OptoTest

Test Solutions for Fiber Optics

OP831

Bidirectional Insertion Loss

Instruction Manual

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MnOP831-RevC

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Overview

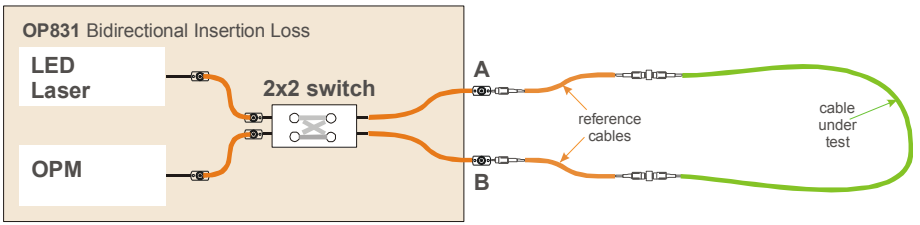
The OP831 offers an economical approach for bidirectional insertion loss measurements for either singlemode cables or multimode cables. For the multimode testing the OP831 is equipped with a 850nm LED, a 1300nm LED or a switched 850nm/1300nm dual LED source.

The source for the singlemode configuration consists of a dual wavelength laser with 1310nm and 1550nm wavelengths. For all models the power meter is equipped with a fiber terminated InGaAs detector. The internal 2x2 switch routes the light in either A-B direction or B-A direction.

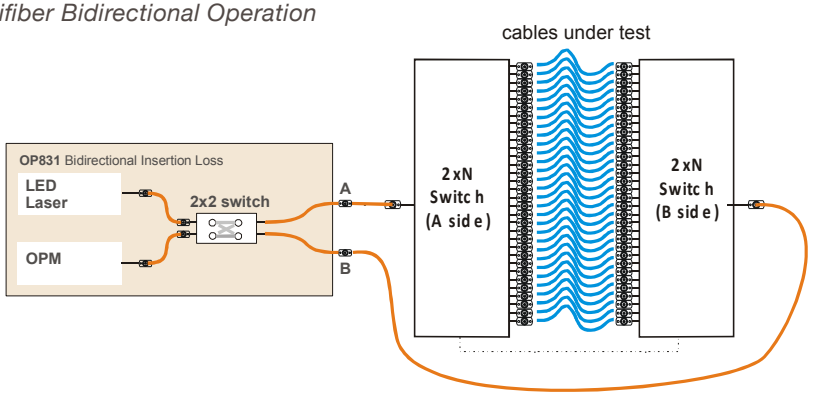
The OP831 also can be combined with a 2xN optical switch for the testing of bidirectional insertion loss on multi-fiber cables, cables harnesses or qualification testing on a series of cables.

Principle of Operation

Single Cable Bidirectional Operation



Multifiber Bidirectional Operation



Initial Preparation

Unpacking and Inspection

The unit was carefully inspected, mechanically, electrically and optically before shipment. When received, the shipping carton should contain the items listed in Standard Contents. Account for and inspect each item. In the event of a damaged instrument, write or call OptoTest Corp, California.

Note: Be aware that accessories such as detector adapters, remote head detectors, and high performance reference cables will be located inside a small box labeled "Accessories Inside". If this box is not included with the original shipment, contact OptoTest of their nearest distributor.

Please retain the shipping container in case re-shipment is required for any reason.

Damaged In Shipment

All instruments are shipped F.O.B. Camarillo when ordered from OptoTest.
If you receive a damaged instrument you should:

1. Report the damage to your shipper immediately.
2. Inform OptoTest Corporation.
3. Save all shipping cartons.

Failure to follow this procedure may affect your claim for compensation.

