

Programmer's Manual V2.03

Signal Source Models

APSIN, APSYN, APGEN, APMS, APULN



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Introduction

This manual provides information for remote operation of the AnaPico Signal Generators using commands sent from an external controller via Ethernet, USB, or GPIB. It includes the following:

- A general description of the LAN and the bus data transfer and control functions
- A general description of how to establish connection via LAN, USB, or GPIB
- A listing of the IEEE-488 Interface Function Messages recognized by the signal generator with a description of its response
- A complete listing and description of all the Standard Commands for Programmable Instruments (SCPI) commands that can be used to control signal generator operation with examples of command usage

Programming the instrument

All instruments described in this manual can be accessed through LAN, USB or GPIB interface. All interfaces use standard SCPI command set to pass commands to the device.

While LAN is the preferred interface for AnaPico instruments, GPIB is only optionally available for some models.

Ethernet LAN

All AnaPico signal generators are preferably remotely programmed via a 10/100Base-T LAN interface and LAN-connected computer using one of several LAN interface protocols. The LAN allows instruments to be connected together and controlled by a LAN based computer. LAN and its associated interface operations are defined in the IEEE 802.2 standard.

All instruments support the following LAN interface protocols:

- **Socket based LAN:** The application programming interface (API) provided with the instrument supports general programming using the LAN interface under Windows operating system.
- **VXI-11**
- **Telephone Network (TELNET):** TELNET is used for interactive, one command at a time instrument control.
- **Internet protocol** optionally supported

For LAN operation, the signal generator must be connected to the LAN, and an IP address must be assigned to the signal generator either manually or by using DHCP client service. Your system administrator can tell you which method to use. Most current LAN networks use DHCP.

DHCP Configuration

If the DHCP server uses dynamic DNS to link the hostname with the assigned IP address, the hostname may be used in place of the IP address. Otherwise, the hostname is not usable.

Ethernet Interface Connection and Setup

The instrument fully supports the IEEE-802.3 standard. Most front panel functions (except power on/off) can be remotely controlled via a network server and an Ethernet connection. The instrument firmware supports the TCP/IP network protocol.

Ethernet uses a bus or star topologies where all of the interfacing devices are connected to a central cable called the bus or are connected to a hub. Ethernet uses the CSMA/CD access method to handle simultaneous transmissions over the bus. CSMA/CD stands for *Carrier Sense Multiple Access/Collision Detection*. This standard enables network devices to detect simultaneous data channel usage, called a *collision*, and provides for a contention protocol. When a network device detects a collision, the CSMA/CD standard dictates that the data will be retransmitted after waiting a random amount of time. If a second collision is detected, the data is again retransmitted after waiting twice as long. This is known as exponential back off.

The TCP/IP setup requires the following:

- **IP Address:** Every computer/electronic device in a TCP/IP network requires an IP address. An IP address has four numbers (each between 0 and 255) separated by periods.

For example: 192.168.1.50 is a valid IP address.

- **Subnet Mask:** The subnet mask distinguishes the portion of the IP address that is the network ID from the portion that is the station ID. The subnet mask 255.255.0.0, when applied to the IP address given above, would identify the network ID as 192.168 and the station ID as 1.50. All stations in the same local area network should have the same network ID, but different station IDs.
- **Default Gateway:** A TCP/IP network can have a gateway to communicate beyond the LAN identified by the network ID. A gateway is a computer or electronic device that is connected to two different networks and can move TCP/IP data from one network to the other. A single LAN that is not connected to other LANs requires a default gateway setting of 0.0.0.0. If you have a gateway, then the default gateway would be set to the appropriate value of your gateway.
- **MAC Address:** A MAC address is a unique 48-bit value that identifies a network interface card to the rest of the network. Every network card has a unique MAC address permanently stored into its memory.

Interface between the instrument and other devices on the network is connected to a network via a category five (CAT-5) interface cable. This cable uses four twisted pairs of copper insulators terminated into an RJ45 connector. CAT-5 cabling is capable of supporting frequencies up to 100 MHz and data transfer speeds up to 1 Gbps, which accommodates 1000Base-T, 100Base-T, and 10Base-T networks.

Generally, a VISA I/O library (like NI-VISA™) is used on the server side to facilitate the communications. A VISA installation on the controller is a prerequisite for remote control over LAN interface. VISA is a standardized software interface library providing input and output functions to communicate with instruments. For more information about VISA refer to the VISA library supplier's documentation.

Only the IP address or the device name is required for link setup. The IP address/device name is part of the "visa resource string" used by the programs for identification and control of the instrument. The visa resource string has the form:

TCPIP::ipaddr::inst0::INSTR

ipaddr has to be replaced by the IP address or the computer name of the instrument.

For instance, if the instrument has the IP address 192.168.1.50, *TCPIP::192.168.1.50::inst0::INSTR* is the valid resource name. Specification of **inst0** in the resource name is optional. In this example, also *TCPIP::192.168.1.50::INSTR* is therefore a valid resource name.

TCPIP designates the network protocol used and **INSTR** indicates that the VXI-11 protocol is used. If several instruments are connected to the network, each instrument has its own IP address and associated resource name. The controller identifies these instruments by means of the resource name.

Using Sockets LAN

Sockets LAN is a method used to communicate with the signal generator over the LAN interface using the Transmission Control Protocol/Internet Protocol (TCP/IP). A socket is a fundamental technology used for computer networking and allows applications to communicate using standard mechanisms built into network hardware and operating systems. The method accesses a port on the signal generator from which bidirectional communication with a network computer can be established.

Sockets LAN can be described as an internet address that combines Internet Protocol (IP) with a device port number and represents a single connection between two pieces of software. The socket can be accessed using code libraries packaged with the computer operating system. Two common versions of socket libraries are the Berkeley Sockets Library for UNIX systems and Winsock for Microsoft operating systems.

Your signal generator implements a socket Applications Programming Interface (API) that is compatible with Berkeley socket for UNIX systems and Winsock for Microsoft systems. The signal generator is also compatible with other standard sockets APIs. The signal generator can be controlled using predefined SCPI functions once the socket connection is established in your program. Socket connection is available on **port 18**.

Using and Configuring VXI-11 (VISA)

The signal generator supports the LAN interface protocol described in the VXI-11 standard. VXI-11 is an instrument control protocol based on Open Network Computing/Remote Procedure Call (ONC/RPC) interfaces running over TCP/IP.

A range of standard software such as NI-VISA or Agilent IO Config is available to setup the computer-signal generator interface for the VXI- 11 protocol. Please refer to the applicable software user manual and documentation for information on running the program and configuring the VXI-11 interface. The program is used to configure the LAN client. Once the computer is configured for a LAN client, you can use the VXI- 11 protocol and the VISA library to send SCPI commands to the signal generator over the LAN interface. Example programs are available on request under support@anapico.com.

VISA is an IO library used to develop IO applications and instrument drivers that comply with industry standards. It is recommended to use the VISA library for programming the signal generator.. The NI-VISA and Agilent VISA libraries are similar implementations of VISA and have the same commands, syntax, and functions.

Using Telnet LAN (Port 18)

Telnet provides a means of communicating with the signal generator over the LAN. The Telnet client, run on a LAN connected computer, will create a login session on the signal generator. A connection, established between computer and signal generator, generates a user interface display screen with ">" prompts on the command line.

Using the Telnet protocol to send commands to the signal generator is similar to communicating with the signal generator over LAN. You establish a connection with the signal generator and then send or receive information using predefined commands. Communication is interactive: one command at a time. The telnet service is available on **port 18**.

Once a telnet session to the device is established, the echo can be enabled by typing

SYST:COMM:SOCK:ECHO ON

Following this command a prompt ">>" should become visible.

USB (USBTMC)

All instruments support the following USB interface protocols:

- 1) **USBTMC class device via VISA: USBTMC** stands for **USB Test & Measurement Class**. USBTMC is a protocol built on top of USB that allows GPIB-like communication with USB devices. From the user's point of view, the USB device behaves just like a GPIB device.
USBTMC allows instrument manufacturers to upgrade the physical layer from GPIB to USB while maintaining software compatibility with existing software such as instrument drivers and any application that uses VISA. This is also what the VXI-11 protocol provides for TCP/IP.
- 2) **USBTMC with IVI drivers:** the application programming interface (API) provided with the instrument supports general programming using the USB interface under Windows operating system using the IVI drivers.

USB-TMC Interface Connection and Setup using VISA

USBTMC stands for USB Test & Measurement Class. USBTMC is a protocol built on top of USB that allows GPIB-like communication with USB devices. From the user's point of view, the USB device behaves just like a GPIB device. For example, you can use VISA Write to send the *IDN? query and use VISA Read to get the response. The USBTMC protocol supports service request, triggers and other GPIB specific operations.

USBTMC upgrades the physical layer from GPIB to USB while maintaining software compatibility with existing software such as instrument drivers and any application that uses VISA. This is also what the VXI-11 protocol provides for TCP/IP.

NI-VISA 3.0 or later allows you to communicate as a controller to APSIN devices. NI-VISA is configured to detect USBTMC compliant instruments such as the APSIN. To use such a device, plug it in and Windows should detect the new hardware and launch the New Hardware Wizard. Instruct the wizard to search for the driver, which in this case is NI-VISA. If NI-VISA is properly installed, the device will be installed as a USB Test & Measurement Class Device. Open Measurement & Automation Explorer (MAX). The new device will appear in MAX under Device and Interfaces » USB Devices. You can then use this resource name as you would use any GPIB resource.

USB-TMC Interface Connection and Setup using AnaPico API

AnaPico API programming interface supports direct communication to instruments using AnaPico's proprietary DLL driver libraries.

Please contact AnaPico for more detailed documentation, programming samples, and updates on the DLL library.

GPIB Interface Connection and Setup

General GPIB information

GPIB (General Purpose Interface Bus) is an interface standard for connecting computers and peripherals, which supports the following international standards: IEEE 488.1, IEC-625, IEEE 488.2, and JIS-C1901. The GPIB interface allows you to control the APPH from an external computer. The computer sends commands and instructions to the APPH and receives data sent from the APPH via GPIB.

You can connect up to 15 devices in a single GPIB system.

The length of cables to connect between devices must be 4 m or less. The total length of connecting cables in a single GPIB system must be 2 m × the number of connected devices (including the controller) or less. You cannot construct the system in which the total cable length exceeds 20 m.

The number of connectors connected to an individual device must be 4 or less. If you connect 5 or more connectors, excessive force is applied to the connector part, which may result in failure.

You can choose the device connection topology from star, linear, and combined. Loop connection is not allowed.

SCPI Commands

The Standard Commands for Programmable Instrumentation (SCPI) provides a uniform and consistent language to control programmable test and measurement devices in instrumentation systems. The SCPI Standard is built on the foundation of IEEE-488.2, Standard Codes and Formats. It requires conformance to IEEE-488.2, but is pure software standard. SCPI syntax is ASCII text, and therefore can be attached to any computer test language such as BASIC, C, or C++. It can also be used with Test Application Environments such

as LabWindows/CVI, LabVIEW™, or Matlab®. SCPI is hardware independent. SCPI strings can be sent over any instrument interface. It works equally well over USB-TMC, GPIB, RS-232, VXIbus or LAN networks.

Please see the chapter 4 for detailed description of supported SCPI commands.

IEEE-488 Interface Commands

IEEE Mandated and Optional Common Commands

The required common commands are IEEE-488.2 mandated commands that are defined in the IEEE-488.2 standard and must be implemented by all SCPI compatible instruments. These commands are identified by the asterisk (*) at the beginning of the command keyword. These commands are used to control instrument status registers, status reporting, synchronization, and other common functions.

Commands declared mandatory by *IEEE 488.2*.

- *CLS Clear Status Command
- *ESE Standard Event Status Enable Command
- *ESE? Standard Event Status Enable Query
- *ESR? Standard Event Status Register Query
- *IDN? Identification Query
- *OPC Operation Complete Command
- *OPC? Operation Complete Query
- *RST Reset Command
- *SRE Service Request Enable Command
- *SRE? Service Request Enable Query
- *STB? Read Status Byte Query
- *TST? Self-Test Query
- *WAI Wait-to-Continue Command

Optional common commands described by *IEEE 488.2*

- *OPT? Option Identification Query

***CLS**

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<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 0–255

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.

***IDN?**

The Identification (IDN) query outputs an identifying string. The response will show the following information: <company name>, <model number>, <serial number>, <firmware revision>

***OPC**

The Operation Complete (OPC) command sets bit 0 in the Standard Event Status Register when all pending operations have finished.

The Operation Complete command causes the device to set the operation complete bit (bit 0) in the Standard Event Status Register when all pending operations have been finished.

***OPC?**

The Operation Complete (OPC) query returns the ASCII character 1 in the Standard Event Status Register when all pending operations have finished.

This query stops any new commands from being processed until the current processing is complete. This command blocks the communication until *all* operations are complete (i.e. the timeout setting should be longer than the longest sweep).

***OPT?**

The options (OPT) query returns a comma-separated list of all currently installed instrument options on the signal generator.

Returned option strings are:

0	Basic device
B3	Rechargeable battery pack
PE PE2 PE3	Extended power range
AVIO	ILS and VOR modulations
GPIB	GPIB (IEEE 488) programming interface

***RCL<reg>**

The Recall (RCL) command recalls the state from the specified memory register <reg>.

***RST**

The Reset (RST) command resets most signal generator functions to factory- defined conditions.

Remarks Each command shows the [*RST] default value if the setting is affected.

***SAV <reg>**

The Save (SAV) command saves signal generator settings to the specified memory register <reg>.

Remarks The save function does not save all signal generator settings. Refer to the *User's Guide* for more information on the save function.

***SRE<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 0–255

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?**

The Service Request Enable (SRE) query returns the value of the Service Request Enable Register.

Range 0–63 & 128–191

***STB?**

The Read Status Byte (STB) query returns the value of the status byte including the master summary status (MSS) bit.

Range 0–255

***TRG**

The Trigger (TRG) command triggers the device if LAN is the selected trigger source, otherwise, *TRG is ignored.

***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.

***WAI**

The Wait- to- Continue (WAI) command causes the signal generator to wait until all pending commands are completed, before executing any other commands.

SCPI Commands

This chapter provides an introduction to SCPI programming that includes descriptions of the command types, hierarchical command structure, data parameters, and notational conventions. Information on APSIN status system and trigger system programming is also provided.

Introduction

Standard Commands for Programmable Instruments (SCPI) is the new instrument command language for controlling instruments that goes beyond *IEEE 488.2* to address a wide variety of instrument functions in a standard manner. SCPI promotes consistency, from the remote programming standpoint, between instruments of the same class and between instruments with the same functional capability. For a given measurement function such as frequency or voltage, SCPI defines the specific command set that is available for that function. Thus, two oscilloscopes made by different manufacturers could be used to make frequency measurements in the same way. It is also possible for a SCPI counter to make a frequency measurement using the same commands as an oscilloscope. SCPI commands are easy to learn, self-explanatory and account for both novice and expert programmer's usage. Once familiar with the organization and structure of SCPI, considerable efficiency gains can be achieved during control program development, independent of the control program language selected.

