AFG3000 Series
Arbitrary Function Generators

Programmer Manual

077-0743-00

Tektronix

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Arbitrary Function Generators

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www.tektronix.com
077-0743-00

Tektronix

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For product information, sales, service, and technical support:

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- Worldwide, visit www.tektronix.com to find contacts in your area.

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[W16 – 15AUG04]

Table of Contents

Preface

This manual provides operating information for the following products:

Table i: Supported products

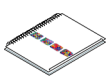
AFG3011	AFG3021B	AFG3011C
AFG3101	AFG3022B	AFG3021C
AFG3102		AFG3022C
AFG3251		AFG3051C
AFG3252		AFG3052C
		AFG3101C
		AFG3102C
		AFG3251C
		AFG3252C

The manual consists of the following sections:

- *Getting Started* covers operating principles of the instrument, which helps you understand how your generator operates.
- *Syntax and Commands* defines the command syntax and processing conventions, describes command notation.
- *Status and Events* explains the status information and event messages reported by the instrument.
- *Programming Examples* contains remote interface application programs to help you develop programs for your application.
- *Appendix A: SCPI Conformance Information* contains a list of commands and SCPI information.

Documentation

The following table lists related documentation available for your instrument. The documentation is available on the Document CD and on the Tektronix Web site (www.tektronix.com/downloads).

Item	Purpose	Location
Quick Start User Manual	Unpacking, Installation, Tutorials, Operation, and Overviews available in English, German, French, Italian, Portuguese, Spanish, Korean, Russian, Japanese, Simplified Chinese, and Traditional Chinese	 +  +  WWW.Tektronix.com
Built-in Help (part of instrument firmware)	UI Help and Operation	
Programmer Manual (this document)	Menu Structures, User Interface, and Programming Information	 +  WWW.Tektronix.com
Service Manual	Self-service and Performance test	 +  WWW.Tektronix.com
Technical Reference	Specifications and performance verification procedures	 +  WWW.Tektronix.com
ArbExpress Software CD	Waveform creation Import waveforms from oscilloscope or PC	 +  WWW.Tektronix.com

Getting Started

Getting Started

To help you get started with programming the arbitrary function generator, this section includes the following subsections

- *Overview of the Manual*
  Summarizes each major section of this manual.
- *Connecting the Interface*
  Describes how to physically connect the arbitrary function generator to a controller.
- *Using the GPIB Port*
  Describes how to use the GPIB port.
- *Setting the GPIB Address*
  Describes how to set the GPIB parameters from the front panel.
- *Using TekVISA*
  Describes how to use the TekVISA communication protocol.

Overview of the Manual

The information contained in each major section of this manual is described below.

Syntax and Commands

Syntax and Commands, describes the structure and content of the messages your program sends to the arbitrary function generator. The following figure shows command parts as described in the *Command Syntax* subsection.

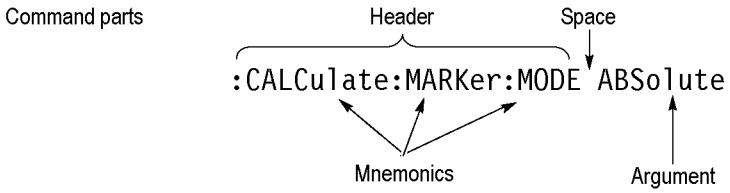


Figure 1-1: Command parts

Section 2 also describes the effect of each command and provides examples of how you might use it. The *Command Groups* subsection provides lists by functional areas. The commands are listed alphabetically in the *Command Descriptions* section.

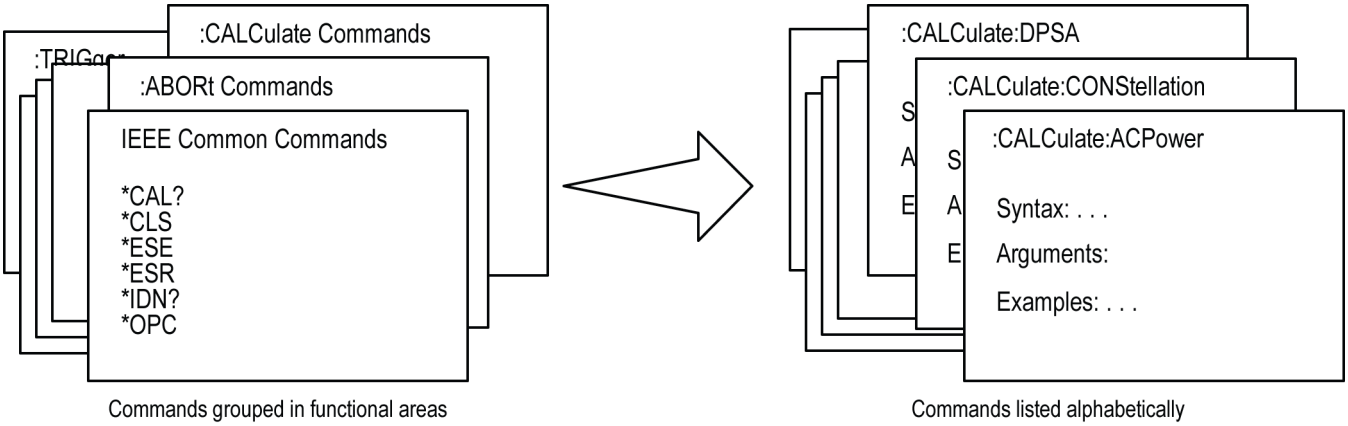
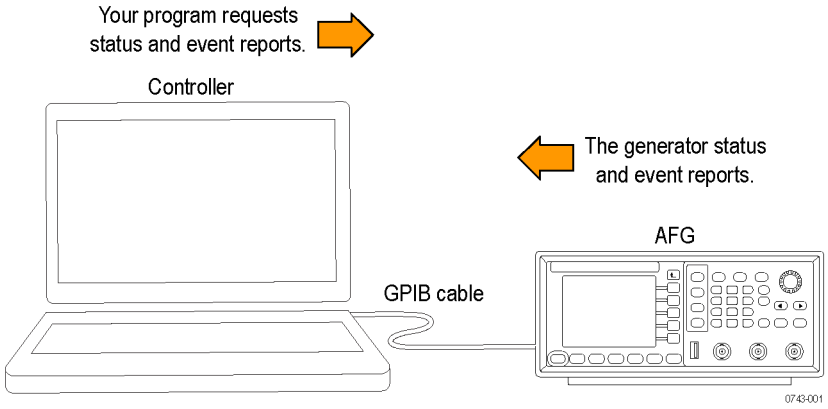


Figure 1-2: Functional groupings and an alphabetical list of commands

Status and Events

The program may request information from the instrument. The instrument provides information in the form of status and error messages. The following figure illustrates the basic operation of this system. Section 3, *Status and Events*, describes how to get status or event information from the program and details the event and error messages.



Connecting the Interface

The instrument has a 24-pin GPIB connector on its rear panel, as shown in the following figure. This connector has a D-type shell and conforms to IEEE Std 488.1-1987. Attach an IEEE Std 488.1-1987 GPIB cable (Tektronix part number 012-0991-00) to this connector.

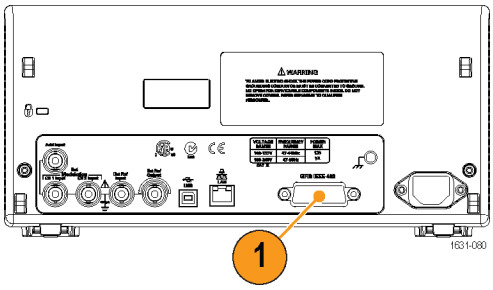


Figure 1-3: GPIB connector (rear panel)

Using the GPIB Port

The arbitrary function generator has Talk/Listen functions through which it can communicate with other devices, as well as the external controller, located on the bus.

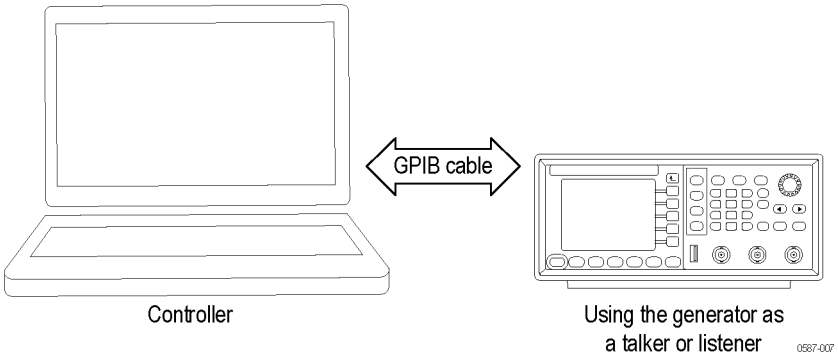


Figure 1-4: GPIB connection

GPIB Requirements

Observe the following rules when you use your arbitrary function generator with a GPIB network

- Assign a unique device address to each device on the bus. No two devices can share the same device address.
- Do not connect more than 15 devices to any one bus.
- Connect one device for every 2 m (6 ft) of cable used.
- Do not use more than 20 m (65 ft) of cable to connect devices to a bus.
- Turn on at least 2/3 of the devices on the network while using the network.
- Connect the devices on the network in a star or linear configuration, as shown in the following figure. Do not use loop or parallel configurations.

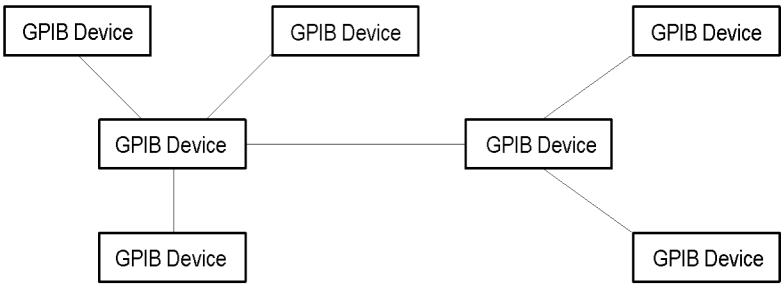


Figure 1-5: Typical GPIB network configurations

Setting the GPIB Address

When you use the GPIB port to communicate with an external controller, follow these steps to set the address of the arbitrary function generator.

1. Press the **Utility** button.
2. Press the **I/O Interface** button.
3. Press the **GPIB** button.
4. Press the **Address** button.
5. Turn the general purpose knob to set the **GPIB Address**. The GPIB address must be from 0 to 30.
6. Press the Return to top menu button when you have set the GPIB address to save the setting.
7. Press the **Configuration** button to toggle the instrument communications to **Talk/Listen** to remotely control the instrument from an external host computer.

NOTE. *The GPIB address cannot be initialized by the *RST command.*

Using TekVISA

TekVISA is Tektronix implementation of VISA (Virtual Instrument Software Architecture), an industry-standard communication protocol. VISA provides a common standard for software developers so that software from multiple vendors, such as instrument drivers, can run on the same platform. TekVISA is industry-compliant software, available with selected Tektronix instruments. You can use this software to write (or draw) interoperable instrument drivers in a variety of Application Development Environments (ADEs). It implements a subset of Version 2.2 of the VISA specification for controlling GPIB and serial (RS-232) instrument interfaces locally or remotely via an Ethernet LAN connection.

Installation

Use an internet browser to access the Tektronix Web site (www.tektronix.com/downloads) and download the current TekVISA to your PC. Unzip the downloaded file in a temporary directory of your choice and run *Setup.exe*.

NOTE. *The details on TekVISA concepts and operations are explained in the TekVISA Programmer Manual that can be also found on the Tektronix Web site.*

Syntax and Commands

Syntax and Commands

This section provides the following information:

- *Command Syntax* defines the command syntax and processing conventions.
- *Command Groups* describes command groups which lists the commands by function.
- *Command Descriptions* describes the notation of each of the commands in alphabetical order.

Command Syntax

You can control the operations and functions of the arbitrary function generator through the GPIB interface using commands and queries. The related topics listed below describe the syntax of these commands and queries. The topics also describe the conventions that the instrument uses to process them. See *Command Groups* ((See page 2-11.)) for a listing of the commands by command group, or use the index to locate a specific command.

Backus-Naur Form Definition

This manual may describe commands and queries using the Backus-Naur Form (BNF) notation. The following table defines the standard BNF symbols.

Table 2-1: BNF symbols and meanings

Symbol	Meaning
< >	Defined element
:=	Is defined as
|	Exclusive OR
{ }	Group; one element is required
[ ]	Optional; can be omitted
. . .	Previous element(s) may be repeated
( )	Comment

Command and Query Structure

Commands consist of set commands and query commands (usually simply called commands and queries). Commands change instrument settings or perform a specific action. Queries cause the instrument to return data and information about its status.

Most commands have both a set form and a query form. The query form of the command is the same as the set form except that it ends with a question mark. For example, the set command `DISPlay:CONTrast` has a query form `DISPlay:CONTrast?`. Not all commands have both a set and a query form; some commands are set only and some are query only.

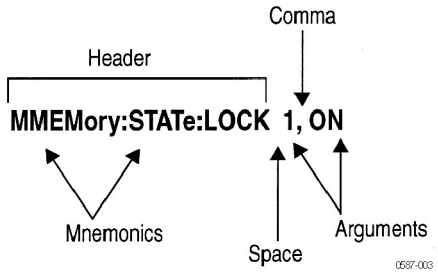
A few commands do both a set and query action. For example, the `*CAL?` command runs a self-calibration program on the instrument, then returns the result of the calibration.

A command message is a command or query name, followed by any information the instrument needs to execute the command or query. Command messages consist of five element types.

Table 2-2: Command message elements

Symbol	Meaning
<Header>	The basic command name. If the header ends with a question mark, the command is a query. The header may begin with a colon (:) character; if the command is concatenated with other commands the beginning colon is required. The beginning colon can never be used with command headers beginning with a star (*).
<Mnemonic>	A header subfunction. Some command headers have only one mnemonic. If a command header has multiple mnemonics, they are always separated from each other by a colon (:) character.
<Argument>	A quantity, quality, restriction, or limit associated with the header. Not all commands have an argument, while other commands have multiple arguments. Arguments are separated from the header by a Arguments are separated from each other by a <Comma>.
<Comma>	A single comma between arguments of multiple-argument commands. It may optionally have white space characters before and after the comma.
<Space>	A white space character between command header and argument. It may optionally consist of multiple white space characters.

The following figure shows the five command message elements.



Commands. Commands cause the instrument to perform a specific function or change one of its settings. Commands have the structure:

```
[:]<Header>[<Space><Argument>[<Comma><Argument>]...]
```

A command header is made up of one or more mnemonics arranged in a hierarchical or tree structure. The first mnemonic is the base or root of the tree and each subsequent mnemonic is a level or branch of the previous one. Commands at a higher level in the tree may affect those at a lower level. The leading colon (:) always returns you to the base of the command tree.

Queries. Queries cause the arbitrary function generator to return information about its status or settings. Queries have the structure:

```
[:]<Header>?
```

```
[:]<Header>?[<Space><Argument>[<Comma><Argument>]...]
```

You can specify a query command at any level within the command tree unless otherwise noted. These branch queries return information about all the mnemonics below the specified branch or level.

Query Responses. When a query is sent to the arbitrary function generator, only the values are returned. When the returned value is a mnemonic, it is noted in abbreviated format, as shown in the following table.(See Table 2-3.).

Table 2-3: Query response examples

Symbol	Meaning
SOURce:PULSe:DCYcle?	50.0
OUTPut:POLarity?	NORM

Command Entry

Follow these general rules when entering commands:

- Enter commands in upper or lower case.
- You can precede any command with white space characters. White space characters include any combination of the ASCII control characters 00 through 09 and 0B through 20 hexadecimal (0 through 9 and 11 through 32 decimal).
- The instrument ignores commands that consists of just a combination of white space characters and line feeds.

SCPI Commands and Queries

The arbitrary function generator uses a command language based on the SCPI standard. The SCPI (Standard Commands for Programmable Instruments) standard was created by a consortium to provide guidelines for remote programming of instruments. These guidelines provide a consistent programming environment for instrument control and data transfer. This environment uses defined programming messages, instrument responses and data formats that operate across all SCPI instruments, regardless of manufacturer.

The SCPI language is based on a hierarchical or tree structure as shown in the following figure that represents a subsystem. The top level of the tree is the root node; it is followed by one or more lower-level nodes.

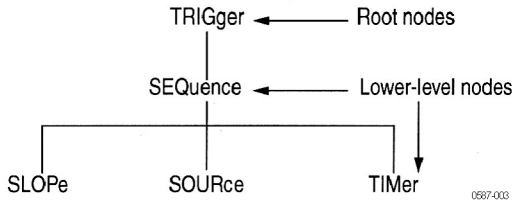


Figure 2-1: Example of SCPI subsystem hierarchy tree

You can create commands and queries from these subsystem hierarchy trees. Commands specify actions for the instrument to perform. Queries return measurement data and information about parameter settings.

Creating Commands

SCPI commands are created by stringing together the nodes of a subsystem hierarchy and separating each node by a colon.

In the figure above, TRIGger is the root node and EVENt, GATed, INPut, and SOURce are lower-level nodes. To create a SCPI command, start with the root node TRIGger and move down the tree structure adding nodes until you reach the end of a branch. Most commands and some queries have parameters; you must include a value for these parameters. If you specify a parameter value that is out of range, the parameter will be set to a default value. The command descriptions, list the valid values for all parameters.

For example, TRIGgerEVENt:SOURce EXTRear is a valid SCPI command created from the hierarchy tree. (See Figure 2-1.)

Parameter Types

Parameters are indicated by angle brackets, such as <file_name>.There are several different types of parameters. (See Table 2-4.) The parameter type is listed after the parameter. Some parameter types are defined specifically for the arbitrary/ function generator command set and some are defined by SCPI.

Creating Queries

To create a query, start at the root node of a tree structure, move down to the end of a branch, and add a question mark. TRIGgerEVENt:SOURce? is an example of a valid SCPI query using the hierarchy tree in the figure. (See Figure 2-1.)

Query Responses

The query causes the arbitrary function generator to return information about its status or settings. When a query is sent to the arbitrary function generator, only the values are returned. When the returned value is a mnemonic, it is noted in abbreviated format, as shown in the following table.

Parameter Types

Every parameter in the command and query descriptions is of a specified type. The parameters are enclosed in brackets, such as <value>. The parameter type is listed after the parameter and is enclosed in parentheses, for example, (boolean). Some parameter types are defined specifically for the arbitrary function generator command set and some are defined by SCPI.

Table 2-4: Parameter types used in syntax descriptions

Parameter type	Description	Example
arbitrary block [1]	A specified length of arbitrary data	#512234xxxxx . . . where 5 indicates that the following 5 digits (12234) specify the length of the data in bytes; xxxxx ... indicates the data or #0xxxxx...<LF><&EOI>
boolean	Boolean numbers or values	ON or ≠ 0 OFF or 0
discrete	a LIST OF SPECIFIC VALUES	min, max
binary	Binary numbers	#B0110
octal	Octal numbers	#Q57, #Q3
hexadecimal [2]	Hexadecimal numbers (0-9, A, B, C, D, E, F)	#HAA, #H1
NR1 [2] numeric	Integers	0, 1, 15, -1
NR2 [2] [3] numeric	Decimal numbers	1.2, 3.141516, -6.5
NR3 [2] numeric	Floating point numbers	3.1415E-9, -16.1E5
NRf [2] numeric	Flexible decimal number that may be type NR1, NR2 or NR3	See NR1, NR2, and NR3 examples
string [4]	Alphanumeric characters (must be within quotation marks)	"Testing 1, 2, 3"

1 Defined in ANSI/IEEE 488.2 as "Definite Length Arbitrary Block Response Data."

2 An ANSI/IEEE 488.2-1992-defined parameter type.

3 Some commands and queries will accept an octal or hexadecimal value even though the parameter type is defined as NR1.

4 Defined in ANSI/IEEE 488.2 as "String Response Data."

Special Characters

The Line Feed (LF) character (ASCII 10), and all characters in the range of ASCII 127-255 are defined as special characters. These characters are used in arbitrary block arguments only; using these characters in other parts of any command yields unpredictable results.

Abbreviating Commands, Queries, and Parameters

You can abbreviate most SCPI commands, queries, and parameters to an accepted short form. This manual shows these short forms as a combination of upper and lower case letters. The upper case letters indicate the accepted short form of a command. As shown in the following figure, you can create a short form by using only the upper case letters. The accepted short form and the long form are equivalent and request the same action of the instrument.

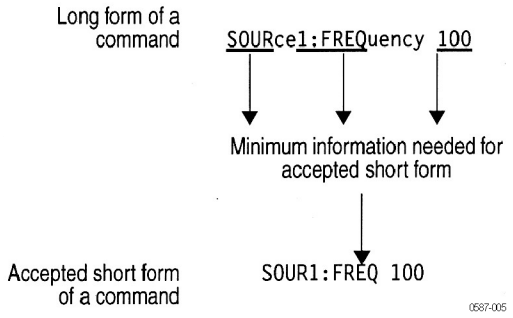


Figure 2-2: Example of abbreviating a command

NOTE. *The numeric suffix of a command or query may be included in either the long form or short form; the arbitrary function generator will default to "1" if no suffix is used.*

Chaining Commands and Queries

You can chain several commands or queries together into a single message. To create a chained message, first create a command or query, add a semicolon (;), and then add more commands or queries and semicolons until the message is complete. If the command following a semicolon is a root node, precede it with a colon (:). The following figure illustrates a chained message consisting of several commands and queries. The single chained message should end in a command or query, not a semicolon. Responses to any queries in your message are separated by semicolons.

