

Keysight N4376D Lightwave Component Analyzer

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Notices

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Subject Matter

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Printing History

New editions are complete revisions of the guide reflecting alterations in the functionality of the instrument. Updates are occasionally made to the guide between editions. The date on the title page changes when an updated guide is published. To find out the current revision of the guide, or to purchase an updated guide, contact your Keysight Technologies representative.

Warranty

This Keysight Technologies instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Keysight will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Keysight. Buyer shall prepay shipping charges to Keysight and Keysight shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Keysight from another country.

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Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

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Assistance

Product maintenance agreements and other customer assistance agreements are available for Keysight Technologies products. For any assistance contact your nearest Keysight Technologies Sales and Service Office.

Certification

Keysight Technologies certifies that this product met its published specifications at the time of shipment from the factory.

Keysight Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, NIST (formerly the United States National Bureau of Standards, NBS) to the extent allowed by the Institutes's calibration facility, and to the calibration facilities of other International Standards Organization members.

ISO 9001 Certification

Produced to ISO 9001 international quality system standard as part of our objective of continually increasing customer satisfaction through improved process control.

Introduction 5

Documentation	6
General Safety Considerations	7
Safety symbols	7
Line power requirements	11
Optical Test Set Front and Rear Panels	14
2-port PNA version	14
4-port PNA version	17
Rear panel	20

Getting Started 21

Unpacking the Lightwave Component Analyzer	22
Setting Up the Lightwave Component Analyzer	24
Using the correct connectors	25
Enabling and disabling the laser output	26
Performance check	27
Starting the LCA	27
Accessing the User's Guide	27

1

Introduction

Documentation	6
General Safety Considerations	7
Optical Test Set Front and Rear Panels	14

Documentation

The documentation for the Keysight N4376D Lightwave Component Analyzer consists of

- The documentation for the Keysight network analyzer.
This documentation is on the hard disk of the network analyzer. Refer to it for using the network analyzer for electrical to electrical measurements, or for the configuration of the network analyzer.
- The documentation for the optical test set and the Lightwave Component Analyzer application.
Refer to this documentation for information on using the optical test set, together with the network analyzer, for optical to optical, electrical to optical and optical to electrical measurements, or for setting up your lightwave component analyzer.

This booklet contains the information you need to get your Lightwave Component Analyzer connected and running, and to perform a first measurement. For further information, please refer to the full User's Guide on the documentation CD.

General Safety Considerations

This product has been designed and tested in accordance with the standards listed on the manufacturer's Declaration of Conformity the User's Guide, and has been supplied in a safe condition. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Safety symbols

CAUTION

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

WARNING

The *warning* sign denotes a hazard. It calls attention to a **procedure 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.**

Instrument markings



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.



The laser radiation symbol. This warning symbol is marked on products which have a laser output.



The Off-On symbols are used to mark the positions of the instrument power operating switch.



The recycling symbol indicates the general ease with which the instrument can be recycled.



N10149

The C-Tick mark is the certification mark of the Australian Communications Authority.



ICES/NMB-001
ISM GRP 1-A

The CE mark is the conformity marking of the European Community.



LR 53538 C

The CSA mark is a the certification mark of the Canadian Standards Association.

WARNING

If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

WARNING

No operator serviceable parts inside. Refer servicing to qualified service personnel. To prevent electrical shock do not remove covers.

WARNING

This is a Safety Class 1 Product (provided with protective earth). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.

WARNING

To prevent electrical shock, disconnect the instrument from 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.

WARNING

Using controls or adjustments or performing procedures other than those specified in the documentation supplied with your equipment can result in hazardous radiation exposure.

CAUTION

This product complies with overvoltage Category II and Pollution Degree 2.

CAUTION

Ventilation requirements: When installing the product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

CAUTION

Install the instrument so that the power switch is readily identifiable and is easily reached by the operator. This is the instrument disconnecting device. It disconnects the mains circuit from the mains supply before other parts of the instrument. Alternatively, an externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator) may be used as a disconnecting device.

CAUTION

Always use the three-prong AC power cord supplied with this instrument. Failure to ensure adequate earth grounding by not using this cord may cause instrument damage.

