Agilent 8163A/B Lightwave Multimeter, Agilent 8164A/B Lightwave Measurement System, & Agilent 8166A/B Lightwave Multichannel System

Programming Guide

Agilent Technologies

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In this Manual

This manual contains information about SCPI commands which can be used to program the following instruments:

- Agilent 8163A/B Lightwave Multimeter
- Agilent 8164A/B Lightwave Measurement System
- Agilent 8166A/B Lightwave Multichannel System

The Structure of this Manual

This manual is divided into 5 parts:

- *"Introduction to Programming" on page 13* gives a general introduction to SCPI programming with the Agilent 8163A/B Lightwave Multimeter, the Agilent 8164A/B Lightwave Measurement System, and the Agilent 8166A/B Lightwave Multichannel System.
- *"Specific Commands" on page 35* lists all instrument specific commands.
- *"Instrument Setup and Status" on page 47*, *"Measurement Operations & Settings" on page 71*, and *"Mass Storage, Display, and Print Functions" on page 171* give fuller explanations of all instrument specific commands.
- *"VISA Programming Examples" on page 175* gives some example programs showing how the SCPI commands can be used with the Agilent 8163A/B Lightwave Multimeter, the Agilent 8164A/B Lightwave Measurement System, and the Agilent 8166A/B Lightwave Multichannel System.
- *"The Agilent 816x VXIplug&play Instrument Driver" on page 197*, *"GPIB Command Compatibility List" on page 245*, and *"Error Codes" on page 229* give information about the Agilent 816x VXI*plug&play* Instrument Driver, compatibility issues, and error codes.

Conventions used in this Manual

- All commands and typed text is written in Courier font, for example `INIT[:IMM]`.

- SCPI commands are written in mixed case: text that you MUST print is written in capitals; text which is helpful but nor necessary is written in lower case.

  So, the command `INITiate[:IMMediate]` can be entered either as `init[:imm]`, or as `initiate[:immediate]`. It does not matter whether you enter text using capitals or lower-case letters.

- SCPI commands often contain extra arguments in square brackets. These arguments may be helpful, but they need not be entered.

  So, the command `INITiate[:IMMediate]` can be entered as `init` or `initiate:imm`.

- A SCPI command which can be either a command or a query is appended with the text `/?`.

  So, `DISPlay:ENABle/?` refers to both the command `DISPlay:ENABle` and the query `DISPlay:ENABle?`.

Related Manuals

You can find more information about the instruments covered by this manual in the following manuals:

- *Agilent 8163A/B Lightwave Multimeter, Agilent 8164A/B Lightwave Measurement System, & Agilent 8166A/B Lightwave Multichannel System User's Guide* (Agilent Product Number 08164-90B14).

NOTE Please note that User Guides no longer contain programming information, and must now be used in conjunction with this manual.

Refer to the books listed on page 15 for additional information about the General Purpose Interface Bus, GPIB.

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Introduction to Programming

This chapter gives general information on how to control your instrument remotely.

Descriptions for the actual commands for the instruments are given in the following chapters. The information in these chapters is specific to the Agilent 8163A/B Lightwave Multimeter, Agilent 8164A/B Lightwave Measurement System, and Agilent 8166A/B Lightwave Multichannel System and assumes that you are already familiar with programming the GPIB.

GPIB Interface

The interface used by your instrument is the GPIB (General Purpose Interface Bus).

GPIB is the interface used for communication between a controller and an external device, such as the tunable laser source. The GPIB conforms to IEEE standard 488-1978, ANSI standard MC 1.1 and IEC recommendation 625-1.

If you are not familiar with the GPIB, then refer to the following books:

- The International Institute of Electrical and Electronics Engineers. *IEEE Standard 488.1-1987, IEEE Standard Digital Interface for Programmable Instrumentation*. New York, NY, 1987
- The International Institute of Electrical and Electronics Engineers. *IEEE Standard 488.2-1987, IEEE Standard Codes, Formats, Protocols and Common Commands For Use with ANSI/IEEE Std 488.1-1987*. New York, NY, 1987

To obtain a copy of either of these last two documents, write to:

The Institute of Electrical and Electronics Engineers, Inc.
345 East 47th Street
New York, NY 10017
USA.

In addition, the commands not from the IEEE-488.2 standard, are defined according to the Standard Commands for Programmable Instruments (SCPI).

For information about SCPI, and SCPI programming techniques, please refer to:

- The SCPI Consortium: *Standard Commands for Programmable Instruments*. To obtain a copy of this manual, contact the following address:

  SCPI Consortium Office
  Bode Enterprise
  2515 Camino del Rio South, Suite 340
  San Diego, CA, 92108
  USA

  Web: http://www.scpiconsortium.org

The interface of the Agilent 8163A/B Lightwave Multimeter, Agilent 8164A/B Lightwave Measurement System, and Agilent 8166A/B Lightwave Multichannel System to the GPIB is defined by the IEEE Standards 488.1 and 488.2.

Table 1 shows the interface functional subset that the instruments implement.

Table 1 GPIB Capabilities

Mnemonic	Function
SH1	Complete source handshake capability
AH1	Complete acceptor handshake capability
T6	Basic talker; serial poll; no talk only mode; unaddressed to talk if addressed to listen
L4	Basic listener; no listen only mode; unaddressed to listen if addressed to talk
SR0	No service request capability
RL1	Complete remote/local capability
PP0	No parallel poll capability
DC1	Complete device clear capability
DT0	No device trigger capability
C0	No controller capability.

Setting the GPIB Address

There are two ways to set the GPIB address:

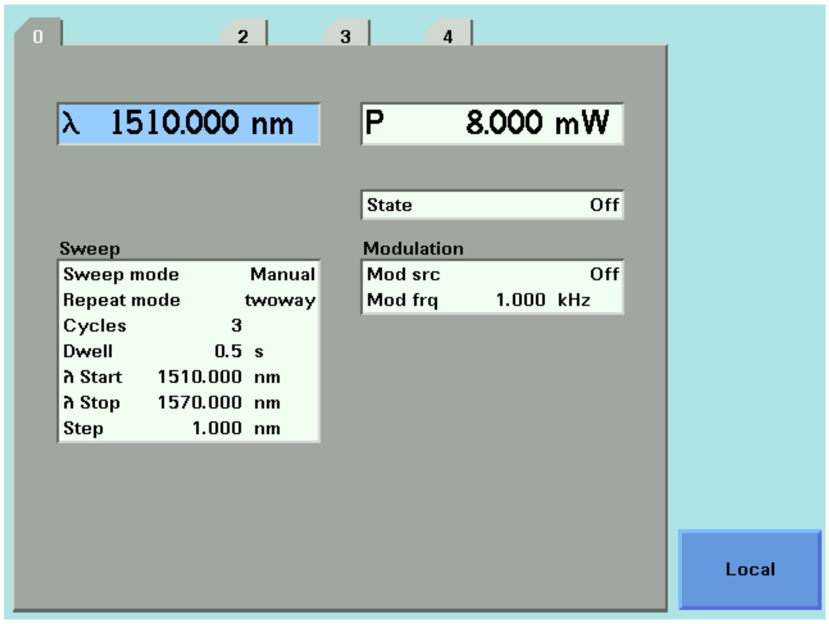
- You can set the GPIB address by using the command *":SYSTem:COMMunicate:GPIB[:SELF]:ADDRess" on page 69*.
- You can set the GPIB address from the front panel. See your instrument's *User's Guide* for more information.

The default GPIB address is 20.

NOTE GPIB address 21 is often applied to the GPIB controller. If so, 21 cannot be used as an instrument address.

Returning the Instrument to Local Control

If the instrument is in remote control, a screen resembling Figure 1 will appear. Press [Local] if you wish to return the instrument to local control.



λ 1510.000 nm

P 8.000 mW

State	Off

Sweep

Sweep mode	Manual
Repeat mode	twoway
Cycles	3
Dwell	0.5 s
λ Start	1510.000 nm
λ Stop	1570.000 nm
Step	1.000 nm

Modulation

Mod src	Off
Mod frq	1.000 kHz

Figure 1 Remote Control

NOTE If your Agilent 8163A/B, 8164A/B or 8166A/B is in local lockout mode (refer to DISPlay:LOCKout on page 142) the Local softkey is not available.

Message Queues

The instrument exchanges messages using an input and an output queue. Error messages are kept in a separate error queue.

How the Input Queue Works

The input queue is a FIFO queue (first-in first-out). Incoming bytes are stored in the input queue as follows:

1 Receiving a byte:
   - Clears the output queue.
   - Clears Bit 7 (MSB).
2 No modification is made inside strings or binary blocks. Outside strings and binary blocks, the following modifications are made:
   - Lower-case characters are converted to upper-case.
   - The characters 00_{16} to 09_{16} and $0B_{16}$ to $1F_{16}$ are converted to spaces (20_{16}).
   - Two or more blanks are truncated to one.
3 An EOI (End Or Identify) sent with any character is put into the input queue as the character followed by a line feed (LF, $0A_{16}$). If EOI is sent with a LF, only one LF is put into the input queue.
4 The parser starts if the LF character is received or if the input queue is full.

Clearing the Input Queue

Switching the power off, or sending a Device Interface Clear signal, causes commands that are in the input queue, but have not been executed to be lost.

The Output Queue

The output queue contains responses to query messages. The instrument transmits any data from the output queue when a controller addresses the instrument as a talker.

Each response message ends with a carriage return (CR, $0D_{16}$) and a LF ($0A_{16}$), with EOI=TRUE. If no query is received, or if the query has an error, the output queue remains empty.

The Message Available bit (MAV, bit 4) is set in the Status Byte register whenever there is data in the output queue.

The Error Queue

The error queue is 30 errors long. It is a FIFO queue (first-in first-out). That is, the first error read is the oldest error to have occurred. For example:

1 If no error has occurred, the error queue contains:
```
+0,"No error"
```
2 After a command such as `wav:pow`, the error queue now contains:
```
+0,"No error"
-113, "Undefined header"
```
3 If the command is immediately repeated, the error queue now contains:
```
+0,"No error"
-113, "Undefined header"
-113, "Undefined header"
```

If more than 29 errors are put into the queue, the message:

```
-350, "Queue overflow"
```

is placed as the last message in the queue.

Programming and Syntax Diagram Conventions

A program message is a message containing commands or queries that you send to the instruments. The following are a few points about program messages:

- You can use either upper-case or lower-case characters.
- You can send several commands in a single message. Each command must be separated from the next one by a semicolon (`;`).
- A command message is ended by a line feed character (LF) or `<CR><LF>`.
- You can use any valid number/unit combination.

  In other words, `1500NM`,`1.5UM` and `1.5E-6M` are all equivalent.

  If you do not specify a unit, then the default unit is assumed. The default unit for the commands are given with command description in the next chapter.

Short Form and Long Form

The instrument accepts messages in short or long forms.

For example, the message

```
:STATUS:OPERATION:ENABLE 768
```

is in long form.

The short form of this message is

```
:STAT:OPER:ENAB 768
```

In this manual, the messages are written in a combination of upper and lower case. Upper case characters are used for the short form of the message.

For example, the above command would be written

```
:STATus:OPERation:ENABle
```

The first colon can be left out for the first command or query in your message. That is, the example given above could also be sent as

```
STAT:OPER:ENAB 768
```

Command and Query Syntax

All characters not between angled brackets must be sent exactly as shown.

The characters between angled brackets (<...>) indicate the kind of data that you should send, or that you get in a response. You do not type the angled brackets in the actual message.

Descriptions of these items follow the syntax description. The following types of data are most commonly used:

string	is ascii data. A string is contained between double quotes (`"..."`) or single quotes (`'...'`).
value	is numeric data in integer (`12`), decimal (`34.5`) or exponential format (`67.8E-9`).
wsp	is a white space.

Other kinds of data are described as required.

The characters between square brackets (`[...]`) show optional information that you can include with the message.

The bar (|) shows an either-or choice of data, for example, *a*|*b* means either *a* or *b*, but not both simultaneously.

Extra spaces are ignored, so spaces can be inserted to improve readability.

Units

Where units are given with a command, usually only the base units are specified. The full sets of units are given in the table below.

Table 2 Units and allowed Mnemonics

Unit	Default	Allowed Mnemonics
meters	M	PM, NM, UM, MM, M
decibel	DB	MDB, DB
second	S	NS, US, MS, S
decibel/1mW	DBM	MDBM, DBM
Hertz	HZ	HZ, KHZ, MHZ, GHZ, THZ
Watt	Watt	PW, NW, UW, MW, Watt
meters per second	M/S	NM/S, UM/S, MM/S, M/S

Data Types

With the commands you give parameters to the instrument and receive response values from the instrument. Unless explicitly specified these data are given in ASCII format. The following types of data are used:

- ***Boolean*** data may only have the values 0 or 1.
- ***Integer*** range is given for each individual command.
- ***Float*** variables may be given in decimal or exponential writing (0.123 or 123E-3).
  All ***Float*** values conform to the 32 bit IEEE Standard, that is, all ***Float*** values are returned as 32-bit real values.
- A ***string*** is contained between double quotes (`"`...`"`) or single quotes (`'`...`'`). When the instrument returns a string, it is always included in " " and terminated by `<END>`.
- When a ***register*** value is given or returned (for example *ESE), the ***decimal*** values for the single bits are added. For example, a value of nine means that bit 0 and bit 3 are set.
- Larger blocks of data are given as ***Binary Blocks***, preceded by "#<*H*><*Len*><*Block*>", terminated by `<END>`; <*H*> represents the number of digits, <*Len*> represents the number of bytes, and <*Block*> is the data block. For example, for a ***Binary Block*** with 1 digit and 6 bytes this is: `#16TRACES<END>`.

Slot and Channel Numbers

Each module is identified by a slot number and a channel number. For commands that require you to specify a channel, the slot number is represented by [*n*] in a command and the channel number is represented by [*m*].

The slot number represents the module's position in the mainframe. These are:

- from one to two for the Agilent 8163A/B,
- from zero to four for the Agilent 8164A/B, and
- from one to seventeen for the Agilent 8166A/B.

These numbers are displayed on the front panel beside each module slot.

NOTE The Agilent 8164A/B slot for a back-loadable tunable laser module is numbered zero.

Channel numbers apply to modules that have two inputs/outputs, for example, the Agilent 81635A Dual Power Sensor.

Modules with two channels, for example, the Agilent 81635A Dual Power Sensor, use the channel number to distinguish between these channels.

NOTE The channel number of single channel modules is always one.

For example, if you want to query slot 1, channel 2 with the command, *":SENSe[n]:[CHANnel[m]]:POWer:WAVelength?" on page 100*, you should send the command:

- :sens1:chan2:pow:wav?

NOTE If you do not specify a slot or channel number, the lowest possible number is used as the default value. This means:
•Slot 1 for the Agilent 8163A/B and Agilent 8166A/B mainframes.
•Slot 0 for the Agilent 8164A/B mainframe.
•Channel 1 for all channels.

Laser Selection Numbers

The laser selection number, [*l*], identifies the upper or lower wavelength laser source for dual wavelength Laser Source modules and Return Loss modules with two internal laser sources. The lower wavelength source is denoted by *1*. The upper wavelength source is denoted by *2*.

NOTE For Return Loss modules, *0* denotes the use of an external laser source as the input to your Return Loss module for the following commands:

- *":SENSe[n]:[CHANnel[m]]:RETurnloss:CORRection:FPDelta[l]" on page 102*,
- *":SENSe[n]:[CHANnel[m]]:RETurnloss:CORRection:FPDelta[l]?" on page 102*,
- *":SENSe[n]:[CHANnel[m]]:RETurnloss:CORRection:REFLectance[l]" on page 102*, and
- *":SENSe[n]:[CHANnel[m]]:RETurnloss:CORRection:FPDelta[l]" on page 102*.

Common Commands

The IEEE 488.2 standard has a list of reserved commands, called common commands. Some of these commands must be implemented by any instrument using the standard, others are optional.

Your instrument implements all the necessary commands, and some optional ones. This section describes the implemented commands.

Common Command Summary

Table 3 gives a summary of the common commands.

Table 3 Common Command Summary

Command	Parameter	Function	Page
*CLS		Clear Status Command	page 49
*ESE		Standard Event Status Enable Command	page 50
*ESE?		Standard Event Status Enable Query	page 50
*ESR?		Standard Event Status Register Query	page 51
*IDN?		Identification Query	page 51
*OPC		Operation Complete Command	page 52
*OPC?		Operation Complete Query	page 52
*OPT?		Options Query	page 53
*RST		Reset Command	page 53
*STB?		Read Status Byte Query	page 54
*TST?		Self Test Query	page 55
*WAI		Wait Command	page 56

NOTE These commands are described in more detail in *“IEEE-Common Commands” on page 49*.

Common Status Information

There are three registers for the status information. Two of these are status-registers and one is an enable-registers. These registers conform to the IEEE Standard 488.2-1987. You can find further descriptions of these registers under `*ESE`, `*ESR?`, and `*STB?`.

Figure 2 shows how the Standard Event Status Enable Mask (SESEM) and the Standard Event Status Register (SESR) determine the Event Status Bit (ESB) of the Status Byte.

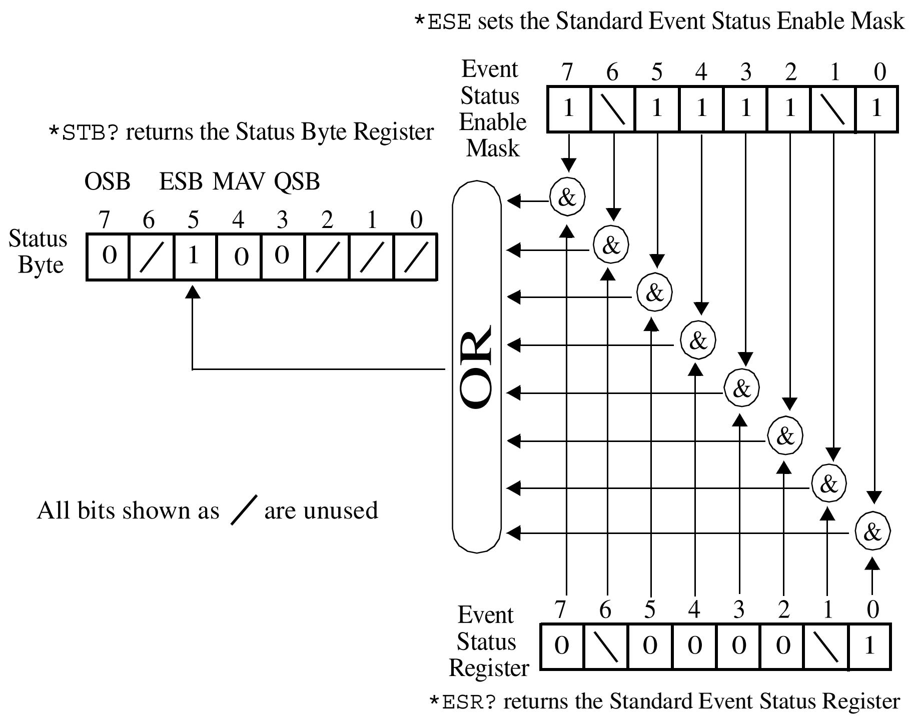

*ESE sets the Standard Event Status Enable Mask
Event Status Enable Mask
7 6 5 4 3 2 1 0
1 1 1 1 1 1
*STB? returns the Status Byte Register
OSB ESB MAV QSB
Status Byte
7 6 5 4 3 2 1 0
0 1 0 0
OR
&
All bits shown as ╱ are unused
Event Status Register
7 6 5 4 3 2 1 0
0 0 0 0 0 1
*ESR? returns the Standard Event Status Register

Figure 2 The Event Status Bit

The SESR contains the information about events that are not slot specific. For details of the function of each bit of the SESR, see *"Standard Event Status Register" on page 31*.

The SESEM allows you to choose the event that may affect the ESB of the Status Byte. If you set a bit of the SESEM to zero, the corresponding event cannot affect the ESB. The default is for all the bits of the SESEM to be set to 0.

The questionable and operation status systems set the Operational Status Bit (OSB) and the Questionable Status Bit (QSB). These status systems are described in *"The Status Model" on page 26* and *"Status Reporting – The STATus Subsystem" on page 57*.

NOTE Unused bits in any of the registers change to 0 when you read them.

The Status Model

Status Registers

Each node of the status circuitry has three registers:

- A condition register (CONDition), which contains the current status. This register is updated continuously. It is not changed by having its contents read.
- The event register (EVENt), which contains details of any positive transitions in the corresponding condition register, that is, when a bit changes from 0 → 1. The contents of this register are cleared when it is read. The contents of any higher-level registers are affected with regard to the appropriate bit.
- The enable register (ENABle), which enables changes in the event register to affect the next stage of registers.

NOTE The event register is the only kind of register that can affect the next stage of registers.

The structures of the Operational and Questionable Status Systems are similar. Figure 4 describe how the Questionable Status Bit (QSB) and the Operational Status Bit (OSB) of the Status Byte Register are determined.

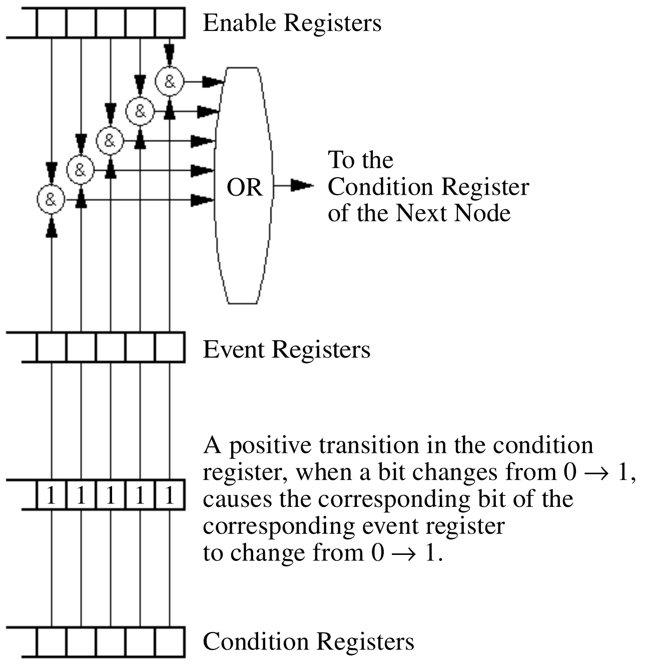

Enable Registers
&
OR
To the Condition Register of the Next Node
Event Registers
1 1 1 1 1
A positive transition in the condition register, when a bit changes from 0 → 1, causes the corresponding bit of the corresponding event register to change from 0 → 1.
Condition Registers

Figure 3 The Registers and Filters for a Node

The Operational/Questionable Slot Status Event Register (OSSER/QSSER) contains the status of a particular module slot. A bit changes from 0 → 1 when an event occurs, for example, when a laser is switched on. For details of the function of each bit of these registers, see *"Operation/Questionable Status Summary Register" on page 32*.

The Operational/Questionable Slot Enable Status Mask (OSESM/QSESM) allows you to choose the events for each module slot that may affect the Operational/Questionable Status Event Register (see below). If you set a bit of the OSESM/QSESM to zero, the occurence of the corresponding event for this particular module slot cannot affect the Operational/Questionable Status Event Register. The default is for all the bits of the OSESM/QSESM to be set to 0.

The Operational/Questionable Status Event Summary Register (OSESR/QSESR) summarizes the status of every module slot of your instrument. If, for any slot, any bit of the QSSER goes from 0 → 1 AND the corresponding bit of the QSSEM is 1 at the same time, the QSESR bit representing that slot is set to 1.

The Operational/Questionable Status Enable Summary Mask (OSESM/QSESM) allows you to choose the module slots that may affect the OSB/QSB of the Status Byte. If any bit of the QSESR goes from 0 → 1 AND the corresponding bit of the QSESM is 1 at the same time, the QSB of the Status Byte is set to 1. If you set a bit of the OSESM/QSESM to zero, the corresponding module slot cannot affect the OSB/QSB. The default is for all the bits of the OSESM/QSESM to be set to 0.

The Operational/Questionable Status Enable Summary Mask for the Agilent 8163A/B Lightwave Multimeter and the Agilent 8164A/B Lightwave Measurement System consists of one level. These are described in *“Status System for 8163A/B & 8164A/B” on page 29*.

As the Agilent 8166A/B Lightwave Multichannel System has 17 module slots, the Operational/Questionable Status Enable Summary Mask consists of two levels. This is described in *“Status System for 8166A/B” on page 29*.

Status System for 8163A/B & 8164A/B

The status system for the Agilent 8163A/B Lightwave Multimeter and the Agilent 8164A/B Lightwave Measurement System returns the status of 2 and 5 module slots respectively. The Operational/Questionable Status Summary Registers consist of one level and are described by Figure 4. Any commands that require LEVel*1* do not apply to these mainframes.

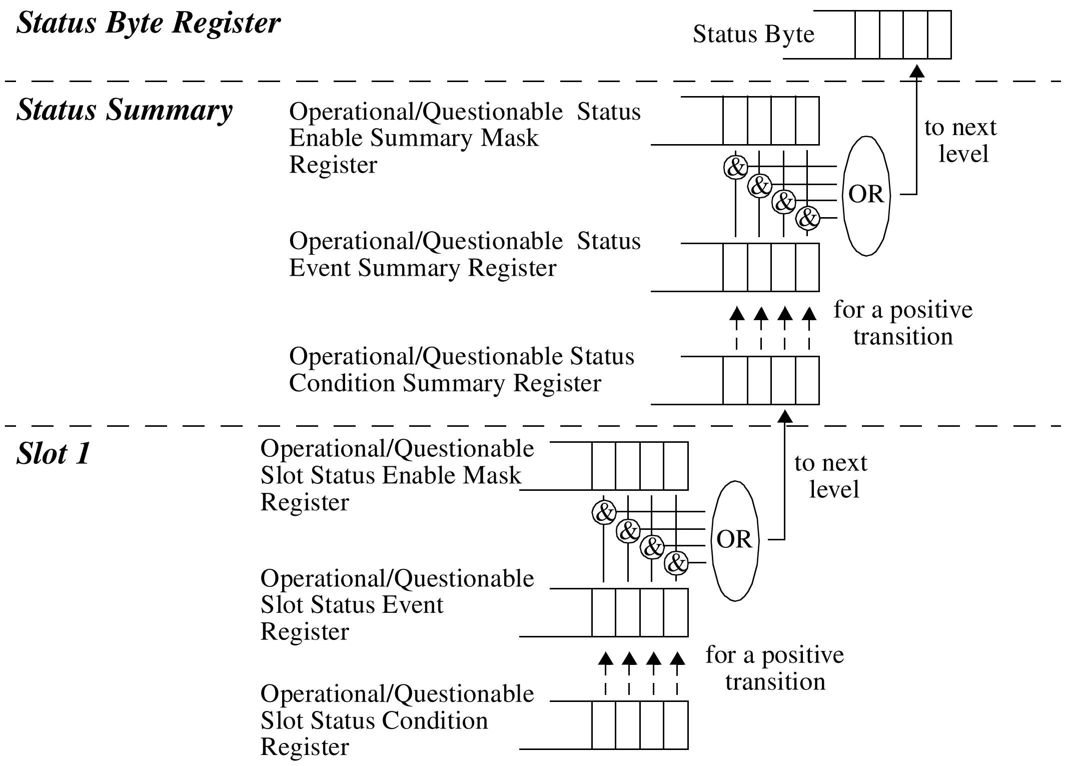

Status Byte Register
Status Byte
Status Summary
Operational/Questionable Status Enable Summary Mask Register
&
OR
to next level
Operational/Questionable Status Event Summary Register
for a positive transition
Operational/Questionable Status Condition Summary Register
Slot 1
Operational/Questionable Slot Status Enable Mask Register
to next level
Operational/Questionable Slot Status Event Register
for a positive transition
Operational/Questionable Slot Status Condition Register

Figure 4 The Operational/Questionable Status System for 8163A/B & 8164A/B

Status System for 8166A/B

The status system for the Agilent 8166A/B Lightwave Multichannel System returns the status of 17 module slots. The Operational/Questionable Status Summary Registers consists of two levels, as described by Figure 5.

Module slots 1 to 14 affect the Level 0 summary register as described in Figure 4. Bit 0 of the Level 0 summary registers represents the summary of the status of module slots 15, 16, and 17. The Level 1 summary registers contain an individual summary for each of these module slots.

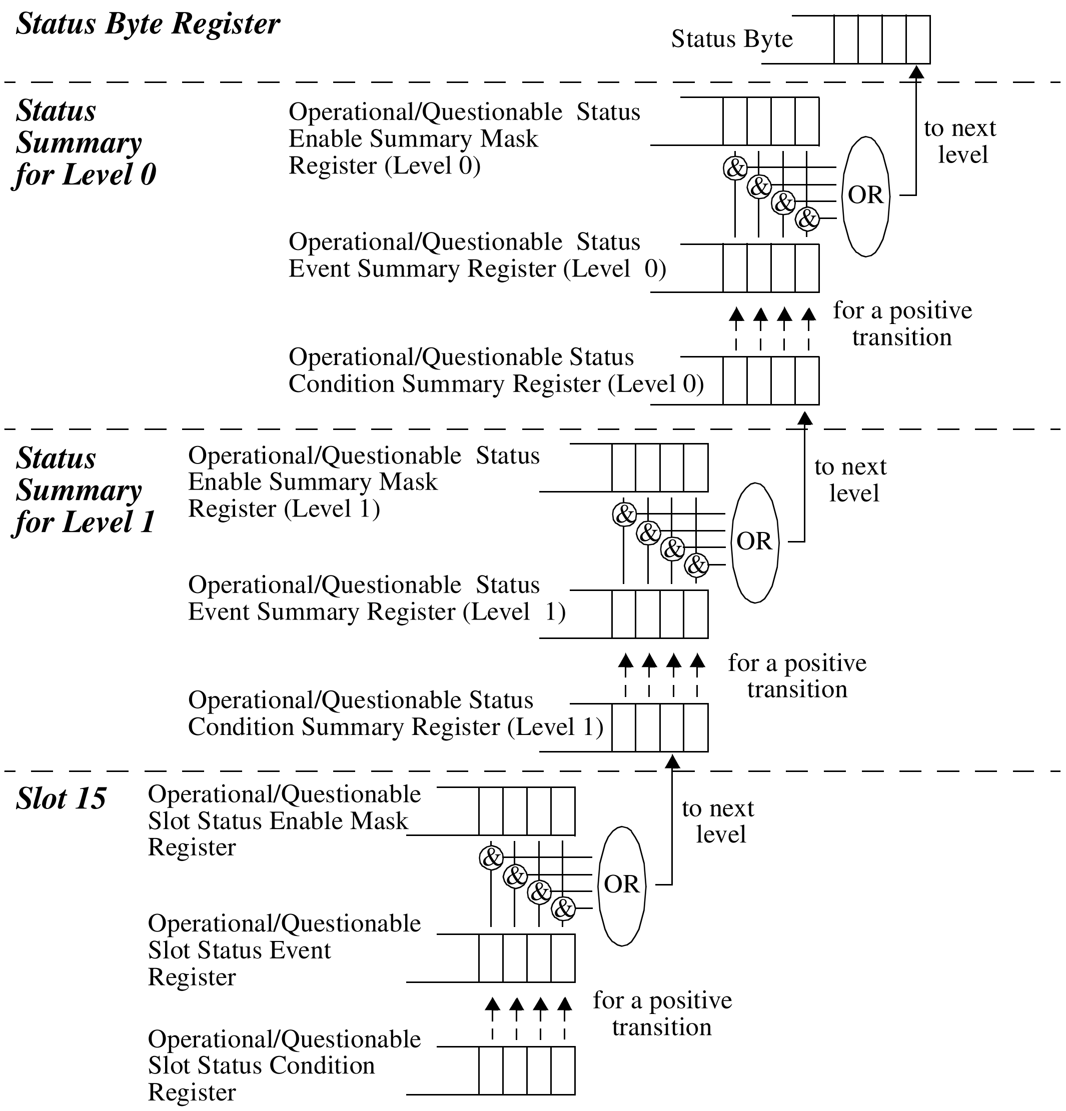

Status Byte Register
Status Byte
Status Summary for Level 0
Operational/Questionable Status Enable Summary Mask Register (Level 0)
OR
to next level
Operational/Questionable Status Event Summary Register (Level 0)
for a positive transition
Operational/Questionable Status Condition Summary Register (Level 0)
Status Summary for Level 1
Operational/Questionable Status Enable Summary Mask Register (Level 1)
OR
to next level
Operational/Questionable Status Event Summary Register (Level 1)
for a positive transition
Operational/Questionable Status Condition Summary Register (Level 1)
Slot 15
Operational/Questionable Slot Status Enable Mask Register
OR
to next level
Operational/Questionable Slot Status Event Register
for a positive transition
Operational/Questionable Slot Status Condition Register

Figure 5 The Operational/Questionable Status System for 8166A/B

Annotations

Status Byte Register

- Bit 3, the QSB, is built from the questionable event status register and its enable mask.
- Bit 4, the MAV, is set if the message output queue is not empty.
- Bit 5, the ESB, is built from the SESR and its SESEM.
- Bit 7, the OSB, is built from the operation event status register and its enable mask.
- All other bits are unused, and therefore set to 0.

Standard Event Status Register

- Bit 0 is set if an operation complete event has been received since the last call to `*ESR?`.
- Bit 1 is always 0 (no service request).
- Bit 2 is set if a query error has been detected.
- Bit 3 is set if a device dependent error has been detected.
- Bit 4 is set if an execution error has been detected.
- Bit 5 is set if a command error has been detected.
- Bit 6 is always 0 (no service request).
- Bit 7 is set for the first call of `*ESR?` after Power On.

Operation/Questionable Status Summary

- The Operation/Questionable Status Summary consist of a condition and an event register.
- A "rising" bit in the condition register is copied to the event register.
- A "falling" bit in the condition register has no effect on the event register.
- Reading the condition register is non-destructive.
- Reading the event register is destructive.
- A summary of the event register and its enable mask is set in the status byte.

Operation/Questionable Status Summary Register

- Bits 0 to 4 are built from the OSSER/QSSER and the OSSEM/QSSEM.
- A summary of the event register, the condition register and the enable mask is set in the status byte.

Operation/Questionable Slot Status

- The Operation/Questionable Slot Status consist of a condition and an event register.
- A "rising" bit in the condition register is copied to the event register.
- A "falling" bit in the condition register has no effect on the event register.
- Reading the condition register is non-destructive.
- Reading the event register is destructive.
- A summary of the event register, the condition register and the enable mask is set in the status byte.

Operation Slot Status Register

- Bit 0 is set if the laser is switched on.
- Bit 1 is set if the Coherence Control is switched on.
- Bit 3 is set if Power Meter zeroing or Tunable Laser module lambda zeroing is ongoing.
- Bit 4 is set if the attenuator output is enabled (shutter open).
- Bits 5 - 7 are set if the wavelength offset table is enabled (see page 61).
- All other bits are unused, and therefore set to 0.

Questionable Slot Status Register

- Bit 0 is set if excessive power is set by the user for any source module or if excessive averaging time is set for any Power Meter.
- Bit 1 is set if the last Power Meter zeroing failed.
- Bit 2 is set if temperature is out of range.
- Bit 3 is set if laser protection is switched on.

- Bit 4 is set if the module has not settled, as during the automatic settling of a Tunable Laser module.
- Bit 5 is set if the module is out of specifications, or if lambda zeroing failed for a Tunable Laser module.
- Bit 6 is set if ARA is recommended.
- Bit 7 is set if the duty cycle is out of range.
- Bit 8 is set if coherence control is uncalibrated
- Bit 9 is set if attenuator beam path protection is enabled (shutter is closed)
- Bit 10 is set if lambda zeroing is recommended.
- All other bits are unused, and therefore set to 0.

Status Command Summary

*STB?	returns status byte, value 0 .. +255
*ESE	sets the standard event status enable mask, parameter 0 .. +255
*ESE?	returns SESE, value 0 .. +255
*ESR?	returns the standard event status register, value 0 .. +255
*OPC	parses all program message units in the message queue, and prevents the instrument from executing any further commands until all pending commands are completed.
*OPC?	returns 1 if all operations (scan trace printout, measurement) are completed. Otherwise it returns 0.
*CLS	clears the status byte and SESR, and removes any entries from the error queue.
*RST	clears the error queue, loads the default setting, and restarts communication. **NOTE:** *RST does NOT touch the STB or SESR. A running measurement is stopped.
*TST?	initiates an instrument selftest and returns the results as a 32 bit LONG.

Other Commands

*OPT?	returns the installed modules and the slots these modules are installed in: For example, `*OPT?` → 81682A, 81533B, 81532A, , Modules 81682A, 81533B, and 81532A are installed in slots 0 to 2 respectively. Slots 3 and 4 are empty.
*WAI	prevents the instrument from executing any further commands until the current command has finished executing. All pending operations are completed during the wait period.
*IDN?	identifies the instrument; returns the manufacturer, instrument model number, serial number, and firmware revision level.

Specific Commands

This chapter lists all the instrument specific commands relating to the Agilent 8163A/B Lightwave Multimeter, the Agilent 8164A/B Lightwave Measurement System, and the Agilent 8166A/B Lightwave Multichannel System with a single-line description.

Each of these summaries contains a page reference for more detailed information about the particular command later in this manual.

Specific Command Summary

The commands are ordered in a command tree. Every command belongs to a node in this tree.

The root nodes are also called the subsystems. A subsystem contains all commands belonging to a specific topic. In a subsystem there may be further subnodes.

All the nodes have to be given with a command. For example in the command `disp:brig`

- `DISPlay` is the subsystem containing all commands for controlling the display,
- `BRIGhtness` is the command selecting brightness.

NOTE If a command and a query are both available, the command ends `/?`. So, `disp:brig/?` means that `disp:brig` and `disp:brig?` are both available.

Table 1 gives an overview of the command tree. You see the nodes, the subnodes, and the included commands.

