier to Noise (C/N).

**Key Entry**
Carrier Power

:NOISE:POWER:CONTrol[:MODE]

**Supported**
N5166B/72B/82B with Options N5180430B and N5180403B


[:SOURce]:RADio:MTONE:ARB:NOISE:POWER:CONTrol[:MODE]?

This command sets the power control to one of the three following modes:

**Total**
This is the default mode where the total power and C/N are independent variables and the carrier power and total noise power are dependent variables set by the total power, C/N and the rest of the noise settings. The carrier power and total noise power will change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values.

**Carrier**
In this mode the carrier power and C/N are independent variables and the total power and total noise power are dependent variables set by the carrier power, C/N and...
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:MTOnE:ARB)

the rest of the noise settings. The total power and total noise power will change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values.

Total Noise
In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.

Default
Total

Key Entry
Total Carrier Total Noise

:NOISe:POWer:NOISe:CHANnel?

Supported
N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce]:RADio:MTOnE:ARB:NOISe:POWer:NOISe:CHANnel?
The query returns the current noise power across the carrier bandwidth in dBm.

:NOISe:POWer:NOISe:TOTal

Supported
N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce]:RADio:MTOnE:ARB:NOISe:POWer:NOISe:TOTal<totalNoisePowerInDbm>
[:SOURce]:RADio:MTOnE:ARB:NOISe:POWer:NOISe:TOTal?

This command sets the current total noise power level if noise is on.

In the NOISe control mode, the total power will be adjusted to achieve the specified total noise power and the total noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the total noise power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the total power is adjusted.

In the CARRier control mode, this will adjust the carrier power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the carrier power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] command.
Arb Commands
Multi-tone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:MTONe:ARB)

Range
The range varies based on the bounds of the total power that results from the noise settings.

Default
The appropriate value given the current total power and the current Carrier to Noise (C/N).

Key Entry
Total Noise Power

:NOISe[:STATe]

Supported
N5166B/72B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:MTONe:ARB:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:MTONe:ARB:NOISe[:STATe]?

This command enables the Multi-Tone modulation mode.
To configure the AWGN, refer to the following sections located in the multitone subsystem:
- To set the AWGN noise bandwidth, refer to "NOISe:BANDwidth" on page 396.
- To set the bandwidth over which the noise power is integrated for calculating the carrier to noise ratio, refer to "NOISe:CBWidth" on page 397.
- To set the carrier to noise ratio as the active function, refer to "NOISe:CN" on page 398.

*RST
Off

Key Entry
Real-Time AWGN Off On

:PHASe:NOISe:F1

Supported
N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:F1 <value><unit>
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:F1?

This command sets the start frequency value of the flat area for the phase noise impairment.
Ensure that this value is less than or equal to the stop frequency value (see :PHASe:NOISe:F2). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.
The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the User’s Guide.

*RST
+1.00000000E+003

Range
0 Hz to 77.50052449 MHz
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:MTONe:ARB)

Key Entry Desired Start Freq (f1)

:PHASe:NOISe:F1:ACTual?

Supported N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:F1:ACTual?

This query returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

:PHASe:NOISe:F2

Supported N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:F2 <value><unit>
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:F2?

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :PHASe:NOISe:F1 command). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the User’s Guide.

*RST +3.00000000E+004

Range 1 Hz to 77.50052449 MHz

Key Entry Desired Stop Freq (f2)

:PHASe:NOISe:F2:ACTual?

Supported N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:F2:ACTual?

This query returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

:PHASe:NOISe:LMID

Supported N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:LMID <value>
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:LMID?

This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator.
Arb Commands

Multitone Subsystem–N5166B/72B/82B with Option N5180430B
(:SOURce:RADio:MTONE:ARB)

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.

For more information on the phase noise impairment option, see the User’s Guide.

**NOTE**

The amplitude range varies depending on the f2 value (“:PHASE:NOISE:F2” on page 403). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.

The range values are expressed in units of dBc/Hz.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>*RST</td>
<td>−7.00000000E+001</td>
</tr>
<tr>
<td>Range</td>
<td>−300 to 100</td>
</tr>
<tr>
<td>Key Entry</td>
<td>Desired Flat Amplitude (Lmid)</td>
</tr>
</tbody>
</table>

**:PHASE:NOISE:LMID:ACTual?**

**Supported**

N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:MTONE:ARB:PHASE:NOISE:LMID:ACTual?

This query returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

**:PHASE:NOISE[:STATE]**

**Supported**

N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:MTONE:ARB:PHASE:NOISE[:STATE] ON|OFF|1|0

[:SOURce]:RADio:MTONE:ARB:PHASE:NOISE[:STATE]?

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the User’s Guide.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>*RST</td>
<td>0</td>
</tr>
<tr>
<td>Key Entry</td>
<td>Phase Noise Off On</td>
</tr>
</tbody>
</table>
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURCE]:RADio:MTONe:ARB)

the phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBc/Hz.

Range
<startFreq> 1 Hz to 100 MHz
<stopFreq> 1 Hz to 100 MHz
<numSamples> 1 to 8192

:SCLock:RATE

Supported N5166B/72B/82B with Option N5180430B

[:SOURCE]:RADio:MTONe:ARB:SCLock:RATE <val>
[:SOURCE]:RADio:MTONe:ARB:SCLock:RATE?

This command sets the sample clock rate for the multitone modulation format. The variable <val> is expressed in units of hertz.

*RST
+60.000000E+006 (with Option 653)
+120.000000E+006 (with Option 655)
+80.000000E+006 (with Option 656)
+160.000000E+006 (with Option 657)

Range
Option 653: 1 Hz to 60 MHz
Option 655: 1 Hz to 120 MHz
Option 656: 1 Hz to 80 MHz
Option 657: 1 Hz to 160 MHz

Key Entry ARB Sample Clock

Remarks
The modulation format should be active before executing this command. If this command is executed before the modulation format is active, the entered value will be overridden by a calculated factory default value. To activate the modulation format, refer to “[:STATE]” on page 410.

:SETup

Supported N5166B/72B/82B with Option N5180430B

[:SOURCE]:RADio:MTONe:ARB:SETup "<file name>"
[:SOURCE]:RADio:MTONe:ARB:SETup?

This command retrieves a multitone waveform file.

Key Entry Load From Selected File
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
(:SOURce):RADio:MTONe:ARB)

Remarks
The name of a multitone waveform file is stored in the signal generator file system of MTONE files. This information is held in memory until you send the command that turns the waveform on.

For information on the file name syntax, refer to “File Name Variables” on page 43.

:SETup:STORe

Supported
N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTONe:ARB:SETup:STORe "<file name>"

This command stores the current multitone waveform setup in the signal generator file system of MTONE files.

Key Entry
Store To File

:SETup:TABLe

Supported
N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTONe:ARB:SETup:TABLe <freq_spacing>, <num_tones>, <phase>, <state>
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe?

This command creates and configures a multitone waveform.

The frequency offset, power, phase, and state value are returned when a query is initiated. The output format is as follows:

<frequency offset>,<power>,<phase>,<state>

The variable <freq_spacing> is expressed in units of Hertz (Hz–MHz).

The variable <power> is expressed in units of decibels (dB).

<table>
<thead>
<tr>
<th>*RST</th>
<th>Tone</th>
<th>&lt;frequency offset&gt;</th>
<th>&lt;power&gt;</th>
<th>&lt;phase&gt;</th>
<th>&lt;state&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tone 1</td>
<td>-35000</td>
<td>+0.00000000E+000</td>
<td>+0</td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td>Tone 2</td>
<td>-25000</td>
<td>+0.00000000E+000</td>
<td>+0</td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td>Tone 3</td>
<td>-15000</td>
<td>+0.00000000E+000</td>
<td>+0</td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td>Tone 4</td>
<td>-5000</td>
<td>+0.00000000E+000</td>
<td>+0</td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td>Tone 5</td>
<td>+5000</td>
<td>+0.00000000E+000</td>
<td>+0</td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td>Tone 6</td>
<td>+15000</td>
<td>+0.00000000E+000</td>
<td>+0</td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td>Tone 7</td>
<td>+25000</td>
<td>+0.00000000E+000</td>
<td>+0</td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td>Tone 8</td>
<td>+35000</td>
<td>+0.00000000E+000</td>
<td>+0</td>
<td>+1</td>
</tr>
</tbody>
</table>

Range
<freq_spacing> (2 tones): 1E1 to Option 65x bandwidth
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:MTOn:ARB)

<freq_spacing> (≥2 tones): 1E1 to (Option 65x bandwidth ÷ (num_tones – 1))

<phase>: 0–359

BBG_max_bandwidth:
653: 60 MHz
655: 120 MHz
656: 80 MHz
657: 160 MHz

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Freq Spacing</th>
<th>Number Of Tones</th>
<th>Toggle State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Entry Freq Spacing Number Of Tones Toggle State</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Toggle State softkey has a different softkey path but the same SCPI command when initializing the Multitone table (For the softkey path, refer to “:SETup:TABLE:ROW” on page 409).

Remarks
To set the frequency spacing, refer to “:SETup:TABLE:FSPacing” on page 407.

:SETup:TABLE:FSPacing

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTOn:ARB:SETup:TABLE:FSPacing

This command sets the frequency spacing between the tones.

The variable <freq_spacing> is expressed in units of Hertz (Hz–MHz).

*RST +1.00000000E+004

Range <freq_spacing> (2 tones): 1E1–Option 65x bandwidth

<freq_spacing> (>2 tones): 1E1 to (Option 65x bandwidth ÷ (num_tones – 1))

Key Entry Freq Spacing

Remarks
To set frequency spacing and additional parameters required to create or configure a multitone waveform, refer to “:SETup:TABLE” on page 406.

This command is the second step in creating a multitone waveform. Refer to “Creating a Multitone Waveform” on page 391 for all four steps.
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:MTONE:ARB)

:SETup:TABLE:NTONes

Supported
N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTONE:ARB:SETup:TABLE:NTONes <num_tones>
[:SOURce]:RADio:MTONE:ARB:SETup:TABLE:NTONes?

This command defines the number of tones in the multitone waveform.

*RST +8

Range 2 to 64

Key Entry Number Of Tones

Remarks To specify the number of tones and additional parameters required to create or configure a multitone waveform, refer to “:SETup:TABLE” on page 406.

This command is the third step in creating a multitone waveform. Refer to “Creating a Multitone Waveform” on page 391 for all four steps.

:SETup:TABLE:PHASe:INITialize

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:MTONE:ARB:SETup:TABLE:PHASe:INITialize FIXed|RANDom
[:SOURce]:RADio:MTONE:ARB:SETup:TABLE:PHASe:INITialize?

This command initializes the phase in the multitone waveform table.

FIXed This choice sets the phase of all tones to the fixed value of 0 degrees.

RANDom This choice sets the phase of all tones to random values based on the setting on the random seed generator.

*RST FIX

Key Entry Initialize Phase Fixed Random

Remarks To change the random number generator seed value, refer to “:SETup:TABLE:PHASe:INITialize:SEED” on page 409.

This command is the first step in creating a multitone waveform. Refer to “Creating a Multitone Waveform” on page 391 for all four steps.
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([SOURce]:RADio:MTOne:ARB)

[:SETup:TABLE:PHAse:INITialize:SEED

<table>
<thead>
<tr>
<th>Supported</th>
<th>N5166B/72B/82B with Option N5180430B</th>
</tr>
</thead>
</table>

[:SOURce]:RADio:MTOne:ARB:SETup:TABLE:PHAse:INITialize:SEED
FIXed|RANDom

[:SOURce]:RADio:MTOne:ARB:SETup:TABLE:PHAse:INITialize:SEED?

This command initializes the random number generator seed that is used to generate the random phase values for the multitone waveform.

FIXed  This choice sets the random number generator seed to a fixed value.

RANDom  This choice sets the random number generator seed to a random value. This changes the phase value after each initialization of the phase.

*RST  FIX

Key Entry  Random Seed Fixed Random

[:SETup:TABLE:ROW

<table>
<thead>
<tr>
<th>Supported</th>
<th>N5166B/72B/82B with Option N5180430B</th>
</tr>
</thead>
</table>

[:SOURce]:RADio:MTOne:ARB:SETup:TABLE:ROW
<row_number>,<power>,
<phase>,<state>

[:SOURce]:RADio:MTOne:ARB:SETup:TABLE:ROW? <row_number>

This command modifies the indicated tone (row) of the multitone waveform.

<row_number>  The number of rows for this variable is determined by the :SETup:TABLE command.

<power>  The power level of the tone defined in the row number. Power levels for all tones must not exceed the power level of the signal generator. The power variable is expressed in decibels (dB)

<phase>  The phase of the tone relative to the carrier. The phase variable is expressed in degrees.

<state>  The state of the tone in this row can be enabled or disabled.

Frequency offset, power, phase, and state value are returned when a query is initiated. The output format is as follows:

<frequency_offset>,<power>,<phase>,<state>

Refer to “SETup:TABLE” on page 406 for information on how to change the number of rows.

This command is the final step in creating a multitone waveform. Refer to “Creating a Multitone Waveform” on page 391 for all four steps.
Arb Commands
Multitone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:MTOne:ARB)

Example
:RAD:MTON:ARB:SET:TABL:ROW 2,-10,40,0

The preceding example modifies row number two in the currently selected multitone table. The power is set to –10 dB, the phase is set to 40 degrees, and the state is off.

*RST frequency offset: <power>: <phase>: <state>
−3.50000000E+004 +0.00000000E+000 +0.00000000E+000 1

Range frequency <power>: <phase>: <state>
offset: −80 0–359 1
653: +/-30 MHz
655: +/-60 MHz
656: +/-40 MHz
657: +/-80 MHz

Key Entry Goto Row Edit Item Toggle State

[:STATe]

Supported N5166B/72B/82B with Option N5180430B

[[:SOURce]:RADio:MTOne:ARB[:STATe] ON|OFF|1|0
[:SOURce]:RADio:MTOne:ARB[:STATe]? ]

This command enables or disables the multitone waveform generator function.

*RST 0

Key Entry Multitone Off On
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:TTONe:ARB)

Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:TTONe:ARB)

:ALIGNment

**Supported** N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:TTONe:ARB:ALIGNment LEFT|CENTER|RIGHT

[:SOURce]:RADio:TTONe:ARB:ALIGNment?

This command will align the two tones either left, center or right of the carrier frequency.

**Example**

:RAD:TTON:ARB:ALIGN CENT

The preceding example aligns each of the two tones equidistant from the carrier frequency.

**Key Entry**

Alignment Left Cent Right

:APPLY

**Supported** N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:TTONe:ARB:APPLY

This command will cause the two-tone waveform to be regenerated using the current settings.

This command has no effect unless the two-tone waveform generator is enabled and a change has been made to the frequency spacing setting.

**Key Entry**

Apply Settings

:BASEband:FREQuency:OFFSet

**Supported** N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:TTONe:ARB:BASEband:FREQuency:OFFSet <val><unit>

[:SOURce]:RADio:TTONe:ARB:BASEband:FREQuency:OFFSet?

This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed-through is not in the center.

The X-Series signal generator provides automatic DAC over-range protection when the offset value is something other than 0 Hz. It scales down the playing I/Q data by $1/\sqrt{2}$.

*RST 0 Hz

Range +5.0E7 to -5.0E7 MHz
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([SOURce]:RADio:TTONe:ARB)

Key Entry

Baseband Frequency Offset

:SASeband:FREQ:OFFSet:PHASE:RESet

Supported
N5166B/72B/82B with Option N5180430B


This command clears the phase accumulation and so zero phase shift.
When the Baseband Frequency Offset is non-zero, the hardware rotator accumulates phase-shift of the baseband signal. This residual phase remains even after the offset value is returned to zero. While there is a non-zero residual phase present in the signal, the DAC Over–Range Protection feature will automatically prevent DAC overrange errors from occurring by scaling the signal down by $1/\sqrt{2}$.

Key Entry

Baseband Frequency Offset Phase Reset

:FSPacing

Supported
N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:TTONe:ARB:FSPacing <freq_spacing>
[:SOURce]:RADio:TTONe:ARB:FSPacing?

This command sets the frequency spacing between the tones.
The variable <freq_spacing> is expressed in hertz (Hz–MHz).

Example

:RAD:TTON:ARB:FSP 10MHZ

The preceding example sets a 10 megahertz frequency spacing for the two tones.

*RST
+1.000000000E+004

Range
1E1 to 1E8

Key Entry
Freq Separation

:HEADer:CLEar

Supported
N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:TTONe:ARB:HEADer:CLEar

This command clears the header information from the header file used for the two-tone waveform format. Header information consists of signal generator settings and marker routings associated with the waveform file. Refer to the User's Guide for information on file headers.
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([SOURce]:RADio:TTONe:ARB)

For this command to function, two tone must be on. To turn two tone on, see “[:STATe]” on page 427.

Key Entry Clear Header

:HEADer:SAVE

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:TTONe:ARB:HEADer:SAVE

This command saves the header information to the header file used for the two-tone waveform format. Header information consists of signal generator settings and marker routings associated with the waveform file. Refer to the User’s Guide for information on header files.

For this command to function, two tone must be on. To turn two tone on, see “[:STATe]” on page 427.

Key Entry Save Setup To Header

:IQ:MODulation:ATTen

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:TTONe:ARB:IQ:MODulation:ATTen <val><unit>
[:SOURce]:RADio:TTONe:ARB:IQ:MODulation:ATTen?

This command sets the attenuation level of the I/Q signals being modulated through the signal generator RF path. The variable <val> is expressed in decibels (dB).

Example


The preceding example sets the modulator attenuator to 20 dB.

*RST +2.00000000E+000

Range 0 to 50 dB

Key Entry Modulator Atten Manual Auto

:IQ:MODulation:ATTen:AUTO

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:TTONe:ARB:IQ:MODulation:ATTen:AUTO ON|OFF|1|0
[:SOURce]:RADio:TTONe:ARB:IQ:MODulation:ATTen:AUTO?

This command enables or disabling the modulator attenuator auto mode. The auto mode will be switched to manual if the signal generator receives an AUTO OFF or AUTO ON command.
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:TTONe:ARB)

ON (1)  This choice enables the attenuation auto mode which allows the signal generator to select the attenuation level that optimizes performance based on the current conditions.

OFF (0)  This choice holds the attenuator at its current setting or at a selected value. For setting the attenuation value, refer to “[:IQ:MODulation:ATTen] on page 392.

Example


The preceding example enables the attenuator automatic mode.

*RST 1

Key Entry  Modulator Atten Manual Auto

[:MDESTination: ALCHold]

Supported  N5166B/72B/82B with Option N5180430B

CAUTION
Incorrect ALC sampling can create a sudden unleveled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.

[:SOURce]:RADio:TTONe:ARB:MDESTination:ALCHold
NONE|M1|M2|M3|M4
[:SOURce]:RADio:TTONe:ARB:MDESTination:ALCHold?

This command disables the marker ALC hold function, or it enables the marker hold function for the selected marker.

Use the ALC hold function when you have a waveform signal that incorporates idle periods, or when the increased dynamic range encountered with RF blanking is not desired. The ALC circuitry responds to the marker signal during the marker pulse (marker signal high), averaging the modulated signal level during this period.

The ALC hold function operates during the low periods of the marker signal. The marker polarity determines when the marker signal is high. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. To set a marker’s polarity, see “[:MPOLarity:MARKer1|2|3|4] on page 417. For more information on markers, see “[:MARKer[:SET]] on page 356.

NOTE
Do not use the ALC hold for more than 100 ms, because it can affect the waveform’s output amplitude.
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:TTONe:ARB)

The marker signal has a minimum of a two–sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want the ALC sampling to begin.

The ALC hold setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

A waveform file that has unspecified settings in the file header uses the previous waveform’s routing settings.

For more information on the marker ALC hold function, see the User’s Guide. To configure marker points, refer to the following sections located in the Dual ARB subsystem:

- For clearing a single marker point or a range of marker points, see “:MARKer:CLEAR” on page 353.
- For clearing all marker points, see “:MARKer:CLEAR:ALL” on page 355.
- For shifting marker points, see “:MARKer:ROTate” on page 355.
- For setting marker points, see “:MARKer[:SET]” on page 356.

NONE  This terminates the marker ALC hold function.
M1–M4  These are the marker choices. The ALC hold feature uses only one marker at a time.

Example


The preceding example routes marker two to the ALC hold function.

*RST  NONE

Key Entry  None  Marker 1  Marker 2  Marker 3  Marker 4
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:TTONe:ARB)

:MDESTination:PULSe

Supported N5166B/72B/82B with Option N5180430B

CAUTION

The pulse function incorporates ALC hold. Incorrect ALC sampling can
create a sudden unleveled condition that may create a spike in the RF
output, potentially damaging a DUT or connected instrument. Ensure that
you set markers to let the ALC sample over an amplitude that accounts for
the high power levels within the signal.

[:SOURce]:RADio:TTONe:ARB:MDESTination:PULSe
NONE|M1|M2|M3|M4
[:SOURce]:RADio:TTONe:ARB:MDESTination:PULSe?

This command disables the marker RF blanking/pulse function, or it enables
the marker RF blanking/pulse function for the selected marker.

This function automatically incorporates the ALC hold function, so there is no
need to select both functions for the same marker.

NOTE

Do not use ALC hold for more than 100 ms, because it can affect the
waveform’s output amplitude.

The signal generator blanks the RF output when the marker signal goes low.
The marker polarity determines when the marker signal is low. For a positive
polarity, this is during the marker points. For a negative polarity, this is when
there are no marker points. To set a marker’s polarity, see
“,:MPOLarity:MARKer1|2|3|4” on page 417. For more information on markers,
see “,:MARKer[:SET]” on page 356.

NOTE

Set marker points prior to using this function. Enabling this function
without setting marker points may create a continuous low or high marker
signal, depending on the marker polarity. This creates the condition where
there is either no RF output or a continuous RF output.

To configure marker points, refer to the following sections located in the Dual
ARB subsystem:

– For clearing a single marker point or a range of marker points,
  see “,:MARKer:CLEar” on page 353.
– For clearing all marker points, see “,:MARKer:CLEar:ALL” on page 355.
– For shifting marker points, see “,:MARKer:ROTate” on page 355.
– For setting marker points, see “,:MARKer[:SET]” on page 356.

The marker signal has a minimum of a two–sample delay in its response
relative to the waveform signal response. To compensate for the marker signal
delay, offset marker points from the waveform sample point at which you want
the RF blanking to begin.
Arb Commands
Two Tone Subsystem—N5166B/72B/82B with Option N5180430B
([[:SOURce]:RADio]:TTOne:ARB)

The RF blanking setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

A waveform file that has unspecified settings in the file header uses the previous waveform’s routing settings. This could create the situation where there is no RF output signal, because the previous waveform used RF blanking.

For more information on the marker RF blanking function, see the User’s Guide.

### Key Entry

<table>
<thead>
<tr>
<th>Marker</th>
<th>Key Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>Marker 1</td>
</tr>
<tr>
<td>3</td>
<td>Marker 2</td>
</tr>
<tr>
<td>4</td>
<td>Marker 3</td>
</tr>
</tbody>
</table>

:MPOLarity:MARKer1|2|3|4

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:TTOne:ARB:MPOLarity:MARKer1|2|3|4
NEGative|POSitive

This command sets the polarity for the selected marker.

For a positive marker polarity, the marker signal is high during the marker points. For a negative marker polarity, the marker signal is high during the period of no marker points. To configure marker points, refer to the following sections located in the Dual ARB subsystem:

- For clearing a single marker point or a range of marker points, see “:MARKer:CLEar” on page 353.
- For clearing all marker points, see “:MARKer:CLEar:ALL” on page 355.
- For shifting marker points, see “:MARKer:ROTate” on page 355.
- For information on markers and setting marker points, see “:MARKer[:SET]” on page 356.

**Example**

:RAD:TTON:ARB:MPOL:MARK1 POS

The preceding example sets the polarity for marker one to positive.
Arb Commands
Two Tone Subsystem—N5166B/72B/82B with Option N5180430B ([:SOURce]:RADio:TTONe:ARB)

:*RST
POS

Key Entry
Marker 1 Polarity Neg
Pos
Marker 2 Polarity Neg
Pos
Marker 3 Polarity Neg
Pos
Marker 4 Polarity Neg Pos

*:NOISe:BANDwidth

Supported
N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce]:RADio:TTONe:ARB:NOISe:BANDwidth <val><unit>
[:SOURce]:RADio:TTONe:ARB:NOISe:BANDwidth?

This command sets the flat noise bandwidth value for the two-tone waveform. This value is typically set wider than the carrier bandwidth.

To configure the AWGN, refer to the following sections located in the Two Tone subsystem:

– To set the bandwidth over which the noise power is integrated for calculating the carrier to noise ratio, refer to*:NOISe:CBWidth” on page 419.

– To set the carrier to noise ratio as the active function, refer to “*:NOISe:CN” on page 419.

– To enable the AWGN, refer to “*:NOISe[:STATe]” on page 424.

Range
Option 653: 1 sa to 75 Msa
Option 655: 1 sa to 150 Msa
Option 656: 1 sa to 100 Msa
Option 657: 1 sa to 200 Msa

:*RST
+1.00000000E+000

Key Entry
Noise Bandwidth

*:NOISe:CBRate

Supported
N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce]:RADio:TTONe:ARB:NOISe:CBRate <val>
[:SOURce]:RADio:TTONe:ARB:NOISe:CBRate?

This command sets a value of the carrier bit rate (gross bit rate) for purposes of calculating the Eb/N0 (energy per bit over noise power density at the receiver). When the carrier to noise ratio format is set to Eb/N0 (refer to the :NOISe:CNFormat command), the adjustment of the carrier bit rate will have
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([[:SOURce]:RADio:TTONe:ARB])

an immediate impact on the carrier to noise ratio as specified by Eb/N0. The
carrier bit rate is derived from the symbol rate and bits per symbol of the
modulation. The carrier bit rate is a saved instrument state that is recorded in
the waveform header.

The query returns the current carrier bit rate setting.

Example

[:RAD:TTONeARB:NOIS:CBR 5

The preceding example sets the carrier bit rate to 5 bps.

Default
1.000 bps

Range
1 bps to 999Mbps

Key Entry
Carrier Bit Rate

:NOISe:CBWidth

Supported
N5166B/72B/82B with Options N5180430B and
N5180403B

[:SOURce]:RADio:TTONe:ARB:NOISe:CBWidth <val><unit>
[:SOURce]:RADio:TTONe:ARB:NOISe:CBWidth?