A key to consistent programming is the reduction of multiple ways to control similar instrument functions. The philosophy of SCPI is for the same instrument functions to be controlled by the same SCPI commands. To simplify learning, SCPI uses industry-standard names and terms that are manufacturer and customer supported.

The advantage of SCPI for the ATE system programmer is reducing the time learning how to program new SCPI instruments after programming their first SCPI instrument.

Programmers who use programming languages such as BASIC, C, FORTRAN, etc., to send instrument commands to instruments will benefit from SCPI. Also, programmers who implement instrument device drivers for ATE program generators and/or software instrument front panels will benefit by SCPI's advantages. SCPI defines instrument commands, parameters, data, and status. It is not an application package, programming language or software intended for instrument front panel control.

SCPI is designed to be layered on top of the hardware-independent portion of *IEEE 488.2*.

SCPI Command Types

SCPI commands, which are also referred to as SCPI instructions, are messages to the instrument to perform specific tasks. The APSIN command set includes:

- “Common” commands (IEEE488.2 mandated commands)
- SCPI required commands
- SCPI optional commands (per SCPI 1999.0)
- SCPI compliant commands that are unique to the APSIN. Not all of the commands supported by the instrument are taken from the SCPI standard; however, their syntax follows SCPI rules.

SCPI Command Syntax

Typical SCPI commands consist of one or more keywords, parameters, and punctuation. SCPI command keywords can be a mixture of upper and lower case characters. Except for common commands, each keyword has a long and a short form. In this manual, the long form is presented with the short form in upper case and the remainder in lower case. Unrecognized versions of long form or short form commands, or improper syntax, will generate an error.

Structure of a Command Line

A command line may consist of one or several commands. It is terminated by an EOI together with the last data byte.

Several commands in a command line must be separated by a semicolon ";". If the next command belongs to a different command system, the semicolon is followed by a colon. A colon ":" at the beginning of a command marks the root node of the command tree.

If the successive commands belong to the same system, having one or several levels in common, the command line can be abbreviated. To this end, the second command after the semicolon starts with the level that lies below the common levels. The colon following the semicolon must be omitted in this case.

Responses to Queries

A query is defined for each setting command unless explicitly specified otherwise. It is formed by adding a question mark to the associated setting command. According to SCPI, the responses to queries are partly subject to stricter rules than in standard IEEE 488.2.

Parameters

Most commands require a parameter to be specified. The parameters must be separated from the header by a "white space". Permissible parameters are numerical values, Boolean parameters, text, character strings and block data. The type of parameter required for the respective command and the permissible range of values are specified in the command description.

Numerical values Numerical values can be entered in any form, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the instrument are rounded up or down. The mantissa may comprise up to 255 characters, the values must be in the value range $-9.9\text{E}37$ to $9.9\text{E}37$. The exponent is introduced by an "E" or "e". Entry of the exponent alone is not allowed.

Units In the case of physical quantities, the unit can be entered. Permissible unit prefixes are G (giga), MA (mega), MHZ are also permissible), K (kilo), M (milli), U (micro) and N (nano). If the unit is missing, the basic unit is used.

Boolean Parameters Boolean parameters represent two states. The ON state (logically true) is represented by ON or a numerical value unequal to 0. The OFF state (logically false) is represented by OFF or the numerical value 0. ON or OFF is returned by a query.

Hierarchical Command Structure

All SCPI commands, except the common commands, are organized in a hierarchical structure similar to the inverted tree file structure used in most computers. The SCPI standard refers to this structure as "the Command Tree." The command keywords that correspond to the major instrument control functions are located at the top of the command tree. The command keywords for the APSIN SCPI command set are shown below.

:ABORt
:DIAGnostic
:DISPlay
:INITiate
:OUTput
:SOURce

:STATus
:SYSTem
:TRIGger
:UNIT

All APSIN SCPI commands, except the :ABORt command, have one or more subcommands (keywords) associated with them to further define the instrument function to be controlled. The subcommand keywords may also have one or more associated subcommands (keywords). Each subcommand level adds another layer to the command tree. The command keyword and its associated subcommand keywords form a portion of the command tree called a command subsystem.

Status System Programming

The APSIN implements the status byte register, the Service Request Enable Register, the Standard Event Status Register, and the Standard Event Status Enable Register.

The APSIN status system consists of the following SCPI-defined status reporting structures:

- The Instrument Summary Status Byte
- The Standard Event Status Group
- The Operation Status Group
- The Questionable Status Group

The following paragraphs describe the registers that make up a status group and explain the status information that each status group provides.

Status Registers

In general, a status group consists of a condition register, a transition filter, an event register, and an enable register. Each component is briefly described in the following paragraphs.

Condition Register

The condition register is continuously updated to reflect the current status of the APSIN. There is no latching or buffering for this register, it is updated in real time. Reading the contents of a condition register does not change its contents.

Transition Filter

The transition filter is a special register that specifies which types of bit state changes in the condition register will set corresponding bits in the event register. Negative transition filters (NTR) are used to detect condition changes from True (1) to False (0); positive transition filters (PTR) are used to detect condition changes from False (0) to True (1). Setting both positive and negative filters True allows an event to be reported anytime the condition changes. Transition filters are read-write. Transition filters are unaffected by queries or *CLS (clear status) and *RST commands. The command :STATus:PRESet sets all negative transition filters to all 0's and sets all positive transition filters to all 1's.

Event Register

The event register latches transition events from the condition register as specified by the transition filter. Bits in the event register are latched, and once set they remain set until cleared by a query or a *CLS command. Event registers are read only.

Enable Register

The enable register specifies the bits in the event register that can produce a summary bit. The APSIN logically ANDs corresponding bits in the event and enable registers, and ORs all the resulting bits to obtain a summary bit. Summary bits are recorded in the Summary Status Byte. Enable registers are read-write. Querying an enable register does not affect it. The command :STATus:PRESet sets the Operation Status Enable register and the Questionable Status Enable register to all 0's.

Status Group Reporting

The state of certain APSIN hardware and operational events and conditions can be determined by programming the status system. Three lower status groups provide status information to the Summary Status Byte group. The Summary Status Byte group is used to determine the general nature of an event or condition and the other status groups are used to determine the specific nature of the event or condition.

Summary Status Byte Group

The Summary Status Byte group, consisting of the Summary Status Byte Enable register and the Summary Status Byte, is used to determine the general nature of an APSIN event or condition. The bits in the Summary Status Byte provide the following:

Operation Status Group

The Operation Status group, consisting of the Operation Condition register, the Operation Positive Transition register, the Operation Negative Transition register, the Operation Event register and the Operation Event Enable register.

Standard Event Status Group

The Standard Event Status group, consisting of the *Standard Event Status register* (an Event register) and the *Standard Event Status Enable register*, is used to determine the specific event that set bit 5 of the Summary Status Byte.

The bits in the *Standard Event Status register* provide the following:

Bit	Description
0	Set to indicate that all pending APSIN operations were completed following execution of the “*OPC” command.
1	Request control
2	Set to indicate that a query error has occurred. Query errors have SCPI error codes from –499 to –400.
3	Set to indicate that a device-dependent error has occurred. Device-dependent errors have SCPI error codes from –399 to –300 and 1 to 32767.
4	Set to indicate that an execution error has occurred. Execution errors have SCPI error codes from –299 to –200.
5	Set to indicate that a command error has occurred. Command errors have SCPI error codes from –199 to –100.
6	User request
7	Power on

Standard Event Status Enable register (ESE commands)

Operation Status Group

The Operation Status group, consisting of the Operation Condition register, the Operation Positive Transition register, the Operation Negative Transition register, the Operation Event register, and the Operation Event Enable register, is used to determine the specific condition that set bit 7 in the Summary Status Byte.

Related commands are covered by the *:STATus Subsystem* chapter.

The bits in the Operation Event register provide the following:

Bit	Description
0	NOT USED.
1	NOT USED.
2	NOT USED.
3	(List) sweep state.
4	NOT USED.
5	NOT USED.
6	NOT USED.
7	NOT USED.
8	NOT USED.
9	NOT USED.
10	NOT USED.
11	NOT USED.

12	NOT USED.
13	NOT USED.
14	NOT USED.
15	NOT USED.

Questionable Status Group

The Questionable Status group, consisting of the Questionable Condition register, the Questionable Positive Transition register, the Questionable Negative Transition register, the Questionable Event register, and the Questionable Event Enable register, is used to determine the specific condition that set bit 3 in the Summary Status Byte.

Related commands are covered by the *:STATus Subsystem* chapter.

The bits in the *Questionable Status register* provide the following:

Bit	Description
0	NOT USED.
1	NOT USED.
2	NOT USED.
3	Output power level inaccurate or out of range.
4	Device temperature out of operating range.
5	Output frequency inaccurate or out of range.
6	NOT USED.
7	Modulation inaccurate or out of range.
8	NOT USED.
9	NOT USED.
10	NOT USED.
11	NOT USED.
12	NOT USED.
13	NOT USED.
14	NOT USED.
15	NOT USED.

SCPI Command Description

:ABORt Subsystem

The :ABORt command is a single command subsystem. There are no subcommands or associated data parameters, as shown below. The :ABORt command, along with the :TRIGger and :INITiate commands, comprise the Trigger group of commands.

Command	Parameters	Unit (default)	Remark
:ABORt			

:ABORt

:ABORt

This command causes the List or Step sweep in progress to abort. Even if INIT:CONT[:ALL] is set to ON, the sweep will not immediately re-initiate.

:INITiate Subsystem

The :INITiate subsystem controls the state of the APSIN trigger system. The subsystem commands and parameters are described below. The :INITiate commands, along with the :ABORt and :TRIGger commands, comprise the Trigger Group of commands.

Command	Parameters	Unit (default)	Remark
:INITiate[:IMMediate]		ON	
:INITiate:CONTInuous	ON OFF 1 0	OFF	

:INITiate[:IMMediate]

Sets trigger to the armed state.

:INITiate:CONTInuous ON|OFF|1|0

Continuously rearms the trigger system after completion of a triggered sweep.

:OUTPut Subsystem

Channel selection for multi-channel devices

Commands applying to a single channel use the <ch> field. Commands that are common to all channels have no <ch> field.

The target channel of such commands under the OUTPut subsystem can be defined by appending the channel index to the OUTPut node: <ch> is 1 to number of channels.

If <ch> is omitted, the command targets the currently selected default channel.

Default channel selection

Default output channel is coupled to default source channel. Refer to [\[SOURce:\]SElect](#) for default channel selection.

Command	Parameters	Unit (default)	Remark
OUTPut<ch>[:STATe]	ON OFF 1 0	OFF	
OUTPut<ch>:BLANKing[:STATe]	ON OFF 1 0	OFF	

[:STATe] ON|OFF|1|0

:OUTPut<ch>[:STATe] ON|OFF|1|0

:OUTPut<ch>[:STATe]?

Turns RF output power on/off.

:BLANKing[:STATe] ON|OFF|1|0

:OUTPut<ch>:BLANKing[:STATe] ON|OFF|1|0

:OUTPut<ch>:BLANKing[:STATe]?

ON causes the RF output to be turned off (blanked) during frequency changes. OFF leaves RF output turned on (unblanked).

[:SOURce<ch>] Subsystem

Channel selection for multi-channel devices

Commands applying to a single channel use the <ch> field. Commands that are common to all channels have no <ch> field.

The target channel of such commands under the SOURce subsystem can be defined by appending the channel index to the SOURce node: <ch> is 1 to number of channels.

If <ch> is omitted, the command targets the currently selected default channel.

Command	Parameters	Unit	Default
[:SOURce]:SElect	<integer>		1

SElect

[:SOURce]:SElect <channel>

[:SOURce]:SElect?

For multi-channel devices, this command sets the default channel. Any command with channel index <ch> omitted applies to the default channel. This command sets the default channel of the following systems:

:MEMory

:OUTput

:SOURce

***RST 1.**

Range 1 to number of channels.

[[:SOURce<ch>]:FREQUENCY Subsystem

Command	Parameters	Unit	Default
[[:SOURce<ch>]:FREQUENCY[:FIXed CW]	<float>	Hz	100 MHz
[[:SOURce<ch>]:FREQUENCY:CENTer	<float>	Hz	1.5 GHz
[[:SOURce<ch>]:FREQUENCY:MODE	FIXed CW SWEep LIST CHIRp		FIXed
[[:SOURce<ch>]:FREQUENCY:RESolution	LOW HIGH		LOW
[[:SOURce<ch>]:FREQUENCY:SPAN	<float>	Hz	1 GHz
[[:SOURce<ch>]:FREQUENCY:STARt	<float>	Hz	1 GHz
[[:SOURce<ch>]:FREQUENCY:STEP	<float>	Hz	1 GHz
[[:SOURce<ch>]:FREQUENCY:STOP	<float>	Hz	2 GHz
[[:SOURce<ch>]:FREQUENCY:TRIGger	ON OFF 1 0		OFF

FREQUENCY[:FIXed|CW]

[[:SOURce<ch>]:FREQUENCY[:CW] <float>

[[:SOURce<ch>]:FREQUENCY[:CW]?]

This command sets the signal generator output frequency for the CW frequency mode.

***RST** 100 MHz

Range Please refer to the *Data Sheet*.

Unit Hz

FREQUENCY:CENTer

[[:SOURce<ch>]:FREQUENCY:CENTer <float>

[[:SOURce<ch>]:FREQUENCY:CENTer?]

This command sets the sweep center frequency.

***RST** 1 GHz

Range Please refer to the *Data Sheet*.

Unit Hz

FREQuency:MODE

[[:SOURce<ch>]:FREQuency:MODE FIXEd|CW|SWEep|LIST|CHIRp

[[:SOURce<ch>]:FREQuency:MODE?

This command sets the frequency mode of the signal generator to CW, (list) sweep or chirp.

FIXEd CW	Selects fixed frequency operation and stops an active frequency sweep or chirp.
SWEep or LIST	<p>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 SWEep frequency sweep.</p> <p>In SWEep mode, frequency will be determined by programmed values for the :START.</p> <p>Use the [:SOURce<ch>]:SWEep subsystem commands for sweep configuration.</p> <p>In LIST mode, frequency is determined by programmed values for [:SOURce<ch>]:LIST:FREQuency.</p> <p>Use the [:SOURce<ch>]:LIST subsystem commands for list sweep configuration.</p>
CHIRp	This choice selects the chirp mode. A chirp is a quasi-analog sweep over limited bandwidth. Refer to the [:SOURce<ch>]:CHIRp subsystem for configuration.

***RST** FIXEd

FREQuency:RESolution

[[:SOURce<ch>]:FREQuency:RESolution LOW|HIGH

[[:SOURce<ch>]:FREQuency:RESolution?

This command selects the frequency resolution. It is available only for APMS devices with limited frequency resolution (serial numbers xxx-xxx5xxxxx-xxxx, xxx-xxx6xxxxx-xxxx, xxx-xxx7xxxxx-xxxx).

LOW	Selects low frequency resolution (typically 1 Hz). Low frequency resolution enables phase shifting and fast frequency switching.
HIGH	Selects high frequency resolution (typically 100 µHz). High frequency resolution disables phase shifting and frequency switching is slower.

