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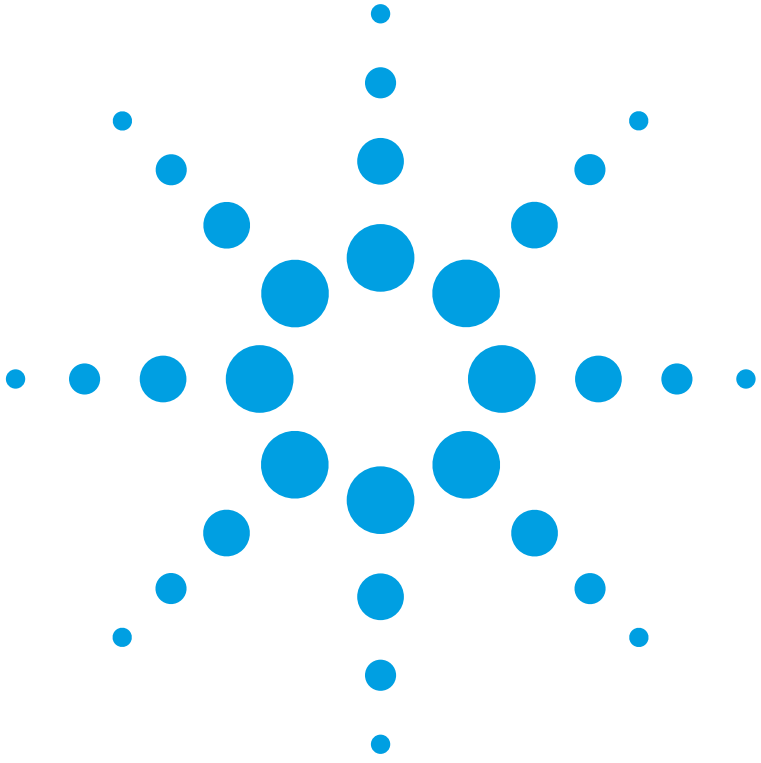
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Agilent 83434A
Lightwave Receiver
User's Guide



Agilent Technologies

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Agilent Technologies
Lightwave Division
3910 Brickway Boulevard-
Santa Rosa, CA 95403, USA

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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.


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 AC symbol is used to indicate the required nature of the line module input power.


| The ON symbols are used to mark the positions of the instrument power line switch.


❍ The OFF symbols are used to mark the positions of the instrument power line switch.


The CE mark is a registered trademark of the European Community.


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ISM1-A This text denotes the instrument is an Industrial Scientific and Medical Group 1 Class A product.

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The following conventions are used in this book:

Key type for keys or text located on the keyboard or instrument.

Softkey type for key names that are displayed on the instrument's screen.

`Display type` for words or characters displayed on the computer's screen or instrument's display.

User type for words or characters that you type or enter.

Emphasis type for words or characters that emphasize some point or that are used as place holders for text that you type.

General Safety Considerations

This product has been designed and tested in accordance with IEC Publication 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, and has been supplied in a safe condition. The instruction 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.

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

WARNING **To prevent electrical shock, disconnect the Agilent 83434A 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 **This is a Safety Class 1 product (provided with a protective earthing ground incorporated in the power cord). 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 product is likely to make the product dangerous. Intentional interruption is prohibited.**

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

WARNING **For continued protection against fire hazard, replace line fuse only with same type and ratings (5x20 mm, 1.6 A, 250 V time-delay, low breaking capacity fuse). The use of other fuses or materials is prohibited.**

CAUTION This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 61010-1 and 664 respectively.

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 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 *Do not* connect ac power until you have verified the line voltage is correct as described in Chapter 4, "Specifications and Regulatory Information". Damage to the equipment could result.

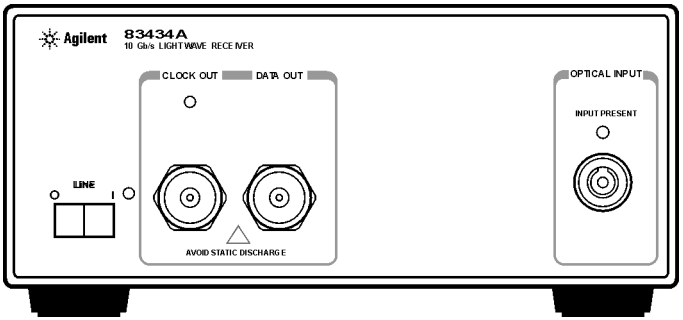
CAUTION This instrument has autoranging line voltage input. Be sure the supply voltage is within the specified range.

Measurement accuracy—it's up to you!

Fiber-optic connectors are easily damaged when connected to dirty or damaged cables and accessories. The Agilent 83434A front-panel OPTICAL INPUT connector is no exception. When you use improper cleaning and handling techniques, you risk expensive instrument repairs, damaged cables, and compromised measurements.

Before you connect any fiber-optic cable to the Agilent 83434A, "Fiber-Optic Connectors" on page 3-8.

The Agilent 83434A—At a Glance



The Agilent 83434A 10 Gb/s lightwave receiver is designed to recover clock data and to provide linear, non-retimed data from digitally modulated SDH/SONET STM-64/OC-192 optical signals, as well as signals employing forward error correction (FEC) at 10.664 Gb/s (option 106). The receiver is based on an amplified PIN receiver to produce a linear output with AGC stabilization. The receiver is designed to provide –16 dBm sensitivity with PRBS lengths to 2^{31} –1 with BER performance of at least 1E-10.

The recovered clock can be used as a trigger input for the Agilent Infiniium DCA to allow optical eye diagram measurements when no external clock signal is available for triggering. The recovered clock also provides the required clock input for the error detector of the Agilent 71612B error performance analyzer. The non-retimed data output can be used with an error detector to measure and optimize BER. The output of the receiver is also appropriate for eye contour and Q-factor measurements.

The Agilent 83434A can be combined with the Agilent 83433A 10 Gb/s lightwave transmitter to create a complete optical link for system or fiber testing, or to form a basis for substitution testing of commercial transmitters and receivers.

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Getting Started

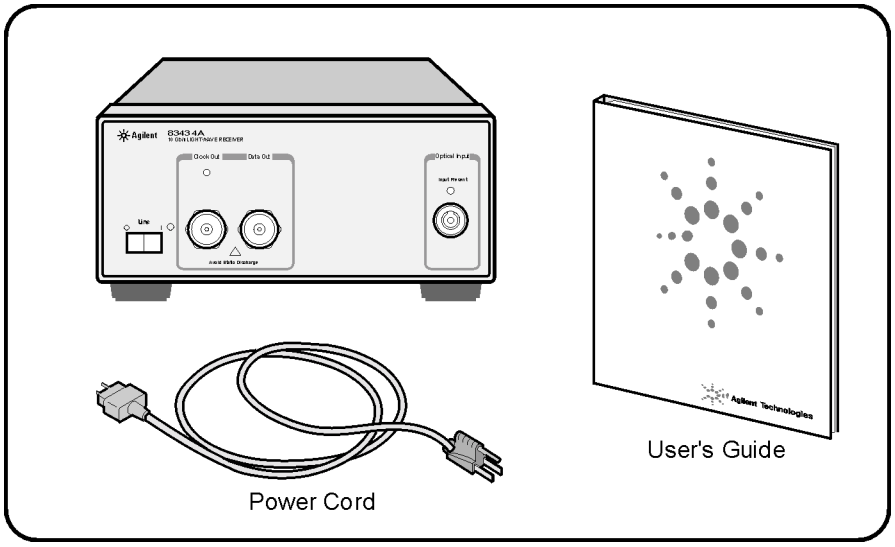
Setting Up the Agilent 83434A

This chapter shows you how to install your lightwave receiver. After you've completed this chapter, continue with Chapter 2, "Using the Agilent 83434A". Refer to Chapter 3, "Reference" for the following additional information:

- Tips on avoiding *costly* repairs by proper optical connection cleaning techniques.
- Lists of available accessories and power cords.
- Instructions on returning your instrument to Agilent Technologies for service.
- Agilent Technologies Sales and Service Offices.

