Keysight 53220A/53230A Frequency Universal Counter/Timer

KEYSIGHT
TECHNOLOGIES

Welcome

This Help file contains reference information to help you program the Keysight 53220A/230A Universal Frequency Counter/Timer over a remote interface using the SCPI programming language.

Introduction to the SCPI Language
Commands by Subsystem
Command Quick Reference
SCPI Error Messages
Power-On and Reset State

Related Information

IO Libraries and Instrument Drivers

The Keysight IO Libraries Suite software is provided on the Keysight Automation Ready CD-ROM provided with your instrument. Installation instructions are provided on the CD-ROM.

You can also download the Keysight IO Libraries Suite software, along with IVI-COM and LABview drivers from the Keysight Developer Network at adn.tm.agilent.com.

Keysight 53220A/230A Documentation

The Keysight 53220A/230A Programmer's Reference is provided as a Windows® Compiled Help (.chm) file on the Keysight 53220A/230A Product Reference CD-ROM shipped with your instrument.

In addition, the following documents are available in Adobe® PDF format on this CD-ROM. (Requires Adobe Reader.)

- *Keysight 53220A/230A 350MHz Universal Counter/Timer Quick Start Tutorial*
- *Keysight 53220A/230A 350MHz Universal Counter/Timer User's Guide*
- *Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide*

You can also download these documents from the Web at www.keysight.com.

For information about connecting instruments to USB, LAN, and GPIB interfaces and how to configure and troubleshoot these interfaces, refer to the Keysight USB/LAN/GPIB Interfaces Connectivity Guide. This guide is provided on the Keysight Automation Ready CD-ROM. Or you can download the guide from the Web at www.keysight.com/find/connectivity.

Keysight 53220A/230A Web Interface

The Keysight 53220A/230A provides a Web Interface that is built into the instrument. You can use this interface over LAN for remote access and control of the instrument via a Java™-enabled Web browser, such as Microsoft® Internet Explorer.

To access and use the 53220A/230A Web Interface:

1. Establish a LAN interface connection from your PC to the instrument (e.g. 53220A/230A).
2. Open your PC's Web browser.
3. Launch the instrument's Web Interface by entering the IP address of the instrument, or its fully-qualified host name, in the browser address field.
4. Follow the instructions in the Web Interface's on-line help.

Example Programs

We have included several example programs on the Keysight 53210A/53220A/53230A Product Reference CD-ROM shipped with your instrument. The examples support the following language environments.

- Microsoft® Visual Basic®
- Microsoft® C++
- Keysight VEE
- National Instruments LabVIEW

To install the programming examples, see the Product Reference CD-ROM. Or, you can download the examples from the Web at www.keysight.com.

Contact Keysight Technologies

You can contact Keysight Technologies at one of the following telephone numbers for warranty, service, or technical support information.

In the United States: (800) 829-4444

In Europe: 31 20 547 2111

In Japan: 0120-421-345

Or use our Web link for information on contacting Keysight worldwide.

www.keysight.com/find/assist

Or contact your Keysight Technologies Representative.

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Version 2.00

Introduction to the SCPI Language

SCPI (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 SENSe subsystem is shown below to illustrate the tree system.

```
SENSe:
    FUNCtion:
        [:ON] "function"
        [:ON]?

    ROSCillator:
        EXTernal:FREQuency?
        SOURce { INTernal|EXTernal|AUTO }
```

SENSe is the root keyword of the command, FUNCtion and ROSCillator are second-level keywords, and ON and SOURce are third-level keywords. A colon (:) separates a command keyword from a lower-level keyword.

Syntax Conventions

The format used to show commands is illustrated below:

SAMPle:COUNt {<*count*> | MINimum | MAXimum | DEFault}

The command syntax shows most commands (and some parameters) as a mixture of upper- and lower-case letters. The upper-case letters indicate the abbreviated spelling for the command. For shorter program lines, you can send the abbreviated form. For better program readability, you can send the long form.

For example, in the above syntax statement, SAMP and SAMPLE are both acceptable forms. You can use upper- or lower-case letters. Therefore, SAMPLE, samp, and Samp are all acceptable. Other forms, such as SAM and SAMPL, are not valid and will generate an error.

- Braces ({ }) enclose the parameter choices for a given command string. The braces are not sent with the command string.
- A vertical bar (|) separates multiple parameter choices for a given command string. For example, {<count> |MINimum | MAXimum | DEFault} in the above command indicates that you can specify a numeric range parameter, or "MINimum", "MAXimum", or "DEFault". The bar is not sent with the command string.
- Triangle brackets (< >) indicate that you must specify a value for the enclosed parameter. For example, the above syntax statement shows the <range> parameter enclosed in triangle brackets. The brackets are not sent with the command string. You must specify a value for the parameter (for example "SAMP:COUN 10") unless you select one of the other options shown in the syntax (for example "SAMP:COUN MIN").
- Some parameters are enclosed in square brackets ([ ]). This indicates that the parameter is optional and can be omitted. The brackets are not sent with the command string. If you do not specify a value for an optional parameter, the instrument chooses a default value.

Numeric Suffixes on Commands

Certain commands have numeric suffixes appended to the command name. For example:

> INPut[{1|2}]:
>   RANGe {<range> | MINimum | MAXimum | DEFault}

These suffixes distinguish multiple instances of the same subsystem. Note that the numeric suffix is optional; if it is omitted, "1" is assumed. In this example, INPut1 or INPut refers to channel 1; INPut2 refers to channel 2.

Command Separators

A colon (:) is used to separate a command keyword from a lower-level keyword. You must insert a blank space to separate a parameter from a command keyword. If a command requires more than one parameter, you must separate adjacent parameters using a comma as shown below:

```
CONF:FREQ 10.0E6,0.003
```

A semicolon (;) is used to separate commands within the same subsystem, and can also minimize typing. For example, sending the following command string:

```
TRIG:SOUR EXT; COUN 10
```

… is the same as sending the following two commands:

```
TRIG:SOUR EXT
 TRIG:COUN 10
```

Use a colon and a semicolon to link commands from different subsystems. For example, in the following command string, an error is generated if you do not use both the colon and semicolon:

```
TRIG:COUN MIN;:SAMP:COUN MIN
```

Using the MINimum, MAXimum, and DEFault Parameters

For most commands, you can substitute "MINimum", "MAXimum" or "DEFault" in place of a parameter. For example, consider the following command:

SAMPle:COUNt {<*count*> | MINimum | MAXimum | DEFault}

Instead of selecting a specific value for the <count> parameter, you can substitute MIN to set the count to its minimum value, MAX to set the count to its maximum value, or DEF to set the count to its default value.

Querying Parameter Settings

You can query the current value of most parameters by adding a question mark (?) to the command. For example, the following command sets the trigger count to 10 measurements:

```
TRIG:COUN 10
```

You can then query the count value by sending:

```
TRIG:COUN?
```

You can also query the minimum or maximum count allowed as follows:

```
TRIG:COUN? MIN
 TRIG:COUN? MAX
```

SCPI Command Terminators

A command string sent to the instrument must terminate with a ‹new line› (‹NL›) character. The IEEE-488 EOI (End-Or-Identify) message is interpreted as a ‹NL› character and can be used to terminate a command string in place of a ‹NL› character. A ‹carriage return› followed by a ‹NL› is also accepted. Command string termination will always reset the current SCPI command path to the root level.

> **NOTE** For every SCPI message that includes a query and is sent to the instrument, the instrument terminates the returned response with a ‹NL› or line-feed character (EOI). For example, if R? is sent, the response is terminated with a ‹NL› after the block of data that is returned. If a SCPI message includes multiple queries separated by semicolons (for example "SYST:ERR?;R?"), the returned response is again terminated by a ‹NL› after the response to the last query. In either case, the program must read this ‹NL› in the response before another command is sent to the instrument, or an error will occur.

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 operations. 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?
```

SCPI Parameter Types

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

Numeric Parameters

Commands that require numeric parameters will accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation. Special values for numeric parameters such as MINimum, MAXimum, and DEFault are also accepted. You can also send engineering unit suffixes with numeric parameters (e.g., M, k, m, or u). If a command accepts only certain specific values, the instrument will automatically round the input numeric parameters to the accepted values. The following command requires a numeric parameter for the count value:

```
SAMPle:COUNt {‹count› | MINimum | MAXimum | DEFault}
```

> **NOTE** Because the SCPI parser is case-insensitive, there is some confusion over the letter "M" (or "m"). For your convenience, the instrument interprets "mS" (or "MS") as milliseconds, but "MHZ" (or "mhz") as megahertz. You can use the prefix "MA" for mega. For example, "MAS" is interpreted as megaseconds.

Discrete Parameters

Discrete parameters are used to program settings that have a limited number of values (like IMMediate, EXTernal, or BUS). 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. The following command requires a discrete parameters for the temperature units:

 INPut:LEVel:AUTO {OFF | ON | ONCE}

Boolean Parameters

Boolean parameters represent a single binary condition that is either true or false. For a false condition, the instrument will accept "OFF" or "0". For a true condition, the instrument will accept "ON" or "1". When you query a boolean setting, the instrument will always return "0" or "1". The following command requires a boolean parameter:

 INPut:NREJect {OFF | 0 | ON | 1}

ASCII String Parameters

String parameters can 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. The following command uses a string parameter:

 DISPlay:TEXT <*quoted string*>

For example, the following command displays the message "WAITING..." on the instrument's front panel (the quotes are not displayed).

```
DISP:TEXT "WAITING..."
```

You can also display the same message using the following command with single quotes.

```
DISP:TEXT 'WAITING...'
```

Using Device Clear

Device Clear is an IEEE-488 low-level bus message that you can use to return the instrument to a responsive state. Different programming languages and IEEE-488 interface cards provide access to this capability through their own unique commands. The status registers, the error queue, and all configuration states are left unchanged when a Device Clear message is received.

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Device Clear performs the following actions:

- If a measurement is in progress, it is aborted.

- The instrument returns to the trigger "idle" state.

- The instrument's input and output buffers are cleared.

- The instrument is prepared to accept a new command string.

- An overlapped command, if any, will be terminated with no "Operation Complete" indication (applies to the INIT command).

NOTE   The ABORt command is the recommended method to terminate a measurement.

Commands by Subsystem

ABORt

Syntax

ABORt

Description

This command aborts a measurement in progress.

Remarks

- This command may be useful to abort a measurement when the instrument is waiting for a trigger, for a long measurement (for example, 1000 sec gate time), or for a long series of timed measurements.
- The command will abort a measurement in progress and stop, returning the instrument to the trigger idle state.
- The *RST command will abort a measurement and set all measurement parameters to their factory settings. The Instrument Preset (SYSTem:PRESet command) does the same.

Example

The following example aborts the measurement in progress.

```
ABOR
```

See Also

*RST

SYSTem:PRESet

AUToscale

Syntax

AUToscale

Description

This command causes the instrument to perform an autoscale operation on the input signal. This will adjust the input threshold, input range, and internal measurement hardware settings based on the input signal levels and frequency.

Remarks

- You should select the measurement function and active input channel(s) prior to sending the AUToscale command.

Example

The following example configures a frequency measurement, performs an autoscale, and makes a measurement on channel 1.

```
CONF:FREQ
 AUT
 READ?
```

Typical Response: +1.21513398300000E+006

See Also

*RST

SYSTem:PRESet

FETCh?

Syntax

FETCh?

Description

This command transfers measurements to the instrument's output buffer where you can read them into your computer. The measurements are not erased from memory when you read them. You can send the command multiple times to retrieve the same data in reading memory.

Remarks

- The FETCh? command will wait until all measurements complete to terminate.
- If no measurements are available or in progress, error -230,"Data corrupt or stale" will be generated, and no data will be returned.
- You can store up to 1,000,000 measurements in the reading memory. If memory overflows, the new measurements will overwrite the first (oldest) measurements stored; the most recent measurements are always preserved. No error is generated, but the Reading Mem Ovfl bit (bit 14) is set in the Questionable Data Register.
- You can use the R? command to obtain whatever measurements are present (with no wait), but the measurements will be erased as you read them.
- The instrument clears all measurements from memory when the measurement function is changed, when the INITiate:IMMediate, MEASure:<*function*>? or READ? commands are executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The command transfers all measurements from memory but does not erase them. The format of the measurements is controlled by the FORMat Subsystem commands.

For timestamp measurements, the command returns the prescaler value followed by a comma, followed by the measurements.   The prescaler value is always returned in the format: +100. The format of the measurements is controlled by the FORMat Subsystem commands.

Example

The following program segment shows how to use the FETCh? command with the CONFigure and INITiate commands. The INITiate command places the instrument in the "wait-for-trigger" state, triggers a measurement when the rear-panel Trig In BNC is pulsed (low by default), and then sends the measurements to memory. The FETCh? command transfers the measurements from memory to the instrument's output buffer.

```
CONF:FREQ 1200,0.003
 TRIG:SOUR EXT
```

```
INIT
FETC?
```

Typical Response: +1.21513398300000E+006

See Also

INITiate[:IMMediate]

INITiate[:IMMediate]

Syntax

INITiate[:IMMediate]

Description

This command changes the state of the triggering system from the "idle" state to the "wait-for-trigger" state. Measurements will begin when the specified trigger conditions are satisfied following the receipt of the INITiate command. Note that the INITiate command also clears the previous set of measurements from memory.

Remarks

- Storing measurements in memory using the INITiate command is faster than sending measurements to the output buffer using the READ? command. The INITiate command is also an "overlapped" command. This means that after executing the INITiate command, you can send other commands that do not affect the measurements.
- You can store up to 1,000,000 measurements in the reading memory. If memory overflows, the new measurements will overwrite the first (oldest) measurements stored; the most recent measurements are always preserved. No error is generated, but the Reading Mem Ovfl bit (bit 14) is set in the Questionable Data Register.
- To retrieve the measurements from memory, use the FETCh? command. Use DATA:REMove? to remove data points. Or use the R? command to read and remove all of the available data.
- The ABORt command may be used to return to idle.

Example

The following program segment shows how to use the INITiate command with the CONFigure and FETCh? commands. The INITiate command places the instrument in the "wait-for-trigger" state, triggers a measurement when the rear-panel Trig In BNC is pulsed (low by default), and then sends the measurements to memory. The FETCh? command transfers the measurements from memory to the instrument's output buffer.

```
CONF:FREQ 4000
 TRIG:SOUR EXT
 INIT
 FETC?
```

Typical Response: +1.21513398300000E+006

See Also

FETCh?

READ?

ABORt

READ?

Syntax

READ?

Description

This command changes the instrument's triggering system from the "idle" state to the "wait-for-trigger" state. Measurements will begin when the specified trigger conditions are satisfied following the receipt of the READ? command. Measurements are then sent immediately to the reading memory and the instrument's output buffer.

Remarks

- Sending the READ? command is similar to sending the INITiate command followed immediately by the FETCh? command.
- You can store up to 1,000,000 measurements in the reading memory. If memory overflows, the new measurements will overwrite the first (oldest) measurements stored; the most measurements are always preserved. No error is generated, but the Reading Mem Ovfl bit (bit 14) is set in the Questionable Data Register.
- The instrument clears all measurements from memory when the measurement function is changed, when the INITiate:IMMediate, MEASure:<function>? or READ? commands are executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The command sends measurements directly to reading memory and the instrument's output buffer. The format of the measurements is affected by the FORMat Subsystem commands.

For timestamp measurements, the command returns the prescaler value followed by a comma, followed by the measurements. The prescaler value is always returned in the format: +100. The format of the measurements is controlled by the FORMat Subsystem commands.

Examples

The following program segment shows how to use the READ? command with the CONFigure command. The READ? command places the instrument in the "wait-for-trigger" state, triggers a measurement when the rear-panel Trig In BNC is pulsed (low by default), sends the measurements to memory, and then transfers the measurements to the instrument output buffer.

```
CONF:FREQ 1.0E6,.001
 TRIG:SOUR EXT
 READ?
```

Typical Response: +1.21513398300000E+006

See Also

FETCh?

FORMat:BORDer

FORMat[:DATA]

INITiate[:IMMediate]

R?

Syntax

R? [<*max_count*>]

Description

This command reads and erases measurements from reading memory up to the specified <max_count>. The measurements are erased from memory starting with the oldest (<u>not</u> the most recent) measurement first. The purpose of this command is to allow you to periodically remove measurements from memory that would normally cause reading memory to overflow.

Parameters

Name	Type	Range of Values	Default Value
<*max_count*>	Numeric	1 to 1,000,000	Read and erase all stored measurements

Remarks

- You can read memory at any time using the R? command, even during a measurement.
- If no measurements are available or in progress, error -230,"Data corrupt or stale" will be generated, and no data will be returned.
- This command differs from the DATA:REMove? command in that R? will read and erase whatever measurements are available in reading memory, up to the specified <max_count>. DATA:REMove will error if the requested number of measurements are not in reading memory when the command is sent.
- You can store up to 1,000,000 measurements in the reading memory. If memory overflows, the new measurements will overwrite the first (oldest) measurements stored; the most recent measurements are always preserved. No error is generated, but the Reading Mem Ovfl bit (bit 14) is set in the Questionable Data Register.
- The instrument clears all measurements from memory when the measurement function is changed, when the INITiate:IMMediate, MEASure:<function>? or READ? commands are executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The command returns a series of measurements in Definite-Length Block format. The syntax is a pound sign (#) followed by a non-zero digit representing the number of digits in the decimal integer to follow. This digit is followed by a decimal integer indicating the number of 8-bit data bytes to follow. This is followed by a block of data containing the specified number of bytes. The return format is determined by the FORMat Subsystem commands.

For timestamp measurements, the command returns the prescaler value followed by a comma, followed by the measurements. The prescaler value is always returned in the format: +100. The measurements are returned in the Definite-Length Block format described above.

Example

This command reads the two oldest measurements and erases them from memory.

```
FORM:DAT ASC
R? 2
```

Typical Response: #243+1.21513398300000E+006,+1.21513392700000E+006

See Also

DATA:REMove?

FETCh?

FORMat:BORDer

FORMat:DATA

CALCulate Subsystem Introduction

The CALCulate subsystem receives real-time data from the measurement hardware and optionally performs scaling and offset, statistics computation and/or limit checking. The data flow is show below:
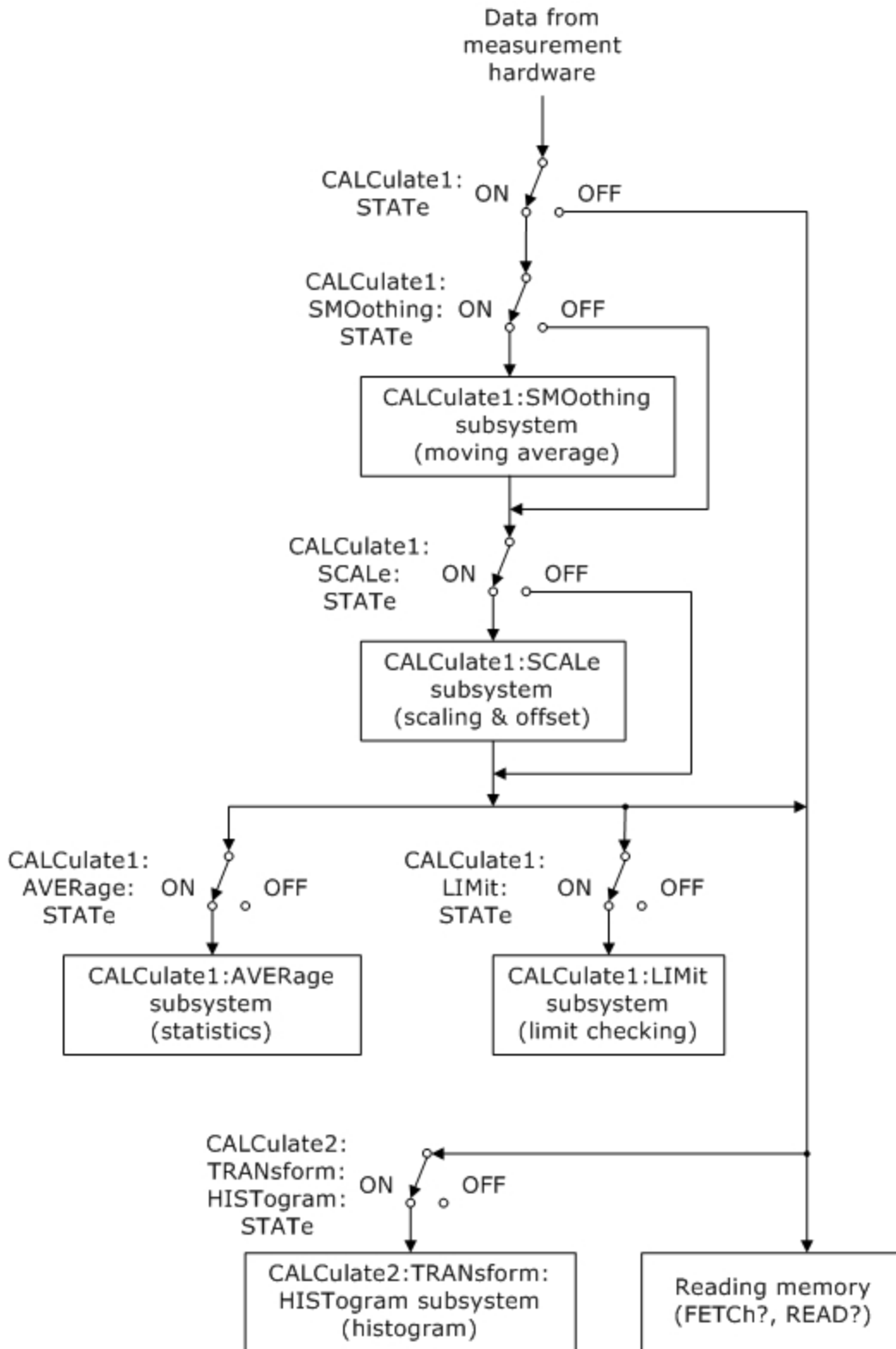
The CALCulate1 subsystem is enabled or disabled by the CALCulate1:STATe command. If CALCulate1:STATe OFF is set, no calculations are performed on the measurements, and the measurements will flow directly to the reading memory.

If CALCulate1:STATe ON is set, only those calculations enabled by CALCulate1:SCALe:STATe, CALCulate1:LIMit:STATe, and CALCulate1:AVERage:STATe are performed. If enabled, scaling and offset is performed first, with the results of the scaling and offset operation then being passed to the reading memory, limit checking and statistics computations.

Histogram computation is enabled or disabled by the CALCulate2:TRANsform:HISTogram:STATe command, independent of the CALCulate1 subsystem.

Command Summary

Enable Functions

CALCulate1:STATe
CALCulate1:STATe?
CALCulate1:SMOothing:STATe
CALCulate1:SMOothing:STATe?
CALCulate1:SCALe:STATe
CALCulate1:SCALe:STATe?
CALCulate1:LIMit:STATe?
CALCulate1:LIMit:STATe?
CALCulate1:AVERage:STATe
CALCulate1:AVERage:STATe?
CALCulate2:TRANsform:HISTogram:STATe
CALCulate2:TRANsform:HISTogram:STATe?

Moving Average Filter Functions

CALCulate1:SMOothing:RESPonse
CALCulate1:SMOothing:RESPonse?
CALCulate1:SMOothing:STATe
CALCulate1:SMOothing:STATe?

Scaling (Mx-B) Functions

CALCulate1:SCALe:FUNCtion
CALCulate1:SCALe:FUNCtion?
CALCulate1:SCALe:GAIN
CALCulate1:SCALe:GAIN?

CALCulate Subsystem Introduction

CALCulate1:SCALe:INVert

CALCulate1:SCALe:INVert?

CALCulate1:SCALe:OFFSet

CALCulate1:SCALe:OFFSet?

CALCulate1:SCALe:REFerence

CALCulate1:SCALe:REFerence?

CALCulate1:SCALe:REFerence:AUTO

CALCulate1:SCALe:REFerence:AUTO?

CALCulate1:SCALe:UNIT

CALCulate1:SCALe:UNIT?

CALCulate1:SCALe:UNIT:STATe

CALCulate1:SCALe:UNIT:STATe?

Limit Functions

CALCulate1:LIMit:CLEar

CALCulate1:LIMit:LOWer

CALCulate1:LIMit:LOWer?

CALCulate1:LIMit:UPPer

CALCulate1:LIMit:UPPer?

Statistical Functions

CALCulate1:AVERage:ADEViation?

CALCulate1:AVERage:ALL?

CALCulate1:AVERage:AVERage?

CALCulate1:AVERage:CLEar

CALCulate1:AVERage:COUNt:CURRent?

CALCulate1:AVERage:MAXimum?

CALCulate1:AVERage:MINimum?

CALCulate1:AVERage:PTPeak?

CALCulate1:AVERage:SDEViation?

Histogram Functions

CALCulate2:TRANsform:HISTogram:ALL?

CALCulate2:TRANsform:HISTogram:CLEar

CALCulate2:TRANsform:HISTogram:COUNT?

CALCulate2:TRANsform:HISTogram:DATA?

CALCulate2:TRANsform:HISTogram:POINts

CALCulate2:TRANsform:HISTogram:POINts?

CALCulate2:TRANsform:HISTogram:RANGe:AUTO

CALCulate2:TRANsform:HISTogram:RANGe:AUTO?

CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt

CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt?

CALCulate2:TRANsform:HISTogram:RANGe:LOWer

CALCulate2:TRANsform:HISTogram:RANGe:LOWer?

CALCulate2:TRANsform:HISTogram:RANGe:UPPer

CALCulate2:TRANsform:HISTogram:RANGe:UPPer?

CALCulate2:TRANsform:HISTogram:STATe

CALCulate2:TRANsform:HISTogram:STATe

CALCulate1:SMOothing:RESPonse

Syntax

CALCulate[1]:SMOothing:RESPonse {SLOW | MEDium | FAST}

CALCulate[1]:SMOothing:RESPonse?

Description

This command selects the number of measurements to be averaged by the moving average (boxcar) filter.

- SLOW selects 100 measurements.

- MEDium selects 50 measurements.

- FAST selects 10 measurements.

Remarks

- The smoothing (moving average) filter produces one result for each measurement made.
- The smoothing (moving average) filter is reset when the measurement function or channel changes, by INITiate:IMMediate, READ?, and the MEASure? subsystem commands, or if a measurement is outside a fixed range from the current average. The amount of measurement change required to reset the filter is:

Filter Response Time	Change required to reset
SLOW	±100 ppm
MEDium	±300 ppm
FAST	±1000 ppm

- After the smoothing (moving average) filter is reset, the filter produces results which are the average of all measurements made after the reset, until the required number of measurements are made as selected by CALCulate1:SMOothing:RESPonse. Once the required number measurements are made, the results are the moving average of the last 10, 50, or 100 measurements. Equal weighting is applied to all measurements used in the average.
- The instrument sets the response time to FAST after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the response time: SLOW, MED, or FAST.

Examples

The following example enables a 50-point moving average filter on 1000 frequency measurements.

```
CONF:FREQ 1.0E6,.001
SAMP:COUN 1000
CALC:SMO:RESP MED
CALC:SMO:STAT ON
CALC:STAT ON
READ?
```

Typical Response: +9.99383828200000E+06,+9.99352315400000E+06,... *(1000 measurements)*

See Also

CALCulate1:SMOothing:STATe

CALCulate1:STATe

CALCulate1:SMOothing:RESPonse

Syntax

CALCulate[1]:SMOothing:RESPonse {SLOW | MEDium | FAST}

CALCulate[1]:SMOothing:RESPonse?

Description

This command selects the number of measurements to be averaged by the moving average (boxcar) filter.

- SLOW selects 100 measurements.

- MEDium selects 50 measurements.

- FAST selects 10 measurements.

Remarks

- The smoothing (moving average) filter produces one result for each measurement made.
- The smoothing (moving average) filter is reset when the measurement function or channel changes, by INITiate:IMMediate, READ?, and the MEASure? subsystem commands, or if a measurement is outside a fixed range from the current average. The amount of measurement change required to reset the filter is:

Filter Response Time	Change required to reset
SLOW	±100 ppm
MEDium	±300 ppm
FAST	±1000 ppm

- After the smoothing (moving average) filter is reset, the filter produces results which are the average of all measurements made after the reset, until the required number of measurements are made as selected by CALCulate1:SMOothing:RESPonse. Once the required number measurements are made, the results are the moving average of the last 10, 50, or 100 measurements. Equal weighting is applied to all measurements used in the average.
- The instrument sets the response time to FAST after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the response time: SLOW, MED, or FAST.

Examples

The following example enables a 50-point moving average filter on 1000 frequency measurements.

```
CONF:FREQ 1.0E6,.001
SAMP:COUN 1000
CALC:SMO:RESP MED
CALC:SMO:STAT ON
CALC:STAT ON
READ?
```

Typical Response: +9.99383828200000E+06,+9.99352315400000E+06,... *(1000 measurements)*

See Also

CALCulate1:SMOothing:STATe

CALCulate1:STATe

CALCulate1:SMOothing:RESPonse

Syntax

CALCulate[1]:SMOothing:RESPonse {SLOW | MEDium | FAST}

CALCulate[1]:SMOothing:RESPonse?

Description

This command selects the number of measurements to be averaged by the moving average (boxcar) filter.

- SLOW selects 100 measurements.

- MEDium selects 50 measurements.

- FAST selects 10 measurements.

Remarks

- The smoothing (moving average) filter produces one result for each measurement made.
- The smoothing (moving average) filter is reset when the measurement function or channel changes, by INITiate:IMMediate, READ?, and the MEASure? subsystem commands, or if a measurement is outside a fixed range from the current average. The amount of measurement change required to reset the filter is:

Filter Response Time	Change required to reset
SLOW	±100 ppm
MEDium	±300 ppm
FAST	±1000 ppm

- After the smoothing (moving average) filter is reset, the filter produces results which are the average of all measurements made after the reset, until the required number of measurements are made as selected by CALCulate1:SMOothing:RESPonse. Once the required number measurements are made, the results are the moving average of the last 10, 50, or 100 measurements. Equal weighting is applied to all measurements used in the average.
- The instrument sets the response time to FAST after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the response time: SLOW, MED, or FAST.

Examples

The following example enables a 50-point moving average filter on 1000 frequency measurements.

```
CONF:FREQ 1.0E6,.001
SAMP:COUN 1000
CALC:SMO:RESP MED
CALC:SMO:STAT ON
CALC:STAT ON
READ?
```

Typical Response: +9.99383828200000E+06,+9.99352315400000E+06,... *(1000 measurements)*

See Also

CALCulate1:SMOothing:STATe

CALCulate1:STATe

CALCulate1:SMOothing:STATe

Syntax

CALCulate[1]:SMOothing[:STATe] {OFF | ON}

CALCulate[1]:SMOothing[:STATe]?

Description

This command enables or disables a smoothing (moving average) filter on the measurements.

Remarks

- The CALCulate1 subsystem must also be enabled by CALCulate1:STATe for smoothing (moving average) to be performed.
- The smoothing (moving average) filter is disabled for continuous totalize since this computation requires more than one measurement to be useful.
- The CALCulate subsystem and the individual calculate functions are disabled for timestamp measurements.
- The instrument disables the smoothing (moving average) filter after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current smoothing (moving average) filter state: 0 (OFF) or 1 (ON).

Examples

The following example enables a 50-point moving average filter on 1000 frequency measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 1000
 CALC:SMO:RESP MED
 CALC:SMO:STAT ON
 CALC:STAT ON
 READ?
```

Typical Response: +9.99383828200000E+06,+9.99352315400000E+06,... *(1000 measurements)*

See Also

CALCulate1:SMOothing:RESPonse

CALCulate1:STATe

CALCulate1:SCALe:FUNCtion

Syntax

CALCulate[1]:SCALe:FUNCtion {NULL | PCT | PPM | PPB | SCALe}

CALCulate[1]:SCALe:FUNCtion?

Description

This command selects the operation that will be performed by the scaling function:

- NULL performs a simple null operation. The result will be the measurement minus the reference value.

- PCT performs a percent change operation. The result will be the percent change of the measurement from the reference value.

- PPM performs a parts per million change operation. The result will be the change of the measurement from the reference value expressed in parts per million.

- PPB performs a parts per billion (10^9) change operation. The result will be the change of the measurement from the reference value expressed in parts per billion.

- SCALe performs a Mx-B operation. The result is the measurement multiplied by the gain value M (CALCulate1:SCALe:GAIN command) minus the offset value B (CALCulate1:SCALe:OFFSet). If CALCulate1:SCALe:INVert is enabled (set to ON), the measurement will first be inverted (1/x), resulting in a M/x-B operation.

Remarks

- For the NULL, PCT, PPM, and PPB operations, the reference value is specified by the CALCulate1:SCALe:REFerence command. If no reference value has been specified, the first measurement will be used as the reference value.
- Scaling function results must be in the range of -1.0E+24 to -1.0E-24, 0.0, or +1.0E-24 to 1.0E+24. Results outside these limits will be replaced with -9.9E+37 (negative infinity), 0, or +9.9E+37 (positive infinity), as appropriate.
- The instrument resets the function to NULL after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the scaling function in the form: NULL, PCT, PPM, PPB or SCAL.

CALCulate1:SCALe:FUNCtion

Examples

The following example enables the percent change scaling function referenced to the next measurement taken.

```
CALC:SCAL:FUNC PCT
 CALC:SCAL:STAT ON
 CALC:STAT ON
```

See Also

CALCulate1:SCALe:GAIN

CALCulate1:SCALe:OFFset

CALCulate1:SCALe:INVert

CALCulate1:SCALe:REFerence

CALCulate1:SCALe:REFerence:AUTO

CALCulate1:SCALe:STATE

CALCulate1:STATe

CALCulate1:SCALe:FUNCtion

Syntax

CALCulate[1]:SCALe:FUNCtion {NULL | PCT | PPM | PPB | SCALe}

CALCulate[1]:SCALe:FUNCtion?

Description

This command selects the operation that will be performed by the scaling function:

- NULL performs a simple null operation. The result will be the measurement minus the reference value.

- PCT performs a percent change operation. The result will be the percent change of the measurement from the reference value.

- PPM performs a parts per million change operation. The result will be the change of the measurement from the reference value expressed in parts per million.

- PPB performs a parts per billion (10^9) change operation. The result will be the change of the measurement from the reference value expressed in parts per billion.

- SCALe performs a Mx-B operation. The result is the measurement multiplied by the gain value M (CALCulate1:SCALe:GAIN command) minus the offset value B (CALCulate1:SCALe:OFFSet). If CALCulate1:SCALe:INVert is enabled (set to ON), the measurement will first be inverted (1/x), resulting in a M/x-B operation.

Remarks

- For the NULL, PCT, PPM, and PPB operations, the reference value is specified by the CALCulate1:SCALe:REFerence command. If no reference value has been specified, the first measurement will be used as the reference value.
- Scaling function results must be in the range of -1.0E+24 to -1.0E-24, 0.0, or +1.0E-24 to 1.0E+24. Results outside these limits will be replaced with -9.9E+37 (negative infinity), 0, or +9.9E+37 (positive infinity), as appropriate.
- The instrument resets the function to NULL after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the scaling function in the form: NULL, PCT, PPM, PPB or SCAL.

CALCulate1:SCALe:FUNCtion

Examples

The following example enables the percent change scaling function referenced to the next measurement taken.

```
CALC:SCAL:FUNC PCT
 CALC:SCAL:STAT ON
 CALC:STAT ON
```

See Also

CALCulate1:SCALe:GAIN

CALCulate1:SCALe:OFFset

CALCulate1:SCALe:INVert

CALCulate1:SCALe:REFerence

CALCulate1:SCALe:REFerence:AUTO

CALCulate1:SCALe:STATE

CALCulate1:STATe

CALCulate1:SCALe:GAIN

Syntax

CALCulate[1]:SCALe:GAIN {<*gain*> | MINimum | MAXimum | DEFault}

CALCulate[1]:SCALe:GAIN? [{MINimum | MAXimum | DEFault}]

Description

This command sets the gain value M for the Mx-B scaling function.

Parameters

Name	Type	Range of Values	Default Value
<*gain*>	Numeric	-1.0E+15 to -1.0E-15, 0.0 +1.0E-15 to 1.0E+15 MIN = -1.0E+15 MAX = +1.0E+15	1.0

Remarks

- CALCulate1:SCALe:GAIN sets the gain value M. CALCulate1:SCALe:OFFset sets the offset value B.
- After setting the gain and offset values, use the CALCulate1:SCALe:STATe command to enable the scaling function.
- Scaling function results must be in the range of -1.0E+24 to -1.0E-24, 0.0, or +1.0E-24 to 1.0E+24. Results outside these limits will be replaced with -9.9E+37 (negative infinity), 0, or +9.9E+37 (positive infinity), as appropriate.
- The instrument resets the gain to 1.0 after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gain value in the form +1.00000000000000E+000.

Examples

The following example enables the scaling function using the equation 100x-5.

```
CALC:SCAL:GAIN 100.0
CALC:SCAL:OFFS 5.0
CALC:SCAL:STAT ON
CALC:STAT ON
```

CALCulate1:SCALe:GAIN

See Also

CALCulate1:SCALe:FUNCtion

CALCulate1:SCALe:OFFset

CALCulate1:SCALe:STATE

CALCulate1:STATe

CALCulate1:SCALe:INVert

Syntax

CALCulate[1]:SCALe:INVert {OFF | ON}

CALCulate[1]:SCALe:INVert?

Description

This command enables or disables 1/x inversion of the incoming reading. This inversion is done **before** the Mx-B scaling function; the scaling function thus effectively becomes M/x-B.

Remarks

- The instrument disables inversion after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current scale and offset state: 0 (OFF) or 1 (ON).

Examples

The following example enables the scaling function using the equation 100/x-5.

```
CALC:SCAL:INV ON
 CALC:SCAL:GAIN 100.0
 CALC:SCAL:OFFS 5.0
 CALC:SCAL:STAT ON
 CALC:STAT ON
```

See Also

CALCulate1:SCALe:FUNCtion

CALCulate1:SCALe:STATE

CALCulate1:STATe

CALCulate1:SCALe:OFFSet

Syntax

CALCulate[1]:SCALe:OFFSet {<*offset*> | MINimum | MAXimum | DEFault}

CALCulate[1]:SCALe:OFFSet? [{MINimum | MAXimum | DEFault}]

Description

This command sets the offset value B for the Mx-B scaling function.

Parameters

Name	Type	Range of Values	Default Value
<*offset*>	Numeric	-1.0E+15 to -1.0E-15, 0.0 +1.0E-15 to 1.0E+15 MIN = -1.0E+15 MAX = +1.0E+15	0.0

Remarks

- Note that the offset value is subtractive, not additive.
- CALCulate1:SCALe:GAIN sets the gain value M. CALCulate1:SCALe:OFFset sets the offset value B.
- After setting the gain and offset values, use the CALCulate1:SCALe:STATe command to enable the scaling function.
- Scaling function results must be in the range of -1.0E+24 to -1.0E-24, 0.0, or +1.0E-24 to 1.0E+24. Results outside these limits will be replaced with -9.9E+37 (negative infinity), 0, or +9.9E+37 (positive infinity), as appropriate.
- The instrument resets the offset to 0.0 after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the offset value in the form +1.00000000000000E+006.

Examples

The following example enables the scaling function using the equation 100x-5.

```
CALC:SCAL:GAIN 100.0
CALC:SCAL:OFFS 5.0
CALC:SCAL:STAT ON
CALC:STAT ON
```

See Also

CALCulate1:SCALe:FUNCtion

CALCulate1:SCALe:GAIN

CALCulate1:SCALe:STATE

CALCulate1:STATe

CALCulate1:SCALe:REFerence

Syntax

CALCulate[1]:SCALe:REFerence {<*reference*> | MINimum | MAXimum | DEFault}

CALCulate[1]:SCALe:REFerence? [{MINimum | MAXimum | DEFault}]

Description

This command sets the reference value for the NULL, PCT, PPM, and PPB operations.

Parameters

Name	Type	Range of Values	Default Value
<*reference*>	Numeric	-1.0E+15 to -1.0E-15, 0.0 +1.0E-15 to 1.0E+15 MIN = -1.0E+15 MAX = +1.0E+15	0.0

Remarks

- Specifying a reference value disables automatic reference selection (CALCulate1:SCALe:REFerence:AUTO set to OFF).
- If automatic reference selection is enabled, the reference value will be set to the first measurement that is made.
- Scaling function results must be in the range of -1.0E+24 to -1.0E-24, 0.0, or +1.0E-24 to 1.0E+24. Results outside these limits will be replaced with -9.9E+37 (negative infinity), 0, or +9.9E+37 (positive infinity), as appropriate.
- The instrument sets the reference value to 0.0 with automatic reference selection enabled after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command))

Return Format

The query returns the reference value in the form +0.00000000000000E+000.

Examples

The following example enables the NULL scaling function. The first measurement will be used as the reference value.

```
CALC:SCAL:FUNC NULL
CALC:SCAL:REF:AUTO ON
CALC:SCAL:STAT ON
CALC:STAT ON
READ?
```

The following example enables the NULL scaling function with 100.0 as the reference value.

```
CALC:SCAL:FUNC NULL
CALC:SCAL:REF 100.0
CALC:SCAL:STAT ON
CALC:STAT ON
READ?
```

See Also

CALCulate1:SCALe:FUNCtion

CALCulate1:SCALe:REFerence:AUTO

CALCulate1:SCALe:STATE

CALCulate1:STATe

CALCulate1:SCALe:REFerence:AUTO

Syntax

CALCulate[1]:SCALe:REFerence:AUTO {OFF | ON}

CALCulate[1]:SCALe:REFerence:AUTO?

Description

This command enables or disables automatic reference selection for the NULL, PCT, PPM, and PPB scaling functions.

- When automatic reference selection is enabled (ON), the first measurement made will be used as the reference for all subsequent measurements. CALCulate1:SCALe:REFerence will be set to this value, and automatic reference selection will be disabled.

- When automatic reference selection is disabled (OFF), CALCulate1:SCALe:REFerence specifies the reference value.

Remarks

- The instrument enables automatic reference selection after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current scaling state: 0 (OFF) or 1 (ON).

Examples

The following example enables the NULL function with automatic reference selection enabled.

```
CALC:SCAL:FUNC NULL
 CALC:SCAL:REF:AUTO ON
 CALC:SCAL:STAT ON
CALC:STAT ON
```

See Also

CALCulate1:SCALe:FUNCtion

CALCulate1:SCALe:REFerence

CALCulate1:SCALe:STATe

CALCulate1:STATe

CALCulate1:SCALe:STATe

Syntax

CALCulate[1]:SCALe[:STATe] {OFF | ON}

CALCulate[1]:SCALe[:STATe]?

Description

This command enables or disables the scaling function.

Remarks

- The CALCulate1 subsystem must also be enabled by CALCulate1:STATe for scaling to be performed.
- The CALCulate subsystem and the individual calculate functions are disabled for timestamp measurements.
- The instrument disables the scaling function state after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current scaling state: 0 (OFF) or 1 (ON).

Examples

The following example enables scaling using the equation 100x-5.

```
CALC:FUNC SCAL
 CALC:SCAL:GAIN 100.0
 CALC:SCAL:OFFS 5.0
 CALC:SCAL:INV OFF
 CALC:SCAL:STAT ON
 CALC:STAT ON
```

See Also

CALCulate1:SCALe:FUNCtion

CALCulate1:SCALe:GAIN

CALCulate1:SCALe:OFFset

CALCulate1:STATe

CALCulate1:SCALe:UNIT

Syntax

CALCulate[1]:SCALe:UNIT "<string>"

CALCulate[1]:SCALe:UNIT?

Description

This command sets the unit string that is displayed with measurements on the front panel when the scaling function is enabled.

Parameters

Name	Type	Range of Values	Default Value
"<string>"	string	one to four characters	"" (null string)

Remarks

- CALCulate1:SCALe:UNIT:STATe controls whether the unit string is displayed.
- The instrument resets the units to the null string after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the unit string in double quotes.

Examples

The following example enables the scaling function using the equation 100x-5 and displays "PSI" with measurements on the front panel.

```
CALC:SCAL:GAIN 100.0
CALC:SCAL:OFFS 5.0
CALC:SCAL:UNIT "PSI"
CALC:SCAL:UNIT:STAT ON
CALC:SCAL:STAT ON
CALC:STAT ON
```

See Also

CALCulate1:SCALe:STATE

CALCulate1:STATe

CALCulate1:SCALe:UNIT:STATe

CALCulate1:SCALe:UNIT:STATe

Syntax

CALCulate[1]:SCALe:UNIT:STATe {OFF | ON}

CALCulate[1]:SCALe:UNIT:STATe?

Description

This command enables or disables displaying the unit string with measurements on the front panel when the scaling function is enabled.

Remarks

- CALCulate1:SCALe:UNIT specifies the unit string to be displayed.
- The instrument disables displaying the unit string after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current unit string display state: 0 (OFF) or 1 (ON).

Examples

The following example enables the scaling function using the equation 100x-5 and displays "PSI" with measurements on the front panel.

```
CALC:SCAL:GAIN 100.0
CALC:SCAL:OFFS 5.0
CALC:SCAL:UNIT "PSI"
CALC:SCAL:UNIT:STAT ON
CALC:SCAL:STAT ON
CALC:STAT ON
```

See Also

CALCulate1:SCALe:STATE

CALCulate1:STATe

CALCulate1:SCALe:UNIT

CALCulate1:LIMit:CLEar

Syntax

CALCulate[1]:LIMit:CLEar[:IMMediate]

Description

This command turns off the front panel Limit annunciator and clears bit 11 ("Lower Limit Failed") and bit 12 ("Upper Limit Failed") in the condition register of the *Questionable Data Register* group. The corresponding bits in the event register are unaffected.

Remarks

- This command does not clear measurements in the reading memory.
- The instrument turns off the front panel Limit annunciator and clears bits 11 and 12 in the condition register of the *Questionable Data Register* group when CALCulate1:LIMit:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:LIMit:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Examples

The following example clears the limit test results.

```
CALC:LIM:CLE
```

See Also

CALCulate1:LIMit:STATe

CALCulate1:STATe

CALCulate1:LIMit:CLEar

Syntax

CALCulate[1]:LIMit:CLEar[:IMMediate]

Description

This command turns off the front panel Limit annunciator and clears bit 11 ("Lower Limit Failed") and bit 12 ("Upper Limit Failed") in the condition register of the *Questionable Data Register* group. The corresponding bits in the event register are unaffected.

Remarks

- This command does not clear measurements in the reading memory.
- The instrument turns off the front panel Limit annunciator and clears bits 11 and 12 in the condition register of the *Questionable Data Register* group when CALCulate1:LIMit:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:LIMit:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Examples

The following example clears the limit test results.

```
CALC:LIM:CLE
```

See Also

CALCulate1:LIMit:STATe

CALCulate1:STATe

CALCulate1:LIMit:LOWer

Syntax

CALCulate[1]:LIMit:LOWer[:DATA] {<*value*> | MINimum | MAXimum | DEFault}

CALCulate[1]:LIMit:LOWer[:DATA]? [{MINimum | MAXimum | DEFault}]

Description

This command sets the lower limit for limit testing.

Parameters

Name	Type	Range of Values	Default Value
<*value*>	Numeric	-1.0E+15 to -1.0E-15, 0.0 +1.0E-15 to 1.0E+15 MIN = -1.0E+15 MAX = +1.0E+15	0.0

Remarks

- *Limit crossing:* If a measurement is less than the specified lower limit, bit 11 ("Lower Limit Failed") is set in the Questionable Data Register, which results in an SRQ if enabled. You can use the STATus:QUEStionable:EVENt? command to read the event register. See STATus Subsystem Introduction for further information.
- The instrument sets the lower limit to 0.0 after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the lower limit in the form +1.00000000000000E+006.

Examples

The following example enables limit testing of 100 frequency measurements and returns an indication whether measurements were outside of the range of 9.9MHz to 10.1MHz. Measurements above 10.1MHz will set bit 12 (Upper Limit Failed) of the questionable status register; measurements below 9.9MHz will set bit 11 (Lower Limit Failed).

```
*CLS
STAT:PRES
CONF:FREQ 1.0E6,.001
SAMP:COUN 100
CALC:LIM:LOW 9.9E6
CALC:LIM:UPP 10.1E6
```

CALCulate1:LIMit:LOWer

```
CALC:LIM:STAT ON
CALC:STAT ON
INIT
*WAI
STAT:QUES?
```

Typical Response: **+4096** *(at least one measurement was above the upper limit)*

See Also

CALCulate1:LIMit:UPPer

CALCulate1:STATe

STATus Subsystem Introduction

CALCulate1:LIMit:STATe

Syntax

CALCulate[1]:LIMit[:STATe] {OFF | ON}

CALCulate[1]:LIMit[:STATe]?

Description

This command enables or disables limit testing.

Remarks

- The CALCulate1 subsystem must also be enabled by CALCulate1:STATe for limit testing to be performed.
- The CALCulate subsystem and the individual calculate functions are disabled for timestamp measurements.
- The instrument clears the front panel Limit annunciator and bits 11 and 12 in the Questionable Data Register when CALCulate1:LIMit:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:LIMit:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).
- The instrument disables limit testing after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current limit state: 0 (OFF) or 1 (ON).

Examples

The following example enables limit testing of 100 frequency measurements and returns an indication whether measurements were outside of the range of 9.9MHz to 10.1MHz. Measurements above 10.1MHz will set bit 12 (Upper Limit Failed) of the questionable status register; measurements below 9.9MHz will set bit 11 (Lower Limit Failed).

```
*CLS
STAT:PRES
CONF:FREQ 1.0E6,.001
SAMP:COUN 100
CALC:LIM:LOW 9.9E6
CALC:LIM:UPP 10.1E6
CALC:LIM:STAT ON
CALC:STAT ON
INIT
```

CALCulate1:LIMit:STATe

```
*WAI
STAT:QUES?
```

Typical Response: +4096 *(at least one measurement was above the upper limit)*

See Also

CALCulate1:LIMit:CLEar

CALCulate1:STATe

CALCulate1:LIMit:UPPer

Syntax

CALCulate[1]:LIMit:UPPer[:DATA] {<*value*> | MINimum | MAXimum | DEFault}

CALCulate[1]:LIMit:UPPer[:DATA]? [{MINimum | MAXimum | DEFault}]

Description

This command sets the upper limit for limit testing.

Parameters

Name	Type	Range of Values	Default Value
<*value*>	Numeric	-1.0E+15 to -1.0E-15, 0.0 +1.0E-15 to 1.0E+15 MIN = -1.0E+15 MAX = +1.0E+15	0.0

Remarks

- *Limit crossing:* If a measurement is greater than the specified upper limit, bit 12 ("Upper Limit Failed") is set in the Questionable Data Register, which results in an SRQ if enabled. You can use the STATus:QUEStionable:EVENt? command to read the event register. See STATus Subsystem Introduction for further information.
- The instrument sets the upper limit to 0.0 after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the upper limit in the form +1.00000000000000E+006.

Examples

The following example enables limit testing of 100 frequency measurements and returns an indication whether measurements were outside of the range of 9.9MHz to 10.1MHz. Measurements above 10.1MHz will set bit 12 (Upper Limit Failed) of the questionable status register; measurements below 9.9MHz will set bit 11 (Lower Limit Failed).

```
*CLS
STAT:PRES
CONF:FREQ 1.0E6,.001
SAMP:COUN 100
CALC:LIM:LOW 9.9E6
CALC:LIM:UPP 10.1E6
```

CALCulate1:LIMit:UPPer

```
CALC:LIM:STAT ON
CALC:STAT ON
INIT
*WAI
STAT:QUES?
```

Typical Response: +4096 *(at least one measurement was above the upper limit)*

See Also

CALCulate1:LIMit:LOWer

CALCulate1:STATe

STATus Subsystem Introduction

CALCulate1:AVERage:ADEViation?

Syntax

CALCulate[1]:AVERage:ADEViation?

Description

This query returns the Allan deviation of all measurements taken since the last time statistics were cleared.

Remarks

- Allan deviation is only computed when the measurement function is frequency or period.
- For a true Allan deviation computation, continuous gap-free measurement mode should be selected (SENSe:FREQuency:MODE CONTinuous set).
- You can read the statistical values at any time.
- The instrument clears the statistical values when CALCulate1:AVERage:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:AVERage:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the Allan deviation of the measurements taken in the form +1.34892723498343E+001.

Examples

The following example returns the Allan deviation of 100 frequency measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 100
 CALC:AVER:STAT ON
 CALC:STAT ON
 INIT
 *WAI                wait for all reading to complete
 CALC:AVER:ADEV?
```

Typical Response: +4.13500000E+001

See Also

CALCulate1:AVERage:CLEar

    CALCulate1:AVERage:STATe

CALCulate1:STATe

CALCulate1:AVERage:ADEViation?

SENSe:FREQuency:MODE

CALCulate1:AVERage:ADEViation?

Syntax

CALCulate[1]:AVERage:ADEViation?

Description

This query returns the Allan deviation of all measurements taken since the last time statistics were cleared.

Remarks

- Allan deviation is only computed when the measurement function is frequency or period.
- For a true Allan deviation computation, continuous gap-free measurement mode should be selected (SENSe:FREQuency:MODE CONTinuous set).
- You can read the statistical values at any time.
- The instrument clears the statistical values when CALCulate1:AVERage:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:AVERage:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the Allan deviation of the measurements taken in the form +1.34892723498343E+001.

Examples

The following example returns the Allan deviation of 100 frequency measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 100
 CALC:AVER:STAT ON
 CALC:STAT ON
 INIT
 *WAI               wait for all reading to complete
 CALC:AVER:ADEV?
```

Typical Response: +4.13500000E+001

See Also

CALCulate1:AVERage:CLEar

   CALCulate1:AVERage:STATe

CALCulate1:STATe

CALCulate1:AVERage:ADEViation?

SENSe:FREQuency:MODE

CALCulate1:AVERage:ALL?

Syntax

CALCulate[1]:AVERage:ALL?

Description

This query returns the mathematical mean (average), standard deviation, minimum value, and maximum value of all measurements taken since the last time statistics were cleared.

Remarks

- You can read the statistical values at any time.
- The instrument clears the statistical values when CALCulate1:AVERage:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:AVERage:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the mean, standard deviation, minimum value, and maximum value of the measurements taken.

Examples

The following example returns the statistics of 100 frequency measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 100
 CALC:AVER:STAT ON
 CALC:STAT ON
 INIT
 *WAI                    wait for all reading to complete
 CALC:AVER:ALL?
```

Typical Response:
+1.00520000E+006,+4.13500000E+001,+1.00512000E+006,+1.005270000E+006

See Also

CALCulate1:AVERage:AVERage?

CALCulate1:AVERage:CLEar

CALCulate1:AVERage:COUNt?

CALCulate1:AVERage:MAXimum?

CALCulate1:AVERage:MINimum?

CALCulate1:AVERage:PTPeak?

CALCulate1:AVERage:ALL?

CALCulate1:AVERage:SDEViation?

CALCulate1:AVERage:STATe

CALCulate1:STATe

CALCulate1:AVERage:AVERage?

Syntax

CALCulate[1]:AVERage:AVERage?

Description

This query returns the mathematical average (mean) of all measurements taken since the last time statistics were cleared.

Remarks

- You can read the statistical values at any time.
- The instrument clears the statistical values when CALCulate1:AVERage:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:AVERage:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the mean of the measurements taken in the form +1.34892723498343E+007.

Examples

The following example returns the mean of 100 frequency measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 100
 CALC:AVER:STAT ON
 CALC:STAT ON
 INIT
 *WAI                  wait for all reading to complete
 CALC:AVER:AVER?
```

Typical Response: +1.00520000E+006

See Also

CALCulate1:AVERage:ALL?