***RST** LOW

FREQuency:SPAN

[[:SOURce<ch>]:FREQuency:SPAN <float>

[[:SOURce<ch>]:FREQuency:SPAN?

This command sets the frequency sweep span.

***RST** 1 GHz

Range Please refer to the *Data Sheet*.

Unit Hz

FREQuency:START

[[:SOURce<ch>]:FREQuency:STARt <float>

[[:SOURce<ch>]:FREQuency:STARt?

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

***RST** 1 GHz

Range Please refer to the *Data Sheet*.

Unit Hz

FREQuency:STEP

[[:SOURce<ch>]:FREQuency:STEP <float>

[[:SOURce<ch>]:FREQuency:STEP?

This command sets the frequency step size for sweeps and chirps.

FREQuency:STOP

[[:SOURce<ch>]:FREQuency:STOP <float>

[[:SOURce<ch>]:FREQuency:STOP?

This command sets the last frequency point in a chirp or step sweep.

***RST** 2 GHz

Range Please refer to the *Data Sheet*.

Unit Hz

FREQuency:TRIGger

[[:SOURce<ch>]:FREQuency:TRIGger ON|OFF|1|0

ON causes frequency changes in CW mode to become effective only after receiving a trigger signal. OFF is the normal CW mode with frequency changes taking effect immediately.

***RST** OFF

[[:SOURce<ch>]:CHIRp Subsystem

The :CHIRp Subsystem allows to run ultrafast quasi-analog frequency sweeps. The frequency can either increase or decrease linear.

Command	Parameters	Unit	Default
[[:SOURce<ch>]:CHIRp:TIME	<float>	s	
[[:SOURce<ch>]:CHIRp:COUNt	INFinite <integer>		INFinite
[[:SOURce<ch>]:CHIRp:DIR	DU UD DOWN UP		UP
[[:SOURce<ch>]:CHIRp:BLANKing	ON OFF 1 0		ON

Related command
[SOURce<ch>]:FREQuency:CENTer
[SOURce<ch>]:FREQuency:MODE
[SOURce<ch>]:FREQuency:SPAN
[SOURce<ch>]:FREQuency:STARt
[SOURce<ch>]:FREQuency:STOP

:CHIRp:COUNT

[SOURce<ch>]:CHIRp:COUNT INF inite| <value>

[SOURce<ch>]:CHIRp:COUNT?

This command specifies the number of repetitions for the chirp. Set to INF for infinite repetitions.

***RST** INF

Range INF or 1 to 32767

:CHIRp:TIME

[SOURce<ch>]:CHIRp:TIME <value><unit>

[SOURce<ch>]:CHIRp:TIME?

Sets the time span for the chirp.

:CHIRp:DIREction

[SOURce<ch>]:CHIRp:DIREction UD|DU|DOWN|UP

[SOURce<ch>]:CHIRp:DIREction?

This command sets the direction of the chirp. DU is bidirectional, direction down first. UD is bidirectional, direction up first.

***RST** UP

CHIRp:BLANKing

[SOURce<ch>]:CHIRp:BLANKing ON|OFF|1|0

[SOURce<ch>]:CHIRp:BLANKing?

This command enables or disables RF output blanking while waiting for the trigger signal. Blanking enabled means the RF output is off while waiting for the trigger event.

***RST** ON

FREQuency:CENter

This related command sets the center frequency of a chirp.
Refer to [\[:SOURce\]:FREQuency:CENTer](#) for a detailed command description.

FREQuency:MODE

This related command sets the frequency mode of the signal generator. A chirp can be enabled by selecting chirp mode or disabled by selecting any other mode.
Refer to [\[:SOURce\]:FREQuency:MODE](#) for a detailed command description.

FREQuency:SPAN

This related command sets the frequency span of a chirp.
Refer to [\[:SOURce\]:FREQuency:SPAN](#) for a detailed command description.

FREQuency:START

This related command sets the start frequency in a chirp.
Refer to [\[:SOURce\]:FREQuency:START](#) for a detailed command description.

FREQuency:STOP

This related command sets the stop frequency in a chirp.
Refer to [\[:SOURce\]:FREQuency:STOP](#) for a detailed command description.

[\[:SOURce<ch>\]:PHASe Subsystem](#)

Command	Parameters	Unit	Default
[:SOURce<ch>]:PHASe:REFerence			
[:SOURce<ch>]:PHASe[:ADJust]	< float>	rad deg	0 rad
[:SOURce<ch>]:PHASe:CENTer	<float>	Hz	3.14 rad
[:SOURce<ch>]:PHASe:COMPensation	<float>	s	0 s
[:SOURce<ch>]:PHASe:MEMory:REStart			
[:SOURce<ch>]:PHASe:MODE	FIXed CW SWEep LIST		FIXed
[:SOURce<ch>]:PHASe:SPAN	<float>	rad deg	6.28 rad
[:SOURce<ch>]:PHASe:START	<float>	rad deg	0 rad
[:SOURce<ch>]:PHASe:STEP?		rad	
[:SOURce<ch>]:PHASe:STOP	<float>	rad deg	6.28 rad

:PHASe:REFerence

[\[SOURce<ch>\]:PHASe:REFerence](#)

This command sets the current output phase as a zero reference. Subsequent phase adjustments are set relative to the new reference.

PHASe[:ADJust]

[[:SOURce<ch>]:PHASe[:ADJust] <float>

[[:SOURce<ch>]:PHASe[:ADJust]?

This command adjusts the phase of the signal.

***RST** 0 rad

Range -1e10 to +1e10 rad

Unit rad|deg

PHASe:CENTer

[[:SOURce<ch>]:PHASe:CENTer <float>

[[:SOURce<ch>]:PHASe:CENTer?

This command sets the sweep center phase.

***RST** 3.14 rad

Range Please refer to the *Data Sheet*.

Unit rad|deg

PHASe:COMPensation

[[:SOURce<ch>]:PHASe:COMPensation <float>

[[:SOURce<ch>]:PHASe: COMPensation?

This command sets the electrical length compensation. It compensates phase shift introduced by external transmission lines.

***RST** 0 s

Range -1e10 to +1e10 s

Unit s

PHASe:MEMory:REStart

[[:SOURce<ch>]:PHASe:MEMory:REStart

For devices with option PHS this command restarts phase memory. Phase memory aligns the output signal phase such that for any frequency a zero crossing occurs at the same reference point in time. Restart resets this reference point in time.

PHASe:MODE

[[:SOURce<ch>]: PHASe:MODE FIXed|CW|SWEep|LIST

[[:SOURce<ch>]: PHASe:MODE?

This command sets the phase mode of the signal generator to CW or (list) sweep.

FIXed|CW Selects fixed phase operation and stops an active phase sweep.

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

In SWEep mode, phase will be determined by programmed values for the :START and :STOP :PHASe subsystem commands.

Use the [:SOURce<ch>]:SWEep subsystem commands for sweep configuration.

In LIST mode, phase is determined by programmed values for

[:SOURce<ch>]:LIST:PHASe.

Use the [:SOURce<ch>]:LIST subsystem commands for list sweep configuration.

***RST** FIXed

PHASe:SPAN

[:SOURce<ch>]:PHASe:SPAN <float>

[:SOURce<ch>]: PHASe:SPAN?

This command sets the phase sweep span.

***RST** 6.28 rad

Range -1e10 to +1e10 rad

Unit rad|deg

PHASe:START

[:SOURce<ch>]: PHASe:START <float>

[:SOURce<ch>]: PHASe:START?

This command sets the first phase point in a sweep.

***RST** 0 rad

Range -1e10 to +1e10 rad

Unit rad|deg

PHASe:STEP

[:SOURce<ch>]: PHASe:STEP?

This query returns the phase step size for a sweep.

Unit rad

PHASe:STOP

[:SOURce<ch>]: PHASe:STOP <float>

[:SOURce<ch>]: PHASe:STOP?

This command sets the last phase point in a sweep.

***RST** 6.28 rad

Range -1e10 to +1e10 rad

Unit rad|deg

[[:SOURce<ch>]:POWER Subsystem

Command	Parameters	Unit	Default
[[:SOURce<ch>]:POWER[:LEVel][:IMMediate][:AMPLitude]	<float>	dBm ...	0 dBm
[[:SOURce<ch>]:POWER:CENTer	<float>	dBm ...	-5 dBm
[[:SOURce<ch>]:POWER:MODE	FIXed CW LIST SWEEp		FIXed
[[:SOURce<ch>]:POWER:SPAN	<float>	dBm ...	+30 dBm
[[:SOURce<ch>]:POWER:START	<float>	dBm ...	-20 dBm
[[:SOURce<ch>]:POWER:STEP?		dBm	
[[:SOURce<ch>]:POWER:STOP	<float>	dBm ...	+10 dBm
[[:SOURce<ch>]:POWER:ALC[:STATe]	ON OFF 1 0		ON
[[:SOURce<ch>]:POWER:ALC:BWIDth BANDwidth	LOW HIGH		-
[[:SOURce<ch>]:POWER:ALC:BWIDth BANDwidth:AUTO	ON OFF 1 0		ON
[[:SOURce<ch>]:POWER:ALC:LOWNoise	ON OFF 1 0		OFF
[[:SOURce<ch>]:POWER:ALC:HOLD	ON OFF 1 0		-
[[:SOURce<ch>]:POWER:ALC:HOLD:AUTO	ON OFF 1 0		ON
[[:SOURce<ch>]:POWER:ATTenuation	<float>	dB	0 dB
[[:SOURce<ch>]:POWER:ATTenuation:AUTO	ON OFF 1 0		ON
[[:SOURce<ch>]:POWER:ATTenuation:LIST?			

POWER[:LEVel][:IMMediate][:AMPLitude]

[[:SOURce<ch>]:POWER[:LEVel][:IMMediate][:AMPLitude] <float>

[[:SOURce<ch>]:POWER[:LEVel][:IMMediate][:AMPLitude]?

This command sets the RF output power.

***RST** 0 dBm

Range Please refer to the *Data Sheet*.

Unit **dBm** | dBu | dBW | W | dBuV | dBmV | dBV | V | dBuA | dBmA | dBA | A

POWER:CENTer

[[:SOURce<ch>]:POWER:CENTer <float>

[[:SOURce<ch>](#)]:POWer:CENTer?

This command sets the sweep center amplitude.

***RST** – 5 dBm

Range Please refer to the *Data Sheet*.

Unit dBm | dBu | dBW | W | dBuV | dBmV | dBV | V | dBuA | dBmA | dBA | A

POWer:MODE

[[:SOURce<ch>](#)]:POWer:MODE CW | LIST | SWEep

[[:SOURce<ch>](#)]:POWer:MODE?

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

FIXed | CW Selects fixed power operation and stops an active power sweep.

SWEep or 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 SWEep power sweep.

In SWEep mode, power will be determined by programmed values for the :START and :STOP :POWer subsystem commands.

Use the [[:SOURce<ch>](#)]:SWEep subsystem commands for sweep configuration.

In LIST mode, power is determined by programmed values for

[\[SOURce<ch>\]:LIST:POWer](#).

Use the [[:SOURce<ch>](#)]:LIST subsystem commands for list sweep configuration.

***RST** FIXed

POWer:SPAN

[[:SOURce<ch>](#)]:POWer:SPAN <float>

[[:SOURce<ch>](#)]:POWer:SPAN?

This command sets the amplitude sweep span.

***RST** +30 dBm

Range Please refer to the *Data Sheet*.

Unit Hz

POWer:START

[[:SOURce<ch>](#)]:POWer:START <float>

[[:SOURce<ch>](#)]:POWer:START?

This command sets the first amplitude point in a sweep.

***RST** -20 dBm

Range Please refer to the *Data Sheet*.

Unit dBm | dBu | dBW | W | dBuV | dBmV | dBV | V | dBuA | dBmA | dBA | A

POWer:STEP

[[:SOURce<ch>]:POWer:STEP[:LINear]?]

This query returns the amplitude step size for a sweep.

POWer:STOP

[[:SOURce<ch>]:POWer:STOP <value><unit>]

[[:SOURce<ch>]:POWer:STOP?]

This command sets the last amplitude point in a sweep.

***RST** +10 dBm

Range Please refer to the *Data Sheet*.

Unit dBm | dBu | dBW | W | dBuV | dBmV | dBV | V | dBuA | dBmA | dBA | A

POWer:ALC[:STATe]

[[:SOURce<ch>]:POWer:ALC[:STATe] ON | OFF | 1 | 0]

[[:SOURce<ch>]:POWer:ALC[:STATe]?]

This command turns the ALC (automatic levelling control) on or off. Specified output power is guaranteed only with ALC on.

For information about how to use different ALC modes please refer to application note *AN3005*.

***RST** ON

POWer:ALC:BWIDth | BANDwidth

[[:SOURce<ch>]:POWer:ALC:BWIDth | BANDwidth LOW | HIGH]

[[:SOURce<ch>]:POWer:ALC:BWIDth | BANDwidth?]

This command selects the ALC (automatic levelling control) bandwidth.

LOW Selects low ALC bandwidth. This mode provides best noise performance and power stability but frequency and power switching time increases.

HIGH Selects high ALC bandwidth. This mode provides lower frequency and power switching time but noise and power stability degrade.

When automatic ALC bandwidth selection is active, the device chooses the appropriate bandwidth setting automatically.

Setting the ALC bandwidth manually with this command disables automatic bandwidth selection.

Refer to the [\[:SOURce<ch>\]:POWer:ALC:BWIDth | BANDwidth:AUTO](#) command.

For information about how to use different ALC modes please refer to application note *AN3005*.

***RST** LOW (automatic)

POWer:ALC:BWIDth | BANDwidth:AUTO

[[:SOURce<ch>]:]Power:ALC:BWIDth|BANDwidth:AUTO ON|OFF|1|0

[[:SOURce<ch>]:]Power:ALC:BWIDth|BANDwidth:AUTO?

This command disables or enables automatic ALC bandwidth selection. Enabling automatic ALC bandwidth selection lets the device select the appropriate ALC bandwidth setting.

Refer to the [[:SOURce<ch>]:]Power:ALC:BWIDth|BANDwidth command.

For information about how to use different ALC modes please refer to application note AN3005.

***RST ON**

Power:ALC:LOWNoise

[[:SOURce<ch>]:]Power:ALC:LOWNoise ON | OFF | 1 | 0

[[:SOURce<ch>]:]Power:ALC:LOWNoise?

This command enables or disables the low amplitude noise mode providing up to 1/1000 dB output power resolution. When enabled, the automatic levelling control will work in a mode similar to hold. In opposite to the hold mode:

- The hold setpoint won't be sampled again when changing the output power setting using the [[:SOURce<ch>]:]Power[:LEVel][:IMMediate][:AMPLitude] command.
- The hold setpoint won't be sampled again when turning RF on or off using the :OUTPut<ch>[:STATe] command.

Switching speed (power and frequency) degrades. Sweeps and modulations are not available in low amplitude noise mode.

***RST OFF**

Power:ALC:HOLD

[[:SOURce<ch>]:]Power:ALC:HOLD ON|OFF|1|0

[[:SOURce<ch>]:]Power:ALC:HOLD?

