/Inritsu

Spectrum Master™
MS2721A

Benchtop Performance in a Handheld Spectrum Analyzer

SiteMaster SpectrumMaster CellMaster Programming Manual

Table of Contents

1 Introduction

Scope of this Manual

This manual contains descriptions of the remote commands available for Anritsu's line of Master™ products.

While it does reference the equivalent front-panel interface for each command, it does not provide a complete front panel reference. Please see the appropriate product's User's Guide for that information.

References

IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI/IEEE Std 488.1-1987*. IEEE, New York, NY, 1992.

SCPI Standard-1999, *Standard Commands for Programmable Instruments Volume 1: Syntax and Style*. SCPI Consortium, San Diego, CA, 1999.

MS2721A Spectrum Analyzer User's Guide (document #10580-00103). Anritsu Company, Morgan Hill, CA, 2004.

NI-VISA User Manual (document #370423A-01). National Instruments Corporation, Austin, TX, 2001.

Trademark Acknowledgments

NI-VISA and LabVIEW are trademarks of National Instruments Corporation. Spectrum Master is a trademark of Anritsu Company.

Firmware Revisions

To check your current firmware revision, press Shift-8 (System), Status.

Remote commands are available beginning with Base Version 1.13. They are available in the applications beginning with the following firmware revisions:

Application	Firmware Revision
Spectrum Analyzer	1.12

2 Programming Overview

Controller Interface

The physical interface is the RJ-45 connection on the instrument for 10BASE-T.

Data transfer takes place over Ethernet using TCP/IP and the VXI-11 protocol. In order to communicate with the instrument the PC must have a VXI-11 client implementation either as part of the controller program or using a third party software package on the controlling PC. The examples in Appendix A of this manual are written using National Instruments' NI-VISA™ product.

Command Structure

Format

The Master™ product line implements a remote interface based on the 1999 SCPI Standard. This is an ASCII-based command set.

Some basic details are described below. For a more detailed description see the SCPI Standard, available for download on the SCPI Consortium website.

Command Tree

SCPI commands are organized in a "tree" structure. The base of the tree is called the "root". The "branches" are the functional subsystems. Each "branch" can have sub-branches. The final node is called the "leaf". The entire sequence of branches, plus the leaf, make up the command. For example, part of the "SENSe" branch looks like this:

```
[:SENSE]
    :FREQuency
       :CENTer
       :STARt
       :STOP
       :SPAN
          :FULL
          :PREVious
```

Although they are at different levels in the tree, "CENTer" and "FULL" are both leaves on the tree.

There can be branches and leaves in the tree with the same name as long as they appear at different levels. For example, there is an "AUTO" leaf at the tip of both of these branches:

```
[:SENSe]                        [:SENSe]
  :BANDwidth                       :BANDwidth
    :RESolution                      :VIDeo
       :AUTO                            :AUTO
```

Subsystems

A colon (':') separates each subsystem. For example, the command
`:SENSe:FREQuency:STARt <freq>` sets the start frequency. The start frequency
is part of the :FREQuency subsystem which is part of the :SENSe subsystem. Stop
frequency is also part of the :SENSe:FREQuency subsystem. It is specified by
`:SENSe:FREQuency:STOP`.

Optional Subsystems

One subsystem at each "tree" level can be specified as optional. That is, the optional
subsystem does not need to be specified to create a valid command. For example, if the
specification is written as `[:SENSe]:FREQuency:STARt`, the :SENSe subsystem is
optional. So, both `:SENS:FREQ:STAR` and `:FREQ:START` are valid commands and
will have the same result.

Long Format vs. Short Format

Each keyword has a long format and a short format. The start frequency can be specified
by `:SENSe:FREQuency:STARt` or `:SENS:FREQ:STAR`. The capital letters in the
command specification indicate the short form of the command.

Only the short form and the long form are acceptable. For example,
`:SENS:FREQuen:STA` is not an acceptable form of the command.

Case Sensitivity

Commands are not case sensitive. For example, `:SENS:FREQ:STAR 1 MHZ` and
`:sens:freq:star 1 mhz` will have the same result.

Parameters

The command and its parameters are separated by a space. Parameters may be specified
with optional units, depending on the command.
For example, `:SENS:FREQ:STAR 1 MHZ` sets the start frequency to 1 MHz.

Multiple parameters are separated by a comma (",").

Query Format

Many commands have a query format that will return a parameter value or other data.
For example, `:SENS:FREQ:STAR?` will return the current value of the start frequency.

Combining Multiple Commands

Multiple commands can be sent together if separated by a semi-colon (';'). For example,
`:SENSe:FREQ:STAR 1MHZ;:SENSe:FREQ:STOP 2 MHZ` would set the start
frequency to 1 MHz and then set the stop frequency to 2 MHz.

Creating Valid Commands

Command Specification	Valid Forms

`[:SENSe]:FREQuency:STARt <freq>`	The following all produce equivalent results:
	
	`:SENSe:FREQuency:STARt 1 MHZ`
	
	`:SENS:FREQ:STAR 1 MHZ`
	
	`:sense:frequency:start 1000000`
	
	`:FREQ:STAR 1000 KHZ`

`:CALCulate:MARKer[1]|2|3| 4|5|6:X <x-parameter>`	The first 2 commands set the location of marker 1. The third command sets the location of marker 2.
	
	`:CALC:MARK:X 1 GHZ`
	
	`:CALC:MARK1:X 1 GHZ`
	
	`:CALC:MARK2:X 2 GHZ`

`:UNIT:POWer DBM|DBV|DBMV|DBUV|V|W`	The following commands are identical:
	`:UNIT:POWer DBM`
	
	`:unit:pow dbm`

`:INITiate:CONTinuous OFF|ON|0|1`	The following commands are identical:
	`:INITiate:CONTinuous OFF`
	
	`:init:cont 0`

Command Terminators

The <new line> character (ASCII 10) in the last data byte of a command string is used as a command terminator. Use of a command terminator will reset the command path to the root of the tree.

Conventions

The following conventions have been used throughout the document.

Notational Conventions

This document uses several notational conventions. They are listed below.

`:COMMands:WILL:LOOK:LIKE:THIS`	Commands will be formatted to differentiate them from text descriptions.
`:COMMand:QUERies:LOOK:LIKE:THIS?`	The query form of the command will be followed by a "?"
Front-panel key sequences use this formatting	Front-panel keypresses will be formatted to differentiate them from text descriptions. Key presses are separated by a comma (",").
`<identifier>`	Identifiers will be enclosed in "< >". They indicate that some type of data must be provided.
`|`	The "|" indicates that a choice must be made.
`[optional input]`	Optional input will be enclosed in "[ ]".

Identifiers

The following identifiers have been used throughout the remote command definitions. Descriptions are provided here. In most cases, units will be specified with the individual command.

Identifier	Description
`<amplitude>`	Amplitude value. Units specified with the command.
`<freq>`	Frequency. Units specified with the command.
`<integer>`	Integer value, no units. Range specified with the command.
`<number>`	Numeric value, integer or real.
`<percentage>`	Percentage value from 0-100. Units are always "%".
`<rel ampl>`	Relative amplitude. Units are always dB.
`<x-parameter>`	Parameter value in the units of the x-axis. Units are specified with the command.
`<string>`	The string should be enclosed in either single quotes (' ') or double quotes (" ").
`<file name>`	The name should be enclosed in either single quotes (' ') or double quotes (" "). The need for an extension will be documented with applicable commands.

3 Remote Commands

3.1 IEEE Common Commands

These commands are specified in IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI/IEEE Std 488.1-1987*. IEEE, New York, NY, 1992.

Identity Query

`*IDN?`

This command returns the following information in `<string>` format separated by commas: manufacturer name ("Anritsu"), model number/options, serial number, firmware package number.

Note that the model number and options will be separated by a "/" and each option will be separated by a "/".

For example, the return string might look like:

`"Anritsu,MS2721A,1234567890,1.00"`

Reset

`*RST`

This command restores parameters in the current application as well as system settings to their factory default values.

System settings affected by this command are Ethernet configuration, language, volume and brightness.

Note that the unit will power-cycle after this command is executed.

Front Panel Access:	Shift-8 (System), System Options, Reset, Factory Defaults
See Also:	`:SYSTem:PRESet`

3.2 Spectrum Analyzer

ABORt Subsystem

This subsystem relates to instrument triggering. It contains only the single command
`:ABORT`. Related commands can be found in the INITiate and TRIGger subsystems.

Abort

`:ABORt`

Restarts the current sweep and/or measurement. Resets the trigger system.

If `:INITiate:CONTinuous` is OFF (i.e. the instrument is in single sweep mode),
send the command `:INITiate[:IMMediate]` to trigger the next sweep.

If `:INITiate:CONTinuous` is ON (i.e. the instrument is in continous sweep mode) a
new sweep will start immediately.

Front Panel Access:	Shift-3 (Sweep), Reset Sweep
See Also:	`:INITiate:CONTinuous`
	`:INITiate[:IMMediate]`

CALCulate Subsystem

The commands in this subsystem process data that has been collected via the SENSe subsystem.

:CALCulate:MARKer Subsystem

This subsystem contains commands related to the function and display of trace markers.

Marker (Maximum) Peak Search

`:CALCulate:MARKer[1]|2|3|4|5|6:MAXimum`
Puts the specified marker at the maximum amplitude in the trace.

Front Panel Access:	Marker, [Marker 1/2/3/4/5/6/,] Peak Search
	Marker, More Peak Options, Peak Search

Marker (Maximum) Peak Search Left

`:CALCulate:MARKer[1]|2|3|4|5|6:MAXimum:LEFT`
Puts the specified marker on the next highest peak to the left of the current peak.

