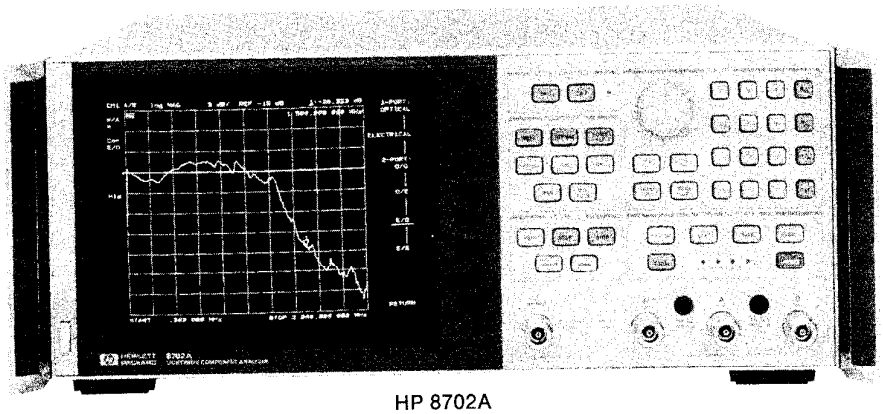
# LIGHTWAVE TEST EQUIPMENT

## Lightwave Component Analyzer

**Model 8702A**

- 300 kHz to 3 GHz Modulation Frequency
- Single and Multimode

NEW



HP 8702A

### Description

The HP 8702A can make calibrated measurements of lasers, photodiodes, optical fiber, and electrical components that operate with high bandwidth. The swept modulation frequency measurements show precisely how a component operates on the "information bearing" signal. Knowing how a single component responds independently of the rest of the transmission system gives insight into how system operates, and how to improve it.

The HP 8702A operates at a fixed wavelength (1300 nm), and sweeps the frequency of the intensity modulation signal. The lightwave source and receiver are independently calibrated. This allows calibrated measurements of the modulation characteristics of lasers and photodiodes.

### Measure Lightwave Components

In-fiber components such as connectors, splitters, couplers, and lenses, as well as fiber itself, can be measured as a function of modulation frequency. This yields modulation bandwidth, insertion loss, length, and optical return loss measurements. With the time domain option, high resolution reflection measurements (6 cm) and modal dispersion measurements can be made.

### Measure Electro-Optical Components

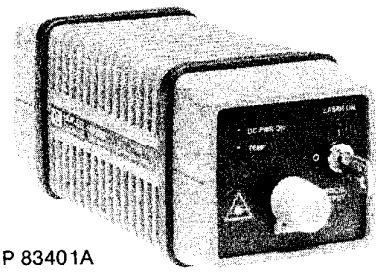
The HP 8702A can make calibrated measurements of the modulation frequency response of lasers, LED's, and modulators. Similarly, it can measure the demodulation frequency response of PIN photodiodes, APD's, and complete receivers. For E/O devices, the measurement shows the actual modulation power generated at a given frequency. For O/E devices, the measurement shows RF current generated as a function of modulation power, at a given frequency. This exact knowledge of the behavior of the electro-optical component gives a designer the ability to optimize the component independently of the measurement system.

### Measure Electrical Components

Typical network analyzer measurements such as bandwidth, insertion loss, gain, phase, and impedance of RF components can be made with the HP 8702A. For example, linear components such as amplifiers, filters, and transmission lines can be characterized.

### Time Domain Measurements

The HP 8702A option 010, Time Domain, takes the data measured in the frequency domain, and applies the inverse Fourier transform to calculate the impulse response of devices. In reflection measurements, the time axis can be related to distance, and the HP 8702A used to locate discontinuities as close as 6 cm apart in fiber. In transmission, the impulse response can be used to calculate dispersion. The time domain calculations apply to all the measurements that the HP 8702A performs.



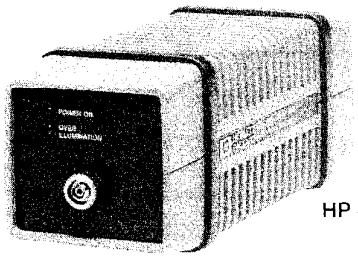
HP 83401A

### Lightwave Source

HP 83400A Single-mode
HP 83401A Multimode

A 1300 nm Fabret-Perot laser directly modulated through the RF Input. The HP 83400A has 9/125 $\mu$ fiber, and the HP 83401A has 50/125 $\mu$ fiber.

