

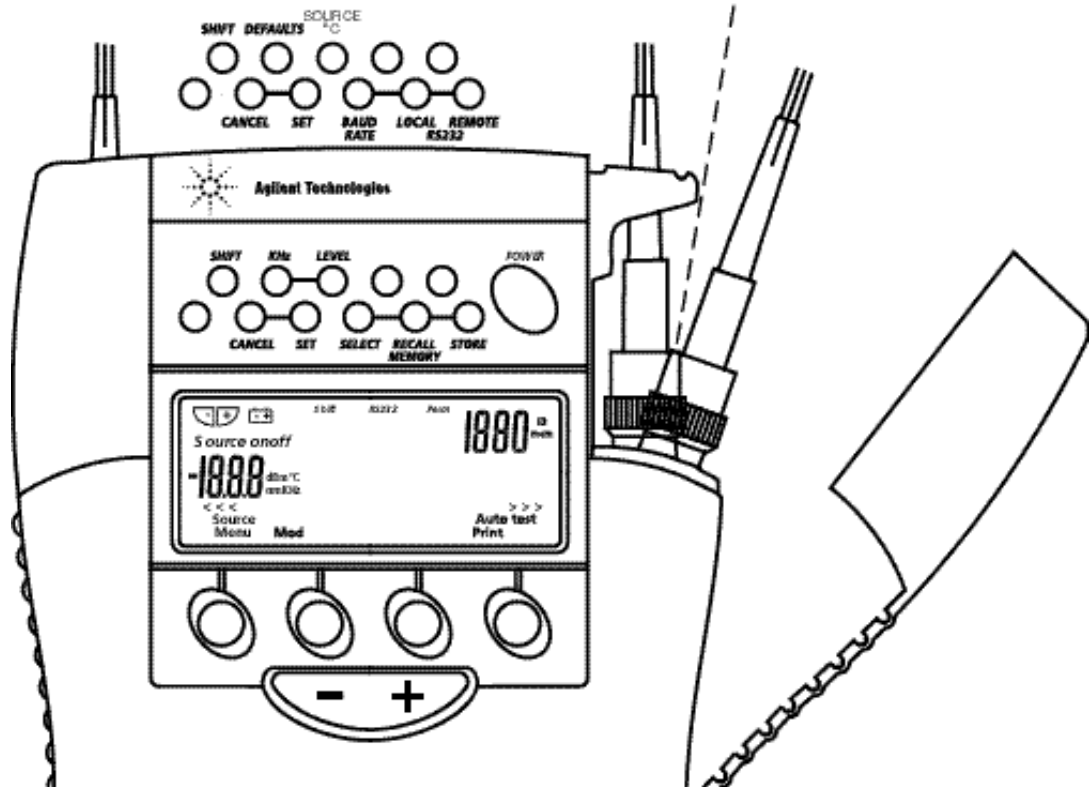
N3974A DUAL LASER SOURCE

Operating and
Maintenance Guide



Agilent Technologies

Position for
adaptor removal



■ N3974A DUAL LIGHT SOURCE QUICK REFERENCE GUIDE

- To remove interchangeable **connector**, move interface to mid position, and pull off adaptor.
- To defeat **auto power-off**, hold *POWER* for 3 seconds at turn on until *ON* and *perm* are displayed.
- To access **hidden keypad**, pull up display cover.

Select *POWER*, *Source*, then:

- To change **wavelength**, push +/-.
- To activate **modulation**, push *Mod*
- To change modulation **frequency**, while source is active push *Hz*, +/-, *Set*.
- To change **laser power** level, while source is active push *level*, +/-, *Set*.

AUTOTEST OPERATION

- Select (*POWER*), **Autotest on source** and wait a few seconds
- Autotest remains for >8 seconds after signal loss, to allow **quick connection** change.
- To **exit autotest**, remove test lead or turn off *Autotest* on source for >8 seconds.

MEMORY

- Enter *Source* mode first
- To **clear** all memory, push both *RECALL* and *CANCEL* together for 3 seconds. *clr* will display.
- To **store** in next default location, push *STORE*.
- To **specify** next store location, push *SELECT* +/-, *SET*.
- To **recall**, push, *RECALL* +/-.
- To **exit** memory display, push *CANCEL*.

ADDITIONAL AUTOTEST MEMORY OPERATION

- To read or cancel memory, first push *Menu* to exit **Autotest**, and enter *Source* mode.
- Autotest memory: use +/- to scroll wavelengths.

N3974A

DUAL LASER SOURCE

Congratulations on your purchase of this instrument, which has been engineered to provide the best possible reliability, convenience and performance. To get the best use from your equipment and ensure its safe operation, please spend a few minutes to read this manual.