The next highest peak must be above the peak threshold. If no point meets that criterion, the marker is set to the first point on the trace.

Front Panel Access:	Marker, More Peak Options, Next Peak Left
See Also:	`:CALCulate:MARKer:PEAK:THReshold`

Marker (Maximum) Peak Search Right

`:CALCulate:MARKer[1]|2|3|4|5|6:MAXimum:RIGHt`
Puts the specified marker on the next highest peak to the right of the current peak.

The next highest peak must be above the peak threshold. If no point meets that criterion, the marker is set to the last point on the trace.

Front Panel Access:	Marker, More Peak Options, Next Peak Right
See Also:	`:CALCulate:MARKer:PEAK:THReshold`

Peak Threshold

`:CALCulate:MARKer:PEAK:THReshold <percentage>`
`:CALCulate:MARKer:PEAK:THReshold?`
Sets the peak threshold as a percentage of the display.

`:CALCulate:MARKer:MAXimum:LEFT` and

`:CALCulate:MARKer:MAXimum:RIGHt` use this value to determine whether a particular display point qualifies as a peak.

Factory Preset / `*RST`:	MS2721A: 10%
Range:	MS2721A: 0% to 100%
Default Unit:	%
Front Panel Access:	Marker, More Peak Options, Peak Threshold

Marker Frequency to Center

`:CALCulate:MARKer[1]|2|3|4|5|6[:SET]:CENTer`

Sets the center frequency equal to the frequency of the specified marker.

Note that this will result in a change to the start and stop frequencies and may also result in a change to the span.

Front Panel Access:	Marker, Marker Freq to Center

Marker to Reference Level

`:CALCulate:MARKer[1]|2|3|4|5|6[:SET]:RLEVel`

Sets the reference level equal to the measured amplitude of the specified marker.

Note that this may result in a change to the input attenuation.

Front Panel Access:	Marker, Marker to Ref Lvl

Marker X Value

`:CALCulate:MARKer[1]|2|3|4|5|6:X <x-parameter>`
`:CALCulate:MARKer[1]|2|3|4|5|6:X?`

Sets the location of the marker on the x-axis at the specified location. `<x-parameter>` is defined in the current x-axis units.

The query version of the command returns the location of the marker on the x-axis.

Default Unit:	Current x-axis unit
Front Panel Access:	Marker, [Marker 1/2/3/4/5/6]

Marker Read Y Value

`:CALCulate:MARKer[1]|2|3|4|5|6:Y?`

Reads the current Y value for the specified marker. The units are the units of the y-axis.

Default Unit:	Current amplitude unit

DISPlay Subsystem

This subsystem provides commands that modify the display of data for the user. They do not modify the way in which data is returned to the controller.

Scale

`:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision <rel ampl>`
`:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision?`
Sets the scale (dB/division) for the y-axis.

Factory Preset / `*RST:`	MS2721A: 10 dB/div
Range:	MS2721A: 1 dB to 15 dB
Default Unit:	dB
Front Panel Access:	Amplitude, Scale

Reference Level

`:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel <amplitude>`
`:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel?`
Sets the reference level amplitude value for the y-axis.

Note that this may cause a change in attenuation if the automatic input attenuation coupling is enabled.

Factory Preset / `*RST:`	MS2721A: 10 dBm
Range:	With reference level offset = 0 dB: MS2721A: 30 dBm to -130 dBm
Default Unit:	Current active amplitude unit
Front Panel Access:	Amplitude, Reference Level
See Also:	`:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFset <rel ampl>` `:UNIT:POWer`

Reference Level Offset

`:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet <rel ampl>`
`:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet?`
Sets the reference level offset value for the y-axis.

Factory Preset / `*RST:`	MS2721A: 0 dB
Range:	MS2721A: 0 dB to 100 dB
Default Unit:	dB
Front Panel Access:	Amplitude, RL Offset

FORMat Subsystem

This subsystem contains commands that determine the formatting of numeric data when it is transferred.

The format setting affects data in specific commands only. If a command is affected, it will be noted in the command description.

Numeric Data Format

```
:FORMat[:READings][:DATA] ASCii|INTeger,32|REAL,32
:FORMat[:READings][:DATA]?
```
This command specifies the format in which data is returned in certain commands.

ASCii format returns the data in comma-separated ASCII format. The units are the current instrument units. This format requires many more bytes so it will be the slowest format.

INTeger,32 format returns the data in 4-byte blocks. The units are always mdBm. For example, if the measured result was -12.345 dBm, that value would be sent as -12345.

REAL,32 format returns the data in 4-byte binary format. The units are the current instrument units.

Both INTeger,32 and REAL,32 formats return a definite block length. Each transfer begins with an ASCII header such as #42204. The first digit represents the number of following digits in the header (in this example, 4). The remainder of the header indicates the number of bytes that follow the header (in this example, 2204). You then divide the number of following bytes by the number of bytes in the data format you've chosen (4 for both INTeger,32 and REAL,32…so 2204/4) to get the number of data points (in this example, 551).

Factory Preset / `*RST`:	ASCii
See Also:	`:TRACe[:DATA]`

INITiate Subsystem

This subsystem works with the ABORt and TRIGger subsystems to control the triggering of a sweep.

Continuous/Single Sweep

`:INITiate:CONTinuous OFF|ON|0|1`
`:INITiate:CONTinuous?`
Specifies whether the sweep is triggered continuously.

If the value is set to ON or 1, another sweep is triggered as soon as the current sweep completes.

If continuous is set to OFF or 0, the instrument enters the "idle" state and waits for the `:INITiate[:IMMediate]` command or for `:INITiate:CONTinuous ON`.

The default value is ON. That is, sending `:INIT:CONT` is equivalent to sending `:INIT:CONT ON`

The query version of the command returns a 1 if the instrument is continuously sweeping and returns a 0 if the instrument is in single sweep mode.

Factory Preset / `*RST`:	MS2721A: ON
Front Panel Access:	Shift-3 (Sweep), Sweep (Single/Continuous)
See Also:	`:INITiate[:IMMediate]`

Trigger Sweep

`:INITiate[:IMMediate]`
Initiates a measurement sweep.

If `:INITitate:CONTinuous` is set to ON, this command is ignored.

Use this command in combination with `:STATus:OPERation?` to synchronize the capture of one complete sweep of data. When this command is sent, the "sweep complete" bit of `:STATus:OPERation?` is set to 0, indicating that the sweep has not completed. The sweep is then triggered. The controlling program can poll `:STATus:OPERation?` to determine the status of the sweep. When the "sweep complete" bit is set to 1, the sweep is complete and data is ready to be retrieved.

Front Panel Access:	Shift-3 (Sweep), Manual Trigger
See Also:	`:INITiate:CONTinuous` `:STATus:OPERation?`

INSTrument Subsystem

One instrument may contain many logical instruments ("modes"). This subsystem controls the selection of the current instrument mode.

Query Available Modes

:INSTrument:CATalog:FULL?

Returns a comma-separated list of available modes. Mode names are enclosed in double quotes (" "). Immediately following the string name is the application number.

For example: "SPA"1,"MODE2"2

Front Panel Access:	Shift-9 (Mode)

Select Mode by Number

:INSTrument:NSELect <integer>
:INSTrument:NSELect?

Sets the instrument mode based on the value of <integer>.

The query version returns the number associated with the current mode.

Use :INSTrument:CATalog:FULL? to get a list of available mode names and their integer representations.

Factory Preset / *RST:	MS2721A: 1
Front Panel Access:	Shift-9 (Mode)
See Also:	:INSTrument:CATalog:FULL?
	:INSTrument[:SELect]

Select Mode by Name

:INSTrument[:SELect] <string>
:INSTrument[:SELect]?

Sets the instrument mode based on the mode name specified by <string>.

The query version returns the name of the current mode.

Use :INSTrument:CATalog:FULL? to get a list of available modes.

Factory Preset / *RST:	MS2721A: "SPA"
Front Panel Access:	Shift-9 (Mode)
See Also:	:INSTrument:CATalog:FULL?
	:INSTrument:NSELect

MMEMory Subsystem

The Mass MEMory subsystem contains functions that provide access to the instrument's setup and data storage.

Recall Setup

:MMEMory:LOAD:STATe <integer>,<file name>

Loads the current setup from the file specified by <file name>.

The instrument must be in the mode of the saved setup in order to recall that setup. Use :INSTrument:SELect or :INSTrument:NSELect to set the mode.

<file name> should be enclosed in either single quotes ('') or double quotes ("") and should include the extension ".stp".

The <integer> parameter is not currently used, but it must be sent. Send a 0.

Front Panel Access:	Shift-7 (File), Save Recall, Recall Setup
See Also:	:MMEMory:STORe:STATe

Recall Measurement

:MMEMory:LOAD:TRACe <integer>,<file name>

Recalls the trace specified by <file name> into the trace specified by <integer>.

The instrument must be in the mode of the saved trace in order to recall that trace. Use :INSTrument:SELect or :INSTrument:NSELect to set the mode.

Valid <integer> values are 1, 2 and 3. They correspond to traces A, B and C, respectively.

<file name> should be enclosed in either single quotes ('') or double quotes ("") and should contain the extension for the given application.

File Extensions:	Spectrum Analyzer: ".spa"
Front Panel Access:	Shift-7 (File), Save Recall, Recall Measurement
See Also:	:MMEMory:STORe:TRACe

Save Setup

:MMEMory:STORe:STATe <integer>,<file name>

Stores the current setup into the file specified by <file name>.

<file name> should be enclosed in either single quotes ('') or double quotes ("") and should not contain a file extension.