**Wavelength:** 1308 ± 10 nm
**Spectral Width:** ≤ 3 nm
**Average Power:** 1.25 ± 0.75 mW
**Responsivity @ 50 Mhz:** −34 dB[1]
**Modulation Bandwidth:** 300 kHz to 3 GHz
**Modulation Frequency Response:** ± 3.5 dB
**Optical Connector:** Selected by option[3]



HP 83410A

### Lightwave Receiver

HP 83410A

A 1300 nm PIN photodiode receiver that accepts fiber core sizes up to 62.5 micrometers.

**Wavelength:** 1300 nm (nominal)
**Maximum Power:** 3 mW
**Responsivity @ 50 Mhz:** 20 dB[2]
**Modulation Bandwidth:** 300 kHz to 3 GHz
**Modulation Frequency Response:** ± 4 dB < 2 GHz
+4, −14 dB
**Optical Connector:** Selected by option[3]

### Lightwave Coupler

HP 11890A Single-mode
HP 11891A Multimode
**Optical Connector:** Selected by option[3]

A 3 port, directional lightwave coupler for making lightwave reflection measurements, and monitoring lightwave transmission. The coupler has a nominal 3 dB coupling factor.

### RF Interface Kit

HP 11889A

This kit contains the RF accessories required to operate the HP 8702A. The HP 85044 or 85046 test sets replace the function of the HP 11889A. Contains a power splitter, a 20 dB pad, male and female SMA barrels, 3 SMA right angle bends, and a custom cable.

### High Frequency Probe

HP 85024A

The HP 85024A makes it easy to perform in-circuit measurements. Its high impedance (0.7 pF in shunt with 1 megaohm) permits high frequency probing without adversely loading the circuit under test, and allows measurements of non-50 ohm devices. Page 246 has a more complete description of the HP 85024A.

### S Parameter Test Set

HP 85046A

The HP 85046A test set provides the capability to measure impedance and transmission characteristics of 2 port electrical devices in either forward or reverse direction with a single connection. See page 244 for more detailed information.

### 3.5 mm Calibration Kit

HP 85033C

Contains precision 3.5 mm standards used to calibrate the HP 8702A for measurements of 3.5 mm and SMA electrical devices. Page 246 has a more complete description of calibration kits.

### Ordering Information

| | |
|---|---|
| **HP 8702A** Lightwave Component Analyzer | $28,000 |
| **Option 010** Time Domain | $4,800 |
| **Option 802** HP 9122 Dual Disc Drive | $1,495 |
| **Option 910** Extra Operating and Service Manual | $125 |
| **Option 913** Rack Mount Kit | $40 |
| **Option W30** Extended return-to-HP service | $540 |
| **HP 83400A** Lightwave Source, Single-mode | $12,700 |
| **Option 01X**[3] Select Optical Connector | $0 |
| **Option W30** Extended return-to-HP service | $260 |
| **HP 83401A** Lightwave Source, Multimode | $12,700 |
| **Option 01X**[3] Select Optical Connector | $0 |
| **Option W30** Extended return-to-HP service | $260 |
| **HP 83410A** Lightwave Receiver | $5,000 |
| **Option 01X**[3] Select Optical Connector | $0 |
| **Option W30** Extended return-to-HP service | $100 |
| **HP 11890A** Lightwave Coupler, Single-mode | $3,900 |
| **Option 01X**[3] Select Optical Connector | $0 |
| **HP 11891A** Lightwave Coupler, Multimode | $3,900 |
| **Option 01X**[3] Select Optical Connector | $0 |
| **HP 11889A** RF Interface Kit | $1,500 |
| **HP 85024A** High Frequency Probe | $1,900 |
| **HP 85046A** S-Parameter Test Set | $7,800 |
| **HP 85033C** 3.5 mm Calibration Kit | $2,500 |