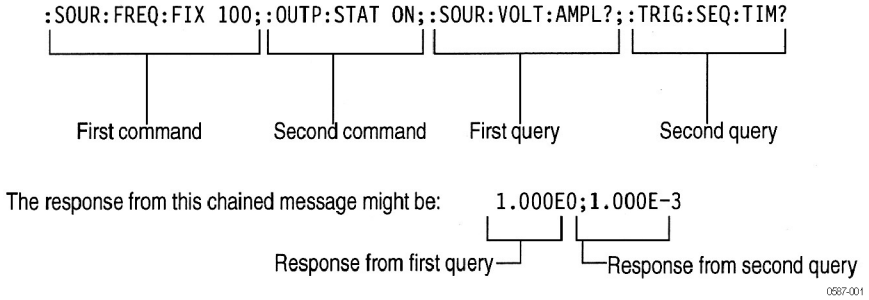


Figure 2-3: Example of chaining commands and queries

If a command or query has the same root and lower-level nodes as the previous command or query, you can omit these nodes. In the following figure, the second command has the same root node (TRIGger:SEQuence) as the first command, so these nodes can be omitted.

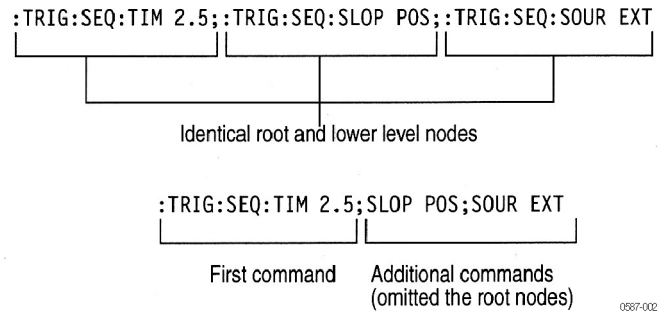


Figure 2-4: Example of omitting root and lower-level nodes in a chained message

Unit and SI Prefix

If the decimal numeric argument refers to amplitude, frequency, or time, you can express it using SI units instead of using the scaled explicit point input value format <NR3>. (SI units are units that conform to the Systeme International d'Unites standard.) For example, you can use the input format 200 mV or 1.0 MHz instead of 200.0E-3 or 1.0E+6, respectively, to specify voltage or frequency.

The following table lists the available units.

Table 2-5: Available units

Symbol	Meaning
dB	decibel (relative amplitude)
dBm	decibel (absolute amplitude)
DEG	degree (phase)
Hz	hertz (frequency)
PCT	percent (%)
s	second (time)
V	volt

The available SI prefixes are shown in the following table.

Table 2-6: Available SI prefixes

SI prefix	Z	A	F	P	N	U	M	K	MA[1]	G	T	PE	EX
Corresponding power	10^{-21}	10^{-18}	10^{-15}	10^{-12}	10^{-9}	10^{-6}	10^{-3}	10^{+3}	10^{+6}	10^{+9}	10^{+12}	10^{+15}	10^{+18}

1 When the unit is "Hz", "M" may be used instead of "MA" so that the frequency can be represented by "MHz".

You can omit a unit in a command, but you must include the unit when using a SI prefix. For example, frequency of 15 MHz can be described as follows

15.0E6, 1.5E7Hz, 15000000, 15000000Hz, 15MHz, etc.
("15M" is not allowed.)

Note that you can use either lower or upper case units and prefixes. The following examples have the same result, respectively.

170mHz, 170mHz, 170MHz, etc.
250mv, 250mV, 250MV, etc.

General rules for using SCPI commands

Here are three general rules for using SCPI commands, queries, and parameters:

- You can use single (‘ ’) or double (“ ”) quotation marks for quoted strings, but you cannot use both types of quotation marks for the same string.

  correct "This string uses quotation marks correctly."

  correct ‘This string also uses quotation marks correctly.'

  incorrect "This string does not use quotation marks correctly.'

- You can use upper case, lower case, or a mixture of both cases for all commands, queries, and parameters.

  ```
  :SOURCE:FREQUENCY 10MHZ
  ```

  is the same as

  ```
  :source:frequency 100mhz
  ```

  and

  ```
  SOURCE:frequency 10MHZ
  ```

NOTE. *Literal strings (quoted) are case sensitive, for example, file names.*

- No embedded spaces are allowed between or within nodes.

  correct `:OUTPUT:FILTER:LPASS:FREQUENCY 200MHZ`

  incorrect `:OUTPUT: FILTER: LPASS:FREQUENCY 200MHZ`

IEEE 488.2 Common Commands

Description

ANSI/IEEE Standard 488.2 defines the codes, formats, protocols, and usage of common commands and queries used on the interface between the controller and the instruments. The arbitrary function generator complies with this standard.

Command and Query Structure

The syntax for an IEEE 488.2 common command is an asterisk (*) followed by a command and, optionally, a space and parameter value. The syntax for an IEEE 488.2 common query is an asterisk (*) followed by a query and a question mark. All of the common commands and queries are listed in the last part of the *Syntax and Commands* section. The following are examples of common commands:

- *ESE 16
- *CLS

The following are examples of common queries:

- *ESR
- *IDN

Command Groups

This section lists the commands organized by functional group. The Command Descriptions section lists all commands alphabetically.

Calibration and Diagnostic Commands. Calibration and Diagnostic commands let you initiate the instrument self-calibration routines and examine the results of diagnostic tests. lists Calibration and Diagnostic commands.

Table 2-7: Calibration and Diagnostic commands

Header	Description
*CAL?	Perform self-calibration and return result status
CALibration[:ALL]	Perform self-calibration
DIAGnostic[:ALL]	Perform self-test
*TST?	Perform self-test and return result status

Display Commands. Display commands let you change the graticule style, displayed contrast, and other display attributes. The following table lists and describes Display commands.

Table 2-8: Display commands

Header	Description
DISPlay:CONTrast	Set/query the LCD display contrast
DISPlay:SAVer:IMMediate	Set screen saver
DISPlay:SAVer[:STATe]	Set/query the screen saver settings
DISPlay[:WINDow]:TEXT[:DATA]	Set/query the text message display
DISPlay[:WINDow]:TEXT:CLEar	Delete text message

Memory Commands. Memory commands let you change setup memory attributes. The following table lists and describes Memory commands.

Table 2-9: Memory commands

Header	Description
MEMory:STATe:DELete	Delete the setup memory
MEMory:STATe:LOCK	Set/query the lock of setup memory overwrite and deletion
MEMory:STATe:RECall:AUTo	Set/query the recall of last set memory
MEMory:STATe:VALid?	Query the availability of setup memory
*RCL	Recall instrument setting from setup memory
*SAV	Save instrument setting to setup memory

Mass Memory Commands. Mass Memory commands let you change mass memory attributes. The following table lists and describes Mass Memory commands.

Table 2-10: Mass Memory commands

Header	Description
MMEMory:CATalog?	Query the status of mass memory
MMEMory:CDIRectory	Set/query current directory
MMEMory:DELete	Delete file or directory in mass memory
MMEMory:LOAD:STATe	Copy instrument setting in mass memory to setup memory
MMEMory:LOAD:TRACe	Copy waveform data file in mass memory to edit memory
MMEMory:LOCK[:STATe]	Set/query the lock of mass memory overwrite and deletion
MMEMory:MDIRectory	Create directory in mass memory
MMEMory:STORe:STATe	Save the setup memory status to mass memory
MMEMory:STORe:TRACe	Save waveform data file in edit memory to mass memory

Output Commands. Output commands let you set output attributes. The following table lists and describes Output commands.

Table 2-11: Output commands

Header	Description
OUTPut[1|2]:IMPedance	Set/query impedance
OUTPut[1|2]:POLarity	Set/query polarity
OUTPut[1|2][:STATe]	Set/query output on or off
OUTPut:TRIGger:MODE	Set/query the mode of Trigger Output

Source Commands. Source commands let you set waveform output parameters. The following table lists and describes Source commands.

Table 2-12: Source commands

Header	Description
[SOURce]:ROSCillator:SOURce	Set/query clock reference input
[SOURce[1|2]]:AM[:DEPTh]	Set/query amplitude modulation depth
[SOURce[1|2]]:AM:INTernal:FREQuency	Set/query internal modulation frequency
[SOURce[1|2]]:AM:INTernal:FUNCtion	Set/query modulation waveform setting
[SOURce[1|2]]:AM:INTernal:FUNCtion:EFILe	Set/query EFILe setting

Table 2-12: Source commands (cont.)

Header	Description
[SOURce[1|2]]:AM:SOURce	Set/query amplitude modulation source
[SOURce[1|2]]:AM:STATe	Set/query amplitude modulation status
[SOURce[1|2]]:BURSt:MODE	Set/query burst mode
[SOURce[1|2]]:BURSt:NCYCles	Set/query burst mode waveform output cycle
[SOURce[1|2]]:BURSt[:STATe]	Set/query burst mode status
[SOURce[1|2]]:BURSt:TDELay	Set/query burst mode trigger delay time
[SOURce[1|2]]:COMBine:FEED	Set/query internal noise or external signal
[SOURce[1|2]]:FM[:DEViation]	Set/query frequency deviation
[SOURce[1|2]]:FM:INTernal:FREQuency	Set/query internal modulation frequency
[SOURce[1|2]]:FM:INTernal:FUNCtion	Set/query internal modulation waveform
[SOURce[1|2]]:FM:INTernal:FUNCtion:EFILe	Set/query EFILe setting
[SOURce[1|2]]:FM:SOURce	Set/query frequency modulation source
[SOURce[1|2]]:FM:STATe	Set/query frequency modulation status
[SOURce[1|2]]:FREQuency:CENTer	Set/query center frequency
[SOURce[1|2]]:FREQuency:CONCurrent[:STATe]	Set/query concurrent change of frequency
[SOURce[1|2]]:FREQuency[:CW|:FIXed]	Set/query output waveform frequency
[SOURce[1|2]]:FREQuency:MODE	Set/query sweep status
[SOURce[1|2]]:FREQuency:SPAN	Set/query sweep frequency span
[SOURce[1|2]]:FREQuency:STARt	Set/query sweep start frequency
[SOURce[1|2]]:FREQuency:STOP	Set/query sweep stop frequency
[SOURce[1|2]]:FSKey[:FREQuency]	Set/query FSK hop frequency
[SOURce[1|2]]:FSKey:INTernal:RATE	Set/query FSK internal modulation rate
[SOURce[1|2]]:FSKey:SOURce	Set/query FSK source
[SOURce[1|2]]:FSKey:STATe	Set/query FSK status
[SOURce[1|2]]:FUNCtion:EFILe	Set/query EFILe name
[SOURce[1|2]]:FUNCtion:RAMP:SYMMetry	Set/query ramp waveform symmetry
[SOURce[1|2]]:FUNCtion[:SHAPe]	Set/query output waveform
[SOURce[1|2]]:PHASe[:ADJust]	Set/query output waveform phase
[SOURce[1|2]]:PHASe:INITiate	Initiate output waveform phase synchronization
[SOURce[1|2]]:PM[:DEViation]	Set/query phase modulation deviation
[SOURce[1|2]]:PM:INTernal:FREQuency	Set/query internal modulation frequency
[SOURce[1|2]]:PM:INTernal:FUNCtion	Set/query internal modulation waveform
[SOURce[1|2]]:PM:INTernal:FUNCtion:EFILe	Set/query EFILe name
[SOURce[1|2]]:PM:SOURce	Set/query phase modulation source

Table 2-12: Source commands (cont.)

Header	Description
[SOURce[1|2]]:PM:STATe	Set/query phase modulation status
[SOURce[1|2]]:PULSe:DCYCle	Set/query pulse waveform duty cycle
[SOURce[1|2]]:PULSe:DELay	Set/query pulse waveform lead delay
[SOURce[1|2]]:PULSe:HOLD	Set/query pulse waveform parameter
[SOURce[1|2]]:PULSe:PERiod	Set/query pulse waveform period
[SOURce[1|2]]:PULSe:TRANsition[:LEADing]	Set/query pulse waveform leading edge time
[SOURce[1|2]]:PULSe:TRANsition:TRAiling	Set/query pulse waveform trailing edge time
[SOURce[1|2]]:PULSe:WIDTh	Set/query pulse waveform width
[SOURce[1|2]]:PWM:INTernal:FREQuency	Set/query pulse width modulation frequency
[SOURce[1|2]]:PWM:INTernal:FUNCtion	Set/query pulse width modulation waveform
[SOURce[1|2]]:PWM:INTernal:FUNCtion:EFILe	Set/query EFILe name
[SOURce[1|2]]:PWM:SOURce	Set/query pulse width modulation source
[SOURce[1|2]]:PWM:STATe	Set/query pulse width modulation status
[SOURce[1|2]]:PWM[:DEViation]:DCYCle	Set/query pulse width modulation deviation
[SOURce[1|2]]:SWEep:HTIMe	Set/query sweep hold time
[SOURce[1|2]]:SWEep:MODE	Set/query sweep mode
[SOURce[1|2]]:SWEep:RTIMe	Set/query sweep return time
[SOURce[1|2]]:SWEep:SPACing	Set/query sweep spacing
[SOURce[1|2]]:SWEep:TIME	Set/query sweep time
[SOURce[1|2]]:VOLTage:CONCurrent[:STATe]	Set/query concurrent change of amplitude level
[SOURce[1|2]]:VOLTage:LIMit:HIGH	Set/query output amplitude upper limit
[SOURce[1|2]]:VOLTage:LIMit:LOW	Set/query output amplitude lower limit
[SOURce[1|2]]:VOLTage:UNIT	Set/query output amplitude units
[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:HIGH	Set/query output amplitude high level
[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:LOW	Set/query output amplitude low level
[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet	Set/query output offset voltage
[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]	Set/query output amplitude
SOURce<3|4>:POWer[:LEVel][:IMMediate][:AMPLitude]	Set/query internal noise level

Status Commands. Status commands let you determine the status of the instrument. lists and describes Status commands.

Table 2-13: Status commands

Header	Description
*CLS	Clear all event registers and queues
*ESE	Set/query standard event status enable register
*ESR?	Return standard event status register
*PSC	Set/query power-on status clear
*SRE	Set/query service request enable register
*STB?	Read status byte
STATus:OPERation:CONDition?	Return operation condition register
STATus:OPERation:ENABle	Set/query operation enable register
STATus:OPERation[:EVENt]?	Return operation event register
STATus:PRESet	Preset SCPI enable register
STATus:QUEStionable:CONDition?	Return questionable condition register
STATus:QUEStionable:ENABle	Set/query questionable enable register
STATus:QUEStionable[:EVENt]?	Return questionable event register

System Commands. System commands let you control miscellaneous instrument functions. lists and describes System commands.

Table 2-14: System commands

Header	Description
*IDN?	Return identification information
*OPT?	Return option information
*RST	Reset
SYSTem:BEEPer[:IMMediate]	Generate an audible tone
SYSTem:BEEPer:STATe	Set/query beeper state
SYSTem:ERRor[:NEXT]?	Return error event queue
SYSTem:KCLick[:STATe]	Set/query click sound
SYSTem:KLOCk[:STATe]	Set/query front panel lock/unlock
SYSTem:PASSword:CDISable	Disable protected commands
SYSTem:PASSword[:CENable]	Enable protected commands to function
SYSTem:PASSword[:CENable]:STATe?	Return security protection state
SYSTem:PASSword:NEW	Change current password
SYSTem:SECurity:IMMediate	Reset to factory default
SYSTem:ULANguage	Set/query language for display screen
SYSTem:VERSion?	Return version information

Synchronization Commands. Synchronization commands let you synchronize the operation of the instrument. lists and describes Synchronization commands.

Table 2-15: Synchronization commands

Header	Description
*OPC	Set/query operation complete
*WAI	Wait to continue

Trace Commands. Trace commands let you set the edit memory and user waveform memory. lists and describes Trace commands.

Table 2-16: Trace commands

Header	Description
TRACe|DATA:CATalog?	Return user waveform memory status
TRACe|DATA:COPY	Copy edit memory (or user waveform memory) content to user waveform memory (or edit memory)
TRACe|DATA[:DATA]	Set/query waveform data to edit memory
TRACe|DATA[:DATA]:LINE	Write waveform data with interpolation
TRACe|DATA[:DATA]:VALue	Set/query waveform data in edit memory
TRACe|DATA:DEFine	Set edit memory content
TRACe|DATA:DELete[:NAME]	Delete user waveform memory contents
TRACe|DATA:LOCK[:STATe]	Set/query lock/unlock of user waveform memory
TRACe|DATA:POINts	Set/query number of points for waveform data in edit memory

Trigger Commands. Trigger commands let you control all aspects of arbitrary function generator triggering. lists and describes Trigger commands.

Table 2-17: Trigger commands

Header	Description
ABORt	Initialize trigger system
*TRG	Force trigger event
TRIGger[:SEQuence][:IMMediate]	Generate a trigger event
TRIGger[:SEQuence]:SLOPe	Set/query the slope of trigger signal
TRIGger[:SEQuence]:SOURce	Set/query the source of trigger signal
TRIGger[:SEQuence]:TIMer	Set/query the period of internal clock

AFG Control. AFG Control command copies setups between two channels.

Table 2-18: AFG Control command

Header	Description
AFGControl:CSCopy	Copy CH1 (or CH2) setup parameters to CH2 (or CH1)

Screen Copy. Screen copy command copies screen image.

Table 2-19: Screen copy command

Header	Description
HCOPy:SDUMp[:IMMediate]	Copy screen image and save the file to USB memory.

Command Descriptions

Commands either set or query instrument values. Some commands both set and query, some only set, and some only query.

Manual Conventions

This manual uses the following conventions:

- No Query Form indicates set-only commands
- A question mark (?) appended to the commands and Query Only indicates query-only commands
- Fully spells out headers, mnemonics, and arguments with the minimal spelling shown in upper case; for example, to use the abbreviated form of the DISPlay:CONTrast command, just type DISP:CONT
- Syntax of some commands varies, depending on the model of arbitrary function generator you are using; differences are noted

ABORt (No Query Form)

Initializes all the current trigger system parameters and resets all trigger sequences.

Group Trigger

Syntax

```
ABORt
```

Arguments None

Examples

```
ABORT
```

resets the trigger system

AFGControl:CSCopy (No Query Form)

This command copies setup parameters for one channel to another channel. If your arbitrary function generator is a single-channel model, this command is not supported.

Group AFG Control

Syntax

```
AFGControl:CSCopy{CH1|CH2},{CH1|CH2}
```

Arguments CH1|CH2

Examples AFGCONTROL:CSCOPYCH1,CH2 copies the CH1 setup parameters into CH2.

*CAL? (Query Only)

This command performs an internal calibration and returns 0 (Pass) or a calibration error code.

NOTE. *The self-calibration can take several minutes to complete. During this time, the arbitrary function generator does not execute any commands. Do not power off the instrument during the self-calibration.*

Group Calibration and Diagnostic

Syntax *CAL?

Related Commands CALibration[:ALL]

Arguments None

Returns <NR1>

where:

<NR1>=0 indicates that the internal calibration completed without errors.

<NR1>≠0 indicates that the arbitrary function generator detected an error.

Examples *CAL?

performs an internal calibration and returns results. For example, it might return 0, which indicates that the calibration completed without any errors.

CALibration[:ALL]

The CALibration[:ALL] command performs an internal calibration.

The CALibration[:ALL]? command performs an internal calibration and returns 0 (Pass) or a calibration error code.

NOTE. *The self-calibration can take several minutes to complete. During this time, the arbitrary function generator does not execute any commands. Do not power off the instrument during the self-calibration.*

Group Calibration and Diagnostic

Syntax
```
CALibration[:ALL]
CALibration[:ALL]?
```

Related Commands *CAL?

Arguments None

Returns <NR1>

where:

<NR1>=0 indicates that the internal calibration completed without errors.

<NR1>≠0 indicates that the arbitrary function generator detected an error.

Examples CALIBRATION[:ALL]

performs an internal calibration.

CALIBRATION[:ALL]?

performs an internal calibration and returns results. For example, it might return 0, which indicates that the calibration completed without any errors.

*CLS (No Query Form)

This command clears all the event registers and queues, which are used in the arbitrary function generator status and event reporting system.

Group Status

Syntax *CLS

Arguments None

Examples `*CLS`

clears all the event registers and queues.

DIAGnostic[:ALL]

The DIAGnostic[:ALL] command performs a self-test. The DIAGnostic[:ALL]? command returns the results after executing the test.

NOTE. *The self-test can take several minutes to complete. During this time, the arbitrary function generator does not execute any commands. Do not power off the instrument during the self-test.*

Group Calibration and Diagnostic

Syntax
```
DIAGnostic[:ALL]
DIAGnostic[:ALL]?
```

Related Commands *TST?

Arguments None

Returns `<NR1>`

where:

<NR1>=0 indicates that the self-test completed without errors.

<NR1>≠0 indicates that the arbitrary function generator detected an error.

Examples `DIAGNOSTIC[:ALL]`

performs a self-test.

`DIAGNOSTIC[:ALL]?`

performs a self-test and returns a number indicating the outcome of the self-test.