This command sets the automatic level control into hold mode. The amplitude level control loop is open. ALC hold can improve power stability when fast sweeps or modulations are active.

When automatic ALC hold mode selection is active, the device chooses the appropriate ALC hold setting automatically.

Setting the ALC hold state manually with this command disables automatic ALC hold mode selection.

Refer to the [[:SOURce<ch>]:]Power:ALC:HOLD:AUTO command.

For information about how to use different ALC modes please refer to application note AN3005.

***RST OFF (automatic)**

Power:ALC:HOLD:AUTO

[[:SOURce<ch>]:]Power:ALC:HOLD:AUTO ON|OFF|1|0

[[:SOURce<ch>]:]Power:ALC:HOLD:AUTO?

This command disables or enables automatic ALC hold mode selection. Enabling automatic ALC hold mode selection lets the device select the appropriate ALC hold mode setting.

Refer to the [[:SOURce<ch>]:]Power:ALC:HOLD command.

For information about how to use different ALC modes please refer to application note AN3005.

***RST ON**

POW:ATTenuation

[[:SOURce<ch>](#)]:POW:ATTenuation <value>

[[:SOURce<ch>](#)]:POW:ATTenuation?

(Devices with option PE only)

This command sets the power range extension attenuator. This command will also turn off automatic attenuation setting. Refer to [\[:SOURce<ch>\]:POW:ATTenuation:AUTO](#) for details. Attenuator input RF power shall be -30...+10 dBm, e.g. using a [\[:SOURce<ch>\]:POW:ATTenuation](#) value of 50 dB, the output RF power range is -80...-40 dBm.

***RST 0**

Range Please refer to the *Data Sheet*.

Unit dBm

POW:ATTenuation:AUTO

[[:SOURce<ch>](#)]:POW:ATTenuation:AUTO ON|OFF|1|0

[[:SOURce<ch>](#)]:POW:ATTenuation:AUTO?

(Devices with option PE only)

This command turns the power range extension on or off. Turning it off allows fast power sweeps for devices featuring an extended output power range.

***RST 0**

POW:ATTenuation:LIST?

[[:SOURce<ch>](#)]:POW:ATTenuation:LIST?

(Devices with option PE only)

This query returns a comma-separated list of available attenuation settings. These can be selected using the [\[:SOURce<ch>\]:POW:ATTenuation](#) command.

For devices with PE4, it returns 2 values:

1. The step in dB at which the PE attenuation can be incremented.
2. The maximum attenuation in dB that can be set.

Refer to the *Data Sheet* for a list of available settings.

[[:SOURce<ch>]:CORRection Subsystem

The flatness correction system provides power correction over frequency. Gain or loss of external components can be compensated.

Flatness correction is global and common to all channels.

Command	Parameters	Unit	Default
[[:SOURce]:CORRection:FLATness:MODE	LOWer HIGHer INTerpolation		INTerpolation
[[:SOURce]:CORRection:FLATness:PAIR [:SOURce]:CORRection:FLATness:PAIR?	<float(f...)>,<float(p...)> <integer>	Hz, dBm ...	(empty)
[[:SOURce]:CORRection:FLATness:POINTS?			0
[[:SOURce]:CORRection:FLATness:PRESet			
[[:SOURce]:CORRection:FLATness[:STATE]	ON OFF 1 0		OFF
[[:MEMory]:FILE:CORRection:FLATness:DATA	<"file name">,<data>		
[[:MEMory]:FILE:CORRection:FLATness:LOAD	<"file name">		
[[:MEMory]:FILE:CORRection:FLATness:PEEK?	<"file name">		
[[:MEMory]:FILE:CORRection:FLATness:STORE	<"file name">		

FLATness:MODE

[[:SOURce]:CORRection:FLATness:MODE LOWer|HIGHer|INTerpolation

[[:SOURce]:CORRection:FLATness:MODE?

This command defines how the flatness correction value will be determined at frequency settings below, between or above the store correction pairs.

LOWer	Selects the pair at or below an output frequency setting.
HIGHer	Selects the pair at or above the output frequency setting.
INTerpolation	Selects linear interpolation between the two pairs closest to the output frequency setting.

*RST INTerpolation

FLATness:PAIR

[[:SOURce]:CORRection:FLATness:PAIR <float(frequency)>,<float(power)>

[[:SOURce]:CORRection:FLATness:PAIR? <integer>

This command form adds or changes a frequency and amplitude correction pair. The maximum number of points that can be entered is 3201.

The query form returns the frequency and amplitude correction pair at the given point index. The index ranges from 0 to the number of points minus 1.

Use the [\[:SOURce\]:CORRection:FLATness:PRESet](#) command to clear the flatness correction list.

*RST empty (no correction)

Range Please refer to the *Data Sheet*.

Unit <float(frequency)>: Hz, <float(power): **dBm** | ...

FLATness:POINTs

[[:SOURce]:CORRection:FLATness:POINTs?

This query returns the number of points in the active (loaded) flatness correction data table.

FLATness:PRESet

[[:SOURce]:CORRection:FLATness:PRESet

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

The current correction data will be overwritten once this command is executed. Save the current data if needed. Refer to the [:MEMory:FILE:CORRection:FLATness:STORE](#) command for storing user flatness files.

FLATness[:STATe]

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

[[:SOURce]:CORRection:FLATness[:STATe]?]

This command enables or disables the user- flatness corrections.

***RST OFF**

MEMory:FILE:CORRection:FLATness:DATA

:MEMory:FILE:CORRection:FLATness:DATA {<"filename">},<data>

:MEMory:FILE:CORRection:FLATness:DATA? {<"filename">}

The command writes data to a flatness correction file.

The query returns flatness correction file data.

Data sent or received has IEEE488.2 definite block data format:

#<num_digits><byte_count><data byte>{<data_byte>

<num_digits> specifies how many digits are contained in <byte_count>.

<byte_count> specifies how many data bytes follow in <data_bytes>.

Example of definite block data:

#2141000000000;1.0

#214...: byte count is two digits wide

#214...: 14 data bytes will follow

...1000000000;1.0: 14 bytes of data

The flatness correction data itself consists of values separated by semicolon “;” and rows separated by carriage return “\r” and/or newline “\n”. Two values (frequency in Hz, power correction in dBm) make a row. Each row defines one flatness correction point.

Example of two points flatness correction (first point 100 MHz, +1 dB; second point 200 MHz, -1 dB):

```
100000000;1.0\r\n
200000000;-1.0;\r\n
```

MEMory:FILE:CORRection:FLATness:LOAD

:MEMory:FILE: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 directory USERFLAT. The directory path is implied in the command and need not be specified in the variable name.

MEMory:FILE:CORRection:FLATness:PEEK

:MEMory:FILE:CORRection:FLATness:PEEK? "<file name>"

This query checks a flatness correction data file. If the file exists, the number of correction points is returned. If there is no such file, 0 is returned.

MEMory:FILE:CORRection:FLATness:STORE

:MEMory:FILE:CORRection:FLATness:STORE "<file name>"

This command stores the current user- flatness correction data to a file named by

the:FLATness:STORE command.:CORRection:FLATness:STORE command. The directory path is implied in the command and need not be specified in the "<file name>" variable.

[:SOURce<ch>]:ROSCillator Subsystem

The ROSCillator subsystem configures internal or external frequency reference.

Reference configuration is global and common to all channels for standard multi-channel devices. For those devices channel index <ch> is ignored and shall be omitted.

Some devices provide optional per channel configuration. Refer to the *Data Sheet*.

Command	Parameters	Unit	Default
[:SOURce<ch>]:ROSCillator:COU[:STATe]	ON OFF 1 0		OFF
[:SOURce<ch>]:ROSCillator:EXternal:FREQuency	<float>	Hz	10 MHz
[:SOURce<ch>]:ROSCillator:EXternal:VARiable:FREQuency	<float>	Hz	10 MHz
[:SOURce<ch>]:ROSCillator:LOCKed?			
[:SOURce<ch>]:ROSCillator:LOCKed:TEST			
[:SOURce<ch>]:ROSCillator:OUTPut[:STATe]	ON OFF 1 0		OFF
[:SOURce<ch>]:ROSCillator:OUTPut:FREQuency	<float>	Hz	10 MHz
[:SOURce<ch>]:ROSCillator:SOURce	INTERNAL EXTERNAL SLAVE EXTVariable CIN		INT
[:SOURce<ch>]:ROSCillator:INTERNAL:TUNing	<float>		varies

ROSCillator:COU[:STATe]

[:SOURce<ch>]:ROSCillator:OUTPut[:STATe] ON|OFF|1|0

[:SOURce<ch>]:ROSCillator:COU[:STATe]?

(APMS devices only)

This command enables or disables the high frequency reference output (CLK OUT) with fixed 3 GHz clock. This output allows locking multiple APMS devices to a common reference by daisy-chaining high frequency reference inputs (CLK IN) and outputs (CLK out). This mode offers the best relative phase stability between daisy-chained APMS devices.

The slave device must be configured for 3 GHz reference input: [\[:SOURce<ch>\]:ROSCillator:SOURce CIN](#).

***RST** OFF

ROSCillator:EXternal:FREQuency

[:SOURce<ch>]:ROSCillator:EXternal:FREQuency <float>

[:SOURce<ch>]:ROSCillator:EXternal:FREQuency?

This command conveys the expected reference frequency value of an externally applied reference to the signal generator.

***RST** 10 MHz

Range Please refer to the *Data Sheet*.

Unit Hz

ROSCillator:EXtErnal:VARiable:FREQuency

[[:SOURce<ch>]:ROSCillator:EXtErnal:VARiable:FREQuency <float>

[[:SOURce<ch>]:ROSCillator:EXtErnal:VARiable:FREQuency?

This command conveys the expected reference frequency value of an externally applied reference to the signal generator with option VREF enabled. Option VREF is enabled by selecting it as the reference source, see [\[:SOURce<ch>\]:ROSCillator:SOURce EXTVariable](#).

***RST** 10 MHz

Range Please refer to the *Data Sheet*.

Unit Hz

ROSCillator:LOCKed?

[[:SOURce<ch>]:ROSCillator:LOCKed?

This command queries if the synthesizer is locked to the externally applied reference.

It is equivalent to checking the frequency bit in [:STATus:QUESTionable:CONDition](#).

Devices featuring a lock check that affects RF output performance require that the lock test is initiated manually before sending this query. Otherwise the last known (possibly outdated) lock state is returned. Please refer to the [\[:SOURce<ch>\]:ROSCillator:LOCKed:TEST](#) command.

ROSCillator:LOCKed:TEST

[[:SOURce<ch>]:ROSCillator:LOCKed:TEST

(APMS devices or APSIN devices with SN xxx-xxDxxxxxx-xxx only)

Only applicable for 10MHz internal and external reference.

This initiates a reference oscillator locked / unlocked test. The result can be queried by [\[:SOURce<ch>\]:ROSCillator:LOCKed?](#). N.B. There should be a delay of at least 3 seconds before querying the result, to ensure the test has completed.

ROSCillator:OUTPut[:STATe]

[[:SOURce<ch>]:ROSCillator:OUTPut[:STATe] ON|OFF|1|0

[[:SOURce<ch>]:ROSCillator:OUTPut[:STATe]?

This command enables or disables the frequency reference output.

***RST** OFF

ROSCillator:OUTPut:FREQuency

[[:SOURce<ch>]:ROSC:OUTPut:FREQuency <value><unit>

[[:SOURce<ch>]:ROSC:OUTPut:FREQuency?

This command selects the reference output frequency.

***RST** device specific

Range Please refer to the *Data Sheet*.

Unit Hz

ROSCillator:SOURce

[[:SOURce<ch>]:ROSCillator:SOURce INTERNAL|EXTERNAL|SLAVE|EXTVariable|CIN

[[:SOURce<ch>]:ROSCillator:SOURce?

This command selects the reference clock source.

INTERNAL	Selects the internal reference oscillator.
EXTERNAL	Selects the reference input as the reference clock source. Option VREF is disabled if available which improves relative phase stability between the reference and the RF output signal. See [:SOURce]:ROSCillator:EXTERNAL:FREQUENCY for the reference input clock setting.
SLAVE	Selects slave mode with fixed 100 MHz reference input clock. This mode allows locking multiple APSIN or APSYN420 devices to a common reference by daisy-chaining reference inputs and outputs. This mode offers the best relative phase stability between daisy-chained APSIN or APSYN420 devices. The master device must be configured for 100 MHz reference output: [:SOURce<ch>]:ROSCillator:OUTPut[:STATe] ON, [:SOURce<ch>]:ROSC:OUTPut:FREQUENCY 100 MHz.
EXTVariable	(Devices with option VREF only) Selects the reference input as the reference clock source and enables option VREF. VREF offers an extended range of reference input clock settings. See [:SOURce]:ROSCillator:EXTERNAL:FREQUENCY for the reference input clock setting.
CIN	(APMS devices only) Selects the high frequency reference input (CLK IN) with fixed 3 GHz clock as the reference clock source. This mode allows locking multiple APMS devices to a common reference by daisy-chaining high frequency reference inputs (CLK IN) and outputs (CLK out). This mode offers the best relative phase stability between daisy-chained APMS devices. The master device must be configured for 3 GHz reference output: [:SOURce<ch>]:ROSCillator:COUT[:STATe] ON.

***RST** INTERNAL

ROSCillator:INTERNAL:TUNing

[[:SOURce<ch>]:ROSCillator:INTERNAL:TUNing <float>

[[:SOURce<ch>]:ROSCillator:INTERNAL:TUNing?

This command is used to adjust the internal frequency reference. An adjustment range of approx +/- 2.5 ppm can be used with when setting 0.5 +/- 0.5.

***RST** device specific

[:SOURce<ch>]:LIST Subsystem

Sweep list memory channel selection for multi-channel devices

The target channel of sweep list memory commands under the MEMory subsystem can be defined by appending the channel index to the MEMory node: <ch> is 1 to number of channels.

If <ch> is omitted, the command targets the currently selected default channel.

Sweep list memory default channel selection

Default sweep list memory channel is coupled to default source channel. Refer to [:SOURce:]SElect for default channel selection.