CALCulate1:AVERage:CLEar

CALCulate1:AVERage:COUNt?

CALCulate1:AVERage:STATe

CALCulate1:STATe

CALCulate1:AVERage:CLEar

Syntax

CALCulate[1]:AVERage:CLEar[:IMMediate]

Description

This command clears all computed statistics values.

Remarks

- This command clears the minimum, maximum, average, count, and deviation values (but no measurements are cleared from memory).
- The instrument clears the statistical values when CALCulate1:AVERage:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:AVERage:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

This command has no query form.

Examples

The following command clears the stored statistical data.

```
CALC:AVER:CLE
```

See Also

CALCulate1:AVERage:COUNt?

CALCulate1:AVERage:STATe

CALCulate1:STATe

CALCulate1:AVERage:COUNt:CURRent?

Syntax

CALCulate[1]:AVERage:COUNt:CURRent?

Description

This query returns the number of measurements used to compute the current statistics values since the last time statistics were cleared.

Remarks

- You can read the statistical values at any time.

- The instrument clears the statistical values when CALCulate1:AVERage:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:AVERage:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the number of measurements used to compute the current statistics values in the form +100.

Examples

The following example returns the number of measurements used to compute the current statistics values.

```
CALC:AVER:COUN:CURR?
```

Typical Response: +73

See Also

CALCulate1:AVERage:CLEar
    CALCulate1:AVERage:STATe
CALCulate1:STATe

CALCulate1:AVERage:MAXimum?

Syntax

CALCulate[1]:AVERage:MAXimum?

Description

This query returns the maximum value of all measurements taken since the last time statistics were cleared.

Remarks

- You can read the statistical values at any time.
- The instrument clears the statistical values when CALCulate1:AVERage:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:AVERage:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the maximum value found in the form +1.34892723498343E+007.

Examples

The following example returns the maximum value of 100 frequency measurements.

```
CONF:FREQ 1.0E6,.001
SAMP:COUN 100
CALC:AVER:STAT ON
CALC:STAT ON
INIT
*WAI                wait for all reading to complete
CALC:AVER:MAX?
```

Typical Response: +1.005270000E+006

See Also

CALCulate1:AVERage:ALL?

CALCulate1:AVERage:CLEar

CALCulate1:AVERage:COUNt?

CALCulate1:AVERage:STATe

CALCulate1:STATe

CALCulate1:AVERage:MINimum?

Syntax

CALCulate[1]:AVERage:MINimum?

Description

This query returns the minimum value of all measurements taken since the last time statistics were cleared.

Remarks

- You can read the statistical values at any time.
- The instrument clears the statistical values when CALCulate1:AVERage:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:AVERage:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the minimum value found in the form +1.34892723498343E+007.

Examples

The following example returns the minimum value of 100 frequency measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 100
 CALC:AVER:STAT ON
 CALC:STAT ON
 INIT
 *WAI              wait for all reading to complete
 CALC:AVER:MIN?
```

Typical Response: +1.00512000E+006

See Also

CALCulate1:AVERage:ALL?

CALCulate1:AVERage:CLEar

CALCulate1:AVERage:COUNt?

CALCulate1:AVERage:STATe

CALCulate1:STATe

CALCulate1:AVERage:PTPeak?

Syntax

CALCulate[1]:AVERage:PTPeak?

Description

This query returns the peak-to-peak value of all measurements taken since the last time statistics were cleared.

Remarks

- You can read the statistical values at any time.
- The instrument clears the statistical values when CALCulate1:AVERage:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:AVERage:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the peak-to-peak value found in the form +1.34892723498343E+007.

Examples

The following example returns the peak-to-peak value of 100 frequency measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 100
 CALC:AVER:STAT ON
 CALC:STAT ON
 INIT
 *WAI               wait for all reading to complete
 CALC:AVER:PTP?
```

Typical Response: +1.50000000E+002

See Also

CALCulate1:AVERage:CLEar

CALCulate1:AVERage:COUNt?
   CALCulate1:AVERage:STATe

CALCulate1:STATe

CALCulate1:AVERage:SDEViation?

Syntax

CALCulate[1]:AVERage:SDEViation?

Description

This query returns the standard deviation of all measurements taken since the last time statistics were cleared.

Remarks

- You can read the statistical values at any time.
- The instrument clears the statistical values when CALCulate1:AVERage:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:AVERage:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the standard deviation of the measurements taken in the form +1.34892723498343E+001.

Examples

The following example returns the standard deviation of 100 frequency measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 100
 CALC:AVER:STAT ON
 CALC:STAT ON
 INIT
 *WAI                wait for all reading to complete
 CALC:AVER:SDEV?
```

Typical Response: +4.13500000E+001

See Also

CALCulate1:AVERage:ALL?

CALCulate1:AVERage:CLEar

   CALCulate1:AVERage:STATe

CALCulate1:STATe

CALCulate1:AVERage:STATe

Syntax

CALCulate[1]:AVERage[:STATe] {OFF | ON}

CALCulate[1]:AVERage[:STATe]?

Description

This command enables or disables statistics computation.

Remarks

- The CALCulate1 subsystem must also be enabled by CALCulate1:STATe for statistics computation to be performed.
- Statistics computation is disabled for continuous totalize since this computation requires more than one measurement to be useful.
- Statistics computation is disabled for timestamp measurements.
- The instrument clears the statistical values when CALCulate1:AVERage:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate1:AVERage:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).
- The instrument disables statistics computation after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current statistics computation state: 0 (OFF) or 1 (ON).

Examples

The following example returns the statistics of 100 frequency measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 100
 CALC:AVER:STAT ON
 CALC:STAT ON
 INIT
 *WAI
 CALC:AVER:ALL?
```

Typical Response: +1.00520000E+06,+1.00512000E+05,+1.005270000E+06,+4.13500000E+01

See Also

CALCulate1:STATe

CALCulate1:STATe

Syntax

CALCulate[1][:STATe] {OFF | ON}

CALCulate[1][:STATe]?

Description

This command enables or disables the entire CALCulate1 subsystem.

Remarks

- You can individually enable or disable the limit testing, scaling, statistics and histogram computation operations using the CALCulate1:LIMit:STATe, CALCulate1:SCALe:STATe, and CALCulate1:AVERage:STATe commands.
- The CALCulate subsystem and the individual calculate functions are disabled for timestamp measurements.
- The instrument disables the calculation subsystem after a Factory Reset (*RST command), after an Instrument Preset (SYSTem:PRESet command), or when the measurement function is changed.

Return Format

The query returns the current calculate state: 0 (OFF) or 1 (ON).

Examples

The following example returns the statistics of 100 frequency measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 100
 CALC:AVER:STAT ON
 CALC:STAT ON
 INIT
 *WAI
 CALC:AVER:ALL?
```

Typical Response:
+1.00520000000000E+006,+1.00512000000000E+005,+1.005270000000000E+006,+4.13500000-000000E+001

See Also

CALCulate1:AVERage:STATe

CALCulate1:LIMit:STATe

CALCulate1:STATe

CALCulate1:SCALe:STATe

CALCulate2:TRANsform:HISTogram:ALL?

Syntax

CALCulate2:TRANsform:HISTogram:ALL?

Description

This query returns the lower and upper range values, the number of measurements, and the bin data collected the last time the histogram data was cleared.

Remarks

- You can read the histogram at any time.
- The instrument clears the histogram data when the CALCulate2:TRANsform:HISTogram:POINts, CALCulate2:TRANsform:HISTogram:RANGe:AUTO, CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt, CALCulate2:TRANsform:HISTogram:RANGe:LOWer, CALCulate2:TRANsform:HISTogram:RANGe:UPPer commands are sent, when CALCulate2:TRANsform:HISTogram:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate2:TRANsform:HISTogram:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns a comma-seperated lower range value, upper range value, number of measurements counted, and bin data. Note that the bin data includes, in order:

- Number of measurements less than the lower range value

- Number of measurements in the each of the CALCulate2:TRANsform:HISTogram:POINts bins, starting at the lower range value bin

- Number of measurements greater than the upper range value

The range values are returned in the form +1.00000000000000E+006. The number of measurements and bin data are returned in the form +100.

Examples

The following example enables an automatically scaled, 128-bin histogram computation of 1000 frequency measurements and returns the computed histogram, including the lower and upper range values, the total measurement count, and the bin data. The automatic scaling is based on the first 100 measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 1000
```

CALCulate2:TRANsform:HISTogram:ALL?

```
CALC2:TRAN:HIST:RANG:AUTO ON
CALC2:TRAN:HIST:RANG:AUTO:COUN 100
CALC2:TRAN:HIST:POIN 128
CALC2:TRAN:HIST:STAT ON
INIT
*WAI
CALC2:TRAN:HIST:ALL?
```

Typical Response: +9.99383828200000E+006,+1.00513398300000E+006,+1000,*<102 bin counts>*

See Also

CALCulate2:TRANsform:HISTogram:COUNt?

CALCulate2:TRANsform:HISTogram:DATA?

CALCulate2:TRANsform:HISTogram:RANGe:LOWer?

CALCulate2:TRANsform:HISTogram:RANGe:UPPer

CALCulate2:TRANsform:HISTogram:STATe

CALCulate2:TRANsform:HISTogram:ALL?

Syntax

CALCulate2:TRANsform:HISTogram:ALL?

Description

This query returns the lower and upper range values, the number of measurements, and the bin data collected the last time the histogram data was cleared.

Remarks

- You can read the histogram at any time.
- The instrument clears the histogram data when the CALCulate2:TRANsform:HISTogram:POINts, CALCulate2:TRANsform:HISTogram:RANGe:AUTO, CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt, CALCulate2:TRANsform:HISTogram:RANGe:LOWer, CALCulate2:TRANsform:HISTogram:RANGe:UPPer commands are sent, when CALCulate2:TRANsform:HISTogram:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate2:TRANsform:HISTogram:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns a comma-seperated lower range value, upper range value, number of measurements counted, and bin data. Note that the bin data includes, in order:

- Number of measurements less than the lower range value

- Number of measurements in the each of the CALCulate2:TRANsform:HISTogram:POINts bins, starting at the lower range value bin

- Number of measurements greater than the upper range value

The range values are returned in the form +1.00000000000000E+006. The number of measurements and bin data are returned in the form +100.

Examples

The following example enables an automatically scaled, 128-bin histogram computation of 1000 frequency measurements and returns the computed histogram, including the lower and upper range values, the total measurement count, and the bin data. The automatic scaling is based on the first 100 measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 1000
```

CALCulate2:TRANsform:HISTogram:ALL?

```
CALC2:TRAN:HIST:RANG:AUTO ON
CALC2:TRAN:HIST:RANG:AUTO:COUN 100
CALC2:TRAN:HIST:POIN 128
CALC2:TRAN:HIST:STAT ON
INIT
*WAI
CALC2:TRAN:HIST:ALL?
```

Typical Response: +9.99383828200000E+006,+1.00513398300000E+006,+1000,*<102 bin counts>*

See Also

CALCulate2:TRANsform:HISTogram:COUNt?

CALCulate2:TRANsform:HISTogram:DATA?

CALCulate2:TRANsform:HISTogram:RANGe:LOWer?

CALCulate2:TRANsform:HISTogram:RANGe:UPPer

CALCulate2:TRANsform:HISTogram:STATe

CALCulate2:TRANsform:HISTogram:CLEar

Syntax

CALCulate2:TRANsform:HISTogram:CLEar[:IMMediate]

Description

This command clears the histogram data. If automatic scaling is enabled (CALCulate2:TRANsform:HISTogram:RANGe:AUTO ON set), the automatic scaling will be restarted.

Remarks

- The instrument clears the histogram data when the CALCulate2:TRANsform:HISTogram:POINts, CALCulate2:TRANsform:HISTogram:RANGe:AUTO, CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt, CALCulate2:TRANsform:HISTogram:RANGe:LOWer, CALCulate2:TRANsform:HISTogram:RANGe:UPPer commands are sent, when CALCulate2:TRANsform:HISTogram:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate2:TRANsform:HISTogram:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Examples

The following example clears the histogram data.

```
CALC2:TEAN:HIST:CLE
```

See Also

CALCulate2:TRANsform:HISTogram:STATe

CALCulate2:TRANsform:HISTogram:COUNt?

Syntax

CALCulate2:TRANsform:HISTogram:COUNt?

Description

This query returns the number of measurements collected since the last time the histogram data was cleared.

Remarks

- You can read the histogram data at any time.
- The instrument clears the histogram data when the CALCulate2:TRANsform:HISTogram:POINts, CALCulate2:TRANsform:HISTogram:RANGe:AUTO, CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt, CALCulate2:TRANsform:HISTogram:RANGe:LOWer, CALCulate2:TRANsform:HISTogram:RANGe:UPPer commands are sent, when CALCulate2:TRANsform:HISTogram:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate2:TRANsform:HISTogram:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the number of measurements counted in the current histogram data in the form +100.

Examples

The following example returns the number of measurements used to compute the current histogram data.

```
CALC2:TRAN:HIST:COUN?
```

Typical Response: +73

See Also

CALCulate2:TRANsform:HISTogram:ALL?
CALCulate2:TRANsform:HISTogram:STATe

CALCulate2:TRANsform:HISTogram:DATA?

Syntax

CALCulate2:TRANsform:HISTogram:DATA?

Description

This query returns the bin data collected since the last time the histogram data was cleared.

Remarks

- You can read the histogram data at any time.
- The instrument clears the histogram data when the CALCulate2:TRANsform:HISTogram:POINts, CALCulate2:TRANsform:HISTogram:RANGe:AUTO, CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt, CALCulate2:TRANsform:HISTogram:RANGe:LOWer, CALCulate2:TRANsform:HISTogram:RANGe:UPPer commands are sent, when CALCulate2:TRANsform:HISTogram:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate2:TRANsform:HISTogram:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns a comma-separated list of the bin data. The bin data includes, in order:

- Number of measurements less than the lower range value

- Number of measurements in the each of the CALCulate2:TRANsform:HISTogram:POINts bins, starting at the lower range value bin

- Number of measurements greater than the upper range value

The bin data is returned in the form +1,+2,+53,....

Examples

The following example enables an automatically scaled, 128-bin histogram computation of 1000 frequency measurements and returns the computed bin data. The automatic scaling is based on the first 100 measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 1000
 CALC2:TRAN:HIST:RANG:AUTO ON
 CALC2:TRAN:HIST:RANG:AUTO:COUN 100
 CALC2:TRAN:HIST:POIN 128
 CALC2:TRAN:HIST:STAT ON
```

CALCulate2:TRANsform:HISTogram:DATA?

```
INIT
*WAI
CALC2:TRAN:HIST:DATA?
```

Typical Response: *<102 bin counts>*

See Also

CALCulate2:TRANsform:HISTogram:ALL?

CALCulate2:TRANsform:HISTogram:STATe

CALCulate2:TRANsform:HISTogram:POINts

Syntax

CALCulate2:TRANsform:HISTogram:POINts {<*value*> | MINimum | MAXimum | DEFault}

CALCulate2:TRANsform:HISTogram:POINts? [{MINimum | MAXimum | DEFault}]

Description

This command sets the number of bins between the lower and upper range values for the histogram. Two additional bins always exist: one for measurements less than the lower range value and one for measurements greater than the upper range value.

Parameters

Name	Type	Range of Values	Default Value
<*value*>	Numeric	10 to 1000 MIN = 10 MAX = 1000	100

Remarks

- The lower and upper range values can be specified using the CALCulate2:TRANsform:HISTogram:RANGe:LOWer or CALCulate2:TRANsform:HISTogram:RANGe:UPPer commands. They are computed automatically if CALCulate2:TRANsform:HISTogram:RANGe:AUTO ON is set.
- The instrument sets the number of bins to 100 after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the number of bins in the form +100.

Examples

The following example enables an automatically scaled, 128-bin histogram computation of 1000 frequency measurements and returns the computed histogram, including the lower and upper range values, the total measurement count, and the bin data. The automatic scaling is based on the first 100 measurements.

```
CONF:FREQ 1.0E6,.001
SAMP:COUN 1000
CALC2:TRAN:HIST:RANG:AUTO ON
CALC2:TRAN:HIST:RANG:AUTO:COUN 100
CALC2:TRAN:HIST:POIN 128
```

CALCulate2:TRANsform:HISTogram:POINts

```
CALC2:TRAN:HIST:STAT ON
INIT
*WAI
CALC2:TRAN:HIST:ALL?
```

Typical Response: +9.99383828200000E+006,+1.00513398300000E+006,+1000,*<102 bin counts>*

See Also

CALCulate2:TRANsform:HISTogram:RANGe:AUTO

CALCulate2:TRANsform:HISTogram:RANGe:LOWer

CALCulate2:TRANsform:HISTogram:RANGe:UPPer

CALCulate2:TRANsform:HISTogram:STATe

CALCulate2:TRANsform:HISTogram:RANGe:AUTO

Syntax

CALCulate2:TRANsform:HISTogram:RANGe:AUTO {OFF | ON}

CALCulate2:TRANsform:HISTogram:RANGe:AUTO?

Description

This command enables or disables automatic selection of the lower and upper range values for the histogram.

- When enabled, the minimum and maximum values from the first CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt measurement will be selected as the lower and upper range values.

- When disabled, the lower and upper range values are specified by the CALCulate2:TRANsform:HISTogram:RANGe:LOWer and CALCulate2:TRANsform:HISTogram:RANGe:UPPer commands.

Remarks

- Setting the lower or upper range value (CALCulate2:TRANsform:HISTogram:RANGe:LOWer and CALCulate2:TRANsform:HISTogram:RANGe:UPPer commands) disables automatic selection of the lower and upper range values for the histogram.
- The instrument restarts automatic range value selection when the CALCulate2:TRANsform:HISTogram:POINts, CALCulate2:TRANsform:HISTogram:RANGe:AUTO, CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt, CALCulate2:TRANsform:HISTogram:RANGe:LOWer, CALCulate2:TRANsform:HISTogram:RANGe:UPPer commands are sent, when CALCulate2:TRANsform:HISTogram:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate2:TRANsform:HISTogram:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).
- The instrument enables automatic selection of the lower and upper range values after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current automatic selection state: 0 (OFF) or 1 (ON).

Examples

The following example enables an automatically scaled, 128-bin histogram computation of 1000 frequency measurements and returns the computed histogram, including the lower and upper range values,

CALCulate2:TRANsform:HISTogram:RANGe:AUTO

the total measurement count, and the bin data. The automatic scaling is based on the first 100 measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 1000
 CALC2:TRAN:HIST:RANG:AUTO ON
 CALC2:TRAN:HIST:RANG:AUTO:COUN 100
 CALC2:TRAN:HIST:POIN 128
 CALC2:TRAN:HIST:STAT ON
 INIT
 *WAI
 CALC2:TRAN:HIST:ALL?
```

Typical Response: +9.99383828200000E+006,+1.00513398300000E+006,+1000,*<102 bin counts>*

See Also

CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt

CALCulate2:TRANsform:HISTogram:RANGe:LOWer

CALCulate2:TRANsform:HISTogram:RANGe:UPPer

CALCulate2:TRANsform:HISTogram:STATe

CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt

Syntax

CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt {<*value*> | MINimum | MAXimum | DEFault}

CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt? [{MINimum | MAXimum | DEFault}]

Description

This command sets the number of measurements used for automatic selection of the lower and upper range values for the histogram.

Parameters

Name	Type	Range of Values	Default Value
<*value*>	Numeric	10 to 1000 MIN = 10 MAX = 1000	100

Remarks

- The instrument sets the number of measurements used for automatic range value selection to 100 after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the number of measurements used for automatic range value selection in the form +100.

Examples

The following example enables an automatically scaled, 128-bin histogram computation of 1000 frequency measurements and returns the computed histogram, including the lower and upper range values, the total measurement count, and the bin data. The automatic scaling is based on the first 100 measurements.

```
CONF:FREQ 1.0E6,.001
SAMP:COUN 1000
CALC2:TRAN:HIST:RANG:AUTO ON
CALC2:TRAN:HIST:RANG:AUTO:COUN 100
CALC2:TRAN:HIST:POIN 128
CALC2:TRAN:HIST:STAT ON
INIT
*WAI
CALC2:TRAN:HIST:ALL?
```

CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt

 Typical Response: +9.99383828200000E+006,+1.00513398300000E+006,+1000,*<102 bin counts>*

See Also

CALCulate2:TRANsform:HISTogram:RANGe:AUTO

CALCulate2:TRANsform:HISTogram:RANGe:LOWer

CALCulate2:TRANsform:HISTogram:RANGe:UPPer

CALCulate2:TRANsform:HISTogram:STATe

CALCulate2:TRANsform:HISTogram:RANGe:LOWer

Syntax

CALCulate2:TRANsform:HISTogram:RANGe:LOWer {<*value*> | MINimum | MAXimum | DEFault}

CALCulate2:TRANsform:HISTogram:RANGe:LOWer? [{MINimum | MAXimum | DEFault}]

Description

This command sets the lower range value for the histogram. Setting the lower range value disables automatic selection of the lower and upper range values for the histogram (sets CALCulate2:TRANsform:HISTogram:RANGe:AUTO to OFF).

If automatic range value selection is enabled (CALCulate2:TRANsform:HISTogram:RANGe:AUTO ON set), the query form will return the computed lower range value. If no histogram data exists, 9.91E37 (Not a Number) will be returned.

Parameters

Name	Type	Range of Values	Default Value
<*value*>	Numeric	-1.0E+15 to -1.0E-15, 0.0 +1.0E-15 to 1.0E+15 MIN = -1.0E+15 MAX = +1.0E+15	0.0

Remarks

- The lower and upper range values are computed automatically if CALCulate2:TRANsform:HISTogram:RANGe:AUTO ON is set.
- The instrument sets the lower range value to 0.0 after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the lower range value in the form +1.00000000000000E+006.

Examples

The following example enables an manually scaled, 128-bin histogram computation of 1000 frequency measurements and returns the computed histogram, including the lower and upper range values, the total measurement count, and the bin data.

```
CONF:FREQ 1.0E6,.001
SAMP:COUN 1000
CALC2:TRAN:HIST:RANG:AUTO OFF
```

CALCulate2:TRANsform:HISTogram:RANGe:LOWer

```
CALC2:TRAN:HIST:RANG:LOW 9.99E6
CALC2:TRAN:HIST:RANG:UPP 1.01E6
CALC2:TRAN:HIST:POIN 128
CALC2:TRAN:HIST:STAT ON
INIT
*WAI
CALC2:TRAN:HIST:ALL?
```

Typical Response: +9.99000000000000E+006,+1.01000000000000E+006,+1000,*<102 bin counts>*

See Also

CALCulate2:TRANsform:HISTogram:RANGe:AUTO

CALCulate2:TRANsform:HISTogram:RANGe:UPPer

CALCulate2:TRANsform:HISTogram:RANGe:UPPer

Syntax

CALCulate2:TRANsform:HISTogram:RANGe:UPPer {<*value*> | MINimum | MAXimum | DEFault}

CALCulate2:TRANsform:HISTogram:RANGe:UPPer? [{MINimum | MAXimum | DEFault}]

Description

This command sets the upper range value for the histogram. Setting the upper range value disables automatic selection of the lower and upper range values for the histogram (sets CALCulate2:TRANsform:HISTogram:RANGe:AUTO to OFF).

If automatic range value selection is enabled (CALCulate2:TRANsform:HISTogram:RANGe:AUTO ON set), the query form will return the computed upper range value. If no histogram data exists, 9.91E37 (Not a Number) will be returned.

Parameters

Name	Type	Range of Values	Default Value
<*value*>	Numeric	-1.0E+15 to -1.0E-15, 0.0 +1.0E-15 to 1.0E+15 MIN = -1.0E+15 MAX = +1.0E+15	0.0

Remarks

- The lower and upper range values are computed automatically if CALCulate2:TRANsform:HISTogram:RANGe:AUTO ON is set.
- The instrument sets the upper range value to 0.0 after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the upper range value in the form +1.00000000000000E+006.

Examples

The following example enables an manually scaled, 128-bin histogram computation of 1000 frequency measurements and returns the computed histogram, including the lower and upper range values, the total measurement count, and the bin data.

```
CONF:FREQ 1.0E6,.001
SAMP:COUN 1000
CALC2:TRAN:HIST:RANG:AUTO OFF
```

CALCulate2:TRANsform:HISTogram:RANGe:UPPer

```
CALC2:TRAN:HIST:RANG:LOW 9.99E6
CALC2:TRAN:HIST:RANG:UPP 1.01E6
CALC2:TRAN:HIST:POIN 128
CALC2:TRAN:HIST:STAT ON
INIT
*WAI
CALC2:TRAN:HIST:ALL?
```

Typical Response: +9.99000000000000E+006,+1.01000000000000E+006,+1000,*<102 bin counts>*

See Also

CALCulate2:TRANsform:HISTogram:RANGe:LOWer

CALCulate2:TRANsform:HISTogram:STATe

Syntax

CALCulate2:TRANsform:HISTogram[:STATe] {OFF | ON}

CALCulate2:TRANsform:HISTogram[:STATe]?

Description

This command enables or disables histogram computation.

Remarks

- The instrument clears the histogram data when the CALCulate2:TRANsform:HISTogram:POINts, CALCulate2:TRANsform:HISTogram:RANGe:AUTO, CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt, CALCulate2:TRANsform:HISTogram:RANGe:LOWer, CALCulate2:TRANsform:HISTogram:RANGe:UPPer commands are sent, when CALCulate2:TRANsform:HISTogram:STATe ON is sent, when the measurement function is changed, when the INITiate:IMMediate, MEASure? or READ? commands are executed, when the CALCulate2:TRANsform:HISTogram:CLEar command is executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).
- Histogram computation is disabled for continuous totalize since this computation requires more than one measurement to be useful.
- The CALCulate subsystem and the individual calculate functions are disabled for timestamp measurements.
- The instrument disables histogram computation after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current histogram computation state: 0 (OFF) or 1 (ON).

Examples

The following example enables an automatically scaled, 128-bin histogram computation of 1000 frequency measurements and returns the computed histogram, including the lower and upper range values, the total measurement count, and the bin data. The automatic scaling is based on the first 100 measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 1000
 CALC2:TRAN:HIST:RANG:AUTO ON
 CALC2:TRAN:HIST:RANG:AUTO:COUN 100
 CALC2:TRAN:HIST:POIN 128
 CALC2:TRAN:HIST:STAT ON
 INIT
```

CALCulate2:TRANsform:HISTogram:STATe

```
*WAI
CALC2:TRAN:HIST:ALL?
```

Typical Response: +9.99383828200000E+006,+1.00513398300000E+006,+1000,*<102 bin counts>*

See Also

CALibration Subsystem Introduction

The CALibration commands are used to calibrate the Keysight 53220A/230A.

| NOTE | For a more detailed discussion of the calibration procedures, see the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide. Please refer to the Service Guide before attempting to calibrate the instrument. Improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument. |

Command Summary

CALibration:ALL?
CALibration:COUNt?
CALibration:LEVel?
CALibration:SECurity:CODE
CALibration:SECurity:STATe
CALibration:SECurity:STATe?
CALibration:STRing
CALibration:STRing?
CALibration:VALue
CALibration:VALue?

Related Commands

*CAL?

CALibration:ALL?

Syntax

CALibration[:ALL]?

Description

This query performs a calibration of the instrument using the specified calibration value (CALibration:VALue command). Before you can calibrate the instrument, you must unsecure it by entering the correct security code.

> **NOTE**
>
> For a more detailed discussion of the calibration procedures, see the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide. Please refer to the Service Guide before attempting to calibrate the instrument. Improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Remarks

- If a calibration fails, "+1" is returned and an error is stored in the error queue. For a complete listing of the error messages related to calibration failures, see SCPI Error Messages.
- This query increments the calibration count on the counter (see CALibration:COUNt? command).

Return Format

The query returns +0 (calibration passed) or +1 (calibration failed).

Examples

The following example performs a calibration and returns a pass/fail indication.

```
CAL?
```

Typical Response: +0

See Also

CALibration:SECurity:STATe

CALibration:VALue

CALibration:COUNt?

Syntax

CALibration:COUNt?

Description

This query queries the instrument to determine how many calibrations have been performed. Note that your instrument was calibrated before it left the factory. When you receive your instrument, be sure to read the count to determine the initial values.

NOTE	For a more detailed discussion of the calibration procedures, see the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide. Please refer to the Service Guide before attempting to calibrate the instrument. Improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Remarks

- The calibration counts increment up to a maximum of over four billion (2^{32} - 1) after which they roll over to "0". Since the value increments by one for each calibration point, a complete calibration may increase the value by many counts. However, it is unlikely that the count will ever roll over due to the high maximum.
- The calibration count is incremented by the CALibration:ALL? and CALibration:LEVel3? commands. The calibration count is also incremented when a calibration override is performed (see the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide for more information). You can read the calibration count whether the instrument is secured or unsecured.
- The calibration count is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the calibration count indicating how many calibrations have been performed in the form +134.

Examples

The following example returns the calibration count.

```
CAL:COUN?
```

Typical Response: +739

CALibration:COUNt?

See Also

CALibration:ALL?

CALibration:LEVel3?

CALibration:LEVel3?

Syntax

CALibration:LEVel3? <frequency>, <power>

Description

This query performs a level calibration of channel 3 at the frequency specified. Before you can calibrate the instrument, you must unsecure it by entering the correct security code.

> **NOTE** For a more detailed discussion of the calibration procedures, see the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide. Please refer to the Service Guide before attempting to calibrate the instrument. Improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Parameters

Name	Type	Range of Values	Default Value
<frequency>	Numeric	See the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide	This is a required parameter
<power>	Numeric	See the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide	This is a required parameter

Remarks

- Refer to the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide for detailed procedures, including how to connect a calibration source, recommended equipment, the specified calibration points, and so forth.
- If a calibration fails, "+1" is returned and an error is stored in the error queue. For a complete listing of the error messages related to calibration failures, see SCPI Error Messages.
- This query increments the calibration count on the counter (see CALibration:COUNt? command).

Return Format

The query returns +0 (level calibration passed) or +1 (level calibration failed).

Examples

The following example performs a level calibration and returns a pass/fail indication.

```
CAL:LEV3? 1.0E9,-27
```

Typical Response: +0

CALibration:LEVel3?

CALibration:SECurity:STATe

CALibration:SECurity:CODE

Syntax

CALibration:SECurity:CODE <*new_code*>

Description

This command allows you to enter a new security code to prevent accidental or unauthorized calibrations. The specified code is used to unsecure calibration memory. To change the security code, you must first unsecure calibration memory using the old security code, and then enter a new code.

NOTE	For a more detailed discussion of the calibration procedures, see the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide. Please refer to the Service Guide before attempting to calibrate the instrument. Improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Parameters

Name	Type	Range of Values	Default Value
<*new_code*>	Unquoted ASCII String	A string of up to 12 characters. You do not have to use all 12 characters but the first character must always be a letter (A-Z). The remaining 11 characters can be letters, numbers (0-9), or the underscore character ("_"). Blank spaces are not allowed.	This is a required parameter

Remarks

- If you forget your security code, you can override the security feature. See the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide for more information.
- The security code is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

Examples

The following example sets a new calibration security code (calibration memory must be unsecured).

```
CAL:SEC:CODE TEST_DUT165
```

See Also

CALibration:SECurity:STATe

CALibration:SECurity:STATe

Syntax

CALibration:SECurity:STATe {OFF | ON}, ‹ *code* ›

CALibration:SECurity:STATe?

Description

This command unsecures or secures the instrument for calibration. To unsecure the instrument, you must provide a security code to prevent accidental or unauthorized calibrations of the instrument. Before you can calibrate the instrument, you must unsecure it by entering the correct security code.

| NOTE | For a more detailed discussion of the calibration procedures, see the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide. Please refer to the Service Guide before attempting to calibrate the instrument. Improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument. |

Parameters

Name	Type	Range of Values	Default Value
‹code›	Unquoted ASCII String	A string of up to 12 characters. You do not have to use all 12 characters but the first character must always be a letter (A-Z). The remaining 11 characters can be letters, numbers (0-9), or the underscore character ("_"). Blank spaces are not allowed.	This parameter is required to disable security, but is optional to enable security (but must be correct if provided).

Remarks

- Once you enter a security code, that code must be used for both front-panel and remote-interface calibration. For example, if you secure the instrument from the front panel, you must use that same code to unsecure it from the remote interface.
- Unsecuring the instrument using this command enables the instrument to be calibrated.
- Changing the instrument's calibration secure state using this command does not increment the calibration count (CALibration:COUNt? command).
- To calibrate the Keysight 53220A/230A, use the CALibration:VALue and CALibration? commands.
- The calibration security setting is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current calibration security setting: 0 (OFF) or 1 (ON).

Examples

The following example unsecures the instrument using the factory default security code.

```
CAL:SEC:STAT OFF,TEST_DUT165
```

The following example returns the current calibration security setting.

```
CAL:SEC:STAT?
```

Typical Response: 0

See Also

CALibration:SECure:CODE

CALibration:STRing

Syntax

CALibration:STRing "*<string>*"

CALibration:STRing?

Description

This command allows you to store one message in calibration memory. For example, you can store such information as the date when the last calibration was performed, the date when the next calibration is due, the instrument's serial number, or even the name and phone number of the person to contact for a new calibration.

> **NOTE**   For a more detailed discussion of the calibration procedures, see the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide. Please refer to the Service Guide before attempting to calibrate the instrument. Improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Parameters

Name	Type	Range of Values	Default Value
< string >	Quoted String	A string of up to 40 characters enclosed in quotes. You can use letters (A-Z), numbers (0-9), and special characters like "@", "%", "*", etc.	This is a required parameter

Remarks

- You can record a calibration message *only* from the remote interface and *only* when the instrument is unsecured (see CALibration:SECurity:STATe OFF command). You can read the message from either the front-panel or over the remote interface. You can read the calibration message whether the instrument is secured or unsecured.
- Storing a calibration message will overwrite any message previously stored in memory.
- The calibration message is stored in non-volatile calibration memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns an ASCII string enclosed in double quotes. If no calibration message has been specified, an empty quoted string ("") is returned.

Examples

The following example stores a message in calibration memory.

```
CAL:STR "CAL: 21 Nov 2009"  or  CAL:STR 'CAL: 21 Nov 2009'
```

The following example returns the message currently stored in calibration memory.

```
CAL:STR?
```

Typical Response: "CAL: 21 Nov 2005"

See Also

CALibration:SECurity:STATe

CALibration:VALue

Syntax

CALibration:VALue <*value*>

CALibration:VALue?

Description

This command specifies the value of the known calibration signal.

| NOTE | For a more detailed discussion of the calibration procedures, see the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide. Please refer to the Service Guide before attempting to calibrate the instrument. Improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument. |

Parameters

Name	Type	Range of Values	Default Value
<value>	Numeric	See the Keysight 53220A/230A *350MHz Universal Counter/Timer Service Guide*	This is a required parameter

Remarks

- Refer to the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide for detailed procedures, including how to connect a calibration source, recommended equipment, the specified calibration points, and so forth.

Return Format

The query returns the calibration value in the form +1.00000000000000E+007.

Examples

The following example sets calibration value to +10.000010E6.

```
CAL:VAL 10.000010E6
```

The following example returns the present calibration value.

```
CAL:VAL?
```

Typical Response: +1.00010100000000E+007

See Also

CALibration:ALL?

CONFigure Subsystem Introduction

The CONFigure command provides the most concise way to program the instrument for measurements. When you execute this command, the instrument uses default values for the requested measurement configuration (same as the MEASure? command). However, the measurement *is not* automatically started and you can change some measurement attributes before actually initiating the measurement. This allows you to incrementally change the instrument's configuration from the default conditions.

| NOTE | Use the INITiate:IMMediate or READ? command to start the measurement. |

Command Summary

CONFigure?
CONFigure:FREQuency
CONFigure:FREQuency:RATio
CONFigure:FREQuency:BURSt
CONFigure:FREQuency:PRF
CONFigure:FREQuency:PRI
CONFigure:PERiod
CONFigure:SPERiod
CONFigure:TINTerval
CONFigure:FTIMe
CONFigure:RTIMe
CONFigure:NDUTycycle
CONFigure:PDUTycycle
CONFigure:NWIDth
CONFigure:PWIDth
CONFigure:NWIDth:BURSt
CONFigure:PWIDth:BURSt
CONFigure:PHASe
CONFigure:TOTalize:CONTinuous
CONFigure:TOTalize:TIMed
CONFigure:ARRay:TSTamp

Default Settings for the CONFigure Command

With the CONFigure command, you can select the function, range, and resolution all in one command. All other measurement parameters are set to their default values as shown below.

Measurement Parameter:	CONFigure Setting:
Input configuration	Range, low-pass filtering, coupling, impedance, noise rejection are unchanged. See the CONFigure commands for the different measurement functions for information about level and slope.

Frequency Mode	AUTO for frequency, frequency ratio, or average period, PRF or PRI measurements. Unchanged otherwise.
<function> Gate Source	Depends on measurement function. See the CONFigure commands for the different measurement functions for details.
Gate Start Source	IMMediate
Gate Start Delay	TIME, 0 sec
Gate Stop Source	IMMediate
Gate Stop Holdoff	TIME, 0 sec
Gate Start and Stop Slope	NEGative
External Gate Source	Gate In/Out BNC
Burst Gate Auto	Enabled
Burst Gate Delay	0.0
Burst Gate Time	1 uS
Narrow Pulse Mode	Disabled
Samples per Trigger	1 sample, except for the CONFigure:ARRay:TSTamp command, which sets this value to the <*count*> parameter for this command.
Trigger Count	1 trigger
Trigger Delay	0 sec
Trigger Source	IMMediate
Trigger Slope	NEGative
Timestamp Rate	1.0E6
CALCulate subsystems	Disabled, including the individual calculate functions. The other parameters are unchanged.
Reference Oscillator	Unchanged
STATus, DATA, and FORMat sub-systems	Unchanged
Auto-level Frequency	Unchanged
Measurement Timeout	Unchanged

Using the CONFigure Command

The following program segment shows how to use the CONFigure command with the READ? command to make an externally-triggered measurement. The CONFigure command configures the instrument for frequency measurements. Note that the CONFigure command does *not* place the instrument in the "wait-for-trigger" state.

CONFigure Subsystem Introduction

The READ? command places the instrument in the "wait-for-trigger" state, initiates a measurement when the rear-panel Trig In BNC is pulsed (low by default), stores the measurement in memory, and then transfers the measurement to the instrument's output buffer. The default measurement configuration is used for the measurement.

```
CONF:FREQ
TRIG:SOUR EXT
READ?
```

 Typical Response: +4.27150000000000E+006

The following program segment is similar to the previous example but it uses the INITiate command to place the instrument in the "wait-for-trigger" state. The INITiate command places the instrument in the "wait-for-trigger" state, initiates a measurement when the rear-panel Trig In BNC is pulsed (low by default), and sends the measurement to reading memory. The FETCh? command transfers the measurement from reading memory to the instrument's output buffer.

```
CONF:FREQ
TRIG:SOUR EXT
INIT
FETC?
```

 Typical Response: +4.27380000000000E+006

Storing measurements in memory using the INITiate command is faster than sending measurements to the output buffer using the READ? command (provided you do not send the FETCh? command until done). The INITiate command is also an "overlapped" command. This means that after executing the INITiate command, you can send other commands that do not affect the measurements. *This allows you to check for data availability before initiating a read attempt that might otherwise time out.* Note that the FETCh? command will wait until all measurements are complete to terminate. The instrument can store up to 1,000,000 measurements in internal reading memory.

The following program segment configures the instrument for frequency measurements, triggers the instrument to make one measurement using the INITiate command, and then stores the measurement in memory.

```
CONF:FREQ 1.2E6,1
INIT
FETC?
```

 Typical Response: +1.23239300000000E+006

CONFigure:ARRay:TSTamp

Syntax

CONFigure:ARRay:TSTamp [(<count>) [,<channel>]]

Description

This command sets all measurement parameters and trigger parameters to default values for timestamp measurements at a nominal 1 MHz timestamp rate. The <*count*> parameter specifies how many timestamps are to be returned.

Parameters

Name	Type	Range of Values	Default Value
<count>	numeric	1 to 1,000,000 MIN = 1 MAX = 1,000,000	100
<channel(s)>	Expression(s)	(@1) | (@2) | (@3)	(@1)

Remarks

- **Available only on the Keysight 53230A.**
- Note the parentheses around the <count> parameter. These are required by the SCPI standard.
- For channel 1 or 2, the input channel is configured for auto-leveling at 50% with a positive slope.
- SAMPle:COUNt is set to the value of <count>.
- The trigger count setting (TRIGger:COUNt) is ignored when making timestamp measurements. Only one trigger will be accepted for each READ? or INITiate[:IMMediate] command.
- The SENSe:GATE subsystem is not used when making timestamp measurements. The measurements will start immediately after a trigger and trigger delay.
- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument to make 1,000 timestamp measurements on channel 1 at a nominal 1 MHz rate, makes the measurements, and then transfers the prescaler value followed by the measurements to the instrument output buffer.

```
CONF:TST (1000)
TST:RATE 1E6
READ?
```

Typical Response: +100,+5.10520000000000E-006,+5.10370000000000E-006, ... *(1,000 timestamps)*

CONFigure:ARRay:TSTamp

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

CONFigure:FREQuency

Syntax

CONFigure:FREQuency [{<*expected*> | MINimum | MAXimum | DEFault} [,{<*resolution*> | MINimum | MAXimum | DEFault}]] [,<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for frequency measurements.

Parameters

Name	Type	Range of Values	Default Value
<*expected*>	Numeric	Channels 1 & 2: 0.1 Hz to 350 MHz MIN = .1 Hz MAX = 350 MHz Channel 3: Option 106: 100 MHz to 6.0 GHz MIN = 100 MHz MAX = 6.0 GHz Option 115: 300 MHz to 15.0 GHz MIN = 300 MHz MAX = 15.0 GHz	Channels 1 & 2: 10 MHz Channel 3: 500 MHz
<*resolution*>	Numeric	1.0E-15 * <*expected*> to 1.0E-5* <*expected*> MIN = $1.0E-15 * <expected>$ MAX = $1.0E-5 * <expected>$	Value corresponding to .1 second gate time
<channel>	Expression	(@1) | (@2) | (@3)	(@1)

Remarks

- If <expected> is greater than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command), the input channel is configured for auto-leveling at 50% with a positive slope. Otherwise, the input channel is configured to use the currently programmed input threshold voltage and slope (see INPut:LEVel and INPut:SLOPe) with auto-leveling disabled.
- As defined in the SCPI standard, <*resolution*> must be specified in absolute frequency (hertz), not as a fraction of the input signal frequency.
- The gate source (see SENSe:FREQuency:GATE:SOURCE) is set to TIME.

CONFigure:FREQuency

- The counter uses the ‹*expected*› and ‹*resolution*› parameters to configure the setting for the SENSe:FREQuency:GATE:TIME command. The table below shows the relationship between relative resolution and gate time in seconds, where relative resolution = ‹*resolution*› / ‹*expected*›.

Relative Resolution	Gate Time (53220A)	Gate Time (53230A)
≤ 1.1E-14	1000 sec	1000 sec
>1.1E-14 to ≤1.1E-13	1000 sec	100 sec
>1.1E-13 to ≤1.1E-12	100 sec	10 sec
>1.1E-12 to ≤1.1E-11	10 sec	1 sec
>1.1E-11 to ≤1.1E-10	1 sec	100 msec
>1.1E-10 to ≤1.1E-9	100 msec	10 msec
>1.1E-9 to ≤1.1E-8	10 msec	1 msec
>1.1E-8 to ≤1.1E-7	1 msec	100 usec
>1.1E-7 to ≤1.1E-6	100 usec	10 usec
>1.1E-6	100 usec	1 usec

- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for frequency measurements on channel 1 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:FREQ
SAMP:COUN 2
READ?
```

Typical Response: +1.00230000000000E+007,+1.00170000000000E+007

The following example configures the instrument for 10-digit frequency measurements of an approximately 250 MHz signal on channel 2, makes one measurement using an external trigger, and then transfers the measurement to the instrument output buffer.

```
CONF:FREQ 250E6,1e-4,(@2)
TRIG:SOUR EXT;SLOP POS
INIT
FETCH?
```

Typical Response: +2.50513398300000E+008

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

SENSe:FREQuency:GATE:SOURce

SENSe:FREQuency:GATE:TIME

CONFigure:FREQuency:BURSt

Syntax

CONFigure:FREQuency:BURSt [<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values to measure the carrier frequency of a burst (pulse frequency).

Parameters

Name	Type	Range of Values	Default Value
<channel>	Expression	(@3)	(@3)

Remarks

- ***Available only on the Keysight 53230A. Requires option 150.***

- CONFigure and MEASure disable narrow burst mode. Because of this, measurements will return 9.91E37 (Not a Number) for bursts shorter than 10 microseconds. For such bursts, you should enable narrow burst mode by sending SENSe:FREQuency:BURSt:GATE:NARRow ON before starting measurements.
- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for burst frequency measurements on channel 3 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:FREQ:BURS
SAMP:COUN 2
READ?
```

Typical Response: +1.00230000000000E+009,+1.00170000000000E+009

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

SENSe:FREQuency:BURSt:GATE:NARRow

CONFigure:FREQuency:PRF

Syntax

CONFigure:FREQuency:PRF [{<*expected*> | MINimum | MAXimum | DEFault} [,{<*resolution*> | MINimum | MAXimum | DEFault}]] [,<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for pulse repetition frequency measurements.

Parameters

Name	Type	Range of Values	Default Value
<*expected*>	Numeric	1 Hz to 10 MHz MIN = 1 Hz MAX = 10 MHz	1 kHz
<*resolution*>	Numeric	1.0E-15 * <*expected*> to 1.0E-5* <*expected*> MIN = 1.0E-15 * <*expected*> MAX = 1.0E-5 * <*expected*>	Value corresponding to .1 second gate time
<channel>	Expression	(@3)	(@3)

Remarks

- *Available only on the Keysight 53230A. Requires option 150.*

- As defined in the SCPI standard, <*resolution*> must be specified in absolute frequency (hertz), not as a fraction of the input signal frequency.
- The gate source (see SENSe:FREQuency:GATE:SOURCE) is set to TIME.
- The counter uses the <*expected*> and <*resolution*> parameters to configure the setting for the SENSe:FREQuency:GATE:TIME command. The table below shows the relationship between relative resolution and gate time in seconds, where relative resolution = <*resolution*> / <*expected*>.

Relative Resolution	Gate Time (53230A)
≤ 1.1E-14	1000 sec
>1.1E-14 to ≤1.1E-13	100 sec
>1.1E-13 to ≤1.1E-12	10 sec
>1.1E-12 to ≤1.1E-11	1 sec
>1.1E-11 to ≤1.1E-10	100 msec
>1.1E-10 to ≤1.1E-9	10 msec
>1.1E-9 to ≤1.1E-8	1 msec

>1.1E-8 to ≤1.1E-7	100 usec
>1.1E-7 to ≤1.1E-6	10 usec
>1.1E-6	1 usec

- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for pulse repetition frequency measurements on chan-nel 3 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:FREQ:PRF (@3)
SAMP:COUN 2
READ?
```

Typical Response: +1.00230000000000E+003,+1.00170000000000E+003

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

SENSe:FREQuency:GATE:SOURce

SENSe:FREQuency:GATE:TIME

CONFigure:FREQuency:PRI

Syntax

CONFigure:FREQuency:PRI [{<*expected*> | MINimum | MAXimum | DEFault} [,{<*resolution*> | MINimum | MAXimum | DEFault}]] [,<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for pulse repetition interval measurements.

Parameters

Name	Type	Range of Values	Default Value
<*expected*>	Numeric	100 nsec to 1 sec MIN = 100 nsec MAX = 1 sec	.001 sec
<*resolution*>	Numeric	1.0E-15 * <*expected*> to 1.0E-5* <*expected*> MIN = 1.0E-15 * <*expected*> MAX = 1.0E-5 * <*expected*>	Value corresponding to .1 second gate time
<channel>	Expression	(@3)	(@3)

Remarks

- ***Available only on the Keysight 53230A. Requires option 150.***

- As defined in the SCPI standard, <*resolution*> must be specified in absolute frequency (hertz), not as a fraction of the input signal frequency.
- The gate source (see SENSe:FREQuency:GATE:SOURCE) is set to TIME.
- The counter uses the <*expected*> and <*resolution*> parameters to configure the setting for the SENSe:FREQuency:GATE:TIME command. The table below shows the relationship between relative resolution and gate time in seconds, where relative resolution = <*resolution*> / <*expected*>.

Relative Resolution	Gate Time (53230A)
≤ 1.1E-14	1000 sec
>1.1E-14 to ≤1.1E-13	100 sec
>1.1E-13 to ≤1.1E-12	10 sec
>1.1E-12 to ≤1.1E-11	1 sec
>1.1E-11 to ≤1.1E-10	100 msec
>1.1E-10 to ≤1.1E-9	10 msec
>1.1E-9 to ≤1.1E-8	1 msec

>1.1E-8 to ≤1.1E-7	100 usec
>1.1E-7 to ≤1.1E-6	10 usec
>1.1E-6	1 usec

- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for pulse repetition interval measurements on channel 3 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:FREQ:PRI (@3)
SAMP:COUN 2
READ?
```

Typical Response: +1.00230000000000E-003,+1.00170000000000E-003

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

SENSe:FREQuency:GATE:SOURce

SENSe:FREQuency:GATE:TIME

CONFigure:FREQuency:RATio

Syntax

CONFigure:FREQuency:RATio [{<*expected*> | MINimum | MAXimum | DEFault} [,{<*resolution*> | MINimum | MAXimum | DEFault}]] [,<channel_pair>]

Description

This command sets all measurement parameters and trigger parameters to default values for frequency ratio measurements between two channels.

Parameters

Name	Type	Range of Values	Default Value
<*expected*>	Numeric	Ch1/Ch2, Ch2/Ch1: 2.8E-10 to 3.5E+9 MIN = 2.8E-10 MAX = 3.5E+9 Ch1/Ch3, Ch2/Ch3 Option 106: 1.6E-11 to 3.5 MIN = 1.6E-11 MAX = 3.5 Option 115: 6.6E-12 to 1.2 MIN = 6.6E-12 MAX = 1.2 Ch3/Ch1, Ch3/Ch2: Option 106: 0.28 to 6.0E10 MIN = .28 MAX = 6.0E10 Option 115: 0.85 to 15.0E10 MIN = .85 MAX = 15.0E10	1.0
<*resolution*>	Numeric	1.0E-15 * <*expected*> to 1.0E-5* <*expected*> MIN = 1.0E-15 * <*expected*> MAX = 1.0E-5 * <*expected*>	Value corresponding to .1 second gate time
<channel_pair>	Pair of Expressions	(@1),(@2) | (@1),(@3) | (@2),(@1) | (@2),(@3) | (@3),(@1) | (@3),(@2)	(@1),(@2)

Remarks

- <expected> is the expected value of the ratio, not of either individual input frequency.
- As defined in the SCPI standard, <*resolution*> must be specified in absolute frequency (hertz), not as a fraction of the input signal frequency.
- The frequency of the first channel in the channel pair is used as the numerator of the ratio; the second channel as the denominator.
- The input channels are configured for auto-leveling at 50% with a positive slope.
- The gate source (see SENSe:FREQuency:GATE:SOURCE) is set to TIME.
- The counter uses the <*expected*> and <*resolution*> parameters to configure the setting for the SENSe:FREQuency:GATE:TIME command. The table below shows the relationship between relative resolution and gate time in seconds, where relative resolution = <*resolution*> / <*expected*>.

Relative Resolution	Gate Time (53220A)	Gate Time (53230A)
≤ 1.1E-14	1000 sec	1000 sec
>1.1E-14 to ≤1.1E-13	1000 sec	100 sec
>1.1E-13 to ≤1.1E-12	100 sec	10 sec
>1.1E-12 to ≤1.1E-11	10 sec	1 sec
>1.1E-11 to ≤1.1E-10	1 sec	100 msec
>1.1E-10 to ≤1.1E-9	100 msec	10 msec
>1.1E-9 to ≤1.1E-8	10 msec	1 msec
>1.1E-8 to ≤1.1E-7	1 msec	100 usec
>1.1E-7 to ≤1.1E-6	100 usec	10 usec
>1.1E-6	100 usec	1 usec

- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for frequency ratio measurements between channel 1 and channel 2 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:FREQ:RAT
SAMP:COUN 2
READ?
```

Typical Response: +1.00230000000000E+001,+1.00190000000000E+001

The following example configures the instrument for 10-digit frequency ratio measurements between channel 2 and channel 1, makes one measurement using an external trigger, and then transfers the measurement to the instrument output buffer.

```
CONF:FREQ:RAT 1.2,1e-10,(@2),(@1)
TRIG:SOUR EXT;SLOP POS
```

CONFigure:FREQuency:RATio

```
INIT
FETCH?
```

Typical Response: +1.21513398300000E+001

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

SENSe:FREQuency:GATE:SOURce

SENSe:FREQuency:GATE:TIME

CONFigure:FTIMe

Syntax

CONFigure:FTIMe [{<lower_*reference*> | MINimum | MAXimum | DEFault} [,{<upper_*reference*> | MINimum | MAXimum | DEFault}]] [,<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for fall time measurements.

Parameters

Name	Type	Range of Values	Default Value
<lower_*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	10 PCT
<upper_*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	90 PCT
<channel>	Expression	(@1)	(@2)	(@1)

Remarks

- The <lower_reference> and <upper_reference> parameters specify the input signal reference level, either in terms of percent of peak-to-peak voltage, or in absolute voltage. To specify the level in percent, use a numeric value with no suffix or with the PCT suffix; for example, 30 or 30 PCT. To specify the level in absolute voltage, use a numeric value with the V or MV (millivolt) suffix: 100 MV or .1V.
- When either <lower_reference> or <upper_reference> is omitted or specified in percent, auto-leveling is enabled. When specified in absolute voltage, auto-leveling is disabled.
- If <lower_reference> is greater than <upper_reference>, no error is generated, but the measurement result is undefined.
- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for fall time measurements on channel 1 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

CONFigure:FTIMe

```
CONF:FTIM
SAMP:COUN 2
READ?
```

Typical Response: +5.10520000000000E-006,+5.10360000000000E-006

The following example configures the instrument for fall time measurements on channel 2 with 20% and 80% reference levels, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
CONF:FTIM 20,80,(@2)
READ?
```

Typical Response: +5.02573000000000E-006

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

CONFigure:NDUTycycle

Syntax

CONFigure:NDUTycycle [{<*reference*> | MINimum | MAXimum | DEFault}] [,<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for negative duty cycle measurements.

Parameters

Name	Type	Range of Values	Default Value
<*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	50 PCT
<channel>	Expression	(@1) | (@2)	(@1)

Remarks

- The <reference> parameter specifies the input signal reference level, either in terms of percent of peak-to-peak voltage, or in absolute voltage. To specify the level in percent, use a numeric value with no suffix or with the PCT suffix; for example, 30 or 30 PCT. To specify the level in absolute voltage, use a numeric value with the V or MV (millivolt) suffix: 100 MV or .1V.
- When the <reference> is omitted or specified in percent, auto-leveling is enabled. When specified in absolute voltage, auto-leveling is disabled.
- Use READ? or INITiate[:IMMediate] to start the measurement.
- Measurements are returned as a fraction (not as percent).