DISPlay:CONTrast

This command sets or queries the contrast of the LCD display.

Group Display

Syntax
```
DISPlay:CONTrast {<contrast>|MINimum|MAXimum}
DISPlay:CONTrast?
```

Arguments <contrast>::=<NR2>

where:

<NR2> is a range of display contrast from 0.00 through 1.00 (resolution: 3 digits). The larger the value, the greater the screen contrast.

MINimum sets the display to the 0 contrast level.

MAXimum sets the display to the largest contrast level.

Returns <NR2>

Examples
```
DISPLAY:CONTRAST MAXIMUM
```

sets the display contrast to the largest contrast level.

DISPlay:SAVer:IMMediate (No Query Form)

This command sets the screen saver state to ON, regardless of the DISPlay:SAVer[:STATe]? command setting.

The screen saver is enabled immediately (without waiting for five minutes).

Group Display

Syntax
```
DISPlay:SAVer:IMMediate
```

Related Commands DISPlay:SAVer[:STATe]

Arguments None

Examples
```
DISPLAY:SAVER:IMMEDIATE
```

sets the screen saver state to ON.

DISPlay:SAVer[:STATe]

This command sets or queries the screen saver setting of the LCD display. When enabled, the screen saver function starts automatically if no operations are applied to the instrument front panel for five minutes.

Group Display

Syntax

```
DISPlay:SAVer[:STATe] {ON|OFF|<NR1>}
DISPlay:SAVer[:STATe]?
```

Related Commands DISPlay:SAVer:IMMediate

Arguments ON or <NR1>≠0 enables the screen saver function.

OFF or <NR1>=0 disables the screen saver function.

Returns <NR1>

indicating the screen saver state.

Examples

```
DISPLAY:SAVER[:STATE] OFF
```

disables the screen saver function.

DISPlay[:WINDow]:TEXT[:DATA]

The DISPlay[:WINDow]:TEXT[:DATA] command displays a text message on the instrument screen.

The DISPlay[:WINDow]:TEXT[:DATA]? query returns the text string currently displayed on the instrument screen.

The displayable characters are ASCII codes 32 through 126, and the instrument can display approximately 64 characters.

Group Display

Syntax

```
DISPlay[:WINDow]:TEXT[:DATA] <string>
DISPlay[:WINDow]:TEXT[:DATA]?
```

Arguments <string>

Returns `<string>`

which is the currently displayed text message.

Examples `DISPLAY[:WINDOW]:TEXT[:DATA]?`

returns the currently displayed text message.

DISPlay[:WINDow]:TEXT:CLEar (No Query Form)

This command clears the text message from the display screen.

Group Display

Syntax `DISPlay[:WINDow]:TEXT:CLEar`

Arguments None

Examples `DISPLAY[:WINDOW]:TEXT:CLEAR`

clears the text message from the screen.

*ESE

This command sets or queries the bits in the Event Status Enable Register (ESER) used in the status and events reporting system of the arbitrary function generator. The query command returns the contents of the ESER.

Group Status

Syntax
```
*ESE <bit_value>
*ESE?
```

Related Commands *CLS*ESR?*PSC*SRE*STB?

Arguments `<bit_value>::=<NR1>`

where:

<NR1> is a value in the range of 0 through 255. The binary bits of the ESER are set according to this value.

Returns <bit_value>

Examples *ESE 177

sets the ESER to 177 (binary 10110001), which sets the PON, CME, EXE and OPC bits.

*ESE?

might return 186, indicating that the ESER contains the binary value 10111010.

*ESR? (Query Only)

This query-only command returns the contents of the Standard Event Status Register (SESR) used in the status events reporting system in the arbitrary function generator. *ESR also clears the SESR (since reading the SESR clears it).

Group Status

Syntax *ESR?

Related Commands *CLS*ESE*SRE*STB?

Arguments None

Returns <NR1>

indicates that the contents of the SESR as a decimal integer.

Examples *ESR?

might return 181, which indicates that the SESR contains the binary number 10110101.

HCOPy:SDUMp[:IMMediate] (No Query Form)

This command copies a screen image and saves the image file to a USB memory. The default file name is TEK00nnn.BMP, where nnn is a consecutive number from 000 through 999. The image files are saved in a folder named “TEK” in the USB memory.

Group Screen copy

Syntax `HCOPy:SDUMp[:IMMediate]`

Arguments None

Examples `HCOPY:SDUMP[:IMMEDIATE]`

copies the screen image and may create a file TEK00001.BMP in a USB memory.

*IDN? (Query Only)

This query-only command returns identification information on the arbitrary function generator.

Group System

Syntax `*IDN?`

Arguments None

Returns `<Manufacturer>,<Model>,<Serial Number>,<Firmware Level>`

where:

<Manufacturer>::=TEKTRONIX

<Model>::={AFG3021}

<Serial Number>

<Firmware Level> ::=SCPI:99.0 FV:2.0

Examples `*IDN?`

might return the following response:

`TEKTRONIX,AFG3021,C100101,SCPI:99.0 FV:1.0`

MEMory:STATe:DELete (No Query Form)

This command deletes the contents of specified setup memory. If a specified setup memory is not allowed to overwrite or delete, this command causes an error.

Group Memory

Syntax
```
MEMory:STATe:DELete {0|1|2|3|4}
```

Arguments 0, 1, 2, 3, or 4 specifies the location of setup memory.

Examples
```
MEMORY:STATE:DELETE 1
```

deletes the contents of specified setup memory.

MEMory:STATe:LOCK

This command sets or queries whether to lock the specified setup memory. If you lock a setup memory, you cannot overwrite or delete the setup file.

You cannot execute this command for the setup memory of location number 0 (last setup memory).

Group Memory

Syntax
```
MEMory:STATe:LOCK {1|2|3|4},{ON|OFF|<NR1>}
MEMory:STATe:LOCK? {1|2|3|4}
```

Arguments 0, 1, 2, 3, or 4 specifies the setup memory to locked or queried.

ON or <NR1>≠0 locks the specified location of setup memory.

OFF or <NR1>=0 allows you to overwrite or delete the specified location of setup memory.

Returns <NR1>

Examples
```
MEMORY:STATE:LOCK 1,ON
```

locks the setup memory of location number 1.

MEMory:STATe:RECall:AUTo

This command sets or queries whether to enable the automatic recall of last setup memory when powered-on. The next time you apply the power, the arbitrary function generator will automatically recall the settings you used when you powered off the instrument.

If you select OFF, the default setups are recalled when you power on the instrument.

Group Memory

Syntax

```
MEMory:STATe:RECall:AUTo {ON|OFF|<NR1>}
MEMory:STATe:RECall:AUTo?
```

Arguments OFF or <NR1>=0 disables the last setup recall function.

ON or <NR1>≠0 enables the recall of the setup memory last used before the instrument was powered off.

Returns <NR1>

Examples

```
MEMORY:STATE:RECALL:AUTO ON
```

sets the instrument to recall the last setup memory when powered-on.

MEMory:STATe:VALid? (Query Only)

This command returns the availability of a setup memory.

Group Memory

Syntax

```
MEMory:STATe:VALid? {0|1|2|3|4}
```

Arguments 0, 1, 2, 3, or 4 specifies the location of setup memory.

Returns <NR1>

1 means that the specified setup memory has been saved.

0 means that the specified setup memory has been deleted.

Examples `MEMORY:STATE:VALID? 0` might return 1 if the specified setup memory has been saved.

MMEMory:CATalog? (Query Only)

This query-only command returns the current state of the mass storage system (USB memory).

Group Mass Memory

Syntax `MMEMory:CATalog?`

Related Commands MMEMory:CDIRectory

Arguments None

Returns `<NR1>,<NR1>[,<file_name>,<file_type>,<file_size>]...`

where:

The first <NR1> indicates that the total amount of storage currently used, in bytes. The second <NR1> indicates that the free space of mass storage, in bytes.

<file_name> is the exact name of a file.

<file_type> is DIR for directory, otherwise it is blank.

<file_size> is the size of the file, in bytes.

Examples `MMEMORY:CATALOG?` might return the following response:

`32751616,27970560,"SAMPLE1.TFS,,5412"`

MMEMory:CDIRectory

This command changes the current working directory in the mass storage system.

Group Mass Memory

Syntax
```
MMEMory:CDIRectory [<directory_name>]
MMEMory:CDIRectory?
```

Arguments <directory_name>::=<string> indicates the current working directory for the mass storage system.

If you do not specify a parameter, the directory is set to the *RST value. At *RST, this parameter is set to the root.

Returns <directory_name>::=<string>

Examples `MMEMORY:CDIRECTORY "/AFG/WORK0"`

changes the current directory to /AFG/WORK0.

MMEMory:DELete (No Query Form)

This command deletes a file or directory from the mass storage system. If a specified file in the mass storage is not allowed to overwrite or delete, this command causes an error. You can delete a directory if it is empty.

Group Mass Memory

Syntax `MMEMory:DELete <file_name>`

Arguments <file_name>::=<string> specifies a file to be deleted.

Examples `MMEMORY:DELETE "TEK001.TFW"`

deletes the specified file from the mass storage.

MMEMory:LOAD:STATe (No Query Form)

This command copies a setup file in the mass storage system to an internal setup memory. If a specified internal setup memory is locked, this command causes an error.

When you power off the instrument, the setups are automatically overwritten in the setup memory 0 (last setup memory).

Group Mass Memory

Syntax `MMEMory:LOAD:STATe {0|1|2|3|4},<file_name>`

Related Commands MEMory:STATe:LOCKMEMory:STATe:RECall:AUToMMEMory:STORe:STATe

Arguments 0, 1, 2, 3, or 4 specifies the location of setup memory.

<file_name>::=<string> specifies a setup file to be copied.

Examples `MMEMORY:LOAD:STATE 1,"SETUP1.TFS"`

copies a file named SETUP1.TFS in the mass storage into the internal memory location 1.

MMEMory:LOAD:TRACe (No Query Form)

This command copies a waveform data file in the mass storage system to Edit Memory. If the file format is different, this command causes an error.

Group Mass Memory

Syntax `MMEMory:LOAD:TRACe EMEMory,<file_name>`

Related Commands MMEMory:STORe:TRACe

Arguments <file_name>::=<string> specifies a waveform data file to be copied.

Examples `MMEMORY:LOAD:TRACE EMEMory,"TEK001.TFW"`

copies a file named TEK001.TFW in the mass storage into Edit Memory.

MMEMory:LOCK[:STATe]

This command sets or queries whether to lock a file or directory in the mass storage system. If you lock a file or directory, you cannot overwrite or delete it.

Group Mass Memory

Syntax
```
MMEMory:LOCK[:STATe] <file_name>,{ON|OFF|<NR1>}
MMEMory:LOCK[:STATe]<file_name>?
```

Arguments ON or <NR1>≠0 locks a file or directory in the mass storage system.

OFF or <NR1>=0 allows you to overwrite or delete a file or directory in the mass storage system.

Returns <NR1>

Examples MMEMORY:LOCK[:STATE] "SETUP1.TFS",ON

locks the file "SETUP1.TFS".

MMEMory:MDIRectory (No Query Form)

This command creates a directory in the mass storage system. If the specified directory is locked in the mass storage system, this command causes an error.

Group Mass Memory

Syntax MMEMory:MDIRectory <directory_name>

Arguments <directory_name>::=<string> specifies a directory name to be created.

Examples MMEMORY:MDIRECTORY "SAMPLE1"

creates a directory named "SAMPLE1" in the mass storage system.

MMEMory:STORe:STATe (No Query Form)

This command copies a setup file in the setup memory to a specified file in the mass storage system. If the specified file in the mass storage system is locked, this command causes an error. You cannot create a new file if the directory is locked. If the setup memory is deleted, this command causes an error. The <file_name> argument is a quoted string that defines the file name and path.

Group Mass Memory

Syntax MMEMory:STORe:STATe {0|1|2|3|4},<file_name>

Related Commands MMEMory:LOAD:STATeMMEMory:LOCK[:STATe]

Arguments 0, 1, 2, 3, or 4 specifies the location of setup memory.

<file_name>::=<string> specifies a file name in the mass storage system. The <file_name> includes path. Path separators are forward slashes (/).

Examples `MMEMORY:STORE:STATE 1,"SETUP1.TFS"`

Copies the setup file in the setup memory location 1 to a file named "SETUP1.TFS" in the mass storage system.

MMEMory:STORe:TRACe (No Query Form)

This command copies a waveform data file in the Edit Memory to a file in the mass storage system. If the file in the mass storage is locked, this command causes an error. You cannot create a new file if the directory is locked.

Group Mass Memory

Syntax `MMEMory:STORe:TRACe EMEMory,<file_name>`

Related Commands MMEMory:LOCK[:STATe]MMEMory:LOAD:TRACe

Arguments <file_name>::=<string> specifies a file name in the mass storage system. The <file_name> includes path. Path separators are forward slashes (/).

Examples `MMEMORY:STORE:TRACE EMEMory,"SAMPLE1.TFW"`

Copies the content of EMEMory to a file named "SAMPLE1.TFW" in the mass storage system.

*OPC

This command generates the operation complete message by setting bit 0 in the Standard Event Status Register (SESR) when all pending commands that generate an OPC message are complete.

The query command places the ASCII character "1" into the output queue when all such OPC commands are complete.

Group Synchronization

Syntax

```
*OPC
*OPC?
```

Arguments None

Returns <execution complete>::=1

where “1” indicates that all pending operations are complete.

Examples *OPC?

might return 1 to indicate that all pending OPC operations are finished.

*OPT? (Query Only)

This query-only command returns a list of the options installed in your arbitrary function generator.

Group System

Syntax *OPT?

Arguments None

Returns <OPT>[,<OPT>[,<OPT>[,<OPT>]]]

Examples *OPT?

might return 0, which indicates no option is installed in the instrument.

OUTPut[1|2]:IMPedance

The OUTPut:IMPedance command sets the output load impedance for the specified channel. The specified value is used for amplitude, offset, and high/low level settings. You can set the impedance to any value from 1 Ω to 10 kΩ with a resolution of 1 Ω or 3 digits. The default value is 50 Ω .

The OUTPut:IMPedance? command returns the current load impedance setting in ohms. If the load impedance is set to INFinity, the query command returns “9.9E+37”.

Group Output

Syntax
```
OUTPut[1|2]:IMPedance {<ohms>|INFinity|MINimum|MAXimum}
OUTPut[1|2]:IMPedance?
```

Arguments <ohms>::=<NR3>[<units>]

where:

<units>::=OHM

INFinity sets the load impedance to >10 kΩ.

MINimum sets the load impedance to 1 Ω.

MAXimum sets the load impedance to 10 kΩ.

Returns <ohms>::=<NR3>

Examples
```
OUTPut1:IMPedance MAXimum
```

sets the CH 1 load impedance to 10 kΩ .

OUTPut[1|2]:POLarity

This command inverts a specified output waveform relative to the offset level. The query command returns the polarity for the specified channel.

Group Output

Syntax
```
OUTPut[1|2]:POLarity {NORMal|INVerted}
OUTPut[1|2]:POLarity?
```

Arguments NORMal sets the specified output waveform polarity to Normal.

INVerted sets the specified output waveform polarity to Inverted.

Returns
```
NORM|INV
```

Examples
```
OUTPut1:POLarity NORMal
```

sets the CH 1 waveform polarity to Normal.

OUTPut[1|2][:STATe]

This command sets or query whether to enable the arbitrary function generator output for the specified channel.

Group Output

Syntax
```
OUTPut[1|2][:STATe] {ON|OFF|<NR1>}
OUTPut[1|2][:STATe]?
```

Arguments ON or <NR1>≠0 enables the arbitrary function generator output.

OFF or <NR1>=0 disables the arbitrary function generator output.

Returns <NR1>

Examples `OUTPUT1:STATE ON` sets the arbitrary function generator CH 1 output to ON.

OUTPut:TRIGger:MODE

This command sets or queries the mode (trigger or sync) for Trigger Output signal.

When the burst count is set to Inf-Cycles in burst mode, TRIGger indicates that the infinite number of cycles of waveform will be output from the Trigger Output connector.

When the burst count is set to Inf-Cycles in burst mode, SYNC indicates that one pulse waveform is output from the Trigger Output connector when the Inf-Cycles starts.

When Run Mode is specified other than Burst Inf-Cycles, TRIGger and SYNC have the same effect.

Group Output

Syntax
```
OUTPut:TRIGger:MODE {TRIGger|SYNC}
OUTPut:TRIGger:MODE?
```

Arguments TRIGger means TRIGger is selected for Trigger Out.

SYNC means SYNC is selected for Trigger Out.

Returns TRIG|SYNC

Examples OUTPUT:TRIGGER:MODE SYNC

outputs one cycle waveform from the Trigger Output connector when Inf-Cycles starts.

*PSC

This command sets and queries the power-on status flag that controls the automatic power-on execution of SRER and ESER. When *PSC is true, SRER and ESER are set to 0 at power-on. When *PSC is false, the current values in the SRER and ESER are preserved in nonvolatile memory when power is shut off and are restored at power-on.

Group Status

Syntax
```
*PSC <NR1>
*PSC?
```

Arguments <NR1>=0 sets the power-on status clear flag to false, disables the power-on clear, and allows the instrument to possibly assert SRQ after power-on.

<NR1>≠0 sets the power-on status clear flag true. Sending *PSC 1 therefore enables the power-on status clear and prevents any SRQ assertion after power-on.

Returns <NR1>

Examples *PSC 0

sets the power-on status clear flag to false.

*RCL (No Query Form)

This command restores the state of the instrument from a copy of the settings stored in the setup memory. The settings are stored using the *SAV command. If the specified setup memory is deleted, this command causes an error.

Group Memory

Syntax *RCL {0|1|2|3|4}

Related Commands *SAV

Arguments 0, 1, 2, 3, or 4 specifies the location of setup memory.

Examples `*RCL 3`

restores the instrument from a copy of the settings stored in memory location 3.

*RST (No Query Form)

This command resets the instrument to the factory default settings. This command is equivalent to pushing the Default button on the front panel. The default values are listed in Default Settings.

Group System

Syntax `*RST`

Arguments None

Examples `*RST`

resets the arbitrary function generator settings to the factory defaults.

*SAV (No Query Form)

This command stores the current settings of the arbitrary function generator to a specified setup memory location.

A setup memory location numbered 0 (last setup memory) is automatically overwritten by the setups when you power off the instrument.

If a specified numbered setup memory is locked, this command causes an error.

Group Memory

Syntax `*SAV {0|1|2|3|4}`

Related Commands *RCL

Arguments 0, 1, 2, 3, or 4 specifies the location of setup memory.

Examples `*SAV 2`

saves the current instrument state in the memory location 2.

[SOURce[1|2]]:AM[:DEPTh]

This command sets or queries the modulation depth of AM modulation for the specified channel. You can set the modulation depth from 0.0% to 120.0% with resolution of 0.1%.

Group Source

Syntax
```
[SOURce[1|2]]:AM[:DEPTh] {<depth>|MINimum|MAXimum}
[SOURce[1|2]]:AM[:DEPTh]?
```

Arguments <depth>::=<NR2>[<units>]

where:

<NR2> is the depth of modulating frequency.

<units>::=PCT

MINimum sets the modulation depth to minimum value.

MAXimum sets the modulation depth to maximum value.

Returns `<depth>`

Examples `SOURce1:AM:DEPth MAXimum`

sets the depth of modulating signal on CH 1 to the maximum value.

[SOURce[1|2]]:AM:INTernal:FREQuency

This command sets or queries the internal modulation frequency of AM modulation for the specified channel. You can use this command only when the internal modulation source is selected. You can set the internal modulation frequency from 2 mHz to 50.00 kHz with resolution of 1 mHz.

You can select the source of modulating signal by using the [SOURce[1|2]]:AM:SOURce [INTernal|EXTernal] command.

Group Source

Syntax
```
[SOURce[1|2]]:AM:INTernal:FREQuency
{<frequency>|MINimum|MAXimum}
[SOURce[1|2]]:AM:INTernal:FREQuency?
```

Related Commands [SOURce[1|2]]:AM:SOURce

Arguments <frequency>::=<NRf>[<units>]

where:

<NRf> is the modulation frequency.

<units>::=[Hz | kHz | MHz]

Returns <frequency>

Examples
```
SOURce1:AM:INTernal:FREQuency 10kHz
```

sets the CH 1 internal modulation frequency to 10 kHz.

[SOURce[1|2]]:AM:INTernal:FUNCtion

This command sets or queries the modulating waveform of AM modulation for the specified channel. You can use this command only when the internal modulation source is selected.

If you specify EFILe when there is no EFILe or the EFILe is not yet defined, this command causes an error.

Group Source

Syntax
```
[SOURce[1|2]]:AM:INTernal:FUNCtion
{SINusoid|SQUare|TRIangle|RAMP |NRAMp|PRNoise|
USER[1]|USER2|USER3|USER4|EMEMory|EFILe}
[SOURce[1|2]]:AM:INTernal:FUNCtion?
```

Related Commands [SOURce[1|2]]:AM:SOURce[SOURce[1|2]]:AM:INTernal:FUNCtion:EFILe

Arguments `SINusoid|SQUare|TRIangle|RAMP|NRAMp|PRNoise`

One of six types of function waveform can be selected as a modulating signal.