Chapter 4, "Specifications and Regulatory Information" contains information on operating conditions, such as temperature.

Step 1. Inspect the Shipment



- ❒ Inspect the shipping container for damage.
- ❒ Inspect the instrument.
- ❒ Verify that you received the accessories you ordered.

Keep the shipping container and cushioning material until you have inspected the contents of the shipment for completeness and have checked the lightwave receiver mechanically and electrically.

The lightwave receiver is packed within a carton. Refer to "Instrument Service" on page 3-18, for the description and part numbers of the packaging materials. Refer to "Options" on page 3-3, for the accessories shipped with the lightwave receiver.

If the shipping materials are in good condition, retain them for possible future use. You may wish to ship the lightwave receiver to another location or return it to Agilent Technologies for service. Refer to "Instrument Service" on page 3-18.

If anything is missing or defective, or if the lightwave receiver does not pass the verification test, contact your nearest Agilent Technologies Sales Office. If the shipment was damaged, contact the carrier, then contact the nearest Agi-

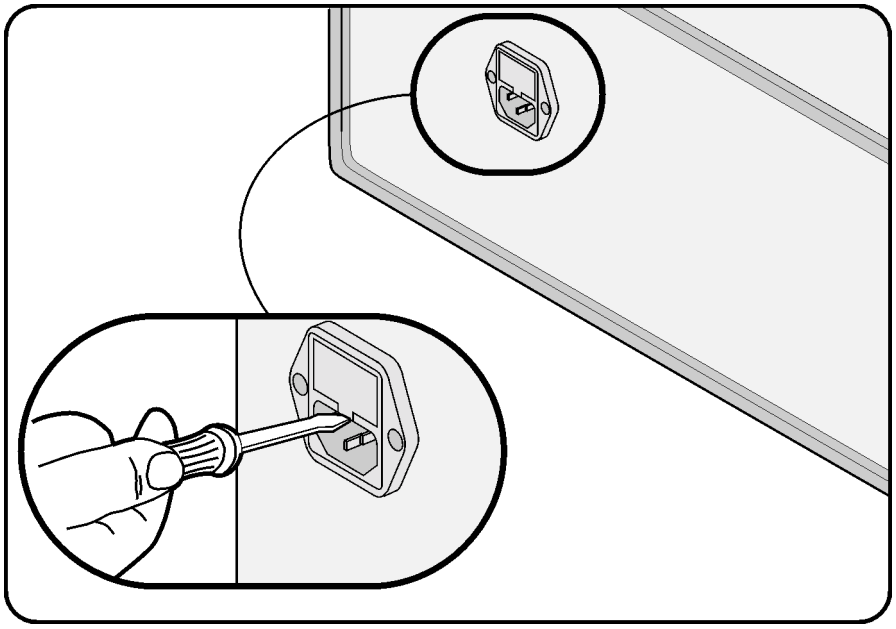
lent Technologies Sales Office. Keep the shipping materials for the carrier's inspection. The Agilent Sales Office will arrange for repair or replacement at Agilent Technologies' option without waiting for claim settlement.

Serial numbers

Agilent Technologies makes frequent improvements to its products to enhance their performance, usability, or reliability, and to control costs. Agilent service personnel have access to complete records of design changes to each type of equipment, based on the equipment's serial number. Whenever you contact Agilent about your lightwave receiver, have the complete serial number available to ensure obtaining the most complete and accurate information possible.

A serial-number label is attached to the rear of the lightwave receiver. It contains the serial number and the options installed in the lightwave receiver. Whenever you specify the serial number or refer to it in obtaining information about your lightwave receiver, be sure to use the complete number.

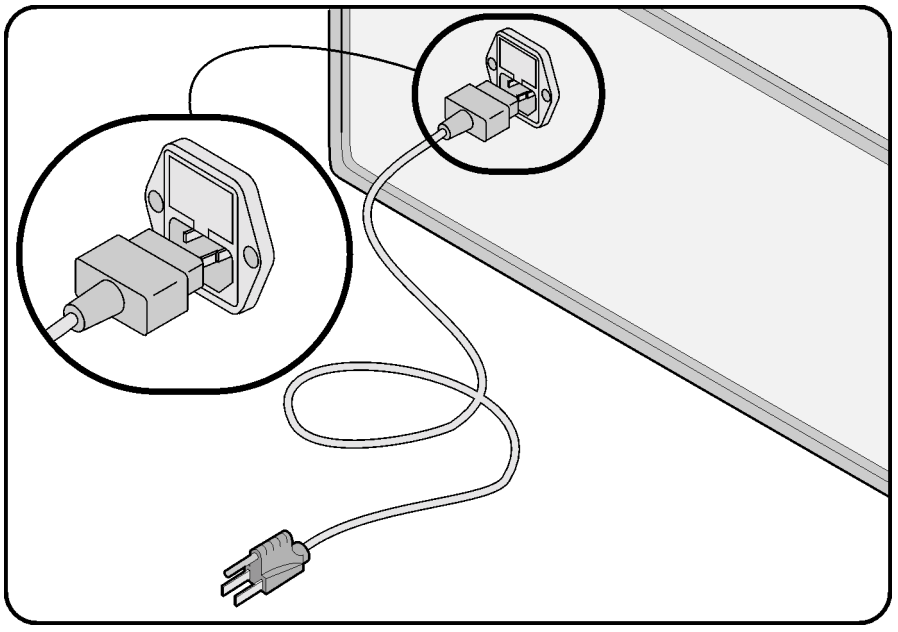
Step 2. Check the Fuse



1. Locate the line-input connector on the instrument's rear panel.
2. Disconnect the line-power cable if it is connected.
3. Use a small flat-blade screwdriver to pry open the fuse holder door.
4. The fuse is housed in a small container. Insert the tip of a screwdriver on the side of the container and gently pull outward to remove the container. A spare fuse is stored below the line fuse.

WARNING **For continued protection against fire hazard, replace line fuse only with same type and ratings (5×20 mm, 1.6 A, 250 V time-delay, low breaking capacity fuse). The use of other fuses or materials is prohibited.**

Step 3. Connect the Line-Power Cable



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 Do *not* connect ac power until you have verified the line voltage is correct as described in the following paragraphs. Damage to the equipment could result.

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

1 Verify that the line power meets the requirements shown in the following table.

Line Power Requirements

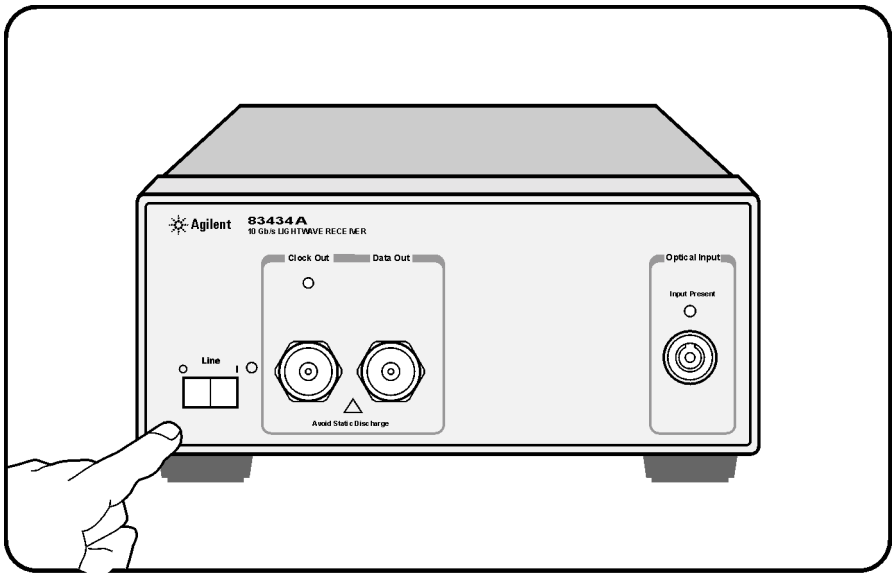
Power	115 VAC: 50 Watts MAX 230 VAC: 50 Watts MAX
VoItage	nominal: 115 VAC range:90–132 V nominal:230 VACrange:98–254 V
Frequency	nominal:50 Hz/60 Hzrange:47–63 Hz

2 Connect the line-power cord to the rear-panel connector of the instrument.

3 Connect the other end of the line-power cord to the power receptacle.

Various power cables are available to connect the Agilent 83434A to ac power outlets unique to specific geographic areas. The cable appropriate for the area to which the Agilent 83434A is originally shipped is included with the unit. You can order additional ac power cables for use in different geographic areas. Refer to “Power Cords” on page 3-7.