This command selects the carrier bandwidth over which the AWGN (additive
white gaussian noise) is applied. The noise power will be integrated over the
selected bandwidth for the purposes of calculating C/N (carrier to noise ratio).
The carrier bandwidth is limited to the ARB sample rate but cannot exceed 125
MHz. For more information refer to “:NOISe[:STATe]” on page 424.

To configure the AWGN, refer to the following sections located in the Two Tone
subsystem:

– To set the AWGN noise bandwidth, refer to “:NOISe:BANDwidth” on
  page 418.

– To set the carrier to noise ratio as the active function, refer to “:NOISe:CN”
  on page 419.

– To enable the AWGN, refer to “:NOISe[:STATe]” on page 424.

*RST
+1.00000000E+000

Range
1Hz to 200MHz (Minimum increment is .001 MHz)

Key Entry
Carrier Bandwidth

:NOISe:CN

Supported
N5166B/72B/82B with Options N5180430B and
N5180403B

[:SOURce]:RADio:TTONe:ARB:NOISe:CN <val><unit>
[:SOURce]:RADio:TTONe:ARB:NOISe:CN?
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:TTONe:ARB)

This command makes Carrier to Noise Ratio the active function. The value you enter sets noise power as a ratio of carrier power to noise power (C/N). Carrier power equals the total modulated signal power before noise is added. When you add noise, the power output from the signal generator does not change; it is the sum of carrier power and the added noise power. You can apply noise in real time while the waveform is playing.

To configure the AWGN, refer to the following sections located in the Two Tone subsystem:

- To set the AWGN noise bandwidth, refer to “:NOISe:BW:ARQ:ARB” on page 418.
- To set the bandwidth over which the noise power is integrated for calculating the carrier to noise ratio, refer to “:NOISe:BW:ARQ:ARB” on page 419.
- To enable the AWGN, refer to “:NOISe[:STATe]” on page 424.

*RST +0.00000000E+000

Range –100dB to 100dB

Key Entry Carrier to Noise Ratio

:NOISe:CNFormat

Supported N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce]:RADio:TTONe:ARB:NOISe:CNFormat CN|EBNO
[:SOURce]:RADio:TTONe:ARB:NOISe:CNFormat?

This command selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (Eb/N0) as the variable controlling the ratio of carrier power to noise power in the carrier bandwidth.

Example

:RAD:TTON:ARB:NOIS:CNF EBNO

The preceding example sets the carrier to noise ratio format to EbNo.

Default Carrier to Noise Ratio Format C/N

Key Entry Carrier to Noise Ratio Format C/N Eb/No

:NOISe:EBNO

Supported N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce]:RADio:TTONe:ARB:NOISe:EBNO <ebno in dB>
[:SOURce]:RADio:TTONe:ARB:NOISe:EBNO?
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:TTONe:ARB)

This command allows the C/N to be set using the Eb/N0 (energy per bit over noise power density at the receiver) form. This requires that the carrier bit rate (:[NOISe:CBRate] on page 418) be set properly. The range of Eb/N0 is limited to the range that is equivalent to –100 to 100 dB of C/N. This value is only effective when Eb/N0 has been enabled by the :NOISe:CNFormat command.

The query returns the value of EBNO.

Default 0 dB
Range –100 to 100 dB
Key Entry Carrier to Noise Ratio Format Eb/No

:NOISe:MUX

Supported N5166B/72B/82B with Options N5180430B and N5180403B

[ :SOURce]:RADio[1]:TTONe:ARB:NOIS:MUX SUM|CARRier|NOISe
[ :SOURce]:RADio[1]:TTONe:ARB:NOIS:MUX?

This command enables diagnostic control of additive noise, such that only the noise, only the carrier, or the sum of both the noise and the carrier are output from the internal baseband generator. With the ALC off, this feature enables direct measurement of just the carrier or the noise contributions to the total power. The system will still behave as if both the noise and the carrier are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

Example

:RAD:TTON:ARB:NOIS:MUX CARR

The preceding example enables the direct measurement of the carrier contribution to the total power.

Default Carrier+Noise
Key Entry Carrier+Noise | Carrier | Noise

:NOISe:POWer:CARRier

Supported N5166B/72B/82B with Options N5180430B and N5180403B

[ :SOURce]:RADio:TTONe:ARB:NOISe:POWer:CARRier <carrierPower>
[ :SOURce]:RADio:TTONe:ARB:NOISe:POWer:CARRier?

This command sets the current carrier power level if noise is on.
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
(:SOURce):RADio:TTONe:ARB)

In the CARRier control mode, the total power will be adjusted to achieve the specified carrier power and the carrier power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the carrier power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total power is adjusted.

In the NOISe control mode, this will adjust the total noise power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total noise power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] and :NOISe:POWer:NOISe:TOTal commands.

| Range | The range varies based on the bounds of the total power that results from the noise settings. |
| Default | The appropriate value given the current total power and the current Carrier to Noise (C/N). |
| Key Entry | Carrier Power |

:NOISe:POWer:CONTrol[:MODE]

| Supported | N5166B/72B/82B with Options N5180430B and N5180403B |

[:SOURce]:RADio:TTONe:ARB:NOISe:POWer:CONTrol[:MODE]

TOTal|CARRier|NOISe

[:SOURce]:RADio:TTONe:ARB:NOISe:POWer:CONTrol[:MODE]?

This command sets the power control to one of the three following modes:

| Total | This is the default mode where the total power and C/N are independent variables and the carrier power and total noise power are dependent variables set by the total power, C/N and the rest of the noise settings. The carrier power and total noise power will change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values. |
| Carrier | In this mode the carrier power and C/N are independent variables and the total power and total noise power are dependent variables set by the carrier power, C/N and the rest of the noise settings. The total power and total noise power will change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values. |
| Total Noise | In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total
Arb Commands

Two Tone Subsystem–N5166B/72B/82B with Option N5180430B

([SOURce]:RADio:TTONe:ARB)

power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.

Default

Key Entry

Total Carrier Total Noise

:NOISe:POWer:NOISe:CHANnel?

Supported

N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce]:RADio:TTONe:ARB:NOISe:POWer:NOISe:CHANnel?

The query returns the current noise power across the carrier bandwidth in dBm.

:NOISe:POWer:NOISe:TOTal

Supported

N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURce]:RADio:TTONe:ARB:NOISe:POWer:NOISe:TOTal

<totalNoisePowerInDbm>

[:SOURce]:RADio:TTONe:ARB:NOISe:POWer:NOISe:TOTal?

This command sets the current total noise power level if noise is on.

In the NOISe control mode, the total power will be adjusted to achieve the specified total noise power and the total noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the total noise power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the total power is adjusted.

In the CARRier control mode, this will adjust the carrier power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the carrier power is adjusted. See also :NOISe:POWer:CONTro[:MODE] command.

Range

The range varies based on the bounds of the total power that results from the noise settings.

Default

The appropriate value given the current total power and the current Carrier to Noise (C/N).

Key Entry

Total Noise Power
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURCE]:RADio:TTONe:ARB)

`:NOISe[:STATe]`

**Supported**
N5166B/72B/82B with Options N5180430B and N5180403B

[:SOURCE]:RADio:TTONe:ARB:NOISe[:STATe] ON|OFF|1|0

[:SOURCE]:RADio:TTONe:ARB:NOISe[:STATe]?

This command enables the Two-Tone modulation mode.

To configure the AWGN, refer to the following sections located in the Two Tone subsystem:

- To set the AWGN noise bandwidth, refer to “`:NOISe:BANDwidth`” on page 418.
- To set the bandwidth over which the noise power is integrated for calculating the carrier to noise ratio, refer to “`:NOISe:CBWidth`” on page 419.
- To set the carrier to noise ratio as the active function, refer to “`:NOISe:CN`” on page 419.

*RST* Off

**Key Entry** Real-Time AWGN Off On

`:PHASe:NOISe:F1`

**Supported**
N5172B/82B with Options N5180430B and N5180432B

[:SOURCE]:RADio:TTONe:ARB:PHASe:NOISe:F1 <value><unit>

[:SOURCE]:RADio:TTONe:ARB:PHASe:NOISe:F1?

This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :PHASe:NOISe:F2 command). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the User’s Guide.

*RST* +1.00000000E+003

**Range** 0 Hz to 77.50052449 MHz

**Key Entry** Desired Start Freq (f1)

`:PHASe:NOISe:F1:ACTual?`

**Supported**
N5172B/82B with Options N5180430B and N5180432B

[:SOURCE]:RADio:TTONe:ARB:PHASe:NOISe:F1:ACTual?
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
(:SOURce):RADio:TTONe:ARB)

This query returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

:PHASe:NOISe:F2

Supported N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:F2 <value><unit>
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:F2?

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :PHASe:NOISe:F1 command). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the User’s Guide.

*RST +3.00000000E+004
Range 1 Hz to 77.50052449 MHz
Key Entry Desired Stop Freq (f2)

:PHASe:NOISe:F2:ACTual?

Supported N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:F2:ACTual?

This query returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

:PHASe:NOISe:LMID

Supported N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:LMID <value>
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:LMID?

This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator.

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.
Arb Commands
Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:TTONe:ARB)

For more information on the phase noise impairment option, see the User’s Guide.

**NOTE**
The amplitude range varies depending on the f2 value (“:PHASe:NOIsE:F2” on page 425). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.

The range values are expressed in units of dBc/Hz.

<table>
<thead>
<tr>
<th>*RST</th>
<th>-7.00000000E+001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>-300 to 100</td>
</tr>
<tr>
<td>Key Entry</td>
<td>Desired Flat Amplitude (Lmid)</td>
</tr>
</tbody>
</table>

**:PHASe:NOIsE:LMD:ACTual?**

Supported N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:TTONe:ARB:PHASe:NOIsE:LMD:ACTual?

This query returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

**:PHASe:NOIsE[:STATe]**

Supported N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:TTONe:ARB:PHASe:NOIsE[:STATe] ON|OFF|1|0

[:SOURce]:RADio:TTONe:ARB:PHASe:NOIsE[:STATe]?

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the User’s Guide.

<table>
<thead>
<tr>
<th>*RST</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Entry</td>
<td>Phase Noise Off On</td>
</tr>
</tbody>
</table>

**:PHASe:NOIsE:TRACe?**

Supported N5172B/82B with Options N5180430B and N5180432B

[:SOURce]:RADio:TTONe:ARB:PHASe:NOIsE:TRACe? <startFreq>,<stopFreq>,<numSamples>

This query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the impairment from
Arb Commands
Two Tone Subsystem—N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:TTONe:ARB)

The phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBc/Hz.

Range

| startFreq | 1 Hz to 100 MHz |
| stopFreq | 1 Hz to 100 MHz |
| numSamples | 1 to 8192 |

:SCLock:RATE

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:TTONe:ARB:SCLock:RATE <sample_clock_rate>
[:SOURce]:RADio:TTONe:ARB:SCLock:RATE?

This command sets the ARB sample clock rate.

The two tone generator should be on before executing this command. If this command is executed before the two tone generator is active, the entered value will be overridden by a calculated factory default value.

Example

:RAD:TTON:ARB:SCL:RATE 1MHZ

The preceding example sets the ARB sample clock to 1 MHz.

*RST +1.00000000E+008
Range 1E3 to 1E8
Key Entry ARB Sample Clock

[:STATe]

Supported N5166B/72B/82B with Option N5180430B

[:SOURce]:RADio:TTONe:ARB[:STATe] ON|OFF|1|0
[:SOURce]:RADio:TTONe:ARB[:STATe]?

This command enables or disables the on/off operational state of the two–tone waveform generator function.

Example

:RAD:TTON:ARB ON

The preceding example turns on the two–tone generator.

*RST 0
Key Entry Two Tone Off On
Arb Commands

Two Tone Subsystem–N5166B/72B/82B with Option N5180430B
([:SOURce]:RADio:TTONe:ARB)
6 Avionics VOR/ILS Commands

With firmware version B.01.75 or later, the following options have changed to a new eight-digit format:

- Option 302 to Option N5180302B
- Option 320 to Option N5180320B
- Option 403 to Option N5180403B
- Option 430 to Option N5180430B
- Option 431 to Option N5180432B
- Option 432 to Option N5180431B
- Option UN7 to Option N5180UN7B

Only software options are changed to the eight-digit format. Hardware options remain with three-digits.

This chapter describes SCPI commands used by Keysight X-Series signal generators with Option N5180302B during either VOR [VHF Omnidirectional Ranging] or ILS [Instrument Landing System] aircraft navigation receiver test. Avionics is a term used to describe the electronic instrumentation on aircraft.

This chapter contains the following sections:

- **Avionics Subsystem VOR—Option N5180302B [:SOURce]:AVlonics:VOR** on page 430
- **Avionics Subsystem COM/ID—Option N5180302B [:SOURce]:AVlonics:CID** on page 436
- **Avionics Subsystem ILS Localizer—Option N5180302B [:SOURce]:AVlonics:ILSLocalizer** on page 439
- **Avionics Subsystem ILS Glide Slope—Option N5180302B [:SOURce]:AVlonics:ILSGslope** on page 446
- **Avionics Subsystem Marker Beacon—Option N5180302B [:SOURce]:AVlonics:MBEacon** on page 453
Avionics Subsystem VOR—Option N5180302B
[:SOURce]:AVIonics:VOR

:BEARing:ANGLe

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:VOR:BEARing:ANGLe <value>
[:SOURce]:AVIonics:VOR:BEARing:ANGLe?

This command sets the VOR Bearing Angle between the Variable Phase (VAR) and the Reference (REF) tones.

*RST 0 deg
Range 0 deg–360 deg
Key Entry Aux Fctn > Avionics > VOR > Bearing > ANGLe > <value> deg

:BEARing:DIRection

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:VOR:BEARing:DIRection FROM|TO
[:SOURce]:AVIonics:VOR:BEARing:DIRec tion?

This command sets the FROM or TO direction, effectively inverting the VOR Bearing Angle.

A VOR instrument in the aircraft can be set to either a FROM or a TO convention.

FROM - In the FROM convention, the VOR transmitter beacon is made the reference point and the Bearing Angle is between magnetic-North and the beacon-to-aircraft radial line (RL).

TO - In the TO convention, the aircraft is made the reference point and the Bearing Angle is between magnetic-North and the aircraft-to-beacon radial line (RL).

RL(TO) = 180° – RL(FROM)

*RST FROM
Choices FROM | TO
Key Entry Aux Fctn > Avionics > VOR > Bearing > Direction From | To
Avionics VOR/ILS Commands
Avionics Subsystem VOR—Option N5180302B [:SOURce]:AVIonics:VOR

:DEPTh:SUBCarrier

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:VOR:DEPTh:SUBCarrier <value>
[:SOURce]:AVIonics:VOR:DEPTh:SUBCarrier?

This command sets the sub-carrier AM depth as it modulates the main carrier of a VOR signal.

*RST 30 PCT
Range 0 PCT–49.9 PCT
Key Entry Aux Fctn > Avionics > VOR > REF/VAR
> SubCarrier Depth > <value>%

:DEPTh:VAR

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:VOR:DEPTh:VAR <value>
[:SOURce]:AVIonics:VOR:DEPTh:VAR?

This command sets the AM depth of the 30 Hz variable phase tone for a VOR signal.

*RST 30 PCT
Range 0 PCT–49.9 PCT
Key Entry Aux Fctn > Avionics > VOR > REF/VAR
> VAR Depth > <value>%

:DEViation:REF

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:VOR:DEViation:REF <value>
[:SOURce]:AVIonics:VOR:DEViation:REF?

This command sets the amount of FM Deviation that the 30 Hz Reference (REF) tone causes on the sub-carrier for a VOR signal.

*RST 480 Hz
Range 0 Hz–1 kHz
Key Entry Aux Fctn > Avionics > VOR > REF/VAR
> REF Deviation > <value> Hz | kHz | MHz | GHz
Avionics VOR/ILS Commands
Avionics Subsystem VOR—Option N5180302B [:SOURce]:AVIonics:VOR

:FREQuency:REFVar

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:VOR:FREQuency:REFVar <value>
[:SOURce]:AVIonics:VOR:FREQuency:REFVar?

This command sets the frequency of the 30 Hz Reference (REF) tone and the Variable Phase (VAR) tone for a VOR signal.

*RST 30 Hz
Range 10 Hz–60 Hz
Key Entry Aux Fctn > Avionics > VOR > REF/VAR
> REF/VAR Freq > <value> Hz | kHz | MHz | GHz

:FREQuency:SUBCarrier

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:VOR:FREQuency:SUBCarrier <value>
[:SOURce]:AVIonics:VOR:FREQuency:SUBCarrier?

This command sets the frequency of the SUBCarrier for a VOR signal.

*RST 9960 Hz
Range 0 Hz–20 kHz
Key Entry Aux Fctn > Avionics > VOR > REF/VAR
> SubCarrier Freq > <value> Hz | kHz | MHz | GHz

:FREQuency[:CARRier]:INDex

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:VOR:FREQuency[:CARRier]:INDex <value>
[:SOURce]:AVIonics:VOR:FREQuency[:CARRier]:INDex?

This command selects one of the standard VOR carrier frequencies.

The index you enter sets the VOR carrier frequency to one of the standard defined corresponding values and produces a VOR carrier from 108.00 to 117.95 MHz.

*RST 1 (108.00 MHz)
Range 1–160

Because ILS Localizer systems overlap with the VOR carrier frequency range (there are forty channels allocated to the ILS Localizer in the range from 108.10 to 111.95 MHz), only frequencies where tenths of a
Avionics VOR/ILS Commands
Avionics Subsystem VOR—Option N5180302B [:SOURce]:AVIonics:VOR

Megacycle count is even are used as VOR Carrier Frequencies (MHz).

<table>
<thead>
<tr>
<th>VOR Carrier Frequencies (MHz)</th>
<th>Carrier Freq Index = 1 to 160</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 32</td>
<td>33 to 64</td>
</tr>
<tr>
<td>108.00</td>
<td>111.20</td>
</tr>
<tr>
<td>108.05</td>
<td>111.25</td>
</tr>
<tr>
<td>108.20</td>
<td>111.40</td>
</tr>
<tr>
<td>108.25</td>
<td>111.45</td>
</tr>
<tr>
<td>108.40</td>
<td>111.60</td>
</tr>
<tr>
<td>108.45</td>
<td>111.65</td>
</tr>
<tr>
<td>108.60</td>
<td>111.80</td>
</tr>
<tr>
<td>108.65</td>
<td>111.85</td>
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<td>110.60</td>
<td>112.90</td>
</tr>
<tr>
<td>110.65</td>
<td>112.95</td>
</tr>
</tbody>
</table>
Avionics VOR/ILS Commands
Avionics Subsystem VOR—Option N5180302B [:SOURce]:AVionics:VOR

<table>
<thead>
<tr>
<th>110.80</th>
<th>113.00</th>
<th>114.60</th>
<th>116.20</th>
<th>117.80</th>
</tr>
</thead>
<tbody>
<tr>
<td>110.85</td>
<td>113.05</td>
<td>114.65</td>
<td>116.25</td>
<td>117.85</td>
</tr>
<tr>
<td>111.00</td>
<td>113.10</td>
<td>114.70</td>
<td>116.30</td>
<td>117.90</td>
</tr>
<tr>
<td>111.05</td>
<td>113.15</td>
<td>114.75</td>
<td>116.35</td>
<td>117.95</td>
</tr>
</tbody>
</table>

Key Entry

Aux Fctn > Avionics > VOR
> Carrier Freq Index > <value> Enter

.MODE

Supported
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVionics:VOR:MODE OFF|NORMal|VAR|SUBCarrier|SCFM
[:SOURce]:AVionics:VOR:MODE?

This command allows selection of a complete or partial VOR signal and can set the VOR Mode to one of the following:
OFF | NORMal | VAR | SUBCarrier | SCFM

- Selecting OFF turns off all VOR signals. When set to OFF, all VOR mode parameter settings are turned off.
- Selecting NORMal turns on all VOR signals so that a standard VOR signal is generated with a default VOR Bearing of zero degrees.
- Selecting VAR turns on the main VOR carrier and the variable phase 30 Hz tone (VAR signal); suppressed the SUBCarrier.
- Selecting SUBCarrier turns on the SUBCarrier without the 30 Hz reference tone; suppresses the main VOR carrier.
- Selecting SCFM turns on the SUBCarrier and the 30 Hz reference tone; suppresses the main VOR carrier.

*RST

OFF

Choices
OFF | NORMal | VAR | SUBCarrier | SCFM

Key Entry

Aux Fctn > Avionics > VOR
> VOR Mode
> OFF | NORM | VAR | Sub-carrier | Sub-carrier+FM
Avionics VOR/ILS Commands
Avionics Subsystem VOR—Option N5180302B [:SOURce]:AVIonics:VOR

[:PRESet]

**Supported**  
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:VOR:PRESet

This command returns the VOR [VHF Omnidirectional Range] system parameters to their *RST (factory-defined) values.

*RST  
N/A

**Key Entry**  
Aux Fctn > Avionics > VOR  
> More 1 of 2 > Recall Default Settings
Avionics Subsystem COM/ID—Option N5180302B
[:SOURce]:AVIonics:CID

**:CODE**

**Supported** N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:CID:CODE "<value>"
[:SOURce]:AVIonics:CID:CODE?

When entering `<value>`, enter a valid COM/ID code (airport identification code) by typing a 3-character code enclosed in single-quotes or double-quotes (for example, ‘STS’ or “STS”).

This command sets the airport communication identification code to be played by the COM/ID generator. (This code may also be referred to as an, “airport call–sign”.)

The COM/ID code is transmitted as a three letter-code signal of 1.02000 kHz and is placed on the VOR carrier; this COM/ID code is used to identify the VOR ground–based transmitting station.

Each COM/ID code (airport identification code) must correspond to one of the International Air Transport Association (IATA) codes.

IATA owns, controls, and has a copyright to the complete list of airport identification codes; STS is the airport identification code that refers to the Sonoma County Airport in Santa Rosa, CA, USA.

*RST  STS

**Range**

To find a valid COM/ID code (airport communication identification code) for a particular area, refer to the following websites:

Airline Coding Directory (http://www.iata.org)

AirNav (http://www.airnav.com)

**Key Entry**

Aux Fctn > Avionics > VOR > COM/ID
> COM/ID Code `<value>` Enter

**:DEPTh**

**Supported** N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:CID:DEPTh `<value>`
[:SOURce]:AVIonics:CID:DEPTh?

This command sets the COM/ID tone AM depth.

*RST  10PCT

**Range**  0PCT–49.9PCT
Avionics VOR/ILS Commands
Avionics Subsystem COM/ID—Option N5180302B [:SOURce]:AVIonics:CID

Key Entry

Aux Fctn > Avionics > VOR > COM/ID >
Depth > <value>%

:FREQuency

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:CID:FREQuency <value>
[:SOURce]:AVIonics:CID:FREQuency?

This command sets the COM/ID tone or code modulating frequency.

*RST 1.02000 kHz
Range 0 Hz–20 kHz

Key Entry Aux Fctn > Avionics > VOR > COM/ID
> Frequency > <value> Hz | kHz | MHz | GHz

:PRESet

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:CID:PRESet

This command returns the COM/ID parameters to their *RST values.

*RST N/A

Key Entry Aux Fctn > Avionics > VOR > COM/ID
> More 1 of 2 > Recall Default Settings

:TYPE

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:CID:TYPE CODE|TONE
[:SOURce]:AVIonics:CID:TYPE?

This command toggles the COM/ID Type.

Code - When set to CODE, the signal generator plays the code associated with the COM/ID Code.

Tone - When set to TONE, the COM/ID Code setting is disabled and the signal generator plays a continuous tone based on the COM/ID Frequency setting;

Obtain this setting with:

[:SOURce]:AVIonics:CID:FREQuency?

*RST Code

Choices Code | Tone

Key Entry Aux Fctn > Avionics > VOR > COM/ID
> COM/ID Type Code | Tone
Avionics VOR/ILS Commands
Avionics Subsystem COM/ID—Option N5180302B [:SOURce]:AVIonics:CID

[:STATe]

**Supported**  N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:CID[:STATe] OFF|ON|0|1
[:SOURce]:AVIonics:CID[:STATe]?

This command toggles COM/ID OFF (0) or ON (1).
OFF (0)—all COM/ID functions are turned off

*RST OFF

Choices  OFF|ON|0|1

Key Entry  Aux Fctn > Avionics > VOR > COM/ID
            > COM/ID Off | On
Avionics Subsystem ILS Localizer—Option N5180302B
[:SOURce]:AVIonic:ILSLocalizer

:DDM:DDM

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonic:ILSLocalizer:DDM:DDM <value>
[:SOURce]:AVIonic:ILSLocalizer:DDM:DDM?

This command sets a value for the “Difference in Depth of Modulation” (DDM).

DDM is defined to be the “percentage modulation depth of the larger signal” minus the “percentage modulation depth of the smaller signal”, divided by 100.

\[
DDM = \frac{[AM(90 \text{ Hz})\% - AM(150 \text{ Hz})\%]}{100}
\]

*RST 0.0000

Range –0.99 to 0.99

Use a value that is within the range of the current SDM value.

Key Entry Aux Fctn > Avionics > ILS Localizer
> DDM/SDM > DDM <value> Enter

Remarks Typically the SDM default value provides sufficient range (–0.40 to 0.40) for most applications.

If SDM is set to 99%, then the full range of DDM is available. The following demonstrates the limits of DDM’s range:

\((-\text{SDM}/100) \text{ to } (\text{SDM}/100)\)

As SDM’s value increases or decrease, so does DDM’s range.
Avionics VOR/ILS Commands
Avionics Subsystem ILS Localizer—Option N5180302B [:SOURce]:AVIonics:ILSLocalizer

:DDM:UAMPs

**Supported**  N5171B/81B & N5172B/82B with Option N5180302B

[[:SOURce]:AVIonics:ILSLocalizer]:DDM:UAMPs <value>
[[:SOURce]:AVIonics:ILSLocalizer]:DDM:UAMPs?

This command sets a value for the difference in depth of modulation (DDM) in uA.

*RST  0.0 µA
Range  –958.1 to 958.1 µA

Use a value that is within the range of the current SDM value.

**Key Entry**  Aux Fctn > Avionics > ILS Localizer
> DDM/SDM > DDM uA <value> Enter

**Remarks**  Typically the SDM default value provides sufficient range for most applications.

If SDM is set to 99%, then the full range of DDM uA is available. The following demonstrates the limits of DDM uA’s range:

\[
((-\text{SDM}/100) \times (150/0.155)) \text{ to } ((\text{SDM}/100) \times (150/0.155))
\]

As SDM’s value increases or decrease, so does the range.