Standard Contents

1. Model OP831 Bidirectional Insertion Loss Meter
2. Power Cord (U.S. Shipments only)
3. USB A-B cable
4. Certificate of Calibration and if requested the Metrology Report
5. Instruction Manual(s)
6. CD/USB drive with applicable software and documentation (if ordered)

Definition of Specifications

Dynamic Range

The dynamic range, or measurement range, of the optical power meter spans from the maximal power level the instrument can measure, without major saturation to the detector, to the minimal power level where the thermal noise of the detector becomes greater than the current produced by the incident light. For accurate power measurements, it is NOT recommended to measure power levels at either end of the dynamic range. (see Linearity). The dynamic range is measured by comparing the absolute measured power against a reference power. When the difference between the two exceeds 1dB either end of the dynamic range has been reached.

Linearity

Photodetectors are, by nature, very linear over a wide range of optical input powers, but the power meter electronics can affect the overall system linearity. The power meter linearity is characterized and specified to know the measurement accuracy and linearity over the full dynamic range. For accurate insertion loss measurements only power levels that fall within the range with the best linearity (+/-0.05dB or better) should be measured.

Calibration Wavelength

The calibration wavelengths are the nominal wavelengths of the instruments calibration points. The exact wavelength of each particular calibration is stated in the certificate of calibration.

Calibration Traceability

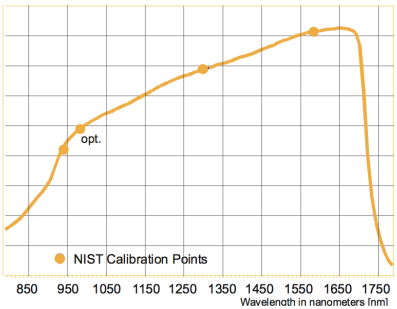
The detector's absolute calibration data is directly traceable to N.I.S.T. at the specified calibration wavelength and the specified power level, typically -10dBm.

Definition of Specifications

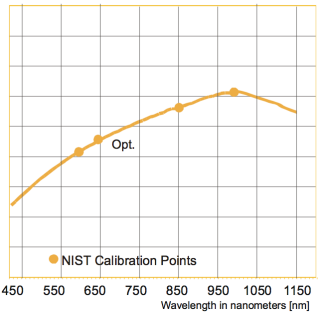
Spectral Responsivity

Depending on the detector type, InGaAs (Indium Gallium Arsenide) or Silicon the spectral responsivity, the efficiency of the detector to convert optical power into electrical current changes with wavelength.

Responsivity of InGaAs Detectors



Responsivity of Silicon Detectors



Note that other detector types are available such as IN5 (5mm InGaAs) IN10 (10mm InGaAs) as well as WSR (wide spectral range) and might exhibit a different spectral responsivity.

Absolute Accuracy

The absolute accuracy specification includes the total measurement uncertainties involved in the calibration process including the transfer of the absolute power standard from N.I.S.T. Contact OptoTest for the detailed chain of uncertainties.

Optical Power Meter, Channel Performance

For multichannel instruments, the power meter circuit converts and digitizes the optical power level with the given sampling interval. Changes in light levels such as modulation will be averaged within that sampling interval.

Instrument, Warm up Time

Optical power meters, in general, do not need any warm-up time unless the instrument has to acclimate to a changing environment. In order to calibrate the instrument or to perform stable measurements, the instrument should be acclimated for 15 minutes for each 5ºC of temperature differential. For example if the instrument was stored at 18ºC and brought into an environment of 28ºC the instrument should be allowed to warm up for 30 minutes.

Definition of Specifications

Recommended Recalibration Period

This is the recommended time period for re-calibration in order to maintain accuracy specifications. The recommendation is made based upon statistics on detector aging; however it is up to the metrology policies and procedures within each company to define the calibration cycles on optical power meters.

Optical Power Meter, Fiber Compatibility

The amount of aerial coverage of the detector, or the portion of the light emitted from the fiber being measured, depends on the mechanical features of the optical interface, the active area of the detector and the numerical aperture (NA) of the fiber. A fiber with a large NA, for example 100/140 multimode fiber, might not under fill a small area detector hence the absolute power reading will be less than actual.