Table 1 Specific Command Summary

Command	Description	Page
:CONFigure[*n*][:CHANnel[*m*]]:OFFSet		
:WAVelength:REFerence/?	Sets or queries the slot and channel of the external reference powermeter.	page 147
:WAVelength:STATe/?	Switches or queries attenuator Offset Table on or off/?	page 146
:WAVelength:TABle?	Queries the complete offset table.	page 150
:WAVelength:TABle:SIZE?	Queries the size of the offset table.	page 150
:WAVelength:VALue	Adds a value pair (wavelength, offset) to the offset table.	page 147
:WAVelength:VALue:DELete	Deletes an offset value pair.	page 149
:WAVelength:VALue:DELete:ALL	Deletes all value pairs from the offset table.	page 149
:WAVelength:VALue:OFFSet?	Queries an offset value according to wavelength or index.	page 148
:WAVelength:VALue:PAIR?	Queries an offset/wavelength value pair according to wavelength or index.	page 149
:WAVelength:VALue:WAVelength?	Queries a wavelength value from its index in the offset table	page 148

Table 1 Specific Command Summary (continued)

Command	Description	Page
:DISPlay		
:BRIGhtness/?	Controls or queries the current display brightness.	page 173
:CONTrast/?	Controls or queries the current display contrast.	page 173
:ENABle/?	Switches the display on or off, or queries whether the display is on or off.	page 174
:LOCKout/?	Sets or queries local lockout mode.	page 174
:FETCh[*n*][:CHANnel[*m*]][:SCALar]		
:POWer[:DC]?	Returns a power value from a sensor.	page 79
:RETurnloss?	Returns the current return loss value.	page 80
:MONitor?	Returns the current power value from the monitor diode within a return loss module.	page 80
:INITiate[*n*]:[CHANnel[*m*]]		
[:IMMediate]	Starts a measurement.	page 80
:CONTinuous/?	Starts or Queries a single/continuous measurement.	page 81
:LOCK/?	Switches the lock on/off or returns the current state of the lock.	page 73
:INPUT[*n*][:CHANnel[*m*]]		
:ATTenuation/?	Sets or returns the attenuation factor for the instrument.	page 135
:OFFset/?	Sets or returns the offset factor for the instrument.	page 136
:OFFset:DISPlay	Sets the offset factor so that attenuation factor is zero.	page 136
:OFFset:POWermeter	Sets the offset factor to the difference between the power measured with a powermeter and with the monitor diode.	page 137
:ATTenuation:SPEed/?	Sets or queries the filter transition speed	page 137
:WAVelength/?	Sets or queries the modules attenuation wavelength	page 138
:OUTPut[*n*][:CHANnel[*m*]]		
:APMode/?	Sets or queries whether power setting or attenuation value has been changed.	page 138
:APOWeron/?	Sets or queries the shutter status at power on.	page 144
:ATIMe/?	Sets or queries the powermeter averaging time.	page 144
:CONNection/?	Selects or returns Analog Output parameter.	page 104
:CORRection:COLLection:ZERO	Zeros the offsets of attenuators powermeter	page 144
:CORRection:COLLection:ZERO:ALL	Zeros all available powermeter channels in mainframe	page 145

Table 1 Specific Command Summary (continued)

Command	Description	Page
:CORRection:COLLection:ZERO?	Queries the status of the last zero operation	page 145
:PATH/?	Sets or returns the regulated path.	page 104
:POWer/?	Sets or queries the output power value.	page 139
:POWer:CONTRol/?	Sets or queries power control mode status	page 142
:POWer:OFFSet/?	Sets or queries the power offset value.	page 141
:POWer:OFFSet:POWermeter	Calculates power offset from measured power values	page 141
:POWer:REFerence/?	Sets or queries the reference power value.	page 140
:POWer:REFerence:POWermeter	Copies power value from power meter to attenuator module ref. power parameter	page 140
:POWer:UNit/?	Sets or queries power unit used (dBm or W)	page 142
[:STATe]/?	Sets a source's or attenuators output terminals to open or closed or returns the current status of a source's or attenuators output terminals.	page 105
:READ[*n*][:CHANnel[*m*]]		
[:SCALar]:POWer[:DC]?	Reads the current power value from a sensor.	page 81
:POWer[:DC]:ALL?	Reads all available power meter channels.	page 82
:POWer[:DC]:ALL:CONFig?	Return all the slot and channel number of every available power meter channel.	page 82
[:SCALar]:RETurnloss?	Reads the current return loss value.	page 83
[:SCALar]:MONitor?	Returns the current power value from the monitor diode within a return loss module.	page 83
:ROUTe[*n*]		
[:CHANnel[m]]/?	Sets or returns the channel route between two ports.	page 155
[:CHANnel[m]]:CONFig?	Reads the switch configuration of an instrument.	page 156
[:CHANnel[m]]:CONFig:ROUTe?	Reads the allowed switch routes of an instrument.	page 156
:SENSe[*n*][:CHANnel[*m*]]:CORRection		
[:LOSS][:INPut][:MAGNitude]/?	Sets or returns the value of correction data for a sensor.	page 83
:COLLECT:ZERO	Executes a zero calibration of a sensor module.	page 84
:COLLECT:ZERO?	Returns the current zero state of a sensor module.	page 84
:COLLECT:ZERO:ALL	Executes a zero calibration of all sensor modules.	page 84
:SENSe[*n*][:CHANnel[m]]:FUNCtion		

Table 1 Specific Command Summary (continued)

Command	Description	Page
:PARameter:LOGGing/?	Sets or returns the number of samples and the averaging time, t_{avg}, for logging.	page 85
:PARameter:MINMax/?	Sets or returns the minmax mode and the window size.	page 86
:PARameter:STABility/?	Sets or returns the total time, delay time and the averaging time, t_{avg}, for stability.	page 88
:RESult?	Returns the data array of the last function.	page 89
:RESult:BLOCk?	Returns a specified binary block from the data array for the last power meter data acquisition function.	page 90
:RESult:MAXBlocksize?	Returns the maximum block size for power meter data acquisition functions.	page 90
:RESult:MONitor?	For return loss module, returns monitor diode data array of last function.	page 91
:STATe/?	Enables/disables the function mode or returns whether the function mode is enabled.	page 92
:THReshold/?	Sets or returns the threshold value and the start mode.	page 93
:SENSe[*n*][:CHANnel[*m*]]:POWer		
:ATIMe/?	Sets or returns the average time of a sensor.	page 93
:RANGe[:UPPer]/?	Sets or returns the most positive signal entry expected for a sensor.	page 94
:RANGe:MONitor[:UPPer]/?	Sets or returns the range of the monitor diode within a return loss module.	page 95
:RANGe:AUTO/?	Sets or returns the range of a sensor to produce the most dynamic range without overloading.	page 96
:REFerence/?	Sets or returns the reference level of a sensor.	page 97
:UNIT/?	Sets or returns the units used for absolute readings on a sensor.	page 99
:WAVelength/?	Sets or returns the wavelength for a sensor.	page 100
:SENSe[*n*][:CHANnel[*m*]]:POWer:Reference		
:DISPlay	Sets the reference level for a sensor from the input power level.	page 97
:STATe/?	Sets or returns whether sensor results are in relative or absolute units.	page 98
:STATe:RATio/?	Sets or returns whether sensor results are displayed relative to a channel or to an absolute reference.	page 98
:SENSe[*n*][:CHANnel[*m*]]:RETurnloss:CALibration		
:FACTory	Sets the calibration value to factory settings.	page 100

Table 1 Specific Command Summary (continued)

Command	Description	Page
:COLLect:REFLectance	Sets the reference reflectance calibration values to the values currently measured by the chosen return loss module. (When, for example, a gold reflector is used.)	page 101
:COLLect:TERMination	Sets the termination calibration values to the values currently measured by the chosen return loss module.	page 101
:COLLect:VALues?	Returns current calibration values.	page 101
:TERMination?	Returns T-Value	page 101
:SENSe[*n*][:CHANnel[*m*]]:RETurnloss:CORRection		
:FPDelta[/]/?	Sets or returns front panel delta, that is, the loss correction value due, for example, to the front panel connector.	page 102
:REFLectance[/]/?	Sets or returns the return loss reference, the return loss value of your reference reflector.	page 102
:SLOT[*n*]		
:EMPTy?	Returns whether the module slot is empty.	page 73
:IDN?	Returns information about the module.	page 74
:OPTions?	Returns the module’s options.	page 74
:TST?	Returns the latest selftest results for a module.	page 74
:SLOT[*n*][:HEAD[*m*]]		
:EMPTy?	Returns whether an optical head is connected.	page 75
:IDN?	Returns information about the optical head.	page 75
:OPTions?	Returns the optical head’s options.	page 75
:TST?	Returns the latest selftest results for an optical head.	page 76
:WAVelength:RESPonse?	Returns the wavelength response from the module with wavelength calibration.	page 76
:WAVelength:RESPonse:CSV?	Returns the wavelength response from the module with wavelength calibration.	page 76
:WAVelength:RESPonse:SIZE?	Returns the no. of elements in the wavelength response table.	page 77
[:SOURce[*n*]][:CHANnel[*m*]]		
:MODout/?	Returns the mode of the modulation output mode of the BNC connector on the front panel of Agilent 81640A/80A/82A Tunable Laser modules.	page 109
[:SOURce[*n*]][:CHANnel[*m*]:]AM		
[:INTernal]:FREQuency[/]/?	Sets or returns the frequency of an internal signal source.	page 106
:SOURce[/]/?	Sets or returns a source for the modulating system.	page 107

Table 1 **Specific Command Summary (continued)**

Command	Description	Page
:STATe[/]/?	Turns Amplitude Modulation of a source on or off or returns whether Amplitude Modulation is on or off.	page 108
:COHCtrl:COHLevel[l]/?	Sets or returns the coherence level.	page 109
[:SOURce[*n*]][:CHANnel[*m*]:]POWer		
[:LEVel][:IMMediate][:AMPLitude[/]]	Sets the laser output power of a source.	page 113
[:LEVel][:IMMediate][:AMPLitude[/]]?	Returns the laser output power of a source.	page 114
[:LEVel]:RISetime[/]/?	Sets or returns the laser rise time of a source.	page 115
:ATTenuation[/]/?	Sets or returns the attenuation level for a source.	page 110
:STATe/?	Sets or returns the state of the source output signal.	page 115
:UNIT/?	Sets or returns the power units.	page 116
:WAVelength/?	Sets or returns the wavelength source of a dual-wavelength source.	page 116
[:SOURce[*n*]][:CHANnel[*m*]:]POWer:ATTenuation[/]		
:AUTO/?	Selects Automatic or Manual Attenuation Mode for a source or returns the selected mode.	page 111
:DARK/?	Enables/disables 'dark' position on a source or returns whether 'dark' position is active for a source.	page 112
[:SOURce[*n*]][:CHANnel[*m*]:]READout		
:DATA?	Returns number of datapoints returned by the [:SOURce[n]][:CHANnel[m]]:READout:POINts? command.	page 117
:DATA:BLOCk?	Returns a specified binary block from either a lambda logging operation, or maximum power at wavelength characteristic.	page 118
:DATA:MAXBlocksize?	Returns the maximum blocksize that a lambda logging, or maximum power at wavelength characteristic will return.	page 118
:POINts?	Returns the data as a binary stream from either a lambda logging operation or the maximum power the laser can produce at each wavelength.	page 118
[:SOURce[*n*]][:CHANnel[*m*]:]WAVelength		
[:CW[/]:FIXED]	Sets the absolute wavelength of a source.	page 119
[:CW[/]:FIXED[/]]?	Returns the absolute wavelength of a source.	page 120
:FREQuency[/]/?	Sets the frequency difference used to calculate a relative wavelength for a source.	page 123
:REFerence[/]?	Returns the reference wavelength of a source.	page 123
[:SOURce[*n*]][:CHANnel[*m*]:]WAVelength:CORRection		
:ARA	Realigns the laser cavity.	page 120

Table 1 Specific Command Summary (continued)

Command	Description	Page
:AUTocalib	Sets or returns tunable laser source Auto Calibration state.	page 121
:ZERO	Executes a wavelength zero.	page 121
:ZERO:TEMPerature:ACTual?	Reports the current lambda zero temperature	page 121
:ZERO:TEMPerature:DIFFerence?	Reports the temperature difference required to trigger an auto lamda zero.	page 122
:ZERO:TEMPerature:LASTzero?	Reports the temperature at which the last auto lamda zero took place.	page 122
:ZERO:AUTO	Forces an auto lamda zero. This is quicker than the equilavent manual process.	page 122
[:SOURce[*n*]][:CHANnel[*m*]:]WAVelength:REFerence		
:DISPlay	Sets the reference wavelength of a source to the value of the output wavelength.	page 124
[:SOURce[*n*]][:CHANnel[*m*]:]WAVelength:SWEep		
:CHECkparams?	Returns whether sweep parameters set are consistent.	page 124
:CYCLes/?	Sets or returns the number of cycles.	page 125
:DWELl/?	Sets or returns the dwell time.	page 126
:EXPectedtriggers?	Returns number of triggers (used to configure power meter).	page 126
:FLAG?	Returns whether waiting for trigger, or logging data available.	page 127
:LLOGging/?	Switches lambda logging on or off or queries the state of lambda logging.	page 128
:MODE/?	Sets or returns the sweep mode.	page 129
:PMAX?	Returns the highest permissible power for a wavelength sweep.	page 129
:REPeat/?	Sets or returns the repeat mode.	page 130
:SOFTtrigger	Sends a soft trigger.	page 130
:SPEed/?	Sets or returns the speed for continuous sweeping.	page 131
:STARt/?	Sets or returns the start point of the sweep.	page 131
:STOP/?	Sets or returns the end point of the sweep.	page 131
[:STATe]/?	Stops, starts, pauses or continues a wavelength sweep or returns the the state of a sweep.	page 133
[:SOURce[*n*]][:CHANnel[*m*]:]WAVelength:SWEep:STEP		
:NEXT	Performs the next sweep step.	page 133
:PREVious	Performs the previous sweep step again.	page 133

Table 1 **Specific Command Summary (continued)**

Command	Description	Page
[:WIDTh]/?	Sets or returns the width of the sweep step.	page 134
:SPECial		
:REBoot	Reboots the mainframe and all modules.	page 77
:STATus[*n*]		
:PRESet	Presets all Enable Registers.	page 62
:STATus:OPERation		
[:EVENt]?	Returns the Operational Status Event Summary Register (OESR).	page 60
[:EVENt]:LEVel*1*?	Returns the Operational Status Event Summary Register for slots 15 - 17 of the Agilent 8166A/B Lightwave Multichannel System.	page 59
:CONDition?	Returns the Operational Status Condition Summary Register.	page 61
:CONDition:LEVel*1*?	Returns the Operational Status Condition Summary Register for slots 15 - 17 of the Agilent 8166A/B Lightwave Multichannel System.	page 59
:ENABle/?	Sets or queries the Operational Status Enable Summary Mask.	page 61
:ENABle:LEVel*1*/?	Sets or queries the Operational Status Enable Summary Mask for slots 15 - 17 of the Agilent 8166A/B Lightwave Multichannel System.	page 60
:STATus*n*:OPERation		
[:EVENt]?	Returns the Operational Slot Status Event Register for slot *n*.	page 60
:CONDition?	Returns the Operational Slot Status Condition Register for slot *n*.	page 61
:ENABle/?	Sets or queries the Operation Slot Status Enable Mask for slot *n*.	page 61
:STATus:QUEStionable		
[:EVENt]?	Returns the Questionable Status Event Summary Register.	page 65
[:EVENt]:LEVel*1*?	Returns the Questionable Status Event Summary Register for slots 15 - 17 of the Agilent 8166A/B Lightwave Multichannel System.	page 64
:CONDition?	Returns the Questionable Status Condition Summary Register.	page 66
:CONDition:LEVel*1*?	Returns the Questionable Status Condition Summary Register for slots 15 - 17 of the Agilent 8166A/B Lightwave Multichannel System.	page 64
:ENABle/?	Sets or queries the Questionable Status Enable Summary Mask.	page 66
:ENABle:LEVel*1*/?	Sets or queries the Questionable Status Enable Summary Mask for slots 15 - 17 of the Agilent 8166A/B Lightwave Multichannel System.	page 65

Table 1 Specific Command Summary (continued)

Command	Description	Page
:STATus*n*:QUEStionable		
[:EVENt]?	Returns the Questionable Slot Status Event Register for slot *n*.	page 65
:CONDition?	Returns the Questionable Slot Status Condition Register for slot *n*.	page 66
:ENABle/?	Sets or queries the Questionable Slot Status Enable Mask for slot *n*.	page 66
:SYSTem		
:DATE/?	Sets or returns the instrument's internal date.	page 67
:ERRor?	Returns the contents of the instrument's error queue.	page 67
:HELP:HEADers?	Returns a list of GPIB commands.	page 68
:PRESet	Sets all parameters to their default values.	page 68
:TIME/?	Sets or returns the instrument's internal time.	page 68
:VERSion?	Returns the instrument's SCPI version.	page 69
:SYSTem:COMMunicate:GPIB		
[:SELF]:ADDress/?	Sets or returns the GPIB address.	page 69
:TRIGger	Generates a hardware trigger.	page 158, page 164
:CONFiguration/?	Sets or returns trigger configuration.	page 163
:TRIGger:CONFiguration		
:EXTended/?	Sets or returns extended trigger configuration.	page 165
:FPEDal/?	Enables/disables the Input Trigger connector to be triggered using a Foot Pedal or returns whether the Input Trigger connector can be triggered using a Foot Pedal.	page 164
:TRIGger[*n*][CHANnel[*m*]]		
:INPut/?	Sets or returns the incoming trigger response .	page 159
:OFFset/?	Sets or returns the number of incoming triggers received before data logging begins	page 161
:INPut:REARm/?	Re-arms input trigger	page 160
:OUTPut/?	Sets or returns the outgoing trigger response.	page 161
:OUTPut:REARm/?	Re-arms output trigger	page 162

Instrument Setup and Status

This chapter gives descriptions of commands that you can use when setting up your instrument. The commands are split into the following separate subsytems:

- IEEE specific commands that were introduced in *"Common Commands" on page 24*.
- `STATus` subsystem commands that relate to the status model.
- `SYSTem` subsystem commands that control the serial interface and internal data.

IEEE-Common Commands

“Common Commands” on page 24 gave a brief introduction to the IEEE-common commands which can be used with the instruments. This section gives fuller descriptions of each of these commands.

command:	***CLS**
syntax:	*CLS
description:	The CLear Status command *CLS clears the following: • Error queue • Standard event status register (SESR) • Status byte register (STB) After the `*CLS` command the instrument is left waiting for the next command. The instrument setting is unaltered by the command, although `*OPC`/`*OPC?` actions are cancelled.
parameters:	none
response:	none
example:	`*CLS`

command:	***ESE**
syntax:	*ESE<wsp><value>
	0 ≤ *value* ≤ 255
description:	The standard Event Status Enable command (`*ESE`) sets bits in the Standard Event Status Enable Mask (SESEM) that enable the corresponding bits in the standard event status register (SESR).

The register is cleared:

- at power-on,
- by sending a value of zero.

The register is not changed by the `*RST` and `*CLS` commands.

parameters: The bit value for the register (a *16-bit signed integer* value):

Bit	Mnemonic	Decimal Value
7 (MSB)	Power On	128
6	Not Used	0
5	Command Error	32
4	Execution Error	16
3	Device Dependent Error	8
2	Query Error	4
1	Not Used	0
0 (LSB)	Operation Complete	1

response: none

example: `*ESE 21`

command:	***ESE?**
syntax:	*ESE?
description:	The standard Event Status Enable query *ESE? returns the contents of the Standard Event Status Enable Mask (see *ESE for information on this register).
parameters:	none
response:	The bit value for the register (a *16-bit signed integer* value).
example:	`*ESE? → 21<END>`

command:	***ESR?**
syntax:	*ESR?
description:	The standard Event Status Register query *ESR? returns the contents of the Standard Event Status Register. The register is cleared after being read.
parameters	none
response	The bit value for the register (a *16-bit signed integer* value):

Bit	Mnemonic	Decimal Value
7 (MSB)	Power On	128
6	Not used	0
5	Command Error	32
4	Execution Error	16
3	Device Dependent Error	8
2	Query Error	4
1	Not used	0
0 (LSB)	Operation Complete	1

example: `*ESR? → 21<END>`

command:	***IDN?**
syntax:	*IDN?
description:	The IDeNtification query *IDN? gets the instrument identification over the interface.
parameters:	none
response:	The identification terminated by <END>:

For example.

`Agilent Technologies`	manufacturer
mmmm	instrument model number (for example 8164B)
ssssssss	serial number
rrrrrrrrr	firmware revision level

example: `*IDN? → Agilent Techologies,`*mmmm*`,`*ssssssss*`,`*rrrrrrrrr*`<END>`

NOTE The Agilent 8163A, Agilent 8164A, and Agilent8166A will always return HEWLETT-PACKARD as the manufacturer. This will not be affected by the transition of these instruments to Agilent Technologies. This will allow programs that use this string to continue functioning.
See *":SLOT[n]:HEAD[n]:IDN?" on page 75* for information on module identity strings.

command:	***OPC**
syntax:	`*OPC`
description:	The instrument parses and executes all program message units in the input queue and sets the operation complete bit in the standard event status register (SESR). This command can be used to avoid filling the input queue before the previous commands have finished executing.

Some module firmware includes commands that set a "StatNOPC" flag during execution to indicate that the module is busy. *OPC blocks the GPIB bus to all commands until every module hosted by the instrument is no longer busy.

The following actions cancel the *OPC command (and put the instrument into Operation Complete, Command Idle State):

- Power-on
- the Device Clear Active State is asserted on the interface.
- *CLS
- *RST

parameters:	none
response:	none
example:	`*OPC`

command:	***OPC?**
syntax:	`*OPC?`
description:	The OPeration Complete query *OPC? parses all program message units in the input queue, sets the operation complete bit in the Standard Event Status register, and places an ASCII '1' in the output queue, when the contents of the input queue have been processed.

Some module firmware includes commands that set a "StatNOPC" flag during execution to indicate that the module is busy. If a module is executing a command which generates a "StatNOPC" flag, the GPIB bus is not blocked to a command to another module. A second command to a busy module is blocked until the module flag "StatOK" is set. Taking advantage of this feature, and using *OPC? in a loop to query until the instrument returns 1, can lead to useful gains in program execution efficiency.

The following actions cancel the *OPC? query (and put the instrument into Operation Complete, Command Idle State):

- Power-on
- the Device Clear Active State is asserted on the interface.
- *CLS
- *RST

parameters:	none
response:	`1<END>` is returned if all modules are ready to execute a new operation.
	`0<END>` is returned if any module is busy.
example:	`*OPC? → 1<END>`

command:	***OPT?**
syntax:	*OPT?
description:	The OPTions query *OPT? returns the modules installed in your instrument.
parameters:	none
response:	Returns the part number of all installed modules, separated by commas.

Slots are listed starting with the lowest slot number, that is, slot 0 for the Agilent 8164A/B and Slot 1 for the Agilent 8163A/B and Agilent 8166A/B.

If any slot is empty or not recognised, two spaces are inserted instead of the module's part number. See the example below, where slots 1 and 4 are empty.

example:
```
*OPT? → 81682A ,   ,  81533B,  81532A,  <END>
```

command:	***RST**
syntax:	*RST
description:	The ReSeT command *RST sets the mainframe and all modules to the reset setting (standard setting) stored internally.

Pending *OPC? actions are cancelled.

The instrument is placed in the idle state awaiting a command. The *RST command clears the error queue.

The *RST command is equivalent to the `*CLS` command AND the `syst:preset` command.

The following are not changed:

- GPIB (interface) state
- Instrument interface address
- Output queue
- Service request enable register (SRE)
- Standard Event Status Enable Mask (SESEM)

parameters:	none
response:	none
example:	`*RST`

command:	***STB?**
syntax:	*STB?
description:	The STatus Byte query *STB? returns the contents of the Status Byte register.
parameters:	none
response:	The bit value for the register (a *16-bit signed integer* value):

Bit	**Mnemonic**	**Decimal Value**
7 (MSB)	Operation Status (OSB)	128
6	Not used	0
5	Event Status Bit (ESB)	32
4	Message Available (MAV)	16
3	Questionable Status (QSB)	8
2	Not used	0
1	Not used	0
0	Not used	0

example: `*STB? → 128<END>`

command:	***TST?**
syntax:	*TST?
description:	The self-TeST query *TST? makes the instrument perform a self-test and place the results of the test in the output queue. If the self-test fails, the results are also put in the error queue. We recommend that you read self-test results from the error queue. No further commands are allowed while the test is running. After the self-test the instrument is returned to the setting that was active at the time the self-test query was processed. The self-test does not require operator interaction beyond sending the `*TST?` query.
parameters:	none
response:	The sum of the results for the individual tests (a *32-bit signed integer* value, where 0 ≤ *value* ≤ 4294967296):

Bits	**Mnemonic**	**Decimal Value**
31	Selftest failed on Mainframe	A negative value
18 - 30	Not used	0
17	Selftest failed on Slot 17	131072
16	Selftest failed on Slot 16	65536
15	Selftest failed on Slot 15	32768
14	Selftest failed on Slot 14	16384
13	Selftest failed on Slot 13	8192
12	Selftest failed on Slot 12	4096
11	Selftest failed on Slot 11	2048
10	Selftest failed on Slot 10	1024
9	Selftest failed on Slot 9	512
8	Selftest failed on Slot 8	256
7	Selftest failed on Slot 7	128
6	Selftest failed on Slot 6	64
5	Selftest failed on Slot 5	32
4	Selftest failed on Slot 4	16
3	Selftest failed on Slot 3	8
2	Selftest failed on Slot 2	4
1	Selftest failed on Slot 1	2
0	Selftest failed on Slot 0	1

If 16 is returned, the module in slot 4 has failed.
If 18 is returned, the modules in slots 1 and 4 have failed.
A value of zero indicates no errors.

example: `*TST? → 0<END>`

command:	***WAI**
syntax:	*WAI
description:	The WAIt command prevents the instrument from executing any further commands until the current command has finished executing. Some module firmware includes commands that set a "StatNOPC" flag during execution to indicate that the module is busy. *WAI blocks the GPIB bus to all commands until every module hosted by the instrument is no longer busy. All pending operations, are completed during the wait period.
parameters:	none
response:	none
example:	`*WAI`

Status Reporting – The STATus Subsystem

The Status subsystem allows you to return and set details from the Status Model. For more details, see *"The Status Model" on page 26*.

command: **:STATus:OPERation[:EVENt][:LEVel*0*]?**

syntax: :STATus:OPERation[:EVENt][:LEVel*0*]?

description: Returns the Operational Status Event Summary Register (OSESR).

parameters: none

response: The sum of the results for the slots (a *16-bit signed integer* value, where 0 ≤ *value* ≤ 32767):

Bits	**Mnemonics**			**Decimal Value**
	Agilent 8163A/B	**Agilent 8164A/B**	**Agilent 8166A/B**	
15	Not used	Not used	Not used	0
14	Not used	Not used	Slot 14 Summary	16384
13	Not used	Not used	Slot 13 Summary	8192
12	Not used	Not used	Slot 12 Summary	4096
11	Not used	Not used	Slot 11 Summary	2048
10	Not used	Not used	Slot 10 Summary	1024
9	Not used	Not used	Slot 9 Summary	512
8	Not used	Not used	Slot 8 Summary	256
7	Not used	Not used	Slot 7 Summary	128
6	Not used	Not used	Slot 6 Summary	64
5	Not used	Not used	Slot 5 Summary	32
4	Not used	Slot 4 Summary	Slot 4 Summary	16
3	Not used	Slot 3 Summary	Slot 3 Summary	8
2	Slot 2 Summary	Slot 2 Summary	Slot 2 Summary	4
1	Slot 1 Summary	Slot 1 Summary	Slot 1 Summary	2
0	Not used	Slot 0 Summary	Level 1 Summary	1

example: `stat:oper? → +0<END>`

command: **:STATus:OPERation:CONDition[:LEVel*0*]?**

syntax: :STATus:OPERation:CONDition[:LEVel*0*]?

description: Reads the Operational Status Condition Summary Register.

parameters: none

response: The sum of the results for the individual slots (a *16-bit signed integer* value, where 0 ≤ *value* ≤ 32767):

Bits	**Mnemonics**			**Decimal Value**
	Agilent 8163A/B	**Agilent 8164A/B**	**Agilent 8166A/B**	
15	Not used	Not used	Not used	0
14	Not used	Not used	Slot 14 Summary	16384
13	Not used	Not used	Slot 13 Summary	8192
12	Not used	Not used	Slot 12 Summary	4096
11	Not used	Not used	Slot 11 Summary	2048
10	Not used	Not used	Slot 10 Summary	1024
9	Not used	Not used	Slot 9 Summary	512
8	Not used	Not used	Slot 8 Summary	256
7	Not used	Not used	Slot 7 Summary	128
6	Not used	Not used	Slot 6 Summary	64
5	Not used	Not used	Slot 5 Summary	32
4	Not used	Slot 4 Summary	Slot 4 Summary	16
3	Not used	Slot 3 Summary	Slot 3 Summary	8
2	Slot 2 Summary	Slot 2 Summary	Slot 2 Summary	4
1	Slot 1 Summary	Slot 1 Summary	Slot 1 Summary	2
0	Not used	Slot 0 Summary	Level 1 Summary	1

example: `stat:oper:cond? → +0<END>`

command: **:STATus:OPERation:ENABle[:LEVel*0*]**

syntax: :STATus:OPERation:ENABle[:LEVel*0*]<wsp><value>

description: Sets the bits in the Operational Status Enable Summary Mask (OSESM) that enable the contents of the OSESR to affect the Status Byte (STB).

Setting a bit in this register to 1 enables the corresponding bit in the OSESR to affect bit 7 of the Status Byte.

parameters: The bit value for the OSESM as a *16-bit signed integer* value (0 .. +32767)

The default value is 0.

response: none

example: `stat:oper:enab 128`

command:	**:STATus:OPERation:ENABle[:LEVel*0*]?**
syntax:	:STATus:OPERation:ENABle[:LEVel*0*]?
description:	Returns the OSESM for the OSESR
parameters:	none
response:	The bit value for the operation enable mask as a *16-bit signed integer* value (0 .. +32767)
example:	`stat:oper:enab? → +128<END>`

command:	**:STATus:OPERation[:EVENt]:LEVel*1*?**
syntax:	:STATus:OPERation[:EVENt]:LEVel*1*?
description:	Returns the Operational Status Event Summary Register (OSESR) for slots 15 to 17 of the Agilent 8166A/B Lightwave Multichannel System.
parameters:	none
response:	The sum of the results for the slots (a *16-bit signed integer* value, where 0 ≤ *value* ≤ 32767):

Bits	**Mnemonics**	**Decimal Value**
	Agilent 8166A/B	
15-4	Not used	0
3	Slot 17 Summary	8
2	Slot 16 Summary	4
1	Slot 15 Summary	2
0	Not used	0

example: `stat:oper:level1? → +0<END>`

command:	**:STATus:OPERation:CONDition:LEVel*1*?**
syntax:	:STATus:OPERation:CONDition:LEVel*1*?
description:	Returns the Operational Status Condition Summary Register for slots 15 to 17 of the Agilent 8166B Lightwave Multichannel System.
parameters:	none
response:	The sum of the results for slots 15 to 17 (a *16-bit signed integer* value, where 0 ≤ *value* ≤ 32767):

Bits	**Mnemonics**	**Decimal Value**
	Agilent 8166A/B	
15-4	Not used	0
3	Slot 17 Summary	8
2	Slot 16 Summary	4
1	Slot 15 Summary	2
0	Not used	0

example: `stat:oper:cond:level1? → +0<END>`

command:	**:STATus:OPERation:ENABle:LEVel*1***
syntax:	:STATus:OPERation:ENABle:LEVel*1*<wsp><value>
description:	Sets the bits in the Operational Status Enable Summary Mask (OSESM) that enable the contents of the OSESR for slots 15 - 17 of the Agilent 8166A/B Lightwave Measurement System to affect the Status Byte (STB). Setting a bit in this register to 1 enables the corresponding bit in the OSESR for slots 15 - 17 of the Agilent 8166A/B Lightwave Measurement System to affect bit 7 of the Status Byte.
parameters:	The bit value for the OSESM as a *16-bit signed integer* value (0 .. +32767) The default value is 0.
response:	none
example:	`stat:oper:enab:level1 128`

command:	**:STATus:OPERation:ENABle:LEVel*1*?**
syntax:	:STATus:OPERation:ENABle:LEVel*1*?
description:	Returns the OSESM for the OSESR for slots 15 - 17 of the Agilent 8166A/B Lightwave Measurement System
parameters:	none
response:	The bit value for the operation enable mask as a *16-bit signed integer* value (0 .. +32767)
example:	`stat:oper:enab:level1? → +128<END>`

command:	**:STATus*n*:OPERation[:EVENt]?**
syntax:	:STATus*n*:OPERation[:EVENt]?
description:	Returns the Operational Slot Status Event Register (OSSER) of slot *n*.
parameters:	none
response:	The results for the individual slot events (a *16-bit signed integer* value, where 0 ≤ *value* ≤ 32767):

Bit	**Mnemonic**	**Decimal Value**
8-15	Not used	0
7	Slot *n*: offset (λ) type bit 2	128
6	Slot *n*: offset (λ) type bit 1	64
5	Slot *n*: offset (λ) has been enabled	32
4	Slot *n*: shutter has been opened	16
3	Slot *n*: Zeroing ongoing	8
2	Not used	0
1	Slot *n*: Coherence Control has been switched on	2
0	Slot *n*: Laser has been switched on	1

example: `stat1:oper? → +0<END>`

command:	**:STATus*n*:OPERation:CONDition?**
syntax:	:STATus*n*:OPERation:CONDition?
description:	Returns the Operational Slot Status Condition Register of slot *n*.
parameters:	none
response:	The results for the individual slot events (a *16-bit signed integer* value, where 0 ≤ *value* ≤ 32767):

Bit	Mnemonic	Decimal Value
8-15	Not used	0
7	Slot *n*: offset (λ) type bit 2	128
6	Slot *n*: offset (λ) type bit 1	64
5	Slot *n*: offset (λ) enabled	32
4	Slot *n*: shutter open	16
3	Slot *n*: Zeroing ongoing	8
2	Not used	0
1	Slot *n*: Coherence Control is switched on	2
0	Slot *n*: Laser is switched on	1

example: `stat1:oper:cond?` → `+0<END>`

NOTE: Only attenuator bits 5 to 7 are used to show whether the offset feature is used and which algorithm is used to calculate the wavelength dependent offset.

Bit 5 states if the feature is enabled or disabled. Bits 6 and 7 are decoded as shown below to say whether the attenuator uses saved, interpolated, or extrapolated values.

Type	Bit 5	Bit 6	Bit 7	Decimal Value
none	0	0	0	0
exact value	1	0	0	32
extrapolate below	1	1	0	96
extrapolate above	1	0	1	160
interpolated	1	1	1	224

command:	**:STATus*n*:OPERation:ENABle**
syntax:	:STATus*n*:OPERation:ENABle<wsp><value>
description:	Sets the bits in the Operation Slot Status Enable Mask (OSSEM) for slot *n* that enable the contents of the Operation Slot Status Event Register (OSSER) for slot *n* to affect the OSESR. Setting a bit in this register to 1 enables the corresponding bit in the OSSER for slot *n* to affect bit *n* of the OSESR.
parameters:	The bit value for the OSSEM as a *16-bit signed integer* value (0 .. +32767)
response:	none
example:	`stat:oper:enab 128`

command:	**:STATus*n*:OPERation:ENABle?**
syntax:	:STATus*n*:OPERation:ENABle?
description:	Returns the OSSEM of slot *n*
parameters:	none
response:	The bit value for the OSSEM as a *16-bit signed integer* value (0 .. +32767)
example:	`stat:oper:enab? → +128<END>`

command:	**:STATus:PRESet**
syntax:	:STATus:PRESet
description:	Presets all bits in all the enable masks for both the OPERation and QUEStionable status systems to 0, that is, OSSEM, QSSEM, OSESM, and QSESM.
parameters:	none
response:	none
example:	`stat:pres`

command:	**:STATus:QUEStionable[:EVENt][:LEVel*0*]?**
syntax:	:STATus:QUEStionable[:EVENt][:LEVel*0*]?
description:	Returns the Questionable Status Event Summary Register (QSESR).
parameters:	none
response:	The sum of the results for the QSESR as a *16-bit signed integer* value (0 .. +32767)

Bits	**Mnemonics**			**Decimal Value**
	Agilent 8163A/B	**Agilent 8164A/B**	**Agilent 8166A/B**	
15	Not used	Not used	Not used	0
14	Not used	Not used	Slot 14 Summary	16384
13	Not used	Not used	Slot 13 Summary	8192
12	Not used	Not used	Slot 12 Summary	4096
11	Not used	Not used	Slot 11 Summary	2048
10	Not used	Not used	Slot 10 Summary	1024
9	Not used	Not used	Slot 9 Summary	512
8	Not used	Not used	Slot 8 Summary	256
7	Not used	Not used	Slot 7 Summary	128
6	Not used	Not used	Slot 6 Summary	64
5	Not used	Not used	Slot 5 Summary	32
4	Not used	Slot 4 Summary	Slot 4 Summary	16
3	Not used	Slot 3 Summary	Slot 3 Summary	8
2	Slot 2 Summary	Slot 2 Summary	Slot 2 Summary	4
1	Slot 1 Summary	Slot 1 Summary	Slot 1 Summary	2
0	Not used	Slot 0 Summary	Level 1 Summary	1

example: `stat:ques? → +0<END>`

command: **:STATus:QUEStionable:CONDition[:LEVel*0*]?**

syntax: :STATus:QUEStionable:CONDition[:LEVel*0*]?

description: Returns the Questionable Status Condition Summary Register.

parameters: none

response: The sum of the results for the Questionable Status Condition Summary Register as a *16-bit signed integer* value (0 .. +32767)

Bits	**Mnemonics**			**Decimal Value**
	Agilent 8163A/B	**Agilent 8164A/B**	**Agilent 8166A/B**	
15	Not used	Not used	Not used	0
14	Not used	Not used	Slot 14 Summary	16384
13	Not used	Not used	Slot 13 Summary	8192
12	Not used	Not used	Slot 12 Summary	4096
11	Not used	Not used	Slot 11 Summary	2048
10	Not used	Not used	Slot 10 Summary	1024
9	Not used	Not used	Slot 9 Summary	512
8	Not used	Not used	Slot 8 Summary	256
7	Not used	Not used	Slot 7 Summary	128
6	Not used	Not used	Slot 6 Summary	64
5	Not used	Not used	Slot 5 Summary	32
4	Not used	Slot 4 Summary	Slot 4 Summary	16
3	Not used	Slot 3 Summary	Slot 3 Summary	8
2	Slot 2 Summary	Slot 2 Summary	Slot 2 Summary	4
1	Slot 1 Summary	Slot 1 Summary	Slot 1 Summary	2
0	Not used	Slot 0 Summary	Level 1 Summary	1

example: `stat:ques:cond? → +0<END>`

command: **:STATus:QUEStionable:ENABle[:LEVel*0*]**

syntax: :STATus:QUEStionable:ENABle[:LEVel*0*]<wsp><value>

description: Sets the bits in the Questionable Status Enable Summary Mask (QSESM) that enable the contents of the QSESR to affect the Status Byte (STB).

Setting a bit in this register to 1 enables the corresponding bit in the QSESR to affect bit 3 of the Status Byte.

parameters: The bit value for the questionable enable mask as a *16-bit signed integer* value (0 .. +32767)

The default value is 0.

response: none

example: `stat:ques:enab 128`

command:	**:STATus:QUEStionable:ENABle[:LEVel*0*]?**
syntax:	:STATus:QUEStionable:ENABle[:LEVel*0*]?
description:	Returns the QSESM for the event register
parameters:	none
response:	The bit value for the QSEM as a *16-bit signed integer* value (0 .. +32767)
example:	`stat:ques:enab? → +128<END>`

command:	**:STATus:QUEStionable[:EVENt]:LEVel*1*?**
syntax:	:STATus:QUEStionable[:EVENt]:LEVel*1*?
description:	Returns the Questionable Status Event Summary Register (QSESR) for slots 15 to 17 of the Agilent 8166A/B Lightwave Multichannel System.
parameters:	none
response:	The sum of the results for the slots (a *16-bit signed integer* value, where 0 ≤ *value* ≤ 32767):

Bits	Mnemonics	Decimal Value
	Agilent 8166A/B	
15-4	Not used	0
3	Slot 17 Summary	8
2	Slot 16 Summary	4
1	Slot 15 Summary	2
0	Not used	0

example: `stat:ques:level1? → +0<END>`

command:	**:STATus:QUEStionable:CONDition:LEVel*1*?**
syntax:	:STATus:QUEStionable:CONDition:LEVel*1*?
description:	Returns the Questionable Status Condition Summary Register for slots 15 to 17 of the Agilent 8166A/B Lightwave Multichannel System.
parameters:	none
response:	The sum of the results for the slots (a *16-bit signed integer* value, where 0 ≤ *value* ≤ 32767):

Bits	Mnemonics	Decimal Value
	Agilent 8166A/B	
15-4	Not used	0
3	Slot 17 Summary	8
2	Slot 16 Summary	4
1	Slot 15 Summary	2
0	Not used	0

example: `stat:ques:cond:level1? → +0<END>`

command:	**:STATus:QUEStionable:ENABle:LEVel*1***
syntax:	:STATus:QUEStionable:ENABle:LEVel*1*<wsp><value>
description:	Sets the bits in the Questionable Status Enable Summary Mask (QSESM) that enable the contents of the QSESR for slots 15 - 17 of the Agilent 8166A/B Lightwave Measurement System to affect the Status Byte (STB). Setting a bit in this register to 1 enables the corresponding bit in the OSESR for slots 15 - 17 of the Agilent 8166A/B Lightwave Measurement System to affect bit 7 of the Status Byte.
parameters:	The bit value for the QSESM as a *16-bit signed integer* value (0 .. +32767) The default value is 0.
response:	none
example:	`stat:oper:enab:level1 128`

command:	**:STATus:QUEStionable:ENABle:LEVel*1*?**
syntax:	:STATus:QUEStionable:ENABle:LEVel*1*?
description:	Returns the QSESM for the QSESR for slots 15 - 17 of the Agilent 8166A/B Lightwave Measurement System
parameters:	none
response:	The bit value for the QSESM as a *16-bit signed integer* value (0 .. +32767)
example:	`stat:oper:enab:level1?` → `+128<END>`

command:	**:STATus*n*:QUEStionable[:EVENt]?**
syntax:	:STATus*n*:QUEStionable[:EVENt]?
description:	Returns the questionable status of slot *n* - the Questionable Slot Status Event Register (QSS-ER).
parameters:	none
response:	The results for the individual slot events (a *16-bit signed integer* value, where 0 ≤ *value* ≤ 32767):

Bit	Mnemonic	Decimal Value
11-15	Not Used	0
10	Slot *n*: Lambda zeroing has been recommended	1024
9	Slot *n*: Beam Path Protection on (shutter off)	512
8	Slot *n*: Coherence control is uncalibrated	256
7	Slot *n*: Duty cycle has been out of range	128
6	Slot *n*: ARA has been recommended	64
5	Slot *n*: Module has been out of specification	32
4	Slot *n*: Module has settled unsuccessfully	16
3	Slot *n*: Laser protection has been on	8
2	Slot *n*: Temperature has been out of range	4
1	Slot *n*: A Zeroing operation has failed	2
0	Slot *n*: Excessive Value has occurred	1

Every *n*th bit is the summary of slot *n*.

example: `stat1:oper?` → `+0<END>`

command:	**:STATus*n*:QUEStionable:CONDition?**
syntax:	:STATus*n*:QUEStionable:CONDition?
description:	Returns the Questionable Slot Status Condition Register for slot *n*.
parameters:	none
response:	The results for the individual slot events (a *16-bit signed integer* value, where 0 ≤ *value* ≤ 32767):

Bit	Mnemonic	Decimal Value
11 - 15	Not Used	
10	Slot *n*: Lambda zeroing is recommended	1024
9	Slot *n*: Beam Path Protection on (shutter off)	512
8	Slot *n*: Coherence control is uncalibrated	256
7	Slot *n*: Duty cycle is out of range	128
6	Slot *n*: ARA recommended	64
5	Slot *n*: Module is out of specification	32
4	Slot *n*: Module has not settled	16
3	Slot *n*: Laser protection on	8
2	Slot *n*: Temperature out of range	4
1	Slot *n*: Zeroing failed	2
0	Slot *n*: Excessive Value	1

Every *n*th bit is the summary of slot *n*.

example: `stat1:ques:cond? → +0<END>`

command:	**:STATus*n*:QUEStionable:ENABle**
syntax:	:STATus*n*:QUEStionable:ENABle<wsp><value>
description:	Sets the bits in the Questionable Slot Status Enable Mask (QSSEM) for slot *n* that enable the contents of the Questionable Slot Status Register (QSSR) for slot *n* to affect the QSESR. Setting a bit in this register to 1 enables the corresponding bit in the QSSER for slot *n* to affect bit *n* of the QSESR.
parameters:	The bit value for the QSSEM as a *16-bit signed integer* value (0 .. +32767)
response:	none
example:	`stat:ques:enab 128`

command:	**:STATus*n*:QUEStionable:ENABle?**
syntax:	:STATus*n*:QUEStionable:ENABle?
description:	Returns the QSSEM for slot *n*
parameters:	none
response:	The bit value for the QSSEM as a *16-bit signed integer* value (0 .. +32767)
example:	`stat:ques:enab? → +128<END>`

Interface/Instrument Behaviour Settings – The SYSTem Subsystem

The SYSTem subsystem lets you control the instrument's serial interface. You can also control some internal data (like date, time, and so on).

command:	**:SYSTem:DATE**
syntax:	:SYSTem:DATE<wsp><year>,<month>,<day>
description:	Sets the instrument's internal date.
parameters:	• the first value is the year (four digits), • the second value is the month, and • the third value is the day.
response:	none
example:	`syst:date 1999, 1, 12`

command:	**:SYSTem:DATE?**
syntax:	:SYSTem:DATE?
description:	Returns the instrument's internal date.
parameters:	none
response:	The date in the format year, month, day (*16-bit signed integer* values)
example:	`syst:date? → +1999,+1,+12<END>`

command:	**:SYSTem:ERRor?**
syntax:	:SYSTem:ERRor?
description:	Returns the next error from the error queue (see *"The Error Queue" on page 19*). Each error has the error code and a *short* description of the error, separated by a comma, for example `0, "No error"`. Error codes are numbers in the range -32768 and +32767. Negative error numbers are defined by the SCPI standard. Positive error numbers are device dependent.
parameters:	none
response:	The number of the latest error, and its meaning.
example:	`syst:err? → -113,"Undefined header"<END>`

command:	**:SYSTem:HELP:HEADers?**
syntax:	:SYSTem:HELP:HEADers?
description:	Returns a list of GPIB commands.
parameters:	none
response:	Returns a list of GPIB commands
example:	syst:help:head? $\longrightarrow$ *Returns a list of all GPIB commands*

command:	**:SYSTem:PRESet**
syntax:	:SYSTem:PRESet
description:	Sets the mainframe and all installed modules to their standard settings. This command has the same function as the `Preset` hardkey.

The following are not affected by this command:

- the GPIB (interface) state,
- the backlight and contrast of the display,
- the interface address,
- the output and error queues,
- the Service Request Enable register (SRE),
- the Status Byte (STB),
- the Standard Event Status Enable Mask (SESEM), and
- the Standard Event Status Register (SESR).

parameters:	none
response:	none
example:	SYST:PRES

command:	**:SYSTem:TIME**
syntax:	:SYSTem:TIME<wsp><hour>,<minute>,<second>
description:	Sets the instrument's internal time.
parameters:	• the first value is the hour (0 .. 23),

- the second value is the minute, and
- the third value is the seconds.

response:	none
example:	`syst:time 20,15,30`

command:	**:SYSTem:TIME?**	
syntax:	:SYSTem:TIME?	
description:	Returns the instrument's internal time.	
parameters:	none	
response:	The time in the format hour, minute, second. Hours are counted 0...23 (*16-bit signed integer* values).	
example:	`syst:time? → +20,+15,+30<END>`	

command:	**:SYSTem:VERSion?**	
syntax:	:SYSTem:VERSion?	
description:	Returns the SCPI revision to which the instrument complies.	
parameters:	none	
response:	The revision year and number.	
example:	`syst:vers? → 1995.0<END>`	

command:	**:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess**	
syntax:	:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess<wsp><GPIB Address>	
description:	Sets the GPIB address.	
parameters:	The GPIB Address	Values allowed 0-30 21 is often reseverved by the GPIB Controller.
response:	none	
example:	SYST:COMM:GPIB:ADDR `20`	

command:	**:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess?**	
syntax:	:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess?	
description:	Returns the GPIB address.	
parameters:	none	
response:	The GPIB Address	
example:	SYST:COMM:GPIB:ADDR? → `+20<END>`	

Measurement Operations & Settings

This chapter gives descriptions of commands that you can use when you are setting up or performing measurements. The commands are split up into the following subsystems:

- Root layer commands that take power measurements, configures triggering, and return information about the mainframe and it's slots
- `SENSe` subsystem commands that control Power Sensors, Optical Head Interface Modules, and Return Loss Modules.
- `SOURce` subsystem commands that control Laser Source modules, DFB source modules, Tunable Laser modules, and Return Loss Modules with internal laser sources.
- Signal Conditioing commands that control Attenuator modules.
- `TRIGger` subsystem commands that control triggering.

