Keysight N77--C Series Attenuators

N7752C 2-Channel Optical Attenuator and Power Meter
N7764C 4-Channel Optical Attenuator
N7768C 4-Channel Optical Multi-Mode Attenuator

KEYSIGHT

USER'S GUIDE

Notices

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Safety Notices

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Contents

General Safety Considerations

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements.

WARNING Ensure the proper usage for the instrument. The protection provided by the instrument may be impaired. The operator of this instrument is advised to use the equipment in a manner as specified in this document.

Before operation, you should review the instrument and manual for safety markings and instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

Some circuits are powered whenever the instrument is connected to the AC power source. To disconnect from the line power, disconnect the power cord either at the rear power inlet or at the AC line power source (receptacle). One of these must always be accessible. If the instrument is in a cabinet, it must be disconnected from the line power by the system's line power switch.

WARNING To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers, panels, etc.).

WARNING Please pay attention to the following laser safety warning:

Under no circumstances look into the end of an optical cable attached to the optical output when the instrument is operational. The laser radiation can seriously damage your eyesight. Do not enable the laser when there is no fiber attached to the optical output connector. Refer servicing only to qualified and authorized personnel.

Safety Summary

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings or operating instructions in the product manuals violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements. Product manuals are provided on the Web. Go to www.keysight.com and type in your product number in the Search field at the top of the page.

General

This product is a Protection Class 1 instrument (provided with a protective earth terminal) and has been manufactured and tested according to international safety standards. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Environment Conditions

This instrument is intended for indoor use in an Overvoltage Category II, pollution degree 2 environment. It is designed to operate at a maximum relative humidity of 80% RH, non-condensing and at altitudes of up to 2000 meters. Refer to the specifications tables for the AC mains voltage requirements and ambient operating temperature range.

Temperature

The instrument should be protected from temperature extremes and changes in temperature that may cause condensation within it.

The operating temperature is from:

+5 °C to +40 °C

The storage temperature is from -40 °C to +70 °C.

Before Applying Power

Verify that all safety precautions are taken. The power cable inlet of the instrument serves as a device to disconnect from the mains in case of hazard. The instrument must be positioned so that the operator can easily access the power cable inlet. When the instrument is rack mounted the rack must be provided with an easily accessible mains switch.

Connection to External Circuits

All external inputs connected to ports shall provide reinforced or double insulation for protection against electric shock and shall have voltage below 30 Vrms and 42.4 Vpeak or 60 VDC.

Ground the Instrument

To minimize shock hazard, the instrument chassis and cover must be connected to an electrical protective earth ground. The instrument must be connected to the AC power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified personnel.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Compliance and Environmental Information

Safety Symbol	Description
	The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by DIRECTIVE 2012/19/EU and other National legislation. See http://about.keysight.com/en/companyinfo/environment/takeback.shtml to understand your Trade in options with Keysight in addition to product takeback instructions.

South Korean Class A EMC Declaration

Information to the user:

This instrument has been conformity assessed for used in business environments. In a residential environment this equipment may caused radio interference.

This EMC statement applies to the equipment only for use in business environment.

사 용 자 안 내 문
이 기 기 는 업 무 용 환 경 에 서 사 용 할 목 적 으 로 적 합 성 평 가 를 받 은 기 기 로 서 가 정 용 환 경 에 서 사 용 하 는 경 우 전 파 간 섭 의 우 려 가 있 습 니 다 .

사용자 안내문은"업무용 방송통신기자재"에만 적용한다.

Declaration of Conformity

Declarations of Conformity for this product and for the Keysight products may be downloaded from the Web. Go to www.keysight.com/go/conformity.

You can then search by product number to find the latest Declaration of Conformity.

Instrument Markings

Instrument Marking	Description
	The instruction manual symbol. The product is marked with this warning symbol when it is necessary for the user to refer to the instructions in the manual.
	Standby supply. Unit is not completely disconnected from AC mains when switch is off.
	The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives. ICES/NMB-001 - This ISM device complies with the Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada. ISM GRP 1-A - This is an Industrial Scientific and Medical (ISM) Group 1 Class A product.
	The CSA mark with the 'C' and 'US' subscript indicates the instrument is certified to the applicable Canadian and United States of America standards respectively.
	The RCM mark is a registered trademark of the Australian Communications and Media Authority.
	This symbol is a South Korean Class A EMC Declaration, with the product identification code. R - Identification of authorization prefix. R - Identification of basic certification information. Kst - Identification of applicant's information. 3E23870 This is a Class A instrument suitable for professional use and in electromagnetic environment outside of the home.

Instrument Marking	Description
	The recycling symbol indicates the general ease with which the instrument can be recycled.
	China Restricted Substance Product Label. The EPUP (environmental protection use period) number in the center indicates the time period during which no hazardous or toxic substances or elements are expected to leak or deteriorate during normal use and generally reflects the expected useful life of the product.
	The UKCA (UK Conformity Assessed) marking is a new UK product marking that is used for goods being placed on the market in Great Britain (England, Wales and Scotland). It covers most goods which previously required the CE marking.
	Alternate Current

Safety Symbols

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements.

Before operation, review the instrument and manual, including the red safety page, for safety markings and instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice or the like, which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

Safety Symbols

Safety Symbols	Description
	Hazardous laser radiation.
	The apparatus will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the apparatus against damage.
	Invisible laser radiation.

Operating Environment

Overview

In order for the instrument to meet specifications, the operating environment must be within these limits. Refer to Safety Summary (page 14).

WARNING The instrument is not designed for outdoor use. To prevent potential fire or shock hazard, do not expose the instrument to rain or other excessive moisture.

Instrument Cooling

The instrument has a cooling fan mounted internally.

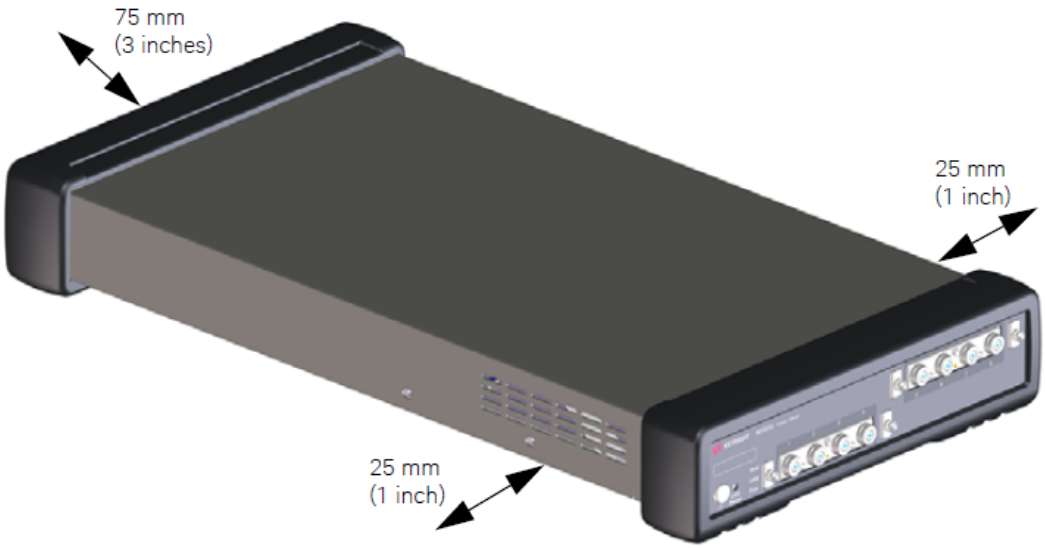
Mount or position your instrument upright and horizontally, as shown in the below figure so that air can circulate through it freely.

Operating Position

When operating the instrument choose a location that provides at least 75 mm (3 inches) of clearance at the rear, and at least 25 mm (1 inch) of clearance at each side. Failure to provide adequate air clearance may result in excessive internal temperature, reducing instrument reliability.

The instrument should not be operated when resting on its rear or side panels.

The following figure shows the correct operating position of Keysight N77--C optical attenuator instruments.


75 mm
(3 inches)
25 mm
(1 inch)
25 mm
(1 inch)

Handling the Instrument

Storage, Carrying and Shipment

Keysight N77--C optical attenuators can be stored and shipped at temperatures between -40 °C and +70 °C.

The N77--C instruments must be stored, carried in its operating position. See Operating Environment (page 20).

Rack Mount the Instrument

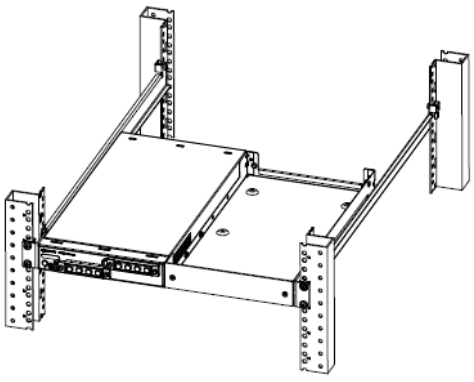
You can mount the instrument in a standard 19-inch rack cabinet using one of two optional kits, each of which includes instructions and mounting hardware.

NOTE Remove the front and rear rubber bumpers before mounting the instrument on a rack.

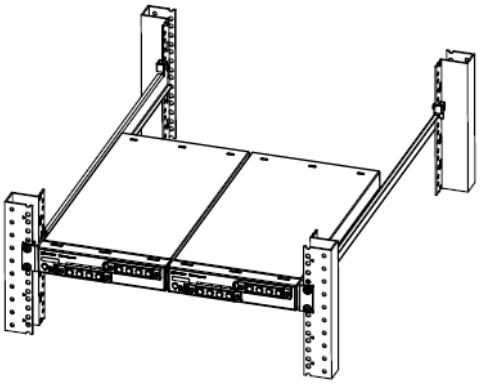
Depending on whether one or two N77--C instruments are to be mounted, different mounting kits are required:

N7799C-1CM Rack Mount Kit 1 HU for 2 instruments - Includes low-profile rails. Requires Filler Kit N7799C-0CM for single device.

N7799C-0CM Filler Kit for N7799C-1CM - Required for single instrument. Includes front panel and base plate.



A. Single Instrument Mounted on a Rack



B. Two Instruments Mounted on a Rack

Obtaining Source Code

This product uses open source packages. To the extent required by the applicable open source license(s), Keysight makes source code available upon request. To request source code, please contact Keysight Support at http://www.keysight.com/main/support.jspx .

Third party software acknowledgments and licenses for the N77--C series with the embedded Linux operating system are located at:

http://www.keysight.com/find/N7752C
http://www.keysight.com/find/N7764C
http://www.keysight.com/find/N7768C

Getting Started

This section provides overview of the following instrument(s):

N7752C Two-Channel Optical Attenuator and Power Meter

N7764C Four-Channel Optical Attenuator

N7768C Four-Channel Multimode Optical Attenuator

Initial Inspection

Inspect the shipping container for damage. If there is damage to the container or cushioning, keep them until you have checked the contents of the shipment for completeness and verified the instrument both mechanically and electrically.

If the contents are incomplete, mechanical damage or defect is apparent, or if an instrument does not pass the operator's checks, notify the nearest Keysight Technologies Sales/Service Office.

WARNING You MUST return malfunctioning instruments to a Keysight Technologies Sales/Service Center for repair and calibration.

Claims and Repackaging

If physical damage is evident or if the instrument does not meet specification when received, notify the carrier and the nearest Keysight Technologies Sales/Service Office. The Keysight Technologies Sales/ Service Office will arrange for repair or replacement of the unit without waiting for settlement of the claim against the carrier.

Return Shipments to Keysight Technologies

If the instrument is to be shipped to an Keysight Technologies Sales/ Service Office, attach a tag showing owner, return address, model number and full serial number and the type of service required.

The original shipping carton and packing material may be reusable, but the Keysight Technologies Sales/Service Office will provide information and recommendations on materials to be used if the original packing is no longer available or reusable. General instructions for repackaging are as follows:

Wrap instrument in heavy paper or plastic.

Use strong shipping container. A double wall carton made of 350-pound test material is adequate.

Use enough shock absorbing material (3 to 4 inch layer) around all sides of the instrument to provide a firm cushion and prevent movement inside container. Protect control panel with cardboard.

Seal shipping container securely.

Mark shipping container FRAGILE to encourage careful handling.

In any correspondence, refer to instrument by model number and serial number.

Power Supply Requirements

Line Power Requirements

The instrument complies with Overvoltage Category II and can operate from the single-phase AC power source that supplies between 100 V and 240 V at a frequency in the range 50/60 Hz. The maximum voltage fluctuation is 10% of the nominal supply voltage. The maximum power consumption is 60 VA with all options installed.

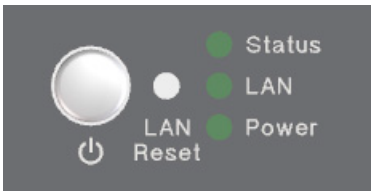
Line Power Cable

In accordance with international safety standards, the instrument has a three-wire power cable. When connected to an appropriate AC power receptacle, this cable earths the instrument cabinet.

CAUTION Please note that the switch on the front panel of the instrument does not stop the flow of power to the instrument.

If you need to turn off the power, unplug the instrument at the mains or remove the power cable connector from the appliance coupler at the rear of the instrument. For this reason, the power cable connection should be easily accessible - allowing you to turn off the power quickly. If the instrument is in a cabinet, it must be disconnected from the line power by the system's line power switch.

The power switch allows you to switch between stand-by mode and power-on mode.



When the instrument is in stand-by mode, the Power LED is orange. When the instrument is powered-on, the Power LED is green.

The AC power requirements are summarized on the rear panel of the instrument.

N77--C Series Attenuators

The Keysight's N77--C series inlcudes the following instrumentss:

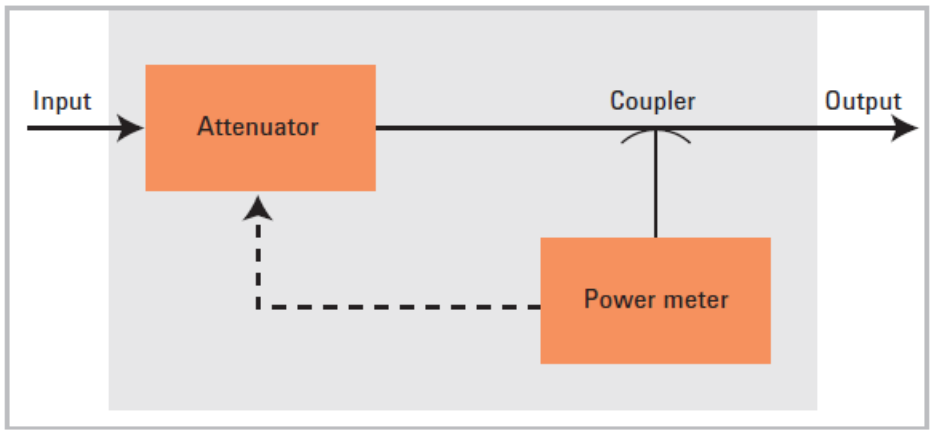
1. N7752C 2-Channel Optical Attenuator and Power Meter
2. N7764C 4-Channel Optical Attenuator
3. N7768C 4-Channel Optical Multimode Attenuator

The Keysight's N77--C series multi-channel attenuators and power meters are a new class of remote controlled fiber optic instruments for optical transceiver and network integration test. High setting speed of attenuation and power as well as power

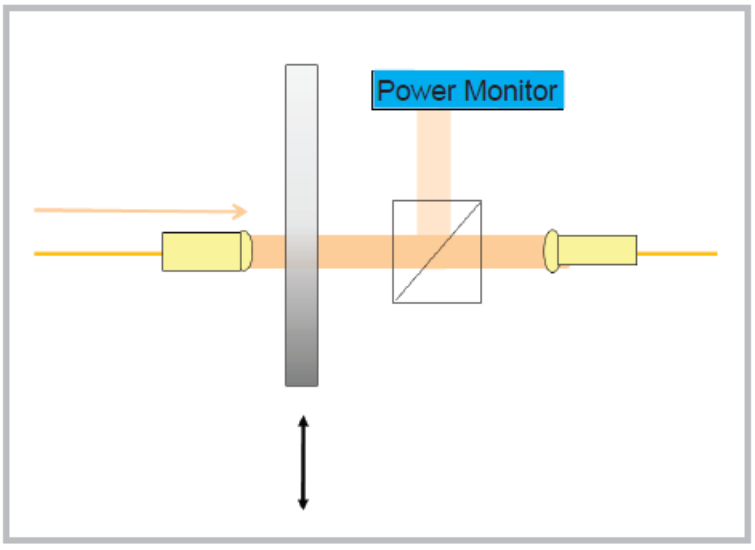
measurement capability, combined with USB and LAN interfaces provides increased throughput and operational efficiency to meet today's challenges in manufacturing.

All attenuators feature both attenuation mode and power control mode. In attenuation mode, the calibrated value of attenuation in dB can be set. The power control functionality allows you to set the power level at the attenuator output. The instrument uses the feedback signal from a photodiode after a monitor tap, both integrated in the instrument, to set the desired power level at the output of the module.

The following figures illustrates the optical attenuator with power control:



The following figure illustrates schematic of multimode attenuator with collimated beam path for homogeneous attenuation and monitoring:



When the power control mode is enabled, the module automatically corrects for power changes at the input so that the output power level you set is maintained.

Absolute power levels can be set with high accuracy after an initial offset calibration for the uncertainties at connector interfaces.

In addition, the Keysight N7752C attenuator includes two extra optical power meter channels for convenient power measurements and setup calibration.

For more details on the N77--C series attenuators, refer to the product data sheet.

N77--C Series Instrument's Front and Rear Panel

This section provides information on the front and rear panel of the N77--C series attenuators. It includes the following instruments:

1. N7752C 2-Channel Optical Attenuator and Power Meter
2. N7764C 4-Channel Optical Attenuator
3. N7768C 4-Channel Optical Multimode Attenuator

Front Panel - N7752C Attenuator

The following figure shows the front panel of the N7752C attenuator:

Front Panel - N7764C Attenuator

The following figure shows the front panel of the N7764C attenuator:

Front Panel - N7768C Attenuator

The following figure shows the front panel of the N7768C attenuator:

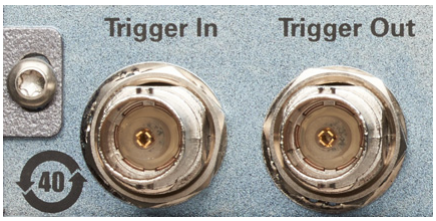
Rear Panel - N77--C Series Attenuators

The following figure shows the rear panel of the N77--C series attenuators:

Electrical Connectors

Rear Panel Trigger BNC Connectors

There are two BNC connectors on the rear panel of the N7768C instrument. These are the Trigger Out and the Trigger In connectors.



CAUTION The Trigger In is a TTL input. A maximum of 5 V can be applied as an external voltage to this input connector.

The Trigger Output is a TTL output. Do not apply an external voltage to this connector.

Powering Up the Instrument

When you power on the instrument, the LEDs on the front panel show the various stages of the instrument.

	Power	LAN	Status
Yellow	Standby Mode	Searching for LAN	Warming Up
Green	ON	Connected with LAN	
Blinking Green			Communicating over LAN / USB
Red		Not Connected	

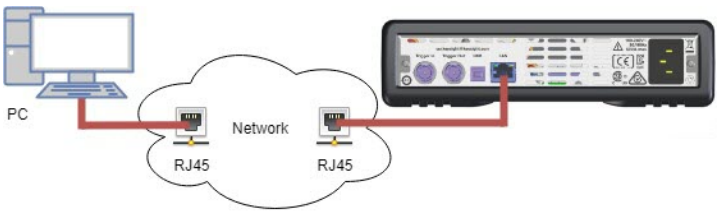
Remote Interface

The N7768C supports remote interface communication over a LAN or a USB interface.

NOTE It is recommended to use the Keysight IO Libraries Suite to enable instrument communication for a variety of development environments. It is available at: http://keysight.com/find/iolibs

LAN Connection with a DHCP server (Site LAN)

A site LAN is a local area network in which LAN-enabled instruments and computers are connected to the network through routers, hubs, and/or switches. They are typically large, centrally-managed networks with services such as DHCP and DNS servers. The following figure illustrates a typical site LAN system.



Connect the instrument to the site LAN or to your computer using a LAN cable. The as-shipped instrument LAN settings are configured to automatically obtain an IP address from the network using a DHCP server (DHCP is set On). The

DHCP server will register the instrument's hostname with the dynamic DNS server. The hostname as well as the IP address can then be used to communicate with the instrument. The front panel LAN indicator will indicate the current LAN state (see LAN Status Indicators).

Use the Connection Expert utility of the Keysight IO Libraries Suite to add the instrument and verify a connection. To add the instrument, you can request the Connection Expert to discover the instrument. If the instrument cannot be found, add the instrument using its hostname or IP address.

You can now use Interactive IO within the Connection Expert to communicate with your instrument, or you can program your instrument using the various programming environments. You can also use the Web browser on your computer to communicate with the instrument as described under User Interface Reference.

LAN Connection without a DHCP server (Private LAN)

A private LAN is a network in which LAN-enabled instruments and computers are directly connected, and not connected to a site LAN. They are typically small, with no centrally-managed resources. The following figure illustrates a typical private LAN system.

NOTE Make sure your computer is configured to obtain its address from DHCP and that NetBIOS over TCP/IP is enabled. Note that if the computer had been connected to a site LAN, it may still retain previous network settings from the site LAN. Wait one minute after disconnecting it from the site LAN before connecting it to the private LAN. This allows the PC to sense that it is on a different network and restart the network configuration.

The factory-shipped instrument LAN settings are configured to automatically obtain an IP address from a site network using a DHCP server. You can leave these settings as they are. Most Keysight products and most computers will automatically choose an IP address using auto-IP if a DHCP server is not present. Each assigns itself an IP address from the block 169.254.nnn.nnn. Note that this may take up to one minute. The front panel LAN indicator will

indicate the current LAN state (see Remote Interface (page 31)).

Use the Connection Expert utility of the Keysight IO Libraries Suite to add the LAN instrument and verify a connection. To add the instrument, you can request the Connection Expert to discover the LAN instrument. If the instrument cannot be found, add the instrument using its hostname or IP address. You can find additional details here: Connecting the Instrument (page 35)

NOTE If this does not work, refer to "Troubleshooting Guidelines" in the Keysight Technologies USB/LAN/GPIB Interfaces Connectivity Guide included with the Keysight IO Libraries Suite.

You can now use Interactive IO within the Connection Expert to communicate with your instrument, or you can program your instrument using the various programming environments. You can also use the Web browser on your computer to communicate with the instrument as described under User Interface Reference.

USB Connection

The following figure illustrates a typical USB interface system:

Connect your instrument to the USB port on your computer using a USB cable.

NOTE Your PC will detect a new USB Mass Storage Device (read-only) and a new virtual Ethernet link over USB. This interface assigns itself an IP address from the block 100.61.nnn.nnn and your PC 100.61.nnn.nnn (n+1).

Use the Connection Expert utility of the Keysight IO Libraries Suite to add the instrument and verify a connection. To add the instrument, you can request the Connection Expert to discover the instrument. If the instrument cannot be found, add the instrument using its hostname or IP address. You can find additional details here: Connecting the Instrument (page 35)

You can now use Interactive IO within the Connection Expert to communicate with your instrument, or you can program your instrument using the various programming environments.

Technical Overview

User Interface	Keysight N7768C
Ethernet Access:	IPv4 and IPv6 Socket connection:
HTTP	http://<ip_address> or http://<host_name>
Telnet	port 23
VXI-11	port 111 (IPv4 only)
SCPI-telnet	port 5024
SCPI-raw	port 5025
HiSLIP	port 4880
USB Access	Remote NDIS (virtual Ethernet link over USB)
	USB Mass Storage functions (read-only)
	USBTMC-USB488

LAN Status Indicators

When the LAN connection is made, you will see the following LAN status indicators:

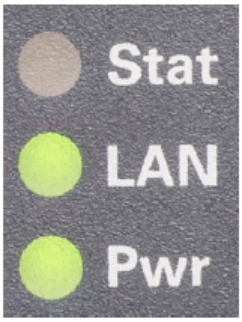
No LAN Link

LAN Red

LAN Link
No IP Address

LAN Yellow

LAN Link



LAN Green

There may be a delay between making the LAN link (yellow status) and getting the IP address (green status). This delay may be longer if there is no DHCP server, for example when the instrument is connected directly to a PC.

LAN Reset Button

This recessed button has two functions.

Pressing the button briefly invokes a preset of the instrument and restores default measurement settings. This is equivalent to the following programming command:
SYSTem:PRESet

Pressing and holding the button for 5 seconds will reset the LAN parameters to the factory default. This includes removing the password. This is equivalent to the following programming command:
:SYSTem:COMMunicate:ETHernet:RESet

Deleting User Data

If you need to delete all your logged data and user configurations, short press the LAN **Reset** button to reset the instrument and all your logged data and user configurations will be deleted.

The N7764C and N7752C attenuators supports a user calibration which is just switched off but not deleted. To delete the user calibration, use the web GUI or execute the following SCPI command:

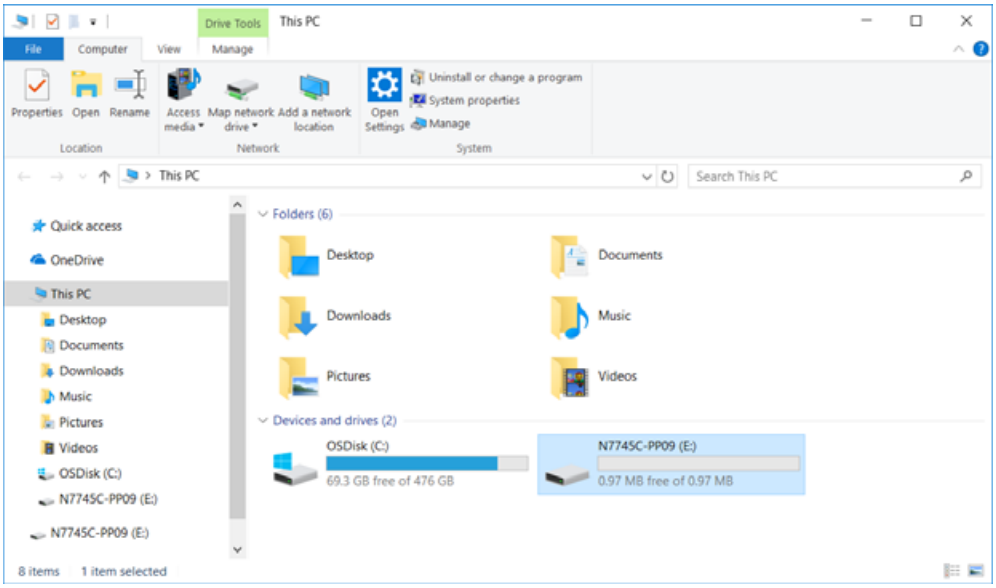
:INPut[n]:ATTenuation:UCALibration:PREset (page 124), where n=1, 3, 5 & 7.