Command	Parameters	Unit	Default
[:SOURce<ch>]:LIST:COUNT	INFinite <integer>		INFinite
[:SOURce<ch>]:LIST:DIRection	UP DOWN RANDom		UP
[:SOURce<ch>]:LIST:DWELl	<float>{,<float>}	s	10 ms,...
[:SOURce<ch>]:LIST:DELay	<float>{,<float>}	s	8 ms,...
[:SOURce<ch>]:LIST:DELay:AUTO	ON OFF 1 0		ON
[:SOURce<ch>]:LIST:FREQuency	<float>{,<float>}	Hz	10 MHz,...
[:SOURce<ch>]:LIST:FREQuency:POINts?			
[:SOURce<ch>]:LIST:MANual	<integer> UP DOWN		1
[:SOURce<ch>]:LIST:MODE	AUTO MANual		AUTO
[:SOURce<ch>]:LIST:PHASe	<float>{,<float>}	rad deg	0 rad,...
[:SOURce<ch>]:LIST:PHASe:POINts?			
[:SOURce<ch>]:LIST:POWer	<float>{,<float>}	dBm ...	6 dBm,...
[:SOURce<ch>]:LIST:POWer:POINts?			
[:SOURce<ch>]:LIST:PROGress?			
[:SOURce<ch>]:LIST:BLANking	ON OFF 1 0		ON
:MEMory<ch>:FILE:LIST?	FIRSt LAST NEXT PREVIous		
:MEMory<ch>:FILE:LIST:DATA	[<"filename">,<data>]		
:MEMory<ch>:FILE:LIST:DELeTe	<"filename"> ALL		
:MEMory<ch>:FILE:LIST:LOAD	<"filename">		
:MEMory<ch>:FILE:LIST:STORe	<"filename">		

LIST:COUNT

[[:SOURce<ch>]:LIST:COUNT INFinite|<integer>

[[:SOURce<ch>]:LIST:COUNT?

This command sets the number of list repetitions being played after triggering a list sweep. If set to INFinite, the list sweep will be repeated until a [:SOURce<ch>]:FREQuency:MODE, [:SOURce<ch>]:PHASe:MODE or [:SOURce<ch>]:POWer:MODE command is issued.

***RST** INFinite

Range INFinite or 2-65535

LIST:DIRection

[[:SOURce<ch>]:LIST:DIRection UP|DOWN|RANDom

[[:SOURce<ch>]:LIST:DIRection?

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 of a list sweep.

DOWN This choice enables a sweep in a descending (reverse) order, last to first point of a list sweep.

RANDom This choice enables a sweep with random selection of each point played.

***RST** UP

LIST:DWELl

[[:SOURce<ch>]:LIST:DWELl <float>{,<float>}

[[:SOURce<ch>]:LIST:DWELl?

This command sets the dwell (on) time for the current list sweep RAM points. 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.

If the programmed list contains one point, this setting is used for all points in the list sweep.

If it contains multiple points, each point in the list sweep uses the individual programmed setting.

***RST** 10 ms, 20 ms, 40 ms, 80 ms

Range 0 to 20 s

Unit s

LIST:DWELl:POINts

[[:SOURce<ch>]:LIST:DWELl:POINts?

This query returns the number of dwell time points in the current list sweep RAM.

LIST:DELay

[[:SOURce<ch>]:LIST:DELay <float>{,<float>}

[[:SOURce<ch>]:LIST:DElay?

This command sets the delay (off) time for the current list sweep points (list in RAM). The off time is the amount of time the output is guaranteed to be blanked after setting the frequency and/or power for the current point to suppress output transients during a frequency change.

If the programmed list contains one point, this setting is used for all points in the list sweep.

If it contains multiple points, each point in the list sweep uses the individual programmed setting.

***RST** 8 ms, 16 ms, 32 ms, 64 ms

Range 0 to 20 s

Unit s

LIST:DElay:POINts

[[:SOURce<ch>]:LIST:DElay:POINts?

This query returns the number of delay time points in the current list sweep RAM.

LIST:DElay:AUTO

[[:SOURce<ch>]:LIST:DElay:AUTO ON|OFF|1|0

[[:SOURce<ch>]:LIST:DElay:AUTO?

This command enables or disables automatic off (delay) time selection. In automatic mode, delay time is selected such that the transients between sweep points are blanked and do not appear at the RF output.

The automatically selected off time varies with device type. It can be queried by

[\[:SOURce<ch>\]:LIST:DElay?](#) while automatic mode is enabled.

***RST** OFF

LIST:FREQuency

[[:SOURce<ch>]:LIST:FREQuency <float>{,<float>}

[[:SOURce<ch>]:LIST:FREQuency?

This command sets the frequency values for the current list sweep points.

If the programmed list contains one point, this setting is used for all points in the list sweep.

If it contains multiple points, each point in the list sweep uses the individual programmed setting.

***RST** 10 MHz, 20 MHz, 30 MHz, 40 MHz

Range Please refer to the *Data Sheet*.

Unit Hz

LIST:FREQuency:POINts

[[:SOURce<ch>]:LIST:FREQuency:POINts?

This query returns the number of frequency points in the current list sweep RAM.

LIST:MANual

[[:SOURce<ch>]:LIST:MANual <integer>|UP|DOWN

[[:SOURce<ch>]:LIST:MANual?

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 [\[:SOURce\]: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.

<integer> Plays the selected point.

UP Plays the next point (last index plus one). The command has no effect if the last point is active already.

DOWN Plays the last point (last index minus one). The command has no effect if the first point is active already.

***RST 1**

Range UP|DOWN or 1 to 65535

LIST:MODE

[[:SOURce<ch>]:LIST:MODE AUTO|MANual

[[:SOURce<ch>]: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 [\[:SOURce\]:LIST:MANual](#) command for selecting a sweep point.

***RST AUTO**

LIST:PHASe

[[:SOURce<ch>]:LIST:PHASe <float>{,<float>}

[[:SOURce<ch>]:LIST:PHASe?

This command sets the amplitude for the current list RAM points.

If the programmed list contains one point, this setting is used for all points in the list sweep.

If it contains multiple points, each point in the list sweep uses the individual programmed setting.

***RST** 6 dBm, 4 dBm, 2 dBm, 0 dBm

Range Please refer to the *Data Sheet*.

Unit dBm|...

LIST:PHASe:POINts

[[:SOURce<ch>]:LIST:PHASe:POINts?

This command queries the number of power points in the current list sweep RAM.

LIST:POWer

[[:SOURce<ch>]:LIST:POWer <float>{,<float>}

[[:SOURce<ch>]:LIST:POWer?

This command sets the amplitude for the current list RAM points.

If the programmed list contains one point, this setting is used for all points in the list sweep.

If it contains multiple points, each point in the list sweep uses the individual programmed setting.

***RST** 6 dBm, 4 dBm, 2 dBm, 0 dBm

Range Please refer to the *Data Sheet*.

Unit dBm | ...

LIST:POWer:POINts

[[:SOURce<ch>]:LIST:POWer:POINts?

This command queries the number of power points in the current list sweep RAM.

LIST:PROGress

[[:SOURce<ch>]:LIST:PROGress?

This query returns the progress of an active list sweep, 0.0...1.0.

LIST:BLANKing

[[:SOURce<ch>]:LIST:BLANKing ON|OFF|1|0

[[:SOURce<ch>]:LIST:BLANKing?

This command enables or disables RF output blanking while waiting for the trigger signal. Blanking enabled means the RF output is off while waiting for the trigger event.

This setting is coupled with [\[:SOURce<ch>:SWEep:BLANKing](#).

***RST** ON

MEMory<ch>:FILE:LIST

:MEMory<ch>:FILE:LIST? FIRST|LAST|NEXT|PREVIOUS

This query returns the file names of the available list files.

FIRST Returns the first available list file name.

LAST Returns the last available list file name.

NEXT	Returns the next available list file name. After reaching the last list file this query continues returning the last list file name.
PREVIOUS	Returns the previous available list file name. After reaching the first list file this query continues returning the first list file name.

This allows enumerating all available list files.

MEMory<ch>:FILE:LIST:DATA

```
:MEMory<ch>:FILE:LIST:DATA [<"filename">],<data>
```

```
:MEMory<ch>:FILE:LIST:DATA? [<"filename">]
```

The command writes data to a list file. If the file name is omitted, data will be loaded to the list RAM. The RAM list will be played when enabling the list mode.

The query returns list file data. If the file name is omitted, list RAM data will be returned.

Data sent or received has IEEE488.2 definite block data format:

```
#<num_digits><byte_count><data byte>{<data_byte>}
```

<num_digits> specifies how many digits are contained in <byte_count>.

<byte_count> specifies how many data bytes follow in <data_bytes>.

Example of definite block data:

```
#221130000000;1.1;0.1;0.1
```

#221...: byte count is two digits wide

#221...: 21 data bytes will follow

...130000000;1.1;0.1;0.1: 21 bytes of data

The list itself consists of values separated by semicolon ";" and rows separated by carriage return "\r" and/or newline "\n". Four values (frequency in Hz, power in dBm, dwell time in s, delay time in s) make a row. Each row defines one point of the list.

Example of a two points list (first point 130 MHz, 1.1 dBm, 100 ms on, 100 ms off; second point 130 MHz, 1 dBm, 100 ms on, 100 ms off):

```
130000000;1.1;0.1;0.1\r\n
```

```
140000000;1;0.1;0.1\r\n
```

MEMory<ch>:FILE:LIST:DELEte

```
:MEMory<ch>:FILE:LIST:DELEte [<"filename">]|ALL
```

This command deletes the specified list file. Passing ALL deletes all present list files.

MEMory<ch>:FILE:LIST:LOAD

```
:MEMory<ch>:FILE:LIST:LOAD [<"filename">]
```

This command loads a list file to the list RAM. The RAM list will be played when enabling the list mode.

MEMory<ch>:FILE:LIST:STORe

:MEMory<ch>:FILE:LIST:STORe <"filename">

This command stores the current list RAM data in a list file.

[[:SOURce]:LFOutput Subsystem

This command subsystem controls the low frequency output.

The low frequency output is global (common to all channels), so no channel selection is available. Commands with channel selection will be accepted, but the channel selection will be ignored.

Command	Parameters	Unit	Default
[[:SOURce]:LFOutput:AMPLitude	<float>	V	1 V
[[:SOURce]:LFOutput:FREQuency	<float>	Hz	400 Hz
[[:SOURce]:LFOutput:STATe	ON OFF 1 0		OFF
[[:SOURce]:LFOutput:SHAPE	SINE TRIangle SQUare		SINE
[[:SOURce]:LFOutput:SOURce	LFGenerator PULM TRI Gger		LFG

LFOutput:AMPLitude

[[:SOURce]:LFOutput:AMPLitude <float>

[[:SOURce]:LFOutput:AMPLitude?

This command sets the low frequency generator amplitude. This setting does only take effect if [\[:SOURce\]:LFOutput:SOURce](#) is set to LFGenerator and LFOutput:SHAPE is either set to SINE or TRIangle. Using any other setting, the output amplitude is fixed 2.5 V.

***RST 1 V**

Range 0 to 2.5 V

Unit V

LFOutput:FREQuency

[[:SOURce]:LFOutput:FREQuency <float>

[[:SOURce]:LFOutput:FREQuency?

This command sets the low frequency generator frequency. This setting does only take effect if :LFOutput:SOURce is set to LFGenerator.

***RST 400 Hz**

Range 10 Hz to 5 MHz

Unit Hz

LFOutput:STATe

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

[[:SOURce]:LFOutput:STATe?

This command sets the function output / low frequency generator state.

***RST OFF**

LFOutput:SHAPE

[[:SOURce]:LFOutput:SHAPE SINE|TRIangle|SQUare

[[:SOURce]:LFOutput:SHAPE?

This command sets the low frequency generator waveform. This setting does only take effect if [:LFOutput:SOURce](#) is set to LFGenerator.

SINE Sine wave output, amplitude is settable by the [\[:SOURce\]:LFOutput:AMPLitude](#) command.

TRIangle Triangle wave output, amplitude is settable by the [\[:SOURce\]:LFOutput:AMPLitude](#) command.

SQUare Square wave output, amplitude is fixed 2.5 V.

***RST SINE**

LFOutput:SOURce

[[:SOURce]:LFOutput:SOURce LFGenerator|PULM|TRIGger

[[:SOURce]:LFOutput:SOURce?

This command sets the low frequency generator waveform. This setting does only take effect if [:LFOutput:SOURce](#) is set to LFGenerator.

LFGenerator This selects the low frequency generator as the function output signal.

PULM This selects the pulse modulation video out as the function output signal.

TRIGger This selects the trigger as the function output signal. Refer to the [:TRIGger](#) system for details.

***RST LFGenerator**

[:SOURce<ch>]:SWEep Subsystem

Command	Parameters	Unit	Default
[:SOURce<ch>]:SWEep:COUNT	INFinite <integer>	INFinite	INFinite
[:SOURce<ch>]:SWEep:DIRection	UP DOWN RANDom	UP	UP
[:SOURce<ch>]:SWEep:POINts	<integer>		2
[:SOURce<ch>]:SWEep:DWELL	<float>	s	400 μ s
[:SOURce<ch>]:SWEep:DELAy	<float>	s	0 s
[:SOURce<ch>]:SWEep:DELAy:AUTO	ON OFF 1 0		OFF
[:SOURce<ch>]:SWEep:PROGress?			
[:SOURce<ch>]:SWEep:SPACing	LINEar LOGarithmic		LINEar
[:SOURce<ch>]:SWEep:BLANKing	ON OFF 1 0		ON

Related command
[:SOURce<ch>]:FREQuency:CENTer
[:SOURce<ch>]:FREQuency:MODE
[:SOURce<ch>]:FREQuency:SPAN
[:SOURce<ch>]:FREQuency:STARt
[:SOURce<ch>]:FREQuency:STOP
[:SOURce<ch>]:PHASe:CENTer
[:SOURce<ch>]:PHASe:MODE
[:SOURce<ch>]:PHASe:SPAN
[:SOURce<ch>]:PHASe:STARt
[:SOURce<ch>]:PHASe:STOP
[:SOURce<ch>]:POWEr:CENTer
[:SOURce<ch>]:POWEr:MODE
[:SOURce<ch>]:POWEr:SPAN
[:SOURce<ch>]:POWEr:STARt
[:SOURce<ch>]:POWEr:STOP

SWEep:COUNT

[:SOURce<ch>]:SWEep:COUNT Infinite | <integer>

[:SOURce<ch>]:SWEep:COUNT?

This command sets the number of sweep repetitions being played after triggering a sweep. If set to INFinite, the sweep will be repeated until a [:SOURce<ch>]:FREQuency:MODE, [:SOURce<ch>]:PHASe:MODE or [:SOURce<ch>]:POWEr:MODE command is issued.

*RST INFinite

Range INFinite or 2 to 65535

SWEp:DIRection

[[:SOURce<ch>]:SWEp:DIRection UP|DOWN|RANDom

[[:SOURce<ch>]:SWEp:DIRection?

This command sets the direction of a step sweep.

UP The sweep moves from start to stop.

DOWN The sweep moves from stop to start.

RANDom The sweep plays random frequencies within the start and stop interval.

***RST UP**

SWEp:POINts

[[:SOURce<ch>]:SWEp:POINts <integer>

[[:SOURce<ch>]:SWEp:POINts?

This command defines the number of step sweep points.

***RST 2**

Range 2–65535

SWEp:DWELl

[[:SOURce<ch>]:SWEp:DWELl <float>

[[:SOURce<ch>]:SWEp:DWELl?

This command sets the dwell time for the current step sweep points. Dwell time is used when IMMEDIATE is the trigger source. 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.

***RST 400 us**

Range 0 to 20 s

Unit s

SWEp:DElay

[[:SOURce<ch>]:SWEp:DElay <float>

[[:SOURce<ch>]:SWEp:DElay?

This command sets the off time for the current step sweep points. Off time is used when IMMEDIATE is the trigger source. The off time is the amount of time the sweep is guaranteed to pause after setting the frequency and/or power for the current point.