The <integer> parameter is not currently used, but it must be sent. Send a 0.

Front Panel Access:	Shift-7 (File), Save Recall, Save Setup
See Also:	:MMEMory:LOAD:STATe

Save Measurement

:MMEMory:STORe:TRACe <integer>,<file name>

Stores the trace in trace A into the file specified by `<file name>`.

`<file name>` should be enclosed in either single quotes ('') or double quotes ("") and should not contain a file extension.

The `<integer>` parameter is not currently used, but it must be sent. Send a 0.

Front Panel Access:	Shift-7 (File), Save Recall, Save Measurement
See Also:	`:MMEMory:LOAD:TRACe`

SENSe Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

:SENSe:AVERage Subsystem

This subsystem contains commands related to the combination of the data from consecutive sweeps. Use commands in this subsystem to control sweep-to-sweep averaging, min hold and max hold functionality.

Number of Traces to Average

`[:SENSe]:AVERage:COUNt <integer>`
`[:SENSe]:AVERage:COUNt?`
Sets the number of traces to average.

Factory Preset / `*RST:`	MS2721A: 10
Range:	MS2721A: 2-65535
Front Panel Access:	Shift-5 (Trace), # of Averages

Trace Mode (Normal/Average/Max Hold/Min Hold)

`[:SENSe]:AVERage:TYPE NONE|SCALar|MAXimum|MINimum`
`[:SENSe]:AVERage:TYPE?`
Specifies how successive traces are combined to produce the resulting display value.

Setting the TYPE to NONE is the equivalent of setting the Trace Mode to "Norm" on the front panel. The displayed value for a point will be the curent measured value for that point.

Setting the TYPE to SCALar is the equivalent of setting the Trace Mode to "Avg" on the front panel. The displayed value for a point will be the average of the last `<integer>` measured values where `<integer>` is set by `[:SENSe]:AVERage:COUNt`.

Setting the TYPE to MAXimum is the equivalent of setting the Trace Mode to "Max" on the front panel (Max Hold). The displayed value for a point will be the maximum measured value for that point over sweeps.

Setting the TYPE to MINimum is the equivalent of setting the Trace Mode to "Min" on the front panel (Min Hold). The displayed value for a point will be the minimum measured value for that point over sweeps.

Factory Preset / `*RST:`	MS2721A: NONE
Front Panel Access:	Shift-5 (Trace), Trace Mode
See Also:	`[:SENSe]:AVERage:COUNt`

:SENSe:BANDwidth|BWIDth Subsystem

This subsystem contains commands related to the filter bandwidth of the instrument.

Resolution Bandwidth

[:SENSe]:BANDwidth|BWIDth[:RESolution] <freq>
[:SENSe]:BANDwidth|BWIDth[:RESolution]?
Sets the resolution bandwidth.

Note that using this command turns the automatic resolution bandwidth setting OFF.

Factory Preset / *RST:	MS2721A: 3 MHz
Range:	MS2721A: 10 Hz to 3 MHz in a 1:3 sequence
Default Unit:	Hz
Front Panel Access:	BW, RBW
See Also:	[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO

Resolution Bandwidth Coupling

[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO OFF|ON|0|1
[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO?
Sets the state of the coupling of the resolution bandwidth to the frequency span.

Setting the value to ON or 1 will result in the resolution bandwidth being coupled to the span. That is, when the span changes, the resolution bandwidth changes.

Setting the value to OFF or 0 will result in the resolution bandwidth being un-coupled from the span. That is, changing the span will not change the resolution bandwidth. When this command is issued, the resolution bandwidth setting itself will not change.

The default value is ON. That is, sending :SENS:BAND:RES is equivalent to sending :SENS:BAND:RES ON.

Factory Preset / *RST:	MS2721A: ON
Front Panel Access:	BW, Auto RBW
See Also:	[:SENSE]:BANDwidth|BWIDth[:RESolution]:RATio

Resolution Bandwidth to Span Ratio

[:SENSe]:BANDwidth|BWIDth[:RESolution]:RATio <number>
[:SENSe]:BANDwidth|BWIDth[:RESolution]:RATio?
Sets the ratio of the resolution bandwidth to the span for use when the resolution bandwidth to span coupling is enabled.

Note that the front panel interface sets the inverse ratio: the span to the resolution bandwidth.

Factory Preset / *RST:	MS2721A: 0.0033
Range:	MS2721A: 0.00001 to 1
Front Panel Access:	BW, Span/RBW (note that this is the inverse ratio)
See Also:	[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO

Video Bandwidth

[:SENSe]:BANDwidth|BWIDth:VIDeo <freq>

`[:SENSe]:BANDwidth|BWIDth:VIDeo?`

Sets the video bandwidth.

Note that using this command turns the automatic video bandwidth setting OFF.

Factory Preset / `*RST`:	MS2721A: 1 MHz
Range:	MS2721A: 1 Hz to 3 MHz in a 1:3 sequence
Default Unit:	Hz
Front Panel Access:	BW, VBW
See Also:	`[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO`

Video Bandwidth Coupling

`[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO OFF|ON|0|1`
`[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO?`

Sets the state of the coupling of the video bandwidth to the resolution bandwidth.

Setting the value to ON or 1 will result in the video bandwidth being coupled to the resolution bandwidth. That is, when the resolution bandwidth changes, the video bandwidth changes.

Setting the value to OFF or 0 will result in the video bandwidth being un-coupled from the resolution bandwidth. That is, changing the resolution bandwidth will not change the video bandwidth. When this command is issued, the video bandwidth setting itself will not change.

The default value is ON. That is, sending `:SENS:BAND:VID` is equivalent to sending `:SENS:BAND:VID ON`.

Factory Preset / `*RST`:	MS2721A: ON
Front Panel Access:	BW, Auto VBW
See Also:	`[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio`

Video Bandwidth to Resolution Bandwidth Ratio

`[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio <number>`
`[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio?`

Sets the ratio of the video bandwidth to the resolution bandwidth for use when the video to resolution bandwidth coupling is enabled.

Note that the front panel interface sets the inverse ratio: the resolution bandwidth to the video bandwidth.

Factory Preset / `*RST`:	MS2721A: 0.33
Range:	MS2721A: 0.00001 to 1
Front Panel Access:	BW, RBW/VBW (note that this is the inverse ratio)
See Also:	`[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO`

:SENSe:CORRection Subsystem

This subsystem provides commands that accounts for losses or gains external to the instrument.

Input Impedance

`[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude] <integer>`
`[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]?`
Sets the input impedance that will be used for amplitude correction and conversion between units (dBm vs. dBV vs. Volts, etc.).

If the value of `<integer>` is 50 no correction will be performed.

If the value of `<integer>` is 75 correction will be done based on Anritsu adapter 12N50-75B.

If the value of <integer> is anything else it will look to the value set by `[:SENSe]:CORRection:IMPedance[:INPut]:OFFSet` for the amplitude correction value. Unit conversion will be done as if the impedance is 75Ω.

If a value other than 50 or 75 is set, it will be returned as 2 by the query form of this command.

Factory Preset / `*RST`:	MS2721A: 50
Range:	MS2721A: 50, 75 all other values will be treated as described above
Front Panel Access:	Shift-8 (System), Application Options, Impedance
See Also:	`[:SENSe]:CORRection:IMPedance[:INPut]:OFFSet`

"Other" Input Impedance Loss

`[:SENSe]:CORRection:IMPedance[:INPut]:OFFSet <rel ampl>`
`[:SENSe]:CORRection:IMPedance[:INPut]:OFFSet?`
Sets the value that will be used for amplitude correction when the value set by `[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]` is something other than 50 or 75. This value is not applied if the impedance is set to either 50 or 75.

Factory Preset / `*RST`:	MS2721A: 0
Range:	MS2721A: 0 dB to 100 dB
Default Unit:	dB
Front Panel Access:	Shift-8 (System), Application Options, Impedance
See Also:	`[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]`

:SENSe:DETector Subsystem

This subsystem includes commands that affect acquisition data points on the instrument.

Detection Type

`[:SENSe]:DETector[:FUNCtion] POSitive|RMS|NEGative|SAMPle`
`[:SENSe]:DETector[:FUNCtion]?`
Sets the detection method for calculating each display point.

Each display point represents several measurements. The detection type determines how the display point is derived from its associated measurements.

POSitive Peak detection displays the maximum value of the associated measurements.

RMS detection displays the average power of the associated measurements.

NEGative Peak detection displays the minimum value of the associated measurements.

SAMPle detection displays the "middle" point of those measurements associated with a display point. For example, if there are 3 measurement frequencies associated with a given display point, sample detection will display the value at the frequency of the second measurement point.

Factory Preset / `*RST`:	MS2721A: (Positive) Peak
Front Panel Access:	Shift-3(Sweep), Detection, Peak|RMS|Negative|Sample

:SENSe:FREQuency Subsystem

Commands in this subsystem pertain to the frequency settings of the instrument.

Center Frequency

`[:SENSe]:FREQuency:CENTer <freq>`
`[:SENSe]:FREQuency:CENTer?`
Sets the center frequency.

Note that changing the value of the center frequency will change the value of the coupled parameters Start Frequency and Stop Frequency. It may also change the value of the span.

Factory Preset / `*RST`:	MS2721A: 3.55 GHz
Range:	MS2721A: 10 Hz – 7.099999995 GHz
Default Unit:	Hz
Front Panel Access:	Freq, Center Freq

Frequency Span

`[:SENSe]:FREQuency:SPAN <freq>`
`[:SENSe]:FREQuency:SPAN?`
Sets the frequency span. Setting the value of `<freq>` to 0 Hz is the equivalent of setting the span mode to zero span.