Connecting the Instrument

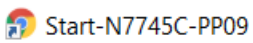
Connecting over USB

1. Power on the instrument.
2. Connect the PC to the instrument using a USB cable.

3. The operating system will detect and display the new instrument as a new drive.



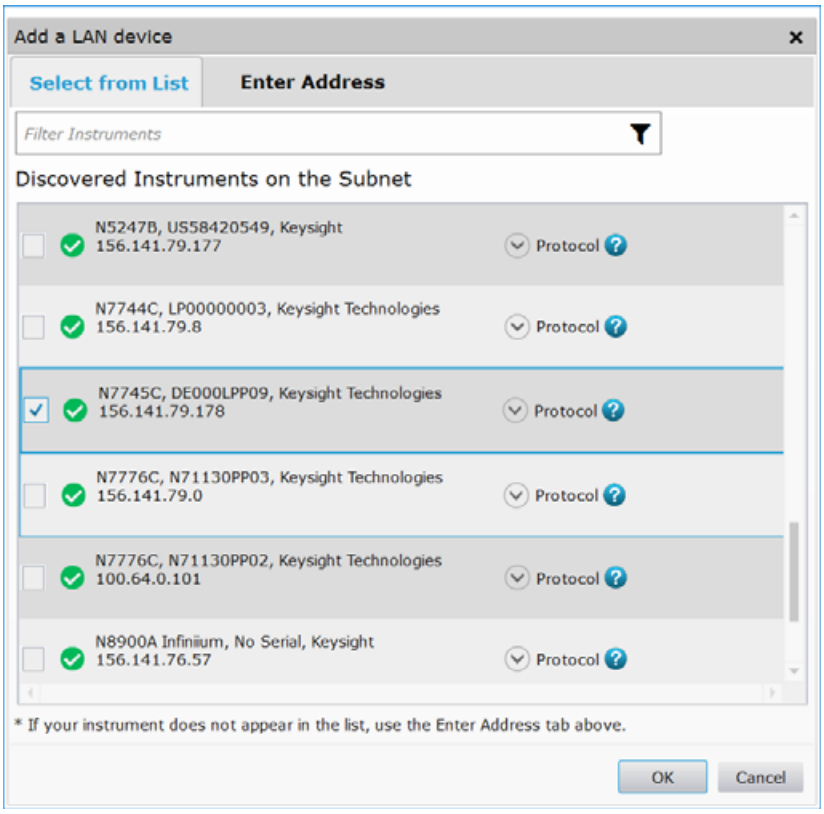
4. Double-click on this new drive. It will show a shortcut to start the user interface.



5. Double -click on this shortcut. This will link to open the user interface of the instrument in a browser.

Connecting over LAN

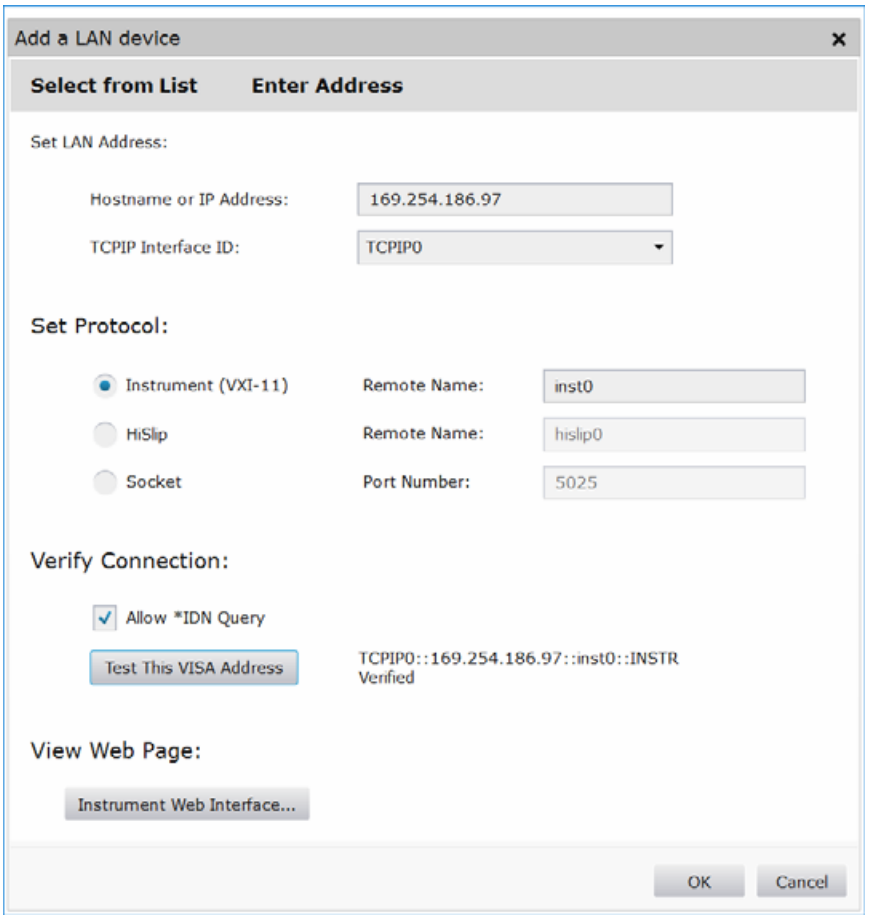
1. Make sure the instrument is connected to the LAN, and that the LAN LED on the front panel is green.
2. If it is not already running, start the Keysight Connection Expert software. The Discovery Service automatically discovers LAN instruments on the same subnet as the PC on which the service is running.
3. To add LAN instruments to the Connection Expert My Instruments list:
   a. Click, select LAN Instrument from the context list. This opens the list of discovered LAN instruments.



b. Click the check box for each instrument you want to add to the list.
c. Click OK.

4. To manually add LAN instruments outside of the local subnet:

   a. Click, select LAN Instrument from the context list. This opens the list of discovered LAN instruments.
   b. Click the Enter Address tab.
   c. Enter the LAN address or host name and select the protocol used to communicate with the instrument.



d. Click OK.

5. Linux or macOS can use the zeroconf / mdns discovery service with tools like Avahi (GNU/Linux) or Bonjour (Mac).

```
steffen@keysight [11:04:34 AM] [~]
-> % avahi-browse --all -t |grep N7781
+   enol IPv4 N7781C DE0000PP03 Polarization Analyzer       _vxi-11._tcp         local
+   enol IPv4 N7781C DE0000PP03 Polarization Analyzer       _scpi-telnet._tcp    local
+   enol IPv4 N7781C DE0000PP03 Polarization Analyzer       _scpi-raw._tcp       local
+   enol IPv4 N7781C DE0000PP03 Polarization Analyzer       _lxi._tcp            local
+   enol IPv4 N7781C DE0000PP03 Polarization Analyzer       Web Site             local
steffen@keysight [11:11:34 AM] [~]
-> % avahi-browse _scpi-raw._tcp --resolve |grep N7781 -A3
+   enol IPv4 N7781C DE0000PP03 Polarization Analyzer       _scpi-raw._tcp       local
--
=   enol IPv4 N7781C DE0000PP03 Polarization Analyzer       _scpi-raw._tcp       local
   hostname = [k-n7781c-0pp03.local]
   address = [156.141.78.199]
   port = [5025]
   txt = ["txtvers=1" "Manufacturer=Keysight Technologies" "Model=N7781C" "SerialNumber=DE0000PP03" "FirmwareVersion=V1.000"]
```

Definition of Terms

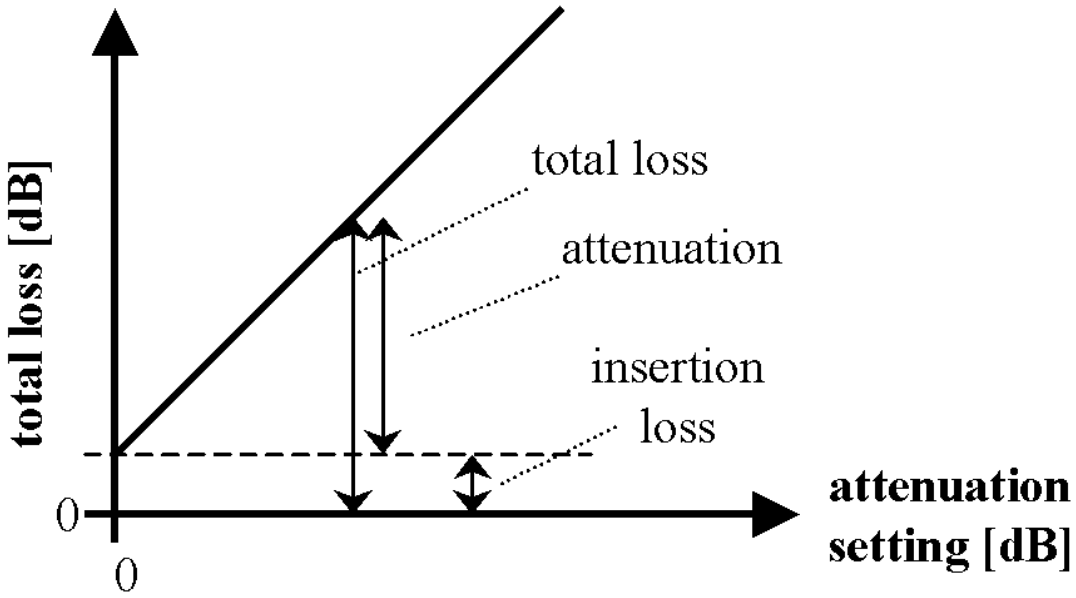
This section defines terms that are used in this document.

(Applicable) fiber type

Connection type for which the specifications and characteristics apply (if not differently stated).

Attenuation

Difference (in dB) between “Total loss” (with any attenuation setting, see Total loss) and Insertion loss (i.e. with attenuation set to zero, see Insertion loss) of the attenuator.

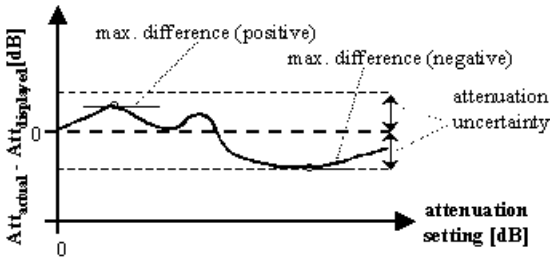


Attenuation setting mode

Operating mode where the user sets the desired attenuation. The power control function is deactivated in this mode (see also Power setting mode).

Attenuation accuracy (uncertainty)

The maximum possible difference (in dB) between the displayed “Attenuation” (see, Attenuation) and actual “Attenuation” (see, Attenuation).



Conditions: Attenuator set to the wavelength of the source. Input polarization, temperature range, maximum power and input mode (multimode attenuators only) as specified. Other conditions as specified.

Measurement: With Fabry-Pérot laser source of applicable wavelength, polarization scrambler (if applicable), and optical power meter.

NOTE When using a polarized source, the attenuation uncertainty increases by ± half the specified polarization dependent loss of the attenuator (if specified).

Averaging time

Specifies the period during which the power meter or monitor power meter takes readings from the photodetector. The displayed power result is the (arithmetical) average of these readings.

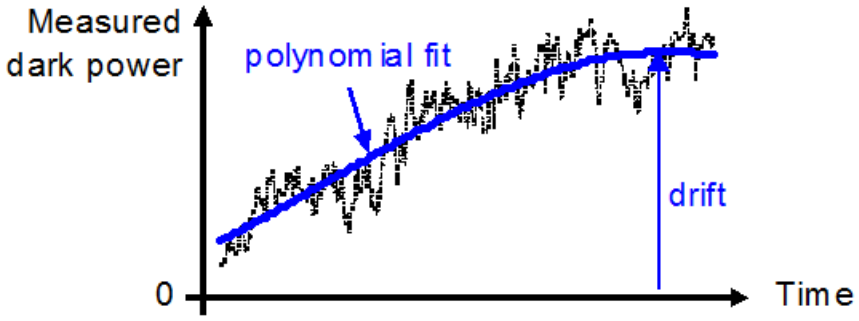
Constant operating conditions

This generally includes constant values of temperature, humidity, wavelength, input power level, polarization state and mode distribution, if the quantity is not explicitly subject to variation.

Drift (dark)

Specifies the maximum deviation from zero of the measured power with no optical input (dark) over time, excluding Noise pp (dark), power expressed in Watts.

Measurement: From the dark measurement result Pi, the 3rd order polynomial fit Fi is calculated. The fit incorporates the least square-sum difference. The Drift D is calculated by D = maxi{Fi} or mini{Fi}, whichever is worse.



Conditions: All ports dark. Observation time as specified. Other conditions as specified.

Insertion loss

Specifies the Total loss at a displayed attenuation of 0 dB

Conditions: Temperature range, wavelength range, source polarization input polarization, input mode (multimode attenuators only) as specified.

Measurement: With Fabry-Pérot Laser Source, polarization controller (if applicable) and power meter, using high quality connectors in perfect optical condition.

NOTE

"Insertion loss excluding connectors" means connector loss is not part of the loss value.

"Insertion loss including connectors" includes the additional insertion loss from the connectors.

Linearity

Specifies the relative difference between the measured (displayed) power ratio D_x/D_0 and the actual (true) power ratio P_x/P_0, caused by changing the power level from the reference level P_0 to an arbitrary level P_x.

Power is expressed in Watt.

Excluding "Noise pp (dark)" (see, Noise pp (dark) and "Drift (dark)" (see, Drift (dark)).

$$L_{\%} = \left(\frac{D_x/D_0}{P_x/P_0} - 1\right) \text{ when expressed in \%.}$$

$$L_{\mathrm{dB}} = 10\log\left(\frac{D_x/D_0}{P_x/P_0}\right) \text{when expressed in dB.}$$

Conditions: Reference power level P_0 = 0.01 mW (-20 dBm). Other conditions as specified.

Maximum safe (input) power

The maximum input power that can be applied to any port of the power meter or

attenuator without permanent change to its characteristics.

Attention: Applying more than the specified power might damage the power meter or attenuator!

NOTE For input powers > 20 dBm, clean connectors in good condition are vital to avoid thermally induced fiber damage.

Noise pp (dark)

Specifies the peak-to-peak (pp) change of displayed power over time with zero input power (dark), excluding "Drift (dark)" (see, Drift (dark)). Powers expressed in Watts.

Conditions: All ports dark. Averaging time as specified. Other conditions as specified.

Measurement: As for “Drift (dark)”. From the measured Pi and the fitted curve Fi the noise curve *Ni = Pi - Fi* is calculated.

The noise N is

N = maxi{Ni} - mini{Ni}

NOTE The noise pp specification (rather than noise 2 sigma) is given for legacy reasons.

Noise 2 sigma (dark)

Specifies twice the standard deviation of the measured dark power (with zero input power), excluding “Drift (dark)”. Power is expressed in Watt.

Conditions: All ports dark. Averaging time as specified. Other conditions as specified.

Measurement: As for "Drift (dark)" (see, Drift (dark)).

From the measurement result Pi and the fitted curve Fi the noise N is calculated by *N = 2*StDevi{Pi - Fi}*, where *StDevi{}* denotes the standard deviation over indices i.

Operating humidity

Humidity range where the instrument is designed to be operated.

The instrument must not be operated outside this range. If previously stored beyond this range, wait for acclimation before turning on the instrument.

Operating temperature

Temperature range for which the specifications apply if not differently stated.

The instrument must not be operated outside this range. If previously stored beyond this range, wait for acclimation before turning on the instrument.

Optical path blocking

Maximum possible attenuation.

Polarization dependent loss (PDL)

The dependence of the “Total loss” (see, Total loss) on the input polarization state, expressed as the full difference (in dB) between the highest and the lowest total loss.

Conditions: Temperature range, input mode as specified.

Measurement: Using high quality connectors in perfect optical condition.

NOTE PDL is a peak-to-peak value.

Polarization dependent responsivity (PDR)

Specifies the dependence of the measured power on the input state of polarization (SOP) as ± half the difference between the highest and the lowest measured power over all SOPs, expressed in dB.

Power is expressed in dBm.

Conditions: As specified.

Power range

Specifies the range from the smallest input power that causes a significant change of the measured (displayed) power to the highest power for which the specifications apply if not differently stated.

Measurement: The lower limit corresponds to half the "Noise pp (dark)" (see, Noise pp (dark)).

Power setting mode

Operating mode where the user sets the desired output power. The power control function of the attenuator automatically adjusts the attenuation to get the set output power (see also, Attenuation setting mode).

Range in attenuation setting mode

Attenuation range that can be set at the attenuator in the Attenuation Setting Mode and for which the specifications apply (if not differently stated).

Range in power setting mode

Range of optical output power that can be set at the attenuator in the Power Setting Mode and for which the specifications apply (if not differently stated).

NOTE The actual minimum value is determined by the optical input power minus the maximum attenuation.

Relative uncertainty of monitor power meter

When changing the output power of the attenuator, the relative power meter uncertainty is the maximum error of the displayed output power ratio to the actual output power ratio. This uncertainty is caused by the internal power meter's nonlinearity and noise and by errors in the sensing hardware, expressed as ± half the span of all possible errors with an offset due to the noise level of the power meter. Symbol RU.

Conditions: Reference power level 1mW, wavelength and polarization state constant; power limitations as in the Specifications; zeroing prior to measurement.

Measurement: The nonlinearity is calculated using the displayed power ratio D2 / D1 and the corresponding actual power ratio P2 / P1:

$$N_{dB}(1,2) = 10\log\left(\frac{D_1/D_2}{P_2/P_1}\right)$$

The relative power meter uncertainty is then calculated using:

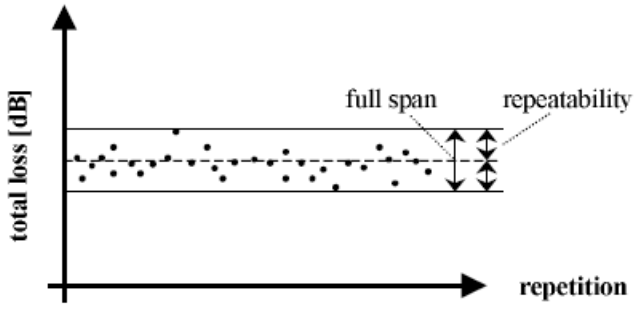
$$RU_{dB} = \pm\frac{max\left|N_{dB}(1,2)\right|}{2}$$

RU is then expressed in dB and the offset is expressed in pW.

NOTE Absolute power accuracy attainable with the help of an external optical power meter.

Repeatability (of attenuation/total loss, or power level)

Specifies the uncertainty in reproducing the Total loss, (Attenuationor power level) after randomly changing and resetting the attenuation or power level. The repeatability is defined as ± half the difference between the highest and the lowest measured attenuation or power level over the repeated changing and resetting of the attenuation or power level.



Conditions: Constant operating conditions. Operating in power setting mode requires zeroing prior to measurement.

Resolution

The smallest possible increment or decrement in Attenuation Setting Mode or Power Setting Mode.

Return loss

The ratio between the incident power and the power reflected back from the instrument into the input fiber, expressed in dB.

Conditions: As specified. (For attenuators: applicable to both ports with fiber cables with high quality connectors in perfect optical condition on both attenuator ports and the respective second port terminated (zero reflectance).)

Measurement: With return loss meter and non-coherent source of applicable wavelength.

> **NOTE** The measurement result includes internal reflections in the instrument, such as reflections from both attenuator ports.

Settling time

Maximum time needed to change the attenuation or power level by a specified step, from the beginning until the end of the change.

Specification wavelength range

The wavelength range for which all specifications and characteristics apply, if not differently stated.

Spectral ripple (power meter; due to interference)

A coherent input signal causes optical interference between reflective interfaces within the power meter's optical assembly, including the end face of a connected fiber. Optical interference causes a wavelength dependent periodic change of the power meter's responsivity. Spectral ripple is defined as ± half the difference between the highest and the lowest power resulting from the periodic change.

Conditions: Constant input power, constant state of polarization (SOP).

Connector as specified. Other conditions as specified.

Measurement: Using a laser source without spectral ripple or with known (monitored) spectral ripple and linewidth < 100 MHz and stepping the wavelength over the specified range. The periodic part in the measurement result is separated by subtracting the polynomial 2nd order fit (low frequency part).

Storage conditions

Allowed temperature and humidity range for the non-operating instrument. Wait for acclimation to within the “Operating temperature” before turning on the instrument.

Total loss

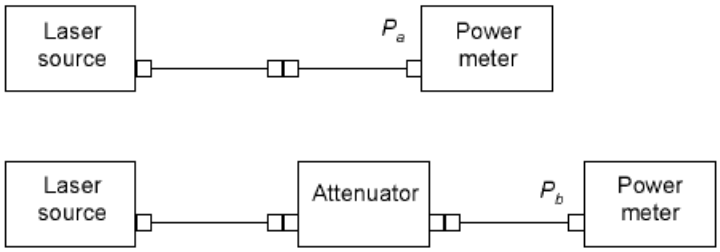
The change of power level after inserting the attenuator between two connectorized patchcords, at an arbitrary attenuation setting, expressed in dB. Its value TL can be calculated from:

$$TL(dB) = 10\log\frac{P_a}{P_b} = P_a(dBm) - P_b(dBm)$$

where:

Pa = power measured at the end of the two patchcords.

P_b = power measured after the insertion of the attenuator.



Conditions: Patchcord cables with high quality connectors in perfect optical condition on both attenuator ports.

NOTE The total loss depends on the attenuation setting.

NOTE Total loss includes the loss of one additional connector pair.

Total uncertainty

The maximum relative difference U between measured (displayed) power M and actual (true) power P for a specified set of operating conditions, expressed in percent. Powers expressed in Watts. Excluding "Noise pp (dark)" (see, Noise pp (dark)) and "Drift (dark)" (see, Drift (dark)).

*U = 100% * (M/P - 1)*

Conditions: Operating conditions as specified. Other conditions as specified.

Transition speed

Specifies the settable attenuation change rate of the attenuator.

Uncertainty at reference conditions

The maximum relative difference U between measured (displayed) power M and actual (true) power P for the specified set of reference conditions, expressed in percent. Powers expressed in Watts.

*U = 100% * (M/P - 1)*

Conditions: Reference conditions as specified.

Wavelength range

The range of wavelengths for which the power meter is calibrated, or that can be set at the attenuator and for which the specifications apply (if not differently stated).

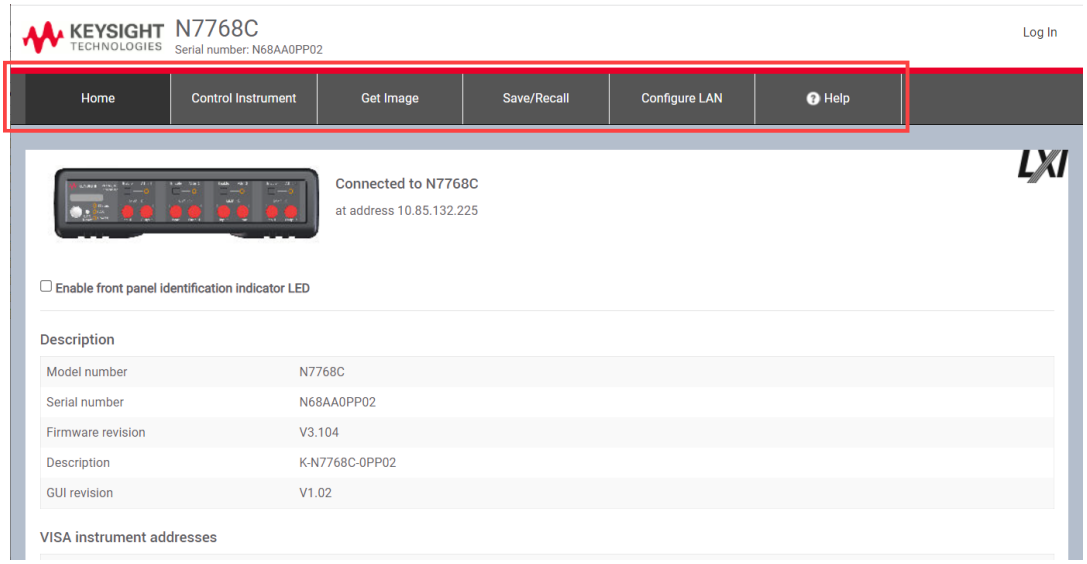
Optical path blocking

Time after power-up of the acclimated instrument after which the specifications and characteristics apply.

User Interface Reference

This section provides an overview of the N77--C series attenuators.

The N77--C user interface provides various tabs to help the user to control the attenuation mode and power control mode. Here is an example of N7768C attenuator user interface with various tabs highlighted. The same user interface is valid for N7764C and N7752C.



These tabs include:

Home – This tab displays the various instrument settings. For details, refer How to Get Current Instrument Settings? (page 59)

Control Instrument – This tab allows you to set the parameters to control the instrument. For details, refer to Controlling N77--C Series Attenuators (page 49).

Get Image – This tab allows you to capture a screen of the **Control Instrument** window. The image is saved in PNG format in your PC. For details, see How to Capture a Screenshot? (page 60)

Save/Recall - This tab allows you to:

- Save Settings - see How to Save and Recall the Instrument's Measurement Settings? (page 61)
- Recall Settings - see How to Save and Recall the Instrument's Measurement Settings? (page 61)
- Export / Import GUI Settings - see How to Export and Import the User Interface Settings?

Configure LAN – This tab displays the current LAN configuration. In addition, this tab also allows you to edit the current LAN configuration. For details, refer to How to Configure LAN?

Help – This tab opens the instrument's help. See How to Access Online Help?

Controlling N77--C Series Attenuators

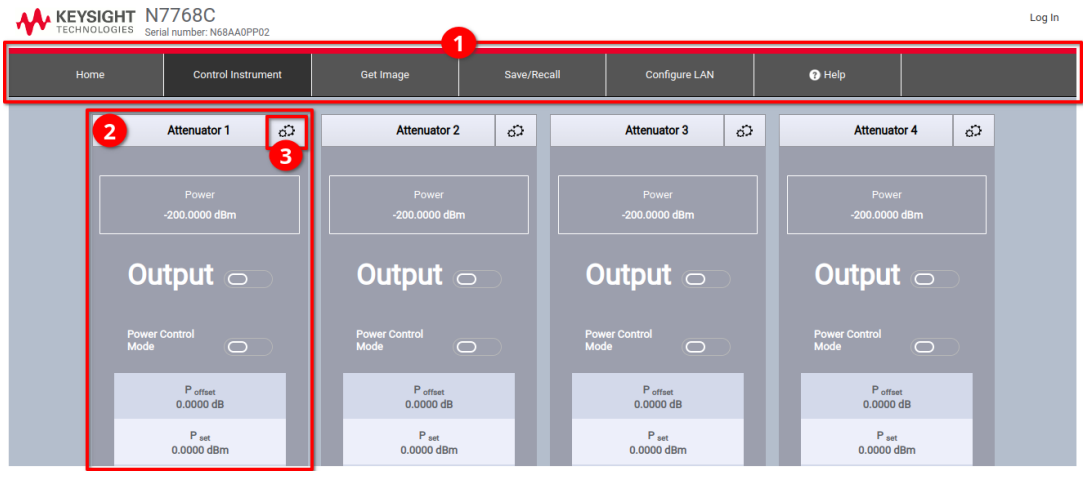
Control Instrument Tab

The **Control Instrument** tab offers flexible and convenient control of the instrument. It allows you to:

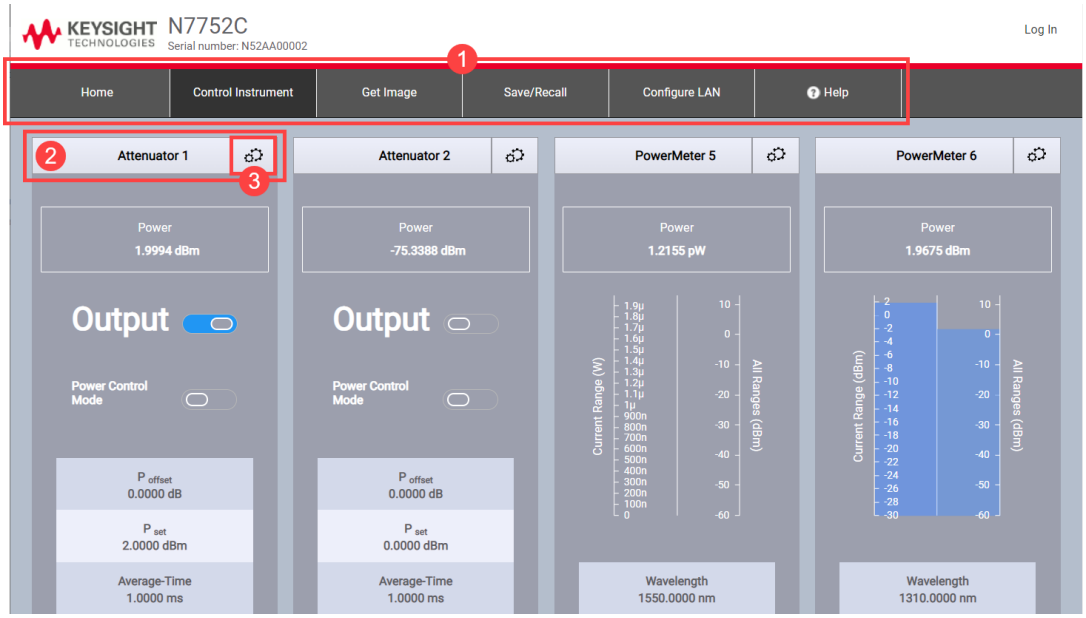
- Easily switch between channels with tabs.
- View all channels at a glance.
- Store and recall instrument configurations.
- Enable or disable the attenuator's output.
- Choose between setting an attenuation or an output power.

