Agilent U8903A Audio Analyzer

Programmer's Reference

Agilent Technologies

Notices

Manual Part Number

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Table of Contents

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Remote Interface Reference

This chapter describes how to configure and program the U8903A over a remote interface.

Remote Interface Configuration

This section describes how to configure the GPIB (IEEE-488), LAN, and USB remote interfaces.

NOTE

- For more information on configuring the remote interface connectivity, refer to the *Agilent Technologies USB/LAN/GPIB Interfaces Connectivity Guide*.
- If you have installed the IO Libraries Suite, you can access the Connectivity Guide via the Agilent IO Libraries Control icon. Alternatively, you can access the Connectivity Guide via the Web at www.agilent.com/find/connectivity.

You can choose to control the U8903A remotely using the GPIB, LAN, or USB interfaces.

GPIB address

Each device on the GPIB interface must have a unique address. You can set the U8903A address to any value between 0 and 30. The U8903A is shipped with a default address of 28. The GPIB address is stored in nonvolatile memory, and does not change when the U8903A is switched off, or after a remote interface reset.

The GPIB bus controller has its own address. Avoid using the bus controller address for any instrument on the interface bus. Agilent controllers generally use the address of 21.

Use the following command to set the GPIB address from the remote interface.

```
SYSTem:COMMunicate:GPIB:ADDRess
```

Use the following command to query the GPIB address from the remote interface.

```
SYSTem:COMMunicate:GPIB:ADDRess?
```

LAN configuration

The U8903A supports three LAN operating modes as follows.

- Dynamic IP (Dynamic Host Configuration Protocol or DHCP)
- Auto IP (local PC control or isolated LAN)
- Static IP (manual configuration)

Configuring the LAN remotely

The IP address, subnet mask, and default gateway can be changed manually or remotely. To remotely specify the LAN settings, use the following commands.

- IP Address: `SYSTem:COMMunicate:LAN:ADDRess`
- Subnet Mask: `SYSTem:COMMunicate:LAN:SMASk`
- Default Gateway: `SYSTem:COMMunicate:LAN:DGATeway`

The values for the IP address, subnet mask, and default gateway can range between `0.0.0.0` and `255.255.255.255`.

NOTE If you set an invalid IP address or an IP address that is used by another device or host, an error message is generated. This error can be read by using the `SYSTem:ERRor?` command.

The LAN settings are stored in nonvolatile memory.

USB interface

The USB interface does not require front panel or remote configuration.

The USB address cannot be changed as it is set at the factory and is unique for each U8903A.

NOTE

- Before connecting the USB cable, make sure that the Agilent IO Libraries software is installed on your PC.
- For more information on the Agilent IO Libraries software, refer to the *Agilent Technologies USB/LAN/GPIB Interfaces Connectivity Guide*. If you have installed other I/O software, refer to the documentation that accompanies the software.

Introduction to the SCPI Language

SCPI, also known as the Standard Commands for Programmable Instruments, is an ASCII-based instrument command language designed for test and measurement instruments. SCPI commands are based on a hierarchical structure, also known as a tree system. In this system, associated commands are grouped together under a common node or root, thus forming subsystems. A portion of the Source subsystem is shown below to illustrate the tree system.

```
[SOURce:]
    SWEep:
        MODE <mode>, (@<channel>)
```

`SOURce` is the root keyword of the command, `SWEep` is the second-level keyword, and `MODE` is the third-level keyword. A colon (:) separates a command keyword from a lower-level keyword.

SCPI Conventions and Data Formats

The following SCPI conventions are used throughout this chapter.

Angle brackets < >	Items within angle brackets are parameter abbreviations. The brackets are not sent with the command string.
Vertical bar |	Vertical bars separate alternative parameters.
Square brackets [ ]	Items within square brackets are optional. The representation of `[SOURce:]FUNCtion` means that `SOURce:` may be omitted. The brackets are not sent with the command string.
Parenthesis ( )	Items within parentheses are used to specify a channel list.
Braces { }	Braces enclose the parameter choices for a given command string. The braces are not sent with the command string.

The SCPI language defines several different data formats to be used in program messages and response messages.

Numeric	Commands that require parameters to accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation. You can also send engineering unit suffixes with numeric parameters such as MHz or kHz.
Discrete	Parameters used to program settings that have a limited number of values such as BUS, IMMediate, and EXTernal. They have a short form and a long form just like command keywords. You can mix upper- and lower-case letters. Query responses will always return the short form in all upper-case letters.
Boolean	Parameters that represent a single binary condition that is either true or false. For a false condition, the U8903A will accept OFF or 0. For a true condition, the U8903A will accept ON or 1. When you query a boolean setting, the U8903A will always return 0 or 1.
String	Parameters that contain virtually any set of ASCII characters. A string must begin and end with matching quotes, either with a single quote or a double quote. You can include the quote delimiter as part of the string by typing it twice without any characters in between.
Block	Parameter that allows binary data (including extended ASCII codes) to be transmitted as a sequence of bytes. This is more efficient than the text format when transferring large amounts of data. Either definite length or indefinite length arbitrary data may be transmitted or returned.

SCPI Command Categorization

IEEE-488.2 Common Commands

Command	Analog interface	Digital interface
*CLS	✓	✓
*RST	✓	✓
*ESE	✓	✓
*ESR?	✓	✓
*IDN?	✓	✓
*OPC	✓	✓
*OPT?	✓	✓
*SRE	✓	✓
*STB?	✓	✓
*TST?	✓	✓
*WAI	✓	✓
*TRG	✓	✓

System Subsystem

Command	Analog interface	Digital interface
SYSTem:ERRor[:NEXT]?	✓	✓
SYSTem:DATE	✓	✓
SYSTem:TIME	✓	✓
SYSTem:VERSion?	✓	✓

Command	Analog interface	Digital interface
SYSTem:COMMunicate:GPIB[:SELF]:ADDRess	✓	✓
SYSTem:COMMunicate:LAN:ADDRess	✓	✓
SYSTem:COMMunicate:LAN:DGATeway	✓	✓
SYSTem:COMMunicate:LAN:HNAMe?	✓	✓
SYSTem:COMMunicate:LAN:SMASk	✓	✓
SYSTem:COMMunicate:LAN:MAC?	✓	✓
SYSTem:COMMunicate:LAN:DHCP:ENABled	✓	✓
SYSTem:CHANnel?	✓	
SYSTem:PRESet	✓	✓
SYSTem:RESet[:MODE]	✓	✓
SYSTem:RESet:CHANnel	✓	✓
SYSTem:LEGacy:MODE	✓	✓
SYSTem:LEGacy:CHANnel	✓	✓
SYSTem:DISPlay:IMAGe?	✓	✓
SYSTem:REMote	✓	✓
SYSTem:RWLock	✓	✓
SYSTem:LOCal	✓	✓
SYSTem:DIGital:CTYPe?		✓
SYSTem:UPDate:FIRMware?	✓	✓
SYSTem:UPDate:HELP?	✓	✓

Output Subsystem

Command	Analog interface	Digital interface
OUTPut:TYPE	✓	
OUTPut:IMPedance	✓	
OUTPut:STATe	✓	
OUTPut:DIGital:TYPE		✓
OUTPut:DIGital:SRATe		✓
OUTPut:DIGital:STATe		✓
OUTPut:DIGital:AUDio[:ENCoding]:FORMat		✓
OUTPut:DIGital:AES:STATe		✓
OUTPut:DIGital:AES:VOLTage		✓
OUTPut:DIGital:AES:AUDio:RESolution		✓
OUTPut:DIGital:AES:AUDio:VALidity		✓
OUTPut:DIGital:AES[:PROTocol]:MODE		✓
OUTPut:DIGital:AES[:PROTocol]:CSTatus:DATA		✓
OUTPut:DIGital:AES[:PROTocol]:CSTatus:BYTE		✓
OUTPut:DIGital:AES[:PROTocol]:CSTatus:FIELd		✓
OUTPut:DIGital:AES[:PROTocol]:USTatus:DATA		✓
OUTPut:DIGital:AES[:PROTocol]:USTatus:BYTE		✓
OUTPut:DIGital:DSI:VOLTage		✓
OUTPut:DIGital:DSI:AUDio:RESolution		✓
OUTPut:DIGital:DSI:AUDio:WLENgth		✓
OUTPut:DIGital:DSI:DATA:FORMat		✓
OUTPut:DIGital:DSI:MCLK:STATe		✓
OUTPut:DIGital:DSI:MCLK:MULTiplier		✓
OUTPut:DIGital:DSI:MCLK:RATE?		✓

Command	Analog interface	Digital interface
OUTPut:DIGital:DSI:BCLK:SYNC:OUT		✓
OUTPut:DIGital:OPTical:STATe		✓
OUTPut:DIGital:RCLK:SOURce		✓
OUTPut:DIGital:RCLK:EXTernal[:TYPE]		✓
OUTPut:DIGital:RCLK:EXTernal:MCLK:WLENgth		✓
OUTPut:DIGital:RCLK:EXTernal:MCLK:MULTiplier		✓
OUTPut:DIGital:SCLK:OUT:STATe		✓
OUTPut:DIGital:SCLK:OUT:SOURce		✓
OUTPut:DIGital:SCLK:OUT:DIVider		✓

Input Subsystem

Command	Analog interface	Digital interface
INPut:TYPE	✓	
INPut:COUPling	✓	
INPut:BANDwidth	✓	
INPut:DIGital:TYPE		✓
INPut:DIGital:SRATe?		✓
INPut:DIGital:IMPedance:BALanced		✓
INPut:DIGital:IMPedance:UNBalanced		✓
INPut:DIGital:AES:AUDio[:DECoding]:FORMat		✓
INPut:DIGital:AES:AUDio:RESolution		✓
INPut:DIGital:DSI:VOLTage		✓
INPut:DIGital:DSI:AUDio[:DECoding]:FORMat		✓
INPut:DIGital:DSI:AUDio:RESolution		✓

Command	Analog interface	Digital interface
INPut:DIGital:DSI:AUDio:WLENgth		✓
INPut:DIGital:DSI:MCLK:SOURce		✓
INPut:DIGital:DSI:WBCLk:DIRection		✓
INPut:DIGital:DSI:MCLK:MULTiplier		✓
INPut:DIGital:DSI:BCLK:SYNC		✓
INPut:DIGital:DSI:DATA:FORMat		✓
INPut:DIGital:DSI:DATA:MSB:PADDing		✓
INPut:DIGital:FREQuency:SCALing		✓
INPut:DIGital:REFerence:SRATe		✓

Source Subsystem

Command	Analog interface	Digital interface
SOURce:FUNCtion	✓	
SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet	✓	
SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]	✓	
SOURce:FREQuency[<j>][:CW]	✓	
SOURce:FREQuency:CENTer	✓	
SOURce:FREQuency:DIFFerence	✓	
SOURce:FREQuency:UPPer	✓	
SOURce:FREQuency:LOWer	✓	
SOURce:VOLTage:RATio	✓	
SOURce:PHASe[:ADJust]	✓	
SOURce:REFerence:IMPedance	✓	
SOURce:MULTitone:FREQuency:STARt	✓	

Command	Analog interface	Digital interface
SOURce:MULTitone:FREQuency:STOP	✓	
SOURce:MULTitone:FREQuency:SPACing	✓	
SOURce:MULTitone:COUNt	✓	
SOURce:MULTitone:WLEN	✓	
SOURce:MULTitone:RLEN	✓	
SOURce:MULTitone:CRESt?	✓	
SOURce:MULTitone:TONE:CLEar	✓	
SOURce:MULTitone:TONE:ADD	✓	
SOURce:MULTitone:TONE:DELete	✓	
SOURce:MULTitone:TONE:FREQuency	✓	
SOURce:MULTitone:TONE:VOLTage	✓	
SOURce:MULTitone:TONE:PHASe	✓	
SOURce:MULTitone:TONE:PHASe:RANDomize	✓	
SOURce:DIGital:FUNCtion		✓
SOURce:DIGital:DITHer:TYPE		✓
SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]		✓
SOURce:DIGital:VOLTage[:LEVel][:IMMediate]:OFFSet		✓
SOURce:DIGital:VOLTage:RATio		✓
SOURce:DIGital:FREQuency[<j>]		✓
SOURce:DIGital:FREQuency:CENTer		✓
SOURce:DIGital:FREQuency:DIFFerence		✓
SOURce:DIGital:FREQuency:UPPer		✓
SOURce:DIGital:FREQuency:LOWer		✓
SOURce:DIGital:SBURst:ONTime		✓
SOURce:DIGital:SBURst:PERiod		✓
SOURce:DIGital:SBURst:LOWLevel		✓

Command	Analog interface	Digital interface
SOURce:DIGital:SAMPle		✓
SOURce:DIGital:PHASe[:ADJust]		✓
SOURce:DIGital:MULTitone:FREQuency:STARt		✓
SOURce:DIGital:MULTitone:FREQuency:STOP		✓
SOURce:DIGital:MULTitone:FREQuency:SPACing		✓
SOURce:DIGital:MULTitone:COUNt		✓
SOURce:DIGital:MULTitone:CRESt?		✓
SOURce:DIGital:MULTitone:TONE:CLEar		✓
SOURce:DIGital:MULTitone:TONE:ADD		✓
SOURce:DIGital:MULTitone:TONE:DELete		✓
SOURce:DIGital:MULTitone:TONE:FREQuency		✓
SOURce:DIGital:MULTitone:TONE:VOLTage		✓
SOURce:DIGital:MULTitone:TONE:PHASe		✓
SOURce:DIGital:MULTitone:TONE:PHASe:RANDomize		✓
SOURce:DIGital:REFerence:VOLTage		✓
SOURce:DIGital:BERT[:MODE]		✓
SOURce:DIGital:BERT:PATTern:CATegory		✓
SOURce:DIGital:BERT:WCONstant:TYPE		✓
SOURce:DIGital:BERT:PSEudorandom:SEED		✓
SOURce:DIGital:BERT:WCONstant[:VALue]		✓
SOURce:DIGital:BERT:DURation		✓
SOURce:DIGital:BERT:BWIDth		✓

Sense Subsystem

Command	Analog interface	Digital interface
SENSe:VOLTage:RANGe:AUTO	✓	
SENSe:VOLTage:RANGe[:UPPer]	✓	
SENSe:MTIMe	✓	
SENSe:VOLTage:DETector	✓	
SENSe:FUNCtion<j>	✓	
SENSe:FUNCtion<j>:UNIT	✓	
SENSe:REFerence:IMPedance	✓	
SENSe:REFerence:LEVel	✓	
SENSe:REFerence:CHANnel	✓	
SENSe:REFerence:FREQuency	✓	
SENSe:REFerence:RATio	✓	
SENSe:REFerence:MEASured	✓	
SENSe:FILTer:LPASs	✓	
SENSe:FILTer:HPASs	✓	
SENSe:FILTer:WEIGhting	✓	
SENSe:FILTer:LEFT	✓	
SENSe:FILTer:RIGHt	✓	
SENSe:AVERaging:MOVing:POINts	✓	
SENSe:AVERaging:SYNC:POINts	✓	
SENSe:WAVeform:POINts	✓	
SENSe:FFT:WINDow	✓	
SENSe:FUNDamental:FREQuency:LOCK	✓	
SENSe:DIGital:FUNDamental:FREQuency:LOCK[:SINad]		✓
SENSe:DIGital:FUNDamental:FREQuency:LOCK:THD		✓

Command	Analog interface	Digital interface
SENSe:DIGital:FUNDamental:FREQuency		✓
SENSe:DIGital:THD:HARMonic:COUNt		✓
SENSe:DIGital:COUPling		✓
SENSe:DIGital:SAMPle:SIZE		✓
SENSe:DIGital:VOLTage:DETector		✓
SENSe:DIGital:FILTer:LPASs		✓
SENSe:DIGital:FILTer:HPASs		✓
SENSe:DIGital:FILTer:WEIGhting		✓
SENSe:DIGital:FILTer:DEEMphasis		✓
SENSe:DIGital:FILTer:SRATe		✓
SENSe:DIGital:FUNCtion<j>		✓
SENSe:DIGital:FUNCtion<j>:UNIT		✓
SENSe:DIGital:REFerence:LEVel		✓
SENSe:DIGital:REFerence:FREQuency		✓
SENSe:DIGital:REFerence:RATio		✓
SENSe:DIGital:REFerence:VOLTage		✓
SENSe:DIGital:REFerence:CHANnel		✓
SENSe:DIGital:REFerence:MEASured		✓
SENSe:DIGital:AVERaging:MOVing:POINts		✓
SENSe:DIGital:AVERaging:SYNC:POINts		✓
SENSe:DIGital:SNR:DELay		✓
SENSe:DIGital:THDN:MODE		✓
SENSe:DIGital:FFT:WINDow		✓
SENSe:DIGital:WAVeform:POINts		✓
SENSe:DIGital:BERT:INTerval		✓

Command	Analog interface	Digital interface
SENSe:DIGital:BERT:UNIT		✓
SENSe:NOTCh:EMULation[:STATe]	✓	

Display Subsystem

Command	Analog interface	Digital interface
DISPlay:ANALysis:MODE	✓	
DISPlay[:WINDow]:GRAPh:TRACe:X:SPACing	✓	✓
DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:AUTO	✓	✓
DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:LEFT	✓	✓
DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:RIGHt	✓	✓
DISPlay[:WINDow]:GRAPh:TRACe:Y:SPACing	✓	✓
DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:AUTO	✓	✓
DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:BOTTom	✓	✓
DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:TOP	✓	✓
DISPlay[:WINDow]:GRAPh:TRACe:AUTO	✓	✓
DISPlay[:WINDow]:GRAPh:TRACe:HOLD	✓	✓
DISPlay[:WINDow]:GRAPh:TRACe:REFerence:STATe	✓	✓
DISPlay[:WINDow]:GRAPh:TRACe:REFerence:SLOT	✓	✓
DISPlay[:WINDow]:GRAPh:TRACe:REFerence:SOURce	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:X:SPACing	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:AUTO	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:LEFT	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:RIGHt	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:Y:SPACing	✓	✓

Command	Analog interface	Digital interface
DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:AUTO	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:BOTTom	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:TOP	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:AUTO	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:HOLD	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:FUNCtion	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:REFerence:STATe	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:REFerence:SLOT	✓	✓
DISPlay[:WINDow]:SWEep:TRACe:REFerence:SOURce	✓	✓
DISPlay[:WINDow]:VIEW	✓	✓
DISPlay[:WINDow]:MODE	✓	✓
DISPlay[:WINDow]:STATe	✓	✓
DISPlay:DIGital:ANALysis:MODE		✓
DISPlay[:WINDow]:DIGital:GRAPh:TRACe:HOLD		✓
DISPlay[:WINDow]:GRAPh:TRACe:INTerface	✓	✓

Calculate Subsystem

Command	Analog interface	Digital interface
CALCulate:HARMonic:COUNt	✓	
CALCulate:HARMonic:FUNDamental?	✓	
CALCulate:HARMonic:VALue?	✓	
CALCulate:HARMonic:FREQuencies?	✓	
CALCulate:THDistortion?	✓	
CALCulate:DIGital:HARMonic:COUNt		✓

Command	Analog interface	Digital interface
CALCulate:DIGital:HARMonic:FUNDamental?		✓
CALCulate:DIGital:HARMonic:VALue?		✓
CALCulate:DIGital:HARMonic:FREQuencies?		✓
CALCulate:DIGital:THDistortion?		✓
CALCulate:GRAPh:MARKer:THReshold[:LEVel]	✓	✓
CALCulate:GRAPh:MARKer:THReshold:STATe	✓	✓
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:STATe	✓	✓
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:TRACe	✓	✓
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:X	✓	✓
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:Y?	✓	✓
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:PEAK	✓	✓
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:MIN	✓	✓
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:REFerence	✓	✓
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:XDELta?	✓	✓
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:YDELta?	✓	✓
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:MOVement	✓	✓
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8[:SET]:MODE	✓	✓
CALCulate:SWEep:MARKer:THReshold[:LEVel]	✓	✓
CALCulate:SWEep:MARKer:THReshold:STATe	✓	✓
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:STATe	✓	✓
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:TRACe?	✓	✓
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:X	✓	✓
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:Y?	✓	✓
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:PEAK	✓	✓
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:MIN	✓	✓
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:REFerence	✓	✓

Command	Analog interface	Digital interface
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:XDELta?	✓	✓
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:YDELta?	✓	✓
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:MOVement	✓	✓
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8[:SET]:MODE	✓	✓
CALCulate:FORMat:LEVel	✓	
CALCulate:FORMat:FREQuency	✓	
CALCulate:FORMat:RATio	✓	
CALCulate:DIGital:FORMat:LEVel		✓
CALCulate:DIGital:FORMat:FREQuency		✓
CALCulate:DIGital:FORMat:RATio		✓

Data Subsystem

Command	Analog interface	Digital interface
DATA:SWEep	✓	✓
DATA:WAVeform	✓	
DATA:WAVFile		✓
DATA:FILTer	✓	
DATA:DIGital:FILTer		✓
DATA:FILE?	✓	✓

Sweep Subsystem

Command	Analog interface	Digital interface
SOURce:SWEep:INTerface	✓	✓
SOURce:SWEep:CHANnel	✓	✓
SOURce:SWEep:REFerence:CHANnel	✓	✓
SOURce:SWEep:MODE	✓	✓
SOURce:SWEep:PARameter	✓	✓
SOURce:SWEep:DWELl	✓	✓
SOURce:SWEep:SPACing	✓	✓
SOURce:SWEep:POINts	✓	✓
SOURce:SWEep:STEP	✓	✓
SOURce:SWEep:STARt	✓	✓
SOURce:SWEep:STOP	✓	✓
SOURce:SWEep:NEXT	✓	✓
SOURce:SWEep:VALues?	✓	✓
SENSe:SWEep:INTerface	✓	✓
SENSe:SWEep:CHANnel	✓	✓
SENSe:SWEep:REFerence:CHANnel	✓	✓

Trigger Subsystem

Command	Analog interface	Digital interface
TRIGger:ANALyzer:SOURce	✓	
TRIGger:GRAPh:SOURce	✓	
TRIGger:GRAPh:SLOPe	✓	

Command	Analog interface	Digital interface
TRIGger:DIGital:ANALyzer:SOURce		✓
TRIGger:DIGital:GRAPh:SOURce		✓
TRIGger:DIGital:GRAPh:SLOPe		✓

Fetch Subsystem

Command	Analog interface	Digital interface
FETCh[:SCALar]?	✓	
FETCh:ARRay?	✓	
FETCh:SWEep?	✓	✓
FETCh:DIGital[:SCALar]?		✓
FETCh:DIGital:AUDio:BITS?		✓
FETCh:DIGital:ERRor:FLAG?		✓
FETCh:DIGital:DELay?		✓
FETCh:DIGital:BERT?		✓
FETCh:DIGital:ARRay?		✓

Initiate Subsystem

Command	Analog interface	Digital interface
INITiate[:IMMediate]:ANALyzer	✓	
INITiate[:IMMediate]:GRAPh	✓	
INITiate[:IMMediate]:SWEep	✓	✓
INITiate[:IMMediate]:DIGital:ANALyzer		✓

Command	Analog interface	Digital interface
INITiate[:IMMediate]:DIGital:AUDio:BITS		✓
INITiate[:IMMediate]:DIGital:BERT		✓
INITiate[:IMMediate]:DIGital:GRAPh		✓
INITiate:CONTinue:ANALyzer	✓	
INITiate:CONTinue:DIGital:ANALyzer		✓
INITiate:CONTinue:DIGital:AUDio:BITS		✓
INITiate:CONTinue:DIGital:DELay		✓

Abort Subsystem

Command	Analog interface	Digital interface
ABORt:ANALyzer	✓	
ABORt:GRAPh	✓	
ABORt:SWEep	✓	✓
ABORt:DIGital:ANALyzer		✓
ABORt:DIGital:GRAPh		✓
ABORt:DIGital:BERT		✓

Mass Memory Subsystem

Command	Analog interface	Digital interface
MMEMory:LOAD	✓	✓
MMEMory:STORe	✓	✓
MMEMory:CATalog?	✓	✓

Command	Analog interface	Digital interface
MMEMory:DELete	✓	✓
MMEMory:LOAD:WAVFile		✓
MMEMory:LOAD:AES:STATus		✓
MMEMory:STORe:AES:STATus		✓
MMEMory:LOAD:STATe:PUP	✓	✓
MMEMory:STORe:SWEep	✓	✓
MMEMory:LOAD:STATe[:MODE]	✓	✓
MMEMory:LOAD:STATe:CHANnel	✓	✓
MMEMory:STORe:STATe[:MODE]	✓	✓
MMEMory:STORe:STATe:CHANnel	✓	✓

Measure Subsystem

Command	Analog interface	Digital interface
MEASure:DIGital:CSTatus:DATA?		✓
MEASure:DIGital:CSTatus:BYTE?		✓
MEASure:DIGital:CSTatus:FIELd?		✓
MEASure:DIGital:USTatus:DATA?		✓
MEASure:DIGital:USTatus:BYTE?		✓

Status Subsystem

Command	Analog interface	Digital interface
STATus:PRESet	✓	✓
STATus:OPERation:CONDition?	✓	✓
STATus:OPERation:ENABle	✓	✓
STATus:OPERation[:EVENt]?	✓	✓
STATus:OPERation:NTRansition	✓	✓
STATus:OPERation:PTRansition	✓	✓
STATus:QUEStionable:CONDition?	✓	✓
STATus:QUEStionable:ENABle	✓	✓
STATus:QUEStionable[:EVENt]?	✓	✓
STATus:QUEStionable:NTRansition	✓	✓
STATus:QUEStionable:PTRansition	✓	✓
STATus:QUEStionable:VOLTage:CONDition?	✓	✓
STATus:QUEStionable:VOLTage:ENABle	✓	✓
STATus:QUEStionable:VOLTage[:EVENt]?	✓	✓
STATus:QUEStionable:VOLTage:NTRansition	✓	✓
STATus:QUEStionable:VOLTage:PTRansition	✓	✓

IEEE-488.2 Common Commands

The IEEE-488.2 standard defines a set of common commands that perform functions such as reset, self-test, and status operation. Common commands always begin with an asterisk (*), are three characters in length, and may include one or more parameters. The command keyword is separated from the first parameter by a blank space. Use a semicolon (;) to separate multiple commands as shown below.

```
*RST; *CLS; *ESE 32; *OPC?
```

*CLS

Syntax

```
*CLS
```

Description

Clears the event registers in all register groups and also clears the error queue.

Example

The following command is used to clear all event registers and the error queue.

```
*CLS
```

*RST

Syntax

```
*RST
```

Description

Resets the U8903A to its factory default settings.

Remarks

- This command does not affect any user-defined files in the U8903A memory.
- The time taken to reset all settings for all channels of the U8903A is approximately 5 s. If you only wish to reset the settings for a particular channel, use the `SYSTem:RESet:CHANnel` command instead. To reset the settings for only a particular mode such as the generator mode, use the `SYSTem:RESet[:MODE]` command.

Example

The following command resets all settings for all channels of the U8903A to its factory default settings.

```
*RST
```

*ESE

Syntax

```
*ESE <value>
```

```
*ESE?
```

Description

Sets the bits in the Standard Event enable register. The selected bits are then reported to bit 5 of the Status Byte register. The query reads the enable register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	0

Remarks

- The bit definitions for the Standard Event register are listed in "Standard Event register" on page 40.
- Use the `<value>` parameter to specify which bits will be enabled. The specified decimal value corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 2 (decimal value = 4), bit 3 (decimal value = 8), and bit 7 (decimal value = 128), the corresponding decimal value would be 140 (4 + 8 + 128).
- The clear status (`*CLS`) command will not clear the enable register but it clears all bits in the event register.
- The `*RST` or `SYSTem:PRESet` command does not affect the settings enabled by this command. However, cycling the U8903A power will reset this register to `0`.

Examples

The following command enables bit 4 (decimal value = 16) in the enable register. If an Execution Error occurs, this condition will be reported to the Status Byte register (bit 5 will be set to high).

```
*ESE 16
```

The following query returns the bits set in the register.

```
*ESE?
```

Typical response: `16`

*ESR?

Syntax

```
*ESR?
```

Description

Reads the event register of the Standard Event register group and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register.

Remarks

- The bit definitions for the Standard Event register are listed in "Standard Event register" on page 40.
- Once a bit is set, it remains set until cleared by a clear status (`*CLS`) command or queried by this command.

Example

The following query reads the event register (bits 3 and 4 are set).

```
*ESR?
```

Typical response: `24`

*IDN?

Syntax

```
*IDN?
```

Description

Reads the U8903A identification string which contains four comma-separated fields. The first field is the manufacturer's name, the second field is the instrument model number, the third field is the serial number, and the fourth field is the firmware revision. This query returns an ASCII string with the following format.

<Manufacturer's name>,<model number>,<serial number>, <firmware revision>

Agilent Technologies	Manufacturer
U8903A	Instrument model number
MYxxxxxxxx	Instrument serial number if available, or 0
x.x.x.x	Firmware revision levels

Example

The following query returns the U8903A identification string.

```
*IDN?
```

Typical response:
`AGILENT TECHNOLOGIES,U8903A,MY00123456,1.0.0.0`

*OPC

Syntax

`*OPC`

`*OPC?`

Description

Sets the “Operation Complete” bit (bit 0) in the Standard Event register when all pending operations have completed. This query sends `1` to the output buffer when all pending operations have completed.

Remark

This command is used to synchronize your application with the U8903A.

Examples

The following command sets the "Operation Complete" bit.

`*OPC`

The following query waits until the completion of the current command and then sends `1` to the output buffer.

`*OPC?`

Typical response: `1`

*OPT?

Syntax

```
*OPT?
```

Description

Returns an ASCII string identifying the digital audio option configuration.

Remark

This command is used to verify the installed option in the U8903A.

Examples

The following query returns the U8903A installed digital audio option string.

```
*OPT?
```

Typical response: “None”

*SRE

Syntax

```
*SRE <value>
*SRE?
```

Description

Enables the bits in the Status Byte enable register. The selected enabled bits are summarized in the “Master Summary” bit (bit 6) of the Status Byte register. If any of the selected bit condition changes from 0 to 1, a Service Request is generated. The query reads the enable register and returns a decimal value that corresponds to the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	0

Remarks

- The bit definitions for the Status Byte register are listed in “Status Byte register” on page 41.
- Use the `<value>` parameter to specify which bits to enable. The specified decimal value corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 2 (decimal value = 4) and bit 5 (decimal value = 32), the corresponding decimal value would be 36 (4 + 32).
- The `STATus:PRESet`, `SYSTem:PRESet`, `*CLS`, or `*RST` command does not clear the bits in the Status Byte enable register.
- Cycling the U8903A power will reset it to `0`.

Examples

The following command enables bit 4 (decimal value = 16) in the enable register.

```
*SRE 16
```

The following query returns which bits are enabled in the register.

```
*SRE?
```

Typical response: `16`

*STB?

Syntax

```
*STB?
```

Description

Queries the condition register for the Status Byte register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. This query is similar to a Serial Poll but it is processed like any other instrument command. This is a read-only register and the bits are not cleared when you read the register.

Remarks

- The bit definitions for the Status Byte register are listed in "Status Byte register" on page 41.
- This query returns the same results as a Serial Poll but the "Master Summary" bit (bit 6) is not cleared if a Serial Poll has occurred.
- A power-on cycle will clear all bits in the condition register.

Example

The following query reads the condition register (bits 2 and 5 are set).

```
*STB?
```

Typical response: `36`

*TST?

Syntax

```
*TST?
```

Description

Initiates an internal self-test of the U8903A and returns a pass or fail indication. The self-test runs a series of tests and will take approximately 30 s to complete.

Remarks

- If one or more tests fail, `1` is returned and the errors are stored in the error queue. For a complete listing of the error messages related to self-test failures, refer to Chapter 3, “Error Messages”. Use the `SYSTem:ERRor?` command to read the error queue.
- If all tests pass, `0` is returned.

NOTE Do not operate the U8903A while the self-test is in progress as doing so might cause unexpected results.

Example

The following query performs a self-test and returns a pass or fail indication.

```
*TST?
```

Typical response: `0`

*WAI

Syntax

`*WAI`

Description

The Wait-to-Continue (WAI) command causes the U8903A to wait until all pending operations have completed, before executing any other command.

Example

The following command waits until all pending operations have completed.

`*WAI`

*TRG

Syntax

`*TRG`

Description

This command is used in conjunction with the `TRIGger:ANALyzer:SOURce`, `TRIGger:GRAPh:SOURce`, `TRIGger:DIGital:ANALyzer:SOURce`, or `TRIGger:DIGital:GRAPh:SOURce` command to trigger the U8903A from the remote interface.

Remarks

- For analog module, use the `TRIGger:ANALyzer:SOURce` command in the analyzer mode or `TRIGger:GRAPh:SOURce` command in the graph mode to select the BUS trigger source.

- For digital module, use the `TRIGger:DIGital:ANALyzer:SOURce` command in the analyzer mode or `TRIGger:DIGital:GRAPh:SOURce` command in the graph mode to select the BUS trigger source.
- After setting the trigger source, the U8903A must be set in the "wait-for-trigger" state. The `*TRG` command will not be accepted unless the U8903A is in the "wait-for-trigger" state.
- For analog module, use the `INITiate[:IMMediate]:ANALyzer` command in the analyzer mode. For the graph mode, use the `INITiate[:IMMediate]:GRAPh` command.
- For digital module, use the `INITiate[:IMMediate]:DIGital:ANALyzer` command in the analyzer mode. For the graph mode, use the `INITiate[:IMMediate]:DIGital:GRAPh` command.

Example

The following command sequence is used to trigger the U8903A in the analog analyzer mode.

```
TRIG:ANAL:SOUR BUS

INIT:ANAL

*TRG
```

SCPI Status System

This section describes the structure of the SCPI status system used by the U8903A. Each register group is made up of several low-level registers called Condition register, Event register, and Enable register which control the action of specific bits within the register group.

Condition register

A condition register continuously monitors the state of the U8903A. The bits in the condition register are updated in realtime and the bits are not latched or buffered. This is a read-only register and the bits are not cleared when you read the register. A query of the condition register returns a decimal value which corresponds to the binary-weighted sum of all bits set in that register.

Event register

An event register latches the various events from the changes in the condition register. There is no buffering in this register; while an event bit is set, subsequent events corresponding to that bit are ignored. This is a read-only register. Once a bit is set, it remains set until cleared by a query or clear status (`*CLS`) command. A query of this register returns a decimal value which corresponds to the binary-weighted sum of all bits set in that register.

Enable register

An enable register defines which bits in the event register will be reported to the Status Byte register group. You can write to or read from an enable register. A clear status (`*CLS`) command will not clear the enable register but it clears all bits in the event register. To enable bits in the enable register to be reported to the Status Byte register, you must write a decimal value which corresponds to the binary-weighted sum of the corresponding bits.

Status system diagram

The U8903A uses the Operation, Questionable, Standard Event, and Status Byte register groups to record a variety of instrument conditions. The relationship between various registers in the U8903A SCPI status system is shown below.

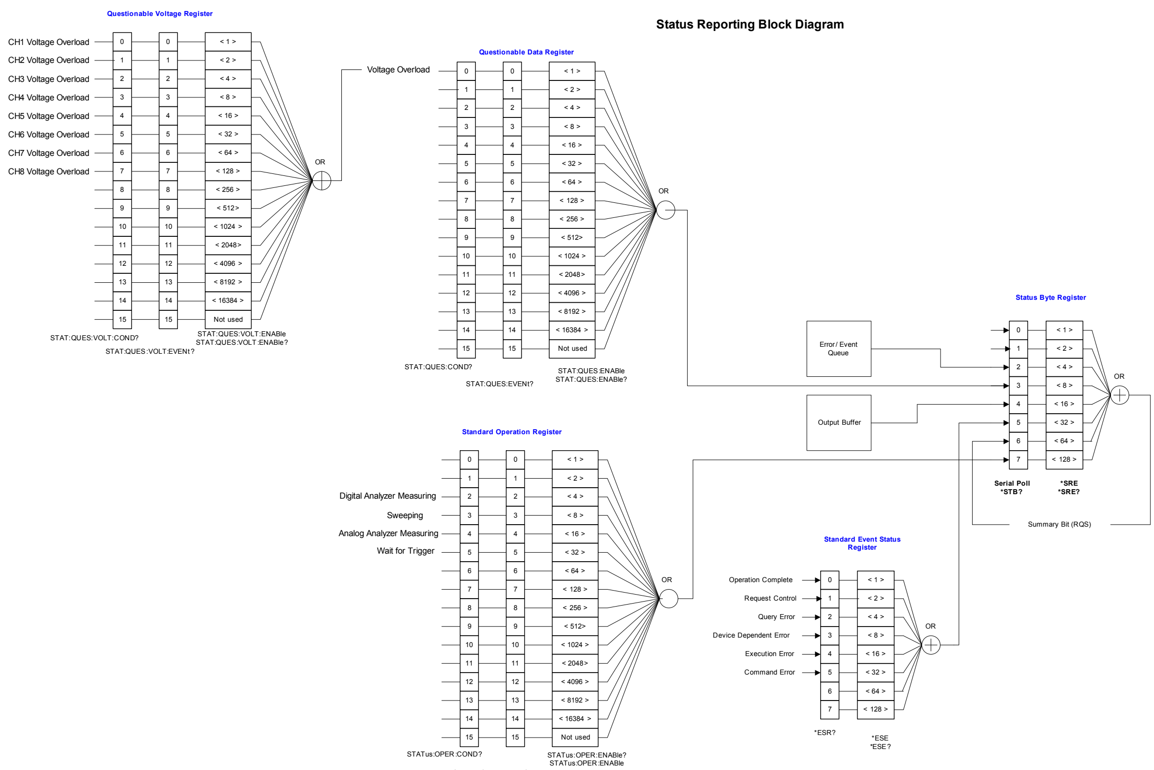


Figure 1-1 Status system diagram

Standard Operation register

This register record signals that occur during normal operation. The outputs of the Standard Operation register are logically-ORed into the OPERation summary bit (7) of the Status Byte register.

Bit definitions: Standard Operation register

Bit number	Decimal value	Definition
0 to 1 Not Used	Not Used	0 is returned
2 Measuring in Progress for Digital Analyzer		The U8903A is initiated, and is making, or about to make a measurement
3 Sweeping in Progress	8	The U8903A is performing sweep
4 Measuring in Progress for Analog Analyzer	16	The U8903A is initiated, and is making, or about to make a measurement
5 Waiting for Trigger	32	The U8903A is waiting for an external or bus trigger
6 to 15 Not Used	Not Used	0 is returned

The `STATus:PRESet` command will clear all bits in the NTR and enable registers.

Questionable Status registers

These registers record signals that indicate abnormal operation. The Questionable Data and Questionable Voltage registers are used for the U8903A. The outputs of the Questionable Voltage register are logically-ORed into the Voltage Overload bit (0) of the Questionable Data register. The outputs of the Questionable Data register are logically-ORed into the QUEStionable summary bit (3) of the Status Byte register.

Bit definitions: Questionable Data register

Bit number	Decimal value	Definition
0 Voltage Overload	1	The voltage of one of the input signals is over the limit
1 to 15 Not Used	Not Used	0 is returned

Bit definitions: Questionable Voltage register

Bit number	Decimal value	Definition
0 Channel 1 Voltage Overload	1	The voltage of channel 1 is over the limit
1 Channel 2 Voltage Overload	2	The voltage of channel 2 is over the limit
2 Channel 3 Voltage Overload	4	The voltage of channel 3 is over the limit
3 Channel 4 Voltage Overload	8	The voltage of channel 4 is over the limit
4 Channel 5 Voltage Overload	16	The voltage of channel 5 is over the limit
5 Channel 6 Voltage Overload	32	The voltage of channel 6 is over the limit
6 Channel 7 Voltage Overload	64	The voltage of channel 7 is over the limit
7 Channel 8 Voltage Overload	128	The voltage of channel 8 is over the limit
8 to 15 Not Used	Not Used	0 is returned

Standard Event register

The Standard Event register reports the following types of instrument events: command syntax errors, command execution errors, device errors (self-test or calibration), query errors, or when an `*OPC` command is executed. All of these conditions can be reported in the Standard Event summary bit through the enable register.

Bit definitions: Standard Event register

Bit number	Decimal value	Definition
0 Operation Complete	1	All commands prior to and including `*OPC` have been executed
1 Not Used	Not Used	0 is returned
2 Query Error	4	The U8903A tried to read the output buffer but it was empty. Or, a new command line was received before a previous query has been read. Or, both the input and output buffers are full.
3 Device-Dependent Error	8	A self-test, calibration, or other device-specific error has occurred
4 Execution Error	16	A command execution error occurred
5 Command Error	32	A command syntax error occurred
6 to 7 Not Used	Not Used	0 is returned

The event register in the Standard Event is cleared when:

- you execute the clear status (`*CLS`) command
- querying the event register using the event status register (`*ESR?`) command

The Standard Event enable register is cleared when you execute the `*ESE 0` command.

Status Byte register

The Status Byte register reports the conditions from the other status registers. Clearing an event register from one of the other registers will clear the corresponding bits in the Status Byte condition register.

Data that is waiting in the U8903A output buffer is immediately reported on the “Message Available” bit (bit 4).

Bit definitions: Status Byte register

Bit number	Decimal value	Definition
0 to 1 Not Used	Not Used	0 is returned
2 Error Queue	4	There is at least one error message in the error queue
3 Questionable Data Summary	8	One or more bits are set in the Questionable Data register (bits must be enabled in the enable register)
4 Message Available	16	Data is available in the U8903A output buffer
5 Event Status Byte Summary	32	One or more bits are set in the Standard Event register (bits must be enabled in the enable register)
6 Master Status Summary (Request for Service)	64	One or more bits are set in the Status Byte register (bits must be enabled in the enable register). Also used to indicate a request for service.
7 Standard Operation Summary	128	One or more bits are set in the Standard Operation register (bits must be enabled in the enable register)

The Status Byte condition register will be cleared when:

- you execute the clear status (`*CLS`) command
- you read the event register from one of the other registers, only the corresponding bits are cleared in the condition register

The Status Byte enable register is cleared when you execute the `*SRE 0` command.

System Subsystem

SYSTem:ERRor[:NEXT]?

Syntax

`SYSTem:ERRor[:NEXT]?`

Description

Returns the error number and its corresponding message string from the U8903A error queue. A record of up to 30 errors can be stored in the U8903A error queue. The format of the response is:

`<error number>,"<error string>"`

where the error number is defined in Chapter 3, “Error Messages”.

Remarks

- Errors are retrieved in the first-in, first-out (FIFO) order where the first error returned is the first error that has been stored.
- If more than 30 errors have occurred, the last error stored in the queue (the most recent error) is replaced with **–350,"Queue overflow"**. No additional errors are stored until you remove errors from the queue. If no error occur when you read the error queue, the U8903A responds with **0,"No error"**.
- The error queues are cleared by the clear status (`*CLS`) command and when power is cycled. The errors are also cleared when you read the error queue. The error queue is not cleared by a factory reset (`*RST`) or `SYSTem:PRESet` command.

- The command reads and clears one error string from the error queue. The error string may contain up to 255 characters and consists of an error number and an error string enclosed in double quotes. For example:

  `-113,"Undefined header"`

Example

The following query reads and clears one error.

`SYST:ERR?`

Typical response: `-101,"Invalid character"`

SYSTem:DATE

Syntax

`SYSTem:DATE <yyyy>, <mm>, <dd>`

`SYSTem:DATE?`

Description

Sets the date of the realtime clock in year (yyyy), month (mm), and day (dd) format. The query returns comma-separated values that correspond to the year, month, and day.

Parameters

Item	Type	Range of values	Default value
yyyy	Numeric	A 4-digit integer representing the year. The value is within the range of 2000 to 2099.	Required parameter
mm	Numeric	An integer from 1 to 12	Required parameter
dd	Numeric	An integer from 1 to 31	Required parameter

Examples

The following command sets the date (April 1, 2008).

```
SYST:DATE 2008, 4, 1
```

The following query returns the date.

```
SYST:DATE?
```

Typical response: `2008,4,1`

SYSTem:TIME

Syntax

```
SYSTem:TIME <hh>, <mm>, <ss>
```

```
SYSTem:TIME?
```

Description

Sets the realtime clock in hours (hh), minutes (mm), and seconds (ss). The query returns comma-separated values that correspond to the hour, minute, and seconds.

Parameters

Item	Type	Range of values	Default value
hh	Numeric	An integer from 0 to 23	Required parameter
mm	Numeric	An integer from 0 to 59	Required parameter
ss	Numeric	An integer from 0 to 59	Required parameter

Examples

The following command sets the time.

```
SYST:TIME 13, 30, 10
```

The following query returns the time.

```
SYST:TIME?
```

Typical response: `13,30,10`

SYSTem:VERSion?

Syntax

```
SYSTem:VERSion?
```

Description

Returns the SCPI standard version with which the U8903A is in compliance. The U8903A complies with the rules and conventions of the indicated SCPI standard version. The response format is in the form of XXXX.Y, where XXXX represents the year of the version and Y represents the version number for that year.

Example

The following query returns the SCPI version.

```
SYST:VERS?
```

Typical response: `1999.0`

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess

Syntax

```
SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <address>
```

```
SYSTem:COMMunicate:GPIB[:SELF]:ADDRess?
```

Description

Assigns the U8903A GPIB (IEEE-488) address. Each device on the GPIB interface must have a unique address.

Parameter

Item	Type	Range of values	Default value
address	Numeric	0 to 30	28

Remarks

- The factory GPIB address setting is 28.
- Your PC GPIB interface card has its own address. Avoid using the PC address for any instrument on the interface bus.
- The GPIB address is stored in nonvolatile memory, and does not change when power has been turned off, after a factory reset (`*RST` command), or after an instrument preset (`SYSTem:PRESet` command).

Examples

The following command sets the GPIB address to 28.

```
SYST:COMM:GPIB:ADDR 28
```

The following query returns the GPIB address.

```
SYST:COMM:GPIB:ADDR?
```

Typical response: `28`

SYSTem:COMMunicate:LAN:ADDRess

Syntax

SYSTem:COMMunicate:LAN:ADDRess <address>

SYSTem:COMMunicate:LAN:ADDRess?

Description

Assigns a static Internet Protocol (IP) address for the U8903A. The query returns the IP address in the form of "A.B.C.D".

Parameter

Item	Type	Range of values	Default value
address	String	Up to 15 characters formatted as A.B.C.D where A, B, C, and D is within the range of 0 to 255 each (no embedded spaces)	Required parameter

Remarks

- Sending this command will automatically disable the DHCP and switch to static IP.
- The IP address is stored in nonvolatile memory, and does not change when power has been turned off, after a factory reset (*RST command), or after an instrument preset (SYSTem:PRESet command).

Examples

The following command sets the IP address.

SYST:COMM:LAN:ADDR "169.254.149.35"

The following query returns the IP address in double quotes.

SYST:COMM:LAN:ADDR?

Typical response: "169.254.149.35"

SYSTem:COMMunicate:LAN:DGATeway

Syntax

`SYSTem:COMMunicate:LAN:DGATeway <gateway>`

`SYSTem:COMMunicate:LAN:DGATeway?`

Description

Assigns the static default gateway address. The query returns the default gateway address in the form of `"A.B.C.D"`.

Parameter

Item	Type	Range of values	Default value
gateway	String	Up to 15 characters formatted as A.B.C.D where A, B, C, and D is within the range of 0 to 255 each (no embedded spaces)	Required parameter

Remarks

- Sending this command will automatically disable the DHCP and switch to static default gateway.
- The default gateway address is stored in nonvolatile memory, and does not change when power has been turned off, after a factory reset (`*RST` command), or after an instrument preset (`SYSTem:PRESet` command).

Examples

The following command sets the default gateway.

`SYST:COMM:LAN:DGAT "255.255.20.11"`

The following query returns the default gateway address in double quotes.

`SYST:COMM:LAN:DGAT?`

Typical response: `"255.255.20.11"`

SYSTem:COMMunicate:LAN:HNAMe?

Syntax

`SYSTem:COMMunicate:LAN:HNAMe?`

Description

Queries the LAN hostname and returns an ASCII string enclosed in double quotes.

Example

The following query returns the hostname of the U8903A in double quotes.

`SYST:COMM:LAN:HNAM?`

Typical response: `"U8903A"`

SYSTem:COMMunicate:LAN:SMASk

Syntax

`SYSTem:COMMunicate:LAN:SMASk <subnet mask>`

`SYSTem:COMMunicate:LAN:SMASk?`

Description

Sets the static subnet mask address. The query returns the subnet mask address in the form of `"A.B.C.D"`.

Parameter

Item	Type	Range of values	Default value
subnet mask	String	Up to 15 characters formatted as A.B.C.D where A, B, C, and D is within the range of 0 to 255 each (no embedded spaces)	Required parameter

Remarks

- Sending this command will automatically disable the DHCP and switch to static subnet mask.
- The subnet mask address is stored in nonvolatile memory, and does not change when power has been turned off, after a factory reset (`*RST` command), or after an instrument preset (`SYSTem:PRESet` command).

Examples

The following command sets the subnet mask.

```
SYST:COMM:LAN:SMAS "255.255.20.11"
```

The following query returns the subnet mask address in double quotes.

```
SYST:COMM:LAN:SMAS?
```

Typical response: `"255.255.20.11"`

SYSTem:COMMunicate:LAN:MAC?

Syntax

```
SYSTem:COMMunicate:LAN:MAC?
```

Description

Reads the U8903A Media Access Control (MAC) address, also known as either the link-layer address, Ethernet (station) address, LANIC ID, or hardware address. This is an unchangeable 48-bit address assigned by the manufacturer to each unique Internet device. The query returns an ASCII string enclosed in double quotes. The MAC address is represented as 12 hexadecimal characters.

NOTE Your network administrator may need the MAC address if they are assigning a static IP address for this device.

Remarks

- The U8903A MAC address is set at the factory and cannot be changed.
- The MAC address is stored in nonvolatile memory, and does not change when power has been turned off, after a factory reset (`*RST` command), or after an instrument preset (`SYSTem:PRESet` command).

Example

The following query returns the MAC address in double quotes.

```
SYST:COMM:LAN:MAC?
```

Typical response: `"0003D3041075"`

SYSTem:COMMunicate:LAN:DHCP:ENABled

Syntax

```
SYSTem:COMMunicate:LAN:DHCP:ENABled
```

Description

Enables the Dynamic Host Configuration Protocol (DHCP) for the U8903A. When the DHCP is enabled (factory setting), the U8903A will try to obtain an IP address from a DHCP server. If a DHCP server is found, it will assign a dynamic IP address, subnet mask, and default gateway to the U8903A.

Example

The following command enables the DHCP.

```
SYST:COMM:LAN:DHCP:ENAB
```

SYSTem:CHANnel?

Syntax

```
SYSTem:CHANnel?
```

Description

Queries the available channels in the U8903A to determine if the channel hardware card is available or in good condition. This query returns comma-separated channel numbers of the available channels in the U8903A.

Remark

If a hardware card is available but in bad condition, this query will not return the channel number for that particular channel.

Example

The following query returns the channel numbers of the available channels which are in good condition.

```
SYST:CHAN?
```

Typical response: `1,2`

SYSTem:PRESet

Syntax

```
SYSTem:PRESet
```

Description

Presets the U8903A to its factory default settings and deletes all user-defined files.

Example

The following command presets the U8903A.

```
SYST:PRES
```

SYSTem:RESet[:MODE]

Syntax

```
SYSTem:RESet[:MODE] <system mode>
```

Description

Resets the customized settings of the specified U8903A system mode to the default settings.

Parameter

Item	Type	Range of values	Default value
system mode	Discrete	AANalyzer, AGENerator, SWEep, GRAPh, DANalyzer, or DGENerator	Required parameter

Remarks

- This command resets the customized settings of the selected system mode excluding the stored files, I/O configuration, and common system settings.
- For the analyzer mode, the measurement bandwidth, measurement time, and trigger source will also be reset to the default settings.

Example

The following command resets the analyzer mode.

```
SYST:RES AAN
```

SYSTem:RESet:CHANnel

Syntax

```
SYSTem:RESet:CHANnel <system mode>, (@<channel>)
```

Description

Resets the customized settings of the U8903A system mode for the specified channel to the default settings.

Parameters

Item	Type	Range of values	Default value
system mode	Discrete	AANalyzer, AGENerator, or DANalyzer	Required parameter
channel	Numeric	1 or 2	Required parameter

Remarks

- This command resets the customized settings of the system mode for the selected channel excluding the stored files, I/O configuration, and common system settings.
- For the analyzer mode, the measurement bandwidth, measurement time, and trigger source will not be reset to the default settings.

Example

The following command resets channel 1 of the analyzer mode.

```
SYST:RES:CHAN AAN, (@1)
```

SYSTem:LEGacy:MODE

Syntax

```
SYSTem:LEGacy:MODE <state>
```

```
SYSTem:LEGacy:MODE?
```

Description

Enables or disables the legacy mode. The legacy mode will enable the U8903A to emulate the HP8903B and accept HP8903B commands.

Parameter

Item	Type	Range of values	Default value
state	Boolean	OFF(0) or ON(1)	ON

Remark

Some of the HP8903B commands are not supported.

Examples

The following command enables the legacy mode.

`SYST:LEG:MODE ON`

The following query returns the legacy mode state.

`SYST:LEG:MODE?`

Typical response: `1`

SYSTem:LEGacy:CHANnel

Syntax

```
SYSTem:LEGacy:CHANnel <channel>
SYSTem:LEGacy:CHANnel?
```

Description

Sets the channel for the U8903A to emulate the HP8903B.

Parameter

Item	Type	Range of values	Default value
channel	Numeric	1 or 2	1

Examples

The following command sets channel 1 as the channel to emulate HP8903B in legacy mode.

```
SYST:LEG:CHAN 1
```

The following query returns the legacy mode channel.

```
SYST:LEG:CHAN?
```

Typical response: 1

SYSTem:DISPlay:IMAGe?

Syntax

```
SYSTem:DISPlay:IMAGe? <invert color>
```

Description

Prints the screen and retrieves the print screen image data. Parameter `invert color` is an optional parameter to invert the background color of the graph view. Setting the parameter `invert color` to 1 will invert the background color from black to white.

Parameter

Item	Type	Range of values	Default value
invert color	Boolean	0 or 1	0

Remarks

- The color inversion is only applicable to black background color image in graph view.
- Inverting the background color will take quite a significant amount of time.
- The print screen image returned is in JPEG format.

Examples

The following command retrieves the print screen image data without any background color inversion.

```
SYST:DISP:IMAG? 0
```

The following command retrieves the print screen image data with the background color inverted to white.

```
SYST:DISP:IMAG? 1
```

SYSTem:REMote

Syntax

```
SYSTem:REMote
```

Description

Activates Remote mode. Locks the U8903A front panel keypad excluding the Local key and displays “Remote” on the LCD display. Local front panel operation can be enabled by pressing the Local key.

Remark

Remote mode can also be activated by sending any SCPI commands.

Example

The following command returns the U8903A from Local mode to Remote mode.

```
SYST:REM
```

SYSTem:RWLock

Syntax

```
SYSTem:RWLock
```

Description

Activates Remote with Lock mode. Locks all the U8903A front panel keypad including the Local key and displays "Remote", and a "keypad lock symbol" on the LCD display. The U8903A cannot return to manual control from the front panel. This state can be cleared by sending the command "SYSTem:LOCal".

Example

The following command locks all the U8903A front panel keys.

```
SYST:RWL
```

SYSTem:LOCal

Syntax

```
SYSTem:LOCal
```

Description

Unlocks all the U8903A front panel keypad including the Local key and enables the U8903A to be controlled from the front panel.

Example

The following command returns the U8903A from Remote mode or Remote with Lock mode to Local mode.

```
SYST:LOC
```

SYSTem:DIGital:CTYPe?

Syntax

`SYSTem:DIGital:CTYPe?`

Description

Queries the installed digital audio type in the U8903A and returns either AES, DSI, or ALL.

Example

The following query returns the installed digital audio type.

`SYST:DIG:CTYP?`

Typical response: `ALL`

SYSTem:UPDate:FIRMware?

Syntax

`SYSTem:UPDate:FIRMware? <firmware list>`

Description

Starts the U8903A firmware update process remotely and returns the firmware update process state as `0` if the update process is not completed, or `1` if the update process is completed successfully.

NOTE Ensure that all measurement or waveform generation are stopped before sending this command.

`APPL`	Application firmware
`ACRd1`	Analog measurement card 1

ADSP	Analog DSP
ACON	Analog controller
DGEN	Digital generator
DAN	Digital analyzer
DCON	Digital controller

Parameter

Item	Type	Range of values	Default value
firmware list	String	One or more firmware files. For example: "APPL;\Storage 1\NK_R2.10.1.0.jel" "ACARd1;\Storage 1\filter.ldr" "ADSP;\Storage 1\FFT.ldr" "ACON;\Storage 1\Master.ldr" "DGEN;\Storage 1\DGenerator.bin" "DAN;\Storage 1\DAnalyzer.ldr" "DCON;\Storage 1\DController.bin"	Required parameter

Remarks

- Multiple firmware files are separated by commas.
- Each firmware list parameter must be sent in the format of <type>;<file path> where ';' is used to separate the firmware type and the file path.
- Before starting the update, ensure that the respective firmware files are accessible.
- The time required to complete this query varies according to the firmware type.

Firmware type	Time required (seconds)
APPL	320 to 350
ACRd1	15 to 20
ADSP	8 to 10
ACON	10 to 15
DGEN	4 to 6
DAN	12 to 15
DCON	35 to 40

Example

The following query updates the firmware for the application, analog DSP, and digital analyzer with the respective firmware files (NK_R2.10.1.0.jel, FFT.ldr, and DAnalyzer.ldr) stored in the external storage.

```
SYST:UPD:FIRM? "APPL;\Storage 1\
NK_R2.10.1.0.jel", "ADSP;\Storage 1\FFT.ldr",
"DAN;\Storage 1\DAnalyzer.ldr"
```

Typical response: 1

SYSTem:UPDate:HELP?

Syntax

```
SYSTem:UPDate:HELP? <filename>
```

Description

Starts the U8903A help file update process remotely and returns the help file update process state as 0 if the update process is not completed, or 1 if the update process is completed successfully.

Parameter

Item	Type	Range of values	Default value
filename	String	Full file path in quoted string. For example, "\Storage 1\u8903a2.10.1.0.cmp"	Required parameter

Remarks

- Before starting the update, ensure that the help files are accessible.
- The time required to complete this query varies according to the help file size. Typically, the query requires 7 to 9 seconds to complete the update process.

Example

The following query updates the help files with the `u8903a2.10.1.0.cmp` file stored in the external storage.

```
SYST:UPD:HELP? "\Storage 1\u8903a2.10.1.0.cmp"
```

Typical response: `1`

Output Subsystem

The Output subsystem provides the commands to program the U8903A generator output configuration.

OUTPut:TYPE

Syntax

```
OUTPut:TYPE <type>, (@<channel list>)
```

```
OUTPut:TYPE? (@<channel list>)
```

Description

Sets the generator output connection for the specified channel(s). The query returns the output connection type of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
type	Discrete	BALanced, UNBalanced, or COMMon	UNBalanced
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remark

You are required to reconfigure the output impedance each time you change the output connection.

Examples

The following commands set the generator outputs for channel 1 and 2 to Unbalanced and Balanced respectively.

```
OUTP:TYPE UNB, (@1)
OUTP:TYPE BAL, (@2)
```

The following query returns the output connection types of channel 1 and 2.

```
OUTP:TYPE? (@1,2)
```

Typical response: `UNB,BAL`

OUTPut:IMPedance

Syntax

```
OUTPut:IMPedance <impedance>, (@<channel list>)
```

```
OUTPut:IMPedance? (@<channel list>)
```

Description

Sets the generator output impedance for the specified channel(s). The query returns the output impedance of the selected channel(s). Multiple responses are separated by commas.

The output impedance selection is described as follows.

`IMP50`	Output impedance is 50 Ω for the Unbalanced output connection
`IMP100`	Output impedance is 100 Ω for the Balanced or Common output connection
`IMP600`	Output impedance is 600 Ω for the UnBalanced, Balanced, or Common output connection

Parameters

Item	Type	Range of values	Default value
impedance	Discrete	• IMP100 or IMP600 (Balanced or Common output connection) • IMP50 or IMP600 (Unbalanced output connection)	IMP600
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remark

You must set the output connection type before configuring the output impedance.

Examples

The following commands set the generator output impedance for channel 1 and 2 to 50 Ω and 100 Ω respectively. Assume that the output connection for channel 1 has been set to Unbalanced, and channel 2 to Balanced.

```
OUTP:IMP IMP50, (@1)
```

```
OUTP:IMP IMP100, (@2)
```

The following query returns the output impedance of channel 1 and 2.

```
OUTP:IMP? (@1,2)
```

Typical response: `IMP50,IMP100`

OUTPut:STATe

Syntax

`OUTPut:STATe <state>, (@<channel list>)`

`OUTPut:STATe? (@<channel list>)`

Description

Enables or disables the generator output for the specified channel(s). The query returns the output state of the selected channel(s) as `0` if the output state is `OFF`, or `1` if the output state is `ON`. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
state	Boolean	OFF(0) or ON(1)	OFF
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remark

You must configure the output connection and impedance before setting the output state.

Examples

The following commands enable the channel 1 generator output but disable the output for channel 2.

`OUTP:STAT ON, (@1)`

`OUTP:STAT OFF, (@2)`

The following query returns the output states of channel 1 and 2.

`OUTP:STAT? (@1,2)`

Typical response: `1,0`

OUTPut:DIGital:TYPE

Syntax

`OUTPut:DIGital:TYPE <type>`

`OUTPut:DIGital:TYPE?`

Description

Sets the digital generator AES3/SPDIF output connection. When a connection type is selected, the AES3/SPDIF output will be turned on. The query returns the AES3/SPDIF output connection type.

Parameter

Item	Type	Range of values	Default value
type	Discrete	BALanced or UNBalanced	UNBalanced

Examples

The following command sets the digital generator AES3/SPDIF output to Balanced.

`OUTP:DIG:TYPE BAL`

The following query returns the AES3/SPDIF output connection type.

`OUTP:DIG:TYPE?`

Typical response: `BAL`

OUTPut:DIGital:SRATe

Syntax

`OUTPut:DIGital:SRATe <sampling rate> [<unit>]`

`OUTPut:DIGital:SRATe?`

Description

Sets the sampling rate of the digital generator output signals. The query returns the sampling rate of the digital generator output signals.

Parameter

Item	Type	Range of values	Default value
sampling rate	Numeric	6.75kHz to 400kHz	48kHz

Remarks

- For AES3/SPDIF output connection, the range is limited to 28 kHz to 192 kHz.
- The AES3/SPDIF output will be turned off, if the sampling rate exceeds the range.

Examples

The following command sets the sampling rate of the digital generator output signal to 32 kHz.

`OUTP:DIG:SRAT 32kHz`

The following query returns the sampling rate of the digital generator output signal.

`OUTP:DIG:SRAT?`

Typical response: `3.200000E+04`

OUTPut:DIGital:STATe

Syntax

```
OUTPut:DIGital:STATe <state>, (@<channel list>)
```

```
OUTPut:DIGital:STATe? (@<channel list>)
```

Description

Enables or disables the digital generator output for the specified channel(s). The query returns the output state of the selected channel(s) as `0` if the output state is `OFF`, or `1` if the output state is `ON`. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
state	Boolean	OFF(0) or ON(1)	OFF
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Examples

The following commands enable the channel 1 digital generator output but disable the output for channel 2.

```
OUTP:DIG:STAT ON, (@D1)
```

```
OUTP:DIG:STAT OFF, (@D2)
```

The following query returns the output states of channel 1 and 2.

```
OUTP:DIG:STAT? (@D1,D2)
```

Typical response: `1,0`

OUTPut:DIGital:AUDio[:ENCoding]:FORMat

Syntax

`OUTPut:DIGital:AUDio[:ENCoding]:FORMat <format>`

`OUTPut:DIGital:AUDio[:ENCoding]:FORMat?`

Description

Sets the audio encoding format of the embedded digital generator audio signals. The query returns the audio encoding format.

LPCM	Linear Pulse Code Modulation
ULAW	μ-Law encoding format
ALAW	A-Law encoding format

Parameter

Item	Type	Range of values	Default value
format	Discrete	LPCM, ULAW, or ALAW	LPCM

Examples

The following command sets the encoding format of the digital generator to A-Law.

`OUTP:DIG:AUD:FORM ALAW`

The following query returns the encoding format.

`OUTP:DIG:AUD:FORM?`

Typical response: `ALAW`

OUTPut:DIGital:AES:STATe

Syntax

`OUTPut:DIGital:AES:STATe <state>`

`OUTPut:DIGital:AES:STATe?`

Description

Enables or disables the AES3/SPDIF output for the digital generator. The query returns the AES3/SPDIF output state as `0` if the output state is `OFF`, or `1` if the output state is `ON`.

Parameter

Item	Type	Range of values	Default value
state	Boolean	OFF(0) or ON(1)	OFF

Remark

The AES3/SPDIF output can also be enabled by setting the AES3/SPDIF output connection type using the `OUTPut:DIGital:TYPE` command.

Examples

The following command enables the AES3/SPDIF output.

`OUTP:DIG:AES:STAT ON`

The following query returns the output state of the AES3/SPDIF output.

`OUTP:DIG:AES:STAT?`

Typical response: `1`

OUTPut:DIGital:AES:VOLTage

Syntax

```
OUTPut:DIGital:AES:VOLTage <level>
```

```
OUTPut:DIGital:AES:VOLTage?
```

Description

Sets the output logic level for the AES3/SPDIF interface in Peak-to-Peak Voltage (Vpp). The query returns the output logic level of the AES3/SPDIF interface.

Parameters

Item	Type	Range of values	Default value
level	Numeric	• 0.3 Vpp to 5.1 Vpp (Balanced output) • 0.3 Vpp to 2.5 Vpp (Unbalanced output)	2.5 Vpp

Examples

The following command sets the output logic level to 1.5 Vpp.

```
OUTP:DIG:AES:VOLT 1.5
```

The following query returns the output logic level.

```
OUTP:DIG:AES:VOLT?
```

Typical response: `1.500000E+00`

OUTPut:DIGital:AES:AUDio:RESolution

Syntax

`OUTPut:DIGital:AES:AUDio:RESolution <resolution>`

`OUTPut:DIGital:AES:AUDio:RESolution?`

Description

Sets the audio resolution or bit depth for the AES3/SPDIF interface audio data to be generated. The query returns the audio resolution.