Step 4. Turn on the Agilent 83434A



With the power cable inserted into the line module, turn the lightwave receiver on by pressing the line switch. The green light-emitting diode (LED) should light.

NOTE

The front panel LINE switch disconnects the mains circuits from the mains supply after the EMC filters and before other parts of the instrument.

If the Agilent 83434A fails to turn on properly, consider the following possibilities:

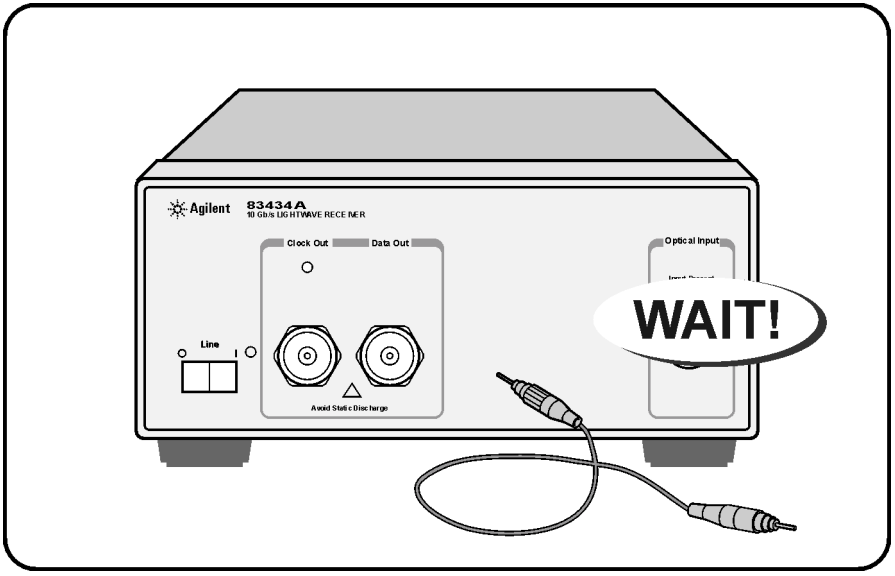
❒ Is the line fuse good?

❒ Does the line socket have power?

❒ Is it plugged into the proper ac power source?

If the instrument still fails, return it to Agilent Technologies for repair. Refer to “Instrument Service” on page 3-18

Step 5. Avoid costly repairs



CAUTION

Fiber-optic connectors are easily damaged when connected to dirty or damaged cables and accessories. The front-panel connectors of the Agilent 83434A are no exception. When you use improper cleaning and handling techniques, you risk expensive instrument repairs, damaged cables, and compromised measurements. Before you connect any fiber-optic cable to the Agilent 83434A, refer to “Fiber-Optic Connectors” on page 3-8.

Step 6. Learn more about our products

To learn more about Agilent Technologies products, visit our website at http://www.agilent.com.

If you wish to find out more about your new lightwave receiver, use the keyword “83434A” in your search.

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Using the Agilent 83434A

Front-Panel Features

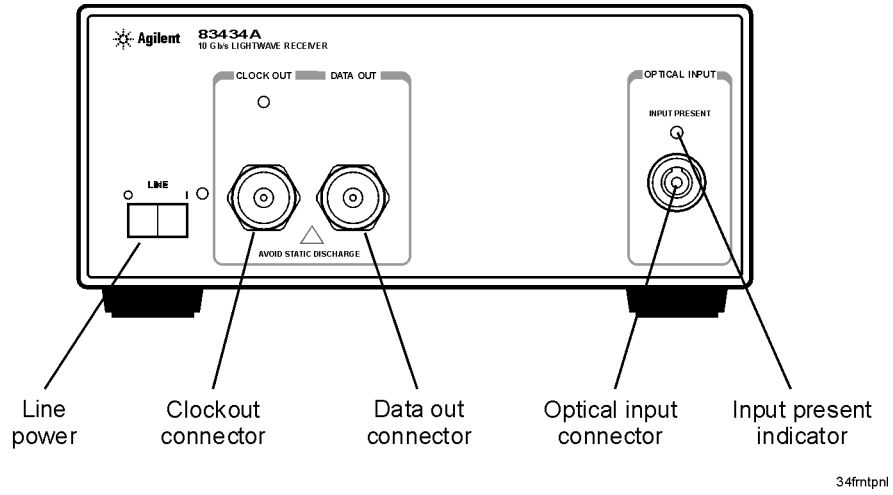


Figure 2-1. The Agilent 83434A front panel.

CLOCK OUT	Output is nominally 9.95328 GHz or 10.66423 GHz (option 106).
DATA OUT	Provides an amplified, non-retimed signal corresponding to the incoming data stream.
OPTICAL IN	Maximum signal input is 0 dBm, damage level input is +7 dBm. This input accepts any of the Agilent 81000-series connector interface adapters.
INPUT PRESENT	Indicates the presence of sufficient optical power.

Rear-Panel Features

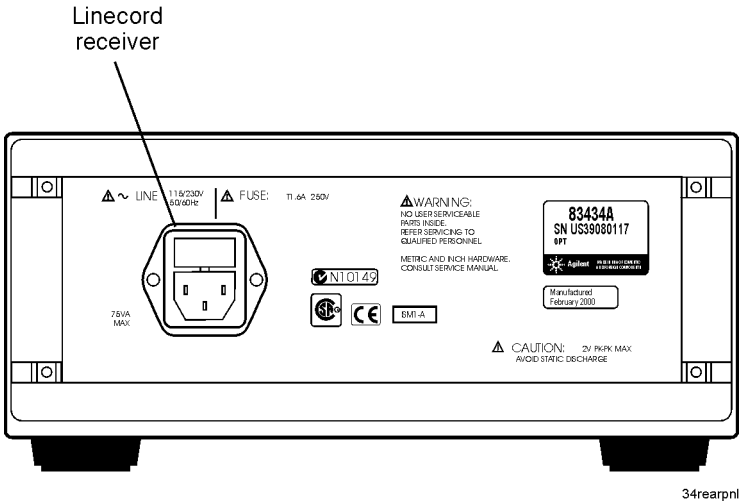


Figure 2-2. The Agilent 83434A rear panel.

Quick Confidence Check

This procedure verifies the basic functionality of the lightwave receiver. The following equipment is used:

- Agilent 83434A lightwave receiver
- Pattern generator
- Clock source
- Optical oscilloscope
- Optical source

> **Note**
>
> Before starting be sure to clean all connectors and optical interfaces using the procedures describe in "Fiber-Optic Connectors" on page 3-8.