Using the **Control Instrument** tab, you to attenuate and control the optical power of light in single and multimode optical fibers. They allow you to set the attenuation factor and/or power level. The
N77--C Series attenuators include power control functionality that allows you to set the output power level of the attenuator.

Here is an example of N7768C **Control Instrument** tab with various options highlighted. The same options are also available in the N7764C **Control Instrument** tab.



Here is an example of N7752C **Control Instrument** tab with various options highlighted. Other than configuring the attenuator settings, this tab allows you to configure the power meter settings as well.

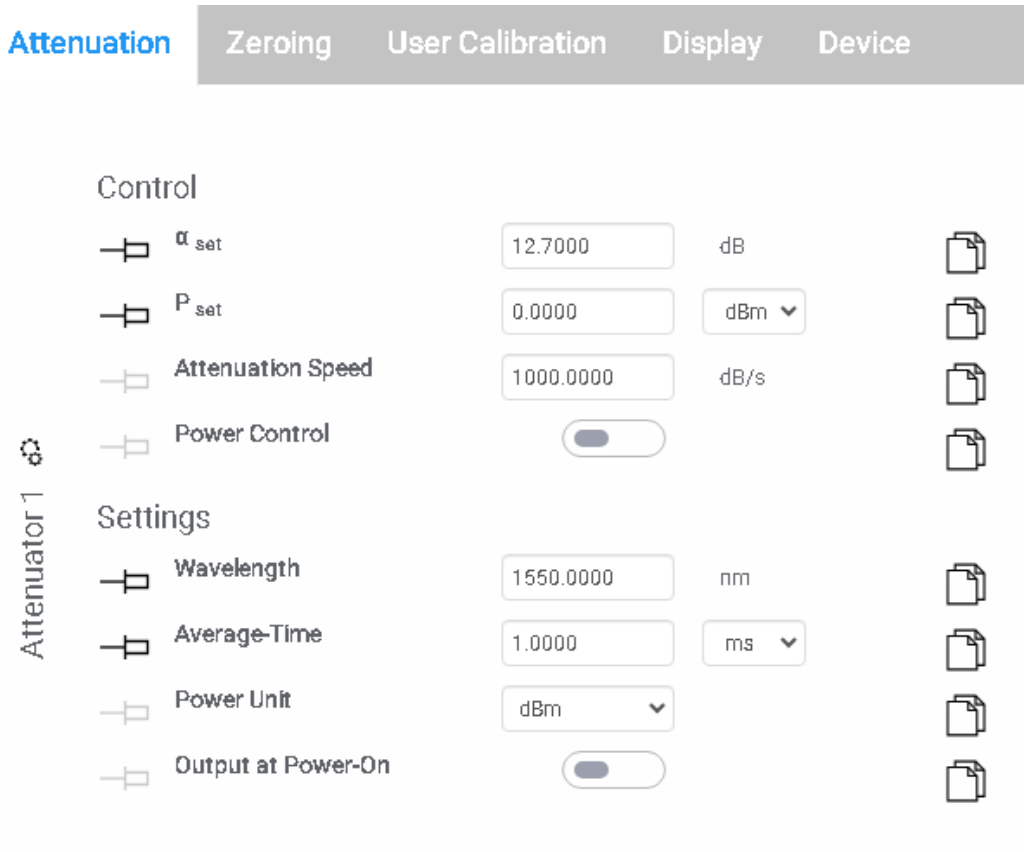


The highlighted items are described below:

1. The N77--C user interface provides various tabs to help the user to control the attenuation mode and power control mode. Here is an example of N7768C attenuator user interface with various tabs highlighted. For more details on these tabs, refer to User Interface Reference (page 48).
2. The N77--C user interface allows you attenuate and control the optical power of light in single and multimode optical fibers. They allow you to set the attenuation factor and/or power level.
3. Use the **Settings** button to configure the N77--C instrument. This button opens a dialog which provides various tabs to configure the N77--C instrument. These settings are further described in the sections that follow.

How to Apply Attenuation Settings?

Before applying an attenuation factor, set the attenuator module to the appropriate wavelength.



Apply an Attenuation Offset

Connecting an attenuated input signal to a DUT introduces additional connectors and other components into your optical test setup. An attenuation offset is typically applied to calibrate for the intrinsic insertion loss of these components. First you measure this insertion loss using a reference powermeter, then you compensate by entering the result into the Attenuator module's **α** Offset parameter.

Set a Power Level

Single-wavelength signals

Set the **λ** parameters to the wavelength of the source. You can edit P_{set} to set the power output of the Attenuator directly.

Use the Power Control Feature

The attenuators can be used with the Power Control functionality that automatically corrects for power changes at its input to maintain your desired output power.

This feature is designed to compensate, for example, for output power drift by the source.

To enable or disable Power Control, click the **Power Control Mode** button.

The filter attenuation is changed until the set power (measured by the module's internal power meter) has been reached.

$P_{set(new)}$ (dBm) = $P_{att(new)}$ (dBm) - P_{offset} (dB)

If the set power cannot be achieved ExP (indicating 'Excessive Power') is displayed.

Set Average Time

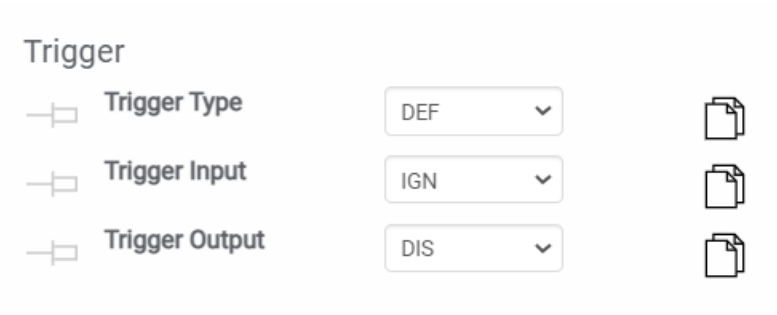
The average-time specifies the period during which the power meter or monitor power meter takes readings from the photodetector. The displayed power result is the (arithmetical) average of these readings. The average-time can be specified in seconds, milliseconds or microseconds.

How to Apply Trigger Settings?

The N77--C series attenuator allows you to trigger the instrument to perform tasks and to output trigger signals to external measurement instruments.

To set the trigger configuration:

1. From the **Control Instrument** tab, click the **Settings** icon.
2. Click on the **Attenuation** tab of the following window to show trigger settings:



The following trigger settings are available:

1. **Tigger-Type**: You can select various the trigger configuration modes. The following trigger configuration modes are available:

   Default (DEF) - To enable the trigger connectors.

   Disabled (DIS) - To disable the trigger connectors. Means no triggers are generated.

   LOOP (LOOP) - An input trigger will generate an output trigger. This lets you trigger another instrument almost simultaneously.

   Pass Through (PASS) - An input trigger will generate an output trigger. This lets you trigger another instrument almost simultaneously.

2. Trigger-Input: You can configure your N77--C series attenuator to perform certain tasks when you apply a trigger to the Input Trigger connector. The following trigger input options are available:

Ignore (IGN) - The trigger is ignored.

Next Step (NEXT) - An input trigger will cause the next step of a stepped sweep to be performed.

Run Sweep (SWS) - An input trigger will start a single sweep cycle.

3. Trigger-Output: You can configure your N77--C series attenuator to output a trigger when the instrument performs certain tasks. The following trigger output options are available:

Disabled (DIS) - No triggers are generated.

Avg Time Over (AVG) - An inverted trigger is generated for each measurement sample.

Meas. Started (MEAS) - An output trigger is generated when a power measurement begins.

Step Finished (STF) - A trigger is output after every step of a sweep finishes.

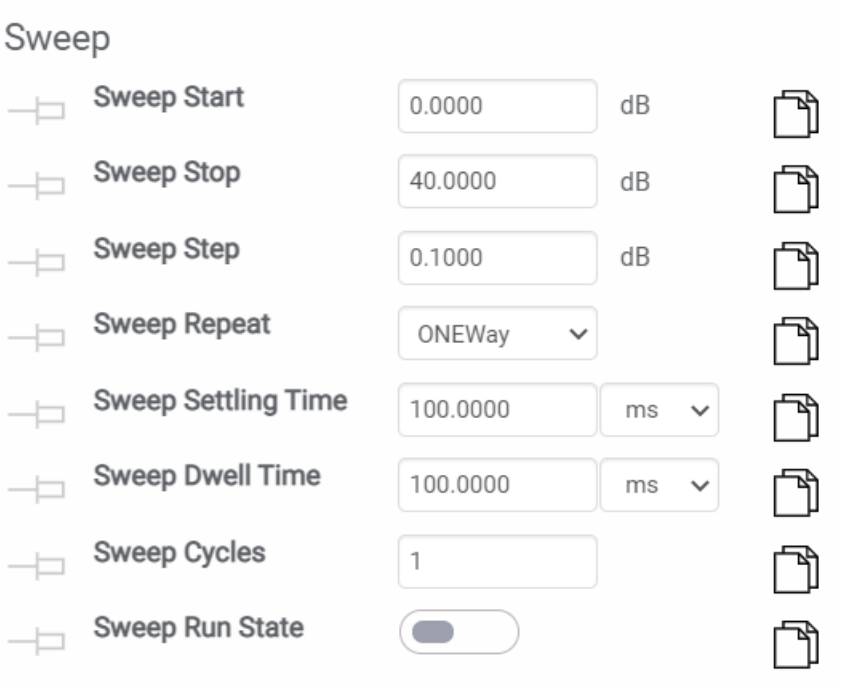
Sweep Finished (SWF) - A trigger is output after a sweep cycle finishes.

Sweep Started (SWST) - A trigger is output after a sweep cycle starts.

How to Set Attenuation Sweep?

An attenuation sweep is performed when the instrument changes the optical wavelength of the optical output across a user-defined wavelength range. You can use an attenuation sweep to measure the wavelength-dependent loss of an optical component.

The following figure shows the parameters required to set up attenuation sweep:



The following sweep settings are available:

Sweep Start: Sets the starting point of the attenuation sweep.

Sweep Stop: Sets the stop of the attenuation sweep.

Sweep Step: Sets the step for next attenuation while sweeping.

Sweep Repeat: Defines behavior for multiple sweeps.
Oneway: Attenuation moves after finishing first sweep to the beginning and start sweeping again.
Twoway: After first sweep it sweeps back to start attenuation.

Sweep Settling Time: Sets the settling time between every sweep step.
NOTE: The settling time is used to wait until the attenuation step has stabilized.

Sweep Dwell Time: Sets the dwell time between every sweep step.
NOTE: The settling time is used to wait until the attenuation step has stabilized.

Sweep Cycles: Sets number of sweep cycles.

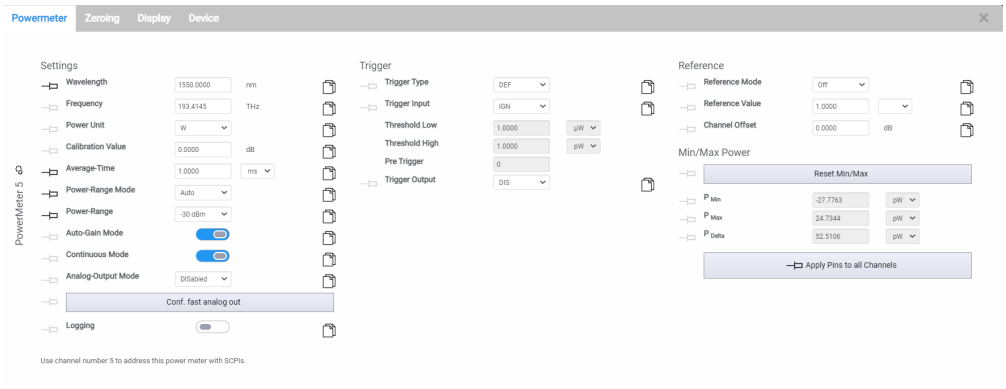
Sweep Run State: Starts or stops sweep.

How to Perform Power Meter Settings?

The N7752C **Control Instrument** tab allows you to configure the attenuator and power meter settings.

To perform a power meter setting:

1. Select the powermeter channel and then click the **Settings** icon and then select **Powermeter** tab. The following **Powermeter** dialog will appear:



2. Apply powermeter settings. The following setting options are available:

   Wavelength - Sets the wavelength value of the signal to be measured in nm.

   Frequency - Sets the frequency value of the signal to be measured in THz.

   Power Unit - Sets the power unit in W or dBm.

   Calibration Value - Sets the calibration value in dB.

   Average Time - This is the length of time over which a signal is averaged to produce a measured value. Longer averaging times increase the accuracy and improve the noise rejection. The averaging time of the N7752C instrument can be set over a wide range from 1 µs to 10s. Up to 2 ms, the setting can be varied with a typical resolution of 2 µs, and for higher averaging times the setting resolution is about 0.1%. This flexible setting time supports optimal synchronization with the time scale of the signals. The high sampling rate with short averaging times is supported by the high cutoff frequency, as shown in the specifications. These bandwidths are reduced in steps, when longer averaging times are used to improve the noise performance while maintaining signal fidelity.

   Power Range Mode - You can choose either of the two ranging modes:

      Auto - the auto-ranging mode, ensures that the result has a returned value between 9% and 100% of full scale. The default state is for automatic ranging to be enabled.

      Manual - the manual mode allows you to set a user-defined range.

   Auto-Gain Mode - A fast Auto Gain switching is used to achieve the high dynamic range in the N7752C. In some applications, like determining the average power of signals modulated with periods shorter than the averaging time, this switching produces irregular readings. In such cases, the Auto Gain should be turned off.

   Continuous Mode - Sets the software trigger system to continuous measurement mode.

   Analog Output Mode - Sets the analog output mode to linear and logarithmic. By default it is disabled.

Logging - Use this option to turn on the logging. This feature sets the number of data points and the averaging time for the logging data acquisition function.

Trigger - Applies the trigger settings. For details, see How to Apply Trigger Settings? (page 52)

Reference Level - Use this option to set the reference mode, reference level and channel offset.

Reset Min/Max Power - MinMax function measures the incoming power and returns the minimum value measured and the maximum value measured of the selected channel. Use this option to reset the minimum value measured, and the maximum value measured.

How to Perform Zeroing?

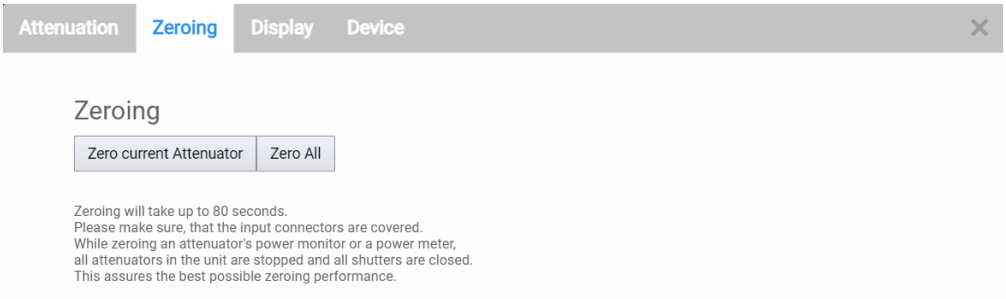
The optical power meters in the attenuator measure optical power by converting optical power to electrical current, and then measuring electrical current. An electrical offset is electrical current that is always present, even if there is no optical power input. If electrical offsets are not removed, they affect the accuracy of attenuation and power control, specially at low optical power levels.

Performing a zero sets the zero power level to the average electrical offset level for the current environmental conditions.

NOTE Before performing zeroing, please make sure that the input connectors are covered.

To perform a zeroing:

1. Select the channel and then click the **Settings** icon and then select **Zeroing**. The following **Zeroing** dialog will appear:



2. Click **Zero current Attenuator** or **Zero All** button. This process may take several minutes (approx. 80 sec). Please wait until the zeroing is completed.

How to Perform User Calibration?

The **User Calibration** tab allows you to calibrate the attenuation setting mode for a chosen source wavelength under the current conditions.

Warning: While calibrating, the attenuator may output optical power.

The output power level varies but can be as high as the input power used to calibrate.

Before starting the calibration, connect a light source with the chosen wavelength and power higher than 0 dBm. An unpolarized source can be used to average out the polarization dependence of the attenuator. If the polarization is scrambled, it needs to be depolarized within a 1ms averaging time. The wavelength setting of the attenuator should also be set correctly. Then the calibration can be started.

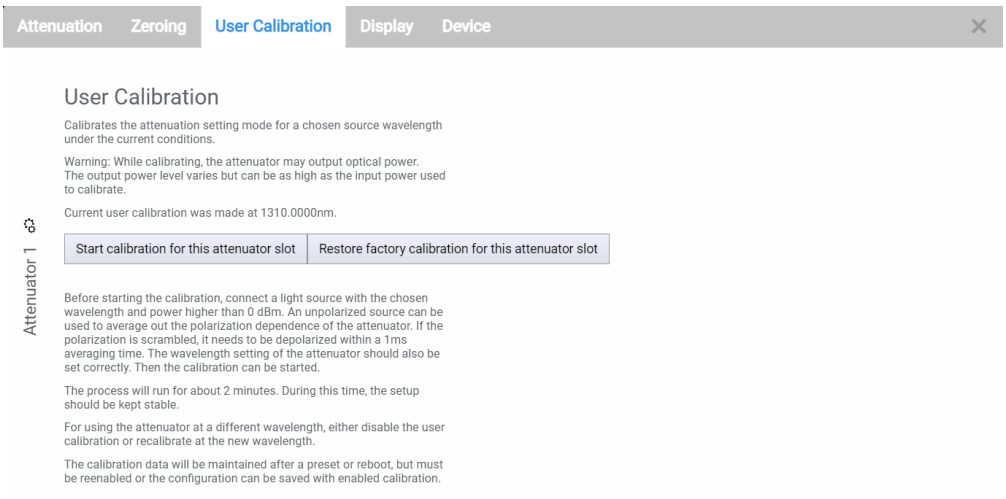
For using the attenuator at a different wavelength, either disable the user calibration or recalibrate at the new wavelength.

The calibration data will be maintained after a preset or reboot, but must be re-enabled or the configuration can be saved with enabled calibration.

NOTE It is recommended to read the provided instructions before you start the calibration.

To perform a **User Calibration** setting:

1. On the **Control Instruments** tab, select the channel on which you want to apply settings and then click on the **Settings** icon.
2. On the **Settings** window click the **User Calibration** tab. The following screen will appear:



3. Perform the following operation:

Start calibration for this attenuator slot - Click this button to start calibration for the selected attenuator slot.

Restore factory calibration for this attenuator slot- Click this button to restore factory calibration for the selected attenuator slot.

The calibration process will run for about 2 minutes. During this time, the setup should be kept stable.

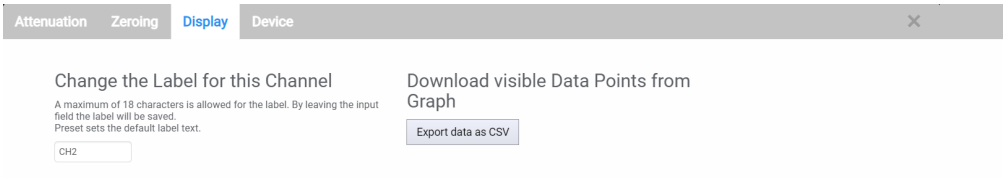
How to Apply Display Settings?

The **Display** tab allows you to:

1. Change the label of the selected channel.
2. Download visible data points from the graph.

Follow the given steps to perform a display settings:

1. On the **Control Instruments** tab, select the channel on which you want to apply the settings and then click on the **Settings** icon.
2. On the **Settings** window click the **Display** tab. The following screen will appear:



3. To change the labels, simply type a desired text and it will be displayed in the **Control Instrument** tab. Here is an example where the user types "Channel 1" and the same is reflected in the **Control Instrument** tab.

NOTE A maximum of 18 characters is allowed for each label. By leaving the input field the label will be saved.

4. To download the visible data points from the graph press the **Export data as CSV** button. The graph data will be saved in CSV format in the PC.

How to Apply Device Settings?

The **Device** tab allows you to perform the following operations:

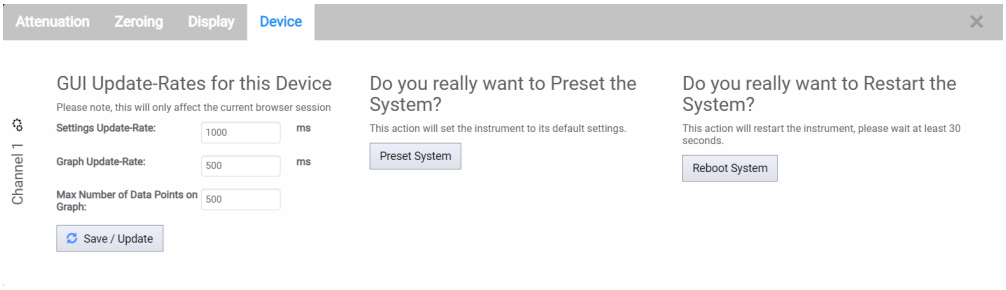
GUI Update-Rates for Switch Settings

Preset the System

Restart the System

To perform a **Device** setting:

1. On the **Control Instruments** tab, select the channel on which you want to apply settings and then click on the **Settings** icon.
2. On the **Settings** window click the **Device** tab. The following screen will appear:



3. Perform the following operation:

   GUI Update-Rates for this Device - Use this option to provide **Settings Update-Rate**, **Graph Update-Rate** and **Max. Number of Data Points on Graph**. Once done, click **Save / Update** button to save the settings.

   NOTE The settings will be saved for current browser session only.

   Preset the System - For details, see How to Preset a Device?

   Restart the System - For details, see How to Reboot a Device? (page 63)

Using Auxiliary Functions

How to Get Current Instrument Settings?

The **Home** tab on the N77--C user interface displays the current instrument settings. This tab displays the following settings:

Description – Displays the instrument description such as instrument's model no., serial no., firmware version and description of the current instrument.

VISA Instrument Address – Displays VISA instrument addresses of the current instrument.

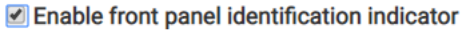
LAN Details – Displays LAN configuration details of the current instrument.

NOTE Please note that the **Home** tab does not allows the user to change the displayed instrument settings.

How to Identify an Instrument?

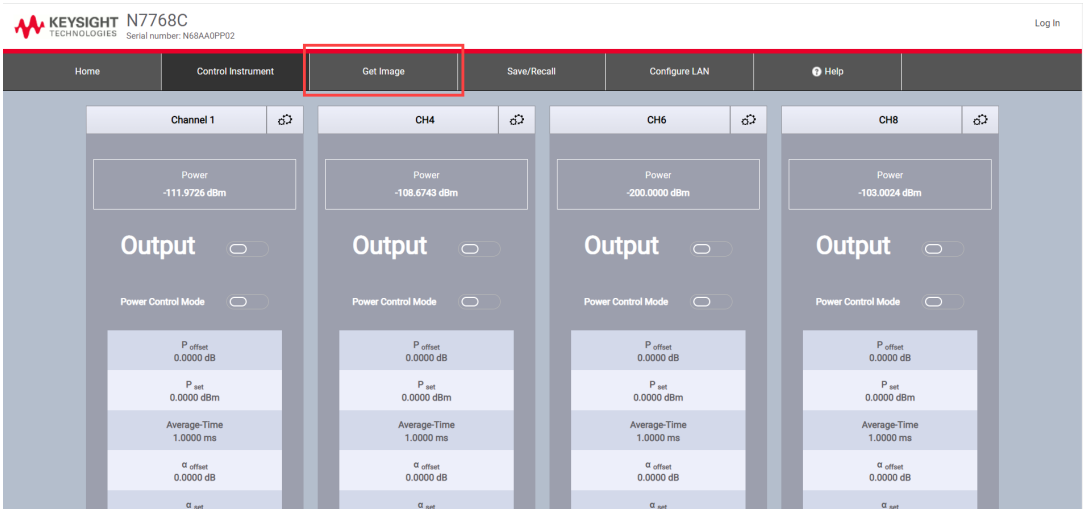
Sometimes, you have many instruments mounted on the rack. In this situation, it becomes difficult to identify a particular instrument which are currently connected.

To identify a particular instrument, select the check-box **Enable front panel identification indicator** available on the N77--C **Home** tab. The **Status** LED on the front panel of the connected instrument will start flashing.



How to Capture a Screenshot?

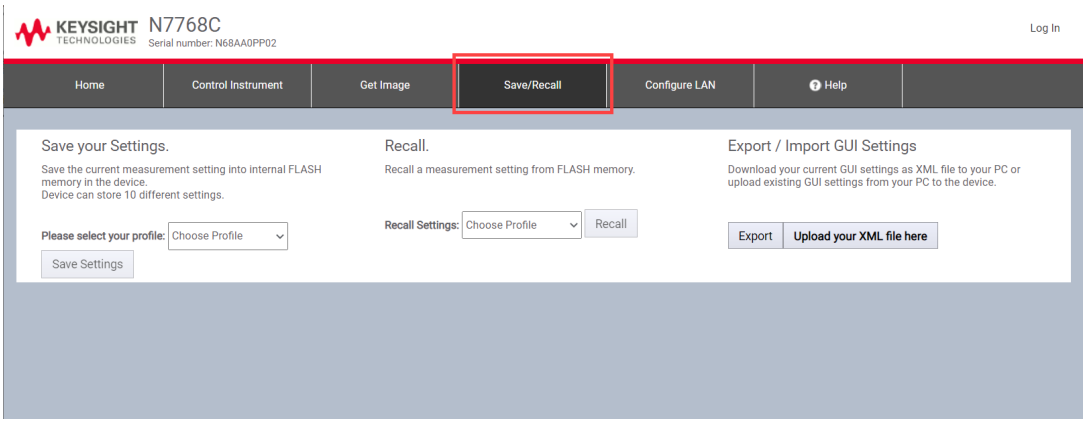
The **Get Image** tab on the N77--C user interface allows you to capture the current screenshot of the **Control Instrument** tab and save it in a PNG format.



NOTE You can only capture the screenshot if you are in the **Control Instrument** tab.

How to Save and Recall the Instrument's Measurement Settings?

The **Save/Recall** tab on the N77--C user interface allows you to save and recall the current instrument's measurement settings.



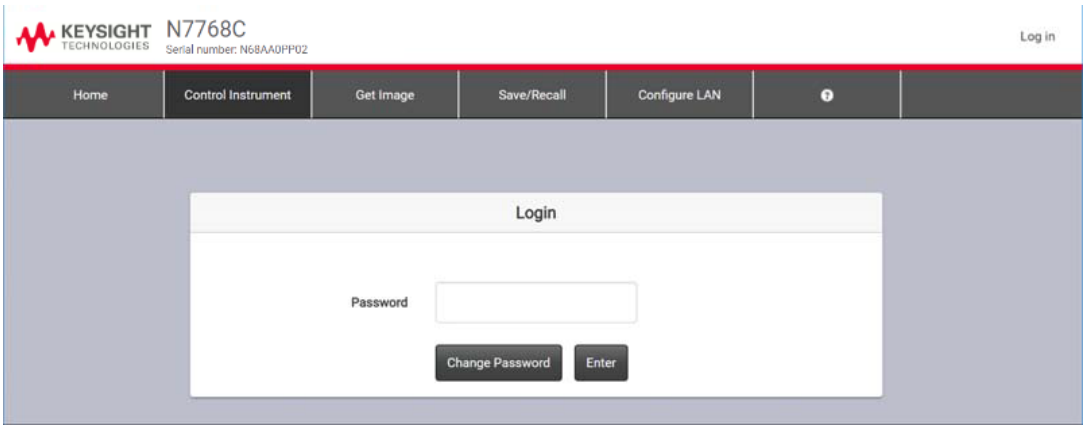
To perform the save or recall operations:

1. Click on the **Save/Recall** tab.
2. To save the current measurement settings, select the profile from 1 to 10 and then click **Save Settings**. The current measurement setting will be saved into the internal FLASH memory in this device.
3. To recall the current measurement settings, select the profile from 1 to 10 and then click **Recall**. Your settings will be restored from the device flash memory.