CAUTION

This instrument has autoranging line voltage input. Be sure the supply voltage is within the specified range.

Initial safety information

The laser source used in the Lightwave Component Analyzer is classified as Class 1M according to IEC 60825-1/2007. All laser sources comply with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated 2007-06-24.

Laser Safety

Laser class 1M label

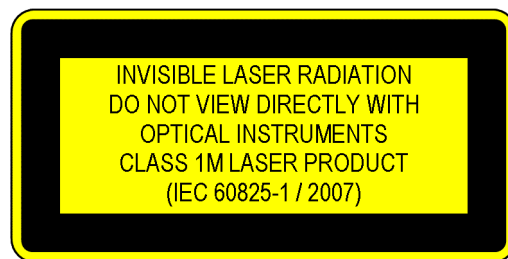


Figure 1 Class 1M Safety Label

A sheet of laser safety labels is included. In order to meet the requirements of IEC 60825-1 we recommend that you stick the laser safety labels, in your language, onto a suitable location on the outside of the instrument where they are clearly visible to anyone using the instrument

	N4376D
Laser wavelength range	850 ± 10 nm
Laser Type	DFB
Laser Class according to IEC 60825-1	1M
Maximum CW output power of LCA ^a	< 4 mW
Maximum permissible CW output power	5.3 mW
Numerical aperture	0.15
Beam waist diameter	< 50 µm

^a CW output power is defined as the highest possible optical output power that the laser source can produce at the output connector

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 fiber attached to the optical output connector.
 - The laser is enabled by the software or by pressing the laser switch on the front panel. The laser is on when the green LED above the switch is lit.
 - The use of the instruments, such as microscopes or spectacles, with this product will increase the hazard to your eyes.
 - The laser module has built-in safety circuitry which will disable the optical output in the case of a fault condition.
 - Refer servicing *only* to qualified and authorized personnel.
-

Line power requirements

CAUTION

The Keysight N4376D Lightwave Component Analyzer 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 to 60 Hz. The maximum power consumption of the optical test set is 40 VA with all options installed.

Please refer to the documentation for your network analyzer for information on its line power requirements.

Line power connectors

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. The type of power cable shipped with each instrument depends on the country of destination. Please refer to the User's Guide for the part numbers of available power cables.

WARNING

To avoid the possibility of injury or death, you must observe the following precautions before switching on the instrument.

- Insert the power cable plug only into a socket outlet provided with a protective earth contact. Do not use an extension cord without a protective conductor. Using an extension cord without a protective conductor means the instrument is not earthed.
- Do not interrupt the protective earth connection intentionally.
- Do not remove protective covers. Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified service 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.
- Defective, damaged, or malfunctioning instruments must be returned to a Keysight Technologies Service Center.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Environmental information

This product is intended for indoor use only.

This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a "Monitoring and Control instrumentation" product.



Do not dispose in domestic household waste.

To return unwanted products, contact your local Keysight office, or see <http://about.keysight.com/en/companyinfo/environment/takeback.shtml> for more information.