1. Turn on the Agilent 83434A and let it warm up for 30 minutes.
2. Connect the output of the optical source (1300–1600 nm, ≥ –16 dBm, modulated at 9953.28 Mb/s or, for option 106, 10664.23 Mb/s) to the OPTICAL INPUT of the Agilent 83434A. The INPUT PRESENT LED should turn on.
3. Connect the CLOCK OUT and DATA OUT of the Agilent 83434A to the input of an oscilloscope.
4. Check for clock and data waveforms.

If the verification check fails

If the lightwave receiver does not pass the verification check, you should review the procedure being performed when the problem occurred. A few minutes spent performing some simple checks may save waiting for your instrument to be repaired. Before calling Agilent Technologies or returning the unit for service, please make the following checks:

1. Is the line fuse good?
2. Does the line socket have power?
3. Is the unit plugged in to the proper ac power source?
4. Is the unit turned on? Verify the green light-emitting diode (LED) next to the line switch is on, indicating that the power supply is on.
5. If other equipment, cables, and connectors are being used with the lightwave receiver, are they connected properly and operating correctly?
6. Review the procedure for the test being performed when the problem appeared. Are all the settings correct?
7. Are the connectors clean? Refer to “Cleaning Connectors” on page 3-15 for more information about cleaning the connectors.

If the lightwave receiver still fails, you can:

Return the lightwave receiver to Agilent Technologies for repair. If the lightwave receiver is still under warranty or is covered by an Agilent Technologies maintenance contract, it will be repaired under the terms of the warranty or contract (the warranty is at the front of this manual). If the lightwave receiver is no longer under warranty or is not covered by an Agilent Technologies maintenance plan, Agilent Technologies will notify you of the cost of the repair after examining the unit. Refer to “Instrument Service” on page 3-18 for more information.

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

Agilent 83434A Connection to a Bit-Error-Ratio Test Set

The following procedure describes how to connect the lightwave receiver to a bit-error-ratio test set (BERT). Refer to Figure 2-3 on page 2-7.

Note

Before starting, be sure to clean all connectors and optical interfaces using the procedures describe in"Fiber-Optic Connectors" on page 3-8.

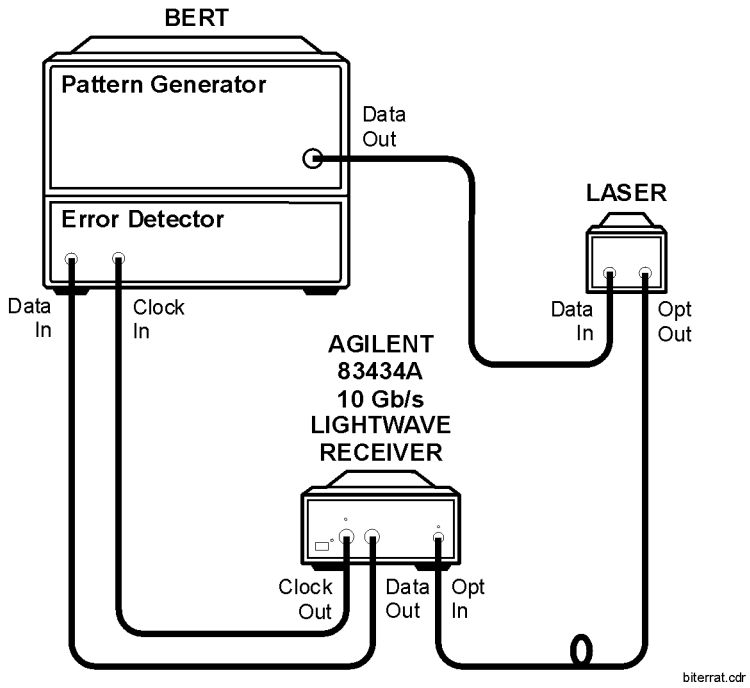


Figure 2-3. Connecting the Agilent 83434A to a bit-error-ratio test system.

1. Turn the lightwave receiver on. Let it warm up for 30 minutes.
2. Turn on the BERT and the laser and let them warm up according to their specifications.
3. Perform any calibrations indicated in the documentation for the BERT.
4. Connect a cable from the CLOCK OUT connector on the lightwave receiver to the clock input connector of the BERT. An adapter may be necessary.
5. Connect a cable from the DATA OUT connector on the lightwave receiver to the data input connector on the BERT. An adapter may be necessary.
6. Clean the end of the OPTICAL INPUT glass fiber on the lightwave receiver and both ends of the glass fiber cable. Refer to "Fiber-Optic Connectors" on page 3-8 for instructions.
7. Connect the optical connector interface to the OPTICAL INPUT. Notice the connector interface has a small protrusion. This protrusion fits in the slot of the OPTICAL INPUT connector.
8. Connect the cable to the receiver optical connector interface.

9 Connect the laser source to the fiber optic cable.

BER Performance Verification

This procedure verifies BER performance of the of the Agilent 83434A lightwave receiver with the Agilent 83433A and 71612B.

The following equipment is used:

- Agilent 83434A lightwave receiver
- Agilent 83433A lightwave transmitter
- Agilent 71612B Bit Error Rate Tester
- Optical attenuator
- Optical multimeter

Note

Before starting, be sure to clean all connectors and optical interfaces using the procedures describe in "Fiber-Optic Connectors" on page 3-8.