Examples

The following example configures the instrument for duty cycle measurements on channel 1 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:NDUT
SAMP:COUN 2
READ?
```

Typical Response: +5.10520000000000E-001,+5.10370000000000E-001

CONFigure:NDUTycycle

The following example configures the instrument for duty cycle measurements on channel 2 with a 1.2V reference level, makes one measurement using an external trigger, and then transfers the measurement to the instrument output buffer.

```
CONF:NDUT 1.2V,(@2)
TRIG:SOUR EXT;SLOP POS
INIT
FETCH?
```

Typical Response: +4.82342300000000E+001

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

CONFigure:NWIDth

Syntax

CONFigure:NWIDth [{<*reference*> | MINimum | MAXimum | DEFault}] [,<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for negative pulse width measurements.

Parameters

Name	Type	Range of Values	Default Value
<*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	50 PCT
<channel>	Expression	(@1) | (@2)	(@1)

Remarks

- The <reference> parameter specifies the input signal reference level, either in terms of percent of peak-to-peak voltage, or in absolute voltage. To specify the level in percent, use a numeric value with no suffix or with the PCT suffix; for example, 30 or 30 PCT. To specify the level in absolute voltage, use a numeric value with the V or MV (millivolt) suffix: 100 MV or .1V.
- When the <reference> is omitted or specified in percent, auto-leveling is enabled. When specified in absolute voltage, auto-leveling is disabled.
- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for pulse width measurements on channel 1 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:NWID
SAMP:COUN 2
READ?
```

Typical Response: +5.10520000000000E-006,+5.10370000000000E-006

CONFigure:NWIDth

The following example configures the instrument for pulse width measurements on channel 2 with a 1.2V reference level, makes one measurement using an external trigger, and then transfers the measurement to the instrument output buffer.

```
CONF:NWID 1.2V,(@2)
TRIG:SOUR EXT;SLOP POS
INIT
FETC?
```

Typical Response: +4.82342300000000E-006

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

CONFigure:NWIDth:BURSt

Syntax

CONFigure:NWIDth:BURSt [<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for negative ("off time") width measurements of a pulsed input signal.

Parameters

Name	Type	Range of Values	Default Value
<channel>	Expression	(@3)	(@3)

Remarks

- ***Available only on the Keysight 53230A. Requires option 150.***

- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for pulse width measurements on channel 3 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:NWID:BURS
SAMP:COUN 2
READ?
```

Typical Response: +5.10520000000000E-006,+5.10370000000000E-006

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

CONFigure:PDUTycycle

Syntax

CONFigure:PDUTycycle [{<*reference*> | MINimum | MAXimum | DEFault}] [,<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for positive duty cycle measurements.

Parameters

Name	Type	Range of Values	Default Value
<*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	50 PCT
<channel>	Expression	(@1) | (@2)	(@1)

Remarks

- The <reference> parameter specifies the input signal reference level, either in terms of percent of peak-to-peak voltage, or in absolute voltage. To specify the level in percent, use a numeric value with no suffix or with the PCT suffix; for example, 30 or 30 PCT. To specify the level in absolute voltage, use a numeric value with the V or MV (millivolt) suffix: 100 MV or .1V.
- When the <reference> is omitted or specified in percent, auto-leveling is enabled. When specified in absolute voltage, auto-leveling is disabled.
- Use READ? or INITiate[:IMMediate] to start the measurement.
- Measurements are returned as a fraction (not as percent).

Examples

The following example configures the instrument for pulsed duty cycle measurements on channel 1 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:PDUT
SAMP:COUN 2
READ?
```

Typical Response: +5.10520000000000E-001,+5.10370000000000E-001

The following example configures the instrument for pulsed duty cycle measurements on channel 2 with a 1.2V reference level, makes one measurement using an external trigger, and then transfers the measurement to the instrument output buffer.

```
CONF:PDUT 1.2V,(@2)
TRIG:SOUR EXT;SLOP POS
INIT
FETC?
```

Typical Response: +4.82342300000000E-001

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

CONFigure:PERiod

Syntax

CONFigure:PERiod [{<*expected*> | MINimum | MAXimum | DEFault} [,{<*resolution*> | MINimum | MAXimum | DEFault}]] [,<channel>]

Description

This command sets all measurement parameters and trigger parameters default values for average period measurements.

Parameters

Name	Type	Range of Values	Default Value
<*expected*>	Numeric	Channels 1 & 2: 2.8 nsec to 10 sec MIN = 2.8 nsec MAX = 10 sec Channel 3: Option 106: 160 pS to 10 nS MIN = 160 pS MAX = 10 nS Option 115: 66 pS to 3.33 nS MIN = 66 pS MAX = 3.33 nS	Channels 1 & 2: 100 nsec Channel 3: 2 nS
<*resolution*>	Numeric	Channels 1 & 2: 1.0E-15 * <*expected*> to 1.0E-5* <*expected*> MIN = 1.0E-15 * <*expected*> MAX = 1.0E-5 * <*expected*>	Value corresponding to .1 second gate time
<channel>	Expression	(@1)	(@2)	(@3)	(@1)

Remarks

- This command configures an averaging measurement. To configure a single-period measurement, use CONFigure:SPERiod.
- If <expected> corresponds to a frequency greater than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command), the input channel is configured for auto-leveling at 50% with a positive slope. Otherwise, the input channel is configured to use the currently programmed input threshold voltage and slope (see INPut:LEVel and INPut:SLOPe) with auto-leveling disabled.

- As defined in the SCPI standard, ‹*resolution*› must be specified in absolute time (seconds), not as a fraction of the input signal period.
- The gate source (see SENSe:FREQuency:GATE:SOURCE) is set to TIME.

- The counter uses the ‹*expected*› and ‹*resolution*› parameters to configure the setting for the SENSe:FREQuency:GATE:TIME command. The table below shows the relationship between relative resolution and gate time in seconds, where relative resolution = ‹*resolution*› / ‹*expected*›.

Relative Resolution	Gate Time (53220A)	Gate Time (53230A)
≤ 1.1E-14	1000 sec	1000 sec
>1.1E-14 to ≤1.1E-13	1000 sec	100 sec
>1.1E-13 to ≤1.1E-12	100 sec	10 sec
>1.1E-12 to ≤1.1E-11	10 sec	1 sec
>1.1E-11 to ≤1.1E-10	1 sec	100 msec
>1.1E-10 to ≤1.1E-9	100 msec	10 msec
>1.1E-9 to ≤1.1E-8	10 msec	1 msec
>1.1E-8 to ≤1.1E-7	1 msec	100 usec
>1.1E-7 to ≤1.1E-6	100 usec	10 usec
>1.1E-6	100 usec	1 usec

- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for average period measurements on channel 1 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:PER
SAMP:COUN 2
READ?
```

Typical Response: +1.00230000000000E-007,+1.00170000000000E-007

The following example configures the instrument for 4-digit average period measurements of an approximately 250 MHz signal on channel 2, makes one measurement using an external trigger, and then transfers the measurement to the instrument output buffer.

```
CONF:PER 4E-9,1e-12,(@2)
TRIG:SOUR EXT;SLOP POS
INIT
FETC?
```

Typical Response: +4.03337934613473E-009

CONFigure:PERiod

See Also

CONFigure?

CONFigure:SPERiod

INITiate[:IMMediate]

MEASure?

READ?

SENSe:FREQuency:GATE:SOURce

SENSe:FREQuency:GATE:TIME

CONFigure:PHASe

Syntax

CONFigure:PHASe [<channel_pair>]

Description

This command sets all measurement parameters and trigger parameters to default values for phase measurements.

Parameters

Name	Type	Range of Values	Default Value
<channel_pair>	Pair of Expressions	(@1),(@2) | (@2),(@1)	(@1),(@2)

Remarks

- The input channels are configured for auto-leveling at 50% with a positive slope.
- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for phase measurements from channel 1 to channel 2, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:PHAS
SAMP:COUN 2
READ?
```

Typical Response: +5.10520000000000E+001,+5.10370000000000E+001

The following example configures the instrument for phase measurements from channel 2 to channel 1, makes one measurement using an external trigger, and then transfers the measurement to the instrument output buffer.

```
CONF:PHAS (@2),(@1)
TRIG:SOUR EXT;SLOP POS
INIT
FETC?
```

Typical Response +4.82342300000000E+001

CONFigure:PHASe

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

CONFigure:PWIDth

Syntax

CONFigure:PWIDth [{<*reference*> | MINimum | MAXimum | DEFault}] [,<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for positive pulse width measurements.

Parameters

Name	Type	Range of Values	Default Value
<*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	50 PCT
<channel>	Expression	(@1) | (@2)	(@1)

Remarks

- The <reference> parameter specifies the input signal reference level, either in terms of percent of peak-to-peak voltage, or in absolute voltage. To specify the level in percent, use a numeric value with no suffix or with the PCT suffix; for example, 30 or 30 PCT. To specify the level in absolute voltage, use a numeric value with the V or MV (millivolt) suffix: 100 MV or .1V.
- When the <reference> is omitted or specified in percent, auto-leveling is enabled. When specified in absolute voltage, auto-leveling is disabled.
- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for pulse width measurements on channel 1 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:PWID
SAMP:COUN 2
READ?
```

Typical Response: +5.10520000000000E-006,+5.10370000000000E-006

CONFigure:PWIDth

The following example configures the instrument for pulse width measurements on channel 2 with a 1.2V reference level, makes one measurement using an external trigger, and then transfers the measurement to the instrument output buffer.

```
CONF:PWID 1.2V,(@2)
TRIG:SOUR EXT;SLOP POS
INIT
FETC?
```

Typical Response: +4.82342300000000E-006

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

CONFigure:PWIDth:BURSt

Syntax

CONFigure:PWIDth:BURSt [<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for positive ("on time") width measurements of a pulsed input signal.

Parameters

Name	Type	Range of Values	Default Value
<channel>	Expression	(@3)	(@3)

Remarks

- ***Available only on the Keysight 53230A. Requires option 150.***

- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for pulse width measurements on channel 3 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:PWID:BURS
SAMP:COUN 2
READ?
```

Typical Response: +5.10520000000000E-006,+5.10370000000000E-006

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

CONFigure:RTIMe

Syntax

CONFigure:RTIMe [{<lower_*reference*> | MINimum | MAXimum | DEFault} [,{<upper_*reference*> | MINimum | MAXimum | DEFault}]] [,<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for rise time measurements.

Parameters

Name	Type	Range of Values	Default Value
<lower_*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	10 PCT
<upper_*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	90 PCT
<channel>	Expression	(@1)	(@2)	(@1)

Remarks

- The <lower_reference> and <upper_reference> parameters specify the input signal reference level, either in terms of percent of peak-to-peak voltage, or in absolute voltage. To specify the level in percent, use a numeric value with no suffix or with the PCT suffix; for example, 30 or 30 PCT. To specify the level in absolute voltage, use a numeric value with the V or MV (millivolt) suffix: 100 MV or .1V.
- When either <lower_reference> or <upper_reference> is omitted or specified in percent, auto-leveling is enabled. When specified in absolute voltage, auto-leveling is disabled.
- If <lower_reference> is greater than <upper_reference>, no error is generated, but the measurement result is undefined.
- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for rise time measurements on channel 1 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:RTIM
SAMP:COUN 2
READ?
```

Typical Response: +5.10520000000000E-006,+5.10360000000000E-006

The following example configures the instrument for rise time measurements on channel 2 with 20% and 80% reference levels, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
CONF:RTIM 20,80,(@2)
READ?
```

Typical Response: +5.02573000000000E-006

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

CONFigure:SPERiod

Syntax

CONFigure:SPERiod [<channel>]

Description

This command sets all measurement parameters and trigger parameters default values for single-period measurements.

Parameters

Name	Type	Range of Values	Default Value
<channel>	Expression	(@1) | (@2)	(@1)

Remarks

- This command configures a single-period measurement. To configure an averaging measurement, use CONFigure:PERiod.
- The input channel is configured for auto-leveling at 50% with a positive slope.
- This measurement is a specialized time interval measurement. The gate is controlled by the SENSe:TINTerval:GATE:SOURce command.
- The gate source (see SENSe:TINTerval:GATE:SOURce) is set to IMMediate.

- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for single-period measurements on channel 1 using default parameters, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:SPER
SAMP:COUN 2
READ?
```

Typical Response: +1.00230000000000E-007,+1.00170000000000E-007

See Also

CONFigure?

CONFigure:PERiod

INITiate[:IMMediate]

MEASure?

READ?

SENSe:TINTerval:GATE:SOURce

CONFigure:TINTerval

Syntax

CONFigure:TINTerval [<channel(s)>]

Description

This command sets all measurement parameters and trigger parameters to default values for time interval measurements on one channel or between two channels.

Parameters

Name	Type	Range of Values	Default Value
<channel(s)>	Expression(s)	(@1),(@2) | (@2),(@1) | (@1) | (@2)	(@1),(@2)

Remarks

- The input channel(s) are configured for auto-leveling at 50% with a positive slope.
- The gate source (see SENSe:TINTerval:GATE:SOURce) is set to IMMediate.
- After configuring a single-channel time interval measurement, you should change the start or stop input thresholds (INPut{1|2}:LEVel{1|2} or INPut{1|2}:LEVel{1|2}:RELative commands) or slopes (INPut{1|2}:SLOPe{1|2} command), or you should set a stop holdoff (SENSe:GATE:STOP:HOLDoff:SOURce). Measurements made without changing at least one of these settings will result in values of approximately 0 seconds.
- To configure a single-period measurement on a channel, use CONFigure:SPERiod.
- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for time interval measurements from channel 1 to channel 2, makes two measurements, and then transfers the measurements to the instrument output buffer.

```
CONF:TINT (@1),(@2)
SAMP:COUN 2
READ?
```

Typical Response: +5.10520000000000E-006,+5.10370000000000E-006

See Also

CONFigure?

INITiate[:IMMediate]

MEASure?

READ?

SENSe:TINTerval:GATE:SOURce

CONFigure:TOTalize:CONTinuous

Syntax

CONFigure:TOTalize:CONTinuous [<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for a continuous totalize measurement.

Parameters

Name	Type	Range of Values	Default Value
<channel>	Expression	(@1) | (@2)	(@1)

Remarks

- The totalize count can be read at any time using the SENSe:TOTalize:DATA? command.
- The input channel is configured to use the current input threshold voltage and slope (see INPut:LEVel and INPut:SLOPe) with auto-leveling **disabled**.
- The gate source (see SENSe:TOTalize:GATE:SOURce) is set to TIME and the gate time (see SENSe:TOTalize:GATE:TIME) is set to infinity.
- Use INITiate[:IMMediate] to start the measurement.
- Use ABORt or a device clear to terminate the measurement.
- Because ABORt or a device clear must be used to terminate the measurement, only one measurement will be made for each INITiate:IMMediate command. The SAMPle:COUNt and TRIGger:COUNt settings are ignored when making a continuous totalize measurement. Additionally, the smoothing (moving average) filter and statistics computation are disabled (CALCulate1:SMOothing:STATe and CALCulate1:AVERage:STATe set to off), since they require more than one reading to be useful.

Examples

The following example configures the instrument for continuous totalize measurements on channel 2 using default parameters, the totalize is started, and then, after 1 second, terminates the measurement and transfers the count to the instrument output buffer.

```
CONF:TOT:CONT (@2)
INIT
<wait one second>
ABOR
FETC?
```

Typical Response: +5.10500000000000E+003

See Also

CONFigure?

CONFigure:TOTalize:TIMed

INITiate[:IMMediate]

INPut:LEVel

SENSe:TOTalize:GATE:SOURce

SENSe:TOTalize:GATE:TIME

CONFigure:TOTalize:TIMed

Syntax

CONFigure:TOTalize:TIMed [{<gate_time> | MINimum | MAXimum | DEFault}] [,<channel>]

Description

This command sets all measurement parameters and trigger parameters to default values for timed totalize measurements.

Parameters

Name	Type	Range of Values	Default Value
<gate_time>	Numeric	100 usec to 1000 sec with 10 usec resolution or +9.9E+37 (INFinity) (Keysight 53220A) 1 usec to 1000 sec with 1 usec resolution or +9.9E+37 (INFinity) (Keysight 53230A) MIN = 100 usec (Keysight 53220A) MIN = 1 usec (Keysight 53230A) MAX = 1000 sec	.1 sec
<channel>	Expression	(@1)	(@2)	(@1)

Remarks

- The input channel is configured to use the current input threshold voltage and slope (see INPut:LEVel and INPut:SLOPe) with auto-leveling **disabled**.
- The gate source (see SENSe:TOTalize:GATE:SOURce) is set to TIME and the gate time (see SENSe:TOTalize:GATE:TIME) is set to the <gate_time> value.
- Use READ? or INITiate[:IMMediate] to start the measurement.

Examples

The following example configures the instrument for timed totalize measurements on channel 1 using default parameters.

```
CONF:TOT:TIM
READ?
```

Typical Response: +5.10500000000000E+003

The following example configures the instrument for 1 second timed totalize measurements on channel 2.

```
CONF:TOT:TIM 1.0,(@2)
INIT
FETC?
```

Typical Response: +4.82342300000000E+006

See Also

CONFigure?

CONFigure:TOTalize:CONTinuous

INITiate[:IMMediate]

INPut:LEVel

INPut:SLOPe

MEASure?

READ?

SENSe:TOTalize:GATE:SOURce

SENSe:TOTalize:GATE:TIME

CONFigure?

Syntax

CONFigure?

Description

This command returns the function configured by the last CONFigure or MEASure? command.

Remarks

- At power-on, this command generates a settings conflict error until the first CONFigure or MEASure? command is sent.
- If the instrument state has been changed via commands other than CONFigure or MEASure?, the instrument will not track these changes, and the query response will not reflect these changes.

Return Format

The command returns a series of comma-separated fields indicating the present function, expected value and resolution or reference level(s), and channel(s). The short form of the function name is always returned (e.g., "FREQ", "PDUT", etc.).

Examples

The following example returns the present configuration of the meter (the quotes are also returned).

```
CONF?
```

Typical Response: "FREQ +1.20000000000000E+006,+1.00000000000000E-006,(@2)"

See Also

CONFigure

DATA Subsystem Introduction

The DATA commands allow you to access data points in reading memory, to determine how many points are stored, and to remove data.

Command Summary

DATA:LAST?
DATA:POINts?
DATA:POINts:EVENt:THReshold
DATA:POINts:EVENt:THReshold?
DATA:REMove?

DATA:LAST?

Syntax

DATA:LAST?

Description

This query returns the last measurement taken. You can execute this command at any time, even during a series of measurements.

Remarks

- The instrument clears all measurements from memory when the measurement function is changed, when the INITiate:IMMediate, MEASure:<*function*>? or READ? commands are executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns one measurement with units. If no data is available, 9.91E37 (Not a Number) is returned with units. The format of the measurements is always ASCII (unaffected by the FORMat Subsystem commands).

Examples

The following example returns the last measurement taken by the meter.

```
DATA:LAST?
```

Typical Response: +1.21513398300000E-006 S

See Also

DATA:POINts?

DATA:REMove?

DATA:POINts:EVENt:THReshold

Syntax

DATA:POINts:EVENt:THReshold ‹*count*›

DATA:POINts:EVENt:THReshold?

Description

This command sets a bit in the *Standard Operation Register* group event register when the specified number of measurements have been stored in reading memory. When the specified number of measurements have been stored in memory, the "Memory Threshold" bit (bit 9) is set to a "1" in the event register.

> **NOTE**　For more information on the SCPI Status System for the Keysight 53220A/230A see Status System Introduction.

Parameters

Name	Type	Range of Values	Default Value
‹*count*›	Numeric	1 to 1,000,000	This is a required parameter

Remarks

- To report any subsequent events, the measurement count must first drop below the programmed threshold before reaching the threshold again.
- To enable the "Memory Threshold" bit (bit 12 in the Standard Operation Event register) to be reported to the Status Byte, use the STATus:OPERation:ENABle command.
- Once the "Memory Threshold" bit (bit 12 in the Standard Operation Event register) is set, it will remain set until cleared by the STATus:OPERation:EVENt? command or *CLS (clear status) command. (The Standard Operation Condition register will show the current condition. See STATus Subsystem Introduction for further information.)
- The instrument sets the threshold to 1 after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the number of measurements currently specified as the memory threshold in the form +1200.

Examples

The following example sets the memory threshold to 125 measurements.

DATA:POINts:EVENt:THReshold

```
DATA:POIN:EVEN:THR 125
```

See Also

DATA:POINts?

DATA:POINts?

Syntax

DATA:POINts?

Description

This query returns the total number of measurements currently stored in the reading memory.

Remarks

- You can read the count at any time, even during a series of measurements.
- You can store up to 1,000,000 measurements in the reading memory.
- The instrument clears all measurements from memory when the measurement function is changed, when the INITiate:IMMediate, MEASure:<*function*>? or READ? commands are executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the number of measurements in the reading memory in the form +1024.

Examples

The following example returns the number of measurements in the reading memory.

```
DATA:POIN?
```

Typical Response: +215

See Also

DATA:POINts:EVENt:THReshold

DATA:REMove?

Syntax

DATA:REMove? <*count*> [,WAIT]

Description

This query reads and erases the specified number of measurements from the reading memory. The measurements are erased from memory starting with the oldest measurement first. This allows you to periodically remove measurements from memory during a series of measurements to avoid a reading memory overflow.

Parameters

Name	Type	Range of Values	Default Value
<*count*>	Numeric	1 to 1,000,000, limited by number of measurements currently in reading memory	This is a required parameter

Remarks

- You can read and erase measurements from memory at any time, even during a series of measurements.
- If no measurements are available or in progress, error -230,"Data corrupt or stale" will be generated, and no data will be returned.
- If WAIT is not specified and fewer than the specified number of measurements are currently in memory, error -222,"Data out of range" will be generated and no data will be returned. You can use the DATA:POINts? command to determine the total number of measurements currently in memory. If WAIT is specified, the command will wait for the requested number of measurements to be completed.
- You can store up to 1,000,000 measurements in the reading memory. If memory overflows, the new measurements will overwrite the first (oldest) measurements stored; the most recent measurements are always preserved. No error is generated, but the Reading Mem Ovfl bit (bit 14) is set in the Questionable Data Register.
- The instrument clears all measurements from memory after a Factory Reset (*RST command), after an Instrument Preset (SYSTem:PRESet command), or when mainframe power is cycled.
- The instrument clears all measurements from memory when the measurement function is changed, when the INITiate:IMMediate, MEASure:<function>? or READ? commands are executed, after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the specified number of measurements and then erases them from memory. The format of the measurements is controlled by the FORMat Subsystem commands.

For timestamp measurements, the command returns the prescaler value followed by <count> meas-
urements.   The prescaler value is always returned in the format: +100. The format of the measurements is
controlled by the FORMat Subsystem commands.

Examples

The following example returns 3 measurements (starting with the oldest measurements first) and erases
them from memory.

```
DATA:REM? 3
```

Typical Response:
+4.27150000000000E+002,+1.32130000000000E+003,+3.65300000000000E+003

See Also

DATA:POINts?

FORMat:BORDer

FORMat:DATA

R?

DISPlay Subsystem Introduction

Command Summary

DISPlay:STATe
DISPlay:STATe?
DISPlay:MODE
DISPlay:MODE?
DISPlay:TEXT
DISPlay:TEXT?
DISPlay:TEXT:CLEar
DISPlay:DIGit:MASK
DISPlay:DIGit:MASK?
DISPlay:DIGit:MASK:AUTO
DISPlay:DIGit:MASK:AUTO?

DISPlay:DIGit:MASK

Syntax

DISPlay[:WINDow]:DIGit:MASK {<*digits*> | MINimum | MAXimum | DEFault}

DISPlay[:WINDow]:DIGit:MASK? [{MINimum | MAXimum | DEFault}]

Description

This command sets the number of significant digits displayed for measurements on the front panel. This command does not affect the measurement resolution; it only selects the number of digits shown on the front panel.

Parameters

Name	Type	Range of Values	Default Value
<*digits*>	Numeric	3 to 15 MIN = 3 MAX = 15	15

Remarks

- Setting a digit mask value disables automatic selection of the number of significant digits displayed (sets DISPlay:DIGit:MASK:AUTO to OFF).
- Measurement data returned by the READ?, FETCh?, and MEASure? queries is unaffected by this command.
- Totalize measurements are unaffected by this command. All digits of the totalize count are always shown.
- The digit mask is unaffected by a Factory Reset (*RST command), or an Instrument Preset (SYSTem:PRESet command). It is set to 15 at power-on.

Return Format

The query returns the lower limit in the form +15.

Examples

The following example sets the number of significant digits displayed on the front to 6.

```
DISP:DIG:MASK 6
```

See Also

DISPlay:DIGit:MASK:AUTO

DISPlay:DIGit:MASK:AUTO

Syntax

DISPlay[:WINDow]:DIGit:MASK:AUTO {OFF | ON}

DISPlay[:WINDow]:DIGit:MASK:AUTO?

Description

This command disables or enables automatic selection of the number of significant digits displayed for measurements on the front panel.

Remarks

- The number of digits display will vary based on measurement function, gate time, and gate source.
- The automatic selection is unaffected by a Factory Reset (*RST command), or an Instrument Preset (SYSTem:PRESet command). It is enabled at power-on.

Return Format

The query returns the automatic selection state: 0 (OFF) or 1 (ON).

Examples

The following example enables automatic selection of the number of significant digits displayed for measurements.

```
DISP:DIG:MASK:AUTO ON
```

See Also

DISPlay:DIGit:MASK

DISPlay:MODE

Syntax

DISPlay[:WINDow]:MODE {NUMeric | HISTogram | TCHart}

DISPlay[:WINDow]:MODE?

Description

This command selects whether the front panel display shows numeric information, histogram data or the trend chart.

Remarks

- Histogram computation must be enabled (CALCulate2:TRANsform:HISTogram:STATe ON set) to display histogram data.
- The display mode is unaffected by a Factory Reset (*RST command), or an Instrument Preset (SYSTem:PRESet command). It is set to NUMeric at power-on.

Return Format

The query returns the current display mode: NUM, HIST, or TCH.

Examples

The following example selects displaying histogram data on the front panel.

```
DISP:MODE HIST
```

See Also

CALCulate:TRANsform:HISTogram:STATe

CALCulate:STATe

DISPlay:STATe

Syntax

DISPlay[:WINDow][:STATe] {OFF | ON}

DISPlay[:WINDow][:STATe]?

Description

This command disables or enables the instrument's front-panel display. For security reasons or for a slight increase in measurement rates, you may want to turn off the front-panel display. When disabled, the front-panel LCD display goes entirely dark.

Remarks

- The entire front panel display is disabled or enabled by this command. The channel key LED's remain active.
- Pressing the **BACK** key will turn the display back on.
- Sending a text message to the display (see DISPlay:TEXT command) overrides the display state; this means that you can display a message even if the display is turned off.
- The display mode is unaffected by a Factory Reset (*RST command), or an Instrument Preset (SYSTem:PRESet command). It is enabled at power-on.

Return Format

The query returns the display enable state: 0 (OFF) or 1 (ON).

Examples

The following example disables the front-panel display.

```
DISP OFF
```

See Also

DISPlay:TEXT:CLEar

DISPlay:TEXT

DISPlay:TEXT:CLEar

Syntax

DISPlay[:WINDow]:TEXT:CLEar

Description

This command clears the text message displayed on the instrument's front-panel display (see DISPlay:TEXT command).

Remarks

- Clearing the text message does not override the display state (see DISPlay:STATe command); if the display was disabled prior to clearing the text message, the display will remain disabled.
- If the text message was displayed by overriding a displayed measurement or math function, that function will reappear when the text message is cleared.
- The front-panel display is automatically cleared after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

Examples

The following example clears the text message on the top line (the default) of the front panel.

```
DISP:TEXT:CLE
```

See Also

DISPlay:TEXT

DISPlay:STATe

DISPlay:TEXT

Syntax

DISPlay[:WINDow]:TEXT[:DATA] "<*string*>"

DISPlay[:WINDow]:TEXT[:DATA]?

Description

This command displays a text message on the instrument's front-panel display.

Parameters

Name	Type	Range of Values	Default Value
<*string*>	Quoted String	A string of up to 80 characters enclosed in quotes. You can use letters (A-Z), numbers (0-9), and special characters like "@", "%", "*", etc. Use "#" character to display a degree symbol (°).	This is a required parameter

Remarks

- Commas, periods, and semicolons share a display space with the preceding character (unless it is also a comma, period, or semicolon), and are not considered individual characters.
- While a message is displayed, measurements are suppressed on the front-panel display.
- Sending a text message to the display overrides the display state (see DISPlay:STATe command); this means that you can display a message even if the display is turned off.
- Pressing the **Local** key on the front-panel clears the text message. To prevent this, use the SYSTem:LOCK:REQuest? command to lock the front panel keypad.
- The display text is unaffected by a Factory Reset (*RST command), or an Instrument Preset (SYSTem:PRESet command). It is cleared at power-on.

Return Format

The query reads the message currently displayed on the front panel in the specified window, and returns an ASCII string enclosed in double quotes. If no message is displayed, a null string ("") is returned.

Examples

The following example displays a message on the front panel (the quotes are not displayed).

```
DISP:TEXT "MEASURING..."  or  DISP:TEXT 'MEASURING...'
```

See Also

DISPlay:TEXT:CLEar

HCOPy Subsystem Introduction

Command Summary

HCOPy:SDUMp:DATA?
HCOPy:SDUMp:DATA:FORMat

HCOPy:SDUMp:DATA?

Syntax

HCOPy:SDUMp:DATA?

Description

This command captures and returns the front-panel display (screen dump) image.

Remarks

- The image format (PNG or BMP) for the image is specified by the HCOPy:SDUMp:DATA:FORMat commmand.

Return Format

The query returns the image as a definite-length binary block.

Examples

The following example captures and returns the front-panel display image in BMP format:

```
HCOP:SDUM:DATA:FORM BMP
 HCOP:SDUM:DATA?
```

Typical Response: *A definite length binary block containing the image*

See Also

HCOPy:SDUMp:DATA:FORMat

HCOPy:SDUMp:DATA:FORMat

Syntax

HCOPy:SDUMp:DATA:FORMat {PNG | BMP}

HCOPy:SDUMp:DATA:FORMat?

Description

This command selects the image format for the front-panel display (screen dump) images returned by the HCOPy:SDUMp:DATA? command.

Remarks

- The instrument selects PNG format after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current image format: PNG or BMP.

Examples

The following example captures and returns the front-panel display image in BMP format:

```
HCOP:SDUM:DATA:FORM BMP
 HCOP:SDUM:DATA?
```

Typical Response: *A definite length binary block containing the image*

See Also

HCOPy:SDUMp:DATA?

FORMat Subsystem Introduction

Command Summary

FORMat:BORDer
FORMat:BORDer?
FORMat:DATA
FORMat:DATA?
FORMat:PHASe
FORMat:PHASe?

FORMat:BORDer

Syntax

FORMat:BORDer {NORMal | SWAPped}

FORMat:BORDer?

Description

*Used for binary block transfers only (*FORMat:DATA REAL set). This command selects the byte order for binary block transfers using the MEASure?, READ?, FETCh?, DATA:REMove? and R?commands.

- In the NORMal byte order, the most-significant byte (MSB) of each data point is sent first (big-endian byte order).
- In the SWAPped byte order, the least-significant byte (LSB) of each data point is sent first (little-endian byte order). Most PCs use the "swapped" byte order.

Remarks

- The instrument selects NORMal byte order after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the byte order: NORM or SWAP.

Examples

The following example enables the "swapped" byte order mode.

```
FORM:BORD SWAP
```

See Also

DATA:REMove?

R?

FORMat:DATA

Syntax

FORMat[:DATA] {ASCii | REAL} [,‹length›]

FORMat[:DATA]?

Description

Specifies the data format to be either ASCII or REAL. This command affects the data format of the MEASure?, READ?, FETCh?, DATA:REMove? and R? commands.

- If ASCii is specified, numeric data is transferred as ASCii characters. The numbers are separated by commas as specified in IEEE 488.2. The ‹length› parameter is optional, but "15" is the default and only allowed value, and the instrument returns 15 significant digits (for example: +4.57538162393720E+006).
- If REAL is specified, numeric data is transferred as IEEE 754 binary data in IEEE 488.2 indefinite-length block format (MEASure?, READ? and FETCh? commands) or definite-length block format (R? and DATA:REMove? commands). The ‹length› parameter is optional, but "64" is the default and only allowed value. The byte order is controlled by the FORMat:BORDer command.

Parameters

Name	Type	Range of Values	Default Value
‹length›	Numeric	ASCii,15	ASCii,15
		REAL,64	REAL,64

Remarks

- The instrument selects ASCii format after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the data format: ASC,15, or REAL,64.

Examples

The following example specifies the data format to be 64-bit REAL.

```
FORM:DATA REAL,64    or    FORM:DATA REAL
```

See Also

DATA:REMove?

FETCh?

FORMat:BORDer

MEASure?

R?

READ?

FORMat:PHASe

Syntax

FORMat:PHASe {AUTO | POSitive | CENTered}

FORMat:PHASe?

Description

This command selects whether phase measurements are displayed in the fixed range of ±180° or 0° to 360°, or whether the instrument will automatically switch between these ranges based on the measurement history.

Remarks

- AUTO is the algorithm used in the Agilent 53131A/132A for phase measurements.
- The phase range is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- The phase range is set to AUTO when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the range: "AUTO", "POS" or "CENT".

Examples

The following example enables the 0° to 360° range for phase measurements.

```
FORM:PHAS  POS
```

See Also

CONFigure:PHASe

MEASure:PHASe?

SENSe:FUNCtion

IEEE-488 Common Commands Introduction

Command Summary

*CAL?
*CLS
*ESE
*ESE?
*ESR?
*IDN?
*LRN?
*OPC
*OPC?
*OPT?
*RCL
*RST
*SAV
*SRE
*SRE?
*STB?
*TRG
*TST?
*WAI

*CAL?

*CAL?

Syntax

*CAL?

Description

This query performs an auto-calibration on the instrument and returns a result indicating whether the auto-calibration succeeded (+0) or failed (+1).

Remarks

- If the auto-calibration fails, use SYSTem:ERRor? get more details concerning the failure.

- This command takes about 10 seconds to execute.

Return Format

The query returns +0 if calibration passes, +1 if it fails.

Examples

The following example performs an auto-calibration:

```
*CAL?
```

Typical Response: +0

See Also

CALibration Subsystem

SYSTem:TEMPerature?

SYSTem:TEMPerature:ACALibration?

*CLS

Syntax

*CLS

Description

This command clears the event registers in all register groups. This command also clears the Error queue.

Examples

The following example clears the event register bits and error queue.

```
*CLS
```

See Also

SYSTem:ERRor?

*ESE

Syntax

*ESE <*enable*>

*ESE?

Description

This command enables bits in the enable register for the *Standard Event Register* group. The selected bits are then reported to bit 5 of the Status Byte Register.

| NOTE | | For more information on the SCPI Status System, see Status System Introduction. |

Parameters

Name	Type	Range of Values	Default Value
<*enable*>	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register (see table below).	This is a required parameter

Remarks

- The following table lists the bit definitions for the Standard Event Register.

Bit Number	Bit Name	Decimal Value	Definition
0	Operation Complete	1	All commands prior to and including *OPC have been executed.
1	Not Used	2	(Reserved for future use)
2	Query Error	4	The instrument 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-Specific Error	8	A device-specific error, including a self-test error or calibration error, occurred (an error in the -300 range or any positive error has been generated). For a complete listing of the error messages, see SCPI Error Messages.
4	Execution Error	16	An execution error occurred (an error in the -200 range has been generated).
5	Command Error	32	A command syntax error occurred (an error in the -100 range has been generated).

| **6** | Not Used | 64 | (Reserved for future use) |
| **7** | Power On | 128 | Power has been turned off and on since the last time the event register was read or cleared. |

- To enable specific bits, you must write a decimal value that corresponds to the binary-weighted sum of the bits in the register. The selected bits are summarized in the "Standard Event Summary" bit (bit 5) of the Status Byte Register.
- Use the <enable_value> parameter to specify which bits will be enabled. The decimal value specified 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 *CLS (clear status) command will not clear the enable register but it does clear all bits in the event register.
- A STATus:PRESet, SYSTem:PRESet, *CLS, or *RST command does not clear the bits in the Standard Event enable register.

Return Format

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. For example, if bit 3 (decimal value = 8) and bit 7 (decimal value = 128) are enabled, the query command will return "+136".

Examples

The following example 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 high).

```
*ESE 16
```

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

```
*ESE?
```

Typical Response: +16

See Also

*ESR?

*STB?

*ESR?

Syntax

*ESR?

Description

This query returns the event register contents for the *Standard Event Register* group. This is a read-only register and the bits are not cleared when you read the register.

| NOTE | For more information on the SCPI Status System, see Status System Introduction. |

Remarks

- The following table lists the bit definitions for the Standard Event Register.

Bit Number	Bit Name	Decimal Value	Definition
0	Operation Complete	1	All commands prior to and including *OPC have been executed.
1	Not Used	2	(Reserved for future use)
2	Query Error	4	The instrument 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-Specific Error	8	A device-specific error, including a self-test error or calibration error, occurred (an error in the -300 range or any positive error has been generated). For a complete listing of the error messages, see SCPI Error Messages.
4	Execution Error	16	An execution error occurred (an error in the -200 range has been generated).
5	Command Error	32	A command syntax error occurred (an error in the -100 range has been generated).
6	Not Used	64	(Reserved for future use)
7	Power On	128	Power has been turned off and on since the last time the event register was read or cleared.

- In order to be reported to the Standard Event Register, the corresponding bits in the event register must be enabled using the *ESE command.
- Once a bit is set, it remains set until cleared by reading the event register or the *CLS (clear status) command.

Return Format

The query reads the event register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register (see table above). For example, if bit 2 (decimal value = 4) and bit 4 (decimal value = 16) are set (and the corresponding bits are enabled), this query will return +20.

Examples

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

```
*ESR?
```

Typical Response: +24

See Also

*ESE

*CLS

*IDN?

Syntax

*IDN?

Description

This query returns the instrument's (mainframe) 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 a revision code which contains four numbers separated by dashes.

Return Format

The query returns a string with the following format:

AGILENT TECHNOLOGIES,53220A,<Serial Number>,**f.ff-b.bb-aa-p**

where:

f.ff	= Firmware revision number
b.bb	= Boot kernel revision number
aa	= ASIC revision number
p	= Printed circuit board revision number

Examples

The following example returns the instrument's identification string.

```
*IDN?
```

Typical Response: AGILENT TECHNOLOGIES,53220A,MY12345678,1.00-1.00-01-1

See Also

*LRN?

Syntax

*LRN?

Description

This query returns the *learn string,* which is an ASCII string of SCPI commands. This string includes all of the commands required to put the instrument into its current state.

Return Format

The query returns an ASCII string of SCPI commands, delimited with semicolons (";") between the commands.

Examples

The following example returns the learn string.

```
*LRN?
```

Typical Response: *A very long string of SCPI commands.*

See Also

*RCL

*SAV

*OPC

Syntax

*OPC

Description

This command sets the "Operation Complete" bit (bit 0) in the Standard Event register at the completion of the current operation.

> **NOTE**   For more information on the SCPI Status System, see Status System Introduction.

Remarks

- The purpose of this command is to synchronize your application with the instrument.
- Note the difference between the *OPC command and the *OPC? query command. The latter returns 1 to the output buffer at the completion of the current operation.

Examples

The following example sets the "Operation Complete" bit.

```
*OPC
```

See Also

*OPC?

*OPC?

Syntax

*OPC?

Description

This query returns 1 to the output buffer at the completion of all pending operations.

| NOTE | For more information on the SCPI Status System, see Status System Introduction. |

Remarks

- The purpose of this query is to synchronize your application with the instrument.
- Note the difference between the *OPC? command and the *OPC command. The latter sets the "Operation Complete" bit (bit 0) in the Standard Event register at the completion of the current operation.

Return Format

The query returns 1.

Examples

The following example sends "1" to the output buffer when pending operations are complete.

```
*OPC?
```

See Also

*OPC

*OPT?

*OPT?

Syntax

*OPT?

Description

This query returns a string identifying any installed options.

Return Format

The query returns a string with the following format:

<timebase option>,<channel 3 option>,<pulse option>,<battery option>,<GPIB option>

where <timebase option> is one of:

0	Standard timebase
010	High-stability oven-controlled crystal oscillator

<channel 3 option> is one of:

```
  0   No channel 3 installed
106  6 GHz channel 3 installed
115  15 GHz channel 3 installed
```

<pulse option> is one of:

```
  0   No Pulse Microwave Measurement option installed
150  Pulse Microwave Measurement option installed
```

<battery option> is one of:

```
  0   No battery installed
300  Battery installed
```

<GPIB option> is one of:

```
  0    No GPIB installed
400   GPIB installed
```

Examples

The following example returns the installed options:

```
*OPT?
```

Typical Response: 1,006,0,0,0 (OCXO and 6 GHz options are installed)

See Also

*IDN?

*RCL

Syntax

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

Description

This command recalls the instrument state stored in the specified storage location. You cannot recall the instrument state from a storage location that is empty or was deleted. When shipped from the factory, storage locations 1 through 4 are empty (location 0 has the power-on state).

Use the *SAV command to store the current instrument state.

Remarks

- The instrument has five storage locations in non-volatile memory to store instrument states. The instrument uses location 0 to automatically hold the state of the instrument at power off. You can only recall a state from a location that contains a previously stored state.
- The instrument states are stored in non-volatile memory and do not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- The MEMory:STATe:DELete and MEMory:STATe:DELete:ALL commands delete, but do not sanitize, stored states.
- SYSTem:SECurity:IMMediate command deletes and sanitizes all stored states.

Examples

The following example recalls the instrument state previously stored in location 1.

```
*RCL 1
```

See Also

*SAV

MEMory:STATe:DELete

MMEMory:LOAD:STATe

MMEMory:STORe:STATe

*RST

Syntax

*RST

Description

This command resets the instrument to the Factory configuration. See Factory Reset State for a complete listing of the instrument's Factory configuration.

Remarks

- This command does not affect any previously-stored instrument states (see *SAV command).

Examples

The following example resets the instrument.

```
*RST
```

See Also

SYSTem:PRESet

*SAV

Syntax

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

Description

This command stores (saves) the current instrument state in the specified storage location. Any state pre-viously stored in the same location is overwritten (no error is generated).

Use the *RCL command to recall a stored instrument state.

Remarks

- The instrument has five storage locations in non-volatile memory to store instrument states. The instru-ment uses location 0 to automatically hold the state of the instrument at power off. You can store the instrument state in location 1, 2, 3, or 4, but you can only recall a state from a location that contains a previously stored state. You can use location 0 to store a fifth instrument state, but keep in mind that location 0 is automatically overwritten when power is cycled.
- When shipped from the factory, storage locations 1 through 4 are empty and the instrument is con-figured to automatically recall the power-down state (location 0) when power is restored. You can change the factory configuration such that a Factory Reset (*RST command) is issued when power is restored.
- The instrument states are stored in non-volatile memory and do not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- The MEMory:STATe:DELete and MEMory:STATe:DELete:ALL commands delete, but do not sanitize, stored states.
- SYSTem:SECurity:IMMediate command deletes and sanitizes all stored states.

Examples

The following example stores the current instrument state in location 1.

```
*SAV 1
```

See Also

*RCL

MEMory:STATe:DELete

MMEMory:LOAD:STATe

MMEMory:STORe:STATe

*SRE

Syntax

*SRE ‹*enable*›

*SRE?

Description

This command enables bits in the enable register for the *Status Byte Register* group. Once enabled, the corresponding bits may generate a Request for Service (RQS) in the Status Byte. This RQS event may gen-erate a "call back" to your application as a type of asynchronous interrupt.

> **NOTE** For more information on the SCPI Status System for the Keysight 53220A/230A, see Status System Introduction.

Parameters

Name	Type	Range of Values	Default Value
‹*enable*›	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register (see table below).	This is a required parameter

Remarks

- The following table lists the bit definitions for the Status Byte Register.

Bit Number	Bit Name	Decimal Value	Definition
0	Not Used	1	(Reserved for future use)
1	Not Used	2	(Reserved for future use)
2	Error Queue	4	One or more errors have been stored in the Error Queue. Use the SYSTem:ERRor? command to read and delete errors.
3	Questionable Data Summary	8	One or more enabled bits are set in the Ques-tionable Data Register (see STATus:QUES-tionable:ENABle command).
4	Message Available	16	Data is available in the instrument's output buffer.
5	Standard Event Summary	32	One or more enabled bits are set in the Standard Event Register (see *ESE command).

6	Master Summary	64	One or more enabled bits (0-5 or 7) are set in the Status Byte Register and may generate a Request for Service (RQS). Bits are enabled by the *SRE command.
			This bit is ignored (set to 0) by the *SRE command.
7	Standard Operation Summary	128	One or more enabled bits are set in the Standard Operation Register (see STATus:OPERation:ENABle command).

- To enable specific bits, you must write a decimal value that corresponds to the binary-weighted sum of the bits in the register. The selected bits are summarized in the "Master Summary" bit (bit 6) of the Status Byte Register. If any of the selected bits change from 0 to 1, the instrument generates Service Request signal.
- Use the ‹enable_value› parameter to specify which bits will be enabled. The decimal value specified 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 5 (decimal value = 32), the corresponding decimal value would be 40 (8 + 32).
- The *CLS (clear status) command will not clear the enable register but it does clear all bits in the event register.
- A STATus:PRESet, SYSTem:PRESet, *CLS, or *RST command does not clear the bits in the Status Byte enable register.

Return Format

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. For example, if bit 3 (decimal value = 8) and bit 5 (decimal value = 32) are enabled, the query will return +40.

Examples

The following example 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

See Also

*ESE

*STB?

STATus:OPERation:ENABle

STATus:QUEStionable:ENABle

*STB?

Syntax

*STB?

Description

This command queries the condition register for the *Status Byte Register* group. This command 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.

> **NOTE** For more information on the SCPI Status System for the Keysight 53220A/230A, see Status System Introduction.

Remarks

- The following table lists the bit definitions for the Status Byte Register.

Bit Number	Bit Name	Decimal Value	Definition
0	Not Used	1	(Reserved for future use)
1	Not Used	2	(Reserved for future use)
2	Error Queue	4	One or more errors have been stored in the Error Queue. Use the SYSTem:ERRor? command to read and delete errors.
3	Questionable Data Summary	8	One or more enabled bits are set in the Questionable Data Register (see STATus:QUEStionable:ENABle command).
4	Message Available	16	Data is available in the instrument's output buffer.
5	Standard Event Summary	32	One or more enabled bits are set in the Standard Event Register (see *ESE command).
6	Master Summary	64	One or more enabled bits (0-5 or 7) are set in the Status Byte Register and may generate a Request for Service (RQS). Bits are enabled by the *SRE command. This bit is ignored (set to 0) by the *SRE command.
7	Standard Operation Summary	128	One or more enabled bits are set in the Standard Operation Register (see STATus:OPERation:ENABle command).

- This command returns the same results as a Serial Poll but the "Master Summary" bit (bit 6) is *not* cleared if a Serial Poll has occurred.

Return Format

The query reads the condition register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register (see table above). For example, if bit 3 (decimal value = 8 and bit 5 (decimal value = 32) are set (and the corresponding bits are enabled), this command will return +40.

Examples

The following example reads the condition register (bits 3 and 5 are set).

```
*STB?
```

Typical Response: +40

See Also

*SRE

*TRG

Syntax

*TRG

Description

This command is used in conjunction with the TRIGger:SOURce command to trigger the instrument from the remote interface.

Remarks

- Use the TRIGger:SOURce command to select the BUS (software) trigger source.
- After setting the trigger source, you must place the instrument in the "wait-for-trigger" state using the INITiate command. The *TRG command will not be accepted unless the instrument is in the "wait-for-trigger" state.

Examples

The following example triggers the instrument.

```
TRIG:SOUR BUS
  INIT
  *TRG
```

See Also

TRIGger:SOURce

*TST?

Syntax

*TST?

Description

This query performs a complete self-test of the instrument and returns a pass/fail indication. The self-test runs a series of tests and will take several seconds to complete. If all tests pass, you can have a high confidence that the instrument is operational.

Remarks

- The instrument self-test takes over five seconds to complete. When sending the *TST? query from the Keysight Connection Expert 'Interactive IO' window or from the Web-based 'SCPI Command Interface' window, it may be necessary to increase the timeout period to allow the command to complete without error.
- If one or more tests fail, "+1" is returned and an error is stored in the error queue. For a complete listing of the error messages related to self-test failures, see SCPI Error Messages.
- If one or more tests fail, see the KeysightKeysight 53210A/53220A/53230A 350 MHz Counter Service Guide for instructions on obtaining service.
- Following the *TST? command, the instrument issues a Factory Reset (*RST command).

Return Format

The query returns +0 (all tests passed) or +1 (one or more tests failed).

Examples

The following example performs a self-test and returns a pass/fail indication.

```
*TST?
```

Typical Response: +0

See Also

*IDN?

*WAI

Syntax

*WAI

Description

This command configures the instrument's output buffer to wait for all pending operations to complete before executing any additional commands over the interface.

Remarks

- Configuration changes and measurements are considered pending operations. Therefore, *WAI will cause these changes to occur and completes.

Examples

The following example waits until all pending operations complete.

```
*WAI
```

See Also

*OPC

INPut{1|2} Subsystem Introduction

Command Summary

Channels 1 and 2

INPut{1|2}:COUPling
INPut{1|2}:COUPling?
INPut{1|2}:FILTer
INPut{1|2}:FILTer?
INPut{1|2}:IMPedance
INPut{1|2}:IMPedance?
INPut{1|2}:LEVel{1|2}
INPut{1|2}:LEVel{1|2}?
INPut{1|2}:LEVel{1|2}:AUTO
INPut{1|2}:LEVel{1|2}:AUTO
INPut{1|2}:LEVel{1|2}:MAXimum?
INPut{1|2}:LEVel{1|2}:MINimum?
INPut{1|2}:LEVel{1|2}:PTPeak?
INPut{1|2}:LEVel{1|2}:RELative
INPut{1|2}:LEVel{1|2}:RELative?
INPut{1|2}:NREJect
INPut{1|2}:NREJect?
INPut{1|2}:PROBe
INPut{1|2}:PROBe?
INPut{1|2}:PROTection:CLEar
INPut{1|2}:PROTection?
INPut{1|2}:RANGe
INPut{1|2}:RANGe?
INPut{1|2}:SLOPe{1|2}
INPut{1|2}:SLOPe{1|2}?

Channel 3

INPut3:BURSt:LEVel
INPut3:BURSt:LEVel
INPut3:STRength?

INPut{1|2}:COUPling

Syntax

INPut[{1|2}]:COUPling {AC | DC}

INPut[{1|2}]:COUPling?

Description

This command selects whether the input channel is AC or DC coupled.

Remarks

- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- CONFigure and MEASure? do not affect the input coupling.
- The instrument selects AC coupling after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns either AC or DC.

Examples

The following example makes a frequency measurement on channel 1. The input is configured for a DC-coupled 0.5V threshold with a negative slope.

```
INP:COUP DC
 CONF:FREQ 1.2E6
 INP:LEV .5
 INP:SLOP NEG
 READ?
```

Typical Response: +1.21513398300000E+006

See Also

INPut{1|2}:FILTer

Syntax

INPut[{1|2}]:FILTer[:LPASs][:STATe] {OFF | ON}

INPut[{1|2}]:FILTer[:LPASs][:STATe]?

Description

This command enables or disables the input channel's low-pass filter. When enabled, the input channel is bandwidth-limited to 100 kHz.

Remarks

- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- The low pass filter cut-off frequency is 100 KHz.
- CONFigure and MEASure? do not affect the low-pass filter setting.
- The instrument disables the low-pass filter after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current low-pass filter state: 0 (OFF) or 1 (ON).

Examples

The following example makes a frequency measurement on channel 1. The input has the low-pass filter enabled and is configured for auto-leveling with a negative slope.

```
INP:FILT ON
CONF:FREQ 1.2E6
INP:SLOP NEG
READ?
```

Typical Response: +1.21513398300000E+006

See Also

INPut{1|2}:IMPedance

Syntax

INPut[{1|2}]:IMPedance {<*impedance*> | MINimum | MAXimum | DEFault}

INPut[{1|2}]:IMPedance? [{MINimum | MAXimum | DEFault}]

Description

This command selects whether the input channel is terminated in 50 ohms or 1 Mohm.

Parameters

Name	Type	Range of Values	Default Value
<*impedance*>	Numeric	50 or 1.0E6 MIN = 50 MAX = 1.0E6	1.0E6

Remarks

- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- Specifying any value less than or equal to 75 ohms selects 50 ohms, above 75 ohms selects 1 Mohm.
- When 50 ohms is selected, the maximum input voltage allowed is ±5.125 V. If the input voltage exceeds ~±10 Vpk, which would damage the 50 ohm terminator, a protection relay will open, changing the actual input impedance to 1 Mohm. If this occurs, the INPut{1|2}:PROTection:CLEar command can be sent to reset the protection relay.
- The INPut{1|2}:PROTection? command returns whether the protection relay has opened due to an input voltage overload.
- The Voltage Overload bit in the Questionable Data Status Register will be set an input voltage overload causes the protection relay to open. The bit is cleared by sending the INPut{1|2}:PROTection:CLEar command to the affected channel, or by setting the affected channel's input impedance to 1 MOhm.
- CONFigure and MEASure? do not affect the input impedance.
- The instrument selects 1 Mohm impedance after a Factory Reset (*RST command) or an Instrument Pre-set (SYSTem:PRESet command).

Return Format

The query returns the input impedance in the form +5.00000000000000E+001.

Examples

The following example makes a frequency measurement on channel 1 The input is configured for a 50 ohm termination and auto-leveling with a negative slope.

```
INP:IMP 50
CONF:FREQ 1.2E6INP:SLOP NEG
READ?
```

Typical Response: +1.21513398300000E+006

See Also

CONFigure

INPut{1|2}:PROTection:CLEar

MEASure?

INPut{1|2}:LEVel:AUTO

Syntax

INPut[{1|2}]:LEVel:AUTO {OFF | ON | ONCE}

INPut[{1|2}]:LEVel:AUTO?

Description

This command enables or disables automatic setting of the input threshold voltage (auto-leveling). If ONCE is specifed, the input is immediately auto-leveled, and auto-leveling is disabled.

Remarks

- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- Setting an input threshold voltage (INPut{1|2}:LEVel{1|2} command) disables auto-leveling.
- When auto-leveling is enabled, the threshold is specified as a percentage of peak-to-peak voltage, set by the INPut{1|2}:LEVel{1|2}:RELative command.

  > **NOTE**　You should disable auto-leveling and specify the reference values in terms of absolute voltage if the input frequency being measured is lower than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command).

- SYSTem:ALEVel:FREQuency selects the minimum input signal frequency for auto-leveling.
- The instrument enables auto-leveling after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current auto-leveling state: 0 (OFF) or 1 (ON).

Examples

The following example makes a frequency measurement on channel 1. The input is configured for an AC-coupled, auto-leveled threshold at 30% with a positive slope. (Note that CONFigure enables auto-leveling, but the INPut:LEVel:AUTO command is included for the example).