Optical Test Set Front and Rear Panels

2-port PNA version

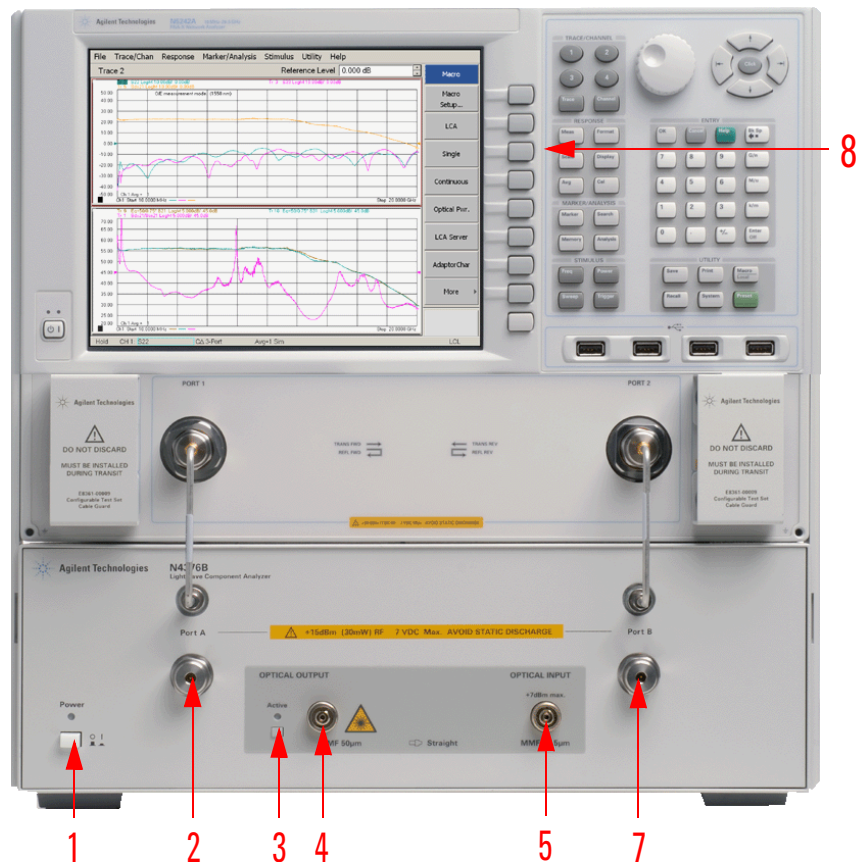







Figure 1 Front Panel (-312)

For further information on the front panel of the network analyzer, please refer to the documentation supplied with the network analyzer.

1	Power switch	Turns on the optical test set. To turn on the PNA, press the PNA's power key.
2	Port A	Caution: Be sure you do not exceed the RF power values and DC levels noted on the front panel of the instrument. This is the RF port used for electrical calibration and to connect to E/O or E/E device.
3	Laser switch	Press the switch to turn the laser on (LED on), and off (LED off). The laser can also be switched on and off from the LCA Measurement Setup Macro (in the LCA System Settings menu), or remotely. This switch overrides other. Pressing this switch during a measurement, will invalidate your results.
4	Optical Output	Warning: Laser Radiation can damage your eyesight! Refer to "Laser Safety" on page 10 for safety instructions. This is the output of the optical transmitter of the lightwave component analyzer.
5	Optical Input 1 (low power)	Caution: Do not apply more than +3 dBm (maximum safe average input power). This input is the standard optical input to the optical test set for optical powers up to 0 dBm.

7	Port B	This is the RF port used for electrical calibration and to connect to O/E and E/E devices.
8	Function keys	<p>Used to control the Lightwave Component Analyzer.</p> <p>Press the [Macro/Local] Utility button on the network analyzer to display the LCA function keys.</p> <ul style="list-style-type: none"> •  : Setup an LCA Measurement •  : Perform a single sweep measurement with the current measurement setup •  : Perform continuous sweep measurements with the current measurement setup •  : Start the optical power meter •  : Start the LCA server (if not already running)