Root Layer Command

command:	**:LOCK**	
syntax:	:LOCK<wsp><boolean>, <value>	
description:	Switches the lock off and on. High power lasers cannot be switched on, if you switch the lock on. High power lasers are switched off immediately when you switch the lock on.	
parameters:	A **boolean** value:	0 or OFF: switch lock off 1 or ON: switch lock on
	<value> is the four-figure lock password.	
response:	none	
example:	`lock 1,1234 - 1234 is the default password`	

command:	**:LOCK?**	
syntax:	:LOCK?	
description:	Returns the current state of the lock.	
parameters:	none	
response:	A *boolean* value:	0: lock is switched off 1: lock is switched on
example:	`lock?` → `1<END>`	

The commands in the Slot subsystem allow you to query the following:

- a particular slot, for example, using `slot1:empt?`,
- or, an Optical Head attached to an Optical Head Interface Module, for example, an Optical Head Interface Module in slot1 with an Optical Head attached to channel 2, using `slot1:head2:empt?`.

command:	**:SLOT[*n*]:EMPTy?**	
syntax:	:SLOT[*n*]:EMPTy?	
description:	Returns whether the module slot is empty.	
parameters:	none	
response:	A *boolean* value:	0: there is a module in the slot 1: the module slot is empty
examples:	`slot1:empt?` → `0<END>`	There is a module in slot1
affects:	Independent of module type	

command:	**:SLOT[*n*]:IDN?**	
syntax:	:SLOT[*n*]:IDN?	
description:	Returns information about the module.	
parameters:	none	
response:	`HEWLETT-PACKARD`:	manufacturer
	mmmm:	instrument model number (for example 81533B)
	ssssssss:	serial number
	rrrrrrrrr:	date of firmware revision
example:	`slot1:idn?` → `HEWLETT-PACKARD, 81533B,3411G06054,07-Aug-98<END>`	

NOTE

- The Agilent 81640A/80A/82A/89A Tunable Laser modules will always return `HEWLETT-PACKARD` as the manufacturer.
- All other Agilent 8163A Series modules return `Agilent Technologies` as the manufacturer.
- The HP 8153A Series modules will always return `HEWLETT-PACKARD` as the manufacturer.

See *“*IDN?” on page 51* for information on mainframe identity strings.

affects: Independent of module type

command:	**:SLOT[*n*]:OPTions?**
syntax:	:SLOT[*n*]:OPTions?
description:	Returns information about a module’s options.
parameters:	none
response:	A string.
example:	`slot1:opt?` → `NO CONNECTOR OPTION, NO INSTRUMENT OPTIONS<END>`
affects:	Independent of module type

command:	**:SLOT[*n*]:TST?**
syntax:	:SLOT[*n*]:TST?
description:	Returns the latest selftest results for a module.
NOTE	This command does not perform a selftest. Use selfTeST command, *TST? on page 59, to perform a selftest.
parameters:	none
response:	Returns an error code and a short description of the error.
example:	`slot:tst?` → `+0,"self test OK"<END>`
affects:	Independent of module type

command:	**:SLOT[*n*]:HEAD[*n*]:EMPTy?**	
syntax:	:SLOT[*n*]:HEAD[*n*]:EMPTy?	
description:	Returns whether an optical head is connected.	
parameters:	none	
response:	A *boolean* value:	0: there is a module in the slot 1: the module slot is empty
examples:	`slot1:head:empt? → 0<END>`	An optical head is connected to the optical head interface module in slot 1

NOTE

- The HP 8153A Series Optical Heads will always return `HEWLETT-PACKARD` as the manufacturer.
- All other Agilent 8163A Series Optical Heads return `Agilent Technologies` as the manufacturer.

See *"*IDN?" on page 51* for information on mainframe identity strings.

affects: Optical heads

command:	**:SLOT[*n*]:HEAD[*n*]:IDN?**	
syntax:	:SLOT[*n*]:HEAD[*n*]:IDN?	
description:	Returns information about the optical head.	
parameters:	none	
response:	`HEWLETT-PACKARD:`	manufacturer
	mmmm:	instrument model number (for example 81520A)
	ssssssss:	serial number
	rrrrrrrrr:	date of firmware revision

example:	`slot1:head:idn? →`
	`HEWLETT-PACKARD, 81520A,3411G06054,07-Aug-98<END>`	

affects:	Optical heads	

command:	**:SLOT[*n*]:HEAD[*m*]:OPTions?**
syntax:	:SLOT[*n*]:HEAD[*m*]:OPTions?
description:	Returns information about an optical head's options.
parameters:	none
response:	A string.
example:	`slot1:head:opt? → NO CONNECTOR OPTION, NO INSTRUMENT OPTIONS<END>`
affects:	Optical heads

command:	**:SLOT[*n*]:HEAD[*m*]:TST?**
syntax:	:SLOT[*n*]:HEAD[*m*]:TST?
description:	Returns the latest selftest results for an optical head.
NOTE	This command does not perform a selftest. Use selfTeST command, *"*TST?" on page 55*, to perform a selftest.
parameters:	none
response:	Returns an error code and a short description of the error.
example:	`slot:head:tst? → +0,"self test OK"<END>`
affects:	Optical heads

command:	**:SLOT[*n*]:HEAD[*m*]:WAVelength:RESPonse?**
syntax:	:SLOT[*n*]:HEAD[*m*]:WAVelength:RESPonse?
description:	Returns the wavelength response from a wavelength calibrated module in binary format.
response:	Wavelength Response table as a *binary block*.
response format:	One 8 byte long wavelength calibration value pair consisting of a 4 byte long float for wavelength and a 4 byte long float for the scalar calibration factor. For more information on binary block formats see *"Data Types" on page 22*
example:	`slot1:head1:wav:resp? → #536570........`
affects:	Attenuator with power control, all powermeters, return loss modules

command:	**:SLOT[*n*]:HEAD[*m*]:WAVelength:RESPonse:CSV?**
syntax:	:SLOT[*n*]:HEAD[*m*]:WAVelength:RESPonse:CSV?
description:	Returns the wavelength response from the attenuator module in CSV format.
response:	Wavelength Response table as a *string*
response format:	The string is a comma separated value (CSV) list and can be written to a file and be processed with a spreadsheet program. List format: λ1, c1\n λ2, c2\n .... λn, cn\n "," separates wavelength and response factor "\n" = ASCII code 10 separate value pairs
example:	`slot1:head1:wav:resp:csv? → 1200e-6,2.019\n 1210e-6, 1.956\n...`
affects:	Attenuator with power control, all powermeters, return loss modules

command:	**:SLOT[*n*]:HEAD[*m*]:WAVelength:RESPonse:SIZE?**
syntax:	:SLOT[*n*]:HEAD[*m*]:WAVelength:RESPonse:SIZE?
description:	Returns the number of elements in the wavelength response table.
response	Number of elements in the wavelength table as an *integer* value
example:	`slot2:head1:wav:resp:size?` → `50<END>`
affects:	Attenuator with power control, all powermeters, return loss modules

command:	**:SPECial:REBoot**
syntax:	:SPECial:REBoot
description:	Reboots the mainframe and all modules.
parameters:	none
response:	none
example:	`spec:reb`

Measurement Functions – The SENSe Subsystem

The SENSe subsystem lets you control measurement parameters for a Power Sensor, an Optical Head Interface module, or a return loss module.

Agilent 81635A and Agilent 81619A- Master and Slave Channels

For the Agilent 81635A Dual Power Sensor and Agilent 81619A Dual Optical Head Interface module, channel 1 is the master channel and channel 2 is the slave channel. The master and slave channels share the same software and hardware triggering system. For some commands, setting parameters for the master channel sets the parameters for the slave channel. In these cases, you may only set parameters for the slave channel by setting master channel parameters.

The commands listed in Table 1 can only be configured using the master channel.

Table 1 Commands that can only be configured using the master channel

Command	Page
:INITiate[n]:[CHANnel[m]][:IMMediate]	page 80
:INITiate[n]:[CHANnel[m]]:CONTinuous/?	page 81
:READ[n][:CHANnel[m]][:SCALar]:POWer[:DC]?	page 82
:SENSe[n]:[CHANnel[m]]:CORRection:COLLect:ZERO	page 84
:SENSe[n][:CHANnel[m]]:FUNCtion:PARameter:LOGGing/?	page 85
:SENSe[n][:CHANnel[m]]:FUNCtion:PARameter:MINMax/?	page 86
:SENSe[n][:CHANnel[m]]:FUNCtion:PARameter:STABility/?	page 88
:SENSe[n][:CHANnel[m]]:FUNCtion:STATe/?	page 92
:SENSe[n]:[CHANnel[m]]:POWer:ATIME/?	page 93
:SENSe[n]:[CHANnel[m]]:POWer:RANGe:AUTO/?	page 96
:TRIGger[n][:CHANnel[m]]:INPut/?	page 159
:TRIGger[n][:CHANnel[m]]:INPut:REARm/?	page 160
:TRIGger[n][:CHANnel[m]]:OUTPut/?	page 161
:TRIGger[n][:CHANnel[m]]:OUTPut:REARm/?	page 162

The commands listed in Table 2 are independent for both master and slave channels.

Table 2 Commands that are independent for both master and slave channels

Command	Page
:FETCh[n][:CHANnel[m]][:SCAlar]:POWer[:DC]?	page 79
:ROUTe[n][:CHANnel[m]]/?	page 155
:ROUTe[n][:CHANnel[m]]:CONFig?	page 156
:ROUTe[n][:CHANnel[m]]:CONFig:ROUTe?	page 156
:SENSe[n]:[CHANnel[m]]:CORRection[:LOSS][:INPut] [:MAGNitude]/?	page 84
:SENSe[n]:[CHANnel[m]]:CORRection:COLLect:ZERO?	page 84
:SENSe[n]:[CHANnel[m]]:CORRection:COLLect:ZERO:ALL	page 84
:SENSe[n][:CHANnel[m]]:FUNCtion:RESult?	page 89
:SENSe[n]:[CHANnel[m]]:POWer:RANGe[:UPPer]/?	page 94
:SENSe[n]:[CHANnel[m]]:POWer:REFerence/?	page 97
:SENSe[n]:[CHANnel[m]]:POWer:REFerence:DISPlay	page 97
:SENSe[n]:[CHANnel[m]]:POWer:REFerence:STATe/?	page 98
:SENSe[n]:[CHANnel[m]]:POWer:REFerence:STATe:RATio/?	page 98
:SENSe[n]:[CHANnel[m]]:POWer:UNIT/?	page 99
:SENSe[n]:[CHANnel[m]]:POWer:WAVelength/?	page 100

command: **:FETCh[*n*][:CHANnel[*m*]][:SCAlar]:POWer[:DC]?**

syntax: :FETCh[*n*]:[CHANnel[*m*]][:SCAlar]:POWer[:DC]?

description: Reads the current power meter value, or for a return loss module returns current power value at return loss diode (back reflection path). It does not provide its own triggering and so must be used with either continuous software triggering (see *":INITiate[n]:[CHANnel[m]]:CONTinuous?" on page 81*) or a directly preceding immediate software trigger (see *":INITiate[n]:[CHANnel[m]][:IMMediate]" on page 80*).

It returns the value the previous software trigger measured. Any subsequent FETCh command will return the same value, if there is no subsequent software trigger.

parameters: none

response: The current value as a **float** value in dBm,W or dB.

NOTE If the reference state is absolute, units are dBm or W.
If the reference state is relative, units are dB.

example: `fetc1:pow? → +6.73370400E-04<END>`

affects: All power meters, return loss modules, and attenuators with power sensors

dual sensors: Master and slave channels are independent.

command:	**:FETCh[*n*][:CHANnel[*m*]][:SCAlar]:RETurnloss?**
syntax:	:FETCh[*n*]:[CHANnel[*m*]][:SCAlar]:RETurnloss?
description:	Reads the current return loss value. It does not provide its own triggering and so must be used with either continuous software triggering (see *":INITiate[n]:[CHANnel[m]]:CONTinuous?" on page 81*) or a directly preceding immediate software trigger (see *":INITiate[n]:[CHANnel[m]][:IMMediate]" on page 80*). It returns the return loss value the previous software trigger measured. Any subsequent FETCh command will return the same value, if there is no subsequent software trigger.
parameters:	none
response:	The current value as a **float** value in dB.
example:	`fetc1:ret? → +6.73370400E-00<END>`
affects:	All return loss modules

command:	**:FETCh[*n*][:CHANnel[*m*]][:SCAlar]:MONitor?**
syntax:	:FETCh[*n*]:[CHANnel[*m*]][:SCAlar]:MONitor?
description:	Reads current power value at a return loss module's monitor diode (forward path). It does not provide its own triggering and so must be used with either continuous software triggering (see *":INITiate[n]:[CHANnel[m]]:CONTinuous?" on page 81*) or a directly preceding immediate software trigger (see *":INITiate[n]:[CHANnel[m]][:IMMediate]" on page 80*). It returns the monitor value the previous software trigger measured. Any subsequent FETCh command will return the same value, if there is no subsequent software trigger.
parameters:	none
response:	The current value as a **float** value in W or dBm.
example:	`fetc1:mon? → +6.73370400E-00<END>`
affects:	All return loss modules

command:	**:INITiate[*n*]:[CHANnel[*m*]][:IMMediate]**
syntax:	:INITiate[*n*]:[CHANnel[*m*]][:IMMediate]
description:	Initiates the software trigger system and completes one full trigger cycle, that is, one measurement is made.
parameters:	none
response:	none
example:	`init`
affects:	All power meters, return loss modules.
dual sensors:	Can only be sent to master channel, slave channel is also affected.

command:	**:INITiate[*n*]:[CHANnel[*m*]]:CONTinuous**
syntax:	:INITiate[*n*]:[CHANnel[*m*]]:CONTinuous<wsp><boolean>
description:	Sets the software trigger system to continuous measurement mode.
parameters:	A *boolean* value: 0 or OFF: do not measure continuously 1 or ON: measure continuously
response:	none
example:	`init2:cont 1`
affects:	All power meters, return loss modules.
dual sensors:	Can only be sent to master channel, slave channel is also affected.

command:	**:INITiate[*n*]:[CHANnel[*m*]]:CONTinuous?**
syntax:	:INITiate[*n*]:[CHANnel[*m*]]:CONTinuous?
description:	Queries whether the software trigger system operates continuously or not
parameters:	none
response:	A *boolean* value: 0 or OFF: measurement is not continuous 1 or ON: measurement is continuous
example:	`init2:cont? → 1<END>`
affects:	All power meters, return loss modules.
dual sensors:	Can only be sent to master channel, slave channel parameters are identical.

command:	**:READ[*n*][:CHANnel[*m*]][SCALar:]:POWer:ALL?**
syntax:	:READ[*n*]:[CHANnel[*m*]]:POWer:[:DC]:ALL?
description:	Reads all available power meter channels. It provides its own software triggering and does not need a triggering command.
NOTE	The power meters must be running for this command to be effective.
parameters:	none
response:	4-byte Intel *float* values in a binary block in Intel byte order. The values are ordered by slot and channel order. See *"Data Types" on page 22* for more information on Binary Blocks.
NOTE	Data values are always in Watt.

example:	`read1:pow:all? → interpreted as`
	`+1.33555600E-006│+1.34789100E-006│+1.37456900E-006<END>`

affects:	All power meters (v3.0x firmware or later).
dual sensors:	Master channels receive a read command, see: *":READ[n][:CHANnel[m]][:SCALar]:POWer[:DC]?" on page 82* Slave channels receive a fetch command, see: *":FETCh[n][:CHANnel[m]][:SCAlar]:POWer[:DC]?" on page 79*.

command:	**:READ[*n*][:CHANnel[*m*]]:POWer:ALL:CONFig?**
syntax:	:READ[*n*]:[CHANnel[*m*]]:POWer[:DC]:ALL:CONFig?
description:	Returns the slot and channel numbers for all available power meter channels. Use this command to match returned power values to the appropriate slot and channel number.
parameters:	none
response:	A binary block (Intel byte order) consisting of 2-byte unsigned integer value pairs (so each pair has 4 bytes). The first member of the pair represents the the slot number, the second member of the pair represents the channel number.
example:	`read1:pow:all:conf? → interpreted as 1|1|1|2|12|1<END>` This 12-byte block means that there are three powermeters present: Slot 1, Channel 1 Slot 1, Channel 2 Slot 12, Channel 1
affects:	All power meters (v3.0x firmware or later).
dual sensors:	

command:	**:READ[*n*][:CHANnel[*m*]][:SCALar]:POWer[:DC]?**
syntax:	:READ[*n*]:[CHANnel[*m*]][:SCALar]:POWer[:DC]?
description:	Reads the current power meter value, or for a return loss module the power value at the return loss diode (back reflection path). It provides its own software triggering and does not need a triggering command. If the software trigger system operates continuously (see *":INITiate[n]:[CHANnel[m]]:CONTinuous?" on page 81*), this command is identical to *":FETCh[n][:CHANnel[m]][:SCAlar]:POWer[:DC]?" on page 79*. If the software trigger system does not operate continuously, this command is identical to generating a software trigger (*":INITiate[n]:[CHANnel[m]][:IMMediate]" on page 80*) and then reading the power meter value.
NOTE	The power meter must be running for this command to be effective.
parameters:	none
response:	The current power meter reading as a *float* value in dBm, W or dB.
NOTE	If the reference state is absolute, units are dBm or W. If the reference state is relative, units are dB.
example:	`read1:pow? → +1.33555600E-006<END>`
affects:	All power meters and return loss modules and attenuator with power control
dual sensors:	Can only be sent to master channel, slave channel is also triggered. To read a simultaneous result from the slave channel, send *":FETCh[n][:CHANnel[m]][:SCAlar]:POWer[:DC]?" on page 79* directly after this command.

command:	**:READ[*n*][:CHANnel[*m*]][:SCALar]:RETurnloss?**
syntax:	:READ[*n*]:[CHANnel[*m*]][:SCALar]:REturnloss?
description:	Reads the current return loss value. It provides its own software triggering and does not need a triggering command.
	If the software trigger system operates continuously (see *":INITiate[n]:[CHANnel[m]]:CONTinuous?" on page 81*), this command is identical to *":FETCh[n][:CHANnel[m]][:SCAlar]:RETurnloss?" on page 80*.
	If the software trigger system does not operate continuously, this command is identical to generating a software trigger (*":INITiate[n]:[CHANnel[m]][:IMMediate]" on page 80*) and then reading the power meter value.
NOTE	The return loss module must be running for this command to be effective.
parameters:	none
response:	The current power meter reading as a *float* value in dB.
example:	`read1:ret? → +1.33555600E-000<END>`
affects:	All return loss modules

command:	**:READ[*n*][:CHANnel[*m*]][:SCALar]:MONitor?**
syntax:	:READ[*n*]:[CHANnel[*m*]][:SCALar]:MONitor?
description:	Reads the power value at the monitor diode (forward path). It provides its own software triggering and does not need a triggering command.
	If the software trigger system operates continuously (see *":INITiate[n]:[CHANnel[m]]:CONTinuous?" on page 81*), this command is identical to *":FETCh[n][:CHANnel[m]][:SCAlar]:MONitor?" on page 80*.
	If the software trigger system does not operate continuously, this command is identical to generating a software trigger (*":INITiate[n]:[CHANnel[m]][:IMMediate]" on page 80*) and then reading the power meter value.
NOTE	The return loss module must be running for this command to be effective.
parameters:	none
response:	The current power meter reading as a *float* value in W or dBm
example:	`read1:mon? → +1.33555600E-000<END>`
affects:	All return loss modules

command:	**:SENSe[*n*]:[CHANnel[*m*]]:CORRection[:LOSS][:INPut][:MAGNitude]**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:CORRection[:LOSS][:INPUT][:MAGNitude]<wsp><value>[DB|MDB]
description:	Enters a calibration value for a module.
parameters:	The calibration factor as a *float* value
	If no unit type is specified, decibels (dB) is implied.
response:	none
example:	`sens1:corr 10DB`
affects:	All power meters
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:CORRection[:LOSS][:INPut][:MAGNitude]?**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:CORRection[:LOSS][:INPUT][:MAGNitude]?
description:	Returns the calibration factor for a module.
parameters:	none
response:	The calibration factor as a *float* value. Units are in dB, although no units are returned in the response message.
example:	`sens1:corr? → +1.00000000E+000<END>`
affects:	All power meters
dual sensors:	Master and slave channels are independent.

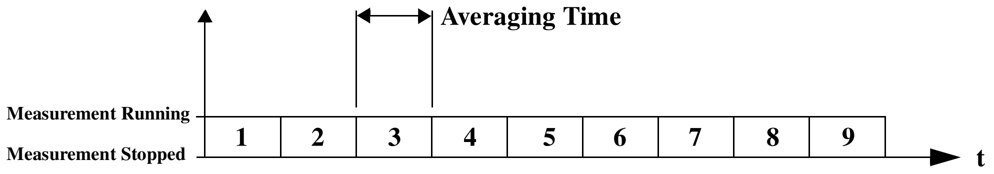
command:	**:SENSe[*n*]:[CHANnel[*m*]]:CORRection:COLLect:ZERO**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:CORRection:COLLect:ZERO
description:	Zeros the electrical offsets for a power meter or return loss module.
parameters:	none
response:	none
example:	`sens1:corr:coll:zero`
affects:	All power meters and return loss modules
dual sensors:	Can only be sent to master channel, slave channel is also zeroed.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:CORRection:COLLect:ZERO?**	
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:CORREction:COLLect:ZERO?	
description:	Returns the status of the most recent zero command.	
parameters:	none	
response:	0:	zero succeeded without errors.
	any other number:	remote zeroing failed (the number is the error code returned from the operation).
example:	`sens1:corr:coll:zero? → 0<END>`	
affects:	All power meters and return loss modules	
dual sensors:	Master and slave channels are independent.	

command:	**:SENSe[*n*]:[CHANnel[*m*]]:CORRection:COLLect:ZERO:ALL**
syntax:	SENSe[*n*]:[CHANnel[*m*]]:CORRection:COLLect:ZERO:ALL
description:	Zeros the electrical offsets for all installed power meter and return loss modules.
parameters:	none
response:	none
example:	`sens:chan:corr:coll:zero:all`
affects:	All power meters and return loss modules
dual sensors:	Command is independent of channel.

NOTE Setting parameters for the logging function sets some parameters, including hidden parameters, for the stability and MinMax functions and vice versa. You must use the :SENSe[n][:CHANnel[m]]:FUNCtion:PARameter:LOGGing command to set parameters before you start a logging function using the :SENSe[n][:CHANnel[m]]:FUNCtion:STATe command.

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:PARameter:LOGGing**	
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:PARameter:LOGGing<wsp><data points>, <averaging time>[NS|US|MS|S]	
description:	Sets the number of data points and the averaging time for the logging data acquisition function.	
parameters:	Data Points:	Data Points is the number of samples that are recorded before the logging mode is completed. Data Points is an **integer** value.
	Averaging time:	Averaging time is a time value in seconds. There is no time delay between averaging time periods. Use *":SENSe[n][:CHANnel[m]]:FUNCtion:PARameter:STABility?" on page 88* if you want to use delayed measurement.



If you specify no units for the averaging time value in your command, seconds are used as the default.

NOTE See *":SENSe[n][:CHANnel[m]]:FUNCtion:STATe" on page 92* for information on starting/stopping a data acquisition function.

NOTE See *":SENSe[n][:CHANnel[m]]:FUNCtion:RESult?" on page 89* for information on accessing the results of a data acquisition function.

NOTE See *"Triggering and Power Measurements" on page 157* for information on how triggering affects data acquisition functions.

response:	none
example:	`sens1:func:par:logg 64,1ms`
affects:	All power meters and return loss modules
dual sensors:	Can only be sent to master channel, slave channel is also affected.

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:PARameter:LOGGing?**
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:PARameter:LOGGing?
description:	Returns the number of data points and the averaging time for the logging data acquisition function.
parameters:	none
response:	Returns the number of data points as an **integer** value and the averaging time, t_{avg}, as a **float** value in seconds.
example:	`sens1:func:par:logg? → +64,+1.00000000E-001<END>`
affects:	All power meters and return loss modules
dual sensors:	Can only be sent to master channel, slave channel parameters are identical.

NOTE Setting parameters for the MinMax function sets some parameters, including hidden parameters, for the stability and logging functions and vice versa. You must use the :SENSe[n][:CHANnel[m]]:FUNCtion:PARameter:MINMax command to set parameters before you start a MinMax function using the :SENSe[n][:CHANnel[m]]:FUNCtion:STATe command.

command: **:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:PARameter:MINMax**

syntax: :SENSe[*n*][:CHANnel[*m*]]:FUNCtion:PARameter:MINMax<wsp>
CONTinous|WINDow|REFResh,<data points>

description: Sets the MinMax mode and the number of data points for the MinMax data acquisition function.

parameters:

CONTinous:	continuous MinMax mode
WINDow:	window MinMax mode
REFResh:	refresh MinMax mode

Data Points is the number of samples that are recorded in the memory buffer used by the WINDow and REFResh modes. Data Points is an **integer** value.

See Chapter 3 of the Agilent 8163A/B Lightwave Multimeter, Agilent 8164A/B Lightwave Measurement System, & Agilent 8166A/B Lightwave Multichannel System User's Guide, for more information on MinMax mode.

NOTE See *":SENSe[n][:CHANnel[m]]:FUNCtion:STATe" on page 92* for information on starting/stopping a data acquisition function.

NOTE See *":SENSe[n][:CHANnel[m]]:FUNCtion:RESult?" on page 89* for information on accessing the results of a data acquisition function.

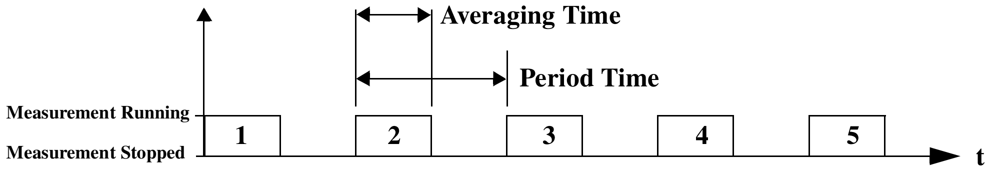
NOTE See *"Triggering and Power Measurements" on page 157* for information on how triggering affects data acquisition functions.

response:	none
example:	`sens1:func:par:minm WIND,10`
affects:	All power meters and return loss modules
dual sensors:	Can only be sent to master channel, slave channel is also affected.

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:PARameter:MINMax?**
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:PARameter:MINMax?
description:	Returns the MinMax mode and the number of data points for the MinMax data acquisition function.
parameters:	none
response:	CONT: continuous MinMax mode WIND: window MinMax mode REFR: refresh MinMax mode The number of data points is returned as an **integer** value.
example:	`sens1:func:par:minm?` → `WIND,+10`<END>
affects:	All power meters and return loss modules
dual sensors:	Can only be sent to master channel, slave channel parameters are identical.

NOTE Setting parameters for the stability function sets some parameters, including hidden parameters, for the logging and MinMax functions and vice versa. You must use the :SENSe[n][:CHANnel[m]]:FUNCtion:PARameter:STABility command to set parameters before you start a stability function using the :SENSe[n][:CHANnel[m]]:FUNCtion:STATe command.

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:PARameter:STABility**
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:PARameter:STABility<wsp> <total time>[NS|US|MS|S],<period time>[NS|US|MS|S],<averaging time>[NS|US|MS|S]
description:	Sets the total time, period time, and averaging time for the stability data acquisition function.
parameters:	Total time: The total time from the start of stability mode until it is completed. Period time: A new measurement is started after the completion of every period time. Averaging time: A measurement is averaged over the averaging time.



NOTE The total time should be longer than the period time.

The period time should be longer than the averaging time.

The number of data points is equal to the total time divided by the period time.

Total time, period time, and averaging time are time values in seconds.

If you specify no units in your command, seconds are used as the default.

NOTE See *":SENSe[n][:CHANnel[m]]:FUNCtion:STATe" on page 92* for information on starting/stopping a data acquisition function.

NOTE See *":SENSe[n][:CHANnel[m]]:FUNCtion:RESult?" on page 89* for information on accessing the results of a data acquisition function.

NOTE See *"Triggering and Power Measurements" on page 157* for information on how triggering affects data acquisition functions.

response:	none
example:	`sens1:func:par:stab 1s,0.1s,0.1s`
affects:	All power meters and return loss modules
dual sensors:	Can only be sent to master channel, slave channel is also affected.

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:PARameter:STABility?**
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:PARameter:STABility?
description:	Returns the total time, period time, and averaging time for the stability data acquisition function.
parameters:	none
response:	Total time, delay time, and averaging time are **float** values in seconds.
example:	`sens1:func:par:stab?` → `+1.00000000E+000, +1.00000000E-001,+1.00000000E-001<END>`
affects:	All power meters and return loss modules
dual sensors:	Can only be sent to master channel, slave channel parameters are identical.

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:RESult?**
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:RESult?
description:	Returns the data array of the last data acquisition function.
parameters:	none
response:	The last data acquisition function's data array as a binary block.

For Logging and Stability Data Acquisition functions, one measurement value is a 4-byte-long **float** in Intel byte order.

For the MinMax Data Acquisition function, the query returns the minimum, maximum and current power values.

See *"Data Types" on page 22* for more information on Binary Blocks.

NOTE See *"How to Log Results" on page 192* for information on logging using VISA calls. There are some tips about how to use float format specifiers to convert the binary blocks into **float** values.

NOTE If you use LabView or HP VEE, we recommend using the Agilent 816x VXI*plug&play* Instrument Driver to perform the Logging and Stability Data Acquisition functions.

example: `sens1:func:res?` →
returns a data array for Logging and Stability Data Acquisition functions

`sens1:func:res?` → #255
Min: 7.24079E-04, Max: 7.24252E-04, Act: 7.24155E-04
returns the minimum, maximum and current power values for the MinMax Data Acquisition function

affects: All power meters and return loss modules

dual sensors: Master and slave channels are independent.

NOTE **Return Loss modules:**

For Logging and Stability Data Acquisition functions, the data array contains power values.

For the MinMax Data Acquisition function, the data array contains return loss values.

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:RESult:BLOCk?**
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:RESult:BLOCk?<wsp><offset>,<# of data points>
description:	Returns a specific binary block (Intel byte order) from the data array for the last data acquisition function.
parameters:	<*offset*> A zero based offset; the number of data points to ignore. *# data points* The number of data points (not bytes!) to return.
response:	The last stablility or logging data acquisition function’s data array as a binary block. This function is not available for min-max measurements. One measurement value is a 4-byte-long **float** in Intel byte order. See *“Data Types” on page 22* for more information on Binary Blocks.
example:	`sens1:func:res:bloc? #5, 2` → `interpreted as 7.24079E-04,7.24252E-04<end>`
affects:	All power meters and return loss modules .
dual sensors:	Master and slave channels are independent.

NOTE **Return Loss modules:**

For Logging and Stability Data Acquisition functions, the data array contains power values.

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:RESult:MAXBlocksize?**
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:RESult:MAXBlocksize?<wsp><offset><# of data points>
description:	Returns the maximum block size for a single GPIB transfer for power meter data acquisition functions. If your application requires more data points please use SENSe[*n*][:CHANnel[*m*]]:FUNCtion:RESult:BLOCk? instead of SENSe[*n*][:CHANnel[*m*]]:FUNCtion:RESult?
parameters:	none
response:	An ***integer*** value, number of data points. See *“Data Types” on page 22* for more information on Binary Blocks.
example:	
affects:	All power meters and return loss modules.
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:RESult:MONitor?**
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:RESult:MONitor?
description:	Returns the monitor diode data array for the last data acquisition function.
parameters:	none
response:	The last data acquisition function's data array as a binary block.

For Logging and Stability Data Acquisition functions, one measurement value is a 4-byte-long **float** in Intel byte order.

For the MinMax Data Acquisition function, the query returns the minimum, maximum and current power values.

See *"Data Types" on page 22* for more information on Binary Blocks.

NOTE See *"How to Log Results" on page 192* for information on logging using VISA calls. There are some tips about how to use float format specifiers to convert the binary blocks into **float** values.

NOTE If you use LabView or HP VEE, we recommend using the Agilent 816x VXI*plug&play* Instrument Driver to perform the Logging and Stability Data Acquisition functions.

example: `sens1:func:res:mon?` →
returns a data array for Logging and Stability Data Acquisition functions

`sens1:func:res?` → #255
`Min: 7.24079E-04, Max: 7.24252E-04,` Act: 7.24155E-04
returns the minimum, maximum and current power values for the MinMax Data Acquisition function

affects: All return loss modules

dual sensors: Master and slave channels are independent.

NOTE **Return Loss modules:**

For Logging and Stability Data Acquisition functions, the data array contains power values for the monitor diode.

For the MinMax Data Acquisition function, the data array contains return loss values for the monitor diode.

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:STATe**
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:STATe<wsp> LOGGing|STABility|MINMax,STOP|STARt
description:	Enables/Disables the logging, MinMax, or stability data acquisition function mode.
parameters:	LOGGing: Logging data acquisition function STABility: Stability data acquisition function MINMax: MinMax data acquisition function STOP: Stop data acquisition function STARt: Start data acquisition function
NOTE	When you enable a logging data acquisition function for a Agilent 8163A/B Series Power Meter with averaging time of less than 100 ms with input hardware triggering disabled, all GPIB commands will be ignored for the duration of the function. See *":SENSe[n][:CHANnel[m]]:FUNCtion:PARameter:LOGGing" on page 85* for more information on the logging data acquisition function.
NOTE	Stop any function before you try to set up a new function. Some parameters cannot be set until you stop the function.
response:	none
example:	`sens1:func:stat` logg,star
affects:	All power meters and return loss modules
dual sensors:	Can only be sent to master channel, slave channel is also affected.

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:STATe?**
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:STATe?
description:	Returns the function mode and the status of the data acquisition function.
parameters:	none
response:	NONE: No function mode selected LOGGING_STABILITY: Logging or stability data acquisition function MINMAX: MinMax data acquisition function PROGRESS: Data acquisition function is in progress COMPLETE: Data acquisition function is complete
example:	`sens1:func:stat?` → LOGGING_STABILITY,COMPLETE<END>
affects:	All power meters and return loss modules
dual sensors:	Can only be sent to master channel, slave channel parameters are identical.

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:THReshold**	
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:THReshold<wsp><mode>, <threshold value>[PW|NW|UW|MW|Watt|DBM]	
description:	Sets the start mode and the threshold value.	
parameters:	ABOVe:	Function starts when power is above the threshold value.
	BELow:	Function starts when power is below the threshold value.
	IMMediately:	Function starts immediately.
	Threshold Value:	A **float** value in Watts or dBm.
response:	none	
example:	`sens1:func:thr` IMM,20nw<END>	
affects:	All HP 8153A Lightwave Multimeter series power meters and the HP 81534A Return Loss module	
NOTE	Does NOT affect Agilent 8161x series return loss modules	

command:	**:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:THReshold?**	
syntax:	:SENSe[*n*][:CHANnel[*m*]]:FUNCtion:THReshold?	
description:	Returns the start mode and the threshold value.	
parameters:	none	
response:	ABOV:	Function starts when power is above the threshold value.
	BEL:	Function starts when power is below the threshold value.
	IMM:	Function starts immediately.
	Threshold Value:	A **float** value in Watts or dBm.
example:	`sens1:func:thr? → IMM,+2.00000000E-008<END>`	
affects:	All HP 8153A Lightwave Multimeter series power meters and the HP 81534A Return Loss module	
NOTE	Does NOT affect Agilent 8161x series return loss modules	

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:ATIMe**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:POWer:ATIMe<wsp><averaging time>[NS|US|MS|S]
description:	Sets the averaging time for the module.
parameters:	The averaging time as a float value in seconds. If you specify no units in your command, seconds are used as the default.
response:	none
example:	`sens1:pow:atim 1s`
affects:	All power meters and return loss modules
dual sensors:	Can only be sent to master channel, slave channel is also affected.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:ATIMe?**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:POWer:ATIMe?
description:	Returns the averaging time for the module.
parameters:	none
response:	The averaging time as a *float* value in seconds.
example:	`sens1:pow:atim? → +1.00000000E+000<END>`
affects:	All power meters and return loss modules
dual sensors:	Can only be sent to master channel, slave channel parameters are identical.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:RANGe[:UPPer]**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:POWer:RANGe[:UPPer]<wsp><value>[DBM]
description:	Sets the power range for the module. For a return loss module, sets the power range of the return loss diode.

The range changes at 10 dBm intervals. The corresponding ranges for linear measurements (measurements in Watts) is given below:

Range	**Upper Linear Power Limit**	**Range**	**Upper Linear Power Limit**
+30 dBm	1999.9 mW	–50 dBm	19.999 nW
+20 dBm	199.99 mW	–60 dBm	1999.9 pW
+10 dBm	19.999 mW	–70 dBm	199.99 pW
0 dBm	1999.9 µW	–80 dBm	19.999 pW
–10 dBm	199.99 µW	–90 dBm	1.999 pW
–20 dBm	19.999 µW	–100 dBm	0.199 pW
–30 dBm	1999.9 nW	–110 dBm	0.019 pW
–40 dBm	199.99 nW		

parameters:	The range as a **float** value in dBm. The number is rounded to the closest multiple of 10, because the range changes at 10 dBm intervals. Units are in dBm.
response:	none
example:	`sens1:pow:rang -20DBM`
affects:	All power meters and return loss modules.
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:RANGe[:UPPer]?**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:POWer:RANGe[:UPPer]?
description:	Returns the range setting for the module. For a return loss module, returns the power range of the return loss diode.
parameters:	none
response:	The range setting as a *float* value in dBm (–110 Š≤ *value* ≤ +30).
example:	`sens1:pow:rang? → -2.00000000E+001<END>`
affects:	All power meters and return loss modules.
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*]:[CHANNel[*m*]]:POWer:RANGe:MONitor[:UPPer]**
syntax:	:SENSe[*n*]:[CHANNel[*m*]]:POWer:RANGe:MONitor[:UPPer]<wsp><value>[DBM]
description:	Sets the power range for a retun loss module's monitor diode.

The range changes at 10 dBm intervals. The corresponding ranges for linear measurements (measurements in Watts) is given below:

Range	**Upper Linear Power Limit**	**Range**	**Upper Linear Power Limit**
+30 dBm	1999.9 mW	–50 dBm	19.999 nW
+20 dBm	199.99 mW	–60 dBm	1999.9 pW
+10 dBm	19.999 mW	–70 dBm	199.99 pW
0 dBm	1999.9 µW	–80 dBm	19.999 pW
–10 dBm	199.99 µW	–90 dBm	1.999 pW
–20 dBm	19.999 µW	–100 dBm	0.199 pW
–30 dBm	1999.9 nW	–110 dBm	0.019 pW
–40 dBm	199.99 nW		

parameters:	The range as a **float** value in dBm. The number is rounded to the closest multiple of 10, because the range changes at 10 dBm intervals. Units are in dBm.
response:	none
example:	`sens1:pow:rang:mon -20DBM`
affects:	All return loss modules.
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*]:[CHANNel[*m*]]:POWer:RANGe:MONitor[:UPPer]?**
syntax:	:SENSe[*n*]:[CHANNel[*m*]]:POWer:RANGe[:UPPer]?
description:	Sets the power range for a retun loss module's monitor diode.
parameters:	none
response:	The range setting as a *float* value in dBm (–110 Š≤ *value* ≤ +30).
example:	`sens1:pow:rang?` → `-2.00000000E+001<END>`
affects:	All return loss modules.
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:RANGe:AUTO**	
syntax:	SENSe[*n*]:[CHANnel[*m*]]:POWer:RANGe:AUTO <wsp><boolean>	
description:	Enables or disables automatic power ranging for the module. If automatic power ranging is enabled, ranging is automatically determined by the instrument. Otherwise, it must be set by the `sensn:pow:rang` command.	
parameters:	A *boolean* value:	0 or OFF: automatic ranging disabled 1 or ON: automatic ranging enabled
response:	none	
example:	`sens1:pow:rang:auto 1`	
affects:	All power meters and return loss modules	
NOTE	For return loss modules, affects return loss diode and monitor diode simultaneously.	
dual sensors:	Can only be sent to master channel, slave channel is also affected.	

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:RANGe:AUTO?**	
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:POWer:RANGe:AUTO?	
description:	Returns whether automatic power ranging is being used by the module.	
parameters:	none	
response:	A *boolean* value:	0: automatic ranging is not being used. 1: automatic ranging is being used.
example:	`sens1:pow:rang:auto?` → `1<END>`	
affects:	All power meters and return loss modules	
dual sensors:	Can only be sent to master channel, slave channel parameters are identical.	

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:REFerence**	
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:POWer:REFerence<wsp> TOMODule|TOREF,<value>PW|NW|UW|MW|Watt|DBM|DB|MDB	
description:	Sets the sensor reference value.	
parameters:	TOMODule:	Sets the reference value in dB used if you choose measurement relative to another channel
	TOREF:	Sets the reference value in Watts or dBm if you choose measurement relative to a constant reference value
	The reference as a **float** value.	

NOTE You must append a unit type

- dB if you use TOMODule or
- Watts or dBm if you use TOREF.

NOTE The two reference values are completely independent. When you change the reference mode using the command *":SENSe[n]:[CHANnel[m]]:POWer:REFerence:STATe:RATio" on page 98*, the instrument uses the last reference value entered for the selected reference mode.

response:	none
example:	`sens1:pow:ref tomod,-40DB`
affects:	All power meters
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:REFerence?**	
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:POWer:REFerence?<wsp>TOMODule|TOREF	
description:	Returns the sensor reference value.	
parameters:	TOMODule:	Returns the reference value in dB used if you choose measurement relative to another channel
	TOREF:	Returns the reference value in Watts or dBm if you choose measurement relative to a constant reference value
response:	The reference as a **float** value.	
example:	`sens1:pow:ref? toref` → `+1.00000000E-006`<END>	
affects:	All power meters	
dual sensors:	Master and slave channels are independent.	