:DDM[:PERCent]

**Supported**  N5171B/81B & N5172B/82B with Option N5180302B

[[:SOURce]:AVIonics:ILSLocalizer]:DDM[:PERCent] <value>
[[:SOURce]:AVIonics:ILSLocalizer]:DDM[:PERCent]?

This command sets a value for the difference in depth of modulation (DDM) in percent (%).

*RST  0.00%
Range  –99% to 99%

Use a value that is within the range of the current SDM value.

**Key Entry**  Aux Fctn > Avionics > ILS Localizer
> DDM/SDM > DDM% <value> Enter

**Remarks**  Typically the SDM default value provides sufficient range (–40% to 40%) for most applications.

If SDM is set to 99%, then the full range of DDM is
Avionics VOR/ILS Commands
Avionics Subsystem ILS Localizer—Option N5180302B [:SOURce]:AVIonics:ILSLocalizer

Available. The following demonstrates the limits of DDM’s range:

(-SDM) to (SDM)

As SDM’s value increases or decrease, so does DDM’s range.

:FLY:DIRection

**Supported** N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSLocalizer:FLY:DIRection LEFT|RIGHT

[:SOURce]:AVIonics:ILSLocalizer:FLY:DIRection?

This command sets the “Difference in Depth of Modulation” (DDM) polarity of the ILS Localizer signal to either:

- LEFT—positive
- RIGHT—negative

The ILS Localizer provides signals that indicate whether an aircraft is Left or Right of the glide path to the runway and enables a pilot to adjust the aircraft Left or Right correctly during landing. This lateral/horizontal correction is performed using two AM carriers with an AM depth of 20%, operating at a carrier frequency range from 108.10 to 111.95 MHz.

For an aircraft on approach, the left tone is modulated at a frequency of 90 Hz by default, and the right tone is modulated at a frequency of 150 Hz by default.

The primary mechanism which makes it possible for a pilot to obtain guidance to a runway is the aircraft receiver's ability to detect the “Difference in Depth of Modulation (DDM)” between the 90 Hz modulation and the 150 Hz modulation.

DDM is defined to be the “percentage modulation depth of the larger signal” minus the “percentage modulation depth of the smaller signal” divided by 100:

$$DDM = \frac{AM(90\text{ Hz})\% - AM(150\text{ Hz})\%}{100}$$

When this formula yields a positive DDM value, the left tone at 90 Hz is stronger; this is indicating that the aircraft is to the Left of the ILS Localizer centerline signal and would have to Fly “Right” to bring the DDM value back to zero so that the aircraft is back in-line with the centerline of the runway.

When this formula yields a negative DDM value, the right tone at 150 Hz is stronger; this is indicating that the aircraft is to the Right of the ILS Localizer centerline signal and would have to Fly “Left” to bring the DDM value back to zero so that the aircraft is back in-line with the centerline of the runway.

Example:

To correct if the left tone at 90 Hz is stronger at 0.2 DDM,
the aircraft would have to be pointed Right

:AVIonics:ILSLocalizer:FLY:DIRection RIGHT

with a DDM of 0.2.

:AVIonics:ILSLocalizer:DDM 0.2

Example:

To correct if the right tone at 150 Hz is stronger at –0.2 DDM,
the aircraft would have to be pointed Left

:AVIonics:ILSLocalizer:FLY:DIRection LEFT

with a DDM of –0.2.

:AVIonics:ILSLocalizer:DDM –0.2

*RST LEFT

Choices LEFT | RIGHT

Key Entry Aux Fctn > Avionics > ILS Localizer
> DDM/SDM > Fly Left | Right

:FLY:PHASe

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSLocalizer:FLY:PHASe <value>
[:SOURce]:AVIonics:ILSLocalizer:FLY:PHASe?

This command sets the phase of the right (150 Hz) ILS Localizer signal relative to the left (90 Hz) ILS Localizer signal.

*RST 0.00 deg

Range 0.00 deg–360 deg

Key Entry Aux Fctn > Avionics > ILS Localizer
> Left/Right Phase <value> deg
Avionics VOR/ILS Commands
Avionics Subsystem ILS Localizer—Option N5180302B [:SOURce]:AVIonics:ILSLocalizer

:FREQuency:LEFT

**Supported**
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSLocalizer:FREQuency:LEFT <value>
[:SOURce]:AVIonics:ILSLocalizer:FREQuency:LEFT?

This command sets the frequency of the LEFT ILS Localizer signal.

*RST* 90 Hz

*Range* 0 Hz–6 MHz

*Key Entry*
Aux Fctn > Avionics > ILS Localizer
> Left/Right > Left Frequency <value> Hz

:FREQuency:RIGHT

**Supported**
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSLocalizer:FREQuency:RIGHT <value>
[:SOURce]:AVIonics:ILSLocalizer:FREQuency:RIGHT?

This command sets the frequency of the RIGHT ILS Localizer signal.

*RST* 150 Hz

*Range* 0 Hz–10 MHz

*Key Entry*
Aux Fctn > Avionics > ILS Localizer
> Left/Right > Right Frequency <value> Hz

:FREQuency[:CARRier]:INDex

**Supported**
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSLocalizer:FREQuency[:CARRier]:INDex <value>
[:SOURce]:AVIonics:ILSLocalizer:FREQuency[:CARRier]:INDex?

This command sets a carrier index between 1 and 40. Each index corresponds to a standard defined ILS Localizer carrier channel.

*RST* 1 (108.10 MHz)

*Range* 1–40 (See table for index versus frequency.)

*Key Entry*
Aux Fctn > Avionics > ILS Localizer
> Carrier Freq Index > <value> Enter

*Remarks*
There are forty channels that are allocated to the ILS Localizer in the range from 108.10 to 111.95 MHz; each ILS Localizer carrier has a corresponding ILS Glide
Slope carrier frequency in the range from 329.15 to 335.00 MHz.

<table>
<thead>
<tr>
<th>ILS Localizer (MHz) Index 1-20</th>
<th>ILS Glide Slope (MHz) Index 1-20</th>
<th>ILS Localizer (MHz) Index 21-40</th>
<th>ILS Glide Slope (MHz) Index 21-40</th>
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Avionics VOR/ILS Commands
Avionics Subsystem ILS Localizer—Option N5180302B [:SOURce]:AVIonics:ILSLocalizer

:MODE

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSLocalizer:MODE OFF|NORMal|SLEFt|SRIGht

[:SOURce]:AVIonics:ILSLocalizer:MODE?

This command allows selection of a complete or partial ILS Localizer signal and can set the ILS Localizer Mode to one of the following:
OFF | NORM | SLEFt (Suppress Left) | SRIGht (Suppress Right)

*RST OFF
Turns off all ILS Localizer signals. When set to OFF, all ILS Localizer mode parameter settings are turned off.

Choices OFF|NORM|SLEF|SRIG

Key Entry Aux Fctn > Avionics > ILS Localizer
> ILS LOC Mode
> OFF | NORM | Suppress Left | Suppress Right

:PRESet

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSLocalizer:PRESet

This command returns the ILS Localizer parameters to their *RST values.

*RST N/A

Key Entry Aux Fctn > Avionics > ILS Localizer
> More 1 of 2 > Recall Default Settings

:SDM

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSLocalizer:SDM <value>

[:SOURce]:AVIonics:ILSLocalizer:SDM?

This command sets the sum of depth of modulation (SDM):
SDM = [AM(90 Hz) + AM(150 Hz)] / 100

*RST 40PCT

Range 0PCT–99PCT

Key Entry Aux Fctn > Avionics > ILS Localizer
> DDM/SDM > SDM <value>%
Avionics Subsystem ILS Glide Slope—Option N5180302B
[:SOURce]:AVIonics:ILSGslope

:DDM:DDM

**Supported**  N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSGslope:DDM:DDM <value>
[:SOURce]:AVIonics:ILSGslope:DDM:DDM?

This command sets a value for the “Difference in Depth of Modulation” (DDM).

DDM is defined to be the “percentage modulation depth of the larger signal” minus the “percentage modulation depth of the smaller signal”, divided by 100.

$$DDM = \frac{AM(90\ Hz)\% - AM(150\ Hz)\%}{100}$$

*RST 0.0000

**Range**  –0.99 to 0.99

Use a value that is within the range of the current SDM value.

**Key Entry**  Aux Fctn > Avionics > ILS Glide Slope
> DDM/SDM > DDM <value> Enter

**Remarks**  Typically the SDM default value provides sufficient range (–0.80 to 0.80) for most applications.

If SDM is set to 99%, then the full range of DDM is available. The following demonstrates the limits of DDM’s range:

(–SDM/100) to (SDM/100)

As SDM’s value increases or decrease, so does DDM’s range.
Avionics VOR/ILS Commands
Avionics Subsystem ILS Glide Slope—Option N5180302B
[:SOURce]:AVIonics:ILSGslope

:DDM:UAMPs

**Supported**  
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSGslope:DDM:UAMPs <value>
[:SOURce]:AVIonics:ILSGslope:DDM:UAMPs?

This command sets a value for the difference in depth of modulation (DDM) in μA.

*RST  
0.0 μA

Range  
–848.6 to 848.6 μA

Use a value that is within the range of the current SDM value.

**Key Entry**  
Aux Fctn > Avionics > ILS Glide Slope > DDM/SDM > DDM μA <value> Enter

**Remarks**  
Typically the SDM default value provides sufficient range for most applications.

If SDM is set to 99%, then the full range of DDM μA is available. The following demonstrates the limits of DDM μA’s range:

\[
((-SDM/100)*(150/.175)) \text{ to } ((SDM/100)*(150/.175))
\]

As SDM’s value increases or decrease, so does the range.

:DDM[:PERCent]

**Supported**  
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSGslope:DDM[:PERCent] <value>
[:SOURce]:AVIonics:ILSGslope:DDM[:PERCent]?

This command sets a value for the difference in depth of modulation (DDM) in %.

*RST  
0.00%

Range  
–99% to 99%

Use a value that is within the range of the current SDM value.

**Key Entry**  
Aux Fctn > Avionics > ILS Glide Slope > DDM/SDM > DDM % <value> Enter

**Remarks**  
Typically the SDM default value provides sufficient range (–80% to 80%) for most applications.

If SDM is set to 99%, then the full range of DDM is
Avionics VOR/ILS Commands
Avionics Subsystem ILS Glide Slope—Option N5180302B
[:SOURce]:AVIonics:ILSGslope

available. The following demonstrates the limits of DDM's range:

(-SDM) to (SDM)

As SDM's value increases or decrease, so does DDM's range.

:FLY:DIRection

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSGslope:FLY:DIRection UP|DOWN
[:SOURce]:AVIonics:ILSGslope:FLY:DIRection?

The ILS Glide Slope enables a pilot to adjust the aircraft up or down correctly during landing.

The ILS Glide Slope provides signals that indicate whether an aircraft is above, below, or in-line with the glide path to the runway and enables a pilot to adjust the aircraft Up or Down correctly during landing.

This is the same type of information as provided by the ILS Localizer, but for the vertical reference rather than the lateral/horizontal reference; the same modulation and antenna techniques are used.

This vertical adjustment is performed using two AM tones with an AM depth of 40% operating at a carrier frequency range from 329.15 to 335.00 MHz.

For aircraft approach, the upper tone is modulated at a frequency of 90 Hz AM by default, and the lower tone is modulated at a frequency of 150 Hz AM by default.

The primary mechanism which makes it possible for a pilot to obtain guidance to a runway is the aircraft receiver's ability to detect the “Difference in Depth of Modulation (DDM)” between the 90 Hz and the 150 Hz amplitude modulation.

DDM is defined to be the “percentage modulation depth of the larger signal” minus the “percentage modulation depth of the smaller signal”, divided by 100:

$$DDM = \frac{[AM(90 \text{ Hz})\% - AM(150 \text{ Hz})\%]}{100}$$

When this formula yields a positive DDM value, the upper tone at 90 Hz is stronger; this is indicating that the aircraft is Above the ILS Glide Slope centerline signal and would have to Fly “Down” to bring the DDM value back to zero so that the aircraft is back in-line with centerline of the runway.

When this formula yields a negative DDM value, the tone at 150 Hz is stronger; this is indicating that the aircraft is Below the ILS Glide Slope centerline signal and would have to Fly “Up” to bring the DDM value back to zero so that the
Avionics VOR/ILS Commands
Avionics Subsystem ILS Glide Slope—Option N5180302B
[:SOURce]:AVIonics:ILSGslope

a aircraft is back in-line with centerline of the runway

Example:

To correct if the upper tone at 90 Hz is stronger at 0.4 DDM,
the aircraft would have to be pointed Down

:AVIonics:ILSGslope:FLY:DIRection DOWN

with a DDM of 0.4

:AVIonics:ILSGslope:DDM 0.4

Example:

To correct if the lower tone at 150 Hz is stronger at –0.4 DDM,
the aircraft would have to be pointed Up

:AVIonics:ILSGslope:FLY:DIRection UP

with a DDM of –0.4.

:AVIonics:ILSGslope:DDM –0.4

*RST

UP | DOWN

Key Entry Aux Fctn > Avionics > ILS Glide Slope
> DDM/SDM > Fly Up | Down

:FLY:PHASe

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSGslope:FLY:PHASe <value>
[:SOURce]:AVIonics:ILSGslope:FLY:PHASe?

This command sets the phase of the Down (150 Hz) ILS Glide Slope signal
relative to the Up (90 Hz) ILS Glide Slope signal.

*RST 0.00 deg

Range 0.00 deg–360 deg

Key Entry Aux Fctn > Avionics > ILS Glide Slope
> Up/Down Phase <value> deg
Avionics VOR/ILS Commands
Avionics Subsystem ILS Glide Slope—Option N5180302B
[:SOURce]:AVIonics:ILSGslope

:FREQuency:DOWN

Supported   N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSGslope:FREQuency:DOWN <value>
[:SOURce]:AVIonics:ILSGslope:FREQuency:DOWN?

This command sets the frequency of the Down ILS Glide Slope signal.

*RST  150 Hz
Range  0 Hz–10 MHz
Key Entry  Aux Fctn > Avionics > ILS Glide Slope
> Up/Down
> Down Frequency <value> Hz | kHz | MHz | GHz

:FREQuency:UP

Supported   N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSGslope:FREQuency:UP <value>
[:SOURce]:AVIonics:ILSGslope:FREQuency:UP?

This command sets the frequency of the Up ILS Glide Slope signal.

*RST  90 Hz
Range  0 Hz–6 MHz
Key Entry  Aux Fctn > Avionics > ILS Glide Slope
> Up/Down
> Up Frequency <value> Hz | kHz | MHz | GHz

:FREQuency[:CARRier]:INDex

Supported   N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSGslope:FREQuency[:CARRier]:INDex <val>
[:SOURce]:AVIonics:ILSGslope:FREQuency[:CARRier]:INDex?

This command sets a carrier index.

*RST  1 (334.70 MHz)
Range  1–40 (See table for index versus frequency.)
Key Entry  Aux Fctn > Avionics > ILS Glide Slope
> Carrier Freq Index > <value> Enter

Remarks  There are forty channels that are allocated to the ILS Localizer in the range from 108.10 to 111.95 MHz; each ILS Localizer carrier has a corresponding ILS Glide
Avionics VOR/ILS Commands
Avionics Subsystem ILS Glide Slope—Option N5180302B
[:SOURce]:AVIonics:ILSGslope

Slope carrier frequency in the range from 329.15 to 335.00 MHz.

### ILS Localizer and Corresponding ILS Glide Slope Carrier Frequencies (MHz)

<table>
<thead>
<tr>
<th>ILS Localizer Index 1-20</th>
<th>ILS Glide Slope Index 1-20</th>
<th>ILS Localizer Index 21-40</th>
<th>ILS Glide Slope Index 21-40</th>
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<td>1=108.10</td>
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<td>10=108.95</td>
<td>10=329.15</td>
<td>30=110.95</td>
<td>30=330.65</td>
</tr>
<tr>
<td>11=109.10</td>
<td>11=331.40</td>
<td>31=111.10</td>
<td>31=331.70</td>
</tr>
<tr>
<td>12=109.15</td>
<td>12=331.25</td>
<td>32=111.15</td>
<td>32=331.55</td>
</tr>
<tr>
<td>13=109.30</td>
<td>13=332.00</td>
<td>33=111.30</td>
<td>33=332.30</td>
</tr>
<tr>
<td>14=109.35</td>
<td>14=331.85</td>
<td>34=111.35</td>
<td>34=332.15</td>
</tr>
<tr>
<td>15=109.50</td>
<td>15=332.60</td>
<td>35=111.50</td>
<td>35=332.90</td>
</tr>
<tr>
<td>16=109.55</td>
<td>16=332.45</td>
<td>36=111.55</td>
<td>36=332.75</td>
</tr>
<tr>
<td>17=109.70</td>
<td>17=333.20</td>
<td>37=111.70</td>
<td>37=333.50</td>
</tr>
<tr>
<td>18=109.75</td>
<td>18=333.05</td>
<td>38=111.75</td>
<td>38=333.35</td>
</tr>
<tr>
<td>19=109.90</td>
<td>19=333.80</td>
<td>39=111.90</td>
<td>39=331.10</td>
</tr>
<tr>
<td>20=109.95</td>
<td>20=333.65</td>
<td>40=111.95</td>
<td>40=330.95</td>
</tr>
</tbody>
</table>

**:MODE**

**Supported**
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSGslope:MODE OFF|NORMal|SUP|SDOWn

[:SOURce]:AVIonics:ILSGslope:MODE?

This command allows selection of a complete or partial ILS Glide Slope signal and can set the ILS Glide Slope Mode to one of the following:
OFF | NORM | SUP (Suppress Up) | SDOWn (Suppress Down).
Avionics VOR/ILS Commands
Avionics Subsystem ILS Glide Slope—Option N5180302B
[:SOURce]:AVIonics:ILSGslope

*RST
OFF (Default)
Turns off all ILS Glide Slope signals that includes all ILS Glide Slope mode parameter settings being turned off.

Choices
OFF|NORMal|SUP|SDOWn

Key Entry
Aux Fctn > Avionics > ILS Glide Slope > ILS GS Mode > OFF | NORM | Suppress Up | Suppress Down

:PRESet

Supported
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSGslope:PRESet
This command returns the ILS Glide Slope parameters to their *RST values.

*RST
N/A

Key Entry
Aux Fctn > Avionics > ILS Glide Slope > More 1 of 2 > Recall Default Settings

:SDM

Supported
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:ILSGslope:SDM <value>
[:SOURce]:AVIonics:ILSGslope:SDM?
This command sets the sum of depth of modulation (SDM):
SDM = [AM(90 Hz) + AM(150 Hz)] / 100

*RST
80PCT

Range
0–99PCT

Key Entry
Aux Fctn > Avionics > ILS Glide Slope > DDM/SDM > SDM <value>%
Avionics Subsystem Marker Beacon—Option N5180302B
[:SOURce]:AVIonics:MBEacon

:DEPTH

**Supported**
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:MBEacon:DEPTH <value>
[:SOURce]:AVIonics:MBEacon:DEPTH?

This command sets the AM depth on the Marker Beacon carrier.

*RST  95PCT
Range  0PCT–99.9PCT
Key Entry  Aux Fctn > Avionics > Marker Beacon
> Marker Depth <value>%

:FREQuency:INNER

**Supported**
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:MBEacon:FREQuency:INNER <value>
[:SOURce]:AVIonics:MBEacon:FREQuency:INNER?

This command sets the frequency for the Inner Marker Beacon.

*RST  3000 Hz
Range  0 Hz–10 MHz
Key Entry  Aux Fctn > Avionics > Marker Beacon
> Marker Beacon > Inner
> Marker Freq > <value> Hz | kHz | MHz | GHz

:FREQuency:MIDDLE

**Supported**
N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:MBEacon:FREQuency:MIDDLE <value>
[:SOURce]:AVIonics:MBEacon:FREQuency:MIDDLE?

This command sets the frequency for the Middle Marker Beacon.

*RST  1300 Hz
Range  0 Hz–10 MHz
Key Entry  Aux Fctn > Avionics > Marker Beacon
> Marker Beacon > Middle
> Marker Freq > <value> Hz | kHz | MHz | GHz
Avionics VOR/ILS Commands
Avionics Subsystem Marker Beacon—Option N5180302B [:SOURce]:AVIonics:MBEacon

:FREQuency:OUTer

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:MBEacon:FREQuency:OUTer <value>
[:SOURce]:AVIonics:MBEacon:FREQuency:OUTer?

This command sets the frequency for the Outer Marker Beacon.

*RST 400 Hz
Range 0 Hz–10 MHz
Key Entry Aux Fctn > Avionics > Marker Beacon > Marker Beacon > Outer > Marker Freq > <val> Hz | kHz | MHz | GHz

:FREQuency[:CARRier]:INDex

Supported N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:MBEacon:FREQuency[:CARRier]:INDex <val>
[:SOURce]:AVIonics:MBEacon:FREQuency[:CARRier]:INDex?

This command sets the carrier frequency for the three Marker Beacons: Inner, Middle, and Outer.

*RST 17 (75.000 MHz)
Range 1–33

<table>
<thead>
<tr>
<th>ILS Marker Beacon Carrier Frequencies in MHz (Index = 1 to 33)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1=74.600</td>
</tr>
<tr>
<td>2=74.625</td>
</tr>
<tr>
<td>3=74.650</td>
</tr>
<tr>
<td>4=74.675</td>
</tr>
<tr>
<td>5=74.700</td>
</tr>
<tr>
<td>6=74.725</td>
</tr>
<tr>
<td>7=74.750</td>
</tr>
<tr>
<td>8=74.775</td>
</tr>
<tr>
<td>9=74.800</td>
</tr>
<tr>
<td>10=74.825</td>
</tr>
<tr>
<td>11=74.850</td>
</tr>
</tbody>
</table>

Key Entry Aux Fctn > Avionics > Marker Beacon > Carrier Freq Index > <value> Enter
Avionics VOR/ILS Commands
Avionics Subsystem Marker Beacon—Option N5180302B [:SOURce]:AVIonics:MBEacon

:MODE

**Supported**  N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:MBEacon:MODE OFF|INNER|MIDDLE|OUTER

This command selects a Marker Beacon Mode and can be one of the following:

OFF | INNER | MIDDLE | OUTER

*RST  OFF

Range  OFF | INNER | MIDDLE | OUTER

Key Entry  Aux Fctn > Avionics > Marker Beacon
> Marker Beacon > Off | Inner | Middle | Outer

:PRESet

**Supported**  N5171B/81B & N5172B/82B with Option N5180302B

[:SOURce]:AVIonics:MBEacon:PRESet

This command returns the ILS Marker Beacon parameters to their *RST values.

*RST  N/A

Key Entry  Aux Fctn > Avionics > Marker Beacon
> More 1 of 2 > Recall Default Settings
Avionics VOR/ILS Commands
Avionics Subsystem Marker Beacon—Option N5180302B [:SOURce]:AVIonics:MBEacon
7 Bit Error Rate Test (BERT) Commands

With firmware version B.01.75 or later, the following options have changed to a new eight-digit format:

- Option 302 to Option N5180302B
- Option 320 to Option N5180320B
- Option 403 to Option N5180403B
- Option 430 to Option N5180430B
- Option 431 to Option N5180432B
- Option 432 to Option N5180431B
- Option UN7 to Option N5180UN7B

Only software options are changed to the eight-digit format. Hardware options remain with three-digits.

For Keysight N5172B/82B X-Series signal generators with firmware version B.01.70 or later installed, before using BERT commands, ensure that the proper baseband operating mode choice is selected. For more information see “:OPERating:MODE” on page 120

This chapter describes SCPI commands used by Keysight X-Series signal generators with Option N5180UN7B.

This chapter contains the following sections:

- “Calculate Subsystem (:CALCulate:BERT[:BASeband])” on page 458
- “Data Subsystem (:DATA)” on page 460
- “Input Subsystem (:INPut:BERT[:BASeband])” on page 463
- “Route Subsystem (:ROUTE:LINE:BERT)” on page 468
- “Sense Subsystem (:SENSe:BERT[:BASeband])” on page 470
### Calculate Subsystem (:CALCulate:BERT[:BASEband])

**[:COMParator:MODE]**

<table>
<thead>
<tr>
<th>Supported</th>
<th>N5172B/82B with Option N5180UN7B</th>
</tr>
</thead>
</table>

**[:CALCulate:BERT[:BASEband]:COMParator:MODE** CEND|FHOLd

This command selects the pass/fail judgment mode of the comparator function.

- **CEND**
  - This choice selects the cycle end mode and each BER measurement result is compared with the limit value to make a pass/fail assessment at the end of a cycle.

- **FHOLd**
  - This choice selects the fail hold mode and only one fail judgment is allowed during that BER measurement loop. Any failed judgment after the first failure is ignored.

**:*RST**

*CEND*

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Cycle End</th>
<th>Fail Hold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remarks</td>
<td>For automated tests, the results of this command can be accessed from the rear panel BER TEST OUT pin on the AUX I/O connector. For more information about the rear panel AUX I/O connector pin configuration, refer to the X-Series Signal Generators User's Guide.</td>
<td></td>
</tr>
</tbody>
</table>

**[:COMParator:THReshold]**

<table>
<thead>
<tr>
<th>Supported</th>
<th>N5172B/82B with Option N5180UN7B</th>
</tr>
</thead>
</table>

**[:CALCulate:BERT[:BASEband]:COMParator:THReshold <value>**

**[:CALCulate:BERT[:BASEband]:COMParator:THReshold?**

This command specifies the threshold value for the pass/fail judgment function.

The variable `<value>` is a decimal notation representing a percentage value.

**:*RST**

+1.00000000E-002

<table>
<thead>
<tr>
<th>Range</th>
<th>0.00000001–1.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Entry</td>
<td>Pass/Fail Limits</td>
</tr>
<tr>
<td>Remarks</td>
<td>This command is valid only while the BER pass/fail command is active. Refer to “:COMParator[:STATE]” on page 459.</td>
</tr>
</tbody>
</table>
Bit Error Rate Test (BERT) Commands
Calculate Subsystem (:CALCulate:BERT[:BASEband])

:COMParator[:STATE]

Supported
N5172B/82B with Option N5180UN7B

:CALCulate:BERT[:BASEband]:COMParator[:STATE] ON|OFF|1|0
:CALCulate:BERT[:BASEband]:COMParator[:STATE]?

This command enables or disables the pass/fail judgment function.

*RST
0
Key Entry Pass/Fail Off On

:DISPlay:MODE:

Supported
N5172B/82B with Option N5180UN7B

:CALCulate:BERT[:BASEband]:DISPlay:MODE PERCent|SCIentific
:CALCulate:BERT[:BASEband]:DISPlay:MODE?