USER[1]|USER2|USER3|USER4|EMEMory

A user defined waveform saved in the user waveform memory or the EMEMory can be selected as a modulating signal.

EFILe

EFILe is used as a modulating signal.

Returns SIN|SQU|TRI|RAMP|NRAM|PRN|USER1|USER2|USER3|USER4|EMEMory|EFILe

Examples SOURce1:AM:INTernal:FUNCtion SQUare

selects Square as the shape of modulating waveform for the CH 1 output.

[SOURce[1|2]]:AM:INTernal:FUNCtion:EFILe

This command sets or queries an EFILe name used as a modulating waveform for AM modulation. A file name must be specified in the mass storage system. This command returns " " if there is no file in the mass storage.

Group Source

Syntax
```
[SOURce[1|2]]:AM:INTernal:FUNCtion:EFILe <file_name>
[SOURce[1|2]]:AM:INTernal:FUNCtion:EFILe?
```

Arguments <file_name>::=<string> specifies a file name in the mass storage system. The <file_name> includes path. Path separators are forward slashes (/).

Returns <file_name>

Examples SOURce1:AM:INTernal:FUNCtion:EFILe "SAMPLE1"

sets a file named "SAMPLE1" in the mass storage.

[SOURce[1|2]]:AM:SOURce

This command sets or queries the source of modulating signal of AM modulation for the specified channel.

Group Source

Syntax

```
[SOURce[1|2]]:AM:SOURce [INTernal|EXTernal]
[SOURce[1|2]]:AM:SOURce?
```

Arguments

INTernal means that the carrier waveform is modulated with an internal source.

EXTernal means that the carrier waveform is modulated with an external source.

Returns

```
INT|EXT
```

Examples

```
SOURce1:AM:SOURce INTernal
```

sets the CH 1 source of modulating signal to internal.

[SOURce[1|2]]:AM:STATe

This command enables or disables AM modulation for the specified channel. The query command returns the state of AM modulation.

Group

Source

Syntax

```
[SOURce[1|2]]:AM:STATe {ON|OFF|<NR1>}
[SOURce[1|2]]:AM:STATe?
```

Arguments

ON or <NR1>≠0 enables AM modulation.

OFF or <NR1>=0 disables AM modulation.

Returns

```
<NR1>
```

Examples

```
SOURce1:AM:STATe ON
```

enables the CH 1 AM modulation.

[SOURce[1|2]]:BURSt:MODE

This command sets or queries the burst mode for the specified channel.

Group

Source

Syntax

```
[SOURce[1|2]]:BURSt:MODE {TRIGgered|GATed}
[SOURce[1|2]]:BURSt:MODE?
```

Arguments

TRIGgered means that triggered mode is selected for burst mode.

GATed means that gated mode is selected for burst mode.

Returns

```
TRIG|GAT
```

Examples

```
SOURce1:BURSt:MODE TRIGgered
```

selects triggered mode.

[SOURce[1|2]]:BURSt:NCYCles

This command sets or queries the number of cycles (burst count) to be output in burst mode for the specified channel. The query command returns 9.9E+37 if the burst count is set to INFinity.

Group

Source

Syntax

```
[SOURce[1|2]]:BURSt:NCYCles {<cycles>|INFinity|MINimum| MAXimum}
[SOURce[1|2]]:BURSt:NCYCles?
```

Arguments

<cycles>::=<NRf>

where:

<NRf> is the burst count. The burst count ranges from 1 to 1,000,000.

INFinity sets the burst count to infinite count.

MINimum sets the burst count to minimum count.

MAXimum sets the burst count to maximum count.

Returns

```
<cycles>
```

Examples

```
SOURce1:BURSt:NCYCles 2
```

sets the CH 1 burst count to 2.

[SOURce[1|2]]:BURSt[:STATe]

This command enables or disables the burst mode for the specified channel. The query command returns the state of burst mode.

Group Source

Syntax

```
[SOURce[1|2]]:BURSt[:STATe] {ON|OFF|<NR1>}
[SOURce[1|2]]:BURSt[:STATe]?
```

Arguments ON or <NR1>≠0 enables the burst mode.

OFF or <NR1>=0 disables the burst mode.

Returns <NR1>

Examples

```
SOURce1:BURSt:STATe ON
```

enables the burst mode for the CH 1.

[SOURce[1|2]]:BURSt:TDELay

This command sets or queries delay time in the burst mode for the specified channel. It specifies a time delay between the trigger and the signal output. This command is available only in the Triggered burst mode.

The setting range is 0.0 ns to 85.000 s with resolution of 100 ps or 5 digits.

Group Source

Syntax

```
[SOURce[1|2]]:BURSt:TDELay {<delay>|MINimum|MAXimum}
[SOURce[1|2]]:BURSt:TDELay?
```

Arguments <delay>::=<NRf>[<units>]

where:

<units>::=[s | ms | µs | ns]

MINimum sets the delay time to minimum value.

MAXimum sets the delay time to maximum value.

Returns <delay>

Examples SOURce1:BURSt:DELay 20ms sets the CH 1 delay time to 20 ms.

[SOURce[1|2]]:COMBine:FEED

This command sets or queries whether to add the internal noise or an external signal to an output signal for the specified channel.

When you specify the internal noise, you can set or query the noise level by SOURce<3|4>:POWer[:LEVel][:IMMediate][:AMPLitude] command.

To disable the internal noise add or the external signal add function, specify "".

You can add an external signal to the CH 1 output signal of the AFG3100 and AFG3200 series arbitrary function generators.

The CH 2 output is not available for adding external signal.

Both the internal noise and an external signal can be added simultaneously to the arbitrary function generator.

Group Source

Syntax
```
[SOURce[1|2]]:COMBine:FEED ["NOISe"|"EXTernal"|"BOTH"|""]
[SOURce[1|2]]:COMBine:FEED?
```

Related Commands SOURce<3|4>:POWer[:LEVel][:IMMediate][:AMPLitude]

Arguments NOISe indicates that the internal noise is added to the output signal.

EXTernal indicates that an external signal is added to the CH 1 output signal of the AFG3100 or AFG3200 series arbitrary function generators.

BOTH indicates that the internal noise and an external signal are added to the CH 1 output signal of the AFG3100 or AFG3200 series arbitrary function generators.

"" disables the internal noise add and external signal add function.

Returns "NOIS"|"EXT"|"BOTH"|""

Examples SOURce1:COMBine:FEED EXTernal

adds an external signal to the CH 1 output signal.

[SOURce[1|2]]:FM[:DEViation]

This command sets or queries the peak frequency deviation of FM modulation for the specified channel. The setting range of frequency deviation depends on the waveform selected as the carrier. For more information, refer to the specifications in the *AFG3000 Series Specifications and Performance Verification Technical Reference*, which can be found on the Tektronix Web site (www.tektronix.com/downloads).

Group Source

Syntax

```
[SOURce[1|2]]:FM[:DEViation] {<deviation>|MINimum|MAXimum}
[SOURce[1|2]]:FM[:DEViation]?
```

Arguments <deviation>::=<NRf>[<units>]

where:

<NRf> is the frequency deviation.

<units>::=[Hz | kHz | MHz]

Returns <deviation>

Examples

```
SOURce1:FM:DEViation 1.0MHz
```

sets the CH 1 frequency deviation to 1.0 MHz.

[SOURce[1|2]]:FM:INTernal:FREQuency

This command sets or queries the internal modulation frequency of FM modulation for the specified channel. You can use this command only when the internal modulation source is selected.

You can set the internal modulation frequency from 2 mHz to 50.00 kHz with resolution of 1 mHz.

You can select the source of modulating signal by using the [SOURce[1|2]]:FM:SOURce [INTernal|EXTernal] command.

Group Source

Syntax

```
[SOURce[1|2]]:FM:INTernal:FREQuency
{<frequency>|MINimum|MAXimum}
```

```
[SOURce[1|2]]:FM:INTernal:FREQuency?
```

Related Commands [SOURce[1|2]]:FM:SOURce

Arguments <frequency>::=<NRf>[<units>]

where:

<NRf> is the modulation frequency.

<units>::=[Hz | kHz | MHz]

Returns `<frequency>`

Examples `SOURce1:FM:INTernal:FREQuency 10kHz` sets the CH 1 internal modulation frequency to 10 kHz.

[SOURce[1|2]]:FM:INTernal:FUNCtion

This command sets or queries the modulating waveform of FM modulation for the specified channel. You can use this command only when the internal modulation source is selected.

If you specify EFILe when there is no EFILe or the EFILe is not yet defined, this command causes an error.

Group Source

Syntax

```
[SOURce[1|2]]:FM:INTernal:FUNCtion {SINusoid|SQUare|TRIangle|
RAMP| NRAMp| PRNoise| USER[1]| USER2|USER3|USER4|EMEMory|EFILe}
[SOURce[1|2]]:FM:INTernal:FUNCtion?
```

Related Commands [SOURce[1|2]]:FM:SOURce

Arguments `SINusoid|SQUare|TRIangle|RAMP|NRAMp|PRNoise`

One of six types of function waveform can be selected as a modulating signal.

`USER[1]|USER2|USER3|USER4|EMEMory`

A user defined waveform saved in the user waveform memory or the EMEMory can be selected as a modulating signal.

`EFILe`

EFILe is used as a modulating signal.

Returns `SIN|SQU|TRI|RAMP|NRAM|PRN|USER1|USER2|USER3|USER4|EMEMory|EFILe`

Examples `SOURce1:FM:INTernal:FUNCtion SQUare`

selects Square as the shape of modulating waveform for the CH 1 output.

[SOURce[1|2]]:FM:INTernal:FUNCtion:EFILe

This command sets or queries an EFILe name used as a modulating waveform for FM modulation. A file name must be specified in the mass storage system. This command returns " " if there is no file in the mass storage.

Group Source

Syntax
```
[SOURce[1|2]]:FM:INTernal:FUNCtion:EFILe <file_name>
[SOURce[1|2]]:FM:INTernal:FUNCtion:EFILe?
```

Arguments <file_name>::=<string> specifies a file name in the mass storage system. The <file_name> includes path. Path separators are forward slashes (/).

Returns `<file_name>`

Examples `SOURce1:FM:INTernal:FUNCtion:EFILe "SAMPLE1"`

sets a file named "SAMPLE1" in the mass storage.

[SOURce[1|2]]:FM:SOURce

This command sets or queries the source of modulating signal of FM modulation for the specified channel.

Group Source

Syntax
```
[SOURce[1|2]]:FM:SOURce [INTernal|EXTernal]
[SOURce[1|2]]:FM:SOURce?
```

Arguments INTernal means that the carrier waveform is modulated with the internal source.

EXTernal means that the carrier waveform is modulated with an external source.

Returns `INT|EXT`

Examples `SOURce1:FM:SOURce INTernal`

sets the CH 1 source of modulating signal to internal.

[SOURce[1|2]]:FM:STATe

This command enables or disables FM modulation. The query command returns the state of FM modulation.

Group Source

Syntax
```
[SOURce[1|2]]:FM:STATe {ON|OFF|<NR1>}
[SOURce[1|2]]:FM:STATe?
```

Arguments ON or <NR1>≠0 enables FM modulation.

OFF or <NR1>=0 disables FM modulation.

Returns `<NR1>`

Examples `SOURce1:FM:STATe ON`

enables the CH 1 FM modulation.

[SOURce[1|2]]:FREQuency:CENTer

This command sets or queries the center frequency of sweep for the specified channel. This command is always used with the [SOURce[1|2]]:FREQuency:SPAN command. The setting range of center frequency depends on the waveform selected for sweep.

Group Source

Syntax
```
[SOURce[1|2]]:FREQuency:CENTer {<frequency>|MINimum|MAXimum}
[SOURce[1|2]]:FREQuency:CENTer?
```

Related Commands [SOURce[1|2]]:FREQuency:SPAN[SOURce[1|2]]:FREQuency:MODE

Arguments <frequency>::=<NRf>[<units>]

where:

<NRf> is the center frequency.

<units>::=[Hz | kHz | MHz]

Returns `<frequency>`

Examples `SOURce1:FREQuency:CENTer 550kHz`

sets the CH 1 center frequency to 550 kHz.

[SOURce[1|2]]:FREQuency:CONCurrent[:STATe]

This command enables or disables the function to copy the frequency (or period) of one channel to another channel.

The `[SOURce[1|2]]:FREQuency:CONCurrent` command copies the frequency (or period) of the channel specified by the header suffix to another channel. If you specify CH 1 with the header, the CH 1 frequency will be copied to CH 2.

The `[SOURce[1|2]]:FREQuency:CONCurrent?` command returns "0" (off) or "1" (on).

If your arbitrary function generator is single-channel model, this command is not supported.

Group Source

Syntax
```
[SOURce[1|2]]:FREQuency:CONCurrent[:STATe] {ON|OFF|<NR1>}
[SOURce[1|2]]:FREQuency:CONCurrent[:STATe]?
```

Arguments ON or <NR1>≠0 enables the concurrent copy function.

OFF or <NR1>=0 disables the concurrent copy function.

Returns `<NR1>`

Examples `SOURce1:FREQuency:CONCurrent ON`

copies the frequency value of CH 1 to CH 2.

[SOURce[1|2]]:FREQuency[:CW|:FIXed]

This command sets or queries the frequency of output waveform for the specified channel. This command is available when the Run Mode is set to other than Sweep.

The setting range of output frequency depends on the type of output waveform. If you change the type of output waveform, it might change the output frequency because changing waveform types impacts on the setting range of output frequency. The resolution is 1 μHz or 12 digits. For more information on the setting range, refer to the *AFG3000 Series Specifications and Performance Verification Technical Reference*, which can be found on the Tektronix Web site (www.tektronix.com/downloads).

Group Source

Syntax

```
[SOURce[1|2]]:FREQuency[:CW|:FIXed]
{<frequency>|MINimum|MAXimum}
[SOURce[1|2]]:FREQuency[:CW|:FIXed]?
```

Arguments <frequency>::=<NRf>[<units>]

where:

<NRf> is the output frequency.

<units>::=[Hz | kHz | MHz]

Returns `<frequency>`

Examples `SOURce1:FREQuency:FIXed 500kHz`

sets the CH 1 output frequency to 500 kHz when the Run Mode is set to other than Sweep.

[SOURce[1|2]]:FREQuency:MODE

This command sets or queries the frequency sweep state. You can select sine, square, ramp, or arbitrary waveform for sweep. The arbitrary function generator automatically changes to the Continuous mode if any waveform is selected other than sine, square, ramp, or an arbitrary waveform.

Group Source

Syntax

```
[SOURce[1|2]]:FREQuency:MODE {CW|FIXed|SWEep}
[SOURce[1|2]]:FREQuency:MODE?
```

Related Commands

[SOURce[1|2]]:FREQuency[:CW|:FIXed][SOURce[1|2]]:FREQuency:CENTer[SOURce[1|2]]:FREQuency:SPAN[SOURce[1|2]]:FREQuency:STARt[SOURce[1|2]]:FREQuency:STOP

Arguments

CW|FIXed means that the frequency is controlled by the [SOURce[1|2]]:FREQuency[:CW|:FIXed] command. The sweep is invalid.

SWEep means that the output frequency is controlled by the sweep command set. The sweep is valid.

Returns

`CW|FIXed|SWEep`

Examples

`SOURce1:FREQuency:MODE SWEep` specifies the sweep command set for controlling the CH 1 output frequency.

[SOURce[1|2]]:FREQuency:SPAN

This command sets or queries the span of frequency sweep for the specified channel. This command is always used with the [SOURce[1|2]]:FREQuency:CENTer command. The setting range of frequency span depends on the waveform selected for sweep.

Group

Source

Syntax

```
[SOURce[1|2]]:FREQuency:SPAN {<frequency>|MINimum|MAXimum}
[SOURce[1|2]]:FREQuency:SPAN
```

Related Commands

[SOURce[1|2]]:FREQuency:CENTer[SOURce[1|2]]:FREQuency:MODE

Arguments

<frequency>::=<NRf>[<units>]

where:

<NRf> is the frequency span.

<units>::=[Hz | kHz | MHz]

Returns

`<frequency>`

Examples

```
SOURce1:FREQuency:SPAN 900 kHz
```

sets the CH 1 frequency span to 900 kHz.

[SOURce[1|2]]:FREQuency:STARt

This command sets or queries the start frequency of sweep for the specified channel. This command is always used with the [SOURce[1|2]]:FREQuency:STOP command. The setting range of start frequency depends on the waveform selected for sweep. For more information on the setting range, refer to the specifications page of Quick Start User Manual.

Group Source

Syntax

```
[SOURce[1|2]]:FREQuency:STARt {<frequency>|MINimum|MAXimum}
[SOURce[1|2]]:FREQuency:STARt?
```

Related Commands [SOURce[1|2]]:FREQuency:MODE [SOURce[1|2]]:FREQuency:STOP

Arguments <frequency>::=<NRf>[<units>]

where:

<NRf> is the start frequency.

<units>::=[Hz | kHz | MHz]

Returns

```
<frequency>
```

Examples

```
SOURce1:FREQuency:STARt 10kHz
```

sets the sweep start frequency of CH 1 to 10 kHz.

[SOURce[1|2]]:FREQuency:STOP

This command sets or queries the start frequency of sweep for the specified channel. This command is always used with the [SOURce[1|2]]:FREQuency:STARt command. The setting range of stop frequency depends on the waveform selected for sweep. For more information on the setting range, refer to the *AFG3000 Series Specifications and Performance Verification Technical Reference*, which can be found on the Tektronix Web site (www.tektronix.com/downloads).

Group Source

Syntax

```
[SOURce[1|2]]:FREQuency:STOP {<frequency>|MINimum|MAXimum}
[SOURce[1|2]]:FREQuency:STOP?
```

Related Commands [SOURce[1|2]]:FREQuency:MODE, [SOURce[1|2]]:FREQuency:STARt

Arguments <frequency>::=<NRf>[<units>]

where:

<NRf> is the stop frequency.

<units>::=[Hz | kHz | MHz]

Returns `<frequency>`

Examples `SOURce1:FREQuency:STOP 100KHz 100KHz`

sets the stop frequency of CH 1 to 100 kHz.

[SOURce[1|2]]:FSKey[:FREQuency]

This command sets or queries the hop frequency of FSK modulation for the specified channel.

Group Source

Syntax

```
[SOURce[1|2]]:FSKey[:FREQuency] {<frequency>|MINimum|MAXimum}
[SOURce[1|2]]:FSKey[:FREQuency]?
```

Arguments <frequency>::=<NRf>[<units>]

where:

<NRf> is the hop frequency.

<units>::=[Hz | kHz | MHz]

Returns `<frequency>`

Examples `SOURce1:FSKey:FREQuency 1.0MHz`

sets the hop frequency of CH 1 FSK modulation to 1.0 MHz.

[SOURce[1|2]]:FSKey:INTernal:RATE

This command sets or queries the internal modulation rate of FSK modulation for the specified channel. You can use this command only when the internal modulation source is selected.

Group Source

Syntax

```
[SOURce[1|2]]:FSKey:INTernal:RATE {<rate>|MINimum|MAXimum}
[SOURce[1|2]]:FSKey:INTernal:RATE?
```

Arguments <rate>::=<NRf>[<units>]

where:

<NRf> is the modulation rate.

<units>::=[Hz | kHz | MHz]

Returns <rate>

Examples

```
SOURce1:FSKey:INTernal:RATE 50Hz
```

sets the CH 1 internal modulation rate to 50 Hz.

[SOURce[1|2]]:FSKey:SOURce

This command sets or queries the source of modulation signal of FSK modulation for the specified channel.

Group Source

Syntax

```
[SOURce[1|2]]:FSKey:SOURce [INTernal|EXTernal]
[SOURce[1|2]]:FSKey:SOURce?
```

Arguments INTernal means that the carrier waveform is modulated with an internal source.

EXTernal means that the carrier waveform is modulated with an external source.

Returns `INT|EXT`

Examples

```
SOURce1:FSKey:SOURce INTernal
```

sets the CH 1 source of modulating signal to internal.

[SOURce[1|2]]:FSKey:STATe

This command enables or disables FSK modulation. The query command returns the state of FSK modulation. You can select a sine, square, ramp, or arbitrary waveform for the carrier waveform.

Group Source

Syntax

```
[SOURce[1|2]]:FSKey:STATe {ON|OFF|<NR1>}
[SOURce[1|2]]:FSKey:STATe?
```

Arguments ON or <NR1>≠0 enables FSK modulation.

OFF or <NR1>=0 disables FSK modulation.

Returns

```
<NR1>
```

Examples

```
SOURce1:FSKey:STATe ON
```

enables the CH 1 FSK modulation.

[SOURce[1|2]]:FUNCtion:EFILe

This command sets or queries an EFILe name used as an output waveform. A file name must be specified in the mass storage system. This command returns " " if there is no file in the mass storage.

Group Source

Syntax

```
[SOURce[1|2]]:FUNCtion:EFILe <file_name>
[SOURce[1|2]]:FUNCtion:EFILe?
```

Arguments <file_name>::=<string> specifies a file name in the mass storage system. The <file_name> includes path. Path separators are forward slashes (/).

Returns

```
<file_name>
```

Examples `SOURce1:FUNCtion:EFILe "SAMPLE1"`

sets a file named "SAMPLE1" in the mass storage.

[SOURce[1|2]]:FUNCtion:RAMP:SYMMetry

This command sets or queries the symmetry of ramp waveform for the specified channel. The setting range is 0.0% to 100.0%.