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:REFerence:DISPlay**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:POWer:REFerence:DISPlay
description:	Takes the input power level value as the reference value.
parameters:	none
response:	none
example:	`sens1:pow:ref:disp`
affects:	All power meters
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:REFerence:STATe**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]POWer:REFerence:STATe<wsp><boolean>
description:	Sets the measurement units to relative or absolute units.
parameters:	A *boolean* value: 0 or OFF: absolute 1 or ON: relative
response:	none
example:	`sens1:pow:ref:stat 1`
affects:	All power meters
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:REFerence:STATe?**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]POWer:REFerence:STATe?
description:	Inquires whether the current measurement units are relative (dB) or absolute (Watts or dBm).
parameters:	none
response:	A *boolean* value: 0: absolute 1: relative
example:	`sens1:pow:ref:stat? → 1<END>`
affects:	All power meters
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:REFerence:STATe:RATio**	
syntax:	:SENSe[*n*]:[CHANnel[*m*]]POWer:REFerence:STATe:RATio<wsp> <slot number>|255|TOREF,<channel number>	
description:	Selects the reference for the module.	
parameters:	`slot number:`	an **integer** value representing the slot number you want to reference
	`255 or TOREF:`	results are displayed relative to an absolute reference
	channel number:	an **integer** value representing the channel number you want to reference

NOTE If you want to reference another power sensor channel, use an integer value corresponding to the slot for the first parameter and an integer value corresponding to the channel for the second value.

If you want to use an absolute reference, use TOREF as the first parameter and any integer value as the second parameter.

response:	none	
examples:	`sens1:pow:ref:stat:rat 2,1`	References channel 2.1
	`sens1:pow:ref:stat:rat TOREF,1`	References an absolute reference
affects:	All power meters	
dual sensors:	Master and slave channels are independent.	

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:REFerence:STATe:RATio?**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]POWer:REFerence:STATe:RATio?
description:	Returns the reference setting for the module.
parameters:	none
response:	results are displayed relative to an absolute reference or to the current power reading from another channel.
examples:	`sens1:pow:ref:stat:rat? → +255,+0<END>` results are displayed relative to an absolute reference
	`sens1:pow:ref:stat:rat? → +2,+1<END>` results are displayed relative to channel 2.1
affects:	All power meters
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:UNIT**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:POWer:UNIT<wsp>DBM|0|Watt|1
description:	Sets the sensor power unit
parameters:	An *integer* value: 0: dBm 1: Watt or DBM or Watt
response:	none
example:	`sens1:pow:unit 1`
affects:	All power meters
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:UNIT?**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:POWer:UNIT?
description:	Inquires the current sensor power unit
parameters:	none
response:	An *integer* value: 0: Current power units are dBm. 1: Current power units are Watts.
example:	`sens1:pow:unit? → +1<END>`
affects:	All power meters
dual sensors:	Master and slave channels are independent.

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:WAVelength**	
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:POWer:WAVelength<wsp><value>|MIN|MAX|DEF [PM|NM|UM|MM|M]	
description:	Sets the sensor wavelength.	
parameters:	The wavelength as a *float* value in meters.	
	Also allowed are:	`MIN`: minimum programmable value
		`MAX`: maximum programmable value
		`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum programmable value and the maximum programmable value
response:	none	
example:	`sens1:pow:wav 1550nm`	
affects:	All power meters	
dual sensors:	Master and slave channels are independent.	

command:	**:SENSe[*n*]:[CHANnel[*m*]]:POWer:WAVelength?**	
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:POWer:WAVelength?[<wsp>MIN|MAX|DEF]	
description:	Inquires the current sensor wavelength.	
parameters:	none	
	Also allowed are:	`MIN`: minimum programmable value
		`MAX`: maximum programmable value
		`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum programmable value and the maximum programmable value
response:	The wavelength as a *float* value in meters.	
example	`sens1:pow:wav? → +1.55000000E-006<END>`	
affects:	All power meters	
dual sensors:	Master and slave channels are independent.	

command:	**:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CALibration:FACTory**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CALibration:FACTory
description:	For all sources, overwrites the current calibration values with the factory-set calibration settings. See *":SENSe[n]:[CHANnel[m]]:RETurnloss:CALibration:COLLect:TERMination" on page 101* and *":SENSe[n]:[CHANnel[m]]:RETurnloss:CORRection:REFLectance[l]?" on page 103* for information on calibrating your return loss module.
parameters:	none
response:	none
example	`sens1:ret:cal:fact`
affects:	All return loss modules

command:	**:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CALibration:COLLect:REFLectance**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CALibration:COLLect:REFLectance
description:	For the currently selected source, start the calibration and save the calibration values for a defined reflectance reference measurement. See *":SENSe[n]:[CHANnel[m]]:RETurnloss:CORRection:REFLectance[l]" on page 102* for information on setting the return loss value of your reference reflector.
parameters:	none
response:	none
example	`sens1:ret:cal:coll:refl`
affects:	All return loss modules

command:	**:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CALibration:COLLect:TERMination**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CALibration:COLLect:TERMination
description:	For the currently selected source, start the calibration and save the calibration values for a defined termination reference measurement. See *":SENSe[n]:[CHANnel[m]]:RETurnloss:CORRection:REFLectance[l]" on page 102* for information on setting the return loss value of your reference reflector.
parameters:	none
response:	none
example	`sens1:ret:cal:coll:term`
affects:	All return loss modules

command:	**:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CALibration:TERMination?**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CALibration:TERMination?
description:	Queries the T-value (termination calibration value) for the return loss module
parameters:	none
response:	Termination calibration value as a float in dB
example	`sens1:ret:cal:term? → +6.5000E+001`
affects:	All return loss modules

command:	**:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CALibration:VALues?**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CALibration:VALues?
description:	Returns the the current calibration values 1. monitor diode reference power 2. return loss diode reference power 3. monitor diode parasitics power 4. return loss diode parasitics power.
parameters:	Returns power values in W
response:	none
example	`sens1:ret:cal:val`
affects:	All return loss modules

command:	**:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CORRection:FPDelta[*l*]**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CORRection:FPDelta[*l*]<wsp><value>[dB]
description:	Sets the front panel delta, that is, the loss correction value, for example, due to the front panel connector. Twice this value is added to the measured Return Loss.
NOTE	Use [*l*] to set the front panel delta for an external source or the upper or lower wavelength laser source of a dual return loss module. An external laser source is denoted by *0*. *0* is the default value of [*l*]. A lower wavelength source is denoted by *1*. An upper wavelength source is denoted by *2*.
parameters:	Sets the front panel delta as a **float** value in dB
response:	none
example	`sens1:ret:cal:corr:fpd 0.08DB`
affects:	All return loss modules

command:	**:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CORRection:FPDelta[*l*]?**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CORRection:FPDelta[*l*]?
description:	Returns the front panel delta, that is, the loss correction value, for example, due to the front panel connector. Twice this value is added to the measured Return Loss.
NOTE	Use [*l*] to query the front panel delta for an external source or the upper or lower wavelength laser source of a dual return loss module. An external laser source is denoted by *0*. *0* is the default value. A lower wavelength source is denoted by *1*. An upper wavelength source is denoted by *2*.
parameters:	Returns the front panel delta as a **float** value in dB
response:	none
example	`sens1:ret:cal:corr:fpd? → +8.00000000E-002<END>`
affects:	All return loss modules

command:	**:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CORRection:REFLectance[*l*]**
syntax:	:SENSe[*n*]:[CHANnel[*m*]]:RETurnloss:CORRection:REFLectance[*l*]<wsp><value>[dB]
description:	Sets the Return Loss Reference, the return loss value of your reference reflector. For example, the Agilent 81000BR reference reflector provides an accurate and stable 0.18 dB reference.
NOTE	Use [*l*] to set the return loss value of your reference reflector for an external source or the upper or lower wavelength laser source of a dual return loss module. An external laser source is denoted by *0*. *0* is the default value of [*l*]. A lower wavelength source is denoted by *1*. An upper wavelength source is denoted by *2*.
parameters:	Sets the Return Loss Reference as a **float** value in dB
response:	none
example	`sens1:ret:cal:corr:refl 0.18DB`
affects:	All return loss modules

command:	**:SENSe[*n*]:[CHANNel[*m*]]:RETurnloss:CORRection:REFLectance[*l*]?**
syntax:	:SENSe[*n*]:[CHANNel[*m*]]:RETurnloss:CORRection:REFLectance[*l*]?
description:	Returns the Return Loss Reference, the return loss value of your reference reflector.
	For example, the Agilent 81000BR reference reflector provides an accurate and stable 0.18 dB reference.
NOTE	Use [*l*] to query the return loss value of your reference reflector for an external source or the upper or lower wavelength laser source of a dual return loss module. An external laser source is denoted by *0*. *0* is the default value of [*l*]. A lower wavelength source is denoted by *1*. An upper wavelength source is denoted by *2*.
parameters:	none
response:	Returns the Return Loss Reference as a float value in dB
example	`sens1:ret:cal:corr:refl? → +1.80000000E-001<END>`
affects:	All return loss modules

Signal Generation – The SOURce Subsystem

The SOURce subsystem allows you to control a laser source module, DFB source module, tunable laser module, or a return loss module that has an internal source.

command:	**:OUTPut[*n*][:CHANnel[*m*]]:CONNection**	
syntax:	OUTPut[*n*][:CHANnel[*m*]]:CONNection<wsp>MOD|VPP	
description:	Sets the analog output parameter.	
parameters:	MOD:	The modulation frequency modulates the analog output.
	VPP:	Output Voltage is proportional to optical power.
response:	none	
example:	`outp0:conn mod`	
affects:	All tunable laser modules	

command:	**:OUTPut[*n*][:CHANnel[*m*]]:CONNection?**	
syntax:	OUTPut[*n*][:CHANnel[*m*]]:CONNection?	
description:	Returns the analog output parameter.	
parameters:	none	
response:	MOD:	The modulation frequency modulates the analog output.
	VPP:	Output Voltage is proportional to optical power.
example:	`outp0:conn?` → `MOD<END>`	
affects:	All tunable laser modules	

command:	**:OUTPut[*n*][:CHANnel[*m*]]:PATH**	
syntax:	:OUTPut[*n*][:CHANnel[*m*]]:PATH<wsp><path>	
description:	Sets the regulated path.	
parameters:	HIGHpower:	The High Power output is regulated.
	LOWSse:	The Low SSE output is regulated.
	BHRegulated:	Both outputs are active but only the High Power output is Regulated.
	BLRegulated:	Both outputs are active but only the Low SSE output is Regulated.
response:	none	
example:	`output0:path high`	
affects:	Tunable laser modules with two outputs.	

command:	**:OUTPut[*n*][:CHANnel[*m*]]:PATH?**
syntax:	:OUTPut[*n*][:CHANnel[*m*]]:PATH?
description:	Returns the regulated path.
parameters:	none
response:	HIGH: The High Power output is regulated. LOWS: The Low SSE output is regulated. BHR: Both outputs are active but only the High Power output is Regulated. BLR: Both outputs are active but only the Low SSE output is Regulated.
example:	`output0:path?` → `HIGH<END>`
affects:	Tunable laser modules with two outputs.

command:	**:OUTPut[*n*][:CHANnel[*m*]][:STATe]**
syntax:	:OUTPut[*n*][:CHANnel[*m*]][:STATe]<wsp>OFF|ON|0|1
description:	Switches the laser current off and on. The laser emits light only when the current is on. Set the state to `OFF` or `0` to switch the laser current off. Set the state to `ON` or `1` to switch the laser current on. The default is for the laser current to be off.
NOTE	For attenuator output see page 143
parameters:	`0` or `OFF`: switch laser current off `1` or `ON`: switch laser current on
response:	none
example:	`outp 1`
affects:	All laser sources, DFB sources, tunable laser modules and return loss modules with an internal source

command:	**:OUTPut[*n*][:CHANnel[*m*]][:STATe]?**
syntax:	:OUTPut[*n*][:CHANnel[*m*]][:STATe]?
description:	Returns the current state of the laser current.
NOTE	For attenuator output see page 143
parameters:	none
response:	A *boolean* value: 0 – laser current off 1 – laser current on
example:	`outp?` → `1<END>`
affects:	All laser sources, DFB sources, tunable laser modules and return loss modules with an internal source

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:AM[:INTernal]:FREQuency[*/*]**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:AM[:INTernal]:FREQuency[*l*]<wsp><frequency> [THZ|GHZ|MHZ|KHZ|HZ]
description:	Sets the frequency of the amplitude modulation of the laser output.
parameters:	The frequency as a *float* value in Hz.

Also allowed are: `MIN`: minimum programmable value

`MAX`: maximum programmable value

`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum programmable value and the maximum programmable value

The default units are `HZ`, although `KHZ`, `MHZ`, `GHZ`, and `THZ` can also be specified.

The resolution of the frequency is always 1 Hz.

NOTE Use [*l*] to set the modulation frequency of the upper or lower wavelength laser source of a dual-wavelength laser source or a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.

response:	none
example:	`sour2:am:freq 270hz`
affects:	All laser sources, DFB sources, and tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:AM[:INTernal]:FREQuency[*/*]?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:AM[:INTernal]:FREQuency[*l*]? `[MIN|DEF|MAX]`
description:	Returns the frequency of the amplitude modulation as a *float* value in Hertz.
parameters:	`MIN`: minimum modulation frequency

`MAX`: maximum modulation frequency

`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum modulation frequency and the maximum modulation frequency

NOTE Use [*l*] to query the modulation frequency of the upper or lower wavelength laser source of a dual-wavelength laser source or a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.

response:	modulation frequency relevant to the current value or specified parameter (if MIN, MAX, or DEF are chosen as a parameter).
example:	`sour2:am:freq? min` → `+2.00000000E+002<END>`
affects:	All laser sources, DFB sources, and tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:AM:SOURce[*l*]**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:AM:SOURce[*l*]<wsp> INT|INT1|INT2|COHC|AEXT|EXT|DEXT|WVLL|BACK|0|1|2|3|5|6
description:	Selects the type or source of the modulation of the laser output.
parameters:	`0`, INT1, `or INTernal:` internal digital modulation `1`, COHCtrl, or INT2: coherence control 2, AEXTernal, or EXT: external analog modulation 3 or DEXTernal: external digital modulation 5 or WVLLocking: wavelength locking 6 or BACKplane: external digital modulation using Input Trigger Connector
NOTE	Use [*l*] to set the modulation source of the upper or lower wavelength laser source of a dual-wavelength laser source or a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.
response:	none
example:	`sour2:am:sour int`
affects:	All laser sources, DFB sources, and tunable laser modules can use internal digital modulation; as can return loss modules containing an internal source. DFB source and tunable laser modules can use coherence control. Other modulation modes are only available with tunable laser modules.

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:AM:SOURce[*l*]?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:AM:SOURce[*l*]?
description:	Returns the type or source of the modulation of the laser output.
parameters:	`0:` internal digital modulation `1:` coherence control 2: external analog modulation 3: external digital modulation 5: wavelength locking 6: external digital modulation using Input Trigger Connector
NOTE	Use [*l*] to query the modulation source of the upper or lower wavelength laser source of a dual-wavelength laser source or a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.
response:	none
example:	`sour2:am:sour?` $\rightarrow$ `+0`<END>
affects:	All laser sources, DFB sources, and tunable laser modules can use internal digital modulation; as can return loss modules containing an internal source. DFB source and tunable laser modules can use coherence control. All other modulation modes are only available with tunable laser modules.

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:AM:STATe[*l*]**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:AM:STATe[*l*]<wsp> OFF|ON|0|1
description:	Enables and disables amplitude modulation of the laser output.
parameters:	A *boolean* value: `OFF` or `0`: modulation disabled (default) `ON` or `1`: modulation enabled.

NOTE Use [*l*] to enable/disable amplitude modulation for the upper or lower wavelength laser source of a dual-wavelength laser source or a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.

NOTE When the internal modulation is selected, the Modulation Output on the front panel outputs a version of the modulating signal that has the same frequency and phase as the modulating signal, but has a fixed, TTL-level amplitude. You can use this to synchronize your external measuring equipment to your instrument.

To allow for your possible synchronization requirements, there are two ways in which the signal can be output. Either the signal is combined with the laser-ready signal, so that the output is kept low when there is no optical signal being output (for example, while the laser is settling after a change of wavelength). Or the modulation signal is output all the time. This is set by the **`:SOURCE:MODOUT`** command (see *"[:SOURce[n]][:CHANnel[m]]:MODout" on page 109*).

NOTE When you enable lambda logging, see *"[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:LLOGging" on page 128*, and modulation simultaneously, a sweep can not be started, see *"[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:[STATe]" on page 133*.

response:	none
example:	`sour2:am:stat 0`
affects:	All laser sources, DFB sources, tunable laser modules, and return loss modules containing an internal source.

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:AM:STATe[*l*]?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:AM:STATe[*l*]?
description:	Returns the current state of modulation.

NOTE Use [*l*] to query the current state of modulation of the upper or lower wavelength laser source of a dual-wavelength laser source or a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.

parameters:	none
response:	A *boolean* value: 0: modulation is disabled 1: modulation is enabled
example:	`sour2:am:stat?` → `0<END>`
affects:	All laser sources, DFB sources, tunable laser modules, and return loss modules containing an internal source.

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:AM:COHCtrl:COHLevel[l]**
syntax:	[:SOURce[n]][:CHANnel[m]]:AM:COHCtrl:COHLevel[l]<wsp><value>
description:	This sets the level of coherence, when using coherence control, on an arbitrary scale from 1 to 99.98%. A 100% coherence level corresponds to maximum coherence length and minimum linewidth. The coherence level required for a specific linewidth and coherence length can vary among modules.
parameters:	optional MIN, MAX, or DEF instead of <value> to set the current coherence control to the minimum, maximum, or default value
response:	`none`
example:	source2:am:cohc 50
affects:	DFB sources

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:AM:COHCtrl:COHLevel[l]? MIN l MAX l DEF**
syntax:	[:SOURce[n]][:CHANnel[m]]:AM:COHCtrl:COHLevel[l]<wsp><value>?
description:	This queries the current level of coherence, when using Coherence Control, on an arbitrary scale from 1 to 99.98%. A 100% coherence level corresponds to maximum coherence length and minimum linewidth.
parameters:	optional MIN, MAX, or DEF instead of <value> to query the minimum, maximum, and default parameter settings.
response:	`none`
example:	`source2:am:cohc? → 50<END>`
affects:	DFB sources

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:MODout**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:MODout<wsp>FRQ|FRQRDY|0|1	
description:	Sets the modulation output mode of the BNC connector on the front panel of tunable laser modules.	
parameters:	`FRQ` or `0`:	modulation signal is output all the time
	`FRQRDY` or `1`:	modulation is combined with the laser-ready signal. In this case, the output is kept low when no optical signal is output (for example, while the laser is settling after a change of wavelength).
response:	none	
example:	sour0:mod 0	
affects:	All tunable laser sources with BNC connector except Agilent 81649A and Agilent 81689A/B	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:MODout?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:MODout?
description:	Returns the mode of the modulation output mode of the BNC connector on the front panel of tunable laser modules.
parameters:	none
response:	`0`: modulation signal is output all the time
	`1`: modulation is combined with the laser-ready signal. In this case, the output is kept low when no optical signal is output (for example, while the laser is settling after a change of wavelength).
example:	`sour0:mod?` → `0<END>`
affects:	All tunable laser sources with BNC connector except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer:ATTenuation[*l*]**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer:ATTenuation[*l*]<wsp><value>[DB|MDB]
description:	Sets the level of attenuation.
parameters:	Any value in the specified range (see the specifications in the appropriate *User's Guide*).

Also allowed (for tunable laser modules only) are:	`MIN`: minimum programmable value
	`MAX`: maximum programmable value
	`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum programmable value and the maximum programmable value

NOTE Use [*l*] to set the attenuation level of the upper or lower wavelength laser source of a dual-wavelength laser source or of a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.

NOTE Tunable laser modules with in-built optical attenuators need to be in Manual Attenuation Mode (see *"[:SOURce[n]][:CHANnel[m]]:POWer:ATTenuation[l]:AUTO" on page 111*) for this value to have an affect. The output power is a combination of this value and the laser output power (see *"[:SOURce[n]][:CHANnel[m]]:POWer[:LEVel][:IMMediate][:AMPLitude[l]]" on page 113*).

NOTE In this respect, this command does not conform to the SCPI standard. The SCPI standard requires that entering an explicit value for the attenuation switches the attenuation mode OFF.

The default units are **dB**.

response:	none
example:	sour0:pow:att `22.32db`
affects:	All tunable laser modules with an in-built optical attenuator, and all laser source modules.

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer:ATTenuation[*l*]?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer:ATTenuation[*l*]? `[MIN|DEF|MAX]`
description:	Returns the attenuation level. When using a tunable laser module with a built-in optical attenuator, the value returned applies only to the attenuation mode (see *"[:SOURce[n]][:CHANnel[m]]:POWer:ATTenuation[l]:AUTO" on page 111*).
NOTE	Use [*l*] to query the attenuation level of the upper or lower wavelength laser source of a dual-wavelength laser source or of a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.
parameters:	Also allowed (for tunable laser modules only) are: `MIN`: minimum amplitude level `MAX`: maximum amplitude level `DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum amplitude level and the maximum amplitude level
response:	attenuation level relevant to the current value or specified parameter (if MIN, MAX, or DEF are chosen as a parameter).
example:	`sour0:pow:att? def → +3.10000000+E001<END>`
affects:	All tunable laser modules with an in-built optical attenuator, and all laser source modules.

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer:ATTenuation[*l*]:AUTO**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer:ATTenuation[*l*]:AUTO<wsp>OFF|ON|0|1
description:	Selects Automatic or Manual Attenuation Mode. In Automatic Attenuation Mode, you specify the output power. In Manual Attenuation Mode, you must specify both the laser output power, and the attenuation level.
NOTE	Use [*l*] to set the attenuation mode of the upper or lower wavelength laser source of a dual-wavelength laser source or of a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.
parameters:	`OFF` or `0`: Attenuation Mode `ON` or `1`: Power Mode
response:	none
example:	sour0:pow:`att:auto 1`
affects:	All tunable laser sources except Agilent 81649A and Agilent 81689A/B.

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer:ATTenuation[*l*]:AUTO?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer:ATTenuation[*l*]:AUTO?
description:	Returns whether the instrument is in Automatic or Manual Attenuation Mode.
NOTE	Use [*l*] to query the attenuation mode of the upper or lower wavelength laser source of a dual-wavelength laser source or of a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.
parameters:	none
response:	`0:` Manual Attenuation Mode
	`1:` Automatic Attenuation Mode
example:	`sour0:pow:att:auto? → 1<END>`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B.

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer:ATTenuation[*l*]:DARK**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer:ATTenuation[*l*]:DARK<wsp>OFF|ON|0|1	
description:	Sets or unsets the attenuator to 'dark' position. Dark position blocks all light from the laser. You can use this as an alternative to disabling the laser, the advantage of doing this is that you avoid the laser rise time. This command is available in Attenuation Mode Only.	
NOTE	Use [*l*] to set the attenuation dark postion of the upper or lower wavelength laser source of a dual-wavelength laser source or of a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.	
parameters:	`OFF` or `0:`	Unsets dark position
	`ON` or `1:`	Sets dark position
response:	none	
example:	sour0:pow:att:`dark 1`	
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B.	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer:ATTenuation[*l*]:DARK?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer:ATTenuation[*l*]:DARK?
description:	Queries whether the attenuator is set to 'dark' position (where all light is blocked by the laser).
NOTE	Use [*l*] to set query the attenuation dark position of the upper or lower wavelength laser source of a dual-wavelength laser source or of a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.
parameters:	none
response:	`0:` dark position not set
	`1:` dark position set
example:	`sour0:pow:att:dark? → 1<END>`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B.

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer[:LEVel][:IMMediate][:AMPLitude[*l*]]**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer[:LEVel][:IMMediate][:AMPLitude[*l*]]<wsp><value> [PW|NW|UW|MW|Watt|DBM]
description:	Sets the power of the laser output.

NOTE If an optical attenuator is installed, the power value returned is dependent on whether you are using power or attenuation mode (see *"[:SOURce[n]][:CHANnel[m]]:POWer:ATTenuation[l]:AUTO" on page 111*).

If you are using power mode, the value returned is the output power.

If you are using attenuation mode, the value returned is the laser output power, and you must also use the attenuation value to calculate the output power (see *"[:SOURce[n]][:CHANnel[m]]:POWer:ATTenuation[l]" on page 110*).

The values for the output power that you set in the Power Mode, and the laser output power that you set in the Attenuation Mode, are stored and used independently.

NOTE The instrument may not be able to output a signal with the maximum programmable power, it will output a signal with the maximum power. Use the *"[:SOURce[n]][:CHANnel[m]]:POWer[:LEVel][:IMMediate][:AMPLitude[l]]?" on page 114* to query the power being output.

The default units are `DBM` or `W`, depending on the unit selected using the following command: *"[:SOURce[n]][:CHANnel[m]]:POWer:UNIT" on page 116*.

parameters: Any value in the specified range (see the appropriate *User's Guide*).

Also allowed are:	`MIN`: minimum programmable value
	`MAX`: maximum programmable value
	`DEF`: This is not the preset (`*RST`) default value, but is the maximum programmable level

NOTE Use [*l*] to set the amplitude level of the output power of the upper or lower wavelength laser source of a dual-wavelength laser source or a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.

response:	none
example:	`sour2:pow 23uW`
affects:	All tunable laser and DFB source modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer[:LEVel][:IMMediate][:AMPLitude[*l*]]?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer[:LEVel][:IMMediate][:AMPLitude[*l*]]?<wsp> `[MIN|DEF|MAX]`
description:	Returns the amplitude level of the output power.

The value returned is the actual amplitude that is output, which may be different from the value set for the output. If these two figures are not the same, it is indicated in the :STATus:OPERation register.

NOTE If an optical attenuator is installed, the power value returned is dependent on whether you are using power or attenuation mode (see *"[:SOURce[n]][:CHANnel[m]]:POWer:ATTenuation[l]:AUTO" on page 111*).

If you are using power mode, the value returned is the output power.

If you are using attenuation mode, the value returned is the laser output power, and you must also use the attenuation value to calculate the output power (see *"[:SOURce[n]][:CHANnel[m]]:POWer:ATTenuation[l]" on page 110*).

The values for the output power that you set in the Power Mode, and the laser output power that you set in the Attenuation Mode, are stored and used independently.

parameters:	Also allowed (for tunable laser modules only) are:	`MIN`: minimum amplitude level
		`MAX`: maximum amplitude level
		`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum amplitude level and the maximum amplitude level

NOTE Use [*l*] to query the amplitude level of the output power of the upper or lower wavelength laser source of a dual-wavelength laser source or a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.

response:	Amplitude level relevant to the current value or specified parameter (if MIN, MAX, or DEF are chosen as a parameter).
example:	sour2:pow? → `+8.00000000E-004<END>`
affects:	All laser sources, DFB sources, and tunable laser modules and return loss modules with an internal source

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer[:LEVel]:RISetime[*l*]**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer[:LEVel]:RISetime[*l*]<wsp><value>[NS|US|MS|S]	
description:	Sets the laser rise time of the chosen source.	
parameters:	Any value in the specified range (see the appropriate *User's Guide*).	
	Also allowed are:	`MIN`: minimum programmable value
		`MAX`: maximum programmable value
		`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum programmable level and the maximum programmable level
NOTE	Use [*l*] to set the risetime of the upper or lower wavelength laser source of a dual-wavelength laser source or a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.	
response:	none	
example:	`sour2:pow:ris 10ns`	
affects:	All laser sources, DFB sources, and tunable laser modules and return loss modules with an internal source	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer[:LEVel]:RISetime[*l*]?**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer[:LEVel]:RISetime[*l*]?<wsp>[MIN|DEF|MAX]	
description:	Returns the laser rise time of the chosen source.	
parameters:	Also allowed are:	`MIN`: minimum programmable value
		`MAX`: maximum programmable value
		`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum programmable level and the maximum programmable level
NOTE	Use [*l*] to query the risetime of the upper or lower wavelength laser source of a dual-wavelength laser source or a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.	
response:	The rise time as a **float** value in seconds.	
example:	`sour2:pow:ris?` → `+1.00000000E-009<END>`	
affects:	All laser sources, DFB sources, and tunable laser modules and return loss modules with an internal source	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer:STATe**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer:STATe<wsp><boolean>	
description:	Switches the laser of the chosen source on or off.	
parameters:	A *boolean* value:	0: Laser Off
		1: Laser On
response:	none	
example:	sour2`:pow:stat 1`	
affects:	All laser source, DFB source, and tunable laser modules and return loss modules with an internal source	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer:STATe?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer:STATe?
description:	Queries the laser state of the chosen source.
parameters:	none
response:	A *boolean* value: 0: Laser Off 1: Laser On
example:	`sour2:pow:stat? → 1<END>`
affects:	All laser source, DFB source, and tunable laser modules and return loss modules with an internal source

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer:UNIT**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer:UNIT<wsp>DBM|0|Watt|1
description:	Sets the power units
parameters:	`0 or DBM`: dBm (default) `1 or W`: Watts
response:	none
example:	sour2:`pow:unit w`
affects:	All tunable laser and DFB source modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer:UNIT?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:POWer:UNIT?
description:	Return the current power units
parameters:	`0`: dBm `1`: Watts
response:	none
example:	`sour2:pow:unit? → +0<END>`
affects:	All tunable laser and DFB source modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer:WAVelength**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]:POWer:WAVelength[<wsp> EXTernal|LOWer|UPPer|BOTH|0|1|2|3]

NOTE For compatibility reasons, WAVelength may be replaced with WAVE.

description:	Sets the wavelength source for a dual-wavelength laser source.	
parameters:	EXTernal: or 0	External
	LOWer: or 1	The lower wavelength source
	UPPer: or 2	The upper wavelength source
	BOTH: or 3	Both wavelength sources
response:	none	
example:	`sour2:pow:wav upp`	
affects:	All dual-wavelength laser source modules and return loss modules with two internal sources	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:POWer:WAVelength?**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]:POWer:WAVelength?	
NOTE	For compatibility reasons, WAVelength may be replaced with WAVE.	
description:	Returns the wavelength source for a dual-wavelength laser source.	
parameters:	none	
response:	LOW	The lower wavelength source
	UPP	The upper wavelength source
	BOTH	Both wavelength sources
example:	`sour2:pow:wav?` → `LOW<END>`	
affects:	All dual-wavelength laser source modules and return loss modules with two internal sources	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:READout:DATA?**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]:READout:DATA?	
description:	Returns the data as a binary stream from either a lambda logging operation or the maximum power the laser can produce at each wavelength.	
parameters:	LLOGging:	Returns a binary stream that contains each wavelength step of the lambda logging operation, see *"[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:LLOGging" on page 128*. Each binary block is an 8-byte long **double** in Intel byte order.
	PMAX:	Returns a binary stream that contains the maximum power the laser can produce at each wavelength. Each binary block is a 8-byte long **double** (the wavelength value) followed by a 4-byte long **float** (the power value). The stream is in Intel byte order.
response:	A binary stream in Intel byte order.	
example:	`sour2:read:data? llog` → *the data as a binary stream*	
affects:	All tunable laser and DFB source modules	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:READout:DATA:BLOCk?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]:READout:DATA:BLOCk?<wsp>LLOGging | PMAX,<offset>,<# of data points>
description:	Returns a specified binary block from either a lambda logging operation, or maximum power at wavelength characteristic.
parameters:	LLOGging: Returns the data block from lambda logging. The binary block is an 8-byte long **double** in Intel byte order.
	PMAX: Returns the data block from the power curve characteristic. Each binary block is a 8-byte long **double** (the wavelength value) followed by a 4-byte long **float** (the power value). The stream is in Intel byte order.
	<offset> A zero based offset that specifies the index of the first value within the block to be transferred.
	<# of data points> The number of points (not bytes!) in the transferred block.
response:	A binary stream in Intel byte order.
example:	`sour0:read:data:block? llog,100,20000` → *the data as a binary stream*
affects:	All tunable laser and DFB source modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:READout:DATA:MAXBlocksize?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]:READout:DATA:MAXBlocksize?
description:	Returns the maximum block size for a single GPIB transfer for lambda logging functions. If your application requires more data points please use SOURce[n]][:CHANnel[m]]:READout:DATA:BLOCk? instead of SOURce[n]][:CHANnel[m]]:READout:DATA?
parameters:	none
response:	The maximum number of data points (not bytes!) in the transferred block, as an *integer* value.
example:	`sour0:read:data:maxb?` → `120<END>`
affects:	All tunable laser and DFB source modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:READout:POINts?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]:READout:POINts?<wsp>LLOGging | PMAX
description:	Returns the number of datapoints that the [:SOURce[*n*]][:CHANnel[*m*]]:READout:DATA? command will return.
parameters:	LLOGging: Returns the number of wavelength steps for a lambda logging operation, see *"[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:LLOGging" on page 128*.
	PMAX: Returns the number of datapoints (each datapoint contains a value for wavelength and power) the [:SOURce[*n*]][:CHANnel[*m*]]:READout:DATA? PMAX command will return, number of datapoints depends on the calibration data for your module.
response:	The number of datapoints as an *integer* value.
example:	`sour2:read:poin? pmax` → `120<END>`
affects:	All tunable laser and DFB source modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength[:CW[*l*]:FIXED[*l*]]**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength[:CW[*l*]:FIXED[*l*]]<wsp><value> [PM|NM|UM|MM|M]
description:	Sets the absolute wavelength of the output.
parameters:	Any wavelength in the specified range (see the specifications in the appropriate *User's Guide*).

The programmable range is larger than the range specified in the *User's Guide*. The programmable range is set individually for each instrument when it is calibrated during production.

Also allowed are:	`MIN`: minimum wavelength value
	`MAX`: maximum wavelength value
	`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum wavelength value and the maximum wavelength value

NOTE Use [*l*] to set the upper or lower wavelength laser source of a dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.

response:	none
example:	sour2:wav `1550NM`
affects:	All tunable laser and DFB source modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength[:CW[*l*]|:FIXED[*l*]]?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]:WAVelength[:CW[*l*] | :FIXED[*l*]]?[<wsp>[MIN | DEF | MAX]
description:	Returns the wavelength value in meters.
parameters:	none

Also allowed, for tunable laser modules only, are:

- `MIN`: minimum wavelength
- `MAX`: maximum wavelength
- `DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum wavelength value and the maximum wavelength value

NOTE Use [*l*] to query the upper or lower wavelength laser source of a dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.

response: The wavelength as a *float* value in meters.

example:

`sour0:wav? → +1.5672030E-006<END>`	Returns the current wavelength value for a tunable laser module.
`sour0:wav? min → +1.5500000E-006<END>`	Returns minimum wavelength for a tunable laser module.
`sour2:wav:fixed2? → +1.61544494E-006<END>`	Returns the wavelength value of the upper wavelength source of a dual-wavelength laser source.

affects: All laser source, DFB source, and tunable laser modules and return loss modules with an internal source

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:ARA**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:ARA
description:	Realigns the laser cavity.
parameters:	none
response:	none
example:	`sour0:wav:corr:ara`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:AUTocalib**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:AUTocalib<wsp>ON (1) | OFF (0)
description:	Sets the Auto Calibration feature On or OFF. Switching it OFF enables the TLS to operate for a long period without interruption from the "auto lambda zeroing" or settling. When Auto Calibration is disabled, it is possible to operate the TLS at a temperature that differs more than 4.4 K from the last Lambda Zeroing temperature. In this case, the accuracy and wavelength performance of the TLS can become less optimal due to temperature variation. The relevent accuracy class is indicated on the user interface when Auto Calibration is off..
parameters:	a boolean value: 1 or ON: enable Autocalibration 0 or OFF: disable Autocalibration
response:	none
example:	`sour0:wav:corr:aut 0`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:AUTocalib?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:AUTocalib?
description:	Returns whether Autocalibration is enabled or disabled
parameters:	none
response:	0 Autocalibration disabled 1 Autocalibration enabled
example:	`sour0:wav:corr:aut?` → `1`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:ZERO**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:ZERO
description:	Executes a wavelength zero.
parameters:	none
response:	none
example:	`sour0:wav:corr:zero`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:ZERO:TEMPerature:ACTual?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:ZERO:TEMPerature:ACTual?
description:	Reports the current lambda zero tempearture.
parameters:	none
response:	**float** value; temperature in $^{\circ}$C
example:	`sour0:wav:corr:zero:temp:act?`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:ZERO:TEMPerature:DIFFerence?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:ZERO:TEMPerature:Difference?
description:	Reports the temperature difference required to trigger an auto lamda zero.
parameters:	none
response:	**float** value; temperature in °C
example:	`sour0:wav:corr:zero:temp:diff?`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:ZERO:TEMPerature:LASTzero?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:ZERO:TEMPerature:LASTzero?
description:	Reports the temperature at which the last auto lamda zero took place.
parameters:	none
response:	**float** value; temperature in °C
example:	`sour0:wav:corr:zero:temp:last?`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:ZERO:AUTO**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:CORRection:ZERO:AUTO
description:	Forces an auto lamda zero. This is quicker than the equilavent manual process because some checks are omitted:

Lambda Zero	**Auto**	**Manual**
Check ARA Current	No	Yes
Mechanical Zero	No	Yes
Optical Zero	Yes	Yes
TCFS k factor calibration	Yes	Yes
Motor Calibration	No	Yes

parameters:	none
response:	none
example:	`sour0:wav:corr:zero:auto`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:FREQuency[*l*]**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:FREQuency[*l*]<wsp><value> [THZ|GHZ|MHZ|KHZ|HZ]
description:	Sets the frequency difference used to calculate a relative wavelength. The output wavelength is made up of the reference wavelength and this frequency difference.

The default units for frequency are Hertz.

The output wavelength (λ) is set from the base wavelength (λ_0) and the frequency offset (df). The formula for calculating the output wavelength is:

$$\lambda = \frac{(c)}{((\lambda_o df) + c)} \quad \lambda_o$$

where c is the speed of light in a vacuum (2.990 x 10^8 ms^{-1})

NOTE Use [*l*] to set the frequency of the upper or lower wavelength laser source of a dual-wavelength laser source or a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.

parameters:	The frequency difference is a **float** value in Hz.
response:	none
example:	`sour0:wav:freq -10THZ`
affects:	All tunable laser sources

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:FREQuency[*l*]?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:FREQuency[*l*]?
description:	Returns the frequency difference used to calculate a relative wavelength.

NOTE Use [*l*] to query the frequency of the upper or lower wavelength laser source of a dual-wavelength laser source or a return loss module with an internal dual-wavelength laser source. The default value of [*l*] is *1*, the lower wavelength source. The upper wavelength source is denoted by *2*.

parameters:	none
response:	Returns the frequency difference as a **float** value in Hz.
example:	`wav:freq?` → `-1.00000000E+013<END>`
affects:	All tunable laser sources

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:REFerence[*l*]?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:REFerence[*l*]?
description:	Returns the reference wavelength (λ_0).
parameters:	none
response:	The wavelength as a *float* value in meters.
example:	`sour2:wav:ref?` → `+1.5500000E-006<END>`
affects:	All tunable laser and DFB modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:REFerence:DISPlay**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:REFerence:DISPlay
description:	Sets the reference wavelength to the value of the output wavelength ($\lambda \rightarrow \lambda_0$), that is, sets the frequency offset (df) to zero.
parameters:	none
response:	none
example:	sour2:wav:ref:disp
affects:	All tunable laser and DFB modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:CHECkparams?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:CHECkparams?
description:	Returns whether the currently set sweep parameters (sweep mode, sweep start, stop, width, etc.) are consistent. If there is a sweep configuration problem, the laser source is not able to pass a wavelength sweep.
parameters:	none
response:	A *string* with a detailed description of a configuration problem, or "OK" if the sweep os configured correctly. The responses shown below are all the possible configuration problem strings:

Message	**Description**
368,LambdaStop <=LambdaStart	start wavelength must be smaller than stop wavelength
369,sweepTime < min	the total time of the sweep is too small
370,sweepTime > max	the total time of the sweep is too large
371,triggerFreq > max	the trigger frequency (calculated from sweep speed divided by sweep step) is too large
372,step < min	step size too small
373,triggerNum > max	the number of triggers exceeds the allowed limit
374,LambdaLogging = On AND Modulation = On AND ModulationSource! = CoherenceControl	The only allowed modulation source with the lambda logging function is coherence control.
375,LambdaLogging = On AND TriggerOut! = StepFinished	lambda logging only works "Step Finished" output trigger configuration
376,Lambda logging in stepped mode	lambda logging can only be done in continuous sweep mode
377,step not multiple of <x>	the step size must be a multiple of the smallest possible step size

example:	`sour0:wav:swe:chec?` → `"triggerNum > max"`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:CYCLes**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:CYCLes<wsp> <value>|MIN|MAX|DEF|0	
description:	Sets the number of cycles.	
NOTE	Cannot be set while a sweep is running.	
parameters:	The number of cycles is an integer value.	
	Also allowed are:	`MIN`: minimum programmable value
		`MAX`: maximum programmable value
		`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum programmable value and the maximum programmable value
		0: cycles continuously.
response:	none	
example:	`wav:swe:cycl 3`	
affects:	All tunable laser modules	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:CYCLes?**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:CYCLes? [<wsp>MIN|MAX|DEF]	
description:	Returns the number of cycles.	
parameters:	none	
	Also allowed are:	`MIN`: minimum programmable value
		`MAX`: maximum programmable value
		`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum programmable value and the maximum programmable value
response:	The number of cycles as an integer value.	
example:	`wav:swe:cycl?` → `+3<END>`	
affects:	All tunable laser modules	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:DWELl**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:DWELl<wsp> <value>|MIN|MAX|DEF[NS|US|MS|S]
description:	Sets the dwell time. Can only be used when sweep is stepped.
NOTE	Cannot be set while a sweep is running.
parameters:	The dwell time as a *float* value.

If you specify no units in your command, seconds are used as the default.

Also allowed are: `MIN`: minimum programmable value

`MAX`: maximum programmable value

`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum programmable value and the maximum programmable value

response:	none
example:	`wav:swe:dwel 500ms`
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:DWELl?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:DWELl?[<wsp>MIN|MAX|DEF]
description:	Returns the dwell time. Can only be used when sweep is stepped.
parameters:	none

Also allowed are: `MIN`: minimum programmable value

`MAX`: maximum programmable value

`DEF`: This is not the preset (`*RST`) default value but is half the sum of, the minimum programmable value and the maximum programmable value

response:	The dwell time in seconds.
example:	`wav:swe:dwel? → +5.00000000E-001<END>`
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:EXPectedtriggers?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:EXPectedtriggers?
description:	Returns the number of triggers. A tunable laser wavelength sweep causes a number of triggers, this number is required to configure a triggering data acquisition function on a power meter. The number returned by this function can be used to configure a Power Meter for co-ordinated measurements with a tunable laser source (see command *":SENSe[n][:CHANnel[m]]:FUNCtion:PARameter:LOGGing" on page 85*).
parameters:	none
response:	the number of expected triggers as an unsigne integer value.
example:	`sour0:wav:swe:exp? → 12001`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:FLAG?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:FLAG?

description: The sweep flag is used to find out when logging data is available and when the next sweep cycle may be triggered.