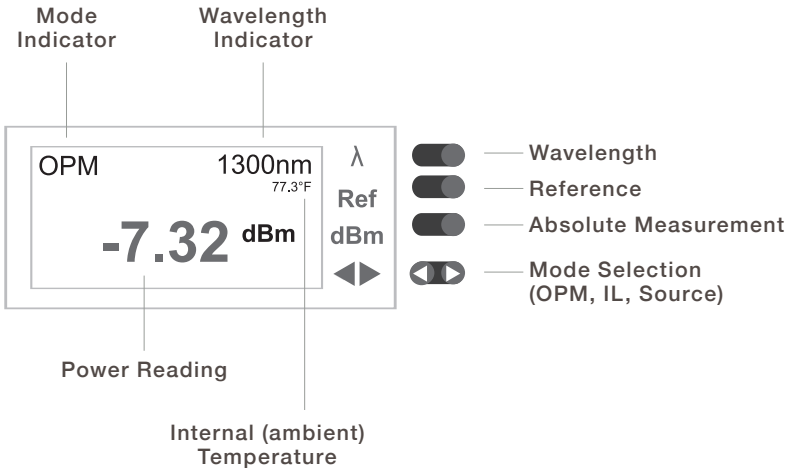
Instrument, Environmental

Operating Temperature: This is the temperature range in which the instrument will conform to the specifications after the specified warm up time.

Storage Temperature: This is the temperature range at which the instrument can be stored with the power off without any damage or any loss of specification to the instrument. It is required that the instrument be brought back to within the operating temperature range before it is turned on.

Humidity: The relative non-condensing humidity levels allowed in the operating temperature range.

Front Panel Operation – OP831



Wavelength

The **wavelength button** toggles through the available calibration wavelengths and source selection depending on the mode of the instrument.

OPM Mode: The measurement wavelengths for the OP831 are 850nm, 1300nm, 1310nm, 1480nm, and 1550nm unless otherwise noted.

A-B, B-A Mode: In bidirectional measurement mode the wavelength button toggles the source wavelength concurrently with the power meter calibration wavelength. For OP831 with a single wavelength source there is no wavelength to be selected, for dual wavelength implementations the wavelength selection is 850nm & 1300nm for multimode, and 1310nm & 1550nm for single mode.

Ref Mode: no function.

Reference

For OPM, A-B, B-A modes: The Ref button switches the power meter into relative measurement mode. At the same time it stores the current absolute power reading at the current wavelength as the reference. The reference power is displayed above the relative power reading (see illustration of Display). If the instrument is already in relative measurement mode pressing the Ref button stores the current power level as the new reference. For each wavelength and for each direction a reference reading can be stored.

Front Panel Operation – OP831

For Ref mode: Pressing the Ref button in Ref mode executes a reference sequence. For single wavelength devices this involves taking the reference in A-B mode and B-A mode, for dual wavelength instruments this involves taking the reference in A-B mode and B-A mode for the first wavelength, then repeats the same for the second wavelength. The referencing cycle can take up to 5 seconds.

Absolute Measurement

For modes: OPM, A-B, B-A:

The dBm button switches the power meter into absolute measurement mode.

Mode Selection

The mode selection switches between the following modes:

OPM Optical Power Meter

The OP831 operates as a standard optical power meter measuring absolute or relative power. In this mode the dBm button switches the instrument into absolute mode. The Ref button switches the instrument to relative mode (also dB mode on other instruments).

A-B Bidirectional

In A-B the upper optical port is the source output and the lower optical port is the power meter input. In this mode the dBm button doesn't have a function. The Ref button takes the reference measurement. Note that the reference is taken only for the selected wavelength. The absolute reference power is reflected in the Reference Indicator. After taking a reference the instrument continuously measures the insertion loss in the A-B direction.