Note that changing the value of the frequency span will change the value of the coupled parameters Start Frequency and Stop Frequency and may change the Center Frequency.

Factory Preset / `*RST`:	MS2721A: 7.1 GHz
Range:	MS2721A: 0 Hz, 10 Hz – 7.1 GHz
Default Unit:	Hz
Front Panel Access:	Freq, Span Span Span, Zero Span

Frequency Span - Full

`[:SENSe]:FREQuency:SPAN:FULL`

Sets the frequency span to full span.

Note that changing the value of the frequency span will change the value of the coupled parameters, Start Frequency and Stop Frequency and may change the Center Frequency.

Factory Preset / `*RST`:	MS2721A: 7.1 GHz
Front Panel Access:	Span, Full Span

Frequency Span - Last

`[:SENSe]:FREQuency:SPAN:PREVious`

Sets the frequency span to the previous span value.

Note that changing the value of the frequency span will change the value of the coupled parameters, Start Frequency and Stop Frequency and may change the Center Frequency.

Front Panel Access:	Freq, Span, Last Span

Start Frequency

`[:SENSe]:FREQuency:STARt <freq>`
`[:SENSe]:FREQuency:STARt?`

Sets the start frequency.

Note that changing the value of the start frequency will change the value of the coupled parameters, Center Frequency and Span.

Factory Preset / `*RST`:	MS2721A: 0 Hz
Range:	MS2721A: 0 Hz – 7.099999990 GHz
Default Unit:	Hz
Front Panel Access:	Freq, Start Freq

Stop Frequency

`[:SENSe]:FREQuency:STOP <freq>`
`[:SENSe]:FREQuency:STOP?`

Sets the stop frequency.

Note that changing the value of the stop frequency will change the value of the coupled parameters, Center Frequency and Span.

Factory Preset / `*RST`:	MS2721A: 7.1 GHz
Range:	MS2721A: 10 Hz – 7.1 GHz
Default Unit:	Hz
Front Panel Access:	Freq, Stop Freq

:SENSe:POWer Subsystem

This system relates to the power amplitude parameters of the instrument.

Input Attenuation

`[:SENSe]:POWer[:RF]:ATTenuation <rel ampl>`
`[:SENSe]:POWer[:RF]:ATTenuation?`
Sets the input attenuation.

Note that issuing this command will set the automatic input attenuation OFF.

Factory Preset / `*RST`:	MS2721A: 30 dB
Range:	MS2721A: 0 dB to 65 dB
Default Unit:	dB
Front Panel Access:	Amplitude, Atten Lvl
See Also:	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO`

Input Attenuation Coupling

`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF|ON|0|1`
`[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`
Sets the input attenuation coupling.

Setting the value to ON or 1 will result in the input attenuation being coupled to the reference level.

Setting the value to OFF or 0 will result in the input attenuation being un-coupled from the reference level. That is, changing the reference level will not change the input attenuation. When this command is issued, the input attenuator setting itself will not change.

The default value is ON. That is, sending `:SENS:POW:ATT:AUTO` is equivalent to sending `:SENS:POW:ATT:AUTO ON`.

Factory Preset / `*RST`:	MS2721A: ON
Front Panel Access:	Amplitude, Auto Atten
See Also:	`[:SENSe]:POWer[:RF]:ATTenuation`

Preamp State

`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF|ON|0|1`
`[:SENSe]:POWer[:RF]:GAIN[:STATe]?`
Sets the state of the preamp.

Note that this may cause a change in the reference level and/or attenuation.

Factory Preset / `*RST`:	MS2721A: OFF
Front Panel Access:	Amplitude, Pre Amp

:SENSe:SWEep Subsystem

This subsystem controls the timebase of the instrument.

Minimum Sweep Time

[:SENSe]:SWEep:TIME
[:SENSe]:SWEep:TIME?

Sets the value of the minimum sweep time parameter. The sweep will complete in the shortest time possible greater than the specified time.

To sweep as fast as possible, enter the minimum value allowed for the sweep time.

Factory Preset / *RST:	MS2721A: 50 µs
Range:	MS2721A: 50 µs to 4,294,967,295 µs
Default Unit:	seconds
Front Panel Access:	Shift-3 (Sweep), Min Sweep Time

STATus Subsystem

This subsystem controls the SCPI status reporting structure.

Query Operation Status

`:STATus:OPERation?`

This command requests information about the current status of the instrument. Each bit of the return value represents some operation. Only a subset of the bits will be implemented for each application.

The number returned will be the decimal representation of the bit-wise OR of the enabled bits.

Bit	Decimal Value	Description
0	1	Not implemented
1	2	Not implemented
2	4	Not implemented
3	8	Not implemented
4	16	Not implemented
5	32	Not implemented
6	64	Not implemented
7	128	Not implemented
8	256	Sweep Complete – This bit will be set to 0 when the command `:INITiate[:IMMediate]` is sent to trigger a sweep. It will have a value of 1 when the sweep has completed.
9	512	Not implemented
10	1024	Not implemented
11	2048	Not implemented
12	4096	Not implemented
13	8192	Not implemented
14	16384	Not implemented
15	0	Will always be 0

SYSTem Subsystem

This subsystem contains commands that affect instrument functionality that does not directly relate to data collection, display or transfer.

Query Installed Options

:SYSTem:OPTions?
Returns a string of the installed options. Options will be separated by a "/".

The string will be empty if no options are installed.

See Also:	*IDN?

Preset

:SYSTem:PRESet
This command restores all application parameters to their factory preset values. This does not modify system parameters such as Ethernet configuration, language, volume or brightness.

Front Panel Access:	Shift-1 (Preset), Preset
See Also:	*RST

TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

Trace Data Transfer

`:TRACe[:DATA] [1]|2|3,<header><block>`
`:TRACe[:DATA]? [1]|2|3`

This command transfers data from the controlling program to the instrument. The query form transfers trace data from the instrument to the controller. Data is transferred in both directions as `<header><block>`.

The ASCII header specifies the number of data bytes. It looks like #AX, where A is the number of digits in X and X is the number of bytes in the `<block>`.

The format of the block data in the query form is specified by `:FORMat:DATA`. The block data in the command form is always sent in ASCII format.

Data can be transferred to and from the 3 available display traces. Use the commands in the MMEMory subsystem to store and recall traces from the instrument memory.

The command form does not support setting all trace points to a single value. To do this, send the same value to each point.

Trace setup information can be acquired using `:TRACe[:DATA]:PREamble?`.

To acquire the data from trace A in the instrument send `:TRACe[:DATA]? 1`. A 551 point trace will be returned as `#42204<block data>`. `<block>` data could be in either INTeger,32 or REAL,32 format. In both cases, there will be 4 bytes per data point. So, 4 bytes per point * 551 data points gives 2204 bytes in `<block>` data. This example assumes that `:FORMat:DATA INTeger,32` or `:FORMat:DATA REAL,32` has been sent to the instrument before the query command is sent.

See Also:	`:FORMat:DATA`
	`:TRACe[:DATA]:PREamble?`

Trace Header Transfer

`:TRACe:PREamble? [1]|2|3`

Returns trace header information for the specified trace.

Data can be transferred to and from the 3 available display traces. Use the commands in the MMEMory subsystem to store and recall traces from the instrument memory.

The response begins with an ASCII header. The header specifies the number of following bytes. It looks like #AX, where A is the number of digits in X and X is the number of bytes that follow the header.

Parameters are returned in comma-delimited ASCII format. Each parameter will be returned as "NAME=VALUE[UNITS],"

Valid parameter names are:

Parameter Name	Description
SN	Instrument serial #
UNIT_NAME	Instrument name
DESCR	Trace name
DATE	Trace date/time
BASE_VER	Base FW version
APP_NAME	Application name
APP_VER	Application FW version

Parameter Name	Description
UNITS	Amplitude units
CENTER_FREQ	Center freq
SPAN	Frequency span
FREQ_STEP	Frequency step size
RBW	Resolution bw
RBW_TYPE	RBW coupling auto/manual
VBW	Video bw
VBW_TYPE	VBW coupling auto/manual
RBW_VBW_RATIO	RBW/VBW ratio
SPAN_RBW_RATIO	Span/RBW ratio
INPUT_ATTEN	Input attenuation
ATTEN_TYPE	Attenuation coupling auto/manual
REFERENCE_LEVEL	Reference level
SCALE	Y-axis scale
PREAMP_SET	Preamp state
REF_LEVEL_OFFSET	Reference level offset
DETECTION	Detection type
TRACE_AVERAGE	Number of traces to average
SWEEP_TYPE	Single/continuous
CURRENT_SIGNAL	Current signal index

CURRENT_CHANNEL	Current signal channel
TRACE_MODE	Normal/Avg/Max
TRACE_STATUS	TRACE_A_VIEW_NOT_BLANK 0x0000000000000001 TRACE_A_WRITE_NOT_HOLD 0x0000000000000002 TRACE_A_DATA_VALID 0x0000000000000004 TRACE_B_VIEW_NOT_BLANK 0x0000000000010000 TRACE_B_WRITE_NOT_HOLD 0x0000000000020000 TRACE_B_DATA_VALID 0x0000000000040000 TRACE_C_VIEW_NOT_BLANK 0x0000000100000000 TRACE_C_WRITE_NOT_HOLD 0x0000000200000000 TRACE_C_DATA_VALID 0x0000000400000000 TRACE_C_IS_B_MINUS_A_ON 0x0000001000000000 TRACE_C_IS_A_MINUS_B_ON 0x0000002000000000
TRACE_COUNT	Number of traces averaged
UI_DATA_POINTS	Number of display points
IMPEDANCE	Input impedance
REFERENCE_ FREQUENCY	Reference freq
SET_SWEEP_TIME	Minimum sweep time setting
TRIGGER_TYPE	Trigger type
VIDEO_TRIGGER_ LEVEL	Video trigger level
TRIGGER_POSITION	Trigger position as a percent of the display
PEAK_THRESHOLD	Marker peak search threshold
MARKER_TABLE	Marker table status