It may also be used as a sweep cycle counter, where: flag/2 = number of sweep cycles

The flag is:

- only used in continuous sweep

- set to 0 at start/end of sweep

- incremented when the sweep is waiting for a trigger

- incremented when logging data is available

- an odd number when, waiting for a trigger

- an even number when, logging data may be read

If the trigger input isn't configured to start a sweep cycle the flag is increased by two when the logging data is available

If no logging data is calculated, because the user doesn't want lambda logging, the flag is incremented at the end of the sweep cycle regardless

Sweep state	Flag
start	0
sweep waiting for trigger	1
trigger $\rightarrow$ first cycle | start moving back | do some post-processing | logging data available	2
sweep waiting for next trigger	3
	.....
sweep stopped or finished	0

parameters:	none
response:	the current sweep flag value as an unsigned integer value
example:	`sour0:wav:swe:flag?` $\rightarrow$ `30`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:LLOGging**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:LLOGging<wsp>OFF|ON|0|1
description:	Switches lambda logging on or off. Lambda logging is a feature that records the exact wavelength of a tunable laser module when a trigger is generated during a continuous sweep. You can read this data using the [:SOURce[*n*]][:CHANnel[*m*]]:READout:DATA? command.

NOTE The following settings are the prerequisites for Lambda Logging:

Set *"[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:MODE" on page 129* to CONTinuous.

Set *":TRIGger[n][:CHANnel[m]]:OUTPut" on page 161* to STFinished (step finished).

Set *"[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:CYCLes" on page 125* to 1.

Set *"[:SOURce[n]][:CHANnel[m]]:AM:STATe[l]" on page 108* to OFF.

If any of the above prerequisites are not met, then when the sweep is started the status "Sweep parameters inconsistent" will be returned and Lambda Logging will automatically be turned off.

NOTE Lambda logging is disabled at the end of a sweep.

NOTE Generally, a continuous sweep can only be started if:

the trigger frequency, derived from the sweep speed and sweep step, is <= 40kHz

the number of triggers, calculated from the sweep span and sweep span, is <=100001

the start wavelength is less than the stop wavelength.

In addition, a continuous sweep with lambda logging requires:

the trigger output to be set to step finished

modulation set to coherence control or off.

parameters:	`0` or `OFF`:	switch lambda logging off
	`1` or `ON`:	switch lambda logging on
response:	none	
example:	`wav:swe:llog 1`	
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:LLOGging?**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:LLOGging?	
description:	Returns the state of lambda logging.	
parameters:	none	
response:	A *boolean* value:	0 – lambda logging is switched off
		1 – lambda logging is switched on
example:	`wav:swe:llog?` → `1<END>`	
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:MODE**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:MODE<wsp><mode>
description:	Sets the sweep mode.
NOTE	Cannot be set while a sweep is running.
parameters:	STEPped: Stepped sweep mode
	MANual: Manual sweep mode
	CONTinuous: Continuous sweep mode
response:	none
example:	`wav:swe:mode STEP`
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:MODE?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:MODE?
description:	Returns the sweep mode.
parameters:	none
response:	STEP: Stepped sweep mode
	MAN: Manual sweep mode
	CONT: Continuous sweep mode
example:	`wav:swe:mode?` → `STEP<END>`
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:PMAX?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:PMAX?<wsp><start wavelength>, <stop wavelength>
description:	Returns the power to the highest permissible power for the selected wavelength sweep.
parameters:	start wavelength: The wavelength at which the sweep starts as a **float** value.
	stop wavelength: The wavelength at which the sweep starts as a **float** value.
response:	The highest permissible power for the selected wavelength sweep as a **float** value.
example:	`wav:swe:pmax? 1540nm,1550nm` → `+3.5500000E-004<END>`
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:REPeat**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:REPeat<wsp><mode>
description:	Sets the repeat mode. Applies in stopped-sweep and manual-sweep modes.
parameters:	ONEWay: Every stepped or continuous sweep cycle starts at the start wavelength of the sweep and ends at the stop wavelength of the sweep
	TWOWay: Every odd stepped sweep cycle starts at the start wavelength of the sweep, and every even stepped sweep cycle starts at the stop wavelength of the sweep.
	Set the start and stop wavelength of the sweep using *"[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STARt" on page 131* and *"[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STOP" on page 132* respectively.
response:	none
example:	`wav:swe:rep twow`
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:REPeat?**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:REPeat?
description:	Returns the repeat mode.
parameters:	none
response:	ONEWay: Every stepped or continuous sweep cycle starts at the start wavelength of the sweep and ends at the stop wavelength of the sweep
	TWOWay: Every odd stepped sweep cycle starts at the start wavelength of the sweep, and every even stepped sweep cycle starts at the stop wavelength of the sweep.
	Set the start and stop wavelength of the sweep using *"[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STARt" on page 131* and *"[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STOP" on page 132* respectively.
example:	`wav:swe:rep?` $\rightarrow$ `ONEW<END>`
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:SOFTtrigger**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:SOFTtrigger
description:	Softtrigger does the same as a normal (hardware) trigger at the backplane, but it doesn't cause a PM to take a measurement because it is only a (software) message sent to the tunable laser source. It only works in continuous sweep. Usage: - Trigger input configuration: Start Sweep - Start Sweep - SoftTrigger
parameters:	none
response:	none
example:	`sour0:wav:sweep:soft`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:SPEed**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:SPEed<wsp><speed> [NM/S|UM/S|MM/S|M/S|]
description:	Sets the speed for continuous sweeping.
NOTE	Cannot be set while a sweep is running.
parameters:	Speed as a **float** value in meters per second (m/s).
response:	none
example:	`wav:swe:spe 10nm/s`
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:SPEed?**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:SPEed?[<wsp>MIN|MAX]	
description:	Returns the speed for continuous sweeping.	
parameters:	optional	MIN Returns the minimum sweep speed available.
		MAX Returns the maximum sweep speed available.
response:	Speed as a **float** value in meters per second (m/s).	
example:	`wav:swe:spe? → +5.00000000E-008<END>`	
affects:	All tunable laser modules except Agilent 81649A and Agilent 81689A/B	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STARt**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STARt<wsp><start value> [PM|NM|UM|MM|M]
description:	Sets the starting point of the sweep.
NOTE	Cannot be set while a sweep is running.
parameters:	The wavelength at which the sweep starts as a **float** value. If you specify no units in your command, meters are used as the default.
response:	none
example:	`wav:swe:star 1500nm`
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STARt?**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STARt?[<wsp>MIN|MAX]	
description:	Returns the starting point of the sweep.	
parameters:	optional	MIN Returns the minimum start wavelength available. This value is wavelength dependent.
		MAX Returns the maximum start wavelength available. This value is wavelength dependent.
response:	The wavelength at which the sweep starts as a **float** value in meters.	
example:	`wav:swe:star? → +1.50000000E-006<END>`	
affects:	All tunable laser modules	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STOP**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STOP<wsp><stop value> [PM|NM|UM|MM|M]
description:	Sets the end point of the sweep.
NOTE	Cannot be set while a sweep is running.
parameters:	The wavelength at which the sweep ends as a **float** value in meters. If you specify no units in your command, meters are used as the default.
response:	none
example:	`wav:swe:stop 1550nm`
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STOP?**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STOP?[<wsp>MIN|MAX]	
description:	Returns the end point of the sweep.	
parameters:	optional	MIN Returns the minimum start wavelength available. This value is wavelength dependent.
		MAX Returns the maximum start wavelength available. This value is wavelength dependent.
response:	The wavelength at which the sweep ends as a **float** value in meters.	
example:	`wav:swe:stop?` → `+1.55000000E-006<END>`	
affects:	All tunable laser modules	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:[STATe]**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:[STATe]<wsp> STOP|0|STARt|1|PAUSe|2|CONTinue|3	
description:	Stops, starts, pauses or continues a wavelength sweep.	
parameters:	0 or STOP:	Stop the sweep.
	1 or STARt:	Start a sweep, run sweep.
	2 or PAUSe:	Pause the sweep.
	3 or CONTinue:	Continue a sweep.

NOTE If you enable lambda logging (see *"[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:LLOGging" on page 128*) and modulation (see *"[:SOURce[n]][:CHANnel[m]]:AM:STATe[l]" on page 108*) simultaneously, a sweep cannot be started.

NOTE Generally, a continuous sweep can only be started if:

the trigger frequency, derived from the sweep speed and sweep step, is <= 40kHz

the number of triggers, calculated from the sweep span and sweep span, is <=100001

the start wavelength is less than the stop wavelength.

In addition, a continuous sweep with lambda logging requires:

the trigger output to be set to step finished

modulation set to coherence control or off.

response:	none
example:	`wav:swe` STOP
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:[STATe]?**	
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:[STATe]?	
description:	Returns the state of a sweep.	
parameters:	none	
response:	+0:	Sweep is not running
	+1:	Sweep is running
example:	`wav:swe?` → +0`<END>`	
affects:	All tunable laser modules	

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STEP:NEXT**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STEP:NEXT
description:	Performs the next sweep step, if a manual sweep is paused.
parameters:	none
response:	none
example:	`wav:swe:step:next`
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STEP:PREVious**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STEP:PREVious
description:	Performs one sweep step backwards, if a manual sweep is paused.
parameters:	none
response:	none
example:	`wav:swe:step:prev`
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STEP:[WIDTh]**
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STEP:[WIDTh]<wsp><value>[PM|NM|UM|MM|M]
description:	Sets the width of the sweep step. In continuous sweep mode, the end of a step is used for triggering.
parameters:	The width of the sweep step as a *float* value. If you specify no units in your command, meters are used as the default.
response:	none
example:	`wav:swe:step 5nm`
affects:	All tunable laser modules

command:	**[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STEP:[WIDTh]?**		
syntax:	[:SOURce[*n*]][:CHANnel[*m*]]:WAVelength:SWEep:STEP:[WIDTh]?[<wsp>MIN|MAX]		
description:	Returns the width of the sweep step		
parameters:	optional	MIN	Returns the minimum step width available.
		MAX	Returns the maximum step width available.
response:	The sweep step as a **float** value in meters.		
example:	`wav:swe:step?` → `+5.00000000E-009<END>`		
affects:	All tunable laser modules		

Signal Conditioning

The commands in this section allow you to control Agilent 8156x, and 8157x Attenuator modules

The INPut and OUTput commands

command: **:INPut[*n*][:CHANNel[*m*]]:ATTenuation**

syntax: :INPut[*n*][:CHANNel[*m*]]:ATTenuation<wsp><value>[dB] | MIN | DEF | MAX

description: Sets the attenuation factor (α) for the instrument. The attenuation factor is used, together with an offset factor (α_{Offset}) to set the filter attenuation (α_{filter}).

$\alpha_{(new)}$ (dB) = $\alpha_{filter\ (new)}$ (dB) + α_{Offset} (dB)

Set the attenuation factor by sending a value (the default units are dB), or by sending MIN, DEF, or MAX.

parameters:

<value>[dB]	The attenuation in dB.
MIN | DEF	The values where α_{filter} = 0dB
MAX	The value where α_{filter} is at its greatest.

response: none

example: `INP1:ATT 14dB`

affects: All attenuator modules

command: **:INPut[*n*][:CHANNel[*m*]]:ATTenuation?**

syntax: :INPut[*n*][:CHANNel[*m*]]:ATTenuation?<wsp> MIN | DEF | MAX

description: Returns the current attenuation factor (α), in dB.

α (dB) = α_{filter} (dB) + α_{Offset} (dB)

parameters: MIN | DEF | MAX Returns the minimum, default, or maximum value of the attenuation factor possible.

response: 4 byte Intel floating point; attenuation in dB.

example: `INP1:ATT?` → `14<END>`

affects: All attenuator modules

command:	**:INPut[*n*][:CHANnel[*m*]]:OFFSet**	
syntax:	:INPut[*n*][:CHANnel[*m*]]:OFFSet<wsp><value>[dB] | MIN | DEF | MAX	
description:	Sets the offset factor (α_{Offset}) for the instrument. This factor does not affect the filter attenuation (α_{filter}). It is used to offset the attenuation factor values. This offset factor is used, with the attenuation factor, to set the attenuation of the filter. In this way it is possible to compensate for external losses. $\alpha_{(new)}$ (dB) = α_{filter} (dB) + $\alpha_{Offset\ (new)}$ (dB) Set the offset factor by sending a value (the default units are dB), or by sending MIN, DEF, or MAX.	
parameters:	<value>[dB]	The offset factor (α_{Offset}) in dB.
	MIN	Sets the minimum value for α_{Offset} = - 200dB.
	DEF	Sets the default value for α_{Offset} = 0dB.
	MAX	Sets the maximum value for α_{Offset} = + 200dB.
response:	none	
example:	`INP1:OFFS 2dB`	
affects:	All attenuator modules	

command:	**:INPut[*n*][:CHANnel[*m*]]:OFFSet?**
syntax:	:INPut[*n*][:CHANnel[*m*]]:OFFSet?<wsp>MIN | DEF | MAX
description:	Returns the current value of the offset factor (α_{Offset}), in dB.
parameters:	MIN | DEF | MAX Returns the minimum, default, or maximum value of the offset factor.
response:	4 byte Intel floating point; offset in dB.
example:	`INP1:OFFS?` $\rightarrow$ `2<END>`
affects:	All attenuator modules

command:	**:INPut[*n*][:CHANnel[*m*]]:OFFSet:DISPlay**
syntax:	:INPut[*n*][:CHANnel[*m*]]:OFFSet:DISPlay
description:	Sets the offset factor (α_{Offset}) such that the attenuation factor is zero. $\alpha_{Offset\ (new)}$ (dB) = $\alpha_{Offset\ (old)}$ (dB) - $\alpha_{(old)}$ (dB) = - α_{filter} (dB)
parameters:	none
response:	none
example:	`INP1:OFFS:DISP`
affects:	All attenuator modules

command:	**:INPut[*n*][:CHANnel[*m*]]:OFFSet:POWermeter**
syntax:	:INPut[*n*][:CHANnel[*m*]]:OFFSet:POWermeter<wsp><slot>,<channel>
description:	Sets the offset factor (α_{Offset}) to the difference between a power value measured by another powermeter (hosted by the same mainframe) (P_{ext}) and the power value measured by the attenuator module's monitor diode (P_{att}). α_{Offset} (dB) = P_{att} *(dBm)* - P_{ext} (dBm)
parameters:	<slot> Slot number of the external powermeter. <channel> Channel number of the external powermeter.
response:	none
example:	`INP1:OFFS:POW 4,2`
affects:	Attenuator modules with power control.

command:	**:INPut[*n*][:CHANnel[*m*]]:ATTenuation:SPEed**
syntax:	:INPut[*n*][:CHANnel[*m*]]:ATTenuation:SPEed<wsp><value> | MIN | MAX | DEF
description:	Sets the filter transition speed; the speed at which the module moves from one attenuation to another (in dBs).
parameters:	<value> The filter transition speed in dB/s. MIN | MAX | DEF Sets the filter transition speed to the module limits, or the module default.
response:	none
example:	`INP1:ATT:SPE 2`
affects:	All attenuator modules.

command:	**:INPut[*n*][:CHANnel[*m*]]:ATTenuation:SPEed?**
syntax:	:INPut[*n*][:CHANnel[*m*]]:ATTenuation:SPEed?<wsp> MIN | MAX | DEF
description:	Without the optional parameter, queries the transition speed of the filter.
parameters:	MIN | MAX | DEF Queries the transition speed limits, or the module default.
response:	4 byte Intel floating point; transition speed in dB/s.
example:	`INP1:ATT:SPE?` → `2`<END>
affects:	All attenuator modules.

command:	**:INPut[*n*][:CHANnel[*m*]]:WAVelength**
syntax:	:INPut[*n*][:CHANnel[*m*]]:WAVelength<wsp><value>[PM | NM | UM| MM | M] | MIN | MAX | DEF
description:	Sets the attenuator module's operating wavelength. This value is used to compensate for the wavelength dependence of the filter, and to calculate a wavelegth dependent offset from the user offset table (if enabled).
parameters:	<value> The wavelength in meters (if you do not specify a unit). MIN | MAX | DEF Sets the wavelength to the module limits, or the module default.
response:	none
example:	`INP1:WAV +1.55000000E-006`
affects:	All attenuator modules.

command:	**:INPut[*n*][:CHANnel[*m*]]:WAVelength?**
syntax:	:INPut[*n*][:CHANnel[*m*]]:WAVelength?<wsp>MIN | MAX | DEF
description:	Without the optional parameter, queries the operating wavelength of the attenuator.
parameters:	MIN | MAX | DEF Queries the operating wavelength limits, or the module default.
response:	4 byte Intel floating point; wavelength in m.
example:	`INP1:WAV` → `+1.55000000E-006`<END>
affects:	All attenuator modules.

command:	**:OUTPut*n*[:CHANnel[*m*]]:APMode**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:APMode<wsp><OFF(0) | ON(1)>
description:	The use of this command is optional and has no effect on operation. Included for compatibility with Agilent 8156A mainframe.
parameters:	OFF or 0 ON or 1
response:	none
example:	`OUTP1:APMode OFF`
affects:	All attenuator modules.

command:	**:OUTPut*n*[:CHANnel[*m*]]:APMode?**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:APMode?
description:	Queries whether the user has amended the power value or the attenuation value.
	This use of this command is optional. Included for compatibility with Agilent 8156A mainframe.
parameters:	none
response:	*boolean* 0 User has amended the attenuation value.
	1 User has amended the power value.
example:	`OUTP1:APMode?` $\rightarrow$ `0<END>`
affects:	All attenuator modules.

command:	**:OUTPut*n*[:CHANnel[*m*]]:POWer**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:POWer<wsp><value>[PW I NW I UW I MW I W I DBM] I MIN I MAX I DEF
description:	Sets the output power value (P).
	If your attenuator module does not include the power control feature, the new filter attenuation ($\alpha_{\text{filter (new)}}$) is calculated from the reference power (P_{ref}) :
	$P_{\text{set(new)}}\,(dBm) = P_{\text{ref}}\,(dBm) - \alpha_{\text{filter (new)}}\,(\text{dB}) - P_{\text{Offset}}\,(\text{dB})$
	If your attenuator module includes the power control feature, the filter attenuation is changed until the set power (measured by the module's internal power meter) has been reached. $P_{\text{set(new)}}\,(dBm) = P_{\text{att(new)}}\,(dBm) - P_{\text{offset}}\,(dB)$
	If the set power cannot be achieved ExP (indicating 'Excessive Power') is displayed, and the appropriate GP-IB status bit is set. The status of these bits can be queried using ":STATus:QUEStionable:CONDition[:LEVel0]?" on page 63
parameters:	<value> Desired output power (if unit not specified current unit is used).
	MIN | MAX | DEF Sets the output power to the module limits, or the module default.
response:	none
example:	`OUTP1:POW 12`
affects:	All attenuator modules.

command:	**:OUTPut*n*[:CHANnel[*m*]]:POWer?**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:POWer<wsp>MIN | MAX | DEF
description:	Without the optional parameter, queries the output power value.
parameters:	MIN | MAX | DEF Queries the output power module limits, or the module default.
response:	4 byte Intel floating point; output power in current power unit.
example:	`OUTP1:POW?` $\rightarrow$ `12<END>`
affects:	All attenuator modules.

command:	**:OUTPut*n*[:CHANNel[*m*]]:POWer:REFerence**
syntax:	:OUTPut*n*[:CHANNel[*m*]]:POWer:REFerence<wsp><value>[PW | NW | UW | MW | W | DBM] | MIN | MAX | DEF
description:	Sets the reference power (${\boldsymbol{P}}_{ref}$). The reference power is used to calculate the filter attenuation ($\alpha_{\boldsymbol{filter}}$) from the output power (P) . A change to the reference power does not affect the filter attenuation. $P_{set(new)}(dBm) = P_{ref\ (new)}(dBm) - \alpha_{filter}(dB) - P_{Offset}(dB)$
parameters:	<value> Desired reference power (if unit not specified current unit is used). MIN | MAX | DEF Sets the reference power to the module limits, or the module default.
response:	none
example:	`OUTP1:POW:REF 6dBm`
affects:	Attenuator modules without power control.

command:	**:OUTPut*n*[:CHANNel[*m*]]:POWer:REFerence?**
syntax:	:OUTPut*n*[:CHANNel[*m*]]:POWer:REFerence?<wsp>MIN | MAX | DEF
description:	Without the optional parameter, queries the reference power value.
parameters:	MIN|MAX|DEF Queries the reference power limits, or the module default.
response:	4 byte Intel floating point; reference power in current power unit.
example:	`OUTP1:POW:REF?` $\rightarrow$ `6<END>`
affects:	Attenuator modules without power control.

command:	**:OUTPut*n*[:CHANNel[*m*]]:POWer:REFerence:POWermeter**
syntax:	:OUTPut*n*[:CHANNel[*m*]]:POWer:REFerence:POWer<wsp><slot>,<channel>
description:	Copies the power value (P_{ext}) from an external powermeter module (hosted by the same mainframe) to the attenuator module's reference power parameter (P_{ref}): $P_{ref}\ (dBm) = P_{ext}\ (dBm) + \alpha_{filter}\ (dB)$
parameters:	<slot> Slot number of the powermeter. <channel> Channel number of the powermeter.
response:	none
example:	`OUTP1:POW:REF:POW 4,2`
affects:	Attenuator modules without power control.

command:	**:OUTPut*n*[:CHANnel[*m*]]:POWer:OFFSet**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:POWer:OFFSet<wsp><value>[DB] | MIN | MAX | DEF
description:	Sets a power offset (P_{offset}). This factor is used to offset the power value. It does not affect the filter, nor does it change the power output at the attenuator module. $P_{set(new)}$ *(dBm) =* P_{att}*(dBm) -* $P_{offset(new)}$ *(dB)* If the wavelength offset table is enabled, the corresponding λ offset is added to this offset.
parameters:	<value> The power offset required, in dB MIN | MAX | DEF Queries the module limits, or the default.
response:	none
example:	`OUTP1:POW:OFFS 2`
affects:	Attenuator modules with power control.

command:	**:OUTPut*n*[:CHANnel[*m*]]:POWer:OFFSet?**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:POWer:OFFSet? <wsp>MIN | MAX| DEF
description:	Without the optional parameter, queries the power offset value.
parameters:	MIN | MAX | REF Queries the power offset limits, or the module default.
response:	4 byte Intel floating point; power offset in current power units.
example:	`OUTP1:POW:OFFS?` $\rightarrow$ `2<END>`
affects:	Attenuator modules with power control.

command:	**:OUTPut*n*[:CHANnel[*m*]]:POWer:OFFSet:POWermeter**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:POWer:OFFSet:POWermeter<wsp><slot>,<channel>
description:	Calculates the power offset by subtracting the power value measured by another powermeter (hosted by the same mainframe) from the power value measured by the attenuator's integrated powermeter, and stores it as P_{offset} . $P_{offset(new)}$ (dBm) = P_{att} (dBm) - P_{ext} (dBm) + $P_{offset(\lambda)}$ (dB)
parameters:	<slot> Slot number of the external powermeter. <channel> Channel number of the external powermeter.
response:	none
example:	`OUTP1:POW:OFFS:POW 4,4`
affects:	Attenuator modules with power control.

command:	**:OUTPut*n*[:CHANnel[*m*]]:POWer:CONTRol**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:POWer:CONTRol<wsp>OFF(0) | ON(1)
description:	Sets whether the power control mode is on or off. If power control is enabled, the attenuator automatically compensates for changes to input power.
parameters:	OFF or 0 Output power follows changes to input power. ON or 1 The filter position automatically adjusts to compensate for changes to input power, so maintaining the output power set by the user.
response:	none
example:	`OUTP1:POW:CONTR ON`
affects:	Attenuator modules with power control.

command:	**:OUTPut*n*[:CHANnel[*m*]]:POWer:CONTRol?**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:POWer:CONTRol?
description:	Queries whether the power control mode is on or off.
parameters:	none
response:	*boolean* 0 The power control mode is off 1 The power control mode is on.
example:	`OUTP1:POW:CONTR?` → `0<END>`
affects:	Attenuator modules with power control.

command:	**:OUTPut*n*[:CHANnel[*m*]]:POWer:UNit**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:POWer:UNit<wsp>DBM(0) | WATT(1)
description:	Sets whether the power unit used is dBm or Watts. This setting affects P_{set} , P_{ref} (if available), and P_{act}
parameters:	DBM (or 0) Sets the power unit to dBm WATT (or 1) Sets the power unit to W
response:	none
example:	`OUTP1:POW:UN DBM`
affects:	All attenuator modules.

command:	**:OUTPut*n*[:CHANnel[*m*]]:POWer:UNit?**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:POWer:UNit?
description:	Queries whether the power unit is dBm or W
parameters:	none
response:	*boolean* 0 The power unit is dBm
	1 The power unit is W.
example:	`OUTP1:POW:UN?` $\rightarrow$ `0<END>`
affects:	All attenuator modules.

command:	**:OUTPut*n*[:CHANnel[*m*]]:[STATe]**	
syntax:	:OUTPut*n*[:CHANnel[*m*]]:[STATe]<wsp>OFF(0) | ON(1)	
description:	Sets the state of the shutter.	
parameters:	OFF or 0	Shutter closed.
	ON or 1	Shutter open.
response:	none	
example:	`OUTP1:STAT OFF`	
affects:	All attenuator modules.	

command:	**:OUTPut*n*[:CHANnel[*m*]]:[STATe]?**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:[STATe]?
description:	Queries the state of the shutter.
parameters:	none
response:	*boolean* 0 The shutter is open.
	1 The shutter is closed.
example:	`OUTP1:STAT?` $\rightarrow$ `0<END>`
affects:	All attenuator modules.

command:	**:OUTPut*n*[:CHANnel[*m*]]:STATe:APOWeron**	
syntax:	:OUTPut*n*[:CHANnel[*m*]]:STATe:APOWeron<wsp>OFF(0) | ON(1)	
description:	Sets the state of the shutter when the mainframe is turned on.	
parameters:	OFF or 0	Shutter closed after mainframe power on.
	ON or 1	Shutter open after mainframe power on.
response:	none	
example:	`OUTP1:APOW OFF`	
affects:	All attenuator modules.	

command:	**:OUTPut*n*[:CHANnel[*m*]]:STATe:APOWeron?**	
syntax:	:OUTPut*n*[:CHANnel[*m*]]:STATe:APOWeron?	
description:	Queries the state of the shutter at power on.	
parameters:	none	
response:	*boolean*	0 The shutter is open after mainframe power on.
		1 The shutter is closed after mainframe power on.
example:	`OUTP1:APOW? → 0<END>`	
affects:	All attenuator modules.	

command:	**:OUTPut*n*[:CHANnel[*m*]]:ATIMe**	
syntax:	:OUTPut*n*[:CHANnel[*m*]]:ATIMe<wsp><value>[NS | US | MS| S]	
description:	Sets the powermeter averaging time, which can, if the attenuator’s power contol feature is activated, affect how the attenuator compensates for changes to input power.	
parameters:	<value>	The averaging time (in seconds if no unit specified).
response:	none	
example:	`OUTP1:ATIM 1s`	
affects:	Attenuator modules with power control.	

command:	**:OUTPut*n*]:CHANnel[*m*]]:ATIMe?**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:ATIMe?
description:	Queries the powermeter averaging time.
parameters:	none
response:	*4 byte Intel floating point; the averaging time in seconds*
example:	`OUTP1:ATIM? → 1<END>`
affects:	Attenuator modules with power control.

command:	**:OUTPut*n*[:CHANnel[*m*]]:CORRection:COLLection:ZERO**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:CORRection:COLLection:ZERO
description:	Zeros the electrical offsets of the attenuator’s integrated powermeter.
parameters:	none
response:	none
example:	`OUTP1:CORR:COLL:ZERO`
affects:	Attenuator modules with power control.

command:	**:OUTPut*n*[:CHANnel[*m*]]:CORRection:COLLection:ZERO:ALL**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:CORRection:COLLection:ZERO:ALL
description:	Zero all available powermeter channels in the mainframe.
parameters:	none
response:	none
example:	`OUTP1:CORR:COLL:ZERO:ALL`
affects:	Powermeter modules; attenuator modules with power control, and return loss modules.

command:	**:OUTPut*n*[:CHANnel[*m*]]:CORRection:COLLection:ZERO?**
syntax:	:OUTPut*n*[:CHANnel[*m*]]:CORRection:COLLection:ZERO?
description:	Queries the status of the last :OUTPutn[:CHANnel[m]]:CORRection:COLLection:ZERO operation.
parameters:	none
response:	integer 0 = OK, otherwise not OK.
example:	`OUTP:CORR:COLL:ZERO?` → `0<END>`
affects:	Attenuator modules with power control.

The table of wavelength-dependent offsets

When enabled, the attenuator uses its λ offset table to compensate for wavelength dependent losses in the test set-up. This table contains, for each wavelength specified, the additional power offset to be applied.

- If the attenuator module is set to a wavelength corresponding to an entry in its λ offset table, the stored offset is added to the global power offset.
- If the attenuator module is set to a wavelength between entries in its λ offset table, linear interpolation is used to calculate the appropriate offset to add to the global power offset.
- If the attenuator module is set to a wavelength beyond the range of the entries in its λ offset table, the offset stored for the nearest wavelength is added to the global power offset.
- Whether an exact, interpolated, or extrapolated offset value is applied, the algorithm applied can be queried using ":STATusn:OPERation:CONDition?" on page 61

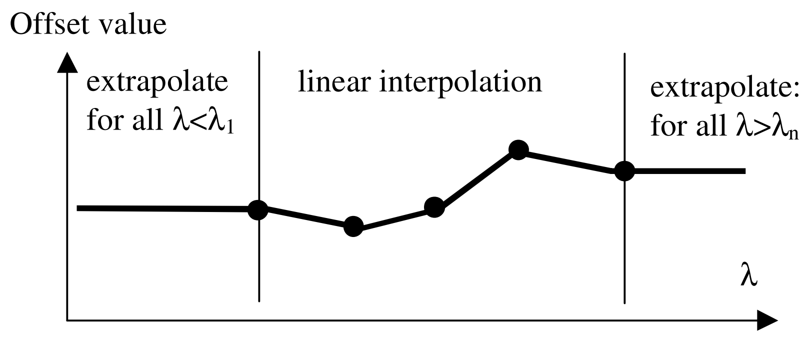


Figure 1 Extrapolation and interpolation of attenuator module λ offset table

command:	**:CONFigure[*n*][:CHANnel[*m*]]:OFFSet:WAVelength:STATe**
syntax:	:CONFigure[*n*]][:CHANnel[*m*]]:OFFSet:WAVelength:STATe<wsp>OFF(0) | ON(1)
description:	Specifies whether the attenuator uses its λ offset table to compensate for wavelength dependent losses in the the test set-up. This table contains, for each wavelength specified, the additional power offset to be applied. This command does not affect the module's internal enviromental temperature and optical wavelength compensation, which remain active.
parameters:	OFF or 0 The offset table is not used to compensate for wavelength dependent losses. ON or 1 The attenuator adds the appropriate value from its λ offset table to the global power offset.
response:	none
example:	`CONF1:OFFS:WAV:STAT ON`
affects:	All attenuator modules.

command:	**:CONFigure[*n*][:CHANnel[*m*]]:OFFSet:WAVelength:STATe?**
syntax:	:CONFigure[*n*]][:CHANnel[*m*]]:OFFSet:WAVelength:STATe?
description:	Queries whether the attenuator uses power values from its λ offset table .
parameters:	none
response:	*boolean* 0 The offset table is not used. 1 The attenuator uses its λ offset table.
example:	`CONF1:OFFS:WAV:STAT? → 0<END>`
affects:	All attenuator modules.

command:	**:CONFigure[*n*][:CHANnel[*m*]]:OFFSet:WAVelength:VALue**
syntax:	:CONFigure[*n*]][:CHANnel[*m*]]:OFFSet:WAVelength:VALue<wsp><lambda>[PM | NM | UM | MM| M],<offset[DB]> | TOREF
description:	Adds a value pair (wavelength; offset) to the offset table, or overwrites an existing value pair. The offset table entries are ordered from shortest to longest wavelength.
parameters:	<lambda> The wavelength for the offset table entry, in m
	<offset> The power offset to be applied at <lambda>. To query the current power value measured by attenuator with power control see page 80 (Fetch) and page 82 (Read).
	TOREF Calculates the difference between the power measured by an external powermeter (hosted in the same mainframe) and the power measured by the attenuator module's integrated powermeter, and stores it as the offset. $P_{\text{Offset}(\lambda)}(\text{dB}) = P_{\text{att}}(\text{dBm}) - P_{\text{ext}}(\text{dBm})$ See: ":CONFigure[n][:CHANnel[m]]:OFFSet:WAVelength:REFerence" on page 147 (Attenuator modules with power control only).
response:	none
example:	`CONF1:OFFS:WAV:VAL +1.55000000E-006,TOREF`
affects:	All attenuator modules (TOREF applicable to attenuator modules with power control only).

command:	**:CONFigure[*n*][:CHANnel[*m*]]:OFFSet:WAVelength:REFerence**
syntax:	:CONFigure[*n*]][:CHANnel[*m*]]:OFFSet:WAVelength:REFerence<wsp><slot>,<channel>
description:	Specifies the slot and channel of the external powermeter (hosted in the same mainframe as the attenuator module) used by TOREF. See: ":CONFigure[n][:CHANnel[m]]:OFFSet:WAVelength:VALue" on page 147
parameters:	<slot> Slot number of the powermeter.
	<channel> Channel number of the powermeter.
response:	none
example:	`CONF1:OFFS:WAV:REF 4,2`
affects:	Attenuator modules with power control.

command:	**:CONFigure[*n*][:CHANNel[*m*]]:OFFSet:WAVelength:REFerence?**
syntax:	:CONFigure[*n*]][:CHANNel[*m*]]:OFFSet:WAVelength:REFerence?
description:	Queries the currently selected slot and channel of the external powermeter (hosted in the same mainframe as the attenuator module) used by TOREF. See: ":CONFigure[n][:CHANNel[m]]:OFFSet:WAVelength:VALue" on page 147
parameters:	none
response:	the slot and channel of the external powermeter as *integer* values.
example:	`CONF1:OFFS:WAV:REF?` → `+2,+1<END>`
affects:	Attenuator modules with power control.

command:	**:CONFigure[*n*][:CHANNel[*m*]]:OFFSet:WAVelength:VALue:WAVelength?**
syntax:	:CONFigure[*n*]][:CHANNel[*m*]]:OFFSet:WAVelength:VALue:WAVelength?<wsp><index>
description:	Queries a wavelength value from its position, or index, in the offset table. Offset table entries are ordered from shortest to longest wavelength. The first index number = 1.
parameters:	<index> The position of the wavelength value in the offset table.
response:	*4 byte Intel floating point; the wavelength in meters*
example:	`CONF1:OFFS:WAV:VAL:WAV? 1` → `+1.55000000E-006<END>`
affects:	All attenuator modules.

command:	**:CONFigure[*n*][:CHANNel[*m*]]:OFFSet:WAVelength:VALue:OFFSet?**
syntax:	:CONFigure[*n*]][:CHANNel[*m*]]:OFFSet:WAVelength:VALue:OFFSet?<wsp><index | wavelength [PM | NM | UM | MM| M],>
description:	Queries an offset value from the position, or index, of the associated wavelength in the offset table. Offset table entries are ordered from shortest to longest wavelength. The first index number =1. Or: Queries the offset applied for a particular wavelength.
parameters:	<index> The position of the value pair (wavelength; offset) in the offset table. <wavelength> The wavelength for the offset table entry, in m
response:	*4 byte Intel floating point; the offset*
example:	`CONF1:OFFS:WAV:VAL:OFFS? 1` → `2`
affects:	All attenuator modules.

command:	**:CONFigure[*n*][:CHANNel[*m*]]:OFFSet:WAVelength:VALue:PAIR?**
syntax:	:CONFigure[*n*]][:CHANNel[*m*]]:OFFSet:WAVelength:VALue:PAIR?<wsp><index | wavelength[PM | NM | UM | MM| M],>
description:	Queries an offset value pair (wavelength:offset) from the position, or index, of the associated wavelength in the offset table. Offset table entries are ordered from shortest to longest wavelength. Or: Queries the offset value pair (wavelength:offset) applied for the specified wavelength.
parameters:	<index> The position of the wavelength; offset value pair in the offset table. <wavelength> The wavelength for the offset table entry, in m
response:	*char$ in SCPI block format (Intel byte order); wavelength:offset*
example:	`CONF1:OFFS:WAV:VAL:PAIR? 1 → "+1.55000000E-006:2"`
affects:	All attenuator modules.

command:	**:CONFigure[*n*][:CHANNel[*m*]]:OFFSet:WAVelength:VALue:DELete**
syntax:	:CONFigure[*n*]][:CHANNel[*m*]]:OFFSet:WAVelength:VALue:DELete<wsp><index | wavelength[PM | NM | UM | MM| M],>
description:	Deletes an offset value pair (wavelength:offset) from the position, or index, of the associated wavelength in the offset table. Offset table entries are ordered from shortest to longest wavelength. Or: Deletes the offset value pair (wavelength:offset) associated with the specified wavelength.
NOTE	Deleting a value pair decrements the index value of every subsequent value pair by 1. When using this command, you may prefer to work from large to small index values.
parameters:	<index> The position of the wavelength:offset value pair in the offset table. <wavelength> The wavelength for the offset table entry, in m
response:	*none*
example:	`CONF1:OFFS:WAV:VAL:DEL 1`
affects:	All attenuator modules.

command:	**:CONFigure[*n*][:CHANNel[*m*]]:OFFSet:WAVelength:VALue:DELete:ALL**
syntax:	:CONFigure[*n*]][:CHANNel[*m*]]:OFFSet:WAVelength:VALue:DELete:ALL
CAUTION	*This command clears the offset table!*
description:	Deletes every value pair (wavelength:offset) from the offset table.
parameters:	none
response:	*none*
example:	`CONF1:OFFS:WAV:VAL:DEL:ALL`
affects:	All attenuator modules.

command:	**:CONFigure[*n*][:CHANNel[*m*]]:OFFSet:WAVelength:TABle?**
syntax:	:CONFigure[*n*]][:CHANNel[*m*]]:OFFSet:WAVelength:TABle?
description:	Queries the complete the offset table.
parameters:	none
response:	*SCPI binary block format format (Intel byte order); wavelength:offset pairs in ascending order.* Each value pair is transferred as 12 bytes; 8 bytes represent the wavelength, 4 bytes represent the offset.
example:	`CONF1:OFFS:WAV:TAB?` $\rightarrow$ binary block interpreted as, for example: `1.55e-6	12	1.7e-6 |3.4 |.....`
affects:	All attenuator modules.

command:	**:CONFigure[*n*][:CHANNel[*m*]]:OFFSet:WAVelength:TABle:SIZE?**	
syntax:	:CONFigure[*n*]][:CHANNel[*m*]]:OFFSet:WAVelength:TABle:SIZE?<wsp>MAX | MIN	
description:	Without optional parameter, queries the size of the offset table.	
parameters:	MAX	Queries the maximum size of the offset table. (available flash memory $\rightarrow$ `1000` entries)
	MIN	Queries the minimum size of the offset table. (should $\rightarrow$ `0`)
response:	*4 byte unsigned integer; offset table size.*	
example:	`CONF1:OFFS:WAV:TAB:SIZE?` $\rightarrow$ `50`	
affects:	All attenuator modules.	

Compatibility of the 81560A/1A/6A/7A modular attenuator family to the 8156A attenuator

The 81560A/1A/6A/7A modular attenuator family is intended to be SCPI compatible with the 8156A attenuator but, because the modular attenuator family is part of a platform concept, there are some compatibility limitations. This section describes the differences between the SCPI syntax and the command semantic and how to deal with them.

NOTE The page numbers in brackets refer to pages in the Agilent Technologies 8156A Attenuator Operating and Programming Guide, Second Edition, May 2000 with part number 08156-91011:E0500.

Slot Numbers

INPUT and OUPUT SCPI commands (page 106-114) are used to access the functionality of the 8156A Attenuator. The 816xA/B mainframes are able to host a number of modules, so a slot identifier is needed. This slot identifier was not required by the 8156A attenuator. Simply substitute INPutn for INPut, and OUTPutn for OUTPut, where n is the slot number of your attenuator module.

Example1: Setting the attenuation

8156A:`INP:ATT 10 dB`

8156x:`INP2:ATT 10 dB`
(when the attenuator is hosted in Slot 2)

Example2: Setting the output power

8156A:`OUTP:POW 10 dBm`

8156x:`OUTP2:POW 10 dBm`
(when the attenuator is hosted in Slot 2)

If you forget to enter the slot number, one of the following error messages is placed in the SCPI error queue:

```
-303,"Module slot empty or slot / channel invalid"
```

```
-301,"Module doesn't support this command (StatCmdUnknown)"
```

TIP Query the SCPI error queue using `SYST:ERR?`

TIP You can use INPut commands without a slot number if the 81560A/1A/6A/7A module is hosted by Slot 1. An INPut command is applied to Slot 1 by default.

Command Semantic

All the INPut and OUTPut commands applicable to the 8156A attenuator are also supported by the 81560A/1A/6A/7A modular attenuator family. In addition, the 81560A/1A/6A/7A modular attenuator family supports new commands to access its new features. To support these new features, and improve the usability of the instrument, the meaning (the semantic) of some existing commands has changed. This section lists all commands already available to the 8156A attenuator, notes whether the semantic of the command has changed, and where applicable, suggests how to handle the change.

Table 3 Comparison of command semantics beween 8156A attenuator and 8156xA modular attenuator family.

Command	Comment
INPut:ATTenuation	No change.
INPut:ATTenuation?	No change.
INPut:LCMode	No longer supported. Use the wavelength dependent offset command.
INPut:LCMode?	No longer supported. Use the wavelength dependent offset command.
INPut:OFFSet	No change.
INPut:OFFSet?	No change.
INPut:OFFSet:DISPlay	No change.
INPut:WAVelength	No change.
OUTPut:APMode	The 8156A uses this command to calculate a base power level while the instrument switches to another mode. This behavior is replaced by a mechanism that is easier to use. To calculate a power level at the device under test, formerly known as *through* power, the 81560A and 81561A attenuator modules use a reference power. This reference power can be modified either via the user interface or by using the SCPI command `OUTPut:POWer:REFerence`. The power is calculated from the attenuation and the reference power using this formula: $P_{set}\,(\mathrm{dBm}) = P_{ref}\,(\mathrm{dBm}) - \alpha\,(\mathrm{dB})$ The 81566A and 81567A attenuator modules do not need a base power level because they are able to measure the output power directly. Despite these new features, the 8156x modular attenuator family supports this command, but only to address compatibility issues. The command only sets an internal flag, which can be read using `OUTput:APMode?` You are free to choose between adjusting the output power or adjusting the attenuation factor.
OUTPut:APMode?	It is now possible to adjust both power and attenuation without changing the mode, so this command is supported only to address compatibility issues. This query returns whether power (1) or attenuation (0) was changed last. All other actions have no effect on this internal flag.

Table 3 Comparison of command semantics beween 8156A attenuator and 8156xA modular attenuator family.

Command	Comment
OUTPut:POWer	Except that the base power level is determined in another way (see `OUTPut:APMode`), there is no change to the semantic of this command.
OUTPut:POWer?	No change.
OUTPut:STATe	No change.
OUTPut:STATe?	No change.
OUTPut:STATe:APOWeron	No change.
OUTPut:STATe:APOWeron?	No change.