NOTE The last saved settings are recalled automatically after a reboot.

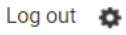
Logging In/Out of the N77--C User Interface

The login screen allows the authorized users to control the N77--C instrument(s). When the users type in their password and click **Enter**, their credentials are validated and if correct they are logged in.



If you want to create a new password or change an existing password, click on **Change Password** button. For details, see How to Create/Change the Password?.

To log out the N77--C user interface, click on the **Log out** icon available on the top right of the user interface.

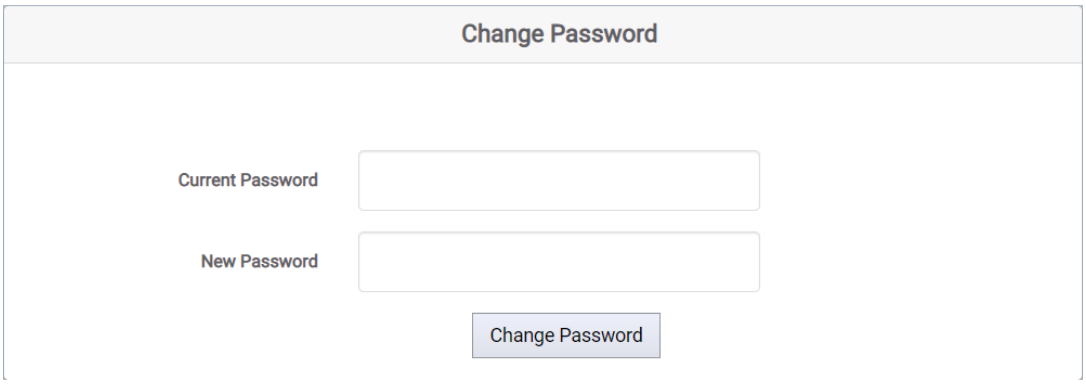


How to Create/Change the Password?

The password is used for logging in to the web page to control the N77--C series instrument(s).

To create or change a password:

1 Click the **Password Options** icon available on the top right of the N77--C user interface. You see a **Change Password** box requesting you to enter the password.



2 Enter the current password (the default password is blank).

3 Enter the new password.

4 Click the **Change Password** button. The password will be changed. Use the new password for logging in to the N77--C web page.

What If You Forget Your Password?

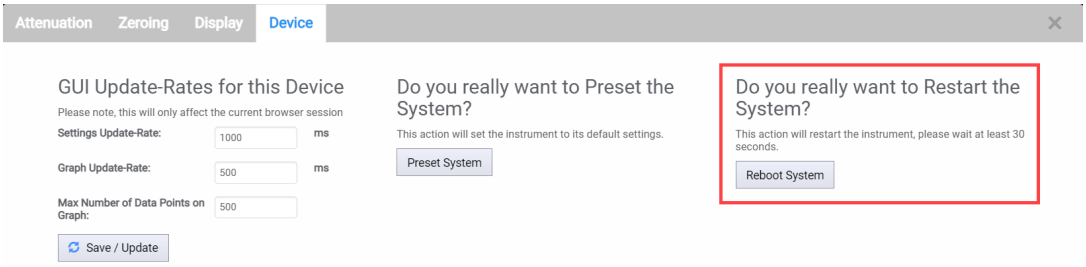
If you forget your password, please follow the instructions to reset the LAN button. See The LAN Reset Button button.

How to Reboot a Device?

An firmware reboot is required if it becomes unresponsive or returns errors.

To perform a reboot:

1. On the **Control Instruments** tab, go to **Settings** and then click **Device** tab. The following screen will appear:



2. Click on the **Reboot System** button. This action will restart the firmware and take at least 30 seconds. Please wait until the reboot process is completed.

NOTE Please save your settings before you reboot the instrument else all your current settings will be lost. See How to Save and Recall the User Interface Settings?

How to Configure LAN?

Show the Current LAN Settings

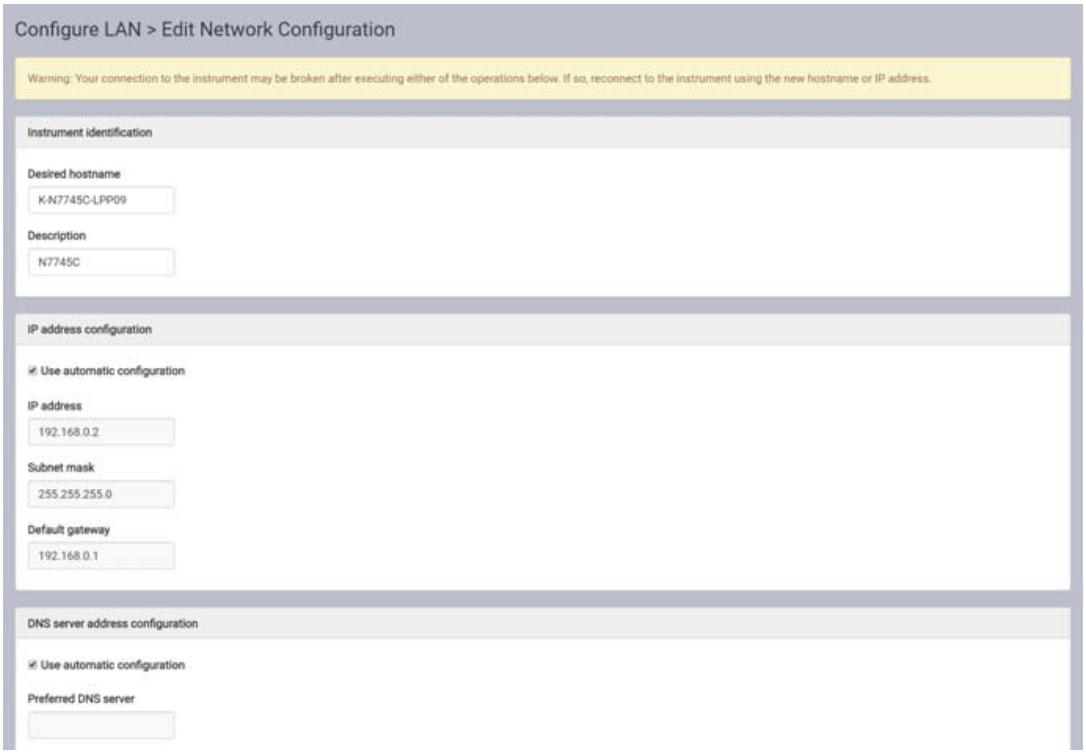
The **Configure LAN** tab on the N77--C user interface displays the currently used LAN settings. It display the following networking parameters:

IP address configuration
IP address
Subnet mask
Default gateway
DNS server(s)
Hostname
Domain

Edit LAN Settings

The **Configure LAN** tab also allows you to edit the currently used LAN settings. To do so,

1. Click on the **Edit** button. The **Edit Network Configuration** page will appear as shown in the figure below:



WARNING Your connection to the instrument may be broken after executing either of the operations below. If so, reconnect to the instrument using the new hostname or IP address.

2. Enter the descriptions for the following LAN configuration parameters:

Instrument identification

IP address configuration

DNS server address configuration

NOTE For IP address and DNS server configuration, you can select the Use Automatic Configuration check-box to automatically select the IP address and DNS server.

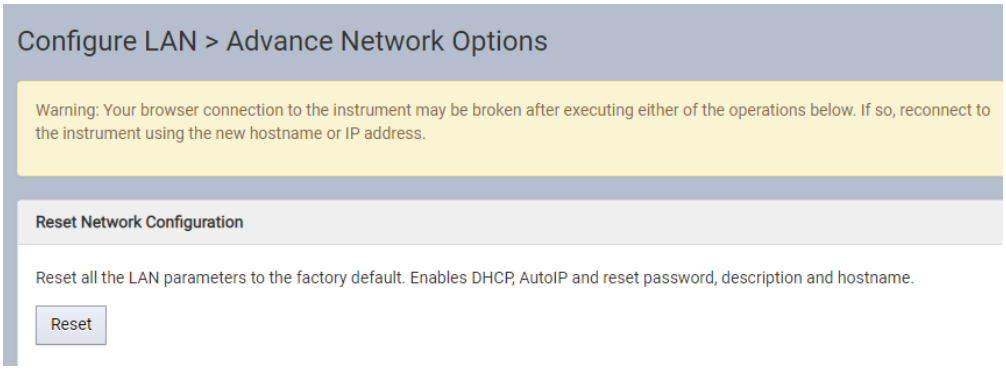
3. Once the changes are done, click on the **Apply Changes** button.

NOTE It can take up to 30 seconds for changes to these settings to take effect. You may need to refresh the Configure LAN page after 30 seconds to see the updated settings. Changes in hostname and description require reboot or LAN restart to take effect.

Reset Network Configuration

The **Configure LAN** tab also allows you to reset all LAN parameters to the factory default. To do so;

1. Click the **Advance Options** button available on **Configure LAN** tab. The **Advance Network Options** page will appear.

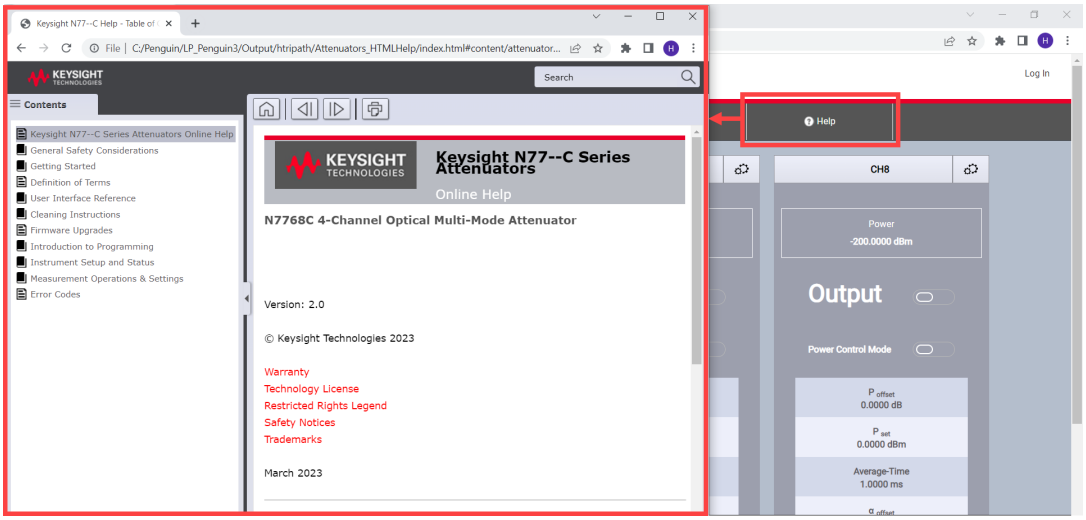


2. Click on the **Reset** button to reset all LAN parameters to the factory default.

WARNING Your browser connection to the instrument may be broken after executing the reset network configuration operation. If so, reconnect to the instrument using the new hostname or IP address.

How to Access Online Help?

The **Help** tab on the N77--C user interface opens the instrument help which provides information on how to perform various operations with the N77--C series instrument.



Cleaning Instructions

The following Cleaning Instructions contain some general safety precautions, which must be observed during all phases of cleaning.

Consult your specific optical device manuals or guides for full information on safety matters.

Please try, whenever possible, to use physically contacting connectors, and dry connections. Clean the connectors, interfaces, and bushings carefully after use.

If you are unsure of the correct cleaning procedure for your optical device, we recommend that you first try cleaning a dummy or test device.

Keysight Technologies assume no liability for the customer's failure to comply with these requirements.

Safety Precautions

Please follow the following safety rules:

- Do not remove instrument covers when operating.
- Ensure that the instrument is switched off throughout the cleaning procedures.
- To prevent electrical shock, disconnect the instrument from the mains before cleaning. Use a dry cloth, or one slightly dampened with water, to clean the external case parts. Do not attempt to clean internally.
- After cleaning, do not switch on the instrument when there is no termination to the optical output connector, to the optical fiber or to the attached device. The laser radiation is not visible to the human eye, but it can seriously damage your eyesight.

Why is it important to clean optical devices?

In transmission links optical fiber cores are about 9 µm (0.00035") in diameter. Dust and other particles, however, can range from tenths to hundredths of microns in diameter. Their comparative size means that they can cover a part of the end of a fiber core, and as a result will reduce the performance of your system.

Furthermore, the power density may burn dust into the fiber and cause additional damage (for example, 0 dBm optical power in a single mode fiber causes a power

density of approximately 16 million W/m^2). If this happens, measurements become inaccurate and non-repeatable.

Before you make any connection you must ensure that all cables and connectors are clean. If they are dirty, use the appropriate cleaning procedure.

When inserting the ferrule of a patchcord into a connector or an adapter, make sure that the fiber end does not touch the outside of the mating connector or adapter. Otherwise you will rub the fiber end against an unsuitable surface, producing scratches and dirt deposits on the surface of your fiber.

What materials do I need for proper cleaning?

You would need the following materials for proper cleaning:

Standard Cleaning Equipment

Before you can start your cleaning procedure you need the following standard equipments:

- Dust and shutter caps
- Isopropyl alcohol
- Cotton swabs
- Soft tissues
- Compressed air

For details on standard cleaning equipment, see Standard Cleaning Equipment (page 68).

Cleaning Instrument Housings

Use a dry and very soft cotton tissue to clean the instrument housing. Do not open the instruments as there is a danger of electric shock, or electrostatic discharge. Opening the instrument can cause damage to sensitive components, and in addition your warranty will be voided.

Standard Cleaning Equipment

Some Standard Cleaning Equipment is necessary for cleaning your instrument.

Dust and shutter caps

All of Keysight Technologies' lightwave instruments are delivered with either laser shutter caps or dust caps on the lightwave adapter. Any cables come with covers to protect the cable ends from damage or contamination.

We suggest these protected coverings should be kept on the equipment at all times, except when your optical device is in use. Be careful when replacing dust caps after use. Do not press the bottom of the cap onto the fiber too hard, as any dust in the cap can scratch or pollute your fiber surface.

If you need further dust caps, please contact your nearest Keysight Technologies sales office.

Isopropyl alcohol

This solvent is usually available from any local pharmaceutical supplier or chemist's shop.

If you use isopropyl alcohol to clean your optical device, do not immediately dry the surface with compressed air (except when you are cleaning very sensitive optical devices). This is because the dust and the dirt is solved and will leave behind filmy deposits after the alcohol is evaporated. You should therefore first remove the alcohol and the dust with a soft tissue, and then use compressed air to blow away any remaining filaments.

If possible avoid using denatured alcohol containing additives. Instead, apply alcohol used for medical purposes.

Never try to drink this alcohol, as it may seriously damage to your health.

Do not use any other solvents, as some may damage plastic materials and claddings. Acetone, for example, will dissolve the poxy used with fiber optic connectors. To avoid damage, only use isopropyl alcohol.

Cotton swabs

We recommend that you use swabs such as Q-tips or other cotton swabs normally available from local distributors of medical and hygiene products (for example, a supermarket or a chemist's shop). You may be able to obtain various sizes of swab. If this is the case, select the smallest size for your smallest devices.

Ensure that you use natural cotton swabs. Foam swabs will often leave behind filmy deposits after cleaning.

Use care when cleaning, and avoid pressing too hard onto your optical device with the swab. Too much pressure may scratch the surface, and could cause your device to become misaligned. It is advisable to rub gently over the surface using only a small circular movement.

Swabs should be used straight out of the packet, and never used twice. This is because dust and dirt in the atmosphere, or from a first cleaning, may collect on your swab and scratch the surface of your optical device.

Soft tissues

These are available from most stores and distributors of medical and hygiene products such as supermarkets or chemists' shops.

We recommend that you do not use normal cotton tissues, but multi-layered soft tissues made from non-recycled cellulose. Cellulose tissues are very absorbent and softer. Consequently, they will not scratch the surface of your device over time.

Use care when cleaning, and avoid pressing on your optical device with the tissue. Pressing too hard may lead to scratches on the surface or misalignment of your device. Just rub gently over the surface using a small circular movement.

Use only clean, fresh soft tissues and never apply them twice. Any dust and dirt from the air which collects on your tissue, or which has gathered after initial cleaning, may scratch and pollute your optical device.

Compressed air

Compressed air can be purchased from any laboratory supplier.

It is essential that your compressed air is free of dust, water and oil. Only use clean, dry air. If not, this can lead to filmy deposits or scratches on the surface of your connector. This will reduce the performance of your transmission system.

When spraying compressed air, hold the can upright. If the can is held at a slant, propellant could escape and dirty your optical device. First spray into the air, as the initial stream of compressed air could contain some condensation or propellant. Such condensation leaves behind a filmy deposit.

General Cleaning Procedure

Light Dirt

If you just want to clean away light dirt, observe the following procedure for all devices:

Use compressed air to blow away large particles.

Clean the device with a dry cotton swab.

Use compressed air to blow away any remaining filament left by the swab.

Heavy Dirt

If the above procedure is not enough to clean your instrument, follow one of the procedures below. Please consult How to clean connectors for the procedure relevant for this instrument.

If you are unsure of how sensitive your device is to cleaning, please contact the manufacturer or your sales distributor.

Additional Cleaning Information

For additional information on cleaning and safety matters for optical devices, refer the following document: https://literature.cdn.keysight.com/litweb/pdf/5989-4473EN.pdf

Firmware Upgrades

This section provides information about the firmware upgrade process for the N77--C optical attenuators.

You may need to upgrade firmware to enhance the usability and functionality of your instrument. New features may be available with new firmware revisions.

Firmware updates can be done by installing the firmware updates installation file, which can be downloaded from www.keysight.com.

CAUTION Ensure to execute the firmware update procedure only under conditions of reliable power and I/O connectivity to the instrument. For example, do not update firmware with an intermittent LAN connection, a loose power cord, or during a thunderstorm that may interrupt power. Loss of power or connectivity may cause the firmware update fail, possibly making instrument non-operational.

NOTE Updating the firmware will not affect your annual instrument calibration.

Requirements

To upgrade firmware for the N77--C, you require a PC, running Windows 10 on it.

Update Procedure

To update the firmware you need to download the current firmware which consist of two components:

Firmware Upload Utility

The latest firmware version (*.bin file)

NOTE This process could take a couple of minutes (5-10 minutes depending on the network speed).

Once you have copied both items to your computer, proceed as follows:

Run the **Firmware Update Utility** and select the device you want to update.

Browse to the location of the firmware that you just downloaded and open the file.

Press **Start**.

The update utility will copy the firmware update file on your local PC.

After the firmware has been updated, the instrument will automatically restart itself with the new software.

During the update process the **Status** and the **Active LED** will flash periodically.

Check the firmware version. Go to instrument's user interface **Home** tab and check for the firmware version.

Introduction to Programming

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

Descriptions for the actual commands for the instruments are given in the respective sections. The information in these sections is specific to the N77--C Optical Attenuators.

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).

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.

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 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>"; <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. The block represents an array of numbers.

Each number has the byte ordering least significant byte first, also called LSBfirst, little-endian or Intel byte ordering.

NOTE Note that within your program, calculations with wavelengths may require double-precision 64-bit floats to provide the desired resolution.

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. The parser starts if the LF character is received.

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 LF (hex 0A). 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. 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.

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 provides the description of these commands.

Common Command Summary

The following table provides a summary of the common commands.

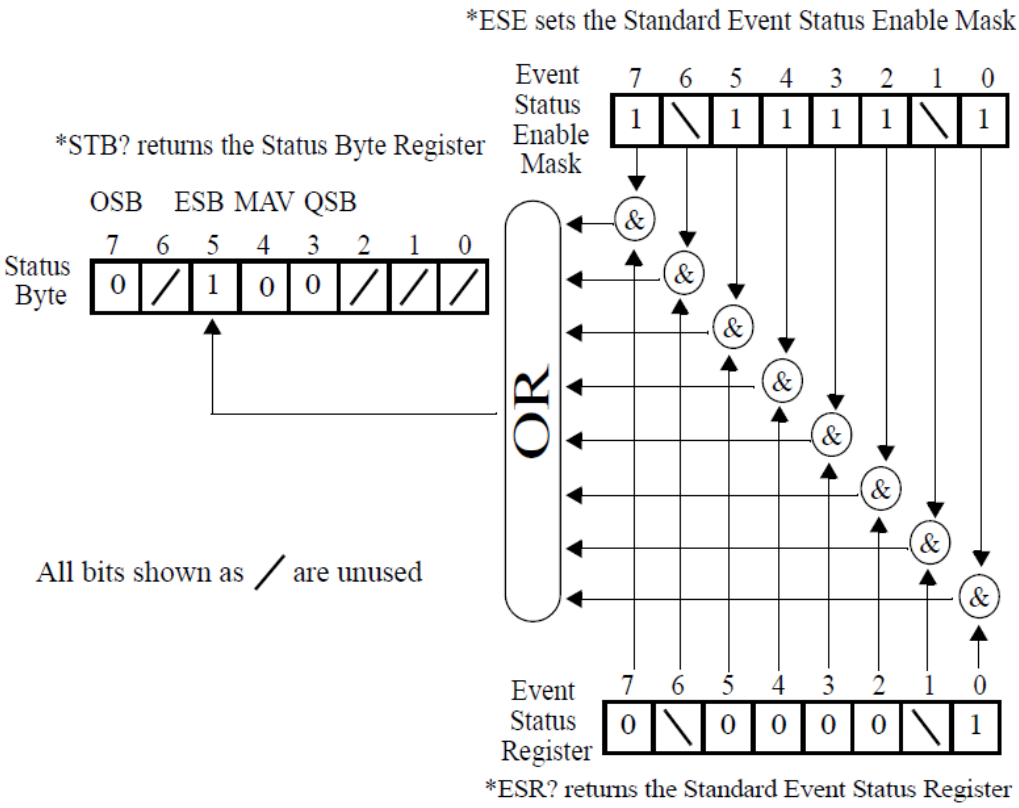
Command	Function
*CLS	Clear Status Command
*ESE	Standard Event Status Enable Command
*ESE?	Standard Event Status Enable Query
*ESR?	Standard Event Status Register Query
*IDN?	Identification Query
*OPC	Operation Complete Command
*OPC?	Operation Complete Query
*OPT?	Options Query
*RST	Reset Command
*STB?	Read Status Byte Query
*TST?	Self Test Query
*WAI	Wait Command

These commands are described in more detail in IEEE-Common Commands (page 82).

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?.

The following figure 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.



The SESR contains the information about events that are not channel specific. For details of the function of each bit of the SESR, see Standard Event Status Register.

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).

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

Status Model

Status Registers

Each node of the status circuitry has three registers:

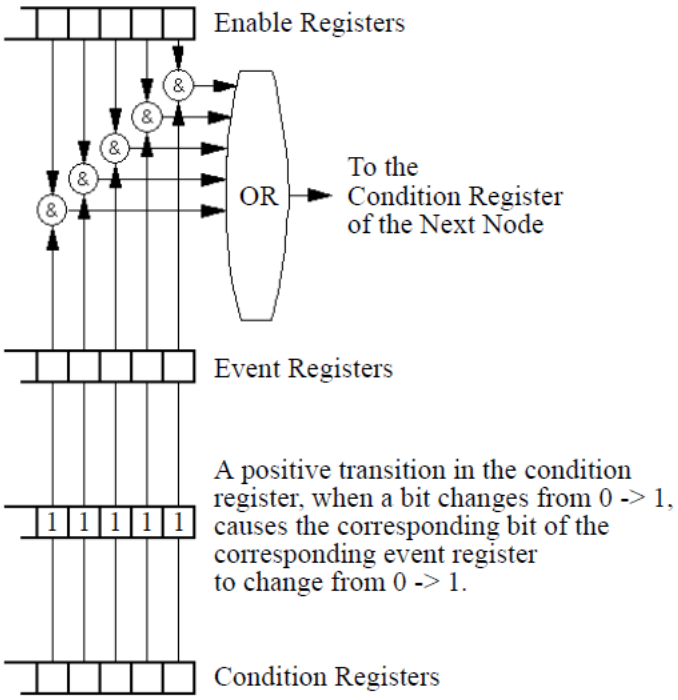
A condition register (CONDition), which contains the current status. This register is updated continuously. It is not changed by having its contents read.

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. The following figure describes how the Questionable Status Bit (QSB) and the Operational Status Bit (OSB) of the Status Byte Register are determined.



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.

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.

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 (page 77).

STATus subsystem commands that relate to the status model.

SYSTem subsystem commands that control the serial interface and internal data.

IEEE-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 provides the description of these IEEE common commands.

Command	Function	Reference
*CLS	Clear Status Command	*CLS (page 83)
*ESE	Standard Event Status Enable Command	*ESE (page 83)
*ESE?	Standard Event Status Enable Query	*ESE? (page 84)
*ESR?	Standard Event Status Register Query	*ESR? (page 84)
*IDN?	Identification Query	*IDN? (page 84)
*OPC	Operation Complete Command	*OPC (page 85)
*OPC?	Operation Complete Query	*OPC? (page 85)
*OPT?	Options Query	*OPT? (page 85)
*RST	Reset Command	*RST (page 86)
*STB?	Read Status Byte Query	*STB? (page 86)
*TST?	Self-Test Query	*TST? (page 87)
*WAI	Wait Command	*WAI (page 87)

*CLS

Syntax	*CLS
Description	The Clear Status (*CLS) command clears the status byte by emptying the error queue and clearing all the event registers (SESR) including the Data Questionable Event Register, the Standard Event Status Register, the Standard Operation Status Register and any other registers that are summarized in the status byte.
Parameters	none
Response	none
Example	*CLS

*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 *CLS commands.
Parameters	The bit value for the register (a 8-bit integer value):

Bit	Mnemonic	Decimal Value
7 (MSB)	Power On	128
6	Not Used	64
5	Command Error	32
4	Execution Error	16
3	Device Dependent Error	8
2	Query Error	4
1	Not Used	2
0 (LSB)	Operation Complete	1

Response	none
Example	*ESE 255

*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 8-bit integer value).
Example	*ESE? –> +255

*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 8-bit integer value):

Bit	Mnemonic	Decimal Value
7 (MSB)	Power On	128
6	Not used	64
5	Command Error	32
4	Execution Error	16
3	Device Dependent Error	8
2	Query Error	4
1	Not used	2
0 (LSB)	Operation Complete	1

Example	*ESR? -> 21

*IDN?

Syntax	*IDN?
Description	The IDeNtification query *IDN? gets the instrument identification over the interface.
Parameters	none
Response	The instrument identification. For example: MMMMMMMM manufacturer, Keysight Technologies mmmm instrument model number (for example N77--C)

	ssssssss	serial number
	rrrrrrrrrr	firmware revision level
Example	*IDN? -> Keysight Technologies, N77--C ,DE42100168	

*OPC

Syntax	*OPC
Description	Generates the OPC message in the standard event status register when all pending overlapped operations have been completed.
Parameters	none
Response	none
Example	*OPC

*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. 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.
Parameters	none
Response	1 is returned if the instrument is ready to execute a new operation. 0 is returned if the instrument is busy.
Example	*OPC? -> 1

*OPT?