Parameter

Item	Type	Range of values	Default value
resolution	Numeric	8 to 24	24

Examples

The following command sets the audio resolution to 20 bits.

`OUTP:DIG:AES:AUD:RES 20`

The following query returns the audio resolution.

`OUTP:DIG:AES:AUD:RES?`

Typical response: `20`

OUTPut:DIGital:AES:AUDio:VALidity

Syntax

`OUTPut:DIGital:AES:AUDio:VALidity <validity>`

`OUTPut:DIGital:AES:AUDio:VALidity?`

Description

Sets the validity bit (bit 28) of the AES3/SPDIF interface output. When the validity bit is set to 0, the data is valid and is normally a linear coded PCM audio, and when it is set to 1, the data is invalid or may be a valid compressed audio. The query returns the validity bit value in integer.

Parameter

Item	Type	Range of values	Default value
validity	Numeric	0 or 1	0

Examples

The following command sets the AES3/SPDIF interface output validity bit to 1.

`OUTP:DIG:AES:AUD:VAL 1`

The following query returns the AES3/SPDIF interface output validity bit value.

`OUTP:DIG:AES:AUD:VAL?`

Typical response: `1`

OUTPut:DIGital:AES[:PROTocol]:MODE

Syntax

```
OUTPut:DIGital:AES[:PROTocol]:MODE <mode>,
(@<channel list>)
```

```
OUTPut:DIGital:AES[:PROTocol]:MODE?
(@<channel list>)
```

Description

Sets the first bit in the channel status block of the AES3/SPDIF interface to indicate the mode. The first bit of the channel status block is `0` if the mode is `CONSumer`, or `1` if the mode is `PROFessional`. The query returns the channel status block mode.

Parameters

Item	Type	Range of values	Default value
mode	Discrete	PROFessional or CONSumer	CONSumer
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Examples

The following command sets the channel status block mode for channel 1 to Consumer.

```
OUTP:DIG:AES:MODE CONS, (@D1)
```

The following query returns the channel status block mode of channel 1.

```
OUTP:DIG:AES:MODE? (@D1)
```

Typical response: `CONS`

OUTPut:DIGital:AES[:PROTocol]:CSTatus:DATA

Syntax

```
OUTPut:DIGital:AES[:PROTocol]:CSTatus:DATA
<data>, (@<channel list>)
```

```
OUTPut:DIGital:AES[:PROTocol]:CSTatus:DATA?
(@<channel list>)
```

Description

Sets the 24 bytes array of the channel status bits in hexadecimal characters for the specified channel(s). The query returns the channel status bits 24 bytes array in hexadecimal characters.

Parameters

Item	Type	Range of values	Default value
data	Hex		
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- `#H` must be added in front of the bytes array to indicate that the array is in hexadecimal characters.
- The channel status bits are arranged in the format of byte-0 to byte-23. For example, the value `#H2F2C6CFBD80055383930445554 31B0E704008E15530 10000` is arranged as follows.
- In Professional mode, the byte-23 (CRCC) is only for query and not modifiable. The byte-23 value will be updated with the auto-computed CRCC value.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
2F	2C	6C	FB	D8	00	55	38	39	30	44	55	54	31	B0	E7	04	00	8E	15	53	01	00	00

Examples

The following command sets the 24 bytes array of the channel status bits for channel 1.

```
OUTP:DIG:AES:CST:DATA
#H2F2C6CFBD8005538393044555431B0E704008E15530100
00, (@D1)
```

The following query returns the 24 bytes array of the channel status bits of channel 1.

```
OUTP:DIG:AES:CST:DATA? (@D1)
```

Typical response:
```
#H2F2C6CFBD8005538393044555431B0E704008E15530100
00
```

OUTPut:DIGital:AES[:PROTocol]:CSTatus:BYTE

Syntax

```
OUTPut:DIGital:AES[:PROTocol]:CSTatus:BYTE
<number>, <value>, (@<channel list>)
```

```
OUTPut:DIGital:AES[:PROTocol]:CSTatus:BYTE?
<number>, (@<channel list>)
```

Description

Sets a particular byte of the channel status bits for the specified channel(s). The query returns the byte(s) value in hexadecimal characters.

Parameters

Item	Type	Range of values	Default value
number	Numeric	0 to 23	0
value	Hex	0 to FF	0
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- `#H` must be added in front of the byte value to indicate that the value is in hexadecimal characters.
- The channel status bits are arranged in the format of byte-0 to byte-23. For example, the value `#H2F2C6CFBD8005538393044555431B0E704008E1553010000` is arranged as follows.
- In Professional mode, the byte-23 (CRCC) is only for query and not modifiable. The byte-23 value will be updated with the auto-computed CRCC value.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
2F	2C	6C	FB	D8	00	55	38	39	30	44	55	54	31	B0	E7	04	00	8E	15	53	01	00	00

Examples

The following command sets the byte 2 of the channel status bits for channel 1 to 6F.

```
OUTP:DIG:AES:CST:BYTE 2, #H6F, (@D1)
```

The following query returns the byte 2 of the channel status bits of channel 1.

```
OUTP:DIG:AES:CST:BYTE? 2, (@D1)
```

Typical response: `#H6F`

OUTPut:DIGital:AES[:PROTocol]:CSTatus:FIELd

Syntax

```
OUTPut:DIGital:AES[:PROTocol]:CSTatus:FIELd
<name>, <value>, (@<channel list>)
```

```
OUTPut:DIGital:AES[:PROTocol]:CSTatus:FIELd?
<name>, (@<channel list>)
```

Description

Sets the channel status bits data of a specified field name for the specified channel(s). The query returns the data of the channel status bits data of a specified field name.

Parameters

Item	Type	Range of values	Default value
name	String	Refer to "Appendix I: AES3/SPDIF Interface Channel Status Bits Field Names" on page 578	
value	String	Refer to "Appendix I: AES3/SPDIF Interface Channel Status Bits Field Names" on page 578	
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- The field name is not case sensitive.
- The field value is case sensitive.
- For Word Length, Channel Number, and Multichannel Mode, there is a condition before the field value can be set. Refer to "Appendix I: AES3/SPDIF Interface Channel Status Bits Field Names" on page 578 for more information.

- Before setting the respective fields or querying, ensure that the correct mode is set.

Examples

The following command sets the field value of “Category Code” for channel 1 to “Musical Instrument”.

```
OUTP:DIG:AES:CST:FIEL “Category Code”, “Musical
Instrument”, (@D1)
```

The following query returns the field value of “Category Code” for channel 1.

```
OUTP:DIG:AES:CST:FIEL? “Category Code”, (@D1)
```

Typical response: `Musical Instrument`

OUTPut:DIGital:AES[:PROTocol]:UStatus:DATA

Syntax

```
OUTPut:DIGital:AES[:PROTocol]:UStatus:DATA
<data>, (@<channel list>)
```

```
OUTPut:DIGital:AES[:PROTocol]:UStatus:DATA?
(@<channel list>)
```

Description

Sets the 24 bytes array of the user status bits in hexadecimal characters for the specified channel(s). The query returns the user status bits 24 bytes array in hexadecimal characters.

Parameters

Item	Type	Range of values	Default value
data	Hex		
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- `#H` must be added in front of the bytes array to indicate that the array is in hexadecimal characters.
- The channel status bits are arranged in the format of byte-0 to byte-23. For example, the value `#H2F2C6CFBD800553839304455431B0E704008E1553010000` is arranged as follows.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
2F	2C	6C	FB	D8	00	55	38	39	30	44	55	54	31	B0	E7	04	00	8E	15	53	01	00	00

Examples

The following command sets the 24 bytes array of the user status bits for channel 1.

```
OUTP:DIG:AES:UST:DATA
#H2F2C6CFBD800553839304455431B0E704008E15530100
00, (@D1)
```

The following query returns the 24 bytes array of the user status bits of channel 1.

```
OUTP:DIG:AES:UST:DATA? (@D1)
```

Typical response:
```
#H2F2C6CFBD800553839304455431B0E704008E15530100
00
```

OUTPut:DIGital:AES[:PROTocol]:USTatus:BYTE

Syntax

```
OUTPut:DIGital:AES[:PROTocol]:USTatus:BYTE
<number>, <value>, (@<channel list>)
```

```
OUTPut:DIGital:AES[:PROTocol]:USTatus:BYTE?
<number>, (@<channel list>)
```

Description

Sets a particular byte of the user status bits for the specified channel(s). The query returns the byte(s) value in hexadecimal characters.

Parameters

Item	Type	Range of values	Default value
number	Numeric	0 to 23	0
value	Hex	0 to FF	0
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- `#H` must be added in front of the bytes value to indicate that the value is in hexadecimal characters.
- The channel status bits are arranged in the format of byte-0 to byte-23. For example, the value `#H2F2C6CFBD800553839304455431B0E704008E1553010000` is arranged as follows.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
2F	2C	6C	FB	D8	00	55	38	39	30	44	55	54	31	B0	E7	04	00	8E	15	53	01	00	00

Examples

The following command sets the byte 2 of the user status bits for channel 1 to 6F.

```
OUTP:DIG:AES:UST:BYTE 2, #H6F, (@D1)
```

The following query returns the byte 2 of the user status bits of channel 1.

```
OUTP:DIG:AES:UST:BYTE? 2, (@D1)
```

Typical response: `#H6F`

OUTPut:DIGital:DSI:VOLTage

Syntax

```
OUTPut:DIGital:DSI:VOLTage <level>
```

```
OUTPut:DIGital:DSI:VOLTage?
```

Description

Sets the output logic level for the digital serial interface (DSI) in Peak-to-Peak Voltage (Vpp). The query returns the output logic level of the DSI.

Parameter

Item	Type	Range of values	Default value
level	Numeric	1.2 Vpp to 3.3 Vpp	2.5 Vpp

Examples

The following command sets the output logic level to 1.5 Vpp.

```
OUTP:DIG:DSI:VOLT 1.5
```

The following query returns the output logic level.

`OUTP:DIG:DSI:VOLT?`

Typical response: `1.500000E+00`

OUTPut:DIGital:DSI:AUDio:RESolution

Syntax

`OUTPut:DIGital:DSI:AUDio:RESolution <resolution>`

`OUTPut:DIGital:DSI:AUDio:RESolution?`

Description

Sets the audio resolution or bit depth for the DSI interface audio data to be generated. The query returns the audio resolution.

Parameter

Item	Type	Range of values	Default value
resolution	Numeric	8 to 24	24

Remark

The audio resolution must be less than or equal to the word length.

Examples

The following command sets the audio resolution to 20 bits.

`OUTP:DIG:DSI:AUD:RES 20`

The following query returns the audio resolution.

`OUTP:DIG:DSI:AUD:RES?`

Typical response: `20`

OUTPut:DIGital:DSI:AUDio:WLENgth

Syntax

`OUTPut:DIGital:DSI:AUDio:WLENgth <length>`

`OUTPut:DIGital:DSI:AUDio:WLENgth?`

Description

Sets the word length for the DSI interface. The query returns the word length.

Parameter

Item	Type	Range of values	Default value
length	Numeric	8 to 32	32

Remarks

- The word length must be greater or equal to the audio resolution.
- Refer to "Appendix J: Word Length, Sampling Rate, and Multiplier for DSI Interface" on page 581 for the range of word length that can be set with different DSI multiplier and sampling rate.
- When setting the word length, the error message, **–221,"Settings conflict..."** may be generated. This error message can be ignored as this is notify that the word length or multiplier is auto adjusted to the nearest allowable value due to the settings conflict.

Examples

The following command sets the word length to 20 bits.

`OUTP:DIG:DSI:AUD:WLEN 20`

The following query returns the word length.

`OUTP:DIG:DSI:AUD:WLEN?`

Typical response: `20`

OUTPut:DIGital:DSI:DATA:FORMat

Syntax

`OUTPut:DIGital:DSI:DATA:FORMat <format>`

`OUTPut:DIGital:DSI:DATA:FORMat?`

Description

Sets the format for the DSI interface audio data to be generated. The query returns the format for the DSI interface audio data.

`LEFT`	Left justified. The active data bits are filled to the left edge of the data word.
`RIGHt`	Right justified. The active data bits are filled to the right edge of the data word.
`I2S`	I2S format. The word clock is low for the first channel (left channel) and high for the second channel (right channel)
`DSP`	The period of the word clock is only 1 bit of the bit clock and the data is 1 bit clock delay from the beginning of the word clock.

Parameter

Item	Type	Range of values	Default value
format	Discrete	LEFT, RIGHt, I2S, or DSP	LEFT

Examples

The following command sets the DSI data format to right.

`OUTP:DIG:DSI:DATA:FORM RIGH`

The following query returns the DSI data format.

`OUTP:DIG:DSI:DATA:FORM?`

Typical response: `RIGH`

OUTPut:DIGital:DSI:MCLK:STATe

Syntax

```
OUTPut:DIGital:DSI:MCLK:STATe <state>
```

```
OUTPut:DIGital:DSI:MCLK:STATe?
```

Description

Enables or disables the DSI interface master clock. The query returns the DSI interface master clock state as `0` if the master clock state is `OFF`, or `1` if the master clock state is `ON`.

Parameter

Item	Type	Range of values	Default value
state	Boolean	OFF(0) or ON(1)	ON

Examples

The following command disables the DSI master clock.

```
OUTP:DIG:DSI:MCLK:STAT OFF
```

The following query returns the DSI master clock state.

```
OUTP:DIG:DSI:MCLK:STAT?
```

Typical response: `0`

OUTPut:DIGital:DSI:MCLK:MULTiplier

Syntax

`OUTPut:DIGital:DSI:MCLK:MULTiplier <multiplier>`

`OUTPut:DIGital:DSI:MCLK:MULTiplier?`

Description

Sets the multiplier that is used to determine the master clock rate. The master clock rate is based on the output sampling frequency and multiplier values. The query returns the multiplier value.

Parameter

Item	Type	Range of values	Default value
multiplier	Numeric	Refer to "Appendix J: Word Length, Sampling Rate, and Multiplier for DSI Interface" on page 581	128

Remark

Refer to "Appendix J: Word Length, Sampling Rate, and Multiplier for DSI Interface" on page 581 for the range of multiplier that can be set with different DSI word length and sampling rate.

Examples

The following command sets the multiplier to 256.

`OUTP:DIG:DSI:MCLK:MULT 256`

The following query returns the multiplier value.

`OUTP:DIG:DSI:MCLK:MULT?`

Typical response: `256`

OUTPut:DIGital:DSI:MCLK:RATE?

Syntax

`OUTPut:DIGital:DSI:MCLK:RATE?`

Description

Queries the master clock rate.

Examples

The following query returns the master clock rate.

`OUTP:DIG:DSI:MCLK:RATE?`

Typical response: `6.144000E+06`

OUTPut:DIGital:DSI:BCLK:SYNC:OUT

Syntax

`OUTPut:DIGital:DSI:BCLK:SYNC:OUT <polarity>`

`OUTPut:DIGital:DSI:BCLK:SYNC:OUT?`

Description

Sets the leading edge of the data to be synchronized to the rising edge or falling edge of the bit clock that is set to Out for the digital generator. The query returns the bit clock sync polarity type.

Parameter

Item	Type	Range of values	Default value
polarity	Discrete	RISing or FALLing	RISing

Examples

The following command sets the polarity to the falling edge.

```
OUTP:DIG:DSI:BCLK:SYNC:OUT FALL
```

The following query returns the bit clock sync polarity type.

```
OUTP:DIG:DSI:BCLK:SYNC:OUT?
```

Typical response: FALL

OUTPut:DIGital:OPTical:STATe

Syntax

```
OUTPut:DIGital:OPTical:STATe <state>
```

```
OUTPut:DIGital:OPTical:STATe?
```

Description

Enables or disables the optical output for digital generator. The query returns the optical output state as 0 if the optical output state is OFF, or 1 if the optical output state is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	OFF(0) or ON(1)	OFF

Examples

The following command enables the optical output.

```
OUTP:DIG:OPT:STAT ON
```

The following query returns the optical output state.

```
OUTP:DIG:OPT:STAT?
```

Typical response: 1

OUTPut:DIGital:RCLK:SOURce

Syntax

`OUTPut:DIGital:RCLK:SOURce <source>`

`OUTPut:DIGital:RCLK:SOURce?`

Description

Sets the system clock reference source type. The query returns the system clock reference source type.

`INTernal`	Internal clock
`EXTernal`	External clock
`AESRclock`	Recovered clock from AES3/SPDIF interface input

Parameter

Item	Type	Range of values	Default value
source	Discrete	INTernal, EXTernal, or AESRclock	INTernal

Examples

The following command sets the system clock reference source type to external clock.

`OUTP:DIG:RCLK:SOUR EXT`

The following query returns the system clock reference source type.

`OUTP:DIG:RCLK:SOUR?`

Typical response: `EXT`

OUTPut:DIGital:RCLK:EXTernal[:TYPE]

Syntax

`OUTPut:DIGital:RCLK:EXTernal[:TYPE] <type>`

`OUTPut:DIGital:RCLK:EXTernal[:TYPE]?`

Description

Sets the external clock source type. The query returns the external clock source type.

MCLK	Master clock in
FSYNc	Frame sync in

Parameter

Item	Type	Range of values	Default value
type	Discrete	MCLK or FSYNc	MCLK

Examples

The following command sets the external clock source type to frame sync in.

`OUTP:DIG:RCLK:EXT FSYN`

The following query returns the external clock type.

`OUTP:DIG:RCLK:EXT?`

Typical response: `FSYN`

OUTPut:DIGital:RCLK:EXTernal:MCLK:WLENgth

Syntax

```
OUTPut:DIGital:RCLK:EXTernal:MCLK:WLENgth
<length>
```

```
OUTPut:DIGital:RCLK:EXTernal:MCLK:WLENgth?
```

Description

Sets the word length of the master clock for the external clock source. The query returns the word length.

Parameter

Item	Type	Range of values	Default value
length	Numeric	8 to 32	32

Remarks

- Refer to "Appendix K: Word Length, Sampling Rate, and Multiplier for Master Clock In" on page 588 for the range of word length that can be set with different master clock in multiplier and sampling rate.
- When setting the word length, the error message, **–221,"Settings conflict..."** may be generated. This error message can be ignored as this is to notify that the word length or multiplier is auto adjusted to the nearest allowable value due to the settings conflict.

Examples

The following command sets the word length to 20 bits.

```
OUTP:DIG:RCLK:EXT:MCLK:WLEN 20
```

The following query returns the word length.

```
OUTP:DIG:RCLK:EXT:MCLK:WLEN?
```

Typical response: `20`

OUTPut:DIGital:RCLK:EXTernal:MCLK:MULTiplier

Syntax

```
OUTPut:DIGital:RCLK:EXTernal:MCLK:MULTiplier
<multiplier>
```

```
OUTPut:DIGital:RCLK:EXTernal:MCLK:MULTiplier?
```

Description

Sets the multiplier of the master clock for the external clock source. The query returns the multiplier value.

Parameter

Item	Type	Range of values	Default value
multiplier	Numeric	Refer to "Appendix K: Word Length, Sampling Rate, and Multiplier for Master Clock In" on page 588	128

Remark

Refer to "Appendix K: Word Length, Sampling Rate, and Multiplier for Master Clock In" on page 588 for the range of multiplier that can be set with different master clock in word length and sampling rate.

Examples

The following command sets the multiplier to 512.

```
OUTP:DIG:RCLK:EXT:MCLK:MULT 512
```

The following query returns the multiplier value.

```
OUTP:DIG:RCLK:EXT:MCLK:MULT?
```

Typical response: `512`

OUTPut:DIGital:SCLK:OUT:STATe

Syntax

```
OUTPut:DIGital:SCLK:OUT:STATe <state>
```

```
OUTPut:DIGital:SCLK:OUT:STATe?
```

Description

Enables or disables the sync clock output for digital generator. The query returns the sync clock output state as `0` if the sync clock output state is `OFF`, or `1` if the sync clock output state is `ON`.

Parameter

Item	Type	Range of values	Default value
state	Boolean	OFF(0) or ON(1)	OFF

Examples

The following command disables the sync clock output.

```
OUTP:DIG:SCLK:OUT:STAT OFF
```

The following query returns the sync clock output state.

```
OUTP:DIG:SCLK:OUT:STAT?
```

Typical response: `0`

OUTPut:DIGital:SCLK:OUT:SOURce

Syntax

`OUTPut:DIGital:SCLK:OUT:SOURce <source>`

`OUTPut:DIGital:SCLK:OUT:SOURce?`

Description

Sets the sync clock source type. The query returns the sync clock source type.

`INTernal`	Internal clock
`EXTernal`	External clock
`AESRclock`	Recovered clock from AES3/SPDIF interface input

Parameter

Item	Type	Range of values	Default value
source	Discrete	INTernal, EXTernal, or AESRclock	INTernal

Examples

The following command sets the sync clock source type to external clock.

`OUTP:DIG:SCLK:OUT:SOUR EXT`

The following query returns the sync clock source type.

`OUTP:DIG:SCLK:OUT:SOUR?`

Typical response: `EXT`

OUTPut:DIGital:SCLK:OUT:DIVider

Syntax

`OUTPut:DIGital:SCLK:OUT:DIVider <divider>`

`OUTPut:DIGital:SCLK:OUT:DIVider?`

Description

Sets the sync clock divider. The query returns the sync clock divider.

`D1`	Divide by 1
`D128`	Divide by 128

Parameter

Item	Type	Range of values	Default value
divider	Discrete	D1 or D128	D1

Examples

The following command sets the sync clock divider to 128.

`OUTP:DIG:SCLK:OUT:DIV D128`

The following query returns the sync clock divider.

`OUTP:DIG:SCLK:OUT:DIV?`

Typical response: `D128`

Input Subsystem

The Input subsystem provides the commands to program the U8903A analyzer input configuration.

INPut:TYPE

Syntax

```
INPut:TYPE <type>, (@<channel list>)
```

```
INPut:TYPE? (@<channel list>)
```

Description

Sets the input connection for the specified channel(s). The query returns the input connection type of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
type	Discrete	BALanced or UNBalanced	UNBalanced
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Examples

The following commands set the analyzer input connections for channel 1 and 2 to Unbalanced and Balanced respectively.

```
INP:TYPE UNB, (@1)
```

```
INP:TYPE BAL, (@2)
```

The following query returns the input connection types of channel 1 and 2.

```
INP:TYPE? (@1,2)
```

Typical response: `UNB,BAL`

INPut:COUPling

Syntax

```
INPut:COUPling <coupling>, (@<channel list>)
INPut:COUPling? (@<channel list>)
```

Description

Sets the analyzer AC or DC coupling for the specified channel(s). The DC coupling allows both AC and DC input signals to pass through to the measurement circuitry. The AC coupling blocks the DC component of the input signal. The query returns the input coupling type of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
coupling	Discrete	AC or DC	AC
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

Ensure that the measurement function is not set to VDC (`SENSe:FUNCtion` command) when you are trying to set the AC coupling. Else, the measurement function will be automatically changed to default.

Examples

The following commands set the input coupling types for channel 1 and 2 to AC and DC respectively.

```
INP:COUP AC, (@1)
```

```
INP:COUP DC, (@2)
```

The following query returns the input coupling types of channel 1 and 2.

```
INP:TYPE? (@1,2)
```

Typical response: `AC,DC`

INPut:BANDwidth

Syntax

```
INPut:BANDwidth <bandwidth>
INPut:BANDwidth?
```

Description

Sets the analyzer measurement bandwidth. The query returns the measurement bandwidth type.

Parameter

Item	Type	Range of values	Default value
bandwidth	Discrete	HIGH or LOW • HIGH: 312.5 kHz • LOW: 78.125 kHz	LOW

Remark

The selected measurement bandwidth applies to all channels.

Examples

The following command sets the High measurement bandwidth.

```
INP:BAND HIGH
```

The following query returns the measurement bandwidth type.

```
INP:BAND?
```

Typical response: `HIGH`

INPut:DIGital:TYPE

Syntax

```
INPut:DIGital:TYPE <type>
INPut:DIGital:TYPE?
```

Description

Sets the digital analyzer input connection. The query returns the digital analyzer input connection type.

`BALanced`	Balanced or differential input
`UNBalanced`	Unbalanced with respect to ground
`OPTical`	Optical connector (TOSLINK)
`DSI`	Digital Serial Interface

Parameter

Item	Type	Range of values	Default value
type	Discrete	BALanced, UNBalanced, OPTical, or DSI	UNBalanced

Examples

The following command sets the digital analyzer input connection to Optical.

```
INP:DIG:TYPE OPT
```

The following query returns the digital analyzer input connection type.

```
INP:DIG:TYPE?
```

Typical response: `OPT`

INPut:DIGital:SRATe?

Syntax

```
INPut:DIGital:SRATe?
```

Description

Queries the sampling rate of the digital analyzer input signals.

Remark

The command `INITiate[:IMMediate]:DIGital:ANALyzer` or `INITiate:CONTinue:DIGital:ANALyzer` must be sent prior to sending this command.

Examples

The following query returns the sampling rate of the digital analyzer input signal.

```
INP:DIG:SRAT?
```

Typical response: `4.800000E+01`

INPut:DIGital:IMPedance:BALanced

Syntax

`INPut:DIGital:IMPedance:BALanced <impedance>`

`INPut:DIGital:IMPedance:BALanced?`

Description

Sets the impedance of the digital analyzer balanced input connection. The query returns the impedance value.

`HIZ`	High impedance
`R110`	Low impedance of 110 Ω for balanced input type

Parameter

Item	Type	Range of values	Default value
impedance	Discrete	HIZ or R110	R110

Examples

The following command sets the impedance of the digital analyzer balanced input connection to 110 Ω.

`INP:DIG:IMP:BAL R110`

The following query returns the impedance value.

`INP:DIG:IMP:BAL?`

Typical response: `R110`

INPut:DIGital:IMPedance:UNBalanced

Syntax

`INPut:DIGital:IMPedance:UNBalanced <impedance>`

`INPut:DIGital:IMPedance:UNBalanced?`

Description

Sets the impedance of the digital analyzer unbalanced input connection. The query returns the impedance value.

HIZ	High impedance
R75	Low impedance of 75 Ω for unbalanced input type

Parameter

Item	Type	Range of values	Default value
impedance	Discrete	HIZ or R75	R75

Examples

The following command sets the impedance of the digital analyzer unbalanced input connection to 75 Ω.

`INP:DIG:IMP:UNB R75`

The following query returns the impedance value.

`INP:DIG:IMP:UNB?`

Typical response: `R75`

INPut:DIGital:AES:AUDio[:DECoding]:FORMat

Syntax

INPut:DIGital:AES:AUDio[:DECoding]:FORMat <format>

INPut:DIGital:AES:AUDio[:DECoding]:FORMat?

Description

Sets the audio decoding format of the embedded AES3/SPDIF interface audio signals. The query returns the audio decoding format.

LPCM	Linear Pulse Code Modulation
ULAW	μ-Law decoding format
ALAW	A-Law decoding format

Parameter

Item	Type	Range of values	Default value
format	Discrete	LPCM, ULAW, or ALAW	LPCM

Examples

The following command sets the decoding format of the AES3/SPDIF interface to A-Law.

INP:DIG:AES:AUD:FORM ALAW

The following query returns the decoding format.

INP:DIG:AES:AUD:FORM?

Typical response: ALAW

INPut:DIGital:AES:AUDio:RESolution

Syntax

```
INPut:DIGital:AES:AUDio:RESolution <resolution>
```

```
INPut:DIGital:AES:AUDio:RESolution?
```

Description

Sets the audio resolution or bit depth for the AES3/SPDIF interface audio data to be analyzed. The query returns the audio resolution.

Parameter

Item	Type	Range of values	Default value
resolution	Numeric	8 to 24	24

Remarks

- If the audio resolution value matches or exceeds the resolution of the incoming digital signal, the signal is passed on.
- If the audio resolution value is lower than the resolution of the incoming digital signal, the signal is truncated at the least significant bit (LSB).

Examples

The following command sets the audio resolution to 20 bits.

```
INP:DIG:AES:AUD:RES 20
```

The following query returns the audio resolution.

```
INP:DIG:AES:AUD:RES?
```

Typical response: `20`

INPut:DIGital:DSI:VOLTage

Syntax

`INPut:DIGital:DSI:VOLTage <level>`

`INPut:DIGital:DSI:VOLTage?`

Description

Sets the input logic level of the incoming signal for the DSI interface. The query returns the input logic level of the DSI interface.

Parameter

Item	Type	Range of values	Default value
level	Numeric	1.2 to 3.3 Vpp	2.5 Vpp

Examples

The following command sets the input logic level to 1.5 Vpp.

`INP:DIG:DSI:VOLT 1.5`

The following query returns the input logic level.

`INP:DIG:DSI:VOLT?`

Typical response: `1.500000E+00`

INPut:DIGital:DSI:AUDio[:DECoding]:FORMat

Syntax

```
INPut:DIGital:DSI:AUDio[:DECoding]:FORMat
<format>
```

```
INPut:DIGital:DSI:AUDio[:DECoding]:FORMat?
```

Description

Sets the audio decoding format of the embedded DSI interface audio signals. The query returns the audio decoding format.

LPCM	Linear Pulse Code Modulation
ULAW	µ-Law decoding format
ALAW	A-Law decoding format

Parameter

Item	Type	Range of values	Default value
format	Discrete	LPCM, ULAW, or ALAW	LPCM

Examples

The following command sets the decoding format of the DSI interface to A-Law.

```
INP:DIG:DSI:AUD:FORM ALAW
```

The following query returns the decoding format.

```
INP:DIG:DSI:AUD:FORM?
```

Typical response: `ALAW`

INPut:DIGital:DSI:AUDio:RESolution

Syntax

```
INPut:DIGital:DSI:AUDio:RESolution <resolution>
```

```
INPut:DIGital:DSI:AUDio:RESolution?
```

Description

Sets the audio resolution or bit depth for the DSI interface audio data to be analyzed. The query returns the audio resolution.

Parameter

Item	Type	Range of values	Default value
resolution	Numeric	8 to 24	24

Remarks

- If the audio resolution value matches or exceeds the resolution of the incoming digital signal, the signal is passed on.
- If the audio resolution value is lower than the resolution of the incoming digital signal, the signal is truncated at the least significant bit (LSB).

Examples

The following command sets the audio resolution to 20 bits.

```
INP:DIG:DSI:AUD:RES 20
```

The following query returns the audio resolution.

```
INP:DIG:DSI:AUD:RES?
```

Typical response: `20`

INPut:DIGital:DSI:AUDio:WLENgth

Syntax

```
INPut:DIGital:DSI:AUDio:WLENgth <length>
```

```
INPut:DIGital:DSI:AUDio:WLENgth?
```

Description

Sets the word length for the DSI interface. The query returns the word length.

Parameter

Item	Type	Range of values	Default value
length	Numeric	8 to 32	32

Examples

The following command sets the word length to 20 bits.

```
INP:DIG:DSI:AUD:WLEN 20
```

The following query returns the word length.

```
INP:DIG:DSI:AUD:WLEN?
```

Typical response: `20`

INPut:DIGital:DSI:MCLK:SOURce

Syntax

`INPut:DIGital:DSI:MCLK:SOURce <source>`

`INPut:DIGital:DSI:MCLK:SOURce?`

Description

Sets the master clock reference source type. The query returns the master clock reference source type.

`INTernal`	Set the internal clock as the master clock
`EXTernal`	Use the external clock as the master clock

Parameter

Item	Type	Range of values	Default value
source	Discrete	INTernal or EXTernal	EXTernal

Examples

The following command sets the internal clock as the master clock.

`INP:DIG:DSI:MCLK:SOUR INT`

The following query returns the master clock reference source type.

`INP:DIG:DSI:MCLK:SOUR?`

Typical response: `INT`

INPut:DIGital:DSI:WBCLk:DIRection

Syntax

```
INPut:DIGital:DSI:WBCLk:DIRection <direction>
```

```
INPut:DIGital:DSI:WBCLk:DIRection?
```

Description

Sets the word clock and bit clock direction. The query returns the word clock and bit clock direction.

Parameter

Item	Type	Range of values	Default value
direction	Discrete	IN or OUT	IN

Examples

The following command sets the word clock and bit clock direction to IN.

```
INP:DIG:DSI:WBCL:DIR IN
```

The following query returns the word clock and bit clock direction.

```
INP:DIG:DSI:WBCL:DIR?
```

Typical response: `IN`

INPut:DIGital:DSI:MCLK:MULTiplier

Syntax

```
INPut:DIGital:DSI:MCLK:MULTiplier <multiplier>
```

```
INPut:DIGital:DSI:MCLK:MULTiplier?
```

Description

Sets the master clock multiplier. The query returns the multiplier value.

Parameter

Item	Type	Range of values	Default value
multiplier	Numeric	Refer to "Appendix J: Word Length, Sampling Rate, and Multiplier for DSI Interface" on page 581	–

Remarks

- If the `INPut:DIGital:DSI:MCLK:SOURce` is set to `INTernal`, refer to "Appendix J: Word Length, Sampling Rate, and Multiplier for DSI Interface" on page 581 for the range of multiplier that can be set with different DSI word length and sampling rate.
- If the `INPut:DIGital:DSI:MCLK:SOURce` is set to `EXTernal`, the multiplier can be set to any value depending on the external master clock rate.
- Master clock rate is obtained by multiplying the sample rate with the multiplier.

Examples

The following command sets the multiplier to 256.

```
INP:DIG:DSI:MCLK:MULT 256
```

The following query returns the multiplier value.

```
INP:DIG:DSI:MCLK:MULT?
```

Typical response: `256`

INPut:DIGital:DSI:BCLK:SYNC

Syntax

```
INPut:DIGital:DSI:BCLK:SYNC <polarity>
INPut:DIGital:DSI:BCLK:SYNC?
```

Description

Sets the leading edge of the data to be synchronized to the rising edge or falling edge of the bit clock. The query returns the bit clock sync polarity type.

Parameter

Item	Type	Range of values	Default value
polarity	Discrete	RISing or FALLing	RISing

Examples

The following command sets the polarity to the falling edge.

```
INP:DIG:DSI:BCLK:SYNC:OUT FALL
```

The following query returns the bit clock sync polarity type.

```
INP:DIG:DSI:BCLK:SYNC:OUT?
```

Typical response: `FALL`

INPut:DIGital:DSI:DATA:FORMat

Syntax

`INPut:DIGital:DSI:DATA:FORMat <format>`

`INPut:DIGital:DSI:DATA:FORMat?`

Description

Sets the format for the DSI interface audio data to be analyzed. The query returns the format for the DSI interface audio data.

`LEFT`	Left justified. The active data bits are filled to the left edge of the data word.
`RIGHt`	Right justified. The active data bits are filled to the right edge of the data word.
`I2S`	I2S format. The word clock is low for the first channel (left channel) and high for the second channel (right channel)
`DSP`	The period of the word clock is only 1 bit of the bit clock and the data is 1 bit clock delay from the beginning of the word clock.

Parameter

Item	Type	Range of values	Default value
format	Discrete	LEFT, RIGHt, I2S, or DSP	LEFT

Examples

The following command sets the DSI data format to I2S.

`INP:DIG:DSI:DATA:FORM I2S`

The following query returns the DSI data format.

`INP:DIG:DSI:DATA:FORM?`

Typical response: `I2S`

INPut:DIGital:DSI:DATA:MSB:PADDing

Syntax

INPut:DIGital:DSI:DATA:MSB:PADDing <bits>

INPut:DIGital:DSI:DATA:MSB:PADDing?

Description

Sets the number of padding bits in front of the most significant bit (MSB). The query returns the number of padding bits.

Parameter

Item	Type	Range of values	Default value
bits	Numeric	0 to 32 bits	0

Examples

The following command sets the number of padding bits to 3 bits.

```
INP:DIG:DSI:DATA:MSB:PADD 3
```

The following query returns the number of padding bits.

```
INP:DIG:DSI:DATA:MSB:PADD?
```

Typical response: 3

INPut:DIGital:FREQuency:SCALing

Syntax

```
INPut:DIGital:FREQuency:SCALing <scaling>,
(@<channel list>)
```

```
INPut:DIGital:FREQuency:SCALing?
(@<channel list>)
```

Description

Sets the reference sampling rate source to scale the frequency measurement for the specified channel(s). The query returns the frequency scaling source.

`MISR`	Measured input sampling rate
`CUSTom`	Custom reference sampling rate

Parameters

Item	Type	Range of values	Default value
scaling	Numeric	MISR or CUSTom	MISR
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

When the reference sampling rate source is set to custom, the value set at `INPut:DIGital:REFerence:SRATe` will be used as the reference sampling rate.

Examples

The following command sets the reference sampling rate source for channel 1 to measured input sampling rate.

```
INP:DIG:FREQ:SCAL MISR, (@D1)
```

The following query returns the frequency scaling source for channel 1.

```
INP:DIG:FREQ:SCAL? (@D1)
```

Typical response: `MISR`

INPut:DIGital:REFerence:SRATe

Syntax

```
INPut:DIGital:REFerence:SRATe <sampling
rate>[<unit>], (@<channel list>)
```

```
INPut:DIGital:REFerence:SRATe? (@<channel list>)
```

Description

Sets the reference sampling rate for the specified channel(s). The query returns the reference sampling rate.

Parameters

Item	Type	Range of values	Default value
sampling rate	Numeric	–	48000
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remark

You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.

Examples

The following command sets the reference sampling rate for channel 1 to 48 kHz.

```
INP:DIG:REF:SRAT 48000 (@D1)
```

The following query returns the reference sampling rate of channel 1.

```
INP:DIG:REF:SRAT? (@D1)
```

Typical response: `4.800000E+04`

Source Subsystem

The Source subsystem provides the commands to select the waveform type and configure the generator parameters.

SOURce:FUNCtion

Syntax

```
SOURce:FUNCtion <waveform type>,
(@<channel list>)
SOURce:FUNCtion? (@<channel list>)
```

Description

Sets the analog generator waveform type for the specified channel(s). The query returns the waveform type of the selected channel(s). Multiple responses are separated by commas.

The waveform types with their corresponding `<waveform type>` parameters are listed as follows.

SINE	Sine waveform
VPHase	Variable phase waveform
DUAL	Dual waveform
SMPTe11	SMPTE IMD 1 to 1 waveform
SMPTe41	SMPTE IMD 4 to 1 waveform
SMPTe101	SMPTE IMD 10 to 1 waveform
DFDiec118	DFD IEC 60118 waveform
DFDiec268	DFD IEC 60268 waveform
WGAussian	Gaussian PDF white noise signal
WRECtangular	Rectangular PDF white noise signal
DC	DC signal
MULTitone	Multitone waveform

`SQUare`	Square waveform
`ARBitrary`	Arbitrary waveform

Parameters

Item	Type	Range of values	Default value
waveform type	Discrete	SINE, VPHase, DUAL, SMPTe11, SMPTe41, SMPTe101, DFDiec118, DFDiec268, WGAussian, WRECtangular, DC, MULTitone, SQUare, or ARBitrary	SINE
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- If you change the waveform type, the particular parameter values of the previous waveform will be set to the default values of the current waveform.
- Selecting the variable phase waveform on a selected channel will change the waveform type for all channels to variable phase.
- Refer to "Appendix C: Waveform Parameters" on page 559 for the configurable parameters of the corresponding waveform types.

Examples

The following commands set the waveform types for channel 1 and 2 to Sine and Square respectively.

```
SOUR:FUNC SINE, (@1)
```

```
SOUR:FUNC SQU, (@2)
```

The following query returns the waveform types of channel 1 and 2.

```
SOUR:FUNC? (@1,2)
```

Typical response: `SINE,SQU`

SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet

Syntax

```
SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet
<voltage>[<unit>], (@<channel list>)
```

```
SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet?
(@<channel list>)
```

Description

Sets the signal DC offset level in V for the specified channel(s). The query returns the DC offset of the selected channel(s) in V. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
voltage	Numeric	±11.3 V	0 V
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- The DC offset is not applicable for the square, DC, and variable phase waveform types.
- The DC offset is dependent on the amplitude of the signal to be generated for a particular channel. When the DC offset and amplitude are added together, it must not exceed the maximum voltage. The relationship between the amplitude in Vp and DC offset is as follows.

  $$Vp \leq Vmax - |Voffset|$$

  where Vmax is the maximum voltage of the output connector. For the Balanced output connection, the maximum voltage is 22.6 Vp, while for Unbalanced and Common, the maximum voltage is 11.3 Vp.

- If the specified DC offset is invalid, the generator will automatically adjust it to the maximum DC offset allowed with the specified amplitude. The **–222,"Data out of range"** error will be generated and the DC offset will be adjusted as described.
- You can also include a multiplier for the unit, for example, mV. The 'm' is the multiplier for the unit V.

Examples

The following commands set the DC offset for channel 1 and 2 to 1 V and 3.1 V respectively.

```
SOUR:VOLT:OFFS 1, (@1)
```

```
SOUR:VOLT:OFFS 3.1, (@2)
```

The following query returns the DC offset values of channel 1 and 2 in V.

```
SOUR:VOLT:OFFS? (@1,2)
```

Typical response: `1.000000E+00,3.100000E+00`

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]

Syntax

```
SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]
<voltage>[<unit>], (@<channel list>)
```

```
SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]?
(@<channel list>)
```

Description

Sets the signal amplitude level for the specified channel(s). The query returns the amplitude of the selected channel(s) in Vrms. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
voltage	Numeric	Refer to "Appendix D: Analog Waveform Amplitude Range" on page 563	0 Vrms
unit	Discrete	• V (for the DC signal) • Vrms, Vpp, Vp, dBV, dBm, or dBu (for other waveform types)	Vrms
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- The amplitude is dependent on the DC offset of the signal to be generated for a particular channel. When the DC offset and amplitude are added together, it must not exceed the maximum voltage. The relationship between the amplitude in Vp and DC offset is as follows.

  $$Vp \leq Vmax - |Voffset|$$

  where Vmax is the maximum voltage of the output connector. For the Balanced output connection, the maximum voltage is 22.6 Vp, while for Unbalanced and Common, the maximum voltage is 11.3 Vp.
- This command is used to set the amplitude of the composite signal if the dual waveform is selected using the `SOURce:FUNCtion` command. Use the `SOURce:VOLTage:RATio` command to set the amplitude ratio of the second component over the first component.
- The allowable unit for the DC signal is only V. The **–131,"Invalid suffix"** error will be generated if other units have been selected for the DC signal.
- For all waveform types except DC, you can select either Vrms, Vpp, Vp, dBV, dBm, or dBu. The **–131,"Invalid suffix"** error will be generated if you have selected an invalid unit.

- You can also include a multiplier for the unit, for example, mVrms. The 'm' is the multiplier for the unit Vrms.
- If the amplitude setting is invalid, the analog generator will automatically adjust the amplitude to the maximum value allowed with the specified DC offset. The **–222,"Data out of range"** error will be generated and the amplitude value will be clipped to the maximum value allowed.

Examples

The following commands set the amplitude levels for channel 1 and 2 to 1 Vrms and 5 Vrms respectively.

```
SOUR:VOLT 1Vrms, (@1)
```

```
SOUR:VOLT 5Vrms, (@2)
```

The following query returns the amplitude levels of channel 1 and 2 in Vrms.

```
SOUR:VOLT? (@1,2)
```

Typical response: `1.000000E+00,5.000000E+00`

SOURce:FREQuency[<j>][:CW]

Syntax

```
SOURce:FREQuency[<j>][:CW] <frequency>[<unit>],
(@<channel list>)
```

```
SOURce:FREQuency[<j>][:CW]? (@<channel list>)
```

Description

Sets the signal frequency for the specified channel(s) in Hz. The query returns the frequency of the selected channel(s) in Hz. Multiple responses are separated by commas.

Parameter

Item	Type	Range of values	Default value
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Refer to “Appendix A: Waveform Frequency Range and Default Values” on page 552 for the <frequency> parameter.

Remarks

- The <j> parameter represents 1 or 2.
  - For backward compatibility, `SOURce:FREQuency1` can also be used to set the lower frequency and `SOURce:FREQuency2` can also be used to set the upper frequency.
  - For the SMPTE IMD 1:1, 4:1, and 10:1 waveforms, `SOURce:FREQuency:LOWer` represents the lower frequency while `SOURce:FREQuency:UPPer` represents the upper frequency.
  - For the dual waveform, `SOURce:FREQuency1` represents the frequency of the first sine component while `SOURce:FREQuency2` represents the frequency of the second sine component.
  - For the DFD IEC 60118 waveform, use `SOURce:FREQuency:UPPer` to set the upper frequency and the `SOURce:FREQuency:DIFFerence` command to set the frequency difference.
  - For the DFD IEC 60268 waveform, use the `SOURce:FREQuency:DIFFerence` command to set the frequency difference and the `SOURce:FREQuency:CENTer` command to set the center frequency.
- The frequency setting is not applicable for the DC, noise, multitone, and arbitrary waveforms.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.

Examples

The following commands set the sine waveform frequency for channel 1 and square waveform frequency for channel 2 to 1 kHz and 5 kHz respectively.

```
SOUR:FREQ1 1000, (@1)
```

```
SOUR:FREQ1 5000, (@2)
```

The following query returns the frequency values of channel 1 and 2 in Hz.

```
SOUR:FREQ1? (@1,2)
```

Typical response: `1.000000E+03,5.000000E+03`

SOURce:FREQuency:CENTer

Syntax

```
SOURce:FREQuency:CENTer <frequency>[<unit>],
(@<channel list>)
```

```
SOURce:FREQuency:CENTer? (@<channel list>)
```

Description

Sets the center frequency of the DFD IEC 60268 waveform for the specified channel(s) in Hz. The center frequency determines the frequency for the two tones of the DFD IEC 60268 signal are spaced in equal increments above and below. The query returns the center frequency value of the selected channel(s) in Hz. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	3 kHz to 79 kHz	10 kHz
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the DFD IEC 60268 waveform. Use the `SOURce:FUNCtion` command to select the DFD IEC 60268 waveform type.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.

Examples

The following commands set the center frequencies for channel 1 and 2 to 1 kHz and 5 kHz respectively.

```
SOUR:FREQ:CENT 1kHz, (@1)
```

```
SOUR:FREQ:CENT 5kHz, (@2)
```

The following query returns the center frequency values of channel 1 and 2 in Hz.

```
SOUR:FREQ:CENT? (@1,2)
```

Typical response: `1.000000E+03,5.000000E+03`

SOURce:FREQuency:DIFFerence

Syntax

```
SOURce:FREQuency:DIFFerence <frequency>[<unit>],
(@<channel list>)
```

```
SOURce:FREQuency:DIFFerence? (@<channel list>)
```

Description

Sets the frequency difference of the DFD IEC 60268 and DFD IEC 60118 waveforms for the specified channel(s) in Hz. The frequency difference determines the difference frequency (spacing) between the two tones of the DFD IEC 60268 and DFD IEC 60118 signals. The query returns the frequency difference of the selected channel(s) in Hz. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	80 Hz to 2 kHz	80 Hz
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the DFD IEC 60118 and DFD IEC 60268 waveforms. Use the `SOURce:FUNCtion` command to select either one of these two waveform types.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.

Examples

The following commands set the frequency difference values for channel 1 and 2 to 100 Hz and 80 Hz respectively.

```
SOUR:FREQ:DIFF 100Hz, (@1)
```

```
SOUR:FREQ:DIFF 80Hz, (@2)
```

The following query returns the frequency difference values of channel 1 and 2 in Hz.

```
SOUR:FREQ:DIFF? (@1,2)
```

Typical response: `1.000000E+02,8.000000E+01`

SOURce:FREQuency:UPPer

Syntax

```
SOURce:FREQuency:UPPer <frequency>[<unit>],
(@<channel list>)
```

```
SOURce:FREQuency:UPPer? (@<channel list>)
```

Description

Sets the upper frequency of the DFD IEC 60118, SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 waveforms for the specified channel(s) in Hz. The upper frequency determines the frequency of the higher frequency tone in the two-tone waveform. The query returns the upper frequency of the selected channel(s) in Hz. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	DFD IEC 60118 3 kHz to 80 kHz	10 Hz
		SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 2 kHz to 60 kHz	7 kHz
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the DFD IEC 60118, SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 waveforms. Use the `SOURce:FUNCtion` command to select either one of these four waveform types.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.

Examples

The following commands set the upper frequency values for channel 1 and 2 to 5 kHz and 10 kHz respectively.

```
SOUR:FREQ:UPP 5kHz, (@1)
```

```
SOUR:FREQ:UPP 10kHz, (@2)
```

The following query returns the upper frequency values of channel 1 and 2 in Hz.

```
SOUR:FREQ:UPP? (@1,2)
```

Typical response: `5.000000E+03,1.000000E+04`

SOURce:FREQuency:LOWer

Syntax

```
SOURce:FREQuency:LOWer <frequency>[<unit>],
(@<channel list>)
```

```
SOURce:FREQuency:LOWer? (@<channel list>)
```

Description

Sets the lower frequency of the SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 waveforms for the specified channel(s) in Hz. The lower frequency determines the frequency of the lower frequency tone in the two-tone waveform. The query returns the lower frequency of the selected channel(s) in Hz. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	40 Hz to 500 Hz	60 Hz
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 waveforms. Use the `SOURce:FUNCtion` command to select either one of these four waveform types.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.

Examples

The following commands set the lower frequency values for channel 1 and 2 to 100 Hz and 80 Hz respectively.

```
SOUR:FREQ:LOW 100Hz, (@1)
```

```
SOUR:FREQ:LOW 80Hz, (@2)
```

The following query returns the lower frequency values of channel 1 and 2 in Hz.

```
SOUR:FREQ:LOW? (@1,2)
```

Typical response: `1.000000E+02,8.000000E+01`

SOURce:VOLTage:RATio

Syntax

```
SOURce:VOLTage:RATio <ratio>, (@<channel list>)
```

```
SOURce:VOLTage:RATio? (@<channel list>)
```

Description

Sets the voltage ratio of the second component over the first component of the dual waveform for the specified channel(s) in percentage. The query returns the amplitude ratio of the selected channel(s) in percentage. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
ratio	Numeric	0 to 100%	100
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

This setting is only applicable for the dual waveform. Use the `SOURce:FUNCtion` command to select the dual waveform type.

Examples

The following commands set the voltage ratio values for channel 1 and 2 to 1% and 10% respectively.

```
SOUR:VOLT:RAT 1, (@1)
```

```
SOUR:VOLT:RAT 10, (@2)
```

The following query returns the voltage ratio values of channel 1 and 2 in percentage.

```
SOUR:VOLT:RAT? (@1,2)
```

Typical response: `1.000E+00,1.000E+01`

SOURce:PHASe[:ADJust]

Syntax

```
SOURce:PHASe[:ADJust] <phase>, (@<channel list>)
SOURce:PHASe[:ADJust]? (@<channel list>)
```

Description

Sets the phase of the selected channel with reference to channel 1 in degree. The query returns the phase of the selected channel(s) in degree. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
phase	Numeric	–180 ° to 179.99 °	0
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the variable phase waveform. Use the `SOURce:FUNCtion` command to select the variable phase waveform type.
- Channel 1 is used as the reference channel and will always have the value of 0 °. Therefore, this command is not applicable for channel 1.

Examples

The following command sets the phase for channel 2 to 100 ° with reference to channel 1.

```
SOUR:PHAS 100, (@2)
```

The following query returns the phase of channel 2 with reference to channel 1.

```
SOUR:PHAS? (@2)
```

Typical response: `1.000000E+02`

SOURce:REFerence:IMPedance

Syntax

```
SOURce:REFerence:IMPedance <impedance>,
(@<channel list>)
SOURce:REFerence:IMPedance? (@<channel list>)
```

Description

Sets the generator reference impedance for the specified channel(s) in ohms (Ω). The reference impedance is used to set the amplitude value in unit dBm. The query returns the generator reference impedance of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
impedance	Numeric	0 < impedance ≤ 1.0E+9	600 Ω
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Examples

The following command sets the reference impedance to 600 Ω for channel 1 and 2.

```
SENS:REF:IMP 600, (@1,2)
```

The following query returns the reference impedances for channel 1 and 2.

```
SENS:REF:IMP? (@1,2)
```

Typical response: `6.000000E+02,6.000000E+02`

SOURce:MULTitone:FREQuency:STARt

Syntax

```
SOURce:MULTitone:FREQuency:STARt
<frequency>[<unit>], (@<channel list>)
```

```
SOURce:MULTitone:FREQuency:STARt?
(@<channel list>)
```

Description

Sets the start frequency of the multitone waveform for the specified channel(s). The start frequency defines the lowest tone frequency in the multitone waveform. The query returns the start frequency of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	5 Hz to 80 kHz	1 kHz
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.

- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following command sets the start frequency value for channel 1 to 5 kHz.

```
SOUR:MULT:FREQ:STAR 5000, (@1)
```

The following query returns the start frequency value of channels 1 in Hz.

```
SOUR:MULT:FREQ:STAR? (@1)
```

Typical response: `5.000000E+03`

SOURce:MULTitone:FREQuency:STOP

Syntax

```
SOURce:MULTitone:FREQuency:STOP
<frequency>[<unit>], (@<channel list>)
```

```
SOURce:MULTitone:FREQuency:STOP?
(@<channel list>)
```

Description

Sets the stop frequency of the multitone waveform for the specified channel(s). The stop frequency defines the highest tone frequency in the multitone waveform. The query returns the stop frequency of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	5 Hz to 80 kHz	5 kHz
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.
- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following command sets the stop frequency value for channel 1 to 10 kHz.

```
SOUR:MULT:FREQ:STOP 10kHz, (@1)
```

The following query returns the stop frequency value of channels 1 in Hz.

```
SOUR:MULT:FREQ:STOP? (@1)
```

Typical response: `1.000000E+04`

SOURce:MULTitone:FREQuency:SPACing

Syntax

```
SOURce:MULTitone:FREQuency:SPACing <spacing>,
(@<channel list>)
```

```
SOURce:MULTitone:FREQuency:SPACing?
(@<channel list>)
```

Description

Sets the frequency spacing type between the start and stop frequency of the multitone waveform for the specified channel(s). The query returns the frequency spacing type of the selected channel(s). Multiple responses are separated by commas.

LINear	Linear frequency spacing
LOG	Logarithmic frequency spacing

Parameters

Item	Type	Range of values	Default value
spacing	Discrete	LINear or LOG	LINear
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.
- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following command sets the frequency spacing for channel 1 to Log.

```
SOUR:MULT:FREQ:SPAC LOG, (@1)
```

The following query returns the frequency spacing type of channel 1.

```
SOUR:MULT:FREQ:SPAC? (@1)
```

Typical response: LOG

SOURce:MULTitone:COUNt

Syntax

```
SOURce:MULTitone:COUNt <tone count>,
(@<channel list>)
```

```
SOURce:MULTitone:COUNt? (@<channel list>)
```

Description

Sets the tones of the multitone waveform for the specified channel(s). Tones refer to the number of signal frequency components. The query returns the number of tones of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
tone count	Numeric	1 to 64	5
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.
- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following commands set the tones for channel 1 and 2 to 3 and 15 respectively.

```
SOUR:MULT:COUN 3, (@1)
```

```
SOUR:MULT:COUN 15, (@2)
```

The following query returns the number of tones of channel 1 and 2.

```
SOUR:MULT:COUN? (@1,2)
```

Typical response: `3,15`

SOURce:MULTitone:WLEN

Syntax

```
SOURce:MULTitone:WLEN <length>,
(@<channel list>)
```

```
SOURce:MULTitone:WLEN? (@<channel list>)
```

Description

Sets the waveform length of the multitone waveform for the specified channel(s). The waveform length determines the number of samples used to create one iteration of the multitone waveform. Longer waveform length provides higher frequency resolution but take more time in generation and processing. The query returns the waveform length of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
length	Discrete	L256, L512, L1024, L2048, L4096, L8192, L16384, or L32768	L1024
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.
- The waveform length value must be less than or equal to the record length.
- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following command sets the waveform length for channel 1 to 2048 points.

```
SOUR:MULT:WLEN L2048, (@1)
```

The following query returns the waveform length of channel 1.

```
SOUR:MULT:WLEN? (@1)
```

Typical response: `L2048`

SOURce:MULTitone:RLEN

Syntax

```
SOURce:MULTitone:RLEN <length>,
(@<channel list>)
```

```
SOURce:MULTitone:RLEN? (@<channel list>)
```

Description

Sets the record length of the multitone waveform for the specified channel(s). The record length determines the number of samples created for one channel in the .arb output file. The output file may contain multiple iterations of the multitone waveform. The record length value is normally set to the same value as the waveform length. The query returns the record length of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
length	Discrete	L256, L512, L1024, L2048, L4096, L8192, L16384, or L32768	L2048
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.
- The record length value must be greater than or equal to the record length.
- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following command sets the record length for channel 1 to 4096 points.

```
SOUR:MULT:RLEN L4096, (@1)
```

The following query returns the record length of channel 1.

```
SOUR:MULT:RLEN? (@1)
```

Typical response: `L4096`

SOURce:MULTitone:CRESt?

Syntax

```
SOURce:MULTitone:CRESt? (@<channel list>)
```

Description

Queries the crest factor of the multitone waveform for the selected channel(s). Multiple responses are separated by commas.

Parameter

Item	Type	Range of values	Default value
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.

Examples

The following query returns the crest factor of multitone waveform for channel 1.

```
SOUR:MULT:CRESt? (@1)
```

Typical response: `1.4142000E+0`

SOURce:MULTitone:TONE:CLEar

Syntax

```
SOURce:MULTitone:TONE:CLEar (@<channel list>)
```

Description

Clears all the tones of the multitone waveform for the specified channel(s).

Parameter

Item	Type	Range of values	Default value
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.
- After all the tones are cleared, an initial tone with 1 kHz frequency, 0 dBV amplitude, and 0 ° will be the default.

Examples

The following command clears all the tones of the multitone waveform for channel 1.

```
SOUR:MULT:TONE:CLE (@1)
```

SOURce:MULTitone:TONE:ADD

Syntax

```
SOURce:MULTitone:TONE:ADD <index>,
<frequency>[<unit>], <voltage>[<unit>], <phase>,
(@<channel list>)
```

Description

Adds a customized tone into the multitone waveform for the specified channel(s).

Parameters

Item	Type	Range of values	Default value
index	Numeric	0 to 63	0
frequency	Numeric	5 Hz to 80 kHz	1 kHz
voltage	Numeric	Unbalanced 0 to 8 Vrms (0 to 11.3 Vp) Balanced 0 to 16 Vrms (0 to 22.6 Vp)	1 Vrms
phase	Numeric	–180 ~ 179.99	0
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.
- This command will add a customized tone into the existing multitone waveform. The position of the added tone will be determined by the index. The index must be less than the total number of tones.

- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following command adds a 5 kHz frequency, 0.5 Vrms voltage, and 80 ° phase tone to the current multitone waveform for channel 1 at position 5.

```
SOUR:MULT:TONE:ADD 4, 5000, 0.5, 80, (@1)
```

SOURce:MULTitone:TONE:DELete

Syntax

```
SOURce:MULTitone:TONE:DELete <index>,
(@<channel list>)
```

Description

Deletes a specific tone from the multitone waveform for the specified channel(s).

Parameters

Item	Type	Range of values	Default value
index	Numeric	0 to 63	0
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.

- This command will delete a tone from the existing multitone waveform. The deleted tone will be determined by the index. The index must be less than the total number of tones.

Examples

The following command deletes the tone 5 of the multitone waveform for channel 1.

```
SOUR:MULT:TONE:DEL 4, (@1)
```

SOURce:MULTitone:TONE:FREQuency

Syntax

```
SOURce:MULTitone:TONE:FREQuency
<frequency>[<unit>], (<tone list>),
(@<channel list>)
```

```
SOURce:MULTitone:TONE:FREQuency? (<tone list>),
(@<channel list>)
```

Description

Sets the frequency of the tone(s) in the multitone waveform for the specified channel(s). The query returns the frequency of the tone(s) of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	5 Hz to 80 kHz	1 kHz
tone list	Discrete	One or more tones. • (1) for tone 1 • (1,2) for tone 1 and 2 • (1:10) for tone 1 through 10	Required parameter
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.
- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following command sets the frequency of the tone 5 for channel 1 to 2 kHz.

```
SOUR:MULT:TONE:FREQ 2kHz, (5), (@1)
```

The following query returns the frequency of tone 5 and tone 6 for channel 1.

```
SOUR:MULT:TONE:FREQ? (5,6), (@1)
```

Typical response: 2.000000E+03,3.000000E+03

SOURce:MULTitone:TONE:VOLTage

Syntax

```
SOURce:MULTitone:TONE:VOLTage <voltage>[<unit>],
(<tone list>), (@<channel list>)
```

```
SOURce:MULTitone:TONE:VOLTage? (<tone list>),
(@<channel list>)
```

Description

Sets the voltage of the tone(s) in the multitone waveform for the specified channel(s). The query returns the voltage of the tone(s) of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
voltage	Numeric	Unbalanced 0 to 8 Vrms (0 to 11.3 Vp) Balanced 0 to 16 Vrms (0 to 22.6 Vp)	1 Vrms
tone list	Discrete	One or more tones. • (1) for tone 1 • (1,2) for tone 1 and 2 • (1:10) for tone 1 through 10	Required parameter
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.

- You can also include a multiplier for the unit, for example, mVrms. The 'm' is the multiplier for the unit Vrms.

Examples

The following command sets the voltage of the tone 5 and tone 6 for channel 1 to 0.5 Vrms.

```
SOUR:MULT:TONE:VOLT 0.5, (5,6), (@1)
```

The following query returns the voltage of tone 5 and tone 6 for channel 1.

```
SOUR:MULT:TONE:VOLT? (5,6), (@1)
```

Typical response: 5.000000E-01,5.000000E-01

SOURce:MULTitone:TONE:PHASe

Syntax

```
SOURce:MULTitone:TONE:PHASe <phase>, (<tone list>), (@<channel list>)
```

```
SOURce:MULTitone:TONE:PHASe? (<tone list>), (@<channel list>)
```

Description

Sets the phase of the tone(s) in the multitone waveform for the specified channel(s). The query returns the phase of the tone(s) of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
phase	Numeric	180 ~ 179,99	0
tone list	Discrete	One or more tones. • (1) for tone 1 • (1,2) for tone 1 and 2 • (1:10) for tone 1 through 10	Required parameter
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.

Examples

The following command sets the phase of the tone 5 and tone 6 for channel 1 to 90°.

```
SOUR:MULT:TONE:PHAS 90, (5,6), (@1)
```

The following query returns the phase of tone 5 and tone 6 for channel 1.

```
SOUR:MULT:TONE:PHAS? (5,6), (@1)
```

Typical response: 9.000000E+01,9.000000E+01

SOURce:MULTitone:TONE:PHASe:RANDomize

Syntax

```
SOURce:MULTitone:TONE:PHASe:RANDomize
(@<channel list>)
```

Description

Randomizes the phase of all the tones in the multitone waveform for the specified channel(s).

Parameter

Item	Type	Range of values	Default value
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

This setting is only applicable for the multitone waveform. Use the `SOURce:FUNCtion` command to select the multitone waveform type.

Examples

The following command randomizes the phase of all the tones for channel 1.

```
SOUR:MULT:TONE:PHAS:RAND (@1)
```

SOURce:DIGital:FUNCtion

Syntax

```
SOURce:DIGital:FUNCtion <waveform type>
SOURce:DIGital:FUNCtion?
```

Description

Sets the digital generator waveform type. The query returns the waveform type.

The waveform types with their corresponding `<waveform type>` parameters are listed as follows.

SINE	Sine waveform
SBURst	Sine burst waveform
STEReo	Stereo waveform
VPHase	Variable phase waveform
DUAL	Dual waveform
SMPTe11	SMPTE IMD 1 to 1 waveform
SMPTe41	SMPTE IMD 4 to 1 waveform
SMPTe101	SMPTE IMD 10 to 1 waveform
DFDiec118	DFD IEC 60118 waveform
DFDiec268	DFD IEC 60268 waveform
SQUare	Square waveform
WGAussian	Gaussian statistic distribution noise signal
WRECtangular	Rectangular statistic distribution noise signal
TNOise	Triangular statistic distribution noise signal
PNOise	Pink noise
CONStant	Constant value
MONotonicity	Monotonicity
WZERo	Walking zero
WONE	Walking one

`MULTitone`	Multitone waveform
`ARBitrary`	Arbitrary waveform

Parameter

Item	Type	Range of values	Default value
waveform type	Discrete	SINE, DUAL, STEReo, SBURst, VPHase, SMPTe11, SMPTe41, SMPTe101, DFDiec118, DFDiec268, SQUare, WGAussian, WRECtagular, TNOise, PNOise, CONStant, MONotonicity, WZERo, WONE, MULTitone, or ARBitrary	SINE

Remarks

- If you change the waveform type, the particular parameter values of the previous waveform will be set to the default values of the current waveform.
- Refer to "Appendix C: Waveform Parameters" on page 559 for the configurable parameters of the corresponding waveform types.

Examples

The following command sets the waveform type to Square.

```
SOUR:DIG:FUNC SQU
```

The following query returns the waveform type.

```
SOUR:DIG:FUNC?
```

Typical response: `SQU`

SOURce:DIGital:DITHer:TYPE

Syntax

```
SOURce:DIGital:DITHer:TYPE <dither>
```

```
SOURce:DIGital:DITHer:TYPE?
```

Description

Sets the dither type of the digital generator signal. The query returns the dither type of the digital generator signal.

Parameter

Item	Type	Range of values	Default value
dither	Discrete	OFF, TRIangular, or RECTangular	OFF

Examples

The following commands set the dither type of the digital generator signal to triangular.

```
SOUR:DIG:DITH:TYPE TRI
```

The following query returns the dither type of the digital generator signal.

```
SOUR:DIG:DITH:TYPE?
```

Typical response: `TRI`

SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]

Syntax

```
SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPL
itude] <voltage>[<unit>], (@<channel list>)
```

```
SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPL
itude]? (@<channel list>)
```

Description

Sets the signal amplitude level for the specified digital channel(s). The query returns the amplitude of the selected digital channel(s) in FFS. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
voltage	Numeric	0 to 1 FFS (–1 FFS to 1 FFS for constant value)	1 FFS
unit	Discrete	Vrms, Vpp, Vp, dBV, dBu, FFS, dBFS, or pctFS	FFS
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This command is not applicable for Monotonicity, Walking One, and Walking Zero waveform types.
- The amplitude is dependent on the DC offset of the signal. When the DC offset and amplitude are added together, it must not exceed the maximum voltage of 1 FFS. The relationship between the amplitude and DC offset is as follows.
  Amplitude ≤1 FFS – |DC Offset|

- For Constant Value waveform, both channel 1 and 2 are sharing the same amplitude parameter. This means that when you change the amplitude value for channel 1, the amplitude for channel 2 will change accordingly to the same value and vice versa. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for more information.
- For Sine, Stereo, Square, noise, and Arbitrary waveforms, the amplitude values for channel 1 and 2 can be different. These waveforms are sharing the same DC offset parameter for both its channels. So, when setting the amplitude, make sure that the added value for the DC offset and amplitude do not exceed the maximum voltage of 1 FFS at both channels.
- This command is used to set the amplitude of the composite signal if the dual waveform is selected. Use the `SOURce:DIGital:VOLTage:RATio` command to set the amplitude ratio of the second component over the first component.
- If the amplitude setting is invalid, the **-222, "Data out of range"** error will be generated and the amplitude value will be clipped to the maximum value allowed.
- If Constant Value waveform is selected, the unit allowed is V, FFS, dBFS, and pctFS. The **-131,"Invalid suffix"** error will be generated if you select other units.
- You can also include a multiplier for the unit. For example, mFFS. The 'm' is the multiplier for the unit FFS.