1 Connect the equipment as shown in Figure 2-4.

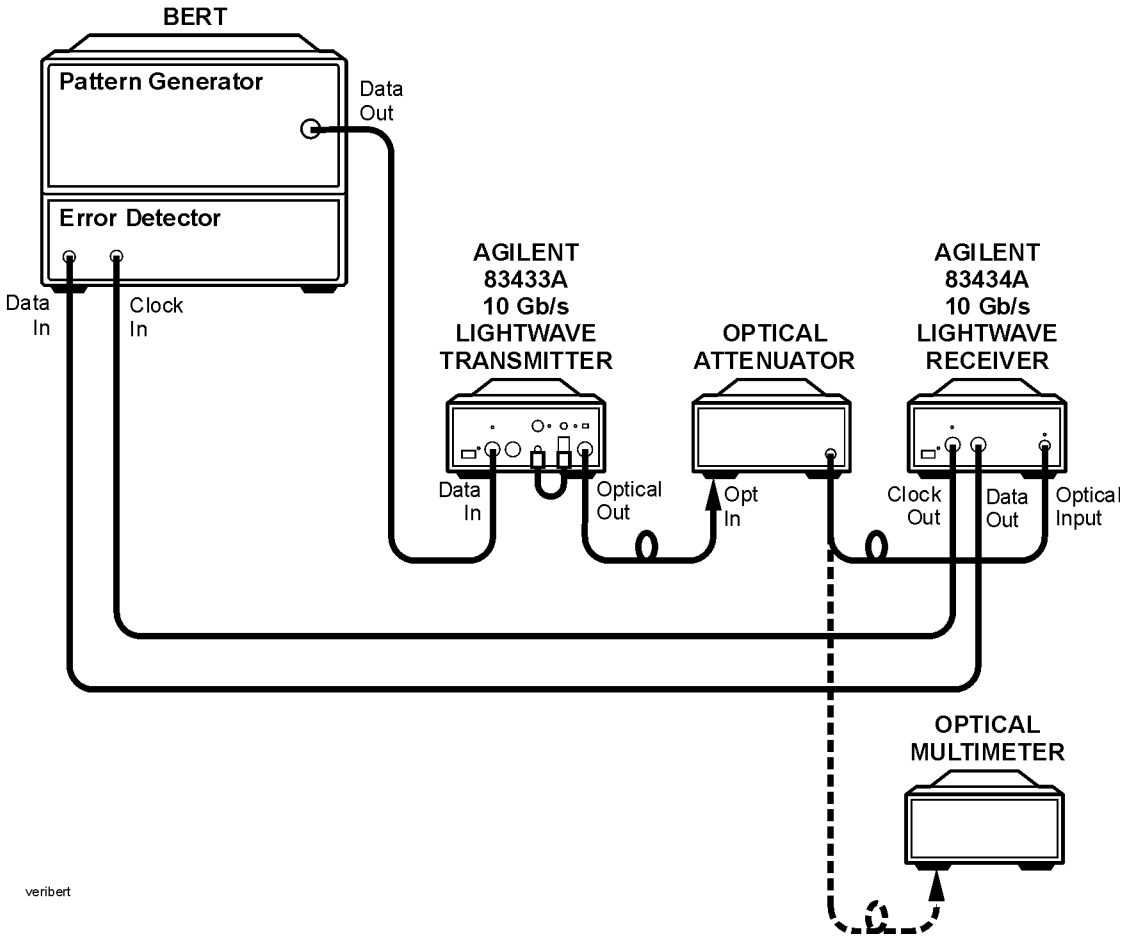


Figure 2-4. Setup to perform BER performance verification of the 83434A

2 Set the Agilent 71612B as follows:

CLOCK OUTPUT
SIG GEN FREQ . . . . . 9953.28 MHZ
SIG GEN FREQ (for 83434 option 106) . . . . . 10664.23 MHZ
MENU
DATA OUTPUT
Ext AC COUPLED
DATA AMPLITUDE . . . . . 1.0 V
PATTERN
PRBS
$2^{31}-1$

3 Disable WAVELENGTH ADJUST on the 83433A.

4 Turn on the 83433A laser.

5 Adjust the optical attenuator for a maximum of 0 dBm and a minimum of –16 dbm at the output of the attenuator.

6 Set the Agilent 71612B as follows:

MENU
INPUT & EYE
0/1 THR CENTER
CLK/DATA ALIGN
MENU
GATING
RUN GATING

7 Verify that the 71612B reports zero errors.

3

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Reference

Accessories Supplied

The Agilent 83434A lightwave receiver is shipped with:

- FC/PC connector interface on the optical input of the lightwave receiver unless a different option was ordered. Refer to “Agilent 83434A Options” on page 3-3 for a complete list of the available connector interfaces.
- *Agilent 83434A Lightwave Receiver User’s Guide*, Agilent part number 83434-90005.

Available seperately

The *Fiber Optics Handbook*, Agilent part number 5952-9654, is an introduction and reference for fiber-optic measurements.

Options

Table 3-1. Agilent 83434A Options

Option	Description
Option 011	Diamond (HMS-10) connector interface on the optical input of the lightwave receiver
Option 013	DIN connector interface on the optical input of the lightwave receiver
Option 014	ST connector interface on the optical input of the lightwave receiver
Option 017	SC connector interface on the optical input of the lightwave receiver
Option 106	For FEC signals, substitutes clock recovery at 10.644 GHz

Replacement Parts

Table 3-2. Replacement Parts

Description	Agilent Part Number
APC 3.5 F-to-F (connector saver)	5061-5311
APC 3.5 50 ohm termination	1810-0118
FC/PC connector interface	81000FI

Front-Panel Fiber-Optic Adapters

Table 3-3. Front Panel Fiber-Optic Adaptes (1 of 2)

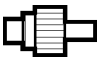
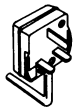
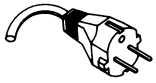
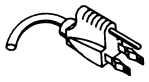
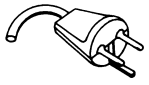
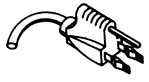
Front Panel Fiber-Optic Adapter	Description	Agilent Part Number
	Diamond HMS-10	81000AI
	FC/PC[a]	81000FI
	D4	81000GI
	SC	81000KI
	DIN	81000SI
	ST	81000VI
	Biconic	81000WI
Dust Covers		
FC connector		1005-0594
Diamond HMS-10 connector		1005-0593
DIN connector		1005-0595

Table 3-3. Front Panel Fiber-Optic Adaptes (2 of 2)

Front Panel Fiber-Optic Adapter	Description	Agilent Part Number
ST connector		1005-0596
SC connector		1005-0597

a. The FC/PC adapter is the standard adapter supplied with the instrument.

Power Cords

Plug Type	Cable Part No.	Plug Description	Length (in/cm)	Color	Country
250V 	8120-1351 8120-1703	Straight *BS1363A 90°	90/228 90/228	Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Zimbabwe, Singapore
250V 	8120-1369 8120-0696	Straight *NZSS198/ASC 90°	79/200 87/221	Gray Mint Gray	Australia, New Zealand
250V 	8120-1689 8120-1692 8120-2857p	Straight *CEE7-Y11 90° Straight (Shielded)	79/200 79/200 79/200	Mint Gray Mint Gray Coco Brown	East and West Europe, Saudi Arabia, So. Africa, India (unpolarized in many nations)
125V 	8120-1378 8120-1521 8120-1992	Straight *NEMA5-15P 90° Straight (Medical) UL544	90/228 90/228 96/244	Jade Gray Jade Gray Black	United States, Canada, Mexico, Philippines, Taiwan
250V 	8120-2104 8120-2296	Straight *SEV1011 1959-24507 Type 12 90°	79/200 79/200	Mint Gray Mint Gray	Switzerland
220V 	8120-2956 8120-2957	Straight *DHCK107 90°	79/200 79/200	Mint Gray Mint Gray	Denmark
250V 	8120-4211 8120-4600	Straight SABS164 90°	79/200 79/200	Jade Gray	Republic of South Africa India
100V 	8120-4753 8120-4754	Straight MITI 90°	90/230 90/230	Dark Gray	Japan

* Part number shown for plug is the industry identifier for the plug only. Number shown for cable is the Agilent Technologies part number for the complete cable including the plug.

Fiber-Optic Connectors

Today, advances in measurement capabilities make connectors and connection techniques more important than ever. Damage to the connectors on calibration and verification devices, test ports, cables, and other devices can degrade measurement accuracy and damage instruments. Replacing a damaged connector can cost thousands of dollars, not to mention lost time! This expense can be avoided by observing the simple precautions presented in this book. This book also contains a brief list of tips for caring for electrical connectors.

Choosing the Right Connector

A critical but often overlooked factor in making a good lightwave measurement is the selection of the fiber-optic connector. The differences in connector types are mainly in the mechanical assembly that holds the ferrule in position against another identical ferrule. Connectors also vary in the polish, curve, and concentricity of the core within the cladding. Mating one style of cable to another requires an adapter. Agilent Technologies offers adapters for most instruments to allow testing with many different cables. Figure 3-1 on page 3-9 shows the basic components of a typical connectors.

The system tolerance for reflection and insertion loss must be known when selecting a connector from the wide variety of currently available connectors. Some items to consider when selecting a connector are:

- How much insertion loss can be allowed?
- Will the connector need to make multiple connections? Some connectors are better than others, and some are very poor for making repeated connections.
- What is the reflection tolerance? Can the system take reflection degradation?
- Is an instrument-grade connector with a precision core alignment required?
- Is repeatability tolerance for reflection and loss important? Do your specifica-

tions take repeatability uncertainty into account?

- Will a connector degrade the return loss too much, or will a fusion splice be required? For example, many DFB lasers cannot operate with reflections from connectors. Often as much as 90 dB isolation is needed.