Syntax	*OPT?
Description	The OPTions query *OPT? returns the options installed in your instrument.
Parameters	none
Response	Returns the part number of all installed options, separated by commas. Channels are listed starting with the lowest channel number, that is, channel 1.
Example	*OPT? -> N77--C, N77--C

*RST

Syntax	*RST
Description	The ReSeT command *RST reset setting (standard setting) stored internally. 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: Instrument interface address Service request enable register (SRE) Standard Event Status Enable Mask (SESEM) To prevent this, use the CONFigure Subsystem (page 110) command to keep the previously stored settings in non-volatile RAM.
Parameters	none
Response	none
Example	*RST

*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 8-bit signed integer value):

Bit	Mnemonic	Decimal Value
7 (MSB)	Operation Status (OSB)	128
6	Not used	64
5	Event Status Bit (ESB)	32
4	Message Available (MAV)	16
3	Questionable Status (QSB)	8
2	Not used	4
1	Not used	2
0	Not used	1

Example	*STB? -> +32

*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	Selftest failed 1 A value of zero indicates no errors.
Example	*TST? -> +0

*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 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. The Status subsystem includes the following commands:

Command	Reference
:STATus:OPERation[:EVENt]?	:STATus:OPERation[:EVENt]? (page 88)
:STATus:OPERation:CONDition?	:STATus:OPERation:CONDition? (page 89)

Command	Reference
:STATus:OPERation:ENABle	:STATus:OPERation:ENABle (page 89)
:STATus:OPERation:ENABle?	:STATus:OPERation:ENABle? (page 90)
:STATus[n]:OPERation[:EVENt]?	:STATus[n]:OPERation[:EVENt]? (page 90)
:STATus[n]:OPERation:CONDition?	:STATus[n]:OPERation:CONDition? (page 90)
:STATus[n]:OPERation:ENABle	:STATus[n]:OPERation:ENABle (page 91)
:STATus[n]:OPERation:ENABle?	:STATus[n]:OPERation:ENABle? (page 91)
:STATus:PRESet	:STATus:PRESet (page 92)
:STATus:QUEStionable[:EVENt]?	:STATus:QUEStionable[:EVENt]? (page 92)
:STATus:QUEStionable:CONDition?	:STATus:QUEStionable:CONDition? (page 92)
:STATus:QUEStionable:ENABle	:STATus:QUEStionable:ENABle (page 93)
:STATus:QUEStionable:ENABle?	:STATus:QUEStionable:ENABle? (page 93)
:STATus[n]:QUEStionable[:EVENt]?	:STATus[n]:QUEStionable[:EVENt]? (page 94)
:STATus[n]:QUEStionable:CONDition?	:STATus[n]:QUEStionable:CONDition? (page 94)
:STATus[n]:QUEStionable:ENABle	:STATus[n]:QUEStionable:ENABle (page 95)
:STATus[n]:QUEStionable:ENABle?	:STATus[n]:QUEStionable:ENABle? (page 95)

:STATus:OPERation[:EVENt]?

Syntax	:STATus:OPERation[:EVENt]?
Description	Returns the Operational Status Event Summary Register (OSESR).
Parameters	none
Response	The sum of the results for the channels (a 16-bit unsigned integer value, where 0 ≤ value ≤ 65535):

Bits	Mnemonics	Decimal Value
	N77--C	
9-15	Not used	
8	Not used	256
7	Attenuator 4 Summary	128
6	Attenuator 4 Summary	64
5	Attenuator 3 Summary	32
4	Attenuator 3 Summary	16
3	Attenuator 2 Summary	8
2	Attenuator 2 Summary	4
1	Attenuator 1 Summary	2

	0	Attenuator 1 Summary	1
Example	stat:oper? -> +0		

:STATus:OPERation:CONDition?

Syntax	:STATus:OPERation:CONDition?
Description	Reads the Operational Status Condition Summary Register.
Parameters	None
Response	The sum of the results for the individual channels (a 16-bit unsigned integer value, where 0 ≤ value ≤ 65535):

Bits	Mnemonics	Decimal Value
	N77--C	
9-15	Not used	
8	Not used	256
7	Attenuator 4 Summary	128
6	Attenuator 4 Summary	64
5	Attenuator 3 Summary	32
4	Attenuator 3 Summary	16
3	Attenuator 2 Summary	8
2	Attenuator 2 Summary	4
1	Attenuator 1 Summary	2
0	Attenuator 1 Summary	1

Example	stat:oper:cond? -> +0

:STATus:OPERation:ENABle

Syntax	:STATus:OPERation:ENABle<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 unsigned integer value (0 .. +65535) The default value is 65535.
Response	none
Example	stat:oper:enab 128

:STATus:OPERation:ENABle?

Syntax	:STATus:OPERation:ENABle?
Description	Returns the OSESM for the OSESR
Parameters	None
Response	The bit value for the operation enable mask as a 16-bit unsigned integer value (0 .. +65535)
Example	stat:oper:enab? -> +128

:STATus[n]:OPERation[:EVENt]?

Syntax	:STATus[n]:OPERation[:EVENt]?
Description	Returns the Operational Slot Status Event Register (OSSER) of channel n.
Parameters	None
Response	The results for the individual channel events (a 16-bit signed integer value, where 0 ≤ value ≤ 65535):

Bit	Mnemonic	Decimal Value
8-15	Not used	256
7	Channel n: offset (**λ**) type bit 2	128
6	Channel n: offset (**λ**) type bit 1	64
5	Channel n: offset (**λ**) enabled 32	32
4	Channel n: shutter open	16
3	Channel n: Zeroing ongoing	8
0-2	Not used	1-4

Example	stat0:oper? -> +0

:STATus[n]:OPERation:CONDition?

Syntax	:STATus[n]:OPERation:CONDition?
Description	Returns the Operational Slot Status Condition Register of channel n.
Parameters	None
Response	The results for the individual channel events (a 16-bit signed integer value, where 0 ≤ value ≤ 32767):

Bit	Mnemonic	Decimal Value
8-15	Not used	256
7	Channel n: offset (**λ**) type bit 2	128

	6	Channel n: offset (λ) type bit 1	64
	5	Channel n: offset (λ) enabled 32	32
	4	Channel n: shutter open	16
	3	Channel n: Zeroing ongoing	8
	0-2	Not used	1-4
Example	stat0:oper:cond? -> +0		

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.

:STATus[n]:OPERation:ENABle

Syntax	:STATus[n]:OPERation:ENABle<wsp><value>
Description	Sets the bits in the Operation Slot Status Enable Mask (OSSEM) for channel n that enable the contents of the Operation Slot Status Event Register (OSSER) for channel n to affect the OSESR. Setting a bit in this register to 1 enables the corresponding bit in the OSSER for channel n to affect bit n of the OSESR.
Parameters	The bit value for the OSSEM as a 16-bit unsigned integer value (0 .. +65535)
Response	None
Example	stat0:oper:enab 128

:STATus[n]:OPERation:ENABle?

Syntax	:STATus[n]:OPERation:ENABle?
Description	Returns the OSSEM of channel n
Parameters	None
Response	The bit value for the OSSEM as a 16-bit unsigned integer value (0 .. +65535)
Example	stat0:oper:enab? -> +128

:STATus:PRESet

Syntax	:STATus:PRESet
Description	Presets all bits in all OPERation and QUEStionable status systems to 0.
Parameters	None
Response	None
Example	stat:pres

:STATus:QUEStionable[:EVENt]?

Syntax	:STATus:QUEStionable[:EVENt]?
Description	Returns the Questionable Status Event Summary Register (QSESR).
Parameters	None
Response	The sum of the results for the QSESR as a 16-bit unsigned integer value (0 .. +65535):

Bits	Mnemonics	Decimal Value
	N77--C	
9-15	Not used	
8	Not used	256
7	Attenuator 4 Summary	128
6	Attenuator 4 Summary	64
5	Attenuator 3 Summary	32
4	Attenuator 3 Summary	16
3	Attenuator 2 Summary	8
2	Attenuator 2 Summary	4
1	Attenuator 1 Summary	2
0	Attenuator 1 Summary	1

Example	stat:oper? -> +0

:STATus:QUEStionable:CONDition?

Syntax	:STATus:QUEStionable:CONDition?
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 unsigned integer value (0 .. +65535):

Bits	Mnemonics	Decimal Value
	N77--C	
9-15	Not used	
8	Not used	256
7	Attenuator 4 Summary	128
6	Attenuator 4 Summary	64
5	Attenuator 3 Summary	32
4	Attenuator 3 Summary	16
3	Attenuator 2 Summary	8
2	Attenuator 2 Summary	4
1	Attenuator 1 Summary	2
0	Attenuator 1 Summary	1

Example	stat:ques:cond? -> +0

:STATus:QUEStionable:ENABle

Syntax	:STATus:QUEStionable:ENABle<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 unsigned integer value (0 .. +65535) The default value is 65535.
Response	None
Example	stat:ques:enab 128

:STATus:QUEStionable:ENABle?

Syntax	:STATus:QUEStionable:ENABle?
Description	Returns the QSESM for the event register
Parameters	None
Response	The bit value for the QSEM as a 16-bit unsigned integer value (0 .. +65535)
Example	stat:ques:enab? -> +128

:STATus[n]:QUEStionable[:EVENt]?

Syntax	:STATus[n]:QUEStionable[:EVENt]?
Description	Returns the questionable status of channel n - the Questionable Channel Status Event Register (QSSER).
Parameters	None
Response	The results for the individual channel events (a 16-bit unsigned integer value, where 0 ≤ value ≤ 65535):

Bit	Mnemonic	Decimal Value
6-15	Not used	64-256
5	Channel n: Module has been out of specification	32
2	Channel n: Temperature has been out of range	4
1	Channel n: A Zeroing operation has failed	2
0	Channel n: Excessive Value has occurred	1

Every nth bit is the summary of channel n.

Example	stat0:oper? -> +0

:STATus[n]:QUEStionable:CONDition?

Syntax	:STATus[n]:QUEStionable:CONDition?
Description	Returns the Questionable Slot Status Condition Register for channel n.
Parameters	None
Response	The results for the individual channel events (a 16-bit unsigned integer value, where 0 ≤ value ≤ 65535):

Bit	Mnemonic	Decimal Value
6-15	Not used	64-256
5	Channel n: Module has been out of specification	32
2	Channel n: Temperature has been out of range	4
1	Channel n: A Zeroing operation has failed	2

	0 Channel n: Excessive Value has occurred Every nth bit is the summary of channel n.	1
Example	stat1:ques:cond? -> +0	

:STATus[n]:QUEStionable:ENABle

Syntax	:STATus[n]:QUEStionable:ENABle<wsp><value>
Description	Sets the bits in the Questionable Slot Status Enable Mask (QSSEM) for channel n that enable the contents of the Questionable Slot Status Register (QSSR) for channel n to affect the QSESR. Setting a bit in this register to 1 enables the corresponding bit in the QSSER for channel n to affect bit n of the QSESR.
Parameters	The bit value for the QSSEM as a 16-bit unsigned integer value (0 .. +65535)
Response	None
Example	stat0:ques:enab 128

:STATus[n]:QUEStionable:ENABle?

Syntax	:STATus[n]:QUEStionable:ENABle?
Description	Returns the QSSEM for channel n
Parameters	None
Response	The bit value for the QSSEM as a 16-bit integer value (0 .. +65535)
Example	stat0:ques:enab? -> +128

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).

:SYSTem	Reference
:DATE?	:SYSTem:DATE? (page 96)
:DATE	:SYSTem:DATE (page 96)

:SYSTem	Reference
:HELP:HEADers?	:SYSTem:HELP:HEADers? (page 96)
:HELP:ERRors?	:SYSTem:HELP:ERRors? (page 97)
:PRESet	:SYSTem:PRESet (page 97)
:TIME	:SYSTem:TIME (page 97)
:TIME?	:SYSTem:TIME? (page 98)
:ERRor[:NEXT]?	:SYSTem:ERRor[:NEXT]? (page 98)
:ERRor:COUNt?	:SYSTem:ERRor:COUNt? (page 98)
:VERSion?	:SYSTem:VERSion? (page 98)
:REBoot	:SYSTem:REBoot (page 99)

:SYSTem:DATE?

Syntax	:SYSTem:DATE?
Description	Returns the instrument's internal date.
Parameters	None
Response	The date in the format year, month, day
Example	syst:date? -> +2019,+1,+26

:SYSTem:DATE

Syntax	:SYSTem:DATE<wsp><year>,<month>,<day>
Description	Sets the instrument's internal date.
Parameters	The date in the format year, month, day
Response	None
Example	syst:date 2019, 1, 26

:SYSTem:HELP:HEADers?

Syntax	:SYSTem:HELP:HEADers?
Description	Returns a list of SCPI commands.
Parameters	None
Response	Returns a list of SCPI commands
Example	syst:help:head? -> Returns a list of all SCPI commands

:SYSTem:HELP:ERRors?

Syntax	:SYSTem:HELP:ERRors?
Description	Return an overview about all Errorcodes and a short description.
Parameters	None
Response	String list of error codes
Example	syst:help:err? -> +0,"No error",-100,"Command error",-101,"Invalid character",-102,"Syntax error",-103,"Invalid separator",-104,"Data type error",-105,"GET not allowed",-108,"Parameter not allowed",...

:SYSTem:PRESet

Syntax	:SYSTem:PRESet
Description	Sets the instrument to the standard settings. The following are not affected by this command: 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). Pressing the "LAN Reset" button for a short time has the same effect. Long pressing of the "LAN Reset" button resets the LAN Parameter.
Parameters	None
Response	None
Example	SYST:PRES

:SYSTem:TIME

Syntax	:SYSTem:TIME<wsp><hour>,<minute>,<second>
Description	Sets the instrument's internal time.
Parameters	24-hour time format: hours (0-23), minutes (0-59), seconds (0-59)
Response	none
Example	:syst:time 20,15,30

: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 (24 hour time format).
Example	syst:time? -> +20,+15,+30

:SYSTem:ERRor[:NEXT]?

Syntax	:SYSTem:ERRor[:NEXT]?
Description	Returns the next error from the error queue.
Parameters	None
Response	The number of the latest error, and its meaning. Note: Every connection uses its own error queue
Example	syst:err? -> -113,"Undefined header"

:SYSTem:ERRor:COUNt?

Syntax	:SYSTem:ERRor:COUNt?
Description	Returns the total no. of errors.
Parameters	None
Response	The total count of errors.
Example	syst:err:coun? -> 20

: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? –> 1999.0

:SYSTem:REBoot

Syntax	:SYSTem:REBoot
Description	Reboots the instrument
Parameters	None
Response	None
Example	syst:reb

System Communicate - The :SYST:COMMunicate Subsystem

This section provides the description of the following system commands.

:SYSTem:COMMunicate	Reference
:ETHernet:AUTOip:ENABle?	:SYSTem:COMMunicate:ETHernet:AUTOip:ENABle? (page 101)
:ETHernet:AUTOip:ENABle	:SYSTem:COMMunicate:ETHernet:AUTOip:ENABle (page 101)
:ETHernet:CANCel	:SYSTem:COMMunicate:ETHernet:CANCel (page 101)
:ETHernet:DGATeway	:SYSTem:COMMunicate:ETHernet:DGATeway (page 101)
:ETHernet:DGATeway?	:SYSTem:COMMunicate:ETHernet:DGATeway? (page 102)
:ETHernet:DGATeway:CURRent?	:SYSTem:COMMunicate:ETHernet:DGATeway:CURRent? (page 102)
:ETHernet:DHCP:ENABle?	:SYSTem:COMMunicate:ETHernet:DHCP:ENABle? (page 102)
:ETHernet:DHCP:ENABle	:SYSTem:COMMunicate:ETHernet:DHCP:ENABle (page 102)
:ETHernet:DOMainname?	:SYSTem:COMMunicate:ETHernet:DOMainname? (page 103)
:ETHernet:DOMainname	:SYSTem:COMMunicate:ETHernet:DOMainname (page 103)
:ETHernet:DOMainname:CURRent?	:SYSTem:COMMunicate:ETHernet:DOMainname:CURRent? (page 103)
:ETHernet:HOSTname?	:SYSTem:COMMunicate:ETHernet:HOSTname? (page

:SYSTem:COMMunicate	Reference
	103)
:ETHernet:HOSTname	:SYSTem:COMMunicate:ETHernet:HOSTname (page 103)
:ETHer-net:HOSTname:CURRent?	:SYSTem:COMMu-nicate:ETHernet:HOSTname:CURRent? (page 104)
:ETHernet:NSERver?	:SYSTem:COMMunicate:ETHernet:NSERver? (page 104)
:ETHernet:NSERver	:SYSTem:COMMunicate:ETHernet:NSERver (page 104)
:ETHernet:NSERver:CURRent?	:SYSTem:COMMunicate:ETHernet:NSERver:CURRent? (page 105)
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:ETHernet:IPADdress?	:SYSTem:COMMunicate:ETHernet:IPADdress? (page 105)
:ETHernet:IPADdress	:SYSTem:COMMunicate:ETHernet:IPADdress (page 105)
:ETHernet:IPADdress:CURRent?	:SYSTem:COMMu-nicate:ETHernet:IPADdress:CURRent? (page 106)
:ETHernet:MACaddress?	:SYSTem:COMMunicate:ETHernet:MACaddress? (page 106)
:ETHernet:NTP:ENABle?	:SYSTem:COMMunicate:ETHernet:NTP:ENABle? (page 106)
:ETHernet:NTP:ENABle	:SYSTem:COMMunicate:ETHernet:NTP:ENABle (page 106)
:ETHernet:NTP:SERVer?	:SYSTem:COMMunicate:ETHernet:NTP:SERVer? (page 107)
:ETHernet:NTP:SERVer	:SYSTem:COMMunicate:ETHernet:NTP:SERVer (page 107)
:ETHernet:DESCription?	:SYSTem:COMMunicate:ETHernet:DESCription? (page 107)
:ETHernet:DESCription	:SYSTem:COMMunicate:ETHernet:DESCription (page 107)
:ETHernet:RESet	:SYSTem:COMMunicate:ETHernet:RESet (page 108)
:ETHernet:RESTart	:SYSTem:COMMunicate:ETHernet:RESTart (page 108)
:ETHernet:SAVE	:SYSTem:COMMunicate:ETHernet:SAVE (page 108)
:ETHernet:SMASk?	:SYSTem:COMMunicate:ETHernet:SMASk? (page 109)
:ETHernet:SMASk	:SYSTem:COMMunicate:ETHernet:SMASk (page 109)
:ETHernet:SMASk:CURRent?	:SYSTem:COMMunicate:ETHernet:SMASk:CURRent? (page 109)

:SYSTem:COMMunicate:ETHernet:AUTOip:ENABle?

Syntax	:SYSTem:COMMunicate:ETHernet:AUTOip:ENABle?
Description	Check whether Automatic IP addressing is enabled or disabled.
Parameters	None
Response	Boolean (0 | 1)
Example	:SYST:COMM:ETH:AUTO:ENAB? -> 1

:SYSTem:COMMunicate:ETHernet:AUTOip:ENABle

Syntax	:SYSTem:COMMunicate:ETHernet:AUTOip:ENABle
Description	Enable or disable whether IP addresses can be created automatically by the instrument. Automatic IP addressing is only used if DHCP is enabled, but the instrument cannot find a DHCP server.
Parameters	Boolean (0 | 1 | OFF | ON)
Response	None
Example	:SYST:COMM:ETH:AUTO:ENAB 1

:SYSTem:COMMunicate:ETHernet:CANCel

Syntax	:SYSTem:COMMunicate:ETHernet:CANCel
Description	Undo all changes to the network parameters that have been made since the last save, reboot or ":syst:comm:eth:restart" command.
Parameters	None
Response	None
Example	:SYST:COMM:ETH:CANC

:SYSTem:COMMunicate:ETHernet:DGATeway

Syntax	:SYSTem:COMMunicate:ETHernet:DGATeway
Description	Set the default gateway.
Parameters	string (Up to four groups of up to 3 digits, groups separated by ".". Groups with leading zeroes are interpreted as octal numbers.)
Response	None

Example	:syst:comm:eth:dgat “192.168.101.11“

:SYSTem:COMMunicate:ETHernet:DGATeway?

Syntax	SYSTem:COMMunicate:ETHernet:DGATeway?
Description	Get the default gateway.
Parameters	None
Response	String
Example	:syst:comm:eth:dgat? -> “192.168.101.11“

:SYSTem:COMMunicate:ETHernet:DGATeway:CURRent?

Syntax	:SYSTem:COMMunicate:ETHernet:DGATeway:CURRent?
Description	Get the currently used default gateway.
Parameters	None
Response	String
Example	:syst:comm:eth:dgat:curr? -> “192.168.101.11“

:SYSTem:COMMunicate:ETHernet:DHCP:ENABle?

Syntax	:SYSTem:COMMunicate:ETHernet:DHCP:ENABle?
Description	Check whether DHCP is enabled or disabled.
Parameters	None
Response	Boolean (0 | 1)
Example	:syst:comm:eth:dhcp:enab? -> 1

:SYSTem:COMMunicate:ETHernet:DHCP:ENABle

Syntax	:SYSTem:COMMunicate:ETHernet:DHCP:ENABle
Description	Enable or disable DHCP
Parameters	Boolean (0 | 1 | OFF | ON)
Response	None
Example	:syst:comm:eth:dhcp:enab ON

:SYSTem:COMMunicate:ETHernet:DOMainname?

Syntax	:SYSTem:COMMunicate:ETHernet:DOMainname?
Description	Get the domain name.
Parameters	None
Response	String
Example	:syst:comm:eth:dom? -> ".companyname.com"

:SYSTem:COMMunicate:ETHernet:DOMainname

Syntax	SYSTem:COMMunicate:ETHernet:DOMainname
Description	Set the domain name (used if DHCP is disabled).
Parameters	String
Response	None
Example	:syst:comm:eth:dom ".companyname.com"

:SYSTem:COMMunicate:ETHernet:DOMainname:CURRent?

Syntax	:SYSTem:COMMunicate:ETHernet:DOMainname:CURRent?
Description	Get the currently used domain name.
Parameters	None
Response	String
Example	:syst:comm:eth:dom:curr? -> ".companyame.com"

:SYSTem:COMMunicate:ETHernet:HOSTname?

Syntax	:SYSTem:COMMunicate:ETHernet:HOSTname?
Description	Get the host name.
Parameters	None
Response	String
Example	:syst:comm:eth:host? -> "K-N77--C-00001"

:SYSTem:COMMunicate:ETHernet:HOSTname

Syntax	:SYSTem:COMMunicate:ETHernet:HOSTname

Description	Set the host name.
Parameters	string (maximum 19 characters, though not all characters can be used) The default host name is K-P...P-S...S; where P...P is the product Number, and S...S is as many of the last digits of the serial number as it takes to get a 15 character host name. If you set an empty host name (""), the host name will be set to its default value.
Response	None
Example	:syst:comm:eth:host “K-N77--C-00001”

:SYSTem:COMMunicate:ETHernet:HOSTname:CURRent?

Syntax	:SYSTem:COMMunicate:ETHernet:HOSTname:CURRent?
Description	Get the current host name.
Parameters	None
Response	String
Example	:syst:comm:eth:host:curr? -> "K-N77--C-00001"

:SYSTem:COMMunicate:ETHernet:NSERver?

Syntax	:SYSTem:COMMunicate:ETHernet:NSERver?
Description	Get the defined (DNS) nameserver for name resolution.
Parameters	None
Response	IP Address String
Example	:syst:comm:eth:nser? -> "1.1.1.1", "2.2.2.2"

:SYSTem:COMMunicate:ETHernet:NSERver

Syntax	:SYSTem:COMMunicate:ETHernet:NSERver
Description	Set one or two nameservers for name resolution. (used if DHCP is disabled).
Parameters	IP Address String
Response	None
Example	:syst:comm:eth:nser "1.1.1.1"

:SYSTem:COMMunicate:ETHernet:NSERver:CURRent?

Syntax	:SYSTem:COMMunicate:ETHernet:NSERver:CURRent?
Description	Get the DNS server addresses assigned from your DHCP sever (this is only valide if DHCP is available and enabled.
Parameters	None
Response	IP Address String
Example	:syst:comm:eth:nser:curr? -> "10.127.72.11","10.127.90.11"

:SYSTem:COMMunicate:ETHernet:IDN

Syntax	:SYSTem:COMMunicate:ETHernet:IDN
Description	The LAN LED on the front panel of the instrument flashes for identification.
Parameters	Boolean (0 | 1 | OFF | ON)
Response	None
Example	:syst:comm:eth:idn 1

:SYSTem:COMMunicate:ETHernet:IPADdress?

Syntax	:SYSTem:COMMunicate:ETHernet:IPADdress?
Description	Get the manually set IP address of the system.
Parameters	None
Response	String
Example	:syst:comm:eth:ipad? -> “192.132.13.2”

:SYSTem:COMMunicate:ETHernet:IPADdress

Syntax	:SYSTem:COMMunicate:ETHernet:IPADdress
Description	Set the IP address of the system manually (used if DHCP is disabled).
Parameters	String (Up to four groups of up to 3 digits, groups separated by ".". Groups with leading zeroes are interpreted as octal numbers.)
Response	None
Example	:syst:comm:eth:ipad “192.132.13.2”

:SYSTem:COMMunicate:ETHernet:IPADdress:CURRent?

Syntax	:SYSTem:COMMunicate:ETHernet:IPADdress:CURRent?
Description	Get the current IP address of the instrument.
Parameters	None
Response	String
Example	:syst:comm:eth:ipad:curr? -> “192.132.13.2”

:SYSTem:COMMunicate:ETHernet:MACaddress?

Syntax	:SYSTem:COMMunicate:ETHernet:MACaddress?
Description	Get the MAC address of the network adapter.
Parameters	None
Response	String (hexadecimal value).
Example	:syst:comm:eth:mac? -> "00-07-E0-14-AE-08"

:SYSTem:COMMunicate:ETHernet:NTP:ENABle?

Syntax	:SYSTem:COMMunicate:ETHernet:NTP:ENABle?
Description	Returns the usage of a NTP Server
Parameters	None
Response	Boolean (0 | 1)
Example	:syst:comm:eth:ntp:enab? -> 1

:SYSTem:COMMunicate:ETHernet:NTP:ENABle

Syntax	:SYSTem:COMMunicate:ETHernet:NTP:ENABle
Description	Disables or enables instrument's use of NTP. The acronym NTP stands for Network Time Protocol, a protocol for clock synchronization between computer systems.
Parameters	Boolean (0 | 1)
Response	None
Example	:syst:comm:eth:ntp:enab 1

:SYSTem:COMMunicate:ETHernet:NTP:SERVer?

Syntax	:SYSTem:COMMunicate:ETHernet:NTP:SERVer?
Description	Get the defined Network Time Protocol (NTP) server for clock synchronization.
Parameters	None
Response	Address String
Example	:syst:comm:eth:ntp:serv? -> "pool.ntp.org"

:SYSTem:COMMunicate:ETHernet:NTP:SERVer

Syntax	:SYSTem:COMMunicate:ETHernet:NTP:SERVer
Description	Get the defined Network Time Protocol (NTP) server for clock synchronization.
Parameters	Address String
Response	None
Example	:syst:comm:eth:ntp:serv "pool.ntp.org"

:SYSTem:COMMunicate:ETHernet:DESCription?

Syntax	:SYSTem:COMMunicate:ETHernet:DESCription?
Description	Get the desired mDNS service name.
Parameters	None
Example	:syst:comm:eth:desc? -> "Keysight N77--C - 00001"

:SYSTem:COMMunicate:ETHernet:DESCription

Syntax	:SYSTem:COMMunicate:ETHernet:DESCription
Description	Set the desired mDNS service name.
Parameters	Quoted string of up to 260 characters
Response	None
Example	:syst:comm:eth:desc "Keysight N77--C - 00001"

:SYSTem:COMMunicate:ETHernet:RESet

Syntax	:SYSTem:COMMunicate:ETHernet:RESet
Description	DHCP On AutoIP On NTP Off Hostname is a concatenation of product number and serial number. The password for the web based LAN configuration interface is reset to a blank password. Press the "LAN Reset" button for a long time has the same effect. Pressing the "LAN Reset" button for a short time is the same as system:preset.
Parameters	None
Response	None
Example	:syst:comm:eth:res

:SYSTem:COMMunicate:ETHernet:RESTart

Syntax	:SYSTem:COMMunicate:ETHernet:RESTart
Description	Restart the system's network interface with the new parameters. This command only works if the instrument has a working network connection at the time the command is issued. If not you either have to wait until the instrument decides on an IP address using AutoIP or reboot the instrument.
Parameters	None
Response	String
Example	:syst:comm:eth:rest

:SYSTem:COMMunicate:ETHernet:SAVE

Syntax	:SYSTem:COMMunicate:ETHernet:SAVE
Description	Save the system's network interface parameters.
Parameters	None
Response	None
Example	:syst:comm:eth:save

:SYSTem:COMMunicate:ETHernet:SMASk?