Group Source

Syntax
```
[SOURce[1|2]]:FUNCtion:RAMP:SYMMetry
{<symmetry>|MINimum|MAXimum}
[SOURce[1|2]]:FUNCtion:RAMP:SYMMetry?
```

Arguments <symmetry>::=<NR2>[<units>]

where:

<NR2> is the symmetry.

<units>::=PCT

Returns <symmetry>

Examples `SOURce1:FUNCtion:RAMP:SYMMetry 80.5` sets the symmetry of the CH 1 ramp waveform to 80.5%.

[SOURce[1|2]]:FUNCtion[:SHAPe]

This command sets or queries the shape of the output waveform. When the specified user memory is deleted, this command causes an error if you select the user memory.

Group Source

Syntax
```
[SOURce[1|2]]:FUNCtion[:SHAPe] {SINusoid|SQUare|PULSe|RAMP
|PRNoise|DC|SINC|GAUSsian|LORentz|ERISe|EDECay|
HAVersine|USER[1]|USER2|USER3|USER4|EMEMory|EFILe}
[SOURce[1|2]]:FUNCtion[:SHAPe]?
```

Arguments SINusoid|SQUare|PULSe|RAMP|PRNoise|DC|SINC|GAUSsian|LORentz|ERISe|EDECay|HAVersine

The following table shows the combination of modulation type and the shape of output waveform.

	Sine, Square, Ramp, Arb, Sin(x)/x, Gaussian, Lorentz, Exponential Rise, Exponential Decay, Haversine	Pulse	Noise, DC
AM	√		
FM	√		
PM	√		
FSK	√		
PWM		√	
Sweep	√		
Burst	√	√	

If you select a waveform shape that is not allowed with a particular modulation, sweep, or burst, the Run mode will automatically be changed to Continuous.

If you specify EFILe when there is no EFILe or the EFILe is not yet defined, this command causes an error.

If you change the type of output waveform, it might change the output frequency because changing waveform types impacts the setting range of output frequency.

USER[1]|USER2|USER3|USER4|EMEMory A user defined waveform saved in the user waveform memory or the EMEMory can be selected as an output waveform.

EFILe EFILe is specified as an output waveform.

Returns `SIN|SQU|PULS|RAMP|PRN|DC|SINC|GAUS|LOR|ERIS|EDEC|HARV|USER1|USER2|USER3|USER4|EMEMory|EFILe`

Examples

```
SOURce1:FUNCtion:SHAPe SQUare
```

selects the shape of CH 1 output waveform to square waveform.

[SOURce[1|2]]:PHASe[:ADJust]

This command sets or queries the phase of output waveform for the specified channel. You can set the value in radians or degrees. If no units are specified, the default is RAD. The query command returns the value in RAD.

This command is supported when you select a waveform other than DC, Noise, and Pulse.

Group Source

Syntax
```
[SOURce[1|2]]:PHASe[:ADJust] {<phase>|MINimum|MAXimum}
[SOURce[1|2]]:PHASe[:ADJust]?
```

Arguments <phase>::=<NR3>[<units>]

where:

<NR3> is the phase of output frequency.

<units>::=[RAD | DEG]

If <units> are omitted, RAD is specified automatically. The setting ranges are:

RAD: -1 PI to +1 PI, relative to phase value

DEG: -180 to +180, relative to phase value

Returns `<phase>`

Examples `SOURce1:PHASe:ADJust MAXimum` sets the maximum value for the phase of CH 1 output frequency.

[SOURce[1|2]]:PHASe:INITiate (No Query Form)

This command synchronizes the phase of CH 1 and CH 2 output waveforms. The arbitrary function generator performs the same operation if you specify either SOURce1 or SOURce2. If your arbitrary function generator is single-channel model, this command is not supported.

Group Source

Syntax
```
[SOURce[1|2]]:PHASe:INITiate
```

Arguments None

Examples `[SOURCE[1|2]]:PHASE:INITIATE` synchronizes the phase of CH 1 and CH 2 output signals.

[SOURce[1|2]]:PM[:DEViation]

This command sets or queries the peak frequency deviation of PM modulation for the specified channel.

Group Source

Syntax

```
[SOURce[1|2]]:PM[:DEViation] {<deviation>|MINimum|MAXimum}
[SOURce[1|2]]:PM[:DEViation]?
```

Arguments <deviation>::=<NR3>[<units>]

where:

<NR3> is the phase deviation.

<units>::=[RAD | DEG]

If <units> are omitted, RAD is specified automatically. The setting ranges are:

RAD: 0 PI to +1 PI, relative to phase value

DEG: 0 to +180, in 1 degree steps, relative to phase value

Returns `<deviation>`

Examples

```
SOURce1:PM:DEViation MAXimum
```

sets the maximum value for the CH 1 phase deviation.

[SOURce[1|2]]:PM:INTernal:FREQuency

This command sets or queries the internal modulation frequency of PM modulation for the specified channel. You can use this command only when the internal modulation source is selected.

You can set the internal modulation frequency from 2 mHz to 50.00 kHz with resolution of 1 mHz.

You can select the source of modulating signal by using the [SOURce[1|2]]:PM:SOURce [INTernal|EXTernal] command.

Group Source

Syntax

```
[SOURce[1|2]]:PM:INTernal:FREQuency
{<frequency>|MINimum|MAXimum}
[SOURce[1|2]]:PM:INTernal:FREQuency?
```

Related Commands [SOURce[1|2]]:PM:SOURce

Arguments <frequency>::=<NRf>[<units>]

where:

<NRf> is the modulation frequency.

<units>::=[Hz | kHz | MHz]

Returns <frequency>

Examples SOURce1:PM:INTernal:FREQuency 10kHz

sets the CH 1 internal modulation frequency to 10 kHz.

[SOURce[1|2]]:PM:INTernal:FUNCtion

This command sets or queries the modulating waveform of PM modulation for the specified channel. You can use this command only when the internal modulation source is selected.

Group Source

Syntax

```
[SOURce[1|2]]:PM:INTernal:FUNCtion {SINusoid|SQUare|TRIangle|
RAMP|NRAMp|PRNoise| USER[1]|USER2|USER3|USER4|EMEMory|EFILe}
[SOURce[1|2]]:PM:INTernal:FUNCtion?
```

Related Commands [SOURce[1|2]]:PM:SOURce

Arguments SINusoid|SQUare|TRIangle|RAMP|NRAMp|PRNoise

One of six types of function waveform can be selected as a modulating signal.

USER[1]|USER2|USER3|USER4|EMEMory

A user defined waveform saved in the user waveform memory or the EMEMory can be selected as a modulating signal.

EFILe EFILe

is used as a modulating signal.

Returns SIN|SQU|TRI|RAMP|NRAM|PRN|USER1|USER2|USER3|USER4|EMEMory|EFILe

Examples SOURce1:PM:INTernal:FUNCtion SQUare

selects Square as the shape of modulating waveform for the CH 1 output.

[SOURce[1|2]]:PM:INTernal:FUNCtion:EFILe

This command sets or queries an EFILe name used as a modulating waveform for PM modulation. A file name must be specified in the mass storage system. This command returns " " if there is no file in the mass storage.

Group Source

Syntax
```
[SOURce[1|2]]:PM:INTernal:FUNCtion:EFILe <file_name>
[SOURce[1|2]]:PM:INTernal:FUNCtion:EFILe?
```

Arguments <file_name>::=<string> specifies a file name in the mass storage system. The <file_name> includes path. Path separators are forward slashes (/).

Returns <file_name>

Examples SOURce1:PM:INTernal:FUNCtion:EFILe "SAMPLE1"

sets a file named "SAMPLE1" in the mass storage.

[SOURce[1|2]]:PM:SOURce

This command sets or queries the source of modulation signal of PM modulation for the specified channel.

Group Source

Syntax
```
[SOURce[1|2]]:PM:SOURce [INTernal|EXTernal]
[SOURce[1|2]]:PM:SOURce?
```

Arguments INTernal means that the carrier waveform is modulated with an internal source.

EXTernal means that the carrier waveform is modulated with an external source.

Returns `INT|EXT`

Examples `SOURce1:PM:SOURce INTernal`

sets the CH 1 source of modulating signal to internal.

[SOURce[1|2]]:PM:STATe

This command enables or disables PM modulation. The query command returns the state of PM modulation. You can select a sine, square, ramp, or arbitrary waveform for the carrier waveform.

Group Source

Syntax
```
[SOURce[1|2]]:PM:STATe {ON|OFF|<NR1>}
[SOURce[1|2]]:PM:STATe?
```

Arguments ON or <NR1>≠0 enables PM modulation.

OFF or <NR1>=0 disables PM modulation.

Returns `<NR1>`

Examples `SOURce1:PM:STATe ON`

enables the CH 1 PM modulation.

SOURce<3|4>:POWer[:LEVel][:IMMediate][:AMPLitude]

This command sets or queries the internal noise level which applies to the output signal for the specified channel. The noise level represents the percent against current amplitude level. The setting range is 0 to 50%.

This command is available when Run Mode is set to Continuous, Burst, or Sweep.

You can set or query whether to add the internal noise to the output signal using the [SOURce[1|2]]:COMBine:FEED command.

Group Source

Syntax
```
SOURce<3|4>:POWer[:LEVel][:IMMediate][:AMPLitude]
{<percent>|MINimum|MAXimum}
SOURce<3|4>:POWer[:LEVel][:IMMediate][:AMPLitude]?
```

Related Commands [SOURce[1|2]]:COMBine:FEED

Arguments <percent>::=<NR2>[<units>]

where:

<NR2> is the noise level.

<units>::=PCT

Returns <percent>

Examples `SOURce3:POWer:LEVel:IMMediate:AMPLitude 50PCT`

sets the internal noise level that is added to the output signal to 50%.

[SOURce[1|2]]:PULSe:DCYCle

This command sets or queries the duty cycle of the pulse waveform for the specified channel. The setting range is 0.001% to 99.999% in increments of 0.001.

The arbitrary function generator will hold the settings of leading edge and trailing edge when the duty cycle is varied.

Refer to the [SOURce[1|2]]:PULSe:WIDTh command for the setting range.

Group Source

Syntax
```
[SOURce[1|2]]:PULSe:DCYCle {<percent>|MINimum|MAXimum}
[SOURce[1|2]]:PULSe:DCYCle?
```

Related Commands [SOURce[1|2]]:PULSe:WIDTh

Arguments <percent>::=<NR2>[<units>]

where:

<NR2> is the duty cycle.

<units>::=PCT

Returns `<percent>`

Examples `SOURce1:PULSe:DCYCle 80.5`

sets the duty cycle of the pulse waveform on CH 1 to 80.5%.

[SOURce[1|2]]:PULSe:DELay

This command sets or queries the lead delay of the pulse waveform for the specified channel.

Group Source

Syntax
```
[SOURce[1|2]]:PULSe:DELay {<delay>|MINimum|MAXimum}
[SOURce[1|2]]:PULSe:DELay?
```

Related Commands

Arguments <delay>::=<NR2>[<units>]

where:

<NR2> is the lead delay.

<units>::=[ns | µs | ms | s]

Setting range:

0 ns to Pulse Period (Continuous mode)

0 ns to Pulse Period - {Pulse Width + 0.8 ∞ (Leading Edge Time + Trailing Edge Time)} (Triggered/Gated burst mode)

Returns `<delay>`

Examples `SOURce1:PULSe:DELay 20ms`

sets the CH 1 lead delay to 20 ms.

[SOURce[1|2]]:PULSe:HOLD

The `[SOURce[1|2]]:PULSe:HOLD` command sets the arbitrary function generator to hold either pulse width or pulse duty.

The `[SOURce[1|2]]:PULSe:HOLD?` query returns `WIDTh` or `DUTY`.

Group Source

Syntax

```
[SOURce[1|2]]:PULSe:HOLD {WIDTh|DUTY}
[SOURce[1|2]]:PULSe:HOLD?
```

Arguments WIDTh means that the arbitrary function generator holds the pulse width setting.

DUTY means that the arbitrary function generator holds the pulse duty setting.

Returns `WIDT|DUTY`

Examples

```
SOURce1:PULSe:HOLD WIDTh
```

holds the CH 1 pulse width setting.

[SOURce[1|2]]:PULSe:PERiod

This command sets or queries the period for pulse waveform.

Group Source

Syntax

```
[SOURce[1|2]]:PULSe:PERiod {<period>|MINimum|MAXimum}
[SOURce[1|2]]:PULSe:PERiod?
```

Arguments <period>::=<NRf>[<units>]

where:

<NRf> is the pulse period.

<units>::=[ns | µs | ms | s]

Returns `<period>`

Examples `SOURce1:PULSe:PERiod 200ns`

sets the CH 1 pulse period to 200 ns.

[SOURce[1|2]]:PULSe:TRANsition[:LEADing]

This command sets or queries the leading edge time of pulse waveform.

Group Source

Syntax
```
[SOURce[1|2]]:PULSe:TRANsition[:LEADing] {<seconds>|MINimum|MAXimum}
[SOURce[1|2]]:PULSe:TRANsition[:LEADing]?
```

Arguments <seconds>::=<NRf>[<units>]

where:

<NRf> is the leading edge time of pulse waveform.

<units>::=[ns | μs | ms | s]

Returns `<seconds>`

Examples `SOURce1:PULSe:TRANsition:LEADing 200ns`

sets the CH 1 leading edge time to 200 ns.

[SOURce[1|2]]:PULSe:TRANsition:TRAiling

This command sets or queries the trailing edge time of pulse waveform.

Group Source

Syntax
```
[SOURce[1|2]]:PULSe:TRANsition:TRAiling {<seconds>|MINimum|MAXimum}
[SOURce[1|2]]:PULSe:TRANsition:TRAiling?
```

Arguments <seconds>::=<NRf>[<units>]

where:

<NRf> is the trailing edge of pulse waveform.

<units>::=[ns | µs | ms | s]

Returns <seconds>

Examples SOURce1:PULSe:TRANsition:TRAiling 200ns

sets the trailing edge time to 200 ns.

[SOURce[1|2]]:PULSe:WIDTh

This command sets or queries the pulse width for the specified channel.

Pulse Width = Period ∞ Duty Cycle / 100

The pulse width must be less than the period. The setting range is 0.001% to 99.999% in terms of duty cycle.

- AFG3011 / 3011C: 80 ns to 999.99 s
- AFG3021B / 3021C / 3022B / 3022C: 16 ns to 999.99 s
- AFG3051C / 3052C: 12 ns to 999.99 s
- AFG3101 / 3101C / 3102 / 3102C: 8 ns to 999.99 s
- AFG3251 / 3251C / 3252 / 3252C: 4 ns to 999.99 s

Pulse Width ≤ Pulse Period - 0.8 ∞ (Leading Edge Time + Trailing Edge Time)

Pulse Width ≥ 0.625 ∞ (Leading Edge Time + Trailing Edge Time)

Group Source

Syntax
```
[SOURce[1|2]]:PULSe:WIDTh {<seconds>|MINimum|MAXimum}
[SOURce[1|2]]:PULSe:WIDTh?
```

Related Commands [SOURce[1|2]]:PULSe:DCYCle

Arguments <seconds>::=<NRf>[<units>]

where:

<NRf> is the pulse width.

<units>::=[ns | µs | ms | s]

Returns <seconds>

Examples

```
SOURce1:PULSe:WIDTh 200ns
```

sets the CH 1 pulse width to 200 ns.

[SOURce[1|2]]:PWM:INTernal:FREQuency

This command sets or queries the internal modulation frequency of PWM modulation for the specified channel. You can use this command only when the internal modulation source is selected.

You can set the internal modulation frequency from 2 mHz to 50.00 kHz with resolution of 1 mHz.

You can select the source of modulating signal by using the [SOURce[1|2]]:PWM:SOURce [INTernal|EXTernal] command.

Group Source

Syntax

```
[SOURce[1|2]]:PWM:INTernal:FREQuency
{<frequency>|MINimum|MAXimum}
[SOURce[1|2]]:PWM:INTernal:FREQuency?
```

Related Commands [SOURce[1|2]]:PWM:SOURce

Arguments <frequency>::=<NRf>[<units>]

where <NRf> is the modulation frequency.

<units>::=[Hz | kHz | MHz]

Returns `<frequency>`

Examples

```
SOURce1:PWM:INTernal:FREQuency 10kHz
```

sets the CH 1 internal frequency to 10 kHz.

[SOURce[1|2]]:PWM:INTernal:FUNCtion

This command sets or queries the modulating waveform of PWM modulation for the specified channel. You can use this command only when the internal modulation source is selected.

If you specify EFILe when there is no EFILe or the EFILe is not yet defined, this command causes an error.

Group Source

Syntax
```
[SOURce[1|2]]:PWM:INTernal:FUNCtion {SINusoid|SQUare|TRIangle
|RAMP|NRAMp|PRNoise|USER[1]|USER2|USER3|USER4|EMOMory|EFILe}
[SOURce[1|2]]:PWM:INTernal:FUNCtion?
```

Related Commands [SOURce[1|2]]:PWM:SOURce

Arguments `SINusoid|SQUare|TRIangle|RAMP|NRAMp|PRNoise`

One of six types of function waveform can be selected as a modulating signal.

`USER[1]|USER2|USER3|USER4|EMEMory`

A user defined waveform saved in the user waveform memory or the EMEMory can be selected as a modulating signal.

`EFILe`

EFILe is used as a modulating signal.

Returns `SIN|SQU|TRI|RAMP|NRAM|PRN|USER1|USER2|USER3|USER4|EMOMory|EFILe`

Examples
```
SOURce1:PWM:INTernal:FUNCtion SQUare
```

selects Square as the shape of modulating waveform for the CH 1 output.

[SOURce[1|2]]:PWM:INTernal:FUNCtion:EFILe

This command sets or queries an EFILe name used as a modulating waveform for PWM modulation. A file name must be specified in the mass storage system. This command returns " " if there is no file in the mass storage.

Group Source

Syntax
```
[SOURce[1|2]]:PWM:INTernal:FUNCtion:EFILe <file_name>
[SOURce[1|2]]:PWM:INTernal:FUNCtion:EFILe?
```

Arguments <file_name>::=<string> specifies a file name in the mass storage system. The <file_name> includes path. Path separators are forward slashes (/).

Returns `<file_name>`

Examples `SOURce1:PWM:INTernal:FUNCtion:EFILe “SAMPLE1”`

creates a file named “SAMPLE1” in the mass storage.

[SOURce[1|2]]:PWM:SOURce

This command sets or queries the source of modulating signal of PWM modulation for the specified channel.

Group Source

Syntax
```
[SOURce[1|2]]:PWM:SOURce [INTernal|EXTernal]
[SOURce[1|2]]:PWM:SOURce?
```

Arguments INTernal means that the carrier waveform is modulated with the internal source.

EXTernal means that the carrier waveform is modulated with an external source.

Returns `INT|EXT`

Examples `SOURce1:PWM:SOURce INTernal`

sets the source of modulating signal on CH 1 to internal.

[SOURce[1|2]]:PWM:STATe

This command enables or disables PWM modulation. The query command returns the state of PWM modulation. You can select only pulse waveform as a carrier waveform for PWM.

Group Source

Syntax
```
[SOURce[1|2]]:PWM:STATe {ON|OFF|<NR1>}
[SOURce[1|2]]:PWM:STATe?
```

Arguments ON or <NR1>≠0 enables PWM modulation.

OFF or <NR1>=0 disables PWM modulation.

Returns `<NR1>`

Examples

```
SOURce1:PWM:STATe ON
```

enables the CH 1 PWM modulation.

[SOURce[1|2]]:PWM[:DEViation]:DCYCle

This command sets or queries the PWM deviation in percent for the specified channel.

The setting range must meet the following conditions:

Deviation ≤ Pulse Width - PWmin

Deviation ≤ Pulse Period - Pulse Width - PWmin

Deviation ≤ Pulse Width - 0.8 × (Leading Edge Time + Trailing Edge Time)

Deviation ≤ Pulse Period - Pulse Width - 0.8 × (Leading Edge Time + Trailing Edge Time)

where PWmin is the minimum pulse width.

Group Source

Syntax

```
[SOURce[1|2]]:PWM[:DEViation]:DCYCle
{<percent>|MINimum|MAXimum}
[SOURce[1|2]]:PWM[:DEViation]:DCYCle?
```

Arguments <percent>::=<NR2>[<units>]

where:

<NR2> is the PWM deviation.

<units>::=PCT

Returns <percent>

Examples

```
SOURce1:PWM[:DEViation]:DCYCle 5.0
```

sets the CH 1 PWM deviation to 5.0%.

[SOURce]:ROSCillator:SOURce

This command sets the reference clock to either internal or external.

Group Source

Syntax
```
[SOURce]:ROSCillator:SOURce {INTernal|EXTernal}
[SOURce]:ROSCillator:SOURce?
```

Arguments INTernal means that the reference clock is set to internal.

EXTernal means that the reference clock is set to external.

Returns `INT|EXT`

Examples `SOURce:ROSCillator:SOURce INTernal`

selects the internal clock reference.

[SOURce[1|2]]:SWEep:HTIMe

This command sets or queries the sweep hold time. Hold time represents the amount of time that the frequency must remain stable after reaching the stop frequency.