4-port PNA version

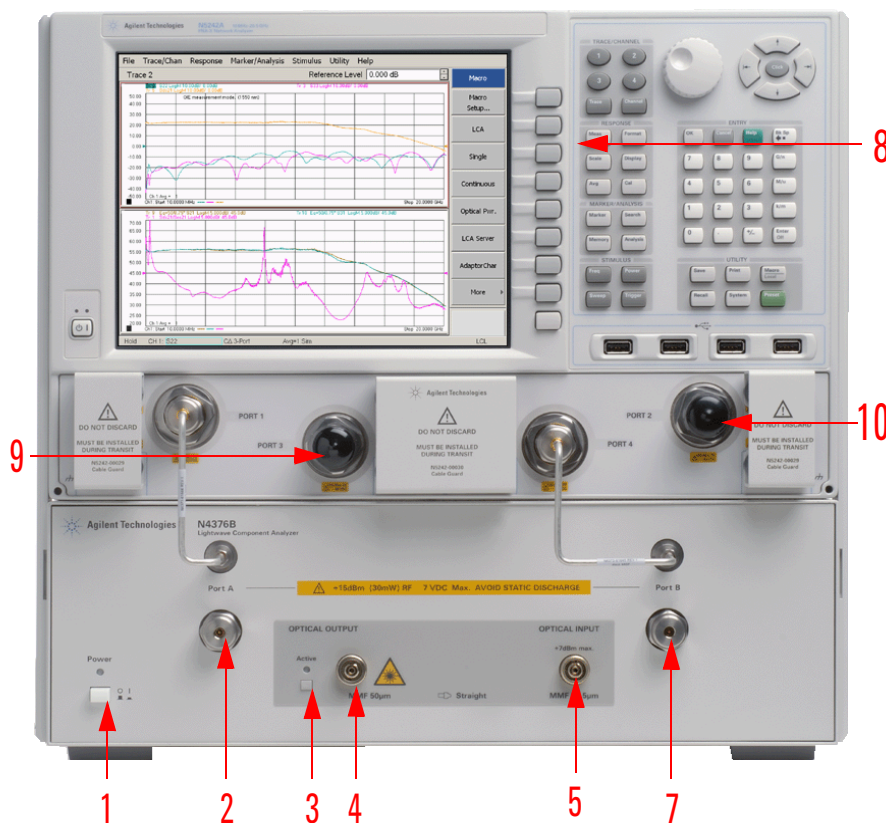







Figure 2 Front Panel for 4-port PNA (Options 42x)

For further information on the front panel of the network analyzer, please refer to the documentation supplied with the network analyzer.

1	Power switch	Turns on the optical test set. To turn on the PNA, press the PNA's power key.
2	Port A	<p>Caution: Be sure you do not exceed the RF power values and DC levels noted on the front panel of the instrument.</p> <p>This is the RF port used for electrical calibration and to connect to single-ended or differential E/O or E/E device.</p>

3	Laser switch	<p>Press the switch to turn the laser on (LED on), and off (LED off).</p> <p>The laser can also be switched on and off from the LCA Measurement Setup Macro (in the LCA System Settings menu), or remotely.</p> <p>This switch overrides other. Pressing this switch during a measurement, will invalidate your results.</p>
4	Optical Output	<p>Warning: Laser Radiation can damage your eyesight! Refer to “Laser Safety” on page 10 for safety instructions.</p> <p>This is the output of the optical transmitter of the lightwave component analyzer.</p>
5	Optical Input 1 (low power)	<p>Caution: Do not apply more than +3 dBm (maximum safe average input power).</p> <p>This input is the standard optical input to the optical test set for optical powers up to 0 dBm.</p>
7	Port B	<p>This is the RF port used for electrical calibration and to connect to single-ended and differential O/E and E/E devices.</p>

8	Function keys	<p>Used to control the Lightwave Component Analyzer.</p> <p>Press the [Macro/Local] Utility button on the network analyzer to display the LCA function keys.</p> <ul style="list-style-type: none"> •  : Setup an LCA Measurement •  : Perform a single sweep measurement with the current measurement setup •  : Perform continuous sweep measurements with the current measurement setup •  : Start the optical power meter •  : Start the LCA server (if not already running)
9	Network analyzer Port 3	<p>This is an S parameter measurement port of the Network analyzer.</p> <p>This is the RF port used for electrical calibration and to connect to differential EO, OE and EE devices.</p>
10	Network analyzer Port 2	<p>This is an S parameter measurement port of the Network analyzer.</p> <p>This is the RF port used for electrical calibration and to connect to differential EO, OE and EE devices.</p>

Rear panel

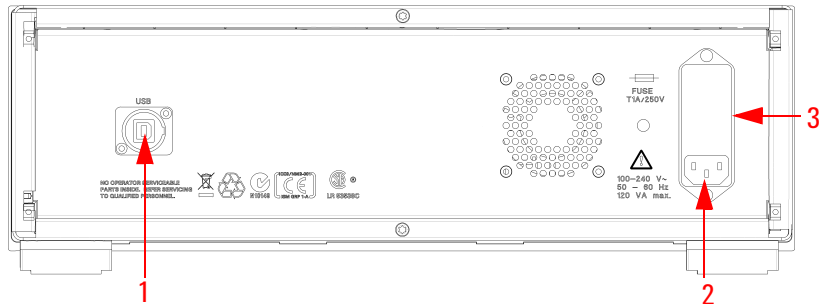


Figure 3 Rear Panel

For information on the rear panel of the network analyzer, please refer to the documentation supplied with the network analyzer.