Display and System Commands

The commands to adjust the instrument display (page 104ff) and query the error queue (page 122) also work with the 816xA/B platform:

DISPlay:BRIGhtness

DISPlay:ENABle

SYSTem:ERRor?

IEEE Commands

Every SCPI compatible measurement instrument implements a subset of the IEEE SCPI command set. The 8156A attenuator and the 81560A/1A/6A/7A attenuator family use almost the same subset. The following IEEE commands are available when using the 8156A but not available when using the 81560A/1A/6A/7A modules (page 93ff):

*RCLRecover parameter setup

*SAVSave parameter setup

*SRE and *SRE?Status request register

Status Commands

The instrument status model can be controlled, and its current state queried, using commands from the SCPI STATus subtree. All the STATus commands available for the 8156A attenuator are supported by the 81560A/1A/6A/7A modular attenuator familiy except:

STATus:OPERation:PTRansition

STATus:OPERation:NTRansition

STATus:QUEStionable:PTRansition

STATus:QUEStionable:NTRansition

There are new status bits available to query the current modular attenuator state.

User Calibration Data

The user calibration mode of the 8156A overrides the attenuator's built-in wavelength calibration table, so allowing user defined wavelength compensation. Since the 81560A/1A/6A/7A modular attenuator family features an improved factory calibration process, so this user calibration feature (page 123) is not supported.

The 81560A/1A/6A/7A modular attenuator family includes a user configurable offset function. If you enable this feature, the module's internal wavelength compensation remains active and you are able to compensate for additional external wavelength-dependent losses within the measurement setup by creating a wavelength/offset table. For additional information, refer to our Application Note "Variable Optical Attenuator in BER Test Applications", part number 5988-3159EN.

Signal Routing

The commands in this section allow you to control Agilent 8159x Optical Switch modules

command:	**:ROUTe[*n*][:CHANnel[*m*]]**	
syntax:	:ROUTe[*n*]:[CHANnel[*m*]]<wsp><channel_list>	
description:	Sets the channel route between two ports.	
NOTE	When you use switches with dependent connections (e.g. the 2x2 switch), it is possible that one route configuration automatically changes another connection!	
parameters:	n:	the slot number of the switch module
	m:	the switch channel within the selected switch module. e.g. for dual 1 x 2 module m = 1 for switch 1; m = 2 for switch 2
	channel_list	the route between left and right ports. channel_list format: [A....Z],[1....n]
response:	If an invalid route is selected the following error message is returned - "StatParamError"	
example:	`rout3:chan1 A,2` (module in slot 3,channel 1, connect port A with port 2)	
affects:	All switch modules	

command:	**:ROUTe[*n*][:CHANnel[*m*]]?**	
syntax:	:ROUTe[*n*]:[CHANnel[*m*]]<wsp><channel_list>	
description:	Queries the current channel route of the switch for a specific module and switch channel.	
parameters:	n:	the slot number of the switch module
	m:	the switch channel within the selected switch module. Default value is 1.
response:	[A.....Z],[1.....n];[A.....Z],[1.....n] as a text string. "," separates input and output ports of a specific connection. ";" separates parallel connections (as used in 2x2 switch).	
example:	`rout3:chan1?` → `A,1` simple 1xN switch `rout2:chan1?` → `A,2;B,1` (2x2 crossover switch in crossover config).	
affects:	All switch modules	

command:	**:ROUTe[*n*][:CHANnel[*m*]]:CONFig?**
syntax:	:ROUTe[*n*]:[CHANnel[*m*]]:CONFig?
description:	Queries the switch configuration of the instrument. For each channel, the minimum and maximum channel number of each port is given.
NOTE	
parameters:	none
response:	<j>,<k>;<l>,<m> as text string where:
	<j> is the first port character on the left
	<k> is the last port character on the left
	<l> is the minmimum port number on the right
	<m> is the maximum port number on the right
example:	`rout2:conf?` → `A,B;1,2` (2 left and 2 right ports)
affects:	All switch modules

command:	**:ROUTe[*n*][:CHANnel[*m*]]:CONFig:ROUTe?**
syntax:	:ROUTe[*n*]:[CHANnel[*m*]]:CONFig:ROUTe?
description:	Queries the allowed switch routes of an instrument.
NOTE	
parameters:	none
response:	[A.....Z],[1.....n];[A.....Z],[1.....n].[A.....Z],[1.....n] as a text string.
	"," separates input and output ports of a single connection.
	";" separates parallel connections
	"." separates possible switch states
example:	`rout2:conf:rout?` → `A,1;B,2.A,2;B,1`
	2x2 x-over switcch:
	state 1: When A to 1 then B to 2nd connection (straight)
	state 2: When A to 2 then B to 1st connection (cross-over)
affects:	All switch modules

Triggering - The TRIGger Subsystem

The TRIGger Subsystem allows you to configure how the instrument reacts to incoming or outgoing triggers.

Table 4 Triggering and Power Measurements

Hardware Triggering	**Trigger Rearming**	**Software Triggering**		**Data Acquisition Functions** `sens:func:stat`	
trig:inp	**trig:inp:rearm**	**init:imm**	**init:cont**	**MINMax**	**LOGGing|STABility**
IGNore	-	One power measurement is performed.	Automatically performs power measurements.		Automatically performs power measurements until the function is finished.
SMEasure	ON	Every hardware trigger starts a new power measurement.			Every hardware trigger starts a new power measurement until the function is finished.
CMEasure	ON				The first hardware trigger starts the function. Subsequent power measurements are automatically performed until the function is finished.
SMEasure	OFF	The first hardware trigger starts a new power measurement. Further hardware triggers are ignored until you send `trig:inp:rearm` again.			Every hardware trigger starts a new power measurement until the function is finished.
CMEasure	OFF				The first hardware trigger starts the function. Subsequent power measurements are automatically performed until the function is finished.

Table 5 Generating Output Triggers from Power Measurements

Hardware Triggering	Trigger Rearming	Software Triggering		Data Acquisition Functions `sens:func:stat`	
trig:outp	**trig:outp:rearm**	**init:imm**	**init:cont**	**MINMax**	**LOGGing|STABility**
DISabled	-	An output trigger will never be generated.			
AVGover	ON	An output trigger is generated for every new power measurement when the averaging time period finishes.			Applies for all subsequent data acquisition functions.
MEASure	ON	An output trigger is generated for every new power measurement when the averaging time period begins.			Applies for all subsequent data acquisition functions.
AVGover	OFF	An output trigger is generated when the averaging time period of the first power measurement finishes. A further hardware output trigger cannot be generated until you send `trig:outp:rearm`.			An output trigger is generated for every new power measurement when the averaging time period finishes. Applies for all subsequent data acquisition functions.
MEASure	OFF	An output trigger is generated when the averaging time period of the first power measurement begins. A further hardware output trigger cannot be generated until you send `trig:outp:rearm`.			An output trigger is generated for every new power measurement when the averaging time period begins. Applies for all subsequent data acquisition functions.

command: **:TRIGger**

syntax: :TRIGger<wsp>NODEA|1|NODEB|2

description: Generates a hardware trigger.

parameters:

1 or NODEA:	Is identical to a trigger at the Input Trigger Connector.
2 or NODEB:	Generates trigger at the Output Trigger Connector.

NOTE A hardware trigger cannot be effective in the DISabled triggering mode but can be effective in DEFault, PASSthrough or LOOPback triggering modes, see *":TRIGger:CONFiguration" on page 163* for information on triggering modes.

NOTE *":TRIGger" on page 164* describes the :TRIGger command for advanced users using *":TRIGger:CONFiguration:EXTended" on page 165*.

response: none

example: `trig 1`

command:	**:TRIGger[*n*][:CHANNel[*m*]]:INPut**
syntax:	:TRIGger[*n*][:CHANNel[*m*]]:INPut<wsp><trigger response>
description:	Sets the incoming trigger response and arms the module.

parameters:

IGNore:	Ignore incoming trigger.
SMEasure:	Start a single measurement. If a measurement function is active, see *":SENSe[n][:CHANNel[m]]:FUNCtion:STATe" on page 92*, one sample is performed and the result is stored in the data array, see *":SENSe[n][:CHANnel[m]]:FUNCtion:RESult?" on page 89*.
CMEasure:	Start a complete measurement. If a measurement function is active, see *":SENSe[n][:CHANNel[m]]:FUNCtion:STATe" on page 92*, a complete measurement function is performed.
NEXTstep:	Perform next step of a stepped sweep.
SWStart:	Start a sweep cycle.

NOTE You must prearm a wavelength sweep or a measurement function before an action can be triggered:

First, set the incoming trigger response.

Then:

- prearm a wavelength sweep using *"[:SOURce[n]][:CHANNel[m]]:WAVelength:SWEep:[STATe]" on page 133*. The wavelength of the tunable laser module is set to the start wavelength of the sweep.
- or prearm a measurement function using *":SENSe[n][:CHANNel[m]]:FUNCtion:STATe" on page 92*.
  NOTE: If a trigger signal arrives at the Input Trigger Connector at the same time that the :SENSe[n][:CHANNel[m]]:FUNCtion:STATe command is executed, the first measurement value is invalid. You should always discard the first measurement value in this case.

The module performs the appropriate action when it is triggered.

response:	none
example:	`trig1:inp ign`
affects:	All Agilent 8163A/B series power meter modules, Agilent 8161x series return loss modules, and attenuators with power control.

NOTE If you use the Agilent 816x VXIplug&play Instrument Driver, you can trigger power measurements using HP 8153A Series power meters.

dual sensors: Can only be sent to master channel, slave channel is also affected.

command:	**:TRIGger[*n*][:CHANnel[*m*]]:INPut?**	
syntax:	:TRIGger[*n*][:CHANnel[*m*]]:INPut?	
description:	Returns the incoming trigger response.	
parameters:	none	
response:	IGNore:	Ignore incoming trigger.
	SMEasure:	Start a single measurement. If a measurement function is active, see *":SENSe[n][:CHANnel[m]]:FUNCtion:STATe" on page 92*, one sample is performed and the result is stored in the data array, see *":SENSe[n][:CHANnel[m]]:FUNCtion:RESult?" on page 89*.
	CMEasure:	Start a complete measurement. If a measurement function is active, see *":SENSe[n][:CHANnel[m]]:FUNCtion:STATe" on page 92*, a complete measurement function is performed.
	NEXTstep:	Perform next step of a stepped sweep.
	SWStart:	Start a sweep.
example:	`trig1:inp? → ign<END>`	
affects:	All tunable laser modules, power meters, and return loss modules, and attenuators with power control.	
dual sensors:	Can only be sent to master channel, slave channel parameters are identical.	

command:	**:TRIGger[*n*][:CHANnel[*m*]]:INPut:REARm**	
syntax:	:TRIGger[*n*][:CHANnel[*m*]]:INPut:REARm<wsp>OFF|ON|0|1	
description:	Sets the arming response of a channel to an incoming trigger.	
NOTE	See Table Table 4, for information on how this command affects triggering power measurements.	
parameters:	A *boolean* value:	`OFF` or `0`: trigger rearming disabled `ON` or `1`: trigger rearming enabled (default)
NOTE	If you return to Local control, all modules return to the default setting.	
response:	none	
example:	`trig1:inp:rearm 0`	
affects:	All Agilent 8163A/B series power meter modules, and Agilent 8161x series return loss modules.	
dual sensors:	Can only be sent to master channel, slave channel is also affected.	

command:	**:TRIGger[*n*][:CHANnel[*m*]]:INPut:REARm?**	
syntax:	:TRIGger[*n*][:CHANnel[*m*]]:INPut:REARm?	
description:	Returns the arming response of a channel to an incoming trigger.	
parameters:	none	
response:	A *boolean* value:	`0`: trigger rearming disabled `1`: trigger rearming enabled (default)
example:	`trig1:inp:rearm? → 0<END>`	
affects:	All Agilent 8163A/B series power meter modules, and Agilent 8161x series return loss modules.	
dual sensors:	Can only be sent to master channel, slave channel parameters are identical.	

command:	**:TRIGger[*n*][:CHANnel[*m*]]:OFFSet**
syntax:	:TRIGger[*n*][:CHANnel[*m*]]:OFFSet <value>
description:	Sets the number of incoming triggers received before data logging begins.
parameters:	<value> - an **integer** value. (maximum possible value is 1e+9)
response:	none
example:	`trig1:offs 5`
affects:	All Agilent 81636B and 81637B series power meter modules.

command:	**:TRIGger[*n*][:CHANnel[*m*]]:OFFSet?**
syntax:	:TRIGger[*n*][:CHANnel[*m*]]:OFFSet?
description:	Returns the number of incoming triggers received before data logging begins.
parameters:	none
response:	an **integer** value.
example:	`trig1:offs?` → `5<END>`
affects:	All Agilent 81636B and 81637B series power meter modules.

command:	**:TRIGger[*n*][:CHANnel[*m*]]:OUTPut**	
syntax:	:TRIGger[*n*][:CHANnel[*m*]]:OUTPut	
description:	Specifies when an output trigger is generated and arms the module.	
parameters:	DISabled:	Never.
	AVGover:	When averaging time period finishes.
	MEASure:	When averaging time period begins.
	MODulation:	For every leading edge of a digitally-modulated (TTL) signal
	STFinished:	When a sweep step finishes.
	SWFinished:	When sweep cycle finishes.
	SWSTarted:	When a sweep cycle starts.
response:	none	
example:	`trig1:outp dis`	
affects:	All tunable laser modules, Agilent 8163A/B series power meters, and Agilent 8161x series return loss modules.	
dual sensors:	Can only be sent to master channel, slave channel is also affected.	

NOTE In continuous mode, `wav:swe:step:[widt]` is used for triggering, see page 134.

command:	**:TRIGger[*n*][:CHANnel[*m*]]:OUTPut?**
syntax:	:TRIGger[*n*][:CHANnel[*m*]]:OUTPut?
description:	Returns the condition that causes an output trigger.
parameters:	none
response:	DISabled: Never.
	AVGover: When averaging time period finishes.
	MEASure: When averaging time period begins.
	MODulation: For every leading edge of a digitally-modulated (TTL) signal
	STFinished: When a sweep step finishes.
	SWFinished: When sweep cycle finishes.
	SWSTarted: When a sweep cycle starts.
example:	`trig1:outp?` → `dis<END>`
affects:	All tunable laser modules, Agilent 8163A/B series power meters, and Agilent 8161x series return loss modules.
dual sensors:	Can only be sent to master channel, slave channel parameters are identical.

command:	**:TRIGger[*n*][:CHANnel[*m*]]:OUTPut:REARm**
syntax:	:TRIGger[*n*][:CHANnel[*m*]]:OUTPut:REARm<wsp>OFF|ON|0|1
description:	Sets the arming response of a channel to an outgoing trigger.
NOTE	See Table Table 5, for information on how this command affects the generation of output triggers using power measurements.
parameters:	A *boolean* value: `OFF` or `0`: trigger rearming disabled
	`ON` or `1`: trigger rearming enabled (default)
NOTE	If you return to Local control, all modules return to the default setting.
response:	none
example:	`trig1:outp:rearm 1`
affects:	All Agilent 8163A/B series power meters, and Agilent 8161x series return loss modules.
dual sensors:	Can only be sent to master channel, slave channel is also affected.

command:	**:TRIGger[*n*][:CHANnel[*m*]]:OUTPut:REARm?**
syntax:	:TRIGger[*n*][:CHANnel[*m*]]:OUTPut:REARm?
description:	Returns the arming response of a channel to an outgoing trigger.
parameters:	none
response:	A *boolean* value: `0`: trigger rearming disabled (default)
	`1`: trigger rearming enabled.
example:	`trig1:outp:rearm?` → `0<END>`
affects:	All Agilent 8163A/B series power meters, and Agilent 8161x series return loss modules.
dual sensors:	Can only be sent to master channel, slave channel parameters are identical.

command:	**:TRIGger:CONFiguration**
syntax:	:TRIGger:CONFiguration<wsp><triggering mode>
description:	Sets the hardware trigger configuration with regard to Output and Input Trigger Connectors.
parameters:	0 or DISabled: Trigger connectors are disabled.
	1 or DEFault: The Input Trigger Connector is activated, the incoming trigger response for each slot *":TRIGger[n][:CHANnel[m]]:INPut" on page 159* determines how each slot responds to an incoming trigger, all slot events (see *":TRIGger[n][:CHANnel[m]]:OUTPut" on page 161*) can trigger the Output Trigger Connector.
	2 or PASSthrough: The same as DEFault but a trigger at the Input Trigger Connector generates a trigger at the Output Trigger Connector automatically.
	3 or LOOPback: The same as DEFault but a trigger at the Output Trigger Connector generates a trigger at the Input Trigger Connector automatically.
response:	none
example:	`trig:conf dis`

command:	**:TRIGger:CONFiguration?**
syntax:	:TRIGger:CONFiguration?
description:	Returns the hardware trigger configuration.
parameters:	none
response:	DIS: Trigger connectors are disabled.
	DEF: The Input Trigger Connector is activated, the incoming trigger response for each slot *":TRIGger[n][:CHANnel[m]]:INPut" on page 159* determines how each slot responds to an incoming trigger, all slot events (see *":TRIGger[n][:CHANnel[m]]:OUTPut" on page 161*) can trigger the Output Trigger Connector.
	PASS: The same as DEFault but a trigger at the Input Trigger Connector generates a trigger at the Output Trigger Connector automatically.
	LOOP: The same as DEFault but a trigger at the Output Trigger Connector generates a trigger at the Input Trigger Connector automatically.
	CUSTOM: A custom configuration is active using either the command *":TRIGger:CONFiguration:EXTended" on page 165* or the Agilent 816x VXI*plug&play* Instrument Driver. See *"The Agilent 816x VXIplug&play Instrument Driver" on page 197*.
example:	`trig:conf? → DEF<END>`

command:	**:TRIGger:CONFiguration:FPEDal**	
syntax:	:TRIGger:CONFiguration:FPEDal<wsp>OFF|ON|0|1	
description:	Enables or disables the Input Trigger connector to be triggered using a Foot Pedal.	
parameters:	A *boolean* value:	`OFF` or `0`: foot pedal disabled (default)
		`ON` or `1`: foot pedal enabled
response:	none	
example:	`trig:conf? → DEF<END>`	

command:	**:TRIGger:CONFiguration:FPEDal?**	
syntax:	:TRIGger:CONFiguration:FPEDal?	
description:	Returns whether the Input Trigger connector can be triggered using a Foot Pedal.	
parameters:	none	
response:	A *boolean* value:	`0`: foot pedal disabled
		`1`: foot pedal enabled
example:	`trig:conf? → DEF<END>`	

Extended Trigger Configuration

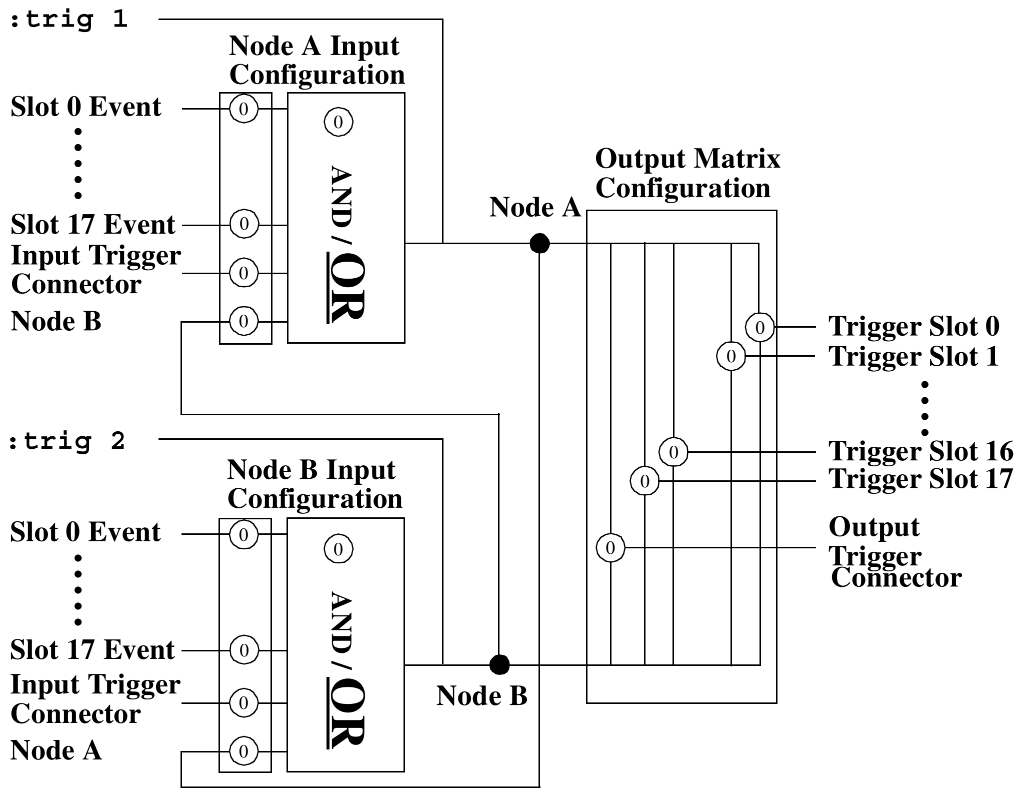
This section includes information for advanced users about how to customize your use of the trigger system.

You can configure the ouputs and inputs from two nodes, Node A and Node B. See Figure 2 on page 166 for more information on Node A and Node B. You can configure these nodes to be triggered by certain events and for these nodes to trigger particular actions.

command:	**:TRIGger**	
syntax:	:TRIGger<wsp>NODEA|1|NODEB|2	
description:	Generates a hardware trigger.	
parameters:	1 or NODEA:	Generates trigger at Node A.
	2 or NODEB:	Generates trigger at Node B.
	Use *":TRIGger:CONFiguration:EXTended" on page 165* to configure Node A and Node B.	
NOTE	*":TRIGger" on page 158* describes the :TRIGger command for basic users.	
response:	none	
example:	`trig 1`	

command:	**:TRIGger:CONFiguration:EXTended**	
syntax:	:TRIGger:CONFiguration:EXTended<wsp><Node A Input Config.>, <Node B Input Config.>,<Output Matrix Config.>	
description:	Sets the extended hardware trigger configuration.	
parameters:	Node A Input Configuration:	A **32-bit unsigned integer**, see below.
	Node B Input Configuration:	A **32-bit unsigned integer**, see below.
	Output Matrix Configuration:	A **32-bit unsigned integer**, see below.
response:	none	
example:	`trig:conf:ext 0,0,0`	

command:	**:TRIGger:CONFiguration:EXTended?**	
syntax:	:TRIGger:CONFiguration:EXTended?	
description:	Returns the extended hardware trigger configuration.	
parameters:	none	
response:	Node A Input Configuration:	A **32-bit unsigned integer**, see below.
	Node B Input Configuration:	A **32-bit unsigned integer**, see below.
	Output Matrix Configuration:	A **32-bit unsigned integer**, see below.
example:	`trig:conf:ext? → +0,+0,+0<END>`	



Bits set in Node A/B Input Configuration determine the conditions that can cause a trigger at Node A/B.

Bits set in Output Matrix Configuration determine whether Node A OR Node B triggers particular module slots or generates an output trigger at the Output Trigger Connector.

":TRIGger[*n*][:CHANnel[*m*]]:OUTPut" explains how slot events can generate triggers.

":TRIGger[*n*][:CHANnel[*m*]]:INPut" explains how a slot responds to an incoming trigger.

":TRIGger" generates a trigger at Node A or Node B directly.

Figure 2 Extended Trigger Configuration

Node A Input Configuration

This **32-bit unsigned integer** determines how inputs to Node A are generated.

Bit	Mnemonic	Hexadecimal
31	Logic: 0 for OR, 1 for AND	**#H**80000000
30	Input Trigger Connector: 0 - Inactive, 1 - Trigger at Input Trigger Connector can trigger Node A	#H40000000
29	Node B: 0 - Inactive, 1 - Trigger at Node B can trigger Node A	#H20000000
18-28	Not used.	0
17	Slot 17: 0 - Inactive, 1 - Event at slot 17 can trigger Node A	#H20000
16	Slot 16: 0 - Inactive, 1 - Event at slot 16 can trigger Node A	#H10000
⋮	⋮	
2	Slot 2: 0 - Inactive, 1 - Event at slot 2 can trigger Node A	#H4
1	Slot 1: 0 - Inactive, 1 - Event at slot 1 can trigger Node A	#H2
0	Slot 0: 0 - Inactive, 1 - Event at slot 0 can trigger Node A	#H1

":TRIGger[n][:CHANnel[m]]:OUTPut" on page 161 explains how slot events can generate triggers.

Node B Input Configuration

This **32-bit unsigned integer** determines how inputs to Node B are generated.

Bit	Mnemonic	Hexadecimal
31	Logic: 0 for OR, 1 for AND	**#H**80000000
30	Input Trigger Connector: 0 - Inactive, 1 - Trigger at Input Trigger Connector can trigger Node B	#H40000000
29	Node A: 0 - Inactive, 1 - Trigger at Node A can trigger Node B	#H20000000
18-28	Not used.	0
17	Slot 17: 0 - Inactive, 1 - Event at slot 17 can trigger Node B	#H20000
16	Slot 16: 0 - Inactive, 1 - Event at slot 16 can trigger Node B	#H10000
⋮		
2	Slot 2: 0 - Inactive, 1 - Event at slot 2 can trigger Node B	#H4
1	Slot 1: 0 - Inactive, 1 - Event at slot 1 can trigger Node B	#H2
0	Slot 0: 0 - Inactive, 1 - Event at slot 0 can trigger Node B	#H1

":TRIGger[n][:CHANnel[m]]:OUTPut" on page 161 explains how slot events can generate triggers.

Output Matrix Configuration

This **32-bit unsigned integer** lets you choose Node A OR Node B to trigger each of the following:

- the Output Trigger Connector or
- individual module slots.

Bit	Mnemonic	Hexadecimal
31	Not used	**0**
30	Output Trigger Connector: 0 - a trigger at Node A is switched to the Output Trigger Connector, 1 - a trigger at Node B is switched to theOutput Trigger Connector	#H40000000
18-29	Not used	
17	Slot 17: 0 - Node A triggers slot 17, 1 - Node B triggers slot 17	0
16	Slot 16: 0 - Node A triggers slot 16, 1 - Node B triggers slot 16	#H20000
⋮		#H10000
2	Slot 2: 0 - Node A triggers slot 2, 1 - Node B triggers slot 2	
1	Slot 1: 0 - Node A triggers slot 1, 1 - Node B triggers slot 1	#H4
0	Slot 0: 0 - Node A triggers slot 0, 1 - Node B triggers slot 0	#H2
	":TRIGger[n][:CHANnel[m]]:INPut" on page 159 explains how a slot responds to an incoming trigger.	#H1

Extended Trigger Configuration Example

The short example below demonstrates how to use extended triggering configuration to make tunable laser source modules sweep simultaneously. Setup your mainframe with two Agilent 81689A modules in slots 1 and 2. The example below presumes you set up identical stepped sweeps for both modules, for example, by pressing *PRESET*.

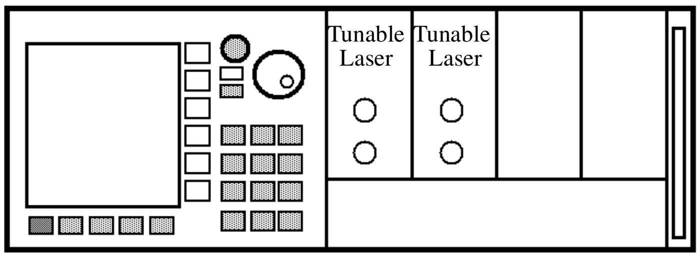


Figure 3 Setup for Extended Trigger Configuration Example

```
trig:conf:ext #H2,#H0,#H0
trig2:outp dis
trig2:inp next
sour2:wav:swe star
trig1:outp stf
trig1:inp ign
sour1:wav:swe star
```

`trig:conf:ext #H2,#H0,#H0` is described by Figure 4-1 and sets one bit:

- for Node A Input Configuration:
    - Bit 1 - an event at slot 1 can trigger Node A. As `trig1:outp stf` is set, Node A can be triggered if a sweep step finishes for a tunable laser module installed in slot 1.

The following explanation explains the sequence with which actions are triggered.

1. `sour2:wav:swe star` arms the sweep for for the tunable laser module in slot 2. Because `trig2:inp next` is set, the module waits for a trigger until it performs the first step of the sweep.
2. `sour1:wav:swe star` commands the tunable laser module in slot 1 to start sweeping. Because `trig1:inp ign` is set, the module performs a sweep as normal.
3. When the module in slot 1 finishes a step, because `trig1:outp stf` is set, Node A is triggered.
4. Node A triggers all modules because the Output Matrix Configuration is set to zero. Node A triggers the tunable laser module in slot 2 to perform a sweep step because `trig2:inp next` is set.
5. The sequence starts again at step 3 and continues until the sweep ends.

Mass Storage, Display, and Print Functions

This chapter gives descriptions of commands that you can use when you want to change the instrument's display.

Display Operations – The DISPlay Subsystem

The DISPlay subsystem lets you control what you see on the instrument’s display.

command:	**:DISPlay:CONTrast**
syntax:	:DISPlay:CONTrast<wsp><value>
description:	Controls the contrast of the display.
parameters:	An **integer** value in the range 0 to 100
response:	none
example:	`disp:cont 50`
affects:	Agilent 8163B Lightwave Multimeter

command:	**:DISPlay:CONTrast?**
syntax:	:DISPlay:CONTrast?
description:	Queries the contrast of the display.
parameters:	none
response:	An **integer** value in the range 0 to 100
example:	`disp:cont? → +50<END>`
affects:	Agilent 8163B Lightwave Multimeter

command:	**:DISPlay:BRIGhtness**
syntax:	:DISPlay:BRIGhtness<wsp><value>
description:	Controls the brightness of the display.
parameters:	An **integer** value in the range 0 to 100
response:	none
example:	`disp:brig 75`
affects:	Agilent 8163B Lightwave Multimeter

command:	**:DISPlay:BRIGhtness?**
syntax:	:DISPlay:BRIGhtness?
description:	Queries the brightness of the display.
parameters:	none
response:	An **integer** value in the range 0 to 100
example:	`disp:brig? → +75<END>`
affects:	Agilent 8163B Lightwave Multimeter

command:	**:DISPlay:ENABle**	
syntax:	:DISPlay:ENABle<wsp>ON|OFF|1|0	
description:	Enables or disables the display. The display is cleared, and an appropriate message displayed. This setting may improve sweep performance.	
parameters:	A *boolean* value:	OFF or boolean 0 – switch off the display ON or boolean 1 – switch on the display
NOTE	If you press [LOCAL] softkey, the display is enabled automatically.	
response:	none	
example:	`disp:enab 1`	

command:	**:DISPlay:ENABle?**	
syntax:	:DISPlay:ENABle?	
description:	Queries the state of the display.	
parameters:	none	
response:	A *boolean* value:	0 – the display is turned off 1 – the display is turned on
example:	`disp:enab? → 1<END>`	

command:	**:DISPlay:LOCKout**	
syntax:	:DISPlay:LOCKout<wsp>ON|OFF|1|0	
description:	Enables or Disables local operation.	
parameters:	A *boolean* value:	OFF or boolean 0 – local operation is disabled ON or boolean 1 – local operation is enabled.
response:	none	
example:	`disp:lock 1<END>`	

command:	**:DISPlay:LOCKout?**	
syntax:	:DISPlay:LOCKout?	
description:	Queries whether local operation is locked out.	
parameters:	none	
response:	A *boolean* value:	0 – local operation is disabled 1 – local operation is enabled.
example:	`disp:lock → 1<END>`	

VISA Programming Examples

These programming examples are implemented using MS Developer Studio. Regardless of the programming environment you use, keep the following in mind:

- The resultant application is a "console application"
- Make sure the header files `visa.h` and `visatype.h` are included.
- Make sure the library path includes `visa32.lib`
- Ensure that the `PATH` environment variable allows loading `visa32.dll`.

The programming examples do not cover the full command set for the instruments. They are intended only as an introduction, how to program the instrument using VISA library calls.

The VISA calls used, are explained in detail in the VISA User’s Guide.

NOTE Never use VISA calls and the Agilent 816x VXI*plug&play* Instrument Driver in the same program.

TIP Additional programming examples are provided on the Support Disk CD-ROM 08164-90BC4

How to Use VISA Calls

The following example demonstrates how to communicate using VISA calls. Also, the use of instrument identification commands is demonstrated.

```
#include <stdio.h>
#include <stdlib.h>
#include <visa.h>

/* This function checks and displays errors, using the error query of the
instrument;
Call this function after every command to make sure your commands are correct
*/

void checkError(ViSession session, ViStatus err_status )
  {
    ViStatus error;
    ViChar errMsg[256];
       /* queries what kind of error occurred */
       error = viQueryf(session,"%s\n","%t","SYST:ERR?",errMsg);
       /*if this command times out, a system error is probable;
         check the GPIB bus communication */
       if (error == VI_ERROR_TMO)
         {
         printf("System Error!\n") ;
         exit(1);
         }
       else
         {
         /* display the error number and the error message */
         if(errMsg[0] != '+')
         printf("error:%ld --> %s\n", err_status,errMsg) ;
         }

  }

void main (void)
  {
  ViStatus      errStatus;    /*return error code from visa call */
  ViSession     defaultRM;    /*default visa resource manager variable*/
  ViSession     vi;           /*current session handle */
  ViChar       replyBuf[256]; /*buffer holding answers from the instrument*/
  ViChar       c;
    /* Initialize visa resource manger */
```

```
      errStatus = viOpenDefaultRM (&defaultRM);
  if(errStatus < VI_SUCCESS)
    { printf("Failed to open VISA Resource manager\n");
      exit(errStatus);
    }

  /* Open session to GPIB device at address 20; the VI_NULL parameters 3,4
     are mandatory and not used for VISA 1.0*/
  errStatus = viOpen (defaultRM, "GPIB::20::INSTR", VI_NULL,VI_NULL,&vi);
  if(errStatus < VI_SUCCESS)
    { printf("Failed to open instrument\n");
      exit(errStatus);
    }

  /* set timeout to 20 sec; this should work for all commands except for
zeroing or READ commands with averaging times greater than the timeout */
  errStatus = viSetAttribute(vi,VI_ATTR_TMO_VALUE,20000);
  checkError(vi,errStatus);

  /* get the identification string of the instrument mainframe*/
  errStatus = viQueryf(vi,"%s\n","%t","*IDN?",replyBuf);
  if(errStatus < VI_SUCCESS)
    { checkError(vi,errStatus); }
  else printf("%s",replyBuf);

  /* identify the installed modules */
  errStatus = viQueryf(vi,"%s\n","%t","*OPT?",replyBuf);
  if(errStatus < VI_SUCCESS)
    { checkError(vi,errStatus); }
  else printf("%s",replyBuf);

  /* get information about the available options of a slot */
  errStatus = viQueryf(vi,"%s","%t","SLOT1:OPT?\n",replyBuf);
  if(errStatus < VI_SUCCESS)
    { checkError(vi,errStatus); }
  else printf("%s",replyBuf);


  /*loop, until a key is pressed */
  while(!scanf("%c",&c));
  /*close the session */
  viClose(vi);
}
```

How to Set up a Fixed Laser Source

This example sets up a fixed laser source.

Install a Laser Source in Slot 2, before executing this example.

```
#include <stdio.h>
#include <stdlib.h>
#include <visa.h>

/* function prototypes for this examples */

/* function for simple error handling explained in example 1 */
void checkError(ViSession session, ViStatus err_status );

void main (void)
  {
  ViStatus      errStatus;     /* returned error code from visa call */
  ViSession     defaultRM;     /* default visa resource manager variable*/
  ViSession     vi;            /* current session handle */
  ViChar        c;             /* used in the keyboard wait loop */
  ViReal32  wavelength;        /* wavelength of the laser source */

    /* initialize the visa library (see example 1) */
    errStatus = viOpenDefaultRM (&defaultRM);
    if(errStatus < VI_SUCCESS)
      {
       printf("Failed to open VISA Resource manager\n");
       exit(errStatus);
      }

    /* Open session to GPIB device at address 20;*/
    errStatus = viOpen (defaultRM, "GPIB::20::INSTR", VI_NULL,VI_NULL,&vi);
    if(errStatus < VI_SUCCESS)
      {
       printf("Failed to open instrument\n");
       exit(errStatus);
      }

    /*set timeout to 20 sec; this should work for all commands except
zeroing */
    errStatus = viSetAttribute(vi,VI_ATTR_TMO_VALUE,20000);
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);
    /* first get the wavelength of the laser source; to address the second
channel of a dual laser source use "CHAN2" instead of "CHAN1"*/
    errStatus = viQueryf(vi,"%s","%f","SOURCE2:CHAN1:WAV?\n",&wavelength);
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);
    else
      { printf("Source Wavelength:%g\n",wavelength); }

    /* to receive the maximum power the attenuation must be set to zero */
    errStatus = viPrintf(vi,"SOURCE2:CHAN1:ATT 0\n");
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /* turn off amplitude modulation */
    errStatus = viPrintf(vi,"SOURCE2:CHAN1:AM:STATE 0\n");
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /* turn the laser on */
    errStatus = viPrintf(vi,"SOURCE2:CHAN1:POW:STATE 1\n");
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /* loop, until a key is pressed */

    while(!scanf("%c",&c));

    /* turn the laser off */
    errStatus = viPrintf(vi,"SOURCE2:CHAN1:POW:STATE 0\n");
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /* close the session */
    viClose(vi);
}

void checkError(ViSession session, ViStatus err_status )
  {
    ViStatus error;
    ViChar errMsg[256];
       error = viQueryf(session,"SYST:ERR?\n","%t",errMsg);
       if (error == VI_ERROR_TMO)
         {
         printf("System Error!\n") ;
         exit(1);
         }
       else
         {
          /* only errors should be displayed */
          if(errMsg[0] != '+')
          printf("error:%ld --> %s\n", err_status,errMsg) ;
         }
   }
```

How to Measure Power using FETCh and READ

The example shows the difference between a "FETCh" and a "READ" command.

Install a power meter in Slot 1, before executing this example.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <visa.h>

/* function prototypes for this examples */

/* function for a simple error handling explained in example 1 */
void checkError(ViSession session, ViStatus err_status );

void main (void)
  {
  ViStatus       errStatus;     /* returned error code from visa call */
  ViSession      defaultRM;     /* default visa resource manager variable */
  ViSession      vi;            /* current session handle */
  ViChar        replyBuf[256]; /* buffer holding answers of the instrument*/
  ViChar         compBuf[256];  /* buffer used for comparsion */
  ViChar         c;             /* used in the keyboard wait loop */
  ViReal64       averagingTime; /* averaging time */
  ViInt32        i;             /* loop counter */

    errStatus = viOpenDefaultRM (&defaultRM);
    if(errStatus < VI_SUCCESS)
      {
        printf("Failed to open VISA Resource manager\n");
        exit(errStatus);
      }

    errStatus = viOpen (defaultRM, "GPIB::20::INSTR", VI_NULL,VI_NULL,&vi);
    if(errStatus < VI_SUCCESS)
      {
        printf("Failed to open instrument\n");
        exit(errStatus);
      }
    /*set timeout to 20 sec; this should work for all commands
      except zeroing */
    errStatus = viSetAttribute(vi,VI_ATTR_TMO_VALUE,20000);
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /* make sure that the reference is not used */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:REF:STATE 0\n");
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /* clear the error queue */
    errStatus = viPrintf(vi,"*CLS\n");
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /* turn auto range on */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:RANGE:AUTO 1\n");
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /* change the power unit to watt */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:UNIT W\n");
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /*set the averaging time for measuring to 0.5s*/
    averagingTime = 0.5;

    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:ATIME %f\n",averagingTime);
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /* turn continous measuring off */
    errStatus = viPrintf(vi,"INIT1:CHAN1:CONT 0\n");
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

        /* trigger a measurement */
    errStatus = viPrintf(vi,"INIT1:CHAN1:IMM\n");
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /* read 10 values and display the result; */
    for (i = 0; i < 10; i++)
      {
  /* Now because an averaged value is available, the value will be fetched */
        errStatus = viQueryf(vi,"%s","%s","FETCH1:CHAN1:POW?\n",replyBuf);
        if (errStatus < VI_SUCCESS) checkError(vi,errStatus);
  /* two consecutive values are compared; if they are equal it will be
marked; because no evaluation is triggered, all values will be the same */
        if(i)
          { if(!strcmp(compBuf,replyBuf))
            { printf("Same:%s\n",replyBuf); }
          else printf("New:%s\n",replyBuf);
          }
        else printf("First:%s\n",replyBuf);
        strcpy(compBuf,replyBuf);
      }
    /* now the read command is used in the same manner to demonstrate the
difference between fetch and read */

      /* read also 10 values, compare them and display the result; */
      for (i = 0; i < 10; i++)
      {
    /* In comparision to the "FETCH" command, the "READ" command implies
triggering a measurement. Make sure the timeout set is greater than the
adjusted averaging time, so that the READ command will not time out; */

       /* send the read command */
       errStatus = viQueryf(vi,"READ1:CHAN1:POW?\n","%t",replyBuf);
       checkError(vi,errStatus);

        if(i)
          {
          if(!strcmp(compBuf,replyBuf))  printf("Same:%s",replyBuf);
          else printf("New  :%s",replyBuf);
          }
        else printf("\nFirst:%s",replyBuf);
        /*copy new value to compare buffer*/
        strcpy(compBuf,replyBuf);
      }
    /* loop, until a key is pressed */
    while(!scanf("%c",&c));

    checkError(vi,errStatus);
    /* close the session */
    viClose(vi);
}

void checkError(ViSession session, ViStatus err_status )
  { ViStatus error;
    ViChar errMsg[256];
       error = viQueryf(session,"SYST:ERR?\n","%t",errMsg);
       if (error == VI_ERROR_TMO)
         {
         printf("System Error!\n") ;
         exit(1);
         }
       else
         {
          /* only errors should be displayed */
          if(errMsg[0] != '+')
          printf("error:%ld --> %s\n", err_status,errMsg) ;
         }
  }
```

How to Co-ordinate Two Modules

This example shows the interaction of two modules in the same frame.

Install a Power Sensor in Slot 1 and a Laser Source in Slot 2 and connect the Laser Source output to the Power Sensor input, before executing this example.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <visa.h>

/* function prototypes for this examples */

/* function for a simple error handling explained in example 1 */
void checkError(ViSession session, ViStatus err_status );



void main (void)
  {

  ViStatus      errStatus;     /* returned error code from visa call */
  ViSession     defaultRM;     /* default visa resource manager variable */
  ViSession     vi;            /* current session handle */
  ViChar       replyBuf[256]; /* buffer holding answers of the instrument */
  ViChar        c;             /* used in the keyboard wait loop */
  ViInt32       i;             /* loop counter */
  ViInt32       cmdDone;       /* return value for OPC command */

    /* First get initialized the visa library (see example 1) */
    errStatus = viOpenDefaultRM (&defaultRM);
    if(errStatus < VI_SUCCESS)
      {
        printf("Failed to open VISA Resource manager\n");
        exit(errStatus);
      }

    /* Open session to GPIB device at address 20; */
    errStatus = viOpen (defaultRM, "GPIB::20::INSTR", VI_NULL,VI_NULL,&vi);
    if(errStatus < VI_SUCCESS)
      {
        printf("Failed to open instrument\n");
        exit(errStatus);
        }



    /* set timeout to 20 sec; this should work for all commands except
zeroing */
    errStatus = viSetAttribute(vi,VI_ATTR_TMO_VALUE,20000);
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /* clear error queue */
    errStatus = viPrintf(vi,"*CLS\n");
    checkError(vi,errStatus);

    /* read the wavelength from the laser source */
    errStatus = viQueryf(vi,"SOURCE2:CHAN1:WAV?\n","%s",replyBuf);
    checkError(vi,errStatus);

    /* feed the source wavelength into the power meter making
       sure to measure the maximum power of the source */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:WAV %s\n",replyBuf);
    checkError(vi,errStatus);

    /* turn auto range on */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:RANGE:AUTO 1\n");
    checkError(vi,errStatus);

    /* change the power unit of the power meter to dBm */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:UNIT 0\n");
    checkError(vi,errStatus);

    /*set the averaging time for measuring to 20 ms,
      therefore no timeout needs to implemented */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:ATIME 0.02\n");
    checkError(vi,errStatus);

    /* set the attenuation to zero for maximum power */
    errStatus = viPrintf(vi,"SOURCE2:CHAN1:POW:ATT 0.0\n");
    checkError(vi,errStatus);

    /* set the reference mode to the internal one,
   which is now the last displayed value  */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:REF:STATE:RATIO TOREF,0\n");
    checkError(vi,errStatus);

    /* set  reference measuremant state to absolute units */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:REF:STAT 1\n");
    checkError(vi,errStatus);
    /* turn laser on */
    errStatus = viPrintf(vi,"SOURCE2:CHAN1:POW:STATE 1\n");
    checkError(vi,errStatus);
    /*ask for command completion */
     do
          {
            errStatus = viQueryf(vi,"*OPC?\n","%d",&cmdDone);
            checkError(vi,errStatus);
          } while (!cmdDone);


    /* set the power meter reference to the displayed value (display to
reference) */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:REF:DISP\n");
    checkError(vi,errStatus);


    /*
       read 30 values and display the result; after ten measurements
       the source output will be halved by making use of the attenuation;
       after an other ten measurements the source output will be halved
       a second time;
       because of the display to reference command and using the
       reference, the value printed should be more or less equal to the
       adjusted source attenuation */

    for (i = 1; i <= 30; i++)
      {
        errStatus = viQueryf(vi,"READ1:CHAN1:POW?\n","%s",replyBuf);
        checkError(vi,errStatus);
        if(errStatus ==VI_SUCCESS)printf("power #%02d:%s\n",i,replyBuf);
        if(i == 10)
          {
           /* reduce the output power for 3.0 dB */
           errStatus = viPrintf(vi,"SOURCE2:CHAN1:POW:ATT 3.0\n");
           checkError(vi,errStatus);
          }
        if(i == 20)
          {
           /* reduce the output power for 6.0 dB */
           errStatus = viPrintf(vi,"SOURCE2:CHAN1:POW:ATT 6.0\n");
           checkError(vi,errStatus);
          }


      }
    /* loop, until a key is pressed */
    while(!scanf("%c",&c));

    /* turn the laser off */
    errStatus = viPrintf(vi,"SOURCE2:CHAN1:POW:STATE 0\n");
    if (errStatus < VI_SUCCESS) checkError(vi,errStatus);

    /*close the session */
    viClose(vi);


}


void checkError(ViSession session, ViStatus err_status )
  {
    ViStatus error;
    ViChar errMsg[256];
       error = viQueryf(session,"SYST:ERR?\n","%t",errMsg);
       if (error == VI_ERROR_TMO)
         {
         printf("System Error!\n") ;
         exit(1);
         }
       else
         {
          /* only errors should be displayed */
          if(errMsg[0] != '+')
          printf("error:%ld --> %s\n", err_status,errMsg) ;
         }

  }
```

How Power Varies with Wavelength

This example shows how the measured power depends on wavelength.