Examples

The following command sets the amplitude level for channel 1 to 0.5 FFS.

```
SOUR:DIG:VOLT 0.5FFS, (@D1)
```

The following query returns the amplitude level of channel 1 in FFS.

```
SOUR:DIG:VOLT? (@D1)
```

Typical response: `5.000000E-01`

SOURce:DIGital:VOLTage[:LEVel][:IMMediate]:OFFSet

Syntax

```
SOURce:DIGital:VOLTage[:LEVel][:IMMediate]:
OFFSet <offset>[<unit>], (@<channel list>)
```

```
SOURce:DIGital:VOLTage[:LEVel][:IMMediate]:
OFFSet? (@<channel list>)
```

Description

Sets the signal DC offset level for the specified digital channel(s). The query returns the DC offset of the selected channel(s) in FFS. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
offset	Numeric	0 to 1 FFS	
unit	Discrete	V, FFS, dBFS, or pctFS	FFS
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This command is not applicable for Sine Burst, Variable Phase, Constant Value, Walking One, Walking Zero, and Multitone waveform.
- The DC offset parameter is channelless. This means both channel 1 and 2 will always have the same DC offset value. When a single channel is selected in the command, the setting is applied to both channel 1 and 2. Refer to “Appendix E: Relationship between Digital Waveform Parameters and Channels” on page 564 for the relationship between the DC offset and channels.

- "The DC offset is dependent on the amplitude of the signal to be generated for a particular channel. When the DC offset and amplitude are added together, it must not exceed the maximum voltage of 1 FFS. The relationship between the amplitude and DC offset is as follows. Amplitude ≤1 FFS – |DC Offset|
- For Sine, Stereo, Square, Noise, and Arbitrary waveform, the amplitude values for channel 1 and 2 can be different. Both the channels at these waveforms are sharing the same DC offset parameter. When setting the DC offset, make sure that the added value for the DC offset and amplitude do not exceed the maximum voltage of 1 FFS at both channels.
- If the DC offset setting is invalid, the **-222, "Data out of range"** error will be generated and the DC offset value will be clipped to the maximum value allowed.
- You can also include a multiplier for the unit. For example, mFFS. The 'm' is the multiplier for the unit FFS.

Examples

The following command sets the DC offset for channel 1 to 0.1 FFS.

```
SOUR:DIG:VOLT:OFFS 0.1, (@D1)
```

The following query returns the DC offset values of channel 1 in FFS.

```
SOUR:DIG:VOLT:OFFS? (@D1)
```

Typical response: `1.000000E-01`

SOURce:DIGital:VOLTage:RATio

Syntax

```
SOURce:DIGital:VOLTage:RATio <ratio>,
(@<channel list>)
```

```
SOURce:DIGital:VOLTage:RATio? (@<channel list>)
```

Description

Sets the voltage ratio of the second component over the first component of the dual waveform for the specified digital channel(s) in percentage. The query returns the amplitude ratio of the selected channel(s) in percentage. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
ratio	Numeric	0 to 100%	100
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the dual waveform. Use the `SOURce:DIGital:FUNCtion` command to select the dual waveform type.
- The ratio parameter is not dependent on the channels. This means that both channel 1 and 2 will always have the same ratio value. If you only select a single channel in the command, the setting is applied to both channel 1 and 2. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between the ratio parameter and channels.

Examples

The following command sets the voltage ratio value for channel 1 to 50%.

```
SOUR:DIG:VOLT:RAT 50, (@D1)
```

The following query returns the voltage ratio values of channel 1 in percentage.

```
SOUR:DIG:VOLT:RAT? (@D1)
```

Typical response: `5.000E+01`

SOURce:DIGital:FREQuency[<j>]

Syntax

```
SOURce:DIGital:FREQuency[<j>]
<frequency>[<unit>], (@<channel list>)
```

```
SOURce:DIGital:FREQuency[<j>]? (@<channel list>)
```

Description

Sets the signal frequency for the specified channel(s) in Hz. The query returns the frequency of the selected channel(s) in Hz. Multiple responses are separated by commas.

Parameter

Item	Type	Range of values	Default value
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Refer to "Appendix A: Waveform Frequency Range and Default Values" on page 552 for the `<frequency>` parameter.

Remarks

- The <j> parameter represents 1 or 2.
  - For the SMPTE IMD 1:1, 4:1, and 10:1 waveforms, SOURce:DIGital:FREQuency:LOWer represents the lower frequency while SOURce:DIGital:FREQuency:UPPer represents the upper frequency.
  - For the dual waveform, SOURce:DIGital:FREQuency1 represents the frequency of the first sine component while SOURce:DIGital:FREQuency2 represents the frequency of the second sine component.
  - For the DFD IEC 60118 waveform, use SOURce:DIGital:FREQuency:Upper to set the upper frequency and the SOURce:DIGital:FREQuency:DIFFerence command to set the frequency difference.
  - For the DFD IEC 60268 waveform, use the SOURce:DIGital:FREQuency:DIFFerence command to set the frequency difference and the SOURce:DIGital:FREQuency:CENTer command to set the center frequency.
- The frequency setting is not applicable for the constant value, noise, monotonicity, walking one, walking zero, multitone, and arbitrary waveforms.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.
- Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between the frequency parameter and channels.

Examples

The following command sets the sine waveform frequency for channel 1 to 5 kHz.

```
SOUR:DIG:FREQ 5000, (@D1)
```

The following query returns the frequency value of channel 1 in Hz.

```
SOUR:DIG:FREQ? (@D1)
```

Typical response: `5.000000E+03`

SOURce:DIGital:FREQuency:CENTer

Syntax

```
SOURce:DIGital:FREQuency:CENTer
<frequency>[<unit>], (@<channel list>)
```

```
SOURce:DIGital:FREQuency:CENTer?
(@<channel list>)
```

Description

Sets the center frequency of the DFD IEC 60268 waveform for the specified channel(s) in Hz. The center frequency determines the frequency for the two tones of the DFD IEC 60268 signal are spaced in equal increments above and below. The query returns the center frequency value of the selected channel(s) in Hz. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	3 kHz to 79 kHz	10 kHz
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the DFD IEC 60268 waveform. Use the `SOURce:DIGital:FUNCtion` command to select the DFD IEC 60268 waveform type.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.
- The center frequency parameter is not dependent on the channels. This means that both channel 1 and 2 will always have the same center frequency value. If you only select a single channel in the command, the setting is applied to both channel 1 and 2. Refer to “Appendix E: Relationship between Digital Waveform Parameters and Channels” on page 564 for the relationship between the center frequency parameter and channels.

Examples

The following command sets the center frequency value for channel 1 and 2 to 5 kHz.

```
SOUR:DIG:FREQ:CENT 5kHz, (@D1,D2)
```

The following query returns the center frequency values of channel 1 and 2 in Hz.

```
SOUR:DIG:FREQ:CENT? (@D1,D2)
```

Typical response: `5.000000E+03,5.000000E+03`

SOURce:DIGital:FREQuency:DIFFerence

Syntax

```
SOURce:DIGital:FREQuency:DIFFerence
<frequency>[<unit>], (@<channel list>)
```

```
SOURce:DIGital:FREQuency:DIFFerence?
(@<channel list>)
```

Description

Sets the frequency difference of the DFD IEC 60268 and DFD IEC 60118 waveforms for the specified channel(s) in Hz. The frequency difference determines the difference frequency (spacing) between the two tones of the DFD IEC 60268 and DFD IEC 60118 signals. The query returns the frequency difference of the selected channel(s) in Hz. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	80 Hz to 2 kHz	80 Hz
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the DFD IEC 60118 and DFD IEC 60268 waveforms. Use the `SOURce:DIGital:FUNCtion` command to select either one of these two waveform types.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.

- The difference frequency parameter is not dependent on the channels. This means that both channel 1 and 2 will always have the same difference frequency value. If you only select a single channel in the command, the setting is applied to both channel 1 and 2. Refer to “Appendix E: Relationship between Digital Waveform Parameters and Channels” on page 564 for the relationship between the difference frequency parameter and channels.

Examples

The following command sets the frequency difference value for channel 1 and 2 to 100 Hz.

```
SOUR:DIG:FREQ:DIFF 100Hz, (@D1,D2)
```

The following query returns the frequency difference values of channel 1 and 2 in Hz.

```
SOUR:DIG:FREQ:DIFF? (@D1,D2)
```

Typical response: `1.000000E+02,1.000000E+02`

SOURce:DIGital:FREQuency:UPPer

Syntax

```
SOURce:DIGital:FREQuency:UPPer
<frequency>[<unit>], (@<channel list>)
```

```
SOURce:DIGital:FREQuency:UPPer?
(@<channel list>)
```

Description

Sets the upper frequency of the DFD IEC 60118, SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 waveforms for the specified channel(s) in Hz. The upper frequency determines the frequency of the higher frequency tone in the two-tone waveform. The query returns the upper frequency of the selected channel(s) in Hz. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	Refer to "Appendix A: Waveform Frequency Range and Default Values" on page 552	3 kHz
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the DFD IEC 60118, SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 waveforms. Use the `SOURce:DIGital:FUNCtion` command to select either one of these four waveform types.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.
- The upper frequency parameter is not dependent on the channels. This means that both channel 1 and 2 will always have the same upper frequency value. If you only select a single channel in the command, the setting is applied to both channel 1 and 2. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between the upper frequency parameter and channels.

Examples

The following command sets the upper frequency values for channel 1 and 2 to 3 kHz.

```
SOUR:DIG:FREQ:UPP 3kHz, (@D1,D2)
```

The following query returns the upper frequency values of channel 1 and 2 in Hz.

```
SOUR:DIG:FREQ:UPP? (@D1,D2)
```

Typical response: `3.000000E+03,3.000000E+03`

SOURce:DIGital:FREQuency:LOWer

Syntax

```
SOURce:DIGital:FREQuency:LOWer
<frequency>[<unit>], (@<channel list>)
```

```
SOURce:DIGital:FREQuency:LOWer?
(@<channel list>)
```

Description

Sets the lower frequency of the SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 waveforms for the specified channel(s) in Hz. The lower frequency determines the frequency of the lower frequency tone in the two-tone waveform. The query returns the lower frequency of the selected channel(s) in Hz. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	40 Hz to 500 Hz	60 Hz
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 waveforms. Use the `SOURce:DIGital:FUNCtion` command to select either one of these three waveform types.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.

- The lower frequency parameter is not dependent on the channels. This means that both channel 1 and 2 will always have the same lower frequency value. If you only select a single channel in the command, the setting is applied to both channel 1 and 2. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between the lower frequency parameter and channels.

Examples

The following command sets the lower frequency value for channel 1 and 2 to 80 Hz.

```
SOUR:DIG:FREQ:LOW 80Hz, (@D1,D2)
```

The following query returns the lower frequency values of channel 1 and 2 in Hz.

```
SOUR:DIG:FREQ:LOW? (@D1,D2)
```

Typical response: `8.000000E+01,8.000000E+01`

SOURce:DIGital:SBURst:ONTime

Syntax

```
SOURce:DIGital:SBURst:ONTime <on time>,
(@<channel list>)
```

```
SOURce:DIGital:SBURst:ONTime? (@<channel list>)
```

Description

Sets the burst on time of the sine burst waveform for the specified channel(s) in number of cycles. The burst on time determines the number of cycles at which the amplitude is at the highest level. The query returns the burst on time of the selected channel(s) in number of cycles. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
on time	Numeric	1 to 65534	1
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the sine burst waveform. Use the `SOURce:DIGital:FUNCtion` command to select the waveform type.
- The burst on time must be smaller than the burst period for the sine burst waveform.
- The burst on time parameter is not dependent on the channels. This means that both channel 1 and 2 will always have the same burst on time value. If you only select a single channel in the command, the setting is applied to both channel 1 and 2. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between the burst on time parameter and channels.

Examples

The following command sets the sine burst on time for channel 1 to 1000 cycles.

```
SOUR:DIG:SBUR:ONT 1000, (@D1)
```

The following query returns the sine burst on time of channel 1 in number of cycles.

```
SOUR:DIG:SBUR:ONT? (@D1)
```

Typical response: `1000`

SOURce:DIGital:SBURst:PERiod

Syntax

```
SOURce:DIGital:SBURst:PERiod <period>,
(@<channel list>)
```

```
SOURce:DIGital:SBURst:PERiod? (@<channel list>)
```

Description

Sets the burst period of the sine burst waveform for the specified channel(s) in number of cycles. The burst period determines the number of cycles from the beginning of one burst to the beginning of the next burst. The query returns the burst period of the selected channel(s) in number of cycles. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
period	Numeric	2 to 65535	3
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the sine burst waveform. Use the `SOURce:DIGital:FUNCtion` command to select the waveform type.
- The burst period must be greater than the burst on time for the sine burst waveform.

- The burst period parameter is not dependent on the channels. This means that both channel 1 and 2 will always have the same burst period value. If you only select a single channel in the command, the setting is applied to both channel 1 and 2. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between the burst period parameter and channels.

Examples

The following command sets the sine burst period for channel 1 to 5000 cycles.

```
SOUR:DIG:SBUR:PER 5000, (@D1)
```

The following query returns the sine burst period of channel 1 in number of cycles.

```
SOUR:DIG:SBUR:PER? (@D1)
```

Typical response: `5000`

SOURce:DIGital:SBURst:LOWLevel

Syntax

```
SOURce:DIGital:SBURst:LOWLevel <low level>,
(@<channel list>)
```

```
SOURce:DIGital:SBURst:LOWLevel?
(@<channel list>)
```

Description

Sets the amplitude ratio of burst on to burst off for the sine burst waveform for the specified channel(s) in percentage. The query returns the low level of the selected channel(s) in percentage. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
low level	Numeric	0 to 100 %	50 %
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the sine burst waveform. Use the `SOURce:DIGital:FUNCtion` command to select the waveform type.
- The low level parameter is not dependent on the channels. This means that both channel 1 and 2 will always have the same low level value. If you only select a single channel in the command, the setting is applied to both channel 1 and 2. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between the low level parameter and channels.

Examples

The following command sets the sine burst low level for channel 1 to 50%.

```
SOUR:DIG:SBUR:LOWL 50, (@D1)
```

The following query returns the sine burst low level of channel 1 in percentage.

```
SOUR:DIG:SBUR:LOWL? (@D1)
```

Typical response: `5.000000E+01`

SOURce:DIGital:SAMPle

Syntax

```
SOURce:DIGital:SAMPle <sample>,
(@<channel list>)
```

```
SOURce:DIGital:SAMPle? (@<channel list>)
```

Description

Sets the samples per step of the Monotonicity, Walking Zero, and Walking One waveform for the specified channel(s). The query returns the samples per step of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
low level	Numeric	1 to 32768 (Monotonicity) 1 to 65535 (Walking Zero and Walking One)	1
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the Monotonicty, Walking Zero, and Walking One waveform. Use the `SOURce:DIGital:FUNCtion` command to select either one of these three waveform types.

- The samples per step parameter is not dependent on the channels. This means that both channel 1 and 2 will always have the same samples per step value. If you only select a single channel in the command, the setting is applied to both channel 1 and 2. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between the samples per step parameter and channels.

Examples

The following command sets the samples per step for channel 1 to 1000 steps.

```
SOUR:DIG:SAMP 1000, (@D1)
```

The following query returns the samples per step of channel 1.

```
SOUR:DIG:SAMP? (@D1)
```

Typical response: `1000`

SOURce:DIGital:PHASe[:ADJust]

Syntax

```
SOURce:DIGital:PHASe[:ADJust] <phase>,
(@<channel list>)
```

```
SOURce:DIGital:PHASe[:ADJust]? (@<channel list>)
```

Description

Sets the phase offset value of the selected channel with reference to the digital generator channel 1 in degree. The query returns the phase of the selected channel(s) in degree. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
phase	Numeric	–180 ° to 179.99 °	0
channel list	DIscrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the variable phase waveform. Use the `SOURce:DIGital:FUNCtion` command to select the variable phase waveform type.
- Channel 1 is used as reference channel and will always have the value of 0 °. Therefore, this command is not applicable for channel 1.

Examples

The following command sets the phase for channel 2 to 100 degrees with reference to channel 1.

```
SOUR:DIG:PHAS 100, (@D2)
```

The following query returns the phase of channel 2 with reference to channel 1.

```
SOUR:DIG:PHAS? (@D2)
```

Typical response: `1.000000E+02`

SOURce:DIGital:MULTitone:FREQuency:STARt

Syntax

```
SOURce:DIGital:MULTitone:FREQuency:STARt
<frequency>[<unit>], (@<channel list>)
```

```
SOURce:DIGital:MULTitone:FREQuency:STARt?
(@<channel list>)
```

Description

Sets the start frequency of the multitone waveform for the specified channel(s). The start frequency defines the lowest tone frequency in the multitone waveform. The query returns the start frequency of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	2 Hz to (0.45 x sampling rate) Hz	1 kHz
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:DIGital:FUNCtion` command to select the multitone waveform type.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.
- The start frequency parameter is channel based. This means that channel 1 and 2 can have different start frequency values. Refer to “Appendix E: Relationship between Digital Waveform Parameters and Channels” on page 564 for the relationship between start frequency parameter and channels.

- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following command sets the start frequency value for channel 1 to 5 kHz.

```
SOUR:DIG:MULT:FREQ:STAR 5000, (@D1)
```

The following query returns the start frequency value of channels 1 in Hz.

```
SOUR:DIG:MULT:FREQ:STAR? (@D1)
```

Typical response: `5.000000E+03`

SOURce:DIGital:MULTitone:FREQuency:STOP

Syntax

```
SOURce:DIGital:MULTitone:FREQuency:STOP
<frequency>[<unit>], (@<channel list>)
```

```
SOURce:DIGital:MULTitone:FREQuency:STOP?
(@<channel list>)
```

Description

Sets the stop frequency of the multitone waveform for the specified channel(s). The stop frequency defines the highest tone frequency in the multitone waveform. The query returns the stop frequency of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	2 Hz to (0.45 x sampling rate) Hz	5 kHz
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:DIGital:FUNCtion` command to select the multitone waveform type.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.
- The stop frequency parameter is channel based. This means that channel 1 and 2 can have different stop frequency values. Refer to “Appendix E: Relationship between Digital Waveform Parameters and Channels” on page 564 for the relationship between stop frequency parameter and channels.
- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following command sets the stop frequency value for channel 1 to 10 kHz.

```
SOUR:DIG:MULT:FREQ:STOP 10kHz, (@D1)
```

The following query returns the stop frequency value of channels 1 in Hz.

```
SOUR:DIG:MULT:FREQ:STOP? (@D1)
```

Typical response: `1.000000E+04`

SOURce:DIGital:MULTitone:FREQuency:SPACing

Syntax

```
SOURce:DIGital:MULTitone:FREQuency:SPACing
<spacing>, (@<channel list>)
```

```
SOURce:DIGital:MULTitone:FREQuency:SPACing?
(@<channel list>)
```

Description

Sets the frequency spacing type between the start and stop frequency of the multitone waveform for the specified channel(s). The query returns the frequency spacing type of the selected channel(s). Multiple responses are separated by commas.

LINear	Linear frequency spacing
LOG	Logarithmic frequency spacing

Parameters

Item	Type	Range of values	Default value
spacing	Discrete	LINear or LOG	LINear
channel list	DIscrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:DIGital:FUNCtion` command to select the multitone waveform type.

- The frequency spacing parameter is channel based. This means that channel 1 and 2 can have different frequency spacing values. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between frequency spacing parameter and channels.
- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following command sets the frequency spacing for channel 1 to Log.

```
SOUR:DIG:MULT:FREQ:SPAC LOG, (@D1)
```

The following query returns the frequency spacing type of channel 1.

```
SOUR:DIG:MULT:FREQ:SPAC? (@D1)
```

Typical response: `LOG`

SOURce:DIGital:MULTitone:COUNt

Syntax

```
SOURce:DIGital:MULTitone:COUNt <tone count>,
(@<channel list>)
```

```
SOURce:DIGital:MULTitone:COUNt?
(@<channel list>)
```

Description

Sets the tones of the multitone waveform for the specified channel(s). Tones refer to the number of signal frequency components. The query returns the number of tones of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
tone count	Numeric	1 to 64	5
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:DIGital:FUNCtion` command to select the multitone waveform type.
- The tone count parameter is channel based. This means that channel 1 and 2 can have different tone count values. Refer to “Appendix E: Relationship between Digital Waveform Parameters and Channels” on page 564 for the relationship between tone count parameter and channels.
- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following commands set the tones for channel 1 and 2 to 3 and 15 respectively.

```
SOUR:DIG:MULT:COUN 3, (@D1)
```

```
SOUR:DIG:MULT:COUN 15, (@D2)
```

The following query returns the number of tones of channel 1 and 2.

```
SOUR:DIG:MULT:COUN? (@D1,D2)
```

Typical response: `3,15`

SOURce:DIGital:MULTitone:CRESt?

Syntax

```
SOURce:DIGital:MULTitone:CRESt?
(@<channel list>)
```

Description

Queries the crest factor of the multitone waveform for the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
channel list	DIscrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:DIGital:FUNCtion` command to select the multitone waveform type.
- The crest factor is channel based. This means that channel 1 and 2 can have different crest factor values. Refer to “Appendix E: Relationship between Digital Waveform Parameters and Channels” on page 564 for the relationship between crest factor and channels.

Examples

The following query returns the crest factor of multitone waveform for channel 1.

```
SOUR:DIG:MULT:CRESt? (@D1)
```

Typical response: `1.4142000E+0`

SOURce:DIGital:MULTitone:TONE:CLEar

Syntax

```
SOURce:DIGital:MULTitone:TONE:CLEar
(@<channel list>)
```

Description

Clears all the tones of the multitone waveform for the specified channel(s).

Parameters

Item	Type	Range of values	Default value
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the SOURce:DIGital:FUNCtion command to select the multitone waveform type.
- After all the tones are cleared, an initial tone with 1 kHz frequency, 1 FFS amplitude, and 0 ° will be the default.
- The command is channel based. This means that the command can be applied differently to channel 1 and 2channel 1 and 2. Refer to “Appendix E: Relationship between Digital Waveform Parameters and Channels” on page 564 for the relationship between this command and channels.

Examples

The following command clears all the tones of the multitone waveform for channel 1.

```
SOUR:DIG:MULT:TONE:CLE (@D1)
```

SOURce:DIGital:MULTitone:TONE:ADD

Syntax

```
SOURce:DIGital:MULTitone:TONE:ADD <index>,
<frequency>[<unit>], <voltage>[<unit>], <phase>,
(@<channel list>)
```

Description

Adds a customized tone into the multitone waveform for the specified channel(s).

Parameters

Item	Type	Range of values	Default value
index	Numeric	0 to 63	0
frequency	Numeric	2 Hz to (0.45 x sampling rate) Hz	1 kHz
voltage	Numeric	0 to 1 FFS	1 FFS
unit	Discrete	Vrms, Vpp, Vp, dBV, dBu, FFS, dBFS, or pctFS	FFS
phase	Numeric	–180 ~ 179.99	0
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:DIGital:FUNCtion` command to select the multitone waveform type.
- This command will add a customized tone into the existing multitone waveform. The position of the added tone will be determined by the index. The index must be less than the total number of tones.

- The command is channel based. This means that the command can be applied differently to channel 1 and 2. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between this command and channels.
- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following command adds a 5 kHz frequency, 0.5 FFS voltage, and 80° phase tone to the current multitone waveform for channel 1 at position 5.

```
SOUR:DIG:MULT:TONE:ADD 4, 5000, 0.5, 80, (@D1)
```

SOURce:DIGital:MULTitone:TONE:DELete

Syntax

```
SOURce:DIGital:MULTitone:TONE:DELete <index>,
(@<channel list>)
```

Description

Deletes a specific tone from the multitone waveform for the specified channel(s).

Parameters

Item	Type	Range of values	Default value
index	Numeric	0 to 63	0
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:DIGital:FUNCtion` command to select the multitone waveform type.
- This command will delete a tone from the existing multitone waveform. The deleted tone will be determined by the index. The index must be less than the total number of tones.
- The command is channel based. This means that the command can be applied differently to channel 1 and 2. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between this command and channels.

Examples

The following command deletes the tone 5 of the multitone waveform for channel 1.

```
SOUR:DIG:MULT:TONE:DEL 4, (@D1)
```

SOURce:DIGital:MULTitone:TONE:FREQuency

Syntax

```
SOURce:DIGital:MULTitone:TONE:FREQuency
<frequency>[<unit>], (<tone list>),
(@<channel list>)
```

```
SOURce:DIGital:MULTitone:TONE:FREQuency? (<tone
list>), (@<channel list>)
```

Description

Sets the frequency of the tone(s) in the multitone waveform for the specified channel(s). The query returns the frequency of the tone(s) of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	2 Hz to (0.45 x sampling rate) Hz	1 kHz
tone list	Discrete	One or more tones. • (1) for tone 1 • (1,2) for tone 1 and 2 • (1:10) for tone 1 through 10	Required parameter
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:DIGital:FUNCtion` command to select the multitone waveform type.
- You can also include a multiplier for the unit, for example, kHz. The 'k' is the multiplier for the unit Hz.
- The command is channel based. This means that the command can be applied differently to channel 1 and 2. Refer to “Appendix E: Relationship between Digital Waveform Parameters and Channels” on page 564 for the relationship between this command and channels.
- If there are tones with the same frequency, the **–221,"Settings Conflict"** error will be generated and the duplicated tone with the same frequency will be removed.

Examples

The following command sets the frequency of the tone 5 for channel 1 to 2 kHz.

```
SOUR:DIG:MULT:TONE:FREQ 2kHz, (5), (@D1)
```

The following query returns the frequency of tone 5 and tone 6 for channel 1.

```
SOUR:DIG:MULT:TONE:FREQ? (5,6), (@D1)
```

Typical response: `2.000000E+03,3.000000E+03`

SOURce:DIGital:MULTitone:TONE:VOLTage

Syntax

```
SOURce:DIGital:MULTitone:TONE:VOLTage
<voltage>[<unit>], (<tone list>),
(@<channel list>)
```

```
SOURce:DIGital:MULTitone:TONE:VOLTage? (<tone
list>), (@<channel list>)
```

Description

Sets the voltage of the tone(s) in the multitone waveform for the specified channel(s). The query returns the voltage of the tone(s) of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
voltage	Numeric	0 to 1 FFS	1 FFS
unit	Discrete	Vrms, Vpp, Vp, dBV, dBu, FFS, dBFS, or pctFS	FFS
tone list	Discrete	One or more tones. • (1) for tone 1 • (1,2) for tone 1 and 2 • (1:10) for tone 1 through 10	Required parameter
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:DIGital:FUNCtion` command to select the multitone waveform type.
- You can also include a multiplier for the unit, for example, mFFS. The 'm' is the multiplier for the unit FFS.

- The command is channel based. This means that the command can be applied differently to channel 1 and 2. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between this command and channels.

Examples

The following command sets the voltage of the tone 5 and tone 6 for channel 1 to 0.5 FFS.

```
SOUR:DIG:MULT:TONE:VOLT 0.5, (5,6), (@D1)
```

The following query returns the voltage of tone 5 and tone 6 for channel 1.

```
SOUR:DIG:MULT:TONE:VOLT? (5,6), (@D1)
```

Typical response: `5.000000E-01,5.000000E-01`

SOURce:DIGital:MULTitone:TONE:PHASe

Syntax

```
SOURce:DIGital:MULTitone:TONE:PHASe <phase>,
(<tone list>), (@<channel list>)
```

```
SOURce:DIGital:MULTitone:TONE:PHASe? (<tone
list>), (@<channel list>)
```

Description

Sets the phase of the tone(s) in the multitone waveform for the specified channel(s). The query returns the phase of the tone(s) of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
phase	Numeric	180 ~ 179,99	0
tone list	Discrete	One or more tones. • (1) for tone 1 • (1,2) for tone 1 and 2 • (1:10) for tone 1 through 10	Required parameter
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the `SOURce:DIGital:FUNCtion` command to select the multitone waveform type.
- The command is channel based. This means that the command can be applied differently to channel 1 and 2. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between this command and channels.

Examples

The following command sets the phase of the tone 5 and tone 6 for channel 1 to 90°.

```
SOUR:DIG:MULT:TONE:PHAS 90, (5,6), (@D1)
```

The following query returns the phase of tone 5 and tone 6 for channel 1.

```
SOUR:DIG:MULT:TONE:PHAS? (5,6), (@D1)
```

Typical response: `9.000000E+01,9.000000E+01`

SOURce:DIGital:MULTitone:TONE:PHASe:RANDomize

Syntax

```
SOURce:DIGital:MULTitone:TONE:PHASe:RANDomize
(@<channel list>)
```

Description

Randomizes the phase of all the tones in the multitone waveform for the specified channel(s).

Parameter

Item	Type	Range of values	Default value
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable for the multitone waveform. Use the SOURce:DIGital:FUNCtion command to select the multitone waveform type.
- The command is channel based. This means that the command can be applied differently to channel 1 and 2. Refer to "Appendix E: Relationship between Digital Waveform Parameters and Channels" on page 564 for the relationship between this command and channels.

Examples

The following command randomized the phase of all the tones for channel 1.

```
SOUR:DIG:MULT:TONE:PHAS:RAND (@D1)
```

SOURce:DIGital:REFerence:VOLTage

Syntax

`SOURce:DIGital:REFerence:VOLTage <voltage>`

`SOURce:DIGital:REFerence:VOLTage?`

Description

Sets the voltage reference of the digital generator in V. The query returns the voltage reference of the digital generator in V.

Parameter

Item	Type	Range of values	Default value
voltage	Numeric	0 < reference voltage ≤ 1.0E+9	1

Examples

The following command sets the voltage reference of the digital generator to 5 V.

`SOUR:DIG:REF:VOLT 5`

The following query returns the voltage reference of the digital generator in V.

`SOUR:DIG:REF:VOLT?`

Typical response: `5.000000E+00`

SOURce:DIGital:BERT[:MODE]

Syntax

`SOURce:DIGital:BERT[:MODE] <mode>`

`SOURce:DIGital:BERT[:MODE]?`

Description

Enables or disables the Bit Error Rate Test (BERT) mode. The query returns the BERT mode state.

Parameter

Item	Type	Range of values	Default value
mode	Discrete	ON or OFF	OFF

Remarks

- This command must be sent prior to the other `SOURce:DIGital:BERT:...` commands.
- When the BERT mode is enabled, you are only able to send BERT commands.

Examples

The following command enables the BERT mode.

`SOUR:DIG:BERT ON`

The following query returns the BERT mode state.

`SOUR:DIG:BERT?`

Typical response: `ON`

SOURce:DIGital:BERT:PATTern:CATegory

Syntax

```
SOURce:DIGital:BERT:PATTern:CATegory <category>
```

```
SOURce:DIGital:BERT:PATTern:CATegory?
```

Description

Sets the pattern category of the Bit Error Rate Test (BERT). The query returns pattern category of the Bit Error Rate Test.

Parameter

Item	Type	Range of values	Default value
category	Discrete	PSEudorandom or WCONstant	PSEudorandom

Remarks

- The command `SOURce:DIGital:BERT[:MODE]` must be sent prior to sending this command.
- When pseudorandom is selected, both channels will output pseudorandom pattern.
- When walking constant is selected, you can select different walking constant pattern types for different channels.

Examples

The following command sets the pattern category of the BERT to walking constant.

```
SOUR:DIG:BERT:PATT:CAT WCON
```

The following query returns the pattern category of the BERT.

```
SOUR:DIG:BERT:PATT:CAT?
```

Typical response: `WCON`

SOURce:DIGital:BERT:WCONstant:TYPE

Syntax

```
SOURce:DIGital:BERT:WCONstant:TYPE <type>,
(@<channel list>)
```

```
SOURce:DIGital:BERT:WCONstant:TYPE?
(@<channel list>)
```

Description

Sets the pattern type of the walking constant for the specified channel(s). The query returns the pattern type of the walking constant.

Parameters

Item	Type	Range of values	Default value
type	Discrete	WONE, WZERo, or CUSTom	WONE
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- The command `SOURce:DIGital:BERT[:MODE]` must be sent prior to sending this command.
- The pattern type can be different for each channel.
- This command is valid when BERT pattern category is set to walking constant.
- Setting the type to CUSTom allows you to specify the constant value of the pattern. Refer to `SOURce:DIGital:BERT:WCONstant[:VALue]` command.

Examples

The following command sets the pattern type of the walking constant of channel 1 to walking zero.

```
SOUR:DIG:BERT:WCON:TYPE WZER, (@D1)
```

The following query returns the pattern type for the walking constant of channel 1.

```
SOUR:DIG:BERT:WCON:TYPE? (@D1)
```

Typical response: `WZER`

SOURce:DIGital:BERT:PSEudorandom:SEED

Syntax

```
SOURce:DIGital:BERT:PSEudorandom:SEED <seed>,
(@<channel list>)
```

```
SOURce:DIGital:BERT:PSEudorandom:SEED?
(@<channel list>)
```

Description

Sets the pseudorandom seed value for the specified channel(s). The query returns the pseudorandom seed value.

Parameters

Item	Type	Range of values	Default value
seed	Hex	0x000001 to 0xFFFFFF	#H100000
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- The command SOURce:DIGital:BERT[:MODE] must be sent prior to sending this command.
- The seed value can be different for each channel.
- This seed value is in hexadecimal format.
- This command is valid when BERT pattern category is set to pseudorandom.

Examples

The following command sets the pseudorandom seed value of channel 1 to 0xA00000.

```
SOUR:DIG:BERT:PSE:SEED #HA00000, (@D1)
```

The following query returns the pseudorandom seed value of channel 1.

```
SOUR:DIG:BERT:PSE:SEED? (@D1)
```

Typical response: #HA00000

SOURce:DIGital:BERT:WCONstant[:VALue]

Syntax

```
SOURce:DIGital:BERT:WCONstant[:VALue] <value>,
(@<channel list>)
```

```
SOURce:DIGital:BERT:WCONstant[:VALue]?
(@<channel list>)
```

Description

Sets the constant value for the custom walking constant pattern for the specified channel(s). The query returns the constant value.

Parameters

Item	Type	Range of values	Default value
value	Hex	0x000001 to 0xFFFFFF	#H100000
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- The command SOURce:DIGital:BERT[:MODE] must be sent prior to sending this command.
- The constant value can be different for each channel.
- This constant value is in hexadecimal format.
- This command is valid when BERT pattern category is set to custom walking constant.
- If the constant value is set to either 0x7FFFFFFF or 0x8000000, the walking constant pattern type will be set to WZERo and WONE respectively.

Examples

The following command sets the constant value for channel 1 to 0x400000.

```
SOUR:DIG:BERT:WCON #H400000, (@D1)
```

The following query returns the constant value of channel 1.

```
SOUR:DIG:BERT:WCON? (@D1)
```

Typical response: #H400000

SOURce:DIGital:BERT:DURation

Syntax

`SOURce:DIGital:BERT:DURation <duration>`

`SOURce:DIGital:BERT:DURation?`

Description

Sets the duration of the bit error rate test (BERT) in seconds. The query returns the duration of the BERT.

Parameter

Item	Type	Range of values	Default value
duration	Numeric	0.1 to 604800	10

Remarks

- The command `SOURce:DIGital:BERT[:MODE]` must be sent prior to sending this command.
- The duration must be greater than the reading interval set at `SENSe:DIGital:BERT:INTerval`.

Examples

The following command sets the duration for the BERT to 20 seconds.

`SOUR:DIG:BERT:DUR 20`

The following query returns the duration for the BERT.

`SOUR:DIG:BERT:DUR?`

Typical response: `2.000000E+01`

SOURce:DIGital:BERT:BWIDth

Syntax

```
SOURce:DIGital:BERT:BWIDth <width>
```

```
SOURce:DIGital:BERT:BWIDth?
```

Description

Sets the pattern bit width of the bit error rate test (BERT). The query returns the pattern bit width of the BERT.

Parameter

Item	Type	Range of values	Default value
width	Numeric	8 to 24	24

Remark

The command `SOURce:DIGital:BERT[:MODE]` must be sent prior to sending this command.

Examples

The following command sets the pattern bit width for the BERT to 24.

```
SOUR:DIG:BERT:BWID 24
```

The following query returns the duration for the BERT.

```
SOUR:DIG:BERT:BWID?
```

Typical response: `24`

Sense Subsystem

The Sense subsystem provides the commands to select the U8903A measurement functions and configure the measurement settings for the analyzer and graph modes.

SENSe:VOLTage:RANGe:AUTO

Syntax

```
SENSe:VOLTage:RANGe:AUTO <mode>,
(@<channel list>)
```

```
SENSe:VOLTage:RANGe:AUTO? (@<channel list>)
```

Description

Disables or enables autoranging for voltage measurements for the specified channel(s). Autoranging allows the U8903A to automatically select the range for each measurement based on the input signal detected. The query returns the autoranging state of the selected channel(s) as `0` if the autoranging is disabled, or `1` if the autoranging is enabled. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
mode	Boolean	OFF(0) or ON(1)	ON
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- Selecting a discrete range using the `SENSe:VOLTage:RANGe[:UPPER]` command will disable the autoranging.
- Autoranging is enabled after a factory reset (`*RST`) command or instrument preset (`SYSTem:PRESet`) command.

Examples

The following commands disable autoranging for channel 1 but enable autoranging for channel 2.

```
SENS:VOLT:RANG:AUTO OFF, (@1)
```

```
SENS:VOLT:RANG:AUTO ON, (@2)
```

The following query returns the autoranging states for channel 1 and 2.

```
SENS:VOLT:RANG:AUTO? (@1,2)
```

Typical response: `0,1`

SENSe:VOLTage:RANGe[:UPPer]

Syntax

```
SENSe:VOLTage:RANGe[:UPPer] <range>[<unit>],
(@<channel list>)
```

```
SENSe:VOLTage:RANGe[:UPPer]? (@<channel list>)
```

Description

Sets the measurement range for voltage measurements for the specified channel(s) in V. The query returns the voltage range of the selected channel(s) in V. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
range	Numeric	400 mV, 800 mV, 1.6 V, 3.2 V, 6.4 V, 12.8 V, 25 V, 50 V, 100 V, or 140 V	Required parameter
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- Selecting a discrete range using this command will disable the autoranging on the specified channel(s).
- If the input signal is greater than the selected measurement range, an overload indication of `9.9E+37` will be generated.
- Autoranging is enabled after a factory reset (`*RST`) command or instrument preset (`SYSTem:PRESet`) command.
- If you set a value in between the selected measurement range, for example, 401 mV, it will clip the value to the upper range which is 800 mV.
- You can also include a multiplier for the unit, for example, mV. The 'm' is the multiplier for the unit V.

Examples

The following commands set the measurement range values to 400 mV and 3.2 V for channel 1 and 2 respectively.

```
SENS:VOLT:RANG 400mV, (@1)
```

```
SENS:VOLT:RANG 3.2V, (@2)
```

The following query returns the measurement range values for channel 1 and 2.

```
SENS:VOLT:RANG? (@1,2)
```

Typical response: `4.000000E-01,3.200000E+00`

SENSe:MTIMe

Syntax

```
SENSe:MTIMe <measurement time>
SENSe:MTIMe?
```

Description

Sets the analyzer measurement time. The query returns the measurement time.

The measurement time values with their corresponding `<measurement time>` parameters are listed as follows.

GTRack	Gen Track
SP128	1/128 s
SP64	1/64 s
SP32	1/32 s
SP16	1/16 s
SP8	1/8 s
SP4	1/4 s
SP2	1/2 s
S1	1 s

Parameter

Item	Type	Range of values	Default value
measurement time	Discrete	GTRack, SP128, SP64, SP32, SP16, SP8, SP4, SP2, or S1	GTRack

Remark

The selected measurement time applies for all channels.

Examples

The following command sets the measurement time to 1/128 s.

```
SENS:MTIM SP128
```

The following query returns the measurement time.

```
SENS:MTIM?
```

Typical response: `SP128`

SENSe:VOLTage:DETector

Syntax

```
SENSe:VOLTage:DETector <detector type>,
(@<channel list>)
SENSe:VOLTage:DETector? (@<channel list>)
```

Description

Sets the analyzer AC level detector for the specified channel(s). The query returns the detector type of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
detector type	Discrete	RMS, QPK, or VPP	RMS
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This command is only applicable if the selected measurement function is Vac.
- If `VPP` is selected, querying `FETCh[:SCALar]?` will return the AC voltage result in Vpp. If `RMS` is selected, the returned AC voltage result is in Vrms. If `QPK` is selected, the returned AC voltage result is in V.

Examples

The following commands set the detector types to RMS and Vpp for channel 1 and 2 respectively.

```
SENS:VOLT:DET RMS, (@1)
```

```
SENS:VOLT:DET VPP, (@2)
```

The following query returns the detector types for channel 1 and 2.

```
SENS:VOLT:DET? (@1,2)
```

Typical response: `RMS,VPP`

SENSe:FUNCtion<j>

Syntax

```
SENSe:FUNCtion<j> <function>, (@<channel list>)
SENSe:FUNCtion<j>? (@<channel list>)
```

Description

Sets the analyzer measurement function for the specified channel(s). The query returns the measurement function of the selected channel(s). Multiple responses are separated by commas.

The measurement functions with their corresponding `<function>` parameters are listed as follows.

FREQuency	Frequency measurement
VAC	AC voltage measurement
VDC	DC voltage measurement
THDRatio	THD+N Ratio measurement
THDLevel	THD+N Level measurement
SINad	SINAD measurement
SNRatio	Signal-to-noise ratio measurement
NOISe	Noise Level measurement
IMD	SMPTE IMD measurement
SDFDiec118	DFD IEC 60118 2nd order measurement
TDFDiec118	DFD IEC 60118 3rd order measurement
SDFDiec268	DFD IEC 60268 2nd order measurement
TDFDiec268	DFD IEC 60268 3rd order measurement
PHASe	Phase measurement
DCRosstalk	Crosstalk (channel driven) measurement
MCRosstalk	Crosstalk (channel measured) measurement

Parameters

Item	Type	Range of values	Default value
j	Numeric	1 to 2 • `SENS:FUNC1` indicates the first measurement function • `SENS:FUNC2` indicates the second measurement function	1
function	Discrete	FREQuency, VAC, VDC, THDRatio, THDLevel, SINad, SNRatio, NOISe, IMD, SDFDiec118, TDFDiec118, SDFDiec268, TDFDiec268, PHASe, DCRosstalk, or MCRosstalk	• FREQuency (first measurement function) • VAC (second measurement function)
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- For the first measurement function, there are only three types of selectable functions comprising frequency, Vac, and Vdc. For the second measurement function, you can select any of the measurement functions listed above.
- You need to set the DC coupling (`INPut:COUPling` command) prior to setting the Vdc measurement function.
- If either phase, crosstalk (channel driven), or crosstalk (channel measured) is selected, you must also specify the reference channel using the `SENSe:REFerence:CHANnel` command. You must set the reference channel prior to sending the `SENSe:FUNCtion` command.
- If phase is selected for a particular channel, the measurement function for all channels will automatically change to phase.

- If crosstalk (channel driven) is selected for a particular channel, all channels will change to the crosstalk measurement. The measurement function for all channels except the reference channel will change to crosstalk (channel measured) and the measurement function for the reference channel will change to crosstalk (channel driven).
- If crosstalk (channel measured) is selected for a particular channel, all channels will change to the crosstalk measurement. The measurement function for all channels except the reference channel will change to crosstalk (channel driven) and the measurement function for the reference channel will change to crosstalk (channel measured).
- Refer to "Measuring the crosstalk" on page 471 for the programming example on measuring crosstalk.
- Noise Level is not applicable for the sweep measurement parameter selection.

Examples

To measure the DC voltage on channel 1, you can set Vdc as the first measurement function. Assume that the DC voltage is measured immediately without waiting for any bus or external trigger. The following commands are configured.

```
SENS:FUNC1 VDC, (@1)

TRIG:ANAL:SOUR IMM

INIT:ANAL (@1)

FETC? FUNC1, (@1)
```

NOTE

- When FETCh is queried, the measurement result will be returned in the unit as listed in "Appendix B: Units of the Measurement Function Returned Values" on page 555.
- For crosstalk measurements, a value of 0 dB or 100% will always be returned when FETCh is used to acquire the result of the reference channel.

The following query returns the measurement function of channel 1.

```
SENS:FUNC1? (@1)
```

Typical response: `VDC`

SENSe:FUNCtion<j>:UNIT

Syntax

```
SENSe:FUNCtion<j>:UNIT <unit>, (@<channel list>)
SENSe:FUNCtion<j>:UNIT? (@<channel list>)
```

Description

Specifies the unit for the measurement result (which is obtained using the `FETCh` command) of the corresponding function for the selected channel(s). The query returns the unit of the corresponding function for the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
j	Numeric	1 to 2 • `SENS:FUNC1` indicates the first measurement function • `SENS:FUNC2` indicates the second measurement function	1
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

For the `<unit>` range of values and formulas, refer to “Appendix B: Units of the Measurement Function Returned Values” on page 555.

Remarks

The unit specified using this command will cause the measurement result to be returned in that unit. For example, changing the unit to dBV for the Vac function will return the measurement result obtained by the `FETCh` command in dBV.

Examples

The following commands set the AC voltage as the second measurement function in the unit dBV for both channels.

```
SENS:FUNC2 VAC, (@1,2)
```

```
SENS:FUNC2:UNIT dBV, (@1,2)
```

The following query returns the unit of the second measurement function for both channels.

```
SENS:FUNC2:UNIT? (@1,2)
```

Typical response: `dBV,dBV`

SENSe:REFerence:IMPedance

Syntax

```
SENSe:REFerence:IMPedance <impedance>,
(@<channel list>)
```

```
SENSe:REFerence:IMPedance? (@<channel list>)
```

Description

Sets the reference impedance for the specified channel(s) in ohms (Ω). The reference impedance is used for conversion of the measurement result in unit W or dBm. The query returns the reference impedance of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
impedance	Numeric	0 < impedance ≤ 1.0E+9	600 Ω
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remark

The reference impedance setting is only applicable for the Vac, Vdc, THD+N Level, and Noise Level measurement functions to specify the measurement results in W or dBm.

Examples

The following commands set the reference impedances to 600 Ω and 50 Ω for channel 1 and 2 respectively.

```
SENS:REF:IMP 600, (@1)
```

```
SENS:REF:IMP 50, (@2)
```

The following query returns the reference impedances for channel 1 and 2.

```
SENS:REF:IMP? (@1,2)
```

Typical response: `6.000000E+02,5.000000E+01`

SENSe:REFerence:LEVel

Syntax

```
SENSe:REFerence:LEVel <level>, (@<channel list>)
SENSe:REFerence:LEVel? (@<channel list>)
```

Description

Sets the reference level for the specified channel(s) in V. The reference level is used for conversion of the measurement result in unit dBr or x. The query returns the reference level of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
level	Numeric	10^{-6} to 140	387.3 mV
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remark

The reference level setting is only applicable for the Vac, Vdc, THD+N Level, and Noise Level measurement functions to specify the measurement results in dBr or x.

Examples

The following commands set the reference levels to 200 mV and 500 mV for channel 1 and 2 respectively.

```
SENS:REF:LEV 0.2, (@1)

SENS:REF:LEV 0.5, (@2)
```

The following query returns the reference levels for channel 1 and 2.

```
SENS:REF:LEV? (@1,2)
```

Typical response: `2.000000E-01,5.000000E-01`

SENSe:REFerence:CHANnel

Syntax

```
SENSe:REFerence:CHANnel <reference channel>
SENSe:REFerence:CHANnel?
```

Description

Sets the reference channel for the phase or crosstalk measurement functions. The query returns the reference channel.

Parameter

Item	Type	Range of values	Default value
reference channel	Numeric	1 or 2	1

Examples

The following commands provide the sequence to measure crosstalk from channel 2 to 1.

```
SENS:REF:CHAN 2
SENS:FUNC2 DCR, (@1,2)
TRIG:ANAL:SOUR IMM
INIT:ANAL (@1)
FETC? FUNC2, (@1)
```

The following query returns the reference channel.

```
SENS:REF:CHAN?
```

Typical response: `2`

SENSe:REFerence:FREQuency

Syntax

```
SENSe:REFerence:FREQuency <frequency>,
(@<channel list>)
SENSe:REFerence:FREQuency? (@<channel list>)
```

Description

Sets the reference frequency for the specified channel(s) in Hz (Hertz). The reference frequency is used for conversion of the measurement result in unit ΔHz (delta Hertz). The query returns the reference frequency of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	$0 \leq$ frequency $\leq$ 1.0E+9	0
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remark

The reference frequency setting is only applicable for the frequency measurement function to specify the measurement results in ΔHz.

Examples

The following commands set the reference frequencies to 100 Hz and 300 Hz for channel 1 and 2 respectively.

```
SENS:REF:FREQ 100, (@1)
```

```
SENS:REF:FREQ 300, (@2)
```

The following query returns the reference frequency for channel 1 and 2.

```
SENS:REF:FREQ? (@1,2)
```

Typical response: `1.000000E+02,3.000000E+02`

SENSe:REFerence:RATio

Syntax

```
SENSe:REFerence:RATio <ratio>, (@<channel list>)
SENSe:REFerence:RATio? (@<channel list>)
```

Description

Sets the reference ratio for the specified channel(s) in dB. The reference ratio is used for conversion of the measurement result in unit ΔdB (delta decibel). The query returns the reference ratio of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
ratio	Numeric	–180 < ratio < 180	0
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remark

The reference ratio setting is only applicable for the SINAD and THD Ratio, DFD, IMD, crosstalk, and SNR measurement functions to specify the measurement results in ΔHz.

Examples

The following commands set the reference ratio to 10 dB and 30 dB for channel 1 and 2 respectively.

```
SENS:REF:RAT 10, (@1)
```

```
SENS:REF:RAT 30, (@2)
```

The following query returns the reference ratio for channel 1 and 2.

```
SENS:REF:RAT? (@1,2)
```

Typical response: `1.000000E+01,3.000000E+01`

SENSe:REFerence:MEASured

Syntax

```
SENSe:REFerence:MEASured <measurement type>,
<source channel>, <@target channel list>
```

Description

Sets the last measurement result obtained from the specified measurement type of the selected source as the reference value for the corresponding target channels.

Parameters

Item	Type	Range of values	Default value
measurement type	Discrete	LEVel, FREQuency or RATio	LEVel
source channel	Discrete	CH1 or CH2	Required parameter
target channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- If there is no data in the last measurement or invalid data such as INF, this command will not have any effect; the previous reference value will be remain.

- If the measurement type selection is level, sending this command will affect the reference level which is set using `SENSe:REFerence:LEVel`. You can use the command `SENSe:REFerence:LEVel?` to query for the reference level.
- If the measurement type selection is frequency, sending this command will affect the reference frequency, which is set using `SENSe:REFerence:FREQuency`. You can use the command `SENSe:REFerence:FREQuency?` to query for the reference frequency.
- If the measurement type selection is ratio, sending this command will affect the reference ratio which is set using `SENSe:REFerence:RATio`. You can use the command `SENSe:REFerence:RATio?` to query for the reference ratio.

Examples

The following command set the measured Vac result of channel 1 as reference value for both channels.

```
SENS:REF:MEAS LEV, CH1, (@1:2)
```

The following query returns the reference level of the measured value. Assume that the measured Vac result for channel 1 is 1 V_{rms}.

```
SENS:REF:LEV? (@1:2)
```

Typical response: `1.000000E+00`

SENSe:FILTer:LPASs

Syntax

```
SENSe:FILTer:LPASs <low pass filter>,
(@<channel list>)
```

```
SENSe:FILTer:LPASs? (@<channel list>)
```

Description

Sets the low pass filter for the specified channel(s). The query returns the low pass filter type of the selected channel(s). Multiple responses are separated by commas.

The low pass filter types with their corresponding `<low pass filter>` parameters are listed as follows.

`NONE`	No low pass filter is applied
`LP15`	Low pass filter with 15 kHz cutoff frequency
`LP20`	Low pass filter with 20 kHz cutoff frequency
`LP30`	Low pass filter with 30 kHz cutoff frequency
`LP80`	Low pass filter with 80 kHz cutoff frequency
`CUSTom`	User-defined low pass filter

Parameters

Item	Type	Range of values	Default value
low pass filter	Discrete	NONE, LP15, LP20, LP30, LP80 or CUSTom	NONE
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- To use a custom low pass filter, you need to load the custom filter data into the U8903A before you can use it. To load a custom filter data, use either the `DATA:FILTer` or `MMEM:LOAD FILTer, <filename>` command.
- The command `DATA:FILTer` or `MMEM:LOAD FILTer, <filename>` must be sent prior to sending the `SENSe:FILTer:LPASs` command.

- If you switch from CUSTom to either NONE, LP15, LP20, LP30, or LP80, your previously downloaded information for the custom filter will be lost. You will need to redownload the filter information into the system. Refer to "Using the user-defined filter data" on page 478 for the information on how to use the custom filter.

Examples

The following commands set the low pass filter types to LP15 and LP30 for channel 1 and 2 respectively.

```
SENS:FILT:LPAS LP15, (@1)
```

```
SENS:FILT:LPAS LP30, (@2)
```

The following query returns the low pass filter types for channel 1 and 2.

```
SENS:FILT:LPAS? (@1,2)
```

Typical response: LP15,LP30

SENSe:FILTer:HPASs

Syntax

```
SENSe:FILTer:HPASs <high pass filter>,
(@<channel list>)
SENSe:FILTer:HPASs? (@<channel list>)
```

Description

Sets the high pass filter for the specified channel(s). The query returns the high pass filter type of the selected channel(s). Multiple responses are separated by commas.

The high pass filter types with their corresponding `<high pass filter>` parameters are listed as follows.

NONE	No high pass filter is applied
HP22	High pass filter with 22 Hz cutoff frequency
HP100	High pass filter with 100 Hz cutoff frequency
HP400	High pass filter with 400 Hz cutoff frequency
CUSTom	User-defined high pass filter

Parameters

Item	Type	Range of values	Default value
high pass filter	Discrete	NONE, HP22, HP100, HP400, or CUSTom	NONE
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- To use a custom high pass filter, you need to load the custom filter data into the U8903A before you can use it. To load a custom filter data, use either the `DATA:FILTer` or `MMEM:LOAD FILTer, <filename>` command.

- The command `DATA:FILTer` or `MMEM:LOAD FILTer, <filename>` must be sent prior to sending the `SENSe:FILTer:HPASs` command.
- If you switch from `CUSTom` to either `NONE`, `HP22`, `HP100`, or `HP400`, your previously downloaded information for the custom filter will be lost. You will need to redownload the filter information into the system. Refer to "Using the user-defined filter data" on page 478 for the information on how to use the custom filter.

Examples

The following commands set the high pass filter types to `HP22` and `HP100` for channel 1 and 2 respectively.

```
SENS:FILT:HPAS HP22, (@1)
```

```
SENS:FILT:HPAS HP100, (@2)
```

The following query returns the high pass filter types for channel 1 and 2.

```
SENS:FILT:HPAS? (@1,2)
```

Typical Response: `HP22,HP100`

SENSe:FILTer:WEIGhting

Syntax

```
SENSe:FILTer:WEIGhting <weighting filter>,
(@<channel list>)
SENSe:FILTer:WEIGhting? (@<channel list>)
```

Description

Sets the weighting filter for the specified channel(s). The query returns the weighting filter type of the selected channel(s). Multiple responses are separated by commas.

The weighting filter types with their corresponding `<weighting filter>` parameters are listed as follows.

NONE	No weighting filter is applied
AWEighting	A-Weighting filter
CCIR1k	CCIR-1k weighted
CCIR2k	CCIR-2k weighted
CMESsage	C-Message
CCITt	CCITT
CUSTom	User-defined arbitrary filter type including Bandpass and Bandstop filters

Parameters

Item	Type	Range of values	Default value
weighting filter	Discrete	NONE, AWEighting, CCIR1k, CCIR2k, CMESsage, CCITt, or CUSTom	NONE
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- The custom filter type includes the bandpass and bandstop arbitrary filters.
- To use a custom weighting pass filter, you need to load the custom filter data into the U8903A before you can use it. To load a custom filter data, use either the `DATA:FILTer` or `MMEM:LOAD FILTer, <filename>` command.
- The command `DATA:FILTER` or `MMEM:LOAD FILTER, <filename>` must be sent prior to sending the `SENSe:FILTer:WEIGhting` command.

- If you switch from CUSTom to either NONE, AWE, CCIR1k, CCIR2k, CMES, or CCIT, your previously downloaded information for the custom filter will be lost. You will need to redownload the filter information into the system. Refer to "Using the user-defined filter data" on page 478 for the information on how to use the custom filter.

Examples

The following commands set the weighting filter types to A-Weighting and C-Message for channel 1 and 2 respectively.

```
SENS:FILT:WEIG AWE, (@1)
```

```
SENS:FILT:WEIG CMES, (@2)
```

The following query returns the weighting filter types for channel 1 and 2.

```
SENS:FILT:WEIG? (@1,2)
```

Typical response: AWE,CMES

SENSe:FILTer:LEFT

Syntax

```
SENSe:FILTer:LEFT <left filter>
SENSe:FILTer:LEFT?
```

Description

Sets the HP8903B mode left filter.

The left filter types with their corresponding `<left filter>` parameters are listed as follows.

`NONE`	No weighting filter is applied
`AWEighting`	A-Weighting filter
`CCIR1k`	CCIR-1k weighted
`CCIR2k`	CCIR-2k weighted
`CMESsage`	C-Message
`CCITt`	CCITT
`HP400`	High pass filter with 400 Hz cutoff frequency

Parameter

Item	Type	Range of values	Default value
left filter	Discrete	NONE, AWEighting, CCIR1k, CCIR2k, CMESsage, CCITt, or HP400	CCITt

Examples

The following command sets the left filter type to HP400.

```
SENS:FILT:LEFT HP400
```

The following query returns the left filter type.

```
SENS:FILT:LEFT?
```

Typical response: `HP400`

SENSe:FILTer:RIGHt

Syntax

```
SENSe:FILTer:RIGHt <right filter>
SENSe:FILTer:RIGHt?
```

Description

Sets the HP8903B mode right filter.

The right filter types with their corresponding `<right filter>` parameters are listed as follows.

NONE	No weighting filter is applied
AWEighting	A-Weighting filter
CCIR1k	CCIR-1k weighted
CCIR2k	CCIR-2k weighted
CMESsage	C-Message
CCITt	CCITT
HP400	High pass filter with 400 Hz cutoff frequency

Parameters

Item	Type	Range of values	Default value
left filter	Discrete	NONE, AWEighting, CCIR1k, CCIR2k, CMESsage, CCITt, or HP400	HP400

Examples

The following command sets the right filter type to HP400.

```
SENS:FILT:RIGH HP400
```

The following query returns the right filter type.

```
SENS:FILT:RIGH?
```

Typical response: `HP400`

SENSe:AVERaging:MOVing:POINts

Syntax

```
SENSe:AVERaging:MOVing:POINts <number of points>
SENSe:AVERaging:MOVing:POINts?
```

Description

Controls the number of points to be included in the moving average. In moving averaging, when a new measurement data is added, the oldest data is discarded.

Parameter

Item	Type	Range of values	Default value
number of points	Numeric	1 to 50	1

Remark

This setting is only applicable in the analyzer mode but not Frequency domain and Time domain mode.

Examples

The following command sets eight averaging points.

```
SENS:AVER:MOV:POIN 8
```

The following query returns the number of averaging points.

```
SENS:AVER:MOV:POIN?
```

Typical response: `8`

SENSe:AVERaging:SYNC:POINts

Syntax

```
SENSe:AVERaging:SYNC:POINts <number of points>
SENSe:AVERaging:SYNC:POINts?
```

Description

Sets the number of points for the synchronous averaging. Synchronous averaging reduces noise levels by averaging the acquired data in the time domain. The query returns the number of averaging points.

Parameter

Item	Type	Range of values	Default value
number of points	Numeric	1 to 64	1

Remark

This setting is only applicable if you trigger from the channel 1 or channel 2 input.

Examples

The following command sets eight averaging points.

```
SENS:AVER:SYNC:POIN 8
```

The following query returns the number of averaging points.

```
SENS:AVER:SYNC:POIN?
```

Typical response: `8`

SENSe:WAVeform:POINts

Syntax

```
SENSe:WAVeform:POINts <number of points>
SENSe:WAVeform:POINts?
```

Description

Sets the number of data points to acquire with the `FETCh:ARRAy?` command. The query returns the selected acquisition length.

If you select the frequency domain analysis, the acquisition length represents the FFT size. The acquisition length of the frequency domain analysis doubles the acquisition length that you select using this command.

Parameter

Item	Type	Range of values	Default value
number of points	Numeric	256, 512, 1024, 2048, 4096, 8192, 16384, or 32768	1024

Remarks

If the number of points that you enter is not the exact value of the acquisition length, the value is always clipped to its lower value. For instance, if the number of points that you enter is 500, it will be clipped to 256 which is the number lower than 500.

Examples

The following command sets the acquisition length to 512.

```
SENS:WAV:POIN 512
```

The following query returns the acquisition length.

```
SENS:WAV:POIN?
```

Typical response: `512`

SENSe:FFT:WINDow

Syntax

`SENSe:FFT:WINDow <type>`

`SENSe:FFT:WINDow?`

Description

Sets the window function for frequency domain analysis. The query returns the window function.

The window functions with their corresponding `<type>` parameters are listed as follows.

`HANN`	Hann window
`RECTangular`	Rectangular window
`BLACkman`	Blackman-Harris window
`RIFe1`	Rife-Vincent 1 window
`RIFe3`	Rife-Vincent 3 window
`HAMMing`	Hamming window
`FLATtop`	Flattop window

Parameter

Item	Type	Range of values	Default value
type	Discrete	RECTangular, HANN, BLACkman, RIFe1, RIFe3, HAMMing, or FLATtop	BLACkman

Examples

The following command sets the Rectangular window function.

`SENS:FFT:WIND RECT`

The following query returns the window function.

`SENS:FFT:WIND?`

Typical response: `RECT`

SENSe:FUNDamental:FREQuency:LOCK

Syntax

```
SENSe:FUNDamental:FREQuency:LOCK <type>,
(@<channel list>)
SENSe:FUNDamental:FREQuency:LOCK?
(@<channel list>)
```

Description

Sets the fundamental frequency lock type for SINAD, THD+N Ratio, or THD+N Level measurement. The query returns the fundamental frequency lock type.

AUTO	Automatically determines the fundamental frequency by selecting the signal with the highest magnitude from the incoming signal at analog analyzer
GLOCK	The fundamental frequency is determined by the frequency value set at the corresponding channel of the analog generator

Parameters

Item	Type	Range of values	Default value
type	Discrete	AUTO or GLOCK	AUTO
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable when the Function 2 measurement of the specified channel is set to SINAD, THD+N Ratio, or THD+N Level.

- If Function 2 measurement is set to SINAD, the default frequency lock type is GLOCK.
- If Function 2 measurement is set to THD+N Ratio and THD+N Level, the default frequency lock type is AUTO.
- Function 1 measurement is set to Frequency if the frequency lock type is AUTO.

Examples

The following command sets the fundamental frequency lock type to AUTO for channel 1.

```
SENS:FUND:FREQ:LOCK AUTO, (@1)
```

The following query returns the fundamental frequency lock type for channel 1.

```
SENS:FUND:FREQ:LOCK? (@1)
```

Typical response: AUTO

SENSe:DIGital:FUNDamental:FREQuency:LOCK[:SINad]

Syntax

```
SENSe:DIGital:FUNDamental:FREQuency:LOCK[:SINad]
<type>, (@<channel list>)
```

```
SENSe:DIGital:FUNDamental:FREQuency:LOCK[:SINad]
? (@<channel list>)
```

Description

Sets the fundamental frequency lock type for SINAD, THD+N Ratio, or THD+N Level for digital analyzer measurement. The query returns the fundamental frequency lock type.

`AUTO`	Automatically determines the fundamental frequency by selecting the signal with the highest magnitude from the incoming signal at digital analyzer
`GLOCk`	The fundamental frequency is determined by the frequency value set at the corresponding channel of the digital generator
`CUSTom`	The fundamental frequency value is user-defined

Parameters

Item	Type	Range of values	Default value
type	Discrete	AUTO, GLOCk, or CUSTom	AUTO
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable when the Function 2 measurement of the specified channel is set to SINAD, THD+N Ratio, or THD+N Level.
- If Function 2 measurement is set to SINAD, the default frequency lock type is GLOCk.
- If Function 2 measurement is set to THD+N Ratio and THD+N Level, the default frequency lock type is AUTO.
- Function 1 measurement is set to Frequency if the frequency lock type is AUTO.
- When the frequency lock type is set to CUSTom, use “SENSe:DIGital:FUNDamental:FREQuency” to set the custom fundamental frequency value.

Examples

The following command sets the fundamental frequency lock type to AUTO for channel 1.

```
SENS:DIG:FUND:FREQ:LOCK AUTO, (@D1)
```

The following query returns the fundamental frequency lock type for channel 1.

```
SENS:DIG:FUND:FREQ:LOCK? (@D1)
```

Typical response: `AUTO`

SENSe:DIGital:FUNDamental:FREQuency:LOCK:THD

Syntax

```
SENSe:DIGital:FUNDamental:FREQuency:LOCK:THD
<type>, (@<channel list>)
```

```
SENSe:DIGital:FUNDamental:FREQuency:LOCK:THD?
(@<channel list>)
```

Description

Sets the fundamental frequency lock type for THD Ratio or THD Level digital analyzer measurement. The query returns the fundamental frequency lock type.