1	USB	The software on the network analyzer uses the USB port to control the optical test set.
2	Line power cable connector	Plug in your power cable here.
3	Line fuse	Replace only with same type.

2

Getting Started

Unpacking the Lightwave Component Analyzer	22
Setting Up the Lightwave Component Analyzer	24

Unpacking the Lightwave Component Analyzer

Unpack your shipment.

- Inspect the shipping containers for damage.
- Inspect the instruments.
- Verify that you received the options and accessories that you ordered.

Keep the shipping containers and cushioning material until you have inspected the contents of the shipment for completeness and have checked the equipment mechanically and electrically.

The shipment should contain

- 1x Network-analyzer depending on option selected
- 1x N4376D optical test set
- 2x 81000NI optical adapter
- 1x 4376D-90A01 Getting started
- 1x 4373B-90CD1 LCA support CD
- 1x 1150-7896 Keyboard
- 1x 1150-7799 Mouse
- 1x 8121-1242 USB cable
- 1x E5525-10285 UK6 report
- 1x N4373-61627 electrical short cut cable
- 1x 9320-6677 RoHS addendum for Photonic T&M accessories
- 1x 9320-6654 RoHS addendum for Photonic T&M products

Additional, option dependent shipping contents:

- Options 4xx (4-port PNAs):
 - 1x N4373-61604 0.5 m (m) to (f) high performance RF cable
- Options 2xx (2-port PNAs):
 - 2x N4373-61604 0.5 m (m) to (f) high performance RF cable
- -023 2x LC 50 μ m to FC/APC 0.5 m patch cord
- -024 2x LC 62.5 μ m to FC/APC 0.5 m patch cord
- -025 2x SC 50 μ m to FC/APC 0.5 m patch cord
- -026 2x SC 62.5 μ m to FC/APC 0.5 m patch cord

Network analyzer options:

- Option 220:
 - 26.5 GHz, 2 ports, single source PNA (N5222A-200) and RF cables
- Option 221:
 - 26.5 GHz, 2 ports, single source PNA (N5222A-201) with configurable test set and RF cables
- Option 222:
 - 26.5 GHz, 2 ports, single source PNA (N5222A-219) with configurable test set, extended power range, bias-tees, and RF cables
- Option 420:
 - 26.5 GHz, 4 ports, dual source PNA (N5222A-400) and RF cables
- Option 421:
 - 26.5 GHz, 4 ports, dual source PNA (N5222A-401) with configurable test set and RF cables
- Option 422:
 - 26.5 GHz, 4 ports, dual source PNA (N5222A-419) with configurable test set, extended power range, bias-tees, and RF cables
- Option 229:
 - Integration of customer's 26.5 GHz, 2 port PNA (N5222A or N5242A) with any configuration and RF cables
- Option 249:
 - Integration of customer's 26.5 GHz, 4 port PNA (N5222A or N5242A) with any configuration and RF cables

If anything is missing or defective, contact your nearest Keysight Technologies sales office. If the shipment was damaged, contact the carrier, then contact the nearest Keysight Technologies sales office.

Setting Up the Lightwave Component Analyzer

CAUTION

The network analyzer and Lightwave Component Analyzer module are assembled as one analyzer unit. Lifting this instrument requires two people using proper lifting techniques. For the combined weight, please consult the specifications in the User's Guide and the user's documentation for the network analyzer.

1. Unpack and inspect the contents as described in [“Unpacking the Lightwave Component Analyzer” on page 22.](#)
2. Remove the dust cap from the Optical Output.

CAUTION

If you are using a patchcord with a straight and angled connectors, make sure you only connect the angled connector (green) to the optical test set.

3. Remove the dust cap from the optical patchcord.
4. Connect the optical patchcord.
5. Repeat [step 2.](#) to [step 4.](#) for the optical input.

CAUTION

Always use patchcords to connect to your DUT. This protects the connectors of the optical test set, by minimizing the number of connector changes.