Install a Power Sensor in Slot 1 and a Tunable Laser Source in Slot 2 and connect the Tunable Laser Source output to the Power Sensor input, before executing this example.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <visa.h>

/* function prototypes for this examples*/

/* function for a simple error handling explained in example 1 */
void checkError(ViSession session, ViStatus err_status );



void main (void)
  {

  ViStatus      errStatus;     /* returned error code from visa call */
  ViSession     defaultRM;     /* default visa resource manager variable*/
  ViSession     vi;            /* current session handle */
  ViChar        replyBuf[256]; /*buffer holding answers of the instrument */
  ViChar        c;             /* used in the keyboard wait loop */
  ViReal64      wavelength;    /* used to hold the wavelength of the tunable
laser source */
  ViReal64  wavelength_max;    /*used to hold the maximum wavelength of the
tunable laser source*/
  ViInt32       i;             /* loop counter */
  ViInt32       cmdDone;       /* return value for OPC command */

    errStatus = viOpenDefaultRM (&defaultRM);
    if(errStatus < VI_SUCCESS)
      {
        printf("Failed to open VISA Resource manager\n");
        exit(errStatus);
      }

    errStatus = viOpen (defaultRM, "GPIB::20::INSTR", VI_NULL,VI_NULL,&vi);
    if(errStatus < VI_SUCCESS)
      {
        printf("Failed to open instrument\n");
        exit(errStatus);
      }


    /*set timeout to 20 sec; this should work for all commands
      except zeroing */
    errStatus = viSetAttribute(vi,VI_ATTR_TMO_VALUE,20000);
    checkError(vi,errStatus);


    errStatus = viPrintf(vi,"*CLS\n");
    checkError(vi,errStatus);

    /* read the minimum wavelength from the tunable laser source*/
    errStatus = viQueryf(vi,"SOURCE2:WAV? MIN\n","%s",replyBuf);
    checkError(vi,errStatus);

    /* save this wavelength */
    wavelength = atof(replyBuf);

    /* set the minimum wavelength as initial wavelength in the tunable laser
source */
    errStatus = viPrintf(vi,"SOURCE2:WAV %s\n",replyBuf);
    checkError(vi,errStatus);

    /* set the power meter to same wavelength like the tunable laser
source */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:WAV %s\n",replyBuf);
    checkError(vi,errStatus);


    /* read the maximum wavelength from the tunable laser source */
    errStatus = viQueryf(vi,"SOURCE2:WAV? MAX\n","%s",replyBuf);
    checkError(vi,errStatus);

    /*save this wavelength */
    wavelength_max = atof(replyBuf);

    /* change the power unit of the power meter to dbm  */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:UNIT DBM\n");
    checkError(vi,errStatus);

    /* read the default power from the tunable laser source */
    errStatus = viQueryf(vi,"SOURCE2:POW? DEF\n","%s",replyBuf);
    checkError(vi,errStatus);

    /* set the default power */
```

```
 errStatus = viPrintf(vi,"SOURCE2:POW %s\n",replyBuf);
 checkError(vi,errStatus);


 /* turn auto range on*/
 errStatus = viPrintf(vi,"SENS1:CHAN1:POW:RANGE:AUTO 1\n");
 checkError(vi,errStatus);



 /*set the averaging time for measuring to 20ms*/
 errStatus = viPrintf(vi,"SENS1:CHAN1:POW:ATIME 0.02\n");
 checkError(vi,errStatus);


 /* turn laser on */
 errStatus = viPrintf(vi,"SOURCE2:POW:STATE 1\n");
 checkError(vi,errStatus);


 /* increase the wavelength of the tunable laser source 10 nm
until the maximum is reached.
    read the results from the power meter and display it */

 for(i=1;1;i++)
   {
     /*query the power */
     errStatus = viQueryf(vi,"READ1:CHAN1:POW?\n","%s",replyBuf);
     checkError(vi,errStatus);

     /* display the power read from power meter and wavelength */
     printf("#%02d power:%s   wavelength:%g\n",i,replyBuf,wavelength);

     /* increase the wavelength */
     wavelength += 10.0e-9;
     if(wavelength > wavelength_max) break;
     /*set the new wavelength*/
     errStatus = viPrintf(vi,"SOURCE2:WAV %g\n",wavelength);

     /*
     poll the instrument for completion of this command
     because adjusting a new wavelength takes some time
     */
     do
       {
         errStatus = viQueryf(vi,"*OPC?\n","%d",&cmdDone);
         checkError(vi,errStatus);
       } while (!cmdDone);
```

```
        }



    /* loop, until a key is pressed */
    while(!scanf("%c",&c));

    /* turn laser off */
    errStatus = viPrintf(vi,"SOURCE2:CHAN1:POW:STATE 0\n");
    checkError(vi,errStatus);

    /* close the session */
    viClose(vi);


}



void checkError(ViSession session, ViStatus err_status )
  {
    ViStatus error;
    ViChar errMsg[256];
       error = viQueryf(session,"SYST:ERR?\n","%t",errMsg);
       if (error == VI_ERROR_TMO) printf("System Error!\n") ;
       else
         {
          /* only errors should be displayed */
          if(errMsg[0] != '+')
          printf("error:%ld --> %s\n", err_status,errMsg) ;
         }

  }
```

How to Log Results

This example demonstrates how to use logging functions.

Install a Power Sensor in Slot 1, before executing this example.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <visa.h>

#define MAX_LOG_VALUES 4000 /* max number of values the instrument is able to
log */
#define HEADER_SIZE    7    /* includes 6 bytes header and 1 CR */

/* function prototypes for this examples/*

/* function for a simple error handling explained in example 1 */
void      checkError(ViStatus session, ViStatus err_status );

/* initialize the visa interface */
ViStatus  InitVisa ( ViSession *iHandle);

/*globals*/
static unsigned char logBuffer[MAX_LOG_VALUES * sizeof(ViReal64) +
HEADER_SIZE];
/*array for the float results */
static ViReal32 logResults[MAX_LOG_VALUES];

void main (void)
  {

   ViStatus     errStatus;      /* returned error code from visa call */
   ViSession    vi;             /* current session handle */
   ViChar       replyBuf[256];  /* buffer holding answers from the
instrument */
   ViChar       c;              /* used in the keyboard wait loop */
   ViInt32      slot;           /* slot number where the power meter is
plugged */
   ViInt32      chan;           /* channel to be logged */
   ViInt32      i;              /* loop counter */
   ViInt32      noOfValues;     /* number of values to be logged*/
   ViReal64     averagingTime;  /* aveaging time used in a logging cycle */
   ViPChar      replySubStr;    /* pointer to a substring of the instruments
reply */
   ViInt32      noOfDigits;     /*number of digits, specifing the amount data
```

```
 to be read */
   ViUInt32      retCnt;        /* returns the number of bytes read calling
viRead */

    errStatus = InitVisa(&vi);

    if(errStatus < VI_SUCCESS)
      {
      exit(errStatus);
      }

    /* clear instrument error queue */
    errStatus = viPrintf(vi,"*CLS\n");
    checkError(vi,errStatus);

    /* turn auto range on */
    errStatus = viPrintf(vi,"SENS1:CHAN1:POW:RANGE:AUTO 1\n");
    checkError(vi,errStatus);

    /* send the command sequence for continuous logging */
    slot = 1;
    chan = 1;
    noOfValues = 100;     /* log 100 values */
    averagingTime = 0.02; /* set averaging time to 20ms */
    viPrintf(vi,"SENS%1d:CHAN%1d:FUNC:PAR:LOGG %d,%f\n",
             slot,
             chan,
             noOfValues,
             averagingTime);
                checkError(vi,errStatus);

    /* start logging */
        viPrintf(vi,"SENS%1d:CHAN%1d:FUNC:STAT LOGG,START\n",slot,chan);
                checkError(vi,errStatus);
    /* to display the results, logging should be completed */
    /* the instrument has to be polled about the progress of the logging */
    do
      {
        errStatus =
viQueryf(vi,"SENS%1d:CHAN%1d:FUNC:STATE?\n","%t",slot,chan,replyBuf);
        /* if an error occurs break the loop */
        if (errStatus < VI_SUCCESS)
          {
          checkError(vi,errStatus);
          break;
          }

        /* find the substring "COMPLETE" in the reply of the instrument */
```

```
         replySubStr = replyBuf;
                     while(*replySubStr)
           {
             if(!strncmp(replySubStr,"COMPLETE",strlen("COMPLETE"))) break;
             replySubStr ++;
           }
       }while (!*replySubStr); /*substring "COMPLETE" not found */
                               /*continue polling */

    /* The instrument returns the logging result in the following format:
#xyyyffff...; the first digits after the hash denotes the number of ascii
digits following (y) ; y specifies the number of binary data following;
"ffff" represent the 32Bit floats as log result. */
    /* get the result */
    errStatus =  viPrintf(vi,"SENS%1d:CHAN%1d:FUNC:RES?\n",slot,chan);
    /* only query an error, if there is one, else the query will be
interrupted ! */
    if(errStatus < VI_SUCCESS)checkError(vi,errStatus);

    /* read the binary data */
    errStatus = viRead(vi, logBuffer, MAX_LOG_VALUES * sizeof(ViReal32) +
HEADER_SIZE, &retCnt);
    checkError(vi,errStatus);

    if(logBuffer[0] != '#')
      {
      printf("invalid format returned from logging\n");
      exit(1);
      }
    else
      {
      noOfDigits = logBuffer[1] -'0';
      memcpy( logResults, &logBuffer[2 + noOfDigits ],
              MAX_LOG_VALUES * sizeof(ViReal32));
      }

    /* stop logging */
    viPrintf(vi,"SENS%1d:CHAN%1d:FUNC:STAT LOGG,STOP\n",slot,chan);
    checkError(vi,errStatus);

    /* display the values using %g, a float format specifier, you may also
use %e or %f */
    for ( i = 0; i < noOfValues; i++)
    printf("\t%g\n",logResults[i]);

    /* loop, until a key is pressed */
    while(!scanf("%c",&c));
    /* close the session */
    viClose(vi);

  }

void checkError(ViStatus session, ViStatus err_status )
  {
    ViStatus error;
    ViChar errMsg[256];
       error = viQueryf(session,"SYST:ERR?\n","%t",errMsg);
       if (error == VI_ERROR_TMO)
         {
         printf("System Error!\n") ;
         exit(1);
         }
       else
         {
          /* only errors should be displayed */
          if(errMsg[0] != '+')
          {
          printf("error:%ld --> %s\n", err_status,errMsg) ;
          if
          ((!strncmp(errMsg,
          "-303,\"Module slot empty or slot / channel invalid\"",
          strlen("-303,\"Module slot empty or slot / channel invalid\"")))
          ||
          (!strncmp(errMsg,
          "-301,\"Module doesn't support this command (StatCmdUnknown)\"",
          strlen(
         "-301,\"Module doesn't support this command (StatCmdUnknown)\""))))
           {
             printf("No power meter in slot 1 so exiting\n\n");
            exit(1);
            }
          }
         }
  }

ViStatus InitVisa ( ViSession *iHandle)
  {
    ViStatus    errStatus;     /* returned error code from visa call */
    ViSession   defaultRM;     /* default visa resource manager variable */

    /* First get initialized the visa library (see example 1) */
    errStatus = viOpenDefaultRM (&defaultRM);
    if (errStatus < VI_SUCCESS)
          printf("Failed to open VISA Resource manager\n");

    /* Open session to GPIB device at address 20; */
    errStatus = viOpen (defaultRM, "GPIB::20::INSTR",
                         VI_NULL,VI_NULL,iHandle);
    if (errStatus < VI_SUCCESS)
          printf("Failed to open instrument\n");

    return errStatus;
  }
```

The Agilent 816x VXI*plug&play* Instrument Driver

This chapter gives you extra information about installing and getting started with the Agilent 816x VXI*plug&play* instrument driver.

There are details about opening and closing an instrument session, data types and constants used, error handling, and the programming environments supported.

Installing the Agilent 816x Instrument Driver

The Agilent 816x VXI*plug&play* Instrument Driver comes as a self-extracting archive with an installation wizard. The installation wizard extracts all the files to preset destinations, asking you appropriate questions as it does so.

You install the driver by running the executable `hp816x.exe`.

1 Run `hp816x.exe`,

The welcome screen for the InstallShield Wizard used to install the Agilent 816x VXI*plug&play* Instrument Driver is displayed.

2 Press `Next>` to continue.

Specify the folder to which files will be saved.

3 Press `Next>` to continue.

Files are copied and extracted.

If necessary, a dialog requests your premission to overwrite existing files.

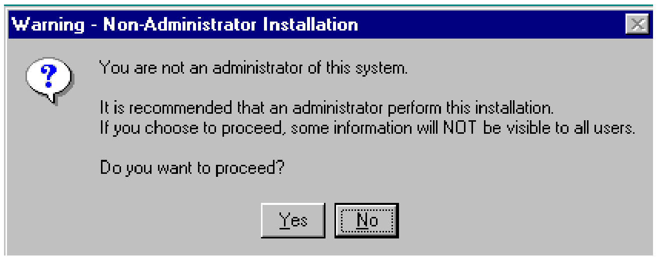
The vesrion number of the instrument driver is displayed.

You may now elect to skip installation at this PC. Copy the extracted disk images to floppy, and use them to install the instrument driver at another PC.

4 Press `OK>` to continue.

If you are not an administrator, you see a VXI*plug&play* window, and a message telling you that if you proceed with the installation, some information will NOT be visible to all users. This means that any program menu options will only be available to the user that performed the installation. If you are the administrator all program menu options will be visible for all users.

If you see the message in Figure 1, press Yes to install the driver or press No and contact your administrator.



You are not an administrator of this system.

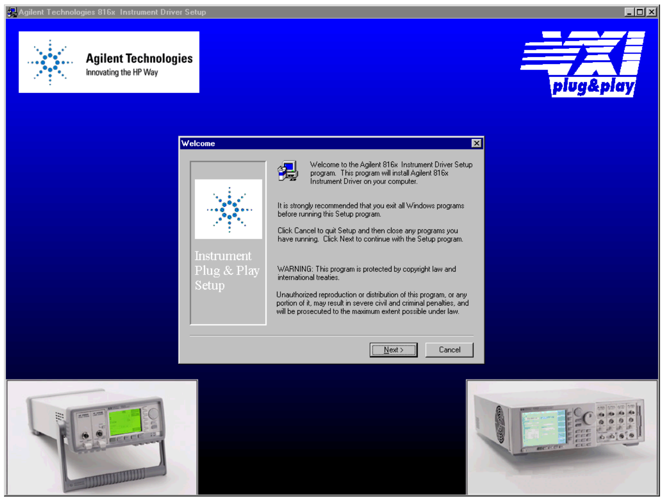
It is recommended that an administrator perform this installation.
If you choose to proceed, some information will NOT be visible to all users.

Do you want to proceed?

Figure 1 Non-Administrator Installation Pop-Up Box

NOTE If Agilent 816x VXI*plug&play* Instrument Driver is already installed on your system, you see a message asking you if you want to uninstall the old version.
Press `Yes`, if required, then wait until you see a message telling you that the uninstall has been successful. You may be asked for permission to remove shared files.
Then press `OK` to continue.

5 You see a message, as shown in Figure 2, advising you to close the programs that you have running.


Agilent Technologies 816x Instrument Driver Setup
Agilent Technologies
Innovating the HP Way
VXI plug&play
Welcome
Instrument Plug & Play Setup

Welcome to the Agilent 816x Instrument Driver Setup program. This program will install Agilent 816x Instrument Driver on your computer.

It is strongly recommended that you exit all Windows programs before running this Setup program.

Click Cancel to quit Setup and then close any programs you have running. Click Next to continue with the Setup program.

WARNING: This program is protected by copyright law and international treaties.

Unauthorized reproduction or distribution of this program, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under law.

Figure 2 Welcome Screen

6 Close these programs and press `Next>` to continue. Then, you see a message informing you if VISA is installed on your PC.

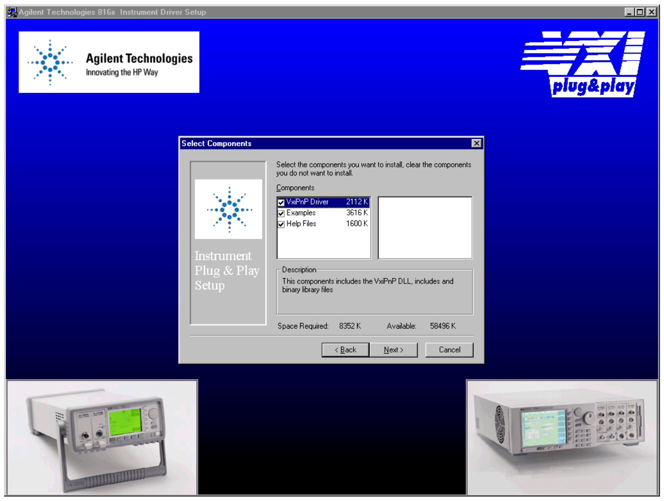
NOTE If you do not have VISA installed, press **`Cancel`** to temporarily exit this installation procedure; install VISA on your PC, then run `hp816x.exe` again.

If you have VISA installed, press `Next>` to continue. You see a window that requests you to choose your Setup.

7 You can choose a `Typical`, `Compact`, or `Custom` Setup. Choose a setup option and press `Next>` to continue.

NOTE If you choose the `Custom` Setup, you may choose the options you want to install from the screen in Figure 3. These options are:

- VxiPnP Driver, you may choose to install the Agilent 816x VXI*plug&play* instrument driver.
- `Examples`, you may choose to install Visual Basic, Visual C, LabView, HP VEE and VISA programming examples.
- `Help Files`, you may choose to install the help file.



Select the components you want to install, clear the components you do not want to install.

Components

✓ VxiPnP Driver	2112 K
✓ Examples	3616 K
✓ Help Files	1600 K

Description

This components includes the VxiPnP DLL, includes and binary library files

Space Required: 8352 K Available: 58496 K

Figure 3 Customizing Your Setup

Select the components you want to install.

8 Press `Next>` to continue.

Specify the program folder required; the default choice is `VXIPNP`.

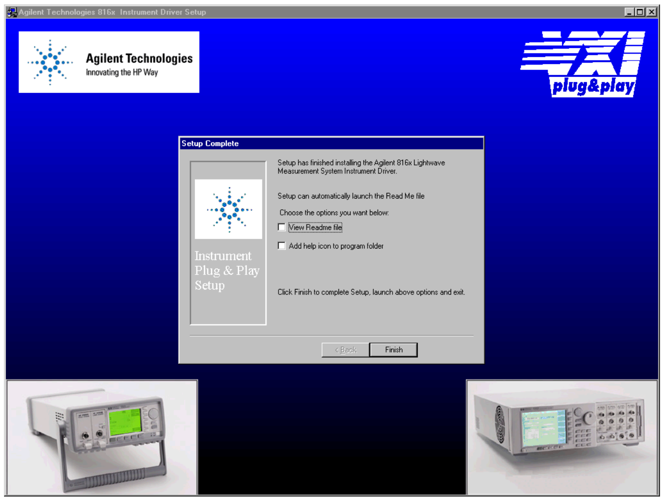
9 Press `Next>` to continue.

Review the settings that you have specified.

If you want to review or change any settings press `Back>`

10 Press `Next>` to continue.

The instrument driver is installed.



Setup Complete

Setup has finished installing the Agilent 816x Lightwave Measurement System Instrument Driver.

Setup can automatically launch the Read Me file

Choose the options you want below:

☐ View Readme file

☐ Add help icon to program folder

Click Finish to complete Setup, launch above options and exit.

Figure 4 Program Folder Item Options

You may elect to:

– Automatically launch the `Readme` file, which provides the instrument driver's version history

– Include a help icon in your program folder, which launches on-line documentation for the instrument driver

11 Press `Finish` to complete installation

If you elected to automatically launch the Readme file, it is displayed.

A webpage explaining how to get started with the Agilent 816x VXI*plug&play* Instrument Driver using HP VEE or LabView appears.

Using Visual Programming Environments

Getting Started with HP VEE

Hewlett-Packard Visual Engineering Environment (HP VEE) is a visual programming language optimized for instrument control applications. To develop programs in HP VEE, you connect graphical ‘objects’ instead of writing lines of code. These programs resemble easy-to-understand block diagrams with lines.

HP VEE allows you to leverage your investment in textual languages by integrating with languages such as C, C++, Visual Basic, FORTRAN, Pascal, and HP BASIC.

HP VEE controls GPIB, VXI, Serial, PC Plug-in, and LAN instruments directly over the interfaces or by using instrument drivers.

HP VEE supports VXI*plug&play* drivers in the WIN, WIN95, WINNT, and HP-UX frameworks. In addition, versions 3.2 and above of HP VEE support the graphical Function Panel interface, providing a function tree of the hierarchy of the driver.

NOTE This appendix assumes that you are using Windows 95. If you are using Windows NT, please replace every reference to `win95` with `winnt`.
Windows 95 and Windows NT are registered trademarks of Microsoft corporation.

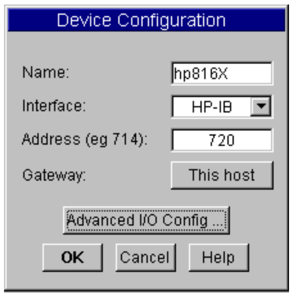
HP VEE automatically calls the *initialize* and *close* functions to perform automatic error checking.

GPIB Interfacing in HP VEE

HP VEE supports interfacing with an instrument from a GPIB card. Before you can do this, you must do the following:

1 Select `Instrument Manager` from the I/O menu.

2 Double-click on the `Add` button to bring up the Device Configuration screen, see Figure 5.



Name: hp816X
Interface: HP-IB
Address (eg 714): 720
Gateway: This host

Figure 5 Device Configuration

3 Enter the following information:

– **`Name`**: enter `hp816X`.

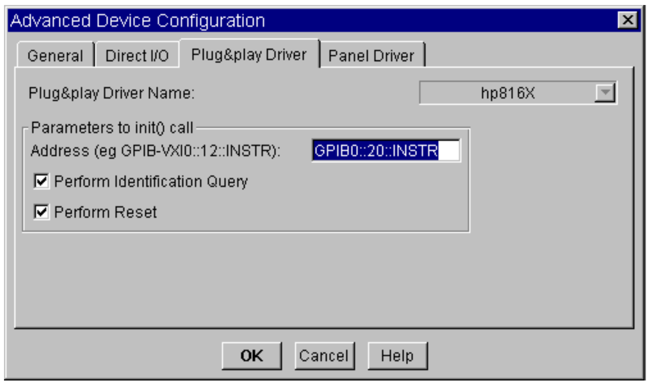
– **`Interface`**: `HP-IB`

– **`Address`**: Enter the GPIB address of your GPIB interface board (the default is 7). Append the GPIB address of your instrument (the default is 20).

NOTE To find out or change the instrument's GPIB address, press the *Config* hardkey on the instrument's front panel and choose GPIB address. The instrument's GPIB address appears, you may edit it if you wish.

– **`Gateway`**: `This host`.

4 Press `Advanced I/O Config ...`, the Advanced Device Configuration box pops up. Select the Plug&play Driver tab, the box in Figure 6 appears.



Plug&play Driver Name: hp816X

Parameters to init() call

Address (eg GPIB-VXI0::12::INSTR): GPIB0::20::INSTR

☑ Perform Identification Query

☑ Perform Reset

Figure 6 Advanced Device Configuration - Plug&play Driver

5 Select `hp816X` *from the* `Plug&play Driver Name` drop-down list.

NOTE If you do not see this driver in the list, the driver has not installed properly.

6 Enter the `Parameters to the init() call` by entering `GPIB::xx::INSTR` where `xx` is your instrument's GPIB address.

NOTE 20 is the default GPIB address for your instrument.

7 Select whether to `Perform Reset` or to `Perform Identification Query` whenever HP VEE opens the instrument for interaction.

8 Confirm the selections pressing the `OK` button.

9 Return to the Instrument Manager screen and press the `Save Config` to save the configuration.

Getting Started with LabView

The 32-bit Agilent 816x driver can be used with LabView 5.0 and above. LabView 5.0 is a 32-bit version of LabView which runs on Windows 95 and Windows NT.

After installing the Agilent 816x instrument driver, the driver must be converted for use with LabView.

1 To convert the driver follow these steps:

   a If you are updating from a previously installed driver, perfrorm the following three steps:

   b Locate the LabView program folder. By default, this is `<drive>:Program Files\National Instruments\LabView`.

   c This folder contains a subfolder named `instr.lib`.

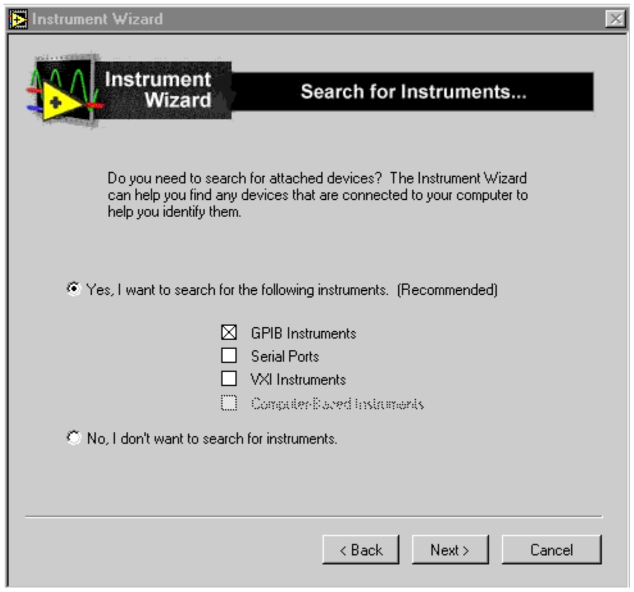
2 Run LabView.

3 On the first window that appears, click on the `Solution Wizards` button.

4 The `LabView Solution Wizard` window appears, click on the `Launch Wizard...` button.

5 The *W*`elcome to Instrument Wizard!` window appears, click on the `Next >` button.

6 The `Search for Instruments...` window appears, click on the `Next >` button. Check that the options are the same as displayed in the figure below:



Do you need to search for attached devices? The Instrument Wizard can help you find any devices that are connected to your computer to help you identify them.

(●) Yes, I want to search for the following instruments. (Recommended)

- [x] GPIB Instruments
- [ ] Serial Ports
- [ ] VXI Instruments
- [ ] Computer-Based Instruments

( ) No, I don't want to search for instruments.

Figure 7 Search for GPIB Instruments

7 Click on the `Next >` button.

8 The `Identify Found Instruments...` window appears, click on the `Next >` button.

9 The `Update VXI Plug and Play Drivers` window appears, select `HP816X`, and click on the `Convert` button.

10 The *Manage Instrument Drivers* window appears, click on the `Finish` button.

11 The first window appears again, click on the `New VI` button.

12 Select `File` and then select `Convert CVI FP file`.

13 The `Select a CVI Function Panel file` window appears, locate the `hp816x.fp` file, which is normally installed into the path `<drive>:VXIPNP\winXX\hp816x`, where XX stands for NT, or 95.

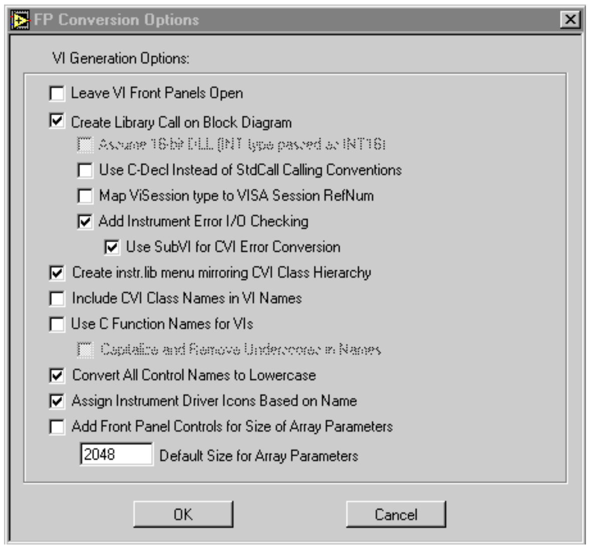
14 Press `Open`.

15 The `CVI Function Panel Converter` window appears.

16 Click on `Browse...` and browse to the following Destination Directory: `\LabView\instr.lib\hp816x\hp816x.llb`

17 Press `Save`.

18 Press `Options...`, the `FP Conversion Options` window appears. Check that the options are the same as displayed in the figure below:.


FP Conversion Options

VI Generation Options:

- ☐ Leave VI Front Panels Open
- ☑ Create Library Call on Block Diagram
  - ☐ Assume 16-bit DLL (INT type passed as INT16)
  - ☐ Use C-Decl Instead of StdCall Calling Conventions
  - ☐ Map ViSession type to VISA Session RefNum
  - ☑ Add Instrument Error I/O Checking
    - ☑ Use SubVI for CVI Error Conversion
- ☑ Create instr.lib menu mirroring CVI Class Hierarchy
- ☐ Include CVI Class Names in VI Names
- ☐ Use C Function Names for VIs
  - ☐ Capitalize and Remove Underscores in Names
- ☑ Convert All Control Names to Lowercase
- ☑ Assign Instrument Driver Icons Based on Name
- ☐ Add Front Panel Controls for Size of Array Parameters
  - 2048 Default Size for Array Parameters

OK Cancel

Figure 8 FP Conversion Options Box

NOTE You must check the `Add Front Panel Controls for Size of Array Parameters` box. There will be a front panel control created for each VI that requires you to assign the array size.

19 Press `OK`. The `CVI Function Panel Converter` window appears.

20 Press `OK`.

21 The `Select a library` window appears. Browse to `<drive>:\vxipnp\winXX\Bin`, where XX stands for NT, or 95, select `hp816x_32.dll` and click on `Open`.

22 The `CVI Conversion Status` window is displayed until the conversion is completed.

NOTE You must use the 32-bit version of the Agilent 816x VXI*plug&play* Instrument Driver with LabView 5.0.

NOTE LabView is a trademark of National Instruments Corporation.

Getting Started with LabWindows

The 32-bit Agilent 816x VXI*plug&play* Instrument Driver can be used with LabWindows 4.0 and above. LabWindows 4.0 is a 32-bit version of LabWindows which runs on Windows 95 and Windows NT.

To access the functions of the Agilent 816x VXI*plug&play* Instrument Driver from within LabWindows, select INSTRUMENT from the main menu, and then select the LOAD... submenu item.

In the file selection dialog box which appears, select `hp816x.fp` and click on the `OK` button. LabWindows loads the function panel and instrument driver.

The driver now appears as a selection on the Instrument menu, and can be treated like any LabWindows driver.

NOTE LabWindows is a trademark of National Instruments Corporation.

Features of the Agilent 816x Instrument Driver

The Agilent 816x VXI*plug&play* instrument driver conforms to all aspects of the VXI*plug&play* driver standard which apply to conventional rack and stack instruments.

The following features are available:

- The Agilent 816x VXI*plug&play* Instrument Driver conforms with the VXI*plug&play* standard.

  There is one exception as the Agilent 816x driver does not have a soft front panel or a knowledge-based file.

- The Agilent 816x VXI*plug&play* Instrument Driver is built on top of VISA, and uses the services provided.

  VISA supports GP-IB and VXI protocols. The driver can be used with any GP-IB card for which the manufacturer has provided a VISA DLL.

- The Agilent 816x VXI*plug&play* Instrument Driver includes a Function Panel (.fp) file.

  The .fp file allows the driver to be used with visual programming environments such as HP-VEE, LabWindows, and LabView.

- The Agilent 816x VXI*plug&play* Instrument Driver includes a comprehensive on-line help file which complements the instrument manual.

  The help file contains application programming examples, a cross-reference between instrument commands and driver functions, and detailed documentation of each function with examples.

- The Agilent 816x VXI*plug&play* Instrument Driver includes a Visual Basic (.BAS) file which contains the function calls in Visual Basic syntax, and allows the driver functions to be called from Visual Basic.

  You should only use Visual Basic with this driver if you are familiar with C/C++ function declarations. You must take particular care when working with C/C++ pointers.

Directory Structure

The setup program which installs the Agilent 816x instrument driver creates the `VXIPNP` directory if it does not already exist. The structures for the Windows NT and Windows 95 vxipnp subdirectory tree are shown in Figure 9.

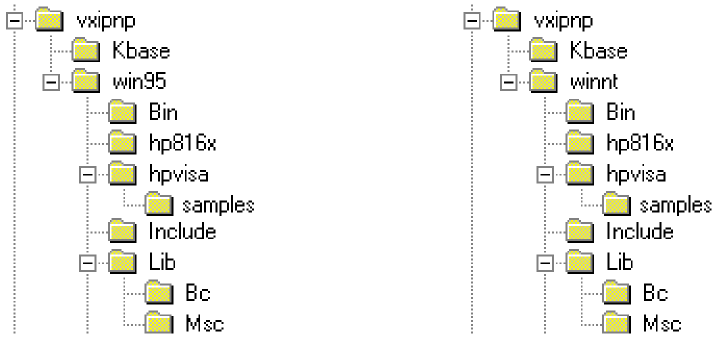


Figure 9 Windows 95 and Windows NT VXIPNP Directory Structure

In the directory example, hp816x is a directory containing the instrument driver. There would be a directory for each instrument driver.

Opening an Instrument Session

To control an instrument from a program, you must open a communication path between the computer/controller and the instrument. This path is known as an instrument session, and is opened with the function

```
ViStatus hp816x_init( ViRsrc InstrDesc, ViBoolean
id_query, ViBoolean reset, ViPSession
instrumentHandle );
```

Instruments are assigned a handle when the instrument session is opened. The handle, which is a pointer to the instrument, is the first parameter passed in all subsequent calls to driver functions.

The parameters of the function `hp816x_init` include:

- **`ViRsrc InstrDesc`**: the address of the instrument
- **`ViBoolean id_query`**: a Boolean flag which indicates if in-system verification should be performed.
  Passing `VI_TRUE` (1) will perform an in-system verification; passing `VI_FALSE` (0) will not.
  If you set `id_query` to false, you can use the generic functions of the instrument driver with other instruments.
- **`ViBoolean reset`**: a Boolean flag which indicates if the instrument should be reset when it is opened.
  Passing `VI_TRUE` (1) will perform a reset when the session is opened; passing `VI_FALSE` (0) will not perform a reset,
- **`ViPSession instrumentHandle`**: a pointer to an instrument session.
  `InstrumentHandle` is the handle which addresses the instrument, and is the first parameter passed in all driver functions.

Successful completion of this function returns `VI_SUCCESS`

Closing an Instrument Session

Sessions (instrumentHandle) opened with the `hp816x_init()` function are closed with the function:

```
hp816x_close( ViSession instrumentHandle);
```

When no further communication with an instrument is required, the session must be explicitly closed (`hp816x_close()` function).

VISA does not remove sessions unless they are explicitly closed. Closing the instrument session frees all data structures and system resources allocated to that session.

VISA Data Types and Selected Constant Definitions

The driver functions use VISA data types. VISA data types are identified by the `Vi` prefix in the data type name (for example, `ViInt16`, `ViUInt16`, `ViChar`).

The file `visatype.h` contains a complete listing of the VISA data types, function call casts and some of the common constants.

NOTE You can find a partial list of the type definitions and constant definitions for the `visatype.h` in the Agilent 816x VXI*plug&play* Instrument Driver Online Help.

Error Handling

Events and errors within a instrument control program can be detected by polling (querying) the instrument. Polling is used in application development environments (ADEs) that do not support asynchronous activities where callbacks can be used.

Programs can set up and use polling as shown below.

1 Declare a variable to contain the function completion code.

   ```
   ViStatus errStatus;
   ```

   Every driver function returns the completion code `ViStatus`.

   If the function executes with no I/O errors, driver errors, or instrument errors, `ViStatus` is 0 (`VI_SUCCESS`).

   If an error occurs, `ViStatus` is a negative error code.

   Warnings are positive error codes, and indicate the operation succeeded but special conditions exist.

2 Enable automatic instrument error checking following each function call.

   ```
   hp816x_errorQueryDetect
   (instrumentHandle, VI_TRUE);
   ```

   When enabled, the driver queries the instrument for an error condition before returning from the function.

   If an error occurred, `errStatus` (Step 1) will contain a code indicating that an error was detected (`hp816x_INSTR_ERROR_DETECTED`).

3 Check for an error (or event) after each function.

   ```
   errStatus = hp816x_cmd(instrumentHandle,
   "SENS1:POW:RANG");
   check(instrumentHandle, errStatus);
   ```

   After the function executes, `errStatus` contains the completion code.

   The completion code and instrument ID are passed to an error checking routine. In the above statement, the routine is called 'check'.

4 Create a routine to respond to the error or event. This example queries whether an error has occured, checks if the error is an instrument error and then checks if the error is a driver error.

```
void check (ViSession instrumentHandle, ViStatus errStatus)
```

```
{
 /* variables for error code and message */
 ViInt32 inst_err;
 ViChar err_message[256];

 /* VI_SUCCESS is 0 and is defined in VISATYPE.h */
 if(VI_SUCCESS > errStatus)
 {
 /* hp816x_INSTR_ERROR_DETECTED defined in hp816x.h */
   if(hp816x_INSTR_ERROR_DETECTED == errStatus)

   {
   /* query the instrument for the error */
   hp816x_error_query(instrumentHandle, &inst_err, err_message);

   /* display the error */
   printf("Instrument Error : %ld, %s\n", inst_err, err_message);
   }
   else /* driver error */
   {
   /* get the driver error message */
   hp816x_error_message(instrumentHandle, errStatus, err_message);

   /* display the error */
   printf("Driver Error : %ld, %s\n", errStatus, err_message);

   }
   /* optionally reset the instrument, close the instrument handle */
   hp816x_reset(instrumentHandle);
   hp816x_close(instrumentHandle);
   exit(1);
 }
 return;
```

Introduction to Programming

Example Programs

See the Online Help and *"VISA Programming Examples" on page 175*.

VISA-Specific Information

The following information is useful if you are using the driver with a version of VISA.

Instrument Addresses

When you are using Agilent VXI*plug&play* instrument drivers, you should enter the instrument addresses using only upper case letters. This is to ensure maximum portability.

For example, use `GPIB0::22` rather than `gpib0::22`.

Callbacks

Callbacks are not supported by this driver.

Development Environments

These sections contains suggestions as to how you can use `hp816x_32.dll` within various application development environments.

Microsoft Visual C++ 4.0 (or higher) and Borland C++ 4.5 (or higher)

Please refer to your Microsoft Visual C++ or Borland C++ manuals for information on linking and calling DLLs.

Microsoft Visual Basic 4.0 (or higher)

Please refer to your Microsoft Visual Basic manual for information on calling DLLs.

The BASIC include file is `hp816x.bas`. You can find this file in the directory `~vxipnp\win95\include`, where ~ is the directory in the VXIPNP variable.

By default, ~ is equivalent to `C:\`. This means that the file is in `C:\vxipnp\win95\include`.

You may also need to include the file `visa.bas`. `visa.bas` is provided with your VISA DLL.

HP VEE 5.01 (or higher)

Your copy of HP VEE for Windows contains a document titled *Using VXIplug&play drivers with HP VEE for Windows*. This document contains the detailed information you need for HP VEE applications.

LabWindows CVI/ (R) 4.0 (or higher)

The Agilent 816x VXI*plug&play* Instrument Driver is supplied as a Dynamic Link Library (.DLL) file.