***RST 0 s**

Range 0 to 20 s

SWEp:DElay:AUTO

```
[ :SOURce<ch>]:SWEp:DElay:AUTO ON|OFF|1|0
```

```
[ :SOURce<ch>]:SWEp:DElay:AUTO?
```

This command enables or disables automatic off (delay) time selection. In automatic mode, delay time is selected such that the transients between sweep points are blanked and do not appear at the RF output. The automatically selected off time varies with device type. It can be queried by [\[:SOURce<ch>\]:SWEp:DElay?](#) while automatic mode is enabled.

***RST OFF**

SWEp:PROGgress

```
[ :SOURce<ch>]:SWEp:PROGgress?
```

This query returns the progress of an active sweep. The returned value is in the range of 0.0 to 1.0, with 0.0 indicating sweep is at start and 1.0 indicating stop.

SWEp:SPACing

```
[ :SOURce<ch>]:SWEp:SPACing LINear|LOGarithmic
```

```
[ :SOURce<ch>]:SWEp:SPACing?
```

This command enables the signal generator linear or logarithmic sweep modes.

LINear Selects linear steps adding the same step size to each point.

LOGarithmic Selects logarithmic steps multiplying each point with the same factor.

Logarithmic step is supported for frequency sweeps only. Power and phase sweeps support linear mode only (linear in dB for power sweeps) and ignore this setting.

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

***RST LINear**

SWEp:BLANKing

```
[ :SOURce<ch>]:SWEp:BLANKing ON|OFF|1|0
```

```
[ :SOURce<ch>]:SWEp:BLANKing?
```

This command enables or disables RF output blanking while waiting for the trigger signal. Blanking enabled means the RF output is off while waiting for the trigger event.

This setting is coupled with [\[:SOURce<ch>\]:LIST:BLANKing](#).

***RST ON**

FREQuency:CENTer

This related command sets the center frequency of a step sweep.
Refer to [\[:SOURce\]:FREQuency:CENTer](#) for a detailed command description.

FREQuency:MODE

This related command sets the frequency mode of the signal generator. A frequency sweep can be enabled by selecting sweep mode or disabled by selecting any other mode.
Refer to [\[:SOURce\]:FREQuency:MODE](#) for a detailed command description.

FREQuency:SPAN

This related command sets the frequency span of a step sweep.
Refer to [\[:SOURce\]:FREQuency:SPAN](#) for a detailed command description.

FREQuency:START

This related command sets the start frequency in a step sweep.
Refer to [\[:SOURce\]:FREQuency:START](#) for a detailed command description.

FREQuency:STOP

This related command sets the stop frequency in a step sweep.
Refer to [\[:SOURce\]:FREQuency:STOP](#) for a detailed command description.

PHASe:CENTer

This related command sets the center phase of a step sweep.
Refer to [\[:SOURce\]:PHASe:CENTer](#) for a detailed command description.

PHASe:MODE

This related command sets the phase mode of the signal generator. A phase sweep can be enabled by selecting sweep mode or disabled by selecting any other mode.
Refer to [\[:SOURce\]:PHASe:MODE](#) for a detailed command description.

PHASe:SPAN

This related command sets the phase span of a step sweep.
Refer to [\[:SOURce\]:PHASe:SPAN](#) for a detailed command description.

PHASe:START

This related command sets the start phase in a step sweep.
Refer to [\[:SOURce\]:PHASe:START](#) for a detailed command description.

PHASe:STOP

This related command sets the stop phase in a step sweep.
Refer to [\[:SOURce\]:PHASe:STOP](#) for a detailed command description.

POWer:CENTer

This related command sets the center amplitude of a step sweep.
Refer to [\[:SOURce\]:POWer:CENTer](#) for a detailed command description.

POWer:MODE

This related command sets the amplitude mode of the signal generator. An amplitude sweep can be enabled by selecting sweep mode or disabled by selecting any other mode.
Refer to [\[:SOURce\]:POWer:MODE](#) for a detailed command description.

POWer:SPAN

This related command sets the amplitude span of a step sweep.
Refer to [\[:SOURce\]:POWer:SPAN](#) for a detailed command description.

POWer:START

This related command sets the start amplitude in a step sweep.
Refer to [\[:SOURce\]:POWer:START](#) for a detailed command description.

POWer:STOP

This related command sets the stop amplitude in a step sweep.
Refer to [\[:SOURce\]:POWer:STOP](#) for a detailed command description.

[\[:SOURce<ch>\]:AM Subsystem \(Amplitude Modulation\)](#)

Command	Parameters	Unit	Default
[:SOURce<ch>]:AM:DEPT h	<float>	1 PCT	0.8
[:SOURce<ch>]:AM:INT ernal:FREQuency	<float>	Hz	400 Hz
[:SOURce<ch>]:AM:SENS itivity	<float>	V ⁻¹	0.8 V ⁻¹
[:SOURce<ch>]:AM:SOUR ce	INTernal EXTernal		INTernal
[:SOURce<ch>]:AM:STAT e	ON OFF 1 0		OFF

AM:DEPTh

[\[:SOURce<ch>\]:AM\[:DEPT](#)h]: <float>

[\[:SOURce<ch>\]:AM\[:DEPT](#)h]:?

This command sets the amplitude modulation depth. This setting will be used if [\[:SOURce<ch>\]:AM:SOURce](#) is set to INTERNAL.

***RST** 0.8

Range 0 to 0.99

Unit 1|PCT

AM:INTERNAL:FREQUENCY

[\[:SOURce<ch>\]:AM:INTERNAL:FREQUENCY](#) <float>

[\[:SOURce<ch>\]:AM:INTERNAL:FREQUENCY?](#)

This command sets the internal amplitude modulation rate.

***RST** 400 Hz

Range 10 Hz to 50 kHz

Unit Hz

AM:SENSITIVITY

[\[:SOURce<ch>\]:AM:INTERNAL:SENSITIVITY](#) <float>

[\[:SOURce<ch>\]:AM:INTERNAL: SENSITIVITY?](#)

This command sets the external amplitude modulation sensitivity. This setting will be used if [\[:SOURce<ch>\]:AM:SOURce](#) is set to EXTERNAL.

***RST** 0.8 V⁻¹

Range 0 to 3 V⁻¹

Unit V⁻¹

AM:SOURce

[\[:SOURce<ch>\]:AM:SOURce](#) INTERNAL|EXTERNAL

[\[:SOURce<ch>\]:AM: SOURce?](#)

This command selects the amplitude modulation signal source.

INTERNAL An internal modulation source is applied.

EXTERNAL The device's AM input (at the rear panel) is activated.

***RST** INTERNAL

AM:STATE

[\[:SOURce<ch>\]:AM:STATE](#) 0|1|OFF|ON

[\[:SOURce<ch>\]:AM: STATE?](#)

This command turns the amplitude modulation on or off.

*RST OFF

[:SOURce<ch>]:FM Subsystem (Frequency Modulation)

Command	Parameters	Unit	Default
[:SOURce<ch>]:FM:DEVIation	<float>	Hz	1000 Hz
[:SOURce<ch>]:FM:SENSitivity	<float>	Hz/V	1000 Hz/V
[:SOURce<ch>]:FM:INT:FREQuency	<float>	Hz	400 Hz
[:SOURce<ch>]:FM:INTernal:SHAPE	RD RU SINE SQUare TRIangle		SINE
[:SOURce<ch>]:FM:SOURce	INTernal EXTernal		EXT
[:SOURce<ch>]:FM:STATe	ON OFF 1 0		OFF
[:SOURce<ch>]:FM:COUPling	AC DC		AC

FM:DEVIation

[:SOURce<ch>]:FM:DEVIation <float>

[:SOURce<ch>]:FM: DEVIation?

This command sets the frequency modulation deviation. This setting will be used if [\[:SOURce<ch>\]:FM:SOURce](#) is set to INTernal.

***RST** 1000 Hz

Range Please refer to the *Data Sheet*.

Unit Hz

FM:SENSitivity

[:SOURce<ch>]:FM:SENSitivity <float>

[:SOURce<ch>]:FM: SENSitivity?

This command sets the frequency modulation deviation per one volt peak amplitude signal input. This setting will be used if [\[:SOURce<ch>\]:FM:SOURce](#) is set to EXTernal.

***RST** 1000 Hz/V

Range Please refer to the *Data Sheet*.

Unit Hz/V

FM:INT:FREQuency

[:SOURce<ch>]:FM:INT:FREQuency <float>

[:SOURce<ch>]:FM:INT:FREQuency?

This command sets the frequency modulation rate in Hz. This setting will be used if [\[:SOURce<ch>\]:FM:SOURce](#) is set to INTernal.

***RST** 400 Hz

Range Please refer to the *Data Sheet*.

Unit Hz

FM:INT:SHAPE

[[:SOURce]:FM:INT:SHAPE RD|RU|SINE|SQUare|TRIangle

[[:SOURce]:FM:INT:SHAPE?

This command specifies the FM modulation shape.

RD Selects ramp down.

RU Selects ramp up.

SINE Selects sine wave.

SQUare Selects square wave.

TRIangle Selects triangle wave.

***RST SINE**

FM:SOURce

[[:SOURce<ch>]:FM:SOURce EXTernal|INTernal

[[:SOURce<ch>]:FM:SOURce?

This command selects the FM modulation signal source.

INTernal An internal modulation signal is applied.

EXTernal The device's Φ M input (at the rear panel) is activated.

***RST EXTernal**

FM:STATe

[[:SOURce<ch>]:FM:STATe ON|OFF|1|0

[[:SOURce<ch>]:FM:STATe?

This command turns the frequency modulation on or off.

***RST OFF**

FM:COUPling

[[:SOURce<ch>]:FM:COUPling AC|DC

[[:SOURce<ch>]:FM:COUPling?

This command selects AC or DC signal coupling for the external FM modulation.

***RST AC**

[:SOURce<ch>]:PM Subsystem (Phase Modulation)

Command	Parameters	Unit	Default
[:SOURce<ch>]:PM:DEVIation	<float>	rad	2.4048 rad
[:SOURce<ch>]:PM:SENSitivity	<float>	rad/V	2.4048 rad/V
[:SOURce<ch>]:PM:INTernal:FREQuency	<float>	Hz	400 Hz
[:SOURce<ch>]:PM:INTernal:SHApe	RD RU SINE SQUare TRIangle		SINE
[:SOURce<ch>]:PM:SOURce	EXTernal INTernal		EXTernal
[:SOURce<ch>]:PM:STATe	ON OFF 1 0		OFF

PM:DEVIation

[:SOURce<ch>]:PM:DEVIation<float>

[:SOURce<ch>]:PM:DEVIation?

This command sets the phase modulation deviation. This setting will be used if [\[:SOURce<ch>\]:PM:SOURce](#) is set to INTernal.

***RST** 2.4048 rad

Range Please refer to the *Data Sheet*.

Unit rad

PM:SENSitivity

[:SOURce<ch>]:PM:SENSitivity <float>

[:SOURce<ch>]:PM: SENSitivity?

This command sets the phase modulation deviation per one volt peak amplitude signal input. This setting will be used if [\[:SOURce<ch>\]:PM:SOURce](#) is set to EXTernal.

***RST** 2.4048 rad/V

Range Please refer to the *Data Sheet*.

Unit rad/V

PM:INTernal:FREQuency

[:SOURce<ch>]:PM:INTernal:FREQuency <float>

[:SOURce<ch>]:PM:INTernal:FREQuency?

This command sets the phase modulation rate in Hz. This setting will be used if [\[:SOURce<ch>\]:PM:SOURce](#) is set to INTernal.

***RST** 400 Hz

Range Please refer to the *Data Sheet*.

PM:INT:SHAPE

[[:SOURce<ch>]:PM:INT:SHAPE RD|RU|SINE|SQUare|TRIangle

[[:SOURce<ch>]:PM:INT:SHAPE?

This command specifies the PM modulation shape.

RD Selects ramp down.

RU Selects ramp up.

SINE Selects sine wave.

SQUare Selects square wave.

TRIangle Selects triangle wave.

***RST SINE**

PM:SOURce

[[:SOURce<ch>]:PM:SOURce EXTernal|INTernal

[[:SOURce<ch>]:PM:SOURce?

This command selects the PM modulation signal source.

INTernal An internal modulation signal is applied.

EXTernal The device's Φ M input (at the rear panel) is activated.

***RST EXTernal**

PM:STATe

[[:SOURce<ch>]:PM:STATe ON|OFF|1|0

[[:SOURce<ch>]:PM:STATe?

This command turns the phase modulation on or off.

***RST OFF**

[[:SOURce<ch>]:PULM Subsystem (Pulse Modulation)

This additional functionality provides pulse modulation of the RF output signal delivered to the load by an internal or external modulation signal. The INTERNAL selection accesses the internally generated modulation input while EXTERNAL selects the external pulse (rear panel connector) input.

Command	Parameters	Unit	Default
[[:SOURce<ch>]:PULM:POLarity	NORMAL INVERTed		NORMAL
[[:SOURce<ch>]:PULM:INTERNAL:FREQuency	<float>	Hz	10 Hz
[[:SOURce<ch>]:PULM:INTERNAL:PERiod	<float>	s	100 ms
[[:SOURce<ch>]:PULM:INTERNAL:PWIDth	<float>	s	50 ms
[[:SOURce<ch>]:PULM:SOURce	INTERNAL EXTERNAL BITStream		INTERNAL
[[:SOURce<ch>]:PULM:STATE	ON OFF 1 0		OFF
[[:SOURce<ch>]:PULM:MODE	RATio BANDwidth BWIDth		RATio
[[:SOURce]:PULM:OUTPut:VIDeo:SOURce	<integer>		1
[[:SOURce<ch>]:PULM:BITStream	<hex data>		5h
[[:SOURce<ch>]:PULM:BITStream:BITS	<integer>		4
[[:SOURce<ch>]:PULM:BITStream:DIRection	MSBFirst LSBFirst		MSBFirst
[[:SOURce<ch>]:PULM:BITStream:RATE	<float>	Hz	20 Hz
[[:SOURce<ch>]:PULM:BITStream:STARTbit	<integer>		0
[[:SOURce<ch>]:PULM:BITStream:TIME	<float>	s	50 ms

PULM:POLarity

[[:SOURce<ch>]:PULM:POLarity NORMAL|INVERTed

[[:SOURce<ch>]:PULM:POLarity?

This command selects the polarity of the pulse modulation, regardless if the internal or external modulation source is used.

***RST** Normal

PULM:INTERNAL:FREQuency

[[:SOURce<ch>]:PULM:INTERNAL:FREQuency <float>

[[:SOURce<ch>]:PULM:INTERNAL:FREQuency?

This command sets the pulse rate for the internally generated square wave.

***RST** 10 Hz

Range 0.1 Hz to 33 MHz

Unit Hz

PULM:INteRnal:PERiod

[[:SOURce<ch>]:PULM:INteRnal:PERiod <float>

[[:SOURce<ch>]:PULM:INteRnal:PERiod?

This command sets the pulse period for the internally generated pulse modulation.

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.