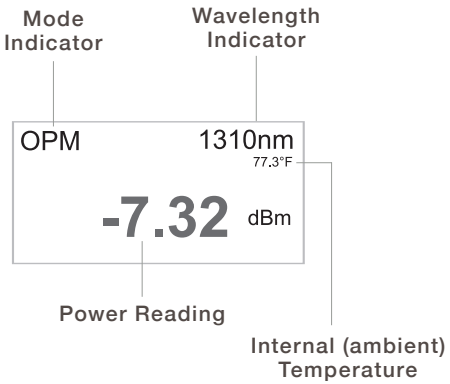
B-A Bidirectional

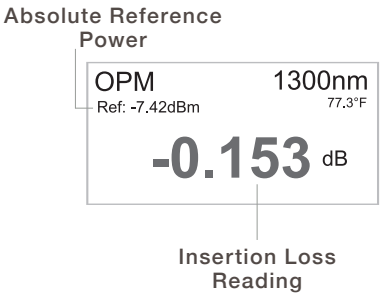
In B-A the upper optical port is the source output and the lower optical port is the power meter input. In this mode the dBm button doesn't have a function. The Ref button takes thereference measurement. Note that the reference is taken only for the selected wavelength.The absolute reference power is reflected in the Reference Indicator. After taking a reference the instrument continuously measures the insertion loss in the B-A direction.

Display Operation – OP831

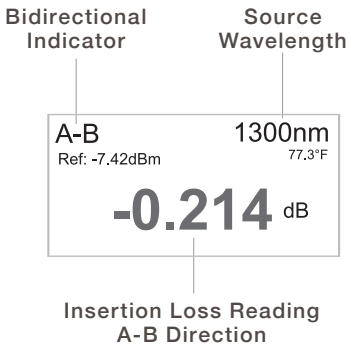
Depending on the selected mode the display shows different measurement parameters and results.

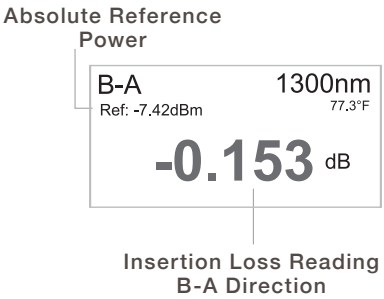
OPM Mode – Power Meter Mode





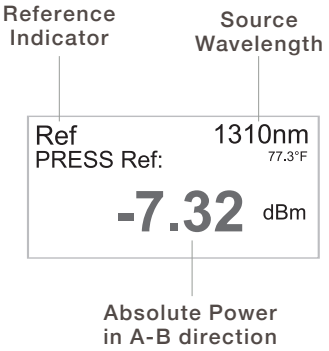
Bidirectional Insertion Loss





Display Operation – OP831

Bidirectional Insertion Loss



Mode Indicator, Bidirectional Indicator, Reference Indicator
Shows the current selected mode: OPM, A-B, B-A, Ref

Wavelength
Displays the currently selected calibration wavelength of the source wavelength used to measure in bidirectional mode. Typical wavelengths are as follows:

OPM Mode	850nm, 980nm, 1300nm, 1310m, 1480nm, 1550nm
A-B, B-A	Multimode: 850nm, 1300nm, Single mode: 1310nm, 1550nm

Absolute Power
The absolute power is displayed in dBm.

Relative Power
The relative power is displayed in dB. It is the difference between the reference power at the corresponding wavelength and the measured absolute power.