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BEFORE READING FURTHER, OPEN THE CONTROL PANEL PICTURE AT THE BACK OF THE MANUAL



■ SERVICE AND SUPPORT

Any adjustment, maintenance, or repair of this product must be performed by qualified personnel. Contact your customer engineer through your local Agilent Technologies Service Center. You can find a list of local service representatives on the Web at: <http://www.agilent.com/find/assist>

If you do not have access to the Internet, one of these centers can direct you to your nearest representative:

United States	1 800 452 4844
Canada	1 877 894 4414 (905) 206 4120 (Fax)
Europe	(31 20) 547 2323 (31 20) 547 2390 (Fax)
Japan	(81) 426 56 7832 (81) 426 56 7840 (Fax)
Latin America	(305) 269 7500 (305) 269 7599 (Fax)

Australia	1 800 629 485 (613) 9272 0749 (Fax)
New Zealand	0800 738 378 64 4 495 8950 (Fax)
Asia-Pacific	(852) 3197 7777 (852) 2506 9284 (Fax)



■ INTRODUCTION AND APPLICATIONS

The N3974A Dual Laser Source is used for testing fibre optic systems at 1310 and 1550 nm. Compact and simple to use, it is the ideal solution for field or laboratory use, with features for use by installers, technicians and engineers.

Features:

Switched dual wavelength sources through one interchangeable connector.

The innovative optical connector port gives improved ease of access, connector lifetime & performance, and is drop protected by a snap on cover. A unique interchangeable connector system covers most connector requirements, and is easily disassembled for cleaning.

Autotest mode enables automatic wavelength detection and attenuation measurement (in combination with a power meter equipped with the Autotest function). This enables higher productivity, greater measurement confidence and lower operator skill levels.

We recommend a 1-year calibration cycle.

The long battery life of around 140 hours from two C cells eliminates the need for inconvenient re-chargeable batteries.

An external power input is also provided.

The easy to learn user interface guides the operator through functional sequences, and a hidden keypad accesses advanced functions.

The instrument has shock absorbing corners for drop protection, and an extremely tough polycarbonate housing. The latest materials and methods have been used to produce an elegant yet rugged instrument.

Typical applications

- Singlemode testing, with interchangeable connectors.
- Automated dual wavelength loss measurement.
- Telecom construction or maintenance, CATV, LAN and R&D applications.
- Measurements where traceability and documentation is required.
- Quality assurance and acceptance testing.
- Ultra stable laser source.
- Test tone generation, detection & fibre identification.



Safety Summary

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. Agilent Technologies Inc. assumes no liability for the customer's failure to comply with these requirements.

Before operation, 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.

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.

WARNING

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

SAFETY SYMBOLS



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.

Initial Inspection

Inspect the shipping container for damage. If there is damage to the container or Cushioning, keep them until you have checked

■ SAFETY SUMMARY

the contents of the shipment for completeness and verified the instrument both mechanically and electrically.

The Performance Tests give procedures for checking the operation of the instrument. 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 Agilent Technologies Sales/Service Office (see page 3).

WARNING

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

WARNING

You **MUST** return instruments with malfunctioning light source to an Agilent Technologies Service Centre for repair and calibration.

Line Power Requirements

The Agilent N3974A Dual Laser Source operates at line power when applied to the optional external power supply N3979A 9V DC.

Operating Environment

The Agilent N3974A Dual Laser Source can be operated at temperatures between - 10°C and + 55°C and at relative humidity of less than 95%.

Storage and Shipment

The Agilent N3974A Dual Laser Source can be stored or shipped at temperatures between - 25°C and + 70°C and at relative humidity of less than 95%. Protect the module from temperature extremes that may cause condensation within it.



Initial Safety Information

Agilent N3974A

Laser type	FP-Laser
InGaAsP	Wavelength ± 15 nm 1310/1550 nm
Max. CW output power*	<1 mW
Beam waist diameter	9 μ m
Numerical aperture	0.1
Laser Class according to IEC 60825-1 (1998)- International	1
Max. permissible CW output power - IEC**	8.9 mW/10 mW
Laser Class according to FDA 21 CFR 1040.10 (1995) – USA	I
Max. permissible CW output power - FDA**	2 mW/8.1 mW

* Max. CW output power is defined as the highest possible optical power that the Dual Laser Source can produce at its output connector.

** Max. permissible CW output power is the highest optical power that is permitted within the appropriate laser class.

■ SAFETY SUMMARY

Agilent Laser Safety Information

In the USA, all laser sources specified by this data sheet are classified as Class I according to 21 CFR 1040.10 (1995).

Internationally, the same laser sources are classified as Class 1 according to IEC 60825-1 (1998).

International safety information

USA label on product

WARNING

Please pay attention to the following laser safety warnings:

- Under no circumstances look into the end of an optical cable attached to the optical output when the device is operational. The laser radiation can seriously damage your eyesight.
- Do not enable the laser when there is no fibre attached to the optical output connector.

- The use of optical instruments with this product will increase eye hazard.
- The laser module has a built-in safety circuitry which will disable the optical output in the case of a fault condition.

WARNING

Refer Servicing only to qualified and authorised personnel.