This command selects the display mode for the bit error rate (BER) measurement.

PERCent This choice reports measurement results as a percentage.
SCIentific This choice reports measurement results in scientific notation.

*RST PERC
Key Entry BER Display % Exp

:DISPlay:UPDate:

Supported
N5172B/82B with Option N5180UN7B

:CALCulate:BERT[:BASEband]:DISPlay:UPDate CEND|CONT
:CALCulate:BERT[:BASEband]:DISPlay:UPDate?

This command selects the display update mode during bit error rate (BER) measurements.

CEND This choice selects the cycle end mode and the previous BER measurement result is displayed during the current measurement cycle.
CONT This choice selects the continuous mode and the display shows the real-time intermediate results during that BER measurement cycle.

*RST CONT
Key Entry Update Display Cycle End Cont
Data Subsystem (:DATA)

:BERT:AUXout

Supported N5172B/82B with Option N5180UN7B

:DATA:BERT[:BASeband]:AUXout ERRor|REFerence|PN9
:DATA:BERT[:BASeband]:AUXout?

This command selects a pre-defined output signal configuration for pins on the AUX I/O rear panel connector. Refer to Table 7-1 for the output pin configuration and signal type.

- **ERRor**: This choice selects the bit error rate (BER) information output.
- **REFerence**: This choice selects the reference information output.
- **PN9**: This choice selects a pseudo-random data output.

### Table 7-1  AUX I/O pin configurations

<table>
<thead>
<tr>
<th>Pin#</th>
<th>ERRor</th>
<th>REFerence</th>
<th>PN9</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>BER Meas End</td>
<td>BER Data Out</td>
<td>PN9 Data Out</td>
</tr>
<tr>
<td>16</td>
<td>BER Sync Loss</td>
<td>Sync Start</td>
<td>No signal</td>
</tr>
<tr>
<td>17</td>
<td>BER Test Out</td>
<td>BER Clock Out</td>
<td>PN9 Clock Out</td>
</tr>
<tr>
<td>18</td>
<td>BER Error Out</td>
<td>BER Error Out</td>
<td>BER Error Out</td>
</tr>
<tr>
<td>19</td>
<td>BER No Data</td>
<td>Reference Data</td>
<td>No signal</td>
</tr>
</tbody>
</table>

- **BER Meas End**: A signal at this pin indicates the status of the bit error rate (BER) measurements. BER measurements are being executed when the signal is high.
- **BER Sync loss**: A low signal at this pin indicates that the synchronization is lost. This signal is valid only when the signal at the BER Meas End pin is high.
- **BER Test Out**: A signal at this pin indicates the test result of the bit error rate measurements. The result is guaranteed at the falling edge of the BER Meas End signal. The result is pass when the signal is low; the result is fail when the signal is high. The signal is also high when the pass/fail judgment is set to off.
- **BER Error Out**: A signal at this pin indicates the number of the error bits. The output is normally low. One pulse signal (pulse width matches the input clock) indicates one error bit. Pulses for the error bits of one measurement cycle are
Bit Error Rate Test (BERT) Commands
Data Subsystem (:DATA)

not synchronized with the rear panel connector BER CLK IN signal and are output when the BER Meas End signal is high.

BER No Data  A low signal at this pin indicates the no data status. The no data status is reported when there has been no clock inputs for more than 3 seconds or there has been no data change for more than 200 bits. This signal is valid only when the signal of the BER Meas End output signal is high.

BER Clock Out  The BER Clock Out signal monitors the rear panel BER CLK IN signal after polarity control, delay control, and gate control (if applicable) have taken place.

BER Data Out  This is a data stream for the bit error rate measurements. The clock signal is used to trigger the reading of the data.

Sync Start  This signal indicates the timing when the PN generator starts to generate a PN sequence. This signal can also indicate if the hardware is triggering a PN synchronization or making a measurement when the signal is high.

PN9 Clock Out  This signal is the clock signal for the PN9 Data. The falling edge of the PN9 Clock indicates the center of PN9 Data. The PN9 Clock rate is 37.5Mbits per second.

PN9 Data Out  This signal is PN9 data for the self-loopback test.

Reference Data  This signal uses the pseudo-random bit stream as the reference signal.

*RST  ERRor

Key Entry  Error Out  Reference Out  PN9 Out

:BERT[:BASEband][:DATA]

Supported  N5172B/82B with Option N5180UN7B

:DATA:BERT[:BASEband] [:DATA]?
BEC | BITC | BER | ALL | TBEC | TBIT | TBER | JUDGE

This query returns the data measurement for the selected variable.

BEC  This choice provides the intermediate bit error count result.

BITC  This choice provides the intermediate bit count result.

BER  This choice provides the intermediate bit error rate result.
### Bit Error Rate Test (BERT) Commands

#### Data Subsystem (:DATA)

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ALL</strong></td>
<td>This choice provides the values of the bit error count, bit error rate, and bit count in the following format: <code>&lt;bit count&gt;, &lt;error count&gt;, &lt;bit error rate&gt;</code></td>
</tr>
<tr>
<td><strong>TBEC</strong></td>
<td>This choice provides the total bit error count at the end of each cycle.</td>
</tr>
<tr>
<td><strong>TBIT</strong></td>
<td>This choice provides the total bit count at the end of each cycle.</td>
</tr>
<tr>
<td><strong>TBER</strong></td>
<td>This choice provides the total bit error rate at the end of each cycle.</td>
</tr>
<tr>
<td><strong>JUDGe</strong></td>
<td>This choice provides the pass or fail string.</td>
</tr>
</tbody>
</table>
Bit Error Rate Test (BERT) Commands
Input Subsystem (:INPut:BERT[: BASeband])

Input Subsystem (:INPut:BERT[: BASeband])

:CGATe:DELa:y:CLOCk

Supported: N5172B/82B with Option N5180UN7B

:INPut:BERT[: BASeband]:CGATe:DELa:y:CLOCk <value>
:INPut:BERT[: BASeband]:CGATe:DELa:y:CLOCk?

This command sets the number of delay bits for the signal applied to the BER GATE IN rear panel connector.

One bit corresponds with one bit of delay for the input clock.

*RST 1
Range 1–16384
Key Entry Gate Clk Delay
Remarks The gate delay mode must be set to CLOCk for this command to work. Refer to ":CGATe:DELa:y:MODE". Also, the gate and gate delay must be enabled for this command to work. Refer to ":CGATe[:STATe]" on page 465 and ":CGATe:DELa:y[:STATe]" on page 464.

:CGATe:DELa:y:MODE

Supported: N5172B/82B with Option N5180UN7B

:INPut:BERT[: BASeband]:CGATe:DELa:y:MODE TIME|CLOCk
:INPut:BERT[: BASeband]:CGATe:DELa:y:MODE:?

This command selects the operating mode of the gate delay.

TIME This choice selects the time mode which makes it possible to set the gate time delay in absolute time and the resolution.

CLOCk This choice selects the clock mode which enables you to set the gate delay by a set number of bits.

*RST TIME
Key Entry Gate Mode Time Clk
Remarks The gate state and gate delay state must be enabled for this command to work. Refer to "CGATe[:STATe]" on page 465 and "CGATe:DELa:y[:STATe]" on page 464.
Bit Error Rate Test (BERT) Commands
Input Subsystem (:INPut:BERT[: BASeband])

:CGATe:DELay:TIME

Supported N5172B/82B with Option N5180UN7B

:INPut:BERT[:BASEband]:CGATe:DELay:TIME <value><unit>
:INPut:BERT[:BASEband]:CGATe:DELay:TIME?

This command sets the delay time of the gate signal. The gate delay time must be the multiple of the minimum resolution value and if not, the delay resolution is automatically rounded to the nearest multiplied value of the gate time delay value.

The variable <value> is expressed in units of seconds (s), milliseconds (ms), microseconds (μs), and nanoseconds (ns).

*RST +2.67000000E−008
Range 2.67 ns–1.0 s
Key Entry Gate Time Delay
Remarks Gate Delay Off On must be set to On and Gate Mode Time Clk set to Time for this command to work. Refer to “:CGATe:DELay[:STATe]” on page 464 and “:CGATe:DELay:MODE” on page 463.

To set the resolution, refer to “:CLOCk:DELAy:RESolution” on page 465.

:CGATe:DELay[:STATe]

Supported N5172B/82B with Option N5180UN7B

:INPut:BERT[:BASEband]:CGATe:DELay[:STATe] ON|OFF|1|0
:INPut:BERT[:BASEband]:CGATe:DELay[:STATe]?

This command enables or disables the operating state of the gate delay.

ON This choice enables the gate delay adjustment function.
OFF This choice disables the gate delay adjustment function.

*RST 0
Key Entry Gate Delay Off On
Remarks The gate must be enabled for this command to work. To enable the gate, refer to “:CGATe[:STATe]” on page 465.

:CGATe:POLarity

Supported N5172B/82B with Option N5180UN7B

:INPut:BERT[:BASEband]:CGATe:POLarity POSitive|NEGative
:INPut:BERT[:BASEband]:CGATe:POLarity?
Bit Error Rate Test (BERT) Commands
Input Subsystem (:INPut:BERT[: BASEband])

This command sets the input polarity of the gate signal supplied to the BER GATE IN rear panel connector.

**POS**  With this choice, the signal is valid when the gate signal is high.

**NEG**  With this choice, the signal is valid when the gate signal is low.

*RST  POS

Key Entry  Gate Polarity Neg Pos

:CGATe[:STATe]

**Supported**  N5172B/82B with Option N5180UN7B

:INPut:BERT[:BASEband]:CGATe[:STATe]  ON|OFF|1|0

:INPut:BERT[:BASEband]:CGATe[:STATe]?

This command sets the operating state of the clock gate function.

**ON**  This choice enables the clock gate function.

**OFF**  This choice disables the clock gate function.

*RST  0

Key Entry  Gate Off On

:CLOCk:DELAy:RESolution

**Supported**  N5172B/82B with Option N5180UN7B

:INPut:BERT[:BASEband]:CLOCk:DELAy:RESolution  <value><unit>

:INPut:BERT[:BASEband]:CLOCk:DELAy:RESolution?

This command sets the resolution of the clock delay. The minimum resolution is 5 ns and it corresponds to 1/200 MHz. The 200 MHz is the DAC clock for the C2 board. The input value must be a multiple of the minimum resolution. If the set value is not a multiple value, the delay resolution is automatically rounded to the nearest multiple value with reference to the set value.

*RST  +1.00000000E−008

Range  5ns–80μs

Key Entry  Resolution

Remarks  The clock delay or the gate delay must be enabled for this command to work. Refer to “:CLOCk:DELAy[:STATe]” on page 466 and “:CGATe:DELAy[:STATe]” on page 464. A change in the resolution value can affect both the clock and the gate delay time automatically.
Bit Error Rate Test (BERT) Commands
Input Subsystem (:INPut:BERT[: BASeband])

:CLOCK:DELAy:TIME

Supported N5172B/82B with Option N5180UN7B

:INPut:BERT[:BASEband]:CLOCk:DELAy:TIME <value><unit>
:INPut:BERT[:BASEband]:CLOCk:DELAy:TIME?

This command sets the clock signal delay time.
The variable <value> is expressed in units of seconds (s), milliseconds (ms), microseconds (μs), and nanoseconds (ns).

*RST +2.67000000E−008

Range 26.7ns–999.9967600ms

Key Entry Clock Time Delay

Remarks The clock delay must be enabled for this command to work. Refer to “:CLOCk:DELAy[:STATe]” on page 466.

:CLOCk:DELAy[:STATe]

Supported N5172B/82B with Option N5180UN7B

:INPut:BERT[:BASEband]:CLOCk:DELAy[:STATe] ON|OFF|1|0
:INPut:BERT[:BASEband]:CLOCk:DELAy[:STATe]?

This command sets the operating state of the clock delay function.

ON This choice enables the clock delay adjustment.
OFF This choice disables the clock delay adjustment.

*RST 0

Key Entry Clock Delay Off On

:CLOCk:POLarity

Supported N5172B/82B with Option N5180UN7B

:INPut:BERT[:BASEband]:CLOCk:POLarity POSitive|NEGative
:INPut:BERT[:BASEband]:CLOCk:POLarity?

This command sets the input polarity of the clock signal supplied to the BER CLK IN rear panel connector.

POS With this choice, the signal is valid when the clock signal is high.
NEG With this choice, the signal is valid when the clock signal is low.

*RST POS

Key Entry Clock Polarity Neg Pos
Bit Error Rate Test (BERT) Commands
Input Subsystem (:INPut:BERT[: BASeband])

:DATA:POLarity

Supported N5172B/82B with Option N5180UN7B

:INPut:BERT[:BASeband]:DATA:POLarity POSitive|NEGative
:INPut:BERT[:BASeband]:DATA:POLarity?

This command sets the input polarity of the data signal supplied to the BER DATA IN rear panel connector.

POS With this choice, the signal is valid when the data signal is high.

NEG With this choice, the signal is valid when the data signal is low.

*RST POS

Key Entry Data Polarity Neg Pos
Route Subsystem (:ROUTE:LINE:BERT)

:CLOCK:BNC:SOURce

Supported  N5172B/82B with Option N5180UN7B

:ROUTE:LINE:BERT:CLOCK:BNC:SOURce?

This command sets the BERT clock source to the BBTRIG 1 rear panel BNC or None.

*RST  None

Key Entry  Clock BNC None BBTrig 1

Remarks  When BERT is enabled (On), the clock source is automatically set to BBTRIG 1. Routing the BNC connectors in other modes can change this setting. (For example, routing a Marker to BBTRIG 1 will turn off the BERT functionality for this connector.) Use this command to re-enable the BERT clock source. Refer to the X-Series Signal Generators User's Guide for rear panel connector configurations.

:DATA:BNC:SOURce

Supported  N5172B/82B with Option N5180UN7B

:ROUTE:LINE:BERT:DATA:BNC:SOURce?

This command sets the BERT data source to the EVENT 1 rear panel BNC or None.

*RST  None

Key Entry  Data BNC None Event 1

Remarks  When BERT is enabled (On), the data source is automatically set to EVENT 1. Routing the BNC connectors in other modes can change this setting. (For example, routing a Marker to EVENT 1 will turn off the BERT functionality for this connector.) Use this command to re-enable the BERT data source. Refer to the X-Series Signal Generators User's Guide for rear panel connector configurations.
Bit Error Rate Test (BERT) Commands
Route Subsystem (:ROUTe:LINE:BERT)

:GATE:BNC:SOURce

Supported N5172B/82B with Option N5180UN7B

:ROUTe:LINE:BERT:GATE:BNC:SOURce?

This command sets the BERT gate source to the BBTRIG 2 rear panel BNC or NONE.

*RST None

Key Entry Gate BNC None BBTrig 2

Remarks
When BERT Gate Control is enabled (On), the gate source is automatically set to BBTRIG 2. Routing the BNC connectors in other modes can change this setting. (For example, routing a Marker to BBTRIG 2 will turn off the BERT functionality for this connector.) Use this command to re-enable the BERT gate source. Refer to the X-Series Signal Generators User's Guide for rear panel connector configurations.
Sense Subsystem (:SENSe:BERT[:BASeband])

:PRBS:FUNCTION:SPIGnore:DATA

<table>
<thead>
<tr>
<th>Supported</th>
<th>N5172B/82B with Option N5180UN7B</th>
</tr>
</thead>
</table>

:SENSe:BERT[:BASeband]:PRBS:FUNCTION:SPIGnore:DATA

ALL_0|ALL_1

:SENSe:BERT[:BASeband]:PRBS:FUNCTION:SPIGnore:DATA?

This command selects the bit parameter of the special pattern ignore function.

| ALL_0 | This choice ignores a bit pattern of 160 or more consecutive 0's. |
| ALL_1 | This choice ignores a bit pattern of 160 or more consecutive 1's. |

*RST

Key Entry Spcl Pattern 0's 1's

Remarks This command is valid only when the special pattern ignore function is enabled (On). Refer to 

":PRBS:FUNCTION:SPIGnore[:STATe]". The special pattern of 160 or more 1's or 0's can appear at any position in the bit stream.

:PRBS:FUNCTION:SPIGnore[:STATe]

<table>
<thead>
<tr>
<th>Supported</th>
<th>N5172B/82B with Option N5180UN7B</th>
</tr>
</thead>
</table>

:SENSe:BERT[:BASeband]:PRBS:FUNCTION:SPIGnore[:STATe]

ON|OFF|1|0

:SENSe:BERT[:BASeband]:PRBS:FUNCTION:SPIGnore[:STATe]?

This command enables (1) or disables (0) the special pattern ignore function. The special pattern ignore function enables the BER to neglect the consecutive 0's or 1's pattern data.

| ON | This choice detects 160 or more consecutive bits of 0's or 1's in the incoming bit stream and ignores these bits when making BER measurements. To select 0's or 1's refer to 
":PRBS:FUNCTION:SPIGnore:DATA"
| OFF | This choice disables the special pattern ignore mode for the BER measurement. |

*RST

Key Entry Spcl Pattern Ignore Off On

Remarks This command is valid only when 2 Mbps mode is selected for the maximum data rate, and when the special pattern ignore function is enabled (On). Refer to
Bit Error Rate Test (BERT) Commands
Sense Subsystem (:SENSe:BERT[:BASEband])

```
"`:PRBS:FUNCtion:SPIGnore[:STATe]". The special pattern of 160 or more 1's or 0's can appear at any position in the bit stream.

`:PRBS[:DATA]

Supported N5172B/82B with Option N5180UN7B

:SENSe:BERT [:BASEband] :PRBS [:DATA] PN9 | PN11 | PN15 | PN20 | PN23
:SENSe:BERT [:BASEband] :PRBS [:DATA]?

This command selects the incoming data pattern for making BER measurements.

PN9–PN23 These choices select an internally generated pseudo-random pattern for BER measurements.

*RST PN9

Key Entry PN9 PN11 PN15 PN20 PN23

:RSYNc:THReshold

Supported N5172B/82B with Option N5180UN7B

:SENSe:BERT [:BASEband] :RSYNc:THReshold <value>
:SENSe:BERT [:BASEband] :RSYNc:THReshold?

This command specifies the threshold level for the resynchronizing function.

*RST 0.40

Range 0.05–0.40

Key Entry Resync Limits

Remarks This command is valid only when the BERT resynchronizing function is on. Refer to "`:RSYNc[:STATe]" on page 471.

:RSYNc[:STATe]

Supported N5172B/82B with Option N5180UN7B

:SENSe:BERT [:BASEband] :RSYNc[:STATe] ON|OFF|1|0
:SENSe:BERT [:BASEband] :RSYNc[:STATe]?

This command sets the operating state of the resynchronization function.

ON This choice enables the resynchronization function.
OFF This choice disables the resynchronization function.

*RST 1

Key Entry BERT Resync Off On
Bit Error Rate Test (BERT) Commands
Sense Subsystem (:SENSe:BERT[:BASeband])

**:STATe**

Supported N5172B/82B with Option N5180UN7B

:SENSe:BERT[:BASeband]:STATE ON|OFF|1|0
:SENSe:BERT[:BASeband]:STATE?

This command sets the operating state of the bit error rate test (BERT) measurement.

- **ON** This choice enables the BERT measurement.
- **OFF** This choice disables the BERT measurement.
- **RST** 0

Key Entry BERT Off On

**:STOP:CRIteria:EBIT**

Supported N5172B/82B with Option N5180UN7B

:SENSe:BERT[:BASeband]:STOP:CRIteria:EBIT <value>
:SENSe:BERT[:BASeband]:STOP:CRIteria:EBIT?

This command specifies the threshold limit to stop the measurement.

- **RST** 100
- **Range** 0–1000000000
- **Key Entry** Error Count
- **Remarks** When the stop mode criteria is set to EBIT, the signal generator monitors the error bits and when it exceeds the set value, the signal generator stops the current BER measurement and waits for the next trigger.

EBIT must be the selection for this command to work.
To select EBIT refer to “**:STOP:CRIteria[:SELeCt]”.

**:STOP:CRIteria[:SELeCt]**

Supported N5172B/82B with Option N5180UN7B

:SENSe:BERT[:BASeband]:STOP:CRIteria[:SELeCt] EBIT|NONE
:SENSe:BERT[:BASeband]:STOP:CRIteria[:SELeCt]?

This command determines which threshold criteria is used to prematurely stop the measurement.

- **EBIT** This choice enables a specified number of bit errors to prematurely stop the measurement.
- **NONE** This choice disables the stop measurement threshold criteria function.
Bit Error Rate Test (BERT) Commands
Sense Subsystem (:SENSe:BERT[:BASeband])

*:RST

Key Entry   Error Count   No Thresholds

Remarks     The measurement will terminate no later than 200 ms after the threshold is exceeded.

:TBITs

Supported    N5172B/82B with Option N5180UN7B

:SENSe:BERT[:BASeband]:TBITs <value>
:SENSe:BERT[:BASeband]:TBITs?

This command specifies the total bit count to be measured in one measurement cycle.

*RST    +10000

Range    100–4294967295

Key Entry   Total Bits

:TRIGger:BDELay

Supported    N5172B/82B with Option N5180UN7B

:SENSe:BERT[:BASeband]:TRIGger:BDELay <value>
:SENSe:BERT[:BASeband]:TRIGger:BDELay?

This command specifies the number of bits to delay the trigger signal.

*RST    0

Range    0–65535

Key Entry   Delay Bits

Remarks     This command is valid only when the trigger bit delay function is on. Refer to ":TRIGger:BDELay:STATe".

:TRIGger:BDELay:STATe

Supported    N5172B/82B with Option N5180UN7B

:SENSe:BERT[:BASeband]:TRIGger:BDELay:STATe ON|OFF|1|0
:SENSe:BERT[:BASeband]:TRIGger:BDELay:STATe?

This command sets the operating state of the trigger delay function.

ON     This choice enables the trigger delay function.
OFF    This choice disables the trigger delay function.

*RST    0

Key Entry   Bit Delay Off On

Keysight CXG, EXG, and MXG X-Series Signal Generators SCPI Command Reference 473
Bit Error Rate Test (BERT) Commands
Sense Subsystem (:SENSe:BERT[:BASEband])

Remarks
This command needs to be set to ON before the number of bits for the trigger delay can be set. Refer to “:TRIGger:BDELay”.

:TRIGger:COUNt

Supported N5172B/82B with Option N5180UN7B

:SENSe:BERT[:BASEband]:TRIGger:COUNt <value>
:SENSe:BERT[:BASEband]:TRIGger:COUNt?

This command sets the number of times the bit error rate test (BERT) measurements will repeat.

*RST 1
Range 0–65535
Key Entry Cycle Count
Remarks With 0 set, the BER measurements are repeated until you set the BERT operating state is set to off. Refer to “:STATE” on page 472.

:TRIGger:EXTernal[:SOURce]

Supported N5172B/82B with Option N5180UN7B

:SENSe:BERT[:BASEband]:TRIGger:EXTernal[:SOURce]?

This command selects the external trigger source.

Trigger 1 This choice allows you to trigger the BER measurement with the rear panel TRIG 1 connector.
Trigger 2 This choice allows you to trigger the BER measurement with the rear panel TRIG 2 connector.
Pulse This choice allows you to trigger the BER measurement with the rear panel PULSE connector.
*RST Trigger 1
Key Entry BERT Trigger EXT Trigger 1 Trigger 2 Pulse

:TRIGger:POLarity

Supported N5172B/82B with Option N5180UN7B

:SENSe:BERT[:BASEband]:TRIGger:POLarity POSitive|NEGative
:SENSe:BERT[:BASEband]:TRIGger:POLarity?

This command selects the polarity of the trigger signal.
Bit Error Rate Test (BERT) Commands
Sense Subsystem (:SENSe:BERT[:BASEband])

| POSitive | This choice triggers on the rising edge of the input data signal. |
| NEGaive | This choice triggers on the falling edge of the input data signal. |
| *RST | POS |

Key Entry

| Aux I/O Trigger Polarity | Pos Neg |

:TRIGger[:SOURce]

**Supported**
N5172B/82B with Option N5180UN7B

:SENSe:BERT[:BASEband]:TRIGger[:SOURce] IMMEDIATE|KEY|EXT|BUS|AUX

:SENSe:BERT[:BASEband]:TRIGger[:SOURce]?

This command selects the triggering type for starting the bit error rate test (BERT) measurements.

| IMMEDIATE | This choice begins the measurement directly after synchronization has been achieved. |
| KEY | This choice begins the measurement when the front panel Trigger key is pressed, provided that synchronization has been achieved. If synchronization has not occurred, the trigger is ignored. |
| EXT | This choice begins the measurement as soon as a trigger signal is applied to the rear panel connector provided that synchronization has been achieved. If synchronization has not occurred, the trigger is ignored. |
| BUS | This choice enables GPIB triggering using the *TRG or GET command or LAN and RS-232 triggering using the *TRG command. |
| AUX | This choice triggers an event using the rear panel AUX I/O connector pin #19. Refer to the X-Series Signal Generators User's Guide. |
| *RST | KEY |

Key Entry

| Immediate | Trigger Key | Ext | Bus | Aux I/O |
Bit Error Rate Test (BERT) Commands
Sense Subsystem (:SENSe:BERT[:BASEband])
8 Digital Signal Interface Module Commands

With firmware version B.01.75 or later, the following options have changed to a new eight-digit format:

- Option 302 to Option N5180302B
- Option 320 to Option N5180320B
- Option 403 to Option N5180403B
- Option 430 to Option N5180430B
- Option 431 to Option N5180432B
- Option 432 to Option N5180431B
- Option UN7 to Option N5180UN7B

Only software options are changed to the eight-digit format. Hardware options remain with three-digits.

For Keysight N5172B/82B X-Series signal generators with firmware version B.01.70 or later installed, before using the Keysight N5102A Digital Signal Interface Module commands, ensure that the proper baseband operating mode choice is selected. For more information see “:OPERating:MODE” on page 120

This chapter describes SCPI commands used by Keysight X-Series signal generators with Option 003, or 004, or both along with the N5102A module.

This chapter contains the following sections:

- “Digital Subsystem—Option 003 and 004 (:SOURce)” on page 478
Digital Subsystem—Option 003 and 004 ([:SOURce])

:DIGital:CLOCk:CPS 1|2|4

Supported N5172B/82B with Option 003 or 004 or both

This command selects the number of clock cycles per sample. The command is used with parallel or parallel interleaved port configurations. If this command is executed with a serial port configuration or an IF signal type, the parameter value is changed, but it is not used by the interface module until the port configuration is changed to parallel or parallel interleaved, and the signal type is changed to IQ.

The query returns the currently set value. Regardless of the port configuration, you must query all four states (clocks per sample, port configuration, data direction, and signal type) to know the interface module’s current setup.

Example

:DIG:CLOC:CPS 2

The preceding example sets two clock cycles for each sample.

*RST 1

Range 1, 2, or 4

Key Entry Clocks Per Sample

:DIGital:CLOCk:PHAS

Supported N5172B/82B with Option 003 or 004 or both

This command sets the phase for the clock relative to the leading edge transition of the data. At 0 degrees the clock and leading edge of the data signal are aligned. Any phase value between 0 and 360 degrees can be used in the command, however, the signal generator rounds up or down to get 90, 180, 270 and 0 degree settings. For example, entering 140 degrees will cause the signal generator to use the 180 degree setting.

If this command is executed when the clock rate is less than 10 MHz or greater than 200 MHz, the resolution changes to 180 degrees, and the maximum phase defaults to 180 degrees.

Example

:DIG:CLOC:PHAS 90DEG
The preceding example sets the clock phase to 90 degrees. The clock signal leading edge transition will be delayed by 1/4 of a clock period relative to the leading edge data transition.

*RST +0.00000000E+000
Range 0 – 360 deg

Key Entry Clock Phase

**:DIG:LOCK:POLarity**

**Supported** N5172B/82B with Option 003 or 004 or both

**:DIG:LOCK:POLarity** POSitive|NEGative
**:DIG:LOCK:POLarity?**

This command sets the alignment for the clock signal to positive or negative. Positive selects the leading edge transition of the clock signal to align with the leading edge data transition and negative selects the falling edge transition of the clock signal to align with the leading edge of the data.

**Example**

**:DIG:LOCK:POL NEG**

The preceding example sets the clock falling edge transition to align with the leading edge data transition.

*RST POS

Key Entry Clock Polarity

**:DIG:LOCK:RATE**

**Supported** N5172B/82B with Option 003 or 004 or both

**:DIG:LOCK:RATE** <value>
**:DIG:LOCK:RATE?**

This command sets the clock rate. If an external clock is used, the rate set with this command must match the external clock rate. Only clock phase settings of 0 or 180 degrees are valid for a clock rate setting below 10 MHz. The variable <value> is a expressed in hertz.

**Example**

**:DIG:LOCK:RATE 100MHZ**

The preceding example sets the clock rate to 100 megahertz.

*RST +1.00000000E+008
Range 1 kHz–200 MHz

Key Entry Clock Rate
:DIG:_CLOCK:REF:FREQ

**Supported**  N5172B/82B with Option 003 or 004 or both

:DIG:_CLOCK:REF:FREQ <freq>
:DIG:_CLOCK:REF:FREQ?

This command allows you to specify the frequency of the external reference supplied to the Freq Ref connector. This command is valid only when the clock source is set to internal.

If this command is executed when the clock source is not set to internal, the parameter value is changed, but it is not used by the signal generator until the clock source is changed to internal.

Because a query returns the currently set value, regardless of the clock source, you must query both states (reference frequency and clock source) to know the signal generator's current setup.

**Example**

:DIG:CLOC:REF:FREQ 50MHZ

The preceding example specifies a 50 megahertz external reference frequency.

* RST  +1.00000000E+007
Range  1 MHz–100 MHz
Key Entry  Reference Frequency

:DIG:_CLOCK:SKEW

**Supported**  N5172B/82B with Option 003 or 004 or both

:DIG:_CLOCK:SKEW <value>
:DIG:_CLOCK:SKEW?

This command sets the clock signal skew value. The skew is a fine-tune adjustment for the course tune clock phase function and helps to align the clock with valid data states. This is useful at high clock rates and available only for clock frequencies above 10 megahertz. The variable <value> is a expressed in nanoseconds.

**Example**

:DIG:CLOC:SKEW 2NS

The preceding example sets the clock skew to 2 nanoseconds.

* RST  +0.00000000E+000
Range  –5ns to 5ns
Key Entry  Clock Skew
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([:SOURce])

**:DIGital:CLOCk:SOURce**

**Supported** N5172B/82B with Option 003 or 004 or both

**:DIGital:CLOCk:SOURce** INTernal|EXTernal|DEVice

**:DIG:CLOC:SOURCe?**

This command selects one of three possible clock sources.

**Example**

**:DIG:CLOC:SOUR DEV**

The preceding example uses the “Device Interface Connector” input clock.

*RST INT

**Key Entry** Clock Source

**:DIGital:DATA:ALIGnment**

**Supported** N5172B/82B with Option 003 or 004 or both

**:DIGital:DATA:ALIGnment** MSB|LSB

**:DIGital:DATA:ALIGnment?**

This command selects the bit alignment for a word less than 16 bits in length. The MSB (most significant bit) selection maintains the MSB of the word on the same data line while the LSB (least significant bit) will move depending on the word size. The opposite effect occurs when the alignment is set to LSB.

**Example**

**:DIG:DATA:ALIG MSB**

The preceding example sets the MSB word format.

*RST LSB

**Key Entry** Word Alignment

**:DIGital:DATA:BORDer**

**Supported** N5172B/82B with Option 003 or 004 or both

**:DIGital:DATA:BORDer** MSB|LSB

**:DIGital:DATA:BORDer?**

This command selects the bit order for data transmitted through the N5102A module. Data can be in least significant (LSB) bit first or most significant (MSB) bit first.

**Example**

**:DIG:DATA:BORD MSB**

The preceding example specifies data in MSB first format.
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([SOURce])

:DIG:DATA:DIR

Supported  N5172B/82B with Option 003 or 004 or both

:DIG:DATA:DIR OUTPut|INPut
:DIG:DATA:DIR?

This command selects an input or output direction for data flow through the N5102A module.

Example
:DIG:DATA:DIR INP

The preceding example selects input as the direction of data flow.

:DIG:DATA:INE

Supported  N5172B/82B with Option 003 or 004 or both

:DIG:DATA:INE OFF|ON|0|1
:DIG:DATA:INE?

This command enables or disables the negation of the I data sample. Negation changes the sample by expressing it in two's complement form, multiplying by negative one, and converting back to the selected numeric format. This can be done for I samples, Q samples, or both.

The sample or word represents a quantized analog voltage level. This analog voltage can be added or multiplied. For a 16-bit sample, the range is from 0 to 65535 in offset binary or -32768 to +32767 in 2's complement mode.

Example
:DIG:DATA:INE ON

The preceding example enables negation of the I data.
:DIGital:DATA:INPut:ATTen:AUTO

Supported N5172B/82B with option 004

:DIG:DATA:INP:ATT: AUTO ON|OFF|1|0
:DIG:DATA:INP:ATT: AUTO?
:DIG:DATA:INP:ATT <value><unit>
:DIG:DATA:INP:ATT?

This command selects Manual mode or Auto mode for the DSIM input attenuation.

When Auto mode is selected, the signal generator automatically optimizes the attenuation for the current conditions. When the Manual mode is selected, attenuation is the active function. The value entered sets the attenuation.

Example

:DIG:DATA:INP:ATT: 20

The preceding example sets the DSIM input attenuation to 20 dB.

*RST Auto

Range 0.00 to 50.00

Key Entry Input Atten

:DIG:DATA:INP:ATT: LEVel

Supported N5172B/82B with option 004

:DIG:DATA:INP:ATT: MODE DEFault|MANual
:DIG:DATA:INP:ATT: MODE?
:DIG:DATA:INP:ATT: LEVel <unit>
:DIG:DATA:INP:ATT: LEVel?

This command specifies the expected value of the IQ input signal.

Example

:DIG:DATA:INP:ATT: LEV 100MV

The preceding example sets the input attenuation to 100 mV.

*RST Default

Range 50.0 to 1.000 V

Key Entry Input Atten Level


Supported N5172B/82B with option 004

:DIG:DATA:INP:BASeband:FREQuency:OFFSet <value><unit>
:DIG:DATA:INP:BASeband:FREQuency:OFFSet?
This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed-through is not in the center.

Keysight X-Series vector signal generators provide automatic DAC over-range protection when the offset value is something other than 0 Hz. It scales down the playing I/Q data by 1/square root of 2.

**NOTE**

When setting Baseband Frequency Offset to a non-zero value and then back to a 0 value, the waveform will be at a random phase (and scaled down to avoid DAC over range). The Baseband Frequency Offset Phase Reset must be used to truly restore to a pre-frequency offset setup.

Also note that when using Baseband Frequency Offset to shift part of a signal outside of the flat bandwidth, DAC overrange errors may occur.

**Example**