```
INP:COUP AC
CONF:FREQ 1.2E6
INP:LEV:AUTO ON
INP:LEV:REL 30
READ?
```

Typical Response: +1.21513398300000E+006

See Also

CONFigure

INPut{1|2}:LEVel{1|2}

INPut{1|2}:LEVel{1|2}:RELative

MEASure?

SYSTem:ALEVel:FREQuency

INPut{1|2}:LEVel:MAXimum?

Syntax

INPut[{1|2}]:LEVel:MAXimum?

Description

This query measures and returns the maximum voltage of the input signal.

Remarks

- SYSTem:ALEVel:FREQuency selects the minimum input signal frequency for voltage measurements. DC signals will also measure correctly.
- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- If this command is sent while measurements are ongoing, the value returned will be the last measured value, not the current value.

Return Format

The query returns the maximum input voltage in the form +1.25000000E+000.

Examples

The following example makes a maximum voltage measurement on channel 1.

```
INP:LEV:MAX?
```

Typical Response: +1.21500000E+000

See Also

INPut{1|2}:PROBe

SYSTem:ALEVel:FREQuency

INPut{1|2}:LEVel:MINimum?

Syntax

INPut[{1|2}]:LEVel:MINimum?

Description

This query measures and returns the minimum voltage of the input signal.

Remarks

- SYSTem:ALEVel:FREQuency selects the minimum input signal frequency for voltage measurements. DC signals will also measure correctly.
- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- If this command is sent while measurements are ongoing, the value returned will be the last measured value, not the current value.

Return Format

The query returns the minimum input voltage in the form +1.25000000E+000.

Examples

The following example makes a minimum voltage measurement on channel 1.

```
INP:LEV:MIN?
```

Typical Response: -1.21500000E+000

See Also

INPut{1|2}:PROBe

SYSTem:ALEVel:FREQuency

INPut{1|2}:LEVel:PTPeak?

Syntax

INPut[{1|2}]:LEVel:PTPeak?

Description

This query measures and returns the peak-to-peak voltage of the input signal.

Remarks

- SYSTem:ALEVel:FREQuency selects the minimum input signal frequency for voltage measurements. DC signals will also measure correctly.
- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- If this command is sent while measurements are ongoing, the value returned will be the last measured value, not the current value.

Return Format

The query returns the peak-to-peak voltage in the form +1.25000000E+000.

Examples

The following example makes a peak-to-peak voltage measurement on channel 1.

```
INP:LEV:PTP?
```

Typical Response: +2.43000000E+000

See Also

INPut{1|2}:PROBe

SYSTem:ALEVel:FREQuency

INPut{1|2}:LEVel{1|2}

Syntax

INPut[{1|2}]:LEVel[{1|2}][:ABSolute] {<*volts*> | MINimum | MAXimum | DEFault}

INPut[{1|2}]:LEVel[{1|2}][:ABSolute]? [{MINimum | MAXimum | DEFault}]

Description

This command sets the input threshold voltage for measurements. Setting the input threshold voltage disables auto-leveling (sets INPut{1|2}:LEVel:AUTO to OFF).

If auto-leveling is enabled (INPut{1|2}:LEVel:AUTO ON set), this value will be updated each time a leveling operation occurs, and will reflect the current threshold voltage.

LEVel2 may only be queried when the measurement is rise/fall time or single-channel time interval; otherwise, querying LEVel2 will also return 9.91E+37.

Parameters

Name	Type	Range of Values	Default Value
<*value*>	Numeric	**5V range:** -5.125 V to +5.125 V with 2.5 mV resolution MIN = -5.125 V MAX = +5.125 V **50V range:** -51.25 V to +51.25 V with 25 mV resolution MIN = -51.25 V MAX = +51.25 V **500V range:** -512.5 V to +512.5 V with 250 mV resolution MIN = -512.5 V MAX = +512.5 V	0.0

Remarks

- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- When a 1:1 probe factor is selected (INPut{1|2}:PROBe set to 1), the available ranges are 5.0 and 50.0. When a 10:1 probe factor is selected (INPut{1|2}:PROBe set to 1), the available ranges are 50.0 and 500.0.

INPut{1|2}:LEVel{1|2}

- LEVel or LEVel1 sets the threshold for all measurements other than rise/fall time and single-channel time interval. For rise/fall time, LEVel or LEVel1 sets the lower reference; LEVel2 sets the upper reference. For single-channel time interval, LEVel or LEVel1 sets the threshold for the start event; LEVel2 sets the threshold for the stop event.
- The instrument sets the input threshold to 0.0 V with auto-leveling enabled after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the input threshold voltage in the form +1.25000000E+000.

Examples

The following example makes a frequency measurement on channel 1. The input is configured for a DC-coupled 0.5V threshold with a negative slope.

```
INP:COUP DC
CONF:FREQ 1.2E6
INP:LEV .5
INP:SLOP NEG
READ?
```

Typical Response: +1.21513398300000E+006

See Also

CONFigure

INPut{1|2}:PROBe

INPut{1|2}:PROTection?

INPut{1|2}:LEVel:AUTO

MEASure?

INPut{1|2}:LEVel{1|2}:RELative

Syntax

INPut[{1|2}]:LEVel[{1|2}]:RELative {<*percent*> | MINimum | MAXimum | DEFault}

INPut[{1|2}]:LEVel[{1|2}]:RELative? [{MINimum | MAXimum | DEFault}]

Description

This command sets the input threshold as a percentage of the peak-to-peak input voltage when auto-leveling in enabled (INPut{1|2}:LEVel:AUTO ON set).

Parameters

Name	Type	Range of Values	Default Value
<*value*>	Numeric	10 to 90 PCT (percent) with 5% resolution MIN=10 MAX=90	50 PCT

Remarks

- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- LEVel or LEVel1 sets the threshold for all measurements other than rise/fall time and single-channel time interval. For rise/fall time, LEVel or LEVel1 sets the lower reference; LEVel2 sets the upper reference. For single-channel time interval, LEVel or LEVel1 sets the threshold for the start event; LEVel2 sets the threshold for the stop event.
- SYSTem:ALEVel:FREQuency selects the minimum input signal frequency for auto-leveling.
- The instrument sets the level to 50% with auto-leveling enabled after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the input threshold voltage in the form +50.

Examples

The following example makes a frequency measurement on channel 1. The input is configured for an AC-coupled, auto-leveled threshold at 30% with a positive slope. (Note that CONFigure enables auto-leveling, but the INPut:LEVel:AUTO command is included for the example).

```
INP:COUP AC
CONF:FREQ 1.2E6
INP:LEV:AUTO ON
```

INPut{1|2}:LEVel{1|2}:RELative

```
INP:LEV:REL 30
READ?
```

Typical Response: +1.21513398300000E+006

See Also

CONFigure

INPut{1|2}:LEVel:AUTO

MEASure?

SYSTem:ALEVel:FREQuency

INPut{1|2}:NREJect

Syntax

INPut[{1|2}]:NREJect {OFF | ON}

INPut[{1|2}]:NREJect?

Description

This command enables or disables noise rejection (hysteresis) on the input channel.

Remarks

- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- CONFigure and MEASure? do not affect the noise rejection setting.
- The instrument disables noise rejection after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current noise rejection state: 0 (OFF) or 1 (ON).

Examples

The following example makes a frequency measurement on channel 1. The input has noise rejection enabled, and is configured auto-leveling with a negative slope.

```
INP:NREJ ON
CONF:FREQ 1.2E6
INP:SLOP NEG
READ?
```

Typical Response: +1.21513398300000E+006

See Also

INPut{1|2}:PROBe

Syntax

INPut[{1|2}]:PROBe {<factor> | MINimum | MAXimum | DEFault}

INPut[{1|2}]:PROBe? [{MINimum | MAXimum | DEFault}]

Description

This command selects the probe factor (1:1 or 10:1) for the input channel. With the correct probe factor set, threshold voltages can be set and measured referenced to the device under test instead of to the input to the instrument.

Parameters

Name	Type	Range of Values	Default Value
<factor>	Numeric	1 or 10 MIN = 1 MAX = 10	1

Remarks

- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- When a 1:1 probe factor is selected (INPut{1|2}:PROBe set to 1), the available ranges are 5.0 and 50.0. When a 10:1 probe factor is selected (INPut{1|2}:PROBe set to 1), the available ranges are 50.0 and 500.0.
- CONFigure and MEASure? do not affect the input probe factor.
- The instrument selects a 1:1 probe factor after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the probe factor in the form +1.

Examples

The following example makes a frequency measurement on channel 1 using a 10:1 probe. The threshold is set to 15V as referenced to the device under test.

```
INP:PROB 10
INP:COUP DC
INP:RANG 50
CONF:FREQ 1.2E6
INP:LEV 15
READ?
```

Typical Response: +1.21513398300000E+006

See Also

INPut{1|2}:PROTection?

Syntax

INPut[{1|2}]:PROTection?

Description

This query returns whether the 50 ohm termination protection relay has opened due to an input voltage overload when 50 ohm input impedance is selected.

Remarks

- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- When 50 ohms is selected, the maximum input voltage allowed is ±5.125 Vpk. If the input voltage exceeds ~±10 Vpk, which would damage the 50 ohm terminator, a protection relay will open, changing the actual input impedance to 1 Mohm. If this occurs, the INPut{1|2}:PROTection:CLEar command can be sent to reset the protection relay.
- The Voltage Overload bit in the Questionable Data Status Register will be set an input voltage overload causes the protection relay to open. The bit is cleared by sending the INPut{1|2}:PROTection:CLEar command to the affected channel, or by setting the affected channel's input impedance to 1 MOhm (INPut{1|2}:IMPedance command).

Return Format

The query returns the current protection relay state: 0 (relay is closed) or 1 (relay has opened).

Examples

The following example queries the input protection on channel 1.

```
INP1:PROT?
```

Typical Response: 0

See Also

INPut{1|2}:IMPedance

INPut{1|2}:PROTection:CLEar

INPut{1|2}:PROTection:CLEar

Syntax

INPut[{1|2}]:PROTection:CLEar

Description

This command resets the 50 ohm termination protection relay after an input voltage overload occurs when 50 ohm input impedance is selected.

Remarks

- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- When 50 ohms is selected, the maximum input voltage allowed is ±5.125 Vpk. If the input voltage exceeds ~±10 Vpk, which would damage the 50 ohm terminator, a protection relay will open, changing the actual input impedance to 1 Mohm. If this occurs, this command can be sent to reset the protection relay.
- If high voltage is still present when this command is sent, the protection relay will not be reset, and error +302, "Cannot reset input protection; high voltage present" will be generated.
- The INPut{1|2}:PROTection? command returns whether the protection relay has opened due to an input voltage overload.
- The Voltage Overload bit in the Questionable Data Status Register will be set an input voltage overload causes the protection relay to open. The bit is cleared by sending INPut{1|2}:PROTection:CLEar to the affected channel, or by setting the affected channel's input impedance to 1 MOhm (INPut {1|2}:IMPedance command).
- The instrument disables noise rejection after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Examples

The following example resets the input protection on channel 1.

```
INP:PROT:CLE
```

See Also

INPut{1|2}:IMPedance

INPut{1|2}:PROTection?

INPut{1|2}:RANGe

Syntax

INPut[{1|2}]:RANGe {<*range*> | MINimum | MAXimum | DEFault}

INPut[{1|2}]:RANGe? [{MINimum | MAXimum | DEFault}]

Description

This command selects the voltage range for the input channel.

Parameters

Name	Type	Range of Values	Default Value
<*range*>	Numeric	**1:1 probe factor:**	
		5.0, 50.0	5.0
		MIN = 5.0 MAX = 50.0	
		10:1 probe factor:	
		50.0, 500.0	50.0
		MIN = 50.0 MAX = 500.0	

Remarks

- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- When a 1:1 probe factor is selected (INPut{1|2}:PROBe set to 1), the available ranges are 5.0 and 50.0. When a 10:1 probe factor is selected (INPut{1|2}:PROBe set to 1), the available ranges are 50.0 and 500.0.
- CONFigure and MEASure? do not affect the input range.
- The instrument selects the 5V range after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the input range in the form +5.00000000E+000.

Examples

The following example makes a frequency measurement on channel 1. The input is configured for the 50V range and a DC-coupled 12V threshold with a negative slope.

```
INP:RANG 50
INP:COUP DC
```

```
CONF:FREQ 1.2E6
INP:LEV 12
INP:SLOP NEG
READ?
```

Typical Response: +1.21513398300000E+006

See Also

INPut{1|2}:LEVel

INPut{1|2}:PROBe

INPut{1|2}:SLOPe{1|2}

Syntax

INPut[{1|2}]:SLOPe[{1|2}] {POSitive | NEGative}

INPut[{1|2}]:SLOPe[{1|2}]?

Description

This command selects the active edge of the input signal that will be used for measurements.

Remarks

- INPut or INPut1 refers to channel 1; INPut2 to channel 2.
- SLOPe or SLOPe1 sets the active edge for all measurements other than single-channel time interval. For single-channel time interval, SLOPe or SLOPe1 sets the slope for the start event; SLOPe2 sets the slope for the stop event.
- The slope is ignored for measurements with pre-defined slopes: duty cycle, pulse width and rise/fall time.
- The instrument selects positive slope after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns either "POS" or "NEG".

Examples

The following example makes a frequency measurement on channel 1. The input is configured for a DC-coupled 0.5V threshold with a negative slope.

```
INP:COUP DC
 CONF:FREQ 1.2E6
 INP:LEV .5
 INP:SLOP NEG
 READ?
```

Typical Response: +1.21513398300000E+006

See Also

CONFigure

MEASure?

# INPut3:BURSt:LEVel

Syntax

INPut3:BURSt:LEVel {<*dB*> | MINimum | MAXimum | DEFault}

INPut3:BURSt:LEVel? [{MINimum | MAXimum | DEFault}]

Description

This command sets the threshold in terms of dB below the peak amplitude of the envelope of a pulsed input signal. This threshold is used for all pulse measurements. This setting can be used to compensate for known overshoot in the pulsed input signal.
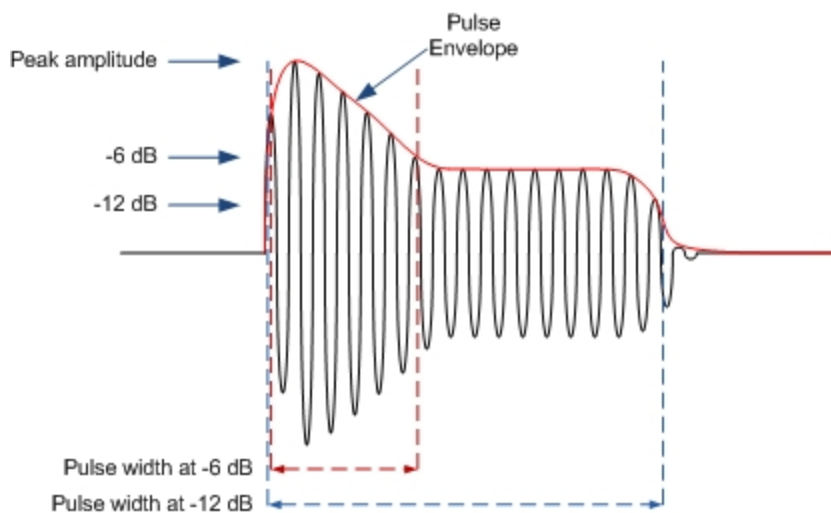
> **NOTE**   The threshold values are *approximate*. These values are not calibrated or specified.

Parameters

Name	Type	Range of Values	Default Value
<*value*>	Numeric	-6 or -12 dB	-6

Remarks

- *Available only on the Keysight 53230A. Requires option 150.*

- The instrument sets the pulse envelope threshold to -6 dB after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

INPut3:BURSt:LEVel

Return Format

The query returns the pulse envelope threshold voltage in the form -6.00000000E+000.

Examples

The following example makes a positive ("on time") width measurement of a pulsed input signal on channel 3 at a –12 dB threshold .

```
CONF:PWID:BURS
INP3:BURS:LEV -12
READ?
```

Typical Response: +1.21513000000000E-006

See Also

INPut3:STRength?

Syntax

INPut3:STRength?

Description

This query measures and returns the relative strength of the input signal on channel 3. The relative strength is a 0 to 4 indication of the input signal amplitude.

Remarks

- The relative strength is a 0 to 4 indication of the input signal amplitude:

Strength	Description
0	Signal strength too low. May not be able to make measurements.
1	Signal strength weak but acceptable.
2, 3	Good signal.
4	Signal may have exceeded level at which an accurate measurement can be made (> +19 dBm). Signal levels ≥ +27 dBM may damage the instrument.

Return Format

The query returns the relative input signal strength in the form +1.

Examples

The following example makes a relative strength measurement on channel 3.

```
INP3:STR?
```

Typical Response: +3

See Also

LXI Subsystem Introduction

Command Summary

LXI:IDENtify:STATe
LXI:IDENtify:STATe?
LXI:MDNS:ENABle
LXI:MDNS:ENABle?
LXI:MDNS:HNAMe:RESolved?
LXI:MDNS:SNAMe:DESired
LXI:MDNS:SNAMe:DESired?
LXI:MDNS:SNAMe:RESolved?
LXI:RESet
LXI:RESTart

LXI Subsystem Introduction

Command Summary

LXI:IDENtify:STATe
LXI:IDENtify:STATe?
LXI:MDNS:ENABle
LXI:MDNS:ENABle?
LXI:MDNS:HNAMe:RESolved?
LXI:MDNS:SNAMe:DESired
LXI:MDNS:SNAMe:DESired?
LXI:MDNS:SNAMe:RESolved?
LXI:RESet
LXI:RESTart

LXI:IDENtify:STATe

Syntax

LXI:IDENtify[:STATe] {OFF | ON}

LXI:IDENtify[:STATe]?

Description

This command turns the LXI LAN Status Indicator on the front panel display on or off.

Remarks

- The LAN Status Indicator helps you identify which LXI instrument is associated with the LAN address you are using.
- The instrument turns off the LAN Status Indicator after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current LAN Status Indicator state: 0 (OFF) or 1 (ON).

Examples

The following example turns on the LAN Status Indicator.

```
LXI:IDEN ON
```

See Also

LXI:MDNS:ENABle

Syntax

LXI:MDNS:ENABle {OFF | ON}

LXI:MDNS:ENABle?

Description

This command enables or disables multicast DNS (mDNS). mDNS provides the capabilities of a DNS server for service discovery in a small network that does not have a DNS server.

Remarks

- The mDNS enable setting is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- mDNS is enabled when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the current mDNS enable state: 0 (OFF) or 1 (ON).

Examples

The following example turns on mDNS.

```
LXI:MDNS:ENAB ON
```

See Also

LXI:MDNS:HNAMe:RESolved?

Syntax

LXI:MDNS:HNAMe[:RESolved]?

Description

This query returns the resolved (unique) mDNS host name.

Remarks

- The resolved mDNS hostname is in the form A-53220A-‹serial›-N (Keysight 53220A) or A-53230A-‹serial›-N (Keysight 53230A), where ‹*serial*› is the last 5 digits of the instrument's serial number. The -N, where N is an integer, is include only if necessary to make the name unique.

Return Format

The query returns the resolved mDNS host name as an ASCII string enclosed in double quotes.

Examples

The following example queries the resolved mDNS host name.

```
LXI:MDNS:HNAM:RES?
```

Typical Response: "A-53230A-00097"

See Also

LXI:MDNS:ENABle

LXI:MDNS:SNAMe:DESired

Syntax

LXI:MDNS:SNAMe:DESired "<*name*>"

LXI:MDNS:SNAMe:DESired?

Description

This command sets the desired mDNS service name.

Parameters

Name	Type	Range of Values	Default Value
<name>	Quoted String	A string of up to 63 characters	This is a required parameter

Remarks

- The desired mDNS servicename is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

- The desired mDNS service name is set to "Keysight 53220A Universal Frequency Counter/Timer - <serial_number>" (Keysight 53220A) or "Keysight 53230A Universal Frequency Counter/Timer - <serial_number>" (Keysight 53230A), where <*serial number*> is the instrument's serial number, when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the desired mDNS service name as an ASCII string enclosed in double quotes.

Examples

The following example defines a desired mDNS service name.

```
LXI:MDNS:SNAM:DES "LAB1-CNTR"
```

See Also

LXI:MDNS:ENABle

LXI:MDNS:SNAMe:RESolved?

LXI:MDNS:SNAMe:RESolved?

Syntax

LXI:MDNS:SNAMe[:RESolved]?

Description

This query returns the resolved (unique) mDNS service name.

Remarks

- The resolved mDNS service name will be the desired service name (LXI:MDNS:SNAMe:DESired command) with "(<n>)" appended , where <n> is an integer, only if it is necessary to make the name unique.

Return Format

The query returns the resolved mDNS service name as an ASCII string enclosed in double quotes.

Examples

The following example queries the resolved mDNS service name.

```
LXI:MDNS:SNAM:RES?
```

Typical Response: "Keysight 53230A Universal Frequency Counter/Timer - MY00000123"

See Also

LXI:MDNS:ENABle

LXI:MDNS:SNAMe:DESired

LXI:RESet

Syntax

LXI:RESet

Description

This command sets all LAN configuration settings to factory settings and restarts the LAN interface of the instrument.

Remarks

- Depending on your local network, the LAN interface may take several seconds to restart after this command is sent.
- If the LAN interface or specific LAN services (VXI-11, sockets, …) have been disabled by SYSTem:COMMunicate:ENABle, you must separately reenable the interface or services and power cycle the instrument for LAN to be operational.

Examples

The following example reset the LAN interface.

```
LXI:RES
```

See Also

SYSTem:COMMunicate:ENABle

LXI:RESTart

Syntax

LXI:RESTart

Description

This command restarts the LAN interface of the instrument using the current LAN configuration settings.

Remarks

- Depending on your local network, the LAN interface may take several seconds to restart after this command is sent.
- If the LAN interface or specific LAN services (VXI-11, sockets, ...) have been disabled by SYSTem:COMMunicate:ENABle, you must separately reenable the interface or services and power cycle the instrument for LAN to be operational.

Examples

The following example restart the LAN interface.

```
LXI:REST
```

See Also

SYSTem:COMMunicate:ENABle

SYSTem:COMMunicate:LAN:UPDate

MEASure Subsystem Introduction

The MEASure? command provides the easiest way to program the instrument for measurements. However, this command does not offer much flexibility. When you execute this command, the instrument uses default values for the requested measurement configuration and immediately performs the measurement. You cannot change any measurement attributes (other than function, range, and resolution) before the measurement is taken. The results are sent directly to the instrument's output buffer.

> **NOTE** Sending MEASure? is functionally the same as sending CONFigure followed immediately by a READ? command.

Command Summary

MEASure:FREQuency?

MEASure:FREQuency:RATio?

MEASure:FREQuency:BURSt?

MEASure:FREQuency:PRF?

MEASure:FREQuency:PRI?

MEASure:PERiod?

MEASure:SPERiod?

MEASure:TINTerval?

MEASure:FTIMe?

MEASure:RTIMe?

MEASure:NDUTycycle?

MEASure:PDUTycycle?

MEASure:NWIDth?

MEASure:PWIDth?

MEASure:NWIDth:BURSt?

MEASure:PWIDth:BURSt?

MEASure:PHASe?

MEASure:TOTalize:TIMed?

MEASure:ARRay:TSTamp?

Default Settings for the MEASure? Command

With the MEASure? command, you can select the function. All other measurement parameters are set to their default values as shown below.

Measurement Parameter:	MEASure Setting:
Input configuration	Range, low-pass filtering, coupling, impedance, noise rejection are unchanged. See the MEASure? commands for the different measurement functions for information about level and slope.
Frequency Mode	AUTO for frequency, frequency ratio, or average period, PRF or PRI measurements. Unchanged otherwise.

<function> Gate Gource	Depends on measurement function. See the MEASure? commands for the different measurement functions for details.
Gate Start Source	IMMediate
Gate Start Delay	TIME, 0 sec
Gate Stop Source	IMMediate
Gate Stop Holdoff	TIME, 0 sec
Gate Start and Stop Slope	NEGative
External Gate Source	Gate In/Out BNC
Burst Gate Auto	Enabled
Burst Gate Delay	0.0
Burst Gate Time	1 uS
Narrow Pulse Mode	Disabled
Samples per Trigger	1 sample, except for the MEASure:ARRay:TSTamp? command, which sets this value to the <count> parameter for this command.
Trigger Count	1 trigger
Trigger Delay	0 sec
Trigger Source	IMMediate
Trigger Slope	NEGative
Timestamp Rate	1.0E6
CALCulate subsystems	Disabled, including the individual calculate functions. The other parameters are unchanged.
Reference Oscillator	Unchanged
STATus, DATA, and FORMat subsystems	Unchanged
Auto-level Frequency	Unchanged
Measurement Timeout	Unchanged

Using the MEASure? Command

The following example shows how to use the MEASure? command to make a measurement. This example configures the instrument for frequency measurements, internally triggers the instrument to take a measurement, and then transfers the measurement to the instrument output buffer. The default resolution is used for the measurement.

```
MEAS:FREQ? 1.0E6
```

Typical Response: +1.03460000000000E+006

MEASure:ARRay:TSTamp?

Syntax

MEASure:ARRay:TSTamp? [(<count>) [,<channel>]]

Description

This query sets all measurement parameters and trigger parameters to default values for timestamp measurements at a nominal 1 MHz timestamp rate, then immediately triggers a measurement. The results are sent directly to the instrument output buffer. The <*count*> parameter specifies how many timestamps are to be returned.

Parameters

Name	Type	Range of Values	Default Value
<count>	numeric	1 to 1,000,000 MIN = 1 MAX = 1,000,000	100
<channel(s)>	Expression(s)	(@1) | (@2) | (@3)	(@1)

Remarks

- ***Available only on the Keysight 53230A.***
- Note the parentheses around the <count> parameter. These are required by the SCPI standard.
- For channel 1 or 2, the input channel is configured for auto-leveling at 50% with a positive slope.

> **NOTE**   Because this command enables auto-leveling if channel 1 or 2 is selected, it should not be used if the input frequency is lower than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command). You should use CONFigure:ARRay:TSTamp, INPut:LEVel{1|2}, and READ? instead of MEASure:ARRay:TSTamp?.

- SAMPle:COUNt is set to the value of <count>.
- The trigger count setting (TRIGger:COUNt) is ignored when making timestamp measurements. Only one trigger will be accepted for each READ? or INITiate[:IMMediate] command.
- The SENSe:GATE subsystem is not used when making timestamp measurements. The measurements will start immediately after a trigger and trigger delay.

Return Format

The query returns the prescaler value followed by a comma, followed by the measurements. The prescaler value is always returned in the format: +100. The format of the measurements is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument to make 1,000 timestamp measurements on channel 1, makes the measurements, and then transfers the prescaler value followed by the measurements to the instrument output buffer.

```
MEAS:ARR:TST? (1000)
```

Typical Response: +100,+5.10520000000000E-006,+5.10370000000000E-006, ... *(1,000 timestamps)*

See Also

CONFigure?

FETCh?

READ?

MEASure:FREQuency?

Syntax

MEASure:FREQuency? [{<*expected*> | MINimum | MAXimum | DEFault} [,{<*resolution*> | MINimum | MAXimum | DEFault}]] [,<channel>]

Description

This query sets all measurement parameters and trigger parameters to default values for frequency measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<*expected*>	Numeric	Channels 1 & 2: 0.1 Hz to 350 MHz MIN = .1 Hz MAX = 350 MHz Channel 3: Option 106: 100 MHz to 6.0 GHz MIN = 100 MHz MAX = 6.0 GHz Option 115: 300 MHz to 15.0 GHz MIN = 300 MHz MAX = 15.0 GHz	Channels 1 & 2: 10 MHz Channel 3: 500 MHz
<*resolution*>	Numeric	1.0E-15 * <*expected*> to 1.0E-5* <*expected*> MIN = 1.0E-15 * <*expected*> MAX = 1.0E-5 * <*expected*>	Value corresponding to .1 second gate time
<channel>	Expression	(@1) | (@2) | (@3)	(@1)

Remarks

- If <expected> is greater than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command), the input channel is configured for auto-leveling at 50% with a positive slope. Otherwise, the input channel is configured to use the currently programmed input threshold voltage and slope (see INPut:LEVel and INPut:SLOPe) with auto-leveling disabled.

- As defined in the SCPI standard, <*resolution*> must be specified in absolute frequency (hertz), not as a fraction of the input signal frequency.
- The gate source (see SENSe:FREQuency:GATE:SOURCE) is set to TIME.

- The counter uses the ‹*expected*› and ‹*resolution*› parameters to configure the setting for the SENSe:FREQuency:GATE:TIME command. The table below shows the relationship between relative resolution and gate time in seconds, where relative resolution = ‹*resolution*› / ‹*expected*›.

Relative Resolution	Gate Time (53220A)	Gate Time (53230A)
≤ 1.1E-14	1000 sec	1000 sec
>1.1E-14 to ≤1.1E-13	1000 sec	100 sec
>1.1E-13 to ≤1.1E-12	100 sec	10 sec
>1.1E-12 to ≤1.1E-11	10 sec	1 sec
>1.1E-11 to ≤1.1E-10	1 sec	100 msec
>1.1E-10 to ≤1.1E-9	100 msec	10 msec
>1.1E-9 to ≤1.1E-8	10 msec	1 msec
>1.1E-8 to ≤1.1E-7	1 msec	100 usec
>1.1E-7 to ≤1.1E-6	100 usec	10 usec
>1.1E-6	100 usec	1 usec

Return Format

The query returns a single measurement. The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for frequency measurements on channel 1 using default parameters, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:FREQ
```

Typical Response: +1.00230000000000E+007

The following example configures the instrument for 10-digit frequency measurements of an approximately 1.2 MHz signal on channel 2, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:FREQ? 1.2E6,1e-4,(@2)
```

Typical Response: +1.21513398300000E+006

See Also

CONFigure?

FETCh?

READ?

MEASure:FREQuency?

SENSe:FREQuency:GATE:SOURce

SENSe:FREQuency:GATE:TIME

SYSTem:ALEVel:FREQuency

SENSe:FREQuency:GATE:SOURce

Keysight 53220A/53230A Programmer's Reference

MEASure:FREQuency:BURSt?

Syntax

MEASure:FREQuency:BURSt? [<channel>]

Description

This query sets all measurement parameters and trigger parameters to default values to measure the carrier frequency of a burst (pulse frequency), then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<channel>	Expression	(@3)	(@3)

Remarks

- **Available only on the Keysight 53230A. Requires option 150.**

- CONFigure and MEASure disable narrow burst mode. Because of this, MEASure:FREQuency:BURSt? will return 9.91E37 (Not a Number) for bursts shorter than 10 microseconds. For such bursts, you should use CONFigure:FREQuency:BURSt, SENSe:FREQuency:BURSt:GATE:NARRow ON, and READ? instead of MEASure:FREQuency:BURSt?.

Return Format

The query returns a single measurement. The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for burst frequency measurements on channel 3 using default parameters, makes one measurement, and then transfers the measurement to the instrument output buffer. The burst must have a duration of at least 10 microseconds.

```
MEAS:FREQ:BURS?
```

Typical Response: +4.30013398300000E+009

See Also

CONFigure?

CONFigure:FREQuency:BURSt

MEASure:FREQuency:BURSt?

FETCh?

READ?

SENSe:FREQuency:BURSt:GATE:NARRow

MEASure:FREQuency:PRF?

Syntax

MEASure:FREQuency:PRF? [{<*expected*> | MINimum | MAXimum | DEFault} [,{<*resolution*> | MINimum | MAXimum | DEFault}]] [,<channel>]

Description

This query sets all measurement parameters and trigger parameters to default values for pulse repetition frequency measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<*expected*>	Numeric	1 Hz to 10 MHz MIN = 1 Hz MAX = 10 MHz	1 kHz
<*resolution*>	Numeric	1.0E-15 * <*expected*> to 1.0E-5* <*expected*> MIN = 1.0E-15 * <*expected*> MAX = 1.0E-5 * <*expected*>	Value corresponding to .1 second gate time
<channel>	Expression	(@3)	(@3)

Remarks

- ***Available only on the Keysight 53230A. Requires option 150.***

- As defined in the SCPI standard, <*resolution*> must be specified in absolute frequency (hertz), not as a fraction of the input signal frequency.
- The gate source (see SENSe:FREQuency:GATE:SOURCE) is set to TIME.
- The counter uses the <*expected*> and <*resolution*> parameters to configure the setting for the SENSe:FREQuency:GATE:TIME command. The table below shows the relationship between relative resolution and gate time in seconds, where relative resolution = <*resolution*> / <*expected*>.

Relative Resolution	Gate Time (53220A)	Gate Time (53230A)
≤ 1.1E-14	1000 sec	1000 sec
>1.1E-14 to ≤1.1E-13	1000 sec	100 sec
>1.1E-13 to ≤1.1E-12	100 sec	10 sec
>1.1E-12 to ≤1.1E-11	10 sec	1 sec
>1.1E-11 to ≤1.1E-10	1 sec	100 msec
>1.1E-10 to ≤1.1E-9	100 msec	10 msec

MEASure:FREQuency:PRF?

>1.1E-9 to ≤1.1E-8	10 msec	1 msec
>1.1E-8 to ≤1.1E-7	1 msec	100 usec
>1.1E-7 to ≤1.1E-6	100 usec	10 usec
>1.1E-6	100 usec	1 usec

Return Format

The query returns a single measurement.   The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for pulse repetition frequency measurements on channel 1 using default parameters, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:FREQ:PRF?
```

Typical Response: +1.00230000000000E+007

The following example configures the instrument for 10-digit pulse repetition frequency measurements of an approximately 1.2 MHz pulsed signal on channel 2, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:FREQ:PRF? 1.2E6,1e-4,(@2)
```

Typical Response: +1.21513398300000E+006

See Also

CONFigure?

FETCh?

READ?

SENSe:FREQuency:GATE:SOURce

SENSe:FREQuency:GATE:TIME

MEASure:FREQuency:PRI?

Syntax

MEASure:FREQuency:PRI? [{<*expected*> | MINimum | MAXimum | DEFault} [,{<*resolution*> | MINimum | MAXimum | DEFault}]] [,<channel>]

Description

This query sets all measurement parameters and trigger parameters default values for pulse repetition interval measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<*expected*>	Numeric	100 nsec to 1 sec MIN = 100 nsec MAX = 1 sec	.001 sec
<*resolution*>	Numeric	1.0E-15 * <*expected*> to 1.0E-5* <*expected*> MIN = 1.0E-15 * <*expected*> MAX = 1.0E-5 * <*expected*>	Value corresponding to .1 second gate time
<channel>	Expression	(@3)	(@3)

Remarks

- ***Available only on the Keysight 53230A. Requires option 150.***

- As defined in the SCPI standard, <*resolution*> must be specified in absolute frequency (hertz), not as a fraction of the input signal frequency.
- The gate source (see SENSe:FREQuency:GATE:SOURCE) is set to TIME.
- The counter uses the <*expected*> and <*resolution*> parameters to configure the setting for the SENSe:FREQuency:GATE:TIME command. The table below shows the relationship between relative resolution and gate time in seconds, where relative resolution = <*resolution*> / <*expected*>.

Relative Resolution	Gate Time (53230A)
≤ 1.1E-14	1000 sec
>1.1E-14 to ≤1.1E-13	100 sec
>1.1E-13 to ≤1.1E-12	10 sec
>1.1E-12 to ≤1.1E-11	1 sec
>1.1E-11 to ≤1.1E-10	100 msec
>1.1E-10 to ≤1.1E-9	10 msec

MEASure:FREQuency:PRI?

>1.1E-9 to ≤1.1E-8	1 msec
>1.1E-8 to ≤1.1E-7	100 usec
>1.1E-7 to ≤1.1E-6	10 usec
>1.1E-6	1 usec

Return Format

The query returns a single measurement.   The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for pulse repetition interval measurements on channel 3 using default parameters, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:FREQ:PRI? (@3)
```

Typical Response: +1.00230000000000E-007

The following example configures the instrument for 10-digit pulse repetition interval measurements of an approximately 1.2 MHz pulsed signal on channel 3, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:FREQ:PRI? 0.833E-6,1e-16,(@3)
```

Typical Response: +8.33337934613473E-007

See Also

CONFigure?

FETCh?

READ?

SENSe:FREQuency:GATE:SOURce

SENSe:FREQuency:GATE:TIME

MEASure:FREQuency:RATio?

Syntax

MEASure:FREQuency:RATio? [{<*expected*> | MINimum | MAXimum | DEFault} [,{<*resolution*> | MINimum | MAXimum | DEFault}]] [,<channel_pair>]

Description

This query sets all measurement parameters and trigger parameters to default values for frequency ratio measurements between two channels, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<*expected*>	Numeric	Ch1/Ch2, Ch2/Ch1: 2.8E-10 to 3.5E+9 MIN = 2.8E-10 MAX = 3.5E+9 Ch1/Ch3, Ch2/Ch3 Option 106: 1.6E-11 to 3.5 MIN = 1.6E-11 MAX = 3.5 Option 115: 6.6E-12 to 1.2 MIN = 6.6E-12 MAX = 1.2 Ch3/Ch1, Ch3/Ch2: Option 106: 0.28 to 6.0E10 MIN = .28 MAX = 6.0E10 Option 115: 0.85 to 15.0E10 MIN = .85 MAX = 15.0E10	1.0
<*resolution*>	Numeric	1.0E-15 * <*expected*> to 1.0E-5* <*expected*> MIN = 1.0E-15 * <*expected*> MAX = 1.0E-5 * <*expected*>	Value corresponding to .1 second gate time
<channel_pair>	Pair of Expressions	(@1),(@2) | (@1),(@3) | (@2),(@1) | (@2),(@3) | (@3),(@1) | (@3),(@2)	(@1),(@2)

MEASure:FREQuency:RATio?

Remarks

- As defined in the SCPI standard, ⟨*resolution*⟩ must be specified in absolute frequency (hertz), not as a fraction of the input signal frequency.
- The frequency of the first channel in the channel pair is used as the numerator of the ratio; the second channel as the denominator.
- The input channels are configured for auto-leveling at 50% with a positive slope.

> **NOTE**
>
> Because this command enables auto-leveling on channel 1 and/or 2, if selected, it should not be used if the input frequency is lower than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command). You should use CONFigure:FREQuency:RATio, INPut:LEVel{1|2}, and READ? instead of MEASure:FREQuency:RATio?.

- The gate source (see SENSe:FREQuency:GATE:SOURCE) is set to TIME.
- The counter uses the ⟨*expected*⟩ and ⟨*resolution*⟩ parameters to configure the setting for the SENSe:FREQuency:GATE:TIME command. The table below shows the relationship between relative resolution and gate time in seconds, where relative resolution = ⟨*resolution*⟩ / ⟨*expected*⟩.

Relative Resolution	Gate Time (53220A)	Gate Time (53230A)
≤ 1.1E-14	1000 sec	1000 sec
>1.1E-14 to ≤1.1E-13	1000 sec	100 sec
>1.1E-13 to ≤1.1E-12	100 sec	10 sec
>1.1E-12 to ≤1.1E-11	10 sec	1 sec
>1.1E-11 to ≤1.1E-10	1 sec	100 msec
>1.1E-10 to ≤1.1E-9	100 msec	10 msec
>1.1E-9 to ≤1.1E-8	10 msec	1 msec
>1.1E-8 to ≤1.1E-7	1 msec	100 usec
>1.1E-7 to ≤1.1E-6	100 usec	10 usec
>1.1E-6	100 usec	1 usec

Return Format

The query returns a single measurement.   The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for frequency ratio measurements between channel 1 and channel 2 using default parameters, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:FREQ:RAT?
```

Typical Response: +1.00230000000000E+001

The following example configures the instrument for 10-digit frequency ratio measurements between channel 2 and channel 1, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:FREQ:RAT? 1.2,1e-10,(@2),(@1)
```

Typical Response: +1.21513398300000E+001

See Also

CONFigure?

FETCh?

READ?

SENSe:FREQuency:GATE:SOURce

SENSe:FREQuency:GATE:TIME

MEASure:FTIMe?

Syntax

MEASure:FTIMe? [{<lower_*reference*> | MINimum | MAXimum | DEFault} [,{<upper_*reference*> | MINimum | MAXimum | DEFault}]] [,<channel>]

Description

This query sets all measurement parameters and trigger parameters to default values for fall time measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<lower_*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	10 PCT
<upper_*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	90 PCT
<channel>	Expression	(@1)	(@2)	(@1)

Remarks

- The <lower_reference> and <upper_reference> parameters specify the input signal reference level, either in terms of percent of peak-to-peak voltage, or in absolute voltage. To specify the level in percent, use a numeric value with no suffix or with the PCT suffix; for example, 30 or 30 PCT. To specify the level in absolute voltage, use a numeric value with the V or MV (millivolt) suffix: 100 MV or .1V.
- When either <lower_reference> or <upper_reference> is omitted or specified in percent, auto-leveling is enabled. When specified in absolute voltage, auto-leveling is disabled.

> **NOTE** Because this command enables auto-leveling if the reference values are omitted or specified in percent, you should specify the reference values in terms of absolute voltage if the input frequency is lower than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command).

- If <lower_reference> is greater than <upper_reference>, no error is generated, but the measurement result is undefined.

Return Format

The query returns a single measurement.   The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for fall time measurements on channel 1 using default parameters, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:FTIM?
```

Typical Response: +5.10520000000000E-006

The following example configures the instrument for fall time measurements on channel 2 with 20% and 80% reference levels, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:FTIM? 20,80,(@2)
```

Typical Response: +5.02573000000000E-006

See Also

CONFigure?

FETCh?

READ?

MEASure:NDUTycycle?

Syntax

MEASure:NDUTycycle? [{<*reference*> | MINimum | MAXimum | DEFault}] [,<channel>]

Description

This query sets all measurement parameters and trigger parameters to default values for negative duty cycle measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	50 PCT
<channel>	Expression	(@1) | (@2)	(@1)

Remarks

- The <reference> parameter specifies the input signal reference level, either in terms of percent of peak-to-peak voltage, or in absolute voltage. To specify the level in percent, use a numeric value with no suffix or with the PCT suffix; for example, 30 or 30 PCT. To specify the level in absolute voltage, use a numeric value with the V or MV (millivolt) suffix: 100 MV or .1V.
- When the <reference> is omitted or specified in percent, auto-leveling is enabled. When specified in absolute voltage, auto-leveling is disabled.

> **NOTE**   Because this command enables auto-leveling if the reference value is omitted or specified in percent, you should specify the reference value in terms of absolute voltage if the input frequency is lower than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command).

Return Format

The query returns a single measurement as a fraction (not as percent).   The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for duty cycle measurements on channel 1 using default parameters, makes one measurement, and then transfers the measurement to the instrument output

buffer.

```
MEAS:NDUT?
```

Typical Response: +5.10520000000000E-001

The following example configures the instrument for duty cycle measurements on channel 2 with a 1.2V reference level, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:NDUT? 1.2V,(@2)
```

Typical Response: +4.82342300000000E-001

See Also

CONFigure?

FETCh?

READ?

MEASure:NWIDth?

Syntax

MEASure:NWIDth? [{<*reference*> | MINimum | MAXimum | DEFault}] [,<channel>]

Description

This query sets all measurement parameters and trigger parameters to default values for negative pulse width measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	50 PCT
<channel>	Expression	(@1) | (@2)	(@1)

Remarks

- The <reference> parameter specifies the input signal reference level, either in terms of percent of peak-to-peak voltage, or in absolute voltage. To specify the level in percent, use a numeric value with no suffix or with the PCT suffix; for example, 30 or 30 PCT. To specify the level in absolute voltage, use a numeric value with the V or MV (millivolt) suffix: 100 MV or .1V.
- When the <reference> is omitted or specified in percent, auto-leveling is enabled. When specified in absolute voltage, auto-leveling is disabled.

> **NOTE** Because this command enables auto-leveling if the reference value is omitted or specified in percent, you should specify the reference value in terms of absolute voltage if the input frequency is lower than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command).

Return Format

The query returns a single measurement.   The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for pulse width measurements on channel 1 using default parameters, makes one measurement, and then transfers the measurement to the instrument

output buffer.

```
MEAS:NWID?
```

Typical Response: +5.10520000000000E-006

The following example configures the instrument for pulse width measurements on channel 2 with a 1.2V reference level, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:NWID? 1.2V,(@2)
```

Typical Response: +4.82342300000000E-006

See Also

CONFigure?

FETCh?

READ?

MEASure:NWIDth:BURSt?

Syntax

MEASure:NWIDth:BURSt? [<channel>]

Description

This query sets all measurement parameters and trigger parameters to default values for negative ("off time") width measurements of a pulsed input signal, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<channel>	Expression	(@3)	(@3)

Remarks

- **_Available only on the Keysight 53230A. Requires option 150._**

Return Format

The query returns a single measurement.   The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for pulse width measurements on channel 3 using default parameters, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:NWID:BURS?
```

Typical Response: +5.10520000000000E-006

See Also

CONFigure?

FETCh?

READ?

MEASure:PDUTycycle?

Syntax

MEASure:PDUTycycle? [{<*reference*> | MINimum | MAXimum | DEFault}] [,<channel>]

Description

This query sets all measurement parameters and trigger parameters to default values for positive duty cycle measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	50 PCT
<channel>	Expression	(@1) | (@2)	(@1)

Remarks

- The <reference> parameter specifies the input signal reference level, either in terms of percent of peak-to-peak voltage, or in absolute voltage. To specify the level in percent, use a numeric value with no suffix or with the PCT suffix; for example, 30 or 30 PCT. To specify the level in absolute voltage, use a numeric value with the V or MV (millivolt) suffix: 100 MV or .1V.
- When the <reference> is omitted or specified in percent, auto-leveling is enabled. When specified in absolute voltage, auto-leveling is disabled.

> **NOTE**
> Because this command enables auto-leveling if the reference value is omitted or specified in percent, you should specify the reference value in terms of absolute voltage if the input frequency is lower than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command).

Return Format

The query returns a single measurement as a fraction (not as percent).   The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for duty cycle measurements on channel 1 using default parameters, makes one measurement, and then transfers the measurement to the instrument output

MEASure:PDUTycycle?

buffer.

```
MEAS:PDUT?
```

Typical Response: +5.10520000000000E-001

The following example configures the instrument for duty cycle measurements on channel 2 with a 1.2V reference level, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:PDUT? 1.2V,(@2)
```

Typical Response: +4.82342300000000E-001

See Also

CONFigure?

FETCh?

READ?

MEASure:PERiod?

Syntax

MEASure:PERiod? [{<*expected*> | MINimum | MAXimum | DEFault} [,{<*resolution*> | MINimum | MAXimum | DEFault}]] [,<channel>]

Description

This query sets all measurement parameters and trigger parameters default values for average period measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<*expected*>	Numeric	Channels 1 & 2: 2.8 nsec to 10 sec MIN = 2.8 nsec MAX = 10 sec Channel 3: Option 106: 160 pS to 10 nS MIN = 160 pS MAX = 10 nS Option 115: 66 pS to 3.33 nS MIN = 66 pS MAX = 3.33 nS	Channels 1 & 2: 100 nsec Channel 3: 2 pS
<*resolution*>	Numeric	1.0E-15 * <*expected*> to 1.0E-5* <*expected*> MIN = 1.0E-15 * <*expected*> MAX = 1.0E-5 * <*expected*>	Value corresponding to .1 second gate time
<channel>	Expression	(@1) | (@2) | (@3)	(@1)

Remarks

- This query makes an averaging measurement. To make a single-period measurement, use MEASure:SPERiod?.
- If <expected> corresponds to a frequency greater than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command), the input channel is configured for auto-leveling at 50% with a positive slope. Otherwise, the input channel is configured to use the currently programmed input threshold voltage and slope (see INPut:LEVel and INPut:SLOPe) with auto-leveling disabled.
- As defined in the SCPI standard, <*resolution*> must be specified in absolute time (seconds), not as a fraction of the input signal period.

MEASure:PERiod?

- The gate source (see SENSe:FREQuency:GATE:SOURCE) is set to TIME.
- The counter uses the ‹*expected*› and ‹*resolution*› parameters to configure the setting for the SENSe:FREQuency:GATE:TIME command. The table below shows the relationship between relative resolution and gate time in seconds, where relative resolution = ‹*resolution*› / ‹*expected*›.

Relative Resolution	Gate Time (53220A)	Gate Time (53230A)
≤ 1.1E-14	1000 sec	1000 sec
>1.1E-14 to ≤1.1E-13	1000 sec	100 sec
>1.1E-13 to ≤1.1E-12	100 sec	10 sec
>1.1E-12 to ≤1.1E-11	10 sec	1 sec
>1.1E-11 to ≤1.1E-10	1 sec	100 msec
>1.1E-10 to ≤1.1E-9	100 msec	10 msec
>1.1E-9 to ≤1.1E-8	10 msec	1 msec
>1.1E-8 to ≤1.1E-7	1 msec	100 usec
>1.1E-7 to ≤1.1E-6	100 usec	10 usec
>1.1E-6	100 usec	1 usec

Return Format

The query returns a single measurement. The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for average period measurements on channel 1 using default parameters, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:PER?
```

Typical Response: +1.00230000000000E-007

The following example configures the instrument for 4-digit average period measurements of an approximately 250 MHz signal on channel 2, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:PER? 4e-9,1e-12,(@2)
```

Typical Response: +4.03337934613473E-009

See Also

CONFigure?

MEASure:SPERiod?

FETCh?

READ?

SENSe:FREQuency:GATE:SOURce

SENSe:FREQuency:GATE:TIME

MEASure:PHASe?

Syntax

MEASure:PHASe? [<channel_pair>]

Description

This query sets all measurement parameters and trigger parameters to default values for phase measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<channel_pair>	Pair of Expressions	(@1),(@2) | (@2),(@1)	(@1),(@2)

Remarks

- The input channels are configured for auto-leveling at 50% with a positive slope.

    NOTE   Because this command enables auto-leveling, it should not be used if either input frequency is lower than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command). You should use CONFigure:PHASe, INPut:LEVel{1|2}, and READ? instead of MEASure:PHASe?.

Return Format

The query returns a single measurement in terms of degrees. The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for phase measurements from channel 1 to channel 2, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:PHAS?
```

Typical Response: +5.10520000000000E+001

The following example configures the instrument for phase measurements from channel 2 to channel 1, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:PHAS? (@2),(@1)
```

Typical Response: +4.82342300000000E+001

See Also

CONFigure?

FETCh?

READ?

MEASure:PWIDth?

Syntax

MEASure:PWIDth? [{<*reference*> | MINimum | MAXimum | DEFault}] [,<channel>]

Description

This query sets all measurement parameters and trigger parameters to default values for positive pulse width measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	50 PCT
<channel>	Expression	(@1) | (@2)	(@1)

Remarks

- The <reference> parameter specifies the input signal reference level, either in terms of percent of peak-to-peak voltage, or in absolute voltage. To specify the level in percent, use a numeric value with no suffix or with the PCT suffix; for example, 30 or 30 PCT. To specify the level in absolute voltage, use a numeric value with the V or MV (millivolt) suffix: 100 MV or .1V.
- When the <reference> is omitted or specified in percent, auto-leveling is enabled. When specified in absolute voltage, auto-leveling is disabled.

> **NOTE**
>
> Because this command enables auto-leveling if the reference value is omitted or specified in percent, you should specify the reference value in terms of absolute voltage if the input frequency is lower than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command).

Return Format

The query returns a single measurement.   The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for pulse width measurements on channel 1 using default parameters, makes one measurement, and then transfers the measurement to the instrument

output buffer.

```
MEAS:PWID?
```

Typical Response: +5.10520000000000E-006

The following example configures the instrument for pulse width measurements on channel 2 with a 1.2V reference level, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:PWID? 1.2V,(@2)
```

Typical Response: +4.82342300000000E-006

See Also

CONFigure?

FETCh?

READ?

MEASure:PWIDth:BURSt?

Syntax

MEASure:PWIDth:BURSt? [<channel>]

Description

This query sets all measurement parameters and trigger parameters to default values for positive ("on time") width measurements of a pulsed input signal, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<channel>	Expression	(@3)	(@3)

Remarks

- **_Available only on the Keysight 53230A. Requires option 150._**

Return Format

The query returns a single measurement.   The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for pulse width measurements on channel 3 using default parameters, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:PWID:BURS?
```

Typical Response: +5.10520000000000E-006

See Also

CONFigure?

FETCh?

READ?

MEASure:RTIMe?

Syntax

MEASure:RTIMe? [{<lower_*reference*> | MINimum | MAXimum | DEFault} [,{<upper_*reference*> | MINimum | MAXimum | DEFault}]] [,<channel>]

Description

This query sets all measurement parameters and trigger parameters to default values for rise time measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<lower_*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	10 PCT
<upper_*reference*>	Numeric	10 to 90 PCT (percent) -5.125 to +5.125 V (5.125V range) -51.25 to +51.25 V (51.25V range) MIN = 10 PCT MAX = 90 PCT	90 PCT
<channel>	Expression	(@1)	(@2)	(@1)

Remarks

- The <lower_reference> and <upper_reference> parameters specify the input signal reference level, either in terms of percent of peak-to-peak voltage, or in absolute voltage. To specify the level in percent, use a numeric value with no suffix or with the PCT suffix; for example, 30 or 30 PCT. To specify the level in absolute voltage, use a numeric value with the V or MV (millivolt) suffix: 100 MV or .1V.
- When either <lower_reference> or <upper_reference> is omitted or specified in percent, auto-leveling is enabled. When specified in absolute voltage, auto-leveling is disabled.

> **NOTE**
>
> Because this command enables auto-leveling if the reference values are omitted or specified in percent, you should specify the reference values in terms of absolute voltage if the input frequency is lower than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command).

- If <lower_reference> is greater than <upper_reference>, no error is generated, but the measurement result is undefined.

MEASure:RTIMe?

Return Format

The query returns a single measurement. The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for rise time measurements on channel 1 using default parameters, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:RTIM?
```

Typical Response: +5.10520000000000E-006

The following example configures the instrument for rise time measurements on channel 2 with 20% and 80% reference levels, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:RTIM? 20,80,(@2)
```

Typical Response: +5.02573000000000E-006

See Also

CONFigure?

FETCh?

READ?

MEASure:SPERiod?

Syntax

MEASure:SPERiod? [<channel>]

Description

This query sets all measurement parameters and trigger parameters default values for single-period measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<channel>	Expression	(@1) | (@2)	(@1)

Remarks

- This query makes a single-period measurement. To make an averaging measurement, use MEASure:PERiod?.
- The input channel is configured for auto-leveling at 50% with a positive slope.

  NOTE Because this command enables auto-leveling on the selected channel, it should not be used if the input frequency is lower than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command). You should use CONFigure:SPERiod, INPut:LEVel{1|2}, and READ? instead of MEASure:SPERiod?.

- This measurement is a specialized time interval measurement. The gate is controlled by the SENSe:TINTerval:GATE:SOURce command.
- The gate source (see SENSe:TINTerval:GATE:SOURce) is set to IMMediate.

Return Format

The query returns a single measurement.   The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for single-period measurements on channel 1 using default parameters, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:SPER?
```

Typical Response: +1.00230000000000E-007

MEASure:SPERiod?

See Also

CONFigure?

MEASure:PERiod?

FETCh?

READ?

SENSe:TINTerval:GATE:SOURce

MEASure:TINTerval?

Syntax

MEASure:TINTerval? [<channel_pair>]

Description

This query sets all measurement parameters and trigger parameters to default values for time interval measurements between two channels, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<channel_pair>	Expression(s)	(@1),(@2) | (@2),(@1)	(@1),(@2)

Remarks

- The input channel are configured for auto-leveling at 50% with a positive slope.