GLOCk	The fundamental frequency is determined by the frequency value set at the corresponding channel of the digital generator
CUSTom	The fundamental frequency value is user-defined

Parameters

Item	Type	Range of values	Default value
type	Discrete	GLOCk or CUSTom	CLOCk
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable when the Function 2 measurement of the specified channel is set to THD Ratio or THD Level.
- When the frequency lock type is set to CUSTom, use “SENSe:DIGital:FUNDamental:FREQuency” to set the custom fundamental frequency value.

Examples

The following command sets the fundamental frequency lock type to CUSTom for channel 1 and 2.

```
SENS:DIG:FUND:FREQ:LOCK:THD CUST, (@D1,D2)
```

The following query returns the fundamental frequency lock type for channel 1.

```
SENS:DIG:FUND:FREQ:LOCK:THD? (@D1)
```

Typical response: `CUST`

SENSe:DIGital:FUNDamental:FREQuency

Syntax

```
SENSe:DIGital:FUNDamental:FREQuency <fundamental
frequency>[<unit>], (@<channel list>)
```

```
SENSe:DIGital:FUNDamental:FREQuency?
(@<channel list>)
```

Description

Sets the custom fundamental frequency value for SINAD, THD+N Ratio, THD+N Level, THD Ratio, or THD Level digital analyzer measurement. The query returns the fundamental frequency value.

Parameters

Item	Type	Range of values	Default value
fundamental frequency	Numeric	(10 – 0.45 *fs*) Hz, where *fs* is the input sampling frequency	1000 Hz
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This setting is only applicable when the Function 2 measurement of the specified channel is set to SINAD, THD+N Ratio, THD+N Level, THD Ratio, or THD Level.
- This setting is only valid when the fundamental frequency lock type is set to CUSTom.

Examples

The following command sets the fundamental frequency value to 2 kHz for digital analyzer channel 1.

```
SENS:DIG:FUND:FREQ 2kHz, (@D1)
```

The following query returns the fundamental frequency value for digital analyzer channel 1.

```
SENS:DIG:FUND:FREQ? (@D1)
```

Typical response: `2.000000E+03`

SENSe:DIGital:THD:HARMonic:COUNt

Syntax

```
SENSe:DIGital:THD:HARMonic:COUNt <count>,
(@<channel list>)
SENSe:DIGital:THD:HARMonic:COUNt? (@<channel
list>)
```

Description

Sets the number of harmonics for the THD Ratio and THD Level digital analyzer measurement. The query returns the number of harmonics in integer.

Parameters

Item	Type	Range of values	Default value
count	Numeric	2 to 20	5
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remark

This setting is only applicable when the Function 2 measurement of the specified channel is set to THD Ratio or THD Level.

Examples

The following command sets the number of harmonics to 12 for channel 1 and 2.

```
SENS:DIG:THD:HARM:COUN 12, (@D1,D2)
```

The following query returns the number of harmonics for channel 1.

```
SENS:DIG:THD:HARM:COUN? (@D1)
```

Typical responseTypical response: `12`

SENSe:DIGital:COUPling

Syntax

```
SENSe:DIGital:COUPling <coupling>,
(@<channel list>)
SENSe:DIGital:COUPling? (@<channel list>)
```

Description

Sets the coupling mode of the embedded digital analyzer audio signal for the selected channel(s). The query returns the coupling mode for the selected channel(s). Multiple responses are separated by commas.

AC	AC coupling blocks the DC component of the audio signal
DC	DC coupling allows both AC and DC input signals to pass through to the digital analyzer and to be measured down to 0 Hz. This setting should be selected when making DC voltage measurements.

Parameters

Item	Type	Range of values	Default value
coupling	Discrete	AC or DC	AC
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Examples

The following command sets the coupling mode for channel 1 to AC.

```
SENS:DIG:COUP AC, (@D1)
```

The following query returns the coupling mode for channel 1.

```
SENS:DIG:COUP? (@D1)
```

Typical response: `AC`

SENSe:DIGital:SAMPle:SIZE

Syntax

```
SENSe:DIGital:SAMPle:SIZE <sample size>
SENSe:DIGital:SAMPle:SIZE?
```

Description

Sets the acquisition data size of the digital analyzer audio signal to be analyzed. The query returns the sample size.

Parameter

Item	Type	Range of values	Default value
sample size	Numeric	2048, 4096, 8192, 16384, 32768, 65536, or 131072	4096

Examples

The following command sets the sample size to 4096.

```
SENS:DIG:SAMP:SIZE 4096
```

The following query returns the sample size.

```
SENS:DIG:SAMP:SIZE?
```

Typical response: `4096`

SENSe:DIGital:VOLTage:DETector

Syntax

```
SENSe:DIGital:VOLTage:DETector <detector type>,
(@<channel list>)
SENSe:DIGital:VOLTage:DETector?
(@<channel list>)
```

Description

Sets the digital analyzer AC level detector for the specified channel(s). The query returns the detector type of the selected channel(s). Multiple responses are separated by commas.

RMS	RMS detector
VPP	1/2 Peak-to-peak detector

Parameters

Item	Type	Range of values	Default value
detector type	Discrete	RMS or VPP	RMS
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

This command is only applicable if the selected measurement function is Vac.

Examples

The following commands set the detector types to RMS and Vpp for channel 1 and 2 respectively.

```
SENS:DIG:VOLT:DET RMS, (@D1)
```

```
SENS:DIG:VOLT:DET VPP, (@D2)
```

The following query returns the detector types for channel 1 and 2.

```
SENS:DIG:VOLT:DET? (@D1,D2)
```

Typical response: `RMS,VPP`

SENSe:DIGital:FILTer:LPASs

Syntax

```
SENSe:DIGital:FILTer:LPASs <low pass filter>,
(@<channel list>)
```

```
SENSe:DIGital:FILTer:LPASs? (@<channel list>)
```

Description

Sets the low pass filter for the specified channel(s). The query returns the low pass filter type of the selected channel(s). Multiple responses are separated by commas.

The low pass filter types with their corresponding `<low pass filter>` parameters are listed as follows.

`NONE`	No low pass filter is applied
`LP15`	Low pass filter with 15 kHz cutoff frequency
`LP20`	Low pass filter with 20 kHz cutoff frequency
`LP22`	Low pass filter with 22 kHz cutoff frequency
`LP30`	Low pass filter with 30 kHz cutoff frequency
`CUSTom`	User-defined low pass filter

Parameters

Item	Type	Range of values	Default value
low pass filter	Discrete	NONE, LP15, LP20, LP22, LP30, or CUSTom	NONE
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- To use a custom low pass filter, you need to load the custom filter data into the U8903A before you can use it. To load a custom filter data, use either the `DATA:DIGital:FILTer` or `MMEM:LOAD DFILter, <filename>` command.
- The command `DATA:DIGital:FILTer` or `MMEM:LOAD DFILter, <filename>` must be sent prior to sending the `SENSe:DIGital:FILTer:LPASs` command.

- If you switch from `CUSTom` to either `NONE`, `LP15`, `LP20`, `LP22`, or `LP30`, your previously downloaded information for the custom filter will be lost. You will need to redownload the filter information into the system. Refer to "Using the user-defined filter data" on page 478 for the information on how to use the custom filter.

Examples

The following commands set the low pass filter types to `LP15` and `LP30` for channel 1 and 2 respectively.

```
SENS:DIG:FILT:LPAS LP15, (@D1)
```

```
SENS:DIG:FILT:LPAS LP30, (@D2)
```

The following query returns the low pass filter types for channel 1 and 2.

```
SENS:DIG:FILT:LPAS? (@D1,D2)
```

Typical response: `LP15,LP30`

SENSe:DIGital:FILTer:HPASs

Syntax

```
SENSe:DIGital:FILTer:HPASs <high pass filter>,
(@<channel list>)
SENSe:DIGital:FILTer:HPASs? (@<channel list>)
```

Description

Sets the high pass filter for the specified channel(s). The query returns the high pass filter type of the selected channel(s). Multiple responses are separated by commas.

The high pass filter types with their corresponding `<high pass filter>` parameters are listed as follows.

`NONE`	No high pass filter is applied
`HP20`	High pass filter with 20 Hz cutoff frequency
`HP100`	High pass filter with 100 Hz cutoff frequency
`HP400`	High pass filter with 400 Hz cutoff frequency
`CUSTom`	User-defined high pass filter

Parameters

Item	Type	Range of values	Default value
high pass filter	Discrete	NONE, HP20, HP100, HP400, or CUSTom	NONE
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- To use a custom high pass filter, you need to load the custom filter data into the U8903A before you can use it. To load a custom filter data, use either the `DATA:DIGital:FILTer` or `MMEM:LOAD DFILter, <filename>` command.
- The command `DATA:DIGital:FILTer` or `MMEM:LOAD DFILter, <filename>` must be sent prior to sending the `SENSe:DIGital:FILTer:HPASs` command.
- If you switch from `CUSTom` to either `NONE`, `HP20`, `HP100`, or `HP400`, your previously downloaded information for the custom filter will be lost. You will need to redownload the filter information into the system. Refer to "Using the user-defined filter data" on page 478 for the information on how to use the custom filter.

Examples

The following commands set the high pass filter types to `HP20` and `HP100` for channel 1 and 2 respectively.

```
SENS:DIG:FILT:HPAS HP20, (@D1)
```

```
SENS:DIG:FILT:HPAS HP100, (@D2)
```

The following query returns the high pass filter types for channel 1 and 2.

```
SENS:DIG:FILT:HPAS? (@D1,D2)
```

Typical response: `HP20,HP100`

SENSe:DIGital:FILTer:WEIGhting

Syntax

```
SENSe:DIGital:FILTer:WEIGhting <weighting
filter>, (@<channel list>)
```

```
SENSe:DIGital:FILTer:WEIGhting?
(@<channel list>)
```

Description

Sets the weighting filter for the specified channel(s). The query returns the weighting filter type of the selected channel(s). Multiple responses are separated by commas.

The weighting filter types with their corresponding `<weighting filter>` parameters are listed as follows.

NONE	No weighting filter is applied
AWEighting	A-Weighting filter
CCIR1k	CCIR-1k weighted
CCIR2k	CCIR-2k weighted
CMESsage	C-Message
CCITt	CCITT
CUSTom	User-defined arbitrary filter type including Bandpass, Bandstop and notch filters

Parameters

Item	Type	Range of values	Default value
weighting filter	Discrete	NONE, AWEighting, CCIR1k, CCIR2k, CMESsage, CCITt, or CUSTom	NONE
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- The custom filter type includes the bandpass, bandstop, notch, and arbitrary filters.
- To use a custom weighting filter, you need to load the custom filter data into the U8903A before you can use it. To load a custom filter data, use either the `DATA:DIGital:FILTer` or `MMEM:LOAD DFILter, <filename>` command.
- The command `DATA:DIGital:FILTer` or `MMEM:LOAD DFILter, <filename>` must be sent prior to sending the `SENSe:DIGital:FILTer:WEIGhting` command.
- If you switch from `CUSTom` to either `NONE`, `AWE`, `CCIR1k`, `CCIR2k`, `CMES`, or `CCIT`, your previously downloaded information for the custom filter will be lost. You will need to redownload the filter information into the system. Refer to "Using the user-defined filter data" on page 478 for the information on how to use the custom filter.

Examples

The following commands set the weighting filter types to A-Weighting and C-Message for channel 1 and 2 respectively.

```
SENS:DIG:FILT:WEIG AWE, (@D1)
```

```
SENS:DIG:FILT:WEIG CMES, (@D2)
```

The following query returns the weighting filter types for channel 1 and 2.

```
SENS:DIG:FILT:WEIG? (@D1,D2)
```

Typical response: `AWE,CMES`

SENSe:DIGital:FILTer:DEEMphasis

Syntax

```
SENSe:DIGital:FILTer:DEEMphasis <de-emphasis>,
(@<channel list>)
SENSe:DIGital:FILTer:DEEMphasis?
(@<channel list>)
```

Description

Sets the de-emphasis condition for the specified channel(s). The query returns the de-emphasis condition of the selected channel(s). Multiple responses are separated by commas.

The de-emphasis conditions with their corresponding `<de-emphasis>` parameters are listed as follows.

`None`	No de-emphasis
`50us`	50µs de-emphasis
`75us`	75µs de-emphasis
`Custom`	User-defined de-emphasis filter

Parameters

Item	Type	Range of values	Default value
de-emphasis	String	None, 50us, 75us, or Custom	None
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- To use a custom deemphasis filter, you need to load the custom filter data into the U8903A before you can use it. To load a custom filter data, use either the `DATA:DIGital:FILTer` or `MMEM:LOAD DFILter, <filename>` command.

- The command DATA:DIGital:FILTer or MMEM:LOAD DFILter, <filename> must be sent prior to sending the SENSe:DIGital:FILTer:DEEMphasis command.
- If you switch from CUSTom to either None, 50us, or 75us, your previously downloaded information for the custom filter will be lost. You will need to redownload the filter information into the system. Refer to "Using the user-defined filter data" on page 478 for the information on how to use the custom filter.

Examples

The following commands set the de-emphasis condition to 50us for channel 1.

```
SENS:DIG:FILT:DEEM "50us", (@D1)
```

The following query returns the de-emphasis condition for channel 1.

```
SENS:DIG:FILT:DEEM? (@D1)
```

Typical response: 50us

SENSe:DIGital:FILTer:SRATe

Syntax

```
SENSe:DIGital:FILTer:SRATe <sampling rate>,
(@<channel list>)
SENSe:DIGital:FILTer:SRATe? (@<channel list>)
```

Description

Sets the filter sampling rate for the specified channel(s). The query returns the filter sampling rate of the selected channel(s). Multiple responses are separated by commas.

The `<sampling rate>` parameters are listed as follows.

S32000	32 kHz
S44100	44.1 kHz
S48000	48 kHz
S88200	88.2 kHz
S96000	96 kHz
S17640	176.4 kHz
S19200	192 kHz

Parameters

Item	Type	Range of values	Default value
sampling rate	Discrete	S32000, S44100, S48000, S88200, S96000, S17640, or S19200	S48000
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Examples

The following command sets the sampling rate for channel 1.

```
SENS:DIG:FILT:SRAT S32000, (@D1)
```

The following query returns the sampling rate for channel 1.

```
SENS:DIG:FILT:SRAT? (@D1)
```

Typical response: `S32000`

SENSe:DIGital:FUNCtion<j>

Syntax

```
SENSe:DIGital:FUNCtion<j> <function>,
(@<channel list>)
SENSe:DIGital:FUNCtion<j>? (@<channel list>)
```

Description

Sets the digital analyzer measurement function for the specified channel(s). The query returns the measurement function of the selected channel(s). Multiple responses are separated by commas.

The measurement functions with their corresponding <function> parameters are listed as follows.

FREQuency	Frequency measurement
VAC	AC voltage measurement
VDC	DC voltage measurement
THDRatio	THD+N Ratio measurement
THDLevel	THD+N Level measurement
SINad	SINAD measurement
SNRatio	Signal-to-noise ratio measurement
NOISe	Noise Level measurement
IMD	SMPTE IMD measurement
SDFDiec118	DFD IEC 60118 2nd order measurement
TDFDiec118	DFD IEC 60118 3rd order measurement
SDFDiec268	DFD IEC 60268 2nd order measurement
TDFDiec268	DFD IEC 60268 3rd order measurement
DCRosstalk	Crosstalk (channel driven) measurement
PHASe	Phase measurement
GDELay	Group delay measurement
PPEak	Maximum peak measurement
NPEak	Minimum peak measurement
DRATio	THD Ratio measurement
DLEVel	THD Level measurement

Parameters

Item	Type	Range of values	Default value
j	Numeric	1 to 2 • `SENS:DIG:FUNC1` indicates the first measurement function • `SENS:DIG:FUNC2` indicates the second measurement function	1
function	Discrete	FREQuency, VAC, VDC, THDRatio, THDLevel, SINad, SNRatio, NOISe, IMD, SDFDiec118, TDFDiec118, SDFDiec268, TDFDiec268, PHASe, DCRosstalk, GDELay, PPEak, NPEak, DRATio, or DLEVel	• FREQuency (first measurement function) • VAC (second measurement function)
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- For the first measurement function, there are only three types of selectable functions comprising frequency, Vac, and Vdc. For the second measurement function, you can select any of the measurement functions listed above.
- You need to set the DC coupling (`SENSe:DIGital:COUPling` command) prior to setting the Vdc measurement function.
- If either phase or crosstalk is selected, you must also specify the reference channel using the `SENSe:DIGital:REFerence:CHANnel` command. You must set the reference channel prior to sending the `SENSe:DIGital:FUNCtion` command.

- If phase is selected for a particular channel, the measurement function for all channels will automatically change to phase.
- Noise Level is not applicable for the sweep measurement parameter selection.

Examples

The following commands set Frequency as the first measurement function and SINAD as the second measurement function for channel 1. Make measurement and fetch the SINAD measurement result.

```
SENS:DIG:FUNC1 FREQ, (@D1)
```

```
SENS:DIG:FUNC2 SIN, (@D1)
```

```
INIT:DIG:ANAL (@D1)
```

```
FETC:DIG:SCAL? FUNC2, (@D1)
```

NOTE

- When FETCh is queried, the measurement result will be returned in the unit as listed in “Appendix B: Units of the Measurement Function Returned Values” on page 555.
- For crosstalk measurements, a value of 0 dB or 100% will always be returned when FETCh is used to acquire the result of the reference channel.

The following query returns the measurement function of channel 1.

```
SENS:DIG:FUNC2? (@D1)
```

Typical response: `SINAD`

SENSe:DIGital:FUNCtion<j>:UNIT

Syntax

```
SENSe:DIGital:FUNCtion<j>:UNIT <unit>,
(@<channel list>)
```

```
SENSe:DIGital:FUNCtion<j>:UNIT?
(@<channel list>)
```

Description

Specifies the unit for the measurement result (which is obtained using the `FETCh:DIGital` command) of the corresponding function for the selected channel(s). The query returns the unit of the corresponding function for the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
j	Numeric	1 to 2 • `SENS:DIG:FUNC1` indicates the first measurement function • `SENS:DIG:FUNC2` indicates the second measurement function	1
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

For the `<unit>` range of values and formulas, refer to "Appendix B: Units of the Measurement Function Returned Values" on page 555.

Remarks

The unit specified using this command will cause the measurement result to be returned in that unit. For example, changing the unit to dBV for the Vac function will return the measurement result obtained by the `FETCh:DIGital` command in dBV.

Examples

The following commands set the AC voltage as the second measurement function in the unit dBV for both channels.

```
SENS:DIG:FUNC2 VAC, (@D1,D2)
```

```
SENS:DIG:FUNC2:UNIT dBV, (@D1,D2)
```

The following query returns the unit of the second measurement function for both channels.

```
SENS:DIG:FUNC2:UNIT? (@D1,D2)
```

Typical response: `dBV,dBV`

SENSe:DIGital:REFerence:LEVel

Syntax

```
SENSe:DIGital:REFerence:LEVel <level>,
(@<channel list>)
```

```
SENSe:DIGital:REFerence:LEVel? (@<channel list>)
```

Description

Sets the reference level for the specified channel(s) in FFS. The reference level is used for conversion of the measurement result in unit dBr or x. The query returns the reference level of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
level	Numeric	0 < level < 1 FFS	100 mFFS
channel list	Discreet	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Examples

The following commands set the reference levels to 200 mFFS and 500 mFFS for channel 1 and 2 respectively.

```
SENS:DIG:REF:LEV 0.2, (@D1)
```

```
SENS:DIG:REF:LEV 0.5, (@D2)
```

The following query returns the reference levels for channel 1 and 2.

```
SENS:DIG:REF:LEV? (@D1,D2)
```

Typical response: `2.000000E-01,5.000000E-01`

SENSe:DIGital:REFerence:FREQuency

Syntax

```
SENSe:DIGital:REFerence:FREQuency <frequency>,
(@<channel list>)
SENSe:DIGital:REFerence:FREQuency?
(@<channel list>)
```

Description

Sets the reference frequency for the specified channel(s) in Hz (Hertz). The reference frequency is used for conversion of the measurement result in unit ΔHz (delta Hertz). The query returns the reference frequency of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
frequency	Numeric	0 ≤ frequency ≤ 1.0E+9	0
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remark

The reference frequency setting is only applicable for the frequency measurement function to specify the measurement results in ΔHz.

Examples

The following commands set the reference frequencies to 100 Hz and 300 Hz for channel 1 and 2 respectively.

```
SENS:DIG:REF:FREQ 100, (@D1)
```

```
SENS:DIG:REF:FREQ 300, (@D2)
```

The following query returns the reference frequency for channel 1 and 2.

```
SENS:DIG:REF:FREQ? (@D1,D2)
```

Typical response: `1.000000E+02,3.000000E+02`

SENSe:DIGital:REFerence:RATio

Syntax

```
SENSe:DIGital:REFerence:RATio <ratio>,
(@<channel list>)
SENSe:DIGital:REFerence:RATio? (@<channel list>)
```

Description

Sets the reference ratio for the specified channel(s) in dB. The reference ratio is used for conversion of the measurement result in unit ΔdB (delta decibel). The query returns the reference ratio of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
ratio	Numeric	–180 < ratio < 180	0
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Examples

The following commands set the reference ratio to 10 dB and 30 dB for channel 1 and 2 respectively.

```
SENS:DIG:REF:RAT 10, (@D1)
```

```
SENS:DIG:REF:RAT 30, (@D2)
```

The following query returns the reference ratio for channel 1 and 2.

```
SENS:DIG:REF:RAT? (@D1,D2)
```

Typical response: `1.000000E+01,3.000000E+01`

SENSe:DIGital:REFerence:VOLTage

Syntax

```
SENSe:DIGital:REFerence:VOLTage <reference voltage>, (@<channel list>)
SENSe:DIGital:REFerence:VOLTage? (@<channel list>)
```

Description

Sets the full scale (FFS) voltage for the specified channel(s) in V. The query returns the FFS voltage of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
reference voltage	Numeric	$0 < \text{voltage} \leq 1.0E+9$	1
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Examples

The following command sets the FFS voltage to 2.5 V for channel 1.

```
SENS:DIG:REF:VOLT 10, (@D1)
```

The following query returns the FFS voltage for channel 1.

`SENS:DIG:REF:VOLT? (@D1)`

Typical response: `2.500000E+01`

SENSe:DIGital:REFerence:CHANnel

Syntax

`SENSe:DIGital:REFerence:CHANnel <reference channel>`

`SENSe:DIGital:REFerence:CHANnel?`

Description

Sets the reference channel for the phase or crosstalk measurement functions. The query returns the reference channel.

Parameter

Item	Type	Range of values	Default value
reference channel	Numeric	1 or 2	1

Examples

The following commands measures phase with channel 2 as the reference channel.

```
SENS:DIG:REF:CHAN 2
SENS:DIG:FUNC2 PHAS, (@D1,D2)
INIT:DIG:ANAL (@D1)
FETC:DIG:SCAL? FUNC2, (@D1)
```

The following query returns the reference channel.

`SENS:DIG:REF:CHAN?`

Typical response: `2`

SENSe:DIGital:REFerence:MEASured

Syntax

```
SENSe:DIGital:REFerence:MEASured <measurement
type>, <source channel>, <@target channel list>
```

Description

Sets the last measurement result obtained from the specified measurement type of the selected source as the reference value for the corresponding target channels.

Parameters

Item	Type	Range of values	Default value
measurement type	Discrete	LEVel, FREQuency, or RATio	LEVel
source channel	Discrete	CH1 or CH2	Required parameter
target channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- If there is no data in the last measurement or invalid data such as INF, this command will not have any effect; the previous reference value will be remain.
- If the measurement type selection is level, sending this command will affect the reference level which is set using `SENSEe:DIGital:REFerence:LEVel`. You can use the command `SENSe:DIGital:REFerence:LEVel?` to query for the reference level.

- If the measurement type selection is frequency, sending this command will affect the reference frequency, which is set using `SENSEe:DIGital:REFerence:FREQuency`. You can use the command `SENSe:DIGital:REFerence:FREQuency?` to query for the reference frequency.
- If the measurement type selection is ratio, sending this command will affect the reference ratio which is set using `SENSEe:DIGital:REFerence:RATio`. You can use the command `SENSe:DIGital:REFerence:RATio?` to query for the reference ratio.

Examples

The following command sets the measured Vac result of channel 1 as reference value for both channels.

```
SENS:DIG:REF:MEAS LEV, CH1, (@D1:D2)
```

The following query returns the reference level of the measured value. Assume that the measured Vac result for channel 1 is 1 FFS.

```
SENS:DIG:REF:LEV? (@D1:D2)
```

Typical response: `1.000000E+00`

SENSe:DIGital:AVERaging:MOVing:POINts

Syntax

```
SENSe:DIGital:AVERaging:MOVing:POINts
<number of points>
```

```
SENSe:DIGital:AVERaging:MOVing:POINts?
```

Description

Controls the number of points to be included in the moving average. In moving averaging, when a new measurement data is added, the oldest data is discarded.

Parameter

Item	Type	Range of values	Default value
number of points	Numeric	1 to 50	1

Remark

This setting is only applicable in the analyzer mode but not Frequency domain and Time domain mode.

Examples

The following command sets eight averaging points.

```
SENS:DIG:AVER:MOV:POIN 8
```

The following query returns the number of averaging points.

```
SENS:DIG:AVER:MOV:POIN?
```

Typical response: 8

SENSe:DIGital:AVERaging:SYNC:POINts

Syntax

```
SENSe:DIGital:AVERaging:SYNC:POINts
<number of points>
SENSe:DIGital:AVERaging:SYNC:POINts?
```

Description

Sets the number of points for the synchronous averaging. Synchronous averaging reduces noise levels by averaging the acquired data in the time domain. The query returns the number of averaging points.

Parameter

Item	Type	Range of values	Default value
number of points	Numeric	1 to 64	1

Remark

This setting is only applicable if you trigger from the channel 1 or channel 2 input.

Examples

The following command sets eight averaging points.

```
SENS:DIG:AVER:SYNC:POIN 8
```

The following query returns the number of averaging points.

```
SENS:DIG:AVER:SYNC:POIN?
```

Typical response: `8`

SENSe:DIGital:SNR:DELay

Syntax

```
SENSe:DIGital:SNR:DELay <delay>
SENSe:DIGital:SNR:DELay?
```

Description

Sets the signal-to-noise ratio (SNR) measurement delay in milliseconds. The measurement delay is the time delay between the start of the signal generation and the start of the signal measurement. The query returns the SNR delay.

Parameter

Item	Type	Range of values	Default value
delay	Numeric	0 to 2000	0

Examples

The following command sets the SNR delay to 200 ms.

```
SENS:DIG:SNR:DEL 200
```

The following query returns the SNR delay.

```
SENS:DIG:SNR:DEL?
```

Typical response: `200`

SENSe:DIGital:THDN:MODE

Syntax

```
SENSe:DIGital:THDN:MODE <mode>,
(<@<channel list>)
```

```
SENSe:DIGital:THDN:MODE? (<@<channel list>)
```

Description

Sets the THD+N measurement mode for digital analyzer. The query returns the THD+N measurement mode.

Parameters

Item	Type	Range of values	Default value
mode	Discrete	NORMal or PRECision	NORMal
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remark

The THD+N mode setting is only applicable when the digital analyzer function 2 is set to THD+N measurement.

Examples

The following command set the THD+N measurement mode to Precision for channel 1.

```
SENS:DIG:THDN:MODE PREC, (@D1)
```

The following query returns the THD+N measurement mode for channel 1.

```
SENS:DIG:THDN:MODE? (@D1)
```

Typical response: `PREC`

SENSe:DIGital:FFT:WINDow

Syntax

```
SENSe:DIGital:FFT:WINDow <type>
SENSe:DIGital:FFT:WINDow?
```

Description

Sets the window function for frequency domain analysis. The query returns the window function.

The window functions with their corresponding `<type>` parameters are listed as follows.

`HANNing`	Hanning window
`RECTangular`	Rectangular window
`BLACkman`	Blackman-Harris window
`RIFe1`	Rife-Vincent 1 window
`RIFe3`	Rife-Vincent 3 window
`HAMMing`	Hamming window
`FLATtop`	Flattop window

Parameter

Item	Type	Range of values	Default value
type	Discrete	RECTangular, HANN, BLACkman, RIFe1, RIFe3, HAMMing, or FLATtop	BLACkman

Examples

The following command sets the Hanning window function.

```
SENS:DIG:FFT:WIND HANN
```

The following query returns the window function.

```
SENS:DIG:FFT:WIND?
```

Typical response: `HANN`

SENSe:DIGital:WAVeform:POINts

Syntax

```
SENSe:DIGital:WAVeform:POINts <number of points>
SENSe:DIGital:WAVeform:POINts?
```

Description

Sets the number of data points to acquire with the `FETCh:ARRAy?` command. The query returns the selected acquisition length.

If you select the frequency domain analysis, the acquisition length represents the FFT size. The acquisition length of the frequency domain analysis doubles the acquisition length that you select using this command.

Parameter

Item	Type	Range of values	Default value
number of points	Numeric	256, 512, 1024, 2048, 4096, 8192, 16384, or 32768	1024

Remarks

If the number of points that you enter is not the exact value of the acquisition length, the value is always clipped to its lower value. For instance, if the number of points that you enter is 500, it will be clipped to 256 which is the number lower than 500.

Examples

The following command sets the acquisition length to 512.

```
SENS:DIG:WAV:POIN 512
```

The following query returns the acquisition length.

```
SENS:DIG:WAV:POIN?
```

Typical response: `512`

SENSe:DIGital:BERT:INTerval

Syntax

```
SENSe:DIGital:BERT:INTerval <reading interval>
SENSe:DIGital:BERT:INTerval?
```

Description

Sets the reading interval of the pattern for the Bit Error Rate Test (BERT) in seconds. The reading interval is used to determine the front panel measurement refresh rate. The query returns the reading interval in seconds.

Parameter

Item	Type	Range of values	Default value
reading interval	Numeric	0.1 to 3600	0.1

Remark

- The SOURce:DIGital:BERT[:MODE] command must be sent prior to sending this command.
- The reading interval must be less than the reading duration set at SOURce:DIGital:BERT:DURation.

Examples

The following command sets the reading interval to 1 second.

```
SENS:DIG:BERT:INT 1
```

The following query returns the reading interval.

```
SENS:DIG:BERT:INT?
```

Typical response: 1

SENSe:DIGital:BERT:UNIT

Syntax

```
SENSe:DIGital:BERT:UNIT <unit>
SENSe:DIGital:BERT:UNIT?
```

Description

Sets the unit of the Total Error and Total Bits for the Bit Error Rate Test (BERT). The query returns the unit of the Total Error and Total Bits.

HEX	Hexadecimal
DEC	Decimal

Parameter

Item	Type	Range of values	Default value
unit	Discrete	HEX or DEC	DEC

Remark

The `SOURce:DIGital:BERT[:MODE]` command must be sent prior to sending this command.

Examples

The following command sets the unit of the Total Error and Total Bits to HEX

```
SENS:DIG:BERT:UNIT HEX
```

The following query returns the unit of the Total Error and Total Bits.

```
SENS:DIG:BERT:UNIT?
```

Typical response: `HEX`

SENSe:NOTCh:EMULation[:STATe]

Syntax

```
SENSe:NOTCh:EMULation[:STATe] <state>,
(@<channel list>)
```

```
SENSe:NOTCh:EMULation[:STATe]? (@<channel list>)
```

Description

Enables or disables the notch emulation for the analog analyzer for the specified channel(s). The query returns the notch emulator state of the selected channel(s) as `0` if the notch emulator state is `OFF`, or `1` if the notch emulator state is `ON`. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
state	Boolean	OFF(0) or ON(1)	OFF
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remark

This command is only applicable if the selected analog analyzer measurement function is SINAD or THD+N Ratio.

Examples

The following command enables the notch emulation for analog analyzer channel 1 and 2.

```
SENS:NOTC:EMUL ON, (@1,2)
```

The following query returns the notch emulation states of channel 1 and 2.

```
SENS:NOTC:EMUL? (@1,2)
```

Typical response: `1,1`

Display Subsystem

The Display subsystem provides the commands to select the U8903A graph display and front panel LCD display, as well as configure the axis settings for the graph and sweep modes.

DISPlay:ANALysis:MODE

Syntax

```
DISPlay:ANALysis:MODE <mode>
DISPlay:ANALysis:MODE?
```

Description

Sets the graph display as either time domain, frequency domain (magnitude), or frequency domain (phase). The query returns the graph display mode in the form of `MAGN`, `PHAS`, or `TIME`.

Parameter

Item	Type	Range of values	Default value
mode	Discrete	MAGNitude, PHASe, or TIME	MAGNitude

Examples

The following command sets the graph display as frequency domain (magnitude).

```
DISP:ANAL:MODE MAGN
```

The following query returns the graph display mode.

```
DISP:ANAL:MODE?
```

Typical response: `MAGN`

DISPlay[:WINDow]:GRAPh:TRACe:X:SPACing

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:X:SPACing
<spacing type>
```

```
DISPlay[:WINDow]:GRAPh:TRACe:X:SPACing?
```

Description

Sets the X-axis spacing as either linear or log. The query returns the X-axis spacing type in the form of `LIN` or `LOG`.

Parameter

Item	Type	Range of values	Default value
spacing type	Discrete	LINear or LOGarithmic	LINear

Examples

The following command sets the log X-axis spacing.

```
DISP:GRAP:TRAC:X:SPAC LOG
```

The following query returns the X-axis spacing type.

```
DISP:GRAP:TRAC:X:SPAC?
```

Typical response: `LOG`

DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:AUTO

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:AUTO
```

Description

Performs an autoscale on the X-axis to automatically scale the graph display according to the signal each time this command is sent.

Example

The following command performs an autoscale on the X-axis.

```
DISP:GRAP:TRAC:X:AUTO
```

DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:LEFT

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:LEFT
<minimum limit>
```

```
DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:LEFT?
```

Description

Sets the value represented by the minimum (left) edge of the X-axis. The query returns the left X-axis setting.

Parameter

Item	Type	Range of values	Default value
minimum limit	Numeric	–200000 to 200000	1

Examples

The following command sets the left X-axis setting to 100.

```
DISP:GRAP:TRAC:X:LEFT 100
```

The following query returns the left X-axis setting.

```
DISP:GRAP:TRAC:X:LEFT?
```

Typical response: `1.000000E+02`

DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:RIGHt

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:RIGHt
<maximum limit>
DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:RIGHt?
```

Description

Sets the value represented by the maximum (right) edge of the X-axis. The query returns the right X-axis setting.

Parameter

Item	Type	Range of values	Default value
maximum limit	Numeric	–200000 to 200000	30000

Examples

The following command sets the right X-axis setting to 10000.

```
DISP:GRAP:TRAC:X:RIGH 10000
```

The following query returns the right X-axis setting.

```
DISP:GRAP:TRAC:X:RIGH?
```

Typical response: `1.000000E+04`

DISPlay[:WINDow]:GRAPh:TRACe:Y:SPACing

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:Y:SPACing
<spacing type>
DISPlay[:WINDow]:GRAPh:TRACe:Y:SPACing?
```

Description

Sets the Y-axis spacing as either linear or log. The query returns the Y-axis spacing type in the form of `LIN` or `LOG`.

Parameter

Item	Type	Range of values	Default value
spacing type	Discrete	LINear or LOGarithmic	LINear

Examples

The following command sets the log Y-axis spacing.

```
DISP:GRAP:TRAC:Y:SPAC LOG
```

The following query returns the Y-axis spacing type.

```
DISP:GRAP:TRAC:Y:SPAC?
```

Typical response: `LOG`

DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:AUTO

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:AUTO
```

Description

Performs an autoscale on the Y-axis to automatically scale the graph display according to the signal each time this command is sent.

Example

The following command performs an autoscale on the Y-axis.

```
DISP:GRAP:TRAC:Y:AUTO
```

DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:BOTTom

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:BOTTom
<minimum limit>
```

```
DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:BOTTom?
```

Description

Sets the value represented by the minimum (bottom) edge of the Y-axis. The query returns the bottom Y-axis setting.

Parameter

Item	Type	Range of values	Default value
minimum limit	Numeric	–200000 to 200000	–150

Examples

The following command sets the bottom Y-axis setting to –200.

```
DISP:GRAP:TRAC:Y:BOTT -200
```

The query returns the bottom Y-axis setting.

```
DISP:GRAP:TRAC:Y:BOTT?
```

Typical response: `-2.000000E+02`

DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:TOP

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:TOP
<maximum limit>
DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:TOP?
```

Description

Sets the value represented by the maximum (top) edge of the Y-axis. The query returns the top Y-axis setting.

Parameter

Item	Type	Range of values	Default value
maximum limit	Numeric	–200000 to 200000	0

Examples

The following command sets the top Y-axis setting to 200.

```
DISP:GRAP:TRAC:Y:TOP 200
```

The following query returns the top Y-axis setting.

```
DISP:GRAP:TRAC:Y:TOP?
```

Typical response: `2.000000E+02`

DISPlay[:WINDow]:GRAPh:TRACe:AUTO

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:AUTO
```

Description

Performs an autoscale to automatically scale the graph display according to the signal each time this command is sent.

Example

The following command performs an autoscale on the graph.

```
DISP:GRAP:TRAC:AUTO
```

DISPlay[:WINDow]:GRAPh:TRACe:HOLD

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:HOLD <hold type>,
(@<channel>)
```

```
DISPlay[:WINDow]:GRAPh:TRACe:HOLD? (@<channel>)
```

Description

Sets the hold configuration for the specified channel(s). The query returns the hold configuration type of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
hold type	Discrete	NONE, MAX, or MIN	NONE
channel	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Example

The following command sets the hold configuration to MAX for channel 1.

```
DISP:GRAP:TRAC:HOLD MAX, (@1)
```

The following query returns the hold configuration type for channel 1 and 2.

```
DISP:GRAP:TRAC:HOLD? (@1,2)
```

Typical response: `MAX,NONE`

DISPlay[:WINDow]:GRAPh:TRACe:REFerence:STATe

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:REFerence:STATe
<state>
DISPlay[:WINDow]:GRAPh:TRACe:REFerence:STATe?
```

Description

Enables or disables the reference trace in the graph mode. The query returns the reference trace state.

Parameter

Item	Type	Range of values	Default value
state	Discrete	ON or OFF	ON

Examples

The following command enables the reference trace in the graph mode.

```
DISP:GRAP:TRAC:REF:STAT ON
```

The following query returns the reference trace state.

```
DISP:GRAP:TRAC:REF:STAT?
```

Typical response: `ON`

DISPlay[:WINDow]:GRAPh:TRACe:REFerence:SLOT

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:REFerence:SLOT
<slot number>
DISPlay[:WINDow]:GRAPh:TRACe:REFerence:SLOT?
```

Description

Sets the reference trace slot in the graph mode. The query returns the reference trace slot.

Parameter

Item	Type	Range of values	Default value
slot number	Numeric	1, 2, or 3	1

Examples

The following command sets the reference trace slot to 2.

```
DISP:GRAP:TRAC:REF:SLOT 2
```

The following query returns the reference trace slot.

```
DISP:GRAP:TRAC:REF:SLOT?
```

Typical response: 2

DISPlay[:WINDow]:GRAPh:TRACe:REFerence:SOURce

Syntax

```
DISPlay:[:WINDow]:GRAPh:TRACe:REFerence:SOURce
<source type>, <filename>
```

```
DISPlay:[:WINDow]:GRAPh:TRACe:REFerence:SOURce?
```

Description

Sets the source for the current reference trace slot. The query returns the source for the current reference trace slot.

Parameters

Item	Type	Range of values	Default value
source type	Discrete	NONE, FILE, CH1, or CH2	NONE
filename	String	Valid file path name. Only used if source_type is FILE. For example, "\Storage 1\ file.csv". Left blank if source type is channel 1 or channel 2.	Required parameter

Examples

The following command sets the source for the current reference slot to File and named ‘file.csv’ in the ‘\Storage 1’ directory.

```
DISP:GRAP:TRAC:REF:SOUR FILE, "\Storage 1\
file.csv"
```

The following query returns the source for the current reference slot.

```
DISP:GRAP:TRAC:REF:SOUR?
```

Typical response: `FILE`

DISPlay[:WINDow]:SWEep:TRACe:X:SPACing

Syntax

```
DISPlay[:WINDow]:SWEep:TRACe:X:SPACing
<spacing type>
DISPlay[:WINDow]:SWEep:TRACe:X:SPACing?
```

Description

Sets the X-axis spacing as either linear or log for the sweep. The query returns the X-axis spacing in the form of `LIN` or `LOG`.

Parameter

Item	Type	Range of values	Default value
spacing type	Discrete	LINear or LOGarithmic	LOGarithmic

Examples

The following command sets the log X-axis spacing.

```
DISP:SWE:TRAC:X:SPAC LOG
```

The following query returns the X-axis spacing type.

```
DISP:SWE:TRAC:X:SPAC?
```

Typical response: `LOG`

DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:AUTO

Syntax

```
DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:AUTO
```

Description

Performs an autoscale on the X-axis of the sweep plot to automatically scale the sweep plot according to the signal each time this command is sent.

Example

The following command performs an autoscale on the X-axis.

```
DISP:SWE:TRAC:X:AUTO
```

DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:LEFT

Syntax

```
DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:LEFT
<minimum limit>
```

```
DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:LEFT?
```

Description

Sets the value represented by the minimum (left) edge of the X-axis of the sweep plot. The query returns the left X-axis setting.

Parameter

Item	Type	Range of values	Default value
minimum limit	Numeric	–200000 to 200000	20

Examples

The following command sets the left X-axis setting to 5.

```
DISP:SWE:TRAC:X:LEFT 5
```

The following query returns the left X-axis setting.

```
DISP:SWE:TRAC:X:LEFT?
```

Typical response: `5.000000E+00`

DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:RIGHt

Syntax

```
DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:RIGHt
<maximum limit>
DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:RIGHt?
```

Description

Sets the value represented by the maximum (right) edge of the X-axis of the sweep plot. The query returns the right X-axis setting.

Parameter

Item	Type	Range of values	Default value
maximum limit	Numeric	–200000 to 200000	20000

Examples

The following command sets the right X-axis setting to 10000.

```
DISP:SWE:TRAC:X:RIGH 10000
```

The following query returns the right X-axis setting.

```
DISP:SWE:TRAC:X:RIGH?
```

Typical response: `1.000000E+04`

DISPlay[:WINDow]:SWEep:TRACe:Y:SPACing

Syntax

```
DISPlay[:WINDow]:SWEep:TRACe:Y:SPACing
<spacing type>
DISPlay[:WINDow]:SWEep:TRACe:Y:SPACing?
```

Description

Sets the Y-axis spacing as either linear or log for the sweep. The query returns the Y-axis spacing in the form of `LIN` or `LOG`.

Parameter

Item	Type	Range of values	Default value
spacing type	Discrete	LINear or LOGarithmic	LINear

Examples

The following command sets the log Y-axis spacing.

```
DISP:SWE:TRAC:Y:SPAC LOG
```

The following query returns the Y-axis spacing type.

```
DISP:SWE:TRAC:Y:SPAC?
```

Typical response: `LOG`

DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:AUTO

Syntax

`DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:AUTO`

Description

Performs an autoscale on the Y-axis of the sweep plot to automatically scale the sweep plot according to the signal each time this command is sent.

Example

The following command performs an autoscale on the Y-axis.

`DISP:SWE:TRAC:Y:AUTO`

DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:BOTTom

Syntax

`DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:BOTTom <minimum limit>`

`DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:BOTTom?`

Description

Sets the value represented by the minimum (bottom) edge of the Y-axis of the sweep plot. The query returns the bottom Y-axis setting.

Parameter

Item	Type	Range of values	Default value
minimum limit	Numeric	–200000 to 200000	1

Examples

The following command sets the bottom Y-axis setting to 50.

`DISP:SWE:TRAC:Y:BOTT 50`

The following query returns the bottom Y-axis setting.

`DISP:SWE:TRAC:Y:BOTT?`

Typical response: `5.000000E+01`

DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:TOP

Syntax

`DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:TOP <maximum limit>`

`DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:TOP?`

Description

Sets the value represented by the maximum (top) edge of the Y-axis of the sweep plot. The query returns the top Y-axis setting.

Parameter

Item	Type	Range of values	Default value
maximum limit	Numeric	–200000 to 200000	30

Examples

The following command sets the top Y-axis setting to 100.

`DISP:SWE:TRAC:Y:TOP 100`

The following query returns the top Y-axis setting.

`DISP:SWE:TRAC:Y:TOP?`

Typical response: `1.000000E+02`

DISPlay[:WINDow]:SWEep:TRACe:AUTO

Syntax

```
DISPlay[:WINDow]:SWEep:TRACe:AUTO
```

Description

Performs an autoscale on the sweep plot to automatically scale the sweep plot according to the signal each time this command is sent.

Example

The following command performs an autoscale on the sweep plot.

```
DISP:SWE:TRAC:AUTO
```

DISPlay[:WINDow]:SWEep:TRACe:HOLD

Syntax

```
DISPlay[:WINDow]:SWEep:TRACe:HOLD <hold type>,
(@<channel>)
```

```
DISPlay[:WINDow]:SWEep:TRACe:HOLD? (@<channel>)
```

Description

Sets the hold configuration for the specified channel(s). The query returns the hold configuration type of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
hold type	Discrete	NONE, MAX, or MIN	NONE
channel	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Example

The following command sets the hold configuration to MAX for channel 1.

```
DISP[:WIND]:SWE:TRAC:HOLD MAX, (@1)
```

The following query returns the hold configuration type for channel 1 and 2.

```
DISP[:WIND]:SWE:TRAC:HOLD? (@1,2)
```

Typical response: `MAX,NONE`

DISPlay[:WINDow]:SWEep:TRACe:FUNCtion

Syntax

```
DISPlay[:WINDow]:SWEep:TRACe:FUNCtion <function number>
DISPlay[:WINDow]:SWEep:TRACe:FUNCtion?
```

Description

Sets the current function in sweep mode. The query returns the current function in sweep mode.

Parameter

Item	Type	Range of values	Default value
function number	Numeric	1 or 2	1

Examples

The following command sets the current function in sweep mode to 1.

```
DISP:SWE:TRAC:FUNC 1
```

The following query returns the current function in sweep mode.

```
DISP:SWE:TRAC:FUNC?
```

Typical response: `1`

DISPlay[:WINDow]:SWEep:TRACe:REFerence:STATe

Syntax

```
DISPlay[:WINDow]:SWEep:TRACe:REFerence:STATe
<state>
DISPlay[:WINDow]:SWEep:TRACe:REFerence:STATe?
```

Description

Enables or disables the current reference trace in sweep mode. The query returns the state of the current reference trace.

Parameter

Item	Type	Range of values	Default value
state	Discrete	ON or OFF	OFF

Examples

The following command enables the current reference trace.

```
DISP:SWE:TRAC:REF:STAT ON
```

The following query returns the state of the current reference trace.

```
DISP:SWE:TRAC:REF:STAT?
```

Typical response: ON

DISPlay[:WINDow]:SWEep:TRACe:REFerence:SLOT

Syntax

```
DISPlay[:WINDow]:SWEep:TRACe:REFerence:SLOT
<slot number>
DISPlay[:WINDow]:SWEep:TRACe:REFerence:SLOT?
```

Description

Sets the reference trace slot in sweep mode. The query returns the reference trace slot.

Parameter

Item	Type	Range of values	Default value
slot number	Numeric	1, 2, or 3	1

Examples

The following command sets the reference trace slot to 2.

```
DISP:SWE:TRAC:REF:SLOT 2
```

The following query returns the reference trace slot.

```
DISP:SWE:TRAC:REF:SLOT?
```

Typical response: 2

DISPlay[:WINDow]:SWEep:TRACe:REFerence:SOURce

Syntax

```
DISPlay:[:WINDow]:SWEep:TRACe:REFerence:SOURce
<source type>, <filename>
```

```
DISPlay:[:WINDow]:SWEep:TRACe:REFerence:SOURce?
```

Description

Sets the source for the current reference trace slot. The query returns the source for the current reference trace slot.

Parameters

Item	Type	Range of values	Default value
source type	Discrete	NONE, FILE, CH1, or CH2	NONE
filename	String	Valid file path name. Only used if source_type is FILE. For example, "\Storage 1\file.csv". Left blank if source type is channel 1 or channel 2.	Required parameter

Examples

The following command sets the source for the current reference slot to File and named ‘file.csv’ in the ‘\Storage 1’ directory.

```
DISP:SWE:TRAC:REF:SOUR FILE, "\Storage 1\
file.csv"
```

The following query returns the source for the current reference slot.

```
DISP:SWE:TRAC:REF:SOUR?
```

Typical response: `FILE`

DISPlay[:WINDow]:VIEW

Syntax

```
DISPlay[:WINDow]:VIEW <view>, <panel>,
[<channel>]
```

Description

Sets the front panel LCD display type for the specified panel.

The display types with their corresponding <view> parameters are listed as follows.

Parameters

Item	Type	Range of values	Default value
view	String	Analog Analyzer, Digital Analyzer, Analog Generator, Digital Generator, Digital Analyzer DSI, Digital Analyzer AES, Digital Generator DSI, Digital Generator AES, Audio Data Bits, Audio Active Bits, Bit Error, Sweep, Graph, Sweep Graph, Sweep List, or System	Analog Generator
panel	Discrete	PANel1, PANel2, PANel3, or PANel4	PANel1
channel	Discrete	CH1 or CH2	CH1

Remarks

- The <channel> parameter is optional.
- When Sweep, Graph, or System is the selected display type, the <panel> and <channel> parameter are ignored.

Examples

The following command sets the analog analyzer channel 1 at panel 2.

```
DISP:VIEW “Analog Analyzer“, PAN2, CH1
```

DISPlay[:WINDow]:MODE

Syntax

```
DISPlay[:WINDow]:MODE <display mode>
DISPlay[:WINDow]:MODE?
```

Description

Sets the display mode of the front panel display. The query returns the current display mode.

Parameter

Item	Type	Range of values	Default value
display mode	Discrete	VIEW2 or VIEW4	VIEW2

Examples

The following command sets the front panel display mode to 2-view.

```
DISP:MODE VIEW2
```

The following query returns the current display mode.

```
DISP:MODE?
```

Typical response: `VIEW2`

DISPlay[:WINDow]:STATe

Syntax

```
DISPlay[:WINDow]:STATe <state>
DISPlay[:WINDow]:STATe?
```

Description

Enables or disables the front panel LCD backlight. The query returns the LCD backlight state as 0 if the state is OFF, or 1 if the state is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	OFF(0) or ON(1)	ON

Remark

Sending the SYSTem:PRESet or *RST command, or cycling the U8903A power, will enable the LCD backlight.

Examples

The following command enables the front panel LCD backlight.

```
DISP:STAT ON
```

The following query returns the LCD backlight state.

```
DISP:STAT?
```

Typical response: 1

DISPlay:DIGital:ANALysis:MODE

Syntax

```
DISPlay:DIGital:ANALysis:MODE <mode>
DISPlay:DIGital:ANALysis:MODE?
```

Description

Sets the graph to display the magnitude of the signal in frequency domain, phase in the frequency domain, or waveform in the time domain for the digital card options. The query returns the digital analysis mode.

MAGNitude	Magnitude in the frequency domain
PHASe	Phase in the frequency domain
TIME	Signal waveform in the time domain

Parameter

Item	Type	Range of values	Default value
mode	Discrete	MAGNitude, PHASe, or TIME	MAGNitude

Examples

The following command sets the analysis mode to Magnitude.

```
DISP:DIG:ANAL:MODE MAGN
```

The following query returns the analysis mode.

```
DISP:DIG:ANAL:MODE?
```

Typical response: MAGN

DISPlay[:WINDow]:DIGital:GRAPh:TRACe:HOLD

Syntax

```
DISPlay[:WINDow]:DIGital:GRAPh:TRACe:HOLD <hold type>, (@<channel>)
```

```
DISPlay[:WINDow]:DIGital:GRAPh:TRACe:HOLD? (@<channel>)
```

Description

Sets the hold configuration for the specified channel(s). The query returns the hold configuration type of the selected channel(s). Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
hold type	Discrete	NONE, MAX, or MIN	NONE
channel	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Example

The following command sets the hold configuration to MAX for channel 1.

```
DISP:DIG:GRAP:TRAC:HOLD MAX, (@D1)
```

The following query returns the hold configuration type for channel 1 and 2.

```
DISP:DIG:GRAP:TRAC:HOLD? (@D1,D2)
```

Typical response: `MAX,NONE`

DISPlay[:WINDow]:GRAPh:TRACe:INTerface

Syntax

```
DISPlay[:WINDow]:GRAPh:TRACe:INTerface
<interface type>
```

```
DISPlay[:WINDow]:GRAPh:TRACe:INTerface?
```

Description

Sets the interface type to be displayed in the graph mode. The query returns the interface type.

Parameter

Item	Type	Range of values	Default value
interface type	Discrete	ANALOG or DIGITAL	ANALOG

Examples

The following command sets interface type to Digital.

```
DISP:GRAP:TRAC:INT DIGITAL
```

The following query returns the interface type.

```
DISP:GRAP:TRAC:INT?
```

Typical response: `DIGITAL`

Calculate Subsystem

The Calculate subsystem provides the commands to configure the frequency domain harmonics settings as well as the graph marker functions.

CALCulate:HARMonic:COUNt

Syntax

```
CALCulate:HARMonic:COUNt <count>
CALCulate:HARMonic:COUNt?
```

Description

Sets the number of signal harmonic components in the frequency domain (magnitude) display. The query returns the number of harmonic components.

Parameter

Item	Type	Range of values	Default value
count	Numeric	1 to 64	10

Remarks

- The graph display must be set to frequency domain (magnitude) using the `DISPlay:ANALysis:MODE` command.
- This command is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command.

Examples

The following command sets eight signal harmonic components.

```
CALC:HARM:COUN 8
```

The following query returns the number of harmonic components.

```
CALC:HARM:COUN?
```

Typical response: `8`

CALCulate:HARMonic:FUNDamental?

Syntax

```
CALCulate:HARMonic:FUNDamental? (@<channel>)
```

Description

Returns the signal fundamental frequency in Hz for the specified channel.

Parameter

Item	Type	Range of values	Default value
channel	Numeric	1 or 2	Required parameter

Remarks

- The graph display must be set to frequency domain (magnitude) using the `DISPlay:ANALysis:MODE` command.
- This query is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command at the particular input channel.

Example

The following commands are used to obtain the signal fundamental frequency of channel 2.

```
INIT:GRAP (@2)
```

```
CALC:HARM:FUND? (@2)
```

Typical response: `1.000000E+03`

CALCulate:HARMonic:VALue?

Syntax

```
CALCulate:HARMonic:VALue? (@<channel>)
```

Description

Returns the harmonic component results of the trace for the specified channel. Multiple responses are separated by commas.

Parameter

Item	Type	Range of values	Default value
channel	Numeric	1 or 2	Required parameter

Remarks

- The graph display must be set to frequency domain (magnitude) using the `DISPlay:ANALysis:MODE` command.
- This query is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command at the particular input channel.
- The number of harmonic component results returned is based on the harmonic count specified in the `CALCulate:HARMonic:COUNt` command.

Example

The following commands are used to obtain the harmonic component results of channel 2.

```
INIT:GRAP (@2)
```

```
CALC:HARM:VAL? (@2)
```

Typical response:
```
-1.440191E+00,-6.487222E+01,-7.282130E+01,
-7.767053E+01,-8.125921E+01,-8.396585E+01,
-8.624970E+01,-8.790641E+01
```

CALCulate:HARMonic:FREQuencies?

Syntax

```
CALCulate:HARMonic:FREQuencies? (@<channel>)
```

Description

Returns the signal harmonic frequency values for the specified channel. Multiple responses are separated by commas.

Parameter

Item	Type	Range of values	Default value
channel	Numeric	1 or 2	Required parameter

Remarks

- The graph display must be set to frequency domain (magnitude) using the `DISPlay:ANALysis:MODE` command.
- This query is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command at the particular input channel.

- The number of harmonic frequency values returned is based on the harmonic count specified in the `CALCulate:HARMonic:COUNt` command.

Example

The following commands are used to obtain the harmonic frequency values of channel 2.

```
INIT:GRAP (@2)
```

```
CALC:HARM:FREQ? (@2)
```

Typical response:
```
9.918210E+02,2.002721E+03,2.994543E+03,
4.005431E+03,4.997250E+03,6.008151E+03,
6.999972E+03,7.991791E+03
```

CALCulate:THDistortion?

Syntax

```
CALCulate:THDistortion? <unit>, (@<channel>)
```

Description

Returns the Total Harmonic Distortion (THD) value of the input signal in the specified unit for the selected channel. The returned value can either be in dB or percentage by setting `<unit>` to `DB` or `PCT` respectively.

Parameters

Item	Type	Range of values	Default value
unit	Discrete	DB or PCT	PCT
channel	Numeric	1 or 2	Required parameter

Remarks

- The graph display must be set to frequency domain (magnitude) using the `DISPlay:ANALysis:MODE` command.
- This query is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command at the particular input channel.

Example

The following commands are used to obtain the distortion value of the input signal at channel 2 in percentage.

```
INIT:GRAP (@2)
CALC:THD? PCT, (@2)
```

Typical response: `1.691385E+01`

CALCulate:DIGital:HARMonic:COUNt

Syntax

```
CALCulate:DIGital:HARMonic:COUNt <count>
CALCulate:DIGital:HARMonic:COUNt?
```

Description

Sets the number of signal harmonic components in the frequency domain (magnitude) display. The query returns the number of harmonic components.

Parameter

Item	Type	Range of values	Default value
count	Numeric	1 to 64	10

Remarks

- The graph display must be set to frequency domain (magnitude) using the `DISPlay:DIGital:ANALysis:MODE` command.
- This command is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:DIGital:GRAPh` command.

Examples

The following command sets eight signal harmonic components.

```
CALC:DIG:HARM:COUN 8
```

The following query returns the number of harmonic components.

```
CALC:DIG:HARM:COUN?
```

Typical response: `8`

CALCulate:DIGital:HARMonic:FUNDamental?

Syntax

```
CALCulate:DIGital:HARMonic:FUNDamental?
(@<channel>)
```

Description

Returns the signal fundamental frequency in Hz for the specified channel.

Parameter

Item	Type	Range of values	Default value
channel	Discrete	D1 or D2	Required parameter

Remarks

- The graph display must be set to frequency domain (magnitude) using the `DISPlay:DIGital:ANALysis:MODE` command.
- This query is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:DIGital:GRAPh` command at the particular input channel.

Example

The following commands are used to obtain the signal fundamental frequency of channel 2.

`INIT:DIG:GRAP (@D2)`

`CALC:DIG:HARM:FUND? (@D2)`

Typical response: `1.000000E+03`

CALCulate:DIGital:HARMonic:VALue?

Syntax

`CALCulate:DIGital:HARMonic:VALue? (@<channel>)`

Description

Returns the harmonic component results of the trace for the specified channel. Multiple responses are separated by commas.

Parameter

Item	Type	Range of values	Default value
channel	Discrete	D1 or D2	Required parameter

Remarks

- The graph display must be set to frequency domain (magnitude) using the `DISPlay:DIGital:ANALysis:MODE` command.
- This query is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:DIGital:GRAPh` command at the particular input channel.
- The number of harmonic component results returned is based on the harmonic count specified in the `CALCulate:DIGital:HARMonic:COUNt` command.

Example

The following commands are used to obtain the harmonic component results of channel 2.

```
INIT:DIG:GRAP (@D2)
```

```
CALC:DIG:HARM:VAL? (@D2)
```

Typical response:
```
-1.440191E+00,-6.487222E+01,-7.282130E+01,
-7.767053E+01,-8.125921E+01,-8.396585E+01,
-8.624970E+01,-8.790641E+01
```

CALCulate:DIGital:HARMonic:FREQuencies?

Syntax

```
CALCulate:DIGital:HARMonic:FREQuencies?
(@<channel>)
```

Description

Returns the signal harmonic frequency values for the specified channel. Multiple responses are separated by commas.

Parameter

Item	Type	Range of values	Default value
channel	Discrete	D1 or D2	Required parameter

Remarks

- The graph display must be set to frequency domain (magnitude) using the `DISPlay:DIGital:ANALysis:MODE` command.
- This query is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:DIGital:GRAPh` command at the particular input channel.
- The number of harmonic frequency values returned is based on the harmonic count specified in the `CALCulate:DIGital:HARMonic:COUNt` command.

Example

The following commands are used to obtain the harmonic frequency values of channel 2.

```
INIT:DIG:GRAP (@D2)
```

```
CALC:DIG:HARM:FREQ? (@D2)
```

Typical response:
```
9.918210E+02,2.002721E+03,2.994543E+03,
4.005431E+03,4.997250E+03,6.008151E+03,
6.999972E+03,7.991791E+03
```

CALCulate:DIGital:THDistortion?

Syntax

```
CALCulate:DIGital:THDistortion? <unit>,
(@<channel>)
```

Description

Returns the Total Harmonic Distortion (THD) value of the input signal in the specified unit for the selected channel. The returned value can either be in dB or percentage by setting `<unit>` to `DB` or `PCT` respectively.

Parameters

Item	Type	Range of values	Default value
unit	Discrete	DB or PCT	PCT
channel	Discrete	D1 or D2	Required parameter

Remarks

- The graph display must be set to frequency domain (magnitude) using the `DISPlay:DIGital:ANALysis:MODE` command.
- This query is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:DIGital:GRAPh` command at the particular input channel.

Example

The following commands are used to obtain the distortion value of the input signal at channel 2 in percentage.

```
INIT:DIG:GRAP (@D2)
```

```
CALC:DIG:THD? PCT, (@D2)
```

Typical response: `1.691385E+01`

CALCulate:GRAPh:MARKer:THReshold[:LEVel]

Syntax

```
CALCulate:GRAPh:MARKer:THReshold[:LEVel]
<threshold level>
```

```
CALCulate:GRAPh:MARKer:THReshold[:LEVel]?
```

Description

Sets the threshold level that the marker can identify as a peak or minimum on the graph display in the graph mode. If the trace is above the threshold level, it will be identified as a peak, whereas the trace below the threshold level will be identified as a minimum. The query returns the specified threshold level.

Parameter

Item	Type	Range of values	Default value
threshold level	Numeric	Within the top edge and bottom edge of the display	–100

Remark

This command is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command.

Examples

The following command sets the threshold level to 20.

```
CALC:GRAP:MARK:THR 20
```

The following query returns the threshold level.

```
CALC:GRAP:MARK:THR?
```

Typical response: `2.000000E+01`

CALCulate:GRAPh:MARKer:THReshold:STATe

Syntax

```
CALCulate:GRAPh:MARKer:THReshold:STATe
<threshold state>
```

```
CALCulate:GRAPh:MARKer:THReshold:STATe?
```

Description

Turns on or off the threshold on the graph display in the graph mode. The query returns the threshold state as `0` if the state is `OFF`, or `1` if the state is `ON`.

Parameter

Item	Type	Range of values	Default value
threshold state	Boolean	OFF(0) or ON(1)	OFF

Remark

This command is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command.

Examples

The following command turns on the threshold on the graph display.

```
CALC:GRAP:MARK:THR:STAT ON
```

The following query returns the threshold state.

```
CALC:GRAP:MARK:THR:STAT?
```

Typical response: 1

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:STATe

Syntax

```
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:STATe
<state>
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:STATe?
```

Description

Turns on or off the selected marker on the graph display in the graph mode. The selected marker will become the active marker when it is turned on. The query returns the marker state as 0 if the marker state is OFF, or 1 if the marker state is ON.

Parameter

Item	Type	Range of values	Default value
state	Boolean	OFF(0) or ON(1)	OFF

Remark

This command is only applicable after the graph data has been acquired using the INITiate[:IMMediate]:GRAPh command.

Examples

The following command turns on marker 2 on the graph display.

```
CALC:GRAP:MARK2:STAT ON
```

The following query returns the state for marker 2.

```
CALC:GRAP:MARK2:STAT?
```

Typical response: `1`

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:TRACe

Syntax

```
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:TRACe
<trace no>
```

```
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:TRACe?
```

Description

Assigns the marker to the trace of the specified channel on the graph display in the graph mode. The trace number corresponds with the channel number. For example, trace number 1 represents the trace for channel 1. The selected marker will become the active marker. The query returns the trace number for the specified marker.

Parameter

Item	Type	Range of values	Default value
trace no	Discrete	CHANnel1 or CHANnel2	CHANnel1

Remarks

- This command is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command.

- If a marker is activated using other command without assigning a channel to it, the marker will be assigned to channel 1 by default.

Examples

The following command assigns marker 1 to the channel 2 trace on the graph display.

```
CALC:GRAP:MARK1:TRAC CHAN2
```

The following query returns the trace number for marker 1.

```
CALC:GRAP:MARK1:TRAC?
```

Typical response: `CHAN2`

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:X

Syntax

```
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:X
<x position>
```

```
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:X?
```

Description

Sets the marker X-axis value on the graph display in the graph mode. The selected marker will become the active marker. The query returns the marker X-axis value. If the marker state is off, the response is not a number (NAN).

Parameter

Item	Type	Range of values	Default value
x position	Numeric	–200000 to 200000	0

Remark

This command is only applicable after the graph data has been acquired using the INITiate[:IMMediate]:GRAPh command.

Examples

The following command sets the marker 2 X-axis value to 550 Hz on the graph display. (Assume that the graph is in the frequency domain mode)

```
CALC:GRAP:MARK2:X 550
```

The following query returns the marker 2 X-axis value.

```
CALC:GRAP:MARK2:X?
```

Typical response: 5.500000E+02

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:Y?

Syntax

```
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:Y?
```

Description

Returns the marker Y-axis value on the graph display in the graph mode.

Remarks

- This query is only applicable after the graph data has been acquired using the INITiate[:IMMediate]:GRAPh command.
- If the graph analysis mode is set to FFT magnitude, the returned value is in dBV.
- If the graph analysis mode is set to FFT phase, the returned value is in degree.

- If the graph analysis mode is set to time domain, the returned value is in Vrms.
- If the marker state is off, the response is not a number (`NAN`).

Example

The following query returns the marker 2 Y-axis value.

`CALC:GRAP:MARK2:Y?`

Typical response: `0.000000E+00`

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:PEAK

Syntax

`CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:PEAK <direction>`

Description

Searches for the peak value of the trace data by placing the specified marker at either the left or right peak of the graph display in the graph mode. Selecting all will search for the highest peak value from the left and right direction. The specified marker will become the active marker.

Parameter

Item	Type	Range of values	Default value
direction	Discrete	LEFT, RIGHt, or ALL	RIGHt

Remark

This command is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command.

Example

The following command places marker 2 at the left peak of the graph display.

```
CALC:GRAP:MARK2:PEAK LEFT
```

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:MIN

Syntax

```
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:MIN
<direction>
```

Description

Searches for the minimum value of the trace data by placing the specified marker at either the left or right minimum of the graph display in the graph mode. Selecting all will search for the lowest minimum value from the left and right direction. The specified marker will become the active marker.