```
:DIG:DATA:INP:BAS:FREQ:OFFS 10HZ
```

The preceding example sets the baseband frequency offset to 10 Hz.

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>*RST</td>
<td>+0.00000000E+000</td>
</tr>
<tr>
<td>Range</td>
<td>+8.0E7 to –8.0E7 Hz</td>
</tr>
<tr>
<td>Baseband Frequency Offset</td>
<td></td>
</tr>
</tbody>
</table>

```
```

This command clears the phase accumulation resulting in a phase shift of zero.

When the Baseband Frequency Offset is non-zero, the hardware rotator accumulates phase-shift of the baseband signal. This residual phase remains even after the offset value is returned to zero.

While there is a non-zero residual phase present in the signal, the DAC Over-Range Protection feature will automatically prevent DAC overrange errors from occurring by scaling the signal down by 1/square root of 2.

```
:DIGital:DATA:INPut:FILTer:ALPHa
```

This command changes the Nyquist or root Nyquist filter’s alpha value.
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([:SOURce])

The filter alpha value can be set to a minimum level (0), a maximum level (1), or in between by using fractional numeric values (0.001–0.999).

**Example**

`:DIG:DATA:INP:FILT:ALPH 1`

The preceding example sets the filter alpha value to the maximum value of 1.

*RST* 0.500

Range 0.000 to 1.000

**Key Entry** Filter Alpha

`:DIG:DATA:INP:FILT:BBT`

**Supported** N5172B/82B with option 004

`:DIG:DATA:INP:FILT:BBT <value>`

`:DIG:DATA:INP:FILT:BBT?`

This command changes the bandwidth-multiplied-by-bit-time (BbT) filter parameter of the selected Gaussian filter.

The filter BbT value can be set to the maximum level (1) or in between the minimum level (0.100) and maximum level by using fractional numeric values (0.101–0.999).

**Example**

`:DIG:DATA:INP:FILT:BBT 1`

The preceding example sets the filter BbT value to the maximum value of 1.

*RST* 0.500

Range 0.000 to 1.000

**Key Entry** Filter Alpha
:DIGital:DATA:INPut:FILTer

**Supported**  N5172B/82B with option 004

:DIGital:DATA:INPut:FILTer
RNYQuist|NYQuist|GAUSsian|IS95|IS95_EQ|IS95_MOD|IS95_MOD_EQ|"<User FIR>"|WCDMA|RECTangle|EDGE|EDGE_Wide|EDGE_HSR|APCO_25_C4FM

This command selects the pre-modulation filter type.

<table>
<thead>
<tr>
<th>Filter Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RNYQuist</td>
<td>This choice selects a Root Nyquist (root raised cosine) filter. This filter is adjusted using Alpha.</td>
</tr>
<tr>
<td>NYQuist</td>
<td>This choice selects a Nyquist (raised cosine) filter. This filter is adjusted using Alpha.</td>
</tr>
<tr>
<td>GAUSsian</td>
<td>This choice selects a Gaussian filter which is adjusted using Bbt values.</td>
</tr>
<tr>
<td>IS95</td>
<td>This choice selects a filter that meets the criteria of the IS-95 standard.</td>
</tr>
<tr>
<td>IS95_EQ</td>
<td>This choice selects a filter which is a combination of the IS-95 filter (above) and the equalizer filter described in the IS-95 standard. This filter is only used for IS-95 baseband filtering.</td>
</tr>
<tr>
<td>IS95_MOD</td>
<td>This choice selects a filter that meets the criteria of the IS-95 error function (for improved adjacent channel performance) with lower passband rejection than the filter specified in the IS-95 standard.</td>
</tr>
<tr>
<td>IS95_MOD_EQ</td>
<td>This choice selects a filter which is a combination of the equalizer filter described in the IS-95 standard and a filter that meets the criteria of the IS-95 error function (for improved adjacent channel performance), with lower passband rejection.</td>
</tr>
<tr>
<td>&quot;&lt;user FIR&gt;&quot;</td>
<td>This variable is any filter file that you have stored into memory. Refer to “File Name Variables” on page 43 for information on the file name syntax.</td>
</tr>
<tr>
<td>WCDMA</td>
<td>This choice selects the W-CDMA filter, which is the equivalent of a root Nyquist filter with an Alpha value of 0.22.</td>
</tr>
<tr>
<td>Rectangle</td>
<td>This choice selects a one-symbol-wide rectangular filter.</td>
</tr>
<tr>
<td>EDGE</td>
<td>This choice selects a linearized Gaussian filter as defined in GSM 05.04.</td>
</tr>
<tr>
<td>EDGE_Wide</td>
<td>This choice selects an EDGE spectrally wide pulse shape filter as per 3GPP TS 45.004.</td>
</tr>
</tbody>
</table>
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([:SOURce])

**EDGE_HSR**  This choice selects an EDGE high symbol rate spectrally narrow pulse shape filter as per 3GPP TS 45.004

**APCO_25_C4FM**  This choice selects a predefined Nyquist filter with alpha of 0.2 combined with a shaping filter. This satisfies the requirements of ITIA/EIA 102.BAAA Sec-9 for the APCO-25 Common Air Interface.

**Example**

`:DIG:DATA:INP:FILT Nyquist`

The preceding example selects the Nyquist filter.

```
*RST RNYQ
```

**Key Entry**

<table>
<thead>
<tr>
<th>Root Nyquist</th>
<th>Nyquist</th>
<th>Gaussian</th>
<th>IS-95</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS-95 w/EQ</td>
<td>IS-95 Mod</td>
<td>IS-95 Mod w/EQ</td>
<td></td>
</tr>
</tbody>
</table>

**User FIR**  | **WCDMA**  | **Rectangle**  | **EDGE**

**EDGE**  | **EDGE**  | **APCO 25 C4FM**

**Wide**  | **HSR**  |

**:DIG:DATA:INP:FILTER:CHANnel**

**Supported**  N5172B/82B with option 004

**:DIG:DATA:INP:FILTER:CHANnel EVM|ACP**

**:DIG:DATA:INP:FILTER:CHANnel?**

This command optimizes the Nyquist and root Nyquist filters to minimize error vector magnitude (EVM) or to minimize adjacent channel power (ACP).

**EVM**  This choice provides the most ideal passband.

**ACP**  This choice improves stopband rejection.

**Example**

**:DIG:DATA:INP:FILT:CHAN EVM**

The preceding example selects error vector magnitude.

```
*RST EVM
```

**Key Entry**  Optimize FIR for EVM

**:DIG:DATA:INP:IQ:SCALe**

**Supported**  N5172B/82B with option 004
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([::SOURce])

`:DIGital:DATA:INPut:IQ:SCALe <value>
`:DIGital:DATA:INPut:IQ:SCALe?`

This command sets the amplitude of the I/Q outputs for better adjacent channel power (ACP); lower scaling values equate to better ACP.

The variable `<value>` is expressed in units of percent.

**Example**

`:DIG:DATA:INP:IQ:SCAL 30`

The preceding example sets the amplitude of the I/Q outputs to 30%.

*RST 100
Range 1 to 100
Key Entry I/Q Scaling


**Supported** N5172B/82B with option 004

`:DIGital:DATA:INPut:MDEStination:AAMPlitude NONE|M1`

`:DIGital:DATA:INPut:MDEStination:AAMPlitude?

This command opens a menu in which you can select a marker to select the alternate amplitude functionality.

Further setups need to be done in the Amplitude > Alternate Amplitude menu to use the functionality.

**Example**

`:DIGital:DATA:INPut:MDES:AAMP M1`

The preceding example routes marker 1 to Alternate Amplitude.

*RST None
Key Entry Alternate Amplitude

`:DIGital:DATA:INPut:MDEStination:ALCHold

**Supported** N5172B/82B with option 004

`:DIGital:DATA:INPut:MDEStination:ALCHold NONE|M1`

`:DIGital:DATA:INPut:MDEStination:ALCHold?


Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([:SOURce])

Opens a menu in which you can select a marker to enable the automatic leveling control (ALC) hold function (or select None to disable the hold feature). The hold selection remains until you reconfigure it, press the Preset key, or cycle the signal generator power.

**CAUTION**

Incorrect ALC settings can cause a sudden unleveled condition to occur. An unleveled RF output can damage a DUT or connected instrument. Ensure that you set markers such that the ALC obtains a sample that accounts for the high power levels within the signal.

**Example**

[:DIGital:DATA:INPut:MDES:ALCH M1]

The preceding example routes marker 1 to ALC Hold.

* RST None

Key Entry ALC Hold

[:DIGital:DATA:INPut:MDEStination:PULSe]

Supported N5172B/82B with option 004

[:DIGital:DATA:INPut:MDEStination:PULSe NONE|M1]

[:DIGital:DATA:INPut:MDEStination:PULSe?]

Opens a menu in which you can select a marker for the Pulse/RF blanking function.

ALC Hold is automatically enabled during RF output blanking.

**Example**

[:DIGital:DATA:INPut:MDES:PULS M1]

The preceding example routes marker 1 to Pulse.

* RST None

Key Entry Pulse/RF Blank

[:DIGital:DATA:INPut:MPOLarity:MARKer1]

Supported N5172B/82B with option 004

[:DIGital:DATA:INPut:MPOLarity:MARKer1 NORMal|INVerted]

[:DIGital:DATA:INPut:MPOLarity:MARKer1?]

Selects whether marker 1 polarity is inverted or not.

**Example**

[:DIG:DATA:INP:MPOL:MARK NORM]

The preceding example sets the marker 1 polarity as not inverted.
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([:SOURce])

*RST       Normal
Key Entry   Marker 1 Polarity Normal/Invert
:DIGital:DATA:INPut:NOISe:BANDwidth

**Supported**  
N5172B/82B with option 004

:DIGital:DATA:INPut:NOISe:BANDwidth <value><unit>
:DIGital:DATA:INPut:NOISe:BANDwidth?

This command selects the flat noise bandwidth value of the real–time noise for an ARB waveform. Typically, this value is set slightly wider than the signal bandwidth. The minimum increment value is 0.001 Hz.

**Example**

:DIG:DATA:INP:NOIS:BAND 8MHZ

The preceding example sets the flat noise bandwidth to 8 MHz.

*RST  
+1.00000000E+000

**Range**  
1 Hz to 160 MHz (depends on the installed baseband generator option)

**Key Entry**  
Flat Noise Bandwidth

:DIGital:DATA:INPut:NOISe:CBRate

**Supported**  
N5172B/82B with option 004

:DIGital:DATA:INPut:NOISe:CBRate <1bps - 999Mbps>
:DIGital:DATA:INPut:NOISe:CBRate?

This command sets a value of the carrier bit rate (gross bit rate) for purposes of calculating the Eb/N0 (energy per bit over noise power density at the receiver). When the carrier to noise ratio format is set to Eb/N0 (refer to the :DIGital:DATA:INPut:NOISe:CNFormat command), the adjustment of the carrier bit rate will have an immediate impact on the carrier to noise ratio as specified by Eb/N0. The carrier bit rate is derived from the symbol rate and bits per symbol of the modulation. The carrier bit rate is a saved instrument state that is recorded in the waveform header.

The query returns the current carrier bit rate setting.

**Example**

:DIG:DATA:INP:NOIS:CBR 5

The preceding example sets the carrier bit rate to 5 bps.

**Default**  
1.000 bps

**Range**  
1 bps to 999 Mbps

**Key Entry**  
Carrier Bit Rate
:DIGital:DATA:INPut:NOISe:CBWidth

**Supported**  N5172B/82B with option 004

:DIGital:DATA:INPut:NOISe:CBWidth <value><unit>

:DIGital:DATA:INPut:NOISe:CBWidth?

This command selects the carrier bandwidth over which the additive white gaussian noise (AWGN) is applied. The carrier RMS power and the noise power will be integrated over the selected carrier–bandwidth for the purposes of calculating carrier to noise ratio (C/N). The minimum increment value is 0.001 Hz. For more information, refer to the ":DIGital:DATA:INPut:NOISe[:STATe]" command and the ":DIGital:DATA:INPut:NOISe:BANDwidth" command.

*RST  +1.00000000E+000

Range  1 Hz to 200 MHz

Key Entry  Carrier Bandwidth

:DIGital:DATA:INPut:NOISe:CN

**Supported**  N5172B/82B with option 004

:DIGital:DATA:INPut:NOISe:CN <value><unit>

:DIGital:DATA:INPut:NOISe:CN?

This command sets the carrier to noise ratio (C/N) in dB. The carrier power is defined as the total modulated signal power without noise power added. The noise power is applied over the specified bandwidth of the carrier signal. For more information, refer to :DIGital:DATA:INPut:NOISe:CBWidth.

**Example**

:DIG:DATAN:INP:NOIS:CN 50DB

The preceding example sets the carrier to noise ratio to 50 dB.

*RST  +0.00000000E+000

Range  –100 to 100 dB

Key Entry  Carrier to Noise Ratio

:DIGital:DATA:INPut:NOISe:CNFormat

**Supported**  N5172B/82B with option 004

:DIGital:DATA:INPut:NOISe:CNFormat CN|EBNO

:DIGital:DATA:INPut:NOISe:CNFormat?

This command selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (E_b/N_0) as the variable controlling the ratio of carrier power to noise power in the carrier bandwidth.

**Example**
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([::SOURce])

:DIG:DATA:INP:NOIS:CNF EBNO

The preceding example sets the carrier to noise ratio format to EbNo. Set the EbNo value with the :DIGital:DATA:INPut:NOISe:EBNO command.

**Default**
Carrier to Noise Ratio Format C/N

**Key Entry**
Carrier to Noise Ratio Format  C/N  Eb/No


**Supported**
N5172B/82B with option 004


This command allows the C/N to be set using the Eb/N0 (energy per bit over noise power density at the receiver) form. This requires that the carrier bit rate (:DIGital:DATA:INPut:NOISe:CBRate) be set properly. The range of Eb/N0 is limited to the range that is equivalent to −100 to 100 dB of C/N. This value is only effective when Eb/N0 has been enabled by the :DIGital:DATA:INPut:NOISe:CNFormat command.

The query returns the value of EBNO.

**Example**

:DIG:DATA:INP:NOIS:EBNO

The preceding example enables the direct measurement of the carrier contribution to the total power.

**Default**
0 dB

**Range**
−100 to 100 dB

**Key Entry**
Eb/No

:DIGital:DATA:INPut:NOISe:MUX

**Supported**
N5172B/82B with option 004

:DIGital:DATA:INPut:NOISe:MUX SUM|CARRier|NOISe
:DIGital:DATA:INPut:NOISe:MUX?

This command enables diagnostic control of additive noise, such that only the noise, only the carrier, or the sum of both the noise and the carrier are output from the internal baseband generator. With the ALC off, this feature enables direct measurement of just the carrier or the noise contributions to the total power. The system will still behave as if both the noise and the carrier are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

**Example**

:DIG:DATA:INP:NOIS:MUX CARR
The preceding example enables the direct measurement of the carrier contribution to the total power.

**Default**  
Carrier + Noise

**Key Entry**  
Carrier + Noise | Carrier | Noise

\[:DIGital:DATA:INPut:NOISe:POWer:CARRier\]

**Supported**  
N5172B/82B with option 004

\[:DIGital:DATA:INPut:NOISe:POWer:CARRier <value>\]  
\[:DIGital:DATA:INPut:NOISe:POWer:NOISe:CARRier?\]

This command sets the current carrier power level if noise is on.

In the CARRier control mode, the total power will be adjusted to achieve the specified carrier power and the carrier power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the carrier power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total power is adjusted.

In the NOISe control mode, this will adjust the total noise power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total noise power is adjusted. See also \[:DIGital:DATA:INPut:NOISe:POWer:CONTrol[:MODE]\] and \[:DIGital:DATA:INPut:NOISe:POWer:NOISe:TOTal\] commands.

In the other control modes, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted.

**Range**  
The range varies based on the bounds of the total power that results from the noise settings.

**Default**  
The appropriate value given the current total power and the current Carrier to Noise (C/N).

**Key Entry**  
Carrier Power

\[:DIGital:DATA:INPut:NOISe:POWer:CONTrol[:MODE]\]

**Supported**  
N5172B/82B with option 004

\[:DIGital:DATA:INPut:NOISe:POWer:NOISe:CONTrol[:MODE]TOTal|CARRier|NOISe|NChannel\]  
\[:DIGital:DATA:INPut:NOISe:POWer:NOISe:CONTrol[:MODE]?\]

This command sets the power control to one of the three following modes:
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([:SOURce])

Total  This is the default mode where the total power and C/N are independent variables and the carrier power and total noise power are dependent variables set by the total power, C/N and the rest of the noise settings. The carrier power and total noise power will change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values.

Carrier  In this mode the carrier power and C/N are independent variables and the total power and total noise power are dependent variables set by the carrier power, C/N and the rest of the noise settings. The total power and total noise power will change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values.

Total Noise  In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.

N Channel  In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.

Default  Total

Key Entry  Total  Carrier  Total Noise


Supported  N5172B/82B with option 004


This command sets the power within the channel bandwidth. The instrument power is changed in relation to this setting if AWGN is turned on. The channel noise power is only settable from the front panel when the Power Control mode is set to channel noise power.

The variable <value> is expressed in units of dBm.

The query returns the current noise power across the carrier bandwidth in dBm.

Example

The preceding example sets the power in the channel bandwidth to 10 dBm.

*RST      Depends on model and options.
Key Entry  Channel Noise Power


Supported  N5172B/82B with option 004


This command sets the current total noise power level if noise is on.

In the NOISe control mode, the total power will be adjusted to achieve the specified total noise power and the total noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the total noise power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the total power is adjusted.

In the CARRier control mode, this will adjust the carrier power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the carrier power is adjusted. See also :DIGital:DATA:INPut:NOISe:POWer:CONTROL[:MODE] command.

Range      The range varies based on the bounds of the total power that results from the noise settings.
Default    The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry  Total Noise Power

:DIgital:DATA:INPut:PHASe:NOISe:F1

Supported  N5172B/82B with option 004

:DIgital:DATA:INPut:PHASe:NOISe:F1 <value><unit>
:DIgital:DATA:INPut:PHASe:NOISe:F1?

This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :DIgital:DATA:INPut:PHASe:NOISe:F2 command). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 (:SOURce)

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the User’s Guide.

**NOTE**

The phase noise is added to the base phase noise of the instrument.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>:DIGital:DATA:INPut:PHASe:NOISe:F1:ACTual?</td>
<td>This SCPI command returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.</td>
</tr>
</tbody>
</table>

*RST +1.00000000E+003
Range 0 Hz to 77.500524490 MHz
Key Entry Desired Start Freq (f1)

Supported N5172B/82B with option 004

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :DIGital:DATA:INPut:PHASe:NOISe:F1 command). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the User’s Guide.

**NOTE**

The phase noise is added to the base phase noise of the instrument.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>:DIGital:DATA:INPut:PHASe:NOISe:F2</td>
<td>This command sets the stop frequency value of the flat area for the phase noise impairment.</td>
</tr>
</tbody>
</table>

*RST +3.00000000E+004
Range 1 Hz to 77.500524490 MHz
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([:SOURce])

Key Entry          Desired Stop Freq (f2)


Supported           N5172B/82B with option 004


This SCPI command returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

The phase noise is added to the base phase noise of the instrument.

*RST          +3.00000000E+004

Range       1 Hz to 77.500524490 MHz

Key Entry          Desired Start Freq (f2)

:DIGital:DATA:INPut:PHASe:NOISe:LMID

Supported           N5172B/82B with option 004

:DIGital:DATA:INPut:PHASe:NOISe:LMID <value>

This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator. The actual value can vary by approximately 0.28 dBc/Hz. The effect of this value can be determined by examining the graphic on the front panel or the actual output.

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.

The amplitude range varies depending on the f2 value (see the “:DIGital:DATA:INPut:PHASe:NOISe:F2” on page 497). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.

The phase noise is added to the base phase noise of the instrument.

The range values are expressed in units of dBc/Hz.

*RST          -

          7.00000000E+001
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([:SOURce])

Range -
300 to 100

Key Entry Desired Flat Amplitude (Lmid)

[:DIGit:DATA:INPut:PHASe:NOISe:LMID:ACTual?]

Supported N5172B/82B with option 004

[:DIGit:DATA:INPut:PHASe:NOISe:LMID:ACTual?]

This SCPI command returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

The amplitude range varies depending on the f2 value (see the “[:DIGit:DATA:INPut:PHASe:NOISe:F2” on page 497). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.

The phase noise is added to the base phase noise of the instrument.

The range values are expressed in units of dBC/Hz.

*RST -
7.00000000E+001

Range -
300 to 100

Key Entry Desired Flat Amplitude (Lmid)

::DIGit:DATA:INPut:PHASe:NOISe:TRACe? <startFreq:1 - 100MHz>,<stopFreq:1 - 100MHz>,<numSamples:1 - 8192>

Supported N5172B/82B with option 004

::DIGit:DATA:INPut:PHASe:NOISe:TRACe? <startFreq:1 - 100MHz>,<stopFreq:1 - 100MHz>,<numSamples:1 - 8192>

This SCPI query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the
impairment from the phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBc/Hz.

<table>
<thead>
<tr>
<th>Range</th>
<th>&lt;startFreq&gt;</th>
<th>1 Hz to 100 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;stopFreq&gt;</td>
<td>1 Hz to 100 MHz</td>
</tr>
<tr>
<td></td>
<td>&lt;numSamples&gt;</td>
<td>1 to 8192</td>
</tr>
</tbody>
</table>

:DIGital:DATA:INPut:PHASe:NOISe[:STATe]

Supported
N5172B/82B with option 004

:DIGital:DATA:INPut:PHASe:NOISe[:STATe] ON|OFF|1|0
:DIGital:DATA:INPut:PHASe:NOISe[:STATe]?  

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the User's Guide.

The actual performance of the added phase noise can only be determined by examining the graphic on the front panel or the actual output, as the parameters simply guide the phase noise response.

**NOTE**

The phase noise is added to the base phase noise of the instrument.

*RST Off

Key Entry Phase Noise Off On


Supported
N5172B/82B with option 004

:DIGital:DATA:INPut:NOISe:POWer:NOISe:CHANnel <value>
:DIGital:DATA:INPut:NOISe:POWer:NOISe:CHANnel?

This command sets the current channel noise power level if noise is on. In the "Channel Noise" control mode, the total power will be adjusted to achieve the specified channel noise power and the channel noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the channel noise power setting appropriately to maintain the C/N ratio.

In the other control modes, this will adjust the total power once for the specified channel noise power level, after which the channel noise power could change if any noise parameters are adjusted.

The range varies based on the bounds of the total power that results from the noise settings.
The query returns the current noise power across the carrier bandwidth in dBm.

The variable <value> is expressed in units of dBm.

**Example**


The preceding example sets the channel noise power level to 0 dBm.

*RST  \(-144\)

Range  \(-144\) to 30

**Key Entry**  Channel Noise Power

:DIG:DATA:INP:NOIS[:STATe]

**Supported**  N5172B/82B with option 004

:DIG:DATA:INP:NOIS[:STATe] ON|OFF|1|0

:DIG:DATA:INP:NOIS[:STATe]?

This command enables or disables the real-time noise generator.

**Example**

:DIG:DATA:INP:NOIS[:STAT] ON

The preceding example enables the real-time noise generator.

*RST  Off

**Key Entry**  Real-Time AWGN Off On

:DIG:DATA:IQSWap

**Supported**  N5172B/82B with Option 003 or 004 or both

:DIG:DATA:IQSWap OFF|ON|0|1

:DIG:DATA:IQSWap?

This command enables or disables swapping of the I and Q data. When enabled, the I data is sent to the N5102A’s Q bus and the Q data is sent to the I bus.

**Example**

:DIG:DATA:IQSW ON

The preceding example enables swapping of I and Q data.

*RST  0

**Key Entry**  Swap IQ
:DIGital:DATA:NFORmat

**Supported**
N5172B/82B with Option 003 or 004 or both

:DIGital:DATA:NFORMat TCOMplement|OBINary
:DIGital:DATA:NFORMat?

This command selects the binary format used to represent the transmitted data values. The selections are offset binary or 2’s complement.

**Example**
:DIG:DATA:NFOR OBIN

The preceding example selects the offset binary format to represent data values.

*RST TCOM

**Key Entry**
Numeric Format

:DIGital:DATA:OUTPut:IGain

**Supported**
N5172B/82B with Option 003 or 004 or both

:DIGital:DATA:OUTPut:IGain <value>
:DIGital:DATA:OUTPut:IGain?

This command adjusts the gain of the I data in the N5102A module. The adjustment does not affect the Q data.

The variable <value> is expressed as a percentage based on 100% being equivalent to a gain of 1. The offset is an adjustment to the analog level that is represented by the digital sample. The analog voltage is limited to a 16-bit data sample.

**Example**
:DIG:DATA:OUTP:IG 90

The preceding example sets the I data gain to 90%.

*RST +0.00000000E+000

**Range**
87.5 to 112.5%

**Key Entry**
I Gain

:DIGital:DATA:OUTPut:IOFFset

**Supported**
N5172B/82B with option 003

:DIGital:DATA:OUTPut:IOFFset <value>
:DIGital:DATA:OUTPut:IOFFset?
This command adjusts the DC offset for I data. The command is available for the N5102A module output mode. The variable <value> is expressed as a +/- 100% of the full scale value.

Example

:DIG:DATA:OUTP:IOFF 40

The preceding example sets the I offset to 40% of full scale.

*RST +0.00000000E+000
Range –100 to 100
Key Entry I Offset

:DIG:DATA:OUTP:POLarity:FRAME

Supported N5172B/82B with Option 003 or 004 or both

:DIG:DATA:OUTP:POLarity:FRAME POSitive|NEGative

This command selects the polarity of the frame marker for serial transmission. The frame marker indicates the beginning of each sample or byte of data. The command is valid for serial transmission only.

POS This choice selects a positive polarity. The frame marker is high for the first data sample.

NEG This choice selects a negative polarity. The frame marker is low for the first data sample.

Example

:DIG:DATA:OUTP:POL:FRAM NEG

The preceding example selects a negative polarity for the frame marker.

*RST POS

Key Entry Frame Polarity

:DIG:DATA:OUTP:QGain

Supported N5172B/82B with Option 003 or 004 or both

:DIG:DATA:OUTP:QGain <value>

This command adjusts the gain for Q data in the N5102A module. The adjustment does not affect the I data.

The variable <value> is expressed as a percentage based on 100% being equivalent to a gain of 1. The offset is an adjustment to the analog level that is represented by the digital sample. The analog voltage is limited to a 16-bit data sample.
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([:SOURce])

Example

:DIG:DATA:OUTP:QG 90

The preceding example sets the gain for Q data to 90%.

*RST +0.00000000E+000
Range 87.5 to 112.5%
Key Entry Q Gain

:DIGital:DATA:OUTPut:QOFFset

Supported N5172B/82B with option 003

:DIGital:DATA:OUTPut:QOFFset <value>
:DIGital:DATA:OUTPut:QOFFset?

This command adjusts the DC offset for Q data. The command is available for the N5102A module output mode. The variable <value> is expressed as a +/-100% of the full scale value.

Example

:DIG:DATA:OUTP:QOFF 40

The preceding example sets the Q offset to 40% of full scale.

*RST +0.00000000E+000
Range -100 to 100
Key Entry Q Offset

:DIGital:DATA:OUTPut:ROTation

Supported N5172B/82B with option 003

:DIGital:DATA:OUTPut:ROTation <value>
:DIGital:DATA:OUTPut:ROTation?

This command rotates the IQ data in the IQ plane. This command is valid for the N5102A output mode. The variable <value> is expressed in degrees with a range from 0 to 360.

Example

:DIG:DATA:OUTP:ROT 45

The preceding example rotates the IQ constellation 45 degrees.

*RST +0.00000000E+000
Range 0 to 360
Key Entry Rotation
:DIG:DATA:OUTP:SCAL

Supported: N5172B/82B with option 003

:DIG:DATA:OUTP:SCAL <value>
:DIG:DATA:OUTP:SCAL?

This command enables scaling of the I and Q data to the level indicated by the 
<value> variable. This command is valid for the N5102A output mode. The 
variable <value> is expressed as a percentage.

Example

:DIG:DATA:OUTP:SCAL 50

The preceding example scales the I and Q data amplitude to 50%.

*RST +0.700000000E+002
Range 0 to 100
Key Entry Scaling

:DIG:DATA:OUTP:SSI:BPRF

Supported: N5172B/82B with Option 003 or 004 or both

:DIG:DATA:OUTP:SSI:BPRF <value>
:DIG:DATA:OUTP:SSI:BPRF?

This command sets how many bits of data are output between TXFS inputs for 
SSI output.

Example

:DIG:DATA:OUTP:SSI:BPRF 40

The preceding example sets the number of bits per frame to 40.

Range 1–64
Key Entry SSI Output Bits Per Frame

:DIG:DATA:OUTP:SSI:SDEL

Supported: N5172B/82B with Option 003 or 004 or both

:DIG:DATA:OUTP:SSI:SDEL
:DIG:DATA:OUTP:SSI:SDEL?

This command sets the expected time between the DMCS output being 
asserted and the first TXFS input (during which time the TXFS signal is ignored) 
for SSI output.

Example

:DIG:DATA:OUTP:SSI:SDEL 250
The preceding example sets the delay to 250 $\mu$s.