  NOTE Because this command enables auto-leveling on the selected channel(s), it should not be used if the input frequency on the channel(s) is lower than the minimum input signal frequency for auto-leveling (see SYSTem:ALEVel:FREQuency command). You should use CONFigure:TINTerval, INPut:LEVel{1|2}, and READ? instead of MEASure:TINTerval?.

- The gate source (see SENSe:TINTerval:GATE:SOURce) is set to IMMediate.
- To make a single-period measurement on a channel, use MEASure:SPERiod?.

Return Format

The query returns a single measurement. The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for time interval measurements from channel 1 to channel 2, makes one measurement, and then transfers the measurements to the instrument output buffer.

```
MEAS:TINT? (@1),(@2)
READ?
```

Typical Response: +5.10520000000000E-006

MEASure:TINTerval?

See Also

CONFigure?

FETCh?

READ?

SENSe:TINTerval:GATE:SOURce

MEASure:TOTalize:TIMed?

Syntax

MEASure:TOTalize:TIMed? [{<gate_time> | MINimum | MAXimum | DEFault}] [,<channel>]

Description

This query sets all measurement parameters and trigger parameters to default values for timed totalize measurements, then immediately triggers a measurement. The results are sent directly to the instrument output buffer.

Parameters

Name	Type	Range of Values	Default Value
<gate_time>	Numeric	1 usec to 1000 sec MIN = 1 usec MAX = 1000 sec	.1 sec
<channel>	Expression	(@1) | (@2)	(@1)

Remarks

- The input channel is configured to use the currently programmed input threshold voltage and slope (see INPut:LEVel and INPut:SLOPe) with auto-leveling **disabled**.
- The gate source (see SENSe:TOTalize:GATE:SOURce) is set to TIME and the gate time (see SENSe:TOTalize:GATE:TIME) is set to the <gate_time> value.

Return Format

The query returns a single measurement. The format of the measurement is controlled by the FORMat Subsystem commands.

Examples

The following example configures the instrument for timed totalize measurements on channel 1 using default parameters, makes one measurement, and then transfers the measurement to the instrument output buffer.

```
MEAS:TOT:TIM?
```

Typical Response: +5.10500000000000E+003

The following example configures the instrument for 1 second timed totalize measurements on channel 2, makes one measurement, and then transfers the measurement to the instrument output buffer.

MEASure:TOTalize:TIMed?

```
MEAS:TOT:TIM? 1.0,(@2)
```

Typical Response: +4.82342300000000E+006

See Also

CONFigure?

FETCh?

INPut:LEVel

INPut:SLOPe

READ?

SENSe:TOTalize:GATE:SOURce

SENSe:TOTalize:GATE:TIME

MEMory Subsystem Introduction

Command Summary

MEMory:NSTates?
MEMory:STATe:DELete
MEMory:STATe:DELete:ALL
MEMory:STATe:RECall:AUTO
MEMory:STATe:RECall:AUTO?
MEMory:STATe:RECall:SELect
MEMory:STATe:RECall:SELect?
MEMory:STATe:VALid?

MEMory:NSTates?

Syntax

MEMory:NSTates?

Description

This command returns the total number of memory locations available for state storage. This command always returns +5 (memory location 0 is included).

Return Format

The query returns +5.

See Also

MEMory:STATe:DELete

Syntax

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

Description

This command deletes the contents of the specified storage location.

Remarks

- Although you may delete the state location 0, it will be recreated when the instrument is powered off.
- You cannot delete a storage location if it is selected and enabled for automatic power-on recall using the MEMory:STATe:RECall:SELect and MEMory:STATe:RECall:AUTO commands. You must either disable power-on state recall using MEMory:STATe:RECall:AUTO OFF or selected a different state using MEMory:STATe:RECall:SELect before deleting a selected and enabled state.
- Note that you cannot recall the instrument state from a storage location that was deleted. An error is generated if you attempt to recall a deleted state.
- The MEMory:STATe:DELete and MEMory:STATe:DELete:ALL commands delete, but do not sanitize, stored states.
- SYSTem:SECurity:IMMediate command deletes and sanitizes all stored states.

Examples

The following example deletes the contents of storage location 1.

```
MEM:STAT:DEL 1
```

See Also

*SAV

*RCL

MEMory:STATe:DELete:ALL

MEMory:STATe:DELete:ALL

Syntax

MEMory:STATe:DELete:ALL

Description

This command deletes the contents of all storage locations.

Remarks

- Although you may delete the state location 0, it will be recreated when the instrument is powered off.
- You cannot delete a storage location if it is selected and enabled for automatic power-on recall using the MEMory:STATe:RECall:SELect and MEMory:STATe:RECall:AUTO commands. You must either disable power-on state recall using MEMory:STATe:RECall:AUTO OFF or selected a different state using MEMory:STATe:RECall:SELect before deleting a selected and enabled state.
- Note that you cannot recall the instrument state from a storage location that was deleted. An error is generated if you attempt to recall a deleted state.
- The MEMory:STATe:DELete and MEMory:STATe:DELete:ALL commands delete, but do not sanitize, stored states.
- SYSTem:SECurity:IMMediate command deletes and sanitizes all stored states.

Examples

The following example deletes the contents of storage locations 0 through 4.

```
MEM:STAT:DEL:ALL
```

See Also

*SAV

*RCL

MEMory:STATe:DELete

MEMory:STATe:RECall:AUTO

Syntax

MEMory:STATe:RECall:AUTO {OFF | ON}

MEMory:STATe:RECall:AUTO?

Description

This command disables or enables the automatic recall of a specific stored instrument state when power is turned on. Select "ON" to automatically recall one of the four stored states, the power-down state (location 0), or a state file (see MEMory:STATe:RECall:SELect command) when power is turned on. Select "OFF" to issue a Factory Reset when power is turned on.

Remarks

- When shipped from the factory, storage locations 1 through 4 are empty and automatic recall is disabled with state 0 selected. The instrument is configured to issue a Factory Reset when power is restored.
- The automatic recall enable state is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the automatic recall state: 0 (OFF) or 1 (ON).

Examples

The following example saves the current state in state 2 and selects it to be used at power-on.

```
*SAV 2
MEM:STAT:REC:SEL 2
MEM:STAT:REC:AUTO ON
```

The following example saves the current state in file MyFreqMeas.sta in the root directory of the internal flash file system and selects it to be used at power-on.

```
MMEM:STOR:STAT "INT:\MyFreqMeas"
MEM:STAT:REC:SEL "INT:\MyFreqMeas"
MEM:STAT:REC:AUTO ON
```

See Also

MEMory:STATe:RECall:SELect

MEMory:STATe:RECall:AUTO

*SAV

MEMory:STATe:RECall:SELect

Syntax

MEMory:STATe:RECall:SELect {0 | 1 | 2 | 3 | 4 | ‹file›}

MEMory:STATe:RECall:SELect?

Description

This command selects which instrument state or state file will be used at power on if the automatic recall mode is enabled (see MEMory:STATe:RECall:AUTO ON command). If the automatic recall mode is disabled (MEMory:STATe:RECall:AUTO OFF), then a Factory Reset is issued when power is turned on.

If a file name is specified, the file name optionally includes the folder name and the .sta file extension.

Remarks

- The format for ‹file› is "[‹drive›:‹path›]‹file_name›", where ‹drive› can be INTernal or USB, and ‹path› must be an absolute folder path.
  - INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  - If ‹drive›:‹path› is omitted, the folder specified by the MMEMory:CDIRectory command is used.
  - Absolute paths begin with a "\" or "/" and start at the root folder of ‹drive›.
  - Folder and file names cannot contain the following characters: \ / : * ? " ‹ › |
  - The combination of folder and file name cannot exceed 240 characters.
  - The specified file must exist and cannot be marked as hidden or system.
- Location 0 is automatically overwritten with the power-down state when power is turned off.
- When shipped from the factory, storage locations 1 through 4 are empty and automatic recall is disabled with state 0 selected. The instrument is configured to issue a Factory Reset when power is restored.
- The automatic recall state selection is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns which instrument state will be used at power on: 0, 1, 2, 3, or 4.

Examples

The following example saves the current state in state 2 and selects it to be used at power-on.

```
*SAV 2
 MEM:STAT:REC:SEL 2
 MEM:STAT:REC:AUTO ON
```

MEMory:STATe:RECall:SELect

The following example saves the current state in file MyFreqMeas.sta in the root directory of the internal flash file system and selects it to be used at power-on.

```
MMEM:STOR:STAT "INT:\MyFreqMeas"
 MEM:STAT:REC:SEL "INT:\MyFreqMeas"
 MEM:STAT:REC:AUTO ON
```

See Also

MEMory:STATe:RECall:AUTO

*SAV

MEMory:STATe:VALid?

Syntax

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

Description

This command queries the specified storage location to determine if a valid state is currently stored in this location.

Remarks

- You can use this command before sending the *RCL command to determine if a state has been previously stored in this location.

Return Format

The query returns 0 if no state has been stored or if it has been deleted. It returns 1 if a valid state is stored in this location.

Example

The following example returns the state of storage location 3.

```
MEM:STAT:VAL? 3
```

Typical Response: 0

See Also

*RCL

*SAV

MMEMory Subsystem Introduction

Command Summary

MMEMory:CATalog:ALL?
MMEMory:CATalog:DATA?
MMEMory:CATalog:STATe?
MMEMory:CDIRectory
MMEMory:CDIRectory?
MMEMory:COPY
MMEMory:DELete
MMEMory:DOWNload:DATA
MMEMory:DOWNload:FNAMe
MMEMory:LOAD:STATe
MMEMory:MDIRectory
MMEMory:MOVE
MMEMory:RDIRectory
MMEMory:STORe:DATA
MMEMory:STORe:STATe
MMEMory:UPLoad?

MMEMory:CATalog:ALL?

Syntax

MMEMory:CATalog[:ALL]? [<folder>]

Description

This command returns a list of all files in the specified folder.

Parameters

Name	Type	Range of Values	Default Value
<folder>	String	Any valid folder name	folder specified by the MMEMory:CDIRectory command

Remarks

- The format for <folder> is "[[<drive>:]<path>]", where <drive> can be INTernal or USB, and <path> is a folder path.

  - INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  - If <drive> is specified, <path> is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of <drive>.
  - If <drive> is omitted, <path> is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must *not* begin with "\" or "/".
  - Folder and file names cannot contain the following characters: \ / : * ? " < > |
  - <folder> cannot exceed 240 characters.
  - The specified folder must exist and cannot be marked as hidden or system.
- MMEMory:CATalog:DATA? will return the catalog of only the data (.csv) files in the selected folder.
- MMEMory:CATalog:STATe? will return the catalog of only the state (.sta) files in the selected folder.

Return Format

The query returns the catalog in the following form:

<mem_used>,<mem_free>{,"<file listing>"}

The instrument returns two numeric values and a string for each file in the selected folder. The first numeric indicates the total number of bytes of storage currently used on the drive. The second indicates the total number of bytes of storage currently available. Each <file listing> is in the format "<file_name>,<file_type>,<file_size>" (the quotes are also returned), where <file_name> is the name of the file including file extension, if any; <file_type> is either STAT for STATe (.sta) files, ASC for DATA (.csv) files, FOLD for folders, or PREF for user preferences (.prf) files, null for all other file extensions; <file_size> is the size of the file in bytes.

MMEMory:CATalog:ALL?

If no files exist, only <mem_used>,<mem_free> is returned.

> **NOTE** Because the counter uses a small amount of space in the flash file system for internal use, the <mem_used> value will not be zero even if no user files exist on the drive.

Examples

The following example returns a list of all files in the folder MyData on the front panel USB storage device.

```
MMEM:CAT? "USB:\MyData"
```

Typical Response: +1000000000,+327168572,"-command.exe,,375808","MyFreqMeas.sta,STAT,8192","Abc.csv,ASC,11265"

See Also

MMEMory:CATalog:DATA?

MMEMory:CATalog:STATe?

MMEMory:CDIRectory

MMEMory:CATalog:DATA?

Syntax

MMEMory:CATalog:DATA? [<folder>]

Description

This command returns a list of all data files (.csv and .dat file extensions) in the specified folder.

Parameters

Name	Type	Range of Values	Default Value
<folder>	String	Any valid folder name	folder specified by the MMEMory:CDIRectory command

Remarks

- The format for <folder> is "[[<drive>:]<path>]", where <drive> can be INTernal or USB, and <path> is a folder path.

  ○ INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  ○ If <drive> is specified, <path> is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of <drive>.
  ○ If <drive> is omitted, <path> is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must *not* begin with "\" or "/".
  ○ Folder and file names cannot contain the following characters: \ / : * ? " < > |
  ○ <folder> cannot exceed 240 characters.
  ○ The specified folder must exist and cannot be marked as hidden or system.
- MMEMory:CATalog:ALL? returns the catalog of all files in the selected folder.
- MMEMory:CATalog:STATe? will return the catalog of only the state (.sta) files in the selected folder.

Return Format

The query returns the catalog in the following form:

<mem_used>,<mem_free>{,"<file listing>"}

The instrument returns two numeric values and a string for each data file in the selected folder. The first numeric indicates the total number of bytes of storage currently used on the drive. The second indicates the total number of bytes of storage currently available. Each <file listing> is in the format "<file_name>,<file_type>,<file_size>" (the quotes are also returned), where <file_name> is the name of the file including file extension, if any; <file_type> is either STAT for STATe (.sta) files, ASC for DATA (.csv) files, FOLD for folders, or null for all other file extensions; <file_size> is the size of the file in bytes.

If no data files exist, only <mem_used>,<mem_free> is returned.

MMEMory:CATalog:DATA?

> **NOTE** Because the counter uses a small amount of space in the flash file system for internal use, the <mem_used> value will not be zero even if no user files exist on the drive.

Examples

The following example returns a list of all data files in the folder MyData on the front panel USB storage device.

```
MMEM:CAT:DATA? "USB:\MyData"
```

Typical Response: +1000000000,+327168572,"Abc.csv,ASC,11265"

See Also

MMEMory:CATalog:ALL?

MMEMory:CDIRectory

MMEMory:STORe:DATA

MMEMory:CATalog:STATe?

Syntax

MMEMory:CATalog:STATe? [<folder>]

Description

This command returns a list of all state files (.sta file extension) in the specified folder.

Parameters

Name	Type	Range of Values	Default Value
<folder>	String	Any valid folder name	folder specified by the MMEMory:CDIRectory command

Remarks

- The format for <folder> is "[[<drive>:]<path>]", where <drive> can be INTernal or USB, and <path> is a folder path.
  - INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  - If <drive> is specified, <path> is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of <drive>.
  - If <drive> is omitted, <path> is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must *not* begin with "\" or "/".
  - Folder and file names cannot contain the following characters: \ / : * ? " < > |
  - <folder> cannot exceed 240 characters.
  - The specified folder must exist and cannot be marked as hidden or system.
- MMEMory:CATalog:ALL? returns the catalog of all files in the selected folder.
- MMEMory:CATalog:DATA? will return the catalog of only the data (.csv) files in the selected folder.

Return Format

The query returns the catalog in the following form:

<mem_used>,<mem_free>{,"<file listing>"}

The instrument returns two numeric values and a string for each state file in the selected folder. The first numeric indicates the total number of bytes of storage currently used on the drive. The second indicates the total number of bytes of storage currently available. Each <file listing> is in the format "<file_name>,<file_type>,<file_size>" (the quotes are also returned), where <file_name> is the name of the file including file extension, if any; <file_type> is either STAT for STATe (.sta) files, ASC for DATA (.csv) files, FOLD for folders, or null for all other file extensions; <file_size> is the size of the file in bytes.

If no state files exist, only <mem_used>,<mem_free> is returned.

MMEMory:CATalog:STATe?

> **NOTE** Because the counter uses a small amount of space in the flash file system for internal use, the <mem_used> value will not be zero even if no user files exist on the drive.

Examples

The following example returns a list of all state files in the folder MyData on the front panel USB storage device.

```
MMEM:CAT? "USB:\MyData"
```

Typical Response: +1000000000,+327168572,"MyFreqMeas.sta,STAT,8192"

See Also

MMEMory:CATalog:ALL?

MMEMory:CDIRectory

MMEMory:STORe:STATe

MMEMory:CDIRectory

Syntax

MMEMory:CDIRectory <folder>

MMEMory:CDIRectory?

Description

This command selects the default folder for the MMEMory subsystem commands. This folder must exist and is used when folder or file names do not include a drive and folder name.

Remarks

- The format for <folder> is "[[<drive>:]<path>]", where <drive> can be INTernal or USB, and <path> is a folder path.

- INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
- If <drive> is specified, <path> is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of <drive>.
- If <drive> is omitted, <path> is relative to the folder currently specified by the MMEMory:CDIRectory command. Relative paths must *not* begin with "\" or "/".
- Folder and file names cannot contain the following characters: \ / : * ? " < > |
- <folder> cannot exceed 240 characters.
- The specified folder must exist and cannot be marked as hidden or system.
- The instrument resets the default folder to the root directory on the internal flash file system ("INT:\") after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the default folder as a quoted string.

Examples

The following example selects the folder "\Backup" on the internal flash file system as the default folder for MMEMory subsystem commands.

```
MMEM:CDIR "INT:\Backup"
```

The following example returns the default folder for MMEMory subsystem commands.

```
MMEM:CDIR?
```

Typical Response: **"\"**

MMEMory:CDIRectory

See Also

MMEMory:CATalog?

MMEMory:CATalog:DATA?

MMEMory:CATalog:STATe?

MMEMory:COPY

MMEMory:DELete

MMEMory:LOAD:STATe

MMEMory:MOVE

MMEMory:STORe:DATA

MMEMory:STORe:STATe

MMEMory:COPY

Syntax

MMEMory:COPY ‹file1›,‹file2›

Description

This command copies ‹file›1 to ‹file2›. The file names must include any file extension.

Remarks

- The format for ‹file1› and ‹file2› is "[[‹drive›:]‹path›]‹file_name›", where ‹drive› can be INTernal or USB, and ‹path› is a file path.
  - INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  - If ‹drive› is specified, ‹path› is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of ‹drive›.
  - If ‹drive› is omitted, ‹path› is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must *not* begin with "\" or "/".
  - Folder and file names cannot contain the following characters: \ / : * ? " ‹ › |
  - The combination of folder and file name cannot exceed 240 characters.
  - The source file and folder must exist and cannot be marked as hidden or system.
  - The destination folder must exist and cannot be marked as hidden or system.
  - If the destination file exists, it will be overwritten, unless marked as a hidden or system file.
- To copy a file to a file of the same name in a different folder, you can specify just the ‹drive› and/or ‹path› for ‹file2›.

Examples

The following example copies the state file MyFreqMeas.sta from the root directory to the folder "Backup" on the internal flash file system.

```
MMEM:COPY "INT:\MyFreqMeas.sta","INT:\Backup"
```

See Also

MMEMory:CDIRectory

MMEMory:MOVE

MMEMory:DELete

Syntax

MMEMory:DELete <file>

Description

This command deletes the specified file. The file name must include any file extension.

Remarks

- The format for <file> is "[[<drive>:]<path>]<file_name>", where <drive> can be INTernal or USB, and <path> is a folder path.
  - INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  - If <drive> is specified, <path> is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of <drive>.
  - If <drive> is omitted, <path> is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must *not* begin with "\" or "/".
  - Folder and file names cannot contain the following characters: \ / : * ? " < > |
  - The combination of folder and file name cannot exceed 240 characters.
  - The specified file cannot be marked as hidden or system.
- This command deletes files. To delete a folder, use the MMEMory:RDIRectory command.

Examples

The following example deletes the state file MyFreqMeas.sta from the root directory of the internal flash file system.

```
MMEM:DEL "INT:\MyFreqMeas.sta"
```

See Also

MMEMory:CDIRectory

MMEMory:DOWNload:DATA

Syntax

MMEMory:DOWNload:DATA <block>

Description

This command downloads data from the host computer to a local file in the instrument. The file name must have been previously specified by MMEMory:DOWNload:FNAMe. The data in <binary_block> is written to the select file.

> **NOTE**   Any data previously stored in the file will be lost.

Remarks

- <block> can be an IEEE 488.2 definite- or indefinite-length block.

Examples

The following example writes the word "Hello" to the file "\Myfile" on the internal flash file system.

```
MMEM:DOWN:FNAM "INT:\Myfile"
 MMEM:DOWN:DATA #15Hello
```

See Also

MMEMory:DOWNload:FNAMe

MMEMory:UPLoad?

MMEMory:DOWNload:FNAMe

Syntax

MMEMory:DOWNload:FNAMe ‹file›

MMEMory:DOWNload:FNAMe?

Description

This command downloads the local file for downloading a file from the host computer to the instrument. The file name must be specified before sending the file contents via the MMEMory:DOWNload:DATA command.

Remarks

- The format for ‹file› is "[[‹drive›:]‹path›]‹file_name›", where ‹drive› can be INTernal or USB, and ‹path› is a folder path.
  - INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  - If ‹drive› is specified, ‹path› is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of ‹drive›.
  - If ‹drive› is omitted, ‹path› is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must *not* begin with "\" or "/".
  - ‹folder› cannot exceed 240 characters.
  - The specified folder must exist and cannot be marked as hidden or system.
  - The file will be created if it does not already exist.

Return Format

The query returns the file name as a quoted string.

Examples

The following example writes the word "Hello" to the file "\Myfile" on the internal flash file system.

```
MMEM:DOWN:FNAM "INT:\Myfile"
 MMEM:DOWN:DATA #15Hello
```

See Also

MMEMory:DOWNload:DATA

MMEMory:UPLoad?

MMEMory:LOAD:PREFerences

Syntax

MMEMory:LOAD:PREFerences <file>

Description

This command loads the non-volatile I/O settings and user preferences from a file. The file name optionally includes the .prf file extension.

> **CAUTION** When loading a preferences file that specifies a static IP address for LAN, be careful that this does not result in a two instruments with the same IP address on your LAN. This could result in LAN configuration errors on both instruments.

Remarks

- The format for <file> is "[<drive>:<path>]<file_name>", where <drive> can be INTernal or USB, and <path> must be an absolute folder path.
  - INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  - If <drive>:<path> is omitted, the folder specified by the MMEMory:CDIRectory command is used.
  - Absolute paths begin with a "\" or "/" and start at the root folder of <drive>.
  - Folder and file names cannot contain the following characters: \ / : * ? " < > |
  - The combination of folder and file name cannot exceed 240 characters.
  - The specified file cannot be marked as hidden or system.
- User preferences include the values for:
  - Display brightness, radix, separator, and screen saver state
  - Help system language
  - MEMory:STATe:RECall:AUTO
  - MEMory:STATe:RECall:SELect
  - SENSe:ROSCillator:EXTernal:FREQuency
  - SENSe:ROSCillator:INTernal:POWer:STANdby
  - SENSe:ROSCillator:SOURce
  - SENSe:ROSCillator:SOURce:AUTO
  - SYSTem:ALEVel:FREQuency
  - SYSTem:BATTery:ENABle
  - SYSTem:BEEPer:STATe
  - SYSTem:LANGuage
  - SYSTem:TIMeout

Examples

The following example loads nonvolatile I/O settings and user preferences from the state file MyPreferences.prf in the root directory of the internal flash file system.

```
MMEM:LOAD:PREF "INT:\MyPreferences"
```

MMEMory:LOAD:PREFerences

MMEMory:CDIRectory

MMEMory:STORe:PREFerences

MMEMory:LOAD:STATe

Syntax

MMEMory:LOAD:STATe ‹file›

Description

This command loads the instrument state from a state file. The file name optionally includes the .sta file extension.

Remarks

- The storage locations are the same as the ones used by *SAV and *RCL.
- The format for ‹file› is "[‹drive›:‹path›]‹file_name›", where ‹drive› can be INTernal or USB, and ‹path› must be an absolute folder path.
  - INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  - If ‹drive›:‹path› is omitted, the folder specified by the MMEMory:CDIRectory command is used.
  - Absolute paths begin with a "\" or "/" and start at the root folder of ‹drive›.
  - Folder and file names cannot contain the following characters: \ / : * ? " ‹ › |
  - The combination of folder and file name cannot exceed 240 characters.
  - The specified file cannot be marked as hidden or system.

Examples

The following example loads the instrument state from the state file MyFreqMeas.sta in the root directory of the internal flash file system.

```
MMEM:LOAD:STAT "INT:\MyFreqMeas"
```

See Also

MMEMory:CDIRectory

MMEMory:STORe:STATe

MMEMory:MDIRectory

Syntax

MMEMory:MDIRectory ‹folder›

Description

This command creates a new folder.

Remarks

- The format for ‹folder› is "[[‹drive›:]‹path›]", where ‹drive› can be INTernal or USB, and ‹path› is a folder path.

- INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
- If ‹drive› is specified, ‹path› is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of ‹drive›.
- If ‹drive› is omitted, ‹path› is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must *not* begin with "\" or "/".
- Folder and file names cannot contain the following characters: \ / : * ? " ‹ › |
- ‹folder› cannot exceed 240 characters.
- Any intermediate folders must exist and cannot be marked as hidden or system.
- This command will only create the last folder in ‹folder›.

Examples

The following example creates the folder "\Backup" on the internal flash file system.

```
MMEM:MDIR "INT:\Backup"
```

See Also

MMEMory:CDIRectory

MMEMory:RDIRectory

MMEMory:MOVE

Syntax

MMEMory:MOVE ‹file1›,‹file2›

Description

This command moves and/or renames ‹file1› to ‹file2›. The file names must include the file extension.

Remarks

- The format for ‹file1› and ‹file2› is "[[‹drive›:]‹path›]‹file_name›", where ‹drive› can be INTernal or USB, and ‹path› is a file path.
  - INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  - If ‹drive› is specified, ‹path› is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of ‹drive›.
  - If ‹drive› is omitted, ‹path› is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must *not* begin with "\" or "/".
  - Folder and file names cannot contain the following characters: \ / : * ? " ‹ › |
  - The combination of folder and file name cannot exceed 240 characters.
  - The destination folder must exist and cannot be marked as hidden or system.
  - If the destination file exists, it will be overwritten, unless marked as a hidden or system file.
- To simply rename a file, specify the same folder for both ‹file1› and ‹file2›.
- To move a file to a file of the same name in a different folder, you can specify just the ‹drive›:‹path› for ‹file2›.

Examples

The following example moves the state file MyFreqMeas.sta from the currently selected default directory to the folder "Backup" on the internal flash file system.

```
MMEM:MOVE "MyFreqMeas.sta","INT:\Backup"
```

See Also

MMEMory:CDIRectory

MMEMory:COPY

MMEMory:RDIRectory

Syntax

MMEMory:RDIRectory ‹folder›

Description

This command removes the specified folder.

Remarks

- The format for ‹folder› is "[[‹drive›:]‹path›]", where ‹drive› can be INTernal or USB, and ‹path› is a folder path.

  ○ INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  ○ If ‹drive› is specified, ‹path› is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of ‹drive›.
  ○ If ‹drive› is omitted, ‹path› is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must *not* begin with "\" or "/".
  ○ Folder and file names cannot contain the following characters: \ / : * ? " ‹ › |
  ○ ‹folder› cannot exceed 240 characters.
  ○ The specified folder must exist and cannot be marked as hidden or system.
  ○ The folder must be empty (no files stored in the folder).
- You cannot delete the folder selected by MMEMory:CDIRectory.

Examples

The following example removes the folder "\Backup" on the internal flash file system.

```
MMEM:RDIR "INT:\Backup"
```

See Also

MMEMory:CDIRectory

MMEMory:STORe:DATA

Syntax

MMEMory:STORe:DATA RDG_STORE, ‹file›

Description

This command stores all measurements in the reading memory to the specified data file. The file name optionally includes the folder name and the file extension.

Remarks

- The file extension (.csv or .dat) specifies the data format. If .csv is specified, the data is stored in comma-separated value (CSV) format, with one measurement per line in ASCII format. If .dat is specified, the data is stored as binary 64-bit floating point values in little-endian byte order. The default data format is CSV.

- The format for ‹file› is "[[‹drive›:]‹path›]‹file_name›", where ‹drive› can be INTernal or USB, and ‹path› is a folder path.
- INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
- If ‹drive› is specified, ‹path› is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of ‹drive›.
- If ‹drive› is omitted, ‹path› is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must *not* begin with "\" or "/".
- Folder and file names cannot contain the following characters: \ / : * ? " ‹ › |
- The combination of folder and file name cannot exceed 240 characters.
- The destination folder must exist and cannot be marked as hidden or system.
- If the destination file exists, it will be overwritten, unless marked as a hidden or system file.

Examples

The following example stores all measurements in the reading memory to the data file MyFreqMeas.csv in the root directory of the internal flash file system.

```
MMEM:STOR:DATA RDG_STORE,"INT:\MyFreqMeas"
```

See Also

MMEMory:CATalog:DATA?

MMEMory:CDIRectory

MMEMory:STORe:PREFerences

Syntax

MMEMory:STORe:PREFerences ‹file›

Description

This command stores non-volatile I/O settings and user preferences to a file. The file name optionally includes the folder name and the .prf file extension.

Remarks

- The format for ‹file› is "[[‹drive›:]‹path›]‹file_name›", where ‹drive› can be INTernal or USB, and ‹path› is a folder path.
  - INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  - If ‹drive› is specified, ‹path› is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of ‹drive›.
  - If ‹drive› is omitted, ‹path› is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must **not** begin with "\" or "/".
  - Folder and file names cannot contain the following characters: \ / : * ? " ‹ › |
  - The combination of folder and file name cannot exceed 240 characters.
  - The destination folder must exist and cannot be marked as hidden or system.
  - If the destination file exists, it will be overwritten, unless marked as a hidden or system file.

- User preferences include the values for:
  - Display brightness, radix, separator, and screen saver state
  - Help system language
  - MEMory:STATe:RECall:AUTO
  - MEMory:STATe:RECall:SELect
  - SENSe:ROSCillator:EXTernal:FREQuency
  - SENSe:ROSCillator:INTernal:POWer:STANdby
  - SENSe:ROSCillator:SOURce
  - SENSe:ROSCillator:SOURce:AUTO
  - SYSTem:ALEVel:FREQuency
  - SYSTem:BATTery:ENABle
  - SYSTem:BEEPer:STATe
  - SYSTem:LANGuage
  - SYSTem:TIMeout

Examples

The following example stores the current instrument state to the state file MyPreferences.prf in the root directory of the internal flash file system.

```
MMEM:STOR:PREF "INT:\MyFreqMeas"
```

See Also

MMEMory:CDIRectory

MMEMory:LOAD:PREFerences

MMEMory:STORe:STATe

Syntax

MMEMory:STORe:STATe ‹file›

Description

This command stores the current instrument state to a state file. The file name optionally includes the folder name and the .sta file extension.

Remarks

- The storage locations are the same as the ones used by *SAV and *RCL.
- The specified state storage location must not be empty.
- The format for ‹file› is "[[‹drive›:]‹path›]‹file_name›", where ‹drive› can be INTernal or USB, and ‹path› is a folder path.
- INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
- If ‹drive› is specified, ‹path› is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of ‹drive›.
- If ‹drive› is omitted, ‹path› is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must *not* begin with "\" or "/".
- Folder and file names cannot contain the following characters: \ / : * ? " ‹ › |
- The combination of folder and file name cannot exceed 240 characters.
- The destination folder must exist and cannot be marked as hidden or system.
- If the destination file exists, it will be overwritten, unless marked as a hidden or system file.

Examples

The following example stores the current instrument state to the state file MyFreqMeas.sta in the root directory of the internal flash file system.

```
MMEM:STOR:STAT "INT:\MyFreqMeas"
```

See Also

*SAV

MMEMory:CDIRectory

MMEMory:LOAD:STATe

MMEMory:UPLoad?

Syntax

MMEMory:UPLoad? ‹file›

Description

This command uploads the contents of a file from the instrument to the host computer.

Remarks

- The format for ‹file› is "[‹drive›:‹path›]‹file_name›", where ‹drive› can be INTernal or USB, and ‹path› must be an absolute folder path.
- INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
- If ‹drive›:‹path› is omitted, the folder specified by the MMEMory:CDIRectory command is used.
- Absolute paths begin with a "\" or "/" and start at the root folder of ‹drive›.
- Folder and file names cannot contain the following characters: \ / : * ? " ‹ › |
- The combination of folder and file name cannot exceed 240 characters.
- The specified file cannot be marked as hidden or system.

Return Format

The query returns the file contents are returned as an IEEE 488.2 definite-length block.

Examples

The following example uploads the contents of the state file "Myfile.sta" in the root directory of the internal flash file system to the host computer.

```
MMEM:UPL? "INT:\Myfile.sta"
```

Typical Response: A definite length binary block containing the file contents

See Also

MMEMory:DOWNload

OUTPut Subsystem Introduction

Command Summary

OUTPut:POLarity
OUTPut:POLarity?
OUTPut:STATe
OUTPut:STATe?

OUTPut:POLarity

Syntax

OUTPut:POLarity {NORMal | INVerted}

OUTPut:POLarity?

Description

This command selects the polarity of the signal that will be generated on the Gate In/Out BNC when output of this signal is enabled by OUTPut:STATe ON:

- NORMal selects a positive-going output

- INVerted selects a negative-going output

Remarks

- The instrument selects normal polarity after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the output polarity: NORM or INV.

Examples

The following example enables generation of a negative-going measurement compete on the Gate In/Out BNC.

```
OUTP:STAT ON
 OUTP:SLOP INV
```

See Also

OUTPut:STATe

OUTPut:STATe

Syntax

OUTPut[:STATe] {OFF | ON}

OUTPut[:STATe]?

Description

This command enables or disables generation of the gate signal on the Gate In/Out BNC. The polarity of the signal can be selected using the OUTPut:POLarity command.

> **NOTE** The Gate In/Out BNC cannot be used to externally gate a measurement while generation of the gate signal is enabled.

Remarks

- When making frequency or average period measurements in continuous, gap-free mode (SENSe:FREQuency:MODE CONT set), the output will be asserted at the start of the first measurement and will remain asserted until after the last measurement for each trigger.
- For timestamp measurements, the output will be asserted at the start of the first measurement and will remain asserted until after the last measurement.
- For other measurements, the output will be asserted and unasserted for each measurement.
- The instrument disables generation of the gate signal after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current generation state: 0 (OFF) or 1 (ON).

Examples

The following example configures the counter to make frequency measurements using an external multiplexer to scan 100 channels. The Channel Closed output on the multiplexer should be connected to the Trig In BNC on the counter, and the Gate In/Out BNC on the counter should be connected to the Channel Advance input on the multiplexer.

```
CONF:FREQ 1.0E6,.001
 TRIG:COUN 100;SOUR EXT;SLOP NEG
 OUTP:STAT ON;POL INV
 INIT
 <wait for all channels to be scanned>
 FETC?
```

Typical Response: +5

See Also

OUTPut:POLarity

SAMPle Subsystem Introduction

Command Summary

SAMPle:COUNt
SAMPle:COUNt?

SAMPle:COUNt

Syntax

SAMPle:COUNt {<*count*> | MINimum | MAXimum | DEFault}

SAMPle:COUNt? [{MINimum | MAXimum | DEFault}]

Description

This command selects the number of measurements (samples) the instrument will take per trigger.

Parameters

Name	Type	Range of Values	Default Value
<*count*>	Numeric	1 to 1,000,000 MIN = 1 MAX = 1,000,000	1

Remarks

- You can use the specified sample count in conjunction with a trigger count (see TRIGger:COUNt command) which sets the number of triggers to be accepted before returning to the "idle" trigger state. In this case, the total number of measurements returned will be the product of the sample count and trigger count.

  Number of measurements = Sample Count x Trigger Count

  If more than 1,000,000 measurements are to be taken, the data must be read from reading memory fast enough to avoid a memory overflow. If memory overflows, the new measurements will overwrite the first (oldest) measurements stored; the most recent measurements are always preserved. No error is generated, but the Reading Mem Ovfl bit (bit 14) is set in the Questionable Data Register.

- The CONFigure and MEASure? commands automatically set the sample count to "1", except for the CONFigure:ARRay:TSTamp and MEASure:ARRay:TSTamp? commands, which set the sample count to the value of the <*count*> parameter for these commands.
- The sample count setting is ignored when making continuous totalize measurements. Only one measurement will be made for each READ? or INITiate[:IMMediate] command.
- The instrument sets the sample count to 1 after a Factory Reset (*RST command) or a Preset (SYSTem:PRESet command).

Return Format

The query returns the sample count in the form +1.

SAMPle:COUNt

Examples

The following example returns 10 sets of 5 frequency measurements on channel 1, using an external trigger to start each set of measurements.

```
CONF:FREQ 1.0E6,.001
SAMP:COUN 5
TRIG:COUN 10
TRIG:SOUR EXT
READ?
```

Typical Response: +1.00520000000000E+006, ... (50 measurements)

See Also

TRIGger:COUNt

SENSe Subsystem Introduction

Command Summary

Function Subsystem

[SENSe:]FUNCtion[:ON]
[SENSe:]FUNCtion[:ON]?

Frequency subsystem

SENSe:FREQuency:GATE:SOURce
SENSe:FREQuency:GATE:SOURce?
SENSe:FREQuency:GATE:TIME
SENSe:FREQuency:GATE:TIME?
SENSe:FREQuency:GATE:POLarity
SENSe:FREQuency:GATE:POLarity?
SENSe:FREQuency:MODE
SENSe:FREQuency:MODE?
SENSe:FREQuency:BURSt:GATE:AUTO
SENSe:FREQuency:BURSt:GATE:AUTO?
SENSe:FREQuency:BURSt:GATE:DELay
SENSe:FREQuency:BURSt:GATE:DELay?
SENSe:FREQuency:BURSt:GATE:NARRow
SENSe:FREQuency:BURSt:GATE:NARRow?
SENSe:FREQuency:BURSt:GATE:TIME
SENSe:FREQuency:BURSt:GATE:TIME?

Time Interval Subsystem

SENSe:TINTerval:GATE:SOURce
SENSe:TINTerval:GATE:SOURce?
SENSe:TINTerval:GATE:POLarity
SENSe:TINTerval:GATE:POLarity?

Totalize Subsystem

SENSe:TOTalize:GATE:SOURce

SENSe:TOTalize:GATE:SOURce?

SENSe:TOTalize:GATE:TIME

SENSe:TOTalize:GATE:TIME?

SENSe:TOTalize:GATE:POLarity

SENSe:TOTalize:GATE:POLarity?

Gate Subsystem

SENSe:GATE:EXTernal:SOURce

SENSe:GATE:STARt:SOURce

SENSe:GATE:STARt:SOURce?

SENSe:GATE:STARt:SLOPe

SENSe:GATE:STARt:SLOPe?

SENSe:GATE:STARt:DELay:SOURce

SENSe:GATE:STARt:DELay:SOURce?

SENSe:GATE:STARt:DELay:EVENts

SENSe:GATE:STARt:DELay:EVENts?

SENSe:GATE:STARt:DELay:TIME

SENSe:GATE:STARt:DELay:TIME?

SENSe:GATE:STOP:SOURce

SENSe:GATE:STOP:SOURce?

SENSe:GATE:STOP:SLOPe

SENSe:GATE:STOP:SLOPe?

SENSe:GATE:STOP:HOLDoff:SOURce

SENSe:GATE:STOP:HOLDoff:SOURce?

SENSe:GATE:STOP:HOLDoff:EVENts

SENSe:GATE:STOP:HOLDoff:EVENts?

SENSe:GATE:STOP:HOLDoff:TIME

SENSe:GATE:STOP:HOLDoff:TIME?

Timestamp Measurements

SENSe:TSTamp:RATE

SENSe:TSTamp:RATE?

Reference Oscillator Subsystem

SENSe:ROSCillator:EXTernal:CHECk
SENSe:ROSCillator:EXTernal:FREQuency
SENSe:ROSCillator:EXTernal:FREQuency?
SENSe:ROSCillator:INTernal:POWer:STANdby
SENSe:ROSCillator:INTernal:POWer:STANdby?
SENSe:ROSCillator:SOURce
SENSe:ROSCillator:SOURce?
SENSe:ROSCillator:SOURce:AUTO
SENSe:ROSCillator:SOURce:AUTO?

SENSe:FUNCtion

Syntax

[SENSe:]FUNCtion[:ON] "<*function*>"

[SENSe:]FUNCtion[:ON]?

Description

This command selects the measurement function (all function-related measurement attributes are retained).

Parameters

Name	Type	Range of Values	Default Value
<*function*>	Discrete	Desired function enclosed in quotes: FREQuency [{1 | 2 | 3}] FREQuency:RATio [{1,2 | 1,3 | 2,1 | 2,3 | 3,1 | 3,2}] PERiod [{1 | 2 | 3}] FTIMe [{1 | 2}] NDUTycycle [{1 | 2}] PDUTycycle [{1 | 2}] NWIDth [{1 | 2}] PWIDth [{1 | 2}] PHASe [{1,2 | 2,1}] RTIMe [{1 | 2}] SPERiod [{1 | 2}] TINTerval [{1,2 | 2,1 | 1 | 2}] TOTalize [{1 | 2}] On the Keysight 53230A, the following additional measurement functions are available: TSTamp [{1 | 2 | 3}] On the Keysight 53230A with option 150, the following additional measurement functions are available: FREQuency:BURSt [3] FREQuency:PRF [3] FREQuency:PRI [3] NWIDth:BURSt [3] PWIDth:BURSt [3]	This is a required parameter

Remarks

- If you change the measurement function, all measurements in the reading memory, the limit test pass/-fail counts, and statistics are cleared, and the CALCulate subsystem and the individual calculate functions are disabled.

- The trigger count (TRIGger:COUNt) and sample count (SAMPle:COUNt) settings are ignored when making continuous totalize measurements. Only one measurement will be made for each READ? or INITiate [:IMMediate] command. Additionally, the moving average filter, statistics computation, and histogram computation (see CALCulate subsystem) are disabled for continuous totalize since these computations require more than one measurement to be useful.
- The trigger count (TRIGger:COUNt) and the SENSe:GATE subsystem are ignored when making timestamp measurements. Only one trigger will be accepted. The measurements will start immediately after a trigger and trigger delay.
- The instrument sets the measurement function to FREQuency after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns a string enclosed in double quotes. The short form of the function name is always returned (e.g., "FREQ", "PER 2", "TOT", "NDUT:BURS").

Examples

The following example sets the function to measure frequency on channel 2 (double or single quotes are allowed).

```
FUNC "FREQ 2"     or    FUNC 'FREQ 2'
```

The following example returns the function selected (the quotes are also returned).

```
FUNC?
```

Typical Response: "FREQ 2"

See Also

CONFigure

MEASure?

SENSe:FREQuency:GATE:SOURce

Syntax

[SENSe:]FREQuency:GATE:SOURce {TIME | EXTernal | INPut[1] | INPut2 | ADVanced}

[SENSe:]FREQuency:GATE:SOURce?

Description

This command selects the gate source for frequency, frequency ratio, average period, PRF, and PRI measurements.

- TIME configures the instrument to start the measurement immediately after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command. SENSe:FREQuency:GATE:TIME controls the time the gate remains open.

- EXTernal configures the instrument to gate the measurement using the Gate In/Out BNC after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command. The SENSe:FREQuency:GATE:POLarity command controls the polarity of the Gate In/Out BNC. The Gate In/Out BNC cannot be used to externally gate a measurement while generation of the gate signal is enabled (OUTPut:STATe ON set).

- INPut[1] configures the instrument to gate the measurement using the channel 1 input after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command. The SENSe:FREQuency:GATE:POLarity command controls the polarity of the input signal. Channel 1 cannot be involved in the measurement and must be configured for fixed input threshold voltage (INPut{1|2}:LEVel{1|2} command).

- INPut2 configures the instrument to gate the measurement using the channel 2 input after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command. The SENSe:FREQuency:GATE:POLarity command controls the polarity of the input signal. Channel 2 cannot be involved in the measurement and must be configured for fixed input threshold voltage (INPut{1|2}:LEVel{1|2} command).

- ADVanced configures the instrument for advanced gating of the measurement via the SENSe:GATE commands after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command.

Remarks

- When SENSe:FREQuency:MODE is set to CONTinuous, the gate source is ignored, and the measurements start immediately after a trigger and trigger delay; the gate closes when SAMPle:COUNt measurements have been made.
- The instrument sets the gate source to TIME after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the frequency gate source: TIME, EXT, INP, INP2 or ADV.

Examples

The following example makes an internally-gated frequency measurement on channel 1 with a 1 second gate time:

```
CONF:FREQ 1.2E6
 FREQ:GATE:SOUR TIME
 FREQ:GATE:TIME 1.0
 READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:FREQuency:GATE:TIME

SENSe:FREQuency:GATE:POLarity

SENSe:GATE:STARt:SOURce

SENSe:GATE:STARt:SLOPe

SENSe:GATE:STARt:DELay:SOURce

SENSe:GATE:STARt:DELay:EVENts

SENSe:GATE:STARt:DELay:TIME

SENSe:GATE:STOP:SOURce

SENSe:GATE:STOP:SLOPe

SENSe:GATE:STOP:HOLDoff:SOURce

SENSe:GATE:STOP:HOLDoff:EVENts

SENSe:GATE:STOP:HOLDoff:TIME

SENSe:FREQuency:GATE:TIME

Syntax

[SENSe:]FREQuency:GATE:TIME {<*time*> | MINimum | MAXimum | DEFault}

[SENSe:]FREQuency:GATE:TIME? [{MINimum | MAXimum | DEFault}]

Description

This command selects the resolution in terms of time for gating frequency, frequency ratio, average period, PRF and PRI measurements.

Parameters

Name	Type	Range of Values	Default Value
<*time*>	Numeric	100 usec to 1000 sec with 10 usec resolution (Keysight 53220A) 1 usec to 1000 sec with 1 usec resolution (Keysight 53230A) MIN = 100 usec (Keysight 53220A) MIN = 1 usec (Keysight 53230A) MAX = 1000 sec	.1 sec

Remarks

- This setting is used only when SENSe:FREQuency:GATE:SOURce is set to TIME.
- The instrument sets the gate time to .1 sec after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate time in the form +1.00000000000000E-001.

Examples

The following example makes an internally-gated frequency measurement with a gate time of 1 msec.

```
CONF:FREQ 1.2E6
FREQ:GATE:TIME .001
READ?
```

Typical Response: +1.21510000000000E+006

See Also

SENSe:FREQuency:GATE:SOURce

SENSe:FREQuency:GATE:POLarity

Syntax

[SENSe:]FREQuency:GATE:POLarity {POSitive | NEGative}

[SENSe:]FREQuency:GATE:POLarity?

Description

This command selects the polarity for the Gate In/Out BNC when externally gating of frequency, frequency ratio, average period, PRF, and PRI measurements is selected (see SENSe:FREQuency:GATE:SOURce command).

- POSitive starts the measurement on a positive edge on the Gate In/Out BNC, and stops the measurement on the next negative edge.

- NEGative starts the measurement on a negative edge on the Gate In/Out BNC, and stops the measurement on the next positive edge.

Remarks

- The instrument selects negative polarity after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate open slope: POS or NEG.

Examples

The following example makes a frequency measurement on channel 1 using external gating. The gate opens on a negative edge on the Gate In/Out BNC, and closes on the next positive edge:

```
CONF:FREQ 1.2E6
 FREQ:GATE:SOUR EXT
 FREQ:GATE:POL NEG
 READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:FREQuency:GATE:SOURce

SENSe:FREQuency:MODE

Syntax

[SENSe:]FREQuency:MODE {AUTO | RECiprocal | CONTinuous}

[SENSe:]FREQuency:MODE?

Description

This command selects the measurement mode for frequency, frequency ratio, and average period on channels 1 and 2. Channel 3 measurements are always made in resolution-enhanced mode.

- AUTO configures the instrument to make resolution-enhanced measurements when possible, or recip-rocal measurements otherwise. This provides the best possible measurement resolution for any input signal and gating configuration.

- RECiprocal configures the instrument to make reciprocal-only measurements.

- CONTinuous configures the instrument to make continuous resolution-enhanced, gap-free meas-urements. This mode should be selected for true Allan deviation computation (CALCulate:AVERage subsystem). In this mode, all samples for a each trigger are started by a single gate open (instead of gate open/close per sample), and the measurements are computed back-to-back with no dead time. CONTinuous can only be used for frequency and average period measurements. ***Available only on the Keysight 53230A.***

Remarks

- The trigger count setting (TRIGger:COUNt) is ignored when making continuous, gap-free frequency and period measurements. Only one trigger will be accepted for each READ? or INITiate[:IMMediate] com-mand.
- The instrument sets the frequency measurement mode to AUTO after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the frequency measurement mode: AUTO, REC, or CONT.

Examples

The following example makes a frequency measurement on channel 1 with a 1 second gate time using the reciprocal measurement technique:

```
CONF:FREQ 1.2E6
 FREQ:GATE:SOUR TIME
 FREQ:GATE:TIME 1.0
```

SENSe:FREQuency:MODE

```
FREQ:MODE REC
READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:FREQuency:MODE

```
FREQ:MODE REC
```

SENSe:FREQuency:BURSt:GATE:AUTO

Syntax

[SENSe:]FREQuency:BURSt:GATE:AUTO {OFF | ON}

[SENSe:]FREQuency:BURSt:GATE:AUTO?

Description

This command controls whether the gate setup for measuring the carrier frequency of a burst (pulse frequency) is determined automatically based on the pulse characteristics, or whether the gate open delay time and gate time are manually controlled.

> **NOTE** When manual control, the gate window must be fully within the pulse envelope; otherwise, the measurement results will be unpredictable.

Remarks

- *Available only on the Keysight 53230A. Requires option 150.*

- Automatic gate setup selection is always used for narrow pulse mode measurements (SENSe:FREQuency:BURSt:GATE:NARRow ON set).
- When manual control (OFF) is selected, SENSe:FREQuency:BURSt:GATE:DELay and SENSe:FREQuency:BURSt:GATE:TIME control the measurement gating.
- Automatic selection of gate setup is enabled after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns whether automatic gate setup is enabled: 0 (OFF) or 1 (ON).

Examples

The following example measures the carrier frequency of a burst. The measurement starts 1 uS after the burst starts with a gate time of 3 uS:

```
CONF:FREQ:BURS
 FREQ:BURS:GATE:AUTO OFF
 FREQ:BURS:GATE:DEL 1E-6
 FREQ:BURS:GATE:TIME 3E-6
 READ?
```

Typical Response: +1.00230000000000E+009

SENSe:FREQuency:BURSt:GATE:AUTO

See Also

SENSe:FREQuency:BURSt:GATE:DELay

SENSe:FREQuency:BURSt:GATE:NARRow

SENSe:FREQuency:BURSt:GATE:TIME

SENSe:FREQuency:BURSt:GATE:DELay

Syntax

[SENSe:]FREQuency:BURSt:GATE:DELay {<*time*> | MINimum | MAXimum | DEFault}

[SENSe:]FREQuency:BURSt:GATE:DELay? [{MINimum | MAXimum | DEFault}]

Description

This command selects the gate open delay time for measuring the carrier frequency of a burst (pulse frequency) when SENSe:FREQuency:BURSt:GATE:AUTO is set to OFF (manual gate control).

> **NOTE**   When manual control, the gate window must be fully within the pulse envelope; otherwise, the measurement results will be unpredictable.

Parameters

Name	Type	Range of Values	Default Value
<*time*>	Numeric	0.0 to 10 sec with 10 nsec resolution MIN = 0.0 MAX = 10 sec	0.0

Remarks

- ***Available only on the Keysight 53230A. Requires option 150.***

- The instrument sets the gate open delay time to 0.0 (no delay) after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate open delay time in the form +1.00000000000000E-007.

Examples

The following example measures the carrier frequency of a burst. The measurement starts 1 uS after the burst starts with a gate time of 3 uS:

```
CONF:FREQ:BURS
FREQ:BURS:GATE:AUTO OFF
FREQ:BURS:GATE:DEL 1E-6
```

SENSe:FREQuency:BURSt:GATE:DELay

```
FREQ:BURS:GATE:TIME 3E-6
READ?
```

Typical Response: +1.00230000000000E+009

See Also

SENSe:GATE:STARt:DELay:SOURce

```
FREQ:BURS:GATE:TIME 3E-6
```

SENSe:FREQuency:BURSt:GATE:NARRow

Syntax

[SENSe:]FREQuency:BURSt:GATE:NARRow {OFF | ON}

[SENSe:]FREQuency:BURSt:GATE:NARRow?

Description

This command enables or disables narrow pulse mode when measuring the carrier frequency of a burst (pulse frequency). Narrow pulse mode must be enabled for bursts with a duration of 10 microseconds or less; it must be disabled for bursts with a duration longer than 20 microseconds.

Remarks

- ***Available only on the Keysight 53230A. Requires option 150.***

- Automatic gate setup selection (see SENSe:FREQuency:BURSt:GATE:AUTO) is always used for narrow pulse mode measurements.
- The instrument disables narrow pulse mode after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the narrow pulse mode enable state: OFF or ON.

Examples

The following example makes a pulse frequency measurement of a narrow pulse on channel 3:

```
CONF:FREQ:BURS
 FREQ:BURS:GATE:NARR ON
 READ?
```

Typical Response: +9.30013398300000E-007

See Also

SENSe:FREQuency:BURSt:GATE:AUTO

SENSe:FREQuency:BURSt:GATE:TIME

Syntax

[SENSe:]FREQuency:BURSt:GATE:TIME {<*time*> | MINimum | MAXimum | DEFault}

[SENSe:]FREQuency:BURSt:GATE:TIME? [{MINimum | MAXimum | DEFault}]

Description

This command selects the gate time for measuring the carrier frequency of a burst (pulse frequency) when SENSe:FREQuency:BURSt:GATE:AUTO is set to OFF (manual gate control).

> **NOTE**
>
> When manual control, the gate window must be fully within the pulse envelope; otherwise, the measurement results will be unpredictable.

Parameters

Name	Type	Range of Values	Default Value
<*time*>	Numeric	1 usec to 1000 sec with 10 nsec resolution MIN = 1 usec MAX = 1000 sec	1 usec

Remarks

- ***Available only on the Keysight 53230A. Requires option 150.***

- The instrument sets the gate time to 1 usec after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate time in the form +1.00000000000000E-007.

Examples

The following example measures the carrier frequency of a burst. The measurement starts 1 uS after the burst starts with a gate time of 3 uS:

```
CONF:FREQ:BURS
FREQ:BURS:GATE:AUTO OFF
FREQ:BURS:GATE:DEL 1E-6
```

```
FREQ:BURS:GATE:TIME 3E-6
READ?
```

Typical Response: +1.00230000000000E+009

See Also

SENSe:GATE:STARt:DELay:SOURce

SENSe:GATE:EXTernal:SOURce

Syntax

[SENSe:]GATE:EXTernal:SOURce {BNC | INPut[1] | INPut2}

[SENSe:]GATE:EXTernal:SOURce?

Description

This command selects the source for external gating of measurements when advanced gating is selected. This source is used when either SENSe:GATE:STARt:SOURce or SENSe:GATE:STOP:SOURce is set to EXTernal.

- BNC configures the instrument to gate the measurement using the Gate In/Out BNC after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command. The SENSe:GATE:STARt:SLOPe and SENSe:GATE:STOP:SLOPe commands controls the polarity of the Gate In/Out BNC. The Gate In/Out BNC cannot be used to externally gate a measurement while generation of the gate signal is enabled (OUTPut:STATe ON set).

- INPut[1] configures the instrument to gate the measurement using the channel 1 input after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command. The SENSe:GATE:STARt:SLOPe and SENSe:GATE:STOP:SLOPe commands command controls the polarity of the input signal. Channel 1 cannot be involved in the measurement and must be configured for fixed input threshold voltage (INPut{1|2}:LEVel{1|2} command). This source is only available for frequency, frequency ratio, average period, PRF, PRI, and totalize measurements.

- INPut2 configures the instrument to gate the measurement using the channel 2 input after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command. The SENSe:GATE:STARt:SLOPe and SENSe:GATE:STOP:SLOPe commands command controls the polarity of the input signal. Channel 2 cannot be involved in the measurement and must be configured for fixed input threshold voltage (INPut{1|2}:LEVel{1|2} command). This source is only available for frequency, frequency ratio, average period, PRF, PRI, and totalize measurements.

Remarks

- The instrument sets the gate source to the Gate In/Out BNC after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the external gate source: BNC, INP, or INP2.

Examples

The following example makes a frequency measurement on channel 1. The gate opens 5 events after a negative edge on the Gate In/Out BNC, and, after .25 seconds, closes on the next positive edge on the BNC.