Syntax	:SYSTem:COMMunicate:ETHernet:SMASk?
Description	Get the subnet mask.
Parameters	None
Response	String
Example	:syst:comm:eth:smas? -> “255.255.255.0”

:SYSTem:COMMunicate:ETHernet:SMASk

Syntax	:SYSTem:COMMunicate:ETHernet:SMASk
Description	Set the subnet mask.
Parameters	String (Up to four groups of up to 3 digits, groups separated by ".". Groups with leading zeroes are interpreted as octal numbers.)
Response	None
Example	:syst:comm:eth:smas “255.255.255.0“

:SYSTem:COMMunicate:ETHernet:SMASk:CURRent?

Syntax	:SYSTem:COMMunicate:ETHernet:SMASk:CURRent?
Description	Get the currently used subnet mask.
Parameters	None
Response	String
Example	:syst:comm:eth:smas:curr? -> “255.255.255.0”

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:

CONFigure subsystem commands that control all instruments.

FETCh, INITiate and READ subsystems let you control measurement parameters for the Optical Attenuators and Return Loss instruments.

INPUt subsystem commands that control Optical Attenuators.

SENSe and SLOT subsystem commands that control Optical Attenuators and Return Loss instruments.

TRIGger subsystem commands that control triggering of the Optical Switch and the Optical Attenuators.

ROUTe subsystem commands that control the Optical Switch.

CONFigure Subsystem

This section provides the description of the following commands.

Command	Reference
:CONFigure[n]:OFFSet:WAVelength:STATe	:CONFigure[n]:OFFSet:WAVelength:STATe (page 111)
:CONFigure[n]:OFFSet:WAVelength:STATe?	:CONFigure [n]:OFFSet:WAVelength:STATe? (page 111)
:CONFigure[n]:OFFSet:WAVelength:TABle?	:CONFigure[n]:OFFSet:WAVelength:TABle? (page 111)
:CONFigure[n]:OFFSet:WAVelength:TABle:SIZe?	:CONFigure [n]:OFFSet:WAVelength:TABle:SIZe? (page 112)
:CONFigure[n]:OFFSet:WAVelength:VALue	:CONFigure[n]:OFFSet:WAVelength:VALue (page 112)
:CONFigure [n]:OFFSet:WAVelength:VALue:DELete:ALL	:CONFigure [n]:OFFSet:WAVelength:VALue:DELete:ALL (page 112)

:CONFigure[n]:OFFSet:WAVelength:STATe

Syntax	:CONFigure[n]: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.

:CONFigure[n]:OFFSet:WAVelength:STATe?

Syntax	:CONFigure[n]: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
Affects	All attenuator modules.

:CONFigure[n]:OFFSet:WAVelength:TABle?

Syntax	:CONFigure[n]: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? -> binary block interpreted as, for example: 1.55e-6 | 12 | 1.7e-6 |3.4 |.....

Affects	All attenuator modules.

:CONFigure[n]:OFFSet:WAVelength:TABle:SIZe?

Syntax	:CONFigure[n]: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 -> 1000 entries) MIN - Queries the minimum size of the offset table. (should -> 0)
Response	4 byte unsigned integer; offset table size.
Example	CONF1:OFFS:WAV:TAB:SIZE? -> 50
Affects	All attenuator modules.

:CONFigure[n]:OFFSet:WAVelength:VALue

Syntax	:CONFigure[n]: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>. 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. $P_{Offset(\lambda)}(dB) = P_{att}(dBm) - P_{ext}(dBm)$
Response	None
Example	CONF1:OFFS:WAV:VAL +1.55000000E-006,TOREF
Affects	All attenuator modules (TOREF applicable to N7752C).

:CONFigure[n]:OFFSet:WAVelength:VALue:DELete:ALL

Syntax	:CONFigure[n]:OFFSet:WAVelength:VALue:DELete:ALL
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.

FETCh Subsystem

The FETCh subsystem includes the following commands:

Command	Reference
:FETCh[n][:SCALar]:POWer[:DC]?	:FETCh[n][:SCALar]:POWer[:DC]? (page 113)
:FETCh[n][:SCALar]:POWer[:DC]:MAX?	:FETCh[n][:SCALar]:POWer[:DC]:MAX?
:FETCh[n][:SCALar]:POWer[:DC]:MIN?	:FETCh[n][:SCALar]:POWer[:DC]:MIN?
:FETCh[n][:SCALar]:POWer[:DC]:EXTRema:RESet	:FETCh[n][:SCALar]:POWer[:DC]:EXTRema:RESet
:FETCh[n][:SCALar]:POWer[:DC]:ALL?	:FETCh[n][:SCALar]:POWer[:DC]:ALL?
:FETCh[n][:SCALar]:POWer[:DC]:ALL:CSV?	:FETCh[n][:SCALar]:POWer[:DC]:ALL:CSV?
:FETCh[n][:SCALar]:POWer[:DC]:ALL:CONFig?	:FETCh[n][:SCALar]:POWer[:DC]:ALL:CONFig? (page 115)

:FETCh[n][:SCALar]:POWer[:DC]?

Syntax	:FETCh[n][:SCALar]:POWer[:DC]?
Description	Returns the previous power measured. Any subsequent FETCh command will return the same value, until a new power is measured depending on used average time.
Parameters	None
Response	The current value as a float value in dBm,W or dB. 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

:FETCh[n][:SCALar]:POWer[:DC]:MAX?

Syntax	:FETCh[n][:SCALar]:POWer[:DC]:MAX?
Description	Returns the maximum power value since the reset.
Parameters	None
Response	Maximum power value
Example	fetc1:pow:max? -> +3.47480224E-03

:FETCh[n][:SCALar]:POWer[:DC]:MIN?

Syntax	:FETCh[n][:SCALar]:POWer[:DC]:MIN?
Description	Returns the minimum power value since the reset.
Parameters	None
Response	Minimum power value
Example	fetc1:pow:max? -> +3.47375195E-03

:FETCh[n][:SCALar]:POWer[:DC]:EXTRema:RESet

Syntax	:FETCh[n][:SCALar]:POWer[:DC]:EXTRema:RESet
Description	Resets the maximum and minimum power values
Parameters	None
Response	None
Example	fetc1:pow:extr:res

:FETCh[n][:SCALar]:POWer[:DC]:ALL?

Syntax	:FETCh[n][:SCALar]:POWer[:DC]:ALL?
Description	Returns ALL previous power measured. Any subsequent FETCh command will return the same value, until a new power is measured depending on used average time.
Parameters	None
Response	4-byte Intel float values in a binary block in Intel byte order. The values are ordered by channel. Data values are always in Watt.
Example	fetc:pow:all? -> interpreted as +1.33555600E-006|+1.34789100E-006|+1.37456900E-006

:FETCh[n][:SCALar]:POWer[:DC]:ALL:CSV?

Syntax	:FETCh[n][:SCALar]:POWer[:DC]:ALL:CSV?
Description	Returns ALL previous power measured. Any subsequent FETCh command will return the same value, until a new power is measured depending on used average time.
Parameters	None
Response	String containing the power values from each available channel in a comma separated format. Data values are always in Watt.
Example	fetc:pow:all:CSV? " -> +1.33555600E-06, +1.34789100E-06, +1.37456900E-06"

:FETCh[n][:SCALar]:POWer[:DC]:ALL:CONFig?

Syntax	:FETCh[n][:SCALar]:POWer[:DC]:ALL:CONFig?
Description	Returns the channel and channel numbers for all available power meter channels. Use this command to match returned power values to the appropriate channel 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 channel number, the second value is always 1.
Example	fetc:pow:all:conf? -> interpreted as 1,1|2,1|3,1|4,1 This 16-byte block means that there are four power meters present: Channel 1, 1 Channel 2, 1 Channel 3, 1 Channel 4, 1

INPUt Subsystem

The INPUt subsystem includes the following commands:

Command	Reference
:INPut[n]:ATTenuation	:INPut[n]:ATTenuation (page 116)
:INPut[n]:ATTenuation?	:INPut[n]:ATTenuation? (page 117)
:INPut[n]:ATTenuation:ALL	:INPut[n]:ATTenuation:ALL (page 117)
:INPut[n]:ATTenuation:SPEed	:INPut[n]:ATTenuation:SPEed (page 117)
:INPut[n]:ATTenuation:SPEed?	:INPut[n]:ATTenuation:SPEed? (page 118)
:INPut[n]:ATTenuation:SWEep:STARt	:INPut[n]:ATTenuation:SWEep:STARt (page 118)
:INPut[n]:ATTenuation:SWEep:STARt?	:INPut[n]:ATTenuation:SWEep:STARt? (page 118)
:INPut[n]:ATTenuation:SWEep:SETTling	:INPut[n]:ATTenuation:SWEep:SETTling (page 119)
:INPut[n]:ATTenuation:SWEep:SETTling?	:INPut[n]:ATTenuation:SWEep:SETTling? (page 119)
:INPut[n]:ATTenuation:SWEep:STOP	:INPut[n]:ATTenuation:SWEep:STOP (page 119)
:INPut[n]:ATTenuation:SWEep:STOP?	:INPut[n]:ATTenuation:SWEep:STOP? (page 119)
:INPut[n]:ATTenuation:SWEep:REPeat	:INPut[n]:ATTenuation:SWEep:REPeat (page 120)
:INPut[n]:ATTenuation:SWEep:REPeat?	:INPut[n]:ATTenuation:SWEep:REPeat? (page 120)
:INPut[n]:ATTenuation:SWEep:STEP	:INPut[n]:ATTenuation:SWEep:STEP (page 120)

Command	Reference
:INPut[n]:ATTenuation:SWEep:STEP?	:INPut[n]:ATTenuation:SWEep:STEP? (page 120)
:INPut[n]:ATTenuation:SWEep:DWELl	:INPut[n]:ATTenuation:SWEep:DWELl (page 121)
:INPut[n]:ATTenuation:SWEep:DWELl?	:INPut[n]:ATTenuation:SWEep:DWELl? (page 121)
:INPut[n]:ATTenuation:SWEep:CYCLes	:INPut[n]:ATTenuation:SWEep:CYCLes (page 121)
:INPut[n]:ATTenuation:SWEep:CYCLes?	:INPut[n]:ATTenuation:SWEep:CYCLes? (page 121)
:INPut[n]:ATTenuation:SWEep[:STATe]	:INPut[n]:ATTenuation:SWEep[:STATe] (page 122)
:INPut[n]:ATTenuation:SWEep[:STATe]?	:INPut[n]:ATTenuation:SWEep[:STATe]? (page 122)
:INPut[n]:ATTenuation:SWEep:FLAG?	:INPut[n]:ATTenuation:SWEep:FLAG? (page 122)
:INPut[n]:ATTenuation:SWEEp:EXPectedtriggers?	:INPut[n]:ATTenuation:SWEep:EXPectedtriggers? (page 123)
:INPut[n]:ATTenuation:UCALibration	:INPut[n]:ATTenuation:UCALibration (page 123)
:INPut[n]:ATTenuation:UCALibration?	:INPut[n]:ATTenuation:UCALibration? (page 124)
:INPut[n]:ATTenuation:UCALibration:ENABle	:INPut[n]:ATTenuation:UCALibration:ENABle (page 124)
:INPut[n]:ATTenuation:UCALibration:ENABle?	:INPut[n]:ATTenuation:UCALibration:ENABle? (page 124)
:INPut[n]:ATTenuation:UCALibration:PREset	:INPut[n]:ATTenuation:UCALibration:PREset (page 124)
:INPut[n]:OFFSet	:INPut[n]:OFFSet (page 125)
:INPut[n]:OFFSet?	:INPut[n]:OFFSet? (page 125)
:INPut[n]:OFFSet:DISPlay	:INPut[n]:OFFSet:DISPlay (page 125)
:INPut[n]:OFFSet:POWermeter	:INPut[n]:OFFSet:POWermeter (page 126)
:INPut[n]:WAVelength	:INPut[n]:WAVelength (page 126)
:INPut[n]:WAVelength?	:INPut[n]:WAVelength? (page 126)
:INPut[n]:WAVelength:ALL	:INPut[n]:WAVelength:ALL (page 126)

:INPut[n]:ATTenuation

Syntax	:INPut[n]:ATTenuation<wsp><value>[dB] | MIN | DEF | MAX
Description	Sets the attenuation factor (*a*) for the instrument. The attenuation factor is used, together with an offset factor (a_{Offset}) to set the filter attenuation (a_{filter}). $a_{(new)}$ (dB) = $a_{filter\ (new)}$ (dB) + a_{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 a_{filter} = 0dB MAX - The value where a_{filter} is at its greatest.
Response	None
Example	INP1:ATT 14dB

:INPut[n]:ATTenuation?

Syntax	:INPut[n]:ATTenuation?<wsp> MIN | DEF | MAX
Description	Returns the current attenuation factor (a), in dB. a (dB) = a_{filter} (dB) + a_{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

:INPut[n]:ATTenuation:ALL

Syntax	:INPut[n]:ATTenuation<wsp><value>[dB] | MIN | DEF | MAX
Description	Sets the attenuation factor (a) to all attenuation slots. The attenuation factor is used, together with an offset factor (a_{Offset}) to set the filter attenuation (a_{filter}). $a_{(new)}$ (dB) = $a_{filter\ (new)}$ (dB) + a_{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 a_{filter} = 0dB MAX - The value where a_{filter} is at its greatest.
Response	None
Example	INP:ATT:ALL 14dB

:INPut[n]:ATTenuation:SPEed

Syntax	:INPut[n]: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). **NOTE** The Optical Multimode Attenuators allow controlled speeds from 0.1 dB/s to 80 dB/s and a full speed of

	approximately 1000 dB/s. All speed inputs higher than 80 dB/s are set to 1000 dB/s.
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

:INPut[n]:ATTenuation:SPEed?

Syntax	:INPut[n]:ATTenuation:SPEed?<wsp> MIN | MAX | DEF
Description	Returns the transition speed of the filter without the optional parameter.
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

:INPut[n]:ATTenuation:SWEep:STARt

Syntax	:INPut[n]:ATTenuation:SWEep:STARt<wsp><value>| MIN | MAX | DEF
Description	Sets the starting point of the attenuation sweep.
Parameters	<value> - The start attenuation of the sweep in dB. MIN | MAX | DEF - Sets the start attenuation to the instruments limits, or default
Response	None
Example	INP1:ATT:SWE:STAR 10

:INPut[n]:ATTenuation:SWEep:STARt?

Syntax	:INPut[n]:ATTenuation:SWEep:STARt?
Description	Returns the starting point of the attenuation sweep.
Parameters	MIN|MAX|DEF
Response	<value> - The start attenuation of the sweep in dB.
Example	INP1:ATT:SWE:STAR? -> +1.00000000E+01

:INPut[n]:ATTenuation:SWEep:SETTling

Syntax	:INPut[n]:ATTenuation:SWEep:SETTling<wsp><value>| MIN | MAX | DEF
Description	Sets the settling time between every sweep step. **NOTE** The settling time is used to wait until the attenuation step has stabilized. A STF (step finished) output Trigger comes after the settling time and an external powermeter. Can now stable measure until the dwell time is over.
Parameters	<value> - The settling time between every sweep step in seconds MIN | MAX | DEF - Sets the settling time to the instruments limits, or default
Response	None
Example	INP1:ATT:SWE:SETT 1

:INPut[n]:ATTenuation:SWEep:SETTling?

Syntax	:INPut[n]:ATTenuation:SWEep:SETTling? <wsp> MIN | MAX | DEF
Description	Returns the settling time between every sweep step.
Parameters	MIN | MAX | DEF
Response	Settling time in seconds
Example	INP1:ATT:SWE:SETT? -> +1.00000000E+00

:INPut[n]:ATTenuation:SWEep:STOP

Syntax	:INPut[n]:ATTenuation:SWEep:STOP<wsp><value>| MIN | MAX | DEF
Description	Sets the stop of the attenuation sweep.
Parameters	<value> - The stop attenuation of the sweep in dB. MIN | MAX | DEF - Sets the stop attenuation to the instruments limits, or default
Response	None
Example	INP1:ATT:SWE:STOP 10

:INPut[n]:ATTenuation:SWEep:STOP?

Syntax	:INPut[n]:ATTenuation:SWEep:STOP?
Description	Returns the stop of the attenuation sweep.
Parameters	MIN | MAX | DEF

Response	<value> - The stop attenuation of the sweep in dB.
Example	INP1:ATT:SWE:STOP? -> +1.00000000E+01

:INPut[n]:ATTenuation:SWEep:REPeat

Syntax	:INPut[n]:ATTenuation:SWEep:REPeat<wsp>ONEWay|TWOWay
Description	Defines behavior for multiple sweeps.
Parameters	Oneway: Attenuation moves after finishing first sweep to the beginning and start sweeping again. Twoway: After first sweep it sweeps back to start attenuation.
Response	None
Example	INP1:ATT:SWE:REP ONEW

:INPut[n]:ATTenuation:SWEep:REPeat?

Syntax	:INPut[n]:ATTenuation:SWEep:REPeat?
Description	Returns behavior for multiple sweeps.
Parameters	None
Response	Oneway: Attenuation moves after finishing first sweep to the beginning and start sweeping again. Twoway: After first sweep it sweeps back to start attenuation.
Example	INP1:ATT:SWE:REP? -> ONEW

:INPut[n]:ATTenuation:SWEep:STEP

Syntax	:INPut[n]:ATTenuation:SWEep:STEP<wsp><value>| MIN | MAX | DEF
Description	Defines the step for next attenuation while sweeping.
Parameters	<value> - The step of the sweep in dB MIN | MAX | DEF - Sets the steps to the instruments limits, or default
Response	None
Example	INP1:ATT:SWE:STEP 0.1

:INPut[n]:ATTenuation:SWEep:STEP?

Syntax	:INPut[n]:ATTenuation:SWEep:STEP?<wsp> MIN | MAX | DEF
Description	Returns the step for next attenuation while sweeping.
Parameters	None
Response	Step in dB

Example	INP1:ATT:SWE:STEP? -> +1.00000001E-01

:INPut[n]:ATTenuation:SWEep:DWELl

Syntax	:INPut[n]:ATTenuation:SWEep:DWELl<wsp><value>| MIN | MAX | DEF
Description	Sets the dwell time between every sweep step. **NOTE** The settling time is used to wait until the attenuation step has stabilized. A STF (step finished) output Trigger comes after the settling time and an external powermeter. Can now stable measure until the dwell time is over.
Parameters	<value> - The dwell time between every sweep step in seconds. MIN | MAX | DEF - Sets the dwell time to the instruments limits, or default.
Response	None
Example	INP1:ATT:SWE:DWEL 1

:INPut[n]:ATTenuation:SWEep:DWELl?

Syntax	:INPut[n]:ATTenuation:SWEep:DWELl? <wsp> MIN | MAX | DEF
Description	Returns the dwell time between every sweep step.
Parameters	MIN | MAX | DEF
Response	Dwell time in seconds
Example	INP1:ATT:SWE:DWEL? -> +1.00000000E+00

:INPut[n]:ATTenuation:SWEep:CYCLes

Syntax	:INPut[n]:ATTenuation:SWEep:CYCLes<wsp><value>| MIN | MAX | DEF
Description	Defines number of sweep cycles
Parameters	<value> - The number of sweep cycles MIN | MAX | DEF - Sets the cycles to the instruments limits, or default
Response	None
Example	INP1:ATT:SWE:CYCL 2

:INPut[n]:ATTenuation:SWEep:CYCLes?

Syntax	:INPut[n]:ATTenuation:SWEep:CYCLes? <wsp> MIN | MAX | DEF
Description	Returns number of sweep cycles

Parameters	MIN | MAX | DEF
Response	Number of cycles
Example	INP1:ATT:SWE:CYCL? 2

:INPut[n]:ATTenuation:SWEep[:STATe]

Syntax	:INPut[n]:ATTenuation:SWEep[:STATe]<wsp>0|1|STOP|STARt
Description	Starts or stops sweep **NOTE** Ensure that when starting the sweep the power control mode is deactivated and the speed is set to 1000 dB/s.
Parameters	0 or STOP - Stops the sweep 1 or STARt- Starts the sweep
Response	None
Example	INP1:ATT:SWE STAR

:INPut[n]:ATTenuation:SWEep[:STATe]?

Syntax	:INPut[n]:ATTenuation:SWEep[:STATe]?
Description	Returns the state of the sweep whether it is in start or stop state.
Parameters	None
Response	0 or 1
Example	INP1:ATT:SWE? -> 1

:INPut[n]:ATTenuation:SWEep:FLAG?

Syntax	:INPut[n]:ATTenuation:SWEep:FLAG?
Description	Returns the flag of the sweep. This has different functions depending on the :TRIGger[n]:INPut Configuration. :TRIGger[n]:INPut IGNore (Ignore incoming trigger) This flag is then a cycle counter. E.g. if we have 3 cycles then the flag shows 3 at the end of the sweep. :TRIGger[n]:INPut SWStart (Start a sweep cycle) If you start a sweep it will return 1. That means instrument is ready for triggers.

	Send a trigger via BNC Input or Trig 1 or Init[n]:imm to start the next sweep cycle. During the running sweep cycle the flag returns 2 after first sweep the flag returns 3, waiting for next trigger... :TRIGger[n]:INPut NEXTstep (Perform next step of a stepped sweep) If you start a sweep it will return 1. That means instrument is ready for triggers. Send a trigger via BNC Input or Trig 1 or Init[n]:imm to start the next sweep step. For every step the flag increments by one until the last step is over. EXAMPLE: if we have a sweep 0...5dB which are 6 steps and we have 3 cycles, then the flag stands at the end at 6steps x 3 cycles = 18 But for every new sweep cycle we have also an additional trigger and flag count so we end in flag = 21
Parameters	None
Response	Sweep flag
Example	INP1:ATT:SWE:FLAG? -> +2

:INPut[n]:ATTenuation:SWEep:EXPectedtriggers?

Syntax	:INPut[n]:ATTenuation:SWEep:EXPectedtriggers?
Description	Returns the number of expected triggers for one sweep cycle
Parameters	None
Response	Expected triggers
Example	INP1:ATT:SWE:EXP? -> +100

:INPut[n]:ATTenuation:UCALibration

Syntax	:INPut[n]::ATTenuation:UCALibration
Description	Starts the user calibration. The user calibration process will run for about two minutes. Check the status with *OPC?
Parameters	1 (to start the user calibration)
Response	None
Example	INP1:ATT:UCAL 1

:INPut[n]:ATTenuation:UCALibration?

Syntax	:INPut[n]:ATTenuation:UCALibration?
Description	Returns the user calibration status.
Parameters	None
Response	string <user calibration available (1=calibration available, 0=no user calibration)>, <user calibration wavelength>, <status info string>
Example	INP1:ATT:UCAL? -> +0,+0,"No User Cal" INP1:ATT:UCAL? -> +1,+1.311e-06,"success"

:INPut[n]:ATTenuation:UCALibration:ENABle

Syntax	:INPut[n]:ATTenuation:UCALibration:ENABle
Description	Enables or disables the user calibration.
Parameters	0 = disable the user calibration 1 = enable the user calibration
Response	None
Example	INP1:ATT:UCAL:ENAB 1

:INPut[n]:ATTenuation:UCALibration:ENABle?

Syntax	:INPut[n]:ATTenuation:UCALibration:ENABle?
Description	Enables or disables the user calibration.
Parameters	None
Response	0 = disable the user calibration 1 = enable the user calibration
Example	INP1:ATT:UCAL:ENAB? 1

:INPut[n]:ATTenuation:UCALibration:PREset

Syntax	:INPut[n]:ATTenuation:UCALibration:PREset
Description	Removes the user calibration from the device.
Parameters	None
Response	None
Example	INP1:ATT:UCAL:PRE

:INPut[n]:OFFSet

Syntax	:INPut[n]:OFFSet<wsp><value>[dB] | MIN | DEF | MAX
Description	Sets the offset factor (*a* Offset) for the instrument. This factor does not affect the filter attenuation (a_{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. $a_{(new)}$ (dB) = a_{filter} (dB) + $a_{Offset\,(new)}$ (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 (a_{Offset}) in dB. MIN - Sets the minimum value for a_{Offset} = - 200dB. DEF - Sets the default value for a_{Offset} = 0dB. MAX - Sets the maximum value for a_{Offset} = + 200dB.
Response	None
Example	INP1:OFFS 2dB

:INPut[n]:OFFSet?

Syntax	:INPut[n]:OFFSet?<wsp>MIN | DEF | MAX
Description	Returns the current value of the offset factor (a_{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? -> 2

:INPut[n]:OFFSet:DISPlay

Syntax	INPut[n]:OFFSet:DISPlay
Description	Sets the offset factor (a Offset) such that the attenuation factor is zero. $a_{Offset\,(new)}$ (dB) = $a_{Offset\,(old)}$ (dB) - $a_{(old)}$ (dB) = - a_{filter} (dB)
Parameters	None
Response	None
Example	INP1:OFFS:DISP

:INPut[n]:OFFSet:POWermeter

Syntax	:INPut[n]:OFFSet:POWermeter<wsp><slot>
Description	Sets the offset factor (a_{Offset}) to the difference between a power value measured by another powermeter (P_{ext}) and the power value measured by the attenuator module's monitor diode (P_{att}). a_{Offset} (dB) = P_{att} (dBm) - P_{ext} (dBm)
Parameters	<slot> - Slot number of the external powermeter.
Response	None
Example	INP1:OFFS:POW 4
Affects	N7752C only

:INPut[n]:WAVelength

Syntax	:INPut[n]:WAVelength<wsp><value>[PM | NM | UM| MM | M] | MIN | MAX | DEF
Description	Sets the attenuator'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 instrument limits, or the instrument default.
Response	None
Example	INP1:WAV +1.55000000E-006

:INPut[n]:WAVelength?

Syntax	:INPut[n]: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 instrument default.
Response	4 byte Intel floating point; wavelength in m.
Example	INP1:WAV -> +1.55000000E-006

:INPut[n]:WAVelength:ALL

Syntax	:INPut[n]:WAVelength:ALL<wsp><value>[PM | NM | UM| MM | M] | MIN | MAX | DEF
Description	Sets the attenuator's operating wavelength to all attenuator channels. 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 instrument limits, or the instrument default.
Response	None
Example	INP:WAV:ALL +1.55000000E-006

INITiate Subsystem - N7752C

The INITiate subsystem includes the following commands:

Command	Reference
:INITiate[n][:IMMediate]	:INITiate[n][:IMMediate] (page 127)
:INITiate[n][:CHANnel[m]]:CONTinuous	:INITiate[n][:CHANnel[m]]:CONTinuous (page 127)
:INITiate[n][:CHANnel[m]]:CONTinuous?	:INITiate[n][:CHANnel[m]]:CONTinuous? (page 128)

:INITiate[n][:IMMediate]

Syntax	:INITiate[n][:IMMediate]
Description	Initiates the software trigger system and completes one full trigger cycle, that is, one measurement is made for selected [n]. In logging mode it triggers all channels independent from [n].
Parameters	None
Response	None
Example	init1:imm

: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 NOTE: This command is supported by N7752C and is only applicable to channels 5 and 6.
Response	None
Example	init5:cont 1

:INITiate[n][:CHANnel[m]]:CONTinuous?