Parameter

Item	Type	Range of values	Default value
direction	Discrete	LEFT, RIGHt, or ALL	RIGHt

Remark

This command is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command.

Example

The following command places marker 2 at the right minimum of the graph display.

```
CALC:GRAP:MARK2:MIN RIGH
```

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:REFerence

Syntax

```
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:REFerence
<reference marker no>

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:REFerence
?
```

Description

Sets the reference marker for the selected marker on the graph display in the graph mode. The query returns the reference marker for the specified marker.

Parameter

Item	Type	Range of values	Default value
reference marker no	Discrete	M1, M2, M3, M4, M5, M6, M7, M8, or OFF	OFF

Remarks

- This command is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command.
- A marker cannot be referenced to itself.
- Sending this command will turn on the reference marker. Select `OFF` to turn off the reference marker.
- If the selected marker has no reference marker when queried, the **–200,"Execution Error;The marker has no reference marker"** error will appear.

Examples

The following command sets the reference marker as marker 2 for marker 1 on the graph display.

```
CALC:GRAP:MARK1:REF M2
```

The following query returns the reference marker for marker 1.

```
CALC:GRAP:MARK1:REF?
```

Typical response: `M2`

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:XDELta?

Syntax

```
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:XDELta?
```

Description

Returns the difference in the X-axis value between the selected marker and its reference marker on the graph display in the graph mode.

Remarks

- This query is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command.
- If the marker state is off, the response is not a number (`NAN`).
- If the selected marker has no reference marker, the response is also not a number (`NAN`).

Examples

The following query returns the delta X-axis value for marker 2.

```
CALC:GRAP:MARK2:XDEL?
```

Typical response: `3.500000E+02`

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:YDELta?

Syntax

```
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:YDELta?
```

Description

Returns the difference in the Y-axis value between the selected marker and its reference marker on the graph display in the graph mode.

Remarks

- This query is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command.
- If the marker state is off, the response is not a number (`NAN`).
- If the selected marker has no reference marker, the response is also not a number (`NAN`).

Example

The following query returns the delta Y-axis value for marker 2.

```
CALC:GRAP:MARK2:YDEL?
```

Typical response: `5.000000E+00`

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:MOVement

Syntax

```
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:MOVement
<movement characteristic>

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:MOVement?
```

Description

Sets the marker movement characteristic of either single or in pair on the graph display in the graph mode. The query returns the marker movement characteristic in the form of either `SING` or `PAIR`.

The description for each `<movement characteristic>` parameter is shown as follows.

`SINGle`	Move only the selected marker on the graph.
`PAIR`	Move both the selected and reference markers in the same direction on the graph.

Parameters

Item	Type	Range of values	Default value
movement characteristic	Discrete	SINGle or PAIR	SINGle

Remarks

- This command is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command.
- To move the markers in pairs, you need to specify the reference marker of the selected marker prior to sending this command.

Examples

The following command sequence sets marker 1 and marker 2 as its reference marker to move together on the graph.

```
CALC:GRAP:MARK1:REF M2
```

```
CALC:GRAP:MARK1:MOV PAIR
```

The following query returns the movement characteristic of marker 1.

```
CALC:GRAP:MARK1:MOV?
```

Typical response: `PAIR`

CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8[:SET]:MODE

Syntax

```
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8[:SET]:
MODE <marker mode>
```

Description

Positions the marker at either the start, stop, or center points of the graph in the graph mode. You may also expand the area between the selected marker and its reference marker.

The description for each `<marker mode>` parameter is shown as follows.

`STARt`	Position the marker at the graph start point.
`STOP`	Position the marker at the graph stop point.
`CENTer`	Position the marker at the graph center point.
`DSPan`	Expand the area of the graph between the selected marker and its reference marker.

Parameter

Item	Type	Range of values	Default value
marker mode	Discrete	STARt, STOP, CENTer, or DSPan	Required parameter

Remarks

- This command is only applicable after the graph data has been acquired using the `INITiate[:IMMediate]:GRAPh` command.
- The DSPan mode is only applicable for a selected marker which has a reference marker.

Example

The following command positions marker 2 at the graph start point.

```
CALC:GRAP:MARK1:MODE STAR
```

CALCulate:SWEep:MARKer:THReshold[:LEVel]

Syntax

```
CALCulate:SWEep:MARKer:THReshold[:LEVel]
<threshold level>
```

```
CALCulate:SWEep:MARKer:THReshold[:LEVel]?
```

Description

Sets the threshold level that the marker can identify as a peak or minimum on the graph display in the sweep mode. If the trace is above the threshold level, it will be identified as a peak, whereas the trace below the threshold level will be identified as a minimum. The query returns the specified threshold level.

Parameter

Item	Type	Range of values	Default value
threshold level	Numeric	Within the top edge and bottom edge of the display	0

Remark

This command is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.

Examples

The following command sets the threshold level to 20.

```
CALC:SWE:MARK:THR 20
```

The following query returns the threshold level.

```
CALC:SWE:MARK:THR?
```

Typical response: `2.000000E+01`

CALCulate:SWEep:MARKer:THReshold:STATe

Syntax

```
CALCulate:SWEep:MARKer:THReshold:STATe
<threshold state>
```

```
CALCulate:SWEep:MARKer:THReshold:STATe?
```

Description

Turns on or off the threshold on the graph display in the sweep mode. The query returns the threshold state as `0` if the state is `OFF`, or `1` if the state is `ON`.

Parameter

Item	Type	Range of values	Default value
threshold state	Boolean	OFF(0) or ON(1)	OFF

Remark

This command is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.

Examples

The following command turns on the threshold on the graph display.

```
CALC:SWE:MARK:THR:STAT ON
```

The following query returns the threshold state.

```
CALC:SWE:MARK:THR:STAT?
```

Typical response: `1`

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:STATe

Syntax

```
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:STATe
<state>
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:STATe?
```

Description

Turns on or off the selected marker on the graph display in the sweep mode. The selected marker will become the active marker when it is turned on. The query returns the marker state as `0` if the marker state is `OFF`, or `1` if the marker state is `ON`.

Parameter

Item	Type	Range of values	Default value
state	Boolean	OFF(0) or ON(1)	OFF

Remark

This command is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.

Examples

The following command turns on marker 2 on the graph display.

`CALC:SWE:MARK2:STAT ON`

The following query returns the state for marker 2.

`CALC:SWE:MARK2:STAT?`

Typical response: `1`

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:TRACe?

Syntax

`CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:TRACe?`

Description

Assigns the marker to the trace of the specified channel on the graph display in the sweep mode. The trace number corresponds with the channel number. For example, trace number 1 represents the trace for channel 1. The selected marker will become the active marker. The returned value is the trace number for the specified marker.

Remarks

- This query is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.
- Only the query is provided for this setting. The selected marker will be automatically assigned to the current active channel. The active channel for the sweep can be selected using the `SOURce:SWEep:CHANnel` command.

Example

The following query returns the trace number for marker 1.

`CALC:SWE:MARK1:TRAC?`

Typical response: `CHAN2`

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:X

Syntax

`CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:X <x position>`

`CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:X?`

Description

Sets the marker X-axis value on the graph display in the sweep mode. The selected marker will become the active marker. The query returns the marker X-axis value. If the marker state is off, the response is not a number (`NAN`).

Parameter

Item	Type	Range of values	Default value
x position	Numeric	–200000 to 200000	0

Remark

This command is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.

Examples

The following command sets the marker 2 X-axis value to 550 Hz on the graph display.

```
CALC:SWE:MARK2:X 550
```

The following query returns the marker 2 X-axis value.

```
CALC:SWE:MARK2:X?
```

Typical response: `5.500000E+02`

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:Y?

Syntax

```
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:Y?
```

Description

Returns the marker Y-axis value on the graph display in the sweep mode.

Remarks

- This query is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.
- If the marker state is off, the response is not a number (`NAN`).

Example

The following query returns the marker 2 Y-axis value.

```
CALC:SWE:MARK2:Y?
```

Typical response: `0.000000E+00`

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:PEAK

Syntax

```
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:PEAK
<direction>
```

Description

Searches for the peak value of the trace data by placing the specified marker at either the left or right peak of the graph display in the sweep mode. Selecting all will search for the highest peak value from the left and right direction. The specified marker will become the active marker.

Parameter

Item	Type	Range of values	Default value
direction	Discrete	LEFT, RIGHt or ALL	RIGHt

Remark

This command is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.

Example

The following command places marker 2 at the left peak of the graph display.

```
CALC:SWE:MARK2:PEAK LEFT
```

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:MIN

Syntax

```
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:MIN
<direction>
```

Description

Searches for the minimum value of the trace data by placing the specified marker at either the left or right minimum of the graph display in the sweep mode. Selecting all will search for the lowest minimum value from the left and right direction. The specified marker will become the active marker.

Parameter

Item	Type	Range of values	Default value
direction	Discrete	LEFT, RIGHt or ALL	RIGHt

Remark

This command is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.

Example

The following command places marker 2 at the right minimum of the graph display.

```
CALC:SWE:MARK2:MIN RIGH
```

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:REFerence

Syntax

```
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:REFerence
<reference marker no>

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:REFerence
?
```

Description

Sets the reference marker for the selected marker on the graph display in the sweep mode. The query returns the reference marker for the specified marker.

Parameter

Item	Type	Range of values	Default value
reference marker no	Discrete	M1, M2, M3, M4, M5, M6, M7, M8, or OFF	OFF

Remarks

- This command is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.
- A marker cannot be referenced to itself.
- Sending this command will turn on the reference marker. Select `OFF` to turn off the reference marker.
- If the selected marker has no reference marker when queried, the **–200,"Execution Error;The marker has no reference marker"** error will appear.

Examples

The following command sets the reference marker as marker 2 for marker 1 on the graph display.

```
CALC:SWE:MARK1:REF M2
```

The following query returns the reference marker for marker 1.

```
CALC:SWE:MARK1:REF?
```

Typical response: `M2`

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:XDELta?

Syntax

```
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:XDELta?
```

Description

Returns the difference in the X-axis value between the selected marker and its reference marker on the graph display in the sweep mode.

Remarks

- This query is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.
- If the marker state is off, the response is not a number (`NAN`).
- If the selected marker has no reference marker, the response is also not a number (`NAN`).

Example

The following query returns the delta X-axis value for marker 2.

```
CALC:SWE:MARK2:XDEL?
```

Typical response: `3.500000E+02`

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:YDELta?

Syntax

`CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:YDELta?`

Description

Returns the difference in the Y-axis value between the selected marker and its reference marker on the graph display in the sweep mode.

Remarks

- This query is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.
- If the marker state is off, the response is not a number (`NAN`).
- If the selected marker has no reference marker, the response is also not a number (`NAN`).

Example

The following query returns the delta Y-axis value for marker 2.

`CALC:SWE:MARK2:YDEL?`

Typical response: `5.000000E+00`

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:MOVement

Syntax

```
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:MOVement
<movement characteristic>

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8:MOVement?
```

Description

Sets the marker movement characteristic of either single or in pair on the graph display in the sweep mode. The query returns the marker movement characteristic in the form of either `SING` or `PAIR`.

The description for each `<movement characteristic>` parameter is shown as follows.

`SINGle`	Move only the selected marker on the graph.
`PAIR`	Move both the selected and reference markers in the same direction on the graph.

Parameter

Item	Type	Range of values	Default value
movement characteristic	Discrete	SINGle or PAIR	SINGle

Remarks

- This command is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.
- To move the markers in pairs, you need to specify the reference marker of the selected marker prior to sending this command.

Examples

The following command sequence sets marker 1 and marker 2 as its reference marker to move together on the graph.

```
CALC:SWE:MARK1:REF M2
```

```
CALC:SWE:MARK1:MOV PAIR
```

The following query returns the movement characteristic of marker 1.

```
CALC:SWE:MARK1:MOV?
```

Typical response: `PAIR`

CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8[:SET]:MODE

Syntax

```
CALCulate:SWEep:MARKer[1]|2|3|4|5|6|7|8[:SET]:
MODE <marker mode>
```

Description

Positions the marker at either the start, stop, or center points of the graph in the sweep mode. You may also expand the area between the selected marker and its reference marker.

The description for each `<marker mode>` parameter is shown as follows.

`STARt`	Position the marker at the graph start point.
`STOP`	Position the marker at the graph stop point.
`CENTer`	Position the marker at the graph center point.
`DSPan`	Expand the area of the graph between the selected marker and its reference marker.

Parameter

Item	Type	Range of values	Default value
marker mode	Discrete	STARt, STOP, CENTer, or DSPan	Required parameter

Remarks

- This command is only applicable after the sweep data has been acquired using the `INITiate[:IMMediate]:SWEep` command.
- The DSPan mode is only applicable for a selected marker which has a reference marker.

Example

The following command positions marker 2 at the graph start point.

```
CALC:SWE:MARK2:MODE STAR
```

CALCulate:FORMat:LEVel

Syntax

```
CALCulate:FORMat:LEVel <format>, (@<channel>)
```

```
CALCulate:FORMat:LEVel? (@<channel>)
```

Description

Sets the format of the measurement data for the specified channel(s) for level measurement function such as Vac, Vdc, and Noise Level. The query returns the format of the measurement data of the selected channel(s).

The description for each `<format>` parameter is shown as follows.

`OFF`	Returns the measurement data in V.
`LOGarithmic`	Returns the measurement data in dBr.
`LINear`	Returns the measurement data in x.

Parameters

Parameter	Type	Range of values	Default value
format	Discrete	OFF, LOGarithmic, or LINear	OFF
channel	Numeric	1 or 2	1

Remark

After this command is sent, the calculated measurement data can be acquired using the `FETCh:SCALar?` command for analyzer mode or the `FETCh:SWEep?` command for sweep mode.

Example

The following command sets the level measurement format to linear for channel 1.

```
CALC:FORM:LEV LIN, (@1)
```

The following query returns the format of the measurement data for channel 1.

```
CALC:FORM:LEV? (@1)
```

Typical response: `LIN`

CALCulate:FORMat:FREQuency

Syntax

```
CALCulate:FORMat:FREQuency <format>,
(@<channel>)
```

```
CALCulate:FORMat:FREQuency? (@<channel>)
```

Description

Sets the format of the measurement data for the specified channel(s) for frequency measurement function. The query returns the format of the measurement data of the selected channel(s).

The description for each `<format>` parameter is shown as follows.

OFF	Returns the measurement data in Hz.
DELTa	Returns the measurement data in ΔHz.

Parameters

Parameter	Type	Range of values	Default value
format	Discrete	OFF or DELTa	OFF
channel	Numeric	1 or 2	1

Remark

After this command is sent, the calculated measurement data can be acquired using the `FETCh:SCALar?` command for analyzer mode or the `FETCh:SWEep?` command for sweep mode.

Example

The following command sets the frequency measurement format to delta for channel 1.

```
CALC:FORM:FREQ DELT, (@1)
```

The following query returns the format of the measurement data for channel 1.

```
CALC:FORM:FREQ? (@1)
```

Typical response: DELT

CALCulate:FORMat:RATio

Syntax

```
CALCulate:FORMat:RATio <format>, (@<channel>)
```

```
CALCulate:FORMat:RATio? (@<channel>)
```

Description

Sets the format of the measurement data for the specified channel(s) for ratio measurement function such as SINAD and THD Ratio, DFD, IMD, crosstalk, and SNR. The query returns the format of the measurement data of the selected channel(s).

The description for each `<format>` parameter is shown as follows.

OFF	Returns the measurement data in dB.
DELTa	Returns the measurement data in ΔdB.
LINear	Returns the measurement data in x.

Parameters

Parameter	Type	Range of values	Default value
format	Discrete	OFF, DELTa, or LINear	OFF
channel	Numeric	1 or 2	1

Remark

After this command is sent, the calculated measurement data can be acquired using the `FETCh:SCALar?` command.

Example

The following command sets the ratio measurement format to delta for channel 1.

```
CALC:FORM:RAT DELT, (@1)
```

The following query returns the format of the measurement data for channel 1.

```
CALC:FORM:RAT? (@1)
```

Typical response: `DELT`

CALCulate:DIGital:FORMat:LEVel

Syntax

```
CALCulate:DIGital:FORMat:LEVel <format>,
(@<channel>)
```

```
CALCulate:DIGital:FORMat:LEVel? (@<channel>)
```

Description

Sets the format of the measurement data for the specified channel(s) for level measurement function such as Vac, Vdc, Noise Level, THD+N Level, Positive Peak, and Negative Peak. The query returns the format of the measurement data of the selected channel(s).

The description for each `<format>` parameter is shown as follows.

OFF	Returns the measurement data in V.
LOGarithmic	Returns the measurement data in dBr.
LINear	Returns the measurement data in x.

Parameters

Parameter	Type	Range of values	Default value
format	Discrete	OFF, LOGarithmic, or LINear	OFF
channel	Numeric	1 or 2	1

Remark

After this command is sent, the calculated measurement data can be acquired using the `FETCh:DIGital:SCALar?` command for analyzer mode or the `FETCh:SWEep?` command for sweep mode.

Example

The following command sets the level measurement format to linear for channel 1.

```
CALC:DIG:FORM:LEV LIN, (@1)
```

The following query returns the format of the measurement data for channel 1.

```
CALC:DIG:FORM:LEV? (@1)
```

Typical response: `LIN`

CALCulate:DIGital:FORMat:FREQuency

Syntax

```
CALCulate:DIGital:FORMat:FREQuency <format>,
(@<channel>)
```

```
CALCulate:DIGital:FORMat:FREQuency? (@<channel>)
```

Description

Sets the format of the measurement data for the specified channel(s) for frequency measurement function. The query returns the format of the measurement data of the selected channel(s).

The description for each `<format>` parameter is shown as follows.

`OFF`	Returns the measurement data in Hz.
`DELTa`	Returns the measurement data in ΔHz.

Parameters

Parameter	Type	Range of values	Default value
format	Discrete	OFF or DELTa	OFF
channel	Numeric	1 or 2	1

Remark

After this command is sent, the calculated measurement data can be acquired using the `FETCh:DIGital:SCALar?` command for analyzer mode or the `FETCh:SWEep?` command for sweep mode.

Example

The following command sets the frequency measurement format to delta for channel 1.

```
CALC:DIG:FORM:FREQ DELT, (@1)
```

The following query returns the format of the measurement data for channel 1.

```
CALC:DIG:FORM:FREQ? (@1)
```

Typical response: DELT

CALCulate:DIGital:FORMat:RATio

Syntax

```
CALCulate:DIGital:FORMat:RATio <format>,
(@<channel>)
```

```
CALCulate:DIGital:FORMat:RATio? (@<channel>)
```

Description

Sets the format of the measurement data for the specified channel(s) for ratio measurement function such as SINAD and THD Ratio, DFD, IMD, crosstalk, and SNR. The query returns the format of the measurement data of the selected channel(s).

The description for each <format> parameter is shown as follows.

OFF	Returns the measurement data in dB.
DELTa	Returns the measurement data in ΔdB.
LINear	Returns the measurement data in x.

Parameters

Parameter	Type	Range of values	Default value
format	Discrete	OFF, DELTa, or LINear	OFF
channel	Numeric	1 or 2	1

Remark

After this command is sent, the calculated measurement data can be acquired using the `FETCh:DIGital:SCALar?` command for analyzer mode or the `FETCh:SWEep?` command for sweep mode.

Example

The following command sets the ratio measurement format to delta for channel 1.

```
CALC:DIG:FORM:RAT DELT, (@1)
```

The following query returns the format of the measurement data for channel 1.

```
CALC:DIG:FORM:RAT? (@1)
```

Typical response: `DELT`

Data Subsystem

The Data subsystem provides the commands which enable you to download the user-defined data for sweep, arbitrary waveform, or filter into the U8903A internal memory.

DATA:SWEep

Syntax

`DATA:SWEep <data>`

Description

Downloads the 32-bit floating point sweep data into the U8903A internal sweep memory. The `<data>` parameter is in the IEEE-488.2 binary block program data format.

Remarks

- Refer to "Appendix G: Using the IEEE-488.2 Binary Block Format" on page 567 for details on the `<data>` format.
- The maximum number of allowable sweep points is 1024.
- Refer to "Performing sweep" on page 473 for the example of the List sweep mode.
- Sending the `SYSTem:PRESet`, `*RST`, or `SYSTem:RESet[:MODE] SWEep` command, or cycling the U8903A power, will delete the downloaded sweep points.
- If you select amplitude as the sweep parameter, your downloaded amplitude points are assumed in unit Vp.
- The command `SOURce:SWEep:CHANnel` must be sent prior to sending the `DATA:SWEep` command.

- When you send this command, the custom sweep points in the file will be loaded into the U8903A based on the source sweep channel set in the `SOURce:SWEep:CHANnel` command. The sweep mode will also be set to Automatic List or Manual list, depending on the previous sweep mode.

Example

The following command downloads the sweep data points into the U8903A internal sweep memory.

```
DATA:SWE <data>
```

DATA:WAVeform

Syntax

```
DATA:WAVeform <Vpeak>, <DC Offset>, <data>
```

Description

Downloads the 32-bit floating point arbitrary waveform data into the U8903A internal waveform memory.

You can download from 32 to 32768 (32K) points per waveform. The data value must be the normalized data between –1 to 1. The values of –1 and +1 correspond to the peak values of the waveform (if the offset is 0 V). For example, if you set the Vpeak to 5 Vp (0 V offset), +1 corresponds to +5 Vp. The `<data>` parameter is in the IEEE-488.2 binary block program data format.

Parameters

Item	Type	Range of values	Default value
Vpeak	Numeric	• 0 to 22.6 Vp (Balanced output connection) • 0 to 11.3 Vp (Unbalanced or Common output connection)	Required parameter
DC Offset	Numeric	–11.3 V to 11.3 V	Required parameter

Remarks

- Refer to "Appendix G: Using the IEEE-488.2 Binary Block Format" on page 567 for details on the `<data>` format.
- Refer to "Generating the arbitrary waveform" on page 468 for the arbitrary waveform example.
- The `DATA:WAVeform` command overwrites the previous waveform data in the U8903A volatile memory.
- Sending the `SYSTem:PRESet`, `*RST`, or `SYSTem:RESet[:MODE] AGENerator` command, or cycling the U8903A power, will delete the downloaded waveform data.

Example

The following command downloads the arbitrary waveform data into the U8903A internal waveform memory.

```
DATA:WAV 5, 0, <data>
```

DATA:WAVFile

Syntax

```
DATA:WAVFile <data>
```

Description

Downloads a Microsoft® compatible .wav file to the digital generator buffer. The `<data>` parameter is in the IEEE-488.2 binary block program data format.

Remarks

- Refer to “Appendix G: Using the IEEE-488.2 Binary Block Format” on page 567 for details on the `<data>` format.
- The acceptable file type is restricted to WAVE file format (.wav).
- The size of the wave file is limited to 5 MB and the supported data resolution is 8, 16, and 24 bits per sample.
- According to the definition of the wave file format, the PCM data is two's-complement except for resolutions of 1 to 8 bits, which are represented as offset binary. Therefore, for wave file with 8 bits per sample resolution, the data will automatically be converted to two's-complement at the output.
- The wave file applies to both channel 1 and 2 of the digital generator.

Example

The following command downloads the wave file data into the digital generator arbitrary waveform.

```
DATA:WAVF <data>
```

DATA:FILTer

Syntax

```
DATA:FILTer <filter category>, <no. of section>,
<no. of group delay>, <data>
```

Description

Downloads the 32-bit floating point user-defined filter data into the U8903A volatile memory allocated for the user-defined filter coefficients.

NOTE There is only one memory slot allocated for this function.

The <data> parameter represents the filter coefficients in the IEEE-488.2 binary block program data format, where the minimum number of bytes is 16 and maximum number of bytes is 1024. The maximum number of filter coefficients is 256 with 32-bit for each coefficient.

Parameters

Item	Type	Range of values	Default value
filter category	Numeric	Infinite Impulse Response (IIR) or Finite Impulse Response (FIR)	Required parameter
no. of section	Numeric	1 to 36	Required parameter
no. of group delay	Numeric	0 to 65535	Required parameter

Remarks

- Refer to “Appendix G: Using the IEEE-488.2 Binary Block Format” on page 567 for details on the <data> format.
- This command must be sent prior to sending the `SENSe:FILTer:LPASs CUSTom`, `SENSe:FILTer:HPASs CUSTom`, or `SENSe:FILTer:WEIGhting CUSTom`.

- The `DATA:FILTer` command overwrites the previous filter data in the U8903A volatile memory.
- The downloaded filter data will remain in the U8903A volatile memory if the CUSTom filter is not changed to any other preset filters for the selected channel.
- Sending the `SYSTem:PRESet`, `*RST`, or `SYSTem:RESet[:MODE] AANalyzer` command, or cycling the U8903A power, will delete the downloaded filter data.
- If the filter type is FIR, the coefficients are arranged in the following manner.

Coefficient[0]	//A[0]
Coefficient[1]	//A[1]
Coefficient[2]	//A[2]
Coefficient[3]	//A[3]
Coefficient[4]	//A[4]
Coefficient[5]	//A[5]
Coefficient[6]	//A[6]

.
.
.

NOTE

The FIR filter transfer function, *H*(*z*), is defined as:

$$H(z) = A[0] + A[1]z^{-1} + A[2]z^{-2} + A[3]z^{-3} + \ldots$$

where z = complex variable

- If the filter type is IIR, the coefficients are arranged in the following manner.

Coefficient[0]	//Section 1: $Gain_1$
Coefficient[1]	//Section 1: $A_1[0]$
Coefficient[2]	//Section 1: $A_1[1]$
Coefficient[3]	//Section 1: $A_1[2]$
Coefficient[4]	//Section 1: $B_1[0]$

Coefficient[5]	//Section 1: $B_1[1]$
Coefficient[6]	//Section 1: $B_1[2]$
Coefficient[0]	//Section 2: $Gain_2$
Coefficient[1]	//Section 2: $A_2[0]$
Coefficient[2]	//Section 2: $A_2[1]$
Coefficient[3]	//Section 2: $A_2[2]$
Coefficient[4]	//Section 2: $B_2[0]$
Coefficient[5]	//Section 2: $B_2[1]$
Coefficient[6]	//Section 2: $B_2[2]$

⋮

where A_x = Denominator and B_x = Numerator

NOTE

The IIR filter transfer function, *H*(*z*), is defined as:

$$H(z) = \prod_{x=1}^{N} Gain_x \left(\frac{B_x[0] + B_x[1]z^{-1} + B_x[2]z^{-2}}{A_x[0] + A_x[1]z^{-1} + A_x[2]z^{-2}} \right)$$

where z = complex variable, N = number of sections, x = section number

- Each section must contain second-order filter coefficients.
- Refer to "Using the user-defined filter data" on page 478 for the user-defined filter example.

Example

The following command downloads the user-defined FIR low pass filter data into the U8903A volatile memory.

```
DATA:FILT FIR, 1, 0, <data>
```

DATA:DIGital:FILTer

Syntax

```
DATA:DIGital:FILTer <filter category>, <no. of
section>, <no. of group delay>, <data>
```

Description

Downloads the 32-bit floating point user-defined filter data into the U8903A volatile memory allocated for the user-defined filter coefficients.

NOTE There is only one memory slot allocated for this function.

The <data> parameter represents the filter coefficients in the IEEE-488.2 binary block program data format, where the minimum number of bytes is 16 and maximum number of bytes is 1024. The maximum number of filter coefficients is 256 with 32-bit for each coefficient.

Parameters

Item	Type	Range of values	Default value
filter category	Numeric	Infinite Impulse Response (IIR) or Finite Impulse Response (FIR)	Required parameter
no. of section	Numeric	1 to 36	Required parameter
no. of group delay	Numeric	0 to 65535	Required parameter

Remarks

- Refer to "Appendix G: Using the IEEE-488.2 Binary Block Format" on page 567 for details on the <data> format.

- This command must be sent prior to sending the `SENSe:DIGital:FILTer:LPASs CUSTom`, `SENSe:DIGital:FILTer:HPASs CUSTom`, `SENSe:DIGital:FILTer:WEIGhting CUSTom`, or `SENSe:DIGital:FILTer:DEEMphasis CUSTom`.
- The `DATA:DIGital:FILTer` command overwrites the previous filter data in the U8903A volatile memory.
- The downloaded filter data will remain in the U8903A volatile memory if the CUSTom filter is not changed to any other preset filters for the selected channel.
- Sending the `SYSTem:PRESet`, `*RST`, or `SYSTem:RESet[:MODE] DANalyzer` command, or cycling the U8903A power, will delete the downloaded filter data.
- If the filter type is FIR, the coefficients are arranged in the following manner.

```
Coefficient[0]        //A[0]
Coefficient[1]        //A[1]
Coefficient[2]        //A[2]
Coefficient[3]        //A[3]
Coefficient[4]        //A[4]
Coefficient[5]        //A[5]
Coefficient[6]        //A[6]
  .
  .
  .
```

NOTE

The FIR filter transfer function, $H(z)$, is defined as:

$$H(z) = A[0] + A[1]z^{-1} + A[2]z^{-2} + A[3]z^{-3} + \ldots$$

where z = complex variable

- If the filter type is IIR, the coefficients are arranged in the following manner.

Coefficient[0]	//Section 1: $Gain_1$
Coefficient[1]	//Section 1: $A_1[0]$
Coefficient[2]	//Section 1: $A_1[1]$
Coefficient[3]	//Section 1: $A_1[2]$
Coefficient[4]	//Section 1: $B_1[0]$
Coefficient[5]	//Section 1: $B_1[1]$
Coefficient[6]	//Section 1: $B_1[2]$
Coefficient[0]	//Section 2: $Gain_2$
Coefficient[1]	//Section 2: $A_2[0]$
Coefficient[2]	//Section 2: $A_2[1]$
Coefficient[3]	//Section 2: $A_2[2]$
Coefficient[4]	//Section 2: $B_2[0]$
Coefficient[5]	//Section 2: $B_2[1]$
Coefficient[6]	//Section 2: $B_2[2]$

⋮

where A_x = Denominator and B_x = Numerator

NOTE

The IIR filter transfer function, *H*(*z*), is defined as:

$$H(z) = \prod_{x=1}^{N} Gain_x \left(\frac{B_x[0] + B_x[1]z^{-1} + B_x[2]z^{-2}}{A_x[0] + A_x[1]z^{-1} + A_x[2]z^{-2}} \right)$$

where z = complex variable, N = number of sections, x = section number

- Each section must contain second-order filter coefficients.

Example

The following command downloads the user-defined FIR low pass filter data into the U8903A volatile memory.

```
DATA:DIG:FILT FIR, 1, 0, <data>
```

DATA:FILE?

Syntax

```
DATA:FILE? <filename>, <data>
```

Description

Uploads a file into the U8903A temporary folder. The `<data>` parameter is in the IEEE-488.2 binary block program data format. This query is used when a respective file is not accessible by the U8903A and needs to be transferred to the U8903A remotely. The query returns the the file uploading state as `0` if the file uploading is not completed, or `1` if the file uploading is completed successfully.

Parameter

Item	Type	Range of values	Default value
filename	String	File name in quoted string. For example, "NK_R2.10.1.0.jel"	Required parameter

Remarks

- Refer to "Appendix G: Using the IEEE-488.2 Binary Block Format" on page 567 for details on the `<data>` format.
- The `<data>` parameter is the file that needs to be transferred to the U8903A in the binary block data byte format.
- The successfully uploaded file will be stored in the U8903A temporary folder, `"\temp\<filename>"`.
- The time required to complete this query varies according to the file size.

Example

The following command uploads the `"NK_R2.10.1.0.jel"` file.

```
DATA:FILE? "NK_R2.10.1.0.jel", <data>
```

Sweep Subsystem

The Sweep subsystem provides the commands to select the channel to perform sweep and sweep mode, as well as configure the sweep settings.

SOURce:SWEep:INTerface

Syntax

```
SOURce:SWEep:INTerface <interface>
SOURce:SWEep:INTerface?
```

Description

Sets the sweep interface. The query returns the sweep interface type.

Parameter

Item	Type	Range of values	Default value
interface	Discrete	ANALog or DIGital	ANALOG

Remarks

This command must be sent prior to the other `SOURce:SWEep:...` commands.

Examples

The following command sets the sweep interface to Digital.

```
SOUR:SWE:INT DIG
```

The following query returns the sweep interface type.

```
SOUR:SWE:INT?
```

Typical response: `DIG`

SOURce:SWEep:CHANnel

Syntax

```
SOURce:SWEep:CHANnel <channel>
SOURce:SWEep:CHANnel?
```

Description

Sets the channel to perform sweep. The query returns the selected sweep channel.

Parameter

Item	Type	Range of values	Default value
channel	Numeric	1 or 2	1

Remarks

- Only one channel can be swept at a time.
- The sweep channel refers to the generator channel to perform sweep.
- Refer to “Performing sweep” on page 473 for the examples on performing sweep.

NOTE

- The analyzer channel number must be the same as the generator channel number to perform sweep.
- You must not select channel 1 as the sweep channel if the generator function is variable phase, as channel 1 is the reference channel for variable phase.

Examples

The following command sets channel 1 to perform sweep.

```
SOUR:SWE:CHAN 1
```

The following query returns the sweep channel.

```
SOUR:SWE:CHAN?
```

Typical response: `1`

SOURce:SWEep:REFerence:CHANnel

Syntax

```
SOURce:SWEep:REFerence:CHANnel <channel>
SOURce:SWEep:REFerence:CHANnel?
```

Description

Sets the reference channel to perform sweep. The query returns the selected sweep reference channel.

Parameter

Item	Type	Range of values	Default value
channel	Numeric	1 or 2	1

Remarks

The command `SOURce:SWEep:INTerface` must be sent prior to sending this command.

Examples

The following command sets the analog reference channel to 1.

```
SOUR:SWE:REF:CHAN 1
```

The following query returns the reference sweep channel.

```
SOUR:SWE:REF:CHAN?
```

Typical response: `1`

SOURce:SWEep:MODE

Syntax

```
SOURce:SWEep:MODE <mode>
SOURce:SWEep:MODE?
```

Description

Sets the sweep or list mode for the channel specified in the "SOURce:SWEep:CHANnel" command. The query returns the sweep mode of the selected channel.

The description for each `<mode>` parameter is shown as follows.

`ASWeep`	Auto Sweep • Sweep is performed automatically. • Sweep points are based on the Start, Stop, and Step Size sweep parameter settings.
`ALISt`	Auto List • Sweep is performed automatically. • Sweep points are predefined and downloaded, or loaded from a file into the U8903A.
`MSWeep`	Manual Sweep • Sweep is performed manually. • Sweep points are based on the Start, Stop, and Step Size sweep parameter settings.
`MLISt`	Manual List • Sweep is performed manually. • Sweep points are predefined and downloaded, or loaded from a file into the U8903A.

Parameter

Item	Type	Range of values	Default value
mode	Discrete	ASWeep, ALISt, MSWeep, or MLISt	ASWeep

Remarks

- The command "SOURce:SWEep:INTerface" must be sent prior to sending this command.
- Refer to "Performing sweep" on page 473 for the examples on performing sweep.

Examples

The following command sets the sweep mode to Auto Sweep.

```
SOUR:SWE:MODE ASW
```

The following query returns the sweep mode.

```
SOUR:SWE:MODE?
```

Typical response: `ASW`

SOURce:SWEep:PARameter

Syntax

```
SOURce:SWEep:PARameter <sweep parameter>
SOURce:SWEep:PARameter?
```

Description

Sets the parameter to sweep for the channel specified in the "SOURce:SWEep:CHANnel" command. The query returns the sweep parameter of the selected channel.

The description for each `<sweep parameter>` is shown as follows.

Analog

FREQuency1	Frequency values of the sine, variable phase, dual, and square waveforms
FREQuency2	Frequency values of the dual waveform
AMPLitude	Amplitude values of all waveform types
PHASe	Phase value of the variable phase waveform
CENTer	Center frequency value of the DFD IEC 60268 waveform
DIFFerence	Difference frequency value of the DFD IEC 60268 or DFD IEC 60268 waveform
UPPer	Upper frequency value of the DFD IEC 60118, SMPTE 1:1, SMPTE 4:1, or SMPTE 10:1 waveform
LOWer	Lower frequency value of the SMPTE 1:1, SMPTE 4:1, or SMPTE 10:1 waveform

Digital

FREQuency1	Frequency values of the sine, variable phase, dual, square, sine burst, and stereo waveforms
FREQuency2	Frequency values of the dual waveform
AMPLitude	Amplitude values of all waveform types except monotonicity, constant value, walking zero, and walking one
PHASe	Phase value of the variable phase waveform
CENTer	Center frequency value of the DFD IEC 60268 waveform
DIFFerence	Difference frequency value of the DFD IEC 60268 or DFD IEC 60268 waveform
UPPer	Upper frequency value of the DFD IEC 60118, SMPTE 1:1, SMPTE 4:1, or SMPTE 10:1 waveform
LOWer	Lower frequency value of the SMPTE 1:1, SMPTE 4:1, or SMPTE 10:1 waveform

Parameter

Item	Type	Range of values	Default value
sweep parameter	Discrete	FREQuency1, FREQuency2, AMPLitude, PHASe, CENTer, DIFFerence, UPPer, or LOWer	FREQuency1

Remarks

- The command "SOURce:SWEep:INTerface" must be sent prior to sending this command.
- Refer to "Performing sweep" on page 473 for the examples on performing sweep.

Examples

The following command sets the sweep parameter to the frequency of the sine waveform.

```
SOUR:SWE:PAR FREQ1
```

The following query returns the sweep parameter.

```
SOUR:SWE:PAR?
```

Typical response: `FREQ1`

SOURce:SWEep:DWELl

Syntax

```
SOURce:SWEep:DWELl <delay>
SOURce:SWEep:DWELl?
```

Description

Sets the sweep dwell time (ms) for the channel specified in the "SOURce:SWEep:CHANnel" command. The dwell time is the delay between the start of the signal generation and the start of making the measurement. The query returns the dwell time of the selected channel in ms.

Parameter

Item	Type	Range of values	Default value
delay	Numeric	0 to 5000 ms	0

Remarks

- The command "SOURce:SWEep:INTerface" must be sent prior to sending this command.
- Refer to "Performing sweep" on page 473 for the examples on performing sweep.

Examples

The following command sets the dwell time to 1 s.

```
SOUR:SWE:DWEL1 1000
```

The following query returns the dwell time.

```
SOUR:SWE:DWEL1?
```

Typical response: `1000`

SOURce:SWEep:SPACing

Syntax

`SOURce:SWEep:SPACing <spacing>`

`SOURce:SWEep:SPACing?`

Description

Sets either linear or log interval for the sweep of the channel specified in the "SOURce:SWEep:CHANnel" command. The query returns the sweep spacing of the selected channel in the form of `LIN` or `LOG`.

The description for each `<spacing>` parameter is shown as follows.

`LINear`	The sweep step size will increment or decrement the sweep point until the sweep limit is reached.
`LOGarithmic`	For nonlinear sweeps, the step size is determined by a logarithmic curve fitted between the start and stop frequency. Stepping is determined by the number of sweep points.

Parameter

Item	Type	Range of values	Default value
spacing	Discrete	LINear or LOGarithmic	• LINear (for amplitude and phase sweep) • LOGarithmic (for frequency sweep)

Remarks

- The command "SOURce:SWEep:INTerface" must be sent prior to sending this command.
- Refer to "Performing sweep" on page 473 for the examples on performing sweep.

Examples

The following command sets the log sweep interval.

```
SOUR:SWE:SPAC LOG
```

The following query returns the sweep spacing.

```
SOUR:SWE:SPAC?
```

Typical response: `LOG`

SOURce:SWEep:POINts

Syntax

```
SOURce:SWEep:POINts <points>
SOURce:SWEep:POINts?
```

Description

Sets the number of sweep points for the channel specified in the "SOURce:SWEep:CHANnel" command. The query returns the number of sweep points of the selected channel.

The relationship between the number of points and the stop, start, and step size for linear sweep is computed as follows.

$$STEP = (STOP - STARt)/(POINts - 1)$$

The following equation shows the relationship between the number of points and the stop, start, and step size for logarithmic sweep.

$$STOP = (STARt)(STEP)^{POINts - 1}$$

If the number of points changes, the step size will also change, but span will not be affected.

(*SPAN* = *STOP* – *STARt*)

Parameter

Item	Type	Range of values	Default value
points	Numeric	Minimum: 2 Maximum: 1024	30

Remarks

- The number of sweep points configuration is not applicable for the Auto List or Manual List sweep mode.
- The command "SOURce:SWEep:INTerface" must be sent prior to sending this command.
- Refer to "Performing sweep" on page 473 for the examples on performing sweep.

Examples

The following command sets the number of sweep points to 20.

```
SOUR:SWE:POIN 20
```

The following query returns the number of sweep points.

```
SOUR:SWE:POIN?
```

Typical response: `20`

SOURce:SWEep:STEP

Syntax

```
SOURce:SWEep:STEP <step>
SOURce:SWEep:STEP?
```

Description

Sets the step size of the linear sweep interval, or multiplier factor of the log sweep interval for the channel specified in the "SOURce:SWEep:CHANnel" command. The query returns the step size of the selected channel.

Refer to `SOURce:SWEep:POINts` for the relationship between the step size and the stop, start, and number of points for linear or logarithmic sweep. The start and stop range of values for each waveform type and sweep parameter are listed in "Appendix F: Sweep Start and Stop Range" on page 566.

Remarks

- The command "SOURce:SWEep:INTerface" must be sent prior to sending this command.
- The multiplier factor for the log interval must not be <0 or equal to 1.
- The unit for the step size of each corresponding sweep parameter is listed as follows. The returned value is also in the unit as listed.

Sweep parameter	Unit for the step size
FREQuency1	Hz
FREQuency2	Hz
AMPLitude	• Vrms • V (for the DC signal)
PHASe	°

Sweep parameter	Unit for the step size
CENTer	Hz
DIFFerence	Hz
UPPer	Hz
LOWer	Hz

- Refer to "Performing sweep" on page 473 for the examples on performing sweep.

Examples

The following command sets the step size to 100 Hz. (Assume that frequency is the sweep parameter)

```
SOUR:SWE:STEP 100
```

The following query returns the step size.

```
SOUR:SWE:STEP?
```

Typical response: `1.000000E+02`

SOURce:SWEep:STARt

Syntax

```
SOURce:SWEep:STARt <start>
SOURce:SWEep:STARt?
```

Description

Sets the sweep start point for the channel specified in the "SOURce:SWEep:CHANnel" command. The query returns the sweep start point of the specified channel.

Refer to "Appendix F: Sweep Start and Stop Range" on page 566 for the range of the start values for each waveform type and sweep parameter.

Remarks

- The command "SOURce:SWEep:INTerface" must be sent prior to sending this command.
- The unit for the start value of each corresponding sweep parameter is listed as follows. The returned value is also in the unit as listed.

Sweep parameter	Unit for the start value
FREQuency1	Hz
FREQuency2	Hz
AMPLitude	• Vrms • V (for the DC signal)
PHASe	°
CENTer	Hz
DIFFerence	Hz
UPPer	Hz
LOWer	Hz

- Refer to "Performing sweep" on page 473 for the examples on performing sweep.

Examples

The following command sets the sweep start point to 1 kHz. (Assume that frequency is the sweep parameter)

```
SOUR:SWE:STAR 1000
```

The following query returns the start point.

```
SOUR:SWE:STAR?
```

Typical response: `1.000000E+03`

SOURce:SWEep:STOP

Syntax

```
SOURce:SWEep:STOP <stop>
SOURce:SWEep:STOP?
```

Description

Sets the sweep stop point for the channel specified in the "SOURce:SWEep:CHANnel" command. The query returns the sweep stop point of the specified channel.

Refer to "Appendix F: Sweep Start and Stop Range" on page 566 for the range of the stop values for each waveform type and sweep parameter.

Remarks

- The command "SOURce:SWEep:INTerface" must be sent prior to sending this command.
- The unit for the stop value of each corresponding sweep parameter is listed as follows. The returned value is also in the unit as listed.

Sweep parameter	Unit for the stop value
FREQuency1	Hz
FREQuency2	Hz
AMPLitude	• Vrms • V (for the DC signal)
PHASe	°
CENTer	Hz
DIFFerence	Hz
UPPer	Hz
LOWer	Hz

- Refer to “Performing sweep” on page 473 for the examples on performing sweep.

Examples

The following command sets the sweep stop point to 3 kHz. (Assume that frequency is the sweep parameter)

```
SOUR:SWE:STOP 3000
```

The following query returns the stop point.

```
SOUR:SWE:STOP?
```

Typical response: `3.000000E+03`

SOURce:SWEep:NEXT

Syntax

```
SOURce:SWEep:NEXT
```

Description

Jumps to the next sweep point in the Manual Sweep or Manual List sweep mode

SOURce:SWEep:VALues?

Syntax

```
SOURce:SWEep:VALues? (@<channel>)
```

Description

Returns the values of the sweep points for the specified channel. Multiple responses are separated by commas.

Parameter

Item	Type	Range of values	Default value
channel	Numeric	1 or 2	Required parameter

Remarks

- The command "SOURce:SWEep:INTerface" must be sent prior to sending this command.
- You may query the values of the sweep points after sending the `INITiate[:IMMediate]:SWEep` command to trigger the sweep.
- Refer to "Performing sweep" on page 473 for the examples on performing sweep.

Example

The following query returns the values of the sweep points. (Assume that the sweep start point is 100 Hz, stop point is 1000 Hz, and step size is 100 Hz.)

```
SOUR:SWE:VAL? (@2)
```

Typical response:

```
1.000000E+02,2.000000E+02,3.000000E+02,
4.000000E+02,5.000000E+02,6.000000E+02,
7.000000E+02,8.000000E+02,9.000000E+02,
1.000000E+03
```

SENSe:SWEep:INTerface

Syntax

```
SENSe:SWEep:INTerface <interface>
SENSe:SWEep:INTerface?
```

Description

Sets the sweep interface. The query returns the sweep interface type.

Parameter

Item	Type	Range of values	Default value
interface	Discrete	ANALog or DIGital	ANALOG

Remarks

This command must be sent prior to the other `SENSe:SWEep:...` commands.

Examples

The following command sets the sweep interface to Digital.

```
SENS:SWE:INT DIG
```

The following query returns the sweep interface type.

```
SENS:SWE:INT?
```

Typical response: `DIG`

SENSe:SWEep:CHANnel

Syntax

```
SENSe:SWEep:CHANnel <channel>
SENSe:SWEep:CHANnel?
```

Description

Sets the analyzer channel to perform sweep. The query returns the selected sweep channel.

Parameter

Item	Type	Range of values	Default value
channel	Numeric	1 or 2	1

Remarks

The command `SENSe:SWEep:INTerface` must be sent prior to sending this command.

Examples

The following command sets channel 1 to perform sweep.

```
SENS:SWE:CHAN 1
```

The following query returns the sweep channel.

```
SENS:SWE:CHAN?
```

Typical response: `1`

SENSe:SWEep:REFerence:CHANnel

Syntax

```
SENSe:SWEep:REFerence:CHANnel <channel>
SENSe:SWEep:REFerence:CHANnel?
```

Description

Sets the analyzer reference channel to perform sweep. The query returns the selected sweep reference channel.

Parameter

Item	Type	Range of values	Default value
channel	Numeric	1 or 2	1

Remarks

The command `SENSe:SWEep:INTerface` must be sent prior to sending this command.

Examples

The following command sets the analog reference channel to 1.

```
SENS:SWE:REF:CHAN 1
```

The following query returns the reference sweep channel.

```
SENS:SWE:REF:CHAN?
```

Typical response: `1`

Trigger Subsystem

The Trigger subsystem provides the commands to configure the trigger source for the analyzer or graph mode, as well as the graph trigger edge.

TRIGger:ANALyzer:SOURce

Syntax

```
TRIGger:ANALyzer:SOURce <trigger source>
TRIGger:ANALyzer:SOURce?
```

Description

Sets the analyzer trigger source for the input signals. The query returns the trigger source in the form of IMM, BUS, or EXT.

The description for each <trigger source> parameter is listed as follows.

IMMediate	Triggers a measurement automatically without waiting for any event to occur.
BUS	Triggers a measurement when the *TRG command is received.
EXTernal	Triggers a measurement when the external signal source connected to the Trigger In connector provides a low-true signal to the U8903A.

Parameter

Item	Type	Range of values	Default value
trigger source	Discrete	IMMediate, BUS, or EXTernal	IMMediate

Examples

The following command sets the analyzer trigger source to External.

```
TRIG:ANAL:SOUR EXT
```

The following query returns the trigger source.

```
TRIG:ANAL:SOUR?
```

Typical response: `EXT`

TRIGger:GRAPh:SOURce

Syntax

```
TRIGger:GRAPh:SOURce <trigger source>
TRIGger:GRAPh:SOURce?
```

Description

Sets the graph trigger source for the input signals. The query returns the trigger source in the form of either `IMM`, `EXT`, `BUS`, `CH1`, or `CH2`.

The description for each `<trigger source>` parameter is listed as follows.

`IMMediate`	Free Run
`EXTernal`	Triggers from an external source
`BUS`	Triggers from the internal bus
`CH1`	Triggers from the channel 1 input
`CH2`	Triggers from the channel 2 input

Parameter

Item	Type	Range of values	Default value
trigger source	Discrete	IMMediate, EXTernal, BUS, CH1, or CH2	IMMediate

Examples

The following command sets the graph trigger source to External.

```
TRIG:GRAP:SOUR EXT
```

The following query returns the trigger source.

```
TRIG:GRAP:SOUR?
```

Typical response: `EXT`

TRIGger:GRAPh:SLOPe

Syntax

```
TRIGger:GRAPh:SLOPe <edge>
TRIGger:GRAPh:SLOPe?
```

Description

Sets the rising or falling edge of the signal to be triggered. The query returns the trigger edge in the form of `POS` or `NEG`.

Parameter

Item	Type	Range of values	Default value
edge	Discrete	POSitive or NEGative	POSitive

Remark

The trigger edge is only applicable for the graph trigger source of CH1 and CH2, else this setting will be ignored.

Examples

The following command sets the rising edge of the signal.

```
TRIG:GRAP:SLOP POS
```

The following query returns the trigger edge.

```
TRIG:GRAP:SLOP?
```

Typical response: POS

TRIGger:DIGital:ANALyzer:SOURce

Syntax

```
TRIGger:DIGital:ANALyzer:SOURce <trigger source>
TRIGger:DIGital:ANALyzer:SOURce?
```

Description

Sets the digital analyzer trigger source for the input signals. The query returns the trigger source in the form of IMM, BUS, or EXT.

The description for each <trigger source> parameter is listed as follows.

IMMediate	Triggers a measurement automatically without waiting for any event to occur.
BUS	Triggers a measurement when the *TRG command is received.
EXTernal	Triggers a measurement when the external signal source connected to the Trigger In connector provides a low-true signal to the U8903A.

Parameter

Item	Type	Range of values	Default value
trigger source	Discrete	IMMediate, BUS, or EXTernal	IMMediate

Remark

This setting is always synchronous with the analog trigger source setting.

Examples

The following command sets the digital analyzer trigger source to External.

```
TRIG:DIG:ANAL:SOUR EXT
```

The following query returns the trigger source.

```
TRIG:DIG:ANAL:SOUR?
```

Typical response: `EXT`

TRIGger:DIGital:GRAPh:SOURce

Syntax

```
TRIGger:DIGital:GRAPh:SOURce <trigger source>
TRIGger:DIGital:GRAPh:SOURce?
```

Description

Sets the graph trigger source for the input signals. The query returns the trigger source in the form of either `IMM`, `EXT`, `BUS`, `CH1`, or `CH2`.

The description for each `<trigger source>` parameter is listed as follows.

`IMMediate`	Free Run
`EXTernal`	Triggers from an external source
`BUS`	Triggers from the internal bus
`CH1`	Triggers from the channel 1 input
`CH2`	Triggers from the channel 2 input

Parameter

Item	Type	Range of values	Default value
trigger source	Discrete	IMMediate, EXTernal, BUS, CH1, or CH2	IMMediate

Examples

The following command sets the graph trigger source to External.

```
TRIG:DIG:GRAP:SOUR EXT
```

The following query returns the trigger source.

```
TRIG:DIG:GRAP:SOUR?
```

Typical response: `EXT`

TRIGger:DIGital:GRAPh:SLOPe

Syntax

```
TRIGger:DIGital:GRAPh:SLOPe <edge>
TRIGger:DIGital:GRAPh:SLOPe?
```

Description

Sets the rising or falling edge of the signal to be triggered. The query returns the trigger edge in the form of `POS` or `NEG`.

Parameter

Item	Type	Range of values	Default value
edge	Discrete	POSitive or NEGative	POSitive

Remark

The trigger edge is only applicable for the graph trigger source of `CH1` and `CH2`, else this setting will be ignored.

Examples

The following command sets the rising edge of the signal.

```
TRIG:DIG:GRAP:SLOP POS
```

The following query returns the trigger edge.

```
TRIG:DIG:GRAP:SLOP?
```

Typical response: `POS`

Fetch Subsystem

The Fetch subsystem provides the commands to acquire the measurement results for the analyzer, graph, or sweep mode.

FETCh[:SCALar]?

Syntax

```
FETCh[:SCALar]? <function>, (@<channel list>)
```

Description

Retrieves the measurement result for the specified measurement function and channel(s). Multiple responses are separated by commas.

The description for each `<function>` parameter is listed as follows.

FUNC1	Measurement result of the first measurement function
FUNC2	Measurement result of the second measurement function
ALL	Measurement results of the first and second measurement functions

Parameters

Item	Type	Range of values	Default value
function	Discrete	FUNC1, FUNC2, or ALL	FUNC1
channel list	Numeric	One or more analyzer channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- The data returned by the `FETCh?` query is the result of the last acquisition trigger. The data is valid until the next `INITiate[:IMMediate]:ANALyzer` command is sent.
- The `FETCh? ALL` query returns a sequential data format. For example, the `FETCh? ALL, (@1,2)` query returns the result of the first measurement function of channel 1, the result of the second measurement function of channel 1, the result of the first measurement function of channel 2, and the result of the second measurement function of channel 2.
- If no measurement has been taken or there is an error occurred when the measurement is being taken for a particular channel, `NAN (9.91E+37)` will be returned. If there is voltage overload, `INF (9.9E+37)` will be returned.

NOTE When FETCh is queried, the measurement result will be returned in the unit as listed in "Appendix B: Units of the Measurement Function Returned Values" on page 555.

Example

The following command sequence is used to measure VDC and VAC at channel 1.

```
SENS:FUNC1 VDC, (@1)

SENS:FUNC2 VAC, (@1)

TRIG:ANAL:SOUR IMM

INIT:ANAL (@1)

FETC? FUNC1, (@1)
```

Typical response: `8.116441E-02`

```
FETC? FUNC2, (@1)
```

Typical response: `9.807300E-01`

FETCh:ARRay?

Syntax

`FETCh:ARRay? (@<channel>)`

Description

Returns an array of measurement data of the selected channel(s). The returned data is the result of the last acquisition trigger, and in the IEEE-488.2 binary block format. The data is valid until the next `INITiate[:IMMediate]:GRAPh` command is sent.

Parameter

Item	Type	Range of values	Default value
channel	Numeric	1 or 2	Required parameter

Remarks

- The channel(s) that you have selected to acquire the array of data is based on the channel(s) specified in the `INITiate[:IMMediate]:GRAPh` command.
- To plot a graph with the array of data, the X-axis points can be calculated using the following equations.
  - If time domain is the graph analysis mode, the X-axis point can be computed as follows.

    $$Point\ x = x \times \left(\frac{1}{Measurement\ bandwidth}\right)$$

    where x = 0, 1, 2, ...
  - If frequency domain is the graph analysis mode, the X-axis point can be computed as follows.

    $$Point\ x = \left(\frac{x \times Measurement\ bandwidth}{2 \times [PointCount - 1]}\right)$$

    where x = 0, 1, 2, ...

- The measurement data is returned in the unit dBV if the graph analysis mode is frequency domain (magnitude). The data is returned in the unit radian if the analysis mode is frequency domain (phase). The data is returned in the unit V if the analysis mode is time domain.

Example

The following command sequence is used to acquire an array of measurement data for channel 1 in the graph mode.

```
TRIG:GRAP:SOUR IMM
INIT:GRAP (@1)
FETC:ARR? (@1)
```

FETCh:SWEep?

Syntax

```
FETCh:SWEep? <function> (@<channel>)
```

Description

Returns the sweep result for the specified measurement function and channel. Multiple responses are separated by commas.

Parameters

Item	Type	Range of values	Default value
function	Discrete	FUNC1, FUNC2, or ALL	FUNC1
channel	Numeric	1 or 2	Required parameter

Remarks

- The "INITiate[:IMMediate]:SWEep" command must be used to initiate the sweep prior to sending the `FETCh:SWEep?` query.

- The specified channel must be one of the channels specified in the "SENSe:SWEep:CHANnel" command.
- The sweep result for the Vac or THD+N Level measurement function is returned in the unit dBV if the `CALCulate:FORMat:LEVel` is set to `OFF`.
- The sweep result for the THD+N Ratio, SINAD, SNR, SMPTE IMD, DFD IEC 60118/60268, or crosstalk measurement function is returned in the unit dB if `CALCulate:FORMat:RATio` is set to `OFF`.
- The sweep result for the Vdc measurement function is returned in the unit V if the `CALCulate:FORMat:LEVel` is set to `OFF`.
- The sweep result for the phase measurement function is returned in degrees.
- Refer to "Performing sweep" on page 473 for the examples on performing sweep.

Example

The following command sequence is used to obtain the sweep result function 1 for channel 1.

```
SOUR:SWE:CHAN 1
```

```
INIT:SWE
```

```
FETC:SWE? FUNC1, (@1)
```

Typical response:
```
7.800041E+04,7.800030E+04,7.377602E+04,
6.919201E+04,6.850725E+04,6.282951E+04,
6.018090E+04,5.758000E+04,5.519361E+04,...
```

FETCh:DIGital[:SCALar]?

Syntax

```
FETCh:DIGital[:SCALar]? <function>,
(@<channel list>)
```

Description

Retrieves the measurement result for the specified measurement function and channel(s). Multiple responses are separated by commas.

The description for each `<function>` parameter is listed as follows.

FUNC1	Measurement result of the first measurement function
FUNC2	Measurement result of the second measurement function
ALL	Measurement results of the first and second measurement functions

Parameters

Item	Type	Range of values	Default value
function	Discrete	FUNC1, FUNC2, or ALL	FUNC1
channel list	Discrete	One or more analyzer channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- The data returned by the `FETCh:DIGital?` query is the result of the last acquisition trigger. The data is valid until the next `INITiate[:IMMediate]:DIGital:ANALyzer` command is sent.

- The `FETCh:DIGital? ALL` query returns a sequential data format. For example, the `FETCh:DIGital? ALL, (@1,2)` query returns the result of the first measurement function of channel 1, the result of the second measurement function of channel 1, the result of the first measurement function of channel 2, and the result of the second measurement function of channel 2.
- If no measurement has been taken or there is an error occurred when the measurement is being taken for a particular channel, `NAN` (`9.91E+37`) will be returned. If there is voltage overload, `INF` (`9.9E+37`) will be returned.

NOTE

When FETCh is queried, the measurement result will be returned in the unit as listed in "Appendix B: Units of the Measurement Function Returned Values" on page 555.

Example

The following command sequence is used to measure VDC and VAC at digital channel 1.

```
SENS:DIG:FUNC1 VDC, (@D1)
SENS:DIG:FUNC2 VAC, (@D1)
INIT:DIG:ANAL (@D1)
FETC:DIG? FUNC1, (@D1)
```

Typical response: `8.116441E-02`

```
FETC:DIG? FUNC2, (@D1)
```

Typical response: `9.807300E-01`

FETCh:DIGital:AUDio:BITS?

Syntax

```
FETCh:DIGital:AUDIO:BITS? <bit type>,
(@<channel list>)
```

Description

Queries the data bits or active bits of the embedded data in the digital signal audio word for each subframe. The two subframes correspond to channel 1 and 2.

Parameters

Item	Type	Range of values	Default value
bit type	Discrete	DATA or ACTive	DATA
channel list	Discrete	(@D1) or (@D2)	Required parameter

Examples

The following query returns the data bits for channel 1.

```
FETC:DIG:AUD:BITS? DATA, (@D1)
```

FETCh:DIGital:ERRor:FLAG?

Syntax

```
FETCh:DIGital:ERRor:FLAG? <error flag>[,<error
flag>[,<error flag>...]]
```

Description

Queries the error flag(s) of the embedded audio data. The returned data is in Boolean. Multiple error flags and responses are separated by commas.

`CONFidence`	Confidence bit. Updated on sub-frame boundaries. 0 - No error 1 - Confidence error. The input data stream may be near error condition due to jitter degradation.
`CODing`	Bi-phase coding error bit. Updated on sub-frame boundaries. 0 - No error. 1 - Bi-phase error. This indicates an error in the received bi-phase coding.
`LOCK`	Receiver lock status when sourced by an incoming AES3-compatible data. Updated on CS block. boundaries. 0 - Receiver locked 1 - Receiver out of lock
`PARity`	Parity bit. Updated on sub-frame boundaries. 0 - No error 1 - Parity error
`VALidity`	Received AES3 Validity bit status. Updated on sub-frame boundaries. 0 - Data is valid and is normally linear coded PCM audio 1 - Data is invalid, or may be valid compressed audio

CCRC	Channel Status Block Cyclic Redundancy Check bit. Updated on CS block boundaries, valid only in Pro mode. 0 - No error 1 - Error
QCRC	Q-subcode data CRC error indicator. Updated on Q-subcode block boundaries. 0 - No error 1 - Error

Parameter

Item	Type	Range of values	Default value
error flag	Discrete	CONFidence, CODing, LOCK, VALidity, PARity, CCRC, or QCRC	VALidity

Examples

The following query returns the Confidence and Parity bit error status.

```
FETC:DIG:ERR:FLAG? CONF, PAR
```

Typical response: `0,1`

FETCh:DIGital:DELay?

Syntax

```
FETCh:DIGital:DELay?
```

Description

Queries the time delay between the digital input and output in seconds.

Examples

The following query returns the time delay.

```
FETC:DIG:DEL?
```

FETCh:DIGital:BERT?

Syntax

```
FETCh:DIGital:BERT? <type>, (@<channel list>)
```

Description

Queries the total bits, total errors, or bit error rate in the Bit Error Rate Test (BERT). The returned data is in string.

TBITs	Total bits
ERRors	Total errors
BER	Bit error ratio

Parameters

Item	Type	Range of values	Default value
type	Discrete	TBITs, ERRors, or BER	BER
channel list	Discrete	One or more analyzer channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Examples

The following query returns the total errors in BERT.

```
FETC:DIG:BERT? ERR, (@D1)
```

Typical response: “`3.000000E+00`”

FETCh:DIGital:ARRay?

Syntax

`FETCh:DIGital:ARRay? (@<channel>)`

Description

Returns an array of measurement data of the selected channel(s). The returned data is the result of the last acquisition trigger, and in the IEEE-488.2 binary block format. The data is valid until the next `INITiate[:IMMediate]:DIGital:GRAPh` command is sent.

Parameter

Item	Type	Range of values	Default value
channel	Numeric	1 or 2	Required parameter

Remarks

- The channel(s) that you have selected to acquire the array of data is based on the channel(s) specified in the `INITiate[:IMMediate]:DIGital:GRAPh` command.
- To plot a graph with the array of data, the X-axis points can be calculated using the following equations.
  - If time domain is the graph analysis mode, the X-axis point can be computed as follows.

$$Point\ x = x \times \left(\frac{1}{Measurement\ bandwidth}\right)$$

    where x = 0, 1, 2, ...

  - If frequency domain is the graph analysis mode, the X-axis point can be computed as follows.

$$Point\ x = \left(\frac{x \times Measurement\ bandwidth}{2 \times [PointCount - 1]}\right)$$

    where x = 0, 1, 2, ...

- The measurement data is returned in the unit dBV if the graph analysis mode is frequency domain (magnitude). The data is returned in the unit radian if the analysis mode is frequency domain (phase). The data is returned in the unit V if the analysis mode is time domain.

Example

The following command sequence is used to acquire an array of measurement data for channel 1 in the graph mode.

```
TRIG:DIG:GRAP:SOUR IMM

INIT:DIG:GRAP (@1)

FETC:DIG:ARR? (@1)
```

Initiate Subsystem

The Initiate subsystem provides the commands to initiate the sweep as well as the analyzer measurement and graph trigger systems.

INITiate[:IMMediate]:ANALyzer

Syntax

```
INITiate[:IMMediate]:ANALyzer (@<channel list>)
```

Description

Initiates the analyzer measurement trigger system for the specified channel(s). When a measurement trigger system is initiated, an event on a selected trigger source causes the specified triggering action to occur. If the trigger system is not initiated, all triggers are ignored.

Parameter

Item	Type	Range of values	Default value
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This is an overlapped command.
- It takes a few milliseconds for the U8903A to be ready to acquire a trigger signal after receiving this command.

- If the analyzer trigger source is set to Immediate, sending this command will cause the U8903A to take the measurement directly. If the trigger source is set to External, sending this command will cause the U8903A to start taking the measurement when the external signal is received. If the trigger source is set to Bus, sending this command will put the U8903A in the ‘waiting for trigger’ state until the `*TRG` command is sent. The U8903A will only start to take the measurement when the `*TRG` command is received.
- You can verify whether a measurement has completed by polling the status register value via the `STATus:OPERation:CONDition?` query. While a measurement is in progress, bit 4 of the condition register of the Standard Operation register group will be set. After the measurement has completed, bit 4 will be cleared to 0.

Example

The following command initiates the measurement trigger system on channel 1.

```
INIT:ANAL (@1)
```

INITiate[:IMMediate]:GRAPh

Syntax

```
INITiate[:IMMediate]:GRAPh (@<channel list>)
```

Description

Initiates the graph trigger system for an array of data for the specified channel(s). When a graph trigger system is initiated, an event on a selected trigger source causes the specified triggering action to occur. If the trigger system is not initiated, all triggers are ignored.

Parameter

Item	Type	Range of values	Default value
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This is an overlapped command.
- It takes a few milliseconds for the U8903A to be ready to acquire a trigger signal after receiving this command.
- You can verify whether a measurement has completed by polling the status register value via the `STATus:OPERation:CONDition?` query. While a measurement is in progress, bit 4 of the condition register of the Standard Operation register group will be set. After the measurement has completed, bit 4 will be cleared to 0.