```
CONF:FREQ 1.2E6
 FREQ:GATE:SOUR ADV
 GATE:STAR:SOUR EXT
 GATE:STAR:SLOP NEG
 GATE:STAR:DEL:SOUR EVEN
 GATE:STAR:DEL:EVEN 5
 GATE:STOP:SOUR EXT
 GATE:STOP:SLOP POS
 GATE:STOP:HOLD:SOUR TIME
 GATE:STOP:HOLD:TIME .25
 GATE:EXT:SOUR BNC
 READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:FREQuency:GATE:SOURce

SENSe:TINTerval:GATE:SOURce

SENSe:TOTalize:GATE:SOURce

SENSe:GATE:STARt:SOURce

SENSe:GATE:STARt:SLOPe

SENSe:GATE:STOP:SOURce

SENSe:GATE:STOP:SLOPe

SENSe:GATE:STARt:SOURce

Syntax

[SENSe:]GATE:STARt:SOURce {IMMediate | EXTernal}

[SENSe:]GATE:STARt:SOURce?

Description

This command selects whether the gate open is enabled immediately following a trigger and trigger delay, or whether the instrument will wait for the selected edge on the source selected by SENSe:GATE:EXTernal:SOURce to open the gate when advanced gating is enabled (SENSe:FREQuency:GATE:SOURce, SENSe:TINTerval:GATE:SOURce, or SENSe:TOTalize:GATE:SOURce set to ADVanced with the appropriate measurement function selected).

Remarks

- The SENSe:GATE:STARt:SLOPe command selects the active edge on the source selected by SENSe:GATE:EXTernal:SOURce.
- If SENSe:GATE:STARt:SOURce and SENSe:GATE:STOP:SOURce are both set to IMMediate, the gate opens immediately following the trigger, trigger delay and gate open (start) delay, and closes after the stop gate holdoff (SENSe:GATE:STOP:HOLDoff subsystem).
- The instrument sets the start gate source to IMMediate after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate open source: IMM or EXT.

Examples

The following example makes a frequency measurement on channel 1. The gate opens on a negative edge on the Gate In/Out BNC, and closes .25 seconds later:

```
CONF:FREQ 1.2E6
 FREQ:GATE:SOUR ADV
 GATE:STAR:SOUR EXT
 GATE:STAR:SLOP NEG
 GATE:STOP:SOUR EXT
 GATE:STOP:SLOP POS
 GATE:STOP:HOLD:SOUR TIME
 GATE:STOP:HOLD:TIME .25
 GATE:EXT:SOUR BNC
 READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:GATE:EXTernal:SOURce

SENSe:FREQuency:GATE:SOURce

SENSe:TINTerval:GATE:SOURce

SENSe:TOTalize:GATE:SOURce

SENSe:GATE:STARt:SLOPe

SENSe:GATE:STARt:SLOPe

Syntax

[SENSe:]GATE:STARt:SLOPe {POSitive | NEGative}

[SENSe:]GATE:STARt:SLOPe?

Description

This command selects whether the instrument uses the rising (POSitive) edge or the falling (NEGative) edge of the external gate signal on the source selected by SENSe:GATE:EXTernal:SOURce to open the gate when external gate open is enabled (SENSe:FREQuency:GATE:SOURce, SENSe:TINTerval:GATE:SOURce, or SENSe:TOTalize:GATE:SOURce set to ADVanced and SENSe:GATE:STARt:SOURce set to EXTernal with the appropriate measurement function selected).

Remarks

- The instrument selects negative slope after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate open slope: POS or NEG.

Examples

The following example makes a frequency measurement on channel 1. The gate opens on a negative edge on the Gate In/Out BNC, and closes .25 seconds later:

```
CONF:FREQ 1.2E6
 FREQ:GATE:SOUR ADV
 GATE:STAR:SOUR EXT
 GATE:STAR:SLOP NEG
 GATE:STOP:SOUR IMM
 GATE:STOP:HOLD:SOUR TIME
 GATE:STOP:HOLD:TIME .25
 GATE:EXT:SOUR BNC
 READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:FREQuency:GATE:SOURce

SENSe:TINTerval:GATE:SOURce

SENSe:TOTalize:GATE:SOURce

SENSe:GATE:STARt:SOURce

SENSe:GATE:STARt:DELay:SOURce

Syntax

[SENSe:]GATE:STARt:DELay:SOURce {IMMediate | TIME | EVENts}

[SENSe:]GATE:STARt:DELay:SOURce?

Description

This command selects whether time or input events (edges) are used to delay the gate open (start) when advanced gating is enabled (SENSe:FREQuency:GATE:SOURce, SENSe:TINTerval:GATE:SOURce, or SENSe:TOTalize:GATE:SOURce set to ADVanced with the appropriate measurement function selected).

Remarks

- Selecting IMMediate disables the gate open delay.

- The delay starts when the gate enable is received.

- If SENSe:GATE:STARt:SOURce is set to IMMediate, the gate will open immediately following the end of the trigger delay.

- If SENSe:GATE:STARt:SOURce is set to EXTernal, the gate will open after the delay. The delay starts on the selected edge on the source selected by SENSe:GATE:EXTernal:SOURce, which must occur after the end of the trigger delay. Events that occur during the trigger delay are ignored.
- The instrument sets the gate open delay source to IMMediate after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current gate open delay source: IMM, TIME or EVEN.

Examples

The following example makes a frequency measurement on channel 1. The gate opens .1 sec after a negative edge on the Gate In/Out BNC, and, after .25 seconds, closes on the next positive edge on the BNC.

```
CONF:FREQ 1.2E6
 FREQ:GATE:SOUR ADV
 GATE:STAR:SOUR EXT
 GATE:STAR:SLOP NEG
 GATE:STAR:DEL:SOUR TIME
 GATE:STAR:DEL:TIME .1
 GATE:STOP:SOUR EXT
 GATE:STOP:SLOP POS
 GATE:STOP:HOLD:SOUR TIME
```

```
GATE:STOP:HOLD:TIME .25
GATE:EXT:SOUR BNC
READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:GATE:STARt:DELay:EVENts

SENSe:GATE:STARt:DELay:TIME

SENSe:GATE:STARt:DELay:EVENts

Syntax

[SENSe:]GATE:STARt:DELay:EVENts {<*count*> | MINimum | MAXimum | DEFault}

[SENSe:]GATE:STARt:DELay:EVENts? [{MINimum | MAXimum | DEFault}]

Description

This command selects the gate open delay event count when SENSe:GATE:STARt:DELay:SOURce is set to EVENts.

Parameters

Name	Type	Range of Values	Default Value
<*count*>	Numeric	1 to 99,999,999 MIN = 1 MAX = 99,999,999	1

Remarks

- For two-channel time interval and phase measurements, delay events are counted on the start channel. For frequency ratio measurements, delay events are counted on the denominator channel.
- The instrument sets the gate open delay event count to 1 after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate open delay event count in the form +100.

Examples

The following example makes a frequency measurement on channel 1. The gate opens 5 events after a negative edge on the Gate In/Out BNC, and, after .25 seconds, closes on the next positive edge on the BNC.

```
CONF:FREQ 1.2E6
FREQ:GATE:SOUR ADV
GATE:STAR:SOUR EXT
GATE:STAR:SLOP NEG
GATE:STAR:DEL:SOUR EVEN
GATE:STAR:DEL:EVEN 5
GATE:STOP:SOUR EXT
GATE:STOP:SLOP POS
GATE:STOP:HOLD:SOUR TIME
```

```
GATE:STOP:HOLD:TIME .25
GATE:EXT:SOUR BNC
READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:GATE:STARt:DELay:SOURce

SENSe:GATE:STARt:DELay:TIME

Syntax

[SENSe:]GATE:STARt:DELay:TIME {<*time*> | MINimum | MAXimum | DEFault}

[SENSe:]GATE:STARt:DELay:TIME? [{MINimum | MAXimum | DEFault}]

Description

This command selects the gate open delay time when SENSe:GATE:STARt:DELay:SOURce is set to TIME.

Parameters

Name	Type	Range of Values	Default Value
<*time*>	Numeric	0.0 to 10 sec with 10 usec resolution (Keysight 53220A) 10 nsec resolution (Keysight 53230A) MIN = 0.0 MAX = 10 sec	0.0

Remarks

- The instrument sets the gate open delay time to 0.0 (no delay) after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate open delay time in the form +1.00000000000000E-007.

Examples

The following example makes a frequency measurement on channel 1. The gate opens .1 sec after a negative edge on the Gate In/Out BNC, and, after .25 seconds, closes on the next positive edge on the BNC.

```
CONF:FREQ 1.2E6
FREQ:GATE:SOUR ADV
GATE:STAR:SOUR EXT
GATE:STAR:SLOP NEG
GATE:STAR:DEL:SOUR TIME
GATE:STAR:DEL:TIME .1
GATE:STOP:SOUR EXT
GATE:STOP:SLOP POS
GATE:STOP:HOLD:SOUR TIME
GATE:STOP:HOLD:TIME .25
GATE:EXT:SOUR BNC
READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:GATE:STARt:DELay:SOURce

SENSe:GATE:STOP:SOURce

Syntax

[SENSe:]GATE:STOP:SOURce {IMMediate | EXTernal}

[SENSe:]GATE:STOP:SOURce?

Description

This command selects whether the gate closes immediately following the stop gate holdoff, or whether the instrument will wait for the selected edge on the source selected by SENSe:GATE:EXTernal:SOURce to close the gate when advanced gating is enabled (SENSe:FREQuency:GATE:SOURce, SENSe:TINTerval:GATE:SOURce, or SENSe:TOTalize:GATE:SOURce set to ADVanced with the appropriate measurement function selected).

Remarks

- The SENSe:GATE:STOP:SLOPe command selects the active edge on the source selected by SENSe:GATE:EXTernal:SOURce.
- If SENSe:GATE:STARt:SOURce and SENSe:GATE:STOP:SOURce are both set to IMMediate, the gate opens immediately following the trigger, trigger delay and gate open (start) delay, and closes after the gate close holdoff (SENSe:GATE:STOP:HOLDoff subsystem).
- The SENSe:GATE:STOP subsystem settings are ignored for rise/fall time, duty cycle, pulse width, phase and single-period measurements. The measurement completes automatically on the next appropriate edge on the input channel.
- The instrument sets the stop gate source to IMMediate after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate close source: IMM or EXT.

Examples

The following example makes a frequency measurement on channel 1. The gate opens on a negative edge on the Gate In/Out BNC, and, after .25 seconds, closes on the next positive edge on the BNC.

```
CONF:FREQ 1.2E6
 FREQ:GATE:SOUR ADV
 GATE:STAR:SOUR EXT
 GATE:STAR:SLOP NEG
 GATE:STOP:SOUR EXT
 GATE:STOP:SLOP POS
 GATE:STOP:HOLD:SOUR TIME
 GATE:STOP:HOLD:TIME .25
```

```
GATE:EXT:SOUR BNC
READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:GATE:EXTernal:SOURce

SENSe:FREQuency:GATE:SOURce

SENSe:TINTerval:GATE:SOURce

SENSe:TOTalize:GATE:SOURce

SENSe:GATE:STOP:SLOPe

SENSe:GATE:STOP:SLOPe

Syntax

[SENSe:]GATE:STOP:SLOPe {POSitive | NEGative}

[SENSe:]GATE:STOP:SLOPe?

Description

This command selects whether the instrument uses the rising (POSitive) edge or the falling (NEGative) edge of the external gate signal on the source selected by SENSe:GATE:EXTernal:SOURce to close the gate when external gate close is enabled (SENSe:FREQuency:GATE:SOURce, SENSe:TINTerval:GATE:SOURce, or SENSe:TOTalize:GATE:SOURce set to ADVanced and SENSe:GATE:STOP:SOURce set to EXTernal with the appropriate measurement function selected).

Remarks

- The instrument selects positive slope after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate close slope: POS or NEG.

Examples

The following example makes a frequency measurement on channel 1. The gate opens on a negative edge on the Gate In/Out BNC, and, after .25 seconds, closes on the next positive edge on the BNC.

```
CONF:FREQ 1.2E6
 FREQ:GATE:SOUR ADV
 GATE:STAR:SOUR EXT
 GATE:STAR:SLOP NEG
 GATE:STOP:SOUR EXT
 GATE:STOP:SLOP POS
 GATE:STOP:HOLD:SOUR TIME
 GATE:STOP:HOLD:TIME .25
 GATE:EXT:SOUR BNC
 READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:FREQuency:GATE:SOURce

SENSe:TINTerval:GATE:SOURce

SENSe:TOTalize:GATE:SOURce

SENSe:GATE:STOP:SOURce

SENSe:GATE:STOP:HOLDoff:SOURce

Syntax

[SENSe:]GATE:STOP:HOLDoff:SOURce {IMMediate | TIME | EVENts}

[SENSe:]GATE:STOP:HOLDoff:SOURce?

Description

This command selects whether time or input events (edges) are used to hold off enabling the gate close (stop) source when advanced gating is enabled (SENSe:FREQuency:GATE:SOURce, SENSe:TINTerval:GATE:SOURce, or SENSe:TOTalize:GATE:SOURce set to ADVanced with the appropriate measurement function selected).

Remarks

- Selecting IMMediate disables the holdoff.

- The holdoff starts when the gate opens for totalize measurements. For other measurements, the holdoff starts on the first input event after the gate opens.

- If SENSe:GATE:STOP:SOURce is set to IMMediate, the gate will close immediately following the end of the holdoff.

- If SENSe:GATE:STOP:SOURce is set to EXTernal, the gate will close on the next selected edge on the source selected by SENSe:GATE:EXTernal:SOURce following the end of the holdoff. Edges that occur during the holdoff are ignored.
- The instrument sets the gate close holdoff source to IMMediate after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the current gate close holdoff source: IMM, TIME or EVEN.

Examples

The following example makes a frequency measurement on channel 1. The gate opens .1 sec after a negative edge on the Gate In/Out BNC, and, after .25 seconds, closes on the next positive edge on the BNC.

```
CONF:FREQ 1.2E6
 FREQ:GATE:SOUR ADV
 GATE:STAR:SOUR EXT
 GATE:STAR:SLOP NEG
 GATE:STAR:DEL:SOUR TIME
 GATE:STAR:DEL:TIME .1
 GATE:STOP:SOUR EXT
```

```
GATE:STOP:SLOP POS
GATE:STOP:HOLD:SOUR TIME
GATE:STOP:HOLD:TIME .25
GATE:EXT:SOUR BNC
READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:GATE:STOP:HOLDoff:EVENts

SENSe:GATE:STOP:HOLDoff:TIME

SENSe:GATE:STOP:HOLDoff:EVENts

Syntax

[SENSe:]GATE:STOP:HOLDoff:EVENts {<*count*> | MINimum | MAXimum | DEFault}

[SENSe:]GATE:STOP:HOLDoff:EVENts? [{MINimum | MAXimum | DEFault}]

Description

This command selects the gate close holdoff event count when SENSe:GATE:STOP:HOLDoff:SOURce is set to EVENts.

Parameters

Name	Type	Range of Values	Default Value
<*count*>	Numeric	1 to 99,999,999 MIN = 1 MAX = 99,999,99	1

Remarks

- For two-channel time interval measurements, holdoff events are counted on the stop channel. For frequency ratio measurements, holdoff events are counted on the denominator channel.
- The instrument sets the gate close holdoff event count to 1 after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate close holdoff event count in the form +100.

Examples

The following example makes a frequency measurement on channel 1. The gate opens .1 sec after a negative edge on the Gate In/Out BNC, and, after 5 events on the input signal, closes on the next positive edge on the BNC.

```
CONF:FREQ 1.2E6
FREQ:GATE:SOUR ADV
GATE:STAR:SOUR EXT
GATE:STAR:SLOP NEG
GATE:STAR:DEL:SOUR TIME
GATE:STAR:DEL:TIME .1
GATE:STOP:SOUR EXT
GATE:STOP:SLOP POS
GATE:STOP:HOLD:SOUR EVEN
```

```
GATE:STOP:HOLD:EVEN 5
GATE:EXT:SOUR BNC
READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:GATE:STOP:HOLDoff:SOURce

SENSe:GATE:STOP:HOLDoff:TIME

Syntax

[SENSe:]GATE:STOP:HOLDoff:TIME {<*time*> | MINimum | MAXimum | INFinity | DEFault}

[SENSe:]GATE:STOP:HOLDoff:TIME? [{MINimum | MAXimum | DEFault}]

Description

This command selects the gate close holdoff time when SENSe:GATE:STOP:HOLDoff:SOURce is set to TIME.

Parameters

Name	Type	Range of Values	Default Value
<*time*>	Numeric	**Time Interval measurements:**	
		0.0 to 1000 sec with 10 usec resolution or +9.9E+37 (INFinity) (Keysight 53220A)	0.0 sec
		0.0, or 30 nsec to 1000 sec with 10 nsec resolution or +9.9E+37 (INFinity) (Keysight 53230A)	
		MIN = 0.0 sec MAX = 1000 sec	
		Frequency, frequency ratio, average period, PRF, PRI and totalize measurements:	
		100 usec to 1000 sec with 10 usec resolution (Keysight 53220A)	.1 sec
		1 usec to 1000 sec with 1 usec resolution (Keysight 53230A)	
		MIN = 100 usec (Keysight 53220A) MIN = 1 usec (Keysight 53230A)	
		MAX = 1000 sec	

Remarks

- INFinity or +9.9E+37 is accepted only for the totalize measurement function. When selected, the gate remains open until an ABORt or *RST command or a device clear is received.
- The instrument sets the gate close holdoff time to 0.0 (no holdoff) after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate close holdoff time in the form +1.00000000000000E-007. For a infinite gate close holdoff time, the query returns 9.9E+37.

Examples

The following example makes a frequency measurement on channel 1. The gate opens .1 sec after a negative edge on the Gate In/Out BNC, and, after .25 seconds, closes on the next positive edge on the BNC.

```
CONF:FREQ 1.2E6
FREQ:GATE:SOUR ADV
GATE:STAR:SOUR EXT
GATE:STAR:SLOP NEG
GATE:STAR:DEL:SOUR TIME
GATE:STAR:DEL:TIME .1
GATE:STOP:SOUR EXT
GATE:STOP:SLOP POS
GATE:STOP:HOLD:SOUR TIME
GATE:STOP:HOLD:TIME .25
GATE:EXT:SOUR BNC
READ?
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:GATE:STOP:HOLDoff:SOURce

SENSe:FREQuency:GATE:TIME

SENSe:TOTalize:GATE:TIME

SENSe:ROSCillator:EXTernal:CHECk

Syntax

[SENSe:]ROSCillator:EXTernal:CHECk ONCE

Description

This command checks whether a valid external reference signal is present on the Ext Ref In BNC. An error is generated if valid signal is not present.

Remarks

- SENSe:ROSCillator:SOURce EXTernal and SENSe:ROSCillator:SOURce:AUTO OFF must be set, or a settings conflict error will be generated.

Examples

The following example checks for a valid reference signal on the Ext Ref In BNC:

```
ROSC:SOUR EXT
 ROSC:EXT:CHEC ONCE
```

See Also

SENSe:ROSCillator:SOURce

SENSe:ROSCillator:SOURce:AUTO

SENSe:ROSCillator:EXTernal:FREQuency

Syntax

[SENSe:]ROSCillator:EXTernal:FREQuency {1E6 | 5E6 | 10E6 | MINimum | MAXimum | DEFault}

[SENSe:]ROSCillator:EXTernal:FREQuency? [{MINimum | MAXimum | DEFault}]

Description

This command specifies the frequency of the external reference input signal, which must be 1, 5, or 10 MHz.

Remarks

- The external reference frequency is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- The external reference frequency is set to 10 MHz when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the external reference signal frequency in the form +1.00000000E+007.

Examples

The following example specifies that a 1 MHz external reference is to be used:

```
ROSC:FREQ 1E6
 ROSC:SOUR EXT
```

See Also

SENSe:ROSCillator:SOURce

SENSe:ROSCillator:SOURce:AUTO

SENSe:ROSCillator:SOURce

Syntax

[SENSe:]ROSCillator:SOURce {INTernal | EXTernal}

[SENSe:]ROSCillator:SOURce?

Description

This command selects the reference oscillator source.

- INTernal selects the internal 10 MHz oscillator

- EXTernal selects the Ext Ref In BNC. A valid 1, 5, or 10 MHz signal, as specified by SENSe:ROSCillator:EXTernal:FREQuency, must be present, or error +2009, "No valid external timebase" will be generated when a measurement is started.

Remarks

- CONFigure and MEASure? do not affect the reference oscillator source.
- Selecting the reference oscillator source will disable automatic selection of the reference oscillator (SENSe:ROSCillator:SOURce:AUTO set to OFF).
- When SENSe:ROSCillator:SOURce:AUTO ON is set, you can send the query form of this command to determine whether the internal or an external reference oscillator is being used.
- The reference oscillator source is stored in non-volatile memory, and is unchanged after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).
- The reference oscillator source is set to INTernal with automatic selection of the reference oscillator source enabled when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the gate source: INT or EXT.

Examples

The following example makes a frequency measurement with an external reference oscillator:

```
ROSC:SOUR EXT
 MEAS:FREQ? 1.2E6
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:ROSCillator:EXTernal:FREQuency

SENSe:ROSCillator:SOURce:AUTO

SENSe:ROSCillator:INTernal:POWer:STANdby

Syntax

[SENSe:]ROSCillator:INTernal:POWer:STANdby {OFF | ON}

[SENSe:]ROSCillator:INTernal:POWer:STANdby?

Description

This command controls whether standby power is provided to the optional internal oven-controlled oscillator (OCXO), if present, when the front-panel power switch is in the standby mode.

- When ON is selected, the internal oven-controlled oscillator remains powered and stable in standby mode as long as ac power is present or the optional internal battery power lasts. This increases power consumption in standby, but the oscillator will be at full accuracy and stability immediately after power-on.

- When OFF is selected, the internal oven-controlled oscillator is powered off in standby mode. This minimizes standby power consumption; however, this will power-cycle the oscillator. When powered on, the oscillator's calibrated accuracy may be affected, and the oscillator may not be stable until the end of the specified warm-up time. If the optional battery is present, you should select OFF before disconnecting the instrument from ac power for an extended period to prevent discharging the battery.

> **CAUTION**   Power cycling the oven-controlled oscillator may affect instrument calibration accuracy.

Remarks

- The standby power setting is stored in non-volatile memory, and is unchanged after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).
- Standby power is disabled when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the gate source: 0 (OFF) or 1 (ON).

Examples

The following example disables standby power:

```
ROSC:INT:POW:STAN OFF
```

See Also

SENSe:ROSCillator:SOURce:AUTO

Syntax

[SENSe:]ROSCillator:SOURce:AUTO {OFF | ON}

[SENSe:]ROSCillator:SOURce:AUTO?

Description

This command enables or disables automatically selecting which reference oscillator will be used:

- OFF disables automatic selection, and the source is controlled by the SENSe:ROSCillator:SOURce command.

- ON enables automatic selection. The instrument will select the external reference oscillator if a valid 1, 5, or 10 MHzsignal, as specified by SENSe:ROSCillator:EXTernal:FREQuency, is present on the the Ext Ref In BNC. Otherwise, the internal reference oscillator will be used.

Remarks

- CONFigure and MEASure? do not affect the automatic selection of the reference oscillator source.
- When SENSe:ROSCillator:SOURce:AUTO ON is set, you can use the SENSe:ROSCillator:SOURce? command to determine whether the internal or an external reference oscillator is being used.
- Selecting the reference oscillator source (SENSe:ROSCillator:SOURce) will disable automatic selection of the reference oscillator.
- The enable/disable state of the automatic selection of the reference oscillator source is stored in non-volatile memory, and is unchanged after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).
- Automatic selection of the reference oscillator source is enabled when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the current automatic selection state: 0 (OFF) or 1 (ON).

Examples

The following example makes a frequency measurement using the external reference oscillator, if a valid signal is present on the Ext Ref In BNC; otherwise, the internal reference oscillator is used..

```
ROSC:SOUR:AUTO ON
 MEAS:FREQ? 1.0E6
```

Typical Response: +1.21513398300000E+006

See Also

SENSe:ROSCillator:EXTernal:FREQuency

SENSe:ROSCillator:SOURce

SENSe:TINTerval:GATE:SOURce

Syntax

[SENSe:]TINTerval:GATE:SOURce {IMMediate | EXTernal | ADVanced}

[SENSe:]TINTerval:GATE:SOURce?

Description

This command selects the gate source for time interval, rise/fall time, duty cycle, pulse width, phase and single-period measurements.

- IMMediate configures the instrument to start the measurement on the first appropriate input edge after a trigger and trigger delay following an INITiate:IMMediate, READ?, or MEASure? command, and stop on the next appropriate edge.

- EXTernal configures the instrument to start the measurement using the Gate In/Out BNC after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command. The SENSe:TINTerval:GATE:POLarity command controls the polarity of the Gate In/Out BNC. The Gate In/Out BNC cannot be used to externally gate a measurement while generation of the gate signal is enabled (OUTPut:STATe ON set).

- ADVanced configures the instrument for advanced gating of the measurement via the SENSe:GATE commands after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command.

Remarks

- The instrument sets the gate source to IMMediate after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the time interval gate source: IMM, EXT, or ADV.

Examples

The following example makes a time interval measurement on channel 1 with an external gate:

```
CONF:TINT
 TINT:GATE:SOUR ADV
 GATE:STAR:SOUR EXT;SLOP POS
 READ?
```

Typical Response: +1.21513398300000E-006

See Also

SENSe:TINTerval:GATE:POLarity

SENSe:GATE:STARt:SOURce

SENSe:GATE:STARt:SLOPe

SENSe:GATE:STARt:DELay:SOURce

SENSe:GATE:STARt:DELay:EVENts

SENSe:GATE:STARt:DELay:TIME

SENSe:GATE:STOP:SOURce

SENSe:GATE:STOP:SLOPe

SENSe:GATE:STOP:HOLDoff:SOURce

SENSe:GATE:STOP:HOLDoff:EVENts

SENSe:GATE:STOP:HOLDoff:TIME

SENSe:TINTerval:GATE:POLarity

Syntax

[SENSe:]TINTerval:GATE:POLarity {POSitive | NEGative}

[SENSe:]TINTerval:GATE:POLarity?

Description

This command selects the polarity for the Gate In/Out BNC when externally gating of time interval, rise/-fall time, duty cycle, pulse width, phase and single-period measurements is selected (SENSe:TINTerval:GATE:SOURce EXTernal selected).

- POSitive starts the measurement on a positive edge on the Gate In/Out BNC.

- NEGative starts the measurement on a negative edge on the Gate In/Out BNC.

Remarks

- The instrument selects negative polarity after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate open slope: POS or NEG.

Examples

The following example makes a rise time measurement on channel 1 using external gating. The measurement starts on a negative edge on the Gate In/Out BNC:

```
CONF:RTIM 20,80
 TINT:GATE:SOUR EXT
 TINT:GATE:POL NEG
 READ?
```

Typical Response: +1.21513398300000E-006

See Also

SENSe:TINTerval:GATE:SOURce

SENSe:TOTalize:DATA?

Syntax

[SENSe:]TOTalize:DATA?

Description

This command returns the current totalize count.

Remarks

- Use this command for obtaining intermediate totalize counts during a continuous or long gate time totalize measurement.
- Unlike FETCh? or READ?, which wait for a measurement to complete before returning data, this command returns intermediate data while the measurement continues.

Return Format

The query returns the totalize count in the form +1.23450000000000E+004.

Examples

The following example configures the instrument to make a continuous totalize measurement, and returns the current totalize count after 1 second:

```
CONF:TOT:CONT
 INIT
 <wait 1 second>
 TOT:DATA?
```

Typical Response: +1.21510000000000E+004

See Also

FETCh?

READ?

SENSe:TOTalize:GATE:SOURce

Syntax

[SENSe:]TOTalize:GATE:SOURce {TIME | EXTernal | INPut[1] | INPut2 | ADVanced}

[SENSe:]TOTalize:GATE:SOURce?

Description

This command selects the gate source for totalize measurements.

- TIME configures the instrument to start the measurement immediately after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command. SENSe:TOTalize:GATE:TIME controls the time the gate remains open.

- EXTernal configures the instrument to gate the measurement using the Gate In/Out BNC after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command. The SENSe:TOTalize:GATE:POLarity command controls the polarity of the Gate In/Out BNC. The Gate In/Out BNC cannot be used to externally gate a measurement while generation of the gate signal is enabled (OUTPut:STATe ON set).

- ADVanced configures the instrument for advanced gating of the measurement via the SENSe:GATE commands after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command.

- INPut[1] configures the instrument to gate the measurement using the channel 1 input after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command. The SENSe:TOTalize:GATE:POLarity command controls the polarity of the input signal. Channel 1 cannot be involved in the measurement and must be configured for fixed input threshold voltage (INPut{1|2}:LEVel{1|2} command).

- INPut2 configures the instrument to gate the measurement using the channel 2 input after a trigger and trigger delay following after an INITiate:IMMediate, READ?, or MEASure? command. The SENSe:TOTalize:GATE:POLarity command controls the polarity of the input signal. Channel 2 cannot be involved in the measurement and must be configured for fixed input threshold voltage (INPut{1|2}:LEVel{1|2} command).

Remarks

- The instrument sets the gate source to TIME after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the totalize gate source: TIME, EXT, ADV, INP or INP2.

Examples

The following example makes an internally-gated totalize measurement on channel 1 with a 1 second gate time:

```
FUNC "TOT"
 TOT:GATE:SOUR TIME
 TOT:GATE:TIME 1.0
 READ?
```

Typical Response: +1.21510000000000E+004

See Also

SENSe:TOTalize:GATE:TIME

SENSe:TOTalize:GATE:POLarity

SENSe:GATE:STARt:SOURce

SENSe:GATE:STARt:SLOPe

SENSe:GATE:STARt:DELay:SOURce

SENSe:GATE:STARt:DELay:EVENts

SENSe:GATE:STARt:DELay:TIME

SENSe:GATE:STOP:SOURce

SENSe:GATE:STOP:SLOPe

SENSe:GATE:STOP:HOLDoff:SOURce

SENSe:GATE:STOP:HOLDoff:EVENts

SENSe:GATE:STOP:HOLDoff:TIME

SENSe:TOTalize:GATE:TIME

Syntax

[SENSe:]TOTalize:GATE:TIME {<*time*> | MINimum | MAXimum | INFinity | DEFault}

[SENSe:]TOTalize:GATE:TIME? [{MINimum | MAXimum | DEFault}]

Description

This command selects the gate time for totalize measurements.

Parameters

Name	Type	Range of Values	Default Value
<*time*>	Numeric	100 usec to 1000 sec with 10 usec resolution or +9.9E+37 (INFinity) (Keysight 53220A) 1 usec to 1000 sec with 1 usec resolution or +9.9E+37 (INFinity) (Keysight 53230A) MIN = 100 usec (Keysight 53220A) MIN = 1 usec (Keysight 53230A) MAX = 1000 sec	.1 sec

Remarks

- This setting is used only SENSe:TOTalize:GATE:SOURce when is set to TIME.
- When INFinity or +9.9E+37 is selected, the gate remains open until an ABORt or *RST command or a device clear is received.
- The instrument sets the gate time to .1 sec after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate time in the form +1.00000000000000E-001. For a infinite gate time, the query returns 9.9E+37.

Examples

The following example makes an internally-gated totalize measurement on channel 1 with a 1 second gate time:

```
FUNC "TOT"
TOT:GATE:SOUR TIME
```

```
TOT:GATE:TIME 1.0
READ?
```

Typical Response: +1.21510000000000E+004

See Also

SENSe:TOTalize:GATE:SOURce

SENSe:TOTalize:GATE:POLarity

Syntax

[SENSe:]TOTalize:GATE:POLarity {POSitive | NEGative}

[SENSe:]TOTalize:GATE:POLarity?

Description

This command selects the polarity for the Gate In/Out BNC when externally gating of totalize measurements is selected (SENSe:TOTalize:GATE:SOURce EXTernal selected).

- POSitive starts the measurement on a positive edge on the Gate In/Out BNC, and stops the measurement on the next negative edge.

- NEGative starts the measurement on a negative edge on the Gate In/Out BNC, and stops the measurement on the next positive edge.

Remarks

- The instrument selects negative polarity after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the gate open slope: POS or NEG.

Examples

The following example makes a totalize measurement on channel 1 using external gating. The gate opens on a negative edge on the Gate In/Out BNC, and closes on the next positive edge:

```
FUNC "TOT"
 TOT:GATE:SOUR EXT
 TOT:GATE:POL NEG
 READ?
```

Typical Response: +1.21510000000000E+004

See Also

SENSe:TOTalize:GATE:SOURce

SENSe:TSTamp:RATE

Syntax

[SENSe:]TSTamp:RATE {<*rate*> | MINimum | MAXimum | DEFault}

[SENSe:]TSTamp:RATE? [{MINimum | MAXimum | DEFault}]

Description

This command selects the nominal rate at which timestamp data is produced. The actual rate will depend on the input frequency.

Parameters

Name	Type	Range of Values	Default Value
<*rate*>	Numeric	10.0E3, 100.0E3, 800.0E3 or 1.0E6 MIN = 10.0E3 MAX = 1.0E6	1.0E6

Remarks

- ***Available only on the Keysight 53230A.***

- The instrument sets the timestamp rate to 1.0E6 after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the timestamp rate in the form +1.00000000E+006.

Examples

The following example makes 5,000 timestamp measurements on channel 1 at a rate of up to 1,000,000 per second. Note that the prescaler value is returned followed by the timestamps.

```
CONF:TST (5000)
TST:RATE 1E6
READ?
```

Typical Response: +13,+1.29383828200000E-006,+1.29352315400000E-006,... *(5000 measurements)*

SENSe:TSTamp:RATE

See Also

STATus Subsystem Introduction

Keysight 53220A/230A Status System Diagram

Printable PDF Version

Keysight 53220A/230A Status System
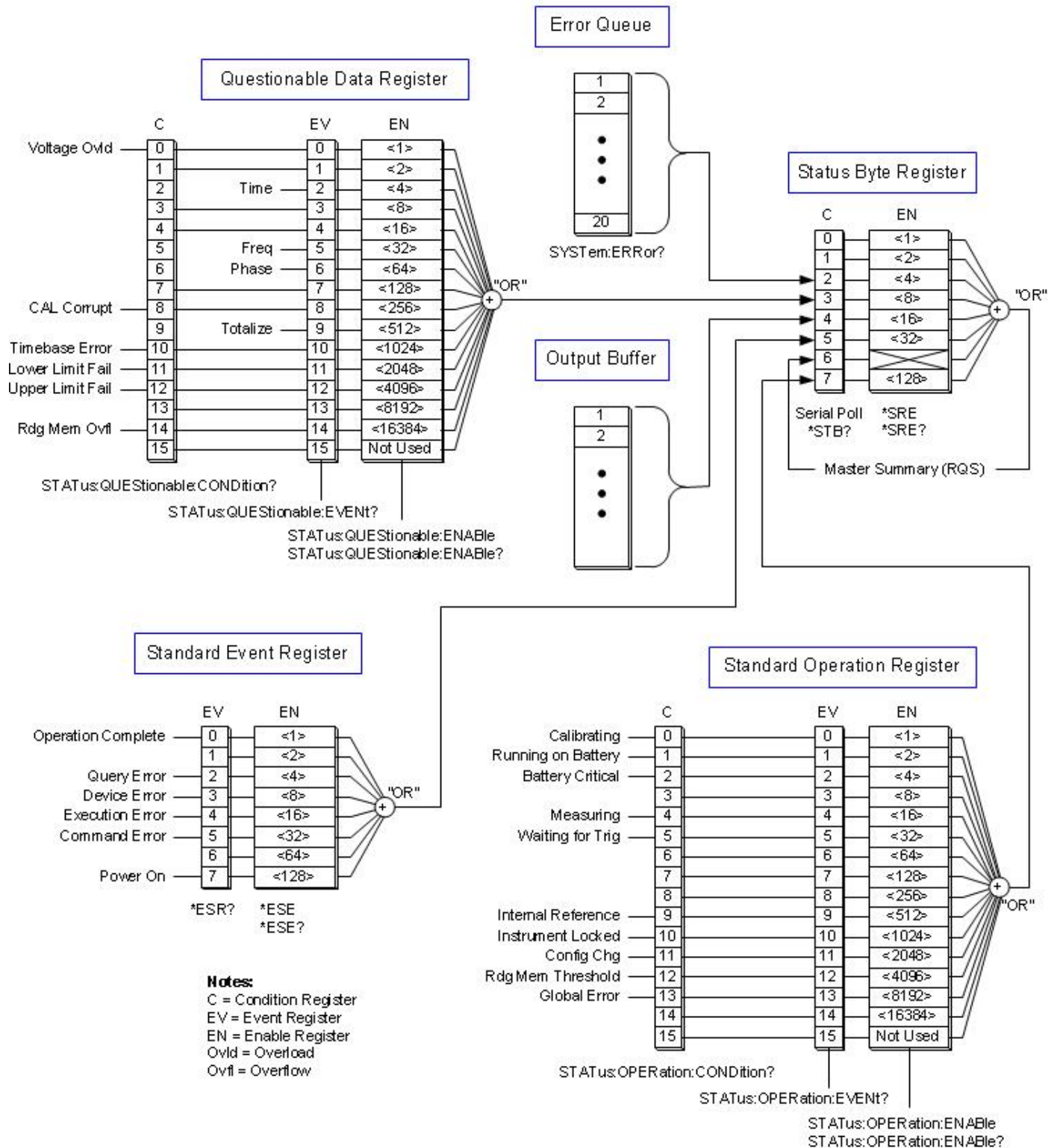
Command Summary

*ESE
*ESE?

*ESR?
*SRE
*SRE?
*STB?
STATus:OPERation:CONDition?
STATus:OPERation:ENABle
STATus:OPERation:ENABle?
STATus:OPERation[:EVENt]?
STATus:PRESet
STATus:QUEStionable:CONDition?
STATus:QUEStionable:ENABle
STATus:QUEStionable:ENABle?
STATus:QUEStionable[:EVENt]?

STATus:OPERation:CONDition?

Syntax

STATus:OPERation:CONDition?

Description

This command queries the condition register for the *Standard Operation Register* group. This is a read-only register and the bits are not cleared when you read the register.

| NOTE | For more information on the SCPI Status System, see the Status System Diagram. |

Remarks

- The condition register bits reflect the current condition. If a condition goes away, the corresponding bit is cleared in the condition register.
- The following table lists the bit definitions for the *Standard Operation Register*.

Bit Number	Bit Name	Decimal Value	Definition
0	Calibrating	1	Instrument is performing a calibration.
1	Running on Battery	2	Instrument is powered from the internal battery.
2	Battery Critical	4	Internal battery power is critically low.
3	Not Used	8	(Reserved for future use)
4	Measuring	16	Instrument is initiated, and is making, or about to make a measurement.
5	Waiting for Trigger	32	Instrument is waiting for a trigger.
6	Not Used	64	(Reserved for future use)
7	Not Used	128	(Reserved for future use)
8	Not Used	256	(Reserved for future use)
9	Internal Reference	512	Set to 1 while the instrument is using its internal reference; set to 0 when using an external reference.
10	Instrument Locked	1024	If a remote interface (GPIB, USB, or LAN) has a lock (see SYSTem:LOCK:REQuest? command), this bit will be set. When a remote interface releases the lock (see SYSTem:LOCK:RELease command), this bit will be cleared.
11	Configuration Change	2048	Instrument configuration has been changed, either from the front panel or from SCPI.
12	Memory Threshold	4096	Programmed number of measurements have been stored in reading memory (see DATA:POINts:EVENt:THReashold command).

13	Global Error	8192	Set if any remote interface has an error in its error queue; cleared otherwise.
14	Not Used	16384	(Reserved for future use)
15	Not Used	32768	"0" is returned.

Return Format

The query reads the condition register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register (see table above). For example, if bit 5 (decimal value = 32) and bit 9 (decimal value = 512) are set, this command will return +544.

Example

The following example reads the condition register (bit 5 is set).

```
STAT:OPER:COND?
```

Typical Response: +32

See Also

STATus:OPERation:ENABle

STATus:OPERation[:EVENt]?

STATus:OPERation:ENABle

Syntax

STATus:OPERation:ENABle <*enable*>

STATus:OPERation:ENABle?

Description

This command enables bits in the enable register for the *Standard Operation Register* group. The selected bits are then reported to the Status Byte.

| NOTE | For more information on the SCPI Status System, see the Status System Diagram. |

Parameters

Name	Type	Range of Values	Default Value
<*enable*>	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register (see table below).	This is a required parameter

Remarks

- The following table lists the bit definitions for the *Standard Operation Register*.

Bit Number	Bit Name	Decimal Value	Definition
0	Calibrating	1	Instrument is performing a calibration.
1	Running on Battery	2	Instrument is powered from the internal battery.
2	Battery Critical	4	Internal battery power is critically low.
3	Not Used	8	(Reserved for future use)
4	Measuring	16	Instrument is initiated, and is making, or about to make a measurement.
5	Waiting for Trigger	32	Instrument is waiting for a trigger.
6	Not Used	64	(Reserved for future use)
7	Not Used	128	(Reserved for future use)
8	Not Used	256	(Reserved for future use)
9	Internal Reference	512	Set to 1 while the instrument is using its internal reference; set to 0 when using an external reference.

10	Instrument Locked	1024	If a remote interface (GPIB, USB, or LAN) has a lock (see SYSTem:LOCK:REQuest? command), this bit will be set. When a remote interface releases the lock (see SYSTem:LOCK:RELease command), this bit will be cleared.
11	Configuration Change	2048	Instrument configuration has been changed, either from the front panel or from SCPI.
12	Memory Threshold	4096	Programmed number of measurements have been stored in reading memory (see DATA:POINts:EVENt:THReashold command).
13	Global Error	8192	Set if any remote interface has an error in its error queue; cleared otherwise.
14	Not Used	16384	(Reserved for future use)
15	Not Used	32768	"0" is returned.

- To enable specific bits, you must write a decimal value that corresponds to the binary-weighted sum of the bits in the register. The selected bits are summarized in the "Standard Operation Summary" bit (bit 7) of the Status Byte Register.
- Use the ‹enable_value› parameter to specify which bits will be summarized to the Status Byte Register. The decimal value specified corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 5 (decimal value = 32) and bit 9 (decimal value = 512), the corresponding decimal value would be 544 (32 + 512).
- The *CLS (clear status) command will not clear the enable register but it does clear all bits in the event register.
- The STATus:PRESet command will clear all bits in the enable register.
- The enable register is unaffected by a Factory Reset (*RST command), or an Instrument Preset (SYSTem:PRESet command). It is set to +32767 at power-on.

Return Format

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. For example, if bit 4 (decimal value = 16) and bit 9 (decimal value = 512) are enabled, the query will return +528.

Examples

The following example enables bit 5 (decimal value = 32) in the enable register.

```
STAT:OPER:ENAB 32
```

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

```
STAT:OPER:ENAB?
```

Typical Response: +32

See Also

*STB?

STATus:OPERation:ENABle

STATus:OPERation:CONDition?

STATus:OPERation[:EVENt]?

STATus:PRESet

STATus:OPERation:EVENt?

Syntax

STATus:OPERation[:EVENt]?

Description

This command queries the event register for the *Standard Operation Register* group. This is a read-only register and the bits are cleared when you read the register.

| NOTE | For more information on the SCPI Status System, see the Status System Diagram. |

Remarks

- The following table lists the bit definitions for the *Standard Operation Register.*

Bit Number	Bit Name	Decimal Value	Definition
0	Calibrating	1	Instrument is performing a calibration.
1	Running on Battery	2	Instrument is powered from the internal battery.
2	Battery Critical	4	Internal battery power is critically low.
3	Not Used	8	(Reserved for future use)
4	Measuring	16	Instrument is initiated, and is making, or about to make a measurement.
5	Waiting for Trigger	32	Instrument is waiting for a trigger.
6	Not Used	64	(Reserved for future use)
7	Not Used	128	(Reserved for future use)
8	Not Used	256	(Reserved for future use)
9	Internal Reference	512	Set to 1 while the instrument is using its internal reference; set to 0 when using an external reference.
10	Instrument Locked	1024	If a remote interface (GPIB, USB, or LAN) has a lock (see SYSTem:LOCK:REQuest? command), this bit will be set. When a remote interface releases the lock (see SYSTem:LOCK:RELease command), this bit will be cleared.
11	Configuration Change	2048	Instrument configuration has been changed, either from the front panel or from SCPI.
12	Memory Threshold	4096	Programmed number of measurements have been stored in reading memory (see DATA:POINts:EVENt:THReashold command).
13	Global Error	8192	Set if any remote interface has an error in its error queue; cleared otherwise.

STATus:OPERation:EVENt?

| 14 | Not Used | 16384 | (Reserved for future use) |
| 15 | Not Used | 32768 | "0" is returned. |

- Once a bit is set, it remains set until cleared by reading the event register or the *CLS (clear status) command.
- The *RST, SYSTem:PRESet, and STATus:PRESet commands have no effect on this register.

Return Format

The query reads the event register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 4 (decimal value = 16) and bit 9 (decimal value = 512) are set, this command will return +528.

Example

The following example reads the event register (bit 9 is set).

```
STAT:OPER?
```

Typical Response: +512

See Also

STATus:OPERation:ENABle

STATus:PRESet

Syntax

STATus:PRESet

Description

This command clears all bits in the Questionable Data enable register and the Standard Operation enable register.

Remarks

- See STATus Subsystem Introduction for an overview of the status system.

Example

The following example clears the enable register bits.

```
STAT:PRES
```

See Also

STATus Subsystem Introduction

STATus:QUEStionable:CONDition?

Syntax

STATus:QUEStionable:CONDition?

Description

This command queries the condition register for the *Questionable Data Register* group. This is a read-only register and the bits are not cleared when you read the register.

| NOTE | For more information on the SCPI Status System, see the Status System Diagram. |

Remarks

- The condition register bits reflect the current condition. If a condition goes away, the corresponding bit is cleared in the condition register.
- The following table lists the bit definitions for the condition register in the Questionable Data Register.

Bit Number	Bit Name	Decimal Value	Definition
0	Voltage Overload	1	The input termination protection relay is open.
1	Not Used	2	(Reserved for future use)
2	Time	4	A timeout or measurement overflow occurred during a time interval, rise/fall time, duty cycle, pulse width or single-period measurement. Only reported as event. "0" is returned. Read the Event Register.
3	Not Used	8	(Reserved for future use)
4	Not Used	16	(Reserved for future use)
5	Freq	32	A timeout or measurement overflow occurred during a frequency, frequency ratio, average period, PRF, or PRI measurement. Only reported as event. "0" is returned. Read the Event Register.
6	Phase	64	A timeout or measurement overflow occurred during a phase measurement. Only reported as event. "0" is returned. Read the Event Register.
7	Not Used	128	(Reserved for future use)
8	CAL Corrupt	256	At least one calibration constant is corrupt.
9	Totalize	512	A totalize measurement has overflowed and rolled over. Only reported as event. "0" is returned. Read the Event Register.
10	Timebase error	1024	The external reference is selected, but no valid external reference signal is present.

11	Lower Limit Failed	2048	The most recent measurement failed the lower limit test.
12	Upper Limit Failed	4096	The most recent measurement failed the upper limit test.
13	Not used	8192	(Reserved for future use)
14	Rdg Mem Overflow	16384	Reading memory is full. One or more (oldest) measurements have been lost.
15	Not Used	32768	"0" is returned.

Return Format

The query reads the condition register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register (see table above). For example, if bit 12 (decimal value = 4096) is set, this command will return +4096.

Example

The following example reads the condition register (bit 12 is set).

```
STAT:QUES:COND?
```

Typical Response: +4096

See Also

STATus:QUEStionable:ENABle

STATus:QUEStionable[:EVENt]?

STATus:QUEStionable:ENABle

Syntax

STATus:QUEStionable:ENABle <*enable*>

STATus:QUEStionable:ENABle?

Description

This command enables bits in the enable register for the *Questionable Data Register* group. The selected bits are then reported to the Status Byte.

| NOTE | For more information on the SCPI Status System for the Keysight, see the Status System Diagram. |

Parameters

Name	Type	Range of Values	Default Value
<*enable*>	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register (see table below).	This is a required parameter

Remarks

- The following table lists the bit definitions for the Questionable Data Register.

Bit Number	Bit Name	Decimal Value	Definition
0	Voltage Overload	1	The input termination protection relay is open.
1	Not Used	2	(Reserved for future use)
2	Time	4	A timeout or measurement overflow occurred during a time interval, rise/fall time, duty cycle, pulse width or single-period measurement.
3	Not Used	8	(Reserved for future use)
4	Not Used	16	(Reserved for future use)
5	Freq	32	A timeout or measurement overflow occurred during a frequency, frequency ratio, average period, PRF, or PRI measurement..
6	Phase	64	A timeout or measurement overflow occurred during a phase measurement.
7	Not Used	128	(Reserved for future use)
8	CAL Corrupt	256	At least one calibration constant is corrupt.

9	Totalize	512	A totalize measurement has overflowed and rolled over.
10	Timebase error	1024	The external reference is selected, but no valid external reference signal is present.
11	Lower Limit Failed	2048	The most recent measurement failed the lower limit test.
12	Upper Limit Failed	4096	The most recent measurement failed the upper limit test.
13	Not used	8192	(Reserved for future use)
14	Rdg Mem Overflow	16384	Reading memory is full. One or more (oldest) measurements have been lost.
15	Not Used	32768	"0" is returned.

- To enable specific bits, you must write a decimal value that corresponds to the binary-weighted sum of the bits in the register. The selected bits are summarized in the "Questionable Data Summary" bit (bit 3) of the Status Byte Register.
- Use the <enable_value> parameter to specify which bits will be reported to the Status Byte. The decimal value specified 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), bit 1 (decimal value = 2), and bit 12 (decimal value = 4096), the corresponding decimal value would be 4099 (1 + 2 + 4096).
- The *CLS (clear status) command will not clear the enable register but it does clear all bits in the event register.
- The STATus:PRESet command will clear all bits in the enable register.
- The enable register is unaffected by a Factory Reset (*RST command), or an Instrument Preset (SYSTem:PRESet command). It is set to +32767 at power-on.

Return Format

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. For example, if bit 0 (decimal value = 1) and bit 1 (decimal value = 2) are enabled, the query will return +3.

Examples

The following example enables bit 9 (decimal value = 512) in the enable register.

```
STAT:QUES:ENAB 512
```

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

```
STAT:QUES:ENAB?
```

Typical Response: +512

See Also

*STB?

STATus:QUEStionable:CONDition?

STATus:QUEStionable:ENABle

STATus:QUEStionable[:EVENt]?

STATus:PRESet

Keysight 53220A/53230A Programmer's Reference

STATus:QUEStionable:EVENt?

Syntax

STATus:QUEStionable[:EVENt]?

Description

This command queries the event register for the *Questionable Data Register* group. This is a read-only register and the bits are cleared when you read the register.

> **NOTE**   For more information on the SCPI Status System for the Keysight, see the Status System Diagram.

Remarks

- The following table lists the bit definitions for the *Questionable Data Register*.

Bit Number	Bit Name	Decimal Value	Definition
0	Voltage Overload	1	The input termination protection relay is open.
1	Not Used	2	(Reserved for future use)
2	Time	4	A timeout or measurement overflow occurred during a time interval, rise/fall time, duty cycle, pulse width or single-period measurement.
3	Not Used	8	(Reserved for future use)
4	Not Used	16	(Reserved for future use)
5	Freq	32	A timeout or measurement overflow occurred during a frequency, frequency ratio, average period, PRF, or PRI measurement.
6	Phase	64	A timeout or measurement overflow occurred during a phase measurement.
7	Not Used	128	(Reserved for future use)
8	CAL Corrupt	256	At least one calibration constant is corrupt.
9	Totalize	512	A totalize measurement has overflowed and rolled over.
10	Timebase error	1024	The external reference is selected, but no valid external reference signal is present.
11	Lower Limit Failed	2048	The most recent measurement failed the lower limit test.
12	Upper Limit Failed	4096	The most recent measurement failed the upper limit test.
13	Not used	8192	(Reserved for future use)

STATus:QUEStionable:EVENt?

| 14 | Rdg Mem Overflow | 16384 | Reading memory is full. One or more (oldest) measurements have been lost. |
| 15 | Not Used | 32768 | "0" is returned. |

- Once a bit is set, it remains set until cleared by reading the event register or the *CLS (clear status) command.
- The *RST, SYSTem:PRESet, and STATus:PRESet commands have no effect on this register.

Return Format

The query reads the event register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 1 (decimal value = 2) and bit 9 (decimal value = 512) are set, this command will return +514.

Example

The following example reads the event register (bit 10 is set).