Group Source

Syntax
```
[SOURce[1|2]]:SWEep:HTIMe {<seconds>|MINimum|MAXimum}
[SOURce[1|2]]:SWEep:HTIMe?
```

Arguments <seconds>::=<NRf>[<units>]

where:

<NRf> is the hold time in seconds.

<units>::=[ns | µs | ms | s]

Returns `<seconds>`

Examples `SOURce1:SWEep:HTIMe 1ms`

sets the CH 1 hold time to 1 ms.

[SOURce[1|2]]:SWEep:MODE

The [SOURce[1|2]]:SWEep:MODE command selects auto or manual for the sweep mode for the specified channel.

The query command returns the sweep mode for the specified channel.

Group Source

Syntax

```
[SOURce[1|2]]:SWEep:MODE {AUTO|MANual}
[SOURce[1|2]]:SWEep:MODE?
```

Related Commands [SOURce[1|2]]:SWEep:HTIMe

[SOURce[1|2]]:SWEep:RTIMe

[SOURce[1|2]]:SWEep:TIME

TRIGger[:SEQuence]:SOURce

TRIGger[:SEQuence]:TIMer

Arguments AUTO sets the sweep mode to auto. The instrument outputs a continuous sweep at a rate specified by Sweep Time, Hold Time, and Return Time.

MANual sets the sweep mode to manual. The instrument outputs one sweep when a trigger input is received.

Returns AUTO|MAN

Examples

```
SOURce1:SWEep:MODE AUTO
```

sets the CH1 sweep mode to auto. The instrument outputs a continuous sweep.

[SOURce[1|2]]:SWEep:RTIMe

This command sets or queries the sweep return time. Return time represents the amount of time from stop frequency through start frequency. Return time does not include hold time.

Group Source

Syntax

```
[SOURce[1|2]]:SWEep:RTIMe {<seconds>|MINimum|MAXimum}
[SOURce[1|2]]:SWEep:RTIMe?
```

Arguments <seconds>::=<NRf>[<units>]

where:

<NRf> is the return time in seconds.

<units>::=[ns | µs | ms | s]

Returns `<seconds>`

Examples `SOURce1:SWEep:RTIMe 1ms`

sets the CH 1 return time to 1 ms.

[SOURce[1|2]]:SWEep:SPACing

The [SOURce[1|2]]:SWEep:SPACing command selects linear or logarithmic spacing for the sweep for the specified channel.

The query command returns the type for the sweep spacing for the specified channel.

Group Source

Syntax
```
[SOURce[1|2]]:SWEep:SPACing {LINear|LOGarithmic}
[SOURce[1|2]]:SWEep:SPACing?
```

Arguments LINear sets the sweep spacing to linear.

LOGarithmic sets the sweep spacing to logarithmic.

Returns `LIN|LOG`

Examples `SOURce1:SWEep:SPACing LINear`

sets the CH1 sweep spacing to linear.

[SOURce[1|2]]:SWEep:TIME

This command sets or queries the sweep time for the sweep for the specified channel. The sweep time does not include hold time and return time. The setting range is 1 ms to 300 s.

Group Source

Syntax
```
[SOURce[1|2]]:SWEep:TIME {<seconds>|MINimum|MAXimum}
[SOURce[1|2]]:SWEep:TIME?
```

Arguments <seconds>::=<NRf>[<units>]

where:

<NRf> is the sweep time in seconds.

<units>::=[ns | μs | ms | s]

Returns `<seconds>`

Examples
```
SOURce1:SWEep:TIME 100ms
```

sets the CH 1 sweep time to 100 ms.

[SOURce[1|2]]:VOLTage:CONCurrent[:STATe]

This command enables or disables the function to copy the voltage level of one channel to another channel.

The[SOURce[1|2]]:VOLTage:CONCurrent[:STATe] command copies the voltage level of the channel specified by the header suffix to another channel. If you specify CH 1 with the header, the CH 1 voltage level will be copied to CH 2.

The query command returns “0” (off) or “1” (on).

If your arbitrary function generator is a single-channel model, this command is not supported.

Group Source

Syntax
```
[SOURce[1|2]]:VOLTage:CONCurrent[:STATe] {ON|OFF|<NR1>}
[SOURce[1|2]]:VOLTage:CONCurrent[:STATe]?
```

Arguments ON or <NR1>≠0 enables the concurrent copy function.

OFF or <NR1>=0 disables the concurrent copy function.

Returns `<NR1>`

Examples

```
SOURce1:VOLTage:CONCurrent:STATe ON
```

enables the concurrent copy function.

[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:HIGH

This command sets or queries the high level of output amplitude for the specified channel. If your instrument is a dual-channel model and the `[SOURce[1|2]]:VOLTage:CONCurrent[:STATe]` command is set to ON, then the high level of other channel is also the same value.

Group Source

Syntax

```
[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:HIGH
{<voltage>|MINimum|MAXimum}
[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:HIGH?
```

Related Commands [SOURce[1|2]]:VOLTage:CONCurrent[:STATe]

Arguments <voltage>::=<NRf>[<units>]

where:

<NRf> is the high level of output amplitude.

<units>::=[mV | V]

Returns `<voltage>`

Examples

```
SOURce1:VOLTage:LEVel:IMMediate:HIGH 1V
```

sets the high level of CH 1 output amplitude to 1 V.

[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:LOW

This command sets or queries the low level of output amplitude for the specified channel. If your instrument is a dual-channel model and the `[SOURce[1|2]]:VOLTage:CONCurrent[:STATe]` command is set to ON, then the low level of other channel is also the same value.

Group Source

Syntax

```
[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:LOW
{<voltage>|MINimum| MAXimum}
[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:LOW?
```

Related Commands [SOURce[1|2]]:VOLTage:CONCurrent[:STATe]

Arguments <voltage>::=<NRf>[<units>]

where:

<NRf> is the low level of output amplitude.

<units>::=[mV | V]

Returns <voltage>

Examples `SOURce1:VOLTage:LEVel:IMMediate:LOW -1V`

sets the low level of CH 1 output amplitude to -1 V.

[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet

This command sets or queries the offset level for the specified channel. If your instrument is a dual-channel model and the `[SOURce[1|2]]:VOLTage:CONCurrent[:STATe]` command is set to ON, then the offset level of the other channel is also the same value.

Group Source

Syntax

```
[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet
{<voltage>|MINimum|MAXimum}
[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate]:OFFSet?
```

Related Commands [SOURce[1|2]]:VOLTage:CONCurrent[:STATe]

Arguments <voltage>::=<NRf>[<units>]

where:

<NRf> is the offset voltage level.

<units>::=[mV | V]

Returns `<voltage>`

Examples

```
SOURce1:VOLTage:LEVel:IMMediate:OFFSet 500mV
```

sets the CH 1 offset level to 500 mV.

[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]

This command sets or queries the output amplitude for the specified channel.

Units	Amplitude resolution
VPP	0.1 mVp-p or four digits
VRMS	0.1 mVrms or four digits
DBM	0.1 dBm

You can set the units of output amplitude by using either the bezel menu selection or the [SOURce[1|2]]:VOLTage:UNIT command. The selection by bezel menu has priority over the remote command.

Group Source

Syntax

```
[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]
{<amplitude>|MINimum|MAXimum}
[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]?
```

Related Commands [SOURce[1|2]]:VOLTage:CONCurrent[:STATe]

Arguments <amplitude>::=<NRf>[<units>]

where:

<NRf> is the output amplitude.

<units>::=[VPP | VRMS | DBM]

Returns `<amplitude>`

Examples

```
SOURce1:VOLTage:LEVel:IMMediate:AMPLitude 1V
```

sets the CH 1output amplitude to 1 V.

[SOURce[1|2]]:VOLTage:LIMit:HIGH

This command sets or queries the higher limit of the output amplitude high level for the specified channel. If your instrument is a dual-channel model and the

[SOURce[1|2]]:VOLTage:CONCurrent[:STATe] command is set to ON, then the higher level limit of the other channel is the same value.

Group Source

Syntax
```
[SOURce[1|2]]:VOLTage:LIMit:HIGH {<voltage>|MINimum|MAXimum}
[SOURce[1|2]]:VOLTage:LIMit:HIGH?
```

Related Commands [SOURce[1|2]]:VOLTage:CONCurrent[:STATe]

Arguments <voltage>::=<NRf>[<units>]

where:

<NRf> is the higher limit of output amplitude.

<units>::=[mV | V]

Returns <voltage>

Examples SOURce1:VOLTage:LIMit:HIGH 1V

sets the higher limit of CH 1 output amplitude to 1 V.

[SOURce[1|2]]:VOLTage:LIMit:LOW

This command sets or queries the lower limit of the output amplitude low level for the specified channel. If your instrument is a dual-channel model and the [SOURce[1|2]]:VOLTage:CONCurrent[:STATe] command is set to ON, then the low level lower limit of the other channel is the same value.

Group Source

Syntax
```
[SOURce[1|2]]:VOLTage:LIMit:LOW {<voltage>|MINimum|MAXimum}
[SOURce[1|2]]:VOLTage:LIMit:LOW?
```

Related Commands [SOURce[1|2]]:VOLTage:CONCurrent[:STATe]

Arguments <voltage>::=<NRf>[<units>]

where:

<NRf> is the lower limit of output amplitude.

<units>::=[mV | V]

Returns `<voltage>`

Examples `SOURce1:VOLTage:LIMit:LOW 10mV`

sets the lower limit of CH 1 output amplitude to 10 mV.

[SOURce[1|2]]:VOLTage:UNIT

This command sets or queries the units of output amplitude for the specified channel. This command does not affect the offset, High level, or Low level of output. The setting of this command is not affected by the units setting of [SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude] command.

$$V_{rms} = \frac{V_{pp}}{2\sqrt{2}} \times (sin)$$

$$dBm = 10 \times \log\left(\frac{P}{0.001}\right)$$

$$P = \frac{V_{rms}^2}{R_L}$$

$$R_L \, load \, impedance \, V_{rms} = \frac{V_{pp}}{2\sqrt{3}} \, (triangle)$$

If your instrument is a dual-channel model and the `[SOURce[1|2]]:VOLTage:CONCurrent[:STATe]` command is set to ON, then the units of the other channel are set the same.

Group Source

Syntax

```
[SOURce[1|2]]:VOLTage:UNIT {VPP|VRMS|DBM}
[SOURce[1|2]]:VOLTage:UNIT?
```

Related Commands [SOURce[1|2]]:VOLTage:CONCurrent[:STATe]

[SOURce[1|2]]:VOLTage[:LEVel][:IMMediate][:AMPLitude]

Arguments VPP sets the units of the output voltage to Vp-p.

VRMS sets the units of the output voltage to Vrms.

DBM sets the units of the output voltage to dBm. You cannot specify DBM if the load impedance is set to infinite.

Returns VPP|VRMS|DBM

Examples SOURce1:VOLTage:UNIT VPP

sets the voltage units to Vp-p.

*SRE

This command sets and queries the bits in the Service Request Enable Register (SRER).

Group Status

Syntax
```
*SRE <bit_value>
*SRE?
```

Related Commands *PSC

Arguments <bit_value>::=<NR1> where <NR1> is a value in the range from 0 through 255. The binary bits of the SRER are set according to this value. Using an out-of-range value causes an execution error. The power-on default for SRER is 0 if *PSC is set to 1. If *PSC is set to 0, the SRER maintains the previous power cycle value through the current power cycle.

Returns <bit_value>

Examples *SRE48

sets the bits in the SRER to binary 00110000.

*SRE?

might return 32, showing that the bits in the SRER have the binary value of 00100000.

STATus:OPERation:CONDition? (Query Only)

This query-only command returns the contents of the Operation Condition Register.

Group Status

Syntax `STATus:OPERation:CONDition?`

Arguments None

Returns `<bit_value>::=<NR1>`

Examples `STATUS:OPERATION:CONDITION?`

might return 32 which indicates that the OCR contains the binary number 00000000 00100000 and the CH 1 of the instrument is waiting for trigger.

STATus:OPERation:ENABle

This command sets or queries the mask for the Operation Enable Register.

Group Status

Syntax
```
STATus:OPERation:ENABle <bit_value>
STATus:OPERation:ENABle?
```

Arguments <bit_value>::=<NR1>

Returns `<bit_value>`

Examples `STATUS:OPERATION:ENABLE 1`

sets the CALibrating bit in the OENR to on.

STATus:OPERation[:EVENt]? (Query Only)

This query-only command returns the value in the Operation Event Register and clears the Operation Event Register.

Group Status

Syntax `STATus:OPERation[:EVENt]?`

Arguments None

Returns <NR1>

Examples STATUS:OPERATION[:EVENT]?

might return 1 which indicates that the OEVR contains the binary number 00000000 00000001 and the CALibrating bit is set to on.

STATus:PRESet (No Query Form)

This command presets the SCPI status registers (OENR and QENR).

Group Status

Syntax STATus:PRESet

Arguments None

Examples STATUS:PRESET

presets the SCPI status registers.

STATus:QUEStionable:CONDition? (Query Only)

This query-only command returns the contents of the Questionable Condition Register.

Group Status

Syntax STATus:QUEStionable:CONDition?

Arguments None

Returns <bit_value>::=<NR1>

Examples `STATUS:QUESTIONABLE:CONDITION?` might return 32 which indicates that the QCR contains the binary number 00000000 00100000 and the accuracy of frequency is questionable.

STATus:QUEStionable:ENABle

This command sets or queries the mask for the Questionable Enable Register.

Group Status

Syntax
```
STATus:QUEStionable:ENABle <bit_value>
STATus:QUEStionable:ENABle?
```

Arguments <bit_value>::=<NR1>

Returns `<bit_value>`

Examples `STATUS:QUESTIONABLE:ENABLE 32`

sets the FREQuency bit in the QENR to on.

STATus:QUEStionable[:EVENt]? (Query Only)

This query-only command returns the value in the Questionable Event Register and clears the Questionable Event Register.

Group Status

Syntax `STATus:QUEStionable[:EVENt]?`

Arguments None

Returns <bit_value>::=<NR1>

Examples `STATUS:QUESTIONABLE[:EVENT]?`

might return 32 which indicates that the QEVR contains the binary number 00000000 00100000 and the FREQuency bit is set to on.

*STB? (Query Only)

This query-only command returns the contents of the Status Byte Register (SBR) using the Master Summary Status (MSS) bit.

Group Status

Syntax `*STB?`

Arguments None

Returns `<NR1>`

Examples `*STB?`

might return 96, showing that the SBR contains the binary value 01100000.

SYSTem:BEEPer[:IMMediate] (No Query Form)

This command causes the instrument to beep immediately.

Group System

Syntax `SYSTem:BEEPer[:IMMediate]`

Arguments None

Examples `SYSTEM:BEEPER[:IMMEDIATE]`

causes a beep.

SYSTem:BEEPer:STATe

The SYSTem:BEEPer:STATe command sets the beeper ON or OFF.

The SYSTem:BEEPer:STATe? command returns “0” (OFF) or “1” (ON).

When the beeper is set to ON, the instrument will beep when an error message or a warning message is displayed on the screen. The instrument does not beep when an error or warning caused by remote command execution.

Group System

Syntax
```
SYSTem:BEEPer:STATe {ON|OFF|<NR1>}
SYSTem:BEEPer:STATe?
```

Arguments ON or <NR1>≠0 enables the beeper.

OFF or <NR1>=0 disables the beeper.

Returns <NR1>

Examples
```
SYSTEM:BEEPER:STATE ON
```

enables the beeper function.

SYSTem:ERRor[:NEXT]? (Query Only)

This query-only command returns the contents of the Error/Event queue.

Group System

Syntax
```
SYSTem:ERRor[:NEXT]?
```

Arguments None

Returns
```
<Error/event number>::=<NR1>
<Error/event description>::=<string>
```

Examples
```
SYSTEM:ERROR[:NEXT]?
```

might return the following response:

```
-410,"Query INTERRUPTED"
```

If the instrument detects an error or an event occurs, the event number and event message will be returned.

SYSTem:KCLick[:STATe]

This command enables or disables the click sound when you push the front panel buttons or turn the general purpose knob. The query command returns “0” (OFF) or “1” (ON).

Group System

Syntax

```
SYSTem:KCLick[:STATe] {ON|OFF|<NR1>}
SYSTem:KCLick[:STATe]?
```

Arguments ON or <NR1>≠0 enables click sound.

OFF or <NR1>=0 disables click sound.

Returns <NR1>

Examples

```
SYSTEM:KCLICK[:STATE] ON
```

enables the click sound.

SYSTem:KLOCk[:STATe]

This command locks or unlocks the instrument front panel controls. The query command returns “0” (OFF) or “1” (ON).

Group System

Syntax

```
SYSTem:KLOCk[:STATe] {ON|OFF|<NR1>}
SYSTem:KLOCk[:STATe]?
```

Arguments ON or <NR1>≠0 locks front panel controls.

OFF or <NR1>=0 unlocks front panel controls.

Returns <NR1>

Examples

```
SYSTEM:KLOCK[:STATE] ON
```

locks front panel controls.

SYSTem:PASSword:CDISable (No Query Form)

This command disables protected commands. The instrument security protection is activated.

In the AFG3000 Series Arbitrary Function Generators, no remote commands are under the control of SYSTem:PASSword commands.

Group System

Syntax `SYSTem:PASSword:CDISable <password>`

Related Commands SYSTem:PASSword[:CENable],

SYSTem:PASSword[:CENable]:STATe?,

SYSTem:PASSword:NEW

Arguments <password>::=<string> specifies current password. The string is case sensitive.

Examples `SYSTEM:PASSWORD:CDISABLE <password>`

activates the security protection.

SYSTem:PASSword[:CENable] (No Query Form)

This command enables protected commands to function. The instrument security protection is deactivated.

In the AFG3000 Series Arbitrary Function Generators, no remote commands are under the control of SYSTem:PASSword commands.

Group System

Syntax `SYSTem:PASSword[:CENable] <password>`

Related Commands SYSTem:PASSword:CDISable,

SYSTem:PASSword[:CENable]:STATe?,

SYSTem:PASSword:NEW

Arguments <password>::=<string> specifies current password. The string is case sensitive.

Examples

`SYSTEM:PASSWORD[:CENABLE] <password>`

deactivates the security protection.

SYSTem:PASSword[:CENable]:STATe? (Query Only)

This query-only command returns the security protection state.

Group System

Syntax `SYSTem:PASSword[:CENable]:STATe?`

Related Commands SYSTem:PASSword:CDISable, SYSTem:PASSword[:CENable], SYSTem:PASSword:NEW

Arguments None

Returns `<NR1>`

where:

<NR1>=0 indicates that the security protection is in the on state.

<NR1>≠0 indicates that the security protection is in the off state.

Examples `SYSTEM:PASSWORD[:CENABLE]:STATE?`

might return 0, indicating that the instrument security protection is on.

SYSTem:PASSword:NEW (No Query Form)

This command changes the password.

Group System

Syntax `SYSTem:PASSword:NEW <current_password>,<new_password>`

Related Commands SYSTem:PASSword:CDISable,

SYSTem:PASSword[:CENable],

SYSTem:PASSword[:CENable]:STATe?

Arguments <current_password>::=<string> specifies current password.
<new_password>::=<string> specifies a new password.

Password strings are case sensitive. A password must have at least four characters, and not more than 12 characters.

Examples `SYSTEM:PASSWORD:NEW "DEFAULT","abc123"`

changes the current password DEFAULT to abc123.

SYSTem:SECurity:IMMediate (No Query Form)

This command erases all the current instrument setups, setup memory, last setup memory, user waveform memory, and log content, and recalls the factory default settings. Calibration data is not erased.

The communication settings are initialized to the factory default settings. This might cause a remote communication error.

Group System

Syntax `SYSTem:SECurity:IMMediate`

Arguments None

Examples `SYSTEM:SECURITY:IMMEDIATE`

initializes the instrument.

SYSTem:ULANguage

This command sets or queries the language that the instrument uses to display information on the screen.

Group System

Syntax `SYSTem:ULANguage {ENGLish|FRENch|GERMan|JAPanese|KOREan|SCHinese|TCHinese|RUSSian}`

SYSTem:ULANguage?

Arguments ENGLish|FRENch|GERMan|JAPanese|KORean|SCHinese|TCHinese|RUSSian specifies which language will be used to display instrument information on the screen.

Returns ENGLish|FRENch|GERMan|JAPanese|KORean|SCHinese|TCHinese|RUSSian

Examples SYSTEM:ULANGUAGE FRENch

specifies that the instrument displays information in French.

SYSTem:VERSion? (Query Only)

This query-only command returns the conformed SCPI version of the instrument.

Group System

Syntax SYSTem:VERSion?

Arguments None

Returns <SCPI Version>::=YYYY.V

where:

YYYY – indicates year.

V – indicates the version number for that year.

Examples SYSTEM:VERSION?

might return 1999.0.

TRACe|DATA:CATalog? (Query Only)

This query-only command returns the names of user waveform memory and edit memory.

Group Trace

Syntax TRACe|DATA:CATalog?

Arguments None

Returns <string>

A series of strings separated by commas is returned. Each string is enclosed within quotation marks.

Examples TRACE|DATA:CATALOG?

might return “USER1”,”USER4”,”EMEM”

This example indicates that waveform data of USER2 and USER3 are deleted and not saved. Edit memory always has data.

TRACe|DATA:COPY (No Query Form)

This command copies the contents of edit memory (or user waveform memory) to a specified user waveform memory (or edit memory).