REQUIREMENT COMPLIANCE



FDA Accession Number 9922312-00



■ BATTERY AND EXTERNAL POWER

The instrument is powered by two 1.5V dry batteries (Alkaline C) for an operating period of typically 140 hours, or two 1.2V rechargeable batteries for an operating period of approximately 70 hours.

Do not use lithium batteries or other batteries with a nominal voltage greater than 1.8 V.


The instrument will be damaged.

When the batteries are low, the low-battery indicator is shown on the display. At this stage, there is approximately enough energy for another 30 minutes of use.

For saving of energy the instrument automatically turns off after 10 minutes without operation.

For changing the battery open the cover of the battery compartment at the base of the instrument, remove the batteries, insert new batteries (check polarity) and close the cover again.

Rechargeable batteries must be charged by an external charger.

For operation of the instrument by external power use Agilent AC adaptor N3979A (9V DC, 1.33 A, ).

Use of the external power supply disconnects the batteries.

Ensure that the mains supply has the correct voltage rating and safety compliance as relevant. Do not use non-compliant or doubtful mains equipment.



■ OPTICAL CONNECTOR

The other port on this instrument is fitted with a dummy cap which can be used to store a spare interchangeable optical connector.

For optimum performance of laser sources, the use of PC polish connectors will give improved stability due to a lower overall level of reflected light.

Optical connectors are precision components, and require care in use:

- Always clean the mating connector tip and ferrule before mating, using approved materials.
- APC polish connectors should not be mated with PC (or flat) polish connectors.
- The soft case enables the instrument to be stored without removing the patchcords. This practice saves time, extends connector life, and gives more repeatable measurements.
- When not in use, keep all ports and connectors covered and away from dust.

- Do not touch connector tips with your fingers, since body oils and dirt can impair connector performance.
- Do not use damaged or incompatible connectors.

Interchangeable connector options

To install a connector adaptor, align the locating slot on the side of the adaptor with that on the instrument connector, and push it on.

To remove the connector adaptor, position the connector port at it's mid-way point (see dotted line on diagram at back of manual), and then pull off the adaptor. It is not possible to remove the adaptor in the 'open' or 'shut' positions. With some styles of connector, it is easier to pull off the adaptor with a patchlead in place, since this gives better grip.

- Different styles of connector adaptor (eg ST, SC, FC,) can be easily fitted by the user.
- Replacement of the fixed part of the connector must be performed at an authorised service centre.



■ GETTING STARTED AND TURNING ON

This and following sections show you how to use your instrument:

Check that the correct accessories have been supplied, and any optical connector adaptors have been fitted.

Put in the batteries, or plug external power into the socket at the top of the instrument (see Battery and External Power section).

Push the green POWER button. The display will come on. If the battery is low, this will be indicated on the display. Pushing POWER again will turn the instrument off.

To stop the instrument turning off 10 minutes after the last key press, hold POWER down for 3 seconds during turn-on. PERM on the display indicates that the unit will stay on permanently.

To backlight the display temporarily, select LIGHT. To backlight continuously, hold down the button for 3 seconds. The backlight will drain the batteries faster.

This instrument uses a menu driven main keypad. The function of each button is shown on the lcd.

To access the optical connectors, grasp a top corner of the instrument, and pull off the cover. The connector can be

swivelled slightly to improve access. When a source has been selected, the display points an arrow (<<< or >>>) to show the correct port.

The hidden keypad is accessed by pulling up the hinged display cover. The hidden keypad can operate in two modes. The second mode is accessed by SHIFT. Access to the second mode can be denied/ permitted by typing the key sequence: POWER (turn on instrument), SHIFT, CANCEL, SET, SELECT, RECALL, STORE.

To disable or enable the buzzer, hold down SHIFT for 3 seconds.

To add the carry strap: slip the end of the strap through the slit on the curved section at the back of the instrument, and secure the buckle.

To learn how to use the instrument features, go to the next section.

Should the instrument fail to turn on, the microprocessor may need re-booting. To do this, remove all batteries and external power for at least 40 seconds. This will not loose stored data.



■ AUTOTEST OPERATION

General Autotest features

For Autotest to function, all instruments involved in the test must be Agilent Technologies N397XA series instruments, or other Agilent Handheld instruments with an Autotest function.

The Autotest feature performs automated measurement (and automatic wavelength detection) by data exchange between the instruments, and requires minimal operator knowledge: turn the instrument on, connect a patchlead, and on the Dual Laser Source select AUTOTEST. Subsequent operation is automated, although some choices can be made for convenience. Autotest also detects and records the serial numbers of instruments used in the test and the sequence in which the tests were recorded.

This Dual Laser Source transmits Autotest signals at two wavelengths to an appropriate power meter.

Autotest actually reduces warm up drift in the source compared to normal operation, since each source is only on for 50% of the time during operation.



Operation

On the **Dual Laser Source**, push POWER, AUTOTEST.

The source display will assist in selecting the correct connector port during operation, by pointing an arrow to the correct port (<<< or >>>). Connect a patchlead to the source, and connect the other end to an Autotest compatible power meter.