```
STAT:QUES?
```

Typical Response: +1024

See Also

STATus:QUEStionable:CONDition?

STATus:QUEStionable:ENABle?

SYSTem Subsystem Introduction

Command Summary

General Commands

SYSTem:ALEVel:FREQuency
SYSTem:ALEVel:FREQuency?
SYSTem:BATTery:ENABle
SYSTem:BATTery:ENABle?
SYSTem:BATTery:LEVel?
SYSTem:BATTery:STATus?
SYSTem:BEEPer:IMMediate
SYStem:BEEPer:STATe
SYStem:BEEPer:STATe?
SYSTem:DATE
SYSTem:DATE?
SYSTem:ERRor?
SYSTem:HELP?
SYSTem:LOCK:NAME?
SYSTem:LOCK:OWNer?
SYSTem:LOCK:RELease
SYSTem:LOCK:REQuest?
SYSTem:PRESet
SYSTem:SECurity:IMMediate
SYSTem:TEMPerature
SYSTem:TEMPerature:ACALibration?
SYSTem:TIME
SYSTem:TIME?
SYSTem:TIMeout
SYSTem:TIMeout?
SYSTem:VERSion?

Language Selection Commands

SYSTem:LANGuage
SYSTem:LANGuage?

License Management Commands

SYSTem:LICense:CATalog?
SYSTem:LICense:DELete
SYSTem:LICense:DELete:ALL
SYSTem:LICense:DESCription?

SYSTem Subsystem Introduction

SYSTem:LICense:ERRor:COUNt?

SYSTem:LICense:ERRor?

SYSTem:LICense:INSTall

SYSTem:LICense:INSTall?

Remote Interface Configuration Commands

SYSTem:COMMunicate:ENABle

SYSTem:COMMunicate:ENABle?

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess

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

SYSTem:COMMunicate:LAN:CONTrol?

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:DHCP?

SYSTem:COMMunicate:LAN:DNS

SYSTem:COMMunicate:LAN:DNS?

SYSTem:COMMunicate:LAN:DOMain?

SYSTem:COMMunicate:LAN:GATeway

SYSTem:COMMunicate:LAN:GATeway?

SYSTem:COMMunicate:LAN:HOSTname

SYSTem:COMMunicate:LAN:HOSTname?

SYSTem:COMMunicate:LAN:IPADdress

SYSTem:COMMunicate:LAN:IPADdress?

SYSTem:COMMunicate:LAN:MAC?

SYSTem:COMMunicate:LAN:SMASk

SYSTem:COMMunicate:LAN:SMASk?

SYSTem:COMMunicate:LAN:TELNet:PROMpt

SYSTem:COMMunicate:LAN:TELNet:PROMpt?

SYSTem:COMMunicate:LAN:TELNet:WMESsage

SYSTem:COMMunicate:LAN:TELNet:WMESsage?

SYSTem:COMMunicate:LAN:UPDate

SYSTem:COMMunicate:LAN:WINS

SYSTem:COMMunicate:LAN:WINS?

NOTE   The Keysight 53220A/230A use the following LAN ports:

· Port 5024 is used for SCPI Telnet sessions.

· Port 5025 is used for SCPI Socket sessions.

SYSTem:COMMunicate:ENABle

Syntax

SYSTem:COMMunicate:ENABle {OFF | ON}, {GPIB | USB | LAN | SOCKets | TELNet | VXI11 | WEB}

SYSTem:COMMunicate:ENABle? {GPIB | USB | LAN | SOCKets | TELNet | VXI11 | WEB}

Description

This command disables or enables the GPIB, USB, or LAN remote interface. In addition, this command disables or enables the available remote services such as Sockets, Telnet, VXI11, and the built-in Web Interface.

> **NOTE** When you disable, or re-enable, an interface (GPIB, USB, or LAN), you must cycle power on the instrument to activate the new setting. This is also true when you disable or re-enable any LAN service.

Remarks

- All interfaces are enabled by default as shipped from the factory.
- If you disable the LAN interface, all associated LAN services will not be started when you power on the instrument.
- The instrument uses the following LAN ports:
- Port 5024 is used for SCPI Telnet sessions.
- Port 5025 is used for SCPI Socket sessions.
- The interface enables are stored in non-volatile memory, and do not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- All interfaces are enabled when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the enable state for the specified interface: 0 (OFF) or 1 (ON).

Examples

The following example disables the USB interface.

```
SYST:COMM:ENAB OFF,USB
```

The following example returns the state of the USB interface.

```
SYST:COMM:ENAB? USB
```

Typical Response: 0

SYSTem:COMMunicate:ENABle

See Also

Remote Interface Configuration Commands

SYSTem:COMMunicate:ENABle

Syntax

SYSTem:COMMunicate:ENABle {OFF | ON}, {GPIB | USB | LAN | SOCKets | TELNet | VXI11 | WEB}

SYSTem:COMMunicate:ENABle? {GPIB | USB | LAN | SOCKets | TELNet | VXI11 | WEB}

Description

This command disables or enables the GPIB, USB, or LAN remote interface. In addition, this command disables or enables the available remote services such as Sockets, Telnet, VXI11, and the built-in Web Interface.

> **NOTE** When you disable, or re-enable, an interface (GPIB, USB, or LAN), you must cycle power on the instrument to activate the new setting. This is also true when you disable or re-enable any LAN service.

Remarks

- All interfaces are enabled by default as shipped from the factory.
- If you disable the LAN interface, all associated LAN services will not be started when you power on the instrument.
- The instrument uses the following LAN ports:
- Port 5024 is used for SCPI Telnet sessions.
- Port 5025 is used for SCPI Socket sessions.
- The interface enables are stored in non-volatile memory, and do not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- All interfaces are enabled when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the enable state for the specified interface: 0 (OFF) or 1 (ON).

Examples

The following example disables the USB interface.

```
SYST:COMM:ENAB OFF,USB
```

The following example returns the state of the USB interface.

```
SYST:COMM:ENAB? USB
```

Typical Response: 0

SYSTem:COMMunicate:ENABle

See Also

Remote Interface Configuration Commands

SYSTem:COMMunicate:GPIB:ADDRess

Syntax

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess ‹*address*›

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

Description

This command assigns the instrument's GPIB (IEEE-488) address. Each device on the GPIB interface must have a unique address. The instrument's GPIB address is displayed on the front-panel at power-on.

> **NOTE**   The new address does not take effect until the next time power is cycled.

Parameters

Name	Type	Range of Values	Default Value
‹*address*›	Numeric	An integral value between 0 and 30.	This is a required parameter

Remarks

- Your computer's GPIB interface card has its own address. Be sure to avoid using the computer's address for any instrument on the interface bus.
- The GPIB address is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- The GPIB address is set to 3 when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the GPIB address in the form "+22".

Examples

The following example sets the GPIB address.

```
SYST:COMM:GPIB:ADDR 15
```

See Also

SYSTem:COMMunicate:ENABle

SYSTem:COMMunicate:LAN:CONTrol?

Syntax

SYSTem:COMMunicate:LAN:CONTrol?

Description

This command reads the initial Control connection port number for Sockets communications. The initial connection is used to send and receive commands, queries, and query responses.

Remarks

- The Control socket connection is used to send a Device Clear to the instrument or to detect pending Service Request (SRQ) events.

Return Format

The query returns the Control connection port number. 0 is returned if the interface does not support a Socket Control connection.

Example

The following example returns the Control connection port number.

```
SYST:COMM:LAN:CONT?
```

Typical Response: 5000

See Also

SYSTem:COMMunicate:LAN:DHCP

Syntax

SYSTem:COMMunicate:LAN:DHCP {OFF | ON}

SYSTem:COMMunicate:LAN:DHCP?

Description

This command disables or enables use of the Dynamic Host Configuration Protocol (DHCP) for the instrument.

When DHCP is enabled (factory setting), the instrument 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 instrument.

When DHCP is disabled or unavailable, the instrument will use the static IP address, Subnet Mask, and Default Gateway during power-on.

> **NOTE**   If you change the DHCP setting, you must send the SYSTem:COMMunicate:LAN:UPDate command to activate the new setting.

Remarks

- Most corporate LANs have a DHCP server.
- If a DHCP LAN address is not assigned by a DHCP server, then a static IP will be assumed after approximately 2 minutes.
- The DHCP setting is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- DHCP is enabled when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the DHCP enable state: 0 (OFF) or 1 (ON).

Examples

The following example disables DHCP.

```
SYST:COMM:LAN:DHCP OFF
 SYST:COMM:LAN:UPD
```

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:GATEway

SYSTem:COMMunicate:LAN:IPADdress

SYSTem:COMMunicate:LAN:SMASk

SYSTem:COMMunicate:LAN:DNS

Syntax

SYSTem:COMMunicate:LAN:DNS[{1|2}] "<*address*>"

SYSTem:COMMunicate:LAN:DNS[{1|2}]? [{CURRent | STATic}]

Description

This command assigns the static IP addresses of the Domain Name System (DNS) servers. A primary and a secondary server address may be assigned. Contact your network administrator to determine if DNS is being used and for the correct addresses. If DHCP is available and enabled, DHCP will auto-assign the DNS server addresses. These auto-assigned DNS server addresses take precedence over the static DNS addresses assigned with this command.

| NOTE | If you change the DNS addresses, you must send the SYSTem:COMMunicate:LAN:UPDate command to activate the new settings. |

Parameters

Name	Type	Range of Values	Default Value
<*address*>	Quoted String	Specified in four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255.	This is a required parameter

Remarks

- The assigned DNS server addresses are used if DHCP is disabled or unavailable. Otherwise, the DNS server addresses are auto-assigned by DHCP.
- Dot-notation addresses ("nnn.nnn.nnn.nnn" where "nnn" is a byte value) must be expressed with care, as most web software on the PC will interpret byte values with leading zeros as *octal* numbers. For example, "255.255.020.011" is actually equivalent to decimal "255.255.16.9" not "255.255.20.11" because ".020" is interpreted as "16" expressed in octal, and ".011" as "9". To avoid confusion, use only decimal expressions of byte values (0 to 255), with **no leading zeros**.

  For example, the instrument assumes that all dot-notation addresses are expressed as decimal byte values and strips all leading zeros from these byte values. Thus, attempting to set an IP address of "255.255.020.011" will become "255.255.20.11" (a purely decimal expression). Be sure to enter the exact expression, "255.255.20.11", in your PC web software to address the instrument. Do not use "255.255.020.011" – the PC will interpret this address differently due to the leading zeros.
- The DNS server addresses are stored in non-volatile memory, and do not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

SYSTem:COMMunicate:LAN:DNS

- The DNS server addresses set to "0.0.0.0" (no servers) when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the current DNS address in the form "nnn.nnn.nnn.nnn" (the quotes are also returned).

Specify "CURRent" (default) to read the DNS address currently being used by the instrument. Specify "STATic" to read the static DNS address currently stored in non-volatile memory within the instrument. This is the address that is used if DHCP is disabled or currently unavailable. If DHCP is enabled, it will auto-assign the DNS address, and that DHCP-assigned address can be read by specifying "CURRent".

Examples

The following example sets a static primary DNS address.

```
SYST:COMM:LAN:DNS "198.105.232.4"
SYST:COMM:LAN:UPD
```

The following example returns the secondary DNS address currently being used by the instrument.

```
SYST:COMM:LAN:DNS2? CURR
```

Typical Response: "198.105.232.4"

See Also

SYSTem:COMMunicate:LAN:HOSTname

SYSTem:COMMunicate:LAN:DOMain?

Syntax

SYSTem:COMMunicate:LAN:DOMain?

Description

This command returns the assigned domain name to the instrument.

Remarks

- If Dynamic domain name System (DNS) is available on your network and your instrument uses DHCP, the domain name is assigned by the Dynamic DNS service at power-on.

- A null value ("") indicates that no domain name is assigned.

Return Format

The query reads the domain name and returns an ASCII string enclosed in double quotes. If a domain name has not been assigned, a null string (" ") is returned.

Examples

The following example returns the domain name currently being used by the instrument.

```
SYST:COMM:LAN:DOM?
```

Typical Response: "example.com"

See Also

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:GATeway

Syntax

SYSTem:COMMunicate:LAN:GATeway "*\<address\>*"

SYSTem:COMMunicate:LAN:GATeway? [{CURRent | STATic}]

Description

This command assigns a default gateway for the instrument. The specified IP Address sets the default gateway which allows the instrument to communicate with systems that are not on the local subnet. Thus, this is the default gateway where packets are sent which are destined for a device not on the local subnet, as determined by the Subnet Mask setting. Contact your network administrator to determine if a gateway is being used and for the correct address.

| NOTE | If you change the default gateway, you must send the SYSTem:COMMunicate:LAN:UPDate command to activate the new setting. |

Parameters

Name	Type	Range of Values	Default Value
\<address\>	Quoted String	Specified in four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255.	This is a required parameter

Remarks

- If DHCP is enabled (see SYSTem:COMMunicate:LAN:DHCP command), the specified default gateway is not used. However, if the DHCP server fails to assign a valid IP address, the currently configured default gateway will be used.
- Dot-notation addresses ("nnn.nnn.nnn.nnn" where "nnn" is a byte value) must be expressed with care, as most web software on the PC will interpret byte values with leading zeros as *octal* numbers. For example, "255.255.020.011" is actually equivalent to decimal "255.255.16.9" not "255.255.20.11" because ".020" is interpreted as "16" expressed in octal, and ".011" as "9". To avoid confusion, use only decimal expressions of byte values (0 to 255), with **no leading zeros**.

   For example, the instrument assumes that all dot-notation addresses are expressed as decimal byte values and strips all leading zeros from these byte values. Thus, attempting to set a default gateway of "255.255.020.011" will become "255.255.20.11" (a purely decimal expression). Be sure to enter the exact expression, "255.255.20.11", in your PC web software to address the instrument. Do not use "255.255.020.011" – the PC will interpret this address differently due to the leading zeros.

- For the query form, specify "CURRent" (default) to read the dynamic default gateway currently being used by the instrument. Specify "STATic" to read the default gateway currently stored in non-volatile memory within the instrument (may not be the actual address used by the instrument if DHCP is enabled).

- The default gateway is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

- The gateway is set to "0.0.0.0" (no subnetting) when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the default gateway address in the form "nnn.nnn.nnn.nnn" (the quotes are also returned).

Examples

The following example sets the default gateway address.

```
SYST:COMM:LAN:GAT "198.105.232.1"
SYST:COMM:LAN:UPD
```

The following example returns the default gateway address currently being used by the instrument.

```
SYST:COMM:LAN:GAT? CURR    or    SYST:COMM:LAN:GAT?
```

Typical Response: "0.0.0.0"

See Also

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:IPADdress

SYSTem:COMMunicate:LAN:SMASk

SYSTem:COMMunicate:LAN:HOSTname

Syntax

SYSTem:COMMunicate:LAN:HOSTname "<*name*>"

SYSTem:COMMunicate:LAN:HOSTname? [{CURRent | STATic}]

Description

This command assigns a host name to the instrument. The host name is the host portion of the domain name, which is translated into an IP address.

> **NOTE**   If you change the host name, you must send the SYSTem:COMMu-nicate:LAN:UPDate command to activate the new setting.

Parameters

Name	Type	Range of Values	Default Value
‹*name*›	Quoted String	A string of up to 15 characters. The first character must be a letter (A-Z), but the remaining 14 characters can be letters, numbers (0-9), or dashes ("-"). Blank spaces are not allowed.	This is a required parameter

Remarks

- If Dynamic Domain Name System (DNS) is available on your network and your instrument uses DHCP, the host name is registered with the Dynamic DNS service at power-on.

- If DHCP is enabled (see SYSTem:COMMunicate:LAN:DHCP command), the DHCP server can change the specified host name.

- For the query form, specify "CURRent" (default) to read the dynamic host name currently being used by the instrument. Specify "STATic" to read the host name currently stored in non-volatile memory within the instrument (may not be the actual name used by the instrument if DHCP is enabled).

- The host name is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

- The host name is set to "A-53220A-nnnnn" (Keysight 53220A) or "A-532320A-nnnnn" (Keysight 53230A) where *nnnnn* is the last 5 digits of the instrument's serial number when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query reads the host name and returns an ASCII string enclosed in double quotes. If a host name has not been assigned, a null string (" ") is returned.

Examples

The following example defines a host name.

```
SYST:COMM:LAN:HOST "LAB1-CNTR"
SYST:COMM:LAN:UPD
```

The following example returns the host name currently being used by the instrument.

```
SYST:COMM:LAN:HOST? CURR    or    SYST:COMM:LAN:HOST?
```

Typical Response: "LAB1-CNTR"

See Also

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:DOMain

SYSTem:COMMunicate:LAN:IPADdress

Syntax

SYSTem:COMMunicate:LAN:IPADdress "<*address*>"

SYSTem:COMMunicate:LAN:IPADdress? [{CURRent | STATic}]

Description

This command assigns a static Internet Protocol (IP) address for the instrument. Contact your network administrator for a valid IP address to use for your instrument.

| NOTE | If you change the IP address, you must send the SYSTem:COMMunicate:LAN:UPDate command to activate the new setting. |

Parameters

Name	Type	Range of Values	Default Value
<*address*>	Quoted String	Specified in four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255.	This is a required parameter

Remarks

- If DHCP is enabled (see SYSTem:COMMunicate:LAN:DHCP command), the specified static IP address is not used. However, if the DHCP server fails to assign a valid IP address, the currently configured static IP address will be used.
- Dot-notation addresses ("nnn.nnn.nnn.nnn" where "nnn" is a byte value) must be expressed with care, as most web software on the PC will interpret byte values with leading zeros as *octal* numbers. For example, "255.255.020.011" is actually equivalent to decimal "255.255.16.9" not "255.255.20.11" because ".020" is interpreted as "16" expressed in octal, and ".011" as "9". To avoid confusion, use only decimal expressions of byte values (0 to 255), with **no leading zeros**.

    For example, the instrument assumes that all dot-notation addresses are expressed as decimal byte values and strips all leading zeros from these byte values. Thus, attempting to set an IP address of "255.255.020.011" will become "255.255.20.11" (a purely decimal expression). Be sure to enter the exact expression, "255.255.20.11", in your PC web software to address the instrument. Do not use "255.255.020.011" – the PC will interpret this address differently due to the leading zeros.

- If you are planning to use a static IP address on a Corporate LAN, contact your network administrator to obtain a fixed IP address to be used exclusively for your instrument.

- For the query form, specify "CURRent" (default) to read the dynamic IP address currently being used by the instrument. Specify "STATic" to read the IP address currently stored in non-volatile memory within the instrument (may not be the actual address used by the instrument if DHCP is enabled).

- The IP address is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

- The IP address is set to "169.254.2.20" (Keysight 53220A) or "169.254.2.30" (Keysight 53230A) when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the IP address in the form "nnn.nnn.nnn.nnn" (the quotes are also returned).

Examples

The following example sets the IP address.

```
SYST:COMM:LAN:IPAD "198.105.232.101"
SYST:COMM:LAN:UPD
```

The following example returns the IP address currently being used by the instrument.

```
SYST:COMM:LAN:IPAD? CURR    or    SYST:COMM:LAN:IPAD?
```

Typical Response: "169.254.149.35"

See Also

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:GATEway

SYSTem:COMMunicate:LAN:SMASk

SYSTem:COMMunicate:LAN:MAC?

Syntax

SYSTem:COMMunicate:LAN:MAC?

Description

This command reads the instrument's Media Access Control (MAC) address.

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

Remarks

- The MAC address is also known as the link-layer address, the 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 instrument's MAC address is set at the factory and cannot be changed.

- The MAC address is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query reads the MAC address and returns an ASCII string enclosed in double quotes. The MAC address is represented as 12 hexadecimal characters.

Example

The following example returns the MAC address (the quotes are also returned).

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

Typical Response: "0030D3001041"

See Also

SYSTem:COMMunicate:LAN:SMASk

Syntax

SYSTem:COMMunicate:LAN:SMASk "<*mask*>"

SYSTem:COMMunicate:LAN:SMASk? [{CURRent | STATic}]

Description

This command assigns a subnet mask for the instrument. The instrument uses the subnet mask to determine if a client IP address is on the same local subnet. When a client IP address is on a different subnet, all packets must be sent to the Default Gateway. Contact your network administrator to determine if subnetting is being used and for the correct subnet mask.

> **NOTE**   If you change the subnet mask, you must send the SYSTem:COMMunicate:LAN:UPDate command to activate the new setting.

Parameters

Name	Type	Range of Values	Default Value
<*address*>	Quoted String	Specified in four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255.	This is a required parameter

Remarks

- If DHCP is enabled (see SYSTem:COMMunicate:LAN:DHCP command), the specified subnet mask is not used. However, if the DHCP server fails to assign a valid IP address, the currently configured subnet mask will be used.
- Dot-notation addresses ("nnn.nnn.nnn.nnn" where "nnn" is a byte value) must be expressed with care, as most web software on the PC will interpret byte values with leading zeros as *octal* numbers. For example, "255.255.020.011" is actually equivalent to decimal "255.255.16.9" <u>not</u> "255.255.20.11" because ".020" is interpreted as "16" expressed in octal, and ".011" as "9". To avoid confusion, use only decimal expressions of byte values (0 to 255), with **no leading zeros**.

  For example, the instrument assumes that all dot-notation addresses are expressed as decimal byte values and strips all leading zeros from these byte values. Thus, attempting to set a subnet mask of "255.255.020.011" will become "255.255.20.11" (a purely decimal expression). Be sure to enter the exact expression, "255.255.20.11", in your PC web software to address the instrument. Do not use "255.255.020.011" – the PC will interpret this address differently due to the leading zeros.
- A value of "0.0.0.0" or "255.255.255.255" indicates that subnetting is not being used.

SYSTem:COMMunicate:LAN:SMASk

- For the query form, specify "CURRent" (default) to read the dynamic subnet mask currently being used by the instrument. Specify "STATic" to read the subnet mask currently stored in non-volatile memory within the instrument (may not be the actual mask used by the instrument if DHCP is enabled).

- The subnet mask is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

- The subnet mask is set to "255.255.0.0" when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the subnet mask in the form "nnn.nnn.nnn.nnn" (the quotes are also returned).

Examples

The following example sets the subnet mask.

```
SYST:COMM:LAN:SMAS "255.255.255.0"
SYST:COMM:LAN:UPD
```

The following example returns the subnet mask currently being used by the instrument.

```
SYST:COMM:LAN:SMAS? CURR   or   SYST:COMM:LAN:SMAS?
```

Typical Response: "255.255.0.0"

See Also

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:GATEway

SYSTem:COMMunicate:LAN:IPADdress

SYSTem:COMMunicate:LAN:TELNet:PROMpt

Syntax

SYSTem:COMMunicate:LAN:TELNet:PROMpt "<*string*>"

SYSTem:COMMunicate:LAN:TELNet:PROMpt?

Description

This command sets the command prompt seen when using a Telnet session to communicate with the instrument.

Parameters

Name	Type	Range of Values	Default Value
<string>	Quoted String	A string of up to 15 characters.	This is a required parameter

Remarks

- The instrument uses LAN port 5024 for SCPI Telnet sessions (but 5025 for SCPI Socket sessions).
- Telnet session can typically be started as follows from a host computer shell:

  telnet <*IP_address*> <*port*>

  For example:

  telnet 169.254.4.10 5024

  To exit a Telnet session, press <**Ctrl-D**>.
- The command prompt is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- The command prompt is set to "53220A>" (Keysight 53220A) or "53230A>" (Keysight 53230A) when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query reads the command prompt and returns an ASCII string enclosed in double quotes.

Examples

The following example defines the command prompt.

```
SYST:COMM:LAN:TELN:PROM "Command> "
```

SYSTem:COMMunicate:LAN:TELNet:PROMpt

See Also

SYSTem:COMMunicate:LAN:TELNet:WMESsage

SYSTem:COMMunicate:LAN:TELNet:WMESsage

Syntax

SYSTem:COMMunicate:LAN:TELNet:WMESsage "*<string>*"

SYSTem:COMMunicate:LAN:TELNet:WMESsage?

Description

This command sets the welcome message seen when using a Telnet session to communicate with the instrument.

Parameters

Name	Type	Range of Values	Default Value
<string>	Quoted String	A string of up to 63 characters.	This is a required parameter

Remarks

- The instrument uses LAN port 5024 for SCPI Telnet sessions (but 5025 for SCPI Socket sessions).
- The welcome message is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- The welcome message is set to "Welcome to Keysight's 53220A Universal Counter/Timer" (Keysight 53220A) or "Welcome to Keysight's 53230A Universal Counter/Timer" (Keysight 53230A) when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query reads the welcome message and returns an ASCII string enclosed in double quotes.

Examples

The following example defines the welcome message.

```
SYST:COMM:LAN:TELN:WMES "Welcome to the 53220A Telnet Session"
```

See Also

SYSTem:COMMunicate:LAN:TELNet:PROMpt

SYSTem:COMMunicate:LAN:UPDate

Syntax

SYSTem:COMMunicate:LAN:UPDate

Description

This command stores any changes made to the LAN settings into non-volatile memory and restarts the LAN driver with the updated settings.

Remarks

- This command must be sent after changing the settings for DHCP, DNS, gateway, hostname, IP address, subnet mask, WINS.

- You should make all desired changes to the LAN settings before sending this command.

Example

The following example configures the instrument to use statically assigned LAN settings.

```
SYST:COMM:LAN:DHCP OFF
SYST:COMM:LAN:DNS "198.105.232.4"
SYST:COMM:LAN:DNS2 "198.105.232.5"
SYST:COMM:LAN:GAT "198.105.232.1"
SYST:COMM:LAN:HOST "LAB1-CNTR"
SYST:COMM:LAN:IPAD "198.105.232.101"
SYST:COMM:LAN:SMAS "255.255.255.0"
SYST:COMM:LAN:WINS "198.105.232.4"
SYST:COMM:LAN:WINS "198.105.232.5"
SYST:COMM:LAN:UPD
```

The following example configures the instrument back to use DHCP.

```
SYST:COMM:LAN:DHCP ON
SYST:COMM:LAN:UPD
```

See Also

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:DNS

SYSTem:COMMunicate:LAN:GATeway

SYSTem:COMMunicate:LAN:HOSTname

SYSTem:COMMunicate:LAN:IPADdress

SYSTem:COMMunicate:LAN:SMASk

SYSTem:COMMunicate:LAN:WINS

SYSTem:COMMunicate:LAN:WINS

Syntax

SYSTem:COMMunicate:LAN:WINS[{1|2}] "<*address*>"

SYSTem:COMMunicate:LAN:WINS[{1|2}]? [{CURRent | STATic}]

Description

This command assigns the static IP addresses of the Windows Internet Name System (WINS) servers. A primary and a secondary server addess may be assigned. Contact your network administrator to determine if WINS is being used and for the correct addresses. If DHCP is available and enabled, DHCP will auto-assign the WINS server addresses. These auto-assigned WINS server addresses take precedence over the static WINS addresses assigned with this command.

> **NOTE** If you change the WINS addresses, you must send the SYSTem:COMMunicate:LAN:UPDate command to activate the new settings.

Parameters

Name	Type	Range of Values	Default Value
<*address*>	Quoted String	Specified in four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255.	This is a required para-meter

Remarks

- The assigned WINS addresses are used if DHCP is disabled or unavailable. Otherwise, the WINS server addresses are auto-assigned by DHCP.
- Dot-notation addresses ("nnn.nnn.nnn.nnn" where "nnn" is a byte value) must be expressed with care, as most web software on the PC will interpret byte values with leading zeros as *octal* numbers. For example, "255.255.020.011" is actually equivalent to decimal "255.255.16.9" not "255.255.20.11" because ".020" is interpreted as "16" expressed in octal, and ".011" as "9". To avoid confusion, use only decimal expressions of byte values (0 to 255), with **no leading zeros**.

  For example, the instrument assumes that all dot-notation addresses are expressed as decimal byte values and strips all leading zeros from these byte values. Thus, attempting to set an IP address of "255.255.020.011" will become "255.255.20.11" (a purely decimal expression). Be sure to enter the exact expression, "255.255.20.11", in your PC web software to address the instrument. Do not use "255.255.020.011" – the PC will interpret this address differently due to the leading zeros.
- The WINS addresses are stored in non-volatile memory, and do not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

- The WINS server addresses set to "0.0.0.0" (no servers) when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the current WINS address in the form "nnn.nnn.nnn.nnn" (the quotes are also returned).

Specify "CURRent" (default) to read the WINS address currently being used by the instrument. Specify "STATic" to read the static WINS address currently stored in non-volatile memory within the instrument. This is the address that is used if DHCP is disabled or currently unavailable. If DHCP is enabled, it will auto-assign the WINS address, and that DHCP assigned address can be read by specifying "CURRent".

Examples

The following example sets a static primary WINS address.

```
SYST:COMM:LAN:WINS "198.105.232.4"
SYST:COMM:LAN:UPD
```

The following example returns the secondary WINS address currently being used by the instrument.

```
SYST:COMM:LAN:WINS2? CURR
```

Typical Response: "198.105.232.4"

See Also

SYSTem:COMMunicate:LAN:HOSTname

SYSTem:LICense:CATalog?

Syntax

SYSTem:LICense:CATalog?

Description

This command returns a comma separated list of options that are currently licensed.

Remarks

- *Available only on the Keysight 53230A.*

- Option 150 is the only licensed option currently available for the Keysight 53230A.
- Not all options installed in the instrument are returned, only those which require a license.

Return Format

The query returns a comma separated list of options; each option is enclosed in double quotes. If no licensed options are found command returns "".

Example

The following example returns a list of licensed options installed on the instrument:

```
SYST:LIC:CAT?
```

Typical response: "150"

See Also

*OPT?

SYSTem:LICense:CATalog?

Syntax

SYSTem:LICense:CATalog?

Description

This command returns a comma separated list of options that are currently licensed.

Remarks

- ***Available only on the Keysight 53230A.***

- Option 150 is the only licensed option currently available for the Keysight 53230A.
- Not all options installed in the instrument are returned, only those which require a license.

Return Format

The query returns a comma separated list of options; each option is enclosed in double quotes. If no licensed options are found command returns "".

Example

The following example returns a list of licensed options installed on the instrument:

```
SYST:LIC:CAT?
```

Typical response: "150"

See Also

*OPT?

SYSTem:LICense:DELete

Syntax

SYSTem:LICense:DELete <option>

Description

This command deletes the specified license on the instrument.

Parameters

Name	Type	Range of Values	Default Value
<option>	String	"150"	This is a required parameter

Remarks

- ***Available only on the Keysight 53230A.***

- Option 150 is the only licensed option currently available for the Keysight 53230A.
- Deleting a license may affect the available measurement functions of the instrument.

Example

The following example delete the license for option 150 on the instrument:

```
SYST:LIC:DEL "150"
```

See Also

SYSTem:LICense:DELete:ALL

SYSTem:LICense:DELete:ALL

SYSTem:LICense:DELete:ALL

Syntax

SYSTem:LICense:DELete:ALL

Description

This command deletes all licenses on the instrument.

Remarks

- ***Available only on the Keysight 53230A.***
- Deleting licenses may affect the available measurement functions of the instrument.

Example

The following example deletes all licenses on the instrument:

```
SYST:LIC:DEL:ALL
```

See Also

SYSTem:LICense:DELete

SYSTem:LICense:DESCription?

Syntax

SYSTem:LICense:DESCription? ‹option›

Description

This command returns a description of the specified option.

Parameters

Name	Type	Range of Values	Default Value
‹option›	String	"150"	This is a required parameter

Remarks

- ***Available only on the Keysight 53230A.***

- Option 150 is the only licensed option currently available for the Keysight 53230A.
- The option does not have to be installed in order for this query to return its description. However, you must know the option name, as the SYSTem:LICense:CATalog? query only returns installed options.

Return Format

The query returns the option description, enclosed in double quotes.

Example

The following example returns the description for option 150:

```
SYST:LIC:DESC? "150"
```

Typical response: "Pulse Microwave Measurements"

See Also

SYSTem:LICense:CATalog?

SYSTem:LICense:INSTall?

SYSTem:LICense:ERRor?

Syntax

SYSTem:LICense:ERRor?

Description

This command returns and clears one error message produced by the most recent SYSTem:LICense:INSTall command.

Remarks

- ***Available only on the Keysight 53230A.***

- The returned string can be up to 2096 bytes long.

Return Format

The query returns a definite-length block containing multi-line ASCII text, including embedded carriage return and line feed characters. If no messages remain, `+18No Error` is returned.

Example

The following example returns the error string produced by the most recent SYSTem:LICense:INSTall:

```
SYST:LIC:ERR?
```

Typical response: #279File: MyFile.lic<CR><LF>[Ignored - The license file is not formatted correctly.] <CR><LF>

See Also

SYSTem:LICense:ERRor:COUNt?

SYSTem:LICense:INSTall

SYSTem:LICense:ERRor:COUNt?

Syntax

SYSTem:LICense:ERRor:COUNt?

Description

This command returns the number of error messages produced by the most recent SYSTem:LICense:INSTall command.

Remarks

- *Available only on the Keysight 53230A.*

Return Format

The query returns a string enclosed in the form +1.

Example

The following example returns the number of errors produced by the most recent SYSTem:LICense:INSTall:

```
SYST:LIC:ERR:COUN?
```

Typical response: +0

See Also

SYSTem:LICense:ERRor?

SYSTem:LICense:INSTall

SYSTem:LICense:INSTall

Syntax

SYSTem:LICense:INSTall [{<folder> | <file>}]

Description

This command installs all licenses from a specified file or from all license files in the specified folder.

Parameters

Name	Type	Range of Values	Default Value
<folder>	String	Any valid folder name	Root directory of a front panel USB storage device
<file>	String	A valid license file name	Required if desired

Remarks

- ***Available only on the Keysight 53230A.***

- License files must have a ".lic" file extension.

- The format for <folder> is "[[<drive>:]<path>]", where <drive> can be INTernal or USB, and <path> is a folder path.

  ○ INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  ○ If <drive> is specified, <path> is interpreted as an absolute folder path. Absolute paths begin with a "\" or "/" and start at the root folder of <drive>.
  ○ If <drive> is omitted, <path> is relative to the folder specified by the MMEMory:CDIRectory command. Relative paths must ***not*** begin with "\" or "/".
  ○ <folder> cannot exceed 240 characters.
  ○ The specified folder must exist and cannot be marked as hidden or system.

- The format for <file> is "[<drive>:<path>]<file_name>", where <drive> can be INTernal or USB, and <path> must be an absolute folder path.

  ○ INTernal specifies the internal flash file system. USB specifies a front panel USB storage device.
  ○ If <drive>:<path> is omitted, the folder specified by the MMEMory:CDIRectory command is used.
  ○ Absolute paths begin with a "\" or "/" and start at the root folder of <drive>.
  ○ Folder and file names cannot contain the following characters: \ / : * ? " < > |
  ○ The combination of folder and file name cannot exceed 240 characters.
  ○ The specified file cannot be marked as hidden or system.

SYSTem:LICense:INSTall

Example

The following example installs licenses from license files in the \Licenses folder on a front panel USB storage device:

```
SYST:LIC:INST "USB:\Licenses"
```

The following example installs licenses from the file "MyLicenses.lic" in the \Licenses folder on a front panel USB storage device:

```
SYST:LIC:INST "USB:\Licenses\MyLicenses.lic"
```

See Also

SYSTem:LICense:DELete

SYSTem:LICense:DELete:ALL

SYSTem:LICense:INSTall?

Syntax

SYSTem:LICense:INSTall? ‹option›

Description

This command returns a comma separated list of options that are currently licensed.

Parameters

Name	Type	Range of Values	Default Value
‹option›	String	"150"	This is a required parameter

Remarks

- ***Available only on the Keysight 53230A.***

- Option 150 is the only licensed option currently available for the Keysight 53230A.

Return Format

The query returns whether the option license is installed or not: 0 (not installed) or 1 (installed).

Example

The following example returns the status of option 150:

```
SYST:LIC:INST? "150"
```

Typical response: 0

See Also

SYSTem:LICense:CATalog?

SYSTem:ALEVel:FREQuency

Syntax

SYSTem:ALEVel:FREQuency {<*frequency*> | MINimum | MAXimum | DEFault}

SYSTem:ALEVel:FREQuency? [{MINimum | MAXimum | DEFault}]

Description

This command sets the minimum input signal frequency for auto-leveling (see INPut{1|2}:LEVel:AUTO).

Parameters

Name	Type	Range of Values	Default Value
<*frequency*>	Numeric	50.0or 10.0E3 MIN = 50.0 MAX = 1.0E3	50.0

Remarks

- Selecting 10 KHz allows for faster auto-leveling for 10 KHz or higher input signals; 50 Hz allows auto-leveling of input signals down to 50 Hz.
- The minimum auto-leveling input frequency is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- The minimum auto-leveling input frequency is set to 50 Hz when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the minimum auto-leveling input frequency in the form +5.00000000E+001.

Examples

The following example sets the minimum auto-leveling input frequency to 10KHz:

```
SYST:ALEV:FREQ 10E3
```

See Also

INPut{1|2}:LEVel:AUTO

INPut{1|2}:LEVel{1|2}:RELative

SYSTem:BATTery:ENABle

Syntax

SYSTem:BATTery:ENABle {OFF | ON}

SYSTem:BATTery:ENABle?

Description

This command enables or disables the battery operation (if present).

Remarks

- The battery is shipped from the factory in the disabled state to prevent discharge of the battery during shipping.
- The battery enable state is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- The battery is disabled when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the battery enable state: 0 (OFF) or 1 (ON).

Example

The following example enables battery operation.

```
SYST:BATT:ENAB ON
```

See Also

SYSTem:BATTery:LEVel?

Syntax

SYSTem:BATTery:LEVel?

Description

This command returns the current battery charge level as a percentage of full charge.

Remarks

- 100% indicates a fully charged battery; 0%, a fully discharged battery.

Return Format

The query returns the battery level in the form +1.000000000E+002.

Example

The following example returns the battery level.

```
SYST:BATT:LEV?
```

Typical Response: +1.000000000E+002

See Also

*CLS

*SRE

SYSTem:BATTery:STATus?

Syntax

SYSTem:BATTery:STATus?

Description

This command returns an indication of whether the instrument is powered by the AC line or by the internal battery (if present).

Return Format

The query returns AC if the instrument is powered by the AC line, BATT if by the internal battery. If the battery option is not installed, it will always return AC.

Example

The following example queries the power source for the instrument.

```
SYST:BATT:STAT?
```

Typical Response: AC

See Also

SYSTem:BEEPer:STATe

Syntax

SYSTem:BEEPer:STATe {OFF | ON}

SYSTem:BEEPer:STATe?

Description

This command disables or enables the beeper tone. The factory default is ON.

Remarks

- Turning off the beeper does *not* disable the key click generated when you press a front-panel key.
- A beep tone is always emitted (even with the beep state turned OFF) when the SYSTem:BEEPer command is sent.
- A beep tone is emitted only if the beep state is ON when an error is generated or when an lower or upper limit is exceeded in a limit test.
- The beeper setting is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- The beeper is enabled when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the beeper enable state: 0 (OFF) or 1 (ON).

Examples

The following example disables the beeper state.

```
SYST:BEEP:STAT OFF
```

See Also

SYSTem:BEEPer[:IMMediate]

SYSTem:BEEPer:IMMediate

Syntax

SYSTem:BEEPer[:IMMediate]

Description

This command issues a single beep immediately from the instrument. This may be useful for program development and troubleshooting.

Remarks

- This command overrides the current beeper state (see the SYSTem:BEEPer:STATe command). This means that you can issue a single beep even if the beeper is turned off.

Example

The following example issues a single beep from the instrument.

```
SYST:BEEP
```

See Also

SYSTem:BEEPer:STATe

SYSTem:DATE

Syntax

SYSTem:DATE <*year*>,<*month*>,<*day*>

SYSTem:DATE?

Description

This command sets the date for the instrument's real-time clock.

Parameters

Name	Type	Range of Values	Default Value
<*year*>	Numeric	2000 to 2099	This is a required parameter
<*month*>	Numeric	1 to 12	This is a required parameter
<*day*>	Numeric	1 to 31	This is a required parameter

Remarks

- The real-time clock is battery-backed, and retains the date and time when power is off.
- Leap years are automatically handled.
- The date and time are unaffected by a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the date in the form +2008,+12,+1.

Examples

The following example sets the date to December 1, 2008:

```
SYST:DATE 2008,12,1
```

See Also

SYSTem:TIME

SYSTem:ERRor?

Syntax

SYSTem:ERRor[:NEXT]?

Description

This command reads and clears one error from the instrument's *error queue*. A record of up to 20 errors can be stored in the instrument's error queue. Each remote interface I/O session (i.e., GPIB, USB, LAN, etc.) has its own error queue. Errors appear in the error queue of the I/O session that caused the error. For example, if an error was generated by a command sent over the GPIB interface, send the SYSTem:ERRor? command from GPIB to read the error queue.

For a complete listing of all error messages, see SCPI Error Messages.

Remarks

- The instrument beeps once each time a command syntax or hardware error is generated. The front-panel ERROR annunciator turns on when one or more errors are currently stored in the error queue.
- Errors are retrieved in first-in-first-out (FIFO) order. The first error returned is the first error that was stored.
- Errors are cleared as you read them. When you have read all errors from the error queue, the ERROR annunciator turns off.
- If more than 20 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 errors from the queue. If no errors have occurred when you read the error queue, the instrument responds with +0,"No error".
- Errors generated by the instrument hardware are broadcast to all I/O sessions.
- The front panel reports errors from all I/O sessions and clears them. To read the error queue from the front panel, use the Utility menu (press the [Utility] key). See the Keysight 53220A/230A *350MHz Universal Counter/Timer* User's Guide for further information.
- Error conditions are also summarized in the Status Byte Register. For more information on the SCPI Status System, see Status System Introduction.
- The error queue is cleared by the *CLS (Clear Status) command (for the I/O session), and when power is cycled (for all errors). All errors are cleared when you read the error queue. However, the error queue is not cleared by a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query 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 such as: -113,"Undefined header".

Example

The following example reads and clears one error.

SYSTem:ERRor?

```
SYST:ERR?
```

Typical Response: -101,"Invalid character"

See Also

*CLS

*SRE

SYSTem:HELP?

Syntax

SYSTem:HELP?

Description

This command returns a complete list of the SCPI commands for the instrument.

Return Format

The query returns the complete list of SCPI commands as Definite Length Block Data, delimited with New Line characters. The first line consists of a pound sign (#) followed by one digit representing the number of digits in the decimal integer to follow. This digit is followed by a decimal integer indicating the number of data bytes to follow, followed by the first New Line. (For example, "#47947" in the first line means that there are 7947 data bytes to follow.) The rest of the block of data consists of one command per line, each terminated with a New Line character.

Example

The following example returns the list of SCPI commands.

```
SYST:HELP?
```

Typical Response:

```
#47947
:ABORt/nquery/
:CALibration:ALL?/qonly/
:CALibration:COUNt?/qonly/
:CALibration:DATA
:CALibration:LFRequency
```

```
*SAV/nquery/
*SRE
*STB?/qonly/
*TRG/nquery/
*TST?/qonly/
*WAI/nquery/
```

In the list of commands:

SYSTem:HELP?

- /nquery/ indicates a command with no query.

- /qonly/ indicates a query only, with no command form.

- All other commands consist of command and query.

See Also

Command Quick Reference

SYSTem:LANGuage

Syntax

SYSTem:LANGuage "<*language*>"

SYSTem:LANGuage?

Description

The Keysight 53220A/230A provide an improved SCPI command set that is easier to use than that included in the Keysight 53132A counter. This command reference documents the improved SCPI command set.

For backwards-compatibility, the 53220A/230A also support most of the SCPI command set from the Keysight 53132A counter (and Hewlett-Packard labelled version) via the SYSTem:LANGuage language switch. Usage of this older SCPI command set is discouraged for new use, but is available for customers who require it.

The SYSTem:LANGuage allows you to select between the 53220A/230A command set or the older 53132A command set.

Parameters

Name	Type	Range of Values	Default Value
<*language*>	string	Keysight 53220A: "53132A" or "53220A"	`"53220A"`
		Keysight 53230A: "53132A" or "53230A"	`"53230A"`

Remarks

- Specify "53132A" for <*language*> to select the SCPI command set for the Keysight 53132A.

  > **NOTE**   Refer to the Keysight 53132A 225 MHz Universal Counter Programming Guide for information on using the older SCPI command set.

- Specify "53220A" or "53230A" for <*language*> to return the instrument to its native SCPI mode. In its native mode, the instrument follows the SCPI language syntax described in this SCPI Command Reference.

- While "53132A" is selected, the front panel operation will be limited to display-only capability. All menus will be disabled.

SYSTem:LANGuage

- The ⟨*language*⟩ parameter is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

- The language is set to "53220A" or "53230A" when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query the language mode as an ASCII string enclosed in double quotes: "53132A", "53220A", or "53230A".

Examples

The following example selects the Keysight 53132A language mode on the Keysight "53230A":

```
SYST:LANG "53132A"
```

See Also

Agilent 53131A/132A Compatibility Mode

SYSTem:LOCK:NAME?

Syntax

SYSTem:LOCK:NAME?

Description

This command returns the current I/O interface (the I/O interface in use by the querying computer).

Remarks

- Use this command to determine the interface that you are using. Then use the SYSTem:LOCK:OWNer? command to determine which interface, if any, has the lock.

Return Format

The query returns GPIB, USB, VXI11, or LAN<*IP Address*> indicating the I/O interface being used by the querying computer.

Example

The following example returns which I/O interface is in use.

```
SYST:LOCK:NAME?
```

Typical Response: LAN169.254.149.35

See Also

SYSTem:LOCK:OWNer?

SYSTem:LOCK:RELease

SYSTem:LOCK:REQuest?

SYSTem:LOCK:OWNer?

Syntax

SYSTem:LOCK:OWNer?

Description

This command returns the I/O interface that currently has a lock.

Remarks

- When a lock is active, Bit 10 in the Standard Operation Register will be set (see STATus:OPERation:CONDition? command). When the lock is released on all I/O interfaces, this bit will be cleared.

Return Format

The query returns GPIB, USB, VXI11, LAN<*IP Address*>, or WEB<*IP Address*> indicating the I/O interface which currently has a lock. If no interfaces have a lock, "NONE" is returned.

Example

The following example returns which I/O interface currently has a lock.

```
SYST:LOCK:OWN?
```

Typical Response: LAN169.254.149.35

See Also

SYSTem:LOCK:NAME?

SYSTem:LOCK:RELease

SYSTem:LOCK:REQuest?

SYSTem:LOCK:RELease

Syntax

SYSTem:LOCK:RELease

Description

This command decrements the lock count by one and may release the I/O interface from which the command is executed.

Remarks

- When a lock is active, Bit 10 in the Standard Operation Register will be set (see STATus:OPERation:CONDition? command). When the lock is released on all I/O interfaces, this bit will be cleared.

Example

The following example decreases the lock count by one.

```
SYST:LOCK:REL
```

The following series of commands illustrates usage.

Initial State = unlocked, Count = 0

```
<FROM USB>    SYST:LOCK:REQ? returns "1" (request successful)
```

State = locked, Count = 1

```
<FROM GPIB>   SYST:LOCK:REQ? returns "0" because USB has lock
```

State = locked, Count = 1

```
<FROM USB>    SYST:LOCK:REQ? returns "1" (request successful)
```

State = locked, Count = 2

```
<FROM USB>    SYST:LOCK:REL
```

State = locked, Count = 1

```
<FROM USB>    SYST:LOCK:REL
```

State = unlocked, Count = 0

SYSTem:LOCK:RELease

Note that for each successful lock request, a lock release is required. Two requests require two releases.

See Also

SYSTem:LOCK:NAME?

SYSTem:LOCK:OWNer?

SYSTem:LOCK:REQuest?

SYSTem:LOCK:REQuest?

Syntax

SYSTem:LOCK:REQuest?

Description

This command requests a lock of the current I/O interface. This provides a mechanism by which you can lock the instrument's configuration or cooperatively share the instrument with other computers.

Remarks

- Lock requests can be nested and each request will increase the lock count by 1. For every request, you will need a release from the same I/O interface (see SYSTem:LOCK:RELease command).
- Instrument locks are handled at the I/O interface level (GPIB, USB, LAN, etc.) and you are responsible for all coordination between threads and/or programs on that interface.
- When a request is granted, only I/O sessions from the present interface will be allowed to change the state of the instrument. From the other I/O interfaces, you can query the state of the instrument but no measurement configuration changes or measurements are allowed.
- Locks from LAN sessions will be automatically released when a LAN disconnect is detected.
- When a lock is granted, Bit 10 in the Standard Operation Register will be set (see STATus:OPERation:CONDition? command). In addition, the entire instrument front panel, including the **Local** key, will be locked out while a lock is in place ("KEYBOARD LOCKED" is displayed).

Return Format

The query returns +1 if the lock request is granted or +0 if denied because another interface owns the lock.

Example

The following example requests a lock of the current I/O interface.

```
SYST:LOCK:REQ?
```

Typical Response: +1

See Also

SYSTem:LOCK:NAME?

SYSTem:LOCK:OWNer?

SYSTem:LOCK:RELease

SYSTem:PRESet

Syntax

SYSTem:PRESet

Description

This command presets the instrument to a known configuration. See Instrument Preset State for a complete listing of the instrument's Preset configuration.

Remarks

- This command is identical in effect to the *RST command.

Example

The following example presets the instrument.

```
SYST:PRES
```

See Also

*RST

SYSTem:SECurity:IMMediate

Syntax

SYSTem:SECurity:IMMediate

Description

This command clears and sanitizes all instrument memory except for the instrument firmware and calibration constants. This command is typically used to clear all memory before removing the instrument from a secure area.

CAUTION This command is not recommended for use in routine applications because of the possibility of unintended loss of data.

Remarks

- This command will *not* clear a USB storage device, if attached.
- The command clears and sanitizes all user files on the internal file system, including stored state information.
- This command clears and sanitizes all stored state information (see *SAV).
- All I/O settings such as the GPIB address and IP address are returned to their factory settings.
- This command initializes all instrument settings to their Factory Reset (*RST command) values.

Example

The following example clears all instrument memory.

```
SYST:SEC:IMM
```

See Also

*SAV

*RCL

*RST

SYSTem:TEMPerature?

Syntax

SYSTem:TEMPerature?

Description

This command returns the current ambient temperature in degrees Celsius.

Return Format

The query returns the temperature in the form +2.53000000E+001.

Example

The following example queries the current temperature.

```
SYST:TEMP?
```

Typical Response: +2.53000000E+001

See Also

SYSTem:TEMPerature:ACALibration?

SYSTem:TEMPerature:ACALibration?

Syntax

SYSTem:TEMPerature:ACALibration?

Description

This command returns the ambient temperature in degrees Celsius at which the last auto-calibration was performed.

Return Format

The query returns the temperature in the form +2.53000000E+001.

Example

The following example queries the temperature at which the last auto-calibration temperature was performed.

```
SYST:TEMP:ACAL?
```

Typical Response: +2.53000000E+001

See Also

SYSTem:TEMPerature?

SYSTem:TIME

Syntax

SYSTem:TIME <*hour*>,<*minute*>,<*second*>

SYSTem:TIME?

Description

This command sets the time for the instrument's real-time clock.

Parameters

Name	Type	Range of Values	Default Value
<*hour*>	Numeric	0 to 23	This is a required parameter
<*minute*>	Numeric	0 to 59	This is a required parameter
<*second*>	Numeric	0 to 59.999	This is a required parameter

Remarks

- The real-time clock is battery-backed, and retains the date and time when power is off.
- The date and time are unaffected by a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the time in the form +13,+5,+1.000.

Examples

The following example sets the time to 1:05:01 p.m.:

```
SYST:TIME 13,5,1
```

See Also

SYSTem:DATE

SYSTem:TIMeout

Syntax

SYSTem:TIMeout {<*time*> | MINimum | MAXimum | INFinity | DEFault}

SYSTem:TIMeout? [{MINimum | MAXimum | DEFault}]

Description

This command sets the per-measurement timeout for all measurements. If a measurement does not complete before the timeout expires, 9.91E37 (Not a Number) will be returned for that measurement. The timeout is disabled if INFinity or 9.9E37 is specified (the instrument will always wait for the measurement to complete).

Parameters

Name	Type	Range of Values	Default Value
<*time*>	Numeric	9.9E+37 (disabled) or 10 msec to 2000 sec with 1 mS resolution MIN = 10 msec MAX = 2000 sec	9.9E+37 (disabled)

Remarks

- When selecting a timeout value, you should include the effects of trigger delay (TRIGger:DELay), the measurement or gate time (SENSe:FREQuency:GATE:TIME or SENSe:TOTalize:GATE:TIME), the gate open delay (SENSe:GATE:STARt:DELay:TIME or SENSe:GATE:STARt:DELay:EVENts), and the gate close holdoff (SENSe:GATE:STOP:HOLDoff:TIME or SENSe:GATE:STOP:HOLDoff:EVENts), as well as the input signal frequency.
- If the timeout value is less than the gate time, or the sum of the gate open delay and close holdoff, then a timeout value of twice the gate time, or twice twice the sum of the gate open delay and close holdoff, will be used for the measurement. The programmed timeout value, however, will remain unchanged.
- If multiple measurements are being made (SAMPle:COUNt or TRIGger:COUNt set to greater than 1), the timeout applies individually to each measurement.
- The timeout is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).
- The timeout is disabled when the instrument is shipped from the factory or after a SYSTem:SECurity:IMMediate command.

Return Format

The query returns the timeout in the form +2.00000000E+000. For a infinite timeout, the query returns 9.9E37.

SYSTem:TIMeout

Examples

The following example sets the timeout to 10 seconds:

```
SYST:TIM 10
```

See Also

SENSe:FREQuency:GATE:TIME

SENSe:TOTalize:GATE:TIME

SENSe:GATE:STOP:HOLDoff:TIME

SENSe:GATE:STOP:HOLDoff:EVENts

TRIGger:DELay

SYSTem:VERSion?

Syntax

SYSTem:VERSion?

Description

This command returns the version of the SCPI (Standard Commands for Programmable Instruments) standard with which the instrument is in compliance. The instrument complies with the rules and conventions of the indicated version of the SCPI standard.

> **NOTE**   You cannot query the SCPI version from the front panel.

Return Format

The query returns 1994.0.

Example

The following example returns the SCPI version.

```
SYST:VERS?
```

Typical Response: 1994.0

See Also

Introduction to SCPI Language

TRIGger Subsystem Introduction

Command Summary

TRIGger:COUNt
TRIGger:COUNt?
TRIGger:DELay
TRIGger:DELay?
TRIGger:SLOPe
TRIGger:SLOPe?
TRIGger:SOURce
TRIGger:SOURce?

TRIGger:COUNt

Syntax

TRIGger:COUNt {<*count*> | MINimum | MAXimum | DEFault}

TRIGger:COUNt? [{MINimum | MAXimum | DEFault}]

Description

This command selects the number of triggers that will be accepted by the instrument before returning to the "idle" trigger state.

Parameters

Name	Type	Range of Values	Default Value
<*count*>	Numeric	1 to 1,000,000 MIN = 1 MAX = 1,000,000	1

Remarks

- You can use the specified trigger count in conjunction with a sample count (see SAMPle:COUNt command) which selects the number of measurements (samples) the meter will take per trigger. In this case, the total number of measurements returned will be the product of the sample count and trigger count.

    Number of Readings = Sample Count x Trigger Count

    If more than 1,000,000 measurements are to be taken, the data must be read from reading memory fast enough to avoid a memory overflow. If memory overflows, the new measurements will overwrite the first (oldest) measurements stored; the most recent measurements are always preserved. No error is generated, but the Reading Mem Ovfl bit (bit 14) is set in the Questionable Data Register.

- The CONFigure and MEASure? commands automatically set the trigger count to 1.
- The trigger count setting is ignored when making continuous, gap-free frequency and period measurements ([SENSe:]FREQ:MODE CONT set), continuous totalize and timestamp measurements. Only one trigger will be accepted for each READ? or INITiate[:IMMediate] command.
- The instrument sets the trigger count to 1 after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the trigger count in the form +100.

TRIGger:COUNt

Examples

The following example returns 10 sets of 5 frequency measurements on channel 1, using a positive-going external trigger to start each set of measurements.

```
CONF:FREQ 1.0E6,.001
SAMP:COUN 5
TRIG:COUN 10
TRIG:SOUR EXT
TRIG:SLOP POS
READ?
```

Typical Response: +1.00520000000000E+006, ... (50 measurements)

See Also

*RST

ABORt

SAMPle:COUNt

TRIGger:SOURce

TRIGger:DELay

Syntax

TRIGger:DELay {<*time*> | MINimum | MAXimum | DEFault}

TRIGger:DELay? [{MINimum | MAXimum | DEFault}]

Description

This command sets the delay time in seconds between the trigger signal and enabling the gate open for the first measurement. This may be useful in applications where the signal you want to measure is delayed with respect to the trigger.

Parameters

Name	Type	Range of Values	Default Value
<*time*>	Numeric	0 to 3600 sec with 1 us resolution MIN = 0 sec MAX = 3600 sec	0.0

Remarks

- The CONFigure and MEASure? commands set the trigger delay time to 0.0 seconds.
- The instrument sets the trigger delay time to 0.0 (no delay) after a Factory Reset (*RST command) or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the delay in seconds in the form +1.00000000000000E+000.

Examples

The following example returns 10 sets of 5 frequency measurements on channel 1, using an external trigger and a 1.2 msec delay to start each set of measurements.