Group Trace

Syntax
```
TRACe|DATA:COPY <trace_name>,EMEMory
TRACe|DATA:COPY EMEMory,{USER[1]|USER2|USER3|USER4}
```

Arguments <trace_name>::={USER[1]|USER2|USER3|USER4}

This command is invalid when <trace_name> is being output.

Examples DATA:COPY USER1,EMEMory

copies the waveform data in the edit memory to the user waveform memory USER1.

DATA:COPY EMEMory,USER1

copies the waveform data in the user waveform memory USER1 to the edit memory.

TRACe|DATA[:DATA]

This command transfers the waveform data from the external controller to the edit memory in the arbitrary function generator. The query command returns the binary block data.

Group Trace

Syntax

```
TRACe|DATA[:DATA] EMEMory,<binary_block_data>
TRACe|DATA[:DATA]?
```

Arguments <binary_block_data> where <binary_block_data> is the waveform data in binary format.

Returns <binary_block_data>

Examples

```
DATA:DATA EMEMory,#42000<DAB><DAB>...<DAB>
```

transmits a waveform to the edit memory in the arbitrary function generator. The block data element #42000 indicates that 4 is the number of digits in 2000 (byte count) and the 2000 bytes of binary data are to be transmitted.

TRACe|DATA[:DATA]:LINE (No Query Form)

This command writes line data to the edit memory. The data between the specified points is interpolated linearly.

Group Trace

Syntax

```
TRACe|DATA[:DATA]:LINE EMEMory,<start_point>,<point_data1>,
<end_point>,<point_data2>
```

Arguments

<start_point>::=<NR1>

where:

<NR1> is the first point from which the data is interpolated linearly.

<point_data1>::=<NR1>

where:

<NR1> is the data value at the start point.

<end_point>::=<NR1>

where:

<NR1> is the last point from which the data is interpolated linearly.

<point_data2>::=<NR1>

where:

<NR1> is the data value at the end point.

Examples

DATA:DATA:LINE EMEMory,1,2047,250,4094

sets a data value of 2047 for start point 1 and a data value of 4094 for end point 250, and interpolates linearly between these two points in the edit memory.

TRACe|DATA[:DATA]:VALue

This command sets or queries the data value at the specified point in the edit memory.

Group

Trace

Syntax

TRACe|DATA[:DATA]:VALue EMEMory,<point>,<data>
TRACe|DATA[:DATA]:VALue?

Arguments

<point>::=<NR1>

where:

<NR1> is the specified point number in the edit memory.

<data>::=<NR1>

where:

<NR1> is the data value for the specified point number.

Returns

<NR1>

Examples

DATA:DATA:VALue EMEMory,500,2047

sets the data value to 2047 for the point number 500 in the edit memory.

DATA:DATA:VALue? EMEMory,500

might return “2047”.

This example indicates that the data value of point number 500 is set to 2047.

TRACe|DATA:DEFine (No Query Form)

This command resets the contents of edit memory.

Group Trace

Syntax `TRACe|DATA:DEFine EMEMory[,{<points>|<trace_name>}]`

Arguments `<points>::=<NR1>`

where

<NR1> is the number of points for the waveform data in the edit memory that ranges from 2 to 131072.

If the second parameter in the argument is a numerical value, the length of the edit memory will be the number of points specified by this number and each point will be initialized to the default value (8191).

`<trace_name>::={SINusoid|SQUare|PULSe|RAMP|NOISe}`

If the second parameter in the argument is specified by <trace_name>, the specified waveform data will be copied to the edit memory. The number of points for the specified waveform data is equal to the number of points for one period of current waveform data in the edit memory.

If the <points> and <trace_name> parameters in the argument are omitted, the edit memory will be initialized to the default number of points (1000) and value (8191).

Examples `DATA:DEFine EMEMory,1000`

sets the length of the edit memory to 1000 points and resets the data points to the default value.

TRACe|DATA:DELete[:NAME] (No Query Form)

This command deletes the contents of specified user waveform memory.

Group Trace

Syntax `TRACe|DATA:DELete[:NAME] <trace_name>`

Arguments `<trace_name>::={USER[1]|USER2|USER3|USER4}`

This command is invalid when <trace_name> is being output, or <trace_name> is locked.

Examples `DATA:DELete:NAME USER1`

deletes the contents of USER1 waveform memory.

TRACe|DATA:LOCK[:STATe]

This command sets or queries whether to lock or unlock the user waveform memory.

Group Trace

Syntax
```
TRACe|DATA:LOCK[:STATe]
{USER[1]|USER2|USER3|USER4},{ON|OFF|<NR1>}
TRACe|DATA:LOCK[:STATe]?  {USER[1]|USER2|USER3|USER4}
```

Arguments `ON` or `<NR1>≠0` locks the specified user waveform memory.

`OFF` or `<NR1>=0` unlocks the specified user waveform memory.

Returns `<NR1>`

Examples `DATA:LOCK:STATe USER1,ON`

locks the USER1 waveform memory.

TRACe|DATA:POINts

This command sets or queries the number of data points for the waveform created in the edit memory.

Group Trace

Syntax
```
TRACe|DATA:POINts EMEMory[,<points>|MINimum|MAXimum]
TRACe|DATA:POINts?  EMEMory{,MIN|MAX}
```

Arguments `<points>::=<NR1>`

where

<NR1> sets the number of points for the waveform created in the edit memory that ranges from 2 to 131072.

Returns `<NR1>`

Examples `DATA:POINts EMEMory, 500` sets the waveform data points to 500 in the edit memory.

*TRG (No Query Form)

This command generates a trigger event.

Group Trigger

Syntax `*TRG`

Related Commands TRIGger[:SEQuence][:IMMediate]

Arguments None

Examples `*TRG`

generates a trigger event.

TRIGger[:SEQuence]:SLOPe

This command sets or queries the slope of trigger signal.

Group Trigger

Syntax
```
TRIGger[:SEQuence]:SLOPe {POSitive|NEGative}
TRIGger[:SEQuence]:SLOPe?
```

Arguments `POSitive` indicates that the event occurs on the rising edge of the external trigger signal.

NEGative indicates that the event occurs on the falling edge of the external trigger signal.

Returns POS|NEG

Examples TRIGGER[:SEQUENCE]:SLOPE POSitive

sets the trigger slope to positive, which triggers on the rising edge of the signal.

TRIGger[:SEQuence]:SOURce

This command sets or queries the trigger source for an external trigger signal.

Group Trigger

Syntax
```
TRIGger[:SEQuence]:SOURce {TIMer|EXTernal}
TRIGger[:SEQuence]:SOURce?
```

Arguments TIMer specifies an internal clock as the trigger source.

EXTernal specifies an external trigger input as the trigger source.

Returns TIM|EXT

Examples TRIGger:SEQuence:SOURce EXTernal

sets an external trigger input as the trigger source.

TRIGger[:SEQuence]:TIMer

This command sets or queries the period of an internal clock when you select the internal clock as the trigger source with the TRIGger[:SEQuence]:SOURce command. The setting range is 1 μs to 500.0 s.

Group Trigger

Syntax
```
TRIGger[:SEQuence]:TIMer <seconds>
TRIGger[:SEQuence]:TIMer
```

Related Commands TRIGger[:SEQuence]:SOURce

Arguments `<seconds>::=<NRf>[<units>]`

where:

<units>::=[µs | ms | s]

Returns `<seconds>`

Examples `TRIGGER[:SEQUENCE]:TIMER 5ms`

sets the internal trigger rate to 5 ms.

TRIGger[:SEQuence][:IMMediate] (No Query Form)

This command forces a trigger event to occur.

Group Trigger

Syntax `TRIGger[:SEQuence][:IMMediate]`

Arguments None

Examples `TRIGger:SEQuence:IMMediate`

generates a trigger event.

*TST? (Query Only)

This command performs a self-test and returns the results.

NOTE. *The self-test can take several minutes to complete. During this time, the arbitrary function generator does not execute any commands. Do not power off the instrument during the self-test.*

Group Calibration and Diagnostic

Syntax `*TST?`

Related Commands DIAGnostic[:ALL]

Arguments None

Returns <NR1>

where:

<NR1>=0 indicates that the self-test completed without errors.

<NR1>≠0 indicates that the arbitrary function generator detected an error.

Examples *TST?

performs a self-test and returns 0 if no error is reported.

*WAI (No Query Form)

This command prevents the instrument from executing further commands or queries until all pending commands that generate an OPC message are complete.

Group Synchronization

Syntax *WAI

Related Commands *OPC

Arguments None

Examples *WAI

prevents the instrument from executing any further commands or queries until all pending commands that generate an OPC message are complete.

Status and Events

Status and Events

This section provides details about the status information and events the arbitrary function generator reports.

Status Reporting Structure

The arbitrary function generator status reporting functions conform to IEEE-488.2 and SCPI standards. Use the status reporting function to check for instrument errors and to identify the types of events that have occurred on the instrument.

shows an outline of the instrument error and event reporting function.

The error and event reporting system consists of the following three blocks:

- Standard/Event Status
- Operation Status
- Questionable Status

The operations processed in these blocks are summarized in status bytes, which provide the error and event data.

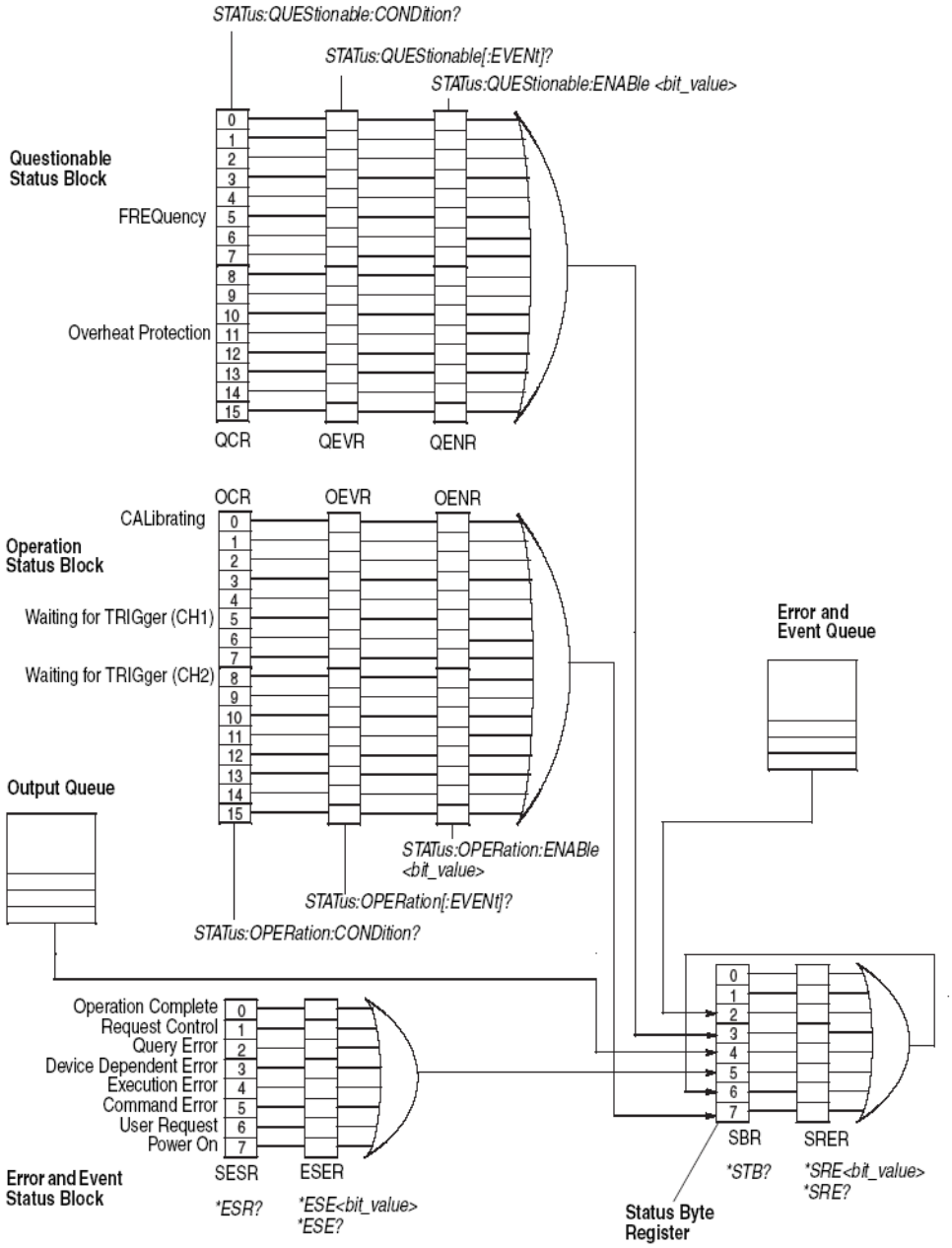


Figure 3-1: Error and event handling process

Standard/Event Status Block

This block is used to report power on/off, command error, and command execution status.

The block has two registers: the Standard Event Status Register (SESR) and the Event Status Enable Register (ESER). Refer to the Standard/Event Status Block shown at the bottom of .

Standard Event Status Register. The SESR is an eight-bit status register. When an error or other type of event occurs on the instrument, the corresponding bit is set. You cannot write to this register.

Event Status Enable Register. The ESER is an eight-bit enable register that masks the SESR. You can set this mask, and take AND with the SESR to determine whether or not the ESB bit in the Status Byte Register (SBR) should be set.

Operation Status Block

This block is used to report on the status of several operations being executed by the arbitrary function generator.

The block has three registers: the Operation Condition Register (OCR), the Operation Event Register (OEVR), and the Operation Enable Register (OENR). Refer to the Operation Status Block shown in .

Operation Condition Register. When the instrument achieves a certain status, the corresponding bit is set to the OCR. It is not allowed for the user to write to this register.

Operation Event Register. The OCR bits that have changed from false (reset) to true (set) status are set in the OEVR.

Operation Enable Register. The function of the OENR is to mask the OEVR. You can set this mask and take AND with the OEVR to determine whether or not the OSS bit in the Status Byte Register (SBR) should be set.

Questionable Status Block

This block reports on the status of signals and data, such as the accuracy of entered data and signals generated by the instrument. The register configuration and process flow are the same as the Questionable Status Block.

Registers

The registers in the event reporting system fall into two functional groups:

- The Status Registers contain information about the status of the instrument.
- Enable Registers determine whether selected types of events are reported to the Status Registers and the Event Queue.

Status Registers

There are six types of status registers:

- Status Byte Register (SBR), (See page 3-4, *Status Byte Register (SBR)*.)
- Standard Event Status Register (SESR), (See page 3-5, *Standard Event Status Register (SESR)*.)
- Operation Condition Register (OCR), (See page 3-8, *Operation Condition Register (OCR)*.)
- Operation Event Register (OEVR), (See page 3-8, *Operation Event Register (OEVR)*.)
- Questionable Condition Register (QCR),
- Questionable Event Register (QEVR),

Status Byte Register (SBR). The SBR is made up of 8 bits. Bits 4, 5 and 6 are defined in accordance with IEEE Std 488.2-1992 (see). These bits are used to monitor the output queue, SESR, and service requests, respectively.

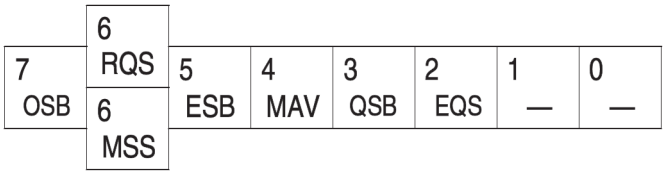


Figure 3-2: The Status Byte Register (SBR)

Table 3-1: SBR bit functions

Bit	Function	
7 (MSB)	OSB	Operation Status Bit. Indicates that an operation event has occurred.
6	RQS	Request Service. When the instrument is accessed using the GPIB serial poll command, this bit is called the Request Service (RQS) bit and indicates to the controller that a service request has occurred (in other words, that the GPIB bus SRQ line is LOW). The RQS bit is cleared when serial poll ends.

Table 3-1: SBR bit functions (cont.)

Bit	Function	
6	MSS	Master Status Summary. When the instrument is accessed using the *STB? query, this bit is called the Master Status Summary (MSS) bit and indicates that the instrument has issued a service request for one or more reasons. The MSS bit is never cleared to 0 by the *STB? query.
5	ESB	Event Status Bit. This bit indicates whether or not a new event has occurred after the previous Standard Event Status Register (SESR) has been cleared or after an event readout has been performed.
4	MAV	Message Available Bit. This bit indicates that a message has been placed in the output queue and can be retrieved.
3	QSB	Questionable Status Bit.
2	EQS	Error/Event Queue Summary.
1-0	—	Not used

Standard Event Status Register (SESR). The SESR records eight types of events that can occur within the instrument as shown in .

7	6	5	4	3	2	1	0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Figure 3-3: The Standard Event Status Register (SESR)

Table 3-2: SESR bit functions

Bit	Function	
7 (MSB)	PON	Power On. Indicates that the power to the instrument is on.
6	URQ	User Request. Indicates that an application event has occurred. The arbitrary function generator does not use this bit.
5	CME	Command Error. Indicates that an error occurred while the arbitrary function generator was parsing a command or query.

Table 3-2: SESR bit functions (cont.)

Bit	Function	
4	EXE	Execution Error. Indicates that an error occurred while the arbitrary function generator was executing a command or query. Execution errors occur for one of the following reasons: ■ A value designated in the argument is outside the allowable range of the instrument, or is in conflict with the capabilities of the instrument. ■ The command was not executed properly because the conditions for execution is differed from those required.
3	DDE	Device Error. An instrument error has been detected.

Table 3-2: SESR bit functions (cont.)

Bit	Function	
2	QYE	Query Error. Indicates that a query error has been detected by the output queue controller. Query errors occur for one of the following reasons: ■ An attempt was made to retrieve messages from the output queue when the output queue is empty or in pending status. ■ The output queue message was cleared while it was being retrieved from the output queue.
1	RQC	Request Control. The arbitrary function generator does not use this bit.
0	OPC	Operation Complete. Indicates that the operation is complete. This bit is set when all pending operations complete following the *OPC command.

Operation Event Register (OEVR). This register has the same content as the Operation Condition Register.

Operation Condition Register (OCR). The Operation Condition Register is made up of sixteen bits, which note the occurrence of events as shown in .

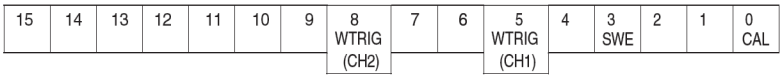


Figure 3-4: Operation Condition Register (OCR)

Table 3-3: OCR bit functions

Bit	Function	
15 to 9	—	Not used
8	WTRIG CH2	Waiting for Trigger. Indicates whether the instrument is waiting for a trigger. This bit is set when CH 2 (in the case of dual-channel model) is waiting for a trigger. Bit is reset when the waiting-for-trigger status is canceled.
5	WTRIG CH1	Waiting for Trigger. Indicates whether the instrument is waiting for a trigger. This bit is set when CH 1 (in the case of dual-channel model) is waiting for a trigger. Bit is reset when the waiting-for-trigger status is canceled.
4	—	Not used
3	SWE	Sweep. Indicates whether the instrument is executing a frequency sweep. This bit is set when a frequency sweep is being executed on CH 1 or another channel (in the case of dual-channel model). Bit is reset when the execution stops.
2 to 1	—	Not used
0	CAL	Calibration. Indicates whether the instrument is being calibrated. This bit is set when calibration is in progress and is reset when the calibration is complete.

Questionable Event Register (QEVR). This register has the same content as the Questionable Condition Register.

Questionable Condition Register (QCR). The Questionable Condition Register is made up of sixteen bits which note the occurrence of two types of events.

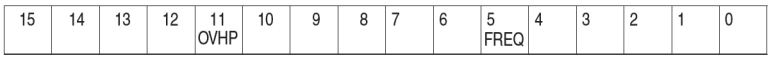


Figure 3-5: Questionable Condition Register (QCR)

Table 3-4: QCR bit functions

Bit	Function	
15 to 12	—	Not used
11	OVHP	Overheat protection. Indicates whether the instrument internal temperature is in questionable condition.
10 to 6	—	Not used
5	FREQ	Frequency. Indicates whether frequency accuracy of the signal is of questionable quality.
4 to 0	—	Not used

Enable Registers

There are four types of enable registers:

- Event Status Enable Register (ESER),
- Service Request Enable Register (SRER),
- Operation Enable Register (OENR),
- Questionable Enable Register (QENR),

Each bit in the enable registers corresponds to a bit in the controlling status register. By setting and resetting the bits in the enable register, you can determine whether or not events that occur will be registered to the status register and queue.

Event Status Enable Register (ESER). The ESER consists of bits defined exactly the same as bits 0 through 7 in the SESR register. You can use this register to control whether or not the Event Status Bit (ESB) in the SBR should be set when an event has occurred, and to determine if the corresponding SESR bit is set.

To set the ESB in the SBR (when the SESR bit has been set), set the ESER bit corresponding to that event. To prevent the ESB from being set, reset the ESER bit corresponding to that event.

Use the *ESC command to set the bits in the ESER. Use the *ESR? query to read the contents of the ESER. shows the ESER functions.

7	6	5	4	3	2	1	0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Figure 3-6: Event Status Enable Register (ESER)

Service Request Enable Register (SRER). The SRER consists of bits defined exactly the same as bits 0 through 7 in the SBR. You can use this register to define which events will generate service requests.