This is all that is required to initiate Autotest operation. A connected power meter will automatically switch to Autotest mode.

The meter will automatically set to the correct wavelength, and the display will alternate between wavelengths.

Storing in memory will always produce the most complete

possible report, including absolute & relative values at all wavelengths.

Refer to your power meter or loss test set manual for details of how to make best use of your power meter in Autotest mode.

To exit AUTOTEST mode, on the **Dual Laser Source**, push "MENU".

■ DUAL LASER SOURCE OPERATION

After instrument turn on, the display will show SOURCE OFF. The source is turned on or off, and the wavelength is set (eg 1310, 1550 nm) using - / +. An arrow on the display will point to the relevant source port (<<< or >>>).

For the simplest level of operation, the sequence is simply: POWER, SOURCE - / +

To modulate the source, select MOD. The modulation frequency is shown on the display.

To select a different modulation frequency, pull up the hinged lcd cover to access the hidden keypad, push MOD and then - / + to select from 270 Hz, 1 KHz, 2 KHz, then SET.

The laser power can be adjusted by the user in 0.01 dB increments over 6 dB. To do this, on the hidden keypad, push LEVEL, - /+ to select the desired level, then SET.

The electronic attenuator is highly linear, and is a very convenient way of creating precision linearity tests with 0.01dB resolution.

Adjusting the relative laser power enables the user to match the source to a meter so that the meter gives the same reference reading as the source wavelength is changed (try it !). This is a very handy feature, since dual wavelength testing can then be performed without altering the meter wavelength setting, which improves measurement confidence (of course if Autotest is available, this is not needed).

This Dual Laser Source provides exceptional guaranteed power stability over time and temperature, zero warm up period and immunity to instability caused by back reflections. It provides a high level of productivity and accuracy for regular instrument users, and laboratory applications. Switched wavelengths from one optical port are provided.



You can store, display and print up to 845 source settings in non volatile memory.

Memory No	Identifier	SPACE
1 -199	Mem	199
200 -1990	Mem	179
1-199	ID	199
200-1990	ID	179
1-89	ID/mem	89

Total Memory 845

The memory location is shown in the top right corner of the display.

When storing data, the memory address automatically increments to facilitate the collection of data on a job.

You can also go back and over-write particular records.

After the data has been down-loaded or recorded, the entire memory can be cleared ready for the next job.

Memory operating sequence

To store data in next location: push STORE

To store data in particular location, push:

SELECT, -/+ , SET, STORE

To read from a particular location, push: RECALL, -/+

To clear the whole memory: push CANCEL and RECALL together for 2 seconds.'Clr' will display.



■ CARE OF YOUR INSTRUMENT

- To clean the instrument, use alcohol or other non solvent cleaning agents. Acetone or other active solvents may damage the case.
- During storage and transport, keep the instrument in it's carry case to protect against crushing, vibration, dust and moisture.
- The instrument is resistant to normal dust and moisture, however it is not waterproof. If moisture does get into the instrument, dry it out carefully before using it again.
- Follow the directions in this manual on cleaning Optical Connectors.
- Where possible, avoid letting strong direct sunlight cause heating to the instrument.
- During prolonged storage, remove batteries to eliminate the possibility of acid leakage. Use only high quality sealed alkaline batteries, to avoid acid leakage.
- The instrument housing is made of tough Polycarbonate material with impact absorbing rubberised corner features, and is therefore drop resistant. However the lasers contain precision alignments of a micron accuracy. Obviously, this kind of accuracy can be affected by rough handling. Therefore, rough treatment and severe vibration can be expected to degrade the instrument performance and lifetime.



■ ACCURACY CONSIDERATIONS

Optical connectors should be kept clean and in good condition.

The initial wavelength tolerance and temperature drift of typically 0.4 nm / °K of room temperature lasers means that the source wavelength is generally slightly different to the power meter or attenuator calibration wavelength.

Source power may drift: when you have finished a test, go back to the start position to check if source stability is still within acceptable limits. The N3974A ultra stable laser option is unusual in offering superb maximum drift specifications.

Most available laser sources except the N3974A are sensitive to reflections. Varying reflections can induce source instability of around 0.3 dB. This is very difficult to verify without a special test system, but can be a source of errors.

If your source is used in a high precision ATE type environment, minor rapid fluctuations of the order of 0.05 dB can occur, since

the source stabilisation controller is heavily damped, and cannot compensate for rapidly fluctuating optical reflections. The solution to this is either to use an optical isolator, or to ensure that a reflective (eg not PC or APC) connector is placed immediately after the source, so that this reflection tends to swamp the variable reflection.

Polarisation changes create disturbances in both the optical system and measurement equipment. To reduce this, keep your system physically stable. Keep patch leads neat, coiled and stable.



■ MAINTENANCE

Enabling / disabling ‘shift’ keypad or re-booting microprocessor: refer to section “Getting Started”

CAUTION! This equipment contains delicate and expensive fiber optic, electronic and mechanical components. Do not open unless:

- The warranty has expired (opening the unit will invalidate any warranty claim).
- You are authorised to do so.
- You have familiarity with handling optical fibres.
- You have a static protected work station.
- You have read the section on safety, and have appropriately calibrated power meters and patchcords available to check the optical emission level of the instrument.