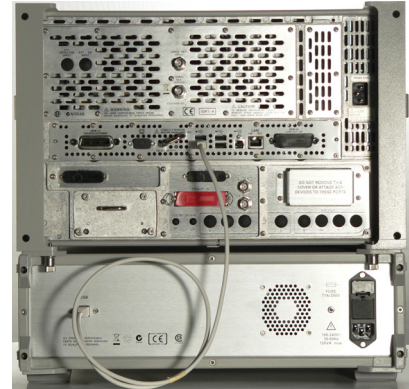
CAUTION

The contact connector on the optical test set is angled. If you are using a patchcord with straight (red) and angled (green) connectors, make sure you connect the angled connector to the optical test set. Connecting to the optical test set with a straight connector will damage it.

CAUTION

Before you connect any fiber-optic cable to the Lightwave Component Analyzer, please ensure it has been properly cleaned. Fiber-optic connectors are easily damaged when connected to dirty or damaged cables and accessories. When you use improper cleaning and handling techniques, you risk expensive instrument repairs, damaged cables, and compromised measurements.

6. On the rear, using the USB cable supplied, connect the network analyzer to the optical test set.
7. Connect the power cables. Refer to the User's Guide for further information.

**NOTE**

We recommend you backup your LCA data regularly.
Please refer to the User's Guide for information on the files to backup.

Using the correct connectors

CAUTION

Always use patchcords to connect to your DUT. This protects the connectors of the optical test set, by minimizing the number of connector changes.

CAUTION

The contact connector on the optical test set is angled. If you are using a patchcord with straight (red) and angled (green) connectors, make sure you connect the angled connector to the optical test set. Connecting to the optical test set with a straight connector will damage it.

CAUTION

Before you connect any fiber-optic cable to the Lightwave Component Analyzer, please ensure it has been properly cleaned. Fiber-optic connectors are easily damaged when connected to dirty or damaged cables and accessories. When you use improper cleaning and handling techniques, you risk expensive instrument repairs, damaged cables, and compromised measurements.

The optical input and output of the Keysight N4376D Lightwave Component Analyzer use angled connectors. Depending on the option you ordered, you will also have received two patchcords with an angled and a straight connector.

- option 023 includes 50 μm patchcords with an angled and an LC connector
- option 024 includes 62.5 μm patchcords with an angled and an LC connector
- option 025 includes 50 μm patchcords with an angled and an SC connector
- option 026 includes 62.5 μm patchcords with an angled and an SC connector

Using the patchcord ensures the best “ripple” performance (lowest ripple) for your measurements. Two or more, straight connector interfaces in the optical measurement path can cause optical cavities. These result in frequency dependent interference effects (ripple), which may significantly degrade the performance of the LCA. This may impact user calibrations in OE and OO measurements. We recommend you use the patchcords supplied to minimize the number of straight connections.

Using the patchcords also keeps service costs down, as the adaptor patchcord can be exchanged easily.

Angled contact connectors have up to 30 dB higher return loss than straight connectors, and we recommend them for best performance results. With angled fiber endfaces, reflected light tends to reflect into the cladding, reducing the amount of light that reflects back to the source.

Enabling and disabling the laser output

You can switch the Laser on and off by pressing the button besides the Optical Output.

After the LCA application running on the network analyzer has initialized it, the green LED besides the laser output indicates whether the laser is emitting radiation. If the Laser output is on, the green LED on the front panel of the module is lit. If the Laser output is off, the green LED on the front panel of the module is unlit.


NOTE

This button overrides the internal laser ON/OFF settings.
Pressing this button during a measurement will cause errors in the results.

Performance check

For a quick performance check, see **Performance Quick Check** in the Users Guide.

Starting the LCA


1. If it is not already running, start the LCA server by pressing , or by clicking the LCA server icon on the desktop.

If the LCA server is running, but the function keys are not displayed, press the [Macro/Local] Utility key until they appear.

2. Press .

You can now proceed with setting up measurement. For further information on measurements refer to **User Interface Reference** and **Making Measurements** in the User's Guide.

Accessing the User's Guide

1. If it is not already started, start the LCA as described above.
2. Press  in the LCA user interface to get to the electronic Version of the users guide.

This information is subject to change without notice.

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