Syntax	:INITiate[n][:CHANnel[m]]:CONTinuous?
Description	Queries whether the software trigger system operates continuously or not.
Parameters	None NOTE: This command is supported by N7752C and is only applicable to channels 5 and 6.
Response	A boolean value: 0 or OFF: do not measure continuously 1 or ON: measure continuously
Example	init5:cont? -> 1

INITiate Subsystem - N7764C & N7768C

The INITiate subsystem includes the following commands:

Command	Reference
:INITiate[n][:IMMediate]	:INITiate[n][:IMMediate] (page 128)

:INITiate[n][:IMMediate]

Syntax	:INITiate[n][:IMMediate]
Description	Initiates the software trigger system and completes one full trigger cycle, that is, one measurement is made for selected [n]. In logging mode it triggers all channels independent from [n].
Parameters	None
Response	None
Example	init1:imm

OUTPut Subsystem

The OUTPut subsystem includes the following commands:

Command	Reference
OUTPut[n]:ATIMe	:OUTPut[n]:ATIMe (page 129)

Command	Reference
OUTPut[n]:ATIMe?	:OUTPut[n]:ATIMe? (page 129)
OUTPut[n]:CORRection:COLLect:ZERO	:OUTPut[n]:CORRection:COLLect:ZERO (page 130)
OUTPut[n]:CORRection:COLLect:ZERO?	:OUTPut[n]:CORRection:COLLect:ZERO? (page 130)
OUTPut[n]:CORRection:COLLect:ZERO:ALL	:OUTPut[n]:CORRection:COLLect:ZERO:ALL (page 130)
OUTPut[n]:CORRection:COLLect:ZERO:ALL?	:OUTPut[n]:CORRection:COLLect:ZERO:ALL? (page 131)
OUTPut[n]:POWer	:OUTPut[n]:POWer (page 131)
OUTPut[n]:POWer?	:OUTPut[n]:POWer? (page 132)
OUTPut[n]:POWer:ALL	:OUTPut[n]:POWer:ALL (page 132)
OUTPut[n]:POWer:CONTrol	:OUTPut[n]:POWer:CONTrol (page 132)
OUTPut[n]:POWer:CONTrol?	:OUTPut[n]:POWer:CONTrol? (page 133)
OUTPut[n]:POWer:OFFSet	:OUTPut[n]:POWer:OFFSet (page 133)
OUTPut[n]:POWer:OFFSet?	:OUTPut[n]:POWer:OFFSet? (page 133)
OUTPut[n]:POWer:UNit	:OUTPut[n]:POWer:UNit (page 134)
OUTPut[n]:POWer:UNit?	:OUTPut[n]:POWer:UNit? (page 134)
OUTPut[n][:STATe]	:OUTPut[n][:STATe] (page 134)
OUTPut[n].[:STATe]?	:OUTPut[n][:STATe]? (page 134)
OUTPut[n][:STATe]:ALL	:OUTPut[n][:STATe]:ALL (page 135)
OUTPut[n][:STATe]:APOWeron	:OUTPut[n][:STATe]:APOWeron (page 135)
OUTPut[n][:STATe]:APOWeron?	:OUTPut[n][:STATe]:APOWeron? (page 135)

:OUTPut[n]:ATIMe

Syntax	:OUTPut[n]:ATIMe<wsp><value>[NS | US | MS| S]
Description	Sets the powermeter averaging time. **NOTE** The attenuator's power control feature always uses 1 ms so this doesn't 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

:OUTPut[n]:ATIMe?

Syntax	:OUTPut[n]:ATIMe?

Description	Queries the powermeter averaging time.
Parameters	None
Response	4 byte Intel floating point; the averaging time in seconds
Example	OUTP1:ATIM? -> 1

:OUTPut[n]:CORRection:COLLect:ZERO

Syntax	:OUTPut[n]:CORRection:COLLection:ZERO
Description	Zeros the electrical offsets of the attenuator's integrated powermeter. **NOTE** Cover the optical inputs or switch the input source off before starting.
Parameters	None
Response	None
Example	OUTP1:CORR:COLL:ZERO

:OUTPut[n]:CORRection:COLLect:ZERO?

Syntax	:OUTPut[n]:CORRection:COLLection:ZERO?
Description	Queries the status of the last :OUTPut#[:CHANnel#]:CORRection:COLLection:ZERO operation. **NOTE** If a channel fails to zero, it continues to use the result of the last successful zeroing.
Parameters	None
Response	integer - 0 = OK, otherwise not OK.
Example	OUTP:CORR:COLL:ZERO? -> 0

:OUTPut[n]:CORRection:COLLect:ZERO:ALL

Syntax	:OUTPut[n]:CORRection:COLLection:ZERO:ALL
Description	Zero all available powermeter channels in the mainframe. **NOTE** Cover the optical inputs or switch the input source off before starting.
Parameters	None
Response	None
Example	OUTP1:CORR:COLL:ZERO:ALL

:OUTPut[n]:CORRection:COLLect:ZERO:ALL?

Syntax	:OUTPut[n]:CORRection:COLLection:ZERO:ALL?
Description	Returns the status of the most recent zero command for a power meter channel. The result is backed up in the nonvolatile RAM. **NOTE** If a channel fails to zero, it continues to use the result of the last successful zeroing.
Parameters	None
Response	A hexadecimal integer value which represents the result for all channels. Each hexadecimal digit represents one channel . 0: zero succeeded without errors. Any other number: remote zeroing failed example 1: outp:corr:coll:zero:all? → +272 272 decimal = 0x110. This means zeroing failed on channels 2 and 3. All other channels were successful. example 2: outp:corr:coll:zero:all? → +286326784 286326784 decimal = 0x11110000. This means zeroing failed on channels 5,6,7,8. All other channels were successful.
Example	OUTP:CORR:COLL:ZERO:ALL? -> 0

:OUTPut[n]:POWer

Syntax	:OUTPut[n]:POWer<wsp><value>[PW | NW | UW | MW | W | DBM] | MIN | MAX | DEF
Description	Sets the output power value (P). If your attenuator module does not include the power control feature, the new filter attenuation ($a_{\text{filter (new)}}$) is calculated from the reference power (P_{ref}): $P_{\text{set(new)}}$ (dBm) = P_{ref} (dBm) - $a_{\text{filter (new)}}$ (dB) - P_{Offset} (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_{offset} (dB) If the set power cannot be achieved ExP (indicating 'Excessive Power') is displayed, and the appropriate GPIB status bit is set. The status of these bits can be queried using :STATus:OPERation:CONDition[:LEVel0]?
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

:OUTPut[n]:POWer?

Syntax	:OUTPut[n]: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? -> 12

:OUTPut[n]:POWer:ALL

Syntax	:OUTPut[n]:POWer<wsp><value>[PW | NW | UW | MW | W | DBM] | MIN | MAX | DEF
Description	Sets the output power value (P) to all channels. If your attenuator module does not include the power control feature, the new filter attenuation ($a_{\text{filter (new)}}$) is calculated from the reference power (P_{ref}): $P_{\text{set(new)}}$ (dBm) = P_{ref} (dBm) - $a_{\text{filter (new)}}$ (dB) - P_{Offset} (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_{offset} (dB) If the set power cannot be achieved ExP (indicating 'Excessive Power') is displayed, and the appropriate GPIB status bit is set. The status of these bits can be queried using :STATus:OPERation:CONDition[:LEVel0]?
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:ALL 12

:OUTPut[n]:POWer:CONTrol

Syntax	:OUTPut[n]: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:CONT ON

:OUTPut[n]:POWer:CONTrol?

Syntax	:OUTPut[n]: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:CONT? -> 0

:OUTPut[n]:POWer:OFFSet

Syntax	:OUTPut[n]: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

:OUTPut[n]:POWer:OFFSet?

Syntax	:OUTPut[n]: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? -> 2

:OUTPut[n]:POWer:UNit

Syntax	:OUTPut[n]: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

:OUTPut[n]:POWer:UNit?

Syntax	:OUTPut[n]:POWer:UNit?
Description	Queries whether the power unit is dBm or W
Parameters	None
Response	boolean 0 - The power unit is dBm boolean 1 - The power unit is W
Example	OUTP1:POW:UN? -> 0

:OUTPut[n][:STATe]

Syntax	:OUTPut[n]:[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

:OUTPut[n][:STATe]?

Syntax	:OUTPut[n]:[STATe]?
Description	Queries the state of the shutter.
Parameters	None
Response	0 - Shutter closed 1 - Shutter open
Example	OUTP1:STAT? -> 0

:OUTPut[n][:STATe]:ALL

Syntax	:OUTPut[n]:[STATe]:ALL<wsp>OFF(0) | ON(1)
Description	Sets the state of the shutter to all channels.
Parameters	OFF or 0 - Shutter closed ON or 1 - Shutter open
Response	None
Example	OUTP:STAT:ALL OFF

:OUTPut[n][:STATe]:APOWeron

Syntax	:OUTPut[n]: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 instrument power on. ON or 1 - Shutter open after instrument power on.
Response	None
Example	OUTP1:APOW OFF

:OUTPut[n][:STATe]:APOWeron?

Syntax	:OUTPut[n]:STATe:APOWeron?
Description	Queries the state of the shutter at power on.
Parameters	None
Response	boolean 0 - Shutter closed after instrument power on. 1 - Shutter open after instrument power on.
Example	OUTP1:APOW? -> 0

READ Subsystem

The READ subsystem includes the following commands:

Command	Reference
:READ[n][:SCALar]:POWer[:DC]?	:READ[n][:SCALar]:POWer[:DC]? (page 136)
:READ[n][:SCALar]:POWer[:DC]:ALL?	:READ[n][:SCALar]:POWer[:DC]:ALL? (page 136)
:READ[n][:SCALar]:POWer[:DC]:ALL:CSV?	:READ[n][:SCALar]:POWer[:DC]:ALL:CSV? (page

Command	Reference
	136)
:READ[n][:SCALar]:POWer[:DC]:ALL:CONFig?	:READ[n][:SCALar]:POWer[:DC]:ALL:CONFig? (page 136)

:READ[n][:SCALar]:POWer[:DC]?

Syntax	:READ[n][:SCALar]:POWer[:DC]?
Description	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 or W.
Example	read1:pow? -> +1.33555600E-006

:READ[n][:SCALar]:POWer[:DC]:ALL?

Syntax	:READ[n][:SCALar]:POWer[:DC]:ALL?
Description	Reads all available power meter channels. It provides its own software triggering and does not need a triggering command. 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 or W.
Example	read1:pow:all? -> +1.33555600E-006

:READ[n][:SCALar]:POWer[:DC]:ALL:CSV?

Syntax	:READ[n][:SCALar]:POWer[:DC]:ALL:CSV?
Description	Reads all available power meter channels . It provides its own software triggering and does not need a triggering command. 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 or W.
Example	read1:pow:all:csv? -> +1.33555600E-006

:READ[n][:SCALar]:POWer[:DC]:ALL:CONFig?

Syntax	:READ[n][:SCALar]:POWer[:DC]:ALL:CONFig?
Description	Returns the channel numbers for all available power meter channels. Use

	this command to match returned power values to the appropriate channel 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 channel number, the second member of the pair represents the channel number. The channel number is always 1.
Example	read1:pow:all:conf? -> interpreted as 1|1|2|1|3|1|4|1 This 16-byte block means that there are four power meters present

SENSe Subsystem - N7764C & N7768C

This subsystem allows you to control N7764C and N7768C attenuators.

The SENSe subsystem includes the following commands:

Command	Reference
:SENSe[n]:CORRection:COLLect:ZERO	:SENSe[n]:CORRection:COLLect:ZERO (page 137)
:SENSe[n]:CORRection:COLLect:ZERO?	:SENSe[n]:CORRection:COLLect:ZERO? (page 137)
:SENSe:CORRection:COLLect:ZERO:ALL	:SENSe:CORRection:COLLect:ZERO:ALL (page 138)
:SENSe:CORRection:COLLect:ZERO:ALL?	:SENSe:CORRection:COLLect:ZERO:ALL? (page 138)

:SENSe[n]:CORRection:COLLect:ZERO

Syntax	:SENSe[n]:CORRection:COLLect:ZERO
Description	Zeros the electrical offsets for a power meter channel. NOTE: Cover the optical inputs or switch the input source off before starting.
Parameters	
Response	None
Example	sens1:corr:coll:zero

:SENSe[n]:CORRection:COLLect:ZERO?

Syntax	:SENSe[n]:CORRection:COLLect:ZERO?
Description	Returns the status of the most recent zero command for a power meter channel.

	The result is backed up in the nonvolatile RAM. NOTE: If a channel fails to zero, it continues to use the result of the last successful zeroing.
Parameters	None
Response	0: zero succeeded without errors. any other number: remote zeroing failed
Example	sens1:corr:coll:zero? → 0

:SENSe:CORRection:COLLect:ZERO:ALL

Syntax	:SENSe:CORRection:COLLect:ZERO:ALL
Description	Zeros the electrical offsets for all power meter channels. NOTE: Cover the optical inputs or switch the input source off before starting.
Parameters	
Response	None
Example	sens:corr:coll:zero:all

:SENSe:CORRection:COLLect:ZERO:ALL?

Syntax	:SENSe:CORRection:COLLect:ZERO:ALL?
Description	Returns the status of the most recent zero command for a power meter channel. The result is backed up in the nonvolatile RAM. NOTE: If a channel fails to zero, it continues to use the result of the last successful zeroing.
Parameters	None
Response	A hexadezimal integer value which represents the result for all channels. Each hexadecimal digit represents one channel . 0: zero succeeded without errors. Any other number: remote zeroing failed example 1: sens:corr:coll:zero:all? → +272 272 decimal = 0x110. This means zeroing failed on channels 2 and 3. All other channels were successful. example 2: sens:corr:coll:zero:all? → +286326784 286326784 decimal = 0x11110000. This means zeroing failed on channels 5,6,7,8. All other channels were successful.
Example	sens:chan:corr:coll:zero:all? → 0

Measurement Operations & Settings

SENSe Subsystem - N7752C

This subsystem allows you to control N7752C attenuator.

NOTE: The commands supported by N7752C are only applicable to channels 5 and 6.

The SENSe subsystem includes the following commands:

Command	Reference
:SENSe[n]:CORRection	:SENSe[n]:CORRection (page 141)
:SENSe[n]:CORRection?	:SENSe[n]:CORRection? (page 141)
:SENSe[n]:CORRection:COLLect:ZERO	:SENSe[n]:CORRection:COLLect:ZERO (page 141)
:SENSe[n]:CORRection:COLLect:ZERO?	:SENSe[n]:CORRection:COLLect:ZERO? (page 141)
:SENSe[n]:CORRection:COLLect:ZERO:ALL	:SENSe[n]:CORRection:COLLect:ZERO:ALL (page 142)
:SENSe[n]:CORRection:COLLect:ZERO:ALL?	:SENSe[n]:CORRection:COLLect:ZERO:ALL? (page 142)
:SENSe[n]:CORRection:COLLect:ZERO:QUAD	:SENSe[n]:CORRection:COLLect:ZERO:QUAD (page 142)
:SENSe[n]:CORRection:COLLect:ZERO:QUAD?	:SENSe[n]:CORRection:COLLect:ZERO:QUAD? (page 143)
:SENSe[n]:FUNCtion:LOOP	:SENSe[n]:FUNCtion:LOOP (page 143)
:SENSe[n]:FUNCtion:LOOP?	:SENSe[n]:FUNCtion:LOOP? (page 144)
:SENSe[n]:FUNCtion:PARameter:CHECk?	:SENSe[n]:FUNCtion:PARameter:CHECk? (page 144)
:SENSe[n]:FUNCtion:PARameter:LOGGing	:SENSe[n]:FUNCtion:PARameter:LOGGing (page 145)
:SENSe[n]:FUNCtion:PARameter:LOGGing?	:SENSe[n]:FUNCtion:PARameter:LOGGing? (page 145)
:SENSe[n]:FUNCtion:PARameter:MINMax	:SENSe[n]:FUNCtion:PARameter:MINMax (page 146)
:SENSe[n]:FUNCtion:PARameter:MINMax?	:SENSe[n]:FUNCtion:PARameter:MINMax? (page 146)
:SENSe[n]:FUNCtion:PARameter:STABility	:SENSe[n]:FUNCtion:PARameter:STABility (page 147)
:SENSe[n]:FUNCtion:PARameter:STABility?	:SENSe[n]:FUNCtion:PARameter:STABility? (page 148)
:SENSe[n]:FUNCtion:RESult?	:SENSe[n]:FUNCtion:RESult? (page 148)
:SENSe[n]:FUNCtion:RESult:BLOCk?	:SENSe[n]:FUNCtion:RESult:BLOCk? (page 150)

Command	Reference
:SENSe[n]:FUNCtion:RESult:BUFA?	:SENSe[n]:FUNCtion:RESult:BUFA? (page 149)
:SENSe[n]:FUNCtion:RESult:BUFB?	:SENSe[n]:FUNCtion:RESult:BUFB? (page 149)
:SENSe[n]:FUNCtion:RESult:BLOCk?	:SENSe[n]:FUNCtion:RESult:BLOCk? (page 150)
:SENSe[n]:FUNCtion:RESult:INDex?	:SENSe[n]:FUNCtion:RESult:INDex? (page 150)
:SENSe[n]:FUNCtion:RESult:MAXBlocksize?	:SENSe[n]:FUNCtion:RESult:MAXBlocksize? (page 150)
:SENSe[n]:FUNCtion:STATe	:SENSe[n]:FUNCtion:STATe (page 151)
:SENSe[n]:FUNCtion:STATe?	:SENSe[n]:FUNCtion:STATe? (page 151)
:SENSe[n]:POWer:GAIN:AUTO	:SENSe[n]:POWer:GAIN:AUTO (page 151)
:SENSe[n]:POWer:GAIN:AUTO?	:SENSe[n]:POWer:GAIN:AUTO? (page 152)
:SENSe[n]:POWer:ATIMe	:SENSe[n]:POWer:ATIMe (page 152)
:SENSe[n]:POWer:ATIMe?	:SENSe[n]:POWer:ATIMe? (page 153)
:SENSe[n]:POWer:OUTPut	:SENSe[n]:POWer:OUTPut (page 153)
:SENSe[n]:POWer:OUTPut?	:SENSe[n]:POWer:OUTPut? (page 153)
:SENSe[n]:POWer:RANGe:AUTO	:SENSe[n]:POWer:RANGe:AUTO (page 154)
:SENSe[n]:POWer:RANGe:AUTO?	:SENSe[n]:POWer:RANGe:AUTO? (page 154)
:SENSe[n]:POWer:RANGe:AUTO:ALL	:SENSe[n]:POWer:RANGe:AUTO:ALL (page 154)
:SENSe[n]:POWer:RANGe	:SENSe[n]:POWer:RANGe (page 155)
:SENSe[n]:POWer:RANGe?	:SENSe[n]:POWer:RANGe? (page 155)
:SENSe[n]:POWer:RANGe:ALL	:SENSe[n]:POWer:RANGe:ALL (page 155)
:SENSe[n]:POWer:REFerence	:SENSe[n]:POWer:REFerence (page 156)
:SENSe[n]:POWer:REFerence?	:SENSe[n]:POWer:REFerence? (page 156)
:SENSe[n]:POWer:REFerence:DISPlay	:SENSe[n]:POWer:REFerence:DISPlay (page 157)
:SENSe[n]:POWer:REFerence:STATe	:SENSe[n]:POWer:REFerence:STATe (page 157)
:SENSe[n]:POWer:REFerence:STATe?	:SENSe[n]:POWer:REFerence:STATe? (page 157)
:SENSe[n]:POWer:REFerence:STATe:RATio	:SENSe[n]:POWer:REFerence:STATe:RATio (page 158)
:SENSe[n]:POWer:REFerence:STATe:RATio?	:SENSe[n]:POWer:REFerence:STATe:RATio? (page 158)
:SENSe[n]:POWer:UNIT[:ALL]	:SENSe[n]:POWer:UNIT[:ALL] (page 158)
:SENSe[n]:POWer:UNIT?	:SENSe[n]:POWer:UNIT? (page 159)
:SENSe[n]:POWer:UNIT:ALL:CSV?	:SENSe[n]:POWer:UNIT:ALL:CSV? (page 159)
:SENSe[n]:POWer:WAVelength[:ALL]	:SENSe[n]:POWer:WAVelength[:ALL] (page 159)
:SENSe[n]:POWer:WAVelength?	:SENSe[n]:POWer:WAVelength? (page 160)

:SENSe[n]:CORRection

Syntax	:SENSe[n]:CORRection<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	sens5:corr 10DB

:SENSe[n]:CORRection?

Syntax	:SENSe[n]:CORRection?
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	sens5:corr? → +1.00000000E+000

:SENSe[n]:CORRection:COLLect:ZERO

Syntax	:SENSe[n]:CORRection:COLLect:ZERO
Description	Zeros the electrical offsets for a power meter channel. NOTE: Cover the optical inputs or switch the input source off before starting.
Parameters	None
Response	None
Example	sens5:corr:coll:zero

:SENSe[n]:CORRection:COLLect:ZERO?

Syntax	:SENSe[n]:CORRection:COLLect:ZERO?
Description	Returns the status of the most recent zero command for a power meter channel. The result is backed up in the nonvolatile RAM. NOTE: If a channel fails to zero, it continues to use the result of the last successful zeroing.
Parameters	None
Response	0: zero succeeded without errors.

	any other number: remote zeroing failed
Example	sens5:corr:coll:zero? → 0

:SENSe[n]:CORRection:COLLect:ZERO:ALL

Syntax	:SENSe[n]:CORRection:COLLect:ZERO:ALL
Description	Zeros the electrical offsets for all power meter channels. NOTE: Cover the optical inputs or switch the input source off before starting.
Parameters	None
Response	None
Example	sens:corr:coll:zero:all

:SENSe[n]:CORRection:COLLect:ZERO:ALL?

Syntax	:SENSe[n]:CORRection:COLLect:ZERO:ALL?
Description	Returns the status of the most recent zero command for a power meter channel. The result is backed up in the nonvolatile RAM. NOTE: If a channel fails to zero, it continues to use the result of the last successful zeroing.
Parameters	None
Response	A hexadezimal integer value which represents the result for all channels. Each hexadecimal digit represents one channel . 0: zero succeeded without errors. Any other number: remote zeroing failed example 1: sens:chan:corr:coll:zero:all? → +272 272 decimal = 0x110. This means zeroing failed on channels 2 and 3. All other channels were successful. example 2: sens:chan:corr:coll:zero:all? → +286326784 286326784 decimal = 0x11110000. This means zeroing failed on channels 5,6,7,8. All other channels were successful.
Example	sens:chan:corr:coll:zero:all? → 0

:SENSe[n]:CORRection:COLLect:ZERO:QUAD

Syntax	:SENSe[n]:CORRection:COLLect:ZERO:QUAD
Description	Zeros the electrical offsets for all 4 power meter channels of the selected quad

	if [n] is between 1 and 4 then the first quad is zeroed if [n] is between 5 and 8 then the second quad is zeroed NOTE: Cover the Optical Inputs or switch the input source off before starting.
Parameters	None
Response	None
Example	sens5:corr:coll:zero:quad

:SENSe[n]:CORRection:COLLect:ZERO:QUAD?

Syntax	:SENSe[n]:CORRection:COLLect:ZERO:QUAD?
Description	Returns the status of the most recent zero command for all 4 power meter channels of the selected quad. if [n] is between 1 and 4 then the first quad zero result is returned if [n] is between 5 and 8 then the second quad zero result is returned The result is backed up in the nonvolatile RAM. NOTE: If a channel fails to zero, it continues to use the result of the last successful zeroing.
Parameters	None
Response	A hexadezimal integer value which represents the result for all 4 power meter channels of the selected quad. Each hexadecimal digit represents one channel . 0: zero succeeded without errors. Any other number: remote zeroing failed example 1: sens5:chan:corr:coll:zero:quad? → +272 272 decimal = 0x110. This means zeroing failed on channels 2 and 3. All other channels were successful. example 2: sens5:chan:corr:coll:zero:quad? → +272 272 decimal = 0x110. This means zeroing failed on channels 6 and 7. All other channels were successful.
Example	sens5:chan:corr:coll:zero:quad? → 0 <END>

:SENSe[n]:FUNCtion:LOOP

Syntax	:SENSe[n]:FUNCtion:LOOP<wsp><value>
Description	Sets the number of logging loops
Parameters	Number of Loops, an integer value. 0 = Endless Streaming 1 = 1 (Default)

	2 = 2 (For 2 Million Points with Buffer A and B) ....
	n
Response	None
Example	sens5:func:loop 0

:SENSe[n]:FUNCtion:LOOP?

Syntax	:SENSe[n]:FUNCtion:LOOP?
Description	Gets the number of logging loops and used Buffer. See: :SENSe [n]:FUNCtion:RESult:BUFA? (page 149)
Parameters	None
Response	Number of loops: Number of loops is an integer value. 0 = Endless Streaming 1 = 1 (Default) 2 = 2 (For 2 Million Points with Buffer A and B) .... n
Example	sens5:func:loop? → 0

:SENSe[n]:FUNCtion:PARameter:CHECk?

Syntax	:SENSe[n]:FUNCtion:PARameter:CHECk?
Description	Returns whether the currently settings are consistent. 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 string Sum of pre trigger and data points is higher than 1048576 No threshold triggering in relative mode allowed
Parameters	None
Response	Returns whether the currently settings are consistent. 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: 0,OK Sum of pre trigger and data points is higher than 1048576 No threshold triggering in relative mode allowed
Example	sens5:func:par:check? → 0,OK

:SENSe[n]:FUNCtion:PARameter:LOGGing

Syntax	:SENSe[n]: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 (page 147) if you want to use delayed measurement. NOTE: Setting parameters for the logging function sets some parameters, including hidden parameters, for the stability and MinMax functions and vice versa. If you specify no units for the averaging time value in your command, seconds are used as the default. See :SENSe[n]:FUNCtion:STATe (page 151) for information on starting/stopping a data acquisition function. See (page 148) for information on accessing the results of a data acquisition function. See Table 8 for information on how triggering affects data acquisition functions. NOTE: Before using this command, ensure to stop logging for all available channels. Details can be found in the Application Note "Transient Optical Power Measurements with the N7744C and N7745C". http://literature.cdn.keysight.com/litweb/pdf/5990-3710EN.pdf
Response	None
Example	sens5:func:par:logg 64,1ms

:SENSe[n]:FUNCtion:PARameter:LOGGing?

Syntax	:SENSe[n]: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	sens5:func:par:logg? → +64,+1.00000000E-001

:SENSe[n]:FUNCtion:PARameter:MINMax

Syntax	:SENSe[n]: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 NOTE: WINDow mode has the same function as REFResh mode. It is included to ensure compatibility. NOTE: The time between samples in MinMax mode is at least the averaging time, but not less than about 2 ms, depending on the interface command rate. 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. NOTE: Setting parameters for the MinMax function sets some parameters, including hidden parameters, for the stability and Logging functions and vice versa. See :SENSe[n]:FUNCtion:STATe (page 151) for information on starting/stopping a data acquisition function. See (page 148) for information on accessing the results of a data acquisition function. See Trigger Subsystem Commands for information on how triggering affects data acquisition functions.
Response	None
Example	sens5:func:par:logg 64,1ms

:SENSe[n]:FUNCtion:PARameter:MINMax?

Syntax	:SENSe[n]: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
	NOTE: WINDow mode has the same function as REFResh mode. It is included to ensure compatibility. The number of data points is returned as an integer value.	
Example	sens5:func:par:minm? → WIND,+10	

:SENSe[n]:FUNCtion:PARameter:STABility

Syntax	:SENSe[n]: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: Setting parameters for the Stability function sets some parameters,including hidden parameters, for the MinMax and Logging functions and vice versa. 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. See :SENSe[n]:FUNCtion:STATe (page 151) for information on starting/stopping a data acquisition function. See :SENSe[n]:FUNCtion:RESult? (page 148) for information on accessing the results of a data acquisition function. See :TRIGger[n][:CHANnel[m]]:INPut for information on how triggering affects data acquisition functions.
Response	None
Example	sens5:func:par:stab 1s,0.1s,0.1s

:SENSe[n]:FUNCtion:PARameter:STABility?