```
Range  0s–648 $\mu$s
```

**Key Entry**  SSI Output Sync Delay

### :DIGital:DATA:OUTPut:STYPe

**Supported**  N5172B/82B with option 003

```
:DIGital:DATA:OUTPut:STYPe IQ|IF
:DIGital:DATA:OUTPut:STYPe?
```

This command selects the output format for the IQ data. The IQ selection outputs digital I and Q data. Whereas the IF (intermediate frequency) selection modulates the I and Q data onto the IF frequency. The IF is calculated as 1/4 the clock sample rate. This command is valid only for the N5102A output mode.

- **IQ**  This choice outputs I and Q digital data.
- **IF**  This choice outputs a modulated signal.

**Example**

```
:DIG:DATA:STYP IF
```

The preceding example sets the I and Q output data to modulate the intermediate frequency.

```
*RST  IQ
```

**Key Entry**  Signal Type

### :DIGital:DATA:POLarity:IQ

**Supported**  N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:POLarity:IQ POSitive|NEGative
:DIGital:DATA:POLarity:IQ?
```

This command selects the logic level for I and Q data. Positive selects a high logic level at the output as a digital one and negative selects a low logic level at the output as a digital one.

- **POS**  This choice selects a logic high level as digital one.
- **NEG**  This choice selects a logic low level as a digital one.

**Example**

```
:DIG:DATA:POL:IQ NEG
```

The preceding example sets low level logic.

```
*RST  POS
```

**Key Entry**  IQ Polarity
**Digital Signal Interface Module Commands**  
**Digital Subsystem—Option 003 and 004 ([:SOURce])**

`:DIGital:DATA:QNEGate`

**Supported** N5172B/82B with Option 003 or 004 or both

`:DIGital:DATA:QNEGate OFF|ON|0|1`  
`:DIGital:DATA:QNEGate?`

This command enables or disables the negation of the Q data sample. Negation changes the sample by expressing it in two's complement form, multiplying by negative one, and converting back to the selected numeric format.

The sample or word represents a quantized analog voltage level. This analog voltage can be added or multiplied. For a 16-bit sample, the range is from 0 to 65535 in offset binary or -32768 to +32767 in 2's complement mode.

**Example**

`:DIG:DATA:QNEG ON`  
The preceding example enables negation of the Q data.

* RST 0

**Key Entry** Negate Q Data

`:DIGital:DATA:SIZE`

**Supported** N5172B/82B with Option 003 or 004 or both

`:DIGital:DATA:SIZE <value>`  
`:DIGital:DATA:SIZE?`

This command selects the number of bits in each sample. A sample can have a maximum word length of 16 bits.

**Example**

`:DIG:DATA:SIZE 8`  
The preceding example sets the sample word size to eight bits.

* RST +1.600000000E+001

**Range** 4–16

**Key Entry** Word Size

`:DIGital:DATA:TYPE`

**Supported** N5172B/82B with Option 003 or 004 or both

`:DIGital:DATA:TYPE SAMPles|PFSamples`  
`:DIGital:DATA:TYPE?`

This command selects filtered baseband data or unfiltered baseband data as the transmitted data type.
If this command is executed while an ARB modulation format is active, the parameter choice is changed, but it is not used by the interface module until a real-time modulation format is turned on.

Because a query returns the current choice, regardless of whether or not an ARB format is active, you must query both states (data type and the modulation format) to know the signal generator’s current setup.

**Example**

```
:DIG:DATA:OUTP:TYPE PFS
```

The preceding example sets the data type to pre-filtered I and Q data.

**Key Entry**

- **Data Type**
- **SAMP**
- **PFS**

**:DIGital:DIAGnostic:LOOPback**

**Supported**

N5172B/82B with Option 003 or 004 or both

```
:DIGital:DIAGnostic:LOOPback? DIGBus|CABLe|N5102A|DEVice
```

This command selects and executes a loop back test that validates the integrity of digital data.

**Example**

```
:DIG:DIAG:LOOP? DEV
```

The preceding example runs the diagnostic test on the Single Ended IO Dual 40 Pin device and returns a pass or fail condition.
:DIGital:LOGic[:TYPE]

**Supported** N5172B/82B with Option 003 or 004 or both

:DIGital:LOGic[:TYPE]
LVDS|LVTT1|CMOS15|CMOS18|CMOS25|CMOS33|SSI
:DIGital:LOGic[:TYPE]?

This command selects the logic data type used by the device being tested.

- **LVDS** This choice selects low voltage differential signaling as the logic data type.
- **LVTT1** This choice selects a low voltage TTL signal as the logic data type.
- **CMOS15** This choice selects a 1.5 volt CMOS signal as the logic data type.
- **CMOS18** This choice selects a 1.8 volt CMOS signal as the logic data type.
- **CMOS25** This choice selects a 2.5 volt CMOS signal as the logic data type.
- **CMOS33** This choice selects a 3.3 volt CMOS signal as the logic data type.
- **SSI** This key sets the logic type of the device interface to SSI (simple serial interface). This logic type uses single ended I/O and a 3.3 V supply.

**Example**

:DIG:LOG CMOS15
The preceding example selects 1.5 volt CMOS as the logic data type.

**Key Entry** Logic Type

:DIGital:PCONfig

**Supported** N5172B/82B with Option 003 or 004 or both

:DIGital:PCONfig PARallel|SERial|PINTIQ|PINTQI
:DIGital:PCONfig?

This command selects the data transmission type used for communication between the N5102A module and the device under test.

- **PARallel** This choice selects parallel data transmission.
- **SERial** This choice selects serial data transmission.
Digital Signal Interface Module Commands
Digital Subsystem—Option 003 and 004 ([:SOURce])

PINTIQ  This choice selects parallel interleaving data transmission. The I data is transmitted on the rising clock edge and the Q data on the falling edge.

PINTQI  This choice selects parallel interleaving data transmission. The Q data is transmitted on the rising clock edge and the I data on the falling edge.

Example
:DIG:PCON PINTQI
The preceding example selects parallel interleaving format

*RST  PAR
Key Entry  Port Config

:DIGital:PRESet:PTHRough

Supported  N5172B/82B with Option 003 or 004 or both

:DIGital:PRESet:PTHRough
This command sets up the preset condition for the N5102A module and allows transmission of data through the module with no modifications. The command is valid only when a modulation format is active.

Example
:DIG:PRES:PTHR
The preceding example sets the N5102A module to a preset condition and allows data to pass through unmodified.

Key Entry  Pass Through Preset

:DIGital[:STATe]

Supported  N5172B/82B with Option 003 or 004 or both

:DIGital[:STATe]  0|1|OFF|ON
:DIGital[:STATe]?

This command enables or disables the operating state of the N5102A module.

Example
:DIG ON
The preceding example turns on the N5102A module.

*RST  OFF
Key Entry  N5102A Off On
# 9 Real-Time Commands

With firmware version B.01.75 or later, the following options have changed to a new eight-digit format:

- Option 302 to Option N5180302B
- Option 320 to Option N5180320B
- Option 403 to Option N5180403B
- Option 430 to Option N5180430B
- Option 431 to Option N5180432B
- Option 432 to Option N5180431B
- Option UN7 to Option N5180UN7B

Only software options are changed to the eight-digit format. Hardware options remain with three-digits.

This chapter describes SCPI commands used by Keysight X-Series signal generators for real–time signal generation during either component or receiver test.

This chapter contains the following sections:

- **All Subsystem ([SOURce]:RADio)** on page 512
- **AWGN Real–Time Subsystem–Option N5180403B ([SOURce]:RADio:AWGN:RT)** on page 513
- **Custom Subsystem–Option N5180431B ([SOURce]:RADio:CUSTom)** on page 516
- **Fsimulator Subsystem–Option 660 ([SOURce])** on page 549
- **Phase Noise Subsystem–Option N5180432B ([SOURce]:RADio:PHASe:NOISe)** on page 550
Real-Time Commands
All Subsystem ([:SOURce]:RADio)

All Subsystem ([:SOURce]:RADio)

:ALL:OFF

**Supported**
N5166B/72B/82B

[:SOURce]:RADio:ALL:OFF

This command turns off all digital modulation formats.

**Remarks**
This command does not affect analog modulation.
Real-Time Commands
AWGN Real–Time Subsystem–Option N5180403B ([:SOURce]:RADio:AWGN:RT)

AWGN Real–Time Subsystem–Option N5180403B ([:SOURce]:RADio:AWGN:RT)

:BWIDth

Supported N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:AWGN:RT:BANDwidth|BWIDth <value>
[:SOURce]:RADio:AWGN:RT:BANDwidth|BWIDth?

This command adjusts the flat bandwidth of the real–time AWGN waveform. The variable <value> is expressed in units of Hertz (Hz–MHz).

*RST +1.00000000E+006

Range
Option 653 1 Hz to 60 MHz
Option 655 1 Hz to 120 MHz
Option 656 1 Hz to 80 MHz
Option 657 1 Hz to 160 MHz

Key Entry Bandwidth

:CBWidth

Supported N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:AWGN:RT:CBWidth <value>
[:SOURce]:RADio:AWGN:RT:CBWidth?

This command sets the channel bandwidth, or the portion of the bandwidth specified by the bandwidth ratio. The variable <value> is expressed in units of Hertz (Hz–MHz).

*RST +1.00000000E+006

Range 1 to the Option 65x maximum bandwidth, not to exceed the flat noise bandwidth

Key Entry Bandwidth

:IQ:MODulation:ATTen

Supported N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:AWGN:RT:IQ:MODulation:ATTen <value>
[:SOURce]:RADio:AWGN:RT:IQ:MODulation:ATTen?

This command attenuates the I/Q signals being modulated through the signal generator's RF path.
Real-Time Commands

AWGN Real-Time Subsystem—Option N5180403B ([SOURce]:RADio:AWGN:RT)

The variable <value> is expressed in units of decibels (dB).

*RST  
Varies (instrument dependent)

Range  
0 to 50

Key Entry  
Modulator Atten Manual Auto

**:IQ:**MODulation:**ATTen:**AUTO

**Supported**  
N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:AWGN:RT:**IQ:**MODulation:**ATTen:**AUTO ON|OFF|1|0  
[:SOURce]:RADio:AWGN:RT:**IQ:**MODulation:**ATTen:**AUTO?

This command enables or disables the I/Q attenuation auto mode.

ON (1)  
This choice enables the attenuation auto mode which optimizes the modulator attenuation for the current conditions.

OFF (0)  
This choice holds the attenuator at its current setting or at a selected value. Refer to “**:IQ:**MODulation:**ATTen**” on page 513 for setting the attenuation value.

*RST  
1

Key Entry  
Modulator Atten Manual Auto

**:POWer:**CONTrol

**Supported**  
N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:AWGN:RT:**POWer:**CONTrol[:MODE] TOTal|NCHannel  
[:SOURce]:RADio:AWGN:RT:**POWer:**CONTrol[:MODE]?

This command selects whether the instrument power is set by the displayed instrument power or the channel noise power when the AWGN is turned on.

TOTal  
This choice selects the displayed instrument power for control.

NChannel  
This choice selects the channel noise power for control. The channel noise power is only settable from the front panel when the Power Control mode is set to channel noise power.

*RST  
TOTal

Key Entry  
Power Control Mode Total Nchannel

**:POWer:**NOISe:**CHANnel

**Supported**  
N5166B/72B/82B with Option N5180403B
Real-Time Commands
AWGN Real–Time Subsystem–Option N5180403B [:SOURce]:RADio:AWGN:RT

[:SOURce]:RADio:AWGN:RT:POWer:NOISe:CHANnel <value>
[:SOURce]:RADio:AWGN:RT:POWer:NOISe:CHANnel?

This command sets the power within the channel bandwidth. The instrument power is changed in relation to this setting if AWGN is turned on. The channel noise power is only settable from the front panel when the Power Control mode is set to channel noise power.

The variable <value> is expressed in units of dBm.

* RST Depends on model and options.
Key Entry Channel Noise Power

:RATio

Supported N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:AWGN:RT:RATio <value>
[:SOURce]:RADio:AWGN:RT:RATio?

This command sets the amount of channel bandwidth compared to the amount of flat bandwidth.

The variable <value> is expressed in units of Hertz (Hz–MHz).

* RST 1.0
Key Entry Bandwidth Ratio

[:STATe]

Supported N5166B/72B/82B with Option N5180403B

[:SOURce]:RADio:AWGN:RT[:STATe] ON|OFF|1|0
[:SOURce]:RADio:AWGN:RT[:STATe]?

This command enables or disables the operating state of real–time AWGN.

* RST 0
Key Entry Real–Time AWGN Off On
Real-Time Commands
Custom Subsystem–Option N5180431B ([::SOURce]:RADio:CUSTom)

Custom Subsystem–Option N5180431B ([::SOURce]:RADio:CUSTom)

:ALPha

**Supported**  
N5166B/72B/82B with Option N5180431B  

[:SOURce]:RADio:CUSTom:ALPHa <val>  
[:SOURce]:RADio:CUSTom:ALPHa?

This command changes the Nyquist or root Nyquist filter's alpha value.

The filter alpha value can be set to a minimum level (0), a maximum level (1), or in between by using fractional numeric values (0.001–0.999).

*RST  
+3.50000000E−001  
Range  
0.000–1.000  
Key Entry  
Filter Alpha  
Remarks  
To change the current filter type, refer to “:FILTert” on page 526.

:BASeband:FREQuency:OFFSet

**Supported**  
N5166B/72B/82B with Option N5180431B  

[:SOURce]:RADio:CUSTom:BASeband:FREQuency:OFFSet <value><unit>  
[:SOURce]:RADio:CUSTom:BASeband:FREQuency:OFFSet?

This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed-through is not in the center.

Keysight X-Series signal generator provide automatic DAC over-range protection when the offset value is something other than 0 Hz. It scales down the playing I/Q data by $1/\sqrt{2}$.

*RST  
+0.00000000E+000  
Range  
+8.0E7 to −8.0E7 Hz  
Key Entry  
Baseband Frequency Offset

:BASeband:FREQuency:OFFSet:PHASe:RESet

**Supported**  
N5166B/72B/82B with Option N5180431B  

[:SOURce]:RADio:CUSTom:BASeband:FREQuency:OFFSet:PHASe:RESet

This command clears the phase accumulation resulting in a phase shift of zero.
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

When the Baseband Frequency Offset is non–zero, the hardware rotator accumulates phase–shift of the baseband signal. This residual phase remains even after the offset value is returned to zero. While there is a non–zero residual phase present in the signal, the DAC Over–Range Protection feature will automatically prevent DAC over-range errors from occurring by scaling the signal down by 1/square root of 2.

Key Entry Baseband Frequency Offset Phase Reset

:BBT

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:BBT <val>
[:SOURce]:RADio:CUSTom:BBT?

This command changes the bandwidth-multiplied-by-bit-time (BbT) filter parameter.

The filter BbT value can be set to the maximum level (1) or in between the minimum level (0.100) and maximum level by using fractional numeric values (0.101–0.999).

*RST +5.00000000E−001
Range 0.100–1.000
Key Entry Filter BbT
Remarks This command is effective only after choosing a Gaussian filter. It does not have an effect on other types of filters.

To change the current filter type, refer to “:FILTer” on page 526.

:BRATe

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:BRATe <val>
[:SOURce]:RADio:CUSTom:BRATe?

This command sets the bit rate in bits per second (bps–Mbps). The maximum bit rate depends on the modulation type as shown in the following tables.

The IQ digital data stream is shaped by a FIR filter.

To change the modulation type, refer to “:MODulation[:TYPE]” on page 530.