There are several advantages to using the .DLL form of the driver, including those listed below:

- transportability across different computer platforms,
- a higher level of support for the compiled driver from Agilent Technologies,
- a faster load time for your project.

LabWindows/CVI (R) will attempt by default to load the source version of the instrument driver. To load the DLL, you must include the file `hp816x.fp` in your project. `hp816x.fp` can be found in the directory `vxipnp\win95\hp816x`.

Do not include `hp816x.C` in your project.

You must provide an include file for `hp816x.H`. You do this by ensuring that the directory `~vxipnp\win95\include` is added to the include paths (CVI Project Option menu).
~ is the directory in the VXIPNP variable. By default, ~ is equivalent to `C:\`. This means that the file is in `C:\vxipnp\win95\include`.

Online Information

The latest copy of this driver can be downloaded via:

http://www.agilent.com/comms/comp-test

If you do not have web access, use the version of `hp816x.exe` on your OCT Support CD, or contact your Agilent Technologies supplier.

Lambda Scan Applications

These functions combine multiple SCPI commands into a single, functional operation. They are designed to allow quick and easy access to common instrument command sequences.

These application functions allow you to perform one of the following applications:

- A Lambda Scan - a Lambda Logging operation where an Agilent 8164A/B Lightwave Measurement System with a back-loadable Tunable Laser module and up to four Power Meters installed, performs a wavelength sweep where the Tunable Laser module and Power Meters are coordinated with each other.
- A Multi Frame Lambda Scan - a Lambda Logging operation where an Agilent 8164A/B Lightwave Measurement System with a back-loadable Tunable Laser module performs a wavelength sweep and the Tunable Laser module is coordinated with Power Meters that are installed in the mainframe and in other mainframes. These mainframes must be connected to the GPIB bus and have their Input Trigger Connector connected to the Output Trigger Connector of the Agilent 8164A/B Lightwave Measurement System mainframe.

The following two functions apply to both Lambda Scan and Multi Frame Lambda Scan applications:

- The Set Lambda Scan Wavelength (hp816x_set_LambdaScan_wavelength) function allows you to use a different wavelength than 1550 nm during a Lambda Scan operation. All Power Meters taking part in the Lambda Scan operation will be set to the chosen wavelength.
- The Enable High Sweep Speed (hp816x_enableHighSweepSpeed) function enables/disables the highest available sweep speed (40 nanometers per second) for Lambda Scan operations. The Lambda Scan operation chooses the highest possible sweep speed for the chosen step size.
  - If you choose Enable, the highest sweep speed possible will be used. This may lead to less accurate measurements.
  - If you choose Disable, the highest sweep speed will not be used.

Equally Spaced Datapoints

A linear interpolation is performed on all wavelength and power data for the Lambda Scan Application and is optional for the Multi Frame Lambda Scan Application.

The advantage of spacing all measurements equally is that presenting results through use of a spreadsheet is greatly simplified. The operation returns one wavelength array and a power array for each power meter channel.

The disadvantage of using equally spaced datapoints is that the linear interpolation is analogous to the use of a low pass filter. Figure 10 shows the original curve as measured directly by a Power Meter and the interpolated curve.

Interpolation will always tend to produce a smoother curve by rounding off any peaks in the curve.

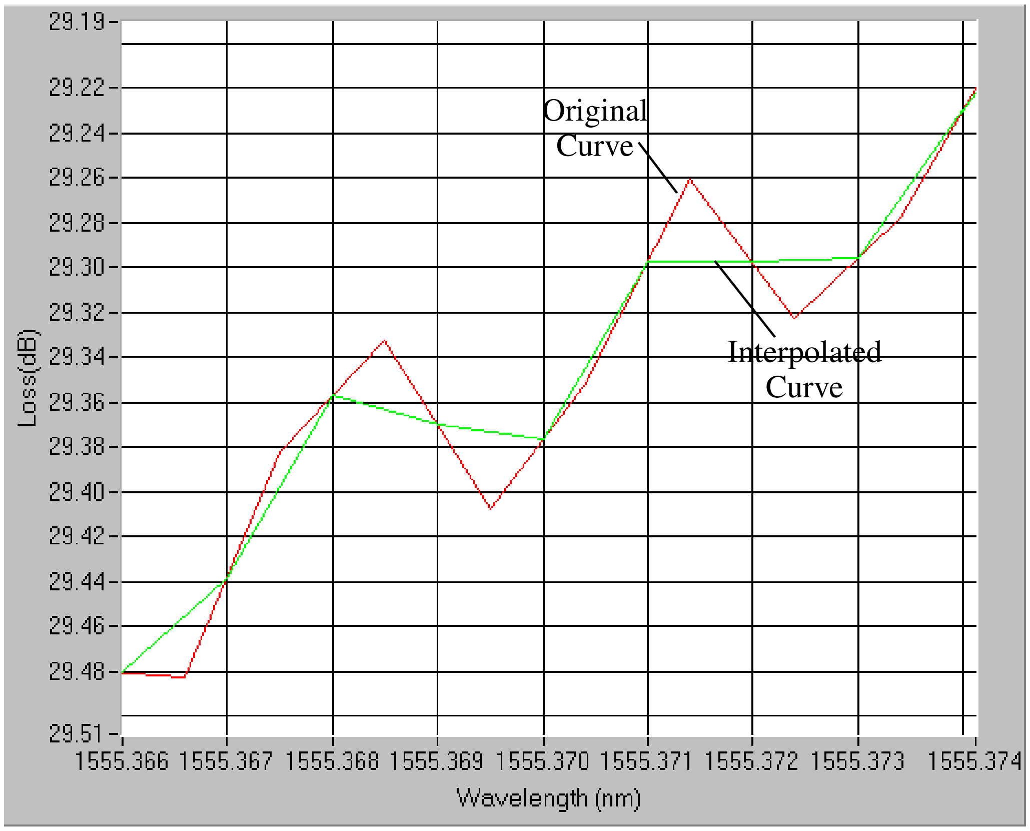


Figure 10 Equally Spaced Datapoints

How to Perform a Lambda Scan Application

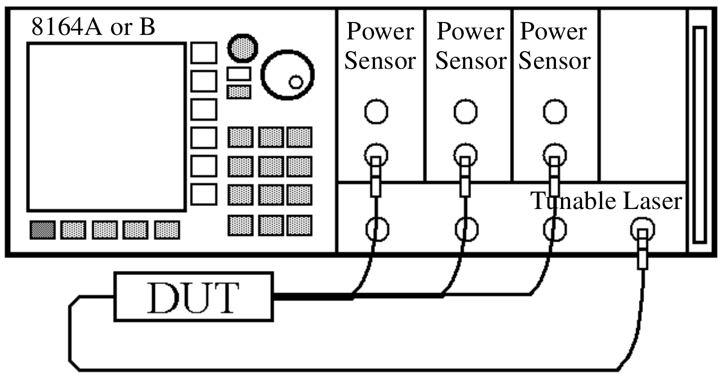


Figure 11 Lambda Scan Operation Setup

The Prepare Lambda Scan Function

The Prepare Lambda Scan (hp816x_prepareLambdaScan) function prepares a Lambda Scan operation.

The Prepare Lambda Scan (hp816x_prepareLambdaScan) function must be called before a Lambda Scan operation is executed. Use the return values of this function (Number of Datapoints and Number of Power Arrays) to allocate arrays for the Execute Lambda Scan (hp816x_executeLambdaScan) function.

To obtain a higher precision, the Tunable Laser Source is set 1 nm before the Start Wavelength, this means, you have to choose a Start Wavelength 1 nm greater than the minimum possible wavelength. Also, the wavelength sweep is actually started 90 pm before the Start Wavelength and ends 90 pm after the Stop Wavelength, this means, you have to choose a Stop Wavelength 90 pm less than the maximum possible wavelength.

Triggers coordinate the Tunable Laser module with all Power Meters. The function sets for the lowest possible averaging time available for the installed Power Meters and, then, sets the highest possible sweep speed for the selected Tunable Laser module sweep.

If one of the following circumstances occurs, the "parameter mismatch" error will be returned:

1 If one Power Meter is out of the specification at 1550 nm, the error "powermeter wavelength does not span 1550nm" will be returned. For example, the HP 81530A Power Sensor and the HP 81520A Optical

Head are out of specification at 1550 nm. Remove the Power Meter that is out of specification at 1550 nm from the mainframe.

2 If the Step Size is too small and results in a trigger frequency that is to high for the installed Power Meters, the error "could not calculate a sweep speed!" will be returned. Increase the Step Size.

3 If the chosen wavelength range is too large and Step Size is too small, the error "too many datapoints to log!" will be returned. In this case, reduce the wavelength range and/or increase the Step Size.

The Get Lambda Scan Parameters Function

The Get Lambda Scan Parameters (hp816x_getLambdaScanParameters_Q) function returns all parameters that the Prepare Lambda Scan (hp816x_prepareLambdaScan) function adjusts or automatically calculates.

The Execute Lambda Scan Function

The Execute Lambda Scan (hp816x_executeLambdaScan) function runs and returns the results of a Lambda Scan operation.

That is, it executes an operation where a Agilent 8164A/B Lightwave Measurement System with a back-loadable Tunable Laser module and up to four Power Sensors installed, performs a wavelength sweep where the Tunable Laser module and Power Sensors are coordinated with each other.

The Prepare Lambda Scan (hp816x_prepareLambdaScan) function must be called before a Lambda Scan operation is executed. Use the return values of this function (Number of Datapoints and Number of Power Arrays) to allocate arrays for the Execute Lambda Scan (hp816x_executeLambdaScan) function.

Equally Spaced Datapoints is enabled as part of this function and cannot be disabled. Use Multi Frame Lambda Scan if you need to have inequally spaced datapoints. See*“Equally Spaced Datapoints” on page 220* for more details.

How to Perform a Multi-Frame Lambda Scan Application

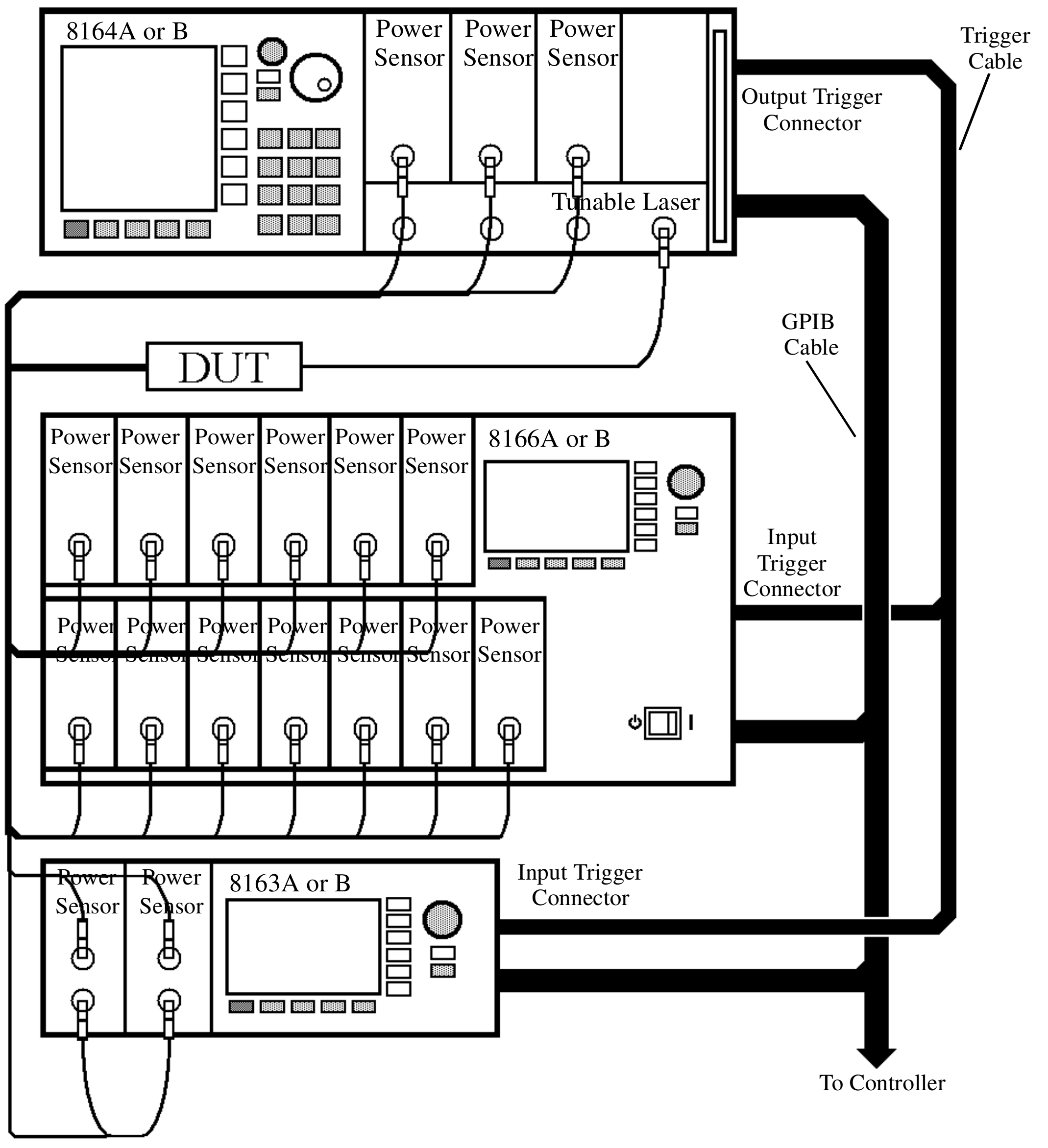


Figure 12 Multi Frame Lambda Scan Operation Setup

The Equally Spaced Datapoints Function

The Equally Spaced Datapoints (hp816x_returnEquidistantData) function allows you to select whether you the results will be equally spaced by performing a linear interpolation on the wavelength point and power measurement data, see*"Equally Spaced Datapoints" on page 220* for more details.

This function is used because Lambda Scan functions make use of Lambda Logging to log the exact wavelength that measurements were triggered at. This results in Lambda Array wavelength points that are not equally spaced.

NOTE Lambda Logging is not available if your Tunable Laser module firmware revision is lower than 2.0.

Equally Spaced Datapoints is enabled as a default.

The Register Mainframe Function

Use the Register Mainframe (hp816x_registerMainframe) function to register your mainframe as a participant in a Multi Frame Lambda Scan operation. The mainframe must be connected to the GPIB bus and have their Input Trigger Connector connected to the Output Trigger Connector of the Agilent 8164A/B Lightwave Measurement System mainframe that the Tunable Laser module is installed in.

The Unregister Mainframe Function

Use the Unregister Mainframe function (hp816x_unregisterMainframe) to remove a mainframe from a Multi Frame Lambda Scan operation and clear the driver's internal data structures.

If you use LabView 5.0 the following items should be noted:

- All multi frame functions are not re-entrant, if the driver is running and initialized more than once, results may be unpredictable.
- To avoid wrong results, call the Unregister Mainframe function prior to the Initialize function (hp816x_init). This is especially necessary during program debugging, if the Close function (hp816x_close) is not called.

The Prepare Multi Frame Lambda Scan Function

The Prepare Multi Frame Lambda Scan (hp816x_prepareMfLambdaScan) function prepares a Lambda Scan operation for multiple Mainframes.

That is, it prepares an operation where a Agilent 8164A/B Lightwave Measurement System with a back-loadable Tunable Laser module and up to 100 Power Meter Channels located in different Mainframes are installed. The function performs a wavelength sweep where the Tunable Laser module and Power Sensors are co-ordinated with each other.

The Prepare Multi Frame Lambda Scan (hp816x_prepareMfLambdaScan) function must be called before a Multi Frame Lambda Scan is executed. Use the return values of this function (Number of Datapoints and Number of Power Arrays) to allocate arrays for the Execute Multi Frame Lambda Scan (hp816x_executeMfLambdaScan) function.

The function scans all mainframes to find back-loadable Tunable Laser Sources. The function scans each mainframe in the order that they were originally registered by the Register Mainframe function (hp816x_registerMainframe). The first back-loadable Tunable Laser Source found will perform the sweep operation.

To obtain a higher precision, the Tunable Laser Source is set 1 nm before the Start Wavelength, this means, you have to choose a Start Wavelength 1 nm greater than the minimum possible wavelength. Also, the wavelength sweep is actually started 90 pm before the Start Wavelength and ends 90 pm after the Stop Wavelength, this means, you have to choose a Stop Wavelength 90 pm less than the maximum possible wavelength.

Triggers coordinate the Tunable Laser module with all Power Meters. The function sets for the lowest possible averaging time available for the installed Power Meters and, then, sets the highest possible sweep speed for the selected Tunable Laser module sweep. All mainframes must be connected to the GPIB bus and have their Input Trigger Connector connected to the Output Trigger Connector of the Agilent 8164A/B Lightwave Measurement System mainframe that the Tunable Laser module is installed in.

If one of the following circumstances occurs, the "parameter mismatch" error will be returned:

1 If one Power Meter is out of the specification at 1550 nm, the error "powermeter wavelength does not span 1550nm" will be returned. For example, the HP 81530A Power Sensor and the HP 81520A Optical

Head are out of specification at 1550 nm. Remove the Power Meter that is out of specification at 1550 nm from the mainframe.

2. If the Step Size is too small and results in a trigger frequency that is to high for the installed Power Meters, the error "could not calculate a sweep speed!" will be returned. Increase the Step Size.
3. If the chosen wavelength range is too large and Step Size is too small, the error "too many datapoints to log!" will be returned. In this case, reduce the wavelength range and/or increase the Step Size.

The Get MF Lambda Scan Parameters Function

The Get MF Lambda Scan Parameters (hp816x_getMFLambdaScanParameters_Q) function returns all parameters that the Prepare Multi Frame Lambda Scan (hp816x_prepareMfLambdaScan) function adjusts or automatically calculates.

The Execute Multi Frame Lambda Scan Function

The Execute Multi Frame Lambda Scan (hp816x_executeMfLambdaScan) function runs a Lambda Scan operation and returns an array that contains the wavelength values at which power measurements are made.

That is, it executes an operation where a Agilent 8164A/B Lightwave Measurement System with a back-loadable Tunable Laser module and up to 100 Power Sensors installed, performs a wavelength sweep where the Tunable Laser module and Power Sensors are coordinated with each other.

Use the values returned from the Prepare Multi Frame Lambda Scan (hp816x_prepareMfLambdaScan) function to set the parameters of the Execute Multi Frame Lambda Scan (hp816x_executeMfLambdaScan) function.

The Get Lambda Scan Result Function

The Get Lambda Scan Result (hp816x_getLambdaScanResult) function returns for a given Power Meter channel a power value array and a wavelength value array.

These arrays contains the results of the last Multi Frame Lambda Scan operation.

The Get Number of PWM Channels Function

The Get Number of PWM Channels (hp816x_getNoOfRegPWMChannnels_Q) function returns the number of Power Meter channels in a test setup.

Only Power Meters whose mainframe was registered using the Register Mainframe (hp816x_registerMainframe) function are counted.

The Get Channel Location Function

The Get Channel Location function (hp816x_getChannelLocation_Q) returns the location of the chosen Power Meter channel as used in a Multi Frame Lambda Scan operation.

The maximum number of channels that may be specified is 1000.

Error Codes

This chapter gives information about error codes used with the Agilent 8163A/B Lightwave Multimeter, the Agilent 8164A/B Lightwave Measurement System, and the Agilent 8166A/B Lightwave Multichannel System.

GPIB Error Strings

Error strings in the range -100 to -183 are defined by the SCPI standard, downloadable from: http://www.scpiconsortium.org/scpistandard.htm

String descriptions taken from this standard (VERSION 1999.0 May, 1999), whether in whole or in part, are enclosed by [ ].

Table 1 Overview for Supported Strings

	Error	
New/Old/Standard	**Number**	**String**
Note:	Error strings in the range -100 to -183 are defined by the SCPI standard, downloadable from: http://www.scpiconsortium.org/scpistandard.htm String descriptions taken from this standard (VERSION 1999.0 May, 1999), whether in whole or in part, are enclosed by [ ] in this table.	
-100 to -199 Command Errors		
Standard	-100	"Command Error" [This is the generic syntax error used when a more specific error cannot be detected. This code indicates only that a Command Error as defined in *IEEE 488*.2,11.5.1.1.4 has occurred.]
Standard	-101	"Invalid character" [A syntactic element contains a character which is invalid for that type; for example, a header containing an ampersand, SETUP&. This error might be used in place of error -114 and perhaps some others.]
Standard	-102	"Syntax error" [An unrecognized command or data type was encountered; for example, a string was received when the **device** does not accept strings.]
Standard	-103	"Invalid separator" [The parser was expecting a separator and encountered an illegal character; for example, the semicolon was omitted after a program message unit]
Standard	-104	"Data type error" [The parser recognized a data element different than one allowed; for example,numeric or string data was expected but block data was encountered.]
Standard	-105	**"GET not allowed"** [A Group Execute Trigger was received within a program message (see *IEEE488*.2, 7.7).]

Table 1 Overview for Supported Strings

	Error	
New/Old/Standard	**Number**	**String**
Standard	-108	**"Parameter not allowed"** [More parameters were received than expected for the header]
Standard	-109	"Missing parameter" [Fewer parameters were recieved than required for the header]
Standard	-112	**"Program mnemonic too long"** [The header contains more than twelve characters (see *IEEE 488*.2, 7.6.1.4.1).]
Standard	-113	"Undefined header" [The header is syntactically correct, but it is undefined for this specific **devic**e; for example, *XYZ is not defined for any device.]
Standard	-120	"Numeric data error" [This error, as well as errors -121 through -129, are generated when parsing a data element which appears to be numeric, including the non-decimal numeric types. This error message is used if the **device** cannot detect a more specific error.]
Standard	-121	"Invalid character in number" [An invalid character for the data type being parsed was encountered; for example, an alpha in a decimal numeric]
Standard	-123	"Exponent too large" [The magnitude of the exponent was larger than 32000 (see *IEEE 488*.2,7.7.2.4.1).]
Standard	-124	"Too many digits" [The mantissa of a decimal numeric data element contained more than 255 digits excluding leading zeros (see *IEEE 488*.2, 7.7.2.4.1).]
Standard	-128	"Numeric data not allowed" [A legal numeric data element was received, but the **device** does not accept one in this position for the header.]
Standard	-131	"Invalid suffix" [The suffix does not follow the syntax described in *IEEE 488*.2, 7.7.3.2, or thesuffix is inappropriate for this **devic**e.]
Standard	-134	**“Suffix too long”** [The suffix contained more than 12 characters (see *IEEE 488*.2, 7.7.3.4).]
Standard	-138	“Suffix not allowed” [A suffix was encountered after a numeric element which does not allow suffixes.]
Standard	-141	“Invalid character data” [Either the character data element contains an invalid character or the particular element received is not valid for the header.]

Table 1 Overview for Supported Strings

New/Old/Standard	Error Number	String
Standard	-148	"Character data not allowed" [A legal character data element was encountered where prohibited by the **devic**e.]
Standard	-150	"String data error" [This error, as well as errors -151 through -159, are generated when parsing a string data element. This error message is used when the **device** cannot detect a more specific error.]
Standard	-151	"Invalid string data" [A string data element was expected, but was invalid for some reason (see *IEEE 488*.2, 7.7.5.2); for example, an END message was received before the terminal quote character.]
Standard	-158	"String data not allowed" [A string data element was encountered but was not allowed by the **device** at this point in parsing.]
Standard	-161	"Invalid block data" [A block data element was expected, but was invalid for some reason (see *IEEE 488*.2, 7.7.6.2); for example, an END message was received before the length was satisfied.]
Standard	-168	"Block data not allowed" [A legal block data element was encountered but was not allowed by the **device** at this point in parsing.]
Standard	-170	"Expression error" [This error, as well as errors -171 through -179, are generated when parsing an expression data element. This particular error message is used when the **device** cannot detect a more specific error.]
Standard	-171	"Invalid expression" [The expression data element was invalid (see *IEEE 488*.2, 7.7.7.2); for example, unmatched parentheses or an illegal character.]
Standard	-178	"Expression data not allowed" [A legal expression data was encountered but was not allowed by the **device** at this point in parsing.]
Standard	-181	"Invalid outside macro definition" [Indicates that a macro parameter placeholder ($<number) was encountered outside of a macro definition.]
Standard	-183	"Invalid inside macro definition" [Indicates that the program message unit sequence, sent with a *DDT or *DMC command, is syntactically invalid (see *IEEE 488*.2, 10.7.6.3).]

Table 1 Overview for Supported Strings

New/Old/Standard	Error Number	String
New	-185	“Subop out of range” *Description:* Suboperations are parameters that are passed to refine the destination of a command. They are used to address slots, channels, laser selections and GPIB/SCPI register levels. This error is generated if the parameter is not valid in the current context or system configuration. *Example:* This error occurs if the user queries the status of a summary register and passes an invalid status level (also see "Status for 816x" on page 28 programmer's guide). *Note:* Incorrect slots and channels addresses are handled by error code -301
-200 to -299 Execution Errors		
Standard	-200	“Execution error (StatExecError)" *Description:* This error occurs when the current function, instrument or module state (or status) prevents the execution of a command. This is a generic error which can for a number of reasons. *Example:* When a powermeter has finished a logging application and data is available, the user is not able to reconfigure the logging application parameters. First, the user must stop the logging application.
New	-201	"Please be patient - HPIB currently locked out" *Description:* Some operations block the complete system. Since no sensible measurements are possible while this is true, the HPIB is locked out. *Example:* When ARA, Lambda zeroing or zeroing is executing on a TLS module, the HPIB is not accessible.
New	-205	“Powermeter not running (StatMeterNotRunning)" *Description:* Some command and actions may stop the data aquisition unit of a powermeter. If a command fetches data, there may be no measurement values and this error is generated. Please check module state and repeat operation.

Table 1 Overview for Supported Strings

New/Old/Standard	Error Number	String
Old	-211	"Trigger ignored" *Description:* A trigger has been detected but ignored because of timing contraints. (For Example: average time to large).
Old	-212	"Arm ignored" *Description:* The user can set the automatic re-arming option for input and output trigger events (see "Triggering - The TRIGger Subsystem" on page 157). When this error occurs, the device ignores the setting because the current module status does not allow the change of trigger settings.
Old	-213	"Init ignored" *Description:* The INIT:IMM command (page 80) initiates a trigger and completes a full measurement cycle. The continuous measurement must be DISABLED. This error code is generated if the powermeter is still in cont. measurement mode.
Old	-220	"Parameter error (StatParmError)" *Description:* The user has passed a parameter that cannot be changed in this way. The device cannot detect one of the following more specific errors:
Old	-220	-220, "Parameter error (StatParmOutOfRange)" *Description:* The user has passed a parameter that exceeds the valid range for this parameter.
Old	-220	"Parameter error (StatParmIllegalVal)" *Description:* The user has passed a parameter that does not match a value in a list of possible values.

Table 1 Overview for Supported Strings

New/Old/Standard	Error Number	String
Old	-221	"Settings conflict (StatParmInconsistent)" *Description:* The user has passed a parameter that conflicts with other already configured parameters. *Example:* There are constrains for TLS sweep parameters: this error is generated when lambda step size exceeds the difference between start and stop wavelength. If error -221 is returned after you try to start a wavelength sweep, one of the following cases of sweep parameter inconsistency has occurred: Continuous Sweep mode AND λ Start is less than λ Stop. Continuous Sweep mode AND Sweep Time is too short. Adjust Sweep Speed, λ Start, or λ Stop. Continuous Sweep mode AND Sweep Time is too long. Adjust Sweep Speed, λ Start, or λ Stop. Continuous Sweep mode AND Trigger Frequency is too high. Adjust Step Size. Trigger Frequency is the Sweep Speed divided by the Step Size. Stepped Sweep mode AND Lambda Logging Enabled. Continuous Sweep mode AND Lambda Logging Enabled AND Output trigger mode not set to STFinished (Step finished). Continuous Sweep mode AND Lambda Logging is Enabled AND Modulation Source is not set to OFF. Continuous Sweep mode AND Lambda Logging is Enabled AND Sweep Cycles is not set to 1. Continuous Sweep mode AND Coherence Control is Enabled.
Standard	-222	"Data out of range (StatParmTooLarge)" *Description:* The user has passed a continuous parameter that is too large. *Example:* Wavelength 1800nm when maximum wavelength is 1700nm.
Standard	-222	"Data out of range (StatParmTooSmall)" *Description:* The user has passed a continuous parameter that is too small. *Example:* Wavelength 700nm when minimum wavelength is 800nm.

Table 1 Overview for Supported Strings

	Error	
New/Old/Standard	**Number**	**String**
Standard	-223	“Too much data” *Description:* A function returns more data or the user requests more data than the application is able to handle. *Example:* A tunable laser source produces more data when lambda values of a sweep are stored than the 816x instrument is able to handle. Use the new SENSE:FUNC:RES:BLOCK? command to split the data aquisition into multiple parts.
Standard	-224	“Illegal parameter value” [Used where exact value, from a list of possibles, was expected.]
New	-225	"Out of memory" *Description:* The request application or function cannot be executed because the instrument runs out of memory.
Old	-231	"Data questionable (StatValNYetAcc)" *Description:* The data that is retured is not accurate or reliable. The user should repeat the operation. The reason for this error is unspecific. *Example:* A powermeter configured a long average time has not completed its current measurement cycle when the user queries the current power.
Old	-231	"Data questionable (StatRangeTooLow)" *Description:* As -231 (StatValNYetAcc) but for a more specific reason: The powermeter readout data is not reliable because the currently set (manual) range does not correspond with the input power.
Old	-261	"Math error in expression (StatUnitCalculationError)" *Description:* This may occur when the user attempts to transform data in a way that is currently not possible. *Example:* When a powermeter is measuring very small powe values in dBm (such as noise power), negative power values in Watt may also be present (such as when the powermeter calibration wavelength does not correspond to the wavelength of input signal). The instrument cannot transform negative Watt values to dBm because the logarithm of a negative value is not defined.

Table 1 Overview for Supported Strings

	Error	
New/Old/Standard	**Number**	**String**
Standard	-272	“Macro execution error” [Indicates that a syntactically legal macro program data sequence could not beexecuted due to some error in the macro definition (see *IEEE 488*.2, 10.7.6.3.)]
Standard	-273	“Illegal macro label” [Indicates that the macro label defined in the *DMC command was a legal string syntax, but could not be accepted by the **device** (see *IEEE 488*.2, 10.7.3 and 10.7.6.2); for example, the label was too long, the same as a common command header, or contained invalid header syntax.]
Standard	-276	“Macro recursion error” [Indicates that a syntactically legal macro program data sequence could not be executed because the device found it to be recursive (see *IEEE 488*.2, 10.7.6.6).]
Standard	-277	“Macro redefinition not allowed” [Indicates that a syntactically legal macro label in the *DMC command could not be executed because the macro label was already defined (see *IEEE 488*.2,10.7.6.4).]
Standard	-278	“Macro header not found” [Indicates that a syntactically legal macro label in the *GMC? query could not be executed because the header was not previously defined.]
Old	-284	"Function currently running (StatModuleBusy)" *Description:* This error is generated when a function is currently running on a module so that it cannot process another commands. *Example:* When a powermeter is running a logging application, you are not able to configure the logging application parameters (also see -200).
Old	-286	"No function currently running" *Description:* This error is generated when a user tries to execute a command which requires a particular set of data that is not available. *Example:* Application data is necessary to execute SENSE:FUNC:RES?. If no suitable function has completed, there is no data and this error is generated. (also see -200).

Table 1 Overview for Supported Strings

New/Old/Standard	Error Number	Error String
New	-290	"Application currently running - no GPIB support" *Description:* The instrument has built-in applications that have no GPIB support (such as Logging,Stability,PACT). *Example* When an application is running error -290 will be returned if any command other than one the following is sent: *WAI *OPC? :SPECial:REBoot :SYSTem:ERRor? :SYSTem:VERSion?
-300 to -399 or between 1 and 32767 Device-Specific Errors (Module)		
Old	-300	"Internal error (StatVals Lost)" "Internal error (StatInternalError)" *Description* These are generic device-dependent errors used when the instrument cannot detect more specific errors.
New	-301	"Module doesn't support this command (StatCmdUnknown)" *Description:* The addressed module does not support the SCPI command. *Example:* When a command from the SENSe SCPI tree is sent to a fixed or tunable laser source.
New	-302	"Internal timeout error (StatTimedOut)" *Description:* A command has not returned in the expected time.
New	-303	"Module slot empty or slot / channel invalid" *Description:* The user has send a command to an empty slot.
New	-304	"Command was aborted (StatAborted)" *Description:* The command has been interrupted by another event.

Table 1 Overview for Supported Strings

	Error	
New/Old/Standard	**Number**	**String**
New	-305	"Internal messaging error (StatCmdError)" "Internal messaging error (StatCmdNotAllowed)" "Internal messaging error (StatWrongLength)" "Internal messaging error (StatWrongReceiver)" "Internal messaging error (StatBufAllocError)" "Internal messaging error (StatDPRamFull)"; } "Internal messaging error (StatSemError)" *Description:* An error has occured in the instrument communication system. Please report this error with a description of the circumstances that generated the error and the configuration of the system.
New	-306	"Channel doesn't support this command (StatCmdUnknownForSlave)" *Description:* Slave channels have limited functionality. The module supports this command, but the command must be sent to the master channel.
New	-307	"Channel without head connection (StatHeadless)" *Description:* The channel supports this command, but it cannot be executed because the optical measurement head is not plugged into the interface module.
Standard	-310	"System error" [Indicates that some error, termed "system error" by the device, has occurred. This code is device-dependent.]
Standard	-321	"Out of memory" [An internal operation needed more memory than was available.]
New	-322	"Flash programming error (StatFlashEraseFailed)" "Flash programming error (StatFlashWriteFailed)" "Flash programming error (StatFlashDataCntError)" "Flash programming error (StatFlashDPAlgoFailed)" *Description:* An error has occured in a module. Please report this error with a description of the circumstances that generated the error and the configuration of the system.

Table 1 Overview for Supported Strings

	Error	
New/Old/Standard	**Number**	**String**
New	-323	"Flash programming error (StatUserCalTable Empty)" It is not possible to activate the offset (λ) functionality when the offset table is empty "Flash programming error (StatUserCalTable Full)" The offset (λ) table is full and no more ? can be stored "Flash programming error (StatUserCalActive)" It is not possible to program the offset (λ) table when the offset (λ) feature is activated. Deactivate first.
Old	-330	"Self-test failed" *Description:* You have started the self test, but the module has detected an error while executing it
New	-340	"Printing error (StatPrintError)" *Description:* An unspecified problem occurred while communicating with the printer.
New	-341	"Printing error - paper out (StatPaperOut)" *Description:* The instrument cannot print because there is no paper in the connected printer.
New	-342	"Printing error - offline (StatOffline)" *Description:* The instrument cannot print because the connected printer is offline.
Standard	-350	"Queue overflow" [A specific code entered into the queue in lieu of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.]
-400 to -499 Query Errors		
Standard	-400	"Query error" [This is the generic query error for **devices** that cannot detect more specific errors. This code indicates only that a Query Error as defined in *IEEE 488.2*, 11.5.1.1.7 and 6.3 has occurred.]
Standard	-410	"Query INTERRUPTED" [Indicates that a condition causing an INTERRUPTED Query error occurred (see *IEEE 488.2*, 6.3.2.3); for example, a query followed by DAB or GET before a response was completely sent.]

Table 1 Overview for Supported Strings

New/Old/Standard	Error Number	Error String
Standard	-420	"Query UNTERMINATED" [Indicates that a condition causing an UNTERMINATED Query error occurred (see *IEEE 488.2*, 6.3.2.2); for example, the **device** was addressed to talk and an incomplete program message was received.]
Standard	-430	"Query DEADLOCKED" [Indicates that a condition causing an DEADLOCKED Query error occurred (see *IEEE 488.2*, 6.3.1.7); for example, both input buffer and output buffer are full and the device cannot continue.]
Standard	-440	"Query UNTERMINATED after indef resp" [Indicates that a query was received in the same program message after an query requesting an indefinite response was executed (see *IEEE 488.2*, 6.5.7.5).]

Table 2 Overview for Unsupported Strings

New/Old/Standard	Error Number	Error String
Old	all positive errors	
Old	-110	"Command header error"
Old	-111	"Header seperator error"
Old	-114	"Header suffix out of range"
Old	-130	"Suffix error"
Old	-140	"Character data error"
Old	-144	"Character data too long"
Old	-160	"Block data error"
Old	-201	"Invalid while in local"
Old	-202	"Settings lost due to ???"
Old	-210	"Trigger error"
Old	-214	"Trigger deadlock"
Old	-215	"Arm deadlock"
Old	-230	"Data corrupt or stale"
Old	-240	"Hardware error"
Old	-241	"Hardware missing"
Old	-260	"Expression error"
Old	-280	"Program error"
Old	-281	"Cannot create program"
Old	-282	"Illegal program name"
Old	-283	"Illegal variable name"

Table 2 Overview for Unsupported Strings

New/Old/Standard	Error Number	String
Old	-285	"Program syntax error"
Old	-286	"Program runtime error"
Old	-311	"Memory error" [checksum or parity]
Old	-312	"Protect user data memory lost"
Old	-313	"Calibration memory lost"
Old	-314	"Save/Recall Memory lost"
Old	-315	"Configuration memory lost"

GPIB Command Compatibility List

This chapter gives information about adapting programs developed for use with HP 8153A Lightwave Multimeter or HP 8167B/8D/8E/8F Tunable Laser Source.

Compatibility Issues

For each table entry in this chapter, it is noted whether the compatibility change affects either:

- the HP 8153A Lightwave Multimeter - 8153,
- the HP 8167B/8D/8E/8F Tunable Laser Source - 8167/8, or
- both of these instruments - Both.

GPIB Bus Compatibility

These commands are incompatible.

Table 1 Incompatible GPIB Bus Commands

Command	Change	Affects
LLO - local lockout		Both
DCL - device clear		Both
GET - group execute trigger		Both

Status Model

The status model is completely incompatible with the HP 8153A and HP 8167/8.

Preset Defaults

The preset defaults are different.

Removed Command

Table 2 contains details of commands that have been removed without replacement.

Table 2 Removed Commands

Command	Change	Affects
*SRE/?	No support for this command/query.	Both
*TRG	No support for triggered commands.	8153
ABORt	This command is not supported; in every case, the bus is blocked during command execution.	8153
STATus:OPERation: NTRansition/?	These status model features are not supported.	8153
STATus:OPERation: PTRansition/?		
STATus:QUEStionable: NTRansition/?		
STATus:QUEStionable: PTRansition/?		
SYSTem:BEEPer:STATe/?	Beeper access is not supplied.	8153
*SAV *RCL	User interface or GPIB settings cannot be stored or re-called.	8167/8
BDATA? DOSMODE/?	Memory card access is not provided.	8167/8
TRACe:CATalog? TRACE:DATA? TRACE:POINts?	The `TRACe` tree is not supported; the CC_UNCAL curve does not exist.	8167/8
WAVEACT	Alignment to external wavemeter is not supported.	8167/8
misc 200	Risetime control is not supported yet.	8167/8

Obsolete Commands

Table 3 contains details of commands that have been directly replaced.

Table 3 Obsolete Commands

Old Command	New Command	Affects
DISPlay:STATe/?	`DISPlay:ENABle/?`	8153
PROGram command tree	`SENSe:FUNCtion` command tree. Some commands from the `PROGram` command tree have not been replaced. The HP 8153A application interface on the GPIB is not supported. Stability/Logging and Min/Max are available via a new interface.	8153
Return Loss Module Commands	The commands for the return loss modules will be completely different than those for the HP 8153A.	8153

Changed Parameter Syntax and Semantics

Table 4 details commands whose parameter syntax or semantics have changed.

Table 4 Commands with Different Parameters or Syntax

Command	Change	Affects
SOUR:AM:FREQ/?	This command does not accept the value CW, instead use SOUR:AM:STAT ON|OFF to switch from and to CW mode. The commands accepts floating point values.	8153
DISP:BRIG	This command now supports integers between 1 and 100, instead of float values between 1 and 0.	8153
SENS:CORR:COLL:ZERO?	This command returns the last zero state, instead of the last remote zero state.	8153
SENS:POW:REF	Accepts `TOMODule` and `TOREF` for the first parameter, instead of accepting `TOA`|`TOB` as the HP 8153A does. The numbers `0`|`1`|`2` cannot be used, only the strings above.	8153
SENS:POW:REF:STAT:RAT	Accepts `TOREF`, `0` or values for slot,channel, instead of accepting `TOA`|`TOB` as the HP 8153A does. The numbers have a different meaning.	8153
SYST:DATe	`SYST:DATe` from HP 8167/8 is not supported, but `SYST:DATe` from HP 8153 is supported.	8167/8

Changed Query Result Values

Table 5 details queries that respond with different return codes than the old instruments.

Table 5 Queries with Different Result Values

Command	Change	Affects
*IDN?	Returns new instrument and module identifiers.	Both
*OPT?	Returns new module options.	Both
*TST	Selftest result codes are completely new. `0` still means passed.	Both
	A head adapter is not overwritten with the head when it is inserted.	8153
SENS:POW:UNIT?	Returns `W`|`DBM` not a number.	8153
SOUR:POW:WAV?	Returns `LOW`|`UPP`|`BOTH`|`EXT` and not the wavelength; use `SOUR:WAV?` to query the wavelength. `SOUR:WAV:FIXED1?` returns the wavelength of the first laser and `SOUR:WAV:FIXED2?` returns the wavelength of the second laser. For the HP 8153A, `SOUR:POW:WAV?` returned the wavelength of the active laser.	8153
SYSTem:ERRor?	Same functionality but different numbers and errors are returned for instrument specific errors.	8153
SOURce:AM:SOURce?	Returns different enum values than the HP 8167/8.	8167/8

Timing Behavior

Table 6 details the ways in which timing behavior is different.

Table 6 Timing Behavior Changes

Change	Affects
Command execution may be different.	Both
GPIB will block during command execution, except when executing functions, such as logging and sweep, that don’t tolerate blocking. This is identical to the behavior of the 8167/8. A side effect of this is that `*OPC?` always returns `1`.	8153
When continuous triggering and averaging times are greater than 1 second, the read-out values reset after the averaging time is over; there is no sliding behavior.	8153

Error Handling

Most error commands and error texts for all instruments are new.

The HP 8153A timed out for every error. Errors are handled differently by the Agilent 8163A/B and 8164A/B; instead of timing out for every error, special values are returned for erroneous queries. Table 7 and Table 8 detail the new errors

The error queue is written to as before.

Table 7 Error Handling Changes

Expected Return Value	Returned Value	Affects
FLOAT(32/64)	FLT/DBL_MAX	8153
(U)INT(16/32)	(U)INT(16/32)_MA	8153
Block	" "	8153
Boolean Value	0	8153
Enum	Time out	8153

Table 8 Specific Errors

Command	Change	Affects
FETCh:POWer? - without using a preceding trigger	Returns the last valid value instead of timing out. No error is generated.	8153

Command Order

It is not yet known if there are any changes in the command order behavior.

Instrument Status Settings

The trigger configuration automatically overrides other instrument setting and control capabilities. This applies to both the HP 8153A and HP 8167/8.

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