CAUTION! Use of controls or adjustments or performance of

procedures other than those specified herein may result in hazardous radiation exposure.

This unit contains static sensitive devices. Anti-static handling procedures should be observed at all times when handling internal circuits.

Please note there are no user adjustable internal components, fuses, or calibration features. If using a soldering iron, be certain never to touch it onto the optical fibres, since damage to the plastic coating will cause subsequent fiber breakage.

Opening the instrument:

- Remove the batteries, and leave the battery cover open.
- Pull open the optical connector covers.
- Place the instrument face down on a soft mat, and undo the 6 screws in the rear housing.



- The instrument can now be gently pulled apart.
- The instrument will come into two halves joined by a ribbon cable. The optical section is located in the bottom half, with the microprocessor, supply, and calibration constants and controls in the top half.
- Hinged display cover removal and optical connector cleaning can be done at this point.
- The ribbon connector can be disengaged to completely separate the instrument halves.
- Further dis-assembly from this stage should be easily apparent to a technician.

General electrical parameters are as follows: Gnd to Vcc = 3V3, -Vss = -3V3, battery power down current about 0.2 mA, active current about 14 mA with emitters off, and generally under 60 mA with emitters on (optional laser cooler circuit may cause up to 0.5 A extra).

Re-assembly

This is the reverse of the previous procedure. Take care not to trap or snag the optical fibres in any way. When mating the two halves, be sure that the two optical connector pivots are properly positioned.

Ensure that the ribbon cable connectors are properly secured so they cannot shake loose. This will be either a moulded rubber retainer, or adhesive tape.

Calibration & laser current check

The Dual Laser Source power levels can be re-calibrated as follows, and the emitter current checked, without instrument dis-assembly

- To enable calibration mode, remove the calibration sticker in the battery compartment, and short the two terminals behind it with a programming jumper. The display shows CAL & installed options (source, return loss, meter)

■ MAINTENANCE

- Connect a calibrated power meter with a known good patchlead. (the patchlead loss will form part of the calibration condition)
- Push SOURCE, set the source wavelength with the -/+ button, push LEVEL. The display will now show the expected power level, cal factor (main display) and laser current in mA (top right). Note the existing values for future reference. Set meter wavelength to match.
- Adjust the -/+ button to change the source output level, to match the displayed level on the source display. The laser current can not go above a level that has been set for the individual laser during manufacture.
- Note new calibration values for future reference, then push SET to exit and store settings, or CANCEL to exit and don't store settings.
- Remove the programming shunt, and place a new sticker over the aperture.



■ INSTRUMENT RETURNS

Before returning equipment to Agilent for repair or calibration, please check with your local Agilent Technologies Service Centre (see page 3) to obtain a tracking number and shipping details.

Please state clearly the problem requiring attention.

Please include your contact email, phone and fax number, and return shipping details.

If the goods are under warranty, it would be helpful to include the original order / contract details.

If the goods are not under warranty, work will only proceed when a repair order has been issued. Please either include a repair order with the equipment, or request that a quotation be provided.



■ SPECIFICATIONS - DEFINITION OF TERMS

**Output Power Level
Power Uncertainty /
Repeatability
Short / Long Term
(Power) Stability**

In CW mode, the output power at the specified wavelength, measured at the end of a jumper cable. The uncertainty in generating a power level at the end of a 9/125μm patchcord. The connector is included (connectors and patchcords must be absolutely clean and undamaged). In CW mode, the uncertainty of the power level observed over the given time, compared to the mean power during this time. Measured with average optical power meter and a 9/125μm fiber, at constant temperature within a specified temperature window and with the line voltage uninterrupted.

Center Wavelength

The wavelength representing the center of mass of the selected peaks.

$$\bar{\lambda} = \frac{1}{P_0} \sum (P_i \lambda_i)$$

where P_i and λ_i are the power and wavelength of each spectral component and P_0 is the total power.

Spectral Bandwidth (FWHM) FWHM (full width at half the maximum)

Describes the spectral width of the half-power points of the laser, assuming a Gaussian envelope of the spectral power distribution. The half-power points are those where the power-spectral density is one half of the peak amplitude of the Gaussian curve:

$$\text{FWHM} = 2.355 \sigma$$

where σ is an rms calculation of the spectral width of the laser-based on a Gaussian distribution.

$$\sigma = \frac{1}{P_0} \sqrt{\sum P_i (\lambda_i - \bar{\lambda})^2}$$

where P_i and λ_i are the power and wavelength of each spectral component and P_0 is the total power.



N3974A SERIES ULTRA STABLE LASER SOURCES

APPLICATIONS

Construction & commissioning, Standards laboratories, R&D

These sources can be used with **Autotest** compatible meters to automate loss testing functions, and provide automatic λ identification.