Parameter Name	Description
ACTIVE_ MEASUREMENT	Current measurement
ANTENNA	Antenna index
OCC_BW_METHOD	Occupied bandwidth method
OCC_BW_PERCENT	Occupied bandwidth % of power setting
OCC_BW_DBC	Occupied bandwidth dBc setting
OCC_BW_MEASURED_ DB	Occupied bandwidth measured dBc value
OCC_BW_MEASURED_	Occupied bandwidth measured % value

PERCENT	
OCC_BW_VALUE	Measured occupied bandwidth
OCC_BW_LINE_MARKER_INFO	Mask off 16 bits at a time to get the display point location of the 3 OBW display indicators
CH_PWR_WIDTH	Channel power integration bandwidth
CH_PWR_VALUE	Measured channel power
CH_PWR_DENSITY	Measured channel power density
CH_PWR_LINE_MARKER_INFO	Mask off 16 bits at a time to get the display point location of the 2 channel power display indicators
ACPR_MAIN_CH_BW	ACPR main channel bw
ACPR_ADJC_CH_BW	ACPR adjacent channel bw
ACPR_CHANNEL_SPACING	ACPR channel spacing
ACPR_MAIN_CH_PWR	ACPR measured main channel power
ACPR_UPPER_CH_PWR	ACPR measured upper channel power
ACPR_LOWER_CH_PWR	ACPR measured lower channel power
ACPR_LOWER_CH_LINE_MARKER_INFO	Mask off 16 bits at a time to get the display point location of the 2 ACPR lower channel display indicators
ACPR_MAIN_CH_LINE_MARKER_INFO	Mask off 16 bits at a time to get the display point location of the 2 ACPR main channel display indicators
ACPR_UPPER_CH_LINE_MARKER_INFO	Mask off 16 bits at a time to get the display point location of the 2 ACPR upper channel display indicators
AM_FM_DEMOD_VOL	AM/FM demod volume
AM_FM_DEMOD_FREQUENCY	AM/FM demod freq
AM_FM_DEMOD_TYPE	AM/FM demod type
AM_FM_DEMOD_TIME	AM/FM demod time
AM_FM_LINE_MARKER	Display point location of the demodulation frequency
BEAT_FREQUENCY_OSC_FREQUENCY	BFO oscillator freq
CI_C_TYPE	C/I measurement carrier type
CI_C_VALUE	C/I measurement measured carrier power
CI_I_BB_VALUE	C/I measurement measured broadband interference power

Parameter Name	Description
CI_I_NB_VALUE	C/I measurement measured narrowband interference power
CI_I_WB_VALUE	C/I measurement measured wideband interference power
CI_BB_VALUE	C/I measurement with broadband interference
CI_NB_VALUE	C/I measurement with narrowband interference
CI_WB_VALUE	C/I measurement with wideband interference

Parameter Name	Description
MKR_REF_FREQNx	Reference marker x frequency (where x is the marker number 0-5)
MKR_REF_POINTx	Reference marker x display point
MKR_REF_MAGNTx	Reference marker x magnitude
MKR_REF_PRCNTx	Reference marker x display percentage
MKR_REF_FLAGSx	Reference marker x flags: MKR_FLAG_ON_OFF　　　　　0x00000001 MKR_FLAG_NOISE　　　　　　0x00000002 MKR_FLAG_PHASE_NOISE　　0x00000004 MKR_FLAG_AMP_TRACK　　　0x00000008 MKR_FLAG_DELTA_MKR　　　0x00000020 MKR_FLAG_DATA_INVALID　　0x00000040 MKR_FLAG_DATA_STALE　　　0x00000080 MKR_FLAG_SELECTED　　　　0x00000100 MKR_FLAG_COUNTER　　　　0x00000200 MKR_FLAG_DELT_DISPL_PER_HZ 0x00000800 MKR_FLAG_TRACE_A　　　　0x00001000 MKR_FLAG_TRACE_B　　　　0x00002000 MKR_FLAG_TRACE_C　　　　0x00004000 MKR_FLAG_TRACE_MASK　　0x00007000
MKR_DLT_FREQNx	Delta marker x frequency (where x is the marker number 0-5)
MKR_DLT_POINTx	Delta marker x display point
MKR_DLT_MAGNTx	Delta marker x magnitude
MKR_DLT_PRCNTx	Delta marker x display percentage
MKR_DLT_FLAGSx	Delta marker x flags:

Parameter Name	Description
LIM_LFLAGS_UP-1	Upper limit flags:

	LIMIT_FLAG_UPPER 0x00000001 LIMIT_FLAG_ON 0x00000004 LIMIT_FLAG_ALARM_ON 0x00000002 LIMIT_FLAG_SEGMENTED 0x00000020 LIMIT_FLAG_ALARM_EVENT 0x00000040 LIMIT_FLAG_LEFT_OF_START_FREQ 0x00000080 LIMIT_FLAG_RIGHT_OF_STOP_FREQ 0x00000100 LIMIT_FLAG_MASK 0x000007FF
LIM_NUMPTS_UP-1	Number of upper limit points
LIM_FREQNC_UPx	Upper limit point x freq (where x is the limit point number starting with 0)
LIM_MAGNTD_UPx	Upper limit point x amplitude
LIM_LFLAGS_LO-1	Lower limit flags: LIMIT_FLAG_UPPER 0x00000001 LIMIT_FLAG_ON 0x00000004 LIMIT_FLAG_ALARM_ON 0x00000002 LIMIT_FLAG_SEGMENTED 0x00000020 LIMIT_FLAG_ALARM_EVENT 0x00000040 LIMIT_FLAG_LEFT_OF_START_FREQ 0x00000080 LIMIT_FLAG_RIGHT_OF_STOP_FREQ 0x00000100 LIMIT_FLAG_MASK 0x000007FF
LIM_NUMPTS_LO-1	Number of lower limit points
LIM_FREQNC_LOx	Lower limit point x freq (where x is the limit point number starting with 0)
LIM_MAGNTD_LOx	Lower limit point x amplitude

See Also:	`:TRACe:DATA`

TRIGger Subsystem

This subsystem contains commands related to the triggering of instrument functions for the purposes of synchronization. Related commands appear in the ABORt and INITiate subsystems.

Trigger Source

```
:TRIGger[:SEQuence]:SOURce IMMediate|EXTernal|VIDeo
:TRIGger[:SEQuence]:SOURce?
```
This command defines the trigger source.

IMMediate triggering is the equivalent of free-run triggering.

EXTernal triggering is triggered when a TTL signal is applied to the External Trigger input connector. EXTernal triggering is always done on the rising edge of the signal. It is available only in zero span mode.

VIDeo triggering is triggered based on the measured signal level. It is available only in zero span mode.

Factory Preset / `*RST`:	MS2721A: Immediate
Front Panel Access:	Shift-3 (Sweep), Trigger Type, Free Run|External|Video
See Also:	`:TRIGger[:SEQuence]:VIDeo:LEVel` `:TRIGger[:SEQuence]:VIDeo:POSition`

Video Trigger Level

```
:TRIGger[:SEQuence]:VIDeo:LEVel <amplitude>
:TRIGger[:SEQuence]:VIDeo:LEVel?
```
This command sets the video triggering level.

Factory Preset / `*RST`:	MS2721A: 10.0 dBm
Range:	MS2721A: 20 dBm to -120 dBm
Default Unit:	Current amplitude unit
Front Panel Access:	Shift-3 (Sweep), Trigger Type, Video

Video Trigger Position

```
:TRIGger[:SEQuence]:VIDeo:POSition <percentage>
:TRIGger[:SEQuence]:VIDeo:POSition?
```
This command sets the video triggering position as a percentage of the display.

When the sweep is triggered, the trigger point will be drawn at the location defined by the position. The graph appearing to the left of the trigger position is data acquired before the trigger. The graph appearing to the right of the trigger position is data acquired after the trigger.

Factory Preset / `*RST`:	MS2721A: 1.00%
Range:	MS2721A: 0% to 100%
Default Unit:	%

Front Panel Access:	Shift-3 (Sweep), Trigger Type, Change Trigger Position

UNIT Subsystem

The unit subsystem is used to modify the default units used for related parameters. These changes affect parameters in both commands and responses.

Measurement Units

:UNIT:POWer DBM|DBV|DBMV|DBUV|V|W
:UNIT:POWer?
Sets the default amplitude units for input, output and display.

Factory Preset / *RST:	MS2721A: dBm
Front Panel Access:	Amplitude, Units, dBm|dBV|dBmV|dBuV|Volt|Watt

4 Measurement Commands

Measurement Command Overview

The measurement commands provide a high-level set of commands to access instrument-specific measurements. While the group of measure instructions is defined in the SCPI standard, the implementation of many specific measurements is not. The five measurement instructions are defined below. The behavior of each command will be defined with each measurement.

MEASure

This command is the most high-level command. It combines the commands CONFigure and READ commands.

CONFigure

This command takes the instrument from its current state, enables the measurement and puts the instrument into single sweep mode, awaiting an :INITiate command. It corrects any parameters that are invalid given the new measurement state such that a valid measurement can take place. Other settings may be changed, see the documentation of CONFigure for each measurement.

READ

This command combines the ABORt, INITiate and FETCh commands. It makes the measurement based on the current configuration of the instrument. It will not return until data collection is complete.