When the bit rate is changed, the signal generator reconfigures the baseband generator. The time required to reconfigure the baseband generator is inversely proportional to the bit rate: lower bit rates require more time.

*RST +2.00000000E+006

Key Entry Baseband Frequency Offset Phase Reset
Real-Time Commands
Custom Subsystem–Option N5180431B ([[:SOURce]:RADio:CUSTom])

The following table lists the range for PRAM or external serial data in the Custom format.

<table>
<thead>
<tr>
<th>Range</th>
<th>Bits/Symbol</th>
<th>Min Bit Rate</th>
<th>N5166B/72B Opt 653 Max Bit Rate</th>
<th>N5166B/72B Opt 655 Max Bit Rate</th>
<th>N5182B Opt 656 Max Bit Rate</th>
<th>N5182B Opt 657 Max Bit Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>37.5 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>1</td>
<td>1 bps</td>
<td>37.5 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>2</td>
<td>2 bps</td>
<td>37.5 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>3</td>
<td>3 bps</td>
<td>37.5 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>4</td>
<td>4 bps</td>
<td>37.5 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>5</td>
<td>5 bps</td>
<td>37.5 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>6</td>
<td>6 bps</td>
<td>37.5 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>7</td>
<td>7 bps</td>
<td>37.5 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>8</td>
<td>8 bps</td>
<td>37.5 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>9</td>
<td>9 bps</td>
<td>37.5 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>10</td>
<td>10 bps</td>
<td>37.5 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
<td>50 Mbps</td>
</tr>
</tbody>
</table>

The following table shows the various data rates by modulation type when the internal data generator is used.

<table>
<thead>
<tr>
<th>Range</th>
<th>Bits/Symbol</th>
<th>Min Bit Rate</th>
<th>N5166B/72B Opt 653 Max Bit Rate</th>
<th>N5166B/72B Opt 655 Max Bit Rate</th>
<th>N5182B Opt 656 Max Bit Rate</th>
<th>N5182B Opt 657 Max Bit Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>37.5 Mbps</td>
<td>75 Mbps</td>
<td>50 Mbps</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>1</td>
<td>1 bps</td>
<td>37.5 Mbps</td>
<td>75 Mbps</td>
<td>150 Mbps</td>
<td>100 Mbps</td>
<td>200 Mbps</td>
</tr>
<tr>
<td>2</td>
<td>2 bps</td>
<td>75 Mbps</td>
<td>150 Mbps</td>
<td>150 Mbps</td>
<td>100 Mbps</td>
<td>200 Mbps</td>
</tr>
<tr>
<td>3</td>
<td>3 bps</td>
<td>112 Mbps</td>
<td>225 Mbps</td>
<td>225 Mbps</td>
<td>150 Mbps</td>
<td>300 Mbps</td>
</tr>
<tr>
<td>4</td>
<td>4 bps</td>
<td>150 Mbps</td>
<td>300 Mbps</td>
<td>300 Mbps</td>
<td>200 Mbps</td>
<td>400 Mbps</td>
</tr>
<tr>
<td>5</td>
<td>5 bps</td>
<td>187 Mbps</td>
<td>375 Mbps</td>
<td>375 Mbps</td>
<td>250 Mbps</td>
<td>500 Mbps</td>
</tr>
<tr>
<td>6</td>
<td>6 bps</td>
<td>225 Mbps</td>
<td>450 Mbps</td>
<td>450 Mbps</td>
<td>300 Mbps</td>
<td>600 Mbps</td>
</tr>
<tr>
<td>7</td>
<td>7 bps</td>
<td>262 Mbps</td>
<td>525 Mbps</td>
<td>525 Mbps</td>
<td>350 Mbps</td>
<td>700 Mbps</td>
</tr>
<tr>
<td>8</td>
<td>8 bps</td>
<td>300 Mbps</td>
<td>600 Mbps</td>
<td>600 Mbps</td>
<td>400 Mbps</td>
<td>800 Mbps</td>
</tr>
<tr>
<td>9</td>
<td>9 bps</td>
<td>337 Mbps</td>
<td>450 Mbps</td>
<td>450 Mbps</td>
<td>450 Mbps</td>
<td>900 Mbps</td>
</tr>
<tr>
<td>10</td>
<td>10 bps</td>
<td>375 Mbps</td>
<td>500 Mbps</td>
<td>500 Mbps</td>
<td>500 Mbps</td>
<td>1000 Mbps</td>
</tr>
</tbody>
</table>
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

The bits per symbol are determined by the modulation type:

<table>
<thead>
<tr>
<th>Bits/Symbol</th>
<th>Modulation Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2-Lvl FSK, ASK, BPSK, MSK</td>
</tr>
<tr>
<td>2</td>
<td>4-Lvl FSK, 4QAM, C4FM, Gray Coded QPSK, IS95 OQPSK, IS95 QPSK, OQPSK, QPSK, pi/4 DQPSK, Unbalanced QPSK</td>
</tr>
<tr>
<td>3</td>
<td>8-Lvl FSK, 8PSK, D8PSK, EDGE</td>
</tr>
<tr>
<td>4</td>
<td>16-Lvl FSK, 16PSK, 16QAM, VSA 16QAM</td>
</tr>
<tr>
<td>5</td>
<td>32QAM, VSA 32QAM</td>
</tr>
<tr>
<td>6</td>
<td>64QAM, VSA 64QAM</td>
</tr>
<tr>
<td>7</td>
<td>128QAM, VSA 128QAM</td>
</tr>
<tr>
<td>8</td>
<td>256QAM, VSA 256QAM</td>
</tr>
<tr>
<td>9</td>
<td>VSA 512QAM</td>
</tr>
<tr>
<td>10</td>
<td>1024QAM, VSA 1024QAM</td>
</tr>
</tbody>
</table>

Key Entry | Symbol Rate
:BURSt:SHAPe:FALL:DELay | Supported N5166B/72B/82B with Option N5180431B
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FALL:DELay <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FALL:DELay?

This command sets the burst shape fall delay.

The variable <val> is expressed in bits.

*RST +0.00000000E+000

Range (depends on modulation type and symbol rate)

Key Entry Fall Delay

Remarks
To change the modulation type, refer to “:MODulation[:TYPE]” on page 530. Refer to “:SRATe” on page 540 for a list of the minimum and maximum symbol rate values.

“:BURSt:SHAPe:FDELay” on page 520 performs the same function; in compliance with the SCPI standard, both commands are listed.

For concept information on burst shaping, refer to the User’s Guide.
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

:BURSt:SHAPe:FALL:TIME

Supported
N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FALL:TIME <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FALL:TIME?

This command sets the burst shape fall time.

The variable <val> is expressed in bits.

*RST +5.00000000E+000
Range (depends on modulation type and symbol rate)
Key Entry Fall Time
Remarks To change the modulation type, refer to “:MODulation[:TYPE]” on page 530. Refer to “:SRATe” on page 540 for a list of the minimum and maximum symbol rate values.

“:BURSt:SHAPe:FTIMe” on page 521 performs the same function; in compliance with the SCPI standard, both commands are listed.

For concept information on burst shaping, refer to the User's Guide.

:BURSt:SHAPe:FDELay

Supported
N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FDELay <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FDELay?

This command sets the burst shape fall delay.

The variable <val> is expressed in bits.

*RST +0.00000000E+000
Range (depends on modulation type and symbol rate)
Key Entry Fall Delay
Remarks To change the modulation type, refer to “:MODulation[:TYPE]” on page 530. Refer to “:SRATe” on page 540 for a list of the minimum and maximum symbol rate values.

“:BURSt:SHAPe:FALL:DELay” on page 519 performs the same function; in compliance with the SCPI standard, both commands are listed.

For concept information on burst shaping, refer to the User’s Guide.
### :BURST:SHAPE:FTIME

**Supported**  
N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:BURSt:SHAPE:FTIMe <val>  
[:SOURce]:RADio:CUSTom:BURSt:SHAPE:FTIMe?

This command sets the burst shape fall time.

The variable <val> is expressed in bits.

<table>
<thead>
<tr>
<th>*RST</th>
<th>+5.00000000E+000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>(depends on modulation type and symbol rate)</td>
</tr>
<tr>
<td>Key Entry</td>
<td>Fall Time</td>
</tr>
<tr>
<td>Remarks</td>
<td></td>
</tr>
</tbody>
</table>

To change the modulation type, refer to "MODulation[:TYPE]" on page 530. Refer to "SRATe" on page 540 for a list of the minimum and maximum symbol rate values.

"BURSt:SHAPE:FALL:TIME" on page 520 performs the same function; in compliance with the SCPI standard, both commands are listed.

For concept information on burst shaping, refer to the User's Guide.

### :BURST:SHAPE:RDELay

**Supported**  
N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:BURSt:SHAPE:RDELay <val>  
[:SOURce]:RADio:CUSTom:BURSt:SHAPE:RDELay?

This command sets the burst shape rise delay.

The variable <val> is expressed in bits.

<table>
<thead>
<tr>
<th>*RST</th>
<th>+0.00000000E+000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>(depends on modulation type and symbol rate)</td>
</tr>
<tr>
<td>Key Entry</td>
<td>Rise Delay</td>
</tr>
<tr>
<td>Remarks</td>
<td></td>
</tr>
</tbody>
</table>

To change the modulation type, refer to "MODulation[:TYPE]" on page 530. Refer to "SRATe" on page 540 for a list of the minimum and maximum symbol rate values.

"BURSt:SHAPE:RISE:DELay" on page 522 performs the same function; in compliance with the SCPI standard, both commands are listed.

For concept information on burst shaping, refer to the User's Guide.
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

:BURSt:SHAPe:RISE:DElay

Supported  N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RISE:DElay <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RISE:DElay?

This command sets the burst shape rise delay.

The variable <val> is expressed in bits.

*RST  +0.000000000E+000
Range  (depends on modulation type and symbol rate)
Key Entry  Rise Delay
Remarks  To change the modulation type, refer to “:MODulation[:TYPE]” on page 530. Refer to “:SRATe” on page 540 for a list of the minimum and maximum symbol rate values.

“:BURSt:SHAPe:RDELay” on page 521 performs the same function; in compliance with the SCPI standard, both commands are listed.

For concept information on burst shaping, refer to the User's Guide.

:BURSt:SHAPe:RISE:TIME

Supported  N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RISE:TIME <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RISE:TIME?

This command sets the burst shape rise time.

The variable <val> is expressed in bits.

*RST  +5.000000000E+000
Range  (depends on modulation type and symbol rate)
Key Entry  Rise Time
Remarks  To change the modulation type, refer to “:MODulation[:TYPE]” on page 530. Refer to “:SRATe” on page 540 for a list of the minimum and maximum symbol rate values.

“:BURSt:SHAPe:RTIMe” on page 523 performs the same function; in compliance with the SCPI standard, both commands are listed.

For concept information on burst shaping, refer to the User's Guide.
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

:BURSt:SHAPe:RTIMe

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RTIMe <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RTIMe?

This command sets the burst shape rise time.

The variable <val> is expressed in bits.

*RST +5.00000000E+000
Range (depends on modulation type and symbol rate)
Key Entry Rise Time
Remarks To change the modulation type, refer to “:MODulation[:TYPE]” on page 530. Refer to “:SRATe” on page 540 for a list of the minimum and maximum symbol rate values.

“:BURSt:SHAPe:RISE:TIME” on page 522 performs the same function; in compliance with the SCPI standard, both commands are listed.

For concept information on burst shaping, refer to the User's Guide.

:BURSt:SHAPe[:TYPE]

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:BURSt:SHAPe[:TYPE] SINE"<file name>"
[:SOURce]:RADio:CUSTom:BURSt:SHAPe[:TYPE]?

This command specifies the burst shape ("<file name>").

SINE This choice selects a burst shape that is defined by the burst rise and fall *RST values, as the default burst shape type.

"<file name>" This choice selects a user designated file from signal generator memory (non-volatile).

*RST SINE

Key Entry Sine User File

:CHANnel

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:CHANnel EVM|ACP
[:SOURce]:RADio:CUSTom:CHANnel?
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

This command optimizes the Nyquist and root Nyquist filters to minimize error vector magnitude (EVM) or to minimize adjacent channel power (ACP).

EVM This choice provides the most ideal passband.
ACP This choice improves stopband rejection.

*RST ACP

Key Entry Optimize FIR For EVM ACP

Remarks To change the current filter type, refer to “:FILTER” on page 526.

:DATA

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:DATA
PN9|PN11|PN15|PN20|PN23|FIX4|"<file name>"|
EXT|P4|P8|P16|P32|P64|PRAM
[:SOURce]:RADio:CUSTom:DATA?

This command sets the data pattern for unframed transmission.

*RST PN23

Key Entry PN9  PN11  PN15  PN20  PN23  FIX4  User File

Ext  4 1’s & 4 0’s  8 1’s & 8 0’s

16 1’s & 16 0’s  32 1’s & 32 0’s  64 1’s & 64 0’s  PRAM  File

Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.

:DATA:FIX4

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:DATA:FIX4 <val>
][:SOURce]:RADio:CUSTom:DATA:FIX4?

This command sets the binary, 4-bit repeating sequence data pattern for unframed transmission according to the modulation type, symbol rate, filter, and burst shape selected for the custom modulation format.

*RST #B0000

Range #B0000–#B1111 or 0–15
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

### :DATA:PRAM

**Key Entry** FIX4

**Remarks** FIX4 must be already be defined as the data type. To change the data type, refer to “:DATA” on page 524.

**Supported** N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:DATA:PRAM "<file_name>"

This command selects a pattern RAM (PRAM) file as the pattern data type for a custom communications format.

"<file_name>" This variable designates the PRAM file in the signal generator’s volatile memory (WFM). Refer to “File Name Variables” on page 43 for information on the file name syntax.

**Key Entry** PRAM File

**Remarks** Selecting this data source forces the burst source to INTERNAL to allow framing control.

The PRAM file must reside in the signal generator’s volatile memory (WFM) in order to be accessed by this command.

### :DENCode

**Key Entry** Diff Data Encode Off On

**Remarks** Executing this command encodes the data bits prior to modulation; each modulated bit is 1 if the data bit is different from the previous one, or 0 if the data bit is the same as the previous one.

**Supported** N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:DENCode ON|OFF|1|0

This command enables or disables the differential data encoding function.

**RST** 0

### :EDATa:DELay

**Supported** N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:EDATa:DELay?
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

This query returns the amount of delay (in symbols) from the external data input to the beginning of the symbol on the I OUT and Q OUT rear panel connectors and the front-panel RF OUTPUT connector.

Remarks When the format is turned off, the delay value is unchanged; the query will return the same delay value if the format is on or off.

:EDCLock

Supported N5166B/72B/82B with Option N5180431B

[[:SOURce]:RADio:CUSTom:EDCLock SYMBol|NORMal
[[:SOURce]:RADio:CUSTom:EDCLock?

This command sets the external data clock use.

SYMBol This choice specifies that a continuous symbol clock signal must be provided to the SYMBOL SYNC input connector.

NORMal This choice specifies that the DATA CLOCK input connector requires a bit clock. The SYMBOL SYNC input connector requires a (one-shot or continuous) symbol sync signal.

*RST NORM

Key Entry Ext Data Clock Normal Symbol

:FILTer

Supported N5166B/72B/82B with Option N5180431B

[[:SOURce]:RADio:CUSTom:FILTer
RNYQuist|NYQuist|GAUSsian|RECTangle|IS95|
IS95_EQ|IS95_MOD|IS95_MOD_EQ|AC4Fm|UGGaussian|"<user FIR>"
[[:SOURce]:RADio:CUSTom:FILTer?

This command selects the pre-modulation filter type.

IS95 This choice selects a filter that meets the criteria of the IS-95 standard.

IS95_EQ This choice selects a filter which is a combination of the IS-95 filter (above) and the equalizer filter described in the IS-95 standard. This filter is only used for IS-95 baseband filtering.

IS95_MOD This choice selects a filter that meets the criteria of the IS-95 error function (for improved adjacent channel performance) with lower passband rejection than the filter specified in the IS-95 standard.
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

IS95_MOD_EQ  This choice selects a filter which is a combination of the equalizer filter described in the IS-95 standard and a filter that meets the criteria of the IS-95 error function (for improved adjacent channel performance), with lower passband rejection.

AC4Fm  This choice selects a predefined Association of Public Safety Communications Officials (APCO) specified compatible 4-level frequency modulation (C4FM) filter.

UGGaussian  This choice selects a GSM Gaussian filter (Gaussian filter with a fixed BbT value of 0.300).

"<user FIR>"  This variable is any filter file that you have stored into memory. Refer to “File Name Variables” on page 43 for information on the file name syntax.

*RST  RNYQ

Key Entry  Root Nyquist  Nyquist  Gaussian

Rectangle  IS-95  IS-95 w/EQ  IS-95 Mod

IS-95 Mod  APCO 25  UN3/4 GSM
w/EQ  C4FM  Gaussian

User FIR  UN3/4 GSM  User FIR  Gaussian

:IQ:MODulation:ATTen

Supported  N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:IQ:MODulation:ATTen  <value>

[:SOURce]:RADio:CUSTom:IQ:MODulation:ATTen?

This command sets the attenuation level of the I/Q signals being modulated through the signal generator RF path.

The variable <value> is expressed in units of decibels (dB).

*RST  Varies (instrument dependent)

Range  0 to 50

Key Entry  Modulator Atten Manual Auto

:IQ:MODulation:ATTen:AUTO

Supported  N5166B/72B/82B with Option N5180431B
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

[:SOURce]:RADio:CUSTom:IQ:MODulation:ATTen:AUTO ON|OFF|1|0
[:SOURce]:RADio:CUSTom:IQ:MODulation:ATTen:AUTO?

This command enables or disables the I/Q attenuation auto mode.

ON (1)  This choice enables the attenuation auto mode which optimizes the modulator attenuation for the current conditions.

OFF (0)  This choice holds the attenuator at its current setting or at a selected value. Refer to the :IQ:MODulation:ATTen command for setting the attenuation value.

*RST 1
Key Entry Modulator Atten Manual Auto

:IQ:SCALe

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:IQ:SCALe <val>
[:SOURce]:RADio:CUSTom:IQ:SCALe?

This command sets the amplitude of the I/Q outputs for better adjacent channel power (ACP); lower scaling values equate to better ACP.

The variable <val> is expressed in units of percent.

*RST +70
Range 1–100
Key Entry I/Q Scaling
Remarks This command has no effect with MSK or FSK modulation.

:MODulation:ASK[:DEPTh]

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:MODulation:ASK[:DEPTh] <0% - 100%>
[:SOURce]:RADio:CUSTom:MODulation:ASK[:DEPTh]?

This command changes the depth for the amplitude shift keying (ASK) modulation. Depth is set as a percentage of the full power on level.

*RST +1.00000000E+002
Range 0 to 100
Key Entry ASK Depth 100%
Remarks The modulation is applied to the I signal, the Q value is always kept at zero.
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

:MODulation:FSK[:DEViation]

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:MODulation:FSK[:DEViation] <val>
[:SOURce]:RADio:CUSTom:MODulation:FSK[:DEViation]?

This command sets the symmetric FSK frequency deviation value.

The variable <val> is expressed in units of Hertz and the maximum range value equals the current symbol rate value multiplied by four, limited to 20 MHz.

*RST +4.00000000E+002
Range 0–2E7
Key Entry Freq Dev
Remarks To change the modulation type, refer to “:MODulation[:TYPE]” on page 530.
Refer to “SRATe” on page 540 for a list of the minimum and maximum symbol rate values.
To set an asymmetric FSK deviation value, refer to the User's Guide for more information.

:MODulation:MSK[:PHASe]

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:MODulation:MSK[:PHASe] <val>
[:SOURce]:RADio:CUSTom:MODulation:MSK[:PHASe]?

This command sets the MSK phase deviation value.

The variable <val> is expressed in units of degrees.

*RST +9.00000000E+001
Range 0–100
Key Entry Phase Dev

:MODulation:UFSK

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:MODulation:UFSK "<file name>"
[:SOURce]:RADio:CUSTom:MODulation:UFSK?

This command selects a user-defined FSK file from the signal generator memory.

Key Entry User FSK
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

Remarks
The user-defined FSK file is held in signal generator memory until the command that selects user FSK as the modulation type is sent. Refer to “>:MODulation[:TYPE]” on page 530 to change the current modulation type.

Refer to “File Name Variables” on page 43 for information on the file name syntax.

>:MODulation:UIQ

Supported
N5166B/72B/82B with Option N5180431B

[[:SOURce]:RADio:CUSTom]:MODulation:UIQ "<file name>"
[[:SOURce]:RADio:CUSTom]:MODulation:UIQ?

This command selects a user-defined I/Q file from the signal generator memory.

Key Entry
User I/Q

Remarks
The user-defined I/Q file is held in signal generator memory until the command that selects user I/Q as the modulation type is sent. Refer to “>:MODulation[:TYPE]” on page 530 to change the current modulation type.

Refer to “File Name Variables” on page 43 for information on the file name syntax.

>:MODulation[:TYPE]

Supported
N5166B/72B/82B with Option N5180431B

[[:SOURce]:RADio:CUSTom]:MODulation[:TYPE]
ASK | BPSK | QPSK | UQPSK | IS95QPSK | GRAYQPSK |
OQPSK | IS95QPSK | P4DQPSK | FSK8 | FSK16 | D8PSK | EDGE | MSK | FSK2 | FSK4 |
FSK8 | FSK16 | C4FM |
QAM4 | QAM16 | QAM32 | QAM64 | QAM128 | QAM256 | QAM1024 | UIQ | UFSK | VSAQAM 16 | VSAQAM32 | VSAQAM64 |
VSAQAM128 | VSAQAM256 | VSAQAM512 | VSAQAM1024
[[:SOURce]:RADio:CUSTom]:MODulation[:TYPE]?

This command sets the modulation type for the Custom personality.

*RST

P4DQPSK

Key Entry
ASK | BPSK | QPSK | Unbalanced QPSK

IS–95 | Gray Coded | QPSK | QPSK

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Keysight CXG, EXG, and MXG X-Series Signal Generators SCPI Command Reference
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

:NOISe:Bandwidth

**Supported**
N5166B72B/82B with Options N5180431B and N5180403B

[:SOURce]:RADio:CUSTom:NOISe:Bandwidth <value><unit>
[:SOURce]:RADio:CUSTom:NOISe:Bandwidth?

This command selects the flat noise bandwidth value of the real–time noise for an ARB waveform. Typically, this value is set slightly wider than the signal bandwidth. The minimum increment value is 0.001 Hz.

*RST +1.00000000E+000

**Range**
1 Hz to 160 MHz (depends on the installed baseband generator option)

**Key Entry**
Noise Bandwidth

:NOISe:CBRate

**Supported**
N5166B72B/82B with Options N5180431B and N5180403B

[:SOURce]:RADio:CUSTom:NOISe:CBRate <val>
[:SOURce]:RADio:CUSTom:NOISe:CBRate?

This command sets a value of the carrier bit rate (gross bit rate) for purposes of calculating the Eb/N0 (energy per bit over noise power density at the receiver). When the carrier to noise ratio format is set to Eb/N0 (refer to the :NOISe:CNFormat command), the adjustment of the carrier bit rate will have an immediate impact on the carrier to noise ratio as specified by Eb/N0. The
carrier bit rate is derived from the symbol rate and bits per symbol of the modulation. The carrier bit rate is a saved instrument state that is recorded in the waveform header.

The query returns the current carrier bit rate setting.

Example

:RAD:ARB:NOIS:CBR 5

The preceding example sets the carrier bit rate to 5 bps.

*RST 1.000 bps
Range 1 bps to 999 Mbps
Key Entry Carrier Bit Rate

:NOISe:CBWidth

Supported N5166B72B/82B with Options N5180431B and N5180403B

[:SOURce]:RADio:CUSTom:NOISe:CBWidth <value><unit>
[:SOURce]:RADio:CUSTom:NOISe:CBWidth?

This command selects the carrier bandwidth over which the additive white gaussian noise (AWGN) is applied. The carrier RMS power and the noise power will be integrated over the selected carrier–bandwidth for the purposes of calculating carrier to noise ratio (C/N). The minimum increment value is 0.001 Hz. For more information, refer to the “:NOISe[:STATe]” command and the “:NOISe:BANDwidth” command.

*RST +1.00000000E+000
Range 1 Hz to 200 MHz
Key Entry Carrier Bandwidth

:NOISe:CN

Supported N5166B72B/82B with Options N5180431B and N5180403B

[:SOURce]:RADio:CUSTom:NOISe:CN <value><unit>
[:SOURce]:RADio:CUSTom:NOISe:CN?

This command sets the carrier to noise ratio (C/N) in dB. The carrier power is defined as the total modulated signal power without noise power added. The noise power is applied over the specified bandwidth of the carrier signal. For more information, refer to “:NOISe:CBWidth” on page 532.

Example

:RAD:ARB:NOIS:CN 50DB

The preceding example sets the carrier to noise ratio to 50 dB.
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

*RST +0.00000000E+000
Range –100 to 100 dB
Key Entry Carrier to Noise Ratio

:NOISe:CNFormat

Supported N5166B72B/82B with Options N5180431B and N5180403B

[:SOURce]:RADio:CUSTom:NOISe:CNFormat CN|EBNO
[:SOURce]:RADio:CUSTom:NOISe:CNFormat?

This command selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (Eb/N0) as the variable controlling the ratio of carrier power to noise power in the carrier bandwidth.

Example

:RAD:ARB:NOIS:CNF EBNO

The preceding example sets the carrier to noise ratio format to EbNo.

*RST Carrier to Noise Ratio Format C/N
Key Entry Carrier to Noise Ratio Format C/N Eb/No

:NOISe:EBNO

Supported N5166B72B/82B with Options N5180431B and N5180403B

[:SOURce]:RADio:CUSTom:NOISe:EBNO <ebno in dB>
[:SOURce]:RADio:CUSTom:NOISe:EBNO?

This command allows the C/N to be set using the Eb/N0 (energy per bit over noise power density at the receiver) form. This requires that the carrier bit rate (:NOISe:CBRate on page 531) be set properly. The range of Eb/N0 is limited to the range that is equivalent to –100 to 100 dB of C/N. This value is only effective when Eb/N0 has been enabled by the :NOISe:CNFormat command.

The query returns the value of EBNO.

*RST 0 dB
Range –100 to 100 dB
Key Entry Carrier to Noise Ratio Format Eb/No

:NOISe:MUX

Supported N5166B72B/82B with Options N5180431B and N5180403B
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

[:SOURce]:RADio:CUSTom:NOISe:MUX SUM|CARRier|NOISe
[:SOURce]:RADio:CUSTom:NOISe:MUX?