***RST** 100 ms

Range 30 ns to 10 s

Unit s

PULM:INteRnal:PWIDth

[[:SOURce<ch>]:PULM:INteRnal:PWIDth <float>

[[:SOURce<ch>]:PULM:INteRnal:PWIDth?

This command sets the pulse width for the internally generated pulse signal.

This command sets the pulse width for the internally-generated pulse modulation.

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.

***RST** 1.25 ms

Range 30 ns to 10 s

Unit s

PULM:SOURce

[[:SOURce<ch>]:PULM:SOURce INteRnal|EXteRnal|BITStream

[[:SOURce<ch>]: PULM:SOURce?

This command select the source of the pulse modulation signal.

INteRnal	Selects the internal modulation signal generator with programmable pulse width and repetition period.
----------	---

EXteRnal	Selects the external pulse modulation signal.
----------	---

BITStream	Selects a programmable arbitrary pulse train.
-----------	---

***RST** INteRnal

PULM:STATe

[[:SOURce<ch>]:PULM:STATe ON|OFF|1|0

[[:SOURce<ch>]:PULM:STATe?

This command enables or disables pulse modulation for the selected path.

***RST OFF**

PULM:MODE

[**:SOURce**<ch>]:PULM:MODE RATio|BANDwidth|BWIDth

[**:SOURce**<ch>]:PULM:MODE?

(APMS33G and APMS40G only)

This command sets the pulse modulator mode. With RATio the modulator is configured for maximum on-off-ratio but reduced modulation bandwidth (ratio priority). With BANDwidth|BWIDth the modulator is configured for maximum modulation bandwidth but reduced on-off-ratio (bandwidth priority).

***RST RATio**

PULM:OUTPut:VIDeo:SOURce

[**:SOURce**<ch>]:PULM:OUTPut:VIDeo:SOURce <integer>

[**:SOURce**<ch>]:PULM:OUTPut:VIDeo:SOURce?

For multi channel devices this command selects the source channel for pulse modulation video output. Refer to [\[SOURce\]:LFOutput:SOURce](#) and [\[SOURce\]:LFOutput:STATe](#) commands for pulse modulation video mode of the low frequency output.

***RST 1**

Range 1 to number of channels

PULM:BITStream

[**:SOURce**<ch>]:PULM:BITStream <hex data>

[**:SOURce**<ch>]:PULM:BITStream?

This command sets the pulse train pattern using the variable <hex data>, in hexadecimal representation. Maximum pattern length is 512 bytes / 1024 hexadecimal digits / 4096 bits.

***RST 5h**

Range 0 to 4096 bits

PULM:BITStream:BITS

[**:SOURce**<ch>]:PULM:BITS <integer>

[**:SOURce**<ch>]:PULM:BITS?

This command sets the number of pattern bits played.

***RST 4**

Range 0 to programmed pattern length in bits

PULM:BITStream:DIRection

[[:SOURce<ch>]:PULM:DIRection MSBFirst|LSBFirst

[[:SOURce<ch>]:PULM:BITS?

This command sets the pattern playback direction.

MSBFirst Selects most significant bit first.

LSBFirst Selects reverse direction, least significant bit first.

***RST** MSBFirst

PULM:BITStream:RATE

[[:SOURce<ch>]:PULM:RATE <float>

[[:SOURce<ch>]:PULM:RATE?

This command sets the pattern playback bit rate.

***RST** 20 Hz

Range 2 Hz – 33 MHz

Unit Hz

PULM:BITStream:STARTbit

[[:SOURce<ch>]:PULM:STARTbit <integer>

[[:SOURce<ch>]:PULM:STARTbit?

This command sets the index of the first pattern bit played.

***RST** 4

Range 0 to programmed pattern length in bits

PULM:BITStream:TIME

[[:SOURce<ch>]:PULM:TIME <float>

[[:SOURce<ch>]:PULM:TIME?

This command sets the pattern playback bit period.

***RST** 50 ms

Range 30 ns – 500 ms

Unit s

[:SOURce]:ILS Subsystem

This subsystem provides ILS glideslope and localizer signal generation. It is only available to devices featuring the avionics modulations extension (AVIO).

Command	Parameters	Unit	Default
[:SOURce]:ILS:GS[:STATe]	ON OFF 1 0		OFF
[:SOURce]:ILS:GS:AM0[:DEPTh]	<float>	1 PCT	0.4
[:SOURce]:ILS:GS:AM1[:DEPTh]	<float>	1 PCT	0.4
[:SOURce]:ILS:GS:TEST	DDM0 UP DOWN FLAG		DDM0
[:SOURce]:ILS:LOCalizer[:STATe]	ON OFF 1 0		OFF
[:SOURce]:ILS:LOCalizer:AM0[:DEPTh]	<float>	1 PCT	0.2
[:SOURce]:ILS:LOCalizer:AM1[:DEPTh]	<float>	1 PCT	0.2
[:SOURce]:ILS:LOCalizer:TEST	DDM0 LEFT RIGHT FLAG		DDM0

ILS:GS[:STATe]

[:SOURce]:ILS:GS[:STATe] ON|OFF|1|0

[:SOURce]:ILS:GS[:STATe]?

This command enables or disables the ILS glide slope modulation.

***RST** OFF

ILS:GS:AM0[:DEPTh]

[:SOURce]:ILS:GS:AM0[:DEPTh] <float>

[:SOURce]:ILS:GS:AM0[:DEPTh]?

This command sets the 90 Hz glide slope amplitude modulation depth.

***RST** 0.4

Range 0.2 to 0.6

Unit 1|PCT

ILS:GS:AM1[:DEPTh]

[:SOURce]:ILS:GS:AM1[:DEPTh] <float>

[:SOURce]:ILS:GS:AM1[:DEPTh]?

This command sets the 150 Hz glide slope amplitude modulation depth.

***RST** 0.4

Range 0.2 to 0.6

Unit 1|PCT

ILS:GS:TEST

[[:SOURce]:ILS:GS:TEST DDM0|UP|DOWN|FLAG

This command selects a predefined ILS glide slope test setting. It overrides all ILS glideslope settings except state.

***RST** DDM0

ILS:LOC[:STATe]

[[:SOURce]:ILS:LOC[:STATe] ON|OFF|1|0

[[:SOURce]:ILS:LOC[:STATe]?

This command enables or disables the ILS localizer modulation.

***RST** OFF

ILS:LOCalizer:AM0[:DEPTh]

[[:SOURce]:ILS:LOCalizer:AM0[:DEPTh] <value>

[[:SOURce]:ILS:LOCalizer:AM0[:DEPTh]?

This command sets the 90 Hz localizer amplitude modulation depth.

***RST** 0.2

Range 0.1 to 0.3

Unit 1|PCT

ILS:LOCalizer:AM1[:DEPTh]

[[:SOURce]:ILS:LOCalizer:AM1[:DEPTh] <value>

[[:SOURce]:ILS:LOCalizer:AM1[:DEPTh]?

This command sets the 150 Hz localizer amplitude modulation depth.

***RST** 0.2

Range 0.1 to 0.3

Unit 1|PCT

ILS:LOC:TEST

[[:SOURce]:ILS:LOC:TEST DDM0|LEFT|RIGHT|FLAG

This command selects a predefined ILS localizer test setting. It overrides all ILS localizer settings except state.

***RST** DDM0

[[:SOURce]:VOR Subsystem

This subsystem provides VOR signal generation. It is only available to devices featuring the avionics modulations extension (AVIO).

Command	Parameters	Unit	Default
[[:SOURce]:VOR[:STATe]	ON OFF 1 0		OFF
[[:SOURce]:VOR:AM0[:DEPTh]	<float>	1 PCT	0.3
[[:SOURce]:VOR:AM1[:DEPTh]	<float>	1 PCT	0.3
[[:SOURce]:VOR:BEARing	<float>	rad deg	0 rad
[[:SOURce]:VOR:FM:INDeX	<float>		16
[[:SOURce]:VOR:TEST	NORTH SOUTH EAST WEST 1 2		NORTH

VOR[:STATe]

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

[[:SOURce]:VOR[:STATe]?

This command enables or disables the VOR modulation.

***RST** OFF

VOR:AM0[:DEPTh]

[[:SOURce]:VOR:AM0[:DEPTh] <float>

[[:SOURce]:VOR:AM0[:DEPTh]?

This command sets the 30 Hz VOR amplitude modulation depth.

***RST** 0.3

Range 0.2 to 0.4

Unit 1|PCT

VOR:AM1[:DEPTh]

[[:SOURce]:VOR:AM1[:DEPTh] <float>

[[:SOURce]:VOR:AM1[:DEPTh]?

This command sets the 9960 Hz VOR subcarrier amplitude modulation depth.

***RST** 0.3

Range 0.2 to 0.4

Unit 1|PCT

VOR[:BEARing]

[[:SOURce]:VOR:BEARing <float>

[[:SOURce]:VOR:BEARing?

This command sets the VOR bearing in radians. Append DEG to set the bearing in degrees.

***RST** 0 rad

Range 0 to 6.28 rad

Unit rad|deg

VOR:FM:INDex

[[:SOURce]:VOR:FM:INDex <float>

[[:SOURce]:VOR:FM:INDex?

This command sets the 30 Hz frequency modulation index on the 9960 Hz AM subcarrier.

***RST** 16

Range 15 to 17

VOR:TEST

[[:SOURce]:VOR:TEST NORTH|SOUTH|EAST|WEST|1|2

This command selects a predefined VOR test setting. It overrides all VOR settings except state.

***RST** NORTH

[:SOURce]:FCPort Subsystem

This subsystem provides configuration of the Fast Control Port. It is only available to devices featuring the Fast Control Port (FCP) option.

Command	Parameters	Unit	Default
[:SOURce]:FCPort:MODE	8 8B 8Bits 16 16B 16Bits		16Bits
[:SOURce]:FCPort:CONTRol:FREQuency	ON OFF 1 0		OFF
[:SOURce]:FCPort:CONTRol:LIST	ON OFF 1 0		OFF

FCP:MODE

[:SOURce]:FCPort:MODE 8|8B|8Bits|16|16B|16Bits

[:SOURce]: FCPort:MODE?

This command configures the FCP in 16-bit data transfer mode or in 8-bit data transfer mode.

***RST** 16Bits

FCP:CONT:FREQ

[:SOURce]:FCPort:CONTRol:FREQuency ON|OFF|1|0

[:SOURce]: FCPort:CONTRol:FREQuency?

This command enables or disables the FCP to control the RF frequency word.

As long as FCP takes control, parameters of SCPI subsystems SOURce, TRIGger and OUTPut can not be changed.

***RST** OFF

FCP:CONT:LIST

[:SOURce]:FCPort:CONTRol:LIST ON|OFF|1|0

[:SOURce]:FCPort:CONTRol:LIST?

This command enables or disables the FCP to control the RF frequency by selecting a frequency of a list of pre-defined frequencies. To set-up the frequency list, see [:SOURce<ch>]:LIST:FREQuency

As long as FCP takes control, parameters of SCPI subsystems SOURce, TRIGger and OUTPut can not be changed.

***RST** OFF

:TRIGger Subsystem

Triggers control the playback by telling the signal generator when to play the signal.

Depending on the trigger settings for the signal generator, the waveform playback can occur once, continuously, or the device 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 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 device recognizes the first trigger and ignores the rest.

When you select a trigger mode, you may lose the signal from the RF output until you trigger the waveform.

There are four parts to configuring the trigger:

1. Choosing the trigger type which controls the waveform's transmission.

NORMal: trigger edge starts sweeps

POINT: trigger edge plays the next point

GATE: trigger level starts/stops sweep

2. Setting the waveform's response to triggers:

CONTinuous: repeatedly accepts trigger events

SINGLe: uses only one trigger event

3. Selecting the trigger source which determines how the device receives its trigger signal, internally or externally. The GATE choice requires an external trigger.

4. Setting the trigger polarity when using an external source.

Command	Parameters	Unit	Default
:TRIGger[:SEQuence]:IMMediate			
:TRIGger[:SEQuence]:TYPE	NORMal GATE POINT		NORMal
:TRIGger[:SEQuence]:SOURce	IMMediate KEY EXT BUS		IMMediate
:TRIGger[:SEQuence]:DELay	<float>	s	0 s
:TRIGger[:SEQuence]:SLOPe	POSitive NEGative NP PN		POSitive
:TRIGger[:SEQuence]:ECOunt	<integer>		1
:TRIGger:OUTPut:POLarity	NORMal INVerted		NORMal
:TRIGger:OUTPut:MODE	NORMal GATE POINT VALid		NORMal
:TRIGger:OUTPut:VALid:SOURce	ALL <integer>		1

TRIGger[:SEQuence][:IMMediate]

:TRIGger[:SEQuence][:IMMediate]

This command triggers the device immediately if it is configured to wait for trigger events.

Immediate triggering is forced regardless of the selected trigger source.

TRIGger[:SEQuence]:TYPE

:TRIGger[:SEQuence]:TYPE NORMal|GATE|POINT

:TRIGger[:SEQuence]:TYPE?

This command sets the trigger type that controls the waveform's playback.

The following list describes the trigger type command choices:

NORMal	Upon triggering, the waveform sequence plays according to settlings defined by :INITiate:CONTinuous (only once or repeatedly)
GATE	An external trigger signal repeatedly starts and stops the waveform's playback. The time duration for playback depends on the duty period of the trigger signal and the gate polarity selection. The waveform plays during the inactive state and stops during the active polarity selection state. The activestate can be set high or low. The gate mode works only with an external trigger source.
POINT	Upon triggering, only a single point of the sweep (list) is played.
*RST NORMal	

TRIGger[:SEQuence]:SOURce

:TRIGger[:SEQuence]:SOURce IMMEDIATE|KEY|EXTernal|BUS

:TRIGger[:SEQuence]:SOURce?

This command sets the trigger source.

IMMediate	No waiting for a trigger event occurs
KEY	This choice enables manual triggering by pressing the front-panel RF on/off .
EXTernal	This choice enables the triggering of a sweep event by an externally applied signal at the MOD IN connector.
BUS	This choice enables triggering over the remote control interface using the :TRIGger[:SEQuence][:IMMediate], *TRG or GET (group execute trigger) commands.
*RST IMMEDIATE	

TRIGger[:SEQuence]:DELaY

:TRIGger[:SEQuence]:DELaY <value>

:TRIGger[:SEQuence]:DELaY?

This command sets the amount of time to delay the APSIN response to an external trigger.

The delay is a path (time) delay between when the APSIN receives the trigger and when it responds to the trigger. The delay does not occur until you turn it on. You can set the delay value either before or after turning it on.

***RST** 0 s

Range 0 to 20 s

Unit s

TRIGger[SEQuence]:SLOPe

:TRIGger[:SEQuence]:SLOPe POSitive|NEGative|NP|PN

:TRIGger[:SEQuence]:EXTernal:SLOPe?

This command sets the polarity for an external trigger signal while using the continuous, single triggering mode.

POSitive|NEGative In normal or point mode selected by :TRIGger[:SEQuence]:TYPE NORMAL|POINT the trigger system reacts to the rising (positive) or falling (negative) edge of the external trigger signal.