INITiate

This command begins the collection of data.

FETCh

This command calculates and returns the acquired data. It will not return until data collection is complete.

4.1 Spectrum Analyzer

CONFigure Commands

This set of commands prepares the instrument for the selected measurement. It disables any currently-enabled measurements and activates the specified measurement. It sets the instrument to single sweep mode, waiting for an :INITiate command. It will not initiate the taking of a measurement.

Current instrument settings may be changed to default values. These changes will be identified with their respective measurement commands.

The `CONFigure?` query returns the name of the current measurement.

Configure Adjacent Channel Power Ratio
`:CONFigure:ACPower`
Configures the default adjacent channel power ratio measurement.

Disables any other active one-button measurements, including channel power, occupied bandwidth, AM/FM demodulation and C/I.

Sets the main channel bandwidth equal to the span.

Sets the adjacent channel bandwidth and channel spacing equal to the main channel bandwidth.

Sets the detection method to RMS.

Sets the instrument to single sweep mode (`:INITiate:CONTinuous OFF`).

Measurement settings can be modified by using the `[:SENSe]:ACPower` commands before initiating a sweep.

See Also:	`[:SENSe]:ACPower:STATe`
	`[:SENSe]:ACPower:BANDwidth|BWIDth:MAIN`
	`[:SENSe]:ACPower:BANDwidth|BWIDth:ADJacent`
	`[:SENSe]:ACPower:BANDwidth|BWIDth:SPACing`

Configure Channel Power
`:CONFigure:CHPower`
Configures the default channel power measurement.

Disables any other active one-button measurements, including ACPR, occupied bandwidth, AM/FM demodulation and C/I.

Sets the integration bandwidth equal to the span.

Sets the detection method to RMS.

Sets the instrument to single sweep mode (`:INITiate:CONTinuous OFF`).

Measurement settings can be modified by using the `[:SENSe]:CHPower` commands before initiating a sweep.

See Also:	`:SENSe:CHPower:STATe` `:SENSe:CHPower:BANDwidth|BWIDth:INTegration`

Configure Occupied Bandwidth

`:CONFigure:OBWidth`

Configures the default occupied bandwidth measurement.

Disables any other active one-button measurements, including channel power, ACPR, AM/FM demodulation and C/I.

Sets the method to %.

Sets the % of power to 99%.

Sets the instrument to single sweep mode (`:INITiate:CONTinuous OFF`).

Measurement settings can be modified by using the `[:SENSe]:OBWidth` commands before initiating a sweep.

See Also:	`[:SENSe]:OBWidth:STATe`
	`[:SENSe]:OBWidth:METHod`
	`[:SENSe]:OBWidth:PERCent`
	`[:SENSe]:OBWidth:XDB`

FETCh Commands

This set of commands returns the most recent measurement data of the active measurement. They will not switch to another measurement.

To get new measurement data, use the READ command.

Fetch Adjacent Channel Power Ratio

:FETCh:ACPower?

Returns the most recent adjacent channel power ratio measurement results.

Data is returned as 3 comma-separated values: main channel power, lower adjacent channel power, upper adjacent channel power.

Default Units:	Current amplitude units

Fetch Channel Power/Density

:FETCh:CHPower?

Returns the most recent channel power measurement results: channel power and channel power density.

Data is returned as 2 comma-separated values: channel power, channel power density.

Default Units:	Current amplitude units
See Also:	:FETCh:CHPower:CHPower? :FETCh:CHPower:DENSity?

Fetch Channel Power

:FETCh:CHPower:CHPower?

Returns the most recent channel power measurement result. It returns only the channel power, not the channel power density. Use :FETCh:CHPower? to get both channel power and channel power density.

Default Units:	Current amplitude units
See Also:	:FETCh:CHPower? :FETCh:CHPower:DENSity?

Fetch Channel Power Density

:FETCh:CHPower:DENSity?

Returns the most recent channel power density measurement result. It returns only the channel power density, not the channel power. Use :FETCh:CHPower? to get both channel power and channel power density.

Default Units:	Current amplitude units
See Also:	:FETCh:CHPower? :FETCh:CHPower:CHPower?

Fetch Occupied Bandwidth

:FETCh:OBWidth?

Returns the most recent occupied bandwidth measurement results: occupied bandwidth, percent of power and dB down.

One of either percent of power or dB down will be measured and the other will be set. That will be determined by the value set using `[:SENSe]:OBWidth:METHod`.

Data is returned as 3 comma-separated values: occupied bandwidth, percent of power, dB down.

Default Units:	For OBW: Hz
	For Percent of Power: %
	For dB Down: dB

MEASure Commands

These command take the instrument from its current state, enable the specified measurement and put the instrument into single sweep mode. They correct any parameters that are invalid given the new measurement state such that a valid measurement can take place. Other settings may be changed; see the documentation of CONFigure for each measurement. They then initiate the measurement. When the measurement is complete, they return the result.

To make a measurement with settings other than the "default" measurement settings applied by CONFigure, do the following:
- Send the appropriate CONFigure command to set the desired measurement.
- Modify the settings as required.
- Send the appropriate READ command to measure and return the result.

To get the current measurement data, use the appropriate FETCh command.

Measure Adjacent Channel Power Ratio

`:MEASure:ACPower?`
Sets the active measurement to adjacent channel power ratio, sets the default measurement parameters, triggers a new measurement and returns the main channel power lower adjacent and upper adjacent channel power results.

It is a combination of the commands `:CONFigure:ACPower;:READ:ACPower?`

For a description of the default adjacent channel power ratio measurement parameters see `:CONFigure:ACPower`.

To make an adjacent channel power ratio measurement with settings other than the default values send
- `:CONFigure:ACPower`
- Commands to set desired settings
- `:READ:ACPower?`

Data is returned as 3 comma-separated values: main channel power, lower adjacent channel power, upper adjacent channel power.

Default Units:	Current amplitude units
See Also:	`:CONFigure:ACPower`

Measure Channel Power/Density

`:MEASure:CHPower?`
Sets the active measurement to channel power, sets the default measurement parameters, triggers a new measurement and returns the channel power and channel power density results.

It is a combination of the commands `:CONFigure:CHPower;:READ:CHPower?`

For a description of the default channel power measurement parameters see `:CONFigure:CHPower`.

To make a channel power measurement with settings other than the default values send

- `:CONFigure:CHPower`
- Commands to set desired settings
- `:READ:CHPower?`

Data is returned as 2 comma-separated values: channel power, channel power density.

Default Units:	Current amplitude units
See Also:	`:MEASure:CHPower:CHPower?`
	`:MEASure:CHPower:DENSity?`
	`:CONFigure:CHPower`

Measure Channel Power

`:MEASure:CHPower:CHPower?`
Sets the active measurement to channel power, sets the default measurement parameters, triggers a new measurement and returns the channel power result. To measure both channel power and channel power density use `:MEASure:CHPower?`

It is a combination of the commands
`:CONFigure:CHPower;:READ:CHPower:CHPower?`

For a description of the default channel power measurement parameters see
`:CONFigure:CHPower.`

To make a channel power measurement with settings other than the default values send

- `:CONFigure:CHPower`
- Commands to set desired settings
- `:READ:CHPower:CHPower?`

Default Units:	Current amplitude units
See Also:	`:MEASure:CHPower?`
	`:MEASure:CHPower:DENSity?`
	`:CONFigure:CHPower`

Measure Channel Power Density

`:MEASure:CHPower:DENSity?`
Sets the active measurement to channel power, sets the default measurement parameters, triggers a new measurement and returns the channel power density result. To measure both channel power and channel power density use `:MEASure:CHPower?`

It is a combination of the commands
`:CONFigure:CHPower;:READ:CHPower:DENSity?`

For a description of the default channel power measurement parameters see
`:CONFigure:CHPower.`

To make a channel power measurement with settings other than the default values send

- `:CONFigure:CHPower`
- Commands to set desired settings
- `:READ:CHPower:DENSity?`

Default Units:	Current amplitude units
See Also:	`:MEASure:CHPower?`
	`:MEASure:CHPower:CHPower?`
	`:CONFigure:CHPower`

Measure Occupied Bandwidth

`:MEASure:OBWidth?`

Sets the active measurement to occupied bandwidth, sets the default measurement parameters, triggers a new measurement and returns the occupied bandwidth, percent of power and dB down results.

It is a combination of the commands `:CONFigure:OBWidth;:READ:OBWidth?`

For a description of the default occupied bandwidth measurement parameters see `:CONFigure:OBWidth`.

To make an occupied bandwidth measurement with settings other than the default values send

- `:CONFigure:OBWidth`
- Commands to set desired settings
- `:READ:OBWidth?`

Data is returned as 3 comma-separated values: occupied bandwidth, percent of power, dB down.

Default Units:	For OBW: Hz
	For Percent of Power: %
	For dB Down: dB
See Also:	`:CONFigure:OBWidth`

READ Commands

This set of commands combines the ABORt, INITiate and FETCh commands. It aborts any current triggering sequence and sets the trigger state to idle. It then initiates a new active measurement (i.e. begins the collection of new data). When the measurement is complete, it returns the result. These commands will not switch to another measurement.

To get the current measurement data, use the FETCh command.

Read Adjacent Channel Power Ratio

`:READ:ACPower?`
Triggers a new adjacent channel power ratio measurement and returns the results: main channel power, lower adjacent and upper adjacent channel power. It is a combination of the commands `:ABORT;:INITiate;:FETCh:ACPower?`

The channel power measurement must be the active measurement (specified by `:CONFigure:ACPower`). The current measurement can be queried using `:CONFigure?`

Data is returned as 3 comma-separated values: main channel power, lower adjacent channel power, upper adjacent channel power.