This command enables diagnostic control of additive noise, such that only the noise, only the carrier, or the sum of both the noise and the carrier are output from the internal baseband generator. With the ALC off, this feature enables direct measurement of just the carrier or the noise contributions to the total power. The system will still behave as if both the noise and the carrier are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

**Example**

:RAD:CUST:NOIS:MUX CARR

The preceding example enables the direct measurement of the carrier contribution to the total power.

*RST Carrier+Noise

**Key Entry** Carrier+Noise | Carrier | Noise

:NOISe:POWer:CARRier

**Supported** N5166B72B/82B with Options N5180431B and N5180403B

[:SOURce]:RADio:CUSTom:NOISe:POWer:CARRier <carrierPower>
[:SOURce]:RADio:CUSTom:NOISe:POWer:CARRier?

This command sets the current carrier power level if noise is on.

In the CARRier control mode, the total power will be adjusted to achieve the specified carrier power and the carrier power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the carrier power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total power is adjusted.

In the NOISe control mode, this will adjust the total noise power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total noise power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] and :NOISe:POWer:NOISe:TOTal commands.

*RST The appropriate value given the current total power and the current Carrier to Noise (C/N).

**Range** The range varies based on the bounds of the total power that results from the noise settings.

**Key Entry** Carrier Power
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURCE]:RADIO:CUSTOM)

:NOISE:POWER:CONTROL[:MODE]

- **Supported**: N5166B72B/82B with Options N5180431B and N5180403B

[:SOURCE]:RADIO:CUSTOM:NOISE:POWER:CONTROL[:MODE] TOTAL|CARRIER|NOISE

[:SOURCE]:RADIO:CUSTOM:NOISE:POWER:CONTROL[:MODE]?

This command sets the power control to one of the three following modes:

- **Total**: This is the default mode where the total power and C/N are independent variables and the carrier power and total noise power are dependent variables set by the total power, C/N and the rest of the noise settings. The carrier power and total noise power will change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values.

- **Carrier**: In this mode the carrier power and C/N are independent variables and the total power and total noise power are dependent variables set by the carrier power, C/N and the rest of the noise settings. The total power and total noise power will change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values.

- **Total Noise**: In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.

*RST Total

**Key Entry** Total Carrier Total Noise

:NOISE:POWER:NOISE:CHANNEL?

- **Supported**: N5166B72B/82B with Options N5180431B and N5180403B

[:SOURCE]:RADIO:CUSTOM:NOISE:POWER:NOISE:CHANNEL?

The query returns the current noise power across the carrier bandwidth in dBm.

:NOISE:POWER:NOISE:TOTAL

- **Supported**: N5166B72B/82B with Options N5180431B and N5180403B
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

<totalNoisePowerInDbm>

This command sets the current total noise power level if noise is on.

In the NOISe control mode, the total power will be adjusted to achieve the
specified total noise power and the total noise power level will be maintained
regardless of changes to the other noise parameters. A change to the total
power will change the total noise power setting appropriately to maintain the
C/N ratio.

In the TOTal control mode, this will adjust the total power once for the
specified total noise power level, after which the total noise power could
change if any noise parameters are adjusted or the total power is adjusted.

In the CARRier control mode, this will adjust the carrier power once for the
specified total noise power level, after which the total noise power could
change if any noise parameters are adjusted or the carrier power is adjusted.
See also :NOISe:POWer:CONTrol[:MODE] command.

Range  The range varies based on the bounds of the total
power that results from the noise settings.

*RST  The appropriate value given the current total power and
the current Carrier to Noise (C/N).

Key Entry  Total Noise Power

:NOISe[:STATe]

Supported  N5166B72B/82B with Options N5180431B and
N5180403B

[ :SOURce ] :RADio:CUSTom:NOISe[:STATe]  ON|OFF|1|0
[ :SOURce ] :RADio:CUSTom:NOISe[:STATe]?

This command enables or disables adding real-time additive white gaussian
noise (AWGN) to the carrier modulated by the waveform being played by the
dual ARB waveform player.

Example

:RAD:CUST:NOIS ON

The preceding example applies real-time AWGN to the carrier.

*RST  0

Key Entry  Real-Time AWGN Off On

:PHASe:NOISe:F1

Supported  N5172B/82B with Options N5180431B and N5180432B
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

[[:SOURce]:RADio:CUSTom]:PHASe:NOISe:F1 <value><unit>
[[:SOURce]:RADio:CUSTom]:PHASe:NOISe:F1?
This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :F2 command). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the User's Guide.

*RST +1.00000000E+003
Range 0 Hz to 77.500524490 MHz
Key Entry Desired Start Freq (f1)

:PHASe:NOISe:F1:ACTual?
Supported N5172B/82B with Options N5180431B and N5180432B

[[:SOURce]:RADio:CUSTom]:PHASe:NOISe:F1:ACTual?
This SCPI command returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

:PHASe:NOISe:F2
Supported N5172B/82B with Options N5180431B and N5180432B

[[:SOURce]:RADio:CUSTom]:PHASe:NOISe:F2 <value><unit>
[[:SOURce]:RADio:CUSTom]:PHASe:NOISe:F2?
This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :PHASE:NOISe:F1 command). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the User's Guide.

*RST +3.00000000E+004
Range 1 Hz to 77.500524490 MHz
Key Entry Desired Stop Freq (f2)

:PHASe:NOISe:F2:ACTual?
Supported N5172B/82B with Options N5180431B and N5180432B
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

[:SOURce]:RADio:CUSTom:PHAse:NOISe:F2:ACTual?

This SCPI command returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

:PHAse:NOISe:LMID

Supported N5172B/82B with Options N5180431B and N5180432B

[:SOURce]:RADio:CUSTom:PHAse:NOISe:LMID <value>
[:SOURce]:RADio:CUSTom:PHAse:NOISe:LMID?

This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator.

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.

For more information on the phase noise impairment option, see the User’s Guide.

The range values are expressed in units of dBc/Hz.

*RST –7.00000000E+001
Range –300 to 100
Key Entry Desired Flat Amplitude (Lmid)

:PHAse:NOISe:LMID:ACTual?

Supported N5172B/82B with Options N5180431B and N5180432B

[:SOURce]:RADio:CUSTom:PHAse:NOISe:LMID:ACTual?

This query returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

:PHASe:NOISe[:STATe]

Supported N5172B/82B with Options N5180431B and N5180432B

[:SOURce]:RADio:CUSTom:PHAse:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:CUSTom:PHAse:NOISe[:STATe]?

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the User’s Guide.
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

*RST 0
Key Entry Phase Noise Off On

:PHASe:NOISe:TRACe?

Supported N5172B/82B with Options N5180431B and N5180432B

[:SOURce]:RADio:CUSTom:PHASe:NOISe:TRACe? <startFreq>,<stopFreq>,<numSamples>

This query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the impairment from the phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBc/Hz.

Range <startFreq> 1 Hz to 100 MHz
<stopFreq> 1 Hz to 100 MHz
<numSamples> 1 to 8192

:POLarity[:ALL]

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:POLarity[:ALL] NORMal|INVerted
[:SOURce]:RADio:CUSTom:POLarity[:ALL]?

This command sets the rotation direction of the phase modulation vector.

NORMal This choice selects normal phase polarity.
INVerted This choice inverts the internal Q signal.

*RST NORM
Key Entry Phase Polarity Normal Invert

:RETRigger

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:RETRigger ON|OFF|1|0|IMMediate
[:SOURce]:RADio:CUSTom:RETRigger?

This command enables or disables the ARB retriggering mode. The retrigger mode controls how the retriggering function performs while a waveform is playing.
Real-Time Commands
Custom Subsystem–Option N5180431B ([::SOURce]:RADio:CUSTom)

ON (1)  This choice (Buffered Trigger) specifies that if a trigger occurs while a waveform is playing, the waveform will retrigger at the end of the current waveform sequence and play once more.

OFF (0)  This choice (No Retrigger) specifies that if a trigger occurs while a waveform is playing, the trigger will be ignored.

IMMediate  This choice (Restart on Trigger) specifies that if a trigger occurs while a waveform is playing, the waveform will reset and replay from the start immediately upon receiving a trigger.

*RST  ON

Key Entry

<table>
<thead>
<tr>
<th></th>
<th>No Retrigger</th>
<th>Buffered Trigger</th>
<th>Restart on Trigger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This command applies to the single trigger type only.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

:SRATe

Supported  N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:SRATe <val>
[:SOURce]:RADio:CUSTom:SRATe?

This command sets the transmission symbol rate. Symbol rate is the bit rate divided by the bits per symbol. A change in the symbol rate affects the bit rate. Refer to “:BRATe” on page 517 for information on bit rate.

The variable <val> is expressed in units of symbols per second (sps–Msps) and the maximum symbol rate depends on the filter. Refer to “:FILTer” on page 526 for minimum filter symbol widths.

The filter may have to be truncated down to 32 or 16 symbols wide to achieve the highest symbol rate. The signal generator’s internal filters are not truncated below their minimum filter length and user-defined FIR filters are not truncated. If the filter cannot be truncated then the symbol rate is limited to the maximum rate of the narrowest filter size possible.

The relative timing of the modulated data, as well as the actual filter response is affected when the filter is truncated.

When the symbol rate changes, the signal generator reconfigures the baseband generator. The time required to reconfigure the baseband generator is inversely proportional to the symbol rate: lower symbol rates require more time.

To change the modulation type, refer to “:MODulation[:TYPE]” on page 530.

*RST  +1.00000000E+06
Real-Time Commands
Custom Subsystem–Option N5180431B ([::SOURce]:RADio:CUSTom)

The following table shows the symbol range for internal Custom data operation.

<table>
<thead>
<tr>
<th>Range</th>
<th>Min Symbol Rate</th>
<th>N5166B/72B Opt 653 Max Symbol Rate</th>
<th>N5166B/72B Opt 655 Max Symbol Rate</th>
<th>N5182B Opt 656 Max Symbol Rate</th>
<th>N5182B Opt 657 Max Symbol Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 sps</td>
<td>37.5 Msps</td>
<td>57 Msps</td>
<td>50 Msps</td>
<td>100 Msps</td>
<td></td>
</tr>
</tbody>
</table>

The limits shown in the following table apply to Custom PRAM and Custom external serial data.

<table>
<thead>
<tr>
<th>Range</th>
<th>Bits/Symbol</th>
<th>Min Symbol Rate</th>
<th>N5166B/72B Opt 653 Max Symbol Rate</th>
<th>N5166B/72B Opt 655 Max Symbol Rate</th>
<th>N5182B Opt 656 Max Symbol Rate</th>
<th>N5182B Opt 657 Max Symbol Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 sps</td>
<td>37.5 Msps</td>
<td>50.0 Msps</td>
<td>50.0 Msps</td>
<td>50.0 Msps</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1 sps</td>
<td>18.7 Msps</td>
<td>37.5 Msps</td>
<td>25.0 Msps</td>
<td>50.0 Msps</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1 sps</td>
<td>12.5 Msps</td>
<td>25.0 Msps</td>
<td>16.6 Msps</td>
<td>33.3 Msps</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1 sps</td>
<td>9.3 Msps</td>
<td>18.7 Msps</td>
<td>12.5 Msps</td>
<td>25.0 Msps</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1 sps</td>
<td>7.5 Msps</td>
<td>15.0 Msps</td>
<td>10.0 Msps</td>
<td>20.0 Msps</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1 sps</td>
<td>6.2 Msps</td>
<td>12.5 Msps</td>
<td>8.3 Msps</td>
<td>16.6 Msps</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1 sps</td>
<td>5.3 Msps</td>
<td>10.7 Msps</td>
<td>7.1 Msps</td>
<td>14.2 Mbss</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1 sps</td>
<td>4.6 Msps</td>
<td>9.3 Msps</td>
<td>6.2 Msps</td>
<td>12.5 Msps</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1 sps</td>
<td>4.1 Msps</td>
<td>8.3 Msps</td>
<td>5.5 Msps</td>
<td>11.1 Msps</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1 sps</td>
<td>3.7 Msps</td>
<td>7.5 Msps</td>
<td>5.0 Msps</td>
<td>10.0 Msps</td>
<td></td>
</tr>
</tbody>
</table>

The bits per symbol are determined by the modulation type:

Table 9-1

<table>
<thead>
<tr>
<th>Bits/Symbol</th>
<th>Modulation Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2-Lvl FSK, ASK, BPSK, MSK</td>
</tr>
<tr>
<td>2</td>
<td>4-Lvl FSK, 4QAM, C4FM, Gray Coded QPSK, IS95 OQPSK, IS95 QPSK, OQPSK, QPSK, pi/4 DQPSK, Unbalanced QPSK</td>
</tr>
<tr>
<td>3</td>
<td>8-Lvl FSK, 8PSK, 8BPSK, EDGE</td>
</tr>
<tr>
<td>4</td>
<td>16-Lvl FSK, 16PSK, 16QAM, VSA 16QAM</td>
</tr>
<tr>
<td>5</td>
<td>32QAM, VSA 32QAM</td>
</tr>
<tr>
<td>6</td>
<td>64QAM, VSA 64QAM</td>
</tr>
</tbody>
</table>
Table 9-1

<table>
<thead>
<tr>
<th>Key Entry</th>
<th>Symbol Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>128QAM, VSA 128QAM</td>
</tr>
<tr>
<td>8</td>
<td>256QAM, VSA 256QAM</td>
</tr>
<tr>
<td>9</td>
<td>VSA 512QAM</td>
</tr>
<tr>
<td>10</td>
<td>1024QAM, VSA 1024QAM</td>
</tr>
</tbody>
</table>

:STANdard:SElECT

**Supported**
N5166B/72B/82B with Option N5180431B

[:SOURce]:RADIo:CUSTom:STANdard:SElECT
NONE|AC4Fm|ACQPsK|BLUEtooth|CDPD
[:SOURce]:RADIo:CUSTom:STANdard:SElECT?

This command selects a predefined setup for Custom (with the appropriate defaults) and/or clears the selection.

- **NONE**: This choice clears the current predefined Custom format.
- **AC4Fm**: This choice sets up an Association of Public Safety Communications Officials (APCO) compliant, compatible 4-level frequency modulation (C4FM) format.
- **ACQPsK**: This choice sets up an Association of Public Safety Communications Officials (APCO) compliant, compatible quadrature phase shift keying (CQPSK) format.
- **BLUEtooth**: This choice sets up a Bluetooth® (2-level frequency shift keying) format.
- **CDPD**: This choice sets up a minimum shift keying Cellular Digital Packet Data (CDPD) format.

*RST

Key Entry Non APCO APCO 25
    e 25w/C4FM w/CQPSK

:TRIGger:TYPE

**Supported**
N5166B/72B/82B with Option N5180431B
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

[:SOURce]:RADio:CUSTom:TRIGger:TYPE CONTinuous|SINGle|GATE
[:SOURce]:RADio:CUSTom:TRIGger:TYPE?

This command sets the trigger type.

CONTinuous  The framed data sequence repeats continuously; the sequence restarts every time the previous playback is completed. To customize continuous triggering, refer to “:TRIGger:TYPE:CONTinuous[:TYPE]” on page 543.

SINGle  The framed data sequence plays once for every trigger received.

GATE  An external trigger signal interrupts the playback while the gating signal is in the inactive state. Playback resumes when the external control signal returns to the active state. The active state can be set to high or low.

*RST  CONT

Key Entry Continuous Single Gated

:TRIGger:TYPE:CONTinuous[:TYPE]

Supported  N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:TRIGger:TYPE:CONTinuous[:TYPE]
FREE|TRIGger|RESet
[:SOURce]:RADio:CUSTom:TRIGger:TYPE:CONTinuous[:TYPE]?

This command selects the waveform’s response to a trigger signal while using the continuous trigger mode.

For more information on triggering and to select the continuous trigger mode, see “:TRIGger:TYPE” on page 542.

The following list describes the waveform’s response to each of the command choices:

FREE  Turning the ARB format on immediately triggers the waveform. The waveform repeats until you turn the format off, select another trigger, or choose another waveform file.

TRIGger  The waveform waits for a trigger before play begins. When the waveform receives the trigger, it plays continuously until you turn the format off, select another trigger, or choose another waveform file.

RESet  The waveform waits for a trigger before play begins. When the waveform receives the trigger, it plays continuously. Subsequent triggers reset the waveform to the beginning. For a waveform sequence, this means to the beginning of the first segment in the sequence.
Real-Time Commands
Custom Subsystem—Option N5180431B ([:SOURce]:RADio:CUSTom)

*RST       FREE
Key Entry     Free Run     Trigger & Run     Reset & Run

:TRIGger:TYPE:GATE:ACTive

Supported   N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:TRIGger:TYPE:GATE:ACTive LOW|HIGH
[:SOURce]:RADio:CUSTom:TRIGger:TYPE:GATE:ACTive?

This command selects the active state (gate polarity) of the gate while using the gating trigger mode.

The LOW and HIGH selections correspond to the low and high states of an external trigger signal. For example, when you select HIGH, the active state occurs during the high of the trigger signal. When the active state occurs, the signal generator stops the waveform playback at the last played sample point, then restarts the playback at the next sample point when the inactive state occurs. For more information on triggering and to select gating as the trigger mode, see “:TRIGger:TYPE” on page 542.

The following list describes the gating behavior for the polarity selections:

- **LOW**: The waveform playback stops when the trigger signal goes low (active state) and restarts when the trigger signal goes high (inactive state).
- **HIGH**: The waveform playback stops when the trigger signal goes high (active state) and restarts when the trigger signal goes low (inactive state).

*RST     HIGH
Key Entry     Gate Active Low High

:TRIGger[:SOURce]

Supported   N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:TRIGger[:SOURce] KEY|EXT|BUS
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]?

This command sets the trigger source.

For more information on triggering, see “:TRIGger:TYPE” on page 542. The following list describes the command choices:

- **KEY**: This choice enables manual triggering by pressing the front-panel Trigger key.
- **EXT**: An externally applied signal triggers the waveform. This is the only choice that works with gating. The following conditions affect an external trigger:
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

— The input connector selected for the trigger signal. You have a choice between the rear-panel PATTERN TRIG IN connector or the PATT TRIG IN 2 pin on the rear-panel AUXILIARY I/O connector. To make the connector selection, see “:TRIGger[:SOURce]:EXTernal[:SOURce]” on page 547.

For more information on the connectors and on connecting the cables, see the User’s Guide.

— The trigger signal polarity:
  – gating mode, see “:TRIGger:TYPE:GATE:ACTive” on page 544
  – continuous and single modes, see “:TRIGger[:SOURce]:EXTernal:SLOPe” on page 546

— The time delay between when the signal generator receives a trigger and when the waveform responds to the trigger. There are two parts to setting the delay:
  – setting the amount of delay, see “:TRIGger[:SOURce]:EXTernal:DELay” on page 545
  – turning the delay on, see “:TRIGger[:SOURce]:EXTernal:DELay:STATe” on page 546

BUS This choice enables triggering over the GPIB or LAN using the *TRG or GET commands or the AUXILIARY INTERFACE (RS-232) using the *TRG command.

*RST KEY

:TRIGger[:SOURce]:EXTernal:DELay

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal:DELay <val>
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal:DELay?

This command sets the number of bits to delay the signal generator’s response to an external trigger.
The bit delay is a delay between when the signal generator receives the trigger and when it responds to the trigger. The delay uses the clocks of the bit-clock to time the delay. After the signal generator receives the trigger and the set number of delay bits (clocks) occurs, the signal generator transmits the data pattern.

The delay occurs after you enable the state. See “:TRIGger[:SOURce]:EXTernal:DELay:STATe” on page 546. You can set the number of bits either before or after enabling the state.

For more information on configuring an external trigger source and to select external as the trigger source, see “:TRIGger[:SOURce]” on page 544.

*RST +0

Range 0–1048575

Key Entry Ext Delay Bits

:TRIGger[:SOURce]:EXTernal:DELay:STATe

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal:DELay:STATe ON|OFF|1|0

This command enables or disables the operating state of the external trigger delay function.

For setting the delay time, see “:TRIGger[:SOURce]:EXTernal:DELay” on page 545, and for more information on configuring an external source, see “:TRIGger[:SOURce]” on page 544.

*RST 0

Key Entry Ext Delay Off On

:TRIGger[:SOURce]:EXTernal:SLOPe

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal:SLOPe POSitive|NEGative

This command sets the polarity for an external trigger signal while using the continuous, single triggering mode. To set the polarity for gating, see “:TRIGger:TYPE:GATE:ACTive” on page 544.

The POSitive and NEGative selections correspond to the high (positive) and low (negative) states of the external trigger signal. For example, when you select POSitive, the waveform responds (plays) during the high state of the trigger.
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

signal. When the signal generator receives multiple trigger occurrences when only one is required, the signal generator uses the first trigger and ignores the rest.

For more information on configuring an external trigger source and to select external as the trigger source, see “:TRIGger[:SOURce]” on page 544.

*RST NEG

Key Entry Ext Polarity Neg Pos

:TRIGger[:SOURce]:EXTernal[:SOURce]

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal[:SOURce]
EPT1|EPT2|
EPTRIGGER1|EPTRIGGER2
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal[:SOURce]?

This command selects which PATTERN TRIG IN connection the signal generator uses to accept an externally applied trigger signal when external is the trigger source selection.

For more information on configuring an external trigger source and to select external as the trigger source, see “:TRIGger[:SOURce]” on page 544. For more information on the rear-panel connectors, see the User’s Guide.

The following list describes the command choices:

EPT1 This choice is synonymous with EPTRIGGER1 and selects the PATTERN TRIG IN rear-panel connector.
EPT2 This choice is synonymous with EPTRIGGER2 and selects the PATT TRIG IN 2 pin on the rear-panel AUXILIARY I/O connector.
EPTRIGGER1 This choice is synonymous with EPT1 and selects the PATTERN TRIG IN rear-panel connector.
EPTRIGGER2 This choice is synonymous with EPT2 and selects the PATT TRIG IN 2 pin on the rear-panel AUXILIARY I/O connector.

*RST EPT1

Key Entry Patt Trig In 1 Patt Trig In 2

[:STATe]

Supported N5166B/72B/82B with Option N5180431B

[:SOURce]:RADio:CUSTom[:STATe] ON|OFF|1|0
[:SOURce]:RADio:CUSTom[:STATe]?
Real-Time Commands
Custom Subsystem–Option N5180431B ([:SOURce]:RADio:CUSTom)

This command enables or disables the Custom modulation.

*RST 0

Key Entry Custom Off On

Remarks Although the Custom modulation is enabled with this command, the RF carrier is not modulated unless you also activate the front-panel Mod On/Off key.
Fsimulator Subsystem–Option 660 ([:SOURce])

:FSIMulator:FADer:MODE

**Supported**

N5172B/82B with Option 660

[[:SOURce]:FSIMulator:FADer:MODE OFF|ON|THR
[[:SOURce]:FSIMulator:FADer:MODE?

This command sets the state of Real-Time Fading simulation.

– Selecting **OFF** sets the state of Real-Time Fading simulation to OFF; do not route through the Fading path.

– Selecting **ON** sets the state of Real-Time Fading simulation to **ON**; route through the Fading path with the Fader in operation; the Fader can only be set to On when a digital personality is on. If all digital personalities are off, the Fader is turned off.

– Selecting **THR** sets the state of Real-Time Fading simulation to Pass-Through; route through the Fading path with the Fader having only a latency and scale effect.

**NOTE**

Before Real-Time Fading can be set to On or **Pass-Through**, a modulation format must be selected and Real-Time Custom Modulation must be set to On; if this is not done, an Error: -221 Setting Conflict is generated and written to the error queue.

If an error occurs, clear the error queue and turn on a modulation format.

To clear the error queue, see **CLS** on page 152.
Phase Noise Subsystem–Option N5180432B
([SOURce:RADio:PHASe:NOISe])

:F1

**Supported** N5172B/82B with Option N5180432B

[:SOURce]:RADio:PHASe:NOISe:F1 <value><unit>

[:SOURce]:RADio:PHASe:NOISe:F1?

This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see :F2). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the User’s Guide.

*RST +1.00000000E+003
Range 0 Hz to 77.500524490 MHz
Key Entry Desired Start Freq (f1)
Key Path Mode > More 2 of 2 > Real-Time Phase Noise Impairment > Desired Start Freq (f1)

:F1:ACTual?

**Supported** N5172B/82B with Option N5180432B

[:SOURce]:RADio:PHASe:NOISe:F1:ACTual?

This query returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

:F2

**Supported** N5172B/82B with Option N5180432B

[:SOURce]:RADio:PHASe:NOISe:F2 <value><unit>

[:SOURce]:RADio:PHASe:NOISe:F2?

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see :F1). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.
Real-Time Commands
Phase Noise Subsystem–Option N5180432B ([SOURce:RADio:PHASe:NOISe])

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the User’s Guide.

*RST +3.00000000E+004
Range 1 Hz to 77.500524490 MHz
Key Entry Desired Stop Freq (f2)
Key Path Mode > More 2 of 2 > Real-Time Phase Noise Impairment > Desired Stop Freq (f2)

:F2:ACTual?

Supported N5172B/82B with Option N5180432B

[:SOURce]:RADio:PHASe:NOISe:F2:ACTual?
This query returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

:LMD

Supported N5172B/82B with Option N5180432B

[:SOURce]:RADio:PHASe:NOISe:LMD <value>
[:SOURce]:RADio:PHASe:NOISe:LMD?
This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator.

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.

For more information on the phase noise impairment option, see the User’s Guide.

The amplitude range varies depending on the f2 value (“:F2” on page 550). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.

The range values are expressed in units of dBc/Hz.

*RST -7.00000000E+001
Range -300 to 100
Key Entry Desired Flat Amplitude (Lmid)
Key Path Mode > More 2 of 2 > Real-Time Phase Noise Impairment > Desired Flat Amplitude (Lmid)
Real-Time Commands
Phase Noise Subsystem–Option N5180432B ([SOURce:RADio:PHAse:NOISe])

:[LMI]D:ACTual?

**Supported**  N5172B/82B with Option N5180432B

This query returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

[:STATe]

**Supported**  N5172B/82B with Option N5180432B

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the *User's Guide*.

*RST  0

**Key Entry**  Phase Noise Off On

**Key Path**  Mode > More 2 of 2 > Real-Time Phase Noise Impairment > Phase Noise Off On

:[TRACe]?

**Supported**  N5172B/82B with Option N5180432B

This query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the impairment from the phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBc/Hz.

**Range**

- `<startFreq>`  1 Hz to 100 MHz
- `<stopFreq>`  1 Hz to 100 MHz
- `<numSamples>`  1 to 8192

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