Syntax	:SENSe[n]: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	sens5:func:par:stab? → +1.00000000E+000, +1.00000000E-001,+1.00000000E-001

:SENSe[n]:FUNCtion:RESult?

Syntax	:SENSe[n]: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. One measurement value is a 4 byte little-endian IEEE 754 single precision value. For Logging and Stability Data Acquisition functions. For the MinMax Data Acquisition function, the query returns the minimum, maximum and current power values. See Data Types on page 16 for more information on Binary Blocks. See How to Log Results for information on logging using VISA calls. There are some tips about how to use float format specifiers to convert the binary blocks (32 Bit / IEEE 754 single precision format).
Example	sens5:func:res? → #255..... returns a data array for Logging and Stability Data Acquisition functions sens5: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

:SENSe[n]:FUNCtion:RESult:BLOCk?

Syntax	:SENSe[n]: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 little-endian IEEE 754 single precision value.
Example	sens5:func:res:bloc? #5, 2 → interpreted as 7.24079E-04,7.24252E-04

:SENSe[n]:FUNCtion:RESult:BUFA?

Syntax	:SENSe[n]:FUNCtion:RESult:BUFA?
Description	Returns the data array of the last data acquisition function in Buffer A. This works only for Logging and Stability Data Acquisition in the loop mode, not for the MinMax Data Acquisition.
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 little-endian IEEE 754 single precision value. . You can read the most recent results out of one buffer while the next logging measurement is filling the other buffer.
Example	sens5:func:res:bufa? → #255....

:SENSe[n]:FUNCtion:RESult:BUFB?

Syntax	:SENSe[n]:FUNCtion:RESult:BUFB?
Description	Returns the data array of the last data acquisition function in Buffer B. This works only for Logging and Stability Data Acquisition in the loop mode, not for the MinMax Data Acquisition.
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 little-endian IEEE 754 single precision value. You can read the most recent results out of one buffer while the next logging measurement is filling the other buffer
Example	sens5:func:res:bufb? → #255....

:SENSe[n]:FUNCtion:RESult:BLOCk?

Syntax	:SENSe[n]: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. This function is not available for min-max measurements.
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 data acquisition function's data array as a binary block. For Logging and Stability Data Acquisition functions, one measurement value is a 4 byte little-endian IEEE 754 single precision value. See "Data Types" for more information on Binary Blocks. See "How to Log Results" 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.
Example	sens5:func:res:bloc? #5, 2 → interpreted as 7.24079E-04,7.24252E-04

:SENSe[n]:FUNCtion:RESult:INDex?

Syntax	:SENSe[n]:FUNCtion:RESult:INDex?
Description	Gets the number of already finished logging loops.
Parameters	None
Response	Number of loops: Number of loops is an integer value.
Example	sens5:func:res:index? → 1

:SENSe[n]:FUNCtion:RESult:MAXBlocksize?

Syntax	:SENSe[n]:FUNCtion:RESult:MAXBlocksize?<wsp><offset><# of data points>
Description	Returns the maximum block size for a single SCPI transfer for power meter data acquisition functions. If your application requires more data points please use SENSe [n]:FUNCtion:RESult:BLOCk? instead of SENSe[n]:FUNCtion:RESult?
Parameters	None
Response	An integer value, number of data points. See Data Types for more information on Binary Blocks.
Example	sens5:func:res:maxb? → +204050

:SENSe[n]:FUNCtion:STATe

Syntax	:SENSe[n]: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 See (page 145) for more information on the logging data acquisition function. Stop any function before you try to set up a new function. Some parameters cannot be set until you stop the function. Details can be found in the Application Note "Transient Optical Power Measurements with the N7744C and N7745C". http://literature.cdn.keysight.com/litweb/pdf/5990-3710EN.pdf
Response	None
Example	sens5:func:stat logg,star

:SENSe[n]:FUNCtion:STATe?

Syntax	:SENSe[n]: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	sens5:func:stat? → LOGGING_STABILITY,COMPLETE

:SENSe[n]:POWer:GAIN:AUTO

Syntax	:SENSe[n]:POWer:GAIN:AUTO<wsp><value>
Description	Set the Auto Gain.
Parameters	0 = Auto Gain Off. This is the position for best transient response.

	1 = Auto Gain On (Default) This is the Position for best dynamic. Auto gain only works for averaging times >=10us. For shorter averaging times, the auto gain is always disabled. The Auto Gain setting works also in the logging and stability modes, where it also increases dynamic or enhances transient response. NOTE: For Logging / Stability, set the Autogain to the same value for all channels. Send the Autogain commands before setting Average Time or configuring Logging /Stability. Details can be found in the Application Note "Transient Optical Power Measurements with the N774x-Series Multipor Power Meter". http://literature.cdn.keysight.com/litweb/pdf/5990-3710EN.pdf NOTE: Disable Auto Gain when modulated Signals are to be measured.
Response	None
Example	sens5:pow:gain:auto 1

:SENSe[n]:POWer:GAIN:AUTO?

Syntax	:SENSe[n]:POWer:GAIN:AUTO?
Description	Get the Auto Gain.
Parameters	None
Response	0 = Auto Gain Off. This is the position for best transient response. 1 = Auto Gain On (Default) This is the Position for best dynamic.
Example	sens5:pow:gain:auto? → 1

:SENSe[n]:POWer:ATIMe

Syntax	:SENSe[n]:POWer:ATIMe<wsp><averaging time>[NS|US|MS|S]
Description	Sets the averaging time.
Parameters	The averaging time as a float value in seconds. If you specify no units in your command, seconds are used as the default. NOTE: For N774-C power meters the internal granularity of the averaging time is 1us which allows flexibility.
Response	None
Example	sens5:pow:atim 1s

:SENSe[n]:POWer:ATIMe?

Syntax	:SENSe[n]:POWer:ATIMe?
Description	Returns the averaging time.
Parameters	None
Response	The averaging time as a float value in seconds.
Example	sens5:pow:atim? → +1.00000000E+000

:SENSe[n]:POWer:OUTPut

Syntax	SENSe[n]:POWer:OUTPut <wsp><mode>	
Description	Enable or Disable the front Front Panel Analog Output BNC Connector of a channel The analog voltage is always in the range between 0 and 2V.	
Parameters	A string value:	DISabled: disable the analog output LINear: For linear output, the voltage represents 1 V corresponds to the nominal value of the current range (like 100 µW in the -10 dBm range) and 0 V corresponds to zero signal. LOGarithmic: For logarithmic output, the voltage represents the optical power independent of the current range. For power meters with a maximum range of +10 dBm, 2 V corresponds to +20 dBm, 1.8 V to +10 dBm, 1.6 V to 0 dBm, 1.4 V to -10 dBm,... 0 V to -80 dBm. For power meters with a maximum range of +20 or +30 dBm, the scale is shifted by 10 dB, so 2 V represents +30 dBm and 0 V is – 70 dBm. For the 81628C with a +40 dBm maximum range, 2 V is +40 dBm and 0 V is -60 dBm.
Response	None	
Example	sens5:pow:outp LIN	
Affects	N774-C instruments (except N7744C and N7745)	

:SENSe[n]:POWer:OUTPut?

Syntax	SENSe[n]:POWer:OUTPut?
Description	Returns the current analog output state of a channel.
Parameters	None

Response	A string value:	DISabled: disable the analog output LINear: linear voltage output is active LOGarithmic : logarithmic voltage output is active
Example	sens5:pow:rang:auto 1	
Affects	N774-C instruments (except N7744C and N7745)	

:SENSe[n]:POWer:RANGe:AUTO

Syntax	SENSe[n]:POWer:RANGe:AUTO <wsp><boolean>	
Description	Enables or disables automatic power ranging for the channel. If automatic power ranging is enabled, ranging is automatically determined by the instrument. Otherwise, it must be set by the sens[n]:pow:rang command. Automatic ranging while other commands are sent to power meters has lead to timing conflicts in some configurations. Automation programs can often better control the range directly. NOTE: Disable Auto Range when modulated Signals are to be measured. In Logging Mode Auto Range is always OFF. Wait 2.5 times the averaging time after power range switching (see Range settling time (one range step)).	
Parameters	A boolean value:	0 or OFF: automatic ranging disabled 1 or ON: automatic ranging enabled
Response	None	
Example	sens5:pow:rang:auto 1	

:SENSe[n]:POWer:RANGe:AUTO?

Syntax	:SENSe[n]:POWer:RANGe:AUTO?	
Description	Returns whether automatic power ranging is being used by the channel.	
Parameters	None	
Response	A boolean value:	0: automatic ranging is not being used. 1: automatic ranging is being used.
Example	sens5:pow:rang:auto? → 1	

:SENSe[n]:POWer:RANGe:AUTO:ALL

Syntax	SENSe[n]:POWer:RANGe:AUTO:ALL <wsp><boolean>
Description	Enables or disables automatic power ranging for all channels.

Parameters	A boolean value:	0: automatic ranging is not being used. 1: automatic ranging is being used.
Response	None	
Example	sens5:pow:rang:auto:all? → 1	

:SENSe[n]:POWer:RANGe

Syntax	:SENSe[n]:POWer:RANGe<wsp><value>[DBM]
Description	Sets the power range for the channel. The range changes at 10 dBm intervals. The corresponding ranges for linear measurements (measurements in Watts) is given below: Range — Upper Linear Power Limit +10 dBm — 19.999 mW 0 dBm — 1.9999 mW -10 dBm — 199.99 uW -20 dBm — 19.999 uW -30 dBm — 1.9999 uW Wait 2.5 times the averaging time after power range switching (see Range settling time (one range step)).
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	sens5:pow:rang -20DBM

:SENSe[n]:POWer:RANGe?

Syntax	:SENSe[n]:POWer:RANGe?
Description	Returns the range setting for the channel.
Parameters	None
Response	The range setting as a float value in dBm (-30 to +10).
Example	sens5:pow:rang? → -2.00000000E+001

:SENSe[n]:POWer:RANGe:ALL

Syntax	:SENSe[n]:POWer:RANGe:ALL<wsp><value>[DBM]
Description	Sets the power range for all channels. The range changes at 10 dBm intervals. The corresponding ranges for linear measurements (measurements in Watts) is given below:

	Range Upper Linear Power Limit +10 dBm 19.999 mW 0 dBm 1.9999 mW -10 dBm 199.99 uW -20 dBm 19.999 uW -30 dBm 1.9999 uW Wait 2.5 times the averaging time after power range switching (see Range settling time (one range step)).
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	sens5:pow:rang:all -20DBM

:SENSe[n]:POWer:REFerence

Syntax	:SENSe[n]:[CHANnel[m]]:POWer:REFerence<wsp> TOMODule|TOREF,<value>PW|NW|UW|MW|Watt|DBM|DB|MDB
Description	Sets the channels 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. You must append a unit type dB if you use TOMODule or Watts or dBm if you use TOREF The two reference values are completely independent. When you change the reference mode using the command :SENSe[n]:POWer:REFerence:STATe:RATio, the instrument uses the last reference value entered for the selected reference mode.
Response	None
Example	sens5:pow:ref tomod,-40DB

:SENSe[n]:POWer:REFerence?

Syntax	:SENSe[n]:POWer:REFerence?<wsp>TOMODule|TOREF
Description	Returns the channels 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	sens5:pow:ref? toref → +1.00000000E-006	

:SENSe[n]:POWer:REFerence:DISPlay

Syntax	:SENSe[n]:POWer:REFerence:DISPlay
Description	Takes the current measured input power level value as the reference value. "disp to ref"
Parameters	None
Response	None
Example	sens5:pow:ref:disp

:SENSe[n]:POWer:REFerence:STATe

Syntax	:SENSe[n]: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	sens5:pow:ref:stat 1	

:SENSe[n]:POWer:REFerence:STATe?

Syntax	:SENSe[n]: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	sens5:pow:ref:stat? → 1	

:SENSe[n]:POWer:REFerence:STATe:RATio

Syntax	:SENSe[n]:POWer:REFerence:STATe:RATio<wsp> <channel number>|255|TOREF,<channel number>	
Description	Selects the reference for the channel.	
Parameters	channel number:	an integer value representing the channel 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
	If you want to reference another power sensor channel, use an integer value corresponding to the channel 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. NOTE: you have to change the reference mode to "relative" to use this function. See :SENSe[n]:POWer:REFerence:STATe (page 157)	
Response	None	
Example	sens5:pow:ref:stat:rat 2,1	References channel 2.1
	sens5:pow:ref:stat:rat TOREF,1	References an absolute reference

:SENSe[n]:POWer:REFerence:STATe:RATio?

Syntax	:SENSe[n]:POWer:REFerence:STATe:RATio?	
Description	Returns the reference setting for the channel.	
Parameters	None	
Response	Results are displayed relative to an absolute reference or to the current power reading from another channel.	
Example	sens5:pow:ref:stat:rat? → +255,+0<END>	Results are displayed relative to an absolute reference
	sens5:pow:ref:stat:rat? → +2,+1<END>	Results are displayed relative to channel 2.1

:SENSe[n]:POWer:UNIT[:ALL]

Syntax	:SENSe[n]:POWer:UNIT<wsp>DBM|0|Watt|1

Description	Sets the sensor power unit of selected channel or of ALL channels.	
Parameters	An integer value:	0: dBm 1: Watt
	or DBM or Watt	
Response	None	
Example	sens5:pow:unit 1 sens:pow:unit:all 1	

:SENSe[n]:POWer:UNIT?

Syntax	:SENSe[n]:POWer:UNIT?	
Description	Gets the current sensor power unit of selected channel	
Parameters	None	
Response	An integer value:	0: Current power units are dBm. 1: Current power units are Watts.
Example	sens5:pow:unit? → +1	

:SENSe[n]:POWer:UNIT:ALL:CSV?

Syntax	:SENSe[n]:POWer:UNIT:ALL:CSV?
Description	Gets the current sensor power units for all channels.
Parameters	None
Response	1, 0
Example	sens:pow:unit:all:csv? → 1,0,1,1,1,1,1,1

:SENSe[n]:POWer:WAVelength[:ALL]

Syntax	:SENSe[n]:[CHANnel[m]]:POWer:WAVelength[:ALL]<wsp><value>|MIN|MAX|DEF [PM|NM|UM|MM|M]	
Description	Sets the sensor wavelength of selected channel or of ALL channels. Frequent use of this command can conflict with the timing of autoranging in some configurations. Autorange can be disabled before and enabled after the command if needed.	
Parameters	The wavelength as a float value in meters.	
	Also allowed are:	MIN: minimum programmable value MAX: maximum programmable value DEF: the preset (*RST) default value

Response	None
Example	sens5:pow:wav 1550nm sens:pow:wav:all 1550nm

:SENSe[n]:POWer:WAVelength?

Syntax	:SENSe[n]:POWer:WAVelength?[<wsp>MIN|MAX|DEF]	
Description	Gets the current sensor wavelength.	
Parameters	None	
Response	The wavelength as a float value in meters.	Also allowed are: MIN: minimum programmable value MAX: maximum programmable value DEF: the preset (*RST) default value.
Example	sens5:pow:wav? → +1.55000000E-006	

SLOT Subsystem

This section provides the description of the following commands.

Command	Reference
:SLOT [n]:WAVelength:RESPonse?	:SLOT[n]:WAVelength:RESPonse? (page 160)
:SLOT[n]:WAVelength:RESPonse:CSV?	:SLOT[n]:WAVelength:RESPonse:CSV? (page 161)
:SLOT[n]:WAVelength:RESPonse:SIZE?	:SLOT[n]:WAVelength:RESPonse:SIZE? (page 161)

:SLOT[n]:WAVelength:RESPonse?

Syntax	:SLOT[n]:WAVelength:RESPonse?
Description	Returns the wavelength response from a wavelength calibrated module in binary format.
Parameters	None

Response	Wavelength Response table as a binary block.
Example	slot1:wav:resp? -> #536570.....
Affects	Attenuator with power control, all powermeters

:SLOT[n]:WAVelength:RESPonse:CSV?

Syntax	:SLOT[n]:WAVelength:RESPonse:CSV?
Description	Returns the wavelength response from the attenuator module in CSV format.
Parameters	None
Response	Wavelength Response table as a string.
Example	slot1:wav:resp:csv? -> 1200e-6,2.019\n 1210e-6, 1.956\n...
Affects	Attenuator with power control, all powermeters

:SLOT[n]:WAVelength:RESPonse:SIZE?

Syntax	:SLOT[n]:WAVelength:RESPonse:SIZE?
Description	Returns the number of elements in the wavelength response table.
Parameters	None
Response	Number of elements in the wavelength table as an integer value
Example	slot2:wav:resp:size? -> 50
Affects	Attenuator with power control, all powermeters

TRIGger Subsystem

The TRIGger Subsystem allows you to configure how the instrument reacts to incoming or outgoing triggers. This section provides the description of the trigger commands.

Command	Reference
:TRIGger[n]:DELay?	:TRIGger[n]:DELay? (page 162)
:TRIGger[n]:DELay	:TRIGger[n]:DELay (page 162)
:TRIGger[n]:INPut	:TRIGger[n]:INPut (page 162)
:TRIGger[n]:INPut?	:TRIGger[n]:INPut? (page 163)
:TRIGger[n]:INPut:ALL	:TRIGger[n]:INPut:ALL (page 163)
:TRIGger[n]:OFFSet	:TRIGger[n]:OFFSet (page 163)

Command	Reference
:TRIGger[n]:OFFSet?	:TRIGger[n]:OFFSet? (page 164)
:TRIGger[n]:OUTPut	:TRIGger[n]:OUTPut (page 164)
:TRIGger[n]:OUTPut?	:TRIGger[n]:OUTPut? (page 164)
:TRIGger[n]:OUTPut:ALL	:TRIGger[n]:OUTPut:ALL (page 165)

:TRIGger[n]:DELay?

Syntax	:TRIGger[n]:DELay?
Description	Returns factor for delay. Effective trigger delay time = factor/32 Mhz
Parameters	None
Response	Factor
Example	trig1:del? → +0

:TRIGger[n]:DELay

Syntax	:TRIGger[n]:DELay<wsp><value>
Description	Defines factor for delay. Effective trigger delay time = factor/32 Mhz. That means, trigger event is excuted after specified time after input trigger.
Parameters	Integer number between 0-997 (including limits)
Response	None
Example	trig1:del 10

:TRIGger[n]:INPut

Syntax	:TRIGger[n]:INPut<wsp><trigger response>	
Description	Sets the incoming trigger response and arms the instrument.	
Parameters	IGNore:	Ignore incoming trigger.
	NEXTstep:	Perform next step of a stepped sweep.
	SWStart:	Start a sweep cycle.
	NOTE: If a trigger signal arrives at the Input Trigger Connector at the same time that the SENSe Subsystem - N7764C & N7768C (page 137) 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	

e

:TRIGger[n]:INPut?

Syntax	:TRIGger[n]:INPut?	
Description	Returns the incoming trigger response.	
Parameters	None	
Response	IGNore:	Ignore incoming trigger.
	NEXTstep:	Perform next step of a stepped sweep.
	SWStart:	Start a sweep cycle.
Example	trig1:inp? -> IGN	

:TRIGger[n]:INPut:ALL

Syntax	:TRIGger[n]:INPut:ALL<wsp><trigger response>	
Descri-ption	Sets the incoming trigger response to all channels.	
Para-meters	IGNore:	Ignore incoming trigger.
	NEXTstep:	Perform next step of a stepped sweep.
	SWStart:	Start a sweep cycle.
	NOTE: If a trigger signal arrives at the Input Trigger Connector at the same time that the SENSe Subsystem - N7764C & N7768C (page 137) command is executed, the first measurement value is invalid. You should always discard the first measurement value in this case. The module per-forms the appropriate action when it is triggered.	
Respo-nse	None	
Exampl-e	:trig1:inp:all ign	

:TRIGger[n]: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 2147483647)
Response	None
Example	trig1:offs 5

:TRIGger[n]: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

:TRIGger[n]:OUTPut

Syntax	:TRIGger[n]:OUTPut	
Description	Specifies when an output trigger is generated and arms the channel.	
Parameters	DISabled:	Never
	AVGover:	When averaging time period finishes
	MEASure:	When averaging time period begins.
	STFinished:	When a sweep step finishes.
	SWFinished:	When sweep cycle finishes.
	SWSTarted:	When a sweep cycle starts.
Response	None	
Example	trig1:outp dis	

:TRIGger[n]:OUTPut?

Syntax	:TRIGger[n]: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.
	STFinished:	When a sweep step finishes.
	SWFinished:	When sweep cycle finishes.
	SWSTarted:	When a sweep cycle starts.
Example	trig1:outp? -> DIS	

:TRIGger[n]:OUTPut:ALL

Syntax	:TRIGger[n]:OUTPut:ALL	
Description	Specifies when an output trigger is generated and arms all channels.	
Parameters	DISabled:	Never
	AVGover:	When averaging time period finishes
	MEASure:	When averaging time period begins.
	STFinished:	When a sweep step finishes.
	SWFinished:	When sweep cycle finishes.
	SWSTarted:	When a sweep cycle starts.
Response	None	
Example	trig:outp:all dis	

Error Codes

This chapter gives information about error codes used with the N77--C series instruments.

Error strings in the range -100 to -183 are defined by the SCPI standard, downloadable from: http://www.ivifoundation.org/docs/scpi-99.pdf

Error Number	Error String
0	"No error"
-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.]
-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.]
-102	"Syntax error" [An unrecognized command or data type was encountered; for example, a string was received when the device does not accept strings.]
-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]
-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.]
-105	"GET not allowed" [A Group Execute Trigger was received within a program message (see IEEE488.2, 7.7).]
-108	"Parameter not allowed" [More parameters were received than expected for the header]
-109	"Missing parameter" [Fewer parameters were received than required for the header]
-110	"Command header error"
-111	"Header separator error"
-112	"Program mnemonic too long"

Error Number	Error String
	[The header contains more than twelve characters (see IEEE 488.2, 7.6.1.4.1).]
-113	"Undefined header" [The header is syntactically correct, but it is undefined for this specific device; for example, *XYZ is not defined for any device.]
-114	"Header suffix out of range"
-115	"Unexpected number of parameters"
-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 nondecimal numeric types. This error message is used if the device cannot detect a more specific error.]
-121	"Invalid character in number" [An invalid character for the data type being parsed was encountered; for example, an alpha in a decimal numeric]
-123	"Exponent too large" [The magnitude of the exponent was larger than 32000 (see IEEE 488.2,7.7.2.4.1).]
-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).]
-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.]
-130	"Suffix error"
-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 device.]
-134	“Suffix too long” [The suffix contained more than 12 characters (see IEEE 488.2, 7.7.3.4).]
-138	“Suffix not allowed” [A suffix was encountered after a numeric element which does not allow suf-fixes.]
-141	“Invalid character data” [Either the character data element contains an invalid character or the par-ticular element received is not valid for the header.]
-144	"Character data too long"
-148	“Character data not allowed” [A legal character data element was encountered where prohibited by the

Error Number	Error String
	device.]
-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.]
-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.]
-158	“String data not allowed” [A string data element was encountered but was not allowed by the device at this point in parsing.]
-160	"Block data error"
-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.]
-168	“Block data not allowed” [A legal block data element was encountered but was not allowed by the device at this point in parsing.]
-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.]
-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.]
-178	“Expression data not allowed” [A legal expression data was encountered but was not allowed by the device at this point in parsing.]
-180	"Macro error"
-181	“Invalid outside macro definition” [Indicates that a macro parameter place-holder ($<number) was encountered outside of a macro definition.]
-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).]
-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

Error Number	Error String
	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. Note: Incorrect slots and channels addresses are handled by error code -301
-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 occur for a number of reasons. Example: When a power meter 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.
-201	"Invalid while in local" "Please be patient - GPIB currently locked out" Description: Some operations block the complete system. Since no sensible measurements are possible while this is true, the GPIB is locked out. Example: When ARA, Lambda zeroing or zeroing is executing on a TLS module, the GPIB is not accessible.
-202	"Settings lost due to rtl"
-203	"Command protected"
-210	"Trigger error"
-211	“Trigger ignored” Description: A trigger has been detected but ignored because of timing contraints. (For Example: average time to large).
-212	“Arm ignored” Description: The user can set the automatic re-arming option for input and output trigger events. When this error occurs, the device ignores the setting because the current module status does not allow the change of trigger settings.
-213	“Init ignored” Description: The INIT:IMM command 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.
-214	"Trigger deadlock"

Error Number	Error String
-215	"Arm deadlock"
-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:
-220	-220, "Parameter error (StatParmOutOfRange)" Description: The user has passed a parameter that exceeds the valid range for this parameter.
-220	"Parameter error (StatParmIllegalVal)" Description: The user has passed a parameter that does not match a value in a list of possible values.
-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 l Start is less than l Stop. Continuous Sweep mode AND Sweep Time is too short. Adjust Sweep Speed, l Start, or l Stop. Continuous Sweep mode AND Sweep Time is too long. Adjust Sweep Speed, l Start, or l 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.
-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.
-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.
-223	“Too much data”

Error Number	Error String
	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.
-224	“Illegal parameter value” [Used where exact value, from a list of possibles, was expected.]
-225	"Out of memory" Description: The request application or function cannot be executed because the instrument runs out of memory.
-226	"Lists not same length"
-230	"Data corrupt or stale"
-231	"Data questionable (StatValNYetAcc)" Description: The data that is returned 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.
-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.
-232	"Invalid format"
-240	"Hardware error"
-241	"Hardware missing"
-250	"Mass storage error"
-251	"Missing mass storage"
-252	"Missing media"
-253	"Corrupt media"
-254	"Media full"
-255	"Directory full"
-256	"File name not found"
-257	"File name error"
-258	"Media protected"
-260	"Expression error"

Error Number	Error String
-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 power 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.
-270	"Macro error"
-271	"Macro syntax error"
-272	“Macro execution error” [Indicates that a syntactically legal macro program data sequence could not be executed due to some error in the macro definition (see IEEE 488.2, 10.7.6.3.)]
-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.]
-274	"Macro parameter error"
-275	"Macro definition too long"
-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).]
-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).]
-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.]
-280	"Program error"
-281	"Cannot create program"
-282	"Illegal program name"
-283	"Illegal variable name"
-284	"Function currently running (StatModuleBusy)"

Error Number	Error String
	Description: This error is generated when a function is currently running on a module so that it cannot process another command. Example: When a powermeter is running a logging application, you are not able to configure the logging application parameters (also see -200).
-285	"Program syntax error"
-286	"Program runtime error"
-290	"Memory use error"
-291	"Out of memory"
-292	"Referenced name does not exist"
-293	"Referenced name already exists"
-294	"Incompatible type"
-300	"Device-specific error"
-303	"Module slot empty or slot / channel invalid" Description: The user has send a command to an empty slot.
-310	“System error” [Indicates that some error, termed “system error” by the device, has occurred. This code is device-dependent.]
-311	"Memory error"
-312	"PUD memory lost"
-313	"Calibration memory lost"
-314	"Save/recall memory lost"
-315	"Configuration memory lost"
-320	"Storage fault"
-321	“Out of memory” [An internal operation needed more memory than was available.]
-330	“Self-test failed” Description: You have started the self test, but the module has detected an error while executing it
-340	"Calibration failed"
-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.]
-360	"Communication error"

Error Number	Error String
-361	"Parity error in program message"
-362	"Framing error in program message"
-363	"Input buffer overrun"
-365	"Time out error"
-368	"LambdaStop<=LambdaStart"
-369	"sweepTime < min"
-370	"sweepTime > max"
-371	"triggerFreq > max"
-372	"step < min"
-373	"triggerNum > max"
-374	"LambdaLogging = On AND Modulation = On AND ModulationSource! = CoherenceControl"
-375	"LambdaLogging = On AND TriggerOut! = StepFinished"
-376	"Lambda logging in stepped mode"
-377	"step not multiple of 0.1pm"
-378	"triggerFreq < min"
-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.]
-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.]
-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.]
-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.]
-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,

Error Number	Error String
	6.5.7.5).]

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