See Also:	`:READ:ACPower?` `:CONFigure`

Read Channel Power/Density

`:READ:CHPower?`
Triggers a new channel power measurement and returns the results: channel power and channel power density. It is a combination of the commands `:ABORT;:INITiate;:FETCh:CHPower?`

The channel power measurement must be the active measurement (specified by `:CONFigure:CHPower`). The current measurement can be queried using `:CONFigure?`

Data is returned as 2 comma-separated values: channel power, channel power density.

See Also:	`:READ:CHPower:CHPower?`
	`:READ:CHPower:DENSity?`
	`:CONFigure`

Read Channel Power

`:READ:CHPower:CHPower?`
Triggers a new channel power measurement and returns the channel power result.

It is a combination of the commands
`:ABORT;:INITiate;:FETCh:CHPower:CHPower?`

It returns only the channel power, not the channel power density. Use `:READ:CHPower?` to get both channel power and channel power density.

The channel power measurement must be the active measurement (specified by
`:CONFigure:CHPower`). The current measurement can be queried using
`:CONFigure?`

Default Units:	Current amplitude units
See Also:	`:READ:CHPower?`
	`:READ:CHPower:DENSity?`
	`:CONFigure`

Read Channel Power Density

`:READ:CHPower:DENSity?`
Triggers a new channel power measurement and returns the channel power density result.

It is a combination of the commands
`:ABORT;:INITiate;:FETCh:CHPower:DENSity?`

It returns only the channel power density, not the channel power. Use
`:READ:CHPower?` to get both channel power and channel power density.

The channel power measurement must be the active measurement (specified by
`:CONFigure:CHPower`). The current measurement can be queried using
`:CONFigure?`

Default Units:	Current amplitude units
See Also:	`:READ:CHPower?`
	`:READ:CHPower:CHPower?`
	`:CONFigure`

Read Occupied Bandwidth

`:READ:OBWidth?`
Triggers a new occupied bandwidth measurement and returns the results: occupied
bandwidth, percent of power and dB down. It is a combination of the commands
`:ABORT;:INITiate;:FETCh:OBWidth?`

The occupied bandwidth measurement must be the active measurement (specified by
`:CONFigure:OBWidth`). The current measurement can be queried using
`:CONFigure?`

Data is returned as 3 comma-separated values: occupied bandwidth, percent of power, dB
down.

Default Units:	For OBW: Hz
	For Percent of Power: %
	For dB Down: dB
See Also:	`:CONFigure`

SENSe (Measurement Command) Subsystem

This subsystem contains commands related to preparing the instrument to make a particular measurement. These measurements are not defined in the SCPI standard so they are maintained separately here.

:SENSe:ACPower Subsystem

This subsystem includes commands related to configuring the adjacent channel power ratio measurement.

ACPR Adjacent Channel Bandwidth

```
[:SENSe]:ACPower:BANDwidth|BWIDth:ADJacent <freq>
[:SENSe]:ACPower:BANDwidth|BWIDth:ADJacent?
```
Sets the adjacent channel bandwidth for the ACPR measurement.

Factory Preset / *RST:	MS2721A: 10.35 MHz
Range:	MS2721A: 10 Hz to 7.1 GHz
Default Unit:	Hz
Front Panel Access:	Shift-4 (Measure), ACPR, Adj Ch BW

ACPR Main Channel Bandwidth

```
[:SENSe]:ACPower:BANDwidth|BWIDth:MAIN <freq>
[:SENSe]:ACPower:BANDwidth|BWIDth:MAIN?
```
Sets the main channel bandwidth for the ACPR measurement.

Factory Preset / *RST:	MS2721A: 10.35 MHz
Range:	MS2721A: 10 Hz to 7.1 GHz
Default Unit:	Hz
Front Panel Access:	Shift-4 (Measure), ACPR, Main Ch BW

ACPR Channel Spacing

```
[:SENSe]:ACPower:BANDwidth|BWIDth:SPACing <freq>
[:SENSe]:ACPower:BANDwidth|BWIDth:SPACing?
```
Sets the channel spacing for the ACPR measurement.

Factory Preset / *RST:	MS2721A: 10.35 MHz
Range:	MS2721A: 10 Hz to 7.1 GHz
Default Unit:	Hz
Front Panel Access:	Shift-4 (Measure), ACPR, Ch Spacing

ACPR Measurement State

```
[:SENSe]:ACPower:STATe OFF|ON|0|1
[:SENSe]:ACPower:STATe?
```
Sets the state of the adjacent channel power ratio measurement, ON or OFF.

When using :CONFigure:ACPower, the state is automatically set to ON.

Factory Preset / `*RST`:	MS2721A: OFF
Front Panel Access:	Shift-4 (Measure), ACPR, On/Off
See Also:	`:CONFigure:ACPower`

:SENSe:CHPower Subsystem

This subsystem includes commands related to configuring the channel power measurement.

Channel Power Integration Bandwidth

`[:SENSe]:CHPower:BANDwidth|BWIDth:INTegration <freq>`
`[:SENSe]:CHPower:BANDwidth|BWIDth:INTegration?`
Sets the integration bandwidth for the channel power measurement.

Integration bandwidth must be less than or equal to the frequency span.

Factory Preset / `*RST`:	MS2721A: 10.35 MHz
Range:	MS2721A: 10 Hz to 7.1 GHz
Default Unit:	Hz
Front Panel Access:	Shift-4 (Measure), Channel Power, Int BW
See Also:	`[:SENSe]:FREQuency:SPAN`

Channel Power Measurement State

`[:SENSe]:CHPower:STATe OFF|ON|0|1`
`[:SENSe]:CHPower:STATe?`
Sets the state of the channel power measurement, ON or OFF.

When using `:CONFigure:CHPower`, the state is automatically set to ON.

Factory Preset / `*RST`:	MS2721A: OFF
Front Panel Access:	Shift-4 (Measure), Channel Power, On/Off
See Also:	`:CONFigure:CHPower`

:SENSe:OBWidth Subsystem

This subsystem includes commands related to configuring the occupied bandwidth measurement.

Occupied Bandwidth Measurement Method

`[:SENSe]:OBWidth:METHod XDB|PERCent`
`[:SENSe]:OBWidth:METHod?`
Sets the method for calculating occupied bandwidth.

XDB calculates the occupied bandwidth based on points a specified number of dB below the carrier. Issue command `[:SENSe]:OBWidth:XDB` to set the number of dB to be used.

PERCent calculates the occupied bandwidth based on points a specified percentage of the carrier power below the carrier. Issue command `[:SENSe]:OBWidth:PERCent` to set the percentage to be used.

Factory Preset / *RST:	MS2721A: PERCent
Front Panel Access:	Shift-4(Measure), OCC BW, % Down|dBc Down
See Also:	[:SENSe]:OBWidth:XDB [:SENSe]:OBWidth:PERCent

Occupied Bandwidth Percent of Power

[:SENSe]:OBWidth:PERCent <percentage>
[:SENSe]:OBWidth:PERCent?
This command sets the percentage of carrier power used to measure the occupied bandwidth.

This value is used in the measurement if `:SENSe:OBWidth:METHod` is set to PERCent.

Factory Preset / *RST:	MS2721A: 99.00%
Range:	MS2721A: 0% to 100%
Default Unit:	%
Front Panel Access:	Shift-4 (Measure), OCC BW, %
See Also:	:SENSe:OBWidth:METHod

Occupied Bandwidth Measurement State

[:SENSe]:OBWidth:STATe OFF\|ON\|0\|1
[:SENSe]:OBWidth:STATe?
Sets the state of the occupied bandwidth measurement, ON or OFF.

When using `:CONFigure:OBWidth`, the state is automatically set to ON.

Factory Preset / *RST:	MS2721A: OFF
Front Panel Access:	Shift-4 (Measure), OCC BW, On/Off
See Also:	:CONFigure:OBWidth

Occupied Bandwidth dB Down

[:SENSe]:OBWidth:XDB <rel ampl>
[:SENSe]:OBWidth:XDB?
This command sets the number of dB below the carrier used to measure the occupied bandwidth.

This value is used in the measurement if `:SENSe:OBWidth:METHod` is set to XDB.