FEATURES

Autotest compatible, easy to use, no warm up period.

Ultra stable (± 0.02 dB / 8 hours)

Interchangeable connectors, rugged polycarbonate case.

140 hours battery life.

The N3974A Ultra Stable Source is a premium instrument for field or laboratory testing of fiber optic systems. It features superb productivity, ease of use and rugged design.

Ultra high stability is guaranteed, with no warm up. Unlike most other sources, power output is independent of back reflection conditions. The dual λ (wavelength) source gives switched wavelengths through one connector.

The instruments incorporate dust and drop protected interchangeable connectors and simple menu driven 5 button operation.

■ SPECIFICATIONS

Operating Time (typical)	140 hours
Output Power	-6dBm
Short-term stability (typical) ¹	± 0.02 dB
Long-term stability (typical) ²	± 0.15 dB
Center Wavelength ³	1310 ± 20 nm 1550 ± 20 nm
Spectral Bandwidth (typical)	3 nm FWHM
Temperature coefficient (typical)	0.4 nm/°K
Optical Output	Removable Connector Adapters. Single port, Open beam.
Source Type	Fabry-Perot Laser

- 1** No warm up, 15 min, at stable temperature, within operating temperature range
- 2** No warm up, 8 hours, within operating temperature range
- 3** at 25°C ambient temperature



■ ORDERING INFORMATION

Connector options.

This instrument is equipped with interchangeable optical connector adaptors. The ferrule type for light sources is PC.

How to order an instrument:

Specify part number as N3974A Dual Laser Source.

Standard accessories (included with instrument):

SC, ST, FC optical connector, manual, batteries, power and λ calibration certificate, carry strap, pouch, protective holster.

The N3974A Dual Laser Source is supplied with a straight contact output connector interface. To connect to the instrument, you must attach your connector interface (see list connector interfaces below) to the interface adaptor, then connect your cable.

Agilent service Part No.

N3970-63240

N3970-63246

N3970-63251

Description

ST

SC

FC

Optional accessories:

Agilent Part No.

N3979A

Australian and international patents.

Description

Power Supply 9V DC



■ PERFORMANCE TEST

The procedures in this section test the performance of the instrument. The complete specifications to which the Agilent N3974A Dual Laser Source is tested are given on pages 23-25. All tests can be performed without access to the interior of the instrument. The test equipment given corresponds to tests carried out with Diamond HMS-10 connectors and FC/PC connectors on the DUT (device under test).

Equipment Required

Equipment required for the performance test is listed in the table on page 27. Any equipment that satisfies the critical specifications of the equipment given in the table may be substituted for the recommended models.



Table 1 Required Equipment

Instrument/Accessory	Recommended Model	Required Characteristics	Alternative Models
Lightwave Multimeter	8163A		8164A, 8166A
Optical Power Sensor	81632A		81635A
Connector Interfaces	81000SI		
Singlemode Fiber	81113PC		
FC Connector Adaptor for N3974A	N3970-63251		
<i>For optional test only</i>			
Optical Spectrum Analyzer	71450B		71452B, (8614xA,B)
Connector Interface	81000AI		
Singlemode Fiber	81101PC		81101FC

Note: Instead of 8163A and 81632A also the older but discontinued equipment 8153A and 81532A can be used.

■ PERFORMANCE TEST

Test Record

Results of the performance test may be tabulated on the Test Record provided at the end of the test procedure. It is recommended that you fill out the Test Record and refer to it while doing the test. Since the test limits and setup information are printed on the Test Record for easy reference, the record can also be used as an abbreviated test procedure (if you are already familiar with the test procedures). The Test Record can also be used as a permanent record and may be reproduced without written permission from Agilent Technologies.

Test Failure

If the Agilent N3974A fails any performance test, return the instrument to the nearest Agilent Technologies Sales/Service Office for repair (see page 3).

Instrument Specification

Specifications are the performance characteristics of the instrument that is certified. These specifications, listed on page 24, are the performance standards or limits against which the Agilent N3974A can be tested.

Any changes in the specifications due to manufacturing changes, design, or traceability to the National Institute of Standards and Technology (NIST), will be covered in a manual change supplement, or revised manual. Such specifications supercede any that were previously published.



Performance Test

The performance test given in this section includes the Output Power (CW) Test. Additionally it includes - as optional tests - the Short-Term Stability Test and the Center Wavelength and Bandwidth (FWHM) Test. Perform each step in the order given, using the corresponding test equipment.

Note Make sure that all optical connections are dry and clean. DO NOT USE INDEX MATCHING OIL. For cleaning, use the cleaning instructions given in "Cleaning Procedures" on page 41.

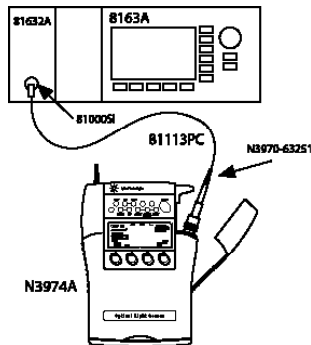
Make sure that all patchcords are fixed to the table so that they won't move during measurements.