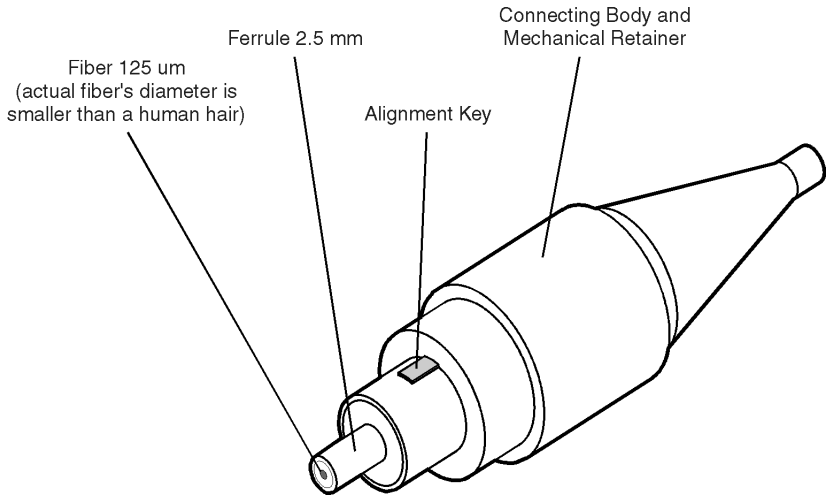


Figure 3-1. Basic components of a connector.

Over the last few years, the FC/PC style connector has emerged as the most popular connector for fiber-optic applications. While not the highest performing connector, it represents a good compromise between performance, reliability, and cost. If properly maintained and cleaned, this connector can withstand many repeated connections.

However, many instrument specifications require tighter tolerances than most connectors, including the FC/PC style, can deliver. These instruments cannot tolerate connectors with the large non-concentricities of the fiber common with ceramic style ferrules. When tighter alignment is required, Agilent Technologies instruments typically use a connector such as the Diamond HMS-10, which has concentric tolerances within a few tenths of a micron. Agilent Technologies then uses a special universal adapter, which allows other cable types to mate with this precision connector. See Figure 3-2.



Figure 3-2. Universal adapters to Diamond HMS-10.

The HMS-10 encases the fiber within a soft nickel silver (Cu/Ni/Zn) center which is surrounded by a tough tungsten carbide casing, as shown in Figure 3-3.

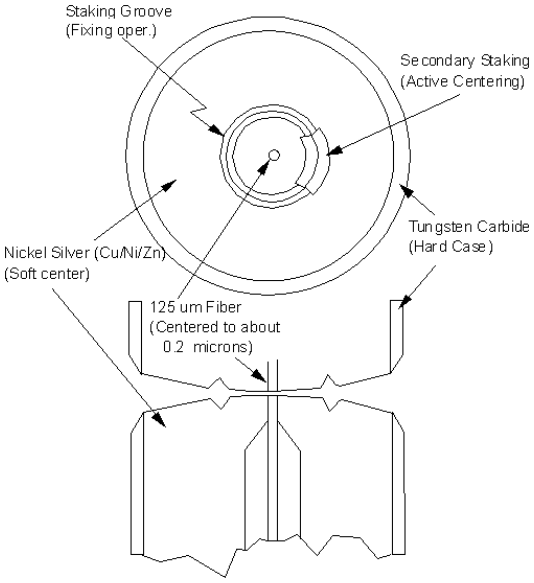


Figure 3-3. Cross-section of the Diamond HMS-10 connector.

The nickel silver allows an active centering process that permits the glass fiber to be moved to the desired position. This process first stakes the soft nickel silver to fix the fiber in a near-center location, then uses a post-active staking to shift the fiber into the desired position within 0.2 µm. This process, plus the keyed axis, allows very precise core-to-core alignments. This connector is found on most Agilent Technologies lightwave instruments.

The soft core, while allowing precise centering, is also the chief liability of the connector. The soft material is easily damaged. Care must be taken to minimize excessive scratching and wear. While minor wear is not a problem if the glass face is not affected, scratches or grit can cause the glass fiber to move out of alignment. Also, if unkeyed connectors are used, the nickel silver can be pushed onto the glass surface. Scratches, fiber movement, or glass contamination will cause loss of signal and increased reflections, resulting in poor return loss.

Inspecting Connectors

Because fiber-optic connectors are susceptible to damage that is not immediately obvious to the naked eye, poor measurements result without the user being aware. Microscopic examination and return loss measurements are the best way to ensure good measurements. Good cleaning practices can help ensure that optimum connector performance is maintained. With glass-to-glass interfaces, any degradation of a ferrule or the end of the fiber, any stray particles, or finger oil can have a significant effect on connector performance. Where many repeat connections are required, use of a connector saver or patch cable is recommended.

Figure 3-4 shows the end of a clean fiber-optic cable. The dark circle in the center of the micrograph is the fiber's 125 µm core and cladding which carries the light. The surrounding area is the soft nickel-silver ferrule. Figure 3-5 shows a dirty fiber end from neglect or perhaps improper cleaning. Material is smeared and ground into the end of the fiber causing light scattering and poor reflection. Not only is the precision polish lost, but this action can grind off the glass face and destroy the connector.

Figure 3-6 shows physical damage to the glass fiber end caused by either repeated connections made without removing loose particles or using improper cleaning tools. When severe, the damage of one connector end can be transferred to another good connector endface that comes in contact with the damaged one. Periodic checks of fiber ends, and replacing connecting cables after many connections is a wise practice.

The cure for these problems is disciplined connector care as described in the following list and in "Cleaning Connectors" on page 3-15.

Use the following guidelines to achieve the best possible performance when making measurements on a fiber-optic system:

- Never use metal or sharp objects to clean a connector and never scrape the connector.
- Avoid matching gel and oils.

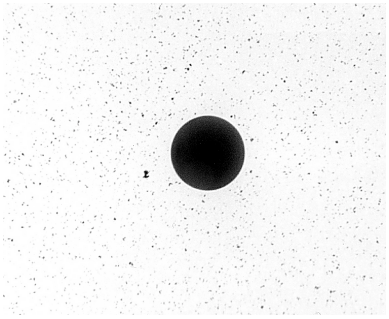


Figure 3-4. Clean, problem-free fiber end and ferrule.

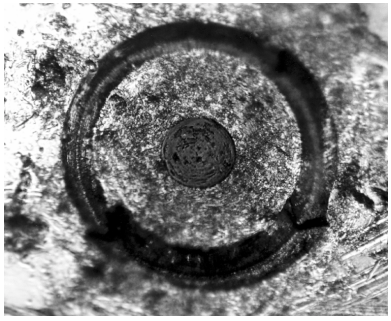


Figure 3-5. Dirty fiber end and ferrule from poor cleaning.



Figure 3-6. Damage from improper cleaning.

While these often work well on first insertion, they are great dirt magnets. The oil or gel grabs and holds grit that is then ground into the end of the fiber. Also, some early gels were designed for use with the FC, non-contacting connectors, using small glass spheres. When used with contacting connectors, these glass balls can scratch and pit the fiber. If an index matching gel or oil must be used, apply it to a freshly cleaned connector, make the measurement, and then immediately clean it off. Never use a gel for longer-term connections and never use it to improve a damaged connector. The gel can mask the extent of damage and continued use of a damaged fiber can transfer damage to the instrument.

- When inserting a fiber-optic cable into a connector, gently insert it in as straight a line as possible. Tipping and inserting at an angle can scrape material off the inside of the connector or even break the inside sleeve of connectors made with ceramic material.
- When inserting a fiber-optic connector into a connector, make sure that the fiber end does not touch the outside of the mating connector or adapter.
- Avoid over tightening connections.

  Unlike common electrical connections, tighter is *not* better. The purpose of the connector is to bring two fiber ends together. Once they touch, tightening only causes a greater force to be applied to the delicate fibers. With connectors that have a convex fiber end, the end can be pushed off-axis resulting in misalignment and excessive return loss. Many measurements are actually improved by backing off the connector pressure. Also, if a piece of grit does happen to get by the cleaning procedure, the tighter connection is more likely to damage the glass. Tighten the connectors just until the two fibers touch.

- Keep connectors covered when not in use.
- Use fusion splices on the more permanent critical nodes. Choose the best connector possible. Replace connecting cables regularly. Frequently measure the return loss of the connector to check for degradation, and clean every connector, every time.