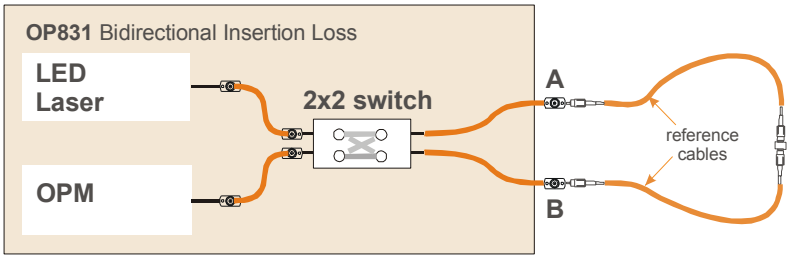
Internal Temperature
The internal, ambient temperature is displayed in either ºF (Fahrenheit) or ºC (Celsius), that selection is performed with a USB command.

Measurement Instructions

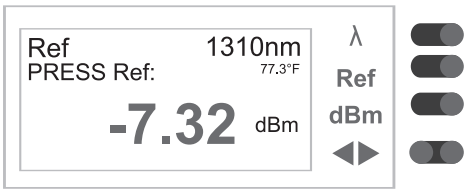
For the manual measurement of unidirectional or bidirectional insertion loss, follow these instructions:

Reference

Connect two reference cables as shown, please note that the use of quality reference cables is essential, a high loss from the reference connection will grossly dilute the measurement result of the actual cable.

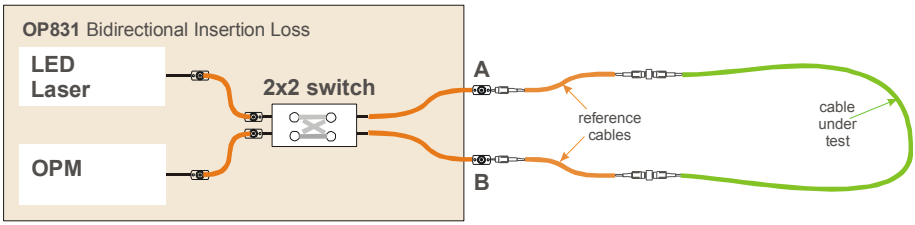


Switch the instrument to Ref mode and press the Ref button to execute the referencing cycle. The instrument will cycle through all the wavelengths in A-B and B-A direction, takes the absolute power reading and stores them. The instrument will end up in A-B mode at the end of this process.

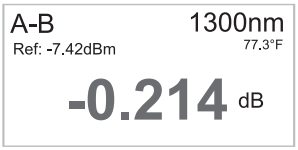


Insertion Loss Measurement in A-B Direction and B-A direction

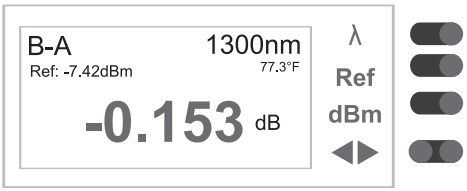
Connect the cable to be tested as shown:



The display of the A-B measurement will show the insertion loss of the connected cable. To measure and display the insertion loss at the other wavelength (if available) use the lambda button and switch the wavelength.



To measure the insertion loss in the other direction use the mode button to switch to B-A mode. The display of the B-A measurement will show the insertion loss of the connected cable. To measure and display the insertion loss at the other wavelength (if available) use the wavelength button and switch the wavelength.



Other cables can be measured by simply connecting them to the two reference cables as shown above. There is no need for a repeated reference cycle unless the reference cables have been changed. If a long time (hours) has elapsed since the last reference cycle or the measurement procedure requires a frequent referencing.

Please note that cleaning the connectors before each measurement should be standard practice.

USB Control of the OP831

The OP831 can be controlled via the USB bus. Upon request, OptoTest can supply the appropriate DLLs along with sample programs to facilitate the software creation process. For these DLLs please contact sales@optotest.com.

Warranty Information

OptoTest Corp. warrants this product to be free from defects in material and workmanship for a period of two years from date of shipment. During the warranty period we will, at our option, either repair or replace any product that proves to be defective. To exercise this warranty contact OptoTest Corp. headquarters. You will be given prompt assistance and return instructions. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days.

NOTE: Do not send instruments for any reason without contacting OptoTest headquarters first.

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