The SRER bit 6 cannot be set. Also, the RQS is not maskable.

The generation of a service request with the GPIB interface involves changing the SRQ line to LOW, and making a service request to the controller. The result is that a status byte for which an RQS has been set is returned in response to serial polling by the controller.

Use the *SRE command to set the bits of the SRER. Use the *SRE? query to read the contents of the SRER. Bit 6 must be set to 0. shows the SRER functions.

7	6 RQS / 6 MSS	5	4	3	2	1	0
OSB		ESB	MAV	QSB	EQS	—	—

Figure 3-7: Service Request Enable Register (SRER)

Operation Enable Register (OENR). The OENR consists of bits defined exactly the same as bits 0 through 15 in the OEVR (see). You can use this register to control whether or not the Operation Status Bit (OSB) in the SBR is set when an event occurs and the corresponding OEVR bit is set.

Use the STATus:OPERation:ENABle command to set the bits in the OENR. Use the STATus:OPERation:ENABle? query to read the contents of the OENR.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
							WTRIG (CH2)			WTRIG (CH1)		SWE			CAL

Figure 3-8: Operation Enable Register (OENR)

Questionable Enable Register (QENR). The QENR consists of bits defined exactly the same as bits 0 through 15 in the QEVR register (see). You can use this register to control whether the QSB in the SBR is set when an event occurs and the corresponding QEVR bit is set.

Use the STATus:QUEStionable:ENABle command to set the bits in the QENR. Use the STATus:QUEStionable:ENABle? query to read the contents of the QENR.

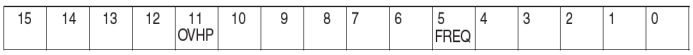


Figure 3-9: Questionable Enable Register (QENR)

Queues

There are two types of queues in the status reporting system: output queue and error/event queues.

Output Queue

The output queue is an FIFO (first-in, first-out) queue that holds response messages to queries awaiting retrieval. When there are messages in the queue, the MAV bit in the SBR is set.

The output queue is emptied each time a command or query is received, so the controller must read the output queue before the next command or query is issued. If this is not done, an error occurs and the output queue is emptied; however, the operation proceeds even if an error occurs.

Error/Event Queue

The event queue is an FIFO queue, which stores events as they occur in the instrument. If more than 64 events are stored, the 64th event is replaced with event code -350 (“Queue Overflow”).

The oldest error code and text are retrieved by using one of the following queries:

SYSTem:ERRor[:NEXT]?

First, issue the *ESR? query to read the contents of the SESR. The contents of the SESR are cleared after they are read. If an SESR bit is set, events are stacked in the Error/Event Queue. Retrieve the event code with the following command sequence:

*ESR?

SYSTem:ERRor[:NEXT]?

If you omit the *ESR? query, the SESR bit will remain set, even if the event disappears from the Error/Event Queue.

Messages and Codes

Error and event codes with negative values are SCPI standard codes. Error and event codes with positive values are unique to the AFG3000 Series Arbitrary Function Generator.

The following table lists event code definitions (See Table 3-5.). When an error occurs, you can find its error class by checking for the code in the following tables. Events in these tables are organized by event class.

Table 3-5: Definition of event codes

Event class	Code range	Description
No error	0	No event or status
Command errors	-100 to -199	Command syntax errors
Execution errors	-200 to -299	Command execution errors
Device-specific errors	-300 to -399	Internal device errors
Query errors	-400 to -499	System event and query errors
Power-on events	-500 to -599	Power-on events
User request events	-600 to -699	User request events
Request control events	-700 to -799	Request control events
Operation complete events	-800 to -899	Operation complete events
Extended device-specific errors	1 to 32767	Device dependent device errors
Reserved	other than above	not used

Command Errors

shows the error messages generated by improper command syntax. Check that the command is properly formed and that it follows the rules in the Syntax and Commands.

Table 3-6: Command error messages

Error code	Error message
-100	Command error
-101	Invalid character
-102	Syntax error
-103	Invalid separator
-104	Data type error
-105	GET not allowed
-108	Parameter not allowed
-109	Missing parameter
-110	Command header error
-111	Header separator error
-112	Program mnemonic too long
-113	Undefined header
-114	Header suffix out of range
-115	Unexpected number of parameters
-120	Numeric data error
-121	Invalid character in number
-123	Exponent too large

Table 3-6: Command error messages (cont.)

Error code	Error message
-124	Too many digits
-128	Numeric data not allowed
-130	Suffix error
-131	Invalid suffix
-134	Suffix too long
-138	Suffix not allowed
-140	Character data error
-141	Invalid character data
-144	Character data too long
-148	Character data not allowed
-150	String data error
-151	Invalid string data
-158	String data not allowed
-160	Block data error
-161	Invalid block data
-168	Block data not allowed
-170	Expression error
-171	Invalid expression
-178	Expression data not allowed
-180	Macro error
-181	Invalid outside macro definition
-183	Invalid inside macro definition
-184	Macro parameter error

Execution Errors

lists the errors that are detected during execution of a command.

Table 3-7: Execution error messages

Error code	Error message
-200	Execution error
-201	Invalid while in local
-202	Settings lost due to RTL
-203	Command protected
-210	Trigger error
-211	Trigger ignored
-212	Arm ignored
-213	Init ignored

Table 3-7: Execution error messages (cont.)

Error code	Error message
-214	Trigger deadlock
-215	Arm deadlock
-220	Parameter error
-221	Settings conflict
-222	Data out of range
-223	Too much data
-224	Illegal parameter value
-225	Out of memory
-226	Lists not same length
-230	Data corrupt or stale
-231	Data questionable
-232	Invalid format
-233	Invalid version
-240	Hardware error
-241	Hardware missing
-250	Mass storage error
-251	Missing mass storage
-252	Missing media
-253	Corrupt media
-254	Media full
-255	Directory full
-256	File name not found
-257	File name error
-258	Media protected
-260	Expression error
-261	Math error in expression
-270	Macro error
-271	Macro syntax error
-272	Macro execution error
-273	Illegal macro label
-274	Macro parameter error
-275	Macro definition too long
-276	Macro recursion error
-277	Macro redefinition not allowed
-278	Macro header not found
-280	Program error
-281	Cannot create program

Table 3-7: Execution error messages (cont.)

Error code	Error message
-282	Illegal program name
-283	Illegal variable name
-284	Program currently running
-285	Program syntax error
-286	Program runtime error
-290	Memory use error
-291	Out of memory
-292	Referenced name does not exist
-293	Referenced name already exists
-294	Incompatible type

Device Specific Errors

lists the device-specific errors that can occur during arbitrary function generator operation. These errors may indicate that the instrument needs repair.

Table 3-8: Device-specific error messages

Error code	Message
-300	Device specific error
-310	System error
-311	Memory error
-312	PUD memory lost
-313	Calibration memory lost
-314	Save/recall memory lost
-315	Configuration memory lost
-320	Storage fault
-321	Out of memory
-330	Self-test failed
-340	Calibration failed
-350	Queue overflow
-360	Communication error
-361	Parity error in program message
-362	Framing error in program message
-363	Input buffer overrun
-365	Time out error

Query Errors

lists the error codes that are returned in response to an unanswered query.

Table 3-9: Query errors

Error codes	Message
-400	query error
-410	query INTERRUPTED
-420	query UNTERMINATED
-430	query DEADLOCKED
-440	query UNTERMINATED after indefinite response

Power-on Events

These events occur when the instrument detects an off to on transition in its power supply.

Table 3-10: Power-on events

Event code	Event message
-500	Power on

User Request Events

These events are not used in this instrument.

Table 3-11: User request events

Event code	Event message
-600	User request

Request Control Events

These events are not used in this instrument.

Table 3-12: Request control events

Event code	Event message
-700	Request control

Operation Complete Events

These events occur when instrument's synchronization protocol, having been enabled by an *OPC command, completes all selected pending operations.

Table 3-13: Operation complete events

Event code	Event message
-800	Operation complete

Device Errors

The following table lists the error codes that are unique to the AFG3000 Series Arbitrary Function Generator.

Table 3-14: Device errors

Error code	Error message
1101	Calibration failed; CH1 Internal offset
1102	Calibration failed; CH2 Internal offset
1103	Calibration failed; CH1 Output offset
1104	Calibration failed; CH2 Output offset
1105	Calibration failed; CH1 Output gain
1106	Calibration failed; CH2 Output gain
1201	Calibration failed; CH1 x 3 dB attenuator
1202	Calibration failed; CH2 x 3 dB attenuator
1203	Calibration failed; CH1 x 6 dB attenuator
1204	Calibration failed; CH2 x 6 dB attenuator
1205	Calibration failed; CH1 x 10 dB attenuator
1206	Calibration failed; CH2 x 10 dB attenuator
1207	Calibration failed; CH1 x 20 dB 1 attenuator
1208	Calibration failed; CH2 x 20 dB 1 attenuator
1209	Calibration failed; CH1 x 20 dB 2 attenuator
1210	Calibration failed; CH2 x 20 dB 2 attenuator
1211	Calibration failed; CH1 Filter
1212	Calibration failed; CH2 Filter
1213	Calibration failed; CH1 x 20 dB 3 attenuator
1301	Calibration failed; CH1 Sine Flatness
1302	Calibration failed; CH2 Sine Flatness
1401	Calibration failed; CH1 ASIC TINT
1402	Calibration failed; CH2 ASIC TINT
1403	Calibration failed; CH1 ASIC SGEN
1404	Calibration failed; CH2 ASIC SGEN
1405	Calibration failed; CH1 ASIC clock duty
1406	Calibration failed; CH2 ASIC clock duty
2100	Self-test failed; Calibration data not found
2101	Self-test failed; Calibration data checksum
2102	Self-test failed; Calibration data invalid
2201	Self-test failed; ASIC 1 memory
2202	Self-test failed; ASIC 2 memory
2203	Self-test failed; ASIC 1 overheat
2204	Self-test failed; ASIC 2 overheat

Table 3-14: Device errors (cont.)

Error code	Error message
2301	Self-test failed; CH1 Internal offset
2302	Self-test failed; CH2 Internal offset
2303	Self-test failed; CH1 Output offset
2304	Self-test failed; CH2 Output offset
2305	Self-test failed; CH1 Output gain
2306	Self-test failed; CH2 Output gain
2401	Self-test failed; CH1 x 3 dB attenuator
2402	Self-test failed; CH2 x 3 dB attenuator
2403	Self-test failed; CH1 x 6 dB attenuator
2404	Self-test failed; CH2 x 6 dB attenuator
2405	Self-test failed; CH1 x 10 dB attenuator
2406	Self-test failed; CH2 x 10 dB attenuator
2407	Self-test failed; CH1 x 20 dB 1 attenuator
2408	Self-test failed; CH2 x 20 dB 1 attenuator
2409	Self-test failed; CH1 x 20 dB 2 attenuator
2410	Self-test failed; CH2 x 20 dB 2 attenuator
2411	Self-test failed; CH1 Filter
2412	Self-test failed; CH2 Filter
2413	Self-test failed; CH1 x 20 dB 3 attenuator
2501	Self-test failed; CH1 Sine Flatness
2502	Self-test failed; CH2 Sine Flatness
9112	Waveform error; invalid waveform length
9113	Waveform error; waveform length is too short

Programming Examples

Programming Examples

The following two example programs demonstrate methods that you can use to control the arbitrary function generator through the General Purpose Interface Bus (GPIB).

- Example 1: Set up a Waveform Output
- Example 2: Waveform Transfer and Copy

The example programs are written in Microsoft Visual Basic Version 6.0. The programs run on Windows PC compatible systems equipped with TekVISA and a National Instruments GPIB board with the associated drivers.

TekVISA is the Tektronix implementation of the VISA Application Programming Interface (API). TekVISA is industry-compliant software for writing interoperable instrument drivers in a variety of Application Development Environments (ADEs).

The example programs assume that the GPIB system recognizes the PC (external controller) as GPIB0, and the address number of the instrument as 11.

If you use an interface other than GPIB, change the resource name of source code. Refer to TekVISA manual for details about resource.

Example 1

This is a sample program for setting the arbitrary function generator outputs.

```
Private Sub Sample1_Click()
'
'Assign resource
'
Tvc1.Descriptor = "GPIB0::11::INSTR"
'
'Initialize of device setting
'
Tvc1.WriteString ("*RST")
'
'Set CH1 output parameters
'
Tvc1.WriteString ("FUNCTION SIN") 'Set output waveform SIN
Tvc1.WriteString ("FREQUENCY 10E3") 'Set frequency 10kHz
Tvc1.WriteString ("VOLTAGE:AMPLITUDE 2.00") 'Set amplitude
2Vpp
```

```
Tvc1.WriteString ("VOLTAGE:OFFSET 1.00") 'Set offset 1V
Tvc1.WriteString ("PHASE:ADJUST 0DEG") 'Set phase 0degree
'
'Set CH2 output parameters
'
Tvc1.WriteString ("SOURCE2:FUNCTION SIN") 'Set output
waveform SIN
Tvc1.WriteString ("SOURCE2:FREQUENCY 10E3") 'Set frequency
10kHz \
Tvc1.WriteString ("SOURCE2:VOLTAGE:AMPLITUDE 1.00") 'Set
amplitude 1Vpp
Tvc1.WriteString ("SOURCE2:VOLTAGE:OFFSET 0.00") 'Set offset
0V
Tvc1.WriteString ("SOURCE2:PHASE:ADJUST 90DEG") 'Set phase
90degrees
'
'Save settings and output on
'
Tvc1.WriteString ("*SAV 1") 'Save settings to Setup1
Tvc1.WriteString ("*RCL 1") 'Recall settings from Setup1
'
End Sub
```

Example 2 This is a sample program for sending an arbitrary waveform to the arbitrary function generator's Edit Memory and copying the contents of Edit Memory to the user waveform memory.

```
Private Sub Sample2_Click()
'
'Assign resource
'
Tvc1.Descriptor = "GPIB0::11::INSTR"'
'Initialize of device setting
'
```

```
Tvc1.WriteString ("*RST")'

'Make arbitrary block data (2000 Points)

'

Dim wave(4000) As Byte

For i = 0 To 499 'Leading edge (500 Points)

   Data = i * Int(16382 / 500) 'Data range is from 0 to
   16382

   High = Int(Data / 256) 'AFG's Data Format is big endian

   Low = Data - (High * 256)

   wave(2 * i) = High wave(2 * i + 1) = Low

Next i

For i = 500 To 799 'Part of High Level (800 Points) Data =
16382 High = Int(Data / 256) Low = Data - (High * 256)

   wave(2 * i) = High

   wave(2 * i + 1) = Low

Next i


For i = 800 To 999 'Trailing Edge (200 Points)

   Data = (1000 - i) * Int(16382 / 200)

   High = Int(Data / 256)

   Low = Data - (High * 256)


   wave(2 * i) = High

   wave(2 * i + 1) = Low


Next i


For i = 1000 To 1999 'Part of Low Level (1000 Points)

   Data = 0

   High = Int(Data / 256)

   Low = Data - (High * 256)
```

```
    wave(2 * i) = High
    wave(2 * i + 1) = Low

Next i

'
'Transfer waveform
' Transfer arbitrary block data to edit memory
'
Tvc1.SendEndEnabled = False
Tvc1.WriteString ("TRACE:DATA EMEMORY,#44000")
Tvc1.SendEndEnabled = True
Tvc1.WriteByteArray (wave)
'
'Copy contents of edit memory to USER1
'
Tvc1.WriteString ("TRAC:COPY USER1,EMEM")
'
'Set CH1 output parameters
'
Tvc1.WriteString ("FUNCTION USER1") 'Set output waveform
USER1
Tvc1.WriteString ("FREQUENCY 8K") 'Set frequency 8kHz
Tvc1.WriteString ("OUTPUT ON") 'Set CH1 output on

End Sub
```

Appendices

Appendix A: SCPI Conformance Information

All commands in the arbitrary function generator are based on SCPI Version 1999.0. lists the SCPI commands the arbitrary function generator supports.

Table A-1: SCPI conformance information

Command				Defined in SCPI 1999.0	Not defined in SCPI 1999.0
ABORt				√	
CALibration	[ALL](?)			√	
DIAGnostic	[ALL](?)				√
DISPlay	CONTrast(?)			√	
	SAVer	[STATe](?)			√
	SAVer	IMMediate		√	
	[WINDow]	TEXT	[DATA](?)	√	
			CLEar	√	
AFGControl	CSCopy				√
HCOPy	SDUMp	[:IMMediate]		√	
MEMory	STATe	VALid?			√
		DELete			√
		LOCK(?)			√
		RECall	AUTo(?)		√
MMEMory	CATalog?			√	
	CDIRectory(?)			√	
	DELete			√	
	LOAD	STATe		√	
		TRACe		√	
	LOCK	[STATe](?)			√
	MDIRectory				√
	STORe	STATe		√	
		TRACe		√	
OUTPut[1|2]	IMPedance(?)			√	
	POLarity(?)			√	
	[STATe](?)			√	
	TRIGger	MODE(?)			√

Table A-1: SCPI conformance information (cont.)

Command					Defined in SCPI 1999.0	Not defined in SCPI 1999.0
[SOURce]	ROSCillator	SOURce(?)			√	
[SOURce[1|2]]	VOLTage	CONCurrent	[STATe](?)			√
	AM	STATe(?)			√	
		INTernal	FREQuency(?)		√	
			FUNCtion(?)			√
				EFILe(?)		√
		SOURce(?)			√	
		[DEPTh](?)			√	
	BURSt	MODE(?)				√
		NCYCles(?)				√
		TDELay(?)				√
		[STATe](?)				√
	COMBine	FEED(?)			√	
	FM	INTernal	FREQuency(?)		√	
			FUNCtion(?)			√
				EFILe(?)		√
		SOURce(?)			√	
		STATe(?)			√	
		[DEViation](?)			√	
	FREQuency	CENTer(?)			√	
		CONCurrent	[STATe](?)			√
		MODE(?)			√	
		SPAN(?)			√	
		STARt(?)			√	
		STOP(?)			√	
		[CW|FIXed](?)			√	
	FSKey	INTernal	RATE(?)			√
		SOURce(?)				√
		STATe(?)				√
		[FREQuency](?)				√
	FUNCtion	EFILe(?)				√

Table A-1: SCPI conformance information (cont.)

Command				Defined in SCPI 1999.0	Not defined in SCPI 1999.0
		RAMP	SYMMetry(?)		√
		[SHAPe](?)		√	
	PHASe	INITiate			√
		[ADJust](?)		√	
	PM	INTernal	FREQuency(?)	√	
			FUNCtion(?)		√
			EFILe(?)		√
		SOURce(?)		√	
		STATe(?)		√	
		[DEViation](?)		√	
	PULSe	DCYCle(?)		√	
		DELay(?)		√	
		HOLD(?)		√	
		PERiod(?)		√	
		TRANsition	TRAiling(?)	√	
			[LEADing](?)	√	
		WIDTh(?)		√	
	PWM	INTernal	FREQuency(?)		√
			FUNCtion(?)		√
			EFILe(?)		√
		SOURce(?)			√
		STATe(?)			√
		[DEViation]	DCYCle(?)		√
	SWEep	HTIMe(?)			√
		MODE(?)		√	
		RTIMe(?)			√
		SPACing(?)		√	
		TIME(?)		√	
	VOLTage	LIMit	HIGH(?)	√	
			LOW(?)	√	
		UNIT(?)			√

Table A-1: SCPI conformance information (cont.)

Command					Defined in SCPI 1999.0	Not defined in SCPI 1999.0
		[LEVel]	[IMMediate]	HIGH(?)	√	
				LOW(?)	√	
				OFFSet(?)	√	
				[AMPLitude](?)	√	
SOURce<3|4>	POWer	[LEVel]	[IMMediate]	[AMPLitude](?)	√	
STATus	OPERation	[EVENt]?			√	
		CONDition?			√	
		ENABle(?)			√	
	PRESet				√	
	QUEStionable	[EVENt]?			√	
		CONDition?			√	
		ENABle(?)			√	
SYSTem	BEEPer	STATe(?)			√	
		[IMMediate]				√
	ERRor	[NEXT]?			√	
	KCLick	[STATe](?)				√
	KLOCk	[STATe](?)			√	
	PASSword	CDISable			√	
		[CENable]			√	
			STATe?		√	
		NEW			√	
	SECurity	IMMediate			√	
	ULANguage(?)					√
	VERSion?				√	
TRACe|DATA	CATalog?				√	
	COPY				√	
	[DATA](?)				√	
		LINE			√	
		VALue(?)			√	
	DEFine				√	
	DELete	[NAME]			√	

Table A-1: SCPI conformance information (cont.)

Command			Defined in SCPI 1999.0	Not defined in SCPI 1999.0
	LOCK	[STATe](?)		√
	POINts(?)		√	
TRIGger	[SEQuence]	SLOPe(?)	√	
		SOURce(?)	√	
		TIMer(?)	√	
		[IMMediate]	√	
*CAL?				√
*CLS			√	
*ESE(?)			√	
*ESR?			√	
*IDN?			√	
*OPC(?)			√	
*OPT?				√
*PSC(?)				√
*RCL				√
*RST			√	
*SAV				√
*SRE(?)			√	
*STB?			√	
*TRG				√
*TST?			√	
*WAI			√	

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