  All connectors should be treated like the high-quality lens of a good camera. The weak link in instrument and system reliability is often the inappropriate use and care of the connector. Because current connectors are so easy to use, there tends to be reduced vigilance in connector care and cleaning. It takes only one missed cleaning for a piece of grit to permanently damage the glass and ruin the connector.

  Measuring insertion loss and return loss
  Consistent measurements with your lightwave equipment are a good indication that you have good connections. Since return loss and insertion loss are key factors in determining optical connector performance they can be used to determine connector degradation. A smooth, polished fiber end should produce a good return-loss measurement. The quality of the polish establishes the difference between the “PC” (physical contact) and the “Super PC” connectors. Most connectors today are physical contact which make glass-to-glass connections, therefore it is critical that the area around the glass core be clean and free of scratches. Although the major area of a connector, excluding the glass, may show scratches and wear, if the glass has maintained its polished smoothness, the connector can still provide a good low level return loss connection.

  If you test your cables and accessories for insertion loss and return loss upon receipt, and retain the measured data for comparison, you will be able to tell in the future if any degradation has occurred. Typical values are less than 0.5 dB of loss, and sometimes as little as 0.1 dB of loss with high performance connectors. Return loss is a measure of reflection: the less reflection the better (the larger the return loss, the smaller the reflection). The best physically contacting connectors have return losses better than 50 dB, although 30 to 40 dB is more common.

Visual inspection of fiber ends

Visual inspection of fiber ends can be helpful. Contamination or imperfections on the cable end face can be detected as well as cracks or chips in the fiber itself. Use a microscope (100X to 200X magnification) to inspect the entire end face for contamination, raised metal, or dents in the metal as well as any other imperfections. Inspect the fiber for cracks and chips. Visible imperfections not touching the fiber core may not affect performance (unless the imperfections keep the fibers from contacting).

WARNING **Always remove both ends of fiber-optic cables from any instrument, system, or device before visually inspecting the fiber ends. Disable all optical sources before disconnecting fiber-optic cables. Failure to do so may result in permanent injury to your eyes.**

Cleaning Connectors

The procedures in this section provide the proper steps for cleaning fiber-optic cables and Agilent Technologies universal adapters. The initial cleaning, using the alcohol as a solvent, gently removes any grit and oil. If a caked-on layer of material is still present, (this can happen if the beryllium-copper sides of the ferrule retainer get scraped and deposited on the end of the fiber during insertion of the cable), a second cleaning should be performed. It is not uncommon for a cable or connector to require more than one cleaning.

CAUTION Agilent Technologies strongly recommends that index matching compounds *not* be applied to their instruments and accessories. Some compounds, such as gels, may be difficult to remove and can contain damaging particulates. If you think the use of such compounds is necessary, refer to the compound manufacturer for information on application and cleaning procedures.

Table 3-4. Cleaning Accessories

Item	Agilent Part Number
Any commercially available denatured alcohol	—
Cotton swabs	8520-0023
Small foam swabs	9300-1223
Compressed dust remover (non-residue)	8500-5262

Table 3-5. Dust Caps Provided with Lightwave Instruments

Item	Agilent Part Number
Laser shutter cap	08145-64521
FC/PC dust cap	08154-44102
Biconic dust cap	08154-44105
DIN dust cap	5040-9364
HMS10/dust cap	5040-9361
ST dust cap	5040-9366

To clean a non-lensed connector

CAUTION Do not use any type of foam swab to clean optical fiber ends. Foam swabs can leave filmy deposits on fiber ends that can degrade performance.

1. Apply pure isopropyl alcohol to a clean lint-free cotton swab or lens paper.

   Cotton swabs can be used as long as no cotton fibers remain on the fiber end after cleaning.

2. Clean the ferrules and other parts of the connector while avoiding the end of the fiber.
3. Apply isopropyl alcohol to a new clean lint-free cotton swab or lens paper.
4. Clean the fiber end with the swab or lens paper.

   Do *not* scrub during this initial cleaning because grit can be caught in the swab and become a gouging element.

5. Immediately dry the fiber end with a clean, dry, lint-free cotton swab or lens paper.
6. Blow across the connector end face from a distance of 6 to 8 inches using filtered, dry, compressed air. Aim the compressed air at a shallow angle to the fiber end face.

   Nitrogen gas or compressed dust remover can also be used.

CAUTION Do not shake, tip, or invert compressed air canisters, because this releases particles in the can into the air. Refer to instructions provided on the compressed air canister.

7 As soon as the connector is dry, connect or cover it for later use.

If the performance, after the initial cleaning, seems poor try cleaning the connector again. Often a second cleaning will restore proper performance. The second cleaning should be more arduous with a scrubbing action.

To clean an adapter

The fiber-optic input and output connectors on many Agilent Technologies instruments employ a universal adapter such as those shown in the following picture. These adapters allow you to connect the instrument to different types of fiber-optic cables.



Figure 3-7. Universal adapters.

1 Apply isopropyl alcohol to a clean foam swab.

Cotton swabs can be used as long as no cotton fibers remain after cleaning. The foam swabs listed in this section's introduction are small enough to fit into adapters.

Although foam swabs can leave filmy deposits, these deposits are very thin, and the risk of other contamination buildup on the inside of adapters greatly outweighs the risk of contamination by foam swabs.

2 Clean the adapter with the foam swab.

3 Dry the inside of the adapter with a clean, dry, foam swab.

4 Blow through the adapter using filtered, dry, compressed air.

Nitrogen gas or compressed dust remover can also be used. Do not shake, tip, or invert compressed air canisters, because this releases particles in the can into the air. Refer to instructions provided on the compressed air canister.

Instrument Service

Before returning your instrument for servicing, you may want to refer to the Agilent website, www.agilent.com (quick search “83434A”). It contains application notes and frequently asked questions (FAQ) specific to the 83434A that may answer many of your questions.

If you continue to experience difficulties, please call the Agilent Technologies Instrument Support Center to initiate service *before* returning your instrument to a service office. This ensures that the repair (or calibration) can be properly tracked and that your instrument will be returned to you as quickly as possible. Call this number regardless of where you are located.

Agilent Technologies Instrument Support Center . . . . . .1(800) 403-0801

After you have initiated service by calling the Agilent Technologies Instrument Support Center, contact your local service office. For a list of offices, refer to “Agilent TechnologiesService Offices” on page 3-21.

If the instrument is still under warranty or is covered by an Agilent Technologies maintenance contract, it will be repaired under the terms of the warranty or contract (the warranty is at the front of this manual). If the instrument is no longer under warranty or is not covered by an Agilent Technologies maintenance plan, Agilent Technologies will notify you of the cost of the repair after examining the unit.

Preparing the Instrument for Shipping

1 Write a complete description of the failure and attach it to the instrument. Include any specific performance details related to the problem. The following information should be returned with the instrument.

- Type of service required.
- Date instrument was returned for repair.
- Description of the problem:
  - Whether problem is constant or intermittent.
  - Whether instrument is temperature-sensitive.
  - Whether instrument is vibration-sensitive.
  - Instrument settings required to reproduce the problem.
  - Performance data.
- Company name and return address.
- Name and phone number of technical contact person.
- Model number of returned instrument.
- Full serial number of returned instrument.
- List of any accessories returned with instrument.

2 Cover all front or rear-panel connectors that were originally covered when you first received the instrument.

CAUTION Cover electrical connectors to protect sensitive components from electrostatic damage. Cover optical connectors to protect them from damage due to physical contact or dust.

CAUTION Instrument damage can result from using packaging materials other than the original materials. Never use styrene pellets as packaging material. They do not adequately cushion the instrument or prevent it from shifting in the carton. They may also cause instrument damage by generating static electricity.

3 Pack the instrument in the original shipping containers. Original materials are available through any Agilent Technologies office. Or, use the following guidelines:

- Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.
- For instruments weighing less than 54 kg (120 lb), use a double-walled, cor-

rugated cardboard carton of 159 kg (350 lb) test strength.