Example

The following command initiates the graph trigger system on channel 1 to acquire an array of graph points.

```
INIT:GRAP (@1)
```

INITiate[:IMMediate]:SWEep

Syntax

```
INITiate[:IMMediate]:SWEep
```

Description

Initiates the sweep for the channel specified in the `SOURce:SWEep:CHANnel` command.

NOTE Do not perform other operations while sweep is in progress as doing so might cause unexpected results.

Remarks

- This is an overlapped command.
- The Sweep bit at the condition register of the Standard Operation register group will be set if the sweep mode is Auto Sweep or Auto List to indicate the automatic sweep is in progress, when sweep is initiated using this command. The Sweep bit is cleared when the automatic sweep has completed.

Example

The following command initiates the sweep.

```
INIT:SWE
```

INITiate[:IMMediate]:DIGital:ANALyzer

Syntax

```
INITiate[:IMMediate]:DIGital:ANALyzer
(@<channel list>)
```

Description

Initiates the digital analyzer measurement trigger system for the specified channel(s). When a measurement trigger system is initiated, an event on a selected trigger source causes the specified triggering action to occur. If the trigger system is not initiated, all triggers are ignored.

Parameter

Item	Type	Range of values	Default value
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This is an overlapped command.
- It takes a few milliseconds for the U8903A to be ready to acquire a trigger signal after receiving this command.
- If the digital analyzer trigger source is set to Immediate, sending this command will cause the U8903A to take the measurement directly. If the trigger source is set to External, sending this command will cause the U8903A to start taking the measurement when the external signal is received. If the trigger source is set to Bus, sending this command will put the U8903A in the 'waiting for trigger' state until the `*TRG` command is sent. The U8903A will only start to take the measurement when the `*TRG` command is received.
- You can verify whether a measurement has completed by polling the status register value via the `STATus:OPERation:CONDition?` query. While a measurement is in progress, bit 2 of the condition register of the Standard Operation register group will be set. After the measurement has completed, bit 2 will be cleared to 0.

Example

The following command initiates the measurement trigger system on channel 1.

```
INIT:DIG:ANAL (@D1)
```

INITiate[:IMMediate]:DIGital:AUDio:BITS

Syntax

```
INITiate[:IMMediate]:DIGital:AUDio:BITS
(@<channel list>)
```

Description

Initiates the digital analyzer audio bits measurement for the specified channel(s).

Parameter

Item	Type	Range of values	Default value
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This is an overlapped command.
- This command is not applicable for the bus trigger source.

Example

The following command initiates the audio bits measurement on channel 1.

```
INIT:DIG:AUD:BITS (@D1)
```

INITiate[:IMMediate]:DIGital:BERT

Syntax

```
INITiate[:IMMediate]:DIGital:BERT
```

Description

Starts the Bit Error Rate Test (BERT).

Remarks

This command is only applicable when the digital analyzer trigger source is set to immediate.

Example

The following command starts the BERT.

```
INIT:DIG:BERT
```

INITiate[:IMMediate]:DIGital:GRAPh

Syntax

```
INITiate[:IMMediate]:DIGital:GRAPh
(@<channel list>)
```

Description

Initiates the graph trigger system for an array of data for the specified channel(s). When a graph trigger system is initiated, an event on a selected trigger source causes the specified triggering action to occur. If the trigger system is not initiated, all triggers are ignored.

Parameter

Item	Type	Range of values	Default value
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This is an overlapped command.
- It takes a few milliseconds for the U8903A to be ready to acquire a trigger signal after receiving this command.
- You can verify whether a measurement has completed by polling the status register value via the `STATus:OPERation:CONDition?` query. While a measurement is in progress, bit 4 of the condition register of the Standard Operation register group will be set. After the measurement has completed, bit 4 will be cleared to 0.

Example

The following command initiates the graph trigger system on channel 1 to acquire an array of graph points.

```
INIT:DIG:GRAP (@D1)
```

INITiate:CONTinue:ANALyzer

Syntax

```
INITiate:CONTinue:ANALyzer <state>,
(@<channel list>)
```

```
INITiate:CONTinue:ANALyzer? (@<channel list>)
```

Description

Enables or disables the analyzer to make continuous measurement.

Parameters

Name	Type	Range of values	Default value
state	Bool	OFF(0) or ON(1)	OFF
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter

Remarks

- This command cannot be sent when the analyzer trigger source is external. However, bus trigger source will not be affected with this command.
- You can obtain the measurement result in continuous measurement with the “FETCh[:SCALar]?” command.
- This command can be stopped by sending the “INITiate[:IMMediate]:ANALyzer” command.

Example

The following command enables the analyzer channel 1 to make continuous measurement.

```
INIT:CONT:ANAL ON, (@1)
```

The following query returns the analyzer channel 1 continuous measurement state.

```
INIT:CONT:ANAL? (@1)
```

Typical response: `1`

INITiate:CONTinue:DIGital:ANALyzer

Syntax

```
INITiate:CONTinue:DIGital:ANALyzer <state>,
(@<channel list>)
```

Description

Enables or disables the digital analyzer to make continuous measurement.

Parameters

Name	Type	Range of values	Default value
state	Bool	OFF(0) or ON(1)	OFF
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This command cannot be sent when the analyzer trigger source is external. However, bus trigger source will not be affected with this command.
- You can obtain the measurement result in continuous measurement with the "FETCh:DIGital[:SCALar]?" command.

- This command can be stopped by sending the "INITiate[:IMMediate]:DIGital:ANALyzer" command.

Example

The following command enables the digital analyzer channel 1 to make continuous measurement.

```
INIT:CONT:DIG:ANAL ON, (@D1)
```

INITiate:CONTinue:DIGital:AUDio:BITS

Syntax

```
INITiate:CONTinue:DIGital:AUDio:BITS <state>,
(@<channel list>)
```

Description

Enables or disables the digital analyzer to make continuous audio bits measurement.

Parameters

Name	Type	Range of values	Default value
state	Bool	OFF(0) or ON(1)	OFF
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- This command cannot be sent when the analyzer trigger source is external. However, bus trigger source will not be affected with this command.
- You can obtain the measurement result in continuous measurement with the "FETCh:DIGital:AUDio:BITS?" command.
- This command can be stopped by sending the "INITiate[:IMMediate]:DIGital:AUDio:BITS" command.

Example

The following command enables the digital analyzer channel 1 to make continuous audio bits measurement.

```
INIT:CONT:DIG:AUD:BITS ON, (@D1)
```

INITiate:CONTinue:DIGital:DELay

Syntax

```
INITiate:CONTinue:DIGital:DELay <state>
```

Description

Starts or Stops the digital analyzer to make time delay measurement. Time delay measurement is done by measuring the delay time from the digital input with reference to the digital output. This measurement measures the time delay introduced by the Device Under Test (DUT).

Parameter

Name	Type	Range of values	Default value
state	Bool	OFF(0) or ON(1)	OFF

Remarks

- This command is only applicable when the analyzer trigger source is set to immediate.
- You can obtain the measurement result in continuous measurement with the "FETCh:DIGital:DELay?" command.
- In order to perform this test, the digital generator must be set to output the signal.
- The delay measurement is only applicable for AES3/SPDIF interface.

Example

The following command starts a time delay measurement.

```
INIT:CONT:DIG:DEL ON
```

The time delay measurement result can be obtained continuously with the following command.

```
FETC:DIG:DEL?
```

Abort Subsystem

The Abort subsystem is used to cancel any triggered actions.

ABORt:ANALyzer

Syntax

```
ABORt:ANALyzer
```

Description

Cancels any initiated analyzer measurement trigger and returns the trigger state to Idle.

Remark

This command will abort all the initiated triggered channels.

Example

The following command aborts the initiated analyzer measurement trigger.

```
ABOR:ANAL
```

ABORt:GRAPh

Syntax

```
ABORt:GRAPh
```

Description

Cancels any initiated measurement trigger for an array of graph points and returns the trigger state to Idle.

Remark

This command will abort all the initiated triggered channels.

Example

The following command aborts the initiated measurement trigger for the graph points.

```
ABOR:GRAP
```

ABORt:SWEep

Syntax

```
ABORt:SWEep
```

Description

Cancels any initiated measurement trigger for sweep and returns the trigger state to Idle.

Remark

This command will abort all the initiated triggered channels.

Example

The following command aborts the initiated measurement trigger for sweep.

```
ABOR:SWE
```

ABORt:DIGital:ANALyzer

Syntax

```
ABORt:DIGital:ANALyzer
```

Description

Cancels any initiated digital analyzer measurement trigger and returns the trigger state to Idle.

Remark

This command will abort all the initiated triggered channels.

Example

The following command aborts the initiated analyzer measurement trigger.

```
ABOR:DIG:ANAL
```

ABORt:DIGital:GRAPh

Syntax

```
ABORt:DIGital:GRAPh
```

Description

Cancels any initiated array of graph points measurement trigger and returns the trigger state to Idle.

Remark

This command will abort all the initiated triggered channels.

Example

The following command aborts the initiated analyzer measurement trigger.

```
ABOR:DIG:GRAP
```

ABORt:DIGital:BERT

Syntax

```
ABORt:DIGital:BERT
```

Description

Stops the Bit Error Rate Test (BERT).

Example

The following command stops the initiated BERT.

```
ABOR:DIG:BERT
```

Mass Memory Subsystem

The Mass Memory subsystem provides the commands to perform file maintenance and also set the U8903A power-up state.

MMEMory:LOAD

Syntax

`MMEMory:LOAD <label>, <filename>`

Description

Loads the 32-bit floating point data from a file into the U8903A. The `<filename>` parameter is a quoted string and the `<label>` parameter refers to an identifier for the data type to be recalled.

Parameters

Item	Type	Range of values	Default value
label	Discrete	FILTer, WAVeform, SWEep, or DFILter	Required parameter
filename	String	Full file path in quoted string. For example: “\Storage 1\filter1.juf”	Required parameter

Remarks

- The file extension type for each `<label>` parameter is listed below.

FILTer	.juf
WAVeform	.arb
SWEep	.csv
DFILter	.juf

- The folders in the U8903A internal storage to store the data are listed as follows.

Data	Folder
Filter data	Filter
Arbitrary waveform data	Waveform
Sweep list values	Sweep

- For the external USB flash storage, the file path must begin with `"\Storage 1\"`.
- The arbitrary waveform data file (.arb) is only applicable for the analog generator.
- For sweep, the `SOURce:SWEep:CHANnel` command must be sent prior to sending the `MMEMory:LOAD SWEep, <filename>` command.
- When you send the `MMEMory:LOAD SWEep, <filename>` command, the custom sweep points in the file will be loaded into the U8903A based on the source sweep channel set in the `SOURce:SWEep:CHANnel` command. The sweep mode will also be set to Automatic List or Manual list, depending on the previous sweep mode.

Examples

The following command loads the filter data into the U8903A from the "filter1.juf" file in the U8903A internal storage.

```
MMEM:LOAD FILT, "\Filter\filter1.juf"
```

The following command loads the arbitrary waveform data into the U8903A from the "waveform1.arb" file in your USB external flash storage.

```
MMEM:LOAD WAV, "\Storage 1\waveform1.arb"
```

The following command loads the sweep list values into the U8903A from the "mySweep.csv" file in the U8903A internal storage.

```
MMEM:LOAD SWE, "\Sweep\mySweep.csv"
```

MMEMory:STORe

Syntax

```
MMEMory:STORe <label>, <filename>
```

Description

Stores the 32-bit floating point data to a file in either the U8903A internal storage or an external USB flash storage. The `<filename>` parameter is a quoted string and the `<label>` parameter refers to an identifier for the data type to be saved.

Parameters

Item	Type	Range of values	Default value
label	Discrete	FILTer, WAVeform, or DFILter	Required parameter
filename	String	Full file path in quoted string. For example: "\Storage 1\filter1.juf"	Required parameter

Remarks

- The file extension type for each `<label>` parameter is listed below.

```
FILTer      .juf
WAVeform    .arb
DFILter     .juf
```

- The folders in the U8903A internal storage to store the data are listed as follows.

Data	Folder
Filter data	Filter
Arbitrary waveform data	Waveform

- For the external USB flash storage, the file path must begin with "\Storage 1\".
- The arbitrary waveform data file (.arb) is only applicable for analog generator.

Examples

The following command stores the filter data in the "filter1.juf" file into the U8903A internal storage.

```
MMEM:STOR FILT, "\Filter\filter1.juf"
```

The following command stores the arbitrary waveform data in the "waveform1.arb" file into your external USB flash storage.

```
MMEM:STOR WAV, "\Storage 1\waveform1.arb"
```

MMEMory:CATalog?

Syntax

```
MMEMory:CATalog? <location>, <directory>
```

Description

Returns the memory usage information (total amount of storage currently used and free space available) in bytes and a list of files and directories in a specified parent directory. The specified parent directory can reside in the U8903A internal memory or an external USB flash storage. Multiple responses are separated by commas.

The response is in the following format:

<used_bytes_in_this_directory>,<free_bytes_on_this_disk>,

"<file_name>,<file_type>,<filesize_in_bytes>",

"<file_name>,<file_type>,<filesize_in_bytes>", ...

Parameters

Item	Type	Range of values	Default value
location	Discrete	INTernal or EXTernal	Required parameter
directory	String	The desired parent directory	Required parameter

Remark

`INTernal` indicates the U8903A internal memory and `EXTernal` indicates an external USB flash storage.

Examples

To query the existing files in the ‘Filter’ folder in the U8903A internal memory.

```
MMEM:CAT? INT, "\Filter"
```

To query the existing files in an external USB flash storage.

```
MMEM:CAT? EXT, "\Storage 1"
```

MMEMory:DELete

Syntax

```
MMEMory:DELete <location>, <directory>,
<filename>
```

Description

Deletes the specified file in the selected directory.

Parameters

Item	Type	Range of values	Default value
location	Discrete	INTernal or EXTernal	Required parameter
directory	String	The directory of the desired folder.	Required parameter
filename	String	Can be any letters (A to Z), numbers (0 to 9) or underscore character ("_"). Blank spaces are not allowed.	Required parameter

Remarks

- `INTernal` indicates the U8903A internal memory and `EXTernal` indicates an external USB flash storage.
- The specified file must reside in the selected folder, otherwise an error will be generated. You can verify whether the file is available in the 'Filter' folder in the U8903A internal memory using the `MMEMory:CATalog? INTernal, "\Filter"` command.

Examples

The following command deletes a file named 'MyFilter.juf' in the '\Filter' directory of the U8903A internal memory.

```
MMEM:DEL INT, "\Filter", "MyFilter.juf"
```

The following command deletes a file named 'MyFilter.juf' in the '\Storage 1' directory of an external USB flash storage.

```
MMEM:DEL EXT, "\Storage 1", "MyFilter.juf"
```

MMEMory:LOAD:WAVFile

Syntax

```
MMEMory:LOAD:WAVFile <filename>
```

Description

Loads a Microsoft compatible .wav file to the digital generator buffer. The `<filename>` parameter is a quoted string.

Parameter

Item	Type	Range of values	Default value
filename	String	Full file path in quoted string. For example: • External storage “\Storage 1\sine.wav” • Internal storage “\waveform\sine.wav”	Required parameter

Remarks

- The acceptable file type is restricted to WAVE file format (.wav).
- For the internal memory, the file path must begin with `"\waveform\"`.
- For the external USB flash storage, the file path must begin with `"\Storage 1\"`.
- The wave file applies to both channel 1 and 2 of the digital generator.
- The size of the wave file is limited to 5 MB and the supported data resolution is 8, 16, and 24 bits per sample.

- According to the definition of the wave file format, the PCM data is two's-complement except for resolutions of 1 to 8 bits, which are represented as offset binary. Therefore, for wave file with 8 bits per sample resolution, the data will automatically be converted to two's-complement at the output.

Examples

The following command loads the “sine.wav” file in the U8903A internal memory into the digital generator buffer.

```
MMEM:LOAD:WAVF "\waveform\sine.wav"
```

The following command loads the “sine.wav” file in the external USB flash storage into the digital generator buffer.

```
MMEM:LOAD:WAVF "\Storage 1\sine.wav"
```

MMEMory:LOAD:AES:STATus

Syntax

```
MMEMory:LOAD:AES:STATus <filename>
```

Description

Loads the channel status and user bits information for digital generator from a file. The `<filename>` parameter is a quoted string.

Parameter

Item	Type	Range of values	Default value
filename	String	Full file path in quoted string. For example: • External storage “\Storage 1\GenStatusInfo.dsb” • Internal storage “\state\GenStatusInfo.dsb”	Required parameter

Remarks

- For the internal storage, the file path must begin with `"\state\"`.
- For the external USB flash storage, the file path must begin with `"\Storage 1\"`.
- The channel status and user bits information apply only to indicated channel in the file.

Examples

The following command loads the channel status and user bits information for digital generator from the "GenStatusInfo.dsb" file in the U8903A internal storage.

```
MMEM:LOAD:AES:STAT "\state\GenStatusInfo.dsb"
```

The following command loads the channel status and user bits information for digital generator from the "GenStatusInfo.dsb" file in the external USB flash storage.

```
MMEM:LOAD:WAVF "\Storage 1\GenStatusInfo.dsb"
```

MMEMory:STORe:AES:STATus

Syntax

```
MMEMory:STORe:AES:STATus <module>, <file
format>, <filename>, (@<channel list>)
```

Description

Stores the channel status and user bits information of the digital generator or analyzer to a file. The `<filename>` parameter is a quoted string.

Parameters

Item	Type	Range of values	Default value
module	Discrete	DGENerator or DANalyzer	DGENerator
file format	Discrete	HEX or XML	HEX
filename	String	Full file path in quoted string. For example: • External storage “\Storage 1\GenStatusInfo.dsb” • Internal storage “\state\GenStatusInfo.dsb”	Required parameter
channel list	Discrete	One or more channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Remarks

- For the internal storage, the file path must begin with `"\state\"`.
- For the external USB flash storage, the file path must begin with `"\Storage 1\"`.

Examples

The following command stores the channel status and user bits information for digital generator channel 1 to the HEX format to the "GenStatusInfo.dsb" file in the U8903A internal storage.

```
MMEM:STOR:AES:STAT DGEN, HEX, "\state\
GenStatusInfo.dsb", (@D1)
```

The following command stores the channel status and user bits information for digital analyzer channel 2 to the XML format to the "AnaStatusInfo.dsb" file in the external USB flash storage.

```
MMEM:STOR:AES:STAT DAN, XML, "\Storage 1\
AnaStatusInfo.dsb", (@D2)
```

MMEMory:LOAD:STATe:PUP

Syntax

```
MMEMory:LOAD:STATe:PUP <power-up state>
MMEMory:LOAD:STATe:PUP?
```

Description

Sets the power-up state of the U8903A. Select LAST to load the last settings of the U8903A, which are the settings before the U8903A was turned off. Select DEFault to load the default settings of the U8903A. The query returns the U8903A power-up state in the form of LAST or DEF.

Parameter

Item	Type	Range of values	Default value
power-up state	Discrete	DEFault or LAST	DEFault

Examples

The following command loads the U8903A last settings upon power up.

```
MMEM:LOAD:STAT:PUP LAST
```

The following query returns the power-up state of the U8903A.

```
MMEM:LOAD:STAT:PUP?
```

Typical response: LAST

MMEMory:STORe:SWEep

Syntax

```
MMEMory:STORe:SWEep <channel>, <function>,
<filename>
```

Description

Stores the measured sweep data points from memory to a file. The `<channel>` parameter refers to the measured channel used in the sweep process. The `<function>` parameter refers to the particular measurement function used in the sweep process. The `<filename>` parameter is a quoted string.

Parameters

Item	Type	Range of values	Default value
channel	Numeric	1 or 2	1
function	Discrete	FUNC1 or FUNC2	
filename	String	Full file path in quoted string. For example: • External storage “\Storage 1\mysweep.csv” • Internal storage “\state\mysweep.csv”	Required parameter

Remarks

- For the internal storage, the file path must begin with `"\state\"`.
- For the external USB flash storage, the file path must begin with `"\Storage 1\"`.

Examples

The following command stores the measured sweep data points of function 2 in channel 2 to the "Sweep_CH2_F2.csv" file in the U8903A external storage.

```
MMEM:STOR:SWE 2, FUNC2, "\Storage 1\
Sweep_CH2_F2.csv"
```

MMEMory:LOAD:STATe[:MODE]

Syntax

```
MMEMory:LOAD:STATe[:MODE] <location>,
<system mode>, <filename>
```

Description

Loads the specified state file to the selected U8903A mode. The <filename> parameter is a quoted string and the <location> parameter refers to the storage location of the state file. The <system mode> parameter refers to the U8903A mode of either analog analyzer, digital analyzer, analog generator, digital generator, sweep, or graph.

Parameters

Item	Type	Range of values	Default value
location	Discrete	INTernal or EXTernal	Required parameter
system mode	Discrete	AANalyzer, DANalyzer, AGENerator, DGENerator, SWEep, or GRAPh	Required parameter
filename	String	Full file path in quoted string for the external storage. For example: “\Storage 1\GenState1.gen” For the internal storage, only the file name and extension are required. For example: “GenState1.gen”	Required parameter

Remarks

- `INTernal` indicates the U8903A internal memory and `EXTernal` indicates an external USB flash storage.
- If the specified state file is located in the internal storage, only the file name and extension are required. However, if the specified state file is located in the external USB flash storage, the file directory must be stated in full, else an error will be generated.
- An error will be generated if the state file to be loaded is not a `<system mode>` parameter.

Examples

The following command loads a generator mode state file named 'GenState1.gen' from the U8903A internal memory to the generator.

```
MMEM:LOAD:STAT INT, AGEN, "GenState1.gen"
```

The following command loads the analyzer mode state file named 'AnaState2.ana' in the root directory from the external USB flash storage to the analyzer.

```
MMEM:LOAD:STAT EXT, AAN, "\Storage 1\
AnaState2.ana"
```

MMEMory:LOAD:STATe:CHANnel

Syntax

```
MMEMory:LOAD:STATe:CHANnel <location>,
<system mode>, (@<channel list>), <filename>
```

Description

Loads the specified single channel state file to the selected U8903A mode channel. The <filename> parameter is a quoted string and the <location> parameter refers to the storage location of the state file. The <system mode> parameter refers to the U8903A mode of either analog analyzer, digital analyzer, or analog generator.

Parameters

Item	Type	Range of values	Default value
location	Discrete	INTernal or EXTernal	Required parameter
system mode	Discrete	AANalyzer, DANalyzer, or AGENerator	Required parameter
channel list	Numeric	One or more channels. • (@1) or (@2) for single channel • (@1,2) for channel 1 and 2	Required parameter
filename	String	Full file path in quoted string for the external storage. For example: “\Storage 1\GenCh1State.gen” For the internal storage, only the file name and extension are required. For example: “GenCh1State.gen”	Required parameter

Remarks

- `INTernal` indicates the U8903A internal memory and `EXTernal` indicates an external USB flash storage.
- If the specified state file is located in the internal storage, only the file name and extension are required. However, if the specified state file is located in an external USB flash storage, the file directory must be stated in full, else an error will be generated.
- The file to be loaded must be a single channel state file and included in the `<system mode>` parameter list.
- This command is not applicable for the digital generator, sweep, and graph mode.

Examples

The following command loads a single channel state file named 'GenCh1State.gen' from the U8903A internal memory to the analog generator channel 1.

```
MMEM:LOAD:STAT:CHAN INT, AGEN, (@1),
"GenCh1State.gen"
```

The following command loads a single channel state file named 'AnaCh1State.ana' in the root directory from the external USB flash storage to the analog analyzer channel 1 and 2.

```
MMEM:LOAD:STAT:CHAN EXT, AAN, (@1,2),
"\Storage 1\AnaCh1State.ana"
```

MMEMory:STORe:STATe[:MODE]

Syntax

```
MMEMory:STORe:STATe[:MODE] <location>,
<system mode>, <filename>
```

Description

Stores the current U8903A state to a file in either the internal storage or an external USB flash storage. The <filename> parameter is a quoted string and the <location> parameter refers to the storage location of the state file. The <system mode> parameter refers to the U8903A mode of either analog analyzer, digital analyzer, analog generator, digital generator, sweep, or graph.

Parameters

Item	Type	Range of values	Default value
location	Discrete	INTernal or EXTernal	Required parameter
system mode	Discrete	AANalyzer, DANalyzer, AGENerator, DGENerator, SWEep, or GRAPh	Required parameter
filename	String	Full file path in quoted string for the external storage. For example: "\Storage 1\GenState1.gen" For the internal storage, only the file name and extension are required. For example: "GenState1.gen"	Required parameter

Remarks

- `INTernal` indicates the U8903A internal memory and `EXTernal` indicates an external USB flash storage.
- The file extension type must follow the system mode. The file extension for the analog analyzer state is '.ana', for the digital analyzer state is '.dan', for the analog generator state is '.gen', for the digital generator state is '.dge', for the sweep state is '.swe', and for the graph state is '.gra'. An error will be generated if the file extension does not match the system mode. However, if you do not enter the file extension, the corresponding extension will be automatically applied to the file name once the file is saved.

Examples

The following command stores the analog generator state to a file named 'GenState1.gen' in the U8903A internal memory.

```
MMEM:STOR:STAT INT, AGEN, "GenState1.gen"
```

The following command stores the analog analyzer state to a file named 'AnaState2.ana' in the root directory of an external USB flash storage.

```
MMEM:STOR:STAT EXT, AAN, "\Storage 1\
AnaState2.ana"
```

MMEMory:STORe:STATe:CHANnel

Syntax

```
MMEMory:STORe:STATe:CHANnel <location>,
<system mode>, (@<channel>), <filename>
```

Description

Stores the current U8903A single channel state to a file in either the internal storage or an external USB flash storage. The <filename> parameter is a quoted string and the <location> parameter refers to the storage location of the state file. The <system mode> parameter refers to the U8903A mode of either analog analyzer, digital analyzer, or analog generator.

Parameters

Item	Type	Range of values	Default value
location	Discrete	INTernal or EXTernal	Required parameter
system mode	Discrete	AANalyzer, DANalyzer, or AGENerator	Required parameter
channel	Numeric	1 or 2	Required parameter
filename	String	Full file path in quoted string for the external storage. For example: "\Storage 1\GenCh1State.gen" For the internal storage, only the file name and extension are required. For example: "GenCh1State.gen"	Required parameter

Remarks

- `INTernal` indicates the U8903A internal memory and `EXTernal` indicates an external USB flash storage.
- The file extension type must follow the system mode. The file extension for the analog analyzer state is '.ana', for the digital analyzer state is '.dan', and for the analog generator state is '.gen'. An error will be generated if the file extension does not match the system mode. However, if you do not enter the file extension, the corresponding extension will be automatically applied to the file name once the file is saved.
- The stored channel state file may be loaded to any other channel but must be within the same system mode. For example, if you have stored the analyzer channel 1 state to a file named 'AnaCh1State.ana', then you may load the 'AnaCh1State.ana' file to channel 2 within the analyzer mode.
- This command is not applicable for the digital generator, sweep, and graph mode.

Examples

The following command stores the generator channel 1 state to a file named 'GenCh1State.gen' in the U8903A internal memory.

```
MMEM:STOR:STAT:CHAN INT, AGEN, (@1),
"GenCh1State.gen"
```

The following command stores the analyzer channel 2 state to a file named 'AnaCh2State.ana' in the '\Storage 1' directory of an external USB flash storage.

```
MMEM:STOR:STAT:CHAN EXT, AAN, (@2),
"\Storage 1\AnaCh2State.ana"
```

Measure Subsystem

The Measure subsystem provides the commands to acquire the channel status and user status bytes for the digital analyzer.

MEASure:DIGital:CSTatus:DATA?

Syntax

```
MEASure:DIGital:CSTatus:DATA? (@<channel list>)
```

Description

Retrieves the 24 bytes of the channel status bytes.

Parameter

Item	Type	Range of values	Default value
channel list	Discrete	One or more analyzer channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Example

The following command queries the 24 bytes of the channel status bytes for digital analyzer channel 1.

```
MEAS:DIG:CST:DATA? (@D1)
```

MEASure:DIGital:CSTatus:BYTE?

Syntax

```
MEASure:DIGital:CSTatus:BYTE? <byte number>
(@<channel list>)
```

Description

Retrieves a particular byte of the channel status bytes in hexadecimal characters.

Parameters

Item	Type	Range of values	Default value
byte number	Numeric	0 to 23	0
channel list	Discrete	One or more analyzer channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Example

The following command queries the byte 2 of the channel status bytes for digital analyzer channel 1.

```
MEAS:DIG:CST:BYTE? (@D1)
```

MEASure:DIGital:CSTatus:FIELd?

Syntax

```
MEASure:DIGital:CSTatus:FIELd? <field name>,
(@<channel list>)
```

Description

Retrieves the channel status bytes field value of a particular field name for the specified channel.

Parameters

Item	Type	Range of values	Default value
field name	String	Refer to "Appendix I: AES3/SPDIF Interface Channel Status Bits Field Names" on page 578.	
channel list	Discrete	One or more analyzer channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Example

The following command queries the field value of the Audio Mode for digital analyzer channel 1.

```
MEAS:DIG:CST:FIEL? "Audio Mode", (@D1)
```

MEASure:DIGital:USTatus:DATA?

Syntax

```
MEASure:DIGital:USTatus:DATA? (@<channel list>)
```

Description

Retrieves the 24 bytes of the user status bytes.

Parameter

Item	Type	Range of values	Default value
channel list	Discrete	One or more analyzer channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Example

The following command queries the 24 bytes of the user status bytes for digital analyzer channel 1.

```
MEAS:DIG:UST:DATA? (@D1)
```

MEASure:DIGital:USTatus:BYTE?

Syntax

```
MEASure:DIGital:USTatus:BYTE? <byte number>
(@<channel list>)
```

Description

Retrieves a particular byte of the user status bytes in hexadecimal characters.

Parameters

Item	Type	Range of values	Default value
byte number	Numeric	0 to 23	0
channel list	Discrete	One or more analyzer channels. • (@D1) or (@D2) for single channel • (@D1,D2) for channel 1 and 2	Required parameter

Example

The following command queries the byte 2 of the user status bytes for digital analyzer channel 1.

```
MEAS:DIG:UST:BYTE? (@D1)
```

Status Subsystem

The Status reporting commands allow you to determine the operating condition of the U8903A at any time. Refer to "SCPI Status System" on page 37 for more information on the status registers.

STATus:PRESet

Syntax

```
STATus:PRESet
```

Description

Sets all defined bits in the status system PTR registers and clears all bits in the NTR and enable registers.

Operation register	Preset setting
STATus:OPERation:ENABle	0 – all bits disabled
STATus:OPERation:NTR	0 – all bits disabled
STATus:OPERation:PTR	32767 – all defined bits enabled
STATus:QUEStionable:ENABle	0 – all bits disabled
STATus:QUEStionable:NTR	0 – all bits disabled
STATus:QUEStionable:PTR	32767 – all defined bits enabled

Example

The following command presets the Operation enable register.

```
STAT:PRES
```

STATus:OPERation:CONDition?

Syntax

```
STATus:OPERation:CONDition?
```

Description

Queries the condition register for the Standard Operation register group and returns the binary-weighted sum of all bits set in the register. This is a read-only register and the bits are not cleared when you read the register.

Remarks

For more information on the Operation condition register, refer to "Status system diagram" on page 38. The bit definitions for the Standard Operation register are listed in "Standard Operation register" on page 39.

Example

The following query reads the condition register (bit 3 is set).

```
STAT:OPER:COND?
```

Typical response: `8`

STATus:OPERation:ENABle

Syntax

```
STATus:OPERation:ENABle <enable value>
STATus:OPERation:ENABle?
```

Description

Enables the bits in the enable register for the Standard Operation register group. The selected bits are then reported to the Status Byte register. The query returns the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
enable value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	0

Remarks

- For more information on the Operation enable register, refer to "Status system diagram" on page 38. The bit definitions for the Standard Operation register are listed in "Standard Operation register" on page 39.
- Use the `<enable value>` parameter to specify which bits will be reported to the Status Byte register. The specified decimal value corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 3 (decimal value = 8) and bit 4 (decimal value = 16), the corresponding decimal value would be 24 (8 + 16).
- The clear status (`*CLS`) command will not clear the enable register but it clears all bits in the event register.
- The `STATus:PRESet` command will clear all bits in the enable register.

- The *RST and instrument preset (SYSTem:PRESet) commands have no effect on this register.

Examples

The following command enables bit 3 (decimal value = 8) in the enable register.

```
STAT:OPER:ENAB 8
```

The following query returns the bits enabled in the register.

```
STAT:OPER:ENAB?
```

Typical response: 8

STATus:OPERation[:EVENt]?

Syntax

```
STATus:OPERation[:EVENt]?
```

Description

Queries the event register for the Standard Operation register group and returns the binary-weighted sum of all bits set in the register. This is a read-only register and the bits are cleared when you read the register.

Remarks

- For more information on the Operation event register, refer to “Status system diagram” on page 38. The bit definitions for the Standard Operation register are listed in “Standard Operation register” on page 39.
- Once a bit is set, it remains set until cleared by reading the event register or the clear status (*CLS) command.
- The *RST, instrument preset (SYSTem:PRESet), and STATus:PRESet commands have no effect on this register.

Example

The following query reads the event register (bit 3 is set).

```
STAT:OPER?
```

Typical response: `8`

STATus:OPERation:NTRansition

Syntax

```
STATus:OPERation:NTRansition <value>
STATus:OPERation:NTRansition?
```

Description

Sets and reads the value of the Operation Negative-Transition (NTR) register. This register serves as a polarity filter between the Operation condition and Operation event registers. When a bit in the Operation NTR register is set to 1, then a 1-to-0 transition of the corresponding bit in the Operation condition register causes that bit in the Operation event register to be set. The query returns the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	Preset = 0

Remarks

- The bit definitions for the Standard Operation register are listed in "Standard Operation register" on page 39.
- If the same bits in both NTR and PTR registers are set to 1, then any transition of that bit at the Operation condition register sets the corresponding bit in the Operation event register.
- If the same bits in both NTR and PTR registers are set to 0, then no transition of that bit at the Operation condition register can set the corresponding bit in the Operation event register.
- The `STATus:PRESet` command will set all bits in the NTR register to 0.
- The `*RST` and instrument preset (`SYSTem:PRESet`) commands have no effect on this register.

Examples

The following command enables bits 3 and 4 (decimal value = 24) in the NTR register.

```
STAT:OPER:NTR 24
```

The following query returns the bits enabled in the register.

```
STAT:OPER:NTR?
```

Typical response: `24`

STATus:OPERation:PTRansition

Syntax

```
STATus:OPERation:PTRansition <value>
STATus:OPERation:PTRansition?
```

Description

Sets and reads the value of the Operation Positive-Transition (PTR) register. This register serves as a polarity filter between the Operation condition and Operation event registers. When a bit in the Operation PTR register is set to 1, then a 0-to-1 transition of the corresponding bit in the Operation condition register causes that bit in the Operation event register to be set. The query returns the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	Preset = 32767

Remarks

- The bit definitions for the Standard Operation register are listed in "Standard Operation register" on page 39.
- If the same bits in both NTR and PTR registers are set to 1, then any transition of that bit at the Operation condition register sets the corresponding bit in the Operation event register.
- If the same bits in both NTR and PTR registers are set to 0, then no transition of that bit at the Operation condition register can set the corresponding bit in the Operation Event register.
- The `STATus:PRESet` command will set all bits in the PTR register to 1.

- The `*RST` and instrument preset (`SYSTem:PRESet`) commands have no effect on this register.

Examples

The following command enables bits 3 and 4 (decimal value = 24) in the PTR register.

```
STAT:OPER:PTR 24
```

The following query returns the bits enabled in the register.

```
STAT:OPER:PTR?
```

Typical response: `24`

STATus:QUEStionable:CONDition?

Syntax

```
STATus:QUEStionable:CONDition?
```

Description

Queries the condition register for the Questionable Data register group and returns the binary-weighted sum of all bits set in the register. This is a read-only register and the bits are not cleared when you read the register.

Remarks

For more information on the Questionable condition register, refer to "Status system diagram" on page 38. The bit definitions for the Questionable Data register are listed in "Questionable Status registers" on page 39.

Example

The following query reads the condition register (bit 0 is set).

```
STAT:QUES:COND?
```

Typical response: `1`

STATus:QUEStionable:ENABle

Syntax

```
STATus:QUEStionable:ENABle <enable value>
STATus:QUEStionable:ENABle?
```

Description

Enables the bits in the enable register for the Questionable Data register group. The selected bits are then reported to the Status Byte register. The query returns the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
enable value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	0

Remarks

- For more information on the Questionable enable register, refer to “Status system diagram” on page 38. The bit definitions for the Questionable Data register are listed in “Questionable Status registers” on page 39.
- Use the `<enable value>` parameter to specify which bits will be reported to the Status Byte register. The specified decimal value corresponds to the binary-weighted sum of the bits you wish to enable in the register.
- The clear status (`*CLS`) command will not clear the enable register but it clears all bits in the event register.
- The `STATus:PRESet` command will clear all bits in the enable register.
- The `*RST` and instrument preset (`SYSTem:PRESet`) commands have no effect on this register.

Examples

The following command enables bit 0 (decimal value = 1) in the enable register.

```
STAT:QUES:ENAB 1
```

The following query returns the bit enabled in the register.

```
STAT:QUES:ENAB?
```

Typical response: `1`

STATus:QUEStionable[:EVENt]?

Syntax

```
STATus:QUEStionable[:EVENt]?
```

Description

Queries the event register for the Questionable Data register group and returns the binary-weighted sum of all bits set in the register. This is a read-only register and the bits are cleared when you read the register.

Remarks

- For more information on the Questionable event register, refer to "Status system diagram" on page 38. The bit definitions for the Questionable Data register are listed in "Questionable Status registers" on page 39.
- Once a bit is set, it remains set until cleared by reading the event register or the clear status (`*CLS`) command.
- The `*RST`, instrument preset (`SYSTem:PRESet`), and `STATus:PRESet` commands have no effect on this register.

Example

The following query reads the event register (bit 0 is set).

```
STAT:QUES?
```

Typical response: `1`

STATus:QUEStionable:NTRansition

Syntax

```
STATus:QUEStionable:NTRansition <value>
STATus:QUEStionable:NTRansition?
```

Description

Sets and reads the value of the Questionable Negative-Transition (NTR) register. This register serves as a polarity filter between the Questionable condition and Questionable event registers. When a bit in the Questionable NTR register is set to 1, then a 1-to-0 transition of the corresponding bit in the Questionable condition register causes that bit in the Questionable event register to be set. The query returns the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	Preset = 0

Remarks

- The bit definitions for the Questionable Data register is listed in “Questionable Status registers” on page 39.
- If the same bits in both NTR and PTR registers are set to 1, then any transition of that bit at the Questionable condition register sets the corresponding bit in the Questionable event register.
- If the same bits in both NTR and PTR registers are set to 0, then no transition of that bit at the Questionable condition register can set the corresponding bit in the Questionable event register.
- The `STATus:PRESet` command will set all bits in the NTR register to 0.
- The `*RST` and instrument preset (`SYSTem:PRESet`) commands have no effect on this register.

Examples

The following command enables bit 0 (decimal value = 1) in the NTR register.

```
STAT:QUES:NTR 1
```

The following query returns the bit enabled in the register.

```
STAT:QUES:NTR?
```

Typical response: `1`

STATus:QUEStionable:PTRansition

Syntax

```
STATus:QUEStionable:PTRansition <value>
STATus:QUEStionable:PTRansition?
```

Description

Sets and reads the value of the Questionable Positive-Transition (PTR) register. This register serves as a polarity filter between the Questionable condition and Questionable event registers. When a bit in the Questionable PTR register is set to 1, then a 0-to-1 transition of the corresponding bit in the Questionable condition register causes that bit in the Questionable event register to be set. The query returns the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	Preset = 32767

Remarks

- The bit definitions for the Questionable Data register is listed in "Questionable Status registers" on page 39.
- If the same bits in both NTR and PTR registers are set to 1, then any transition of that bit at the Questionable condition register sets the corresponding bit in the Questionable event register.
- If the same bits in both NTR and PTR registers are set to 0, then no transition of that bit at the Questionable condition register can set the corresponding bit in the Questionable event register.
- The `STATus:PRESet` command will set all bits in the PTR register to 1.

- The `*RST` and instrument preset (`SYSTem:PRESet`) commands have no effect on this register.

Examples

The following command enables bit 0 (decimal value = 1) in the PTR register.

```
STAT:QUES:PTR 1
```

The following query returns the bit enabled in the register.

```
STAT:QUES:PTR?
```

Typical response: `1`

STATus:QUEStionable:VOLTage:CONDition?

Syntax

```
STATus:QUEStionable:VOLTage:CONDition?
```

Description

Queries the condition register for the Questionable Voltage register group and returns the binary-weighted sum of all bits set in the register. This is a read-only register and the bits are not cleared when you read the register.

Remarks

For more information on the Questionable condition register, refer to "Status system diagram" on page 38. The bit definitions for the Questionable Voltage register are listed in "Questionable Status registers" on page 39.

Example

The following query reads the condition register (bit 1 is set).

```
STAT:QUES:VOLT:COND?
```

Typical response: `2`

STATus:QUEStionable:VOLTage:ENABle

Syntax

```
STATus:QUEStionable:VOLTage:ENABle <enable value>
STATus:QUEStionable:VOLTage:ENABle?
```

Description

Enables the bits in the enable register for the Questionable Voltage register group. The selected bits are then reported to the Questionable Data register. The query returns the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
enable value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	0

Remarks

- For more information on the Questionable enable register, refer to "Status system diagram" on page 38. The bit definitions for the Questionable Voltage register are listed in "Questionable Status registers" on page 39.
- Use the <enable value> parameter to specify which bits will be reported to the Questionable Data register. The specified decimal value corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 0 (decimal value = 1) and bit 1 (decimal value = 2), the corresponding decimal value would be 3 (1 + 2).
- The clear status (*CLS) command will not clear the enable register but it clears all bits in the event register.
- The *RST and instrument preset (SYSTem:PRESet) commands have no effect on this register.

Examples

The following command enables bit 1 (decimal value = 2) in the enable register.

```
STAT:QUES:VOLT:ENAB 2
```

The following query returns the bit enabled in the register.

```
STAT:QUES:VOLT:ENAB?
```

Typical response: 2

STATus:QUEStionable:VOLTage[:EVENt]?

Syntax

```
STATus:QUEStionable:VOLTage[:EVENt]?
```

Description

Queries the event register for the Questionable Voltage register group and returns the binary-weighted sum of all bits set in the register. This is a read-only register and the bits are cleared when you read the register.

Remarks

- For more information on the Questionable event register, refer to "Status system diagram" on page 38. The bit definitions for the Questionable Voltage register are listed in "Questionable Status registers" on page 39.
- Once a bit is set, it remains set until cleared by reading the event register or the clear status (`*CLS`) command.
- The `*RST`, instrument preset (`SYSTem:PRESet`), and `STATus:PRESet` commands have no effect on this register.

Example

The following query reads the event register (bit 1 is set).

`STAT:QUES:VOLT?`

Typical response: 2

STATus:QUEStionable:VOLTage:NTRansition

Syntax

```
STATus:QUEStionable:VOLTage:NTRansition <value>
STATus:QUEStionable:VOLTage:NTRansition?
```

Description

Sets and reads the value of the Questionable Voltage Negative-Transition (NTR) register. This register serves as a polarity filter between the Questionable Voltage condition and Questionable Voltage event registers. When a bit in the Questionable Voltage NTR register is set to 1, then a 1-to-0 transition of the corresponding bit in the Questionable Voltage condition register causes that bit in the Questionable Voltage event register to be set. The query returns the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	Preset = 0

Remarks

- The bit definitions for the Questionable Voltage register are listed in “Questionable Status registers” on page 39.

- If the same bits in both NTR and PTR registers are set to 1, then any transition of that bit at the Questionable Voltage condition register sets the corresponding bit in the Questionable Voltage event register.
- If the same bits in both NTR and PTR registers are set to 0, then no transition of that bit at the Questionable Voltage condition register can set the corresponding bit in the Questionable Voltage event register.
- The `STATus:PRESet` command will set all bits in the NTR register to 0.
- The `*RST` and instrument preset (`SYSTem:PRESet`) commands have no effect on this register.

Examples

The following command enables bits 0 and 1 (decimal value = 3) in the NTR register.

```
STAT:QUES:VOLT:NTR 3
```

The following query returns the bits enabled in the register.

```
STAT:QUES:VOLT:NTR?
```

Typical response: `3`

STATus:QUEStionable:VOLTage:PTRansition

Syntax

```
STATus:QUEStionable:VOLTage:PTRansition <value>
STATus:QUEStionable:VOLTage:PTRansition?
```

Description

Sets and reads the value of the Questionable Voltage Positive-Transition (PTR) register. This register serves as a polarity filter between the Questionable Voltage condition and Questionable Voltage event registers. When a bit in the Questionable Voltage PTR register is set to 1, then a 0-to-1 transition of the corresponding bit in the Questionable Voltage condition register causes that bit in the Questionable Voltage event register to be set. The query returns the binary-weighted sum of all bits set in the register.

Parameter

Item	Type	Range of values	Default value
value	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register	Preset = 32767

Remarks

- The bit definitions for the Questionable Voltage register are listed in "Questionable Status registers" on page 39.
- If the same bits in both NTR and PTR registers are set to 1, then any transition of that bit at the Questionable Voltage condition register sets the corresponding bit in the Questionable Voltage event register.
- If the same bits in both NTR and PTR registers are set to 0, then no transition of that bit at the Questionable Voltage condition register can set the corresponding bit in the Questionable Voltage event register.
- The `STATus:PRESet` command will set all bits in the PTR register to 1.

- The *RST and instrument preset (SYSTem:PRESet) commands have no effect on this register.

Examples

The following command enables bits 0 and 1 (decimal value = 3) in the PTR register.

```
STAT:QUES:VOLT:PTR 3
```

The following query returns the bits enabled in the register.

```
STAT:QUES:VOLT:PTR?
```

Typical response: 3

Programming Examples

Generating the normal sine waveform

Example 1

The following command sequence provides an example on how to generate a normal 3 kHz, 2 Vrms sine waveform on the analog generator channel 1.

```
SOUR:FUNC SINE, (@1)          //Sets the waveform type to sine.
SOUR:VOLT 2Vrms, (@1)         //Sets the amplitude to 2 Vrms.
SOUR:FREQ1 3kHz, (@1)         //Sets the frequency to 3 kHz.
OUTP:STAT ON, (@1)            //Turns on the analog output.
```

Example 2

The following command sequence provides an example on how to generate a normal 3 kHz, 1 FFS sine waveform on the digital generator channel 1.

```
SOUR:DIG:FUNC SINE, (@D1)     //Sets the digital waveform type to sine.
SOUR:DIG:VOLT 1FFS, (@D1)     //Sets the amplitude to 1 FFS.
SOUR:DIG:FREQ1 3kHz, (@D1)    //Sets the frequency to 3 kHz.
OUTP:DIG:STAT ON, (@D1)       //Turns on the digital output.
```

Generating the multitone waveform

Example 1

The following command sequence gives an example on how to generate a multitone waveform on the analog generator channel 1.

```
SOUR:FUNC MULT, (@1)                //Sets the waveform type to multitone.
SOUR:MULT:RLEN L32768, (@1)         //Sets the multitone record length to 32768
                                      points.
SOUR:MULT:WLEN L32768, (@1)         //Sets the multitone waveform length to 32768
                                      points.
SOUR:MULT:FREQ:STAR 500Hz, (@1)     //Sets the start frequency to 500 Hz.
SOUR:MULT:FREQ:STOP 5kHz, (@1)      //Sets the stop frequency to 5 kHz.
SOUR:MULT:COUN 20, (@1)             //Sets the number of tones to 20.
SOUR:MULT:FREQ:SPAC LOG, (@1)       //Sets the frequency spacing among the tones to
                                      logarithmic.
SOUR:VOLT 2Vrms, (@1)               //Sets the amplitude to 2 Vrms.
OUTP:STAT ON, (@1)                  //Turns on the analog output.
```

Example 2

The following command sequence gives an example on how to generate a multitone waveform on the digital generator channel 1.

```
SOUR:DIG:FUNC MULT                  //Sets the waveform type to multitone.
SOUR:DIG:MULT:COUN 20, (@D1)        //Sets the number of tones to 20.
SOUR:DIG:MULT:FREQ:STAR 500Hz,      //Sets the start frequency to 500 Hz.
(@D1)
SOUR:DIG:MULT:FREQ:STOP 5kHz,       //Sets the stop frequency to 5 kHz.
(@D1)
SOUR:DIG:MULT:FREQ:SPAC LOG, (@D1) //Sets the frequency spacing among the tones to
                                      logarithmic.
```

`SOUR:DIG:VOLT 1FFS, (@D1)`	//Sets the amplitude to 1 FFS.
`OUTP:DIG:STAT ON, (@D1)`	//Turns on the digital output.

Example 3

The following command sequence gives an example on how to manipulate the tones of multitone waveform on the digital generator channel 1.

`SOUR:DIG:FUNC MULT`	//Sets the waveform type to multitone.
`SOUR:DIG:MULT:TONE:CLE (@D1)`	//Clears all the tones and an initial tone with 1 kHz frequency, 1 FFS amplitude, and 0 ° phase will be the default.
`SOUR:DIG:MULT:TONE:FREQ 5kHz, (1), (@D1)`	//Sets the frequency of the first tone to 5 kHz.
`SOUR:DIG:MULT:TONE:VOLT 1FFS, (1), (@D1)`	//Sets the amplitude of the first tone to 1 FFS.
`SOUR:DIG:MULT:TONE:PHAS 15, (1), (@D1)`	//Sets the phase of the first tone to 15 °.
`SOUR:DIG:MULT:TONE:ADD 1, 10kHz, 0.5FFS, 30, (@D1)`	//Adds a 10 kHz frequency, 0.5 FFS amplitude and 30 ° phase tone.
`SOUR:DIG:MULT:TONE:ADD 2, 15kHz, 0dBV, 45, (@D1)`	//Adds a 15 kHz frequency, 0 dBV amplitude and 45 ° phase tone.
`SOUR:DIG:MULT:TONE:ADD 3, 20kHz, 0.5Vrms, 90, (@D1)`	//Adds a 20 kHz frequency, 0.5 Vrms amplitude and 90 ° phase tone.
`SOUR:DIG:MULT:TONE:DEL 1, (@D1)`	//Delete the tone index 1 (tone with 10 kHz frequency).
`SOUR:DIG:MULT:TONE:PHAS:RAND (@D1)`	//Randomize the phase of all the tones.
`SOUR:DIG:VOLT 0.5FFS, (@D1)`	//Sets the multitone waveform amplitude to 0.5 FFS.
`OUTP:DIG:STAT ON, (@D1)`	//Turns on the output.

Generating the arbitrary waveform

The following examples show how to generate a 3 Vp, 0 V offset arbitrary waveform on the generator channel 1.

NOTE The arbitrary data must be uploaded before setting the waveform type to arbitrary.

Example 1

The following command sequence provides an example to generate an arbitrary waveform by uploading the data stream from the PC to the U8903A.

`DATA:WAV 3, 0, <data>`	//Uploads the arbitrary data into the U8903A. The <data> parameter is in the IEEE-488.2 binary block program data format.
`SOUR:FUNC ARB, (@1)`	//Sets the waveform type to arbitrary on channel 1.
`OUTP:STAT ON, (@1)`	//Turns on the output.

Example 2

The following command sequence provides an example to generate an arbitrary waveform by loading the arbitrary waveform data into the U8903A from the "waveform1.arb" file in your USB external flash storage.

`MMEM:LOAD WAV, "\Storage 1\waveform1.arb"`	//Loads the arbitrary waveform data into the U8903A from the "waveform1.arb" file in your external USB flash storage.
`SOUR:FUNC ARB, (@1)`	//Sets the waveform type to arbitrary on channel 1.
`OUTP:STAT ON, (@1)`	//Turns on the output.

After generating the arbitrary waveform, if you wish to change the amplitude of the waveform from 3 Vp to 5 Vp, just send the `SOUR:VOLT 5Vp, (@1)` command to change the amplitude to 5 Vp without the need to reupload the arbitrary data. This also applies to changing the value of the DC offset.

The following examples show how to generate a 0.5 FFS arbitrary waveform on the digital generator channel 1.

Example 3

The following command sequence provides an example to generate an arbitrary waveform by uploading the wave file as data stream from the PC to the U8903A.

`DATA:WAVF <data>`	//Uploads the wave file data into the U8903A. The <data> parameter is in the IEEE-488.2 binary block program data format.
`SOUR:DIG:FUNC ARB`	//Sets the waveform type to arbitrary.
`SOUR:DIG:VOLT 0.5FFS, (@D1)`	//Sets the amplitude to 0.5 FFS.
`OUTP:DIG:STAT ON, (@D1)`	//Turns on the output.

Example 4

The following command sequence provides an example to generate an arbitrary waveform by loading the wave file data into the U8903A from the "sine.wav" file in your USB external flash storage.

`MMEM:LOAD:WAVF "\Storage 1\sine.wav"`	//Loads the wave file data into the U8903A from the "sine.wav" file in your external USB flash storage.
`SOUR:DIG:FUNC ARB`	//Sets the waveform type to arbitrary.
`SOUR:DIG:VOLT 0.5FFS, (@D1)`	//Sets the amplitude to 0.5 FFS
`OUTP:DIG:STAT ON, (@D1)`	//Turns on the output.

Making basic measurements

Example 1

The following command sequence provides an example on how to measure the frequency and amplitude using the analog analyzer.

`SENS:FUNC1 FREQ, (@1)`	//Sets the first measurement function to frequency on analog channel 1.
`SENS:FUNC2 VAC, (@1)`	//Sets the second measurement function to amplitude on analog channel 1.
`INIT:ANAL (@1)`	//Initiates the frequency and amplitude measurements on analog channel 1.
`FETC? FUNC1, (@1)`	//Acquires the frequency measurement result.
`FETC? FUNC2, (@1)`	//Acquires the amplitude measurement result.

Example 2

The following command sequence provides an example on how to measure the frequency and amplitude using the digital analyzer.

`SENS:DIG:FUNC1 FREQ, (@D1)`	//Sets the first measurement function to frequency on digital channel 1.
`SENS:DIG:FUNC2 VAC, (@D1)`	//Sets the second measurement function to amplitude on digital channel 1.
`INIT:DIG:ANAL (@D1)`	//Initiates the frequency and amplitude measurements on channel 1.
`FETC:DIG? FUNC1, (@D1)`	//Acquires the frequency measurement result.
`FETC:DIG? FUNC2, (@D1)`	//Acquires the amplitude measurement result.

Measuring the crosstalk

There are two modes of crosstalk measurement comprising channel driven (DCRosstalk) and channel measured (MCRosstalk).

In the channel driven mode, the designated reference channel will be injected with the stimulus. The presence of this signal in the other channel will be measured. The crosstalk result of the channel indicates the crosstalk from the reference channel to that channel. In the channel measured mode, the designated reference channel is used to measure the crosstalk from the other channel to this channel. The crosstalk result of the channel indicates the crosstalk from the other channel to the reference channel.

To measure the crosstalk from channel 2 to channel 1, send the following command sequence.

```
SENS:REF:CHAN 2              //Sets the reference channel to channel 2
                               (channel driven).
SENS:FUNC2 DCR, (@1,2)       //Sets the analyzer second measurement
                               function to crosstalk for all channels in the
                               U8903A.
INIT:ANAL (@1)               //Initiates the crosstalk measurement.
FETC? FUNC2 (@1)             //Acquires the measurement result.
```

Measuring the FFT magnitude

The following command sequence gives you an example on how to perform the FFT magnitude measurement of the input signals.

`DISP:ANAL:MODE MAGN`	//Sets the analysis mode to FFT magnitude.
`SENS:WAV:POIN 256`	//Sets the acquisition length to 256.
`TRIG:GRAP:SOUR IMM`	//Sets the graph trigger source to Immediate.
`INIT:GRAP (@1)`	//Initiates the measurements on channel 1.
`STAT:OPER:COND?`	//Polls the status register to check if the measuring operation has completed. The condition register will return 0 if the operation has completed.
`FETC:ARR? (@1)`	//Acquires the array of measurement data for channel 1.

Measuring the FFT phase

The following command sequence gives you an example on how to perform the FFT phase measurement of the input signals.

`DISP:ANAL:MODE PHAS`	//Sets the analysis mode to FFT phase.
`SENS:WAV:POIN 256`	//Sets the acquisition length to 256.
`TRIG:GRAP:SOUR IMM`	//Sets the graph trigger source to Immediate.
`INIT:GRAP (@1,2)`	//Initiates the measurements on all channels. For the FFT phase measurement, you need to include all the U8903A channels.
`STAT:OPER:COND?`	//Polls the status register to check if the measuring operation has completed. The condition register will return 0 if the operation has completed.
`FETC:ARR? (@2)`	//Acquires the array of measurement data for channel 2.

Measuring in the time domain

The following command sequence gives you an example on how to perform the time domain measurement of the digital interface input signals.

`DISP:ANAL:MODE TIME`	//Sets the analysis mode to time domain.
`SENS:DIG:WAV:POIN 1024`	//Sets the acquisition length to 1024.
`TRIG:DIG:GRAP:SOUR IMM`	//Sets the graph trigger source to Immediate.
`INIT:DIG:GRAP (@D1)`	//Initiates the measurements on channel 1.
`STAT:OPER:COND?`	//Polls the status register to check if the measuring operation has completed. The condition register will return 0 if the operation has completed.
`FETC:DIG:ARR? (@D1)`	//Acquires the array of measurement data for channel 1.

Performing sweep

Example 1

Frequency response is a very common test. The sweep feature of U8903A can be utilized to perform this analysis. To perform a frequency response analysis of your DUT, you can connect your DUT to any generator channel and the corresponding analyzer channel. In this example, the DUT must be connected to the analog generator channel 1 and analog analyzer channel 2.

The following command sequence provides an example to perform an automatic linear sweep on a 5 Vp sine waveform on analog generator channel 1, from 100 Hz to 1000 Hz with a step size of 200 Hz and 1 s dwell time to stabilize the DUT. The DUT signal amplitude is measured.

`SOUR:SWE:INT ANAL`	//Sets the sweep generator interface to analog.
`SOUR:FUNC SINE, (@1)`	//Sets the generator waveform type to sine on channel 1.
`SOUR:VOLT 5Vp, (@1)`	//Sets the amplitude of the sine waveform to 5 Vp.
`SOUR:SWE:REF:CHAN 1`	//Sets the sweep reference channel of the generator to channel 1.
`SOUR:SWE:CHAN 1`	//Sets channel 1 to perform sweep.
`SOUR:SWE:MODE ASW`	//Sets the sweep mode to Auto.
`SOUR:SWE:PAR FREQ`	//Sets the sweep parameter to frequency.
`SOUR:SWE:SPAC LIN, (@1)`	//Sets the spacing type to linear.
`SOUR:SWE:DWEL1 1000`	//Sets the dwell time to 1 s (1000 ms).
`SENS:MTIM GTR`	//Sets the measurement time to Gen Track.
`SOUR:SWE:STAR 100`	//Sets the sweep start value to 100 Hz.
`SOUR:SWE:STOP 1000`	//Sets the sweep stop value to 1000 Hz.
`SOUR:SWE:STEP 200`	//Sets the sweep step size to 200 Hz.
`SENS:SWE:INT ANAL`	//Sets the sweep analyzer interface to analog.
`SENS:SWE:REF:CHAN 1`	//Sets the sweep reference channel for measurement to channel 1.
`SENS:SWE:CHAN 2`	//Sets the analyzer channel to perform sweep to channel 2.
`SENS:FUNC1 FREQ, (@2)`	//Sets the measurement function 1 to frequency.
`SENS:FUNC2 VAC, (@2)`	//Sets the measurement function 2 to Vac.
`INIT:SWE`	//Initiates the sweep.
`STAT:OPER:COND?`	//Polls the status register to check if the measuring operation has completed. The condition register will return 0 if the operation has completed.
`SOUR:SWE:VAL? (@2)`	//Acquires the X-axis sweep points values.
`FETC:SWE? FUNC1, (@2)`	//Acquires the sweep result for function 1.
`FETC:SWE? FUNC2, (@2)`	//Acquires the sweep result for function 2.

Example 2

The following command sequence provides an example to perform a manual log sweep on a 5 Vrms sine waveform on channel 2, from 100 Hz to 10 kHz with a 10 ms dwell time. The number of points to sweep is 20 points. The signal amplitude is measured at the analog analyzer channel 2.

```
SOUR:SWE:INT ANAL          //Sets the sweep generator interface to analog.
SOUR:FUNC SINE, (@2)       //Sets the generator waveform type to sine on
                             channel 2.
SOUR:VOLT 5Vrms, (@2)      //Sets the amplitude of the sine waveform to
                             5 Vrms.
SOUR:SWE:REF:CHAN 1        //Sets the sweep reference channel of the
                             generator to channel 1
SOUR:SWE:CHAN 2            //Sets channel 2 to perform sweep.
SOUR:SWE:MODE MSW          //Sets the sweep mode to Manual.
SOUR:SWE:PAR FREQ1         //Sets the sweep parameter to frequency.
SOUR:SWE:SPAC LOG          //Sets the spacing type to logarithmic.
SOUR:SWE:DWEL 10           //Sets the dwell time to 10 ms.
SENS:MTIM GTR              //Sets the measurement time to Gen Track.
SOUR:SWE:STAR 100          //Sets the sweep start value to 100 Hz.
SOUR:SWE:STOP 10000        //Sets the sweep stop value to 10 kHz.
SOUR:SWE:POIN 20           //Sets the sweep points to 20.
SENS:SWE:INT ANAL          //Sets the sweep analyzer interface to analog.
SENS:SWE:REF:CHAN 1        //Sets the sweep reference channel for
                             measurement to channel 1.
SENS:SWE:CHAN 2            //Sets the analyzer channel to perform sweep
                             to channel 2.
SENS:FUNC1 FREQ, (@2)      //Sets the measurement function 1 to
                             frequency.
SENS:FUNC2 VAC, (@2)       //Sets the measurement function 2 to Vac.
INIT:SWE                   //Initiates the sweep.
```

`STAT:OPER:COND?`	//Polls the status register to check if the measuring operation has completed. The condition register will return 0 if the operation has completed.
`FETC:SWE? FUNC1, (@2)`	//Acquires the sweep result. For Manual sweep, only a single result will be returned each time this query is sent.
`FETC:SWE? FUNC2, (@2)`	//Acquires the sweep result.
`SOUR:SWE:NEXT`	//Jumps to the next sweep point.
`FETC:SWE? FUNC1, (@2)`	//Acquires the sweep result for the current point.

Use the `SOUR:SWE:NEXT` command and `FETC:SWE?` query to obtain the sweep results for the rest of the 20 sweep points.

Example 3

The following command sequence provides an example on how to use the List sweep function with the U8903A digital interface. Assume that you wish to sweep a series of predefined frequency points with no fixed step size and to measure the amplitude of your DUT. You may perform an automatic sweep on the generator and analyzer channel 1 with a 0 ms dwell time, using your predefined list of frequency points.

`SOUR:SWE:INT DIG`	//Sets the sweep generator interface to digital.
`SOUR:DIG:FUNC SINE`	//Sets the generator waveform type to sine.
`SOUR:DIG:VOLT 1FFS, (@D1)`	//Sets the amplitude of the sine waveform to 1 FFS.
`SOUR:SWE:REF:CHAN 1`	//Sets the sweep reference channel of the generator to channel 1
`SOUR:SWE:CHAN 1`	//Sets channel 1 to perform sweep.
`SOUR:SWE:PAR FREQ1`	//Sets the sweep parameter to frequency.

`MMEM:LOAD SWE, <filename>`	//Create your sweep points in .csv file format and save it into an external USB flash storage. For example, the file name is "`\Storage 1\file1.csv`".
`SOUR:SWE:MODE ALIS`	//Sets the sweep mode to Auto List.
`SOUR:SWE:DWEL1 0`	//Sets the dwell time to 0 ms.
`SENS:SWE:INT DIG`	//Sets the sweep analyzer interface to digital
`SENS:SWE:REF:CHAN 1`	//Sets the sweep reference channel for measurement to channel 1.
`SENS:SWE:CHAN 2`	//Sets the analyzer channel to perform sweep to channel 2.
`SENS:DIG:FUNC1 VAC, (@D1)`	//Sets the measurement function 1 to VAC.
`SENS:DIG:FUNC2 VDC, (@D1)`	//Sets the measurement function 2 to VDC.
`SOUR:SWE:POIN?`	//Queries the number of sweep points in the list.
`SOUR:SWE:VAL? (@D1)`	//Acquires the X-axis sweep points values.
`INIT:SWE`	//Initiates the sweep.
`FETC:SWE? FUNC1, (@D1)`	//Acquires the sweep result. For Manual sweep, only a single result will be returned each time this query is sent.
`FETC:SWE? FUNC2, (@D1)`	//Acquires the sweep result.

Using the user-defined filter data

This section describes the methods to load a custom filter into the U8903A by downloading the filter coefficients through SCPI or by loading the filter coefficients from a custom filter file stored in the U8903A. To create your own custom filter, you need to configure your custom filter data using an external software.

Example 1

The following command sequence provides an example on how to download a custom filter coefficients through SCPI. Assume that you wish to load an IIR low pass filter (two sections and three group delays) to the U8903A at channel 1, as well as a FIR low pass filter (one section and ten group delays) at channel 2.

`DATA:FILT IIR, 2, 3, <data>`	//Sends the IIR custom filter data to the U8903A volatile memory allocated for the user-defined filter data. Refer to "Appendix G: Using the IEEE-488.2 Binary Block Format" on page 567 for the `<data>` parameter.
`SENS:FILT:LPAS CUST, (@1)`	//Sets the low pass filter to Custom at channel 1.
`DATA:FILT FIR, 1, 10, <data>`	//Downloads the FIR custom filter data into the U8903A.
`SENS:FILT:LPAS CUST, (@2)`	//Sets the low pass filter to Custom at channel 2.

The custom filters for channel 1 and 2 are now ready to be used in the analyzer mode.

Example 2

The following command sequence provides an example on how to load a custom filter coefficients from a custom filter file stored in the U8903A. Assume that you wish to use a custom low pass filter stored in the U8903A at both the analyzer channel 1 and 2.

`MMEM:LOAD FILT, "\Filter\LPF80kHz_MF_HIGH.juf"`	//Loads the filter coefficients from the file "LPF80kHz_MF_HIGH.juf"
`SENS:FILT:LPAS CUST, (@1,2)`	//Sets the low pass filter to Custom at channel 1 and 2.