Factory Preset / *RST:	MS2721A: 3 dBc
Range:	MS2721A: 0 to 100 dBc
Default Unit:	dBc
Front Panel Access:	Shift-4 (Measure), OCC BW, dBc
See Also:	:SENSe:OBWidth:METHod

Appendix A Examples

C/C++

This example is run on the command line. It sends the *IDN? query to the instrument and prints the response to the console.

```cpp
// IdnExample.cpp : Microsoft Visual Studio-Generated Example
//          Based on Example 2-1 in the NI-VISA User Manual
//          Usage : IdnExample "TCPIP::xxx.xxx.xxx.xxx:inst0:INSTR"
//                  where xxx.xxx.xxx.xxx is the IP address of the
//                  instrument.
//          Output : The string identity string returned from the
//                  instrument.
//          VISA Header : visa.h  (must be included)
//          VISA Libarary : visa32.lib   (must be linked with)

#include "stdafx.h"
#include "stdio.h"
#include "string.h"
#include "visa.h"

#define BUFFER_SIZE 255

int main(int argc, char* argv[])
{
      ViStatus status; /* For checking errors */
      ViSession defaultRM, instr; /* Communication channels */
      ViUInt32 retCount; /* Return count from string I/O */
      ViChar buffer[BUFFER_SIZE]; /* Buffer for string I/O */
      char tempDisplay[BUFFER_SIZE]; /* Display buffer for example */
      char *pAddress;


      /* Make sure we got our address. */
      if ( argc < 2 )
      {
            printf("Usage: IdnExample
\"TCPIP::xxx.xxx.xxx.xxx:inst0:INSTR\"\n");
            printf("\t where xxx.xxx.xxx.xxx is the IP address of your
instrument.\n");
            return -1;
      }

      /* Store the address. */
      pAddress = argv[1];

      /* Begin by initializing the system*/
      status = viOpenDefaultRM(&defaultRM);

      if (status < VI_SUCCESS)
      {
            /* Error Initializing VISA...exiting*/
            printf("Can't initialize VISA\n");
            return -1;
```

```
        }

        /* Open communication with TCP/IP device at xxx.xxx.xxx.xxx*/
        /* NOTE: For simplicity, we will not show error checking*/
        /* TODO: Add error handling. */
        status = viOpen(defaultRM, pAddress, VI_NULL, VI_NULL, &instr);

        /* Set the timeout for message-based communication*/
        /* TODO: Add error handling. */
        status = viSetAttribute(instr, VI_ATTR_TMO_VALUE, 5000);

        /* Ask the device for identification */
        sprintf(buffer, "*IDN?\n");
        status = viWrite(instr, (unsigned char *)&buffer[0], 6,
&retCount);
        status = viRead(instr, (unsigned char *)buffer, BUFFER_SIZE,
&retCount);

        /* TODO:  Add code to process data. */
        strncpy(tempDisplay, buffer, retCount);
        tempDisplay[retCount] = 0;    /* Null-terminate display string. */
        printf("*IDN? Returned %d bytes: %s\n", retCount, tempDisplay);

        /* Close down the system */
        /* TODO: Add error handling. */
        status = viClose(instr);
        status = viClose(defaultRM);

        return 0;
}
```

Visual Basic

This function can be called in a Visual Basic program. It sends the *IDN? query to the instrument and returns the byte count and ASCII response string.

```
Rem This example is based on Example 2-1 from the NI-VISA User Manual.

Public Sub IdnMain(ByVal address As String, ByRef byteCount As String,
ByRef returnBytes As String)
    Const BUFFER_SIZE = 200
    Dim stat As ViStatus
    Dim dfltRM As ViSession
    Dim sesn As ViSession
    Dim retCount As Long
    Dim buffer As String * BUFFER_SIZE

    Rem ***Include visa32.dll as a reference in your project.***

    Rem Begin by initializing the system
    stat = viOpenDefaultRM(dfltRM)
    If (stat < VI_SUCCESS) Then
        Rem Error initializing VISA...exiting
        MsgBox "Can't initialize VISA"
        Exit Sub
    End If

    Rem Open communication with GPIB Device at Primary Addr 1
    Rem NOTE: For simplicity, we will not show error checking
    Rem TODO: Add error handling.
    stat = viOpen(dfltRM, address, VI_NULL, VI_NULL, sesn)

    Rem Set the timeout for message-based communication
    Rem TODO: Add error handling.
    stat = viSetAttribute(sesn, VI_ATTR_TMO_VALUE, 5000)

    Rem Ask the device for identification
    Rem TODO: Add error handling.
    stat = viWrite(sesn, "*IDN?", 5, retCount)
    stat = viRead(sesn, buffer, BUFFER_SIZE, retCount)

    Rem TODO: Add code to process the data.
    byteCount = retCount
    returnBytes = Left(buffer, retCount)

    Rem Close down the system
    Rem TODO: Add error handling.
    stat = viClose(sesn)
    stat = viClose(dfltRM)
End Sub
```
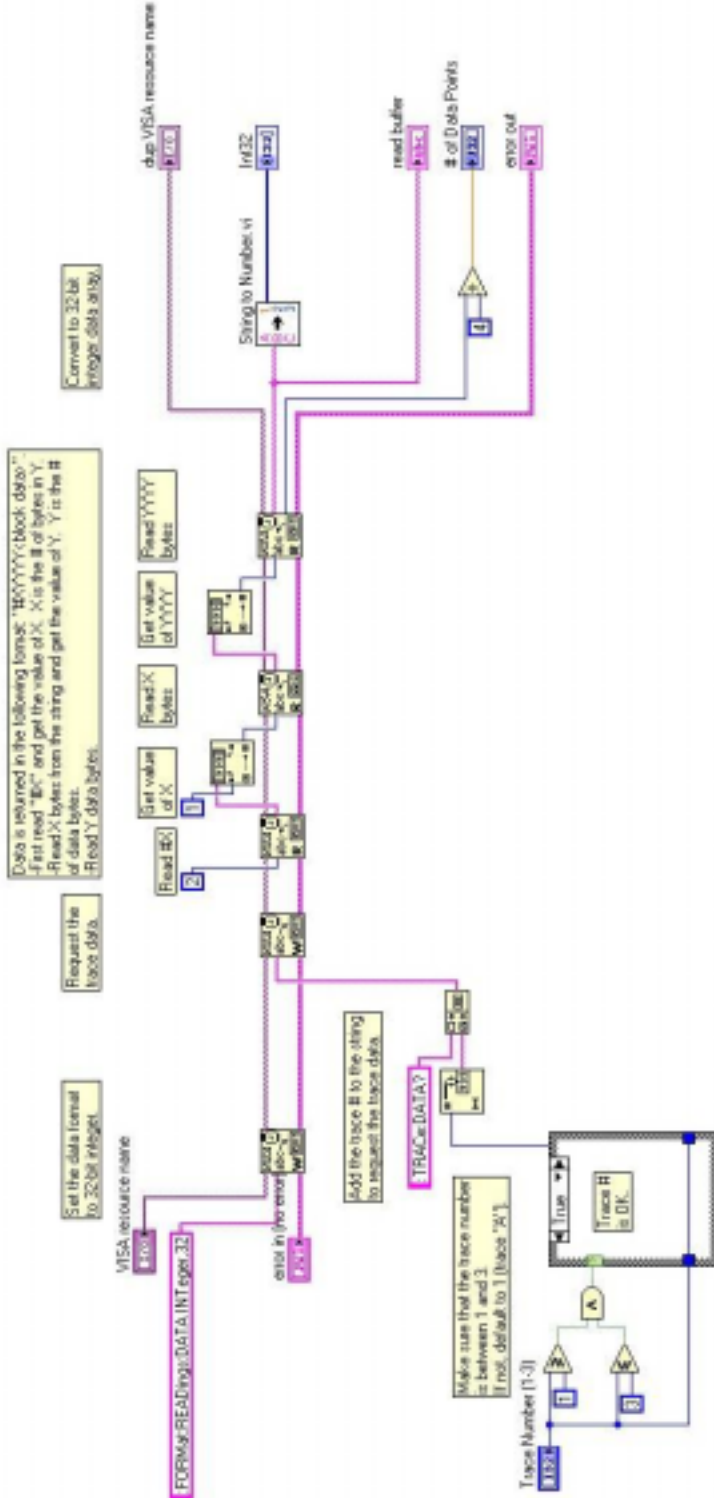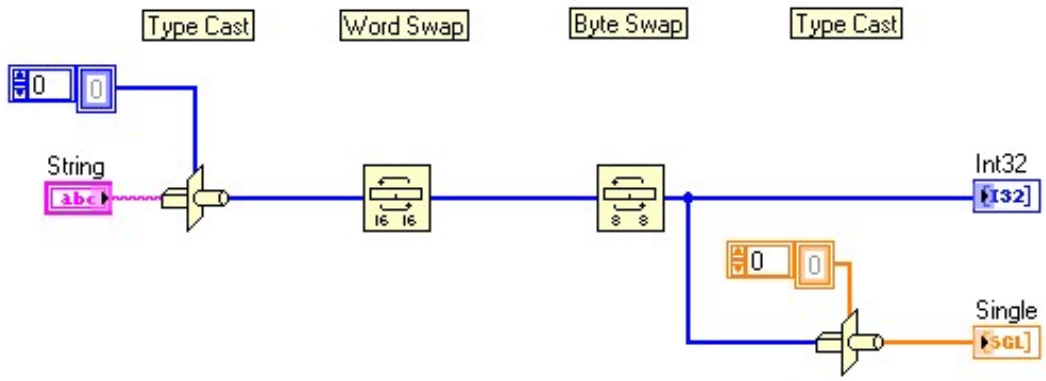
LabVIEW™

This example shows how to read the trace data from the instrument in 32-bit integer format. The output is an array of data point magnitudes. The first .vi pictured shows the data capture. The second .vi does the conversion.

String To Number.vi

Type Cast   Word Swap   Byte Swap   Type Cast

0 0

String   Int32
abc   [I32]

16 16   8 8

0 0

Single
[SGL]

Revision History

Date	Manual Section Name /Command Name	Change Description
1/31/05		Initial release
Manual Revision B (10580-00104A.pdf) Released		
3/17/05	:TRACe[:DATA] :TRACe[:DATA]?	Source/destination trace is now specified only as a number (A=1, B=2, C=3). Data can be sent to the instrument using :TRACe[:DATA] only in ASCII form. :TRACe[:DATA]? will return data in the format specified by :FORMat:DATA.
3/17/05	:TRACe:PREamble?	Source/destination trace is now specified only as a number (A=1, B=2, C=3).
3/17/05	*IDN?	Returns string with 1 set of double quotes.
3/21/05	Appendix A.	Added.
3/22/05	ABORt, INITiate:CONTinuous, INITiate:IMMediate, STATus:OPERation	IMMediate is an optional part of the INITiate[:IMMediate] command.
3/22/05	Trademark Acknowledgements	Added.
Manual Revision B (10580-00104B.pdf) Released		