- The carton must be large enough to allow approximately 7 cm (3 inches) on all sides of the instrument for packing material, and strong enough to accommodate the weight of the instrument.
- Surround the equipment with approximately 7 cm (3 inches) of packing material, to protect the instrument and prevent it from moving in the carton. If packing foam is not available, the best alternative is S.D-240 Air Cap™ from Sealed Air Corporation (Commerce, California 90001). Air Cap looks like a plastic sheet filled with air bubbles. Use the pink (antistatic) Air Cap™ to reduce static electricity. Wrapping the instrument several times in this material will protect the instrument and prevent it from moving in the carton.

4 Seal the carton with strong nylon adhesive tape.

5 Mark the carton “FRAGILE, HANDLE WITH CARE”.

6 Retain copies of all shipping papers.

Agilent TechnologiesService Offices

Before returning an instrument for service, call the Agilent Technologies Instrument Support Center at 1 (800) 403-0801. If you continue to experience difficulties, please call one of the numbers listed below.

Agilent Technologies Service Numbers (1 of 2)

Austria	01/25125-7171
Belgium	32-2-778.37.71
Brazil	(11) 7297-8600
China	86 10 6261 3819
Denmark	45 99 12 88
Dominican Republic	(809) 563-6350
Finland	358-10-855-2360
France	01.69.82.66.66
Germany	0180/524-6330
India	080-34 35788
Italy	+39 02 9212 2701
Ireland	01 615 8222
Japan	(81)-426-56-7832
Korea	82/2-3770-0400
Mexico	(5) 258-4826
Netherlands	020-547 6463
Norway	+47 22 73 57 59
Puerto Rico	(800) 403-0801
Russia	+7-095-797-3930
Spain	(34/91) 631 1213

Agilent Technologies Service Numbers (2 of 2)

Sweden	08-5064 8700
Switzerland	(01) 735 7200
Taiwan	(886 2) 2-712-0404
United Kingdom	01 344 366666
United States and Canada	(800) 403-0801

4

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Specifications and Regulatory Information

Specifications and Regulatory Information

This chapter lists specification and characteristics of the instrument. The distinction between these terms is described as follows:

- Specifications describe warranted performance over the temperature range 0°C to +45°C and relative humidity <95% non-condensing (unless otherwise noted). All specifications apply after the temperature of the instrument is stabilized after 30 minutes of continuous operation.
- *Characteristics* provide useful information by giving functional, but nonwarranted, performance parameters. *Characteristics are printed in this typeface.*

Calibration cycle

This instrument requires periodic verification of performance. The instrument should have a complete verification of specifications at least once every two years.

Agilent 83434A Specifications and Characteristics

OPERATING SPECIFICATIONS	
Optical Input	
Wavelength	1300 to 1600 nm
Optical input power[a,b,c,d]	–16 to 0 dBm
Return loss	28 dB minimum
"Loss of optical input" alarm threshold	*–25 to –20 dBm*
Maximum Safe Input Level	
Optical input power[e]	+7 dBm maximum
Data Output	
Amplitude[f,g]	0.5 to 1.5 V pk-pk
Lower 3 dB frequency[h]	0.10 MHz
Upper 3 dB frequency[h, i]	6.5 GHz
Return loss[j]	9.5 dB minimum
Impedance	*50*Ω

Recovered Clock Output	
Amplitude[h]	0.5 to 1. 5 V pk-pk
Frequency[k]	9953.26 to 9953.30 MHz; *9953.28 nominal*
Frequency (opt. 106)	10664.03 to 10664.43 MHz; *10664.23 nominal*
Duty cycle	45/55% maximum; *50/50% nominal*
Clock to data alignment[l]	±25.12 ps maximum
3 dB bandwidth[k]	8 to 12 MHz; *10 MHz nominal*
Jitter generation[g,m]	2 ps rms maximum
Return loss[n]	12 dB minimum
Impedance	*50Ω*
GENERAL SPECIFICATIONS	
Temperature Range	
Operating	0°C to +45°C
Storage	–40°C to +70°C
EMI Compatibility	Conducted and radiated emissions meet the requirements of CISPR Publication 11, Class A and immunity in compliance with IEC 61326-1
Power Requirements	100/120/220/240 V (±10%), 47 to 63 Hz
Weight *(characteristic)*	*3.4 kg (7.6 lb)*
Dimensions	102mm (4 in) height, 216 mm (8.5 in) width, 444 mm (17.5 in) depth (Agilent System II, half-width case)
FRONT-PANEL INPUT / OUTPUT	
Optical Input Connector	Diamond HMS-10/HP[o]
Data Output Connector	APC-3.5 male
Recovered Clock Output Connector	APC-3.5 male

a. Better than $1x10^{-10}$ BER when tested with the Agilent 71612B using either of two patterns: a) 2^{31}–1 PRBS, or b)100 consecutive "ones" or "zeros" on a 2^{31}–1 PRBS.
b. Source extinction ratio ≥ 8.2 dB measured within ±10% of eye center
c. Applies over the temperature range 25°C ±10°C.
d. Tested with FC/PC adapter.
e. 1310 or 1550 nm.
f. Non-inverting, non-retimed linear output with AGC stabilization.
g. For PRBS up to and including 2^{31}–1.
h. AC coupled
i. Measured with a swept network analyzer at –8 dBm optical input with fixed AGC control in Tx and Rx.
j. 0.01 to 10,700 MHz.
k. Type A resonator based clock recovery.

l. Falling clock edge to data transition measured with 2^{31}–1 PRBS.
m. Integrated phase noise measurement method.
n. 9,940 to 9,960 MHz standard, 10624 to 10684 MHz (option 106).
o. Standard instrument has FC/PC adapters. Other adapters available as options.

Regulatory Information

This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2, per IEC 61010-1 and 664 respectively.

Notice for Germany: Noise Declaration

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermrerordnung –3.GSGV Deutschland).

Acoustic Noise Emission	Geraeuschemission
LpA < 70 dB Operator position Normal position per ISO 7779	LpA < 70 dB am Arbeitsplatz normaler Betrieb nach DIN 45635 t.19

Declaration of Conformity

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014

Manufacturer's Name:	Agilent Technologies, Inc.
Manufacturer's Address:	1400 Fountaingrove Parkway Santa Rosa, CA 95403-1799 USA

Declares that the product:

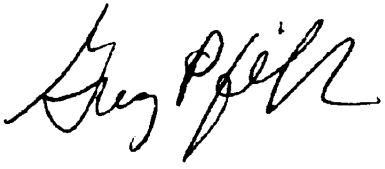
Product Name:	10Gb/sec Lightwave Receiver
Model Number:	83434A
Product Options:	This declaration covers all options of the above product.

Is in conformity with:

Safety: IEC 61010-1:1990 +A1:1992+A2:1995 / EN 61010-1:1994+A2:1995
CAN/CSA-C22.2 No. 1010.1-92

EMC: CISPR 11:1990/EN 55011:1991 Group 1, Class A
IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995, 4 kV CD, 8 kV AD
IEC 61000-4-3:1995 / EN 61000-4-3:1995, 3 V/m, 80-1000 MHz
IEC 61000-4-4:1995 / EN 61000-4-4:1995, 0.5 kV sig. lines, 1 kV pow. lines
IEC 61000-4-5:1995 / EN 61000-4-5:1995, 0.5 kV l-l, 1 kV l-e
IEC 61000-4-6:1996 / EN 61000-4-6:1996, 3V 80% AM, power line
IEC 61000-4-11:1994 / EN 61000-4-11:1994, 100 %, 20 ms

Supplementary Information:
The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carries the CE-marking accordingly.



Santa Rosa, CA, USA 20 Dec. 1999

Greg Pfeiffer/Quality Engineering Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.

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