Make sure that the ambient conditions are in the following ranges:

temperature	23°C ±3K
Relative humidity	45 to 75 %

Output Power (CW) Test

1. Make sure that you satisfy the environmental conditions.
2. Make sure all your connectors are clean.
3. Connect the equipment as shown in figure below.



Test setup for the Output Power Test

Make sure that all Patchcords are fixed to the table and won't move during measurements.

■ PERFORMANCE TEST

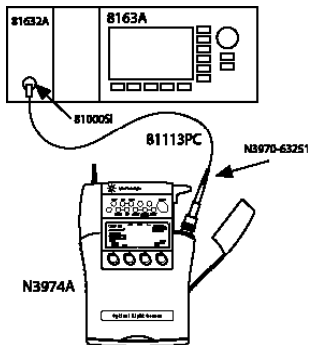
4. Switch on the instruments.
 - a. Switch on the lightwave multimeter
 - b. Configure the optical power sensor.
 - Set the unit to dBm
 - Set the wavelength to 1310 nm
 - Set the averaging time, T, to 100 ms
 - Set AUTO ranging on
 - With the DUT disabled, zero the power meter
 - c. Switch on the N3974A (DUT) for permanent operation, by holding the POWER key down for 3 seconds during turn-on until PERM is shown in the display.
 - Set the wavelength to 1310 nm

Setting the wavelength does automatically enable the light source
- Ensure the frequency modulation is off (CW mode). That is when the display shows only the wavelength and the output power value.
- Ensure the output power level is set to the max. value -5 dBm
5. Note the value shown on the lightwave multimeter in the test report.
6. Repeat this measurement (list item 5) with the DUT and the 8163A set to 1550 nm.



Short - Term Stability Test (Optional)

1. Make sure that you satisfy the environmental conditions.
2. Make sure all your connectors are clean.
3. Connect the equipment as shown in figure below.



Test setup for the Short Term Stability Test

- a. Make sure that all Patchcords are fixed to the table and won't move during measurements.

4. Switch on the instruments.
 - a. Switch on the lightwave multimeter.
 - i. Configure the optical power sensor.
 - Set the unit to dBm
 - Set the wavelength to 1310 nm
 - Set the averaging time, T, to 100 ms
 - Set AUTO ranging on
 - ii. With the DUT disabled, zero the power meter
 - c. Switch on the N3974A (DUT) for permanent operation, by holding the POWER key down for 3 seconds during turn-on until PERM is shown in the display.
 - i. Set the wavelength to 1310 nm
Setting the wavelength does automatically enable the light source
 - ii. Ensure the frequency modulation is off (CW mode)
That is when the display shows only the wavelength and the output power value
 - iii. Ensure the output power level is set to the max. value -5 dBm

■ PERFORMANCE TEST

5. On the lightwave multimeter select the Stability application and configure the parameters as following:

Total Time 00:15:00 (= 15 min)
Average Time 100 ms
Max 4000 (sample points)
Wavelength 1310 nm
Range Mode AUTO

6. Start the measurement

- a. Ensure the DUT is enabled
- b. Start the Stability application with the "Measure" key

The display shows the progress during the application is running. The application stops automatically when the stability measurement time is over.

7. Get the measurement result.

- a. Press the "Analysis" key.
- b. Set the Pwr Unit to dBm.

- c. Press the "more" key to get the statistics screen.
- d. Note the displayed P value in your test record.

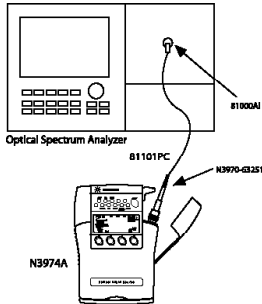


Center Wavelength & Spectral Bandwidth (FWHM) Test

(optional)

This test is not mandatory but optional

1. Make sure that you satisfy the environmental conditions.
2. Make sure all your connectors are clean.
3. Connect the equipment as shown in figure below.



Test setup for the Attenuation repeatability Test

- a. Make sure that all Patchcords are fixed to the table and won't move during measurements.
3. Switch on the instruments.
 - a. Switch on the N3974A (DUT) for permanent operation, by holding the POWER key down for 3 seconds during turn-on until PERM is shown in the display.
 - Set the wavelength to 1310 nmSetting the wavelength does automatically enable the Dual Laser Source
 - Ensure the frequency modulation is off (CW mode)That is when the display shows only the wavelength and the output power value
 - Ensure the output power level is set to the max. value -5 dBm
 - b. Switch on the OSA and ensure that it has warmed up.
 - Press the "Instr Preset" key
 - Press "Auto/Meas" and wait until 'End of Automeasure' is displayed

■ PERFORMANCE TEST

- Choose "User" and select the type of source to be measured (FP for Fabry Perot laser).
4. To show the display in linear mode:
 - a. Press "Menu".
 - b. Select "Amptd" on the left side of the display.
 - c. Press "Linear" on the right side of the display.
 5. To ensure interference free reading of the display it is advisable to stop the repeating calculations.
 - a. Select "User".
 - b. Press "Single Sweep".