The custom filters for channel 1 and 2 are now ready to be used in the analyzer mode.

Example 3

The following command sequence provides an example on how to load two different custom filters for the analyzer channel. Assume that you wish to use a custom low pass filter at analyzer channel 1 where the file *"LPF80kHz_MF_HIGH.juf "* is stored in the U8903A and a custom high pass filter at analyzer channel 1 where the file *"myHighPass.juf"* is stored in your USB external flash storage.

`MMEM:LOAD FILT, "\Filter\LPF80kHz_MF_HIGH.juf"`	//Loads the filter coefficients from the file "LPF80kHz_MF_HIGH.juf"
`SENS:FILT:LPAS CUST, (@1)`	//Sets the low pass filter to Custom at channel 1.
`MMEM:LOAD FILT, "\Storage 1\myHighPass.juf"`	//Loads the filter coefficients from the file "myHighPass.juf"
`SENS:FILT:HPAS CUST, (@1)`	//Sets the high pass filter to Custom at channel 1.

The custom filters for channel 1 are now ready to be used in the analyzer mode.

Making relative measurement

This section describes the methods to obtain a relative measurement based on the previous measurement result of the same channel or other channels by changing the data format rather than using an absolute measurement data.

Example 1

The following command sequence provides an example to perform a relative measurement for Vac function in analyzer mode. The data measured by channel 1 will be set as a reference level for the subsequent measurement data of channel 2.

```
SENS:FUNC2 VAC, (@1,2)           //Sets the second measurement function to Vac
                                   on channel 1 and channel 2.
INIT:ANAL (@1)                   //initiates the analyzer measurement trigger
                                   system to take the measurement directly on
                                   channel 1.
SENS:REF:MEAS LEV, CH1, (@2)     //Sets the last measurement result obtained
                                   from channel 1 as the reference level for
                                   channel 2.
INIT:ANAL (@2)                   //Initiates the analyzer measurement trigger
                                   system to take the measurement directly on
                                   channel 2.
CALC:FORM:LEV LOG, (@2)          //Sets the level measurement format to
                                   logarithmic for channel 2.
SENS:FUNC2:UNIT? (@2)            //Acquires the unit of the second measurement
                                   function for channel 2.
FETCH? FUNC2, (@2)               //Acquires the second measurement function
                                   data for channel 2 that has been set relative
                                   to the reference level.
```

NOTE The acquired data is in dBr due to the `CALC:FORM:LEV LOG` command, which sets the level measurement format to logarithmic.

Example 2

The following command sequence provides an example to perform a relative measurement for Vac measurement by varying frequency in sweep mode with one fixed reference value.

`SOUR:SWE:INT ANAL`	//Sets the sweep generator interface to analog.
`SOUR:FUNC SINE, (@2)`	//Sets the generator waveform type to Sine for channel 2.
`SOUR:VOLT 5Vp, (@2)`	//Sets the signal amplitude level to 5 V for channel 2.
`SENS:SWE:REF:CHAN 1`	//Sets the sweep reference channel for measurement to channel 1.
`SOUR:SWE:CHAN 2`	//Sets channel 2 to perform sweep.
`SOUR:SWE:MODE ASW`	//Sets the sweep mode to Auto Sweep at channel 2.
`SOUR:SWE:PAR FREQ1`	//Sets the sweep parameter to frequency at channel 2.
`SOUR:SWE:SPAC LIN`	//Sets the sweep spacing to Log interval at channel 2.
`SOUR:SWE:DWEL1 1000`	//Sets the sweep dwell time to 1 s (1000 ms) at channel 2.
`SENS:MTIM GTRACK`	//Sets the analyzer measurement time to Gen Track.
`SOUR:SWE:STAR 100`	//Sets the sweep start point to 100 Hz for channel 2.
`SOUR:SWE:STOP 1000`	//Sets the sweep stop point to 1 kHz for channel 2.
`SOUR:SWE:STEP 200`	//Sets the sweep step size to 200 Hz for channel 2.
`SENS:SWE:INT ANAL`	//Sets the sweep analyzer interface to analog.
`SENS:SWE:REF:CHAN 1`	//Sets the sweep reference channel for measurement to channel 1.
`SENS:SWE:CHAN 2`	//Sets the analyzer channel to perform sweep to channel 2.

SENS:FUNC2 VAC, (@2)	//Sets the second measurement function to Vac on channel 2.
SENS:REF:LEV 1, (@2)	//Sets the reference level to 1 V for channel 2.
INIT:SWE	//Initiates the sweep for channel 2.
SOUR:SWE:VAL? (@2)	//Acquires the values of the sweep points for channel 2.
CALC:FORM:LEV LOG, (@2)	//Sets the level measurement format to logarithmic for channel 2.
FETC:SWE? FUNC2, (@D1)	//Acquires the sweep result for channel 2 that has been set relative to the reference level of 1 V.

NOTE The acquired data is in dBr due to the `CALC:FORM:LEV LOG` command, which sets the level measurement format to logarithmic.

Configuring the system clock reference settings

The following command sequence provides an example to configure the system clock reference source to external Master clock in with word length of 24, and multiplier of 192.

```
OUTP:DIG:RCLK:SOUR EXT                 //Sets the system clock reference source to External.
OUTP:DIG:RCLK:EXT MCLK                 //Selects the external clock source type as Master clock.
OUTP:DIG:RCLK:EXT:MCLK:WLEN 24         //Sets the Master clock word length to 24.[1][2]
OUTP:DIG:RCLK:EXT:MCLK:MULT 192        //Sets the Master clock multiplier to 192.[3]
```

[1] Sampling rate constrains the word length values. Please refer to "Appendix K: Word Length, Sampling Rate, and Multiplier for Master Clock In" on page 588 for the allowed word length value under different sampling rate.

[2] When setting the word length, you may get the error message "**-221, Settings conflict...**". This message can be ignored. The purpose of this message is to inform that either the word length or multiplier is auto adjusted to the nearest allowable value due to the settings conflict.

[3] Sampling rate and word length constrain the multiplier values. Please refer to "Appendix K: Word Length, Sampling Rate, and Multiplier for Master Clock In" on page 588 for the allowed multiplier value under different sampling rate and word length.

Configuring the DSI output settings

The following command sequence provides an example to configure the DSI output settings to DSP format, sample rate of 192 kHz, word length of 24, and multiplier of 192.

```
OUTP:DIG:DSI:DATA:FORM DSP             //Sets the DSI audio data to DSP format.
OUTP:DIG:SRAT 192kHz                   //Sets the sampling rate to 192 kHz.
OUTP:DIG:DSI:AUD:WLEN 24               //Sets the DSI word length to 24.[1][2]
OUTP:DIG:DSI:MCLK:MULT 192             //Sets the DSI multiplier to 192.[3]
```

[1] Sampling rate constrains the word length values. Please refer to "Appendix J: Word Length, Sampling Rate, and Multiplier for DSI Interface" on page 581 for the allowed word length value under different sampling rate.

[2] When setting the word length, you may get the error message "**-221, Settings conflict...**". This message can be ignored. The purpose of this message is to inform that either the word length or multiplier is auto adjusted to the nearest allowable value due to the settings conflict.

[3] Sampling rate and word length constraint the multiplier values. Please refer to "Appendix J: Word Length, Sampling Rate, and Multiplier for DSI Interface" on page 581 for the allowed multiplier value under different sampling rate and word length.

Configuring the AES3/SPDIF interface channel status bits data

The following examples show how to configure the channel status bits data of AES3/SPDIF interface to Professional mode, 50/15us of emphasis, 96 kHz of sample frequency and Stereo channel mode for digital generator channel 1.

Example 1

The following command sequence provides an example to configure the channel status bits data by referring to the respective field names from "Appendix I: AES3/SPDIF Interface Channel Status Bits Field Names" on page 578.

```
OUTP:DIG:AES:MODE PROF, (@D1)           //Sets the channel status bits data to
                                          Professional mode
OUTP:DIG:AES:CST:FIEL "Emphasis",       //Sets the channel status bits data emphasis to
"50/15us", (@D1)                          50/15us.
OUTP:DIG:AES:CST:FIEL "Sample           //Sets the channel status bits data sample
Freq", "96kHz", (@D1)                     frequency to 96 kHz.
OUTP:DIG:AES:CST:FIEL "Channel          //Sets the channel status bits data channel
Mode", "Stereo", (@D1)                    mode to Stereo.
```

Example 2

The following command sequence provides an example to configure the channel status bits data by setting the 24 bytes array of the channel status bits in hexadecimal characters.

`OUTP:DIG:AES:CST:DATA #H0D020000100000000000000000000000 0000000000000000, (@D1)`	//Sets the channel status bits data to Professional mode, 50/15µs of emphasis, 96 kHz of sample frequency, and Stereo channel mode.

Example 3

The following command sequence provides an example to configure the channel status bits data by setting a particular byte of channel status bits in hexadecimal characters.

`OUTP:DIG:AES:CST:BYTE 0, #H0D, (@D1)`	//Sets the channel status bits data to Professional mode and 50/15µs of emphasis.
`OUTP:DIG:AES:CST:BYTE 1, #H02, (@D1)`	//Sets the channel status bits data to 96 kHz of sample frequency.
`OUTP:DIG:AES:CST:BYTE 4, #H10, (@D1)`	//Sets the channel status bits data to Stereo channel mode.

Configuring for Bit Error Rate Test (BERT)

Example 1

The following command sequence provides an example to setup the Bit Error Rate Test (BERT). In this example, a 24-bit walking one waveform is selected as the generator test pattern. Output sampling rate is fixed to 48 kHz. The duration of the Bit Error Test is set to 100 seconds. The result of the measurement is set to be returned in hexadecimal value. Unbalanced connectors are used in this test.

NOTE The input audio bit depth must be the same with the output bit depth.

`OUTP:DIG:TYPE UNB`	//Sets the output connector of the digital interface to Unbalanced.
`INP:DIG:TYPE UNB`	//Sets the input connector of the digital interface to Unbalanced.
`OUTP:DIG:SRAT 48kHz`	//Sets the output sample rate to 48 kHz.
`SOUR:DIG:BERT:MODE ON`	Enables the BERT mode.
`SOUR:DIG:BERT:PATT:CAT WCON`	//Sets the test pattern category to walking constant.
`SOUR:DIG:BERT:WCON:TYPE WONE, (@D1,D2)`	//Selects Walking One as the test pattern at digital generator channel 1 and 2.
`SOUR:DIG:BERT:BWID 24`	//Sets the bit depth of the test pattern to 24 bits.
`SOUR:DIG:BERT:DUR 100`	//Sets the duration of the test to 100 s.
`SENS:DIG:BERT:UNIT HEX`	//Sets the unit of the measurement data return in hexadecimal value.
`SENS:DIG:BERT:INT 1`	//Sets the reading rate to 1 second. This is only useful for the front panel. It is actually setting the refresh rate of the front panel.

`INIT:DIG:BERT`	//Initiates the BERT measurement. This is a single value measurement. It triggers the measurement at the moment the command below is sent.
`FETC:DIG:BERT? BER, (@D1,D2)`	//Acquires the Bit Error Ratio data at the end of the duration.
`FETC:DIG:BERT? TBIT, (@D1,D2)`	//Acquires the Total Bits to be compared.
`FETC:DIG:BERT? ERR, (@D1,D2)`	//Acquires the Total Errors at the end of the test duration.
`SOUR:DIG:BERT:MODE OFF`	Disables the BERT mode.

Example 2

In this example, a 16-bit pseudo-random waveform is used as the generator test pattern. Output sampling rate is fixed to 48 kHz. The duration of the test is set to 500 seconds. The result of the measurement is returned in decimal value. DSI connectors are used in this test.

`INP:DIG:TYPE DSI`	//Sets the input connector of the digital interface to Unbalanced.
`OUTP:DIG:SRAT 48kHz`	//Sets the output sample rate to 48 kHz.
`SOUR:DIG:BERT:MODE ON`	Enables the BERT mode.
`SOUR:DIG:BERT:PATT:CAT PSE`	//Sets the test pattern category to pseudo-random.
`SOUR:DIG:BERT:PSE:SEED #H0000000A, (@D1,D2)`	//Sets the seed value to 10 for the pseudo-random test pattern at digital generator channel 1 and 2.
`SOUR:DIG:BERT:BWID 16`	//Sets the bit width of the test pattern to 16 bits.
`SOUR:DIG:BERT:DUR 500`	//Sets the duration of the test to 500 s.
`SENS:DIG:BERT:UNIT DEC`	//Sets the unit of the measurement data return in decimal value.
`SENS:DIG:BERT:INT 1`	//Sets the reading rate to 1 s. This is only useful for front panel. It is actually setting the refresh rate of the front panel.

INIT:DIG:BERT	//Initiate the BERT measurement. This is a single value measurement. It triggers the measurement at the moment the command below is sent.
FETC:DIG:BERT? BER, (@D1,D2)	//Acquires the Bit Error Ratio data at the end of the duration.
FETC:DIG:BERT? TBIT, (@D1,D2)	//Acquires the Total Bits compared.
FETC:DIG:BERT? ERR, (@D1,D2)	//Acquires the total errors at the end of the test duration.
SOUR:DIG:BERT:MODE OFF	Disables the BERT mode.

Measuring time delay introduced by DUT

A digital audio signal will have delay when the signal is transmitted through a DUT. Digital Out to Digital In Delay Measurement is a measure of time difference of the AES3 signal between the start of the first output frame and the start of the first input frame. In general, it is to measure the delay time from the selected digital input (either Balanced, Unbalanced or Optical) with reference to the selected digital output (either Balanced, Unbalanced, or Optical).

The following command sequence provides an example to measure the time delay of a DUT with Unbalanced connectors. Connect a DUT to the Digital Unbalanced output and the Digital Unbalanced input.

OUTP:DIG:TYPE UNB	//Sets the digital output type to Unbalanced.
INP:DIG:TYPE UNB	//Sets the digital input type to Unbalanced.
INIT:CONT:DIG:DEL ON	//Starts the Delay Measurement.
FETC:DIG:DEL?	//You can continuously acquires the result until the reading is stable.

Configuring Digital Serial Interface (DSI) receiver

The U8903A allows you to analyze signal generated by DUT (Device Under Test) with the DSI connector. The examples below will show you how to configure the DSI Receiver settings. Example 1 shows you how to configure the received data content. Example 2 to 5 show you how to configure the data and clock direction for the DSI receiver. To perform this test, connect your DUT Digital Serial Output to the U8903A DSI connector.

Example 1

In this example, assume that the data input from the DSI connector contains 16-bit audio data with Left Justified format. The word length of the data is 24 bits and the decoding format of the audio data is A-Law.

```
INP:DIG:DSI:AUD:FORM ALAW       //Sets the decoding format of the input audio
                                  data to A-Law.
INP:DIG:DSI:DATA:FORM LEFT      //Sets the received data format to left justified.
INP:DIG:DSI:AUD:RES 16          //Sets the received audio resolution to 16 bits.
INP:DIG:DSI:AUD:WLEN 24         //Sets the received word length to 24 bits.
```

Example 2

In this example, the Device under Test (DUT) will send bit clock, word clock and data to the U8903A DSI receiver, while Master Clock may be an external clock to the DUT or generated by the DUT. Assume that the leading edge of the word clock and data is synchronized with the rising edge of the bit clock.

To configure the receiver data format, refer to Example 1.

```
INP:DIG:TYPE DSI                //Sets the input connector to Digital Serial
                                  Interface (DSI).
INP:DIG:DSI:MCLK:SOUR EXT       //Sets the Master Clock source to external.
```

`INP:DIG:DSI:WBCL:DIR IN`	//Sets the word clock and bit clock direction to In.
`INP:DIG:DSI:BCLK:SYNC RIS`	//Sets the leading edge of the word clock and data to be synchronized with the rising edge of the bit clock.

Example 3

In this example, the U8903A will receive a master clock either from the DUT or other external clock source. The U8903A will generate the word clock and bit clock to the DUT. The DUT will send data to the U8903A DSI receiver. Assume that the leading edge of the word clock and data is synchronized with the rising edge of the bit clock.

To configure the receiver data format, refer to Example 1.

`INP:DIG:TYPE DSI`	//Sets the input connector to Digital Serial Interface (DSI).
`INP:DIG:DSI:MCLK:SOUR EXT`	//Sets the Master Clock source to external.
`INP:DIG:DSI:WBCL:DIR OUT`	//Sets the word clock and bit clock direction to Out.
`INP:DIG:DSI:BCLK:SYNC RIS`	//Sets the leading edge of the word clock and data to be synchronized with the rising edge of the bit clock.
`INP:DIG:DSI:MCLK:MULT 512`	//Sets the multiplier so that the U8903A can determine the sample rate of the received signal.

Example 4

In this example, the U8903A provides the master clock to the DUT. The DUT will then generates the word clock and bit clock based on the master clock and transmits to the U8903A. At the same time, the DUT will also send data to the U8903A DSI receiver for analysis. Assume that the leading edge of the word clock and data is synchronized with the rising edge of the bit clock. The U8903A internal system clock (i.e., 10 MHz) will be used as the reference clock source for the master clock.

To configure the receiver data format, refer to Example 1.

`INP:DIG:TYPE DSI`	//Sets the input connector to Digital Serial Interface (DSI).
`OUTP:DIG:RCLK:SOUR INT`	//Sets the reference clock source to Internal system clock 10 MHz.
`INP:DIG:DSI:MCLK:SOUR INT`	//Sets the Master Clock source to internal.
`INP:DIG:DSI:WBCL:DIR IN`	//Sets the word clock and bit clock direction to In.
`OUTP:DIG:SRAT 48kHz`	//Sets the sample rate to 48 kHz.
`INP:DIG:DSI:MCLK:MULT 96`	//Sets the multiplier to determine the master clock rate. The master clock rate is set to 4.608 MHz. Master clock rate = sample rate × multiplier
`INP:DIG:DSI:BCLK:SYNC RIS`	//Sets the leading edge of the word clock and data to be synchronized with the rising edge of the bit clock.

Example 5

In this example, the U8903A generates and provides the master clock, word clock, and bit clock to the DUT, and the DUT will transmit the data to the instrument for analysis. Assume that the leading edge of the word clock and data is synchronized with the rising edge of the bit clock. Assume that the master clock reference is the U8903A internal system clock which is 10 MHz.

To configure the receiver data format, refer to Example 1.

`INP:DIG:TYPE DSI`	//Sets the input connector to Digital Serial Interface (DSI).
`OUTP:DIG:RCLK:SOUR INT`	//Sets the reference clock source to Internal system clock 10 MHz.
`INP:DIG:DSI:MCLK:SOUR INT`	//Sets the Master Clock source to internal.
`INP:DIG:DSI:WBCL:DIR OUT`	//Sets the word clock and bit clock direction to In.
`OUTP:DIG:SRAT 48kHz`	//Sets the sample rate to 48 kHz.
`INP:DIG:DSI:MCLK:MULT 96`	//Sets the multiplier to determine the master clock rate. The master clock rate is set to 4.608 MHz. Master clock rate = sample rate × multiplier
`INP:DIG:DSI:BCLK:SYNC RIS`	//Sets the leading edge of the word clock and data to be synchronized with the rising edge of the bit clock.

Reading the bits value in the embedded received audio data

The following command sequence provides an example to view the bits value of each word of the embedded audio data in the digital signal in binary.

`INIT:DIG:AUD:BITS (@D1)`	//Captures once the audio bits data from the digital signal for channel 1 is received.
`FETC:DIG:AUD:BITS? DATA, (@D1)`	//Acquires the Data bits value of channel 1 in binary.
`FETC:DIG:AUD:BITS? ACT, (@D1)`	//Acquires the Active bits value of channel 1 in binary. (Active bits are bits that have changed state during the measurement period. "1" indicates that the bit has changed state, "0" indicates that there is no change)

Acquiring the Channel Status Byte information

Example 1

The following command sequence provides an example to get the raw data of the Channel Status Byte information of the AES3 signal in Hexadecimal.

`MEAS:DIG:CST:DATA? (@D1)`	//Acquires the Channel Status Byte information for channel 1.

Example 2

The following command sequence provides an example to obtain a specific field information of the Channel Status Byte by providing the field name. In this example, we will acquire the field information of "Emphasis" for Channel 1.

`MEAS:DIG:CST:FIEL? "Emphasis", (@D1)`	//Acquires the Channel Status Byte information of Emphasis for channel 1.

2
SCPI Command Summary

The summary of the SCPI commands is listed in this chapter.

SCPI Command Summary

IEEE-488.2 common commands

*CLS	Clears the event registers in all register groups and also clears the error queue.
*RST	Resets the U8903A to its factory default settings.
*ESE <value>	Sets the bits in the Standard Event enable register.
*ESE?	Returns the value of the Standard Event enable register.
*ESR?	Returns the value of the event register of the Standard Event group.
*IDN?	Reads the U8903A identification string which contains four comma-separated fields.
*OPC	Sets the “Operation Complete” bit (bit 0) in the Standard Event register when all pending operations have completed.
*OPC?	Sends 1 to the output buffer when all pending operations have completed.
*OPT?	Returns an ASCII string identifying the digital audio option configuration.
*SRE <value>	Enables the bits in the Status Byte enable register.
*SRE?	Returns the value of the Status Byte enable register.
*STB?	Reads the summary (condition) of the Status Byte register.
*TST?	Initiates an internal self-test of the U8903A and returns a pass or fail indication.

*WAI	Sets the U8903A to wait for the completion of all pending operations before executing any other command.
*TRG	Triggers the U8903A from the remote interface.

System commands

SYSTem:ERRor[:NEXT]?	Returns the error number and its corresponding message string from the U8903A error queue.
SYSTem:DATE <yyyy>, <mm>, <dd>	Sets the date of the realtime clock in year (yyyy), month (mm), and day (dd) format.
SYSTem:TIME <hh>, <mm>, <ss>	Sets the realtime clock in hours (hh), minutes (mm), and seconds (ss).
SYSTem:VERSion?	Returns the SCPI standard version with which the U8903A is in compliance.
SYSTem:COMMunicate:GPIB [:SELF]:ADDRess <address>	Assigns the U8903A GPIB (IEEE-488) address.
SYSTem:COMMunicate:LAN: ADDRess <address>	Assigns a static Internet Protocol (IP) address for the U8903A.
SYSTem:COMMunicate:LAN: DGATeway <gateway>	Assigns the static default gateway address.
SYSTem:COMMunicate:LAN: HNAMe?	Queries the LAN hostname and returns an ASCII string enclosed in double quotes.
SYSTem:COMMunicate:LAN: SMASk <subnet mask>	Sets the static subnet mask address.
SYSTem:COMMunicate:LAN:MAC?	Reads the U8903A Media Access Control (MAC) address and returns an ASCII string enclosed in double quotes.
SYSTem:COMMunicate:LAN: DHCP:ENABled	Enables the Dynamic Host Configuration Protocol (DHCP) for the U8903A.

SYSTem:CHANnel?	Queries the available channels in the U8903A to determine if the channel hardware card is available or in good condition.
SYSTem:PRESet	Presets the U8903A to its factory default settings and deletes all user-defined files.
SYSTem:RESet[:MODE] <system mode>	Resets the customized settings of the specified U8903A system mode to the default settings.
SYSTem:RESet:CHANnel <system mode>, (@<channel>)	Resets the customized settings of the U8903A system mode for the specified channel to the default settings.
SYSTem:LEGacy:MODE <state>	Enables or disables the legacy mode.
SYSTem:LEGacy:CHANnel <channel>	Sets the channel for the U8903A to emulate the HP8903B.
SYSTem:DISPlay:IMAGe? <invert color>	Prints the screen and retrieves the print screen image data.
SYSTem:REMote	Activates Remote mode.
SYSTem:RWLock	Activates Remote with Lock mode.
SYSTem:LOCal	Unlocks all the U8903A front panel keypad including the Local key and enables the U8903A to be controlled from the front panel.
SYSTem:DIGital:CTYPe?	Queries the installed digital audio type in the U8903A and returns either AES, DSI, or ALL.
SYSTem:UPDate:FIRMware? <firmware list>	Starts the U8903A firmware update process remotely and returns the firmware update process state as 0 if the update process state is not completed, or 1 if the update process state is completed successfully.
SYSTem:UPDate:HELP? <filename>	Starts the U8903A help file update process remotely and returns the help file update process state as 0 if the update process state is not completed, or 1 if the update process state is completed successfully.

Output commands

OUTPut:TYPE <type>, (@<channel list>)	Sets the generator output connection for the specified channel(s).
OUTPut:IMPedance <impedance>, (@<channel list>)	Sets the generator output impedance for the specified channel(s).
OUTPut:STATe <state>, (@<channel list>)	Enables or disables the generator output for the specified channel(s).
OUTPut:DIGital:TYPE <type>	Sets the digital generator AES3/SPDIF output connection.
OUTPut:DIGital:SRATe <sampling rate> [<unit>]	Sets the sampling rate of the digital generator output signals.
OUTPut:DIGital:STATe <state>, (@<channel list>)	Enables or disables the digital generator output for the specified channel(s).
OUTPut:DIGital:AUDio[:ENCoding]:FORMat <format>	Sets the audio encoding format of the embedded digital generator audio signals.
OUTPut:DIGital:AES:STATe <state>	Enables or disables the AES3/SPDIF output for the digital generator.
OUTPut:DIGital:AES:VOLTage <level>	Sets the output logic level for the AES3/SPDIF interface in Peak-to-Peak Voltage (Vpp).
OUTPut:DIGital:AES:AUDio:RESolution <resolution>	Sets the audio resolution or bit depth for the AES3/SPDIF interface audio data to be generated.
OUTPut:DIGital:AES:AUDio:VALidity <validity>	Sets the validity bit (bit 128) of the AES3/SPDIF interface output.
OUTPut:DIGital:AES[:PROTocol]:MODE <mode>, (@<channel list>)	Sets the first bit in the channel status block of the AES3/SPDIF interface to indicate the mode.
OUTPut:DIGital:AES[:PROTocol]:CSTatus:DATA <data>, (@<channel list>)	Sets the 24 bytes array of the channel status bits in hexadecimal characters for the specified channel(s).

`OUTPut:DIGital:AES[:PROTocol]:CSTatus:BYTE <number>, <value>, (@<channel list>)`	Sets a particular byte of the channel status bits for the specified channel(s).
`OUTPut:DIGital:AES[:PROTocol]:CSTatus:FIELd <name>, <value>, (@<channel list>)`	Sets the channel status bits data of a specified field name for the specified channel(s).
`OUTPut:DIGital:AES[:PROTocol]:UStatus:DATA <data>, (@<channel list>)`	Sets the 24 bytes array of the user status bits in hexadecimal characters for the specified channel(s).
`OUTPut:DIGital:AES[:PROTocol]:UStatus:BYTE <number>, <value>, (@<channel list>)`	Sets a particular byte of the user status bits for the specified channel(s).
`OUTPut:DIGital:DSI:VOLTage <level>`	Sets the output logic level for the digital serial interface (DSI) in Peak- to-Peak Voltage (Vpp).
`OUTPut:DIGital:DSI:AUDio:RESolution <resolution>`	Sets the audio resolution or bit depth for the DSI interface audio data to be generated.
`OUTPut:DIGital:DSI:AUDio:WLENgth <length>`	Sets the word length for the DSI interface.
`OUTPut:DIGital:DSI:DATA:FORMat <format>`	Sets the format for the DSI interface audio data to be generated.
`OUTPut:DIGital:DSI:MCLK:STATe <state>`	Enables or disables the DSI interface master clock.
`OUTPut:DIGital:DSI:MCLK:MULTiplier <multiplier>`	Sets the multiplier that is used to determine the master clock rate.
`OUTPut:DIGital:DSI:MCLK:RATE?`	Queries the master clock rate.
`OUTPut:DIGital:DSI:BCLK:SYNC:OUT <polarity>`	Sets the leading edge of the data to be synchronized to the rising edge or falling edge of the bit clock that is set to Out for the digital generator.
`OUTPut:DIGital:OPTical:STATe <state>`	Enables or disables the optical output for digital generator.
`OUTPut:DIGital:DSI:RCLK:SOURce <source>`	Sets the system clock reference source type.

OUTPut:DIGital:RCLK:EXTernal[:TYPE] <type>	Sets the external clock source type.
OUTPut:DIGital:RCLK:EXTernal:MCLK:WLENgth <length>	Sets the word length of the master clock for the external clock source.
OUTPut:DIGital:RCLK:EXTernal:MCLK:MULTiplier <multiplier>	Sets the multiplier of the master clock for the external clock source.
OUTPut:DIGital:SCLK:OUT:STATe <state>	Enables or disables the sync clock output for digital generator.
OUTPut:DIGital:SCLK:OUT:SOURce <source>	Sets the sync clock source type.
OUTPut:DIGital:SCLK:OUT:DIVider <divider>	Sets the sync clock divider.

Input commands

INPut:TYPE <type>, (@<channel list>)	Sets the input connection for the specified channel(s).
INPut:COUPling <coupling>, (@<channel list>)	Sets the analyzer AC or DC coupling for the specified channel(s).
INPut:BANDwidth <bandwidth>	Sets the analyzer measurement bandwidth.
INPut:DIGital:TYPE <type>	Sets the digital analyzer input connection.
INPut:DIGital:SRATe?	Queries the sampling rate of the digital analyzer input signals.
INPut:DIGital:IMPedance:BALanced <impedance>	Sets the impedance of the digital analyzer balanced input connection.
INPut:DIGital:IMPedance:UNBalanced <impedance>	Sets the impedance of the digital analyzer unbalanced input connection.
INPut:DIGital:AES:AUDio[:DECoding]:FORMat <format>	Sets the audio decoding format of the embedded AES3/SPDIF interface audio signals.

`INPut:DIGital:AES:AUDio:RESolution <resolution>`	Sets the audio resolution or bit depth for the AES3/SPDIF interface audio data to be analyzed.
`INPut:DIGital:DSI:VOLTage <level>`	Sets the input logic level of the incoming signal for the DSI interface.
`INPut:DIGital:DSI:AUDio[:DECoding]:FORMat <format>`	Sets the audio decoding format of the embedded DSI interface audio signals.
`INPut:DIGital:DSI:AUDio:RESolution <resolution>`	Sets the audio resolution or bit depth for the DSI interface audio data to be analyzed.
`INPut:DIGital:DSI:AUDio:WLENgth <length>`	Sets the word length for the DSI interface.
`INPut:DIGital:DSI:MCLK:SOURce <source>`	Sets the master clock reference source type.
`INPut:DIGital:DSI:WBCLK:DIRection <direction>`	Sets the word clock and bit clock direction.
`INPut:DIGital:DSI:MCLK:MULTiplier <multiplier>`	Sets the master clock multiplier.
`INPut:DIGital:DSI:BCLK:SYNC <polarity>`	Sets the leading edge of the data to be synchronized to the rising edge or falling edge of the bit clock.
`INPut:DIGital:DSI:DATA:FORMat <format>`	Sets the format for the DSI interface audio data to be analyzed.
`INPut:DIGital:DSI:DATA:MSB:PADDing <bits>`	Sets the number of padding bits in front of the most significant bit (MSB).
`INPut:DIGital:FREQuency:SCALing <scaling>, (@<channel list>)`	Sets the reference sampling rate source to scale the frequency measurement for the specified channel(s).
`INPut:DIGital:REFerence:SRATe <sampling rate>[<unit>], (@<channel list>)`	Sets the reference sampling rate for the specified channel(s).

Source commands

SOURce:FUNCtion <waveform type>, (@<channel list>)	Sets the generator waveform type for the specified channel(s).
SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet <voltage>[<unit>], (@<channel list>)	Sets the signal DC offset level in V for the specified channel(s).
SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude] <voltage>[<unit>], (@<channel list>)	Sets the signal amplitude level for the specified channel(s).
SOURce:FREQuency[<j>][:CW] <frequency>[<unit>], (@<channel list>)	Sets the signal frequency for the specified channel(s) in Hz.
SOURce:FREQuency:CENTer <frequency>[<unit>], (@<channel list>)	Sets the center frequency of the DFD IEC 60268 waveform for the specified channel(s) in Hz.
SOURce:FREQuency:DIFFerence <frequency>[<unit>], (@<channel list>)	Sets the frequency difference of the DFD IEC 60268 and DFD IEC 60118 waveforms for the specified channel(s) in Hz.
SOURce:FREQuency:UPPer <frequency>[<unit>], (@<channel list>)	Sets the upper frequency of the DFD IEC 60118, SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 waveforms for the specified channel(s) in Hz.
SOURce:FREQuency:LOWer <frequency>[<unit>], (@<channel list>)	Sets the lower frequency of the SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 waveforms for the specified channel(s) in Hz.
SOURce:VOLTage:RATio <ratio>, (@<channel list>)	Sets the amplitude ratio of the second component over the first component of the dual waveform for the specified channel(s) in percentage.
SOURce:PHASe[:ADJust] <phase>, (@<channel list>)	Sets the phase of the selected channel with reference to channel 1 in degree.

SOURce:REFerence:IMPedance <impedance>, (@<channel list>)	Sets the generator reference impedance for the specified channel(s) in ohms (Ω).
SOURce:MULTitone:FREQuency:STARt <frequency>[<unit>], (@<channel list>)	Sets the start frequency of the multitone waveform for the specified channel(s).
SOURce:MULTitone:FREQuency:STOP <frequency>[<unit>], (@<channel list>)	Sets the stop frequency of the multitone waveform for the specified channel(s).
SOURce:MULTitone:FREQuency:SPACing <spacing>, (@<channel list>)	Sets the frequency spacing type between the start and stop frequency of the multitone waveform for the specified channel(s).
SOURce:MULTitone:COUNt <tone count>, (@<channel list>)	Sets the tones of the multitone waveform for the specified channel(s).
SOURce:MULTitone:WLEN <length>, (@<channel list>)	Sets the waveform length of the multitone waveform for the specified channel(s).
SOURce:MULTitone:RLEN <length>, (@<channel list>)	Sets the record length of the multitone waveform for the specified channel(s).
SOURce:MULTitone:CRESt? (@<channel list>)	Queries the crest factor of the multitone waveform for the selected channel(s).
SOURce:MULTitone:TONE:CLEar (@<channel list>)	Clears all the tones of the multitone waveform for the specified channel(s).
SOURce:MULTitone:TONE:ADD <index>, <frequency>[<unit>], <voltage>[<unit>], <phase>, (@<channel list>)	Adds a customized tone into the multitone waveform for the specified channel(s).
SOURce:MULTitone:TONE:DELete <index>, (@<channel list>)	Deletes a specific tone from the multitone waveform for the specified channel(s).
SOURce:MULTitone:TONE:FREQuency <frequency>[<unit>], (<tone list>) (@<channel list>)	Sets the frequency of the tone(s) in the multitone waveform for the specified channel(s).

SOURce:MULTitone:TONE:VOLTage <voltage>[<unit>], (<tone list>) (@<channel list>)	Sets the voltage of the tone(s) in the multitone waveform for the specified channel(s).
SOURce:MULTitone:TONE:PHASe <phase>, (<tone list>) (@<channel list>)	Sets the phase of the tone(s) in the multitone waveform for the specified channel(s).
SOURce:MULTitone:TONE:PHASe:RANDomize (@<channel list>)	Randomizes the phase of all the tones in the multitone waveform for the specified channel(s).
SOURce:DIGital:FUNCtion <waveform type>	Sets the digital generator waveform type. The query returns the waveform type.
SOURce:DIGital:DITHer:TYPE <dither>	Sets the dither type of the digital generator signal.
SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude] <voltage>[<unit>], (@<channel list>)	Sets the signal amplitude level for the specified digital channel(s).
SOURce:DIGital:VOLTage[:LEVel][:IMMediate]:OFFSet <offset>[<unit>], (@<channel list>)	Sets the signal DC offset level in FFS for the specified digital channel(s).
SOURce:DIGital:VOLTage:RATio <ratio>, (@<channel list>)	Sets the voltage ratio of the second component over the first component of the dual waveform for the specified digital channel(s) in percentage.
SOURce:DIGital:FREQuency[<j>] <frequency>[<unit>], (@<channel list>)	Sets the signal frequency for the specified channel(s) in Hz.
SOURce:DIGital:FREQuency:CENTer <frequency>[<unit>], (@<channel list>)	Sets the center frequency of the DFD IEC 60268 waveform for the specified channel(s) in Hz.
SOURce:DIGital:FREQuency:DIFFerence <frequency>[<unit>], (@<channel list>)	Sets the frequency difference of the DFD IEC 60268 and DFD IEC 60118 waveforms for the specified channel(s) in Hz.

SOURce:DIGital:FREQuency:UPPer <frequency>[<unit>], (@<channel list>)	Sets the upper frequency of the DFD IEC 60118, SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 waveforms for the specified channel(s) in Hz.
SOURce:DIGital:FREQuency:LOWer <frequency>[<unit>], (@<channel list>)	Sets the lower frequency of the SMPTE 1:1, SMPTE 4:1, and SMPTE 10:1 waveforms for the specified channel(s) in Hz.
SOURce:DIGital:SBURst:ONTime <on time>, (@<channel list>)	Sets the burst on time of the sine burst waveform for the specified channel(s) in number of cycles.
SOURce:DIGital:SBURst:PERiod <period>, (@<channel list>)	Sets the burst period of the sine burst waveform for the specified channel(s) in number of cycles.
SOURce:DIGital:SBURst:LOWLevel <low level>, (@<channel list>)	Sets the amplitude ratio of burst on to burst off for the specified channel(s) in percentage.
SOURce:DIGital:SAMPle <sample>, (@<channel list>)	Sets the samples per step of the Monotonicity, Walking Zero, and Walking One waveform for the specified channel(s).
SOURce:DIGital:PHASe[:ADJust] <phase>, (@<channel list>)	Sets the phase offset value of the selected channel with reference to the digital generator channel 1 in degree.
SOURce:DIGital:MULTitone:FREQuency:STARt <frequency>[<unit>], (@<channel list>)	Sets the start frequency of the multitone waveform for the specified channel(s).
SOURce:DIGital:MULTitone:FREQuency:STOP <frequency>[<unit>], (@<channel list>)	Sets the stop frequency of the multitone waveform for the specified channel(s).
SOURce:DIGital:MULTitone:FREQuency:SPACing <spacing>, (@<channel list>)	Sets the frequency spacing type between the start and stop frequency of the multitone waveform for the specified channel(s).
SOURce:DIGital:MULTitone:COUNt <tone count>, (@<channel list>)	Sets the tones of the multitone waveform for the specified channel(s).

`SOURce:DIGital:MULTitone:CREST? (@<channel list>)`	Queries the crest factor of the multitone waveform for the selected channel(s).
`SOURce:DIGital:MULTitone:TONE:CLEar (@<channel list>)`	Clears all the tones of the multitone waveform for the specified channel(s).
`SOURce:DIGital:MULTitone:TONE:ADD <index>, <frequency>[<unit>], <voltage>[<unit>], <phase>, (@<channel list>)`	Adds a customized tone into the multitone waveform for the specified channel(s).
`SOURce:DIGital:MULTitone:TONE:DELete <index>, (@<channel list>)`	Deletes a specific tone from the multitone waveform for the specified channel(s).
`SOURce:DIGital:MULTitone:TONE:FREQuency <frequency>[<unit>], (<tone list>) (@<channel list>)`	Sets the frequency of the tone(s) in the multitone waveform for the specified channel(s).
`SOURce:DIGital:MULTitone:TONE:VOLTage <voltage>[<unit>], (<tone list>) (@<channel list>)`	Sets the voltage of the tone(s) in the multitone waveform for the specified channel(s).
`SOURce:DIGital:MULTitone:TONE:PHASe <phase>, (<tone list>) (@<channel list>)`	Sets the phase of the tone(s) in the multitone waveform for the specified channel(s).
`SOURce:DIGital:MULTitone:TONE:PHASe:RANDomize (@<channel list>)`	Randomizes the phase of all the tones in the multitone waveform for the specified channel(s).
`SOURce:DIGital:REFerence:VOLTage <voltage>`	Sets the voltage reference of the digital generator for the specified channel(s) in V.
`SOURce:DIGital:BERT[:MODE]`	Enables or disables the Bit Error Rate Test (BERT) mode.
`SOURce:DIGital:BERT:PATTern:CATegory <category>`	Sets the pattern category of the Bit Error Rate Test (BERT).

SOURce:DIGital:BERT:WCONstant:TYPE <type>, (@<channel list>)	Sets the pattern type of the walking constant for the specified channel(s).
SOURce:DIGital:BERT:PSEudorandom:SEED <seed>, (@<channel list>)	Sets the pseudorandom seed value for the specified channel(s).
SOURce:DIGital:BERT:WCONstant[:VALue] <value>, (@<channel list>)	Sets the constant value for the custom walking constant pattern for the specified channel(s).
SOURce:DIGital:BERT:DURation <duration>	Sets the duration of the bit error rate test (BERT) in seconds.
SOURce:DIGital:BERT:BWIDth <width>	Sets the pattern bit width of the bit error rate test (BERT).

Sense commands

SENSe:VOLTage:RANGe:AUTO <mode>, (@<channel list>)	Disables or enables autoranging for voltage measurements for the specified channel(s).
SENSe:VOLTage:RANGe[:UPPer] <range>[<unit>], (@<channel list>)	Sets the measurement range for voltage measurements for the specified channel(s) in V.
SENSe:MTIMe <measurement time>	Sets the analyzer measurement time. The query returns the measurement time.
SENSe:VOLTage:DETector <detector type>, (@<channel list>)	Sets the analyzer AC level detector for the specified channel(s).
SENSe:FUNCtion<j> <function>, (@<channel list>)	Sets the analyzer measurement function for the specified channel(s).
SENSe:FUNCtion<j>:UNIT <unit>, (@<channel list>)	Specifies the unit for the measurement result (which is obtained using the FETCh command) of the corresponding function for the selected channel(s).

`SENSe:REFerence:IMPedance <impedance>, (@<channel list>)`	Sets the reference impedance for the specified channel(s) in ohms (Ω).
`SENSe:REFerence:LEVel <level>, (@<channel list>)`	Sets the reference level for the specified channel(s) in V.
`SENSe:REFerence:CHANnel <reference channel>`	Sets the reference channel for the phase or crosstalk measurement functions.
`SENSe:REFerence:FREQuency <frequency>,(@<channel list>)`	Sets the reference frequency for the specified channel(s) in Hz (Hertz).
`SENSe:REFerence:RATio <ratio>, (@<channel list>)`	Sets the reference ratio for the specified channel(s) in dB.
`SENSe:REFerence:MEASured <measurement type>,<source channel>, <@target channel list>`	Sets the last measurement result obtained from the specified measurement type of the selected source as the reference value for the corresponding target channels.
`SENSe:FILTer:LPASs <low pass filter>, (@<channel list>)`	Sets the low pass filter for the specified channel(s).
`SENSe:FILTer:HPASs <high pass filter>, (@<channel list>)`	Sets the high pass filter for the specified channel(s).
`SENSe:FILTer:WEIGhting <weighting filter>, (@<channel list>)`	Sets the weighting filter for the specified channel(s).
`SENSe:FILTer:LEFT <left filter>`	Sets the HP8903B mode left filter.
`SENSe:FILTer:RIGHt <right filter>`	Sets the HP8903B mode right filter.
`SENSe:AVERaging:MOVing:POINts <number of points>`	Controls the number of points to be included in the moving average.
`SENSe:AVERaging:SYNC:POINts <number of points>`	Sets the number of points for the synchronous averaging.

`SENSe:WAVeform:POINTs <number of points>`	Sets the number of data points to acquire with the `FETCh:ARRAy?` command.
`SENSe:FFT:WINDow <type>`	Sets the window function for frequency domain analysis.
`SENSe:FUNDamental:FREQuency:LOCK <type>, (@<channel list>)`	Sets the fundamental frequency lock type for SINAD, THD+N Ratio, or THD+N Level measurement.
`SENSe:DIGital:FUNDamental:FREQuency:LOCK[:SINad]`	Sets the fundamental frequency lock type for SINAD, THD+N Ratio, or THD+N Level for digital analyzer measurement.
`SENSe:DIGital:FUNDamental:FREQuency:LOCK:THD`	Sets the fundamental frequency lock type for THD Ratio or THD Level for digital analyzer measurement.
`SENSe:DIGital:FUNDamental:FREQuency`	Sets the custom fundamental frequency value for SINAD, THD+N Ratio, or THD+N Level digital analyzer measurement.
`SENSe:DIGital:THD:HARMonic:COUNt`	Sets the number of harmonics for the THD Ratio and THD Level digital analyzer measurement.
`SENSe:DIGital:COUPling <coupling>, (@<channel list>)`	Sets the coupling mode of the embedded digital analyzer audio signal for the selected channel(s).
`SENSe:DIGital:SAMPle:SIZE <sample size>`	Sets the acquisition data size of the digital analyzer audio signal to be analyzed.
`SENSe:DIGital:VOLTage:DETector <detector type>, (@<channel list>)`	Sets the digital analyzer AC level detector for the specified channel(s).
`SENSe:DIGital:FILTer:LPASs <low pass filter>, (@<channel list>)`	Sets the low pass filter for the specified channel(s).
`SENSe:DIGital:FILTer:HPASs <high pass filter>, (@<channel list>)`	Sets the high pass filter for the specified channel(s).

`SENSe:DIGital:FILTer:WEIGhting <weighting filter>, (@<channel list>)`	Sets the weighting filter for the specified channel(s).
`SENSe:DIGital:FILTer:DEEMphasis <de-emphasis>, (@<channel list>)`	Sets the de- emphasis condition for the specified channel(s).
`SENSe:DIGital:FILTer:SRATe <sampling rate>, (@<channel list>)`	Sets the filter sampling rate for the specified channel(s).
`SENSe:DIGital:FUNCtion<j> <function>, (@<channel list>)`	Sets the digital analyzer measurement function for the specified channel(s).
`SENSe:DIGital:FUNCtion<j>:UNIT <unit>, (@<channel list>)`	Specifies the unit for the measurement result (which is obtained using the FETCh command) of the corresponding function for the selected channel(s).
`SENSe:DIGital:REFerence:LEVel <level>, (@<channel list>)`	Sets the reference level for the specified channel(s) in V.
`SENSe:DIGital:REFerence:FREQuency <frequency>, (@<channel list>)`	Sets the reference frequency for the specified channel(s) in Hz (Hertz).
`SENSe:DIGital:REFerence:RATio <ratio>, (@<channel list>)`	Sets the reference ratio for the specified channel(s) in dB.
`SENSe:DIGital:REFerence:Voltage <FS voltage>, (@<channel list>)`	Sets the full scale (FFS) voltage for the specified channel(s) in V.
`SENSe:DIGital:REFerence:CHANnel <reference channel>`	Sets the reference channel for the phase or crosstalk measurement functions.
`SENSe:DIGital:REFerence:MEASured <measurement type>, <source channel>, <@target channel list>`	Sets the last measurement result obtained from the specified measurement type of the selected source as the reference value for the corresponding target channels.
`SENSe:DIGital:AVERaging:MOVing:POINts <number of points>`	Controls the number of points to be included in the moving average.

SENSe:DIGital:AVERaging:SYNC:POINts <number of points>	Sets the number of points for the synchronous averaging.
SENSe:DIGital:SNR:DELay <delay>	Sets the signal-to-noise ratio (SNR) measurement delay in milliseconds.
SENSe:DIGital:THDN:MODE <mode>, (<@<channel list>)	Sets the THD+N measurement mode for digital analyzer.
SENSe:DIGital:FFT:WINDow <type>	Sets the window function for frequency domain analysis.
SENSe:DIGital:WAVeform:POINts <number of points>	Sets the number of data points to acquire with the FETCh:ARRAy? command.
SENSe:DIGital:BERT:INTerval <reading interval>	Sets the reading interval of the pattern for the Bit Error Rate Test (BERT) in seconds.
SENSe:DIGital:BERT:UNIT <bit width>	Sets the unit of the Total Error and Total Bits for the Bit Error Rate Test (BERT).
SENSe:NOTCh:EMULation[:STATe]	Enables or disables the notch emulation for the analog analyzer for the specified channel(s).

Display commands

DISPlay:ANALysis:MODE <mode>	Sets the graph display as either time domain, frequency domain (magnitude), or frequency domain (phase).
DISPlay[:WINDow]:GRAPh:TRACe:X:SPACing <spacing type>	Sets the X-axis spacing as either linear or log.
DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:AUTO	Performs an autoscale on the X-axis to automatically scale the graph display according to the signal each time this command is sent.
DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:LEFT <minimum limit>	Sets the value represented by the minimum (left) edge of the X-axis.

DISPlay[:WINDow]:GRAPh:TRACe:X[:SCALe]:RIGHt <maximum limit>	Sets the value represented by the maximum (right) edge of the X-axis.
DISPlay[:WINDow]:GRAPh:TRACe:Y:SPACing <spacing type>	Sets the Y-axis spacing as either linear or log.
DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:AUTO	Performs an autoscale on the Y-axis to automatically scale the graph display according to the signal each time this command is sent.
DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:BOTTom <minimum limit>	Sets the value represented by the minimum (bottom) edge of the Y-axis.
DISPlay[:WINDow]:GRAPh:TRACe:Y[:SCALe]:TOP <maximum limit>	Sets the value represented by the maximum (top) edge of the Y-axis.
DISPlay[:WINDow]:GRAPh:TRACe:AUTO	Performs an autoscale to automatically scale the graph display according to the signal each time this command is sent.
DISPlay[:WINDow]:GRAPh:TRACe:HOLD <hold type>, (@<channel>)	Sets the hold configuration for the specified channel(s).
DISPlay[:WINDow]:GRAPh:TRACe:REFerence:STATe <state>	Enables or disables the reference trace in the graph mode.
DISPlay[:WINDow]:GRAPh:TRACe:REFerence:SLOT <slot number>	Sets the reference trace slot in the graph mode.
DISPlay:[:WINDow]:GRAPh:TRACe:REFerence:SOURce <source type>, <filename>	Sets the source for the current reference trace slot.
DISPlay[:WINDow]:SWEep:TRACe:X:SPACing <spacing type>	Sets the X-axis spacing as either linear or log for the sweep.
DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:AUTO	Performs an autoscale on the X-axis of the sweep plot to automatically scale the sweep plot according to the signal each time this command is sent.

DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:LEFT <minimum limit>	Sets the value represented by the minimum (left) edge of the X-axis of the sweep plot.
DISPlay[:WINDow]:SWEep:TRACe:X[:SCALe]:RIGHt <maximum limit>	Sets the value represented by the maximum (right) edge of the X-axis of the sweep plot.
DISPlay[:WINDow]:SWEep:TRACe:Y:SPACing <spacing type>	Sets the Y-axis spacing as either linear or log for the sweep.
DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:AUTO	Performs an autoscale on the Y-axis of the sweep plot to automatically scale the sweep plot according to the signal each time this command is sent.
DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:BOTTom <minimum limit>	Sets the value represented by the minimum (bottom) edge of the Y-axis of the sweep plot.
DISPlay[:WINDow]:SWEep:TRACe:Y[:SCALe]:TOP <maximum limit>	Sets the value represented by the maximum (top) edge of the Y-axis of the sweep plot.
DISPlay[:WINDow]:SWEep:TRACe:AUTO	Performs an autoscale on the sweep plot to automatically scale the sweep plot according to the signal each time this command is sent.
DISPlay[:WINDow]:SWEep:TRACe:HOLD	Sets the hold configuration for the specified channel(s).
DISPlay[:WINDow]:SWEep:TRACe:FUNCtion <function number>	Sets the current function in sweep mode.
DISPlay[:WINDow]:SWEep:TRACe:REFerence:STATe <state>	Enables or disables the current reference trace in sweep mode.
DISPlay[:WINDow]:SWEep:TRACe:REFerence:SLOT <slot number>	Sets the reference trace slot in sweep mode.
DISPlay:[:WINDow]:SWEep:TRACe:REFerence:SOURce <source type>, <filename>	Sets the source for the current reference trace slot.

DISPlay[:WINDow]:VIEW <view>, <panel>, [<channel>]	Sets the front panel LCD display type for the specified channel.
DISPlay[:WINDow]:MODE <display mode>	Sets the display mode of the front panel display.
DISPlay[:WINDow]:STATe <state>	Enables or disables the front panel LCD backlight.
DISPlay:DIGital:ANALysis:MODE <mode>	Sets the graph to display the magnitude of the signal in frequency domain, phase in the frequency domain, or waveform in the time domain for the digital card options.
DISPlay[:WINDow]:DIGital:GRAPh:TRACe:HOLD <hold type>, (@<channel>)	Sets the hold configuration for the specified channel(s).
DISPlay[:WINDow]:GRAPh:TRACe:INTerface <interface type>	Sets the interface type to be displayed in the graph mode.

Calculate commands

CALCulate:HARMonic:COUNt <count>	Sets the number of signal harmonic components in the frequency domain (magnitude) display.
CALCulate:HARMonic:FUNDamental? (@<channel>)	Returns the signal fundamental frequency in Hz for the specified channel.
CALCulate:HARMonic:VALue? (@<channel>)	Returns the harmonic component results of the trace for the specified channel.
CALCulate:HARMonic:FREQuencies? (@<channel>)	Returns the signal harmonic frequency values for the specified channel.
CALCulate:THDistortion? <unit>, (@<channel>)	Returns the Total Harmonic Distortion (THD) value of the input signal in the specified unit for the selected channel.
CALCulate:DIGital:HARMonic:COUNt <count>	Sets the number of signal harmonic components in the frequency domain (magnitude) display.

CALCulate:DIGital:HARMonic:FUNDamental? (@<channel>)	Returns the signal fundamental frequency in Hz for the specified channel.
CALCulate:DIGital:HARMonic:VALue? (@<channel>)	Returns the harmonic component results of the trace for the specified channel.
CALCulate:DIGital:HARMonic:FREQuencies? (@<channel>)	Returns the signal harmonic frequency values for the specified channel.
CALCulate:DIGital:THDistortion? <unit>, (@<channel>)	Returns the Total Harmonic Distortion (THD) value of the input signal in the specified unit for the selected channel.
CALCulate:GRAPh:MARKer:THReshold[:LEVel] <threshold level>	Sets the threshold level that the marker can identify as a peak or minimum on the graph display in the graph mode.
CALCulate:GRAPh:MARKer:THReshold:STATe <threshold state>	Turns on or off the threshold on the graph display in the graph mode.
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:STATe <state>	Turns on or off the selected marker on the graph display in the graph mode.
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:TRACe <trace no>	Assigns the marker to the trace of the specified channel on the graph display in the graph mode.
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:X <x position>	Sets the marker X-axis value on the graph display in the graph mode.
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:Y?	Returns the marker Y-axis value on the graph display in the graph mode.
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:PEAK <direction>	Searches for the peak value of the trace data by placing the specified marker at either the left or right peak of the graph display in the graph mode.
CALCulate:GRAPh:MARKer[1]|2|3|4|5|6|7|8:MIN <direction>	Searches for the minimum value of the trace data by placing the specified marker at either the left or right minimum of the graph display in the graph mode.

CALCulate:GRAPh:MARKer [1]|2|3|4|5|6|7|8:REFerence <reference marker no>	Sets the reference marker for the selected marker on the graph display in the graph mode.
CALCulate:GRAPh:MARKer [1]|2|3|4|5|6|7|8:XDELta?	Returns the difference in the X-axis value between the selected marker and its reference marker on the graph display in the graph mode.
CALCulate:GRAPh:MARKer [1]|2|3|4|5|6|7|8:YDELta?	Returns the difference in the Y-axis value between the selected marker and its reference marker on the graph display in the graph mode.
CALCulate:GRAPh:MARKer [1]|2|3|4|5|6|7|8:MOVement <movement characteristic>	Sets the marker movement characteristic of either single or in pair on the graph display in the graph mode.
CALCulate:GRAPh:MARKer [1]|2|3|4|5|6|7|8[:SET]:MODE <marker mode>	Positions the marker at either the start, stop, center points of the graph, or expands the area between the selected marker and its reference marker in the graph mode.
CALCulate:SWEep:MARKer:THReshold[:LEVel] <threshold level>	Sets the threshold level that the marker can identify as a peak or minimum on the graph display in the sweep mode.
CALCulate:SWEep:MARKer:THReshold:STATe <threshold state>	Turns on or off the threshold on the graph display in the sweep mode.
CALCulate:SWEep:MARKer [1]|2|3|4|5|6|7|8:STATe <state>	Turns on or off the selected marker on the graph display in the sweep mode.
CALCulate:SWEep:MARKer [1]|2|3|4|5|6|7|8:TRACe?	Assigns the marker to the trace of the specified channel on the graph display in the sweep mode.
CALCulate:SWEep:MARKer [1]|2|3|4|5|6|7|8:X <x position>	Sets the marker X-axis value on the graph display in the sweep mode.
CALCulate:SWEep:MARKer [1]|2|3|4|5|6|7|8:Y?	Returns the marker Y-axis value on the graph display in the sweep mode.
CALCulate:SWEep:MARKer [1]|2|3|4|5|6|7|8:PEAK <direction>	Searches for the peak value of the trace data by placing the specified marker at either the left or right peak of the graph display in the sweep mode.

CALCulate:SWEep:MARKer [1]|2|3|4|5|6|7|8:MIN <direction>	Searches for the minimum value of the trace data by placing the specified marker at either the left or right minimum of the graph display in the sweep mode.
CALCulate:SWEep:MARKer [1]|2|3|4|5|6|7|8:REFerence <reference marker no>	Sets the reference marker for the selected marker on the graph display in the sweep mode.
CALCulate:SWEep:MARKer [1]|2|3|4|5|6|7|8:XDELta?	Returns the difference in the X-axis value between the selected marker and its reference marker on the graph display in the sweep mode.
CALCulate:SWEep:MARKer [1]|2|3|4|5|6|7|8:YDELta?	Returns the difference in the Y-axis value between the selected marker and its reference marker on the graph display in the sweep mode.
CALCulate:SWEep:MARKer [1]|2|3|4|5|6|7|8:MOVement <movement characteristic>	Sets the marker movement characteristic of either single or in pair on the graph display in the sweep mode.
CALCulate:SWEep:MARKer [1]|2|3|4|5|6|7|8[:SET]:MODE <marker mode>	Positions the marker at either the start, stop, center points of the graph, or expands the area between the selected marker and its reference marker in the sweep mode.
CALCulate:FORMat:LEVel <format>, (@<channel>)	Sets the format of the measurement data for the specified channel(s) for level measurement function such as Vac, Vdc, THD+N Level, and Noise Level.
CALCulate:FORMat:FREQuency <format>, (@<channel>)	Sets the format of the measurement data for the specified channel(s) for frequency measurement function.
CALCulate:FORMat:RATio <format>, (@<channel>)	Sets the format of the measurement data for the specified channel(s) for ratio measurement function such as SINAD and THD Ratio, DFD, IMD, crosstalk, and SNR.
CALCulate:DIGital:FORMat:LEVel <format>, (@<channel>)	Sets the format of the measurement data for the specified channel(s) for level measurement function such as Vac, Vdc, and Noise Level.

CALCulate:DIGital:FORMat:FREQuency <format>, (@<channel>)	Sets the format of the measurement data for the specified channel(s) for frequency measurement function.
CALCulate:DIGital:FORMat:RATio <format>, (@<channel>)	Sets the format of the measurement data for the specified channel(s) for ratio measurement function such as SINAD and THD Ratio, DFD, IMD, crosstalk, and SNR.

Data commands

DATA:SWEep <data>	Downloads the 32-bit floating point sweep data into the U8903A internal sweep memory.
DATA:WAVeform <Vpeak>, <DC Offset>, <data>	Downloads the 32-bit floating point arbitrary waveform data into the U8903A internal waveform memory.
DATA:WAVFile <data>	Downloads a Microsoft compatible .wav file to the digital generator buffer.
DATA:FILTer <filter category>, <no. of section>, <no. of group delay>, <data>	Downloads the 32-bit floating point user-defined filter data into the U8903A volatile memory allocated for the user-defined filter coefficients.
DATA:DIGital:FILTer <filter category>, <no. of section>, <no. of group delay>, <data>	Downloads the 32-bit floating point user-defined filter data into the U8903A volatile memory allocated for the user-defined filter coefficients.
DATA:FILE? <filename>, <data>	Uploads a file into the U8903A temporary folder.

Sweep commands

SOURce:SWEep:INTerface <interface>	Sets the sweep interface.
SOURce:SWEep:CHANnel <channel>	Sets the channel to perform sweep.
SOURce:SWEep:REFerence:CHANnel <channel>	Sets the reference channel to perform sweep.
SOURce:SWEep:MODE <mode>, (@<channel>)	Sets the sweep or list mode for the specified channel.
SOURce:SWEep:PARameter <sweep parameter>, (@<channel>)	Sets the parameter to sweep for the specified channel.
SOURce:SWEep:DWELl <delay>, (@<channel>)	Sets the sweep dwell time (ms) for the specified channel.
SOURce:SWEep:SPACing <spacing>, (@<channel>)	Sets either linear or log interval for the sweep of the specified channel.
SOURce:SWEep:POINts <points>, (@<channel>)	Sets the number of sweep points for the specified channel.
SOURce:SWEep:STEP <step>, (@<channel>)	Sets the step size of the linear sweep interval, or multiplier factor of the log sweep interval for the specified channel.
SOURce:SWEep:STARt <start>, (@<channel>)	Sets the sweep start point for the specified channel.
SOURce:SWEep:STOP <stop>, (@<channel>)	Sets the sweep stop point for the specified channel.
SOURce:SWEep:NEXT	Jumps to the next sweep point in the Manual Sweep or Manual List sweep mode.
SENSe:SWEep:VALues? (@<channel>)	Returns the values of the sweep points for the specified channel.
SENSe:SWEep:INTerface <interface>	Sets the sweep interface.

SENSe:SWEep:CHANnel <channel>	Sets the analyzer channel to perform sweep.
SENSe:SWEep:REFerence:CHANnel <channel>	Sets the analyzer reference channel to perform sweep.

Trigger commands

TRIGger:ANALyzer:SOURce <trigger source>	Sets the analyzer trigger source for the input signals.
TRIGger:GRAPh:SOURce <trigger source>	Sets the graph trigger source for the input signals.
TRIGger:GRAPh:SLOPe <edge>	Sets the rising or falling edge of the signal to be triggered.
TRIGger:DIGital:ANALyzer:SOURce <trigger source>	Sets the digital analyzer trigger source for the input signals.
TRIGger:DIGital:GRAPh:SOURce <trigger source>	Sets the graph trigger source for the input signals.
TRIGger:DIGital:GRAPh:SLOPe <edge>	Sets the rising or falling edge of the signal to be triggered.

Fetch commands

FETCh[:SCALar]? <function>, (@<channel list>)	Retrieves the measurement result for the specified measurement function and channel(s).
FETCh:ARRay? (@<channel>)	Returns an array of measurement data of the selected channel(s).
FETCh:SWEep?	Returns the sweep result for the channel specified in the SOURce:SWEep:CHANnel command.

FETCh:DIGital[:SCALar]? <function>, (@<channel list>)	Retrieves the measurement result for the specified measurement function and channel(s).
FETCh:DIGital:AUDIO:BITS? <bit type>, (@<channel list>)	Queries the data bits or active bits of the embedded data in the digital signal audio word for each subframe.
FETCh:DIGital:ERRor:FLAG? <error flag>[,<error flag>[,<error flag>...]]	Queries the error flag(s) of the embedded audio data.
FETCh:DIGital:DELay?	Queries the time delay between the digital input and output in milliseconds.
FETCh:DIGital:BERT? <type>, (@<channel list>)	Queries the total bits, total errors, or bit error rate in the Bit Error Rate Test (BERT).
FETCh:DIGital:ARRay? (@<channel>)	Returns an array of measurement data of the selected channel(s).

Initiate commands

INITiate[:IMMediate]:ANALyzer (@<channel list>)	Initiates the analyzer measurement trigger system for the specified channel(s).
INITiate[:IMMediate]:GRAPh (@<channel list>)	Initiates the graph trigger system for an array of data for the specified channel(s).
INITiate[:IMMediate]:SWEep	Initiates the sweep for the channel specified in the SOURce:SWEep:CHANnel command.
INITiate[:IMMediate]:DIGital:ANALyzer (@<channel list>)	Initiates the digital analyzer measurement trigger system for the specified channel(s).
INITiate[:IMMediate]:DIGital:AUDio:BITS (@<channel list>)	Initiates the digital analyzer audio bits measurement for the specified channel(s).
INITiate[:IMMediate]:DIGital:BERT	Starts the Bit Error Rate Test (BERT).

`INITiate[:IMMediate]:DIGital:GRAPh (@<channel list>)`	Initiates the graph trigger system for an array of data for the specified channel(s).
`INITiate:CONTinue:ANALyzer <state>, (@<channel list>)`	Enables or disables the analyzer to make continuous measurement.
`INITiate:CONTinue:DIGital:ANALyzer <state>, (@<channel list>)`	Enables or disables the digital analyzer to make continuous measurement.
`INITiate:CONTinue:DIGital:AUDio:BITS <state>, (@<channel list>)`	Enables or disables the digital analyzer to make continuous audio bits measurement.
`INITiate:CONTinue:DIGital:DELay <state>`	Starts or Stops the digital analyzer to make continuous time delay measurement.

Abort commands

ABORt:ANALyzer	Cancels any initiated analyzer measurement trigger and returns the trigger state to Idle.
ABORt:GRAPh	Cancels any initiated measurement trigger for an array of graph points and returns the trigger state to Idle.
ABORt:SWEep	Cancels any initiated measurement trigger for sweep and returns the trigger state to Idle.
ABORt:DIGital:ANALyzer	Cancels any initiated digital analyzer measurement trigger and returns the trigger state to Idle.
ABORt:DIGital:GRAPh	Cancels any initiated array of graph points measurement trigger and returns the trigger state to Idle.
ABORt:DIGital:BERT	Stops the Bit Error Rate Test (BERT).

Mass Memory commands

MMEMory:LOAD <label>, <filename>	Loads the 32-bit floating point data from a file into the U8903A.
MMEMory:STORe <label>, <filename>	Stores the 32-bit floating point data to a file in either the U8903A internal storage or a USB external flash storage.
MMEMory:CATalog? <location>, <directory>	Returns the memory usage information (total amount of storage currently used and free space available) in bytes and a list of files and directories in a specified parent directory.
MMEMory:DELete <location>, <directory>, <filename>	Deletes the specified file in the selected directory.
MMEMory:LOAD:WAVFile <filename>	Loads a Microsoft compatible .wav file to the digital generator buffer.
MMEMory:LOAD:AES:STATus <filename>	Loads the channel status and user bits information for digital generator from a file.
MMEMory:STORe:AES:STATus <module>, <file format>, <filename>, (@<channel list>)	Stores the channel status and user bits information of the digital generator or analyzer to a file.
MMEMory:LOAD:STATe:PUP <power-up state>	Sets the power-up state of the U8903A.
MMEMory:STORe:SWEep <channel>, <function>, <filename>	Stores the measured sweep data points from memory to a file.
MMEMory:LOAD:STATe[:MODE] <location>, <system mode>, <filename>	Loads the specified state file to the selected U8903A mode.
MMEMory:LOAD:STATe:CHANnel <location>, <system mode>, (@<channel list>), <filename>	Loads the specified single channel state file to the selected U8903A mode channel.