```
CONF:FREQ 1.0E6,.001
SAMP:COUN 5
TRIG:COUN 10
TRIG:SOUR EXT
TRIG:DEL .0012
READ?
```

Typical Response: +1.0052000000000E+006, ... (50 measurements)

TRIGger:DELay

See Also

TRIGger:SLOPe

Syntax

TRIGger:SLOPe {POSitive | NEGative}

TRIGger:SLOPe?

Description

This command selects whether the instrument uses the rising edge or the falling edge of the trigger signal on the rear-panel Trig In BNC.

Remarks

- The actual trigger event occurs on either the rising edge (if POS is selected) or the falling edge (if NEG is selected) of the trigger signal.
- The instrument selects a negative slope after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the trigger slope: POS or NEG.

Examples

The following example returns 10 sets of 5 frequency measurements on channel 1, using a positive-going external trigger to start each set of measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 5
 TRIG:COUN 10
 TRIG:SOUR EXT
 TRIG:SLOP POS
 READ?
```

Typical Response: +1.00520000000000E+006, ... (50 measurements)

See Also

TRIGger:SOURce

TRIGger:SOURce

Syntax

TRIGger:SOURce {IMMediate | EXTernal | BUS}

TRIGger:SOURce?

Description

This command selects the trigger source for measurements.

- For the IMMediate (continuous) source, the trigger signal is always present. When you place the instrument in the "wait-for-trigger" state, the trigger is issued immediately.
- For the BUS (software) source, the instrument is triggered by the *TRG command received over the remote interface. The *TRG command will not be accepted unless the instrument is in the "wait-for-trigger" state.
- For the EXTernal source, the instrument will accept a hardware trigger applied to the rear-panel Trig In BNC connector. When the instrument is configured to accept multiple triggers (TRIGger:COUNt set to >1), after the first trigger is accepted, if the instrument receives another external trigger before it is ready (back in the the "wait-for-trigger" state), it will buffer one trigger.

Remarks

- After selecting the trigger source, you must place the instrument in the "wait-for-trigger" state using the INITiate[:IMMediate] or READ? command. A trigger will not be accepted from the selected trigger source unless the instrument is in the "wait-for-trigger" state.
- The CONFigure and MEASure? commands automatically set the trigger source to IMMediate.
- The instrument selects the IMMediate trigger source after a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).

Return Format

The query returns the trigger source: IMM, EXT, or BUS.

Examples

The following example returns 10 sets of 5 frequency measurements on channel 1, using a positive-going external trigger to start each set of measurements.

```
CONF:FREQ 1.0E6,.001
 SAMP:COUN 5
 TRIG:COUN 10
 TRIG:SOUR EXT
 TRIG:SLOP POS
 READ?
```

Typical Response: +1.00520000000000E+006, ... (50 measurements)

See Also

*TRG

TRIGger:SLOPe

SCPI Error Messages

Command Errors (-100...) | Execution Errors (-200..) | Device-Specific Errors (-300...) | Query Errors (-400...) |
Instrument Errors (200...) | Self-Test Errors (601...) | Calibration Errors (700...)

The Keysight 53220A/230A return error messages in accord with the SCPI standard.

- A record of up to 20 errors can be stored in the instrument's error queue. Each remote interface I/O session (GPIB, USB, VXI-11, Telnet/Sockets) has its own interface-specific error queue. Errors appear in the error queue of the I/O session that caused the error. For example, if an error was generated by a command sent over the GPIB interface, send the command from GPIB to read the error queue.
- The instrument beeps once each time a command syntax or hardware error is generated. The front-panel ERROR annunciator turns on when one or more errors are currently stored in the error queue.
- A special global error queue holds all power-on and hardware-related errors (for example, over-temperature).
- Errors are retrieved in first-in-first-out (FIFO) order. The first error returned is the first error that was stored. Once you have read all of the interface-specific errors, the errors in the global error queue are retrieved.
- Errors are cleared as you read them. When you have read all errors from the interface-specific and global error queues, the ERROR annunciator turns off and the errors are cleared.
- If more than 20 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 errors from the queue. If no errors have occurred when you read the error queue, the instrument responds with +0,"No error".
- The front panel reports errors from all I/O sessions as well as the global error queue. To read the error queue from the front panel, press the Help key, and then select "View remote command error queue" in the utility menu.
- Error conditions are also summarized in the Status Byte Register. For more information on the SCPI Status System, see Status Subsystem Introduction.
- The interface-specific error queues are cleared by the *CLS (Clear Status) command and when power is cycled. All errors are cleared when you read the error queue. The error queue is not cleared by a Factory Reset (*RST command) or an Instrument Preset (SYSTem:PRESet command).
- **Front-Panel Operation:**

  If the ERR annunciator is on, there are errors in the error queue. The REM annunciator is likely on as well. Press the Back (Local) key to return the instrument to local operation (the REM annunciator will go off). Then press the Help key, select "View remote command error queue" in the menu, and press Select. Use the menu navigation "arrow" keys to view the error messages. Press Back to exit and clear the error queue.

- Remote Interface Operation:

SYSTem:ERRor? Read and clear one error from the queue

Errors have the following format (the error string may contain up to 255 characters):

-113,"Undefined header"

Command Errors

-100, "Command error"

-101, "Invalid character"

-102, "Syntax error"

-103, "Invalid separator"

-104, "Data type error"

-108, "Parameter not allowed"

-109, "Missing parameter"

-110, "Command header error"

-111, "Header separator error"

-112, "Program mnemonic too long"

-113, "Undefined header"

-114, "Header suffix out of range"

-120, "Numeric data error"

-121, "Invalid character in number"

-123, "Exponent too large"

-123, "Numeric overflow"

-124, "Too many digits"

-128, "Numeric data not allowed"

-130, "Suffix error"

-131, "Invalid suffix"

-134, "Suffix too long"

-138, "Suffix not allowed"

-140, "Character data error"

-141, "Invalid character data"

-144, "Character data too long"

-148, "Character data not allowed"

-150, "String data error"

-151, "Invalid string data"

-158, "String data not allowed"

-160, "Block data error"

-161, "Invalid block data"

SCPI Error Messages

-168, "Block data not allowed"

-170, "Expression error"

-171, "Invalid expression"

-178, "Expression data not allowed"

Execution Errors

-203, "Command protected; pulsed measurements require option 150"

-213, "INIT ignored"

-221, "Settings conflict"

-221, "Settings conflict; *TRG when TRIG:SOUR BUS not selected; trigger ignored"

-221, "Settings conflict; CALC:SCAL:REF 0.0 not compatible with CALC:SCAL:FUNC PCT|PPM|PPB; CALC:SCAL:FUNC set to NULL"

-221, "Settings conflict; CALC:STATe or CALC:AVER:STATe OFF set"

-221, "Settings conflict; CALC2:TRAN:HIST:STATe OFF set"

-221, "Settings conflict; GATE:STAR:DEL:SOUR EVENts on channel 3; GATE:STAR:DEL:SOUR IMM set"

-221, "Settings conflict; GATE:STOP:HOLD:SOUR EVENts on channel 3; GATE:STOP:HOLD:SOUR TIM set"

-221, "Settings conflict; ROSC:EXT:CHEC can only be sent when ROSC:SOUR EXT selectd;AUTO OFF set"

-221, "Settings conflict; SAMP:COUN limited to 100,000 in time stamp function with SENS:TST:RATE SLOW; SAMP:COUN set to 100,000"

-221, "Settings conflict; SENS:FREQ:GATE:SOUR on measurement channel; SENS:FREQ:GATE:SOUR set to EXT"

-221, "Settings conflict; SENS:FREQ:MODE CONT only valid for frequency/period; SENS:FREQ:MODE AUTO set"

-221, "Settings conflict; SENS:GATE:EXT:SOUR on measurement channel; SENS:GATE:EXT:SOUR set to EXT"

-221, "Settings conflict; SENS:TINT:GATE:SOUR on measurement channel; SENS:TINT:GATE:SOUR set to EXT"

-221, "Settings conflict; SENS:TOT:GATE:SOUR on measurement channel; SENS:TOT:GATE:SOUR set to EXT"

-221, "Settings conflict; cannot auto-level input channel used as gate; INP:LEV set to 0V, auto-level off"

-221, "Settings conflict; cannot delete state selected and enabled for automatic power-on recall"

-221, "Settings conflict; cannot gate time interval-type measurement with baseband channel; SENS:GATE:EXT:SOUR set to BNC"

-221, "Settings conflict; cannot have immediate, no-holdoff gate stop for frequency or totalize measurements; GATE:STOP:HOLD:SOUR TIME set"

-221, "Settings conflict; cannot use READ? with continuous totalize"

-221, "Settings conflict; external gating not compatible with gate output; gate output disabled"

-221, "Settings conflict; histogram bin width is 0.0; CALC2:TRAN:HIST:RANG:AUTO ON set"

-221, "Settings conflict; histogram lower range > upper range; CALC2:TRAN:HIST:RANG:AUTO ON set"

-221, "Settings conflict; infinite stop holdoff time for frequency; SENS:FREQ:GATE:SOUR set to TIME"

-221, "Settings conflict; infinite stop holdoff time for time interval; SENS:TINT:GATE:SOUR set to IMM"

-221, "Settings conflict; input range not compatible with input probe factor; INP:RANG set to 50V range"

-221, "Settings conflict; input threshold voltage > input range; threshold clipped to range"

-221, "Settings conflict; low reference >= high reference"

-221, "Settings conflict; low reference >= high reference; reference values changed to defaults"

-221, "Settings conflict; lower limit > upper limit; CALC:LIM:UPP set to CALC:LIM:LOW value"

-221, "Settings conflict; lower reference and upper reference have different units"

-221, "Settings conflict; stop holdoff < minimum gate time for frequency or totalize; SENSe:GATE:STOP:HOLD:TIME set to minimum"

-221, "Settings conflict; trigger source is BUS"

-222, "Data out of range"

-222, "Data out of range; value clipped to lower limit"

-222, "Data out of range; value clipped to upper limit"

-223, "Too much data"

-224, "Illegal parameter value"

-225, "Out of memory; measurement data overrun"

-230, "Data corrupt or stale"

-240, "Hardware error; CPU board initialization failed"

-240, "Hardware error; GPIB interface failed

-240, "Hardware error; cannot communicate with channel 3 hardware"

-240, "Hardware error; cannot communicate with measurement hardware"

-240, "Hardware error; channel 3 operation failed"

-240, "Hardware error; measurement hardware initialization failed"

-240, "Hardware error; measurement operation failed"

-240, "Hardware error; failed to program measurement FPGA security EEProm"

-241, "Hardware missing"

SCPI Error Messages

-250, "Mass storage error: file read/write error"

-252, "Missing media"

-254, "Media full"

-256, "File or folder name not found"

-257, "File name error; invalid character in name"

-257, "File name error; relative path not allowed"

-257, "File name error; path too long"

-257, "File name error; path is a folder name"

-257, "File name error; not a folder name"

-257, "File name error; drive name missing or not recognized"

-257, "File name error; path name missing"

-257, "File name error; file or folder already exists"

-257, "File name error; folder not empty"

-257, "File name error; folder is default folder"

-257, "File name error; access denied"

-257, "File name error"

-257, "File name error; file too large"

-257, "File name error; unknown file extension"

Device-Specific Errors

-310, "System error; internal software error"

-310, "System error; software initialization failed"

-310, "System error; out of memory"

-310, "System error; failed to erase calibration data in PIC EEProm"

-310, "System error; failed to erase system information in PIC EEProm"

-310, "System error; failed to read calibration information from PIC EEProm"

-310, "System error; failed to read system information from PIC EEProm"

-310, "System error; failed to write calibration information to PIC EEProm"

-310, "System error; failed to write system data to PIC EEProm"

-310, "System error; I2C Comms Failure, PIC:Ac Power Detect"

-310, "System error; I2C Comms Failure, PIC:BatteryFuelGauge"

-310, "System error; I2C Comms Failure, PIC:BatteryInfo"

-310, "System error; I2C Comms Failure, PIC:OCXO"

-310, "System error; I2C Comms Failure, PIC:PwrCondition"

-310, "System error; I2C Comms Failure, PIC:PwrOverVolt"

-310, "System error; I2C Comms Failure, PIC:PwrUnderVolt"

-310, "System error; I2C Comms Failure, PIC:SetOCXOStanby"

-310, "System error; I2C Comms Failure, PIC:Temperature"

-310, "System error; I2C Comms Failure, PIC:clearPwrCondition"

-310, "System error; I2C Comms Failure, PIC:cyclePower"

-310, "System error; I2C Comms Failure, PIC:finishPowerdown"

-310, "System error; I2C Comms Failure, PIC:picCommunication"

-310, "System error; I2C Comms Failure, PIC:setBattStorage"

-310, "System error; I2C Comms Failure, PIC:setBatteryPresent"

-310, "System error; PIC EEProm access failed"

-310, "System error; PIC EEProm failed waiting for unbusy"

-311, "Internal software error"

-313, "Calibration memory lost"

-313, "Calibration memory lost; memory corruption detected"

-313, "Calibration memory lost; due to firmware revision change"

-314, "Save/recall memory lost; memory corruption detected"

-314, "Save/recall memory lost; due to firmware revision change"

-315, "Configuration memory lost; memory corruption detected"

-315, "Configuration memory lost; due to firmware revision change"

-330, "Self-test failed"

-350, "Error queue overflow"

Query Errors

–410, "Query INTERRUPTED"

–420, "Query UNTERMINATED"

–430, "Query DEADLOCKED"

–440, "Query UNTERMINATED after indefinite response"

Instrument Errors

+100, "Network Error"

SCPI Error Messages

+110, "LXI mDNS Error"

+201, "Memory lost: stored state"

+202, "Memory lost: power-on state"

+203, "Memory lost: stored measurements"

+263, "Not able to execute while instrument is measuring"

+291, "Not able to recall state: it is empty"

+292, "State file size error"

+293, "State file corrupt"

+294, "Preference file size error"

+295, "Preference file corrupt"

+301, "Input termination protection relay opened"

+302, "Cannot reset input protection; high voltage present"

+305, "Not able to perform requested operation"

+310, "Channel 3 pulse width too short"

+311, "Channel 3 pulse width too long"

+312, "Channel 3 pulse width could not be measured"

+313, "Channel 3 burst frequency could not be measured"

+314, "Channel 3 pulse ended before gate closed"

+315, "Channel 3 power too high for operation"

+316, "Channel 3 power too low for operation"

+317, "Channel 3 power changed during measurement"

+318, "Channel 3 input is not pulsed signal"

+319, "Channel 3 frequency shift detected during measurement"

+320, "Input signal frequency shift caused internal counter overflow"

+321, "Measurement timeout occurred"

+322, "Measurement overflow occurred"

+514, "Not allowed"

+514, "Not allowed; Instrument locked by another I/O session"

+521, "Communications: input buffer overflow"

+522, "Communications: output buffer overflow"

+532, "Not able to achieve requested resolution"

+540, "Cannot use overload as math reference"

+541, "Cannot use zero as math reference for PCT, PPM, or PPB scaling functions"

+550, "Not able to execute command in local mode"

+580, "No valid external timebase"

+600, "Internal licensing error"

+601, "License file corrupt or empty"

+602, "No valid licenses found for this instrument"

+603, "Some licenses could not be installed"

+604, "License not found"

+800, "Nonvolatile memory write failure"

+810, "State has not been stored"

+820, "Model and Serial Numbers not restored"

+821, "Controller and measurement board model numbers do not match"

+822, "Controller and measurement board serial numbers do not match"

Self-Test Errors

The 53220A/230A self-test (see the *TST? command) performs a series of tests on the instrument hardware. Any failure of these tests will generate a SCPI error with additional test failure information. Refer to the Keysight 53210A/53220A/53230A 350 MHz Counter Service Guide for more information.

The following is the list of test numbers and descriptions:

+901, "Self Test failed; auto-calibration failure"

+902, "Self-test failed; main CPU power supply out of range"

+903, "Self-test failed; real time clock settings lost"

+904, "Self-test failed; main CPU error accessing boot environment"

+905, "Self-test failed; failed to read FPGA revision"

+906, "Self-test failed; FPGA revision is less than expected"

+907, "Self-test failed; PIC communication failure"

+908, "Self-test failed; battery test failed"

+909, "Self-test failed; GPIB test failed"

+910, "Self-test failed; channel 3 test failed"

+911, "Self-test failed; front panel revision check failed"

+912, "Self-test failed; measurement board test failed"

Calibration Errors

The following errors indicate failures that may occur during a calibration. Refer to the Keysight *53220A/230AService Guide* for more information.

+701, "Calibration error; security defeated"

+702, "Calibration error; calibration memory is secured"

+703, "Calibration error; secure code provided was invalid"

+704, "Calibration error: secure code too long"

+705, "Calibration error; calibration aborted"

+706, "Calibration error: provided value out of range"

+707, "Calibration error: computed correction factor out of range"

+708, "Calibration error: signal measurement out of range"

+709, "Calibration error: no calibration for this function"

+710, "Calibration error: full scale correction out of range"

+711, "Calibration error: calibration string too long"

+712, "Calibration failed"

+713, "Channel 3 calibration signal not detected"

+714, "Channel 3 calibration signal power level error"

+715, "Channel 3 calibration signal frequency error"

+716, "Channel 3 calibration signal is not CW"

+717, "Channel 3 calibration timeout occurred"

+720, "Auto-calibration failed; input signal detected"

+740, "Calibration data lost: secure state"

+740, "Calibration information lost: count, security state, security code, string"

+741, "Calibration data lost: string data"

+742, "Calibration data lost: corrections"

+748, "Calibration memory write failure"

+750, "Calibration data not restored"

Keysight 53220A/230A Command Quick Reference

[Printable PDF Version]

Syntax Conventions

- Braces ({ }) enclose the parameter choices for a given command string. The braces are not sent with the command string.

- A vertical bar (|) separates multiple parameter choices for a given command string. The bar is not sent with the command string.

- Triangle brackets (< >) indicate that you must specify a value for the enclosed parameter. For example, the above syntax statement shows the <range> parameter enclosed in triangle brackets. The brackets are not sent with the command string. You must specify a value for the parameter (e.g., "TRIG:COUN 10").

- Some parameters are enclosed in square brackets ([ ]). The square brackets indicate that the parameter is optional and can be omitted. The brackets are not sent with the command string. If you do not specify a value for an optional parameter, the instrument chooses a default value.

Measurement Commands

MEASure:ARRay:TSTamp? [(<count>)[,<channel>]]

MEASure:FREQuency? [{<expected> | MINimum | MAXimum | DEFault} [,{<resolution> | MINimum | MAXimum | DEFault}]] [,<channel>]

MEASure:FREQuency:BURSt? [<channel>]

MEASure:FREQuency:PRF? [{<expected> | MINimum | MAXimum | DEFault} [,{<resolution> | MINimum | MAXimum | DEFault}]] [,<channel>]

MEASure:FREQuency:PRI? [{<expected> | MINimum | MAXimum | DEFault} [,{<resolution> | MINimum | MAXimum | DEFault}]] [,<channel>]

MEASure:FREQuency:RATio? [{<expected> | MINimum | MAXimum | DEFault} [,{<resolution> | MINimum | MAXimum | DEFault}]] [,<channel_pair>]

MEASure:PERiod? [{<expected> | MINimum | MAXimum | DEFault} [,{<resolution> | MINimum | MAXimum | DEFault}]] [,<channel>]

MEASure:SPERiod? [<channel>]

MEASure:TINTerval? [<channel_pair>]

MEASure:FTIMe? [{<lower_reference> | MINimum | MAXimum | DEFault} [,{<upper_reference> | MINimum | MAXimum | DEFault}]] [,<channel>]

MEASure:RTIMe? [{<lower_reference> | MINimum | MAXimum | DEFault} [,{<upper_reference> | MINimum | MAXimum | DEFault}]] [,<channel>]

MEASure:NDUTycycle? [{<reference> | MINimum | MAXimum | DEFault}] [,<channel>]

MEASure:PDUTycycle? [{<reference> | MINimum | MAXimum | DEFault}] [,<channel>]

MEASure:NWIDth? [{<reference> | MINimum | MAXimum | DEFault}] [,<channel>]

MEASure:NWIDth:BURSt? [<channel>]

MEASure:PWIDth? [{<reference> | MINimum | MAXimum | DEFault}] [,<channel>]

MEASure:PWIDth:BURSt? [<channel>]

MEASure:PHASe? [<channel_pair>]

MEASure:TOTalize:TIMed? [{<gate_time> | MINimum | MAXimum | DEFault}] [,<channel>]

[SENSe:]TOTalize:DATA?

Measurement Configuration Commands

CONFigure:ARRay:TSTamp [(<count>)[,<channel>]]

CONFigure:FREQuency [{<expected> | MINimum | MAXimum | DEFault} [,{<resolution> | MINimum | MAXimum | DEFault}]] [,<channel>]

CONFigure:FREQuency:BURSt [<channel>]

CONFigure:FREQuency:PRF [{<expected> | MINimum | MAXimum | DEFault} [,{<resolution> | MINimum | MAXimum | DEFault}]] [,<channel>]

CONFigure:FREQuency:PRI [{<expected> | MINimum | MAXimum | DEFault} [,{<resolution> | MINimum | MAXimum | DEFault}]] [,<channel>]

CONFigure:FREQuency:RATio [{<expected> | MINimum | MAXimum | DEFault} [,{<resolution> | MINimum | MAXimum | DEFault}]] [,<channel_pair>]

CONFigure:PERiod [{<expected> | MINimum | MAXimum | DEFault} [,{<resolution> | MINimum | MAXimum | DEFault}]] [,<channel>]

CONFigure:SPERiod [<channel>]

CONFigure:TINTerval [<channel(s)>]

CONFigure:FTIMe [{<lower_reference> | MINimum | MAXimum | DEFault} [,{<upper_reference> | MINimum | MAXimum | DEFault}]] [,<channel>]

CONFigure:RTIMe [{<lower_reference> | MINimum | MAXimum | DEFault} [,{<upper_reference> | MINimum | MAXimum | DEFault}]] [,<channel>]

CONFigure:NDUTycycle [{<reference> | MINimum | MAXimum | DEFault}] [,<channel>]

CONFigure:PDUTycycle [{<reference> | MINimum | MAXimum | DEFault}] [,<channel>]

CONFigure:NWIDth [{<reference> | MINimum | MAXimum | DEFault}] [,<channel>]

CONFigure:NWIDth:BURSt [<*channel*>]

CONFigure:PWIDth [{<reference> | MINimum | MAXimum | DEFault}] [,<channel>]

CONFigure:PWIDth:BURSt [<channel>]

CONFigure:PHASe [<channel_pair>]

CONFigure:TOTalize:CONTinuous [<channel>]

CONFigure:TOTalize:TIMed [{<gate_time> | MINimum | MAXimum | DEFault}] [,<channel>]

CONFigure?

[SENSe:]FUNCtion[:ON] "<function>"
[SENSe:]FUNCtion[:ON]?

[SENSe:]FREQuency:MODE {AUTO | RECiprocal | CONTinuous}
[SENSe:]FREQuency:MODE?

[SENSe:]ROSCillator:EXTernal:CHECk ONCE

[SENSe:]ROSCillator:EXTernal:FREQuency {1E6 | 5E6 | 10E6 | MINimum | MAXimum | DEFault}
[SENSe:]ROSCillator:EXTernal:FREQuency? [{MINimum | MAXimum | DEFault}]

[SENSe:]ROSCillator:INTernal:POWer:STANdby {OFF | ON}
[SENSe:]ROSCillator:INTernal:POWer:STANdby?

[SENSe:]ROSCillator:SOURce {INTernal | EXTernal}
[SENSe:]ROSCillator:SOURce?

[SENSe:]ROSCillator:SOURce:AUTO {OFF | ON}
[SENSe:]ROSCillator:SOURce:AUTO?

Input Configuration Commands

AUToscale

INPut[{1|2}]:RANGe {<range> | MINimum | MAXimum | DEFault}
INPut[{1|2}]:RANGe? [{MINimum | MAXimum | DEFault}]

INPut[{1|2}]:FILTer[:LPASs][:STATe] {OFF | ON}
INPut[{1|2}]:FILTer[:LPASs][:STATe]?

INPut[{1|2}]:COUPling {AC | DC}
INPut[{1|2}]:COUPling?

INPut[{1|2}]:IMPedance {<impedance> | MINimum | MAXimum | DEFault}
INPut[{1|2}]:IMPedance? [{MINimum | MAXimum | DEFault}]

INPut[{1|2}]:LEVel:AUTO {OFF | ON | ONCE}
INPut[{1|2}]:LEVel:AUTO?

INPut[{1|2}]:LEVel:MAXimum?

INPut[{1|2}]:LEVel:MINimum?

INPut[{1|2}]:LEVel:PTPeak?

INPut[{1|2}]:LEVel[{1|2}][:ABSolute] {<volts> | MINimum | MAXimum | DEFault}
INPut[{1|2}]:LEVel[{1|2}][:ABSolute]? [{MINimum | MAXimum | DEFault}]

INPut[{1|2}]:LEVel[{1|2}]:RELative {<percent> | MINimum | MAXimum | DEFault}
INPut[{1|2}]:LEVel[{1|2}]:RELative? [{MINimum | MAXimum | DEFault}]

INPut[{1|2}]:NREJect {OFF | ON}
INPut[{1|2}]:NREJect?

INPut[{1|2}]:PROBe {<factor> | MINimum | MAXimum | DEFault}
INPut[{1|2}]:PROBe? [{MINimum | MAXimum | DEFault}]

INPut[{1|2}]:PROTection:CLEar

INPut[{1|2}]:PROTection?

INPut[{1|2}]:SLOPe[{1|2}] {POSitive | NEGative}
INPut[{1|2}]:SLOPe[{1|2}]?

INPut3:BURSt:LEVel {<db> | MINimum | MAXimum | DEFault}
INPut3:BURSt:LEVel? [{MINimum | MAXimum | DEFault}]

INPut3:STRength?

Triggering Commands

*TRG

Keysight 53220A/230A Command Quick Reference

ABORt

INITiate[:IMMediate]

READ?

SAMPle:COUNt {<count> | MINimum | MAXimum | DEFault}
SAMPle:COUNt? [{MINimum | MAXimum | DEFault}]

TRIGger:SOURce {IMMediate | EXTernal | BUS}
TRIGger:SOURce?

TRIGger:SLOPe {POSitive | NEGative}
TRIGger:SLOPe?

TRIGger:COUNt {<count> | MINimum | MAXimum | DEFault}
TRIGger:COUNt? [{MINimum | MAXimum | DEFault}]

TRIGger:DELay {<time> | MINimum | MAXimum | DEFault}
TRIGger:DELay? [{MINimum | MAXimum | DEFault}]

Gate Control Commands

[SENSe:]FREQuency:GATE:POLarity {POSitive | NEGative}
[SENSe:]FREQuency:GATE:POLarity?

[SENSe:]FREQuency:GATE:SOURce {TIME | EXTernal | INPut[1] | INPut2 | ADVanced}
[SENSe:]FREQuency:GATE:SOURce?

[SENSe:]FREQuency:GATE:TIME {<time> | MINimum | MAXimum | DEFault}
[SENSe:]FREQuency:GATE:TIME? [{MINimum | MAXimum | DEFault}]

[SENSe:]FREQuency:BURSt:GATE:AUTO {OFF | ON}
[SENSe:]FREQuency:BURSt:GATE:AUTO?

[SENSe:]FREQuency:BURSt:GATE:DELay {<time> | MINimum | MAXimum | DEFault}
[SENSe:]FREQuency:BURSt:GATE:DELay? [{MINimum | MAXimum | DEFault}]

[SENSe:]FREQuency:BURSt:GATE:NARRow {OFF | ON}
[SENSe:]FREQuency:BURSt:GATE:NARRow?

[SENSe:]FREQuency:BURSt:GATE:TIME {<time> | MINimum | MAXimum | DEFault}
[SENSe:]FREQuency:BURSt:GATE:TIME? [{MINimum | MAXimum | DEFault}]

[SENSe:]TINTerval:GATE:POLarity {POSitive | NEGative}
[SENSe:]TINTerval:GATE:POLarity?

[SENSe:]TINTerval:GATE:SOURce {IMMediate | EXTernal | INPut[1] | INPut2 | ADVanced}
[SENSe:]TINTerval:GATE:SOURce?

[SENSe:]TOTalize:GATE:POLarity {POSitive | NEGative}
[SENSe:]TOTalize:GATE:POLarity?

[SENSe:]TOTalize:GATE:SOURce {TIME | EXTernal | INPut[1] | INPut2 | ADVanced}
[SENSe:]TOTalize:GATE:SOURce?

[SENSe:]TOTalize:GATE:TIME {<time> | MINimum | MAXimum | INFinity | DEFault}
[SENSe:]TOTalize:GATE:TIME? [{MINimum | MAXimum | DEFault}]

[SENSe:]TSTamp:RATE {<rate> | MINimum | MAXimum | DEFault}
[SENSe:]TSTamp:RATE? [{MINimum | MAXimum | DEFault}]

[SENSe:]GATE:EXTernal:SOURce {EXTernal | INPut[1] | INPut2}
[SENSe:]GATE:EXTernal:SOURce?

[SENSe:]GATE:STARt:SOURce {IMMediate | EXTernal}
[SENSe:]GATE:STARt:SOURce?

[SENSe:]GATE:STARt:SLOPe {POSitive | NEGative}
[SENSe:]GATE:STARt:SLOPe?

[SENSe:]GATE:STARt:DELay:SOURce {IMMediate | TIME | EVENts}
[SENSe:]GATE:STARt:DELay:SOURce?

[SENSe:]GATE:STARt:DELay:EVENts {<count> | MINimum | MAXimum | DEFault}
[SENSe:]GATE:STARt:DELay:EVENts? [{MINimum | MAXimum | DEFault}]

[SENSe:]GATE:STARt:DELay:TIME {<time> | MINimum | MAXimum | DEFault}
[SENSe:]GATE:STARt:DELay:TIME? [{MINimum | MAXimum | DEFault}]

[SENSe:]GATE:STOP:SOURce {IMMediate | EXTernal}
[SENSe:]GATE:STOP:SOURce?

[SENSe:]GATE:STOP:SLOPe {POSitive | NEGative}
[SENSe:]GATE:STOP:SLOPe?

[SENSe:]GATE:STOP:HOLDoff:SOURce {IMMediate | TIME | EVENts}
[SENSe:]GATE:STOP:HOLDoff:SOURce?

[SENSe:]GATE:STOP:HOLDoff:EVENts {<count> | MINimum | MAXimum | DEFault}
[SENSe:]GATE:STOP:HOLDoff:EVENts? [{MINimum | MAXimum | DEFault}]

[SENSe:]GATE:STOP:HOLDoff:TIME {<time> | MINimum | MAXimum | INFinity | DEFault}
[SENSe:]GATE:STOP:HOLDoff:TIME? [{MINimum | MAXimum | DEFault}]

Output Control Commands

OUTPut:POLarity {NORMal | INVerted}
OUTPut:POLarity?

OUTPut[:STATe] {OFF | ON}
OUTPut[:STATe]?

Calculation (Math) Commands

CALCulate[1][:STATe] {OFF | ON}
CALCulate[1][:STATe]?

Histogram

CALCulate2:TRANsform:HISTogram[:STATe] {OFF | ON}
CALCulate2:TRANsform:HISTogram[:STATe]?

CALCulate2:TRANsform:HISTogram:ALL?

CALCulate2:TRANsform:HISTogram:DATA?

CALCulate2:TRANsform:HISTogram:COUNt?

CALCulate2:TRANsform:HISTogram:CLEar[:IMMediate]

CALCulate2:TRANsform:HISTogram:POINts {<value> | MINimum | MAXimum | DEFault}
CALCulate2:TRANsform:HISTogram:POINts? [{MINimum | MAXimum | DEFault}]

CALCulate2:TRANsform:HISTogram:RANGe:AUTO {OFF | ON}
CALCulate2:TRANsform:HISTogram:RANGe:AUTO?

CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt {<value> | MINimum | MAXimum | DEFault}
CALCulate2:TRANsform:HISTogram:RANGe:AUTO:COUNt? [{MINimum | MAXimum | DEFault}]

CALCulate2:TRANsform:HISTogram:RANGe:LOWer {<value> | MINimum | MAXimum | DEFault}
CALCulate2:TRANsform:HISTogram:RANGe:LOWer? [{MINimum | MAXimum | DEFault}]

CALCulate2:TRANsform:HISTogram:RANGe:UPPer {<value> | MINimum | MAXimum | DEFault}
CALCulate2:TRANsform:HISTogram:RANGe:UPPer? [{MINimum | MAXimum | DEFault}]

Limit Testing

CALCulate[1]:LIMit[:STATe] {OFF | ON}
CALCulate[1]:LIMit[:STATe]?

CALCulate[1]:LIMit:CLEar[:IMMediate]

CALCulate[1]:LIMit:LOWer[:DATA] {<value> | MINimum | MAXimum | DEFault}
CALCulate[1]:LIMit:LOWer[:DATA]? [{MINimum | MAXimum | DEFault}]

CALCulate[1]:LIMit:UPPer[:DATA] {<value> | MINimum | MAXimum | DEFault}
CALCulate[1]:LIMit:UPPer[:DATA]? [{MINimum | MAXimum | DEFault}]

Smoothing (Moving Average)

CALCulate[1]:SMOothing:RESPonse {SLOW | MEDium | FAST}
CALCulate[1]:SMOothing:RESPonse?

CALCulate[1]:SMOothing[:STATe] {OFF | ON}
CALCulate[1]:SMOothing[:STATe]?

Scaling

CALCulate[1]:SCALe:FUNCtion {NULL | PCT | PPM | PPB | SCALe}
CALCulate[1]:SCALe:FUNCtion?

CALCulate[1]:SCALe[:STATe] {OFF | ON}
CALCulate[1]:SCALe[:STATe]?

CALCulate[1]:SCALe:GAIN {<gain> | MINimum | MAXimum | DEFault}
CALCulate[1]:SCALe:GAIN? [{MINimum | MAXimum | DEFault}]

CALCulate[1]:SCALe:OFFSet {<offset> | MINimum | MAXimum | DEFault}
CALCulate[1]:SCALe:OFFSet? [{MINimum | MAXimum | DEFault}]

CALCulate[1]:SCALe:INVert {OFF | ON}
CALCulate[1]:SCALe:INVert?

CALCulate[1]:SCALe:REFerence {<reference> | MINimum | MAXimum | DEFault}
CALCulate[1]:SCALe:REFerence? [{MINimum | MAXimum | DEFault}]

CALCulate[1]:SCALe:REFerence:AUTO {OFF | ON}
CALCulate[1]:SCALe:REFerence:AUTO?

CALCulate[1]:SCALe:UNIT "<string>"
CALCulate[1]:SCALe:UNIT?

CALCulate[1]:SCALe:UNIT:STATe {OFF | ON}
CALCulate[1]:SCALe:UNIT:STATe?

Statistics

CALCulate[1]:AVERage[:STATe] {OFF | ON}
CALCulate[1]:AVERage[:STATe]?

CALCulate[1]:AVERage:ADEViation?

CALCulate[1]:AVERage:ALL?

CALCulate[1]:AVERage:AVERage?

CALCulate[1]:AVERage:MAXimum?

CALCulate[1]:AVERage:MINimum?

CALCulate[1]:AVERage:PTPeak?

CALCulate[1]:AVERage:SDEViation?

CALCulate[1]:AVERage:COUNt:CURRent?

CALCulate[1]:AVERage:CLEar[:IMMediate]

Reading Memory Commands

FETCh?

R? [<*max_count*>]

DATA:REMove? <*count*>

DATA:LAST?

DATA:POINts?

DATA:POINts:EVENt:THReshold <*count*>
DATA:POINts:EVENt:THReshold?

FORMat[:DATA] {ASCii | REAL} [,<length>]
FORMat[:DATA]?

FORMat:BORDer {NORMal | SWAPped}
FORMat:BORDer?

FORMat:PHASe {AUTO | POSitive | CENTered}
FORMat:PHASe?

Calibration Commands

*CAL?

CALibration[:ALL]?

CALibration:COUNt?

CALibration:LEVel3? <frequency>, <power>

CALibration:SECurity:CODE <*new_code*>

CALibration:SECurity:STATe {OFF | ON}, <code>
CALibration:SECurity:STATe?

CALibration:STRing "<*string*>"
CALibration:STRing?

CALibration:VALue <*value*>
CALibration:VALue?

State Storage Commands

*LRN?

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

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

MEMory:NSTates?

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

MEMory:STATe:DELete:ALL

MEMory:STATe:RECall:AUTO {OFF | ON}
MEMory:STATe:RECall:AUTO?

MEMory:STATe:RECall:SELect {0 | 1 | 2 | 3 | 4 | <file>}
MEMory:STATe:RECall:SELect?

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

Mass Storage Device Commands

MMEMory:LOAD:STATe <file>

MMEMory:STORe:STATe <file>

MMEMory:STORe:DATA RDG_STORE, <file>

MMEMory:CATalog[:ALL]? [<folder>]

MMEMory:CATalog:DATA? [<folder>]

MMEMory:CATalog:STATe? [<folder>]

MMEMory:CDIRectory <folder>
MMEMory:CDIRectory?

MMEMory:COPY <file1>, <file2>

MMEMory:DOWNload:DATA <block>

MMEMory:DOWNload:FNAMe <file>
MMEMory:DOWNload:FNAMe?

MMEMory:MOVE <file1>, <file2>

MMEMory:DELete <file>

MMEMory:LOAD:PREFerences <file>

MMEMory:MDIRectory <folder>

MMEMory:STORe:PREFerences <file>

MMEMory:RDIRectory <folder>

MMEMory:UPLoad? <file>

IEEE-488 Commands

*CAL?

*CLS

*ESE <enable>
*ESE?

*ESR?

*IDN?

*LRN?

*OPC

*OPC?

*OPT?

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

*RST

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

*SRE <enable>
*SRE?

*STB?

*TRG

*TST?

*WAI

System-Related Commands

*IDN?

*OPT?

*RST

*TST?

DISPlay[:WINDow][:STATe] {OFF | ON}
DISPlay[:WINDow][:STATe]?

DISPlay[:WINDow]:DIGit:MASK {<digits> | MINimum | MAXimum | DEFault}
DISPlay[:WINDow]:DIGit:MASK? [{MINimum | MAXimum | DEFault}]

DISPlay[:WINDow]:DIGit:MASK:AUTO {OFF | ON}
DISPlay[:WINDow]:DIGit:MASK:AUTO?

DISPlay[:WINDow]:MODE {NUMeric | HISTogram | STATistics | TCHart}
DISPlay[:WINDow]:MODE?

DISPlay[:WINDow]:TEXT:CLEar

DISPlay[:WINDow]:TEXT[:DATA] "<*string*>"
DISPlay[:WINDow]:TEXT[:DATA]?

HCOPy:SDUMp:DATA?

HCOPy:SDUMp:DATA:FORMat {PNG | BMP}
HCOPy:SDUMp:DATA:FORMat?

LXI:IDENtify[:STATe] {OFF | ON}
LXI:IDENtify[:STATe]?

LXI:MDNS:ENABle {OFF | ON}
LXI:MDNS:ENABle?

LXI:MDNS:HNAMe[:RESolved]?

LXI:MDNS:SNAMe:DESired "<name>"
LXI:MDNS:SNAMe:DESired?

LXI:MDNS:SNAMe[:RESolved]?

LXI:RESet

LXI:RESTart

SYSTem:ALEVel:FREQuency {<*frequency*> | MINimum | MAXimum | DEFault}
SYSTem:ALEVel:FREQuency? [{MINimum | MAXimum | DEFault}]

SYSTem:BATTery:ENABle {OFF | ON}
SYSTem:BATTery:ENABle?

SYSTem:BATTery:LEVel?

SYSTem:BATTery:STATus?

SYSTem:BEEPer[:IMMediate]

SYSTem:BEEPer:STATe {OFF | ON}
SYSTem:BEEPer:STATe?

SYSTem:DATE <year>,<month>,<day>
SYSTem:DATE?

SYSTem:ERRor[:NEXT]?

SYSTem:HELP?

SYSTem:LANGuage "<language>"
SYSTem:LANGuage?

SYSTem:PRESet

SYSTem:SECurity:IMMediate

SYSTem:TEMPerature?

SYSTem:TEMPerature:ACALibration?

SYSTem:TIME <hour>,<minute>,<second>
SYSTem:TIME?

SYSTem:TIMeout {<time> | MINimum | MAXimum | INFinity | DEFault}
SYSTem:TIMeout? [{MINimum | MAXimum | DEFault}]

SYSTem:VERSion?

Interface Locking Commands

SYSTem:LOCK:NAME?

SYSTem:LOCK:OWNer?

SYSTem:LOCK:RELease

SYSTem:LOCK:REQuest?

Licensing Commands

SYSTem:LICense:CATalog?

SYSTem:LICense:DELete <option>

SYSTem:LICense:DELete:ALL

SYSTem:LICense:DESCription? <option>

SYSTem:LICense:ERRor:COUNt?

SYSTem:LICense:ERRor?

SYSTem:LICense:INSTall [{<folder> | <file>}]

SYSTem:LICense:INSTall? <option>

Interface Configuration Commands

SYSTem:COMMunicate:ENABle {OFF | ON},{GPIB | USB | LAN | SOCKets | TELNet | VXI11 | WEB}
SYSTem:COMMunicate:ENABle? {GPIB | USB | LAN | SOCKets | TELNet | VXI11 | WEB}

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

SYSTem:COMMunicate:LAN:CONTrol?

SYSTem:COMMunicate:LAN:DHCP {OFF | ON}
SYSTem:COMMunicate:LAN:DHCP?

SYSTem:COMMunicate:LAN:DNS[{1|2}] "<*address*>"
SYSTem:COMMunicate:LAN:DNS[{1|2}]? [{CURRent | STATic}]

SYSTem:COMMunicate:LAN:DOMain?

SYSTem:COMMunicate:LAN:GATeway "<*address*>"
SYSTem:COMMunicate:LAN:GATeway? [{CURRent | STATic}]

SYSTem:COMMunicate:LAN:HOSTname "<*name*>"
SYSTem:COMMunicate:LAN:HOSTname? [{CURRent | STATic}]

SYSTem:COMMunicate:LAN:IPADdress "<*address*>"
SYSTem:COMMunicate:LAN:IPADdress? [{CURRent | STATic}]

SYSTem:COMMunicate:LAN:MAC?

SYSTem:COMMunicate:LAN:SMASk "<*mask*>"
SYSTem:COMMunicate:LAN:SMASk? [{CURRent | STATic}]

SYSTem:COMMunicate:LAN:TELNet:PROMpt "<*string*>"
SYSTem:COMMunicate:LAN:TELNet:PROMpt?

SYSTem:COMMunicate:LAN:TELNet:WMESsage "<*string*>"
SYSTem:COMMunicate:LAN:TELNet:WMESsage?

SYSTem:COMMunicate:LAN:UPDate

SYSTem:COMMunicate:LAN:WINS[{1|2}] "<*address*>"
SYSTem:COMMunicate:LAN:WINS[{1|2}]? [{CURRent | STATic}]

Status System Commands

*CLS

*ESE <*enable*>
*ESE?

*ESR?

*SRE <*enable*>
*SRE?

*STB?

STATus:OPERation:CONDition?

STATus:OPERation:ENABle <*enable*>
STATus:OPERation:ENABle?

STATus:OPERation[:EVENt]?

STATus:PRESet

STATus:QUEStionable:CONDition?

STATus:QUEStionable:ENABle <*enable*>
STATus:QUEStionable:ENABle?

STATus:QUEStionable[:EVENt]?

Power-On and Reset State

The following tables show the factory defaults for various instrument settings. The parameters marked with a bullet (·) are stored in non-volatile memory, and are not affected by power-on or a system reset; the indicated value is set when the instrument is shipped from the factory or by SYSTem:SECurity:IMMediate. Other parameters are stored in volatile memory and are reset to the indicated values at power-on or after a *RST or SYSTem:PRESet command.

| NOTE | The power-on state may be different than what is shown in the tables if you have enabled the power-on state recall mode. This mode is entered from the Utility menu. See the Keysight 53220A/230A 350MHz Universal Counter/Timer User's Guide for further information. |

Measurement Configuration	Default/Factory Setting
Measurement Function	Frequency
Frequency Gate Source	TIME
Frequency Gate Time	0.1 sec
Frequency Gate Polarity	NEGative
Frequency Mode	AUTO
Burst Gate Automatic Mode	ON
Burst Gate Delay	0.0
Burst Gate Time	0.1 sec
Burst Narrow Pulse Mode	OFF
Time Interval Gate Source	IMMediate
Time Interval Gate Polarity	NEGative
Totalize Gate Source	TIME
Totalize Gate Time	0.1 sec
Totalize Gate Polarity	NEGative
Gate Start Source	EXTernal
Gate Start Slope	NEGative
Gate Start Delay Source	TIME
Gate Start Delay Time	0.0
Gate Start Delay Events	1
Gate Stop Source	EXTernal
Gate Stop Slope	POSitive
Gate Stop Holdoff Source	TIME
Gate Stop Holdoff Time	0.0
Gate Stop Holdoff Events	1
External Gate Source	EXTernal
Timestamp Rate	1.0E6

Input Configuration	Default/Factory Setting

Power-On and Reset State

Channels 1 & 2:	
Coupling	AC
Low-pass Filter	OFF
Impedance	1 Mohm
Level (absolute)	0.0
Level (relative)	50
Auto-level	Enabled
Noise rejection	Disabled
Range	5 V
Slope	POSitive
Channel 3:	
Level	-6 dB

Output Configuration	Default/Factory Setting
Output enable	OFF
Output polarity	POSitive

Trigger/Sample Configuration	Default/Factory Setting
Trigger Count	1
Trigger Source	Immediate
Trigger Slope	NEGative
Trigger Delay	0.0
Sample Count	1

Calculate Operations	Default/Factory Setting
Calculate State	Disabled
Smoothing State	Disabled
Smoothing Response	FAST
Scaling State	Disabled
Gain factor	1.0
Offset	0.0
Limit testing State	Disabled
Lower limit	0.0
Upper limit	0.0
Statistics State	Disabled
Histogram State	Disabled
Number of Bins	100
Automatic Range Value Selection	Enabled

Automatic Range Selection Count	100
Lower range value	0.0
Upper range value	0.0

Reading Format Configuration	Default/Factory Setting
Byte Order	NORmal (MSB first)
Reading format	ASCii
Phase format	AUTO

Output Configuration	Default/Factory Setting
Polarity	NORmal
State	Disabled

Status Configuration	Default/Factory Setting
*SRE, *ESE enable masks	Cleared at power-on. Unaffected by *RST, SYSTem:PRESet or front panel reset.
QUEStionable and OPERational register enable masks	Enabled at power-on and by STATus:PRESet. Unaffected by *RST, SYSTem:PRESet or front panel reset.

System-Related Configuration	Default/Factory Setting
• Auto-level Frequency	• 50.0
• Battery Enable	• Disabled
• Reference Oscillator Source	• Internal with AUTO enabled
• External Reference Frequency	• 10 MHz
• Reference Oscillator Standby Battery Power	• Disabled
• Power-up state	• Default (*RST state)
• Beeper	• On
Display Mode	Numeric Unaffected by *RST or SYSTem:PRESet.
Display State	On Unaffected by *RST or SYSTem:PRESet.
Display Text	Cleared Unaffected by *RST or SYSTem:PRESet.
Reading Memory	Cleared
Error Queue	Cleared at power on or by the *CLS command. Unaffected by *RST, SYSTem:PRESet or front panel reset.

Power-On and Reset State

• Stored States	• Factory: State 0 contains *RST state; others empty • SYSTem:SECurity:IMMediate: All states empty
• Calibration State	• Unsecured
• Measurement Timeout	0.0 (disabled) Unaffected by *RST, SYSTem:PRESet or front panel reset.

Input/Output Configuration	Default/Factory Setting
Enable Interfaces:1	
• LAN	• Enabled
• GPIB	• Enabled
• USB	• Enabled
LAN Settings:2	
• DHCP Enable	• On
• IP Address	• 169.254.2.20 (Keysight 53220A) or • 169.254.2.30 (Keysight 53230A)
• Host Name	• A-53220-nnnnn (Keysight 53220A)3 or • A-53230-nnnnn (Keysight 53230A)3
• Default Gateway	• 0.0.0.0
• Subnet Mask	• 255.255.0.0
• DNS Servers	• 0.0.0.0
• WINS Servers	• 0.0.0.0
• Telnet Prompt	• "53220A>" (Keysight 53220A) or • "53232A>" (Keysight 53230A)
• Telnet Welcome Message	• "Welcome to Keysight's 53220A Universal Frequency Counter/Timer" (Keysight 53220A) or • "Welcome to Keysight's 53230A Universal Frequency Counter/Timer" (Keysight 53230A)
• LAN Services[4]	• Enable All (VISA LAN, Sockets, Telnet, Web Server)
• mDNS	• Enabled
• mDNS Desired Service Name	• "Keysight 53220A Universal Frequency Counter/Timer <serial_number>" (Keysight 53220A) or • "Keysight 53230A Universal Frequency Counter/Timer <serial_number>" (Keysight 53230A)
GPIB Settings:	
• GPIB Address	• 3

1 Interface enable and LAN Services changes take effect only after you cycle power.

2 LAN setting changes must be followed by the SYSTem:COMMunicate:LAN:UPDate command to take effect.

3 Where nnnnn represents the last 5 digits of the instrument serial number.

NOTE | The Keysight 53220A/230A use the following LAN ports:

• Port 5024 is used for SCPI Telnet sessions.

• Port 5025 is used for SCPI Socket sessions.

Agilent 53131A/132A Compatibility Mode

The Keysight 53220A/230A Universal Frequency Counter/Timers provide an improved SCPI command set that is easier to use than that included in the Agilent 53131A and 53132A counters. However, via the SYSTem:LANGuage command, the 53220A/230A also supports most of the older SCPI command set of the 53131A/132A counter. When SYSTem:LANGuage "53131A" or "53132A" is selected, the 53220A/230A will emulate the SCPI command set of the 53131A/132A. When SYSTem:LANGuage "53220A" or "53230A" is selected, the 53220A/230A will use its native command set.

When the 53131A/132A compatibility mode has been selected, most SCPI commands should execute semantically the same as the SCPI commands described in the Agilent 53131A/132A 225 MHz Universal Counter Programming Guide. In fact, the instrument even returns the identification string for a 53131A or 53132A when you execute *IDN?. Nevertheless, there are some differences that may prevent your 53131A/132A program from running identically on the 53220A/230A:

1. The 53131A/132A CALCulate1:IMMediate, CALCulate1:IMMediate:AUTO, CALCulate2:IMMediate, and CALCulate2:IMMediate:AUTO commands, which allowed recalculation of old measurements, are not supported.
2. The 53131A/132A READ?, FETCh?, and MEASure? commands returned a variable-length ASCII string whose number of digits depended on the actual measurement resolution. The 53220A/230A always return 15 digits.
3. The 53131A/132A READ:<function>? and FETch:<function>? commands do not allow data conversion from one function to another. <function> must match the currently configured measurement function.
4. The 53220A/230A hardware has only two input hysteresis levels, compared to three on the 53131A/132A. Sending the 53131A/132A SENSe:EVENt{1|2}:HYSTeresis 50 or 100 command enables noise rejection (INPut{1|2}:NREJect ON) in the 53220A/230A; SENSe:EVENt{1|2}:HYSTeresis 0 disables noise rejection.
5. The 53131A/132A allowed you to set different reference levels for the rising and falling edges for pulse width and duty cycle measurements using the SENSe:EVENt{1|2}:LEVel subsystem commands. The 53220A/230A use the same reference level for both edges. If you require different references levels for the two edges, you can accomplish this by using the time interval measurement function instead of pulse width or duty cycle.
6. The 53131A/132A allowed the lower and upper reference values for rise and fall time measurements to be in different units (percent vs. voltage). The 53220A/230A require the same units for both reference values (both must be percent, or both must be voltage).
7. The 53131A/132A updated the SENSe:EVENt{1|2}:LEVel:ABSolute value each time an auto-level was performed. The 53220A/230A retain the programmed value.
8. The 53131A/132A had different resolutions for long and short gate times and delays (CONFigure:TOTalize:TIMed, MEASure:TOTalize:TIMed?, SENSe:FREQuency:ARM:STOP:TIMer, SENSe:TINTerval:ARM:STOP:TIMer, SENSe:TINTerval:ARM:ESTOP:LAYer1:TIMer, SENSe:TOTalize:ARM:STOP:TIMer commands). The resolution for gate time and delay does not change based on value on the 53220A/230A.
9. The 53131A could automatically adapt to external reference signals of 1 MHz, 5 MHz, or 10 MHz. The 53132A only accepted 10 MHz signals. The SENSe:ROSCillator:EXTernal:FREQuency? query would measure and return which frequency was present. The 53220A/230A accepts 1 MHz, 5 MHz, or 10 MHz, but you need to specify via the SENSe:ROSCillator:EXTernal:FREQuency command which frequency is present. This command form is available in 53131A/132A compatibility mode; the query form returns the programmed value, not a measured value.

10. The 53131A/132A SENSe:ROSCillator:EXTernal:CHECk command controlled whether the instrument would detect and report errors if the external reference signal was not present at the end of a measurement. The 53220A/230A always detect this condition and report errors. The 53131A/132A command is accepted by the 53220A/230A, but has no effect on the instrument.

11. The 53131A/132A SCPI macro capability is not supported, including the *DMC, *EMC, *EMC?, *GMC?, *LMC?, *PMC, MEMory:DELete:MACRo, and MEMory:FREE:MACRo? commands.

12. The 53220A/230A do not include an RS-232 port, and do not support hard copy output. The associated HCOPy:CONTinuous and SYStem:COMMunicate:SERial subsystem SCPI commands of the 53131A/132A are accepted by the 53220A/230A, but have no effect on the instrument.

13. The 53131A/132A DIAGnostic subsystem commands are not supported.

14. Front panel menus are disabled when the 53131A/132A compatibility mode has been selected.

15. Due to significant hardware differences between the 53220A/230A and the 53131A/132A, the calibration procedure and some of the CALibration subsystem commands are different.

16. The 53131A/132A SYSTem:KEY and SYSTem:KEY:LOG? commands are not supported.

17. When 50 ohm input impedance is selected, the 53131A/132A and the 53220A/230A specifications limit the input voltage to 5 Vrms to prevent damage to the input termination resistor. If higher voltage is present, 53220A/230A automatically switch the input impedance to 1 Mohm to prevent damage; the 53131A/132A has no such protection. If the automatic protection is triggered on the 53220A/230A, you will need to send the 53131A/132A INPut{1|2}:IMPedance SCPI command to reset the input impedance to 50 ohms.

DHCP

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Condition Register

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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.

Event Register

An event register latches the various events from 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.

Definite-Length Block Data

Definite-length block response data allows any type of device-dependent data to be transmitted as a series of 8-bit binary data bytes. This is particularly useful for transferring large quantities of data or 8-bit extended ASCII codes.

Line Terminator

<NL> = New Line or Line Feed (ASCII decimal 10)

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