In gated mode selected by :TRIGger[:SEQuence]:TYPE GATE the trigger is active while the external signal is high (positive) or low (negative). For example, when you select POSitive, the waveform responds (plays) during the high state of the trigger signal.

NP|PN (Devices without option FS only)

In normal or point mode selected by :TRIGger[:SEQuence]:TYPE NORMAL|POINT the trigger system reacts to both rising and falling edges of the trigger signal. NP selects falling, PN selects rising edge first.

When the APSIN receives multiple trigger occurrences when only one is required, the signal generator uses the first trigger and ignores the rest.

***RST** POSitive

TRIGger[:SEQuence]:ECOut

:TRIGger[:SEQuence]:ECOut <integer>

:TRIGger[:SEQuence]:ECOut?

This command sets a modulus counter on consecutive trigger events. Setting the value to N means that only every Nth trigger event will be considered. Setting it to one means will use every trigger event that does not occur during a running sweep.

***RST** 1

Range 1 to 255

TRIGger:OUTPut:POLarity

:TRIGger:OUTPut:POLarity NORMAl|INVerted

:TRIGger:OUTPut:POLarity?

This command sets the trigger output signal polarity.

NORMal	The idle state of the trigger output signal is low. A high pulse or high signal is played upon trigger events or when the RF output signal is valid.
INVERTed	The idle state of the trigger output signal is high. A low pulse or low signal is played upon trigger events or when the RF output signal is valid.

Note that the low frequency output must be configured for trigger output by sending the [\[:SOURce\]:LFOutput:SOURce TRIGger](#) and [\[:SOURce\]:LFOutput:STATe ON](#) commands.

***RST NORMal**

TRIGger:OUTPut:MODE

:TRIGger:OUTPut:MODE NORMal|GATE|POINT|VALid

:TRIGger:OUTPut:MODE?

This command sets the trigger output signal mode.

NORMal	The trigger output signal is pulsed once whenever playing a waveform sequence is triggered.
GATE	The trigger output signal is set when playing a waveform sequence is triggered, and reset when playing stops.
POINT	The trigger output signal is pulsed for each point of the sweep (list) playing.
VALid	The trigger output is set while the RF output signal at one or multiple channels is valid (settled).

Note that the low frequency output must be configured for trigger output by sending the [\[:SOURce\]:LFOutput:SOURce TRIGger](#) and [\[:SOURce\]:LFOutput:STATe ON](#) commands.

***RST NORMal**

TRIGger:OUTPut:VALid:SOURce

:TRIGger:OUTPut:VALid:SOURce ALL|<integer>

:TRIGger:OUTPut:VALid:SOURce?

This command selects the source channel for the RF output valid signal.

ALL	The trigger output is set while RF output of all currently enabled channels is valid (settled) and reset while any of the outputs has no valid RF signal (transient).
<integer>	The trigger output is set while RF output of the selected channel is valid (settled).

***RST 1**

Range ALL|1 to number of channels

:STATus Subsystem

This subsystem controls the status-reporting structures. Refer to chapters *Operation Status Group* and *Questionable Status Group* for a description of the individual status bits.

Command	Parameters	Unit	Default
:STATus:OPERation[:EVENT]?			
:STATus:OPERation:CONDition?			
:STATus:OPERation:ENABle	<integer>		0
:STATus:OPERation:PTR	<integer>		0
:STATus:OPERation:NTR	<integer>		0
:STATus:PREset			
:STATus:QUEStionable[:EVENT]?			
:STATus:QUEStionable:CONDition?			
:STATus:QUEStionable:ENABle	<integer>		0
:STATus:QUEStionable:PTR	<integer>		0
:STATus:QUEStionable:NTR	<integer>		0

STATus:OPERation[:EVENT]?

:STATus:OPERation[:EVENT]?

This query returns the contents of the operation status event register and clears it.

STATus:OPERation:CONDition?

:STATus:OPERation:CONDition?

This query returns the contents of the operation status condition register.

STATus:OPERation:ENABle

:STATus:OPERation:ENABle <integer>

:STATus:OPERation:ENABle?

This command sets the enable bit mask of the operation status event register. Enabled event bits add to the sum bit in the status byte.

***RST 0**

Range 0 to 65535

STATus:OPERation:PTR

:STATus:OPERation:PTR <integer>

:STATus:OPERation:PTR?

This command sets the positive transition filter bit mask of the operation status event register.

***RST 0**

Range 0 to 65535

STATus:OPERation:NTR

:STATus:OPERation:NTR <integer>

:STATus:OPERation:NTR?

This command sets the negative transition filter bit mask of the operation status event register.

***RST 0**

Range 0 to 65535

STATus:PRESet

:STATus:PRESet

Disables all status events, clears all negative transition filters and sets all positive transition filters.

STATus:QUEStionable[:EVENT]?

:STATus:QUEStionable [:EVENT]?

This query returns the contents of the questionable status event register and clears it.

STATus:QUEStionable:CONDition?

:STATus:QUEStionable:CONDition?

This query returns the contents of the questionable status condition register.

STATus:QUEStionable:ENABle

:STATus:QUEStionable:ENABle <integer>

:STATus:QUEStionable:ENABle?

This command sets the enable mask of the questionable status event register. Enabled event bits add to the sum bit in the status byte.

***RST 0**

Range 0 to 65535

STATus:QUEStionable:PTR

:STATus:QUEStionable:PTR <integer>

:STATus:QUEStionable:PTR?

This command sets the positive transition filter bit mask of the questionable status event register.

***RST 0**

Range 0 to 65535

STATus:QUEStionable:NTR

:STATus:QUEStionable:NTR <integer>

:STATus:QUEStionable:NTR?

This command sets the negative transition filter bit mask of the questionable status event register.

***RST 0**

Range 0 to 65535

:SYSTem Subsystem

Command	Parameters	Unit	Default
:SYSTem:ERRor[:NEXT]?			
:SYSTem:ERRor:ALL?			
:SYSTem:PRESet			
:SYSTem:VERsion?			
:SYSTem:LOCK			
:SYSTem:LOCK:RELease			

SYSTem:ERRor[:NEXT]?

:SYSTem:ERRor[:NEXT]?

Return Parameters: Integer error number

Query command is a request for the next entry in the instrument's error queue. Error messages in the queue contain an integer in the range [–32768, 32768] denoting an error code and associated descriptive text. This query clears the returned error from the instrument's error queue.

If the error queue is empty, 0 (no error) is returned.

SYSTem:ERRor:ALL?

:SYSTem:ERRor:ALL?

Return Parameters: List of integer error number

Query command is a request for the all entries in the instrument's error queue. Error messages in the queue contain an integer in the range [–32768, 32768] denoting an error code and associated descriptive text. This query clears the instrument's error queue.

If the error queue is empty, 0 (no error) is returned.

SYSTem:PRESet

:SYSTem:PRESet

Resets most signal generator functions to factory- defined conditions. This command is similar to the *RST command.

SYSTem:VERsion?

:SYSTem:VERsion?

Returns the SCPI version number that the instrument software complies with [1999.0]

SYSTem:LOCK

:SYSTem:LOCK

Locks (disables) front panel control.

SYSTem:LOCK:RELease

:SYSTem:LOCK:RELease

Unlocks (enables) front panel control.

:SYSTem:COMMunicate Subsystem

Command	Parameters	Unit	Default
:SYSTem:COMMunicate:GPIB:ADDRes	<"string">		1
:SYSTem:COMMunicate:LAN:CONFig	DHCP MANual AUTO		AUTO
:SYSTem:COMMunicate:LAN:DEFaults			
:SYSTem:COMMunicate:LAN:GATEway	<"ipv4string">		automatic
:SYSTem:COMMunicate:LAN:IP	<"ipv4string">		automatic
:SYSTem:COMMunicate:LAN:MSESSion	ON OFF 1 0		OFF
:SYSTem:COMMunicate:LAN:PORT	<integer>		18
:SYSTem:COMMunicate:LAN:REStart			
:SYSTem:COMMunicate:LAN:RTMO	INFinite <float>		INFinite
:SYSTem:COMMunicate:LAN:SUBNet	<"ipv4string">		automatic
:SYSTem:COMMunicate:VXI:RTMO	INFinite <float>		INFinite

COMMunicate:GPIB:ADDRes

:SYSTem:COMMunicate:GPIB:ADDRes <"string">

:SYSTem:COMMunicate:GPIB:ADDRes?

This command sets the signal generator's GPIB device address. The address has SCPI string format, example command to set address 10: :SYSTem:COMMunicate:GPIB:ADDRes "10".

*RST unchanged, 1 on factory preset

COMMunicate:LAN:CONFig

:SYSTem:COMMunicate:LAN:CONFig DHCP|MANual|AUTO

:SYSTem:COMMunicate:LAN:CONFig?

This command sets the signal generator's internet protocol (IP) address.

MANual	The user assigns an IP address to the signal generator.
DHCP	The network assigns an IP address to the signal generator. Requests will be repeated continuously with infinite timeout until a valid address has been assigned.
AUTO	The network assigns an IP address to the signal generator with a fallback to Auto-IP if DHCP request continue to fail for more than 10 seconds.

*RST unchanged, AUTO on factory preset

COMMunicate:LAN:DEFaults

:SYSTem:COMMunicate:LAN:DEFaults

This command restores the instrument's LAN settings to their factory default values.

The default mode is :SYSTem:COMMunicate:LAN:CONFig AUTO. In this mode the instrument uses DHCP to retrieve an IP address and falls back to auto IP if DHCP fails.

COMMunicate:LAN:GATEway

:SYSTem:COMMunicate:LAN:GATEway <ipv4string>

: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.

The expected format for <"ipv4string"> is four decimal octets separated by periods, surrounded by quotation marks. Example command: :SYST:COMM:LAN:GATE "192.168.1.1".

In :SYSTem:COMMunicate:LAN:CONFig DHCP|AUTO mode this setting is configured automatically.

*RST unchanged, automatic in :SYSTem:COMMunicate:LAN:CONFig DHCP|AUTO mode

Range "0.0.0.0" to "255.255.255.255"

COMMunicate:LAN:IP

:SYSTem:COMMunicate:LAN:IP <"ipv4string">

:SYSTem:COMMunicate:LAN:IP?

This command sets the signal generator's local area network (LAN) internet protocol (IP) address for your IP network connection.

The expected format for <"ipv4string"> is four decimal octets separated by periods, surrounded by quotation marks. Example command: `:SYST:COMM:LAN:IP "192.168.1.100"`.

In `:SYSTem:COMMunicate:LAN:CONFig DHCP|AUTO` mode this setting is configured automatically.

***RST** unchanged, automatic in `:SYSTem:COMMunicate:LAN:CONFig DHCP|AUTO` mode

Range "0.0.0.0" to "255.255.255.255"

COMMunicate:LAN:MSEsion

`:SYSTem:COMMunicate:LAN:MSEsion ON|OFF|1|0`

`:SYSTem:COMMunicate:LAN:MSEsion ?`

This command enables multi-session for LAN communications. If it is enabled, up to 20 communication sockets can be opened to the device. If it is disabled, only a single LAN connection is possible.

***RST** unchanged

COMMunicate:LAN:PORT

`:SYSTem:COMMunicate:LAN:PORT < integer >`

`:SYSTem:COMMunicate:LAN:MSEsion ?`

This command allows to change the port on which the device is listening to incoming LAN connections. The default port is 18.

***RST** unchanged

Range 1 to 65535

COMMunicate:LAN:REStart

`:SYSTem:COMMunicate:LAN:REStart`

This command restarts the network to enable changes that have been made to the LAN setup.

COMMunicate:LAN:RTMO

`:SYSTem:COMMunicate:LAN:RTMO INFinite|<float>`

`:SYSTem:COMMunicate:LAN:RTMO?`

This command sets the LAN reconnect timeout in seconds or INFinite timeout. After the LAN connection is inactive for the configured timeout, a new connection can be established (reconnect).

INFinite timeout disables reconnect.

Finite or zero timeout enables reconnect. Non-zero finite timeout protects against undesired connection attempts.

***RST** unchanged, INFinite on power up

Range INFinite or 0 to 1e6 s

COMMunicate:LAN:SUBNet

: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.

The expected format for <"ipv4string"> is four decimal octets separated by periods, surrounded by quotation marks. Example command: :SYST:COMM:LAN:SUBN "255.255.255.0".

In :SYSTem:COMMunicate:LAN:CONFig DHCP|AUTO mode this setting is configured automatically.

*RST unchanged, automatic in :SYSTem:COMMunicate:LAN:CONFig DHCP|AUTO mode

Range "0.0.0.0" to "255.255.255.255"

COMMunicate:VXI:RTMO

:SYSTem:COMMunicate:VXI:RTMO INFinite|<float>

:SYSTem:COMMunicate:VXI:RTMO?

This command sets the VXI-11 reconnect timeout in seconds or INFinite timeout. After the VXI-11 connection is inactive for the configured timeout, a new connection can be established (reconnect). INFinite timeout disables reconnect.

Finite or zero timeout enables reconnect. Non-zero finite timeout protects against undesired connection attempts.

*RST unchanged, INFinite on power up

Range INFinite or 0 to 1e6 s

:UNIT Subsystem

Command	Parameters	Unit	Default
:UNIT:POWer	DBM DBMW DM DBUW DBW DB DBUA DBMA DBA DBUV DBMV DBV UW MW W UV MV V UA MA A		DBM

UNIT:POWer

:UNIT:POWer DBM|DBMW|DM|DBUW|DBW|DB|DBUA|DBMA|DBA|DBUV|DBMV|DBV|UW|MW|W|UV|MV|V|UA|MA|A

:UNIT:POWer?

This command sets the default unit for power setting commands and queries. All units listed can be appended to all power setting commands. Example: *POW 100MV*.

DBM|DBMV|DM Sets dBm (decibels with reference to 1 mW) as the default unit.

DBUW	Sets dBuW (decibels with reference to 1 μ W) as the default unit.
DBW DB	Sets dBW (decibels with reference to 1 W) as the default unit.
DBUA	Sets dB μ A (decibels with reference to 1 μ A into 50 Ω load) as the default unit.
DBMA	Sets dBmA (decibels with reference to 1 mA into 50 Ω load) as the default unit.
DBA	Sets dBA (decibels with reference to 1 A into 50 Ω load) as the default unit.
DBUV	Sets dB μ V (decibels with reference to 1 μ V into 50 Ω load) as the default unit.
DBMV	Sets dBmV (decibels with reference to 1 mV into 50 Ω load) as the default unit.
DBV	Sets dBV (decibels with reference to 1 V into 50 Ω load) as the default unit.
UW	Sets μ W as the default unit.
MW	Sets mW as the default unit.
W	Sets W as the default unit.
UV	Sets μ V into 50 Ω load as the default unit.
MV	Sets mV into 50 Ω load as the default unit.
V	Sets V into 50 Ω load as the default unit.
UA	Sets μ A into 50 Ω load as the default unit.
MA	Sets mA into 50 Ω load as the default unit.
A	Sets A into 50 Ω load as the default unit.
*RST DBM	



Document History

[illegible]

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