If the trace on the display is not clear, you can change resolution by using the span key.
 6. From the displayed measurements check and note the values for "mean waveln" (Center Wavelength) and "FWHM" (Spectral Bandwidth) in the test report.
 7. Repeat the test with the DUT wavelength set to 1550 nm.



■ PERFORMANCE TEST

Model N3974A Dual Laser Source _____ Date _____
Serial No. _____ Ambient Temperature _____ °C
Options _____ Relative Humidity _____ %
Firmware Rev. _____ Line Frequency _____ Hz

Test Facility _____ Customer _____
Performed by _____ Report No _____

Special Notes _____

■ PERFORMANCE TEST

Description

1. Lightwave Multimeter

2. Optical Power Sensor

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

Model No.

8163A

8163A

Trace No

Cal. Due Date

Accessories

Singlemode Fiber
Connector Interfaces

#Product

1 81113PC

1 81000SI

1 N3970-63251



■ PERFORMANCE TEST

Model N3974A Dual Laser Source

Report No. _____ Date _____

Output Power (CW) Test			
Wavelength		Minimum Spec.	N3974A, DUT Measurement Results
1310 nm		-6.00 dBm	_____ dBm
1550 nm		-6.00 dBm	_____ dBm
Measurement Uncertainty			_____ dB

Short Term Stability Test				
Wavelength			N3974A, DUT Measurement Results	Maximum Spec.
1310 nm			_____ dBpp	(0.10 dBpp) 0.04 dBpp typical
1550 nm			_____ dBpp	(0.10 dBpp) 0.04 dBpp typical
Measurement Uncertainty			_____ dB	



■ PERFORMANCE TEST

Center Wavelength & Spectral Bandwidth (FWHM) Test (optional)				
Wavelength		Minimum Spec.	N3974A, DUT Measurement Results	Maximum Spec.
Center Wavelength				
1310nm		1290.00nm	_____ nm	1330.00nm
1550 nm		1530.00nm	_____ nm	1570.00nm
Spectral Bandwidth				
1310nm			_____ nm	(6nm) 3nm typical
1550 nm			_____ nm	(6nm) 3nm typical
Measurement Uncertainty			_____ dB	



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.

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

For more information about Cleaning Instruments, please consult the Pocket Guide "Cleaning Procedures for Lightwave Test and Measurement Equipment" (Agilent P/N 5963-3538F). If you do not have a copy of this pocket guide, Agilent will provide you with one free of charge.

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.
- Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.
- Make sure that you disable all sources when you are cleaning any optical interfaces.
- Under no circumstances look into the end of an optical device attached to optical outputs when the device is operational. The laser radiation is not visible to the human eye, but it can seriously damage your eyesight.
- To prevent electrical shock, disconnect the instrument from the mains before cleaning. Use a dry cloth, or one slightly.



■ CLEANING INFORMATION

dampened with water, to clean the external case parts. Do not attempt to clean internally.

Do not install parts or perform any unauthorised modification to optical devices.

* Refer servicing only to qualified and authorised personnel.

Why is it important to clean optical devices ?

In transmission links optical fiber cores are about $9\mu\text{m}$ (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. Cleaning is, therefore, an essential yet difficult task. Unfortunately, when comparing most published cleaning recommendations, you will discover that they contain several inconsistencies. In this section, we want to suggest ways to help you clean your various optical devices, and thus significantly improve the accuracy and repeatability of your lightwave measurements.



■ CLEANING PROCEDURES

You should only clean instruments with a fixed connector interface when it is absolutely necessary. This is because it is difficult to remove any used alcohol or filaments from the input of the optical block.

It is important, therefore, to keep dust caps on the equipment at all times, except when your optical device is in use.

If you do discover filaments or particles, the only way to clean a fixed connector interface and the input of the optical block is to use compressed air.

If there are fluids or fat in the connector, please refer the instrument to the skilled personnel of Agilent's service team.

CAUTION! Only use clean, dry compressed air. Make sure that the air is free of dust, water, and oil. If the air that you use is not clean and dry, this can lead to filmy deposits or scratches on the surface of your connector interface. This will degrade the performance of your transmission system.

Never try to open the instrument and clean the optical block by yourself, because it is easy to scratch optical components, and cause them to become misaligned.



■ DISCLAIMER & WARRANTY

Information in this manual is given in good faith for the benefit of the user. It cannot be used as the basis for claims against Agilent Technologies or its representatives, if accidental damage or inconvenience results from use or attempted repair of the equipment.

Agilent Technologies products are guaranteed against defective components and workmanship for a period of 3 years from the date of delivery, unless specifically stated in the original purchase contract or agreement. This warranty excludes optical connectors or incorrect use. Opening the instrument will invalidate the warranty. Liability is limited solely to repair of the equipment.





■ NOTES