MMEMory:STORe:STATe[:MODE] <location>, <system mode>, <filename>	Stores the current U8903A state to a file in either the internal storage or a USB external flash storage.
MMEMory:STORe:STATe:CHANnel <location>, <system mode>, (@<channel>), <filename>	Stores the current U8903A single channel state to a file in either the internal storage or a USB external flash storage.

Measure commands

MEASure:DIGital:CSTatus:DATA? (@<channel list>)	Retrieves the 24 bytes of the channel status bytes.
MEASure:DIGital:CSTatus:BYTE? <byte number> (@<channel list>)	Retrieves a particular byte of the channel status bytes in hexadecimal characters.
MEASure:DIGital:CSTatus:FIELd? <field name>, (@<channel list>)	Retrieves the channel status bytes field value of a particular field name for the specified channel.
MEASure:DIGital:UStatus:DATA? (@<channel list>)	Retrieves the 24 bytes of the user status bytes.
MEASure:DIGital:UStatus:BYTE? <byte number> (@<channel list>)	Retrieves a particular byte of the user status bytes in hexadecimal characters.

Status commands

STATus:PRESet	Sets all defined bits in the status system PTR registers and clears all bits in the NTR and enable registers.
STATus:OPERation:CONDition?	Queries the condition register for the Standard Operation register group and returns the binary-weighted sum of all bits set in the register.
STATus:OPERation:ENABle <enable value>	Enables the bits in the enable register for the Standard Operation register group.
STATus:OPERation[:EVENt]?	Queries the event register for the Standard Operation register group and returns the binary-weighted sum of all bits set in the register.
STATus:OPERation: NTRansition <value>	Sets and reads the value of the Operation Negative-Transition (NTR) register.
STATus:OPERation: PTRansition <value>	Sets and reads the value of the Operation Positive-Transition (PTR) register.
STATus:QUEStionable: CONDition?	Queries the condition register for the Questionable Data register group and returns the binary-weighted sum of all bits set in the register.
STATus:QUEStionable:ENABle <enable value>	Enables the bits in the enable register for the Questionable Data register group.
STATus:QUEStionable[:EVENt]?	Queries the event register for the Questionable Data register group and returns the binary-weighted sum of all bits set in the register.
STATus:QUEStionable: NTRansition <value>	Sets and reads the value of the Questionable Negative-Transition (NTR) register.
STATus:QUEStionable: PTRansition <value>	Sets and reads the value of the Questionable Positive-Transition (PTR) register.
STATus:QUEStionable: VOLTage:CONDition?	Queries the condition register for the Questionable Voltage register group and returns the binary-weighted sum of all bits set in the register.

STATus:QUEStionable:VOLTage:ENABle <enable value>	Enables the bits in the enable register for the Questionable Voltage register group.
STATus:QUEStionable:VOLTage[:EVENt]?	Queries the event register for the Questionable Voltage register group and returns the binary-weighted sum of all bits set in the register.
STATus:QUEStionable:VOLTage:NTRansition <value>	Sets and reads the value of the Questionable Voltage Negative-Transition (NTR) register.
STATus:QUEStionable:VOLTage:PTRansition <value>	Sets and reads the value of the Questionable Voltage Positive-Transition (PTR) register.

3
Error Messages

The U8903A SCPI command errors are summarized in this chapter.

Error Messages

Error messages are created once a command error or an erroneous condition has been detected.

- Errors are retrieved in the first-in-first-out (FIFO) order. The first error returned is the first error that has been stored.
- If more than 30 errors have occurred, the last error stored in the queue (the most recent error) is replaced with **–350,"Error queue overflow"**. No additional errors are stored until you remove all the errors from the queue. If no error occurs when you read the error queue, the U8903A responds with **0,"No error"**.
- The error queue is cleared by the clear status (`*CLS`) command or when power is cycled. The errors are also cleared when you read the queue. The error queue is not cleared by a factory reset (`*RST`) command or an instrument preset (`SYSTem:PRESet`) command.
- The error string may contain up to 255 characters and consists of an error number and an error string enclosed in double quotes.

  For example: **–113,"Undefined header"**

Error List

Missing parameter

Error code	Error message
–109	No arbitrary points is loaded for channel {0} due to the missing file

Block data error

Error code	Error message
–160	The number of data points for array measured voltages exceeds the maximum of 200
–160	The number of data points array measured voltages is less than the minimum of 1

Execution error

Error code	Error message
–200	The file name "<file name>" does not exist
–200	The file "<file name>" has exceeded the maximum size of 5 MB
–200	The file "<file name>" is not in the valid WAVE file format
–200	The function2 (<measurement function>) of analyzer channel <channel no> does not support <HP8903B command> command
–200	Left/Right filter not set
–200	Invalid channel
–200	Invalid channel; value set to <valid channel>
–200	Function <name> does not support unit <unit>
–200	The selected channel is not in the initiated channel list
–200	Analyzer measurement has been aborted
–200	Graph measurement has been aborted

Error code	Error message
–200	No pre-stored coefficients are available
–200	{<Parameter Type>} is not valid in one or more waveforms for the selected channels.
–200	This command is not valid in one or more waveforms for the selected channels
–200	Waveform at channel {0} does not contain tone {1}
–200	Trigger slope setting is only applicable when the trigger source is Ch1~2
–200	Failed to parse the file. Please make sure it is a valid XML file
–200	The < filename> does not exist
–200	Path is not specified
–200	Not supported for this input connector type
–200	Command cannot be executed in pseudo random mode
–200	Command cannot be executed in walking constant mode
–200	Command cannot be executed in pseudo random mode
–200	Harmonic Analysis is only valid when Graph Analysis mode is Magnitude (Frequency Domain)
–200	A file with the same name of the directory already exists
–200	The destination is a directory
–200	Import wave file failed
–200	This command is not applicable to Graph Mode
–200	The filter type is missing or invalid
–200	The group delay is missing or invalid
–200	The filter coefficients are missing
–200	Invalid number of section
–200	No points available
–200	Waveform points are empty
–200	Sweep data is empty

Error code	Error message
–200	This command is not applicable to Sweep Mode
–200	This command is not applicable to Digital Generator Mode
–200	The loaded points are insufficient (minimum 32 points) to generate the arbitrary waveform
–200	This command is not applicable for the AANalyzer mode
–200	This command cannot be executed in HP8903B mode
–200	Only 1 channel is allowed
–200	Invalid channel format
–200	Invalid {0} list format
–200	Changing sweep channel is not allowed while sweeping is in progress
–200	Changing sweep reference channel is not allowed while sweeping is in progress
–200	Changing trigger source is not allowed while instrument is in the waiting for trigger or measuring state
–200	One or more of the values is missing or duplicated, they have been set to value 0 accordingly

Parameter error

Error code	Error message
–220	Import wave file failed
–220	Not a valid choice

Settings conflict

Error code	Error message
–221	No measurement value for channel <channel>
–221	No measurement value for channel <channel>
–221	Word length and multiplier are clipped to the value of 32 and 128 respectively
–221	Not applicable when Master Clock Source is Internal and Bit/Frame Clock is In
–221	Waveform <name> of generator ch<channel no> is not sweepable
–221	Cannot change parameter while sweep is not in auto mode
–221	Cannot set arbitrary spacing in auto mode
–221	<Parameter> setting is not allowed for waveform type <name> at channel <channel number>
–221	Parameter <name> not supported by <waveform name> waveform of generator ch<channel id>
–221	Dwell time must be a positive number
–221	<Parameter> setting is not allowed for waveform type <waveform>
–221	No pre-loaded wave file
–221	FFS reference voltage must be greater than 0
–221	<Parameter> setting is not allowed for waveform type <waveform> at channel <channel id>
–221	Reference impedance must be greater than 0
–221	Cannot set phase at channel 1 because it is the reference channel. The phase for channel 1 is always 0.
–221	One of the output type for the selected channels is not Balanced. The selected impedance {0} is only applicable to Balanced output type.
–221	One of the output type for the selected channels is not Unbalanced. The selected impedance {0} is only applicable to Unbalanced output type.

Error code	Error message
–221	This setting is only applicable to Balanced input
–221	This setting is only applicable to Unbalanced input
–221	Frequency 1 and 2 cannot be set to the same value for Dual waveform
–221	Pattern switched to Walking 1
–221	Pattern switched to Walking 0
–221	Pattern switched to Custom
–221	Current input type does not support this type of view. Please change to the correct input type.
–221	<number> duplicate frequency at channel <channel> removed. Tone count has been clipped to <new tone count>.

Data out of range

Error code	Error message
–222	Multiplier is clipped to the minimum value of 16
–222	Multiplier is clipped to the maximum value of 32704
–222	Point index out of range
–222	The value {0} was clipped to the maximum/minimum value of <max value/min value> <channel>
–222	The <Parameter> value of <value> is clipped to maximum/minimum value of <max value/min value>
–222	<channel>'s <parameter> is clipped to <value>
–222	<field> must be between <lower bound>~<upper bound>
–222	Multichannel mode is defined, ChannelNumber must be between 1~16
–222	Multichannel mode not defined, ChannelNumber must be between 1~128
–222	Duration/Interval cannot be lower than to 0.1 s
–222	Duration cannot be lower than/equal to interval (= <interval>s)
–222	Duration cannot be larger than 604.8 ks (1 week)
–222	Interval cannot be larger than/equal to duration (= <duration>s)
–222	Interval cannot be larger than 1 hour
–222	Value below minimum <value>
–222	Value exceeds maximum <value>
–222	The value of <value> is below value of <min value>
–222	Number of filter coefficients less than the minimum of 4
–222	Number of filter coefficients exceed the maximum of 256
–222	The number of waveform data is less than the minimum of 32
–222	The number of waveform data exceeds the maximum of 32768
–222	One or more of the values is less than -1 or has exceeded 1, they have been clipped to -1 or 1 accordingly

Error code	Error message
–222	The index number is exceeded the total tones available at channel {0}
–222	Total tones at channel {0} has reached the maximum of 64. No additional tones can be added
–222	The total tones at channel {0} cannot be less than 1
–222	Step size cannot be zero
–222	Channel number must be between 1 and 2
–222	Threshold value is set outside of the grid. The value must be between {0} and {1}
–222	Channel 1 in not a valid choice because it is the reference channel for skew timing
–222	Reference impedance must be greater than 0
–222	Reference level must be greater than 0
–222	Reference frequency must be greater than or equal to 0
–222	Full scale voltage must be greater than 0
–222	The value <user value> was clipped to the minimum value of <clipped value>
–222	The value <user value> was clipped to the maximum value of <clipped value>
–222	The value was clipped to the value of <clipped value>
–222	The AES3/SPDIF output has been turned off due to the sampling rate is below/has exceeded the supported range of AES3/SPDIF output.

Illegal parameter value

Error code	Error message
–224	Current measurement functions do not support this reference setting
–224	Unsupported reference type for channel <channel>
–224	Channel <channel>'s functions do not support this reference mode
–224	Current measurement functions do not support this reference setting
–224	Invalid measurement function
–224	Invalid measurement function for digital/analog
–224	Invalid field name or field value
–224	QPK detector type is not supported
–224	Entered value cannot exceed <limit grid value>
–224	Entered value cannot be less than<limit grid value>
–224	Spacing not applied. Current grid settings not applicable for this spacing
–224	Invalid data format

List not same length

Error code	Error message
–226	The length of the array of measured voltages and frequencies are different

Data corrupt or stale

Error code	Error message
–230	Data not available for command <HP8903B command name>
–230	Graph data is not available

Error code	Error message
–230	Waveform set to arbitrary but there are no valid points available in channel {<channel number>}
–230	Waveform set to arbitrary but there is no valid wave file available

Invalid format

Error code	Error message
–232	The state file contains more than one channel information
–232	Invalid Arbitrary file format

Hardware missing

Error code	Error message
–241	Digital audio card is not present

File name error

Error code	Error message
–257	Invalid file extension

Device specific error

Error code	Error message
–300	Bit error rate query is running, stop the auto query first
–300	Cannot change setting while sweep is running
–300	SweepSettingsConflict
–300	Burst on cycles must be smaller than burst period
–300	DcOffsetOutOfRange
–300	AmplitudeExceedMax
–300	ValueBelowMin
–300	ValueExceedMax
–300	FileWriteError
–300	FileReadError
–300	InvalidDeviceType
–300	Setting combinations of sampling rate, word length and multiplier are invalid for the clock PLL
–300	DigitalFwUpgradeWrongCRC
–300	DigitalFwUpgradeWrongFileSize
–300	DigitalFwUpgradeWrongOperation
–300	DigitalWrongSamplingRate
–300	DigitalWrongWordlength
–300	DigitalSharcBackupMode
–300	DigitalNiosBackupMode
–300	DigitalWrongResponse
–300	DigitalWrongSize
–300	DigitalWrongCH
–300	DigitalWrongData
–300	DigitalWrongCmd

Error code	Error message
–300	DigitalTimeOut
–300	DigitalHWError
–300	DigitalHWAvailNotWorking
–300	DisplayClockTestFailed
–300	AdcRangeTestFailed
–300	NoiseTestFailed
–300	CommandInWrongMode
–300	AbortNotAllowed
–300	MasterDspTimeOut
–300	CommandAborted
–300	Command not allowed in current auto mode
–300	System not in calibration mode
–300	Clearing calibration data. Please retry later
–300	The AES3/SPDIF's output cannot be turned on due to the current sampling rate is below the minimum/has exceeded the supported range of AES3/SPDIF output
–300	DSI is not supported
–300	AES is not supported
–300	Some Devices cannot be reset
–300	Failed to load <file name>
–300	Measurement NOISe is not allowed in Sweep
–300	Sense channels not added
–300	Sweep parameter must be frequency when measuring group delay
–300	Sweep aborted at point <point id>
–300	Current waveform cannot be swept
–300	Current waveform <name> of generator <channel> cannot be swept

Error code	Error message
–300	Waveform <name> cannot be swept
–300	Manual sweep points not loaded
–300	Invalid data format for DC offset
–300	Invalid data format for Vpeak
–300	Invalid points format
–300	The total points exceeds the limit of 32768
–300	Invalid file format
–300	Multichannel mode not defined
–300	Some of the wave file information is not available
–300	Wave file cannot be null
–300	Bit error rate is running, please stop it first
–300	Delay measurement is running, please stop it first
–300	Not in calibration mode
–300	Unable to retrieve BNC output cal data
–300	Unable to retrieve XLR output cal data
–300	Wrong card type entered in GraphFeatures.GetGraphEntity
–300	<HP8903B command> or part of the commands are not supported
–300	No clock input. Please check the clock settings and connection.

System error

Error code	Error message
–310	Sweep reset error: <error type>
–310	Digital card not present
–310	Related hardware not detected. Ensure that it is installed properly.
–310	The values of start and stop cannot be the same
–310	Step Size value cannot be 1 or negative in log spacing
–310	The Start/Stop value cannot be less than 1 in log spacing
–310	Absolute step size value (|<value>|) is smaller than minimum value (<minimum>)
–310	Invalid IP address
–310	Invalid Subnet Mask address
–310	Invalid Gateway address
–310	Invalid Primary DNS address
–310	Invalid Secondary DNS address
–310	<IP> is a special IP address and cannot be used here. Please assign another IP address.
–310	<IP> is a reserved static IP address and cannot be used here. Please assign another IP address.
–310	Duplicate IP address. The system has detected a conflict for statically assigned IP address. Please assign another IP address.
–310	Error registering name on network (may be duplicate)
–310	The Host cannot be blank
–310	<Name> is not a valid hostname
–310	<Name> : Two adjacent hyphens are not valid
–310	Invalid IP address. The IP address must be between 0.0.0.0 to 223.255.255.255. Please assigns another IP address.
–310	Invalid filter type

Error code	Error message
–310	There is no valid delta value at this current marker position (<value>)
–310	The selected marker index is out of range. Please choose from range 1 to 8.
–310	Feature not removed. Please call *OPT? to verify feature name.
–310	Please provide a valid file path
–310	GPIB Card Not Found
–310	Channel Status Bits information is not available
–310	Directory does not exist
–310	Invalid module value
–310	Current function 2 of channel 1 does not support fundamental frequency lock

Storage fault

Error code	Error message
–320	Load wave file failed

Error messages

Error message
Digital card option not installed
No channel selected
Selected channels do not have any points to save
No Data to be analyzed
Value out of measurement bandwidth
Please turn on sweep control mode to run sweep
Sweep parameter from file do not match with current sweep settings

Error message
Could not obtain measurement results for certain points for Function <function number> Channel <ch num>.
Unable to load data points. Please check if the file format is valid.
Sweep must contain at least 1 point
Error Loading Custom Filter File. Incorrect file format.
No valid update found
You cannot perform self test when HP8903B mode is enabled
Please key in the value
The input value is not allowed
The input <Value> <Unit> is out of range. Input was clipped to the <Type> value of <New Value>
The input must between 0 and 255
Day must between 1 and 31
Month must between 1 and 12
Year must between 2000 and 2099
Hour must between 0 and 23
Minute must between 0 and 59
Second must between 0 and 59
Input must be between <minimum value> and <maximum value>
Invalid input, please enter numeric data or select a channel
<Directory Name> does not exist
No USB external flash storage is detected. Please insert a USB external flash storage through USB port.
Do you want to permanently delete <File Name>?
Only file can be deleted
No item in the list
The selected file does not exist

Error message
Only file can be recalled
No item in the list
This folder already contains <File Name>. Do you want to overwrite it?
Only file can be transferred
<File Name> has been successfully exported
<File Name> has been successfully imported
Invalid file name. Please rename to another file name
No input is assigned to rename current file
Only file can be renamed
Please insert a USB external flash storage
You are capturing graph plot page. Do you want to invert the colors in the plot area?
NOTE: System will become slow for awhile while the system is inverting the image
Please do not remove the USB thumb drive during the inverting process. Another message box will appear once the process is completed.
Insufficient free space
The chosen USB drive has been removed
Please enter value only
No pre-loaded wave file available
No arbitrary points available for the current channel
Current action will overwrite some of the custom values. Continue anyway?
<Number> duplicate frequency removed
The number of tones must be between 1 and 64
Are you sure you want to apply the changes ?
Changes have been made to the current multitone settings. Are you sure you want to undo the changes and navigate away?
Unable to perform the preset operation. Please try again.

Error message
The arbitrary waveform points cannot be loaded from file <file name>. Do you want to load the points from other files?
The arbitrary waveform file <file name> cannot be found. Do you want to manually search for the file?
Load arbitrary waveform file <file name> failed. <Exception message from system>
The arbitrary waveform points cannot be loaded for channel <ch>. Do you want to load the points from other files?
The channel <ch> recall is aborted
The filter file contains more than one channel information
Failed to recall state file
The corresponding analyzer filter file is not found. Do you want to manually load the file?
Unable to perform the save operation. Please try again.
The [<key>] key is malfunction or not pressed. Please retry.
There are 5 keys malfunction or not pressed. Please retry.
Failed to set the GPIB address
Invalid GPIB address. The GPIB address must be between 0 and 30.
Failed to set the FTP service control
Failed to save the LAN settings
Failed to reset the LAN settings
General Error. Check log file for more details.
Error(s) occur during the operation
You cannot perform this operation when HP8903B mode is on
File system not found. Please try again.
File system open failed. Please try again.
File system dismount failed. Please try again.
File system erase failed. Please try again.

Error message
File system format failed. Please try again.
File system find partition failed. Please try again.
File system create partition failed. Please try again.
File system open partition failed. Please try again.
File system format partition failed. Please try again.
Unknown error. Please try again.
Error occurs while reading the file
Second part of the application update file (.jel2) is not found
Please choose the correct firmware
The system cannot recognize the firmware file. This may due to the file is corrupted or file type is incorrect.
<Firmware type>'s firmware update failed
File not found. Is the USB drive removed?
Error occurs while reading <file name>
The type of the firmware update file is not recognized by the system
The type of the firmware update file is not applicable on the current system configuration
The selected file is not recognized by the system
Error(s) occur during <Firmware type> firmware update. Do you still want to continue with the remaining update?
Please press power key to reboot the instrument for the system to recover.
The parameter for <type> is out of range
Set key sound failed
Card <type> is not responding
FFT is not working
This may due to the firmware corruption caused by last incomplete firmware update.Please try to update the firmware again.
LAN is faulty or not connected

Error message
The log viewer is not installed
The system cannot find the corresponding Master DSP firmware update file. Please plug in the USB drive that contains the file and press "OK".
Please choose the correct firmware
Please download the firmware again

Appendixes

Appendix A: Waveform Frequency Range and Default Values

Analog waveforms

Waveform	Frequency range	Default
Sine	Frequency1: 5 Hz to 80 kHz Frequency2: –	1 kHz 0
Dual	Frequency1: 5 Hz to 80 kHz Frequency2: 5 Hz to 80 kHz	1 kHz 2 kHz
Variable phase	Frequency1: 5 Hz to 80 kHz Frequency2: –	1 kHz 0
SMPTE IMD 1:1/ 4:1/ 10:1	Lower frequency: 40 Hz to 500 Hz Upper frequency: 2 kHz to 60 kHz	60 Hz 7 kHz
DFD IEC 60118	Difference frequency: 80 Hz to 2 kHz Upper frequency: 3 kHz to 80 kHz	80 Hz 10 kHz
DFD IEC 60268	Difference frequency: 80 Hz to 2 kHz Center frequency: 3 kHz to 79 kHz	80 Hz 10 kHz
Gaussian	–	–
Rectangular	–	–
DC	–	–
Multitone	Start frequency: 5 Hz to 80 kHz Stop frequency: 5 Hz to 80 kHz Tone frequency: 5Hz to 80 kHz	1 kHz 5 kHz Depends on spacing
Square	Frequency1: 5 Hz to 30 kHz Frequency2: –	1 kHz 0
Arbitrary	–	–

Digital waveforms

Waveform	Frequency range	Default
Sine	Frequency1: 2 Hz to (0.45 x sampling rate) Hz	1 kHz
Stereo	Frequency1: 2 Hz to (0.45 x sampling rate) Hz	1 kHz
Sine Burst	Frequency1: 2 Hz to (0.45 x sampling rate) Hz	1 kHz
Dual[1]	Frequency1: 2 Hz to (0.45 x sampling rate) Hz Frequency2: 2 Hz to (0.45 x sampling rate) Hz	1 kHz 2 kHz
Variable phase	Frequency1: 2 Hz to (0.45 x sampling rate) Hz	1 kHz
SMPTE IMD 1:1/ 4:1/ 10:1[2]	Lower frequency: 40 Hz to 500 Hz Upper frequency: 2 kHz to 60 kHz	60 Hz 7 kHz
DFD IEC 60118[3]	Difference frequency: 80 Hz to 2 kHz Upper frequency: 3 kHz to 80 kHz	80 Hz 10 kHz
DFD IEC 60268[3]	Difference frequency: 80 Hz to 2 kHz Center frequency: 3 kHz to 79 kHz	80 Hz 10 kHz
Gaussian	–	–
Rectangular	–	–
Triangular	–	–
Constant	–	–
Monotonicity	–	–
Walking Zero	–	–
Walking One	–	–
Multitone	Start frequency: 2 Hz to (0.45 x sampling rate) Hz Stop frequency: 2 Hz to (0.45 x sampling rate) Hz Tone frequency: 2 Hz to (0.45 x sampling rate) Hz	1 kHz 5 kHz Depends on spacing
Square	Frequency1: 5 Hz to (0.5 x sampling rate) Hz	1 kHz
Arbitrary	–	–

[1] For dual waveform, the Frequency1 and Frequency2 value cannot be the same.

[2] For SMPTE waveforms, the maximum for the Upper Frequency is bounded by the sampling rate. For example, at the sampling rate of 48 kHz, the maximum for the Upper Frequency is only 21.6 kHz (0.45 sampling rate) and not 60 kHz. For sampling rate of 192 kHz, the maximum for the Upper Frequency is 60 kHz.

[3] For DFD IEC waveforms, the maximum for the Upper Frequency and Center Frequency are bounded by the sampling rate also. This means that the maximum for the Upper Frequency is either 0.45 sampling rate or 80 kHz, depends on which one is lower. The same situation is applied to the Center Frequency.

Appendix B: Units of the Measurement Function Returned Values

Analog analyzer

Measurement function	<unit>	Default unit
Frequency	Hz dHz	Hz
AC voltage DC voltage THD+N Level Noise level	V dBu dBV dBm W dBr dBg x	V
THD+N Ratio SINAD SNR SMPTE IMD DFD IEC 60118 2nd order DFD IEC 60118 3rd order DFD IEC 60268 2nd order DFD IEC 60268 3rd order Crosstalk (channel driven) Crosstalk (channel measured)	dB ddB PCT (%) x	dB
Phase	deg (°)	deg (°)

Digital analyzer

Measurement function	<unit>	Default unit
Frequency	Hz	Hz
	dHz	
AC voltage	V	V
DC voltage	dBu	FFS (AC voltage)
THD+N Level	dBV	dBFS (Noise level)
Noise level	dBr	
Max peak value	x	
Min peak value	FFS	
	pctFS	
	dBFS	
	LSB	
	Hex	
	Dec	
THD+N Ratio	dB	dB
SINAD	ddB	
SNR	PCT (%)	
SMPTE IMD	x	
DFD IEC 60118 2nd order		
DFD IEC 60118 3rd order		
DFD IEC 60268 2nd order		
DFD IEC 60268 3rd order		
Crosstalk (channel driven)		
Phase	deg (°)	deg (°)
Group Delay	s	s

The units can be computed using the following formulas:

<unit>	Formula	Description
dHz	$f - f_{ref}$	f_{ref} = reference frequency
dB	$20 \times \log_{10}(\text{ratio})$	
ddB	$(\text{ratio}) - R_{ref}$	R_{ref} = reference ratio
dBu[1]	$20 \times \log_{10}\left(\frac{V}{\sqrt{0.6}}\right)$	
dBV[1]	$20 \times \log_{10}(V)$	
dBm	$10 \times \log_{10}\left(\frac{1000\,V^2}{Zref}\right)$	Z_{ref} = reference impedance[2]
dBr[1]	$20 \times \log_{10}\left(\frac{V}{Vref}\right)$	V_{ref} = reference level[3]
dBg	$20 \times \log_{10}\left(\frac{V}{Vgen}\right)$	V_{gen} = amplitude of the generator signal for a corresponding channel
W	$\frac{V^2}{Zref}$	Z_{ref} = reference impedance[2]
x	$\frac{V}{Vref}$ or $\frac{Ratio\ (\text{in }\%)}{R_{ref}\ (\text{in }\%)}$	V_{ref} = reference level[3]; R_{ref} = reference ratio
PCT (%)	$100 \times (\text{ratio})$	
dBFS	$20 \times \log_{10}(\text{FFS})$	
pctFS	$100 \times \text{FFS}$	

<unit>	Formula	Description
`LSB`	FFS x $2^{(r-1)}$	r = audio resolution
`Hex`	(FFS x $2^{(r-1)}$) – 1	r = audio resolution The value calculated is represented in hexadecimal (base 16)
`Dec`	(FFS x $2^{(r-1)}$) – 1	r = audio resolution The value calculated is represented in decimal (base 10)

[1] For digital analyzer, the dBu, dBV, and dBr calculations are derived using the reference value set at Volt/FS. (V = FFS $\times$ Volt/FS)

[2] When the Vrms measurement unit is changed to Watt or dBm, the reference impedance setting will be used for the power level calculation. The reference impedance refers to the circuitry impedance or load impedance connected to the analyzer when calculating power level.

[3] Reference level is defined as a user-entered or a captured value from the current reading as a relative level for the subsequent measurement reading. It can be set to delta, linear, or log scale.

Appendix C: Waveform Parameters

Analog generator

Waveform	Parameter	SCPI command
Sine	Frequency	SOURce:FREQuency1
	Amplitude	SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	DC Offset	SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet
Dual	Frequency 1	SOURce:FREQuency1
	Frequency 2	SOURce:FREQuency2
	Amplitude	SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	Ratio	SOURce:VOLTage:RATio
	DC Offset	SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet
Variable phase	Frequency	SOURce:FREQuency1
	Amplitude	SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	Phase → 1	SOURce:PHASe[:ADJust]
SMPTE IMD 1:1/ 4:1/ 10:1	Lower Frequency	SOURce:FREQuency:LOWer
	Upper Frequency	SOURce:FREQuency:UPPer
	Amplitude	SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	DC Offset	SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet
DFD IEC 60118	Difference Frequency	SOURce:FREQuency:DIFFerence
	Upper Frequency	SOURce:FREQuency:UPPer
	Amplitude	SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	DC Offset	SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet
DFD IEC 60268	Difference Frequency	SOURce:FREQuency:DIFFerence
	Center Frequency	SOURce:FREQuency:CENTer
	Amplitude	SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	DC Offset	SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet
Gaussian / Rectangular	Amplitude	SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	DC Offset	SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet

Waveform	Parameter	SCPI command
DC	Amplitude	SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]
Multitone	DC offset	SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet
	Amplitude	SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	Start frequency	SOURce:MULTitone:FREQuency:STARt
	Stop frequency	SOURce:MULTitone:FREQuency:STOP
	Frequency Spacing	SOURce:MULTitone:FREQuency:SPACing
	Count	SOURce:MULTitone:COUNt
	Waveform Length	SOURce:MULTitone:WLEN
	Record Length	SOURce:MULTitone:RLEN
	Crest Factor	SOURce:MULTitone:CRESt
	Clear All Tones	SOURce:MULTitone:TONE:CLEar
	Add Tone	SOURce:MULTitone:TONE:ADD
	Delete Tone	SOURce:MULTitone:TONE:DELete
	Tone Frequency	SOURce:MULTitone:TONE:FREQuency
	Tone Amplitude	SOURce:MULTitone:TONE:VOLTage
	Tone Phase	SOURce:MULTitone:TONE:PHASe
	Randomize Tone Phase	SOURce:MULTitone:TONE:PHASe:RANDomize
Square	Frequency	SOURce:FREQuency1
	Amplitude	SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]
Arbitrary	Amplitude	SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	DC Offset	SOURce:VOLTage[:LEVel][:IMMediate]:OFFSet

Digital generator

Waveform	Parameter	SCPI command
Sine/Stereo/Square	Frequency	SOURce:DIGital:FREQuency
	Amplitude	SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	DC Offset	SOURce:DIGital:VOLTage[:LEVel][:IMMediate]:OFFSet

Waveform	Parameter	SCPI command
Sine burst	Frequency	SOURce:DIGital:FREQuency
	Amplitude	SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	Burst On	SOURce:DIGital:SBURst:ONTime
	Period	SOURce:DIGital:SBURst:PERiod
	Low Level	SOURce:DIGital:SBURst:LOWLevel
Variable phase	Frequency	SOURce:DIGital:FREQuency
	Amplitude	SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	Phase → 1	SOURce:DIGital:PHASe[:ADJust]
Dual	Frequency 1	SOURce:DIGital:FREQuency1
	Frequency 2	SOURce:DIGital:FREQuency2
	Amplitude	SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	Ratio	SOURce:DIGital:VOLTage:RATio
	DC Offset	SOURce:DIGital:VOLTage[:LEVel][:IMMediate]:OFFSet
SMPTE IMD 1:1/ 4:1/ 10:1	Lower Frequency	SOURce:DIGital:FREQuency:LOWer
	Upper Frequency	SOURce:DIGital:FREQuency:UPPer
	Amplitude	SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	DC Offset	SOURce:DIGital:VOLTage[:LEVel][:IMMediate]:OFFSet
DFD IEC 60118	Difference Frequency	SOURce:DIGital:FREQuency:DIFFerence
	Upper Frequency	SOURce:DIGital:FREQuency:UPPer
	Amplitude	SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	DC Offset	SOURce:DIGital:VOLTage[:LEVel][:IMMediate]:OFFSet

Waveform	Parameter	SCPI command
DFD IEC 60268	Difference Frequency	SOURce:DIGital:FREQuency:DIFFerence
	Center Frequency	SOURce:DIGital:FREQuency:CENTer
	Amplitude	SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	DC Offset	SOURce:DIGital:VOLTage[:LEVel][:IMMediate]:OFFSet
Gaussian/ Rectangular/ Triangular / Pink	Amplitude	SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	DC Offset	SOURce:DIGital:VOLTage[:LEVel][:IMMediate]:OFFSet
Constant	Amplitude	SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]
Multitone	Amplitude	SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	Start Frequency	SOURce:DIGital:MULTitone:FREQuency:STARt
	Stop Frequency	SOURce:DIGital:MULTitone:FREQuency:STOP
	Frequency Spacing	SOURce:DIGital:MULTitone:FREQuency:SPACing
	Count	SOURce:DIGital:MULTitone:COUNt
	Crest Factor	SOURce:DIGital:MULTitone:CRESt
	Clear All Tones	SOURce:DIGital:MULTitone:TONE:CLEar
	Add Tone	SOURce:DIGital:MULTitone:TONE:ADD
	Delete Tone	SOURce:DIGital:MULTitone:TONE:DELete
	Tone Frequency	SOURce:DIGital:MULTitone:TONE:FREQuency
	Tone Amplitude	SOURce:DIGital:MULTitone:TONE:VOLTage
	Tone Phase	SOURce:DIGital:MULTitone:TONE:PHASe
	Randomize Tone Phase	SOURce:DIGital:MULTitone:TONE:PHASe:RANDomize
Arbitrary	Amplitude	SOURce:DIGital:VOLTage[:LEVel][:IMMediate][:AMPLitude]
	DC Offset	SOURce:DIGital:VOLTage[:LEVel][:IMMediate]:OFFSet

Appendix D: Analog Waveform Amplitude Range

Waveform	Amplitude range	
	Unbalanced/Common output	Balanced output
Sine Dual Variable phase SMPTE IMD 1:1/ 4:1/ 10:1 DFD IEC 60118/ 60268	0 to 8 Vrms (0 to 11.3 Vp)	0 to 16 Vrms (0 to 22.6 Vp)
Gaussian	0 to 3.6 Vrms (0 to 11.3 Vp)	0 to 7.2 Vrms (0 to 22.6 Vp)
Rectangular	0 to 5.09 Vrms (0 to 11.3 Vp)	0 to 10.19 Vrms (0 to 22.6 Vp)
DC	–11.3 V to 11.3 V	–22.6 V to 22.6 V
Multitone	0 to 11.3 Vp	0 to 22.6 Vp
Square	0 to 11.3 Vrms (0 to 11.3 Vp)	0 to 22.6 Vrms (0 to 22.6 Vp)
Arbitrary	0 to 11.3 Vp	0 to 22.6 Vp

Appendix E: Relationship between Digital Waveform Parameters and Channels

Waveform	Parameter	Channel
Sine	Frequency	Channel 1 and Channel 2 are the same
	Amplitude	Channel 1 and Channel 2 can be different
	DC Offset	Channel 1 and Channel 2 are the same
Stereo	Frequency	Channel 1 and Channel 2 can be different
	Amplitude	Channel 1 and Channel 2 can be different
	DC Offset	Channel 1 and Channel 2 are the same
Square	Frequency	Channel 1 and Channel 2 are the same
	Amplitude	Channel 1 and Channel 2 can be different
	DC Offset	Channel 1 and Channel 2 are the same
Sine burst	Frequency	Channel 1 and Channel 2 are the same
	Amplitude	Channel 1 and Channel 2 can be different
	Burst On	Channel 1 and Channel 2 are the same
	Period	Channel 1 and Channel 2 are the same
	Low Level	Channel 1 and Channel 2 are the same
Variable phase	Frequency	Channel 1 and Channel 2 are the same
	Amplitude	Channel 1 and Channel 2 can be different
	Phase → 1	Channel 1 and Channel 2 are the same
Dual	Frequency 1	Channel 1 and Channel 2 are the same
	Frequency 2	Channel 1 and Channel 2 are the same
	Amplitude	Channel 1 and Channel 2 are the same
	Ratio	Channel 1 and Channel 2 are the same
	DC Offset	Channel 1 and Channel 2 are the same
SMPTE IMD 1:1/ 4:1/ 10:1	Lower Frequency	Channel 1 and Channel 2 are the same
	Upper Frequency	Channel 1 and Channel 2 are the same
	Amplitude	Channel 1 and Channel 2 are the same
	DC Offset	Channel 1 and Channel 2 are the same

Waveform	Parameter	Channel
DFD IEC 60118	Difference Frequency	Channel 1 and Channel 2 are the same
	Upper Frequency	Channel 1 and Channel 2 are the same
	Amplitude	Channel 1 and Channel 2 are the same
	DC Offset	Channel 1 and Channel 2 are the same
DFD IEC 60268	Difference Frequency	Channel 1 and Channel 2 are the same
	Center Frequency	Channel 1 and Channel 2 are the same
	Amplitude	Channel 1 and Channel 2 are the same
	DC Offset	Channel 1 and Channel 2 are the same
Gaussian/	Amplitude	Channel 1 and Channel 2 can be different
Rectangular/ Triangular Pink	DC Offset	Channel 1 and Channel 2 are the same
Constant	Amplitude	Channel 1 and Channel 2 are the same
Multitone	Amplitude	Channel 1 and Channel 2 can be different
	Start Frequency	Channel 1 and Channel 2 can be different
	Stop Frequency	Channel 1 and Channel 2 can be different
	Frequency Spacing	Channel 1 and Channel 2 can be different
	Count	Channel 1 and Channel 2 can be different
	Crest Factor	Channel 1 and Channel 2 can be different
	Clear All Tones	Channel 1 and Channel 2 can be different
	Add Tone	Channel 1 and Channel 2 can be different
	Delete Tone	Channel 1 and Channel 2 can be different
	Tone Frequency	Channel 1 and Channel 2 can be different
	Tone Amplitude	Channel 1 and Channel 2 can be different
	Tone Phase	Channel 1 and Channel 2 can be different
	Randomize Tone Phase	Channel 1 and Channel 2 can be different
Arbitrary	Amplitude	Channel 1 and Channel 2 can be different
	DC Offset	Channel 1 and Channel 2 are the same

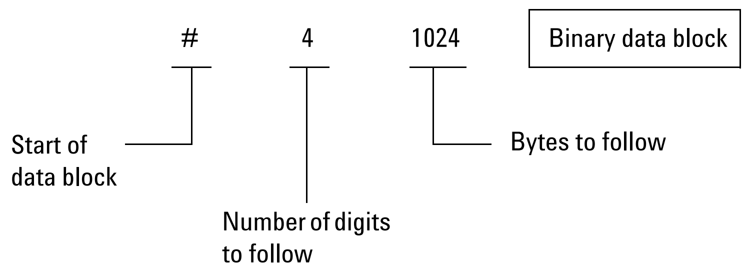
Appendix F: Sweep Start and Stop Range

<sweep parameter>	Waveform	Sweep start range	Sweep stop range
`FREQuency1`	Sine Dual	5 Hz to 80 kHz	5 Hz to 80 kHz
	Square	5 Hz to 30 kHz	5 Hz to 30 kHz
	SMPTE IMD 1:1/ 4:1/ 10:1	40 Hz to 500 Hz	40 Hz to 500 Hz
`FREQuency2`	Dual	5 Hz to 80 kHz	5 Hz to 80 kHz
	SMPTE IMD 1:1/ 4:1/ 10:1	2 kHz to 60 kHz	2 kHz to 60 kHz
	DFD IEC 60118	3 kHz to 80 kHz	3 kHz to 80 kHz
`AMPLitude`	Sine Dual Square Gaussian Rectangular SMPTE IMD 1:1/ 4:1/ 10:1 DFD IEC 60118/ 60268	• 0 to 22.6 Vp (Balanced output) • 0 to 11.3 Vp (Unbalanced or Common output)	• 0 to 22.6 Vp (Balanced output) • 0 to 11.3 Vp (Unbalanced or Common output)
	DC	• –22.6 V to 22.6 V (Balanced output) • –11.3 V to 11.3 V (Unbalanced or Common output)	• –22.6 V to 22.6 V (Balanced output) • –11.3 V to 11.3 V (Unbalanced or Common output)
`PHASe`	Variable Phase	–180 ° to 179.99 °	–180 ° to 179.99 °
`CENTer`	DFD IEC 60268	3 kHz to 79 kHz	3 kHz to 79 kHz

Appendix G: Using the IEEE-488.2 Binary Block Format

In the binary block format, a block header precedes the user data.

The block header has the following format:



The U8903A represents binary data as 32-bit floating points, which are sent as four bytes. Therefore, the total number of bytes is always four times the number of data points in the user data (and must always be an even number).

Appendix H: Sending HP8903B Commands to the U8903A

Before sending the HP8903B commands to the U8903A, enable the legacy mode. Refer to "SYSTem:LEGacy:MODE" on page 56 for more information on the legacy mode.

The default channel for the legacy mode is channel 1 as the HP8903B supports only one channel. However, the U8903A provides the flexibility to switch to channel 2. Refer to "SYSTem:LEGacy:CHANnel" on page 57 for more information on the legacy mode channel.

NOTE

- You can still send SCPI commands when the legacy mode is enabled. When the legacy mode is disabled or enabled, the U8903A will reset.
- Concatenated HP8903B commands is allowed in the legacy mode. For example, sending AP1.2VLFR2KZ47.1SP command is equivalent to sending the AP1.2VL, FR2KZ, and 47.1SP commands separately.
- If there is an invalid HP8903B command in a concatenated HP8903B command, the whole command will be ignored. For example, AP1.2VLFFXZ47.1SP will not be executed as FFXZ is not a valid HP8903B command.

Supported HP8903B commands list

The supported versions of the HP8903B commands are versions R2.1.4.0 and above. The list of supported HP8903B commands are grouped into five different groups.

Generator commands

Command syntax	Description
AP<voltage><unit>	Sets the amplitude level of the source signal. The supported units are as follows. • VL – Vrms • MV – mVrms • DV – dBV (= voltage – 2.218 dB) Examples: AP1.5VL → sets the amplitude to 1.5 Vrms AP0DV → sets the voltage to – 2.218 dB
FR<frequency><unit>	Sets the frequency of the source signal. The supported units are as follows. • HZ • KZ where KZ = kHz Example: FR3.2KZ → sets the frequency to 3.2 kHz
AN<amplitude><unit>	Sets the step value to increase or decrease the amplitude. The supported units are as follows. • VL – Vrms • MV – mVrms • DV – dBV (= voltage – 2.218 dB)
FN<frequency><unit>	Sets the step value to increase or decrease the frequency. The supported units are as follows. • HZ • KZ where KZ = kHz

Command syntax	Description
UP, DN	UP increases the amplitude or frequency to the step value set by the AN or FN commands. DN increases the amplitude or frequency to the step value set by the AN or FN commands. The parameter to increase or decrease depends on the last AN or FN command. Examples: Current amplitude = 0 Vrms, Frequency = 1 kHz AN0.5VL UP → increases the amplitude to 0.5 Vrms UP → increases the amplitude to 1 Vrms DN → decreases the amplitude to 0.5 Vrms FN1KZ UP → increases the frequency to 2 kHz
47.0SP 47.1SP	Sets the impedance to 50 Ω and 600 Ω respectively.
10.0SP	Sets the display mode to the analyzer-generator view. Refer to "DISPlay[:WINDow]:VIEW" on page 299 for more information on the display mode view.

Measurement commands

Command syntax	Description
T0 T1	T0 turns on the auto query mode and T1 turns off the auto query mode. T0 and T1 cannot be used in a concatenated command.
T2 T3	Initiates the analyzer and returns the measurement readings. T3 returns the measurement readings with a delay of 300 ms. This command returns the measurement readings of only one function which is determined by the RR and RL commands.

Command syntax	Description
RR[?] or 20.0SP RL[?] or 20.1SP	Determines the function type for the measurement readings return by the T2 and T3 commands. RR[?] or 20.0SP will set the T2 or T3 command to return the measurement readings of function 2. RL[?] or 20.1SP will set the T2 or T3 command to return the measurement readings of function 1. RR[?] is equivalent to FETC? FUNC2, (@1). RL[?] is equivalent to FETC? FUNC1, (@1).
16.0SP 16.1SP	Determines the resolution of SINAD and SNR measurement in dB. 16.0SP will set the resolution to 0.01 dB for values more than 25 dB and set the resolution to 0.5 dB for values less than 25 dB. 16.1SP will set the resolution to 0.01 dB for all range of values. 16.0SP and 16.1SP are effective to RR, T2 and T3 (if RR is sent), and GUI. Sending FETC? FUNC1, (@1) will still return in the 6-digit scientific format as shown in “FETCh[:SCALar]?” on page 389.

Analyzer commands

Command syntax	Description
M1	Sets the measurement of function 2.
M2	M1 → Vac
M3	M2 → SINAD
S1	M3 → THD Ratio
S2	S1 → DC
S3	S1 → SNR
	S1 → THD Level
AU	Sets the input range of the analyzer.
1.0SP	AU, 1.0SP, 2.0SP → enable auto range
1.3SP	9.0SP → disable auto range
1.4SP	1.3SP → 140 V
1.5SP	1.4SP, 2.2SP → 100V
1.6SP	1.5SP, 1.6SP → 50V
1.7SP	1.7SP, 2.3SP → 25V
1.8SP	1.8SP, 1.9SP → 12.8V
1.9SP	1.10SP, 2.4SP → 6.4V
1.10SP	1.11SP, 1.12SP → 3.2V
1.11SP	1.13SP → 1.6V
1.12SP	1.14SP, 1.15SP → 0.8V
1.13SP	1.6SP, 1.17SP, 1.18SP, 1.19SP → 0.4V
1.14SP	
1.15SP	
1.16SP	
1.17SP	
1.18SP	
1.19SP	
2.0SP	
2.2SP	
2.3SP	
2.4SP	
9.0SP	

Command syntax	Description
A0 5.0SP 5.1SP 5.7SP	Sets the input detector. A0, 5.0SP, 5.1SP → RMS 5.7SP → QPK
H0 H1 H2 L0 L1 L2	Sets the filters of the U8903A. H0 → turns off the left or right plug-in filter H1, H2 → sets the left and right plug-in filters to high pass filter or weighting filter respectively L0 → turns off the low pass filter L1 → sets the low pass filter to 30 kHz L2 → sets the low pass filter to 80 kHz (this filter is loaded as a custom filter as there is no predefined 80 kHz low pass filter in the U8903A) Configure the left and right filters before sending the H1 and H2 commands. Only one of the filters can be turned on at a time. Refer to “SENSe:FILTer:LEFT” on page 229 and “SENSe:FILTer:RIGHt” on page 231 for more information on the filters. Example: Configure the left and right filters. SENS:FILT:LEFT HP400 → sets the left filter to high pass filter with 400 Hz cutoff frequency SENS:FILT:RIGH CMES → sets the right filter to C-Message filter H1 → enables the HP400 filter H2 → enables the HP400 filter and disables the HP400 filter
LN	Changes the measurement result unit to linear unit. Measurement unit for AC, DC, and THD Level will change to V or x depending on the type of reference mode. Measurement unit for SINAD, SNR, and THD Ratio will change to % only when the reference mode is not in Delta mode. Example: LN → measurement unit for AC, DC, and THD Level will change to x if the reference mode is in Log mode

Command syntax	Description
LG	Changes the measurement result unit to logarithmic unit. Measurement unit for AC, DC, and THD Level will change to dBr or dBm depending on the type of reference mode . Measurement unit for SINAD, SNR, and THD Ratio will change to ddB. Example: LG → measurement unit for AC, DC , and THD Level will change to dBr if the reference mode is in Linear mode
R0	Disables the ratio mode. Measurement unit for AC, DC, and THD Level will change to dBm or V depending on the previous measurement unit. Measurement unit for SINAD, SNR, and THD Ratio will change to dB if the previous measurement unit is in ddB. Example: R0 → measurement unit for AC, DC, and THD Level will change to dBm if the previous measurement unit is in dBr
<value>R1	Compares the measurement result to a reference value. If the <value> is not specified, the previous measurement will be used. Measurement unit for AC, DC, and THD Level will change to dBr or x depending on the previous measurement unit before the ratio mode is disabled. Measurement unit for SINAD, SNR, and THD Ratio will change to ddB if the previous measurement unit is in dB. Example: Measurement unit = x R0 → measurement unit will change to V R1 → measurement unit will change to x
11.0SP	Enables the ratio mode with the previous reference value. Equivalent to R1 but without taking the measurement before switching the measurement unit.

Command syntax	Description
11.1SP	Reads the reference type.
19.0SP 19.NNNSP	Sets the reference impedance and changes the value to W (supported functions only) 19.0SP → sets the reference impedance to 8 Ω 19.NNNSP → sets the reference impedance to a specific value NNN:1 ~ 999 Ω Example: 19.8SP → equivalent to the 19.0SP command

Sweep commands

Command syntax	Description
FA<start frequency><unit> FA<stop frequency><unit>	Sets the start stop frequency. The supported units are as follows. • HZ • KZ where KZ = kHz Example: FA100Hz → sets the start frequency to 100 Hz
17.0SP 17.1SP 17.2SP 17.3SP 17.4SP 17.5SP 17.6SP 17.7SP 17.8SP 17.9SP	Sets the sweep resolution. Each command determines the number of points over decade. 17.1SP → 1/dec 17.2SP → 2/dec 17.3SP → 5/dec 17.0SP & 17.4SP → 10/dec 17.5SP → 20/dec 17.6SP → 50/dec 17.7SP → 100/dec 17.8SP → 200/dec 17.9SP → 500/dec The total number of points is computed using the following formula. Point Count = Sweep Range × Points/Decade where Sweep Range (in decades) = $\log_{10}$ (Stop Frequency/Start Frequency) Example: Start Frequency = 30 Hz, Stop Frequency = 30 kHz 17.3SP → 15 points
W1	Initiates the frequency sweep.
W0	Aborts the frequency sweep.

System commands

Command syntax	Description
21.1SP	Reads the GPIB address.
22.1SP	Equivalent to the *SRE 16 command. Refer to "*SRE" on page 31 for more information.
22.2SP	Equivalent to the *ESE 32; SRE 32 command. Refer to "*ESE" on page 27 and "*SRE" on page 31 for more information.
22.4SP	Equivalent to the *SRE 4 command. Refer to "*SRE" on page 31 for more information.

Example of usage

Amplitude = 5 Vrms

Frequency = 500 Hz

Measurement function = SINAD

Bandwidth = High

In order to set to the settings above, the following commands are sent.

1 `SYST:LEG:MODE ON`
2 `INP:BAND HIGH`
3 `AP5VLFR0.5KZM2`

In order to increment the amplitude by three times with step value of 100 mVrms, the following command is sent.

```
AN100MVUPUPUP
```

Appendix I: AES3/SPDIF Interface Channel Status Bits Field Names

Field Name	Field Values
Mode	Consumer or Professional
Audio Mode	Non Linear PCM or Linear PCM
Consumer	
Copyright	Non Copyright or Copyright
Emphasis	No pre-emphasis, 50/15µs,Reserved 1, or Reserved 2
Channel Mode	0 to 3
Category Code	General, Laser Optical, D/D Converter, Magnetic, Digital Broadcast 1, Digital Broadcast 2, Musical Instrument, ADC Non Copyright, Solid State Memory, ADC Copyright, Experimental, Reserved 1, or Reserved 2
Source Number	0 to 15
Channel Number	0 to 15
Sample Freq	Not indicated, 22.05kHz, 24kHz, 32kHz, 44.1kHz, 48kHz, 88.2kHz, 96kHz, 176.4kHz, 192kHz, or 768kHz
Clock Accuracy	Level 1, Level 2, Level 3, or Reserved
Max Word Length	20 bits or 24 bits
Word Length	For Max Word Length = 20 bits, Not indicated, 16 bits, 17 bits, 18 bits, 19 bits, or 20 bits For Max Word Length = 24 bits, Not indicated, 20 bits, 21 bits, 22 bits, 23 bits, or 24 bits
Original Sample Freq	Not indicated, 8kHz, 11.025kHz, 12kHz, 16kHz, 22.05kHz, 24kHz, 32kHz, 44.1kHz, 48kHz, 88.2kHz, 96kHz, 176.4kHz, 192kHz, Reserved 1, or Reserved 2
CGMS-A	Copying Permitted, Condition Not Used, One Generation Copy, or Copying Denied
Professional	

Field Name	Field Values
Emphasis	Not indicated, No pre-emphasis, 50/15us, or CCITT J.17
Sample Freq	Not indicated, 22.05kHz, 24kHz, 32 kHz, 44.1kHz, 48kHz, 88.2kHz, 96kHz, 176.4kHz, or 192kHz
Sample Freq Scaling	Disable or Enable
Channel Mode	Not indicated, 2-channel, Single Channel, Primary-Secondary, Stereo, Reserved 1, Reserved 2, Mono Double Rate, Left Double Rate, Right Double Rate, or Multichannel
User Bits	Not indicated, 192-bit block, Reserved for AES18, User defined, Reserved for Metadata, or As in IEC60958-3
Auxiliary Bits	20-bit not defined, 24-bit main audio, 20-bit single, or Reserved
Word Length	If Auxiliary Bits = 24-bit main audio, Not indicated, 20 bits, 21 bits, 22 bits, 23 bits, 24 bits If Auxiliary Bits = 20-bit not defined, 20-bit single, or Reserved, Not indicated, 16 bits, 17 bits, 18 bits, 19 bits, or 20 bits
Alignment Level	Not indicated, -18.06dBFS, -20dBFS, or Reserved
Multichannel Status	Undefined or Defined
Multichannel Mode	Mode 0, Mode 1, Mode 2, Mode 3, or User Defined Note: The Multichannel Mode is only applicable when the Multichannel Status is set to Defined.
Channel Number	If Multichannel Status = Defined, 1 to 16 If Multichannel Status = Undefined, 1 to 128
Reference Signal	Not a ref. signal, Grade 1, Grade 2, or Reserved
Channel Origin	0 to 4 (alphanumeric digit)
Channel Destination	0 to 4 (alphanumeric digit)
Local Address	0 to 2^{32}-1
Time-of-day	0 to 2^{32}-1

Field Name	Field Values
0-5 Reliable	False or True
6-13 Reliable	False or True
14-17 Reliable	False or True
18-21 Reliable	False or True
CRCC	Value between 0 to 255 (query only)

Appendix J: Word Length, Sampling Rate, and Multiplier for DSI Interface

≤ Sampling rate (kHz)[1]	Word length	Multiplier
400	8	128
400	9	72, 144
400	10	80, 160
400	11	88, 176
400	12	96, 192
400	13	104, 208
400	14	112, 224
400	15	120, 240
400	16	64, 128
400	17	68, 136
400	18	72, 144
400	19	76, 152
400	20	80, 160
400	21	84, 168
400	22	88, 176
400	23	92, 184
400	24	96, 192
400	25	100, 200
400	26	104, 208
400	27	108, 216
400	28	112, 224
400	29	116, 232
400	30	120, 240

≤ Sampling rate (kHz)[1]	Word length	Multiplier
400	31	124, 248
400	32	128
200	8	128, 256
200	9	72, 144, 288
200	10	80, 160, 320
200	11	88, 176, 352
200	12	96, 192, 384
200	13	104, 208, 416
200	14	112, 224, 448
200	15	120, 240, 480
200	16	64, 128, 256
200	17	68, 136, 272
200	18	72, 144, 288
200	19	76, 152, 304
200	20	80, 160, 320
200	21	84, 168, 336
200	22	88, 176, 352
200	23	92, 184, 368
200	24	96, 192, 384
200	25	100, 200, 400
200	26	104, 208, 416
200	27	108, 216, 432
200	28	112, 224, 448
200	29	116, 232, 464
200	30	120, 240, 480
200	31	124, 248, 496

≤ Sampling rate (kHz)[1]	Word length	Multiplier
200	32	128, 256
100	8	128, 256, 512
100	9	72, 144, 288, 576
100	10	80, 160, 320, 640
100	11	88, 176, 352, 704
100	12	96, 192, 384, 768
100	13	104, 208, 416, 832
100	14	112, 224, 448, 896
100	15	120, 240, 480, 960
100	16	64, 128, 256, 512
100	17	68, 136, 272, 544
100	18	72, 144, 288, 576
100	19	76, 152, 304, 608
100	20	80, 160, 320, 640
100	21	84, 168, 336, 672
100	22	88, 176, 352, 704
100	23	92, 184, 368, 736
100	24	96, 192, 384, 768
100	25	100, 200, 400, 800
100	26	104, 208, 416, 832
100	27	108, 216, 432, 864
100	28	112, 224, 448, 896
100	29	116, 232, 464, 928
100	30	120, 240, 480, 960
100	31	124, 248, 496, 992
100	32	128, 256, 512

≤ Sampling rate (kHz)[1]	Word length	Multiplier
50	8	128, 256, 512, 1024
50	9	72, 144, 288, 576
50	10	80, 160, 320, 640
50	11	88, 176, 352, 704
50	12	96, 192, 384, 768
50	13	104, 208, 416, 832
50	14	112, 224, 448, 896
50	15	120, 240, 480, 960
50	16	64, 128, 256, 512
50	17	68, 136, 272, 544
50	18	72, 144, 288, 576
50	19	76, 152, 304, 608
50	20	80, 160, 320, 640
50	21	84, 168, 336, 672
50	22	88, 176, 352, 704
50	23	92, 184, 368, 736
50	24	96, 192, 384, 768
50	25	100, 200, 400, 800
50	26	104, 208, 416, 832
50	27	108, 216, 432, 864
50	28	112, 224, 448, 896
50	29	116, 232, 464, 928
50	30	120, 240, 480, 960
50	31	124, 248, 496, 992
50	32	128, 256, 512, 1024
25	8	128, 256, 512, 1024

≤ Sampling rate (kHz)[1]	Word length	Multiplier
25	9	72, 144, 288, 576
25	10	80, 160, 320, 640
25	11	88, 176, 352, 704
25	12	96, 192, 384, 768
25	13	104, 208, 416, 832
25	14	112, 224, 448, 896
25	15	120, 240, 480, 960
25	16	64, 128, 256, 512
25	17	68, 136, 272, 544
25	18	72, 144, 288, 576
25	19	76, 152, 304, 608
25	20	80, 160, 320, 640
25	21	84, 168, 336, 672
25	22	88, 176, 352, 704
25	23	92, 184, 368, 736
25	24	96, 192, 384, 768
25	25	100, 200, 400, 800
25	26	104, 208, 416, 832
25	27	108, 216, 432, 864
25	28	112, 224, 448, 896
25	29	116, 232, 464, 928
25	30	120, 240, 480, 960
25	31	124, 248, 496, 992
25	32	128, 256, 512, 1024
12.5	8	128, 256, 512, 1024
12.5	9	72, 144, 288, 576

≤ Sampling rate (kHz)[1]	Word length	Multiplier
12.5	10	80, 160, 320, 640
12.5	11	88, 176, 352, 704
12.5	12	96, 192, 384, 768
12.5	13	104, 208, 416, 832
12.5	14	112, 224, 448, 896
12.5	15	120, 240, 480, 960
12.5	16	64, 128, 256, 512
12.5	17	68, 136, 272, 544
12.5	18	72, 144, 288, 576
12.5	19	76, 152, 304, 608
12.5	20	80, 160, 320, 640
12.5	21	84, 168, 336, 672
12.5	22	88, 176, 352, 704
12.5	23	92, 184, 368, 736
12.5	24	96, 192, 384, 768
12.5	25	100, 200, 400, 800
12.5	26	104, 208, 416, 832
12.5	27	108, 216, 432, 864
12.5	28	112, 224, 448, 896
12.5	29	116, 232, 464, 928
12.5	30	120, 240, 480, 960
12.5	31	124, 248, 496, 992
12.5	32	128, 256, 512, 1024
6.75	8	128, 256, 512, 1024
6.75	9	72, 144, 288, 576
6.75	10	80, 160, 320, 640

≤ Sampling rate (kHz)[1]	Word length	Multiplier
6.75	11	88, 176, 352, 704
6.75	12	96, 192, 384, 768
6.75	13	104, 208, 416, 832
6.75	14	112, 224, 448, 896
6.75	15	120, 240, 480, 960
6.75	16	128, 256, 512
6.75	17	136, 272, 544
6.75	18	144, 288, 576
6.75	19	152, 304, 608
6.75	20	160, 320, 640
6.75	21	168, 336, 672
6.75	22	176, 352, 704
6.75	23	184, 368, 736
6.75	24	192, 384, 768
6.75	25	200, 400, 800
6.75	26	208, 416, 832
6.75	27	216, 432, 864
6.75	28	224, 448, 896
6.75	29	116, 232, 464, 928
6.75	30	120, 240, 480, 960
6.75	31	124, 248, 496, 992
6.75	32	128, 256, 512, 1024

[1] For sampling rate less than or equal to.

Appendix K: Word Length, Sampling Rate, and Multiplier for Master Clock In

≤ Sampling rate (kHz)[1]	Word length	Multiplier
400	8	64, 128
400	9	72, 144
400	10	80, 160
400	11	88
400	12	96
400	13	104
400	14	112
400	15	120
400	16	64, 128
400	17	68, 136
400	18	72, 144
400	19	76
400	20	80
400	21	84
400	22	88
400	23	92
400	24	96, 192
400	25	100
400	26	104
400	27	108
400	28	112
400	29	116
400	30	120

≤ Sampling rate (kHz)[1]	Word length	Multiplier
400	31	124
400	32	128
200	8	64, 128, 256
200	9	72, 144, 288
200	10	80, 160
200	11	88, 176
200	12	96, 192
200	13	104, 208
200	14	112, 224
200	15	120, 240
200	16	64, 128, 256
200	17	68, 136, 272
200	18	72, 144, 288
200	19	76, 152
200	20	80, 160
200	21	84, 168
200	22	88, 176
200	23	92, 184
200	24	96, 192
200	25	100, 200
200	26	104, 208
200	27	108, 216
200	28	112, 224
200	29	116, 232
200	30	120, 240
200	31	124, 248

≤ Sampling rate (kHz)[1]	Word length	Multiplier
200	32	128, 256
100	8	64, 128, 256, 512
100	9	72, 144, 288, 576
100	10	80, 160, 320
100	11	88, 176, 352
100	12	96, 192, 384
100	13	104, 208, 416
100	14	112, 224, 448
100	15	120, 240, 480
100	16	64, 128, 256, 512
100	17	68, 136, 272, 544
100	18	72, 144, 288, 576
100	19	76, 152, 304
100	20	80, 160, 320
100	21	84, 168, 336
100	22	88, 176, 352
100	23	92, 184, 368
100	24	96, 192, 384
100	25	100, 200, 400
100	26	104, 208, 416
100	27	108, 216, 432
100	28	112, 224, 448
100	29	116, 232, 464
100	30	120, 240, 480
100	31	124, 248, 496
100	32	128, 256, 512

≤ Sampling rate (kHz)[1]	Word length	Multiplier
50	8	64, 128, 256, 512
50	9	72, 144, 288, 576
50	10	80, 160, 320, 640
50	11	88, 176, 352, 704
50	12	95, 192, 384, 768
50	13	104, 208, 416, 832
50	14	112, 224, 448, 896
50	15	120, 240, 480, 960
50	16	64, 128, 256, 512
50	17	68, 136, 272, 544
50	18	72, 144, 288, 576
50	19	76, 152, 304, 608
50	20	80, 160, 320, 640
50	21	84, 168, 336, 672
50	22	88, 176, 352, 704
50	23	92, 184, 368, 736
50	24	96, 192, 384, 768
50	25	100, 200, 400, 800
50	26	104, 208, 416, 832
50	27	108, 216, 432, 864
50	28	112, 224, 448, 896
50	29	116, 232, 464, 928
50	30	120, 240, 480, 960
50	31	124, 248, 496, 992
50	32	128, 256, 512
25	8	64, 128, 256, 512

≤ Sampling rate (kHz)[1]	Word length	Multiplier
25	9	72, 144, 288, 576
25	10	80, 160, 320, 640
25	11	88, 176, 352, 704
25	12	96, 192, 384, 768
25	13	104, 208, 416, 832
25	14	112, 224, 448, 896
25	15	120, 240, 480, 960
25	16	64, 128, 256, 512
25	17	136, 272, 544
25	18	72, 144, 288, 576
25	19	152, 304, 608
25	20	80, 160, 320, 640
25	21	168, 336, 672
25	22	88, 176, 352, 704
25	23	184, 368, 736
25	24	96, 192, 384, 768
25	25	200, 400, 800
25	26	104, 208, 416, 832
25	27	216, 432, 864
25	28	112, 224, 448, 896
25	29	232, 464, 928
25	30	120, 240, 480, 960
25	31	248, 496, 992
25	32	128, 256, 512
12.5	8	64, 128, 256, 512
12.5	9	144, 288, 576

≤ Sampling rate (kHz)[1]	Word length	Multiplier
12.5	10	80, 160, 320, 640
12.5	11	176, 352, 704
12.5	12	96, 192, 384, 768
12.5	13	208, 416, 832
12.5	14	112, 224, 448, 896
12.5	15	240, 480, 960
12.5	16	64, 128, 256, 512
12.5	17	272, 544
12.5	18	144, 288, 576
12.5	19	304, 608
12.5	20	160, 320, 640
12.5	21	336, 672
12.5	22	176, 352, 704
12.5	23	368, 736
12.5	24	192, 384, 768
12.5	25	400, 800
12.5	26	208, 416, 832
12.5	27	432, 864
12.5	28	224, 448, 896
12.5	29	464, 928
12.5	30	240, 480, 960
12.5	31	496, 992
12.5	32	128, 256, 512
6.75	8	64, 128, 256, 512
6.75	9	288, 576
6.75	10	160, 320, 640

≤ Sampling rate (kHz)[1]	Word length	Multiplier
6.75	11	352, 704
6.75	12	192, 384, 768
6.75	13	416, 832
6.75	14	224, 448, 896
6.75	15	480, 960
6.75	16	64, 128, 256, 512
6.75	17	544
6.75	18	288, 576
6.75	19	608
6.75	20	320, 640
6.75	21	672
6.75	22	352, 704
6.75	23	736
6.75	24	384, 768
6.75	25	800
6.75	26	416, 832
6.75	27	864
6.75	28	448, 896
6.75	29	928
6.75	30	480, 960
6.75	31	992
6.75	32	128, 256, 512

[1] For sampling rate less than or equal to.

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