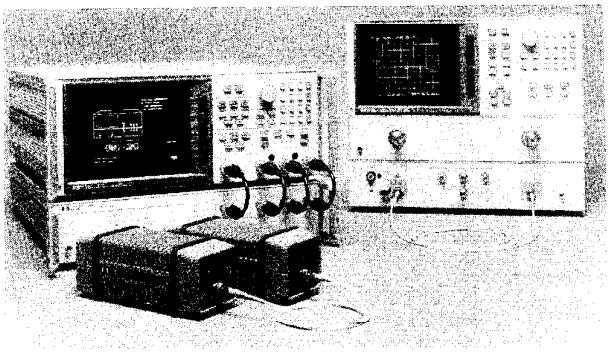
[1] Nominal responsivity, expressed in log format, referenced to 1 Amp/Watt.
[2] Nominal responsivity, expressed in log format, referenced to 1 Watt/Amp.
[3] The optical connector used with these products are determined by an exchangeable adapter. One adapter option must be specified:
011 Diamond HMS 10/HP
012 FC/PC
013 DIN 47256
014 ST

# LIGHTWAVE TEST EQUIPMENT

## Lightwave Component Analyzer

**HP 8702B, 8703A**

- 300 kHz to 20 GHz Modulation Frequency
- Calibrated measurements of high-speed optical, electro-optical, and electrical components.
- 850, 1300, or 1550 nm Operation
- Reflection measurements with <1mm resolution
- up to 50 dB dynamic range.



NEW

HP 8702B & 8703A

### Lightwave Component Analyzer

As the transmission rate or bandwidth of fiber optic systems is pushed upward, high frequency design considerations become key. Both the HP 8702B and 8703A measure each of the elements that transmit these wide bandwidths. They make calibrated measurements of lasers or LED transmitters, photodiode receivers, optical fibers, and the electrical components they work with. The lightwave component analyzers operate with a swept modulation frequency to precisely characterize how these components operate on the high-speed, information-bearing signal. Information on how each component responds independent of the others provides insight into how systems can be predicted and improved.

Both the HP 8702B and 8703A operate at a fixed wavelength and sweep the frequency of the intensity modulation signal over the bandwidth you select. The HP 8702B has transducers (lightwave source and receivers), which allow it to operate at 850, 1300, and 1550 nm. The HP 8703A can operate at 1300 and 1550 nm. These sources and receivers come with calibration data to allow calibrated measurements of the electro-optical components.

#### Measure Optical Components

Measurements can be made of components such as connectors, splitters, couplers, and lenses, as well as fiber itself. This yields modulation bandwidth, insertion loss, length, and optical return loss. In the distance-time domain, reflections can be located without the dead zone typical of OTDR type measurements. Transmission measurements can be also be displayed in the distance-time domain to view the impulse or step response of the component. Delay and dispersion are easily viewed in this manner.

#### Measure Electro-Optical Components

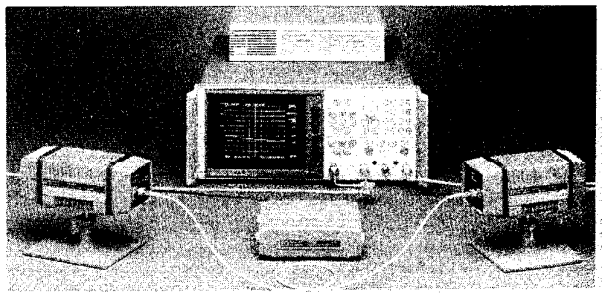
Often the limiting elements in a fiber optic system are the electro-optical components (e.g., lasers, APD's, PIN photodiodes, and modulators), which convert the electrical information to optical or vice versa. The conversion efficiency or responsivity of these devices is a function of many variables. The characterized lightwave source and receiver in the lightwave component analyzer allows each of these devices to be uniquely tested. Data can be displayed in the frequency domain as the modulation frequency response or in the time domain as the step response.

#### Measure Electrical Components

When used to measure linear electrical components such as amplifiers, filters, and transmission lines, the lightwave component analyzers have the full measurement capability of a microwave network analyzer. Typical measurements are bandwidth, insertion loss/gain, phase, impedance, match, and group delay

#### Measure Both Transmission and Reflection Characteristics

Complete characterization on component behavior depends on knowing how the signal is transmitted through it and how it is reflected back. For optical reflections, the lightwave component analyzers use a lightwave directional coupler to make the reflection measurements. Data can be presented in the modulation frequency domain or in the distance-time domain to locate and measure the source of the reflection. Because of the wide measurement bandwidth, reflections can be located with <1mm of resolution and up to 50 dB dynamic range. For electrical reflection measurements, the analyzer uses a test set to perform the measurement. Results, such as impedance, can then be displayed.



HP 8702B

### HP 8702B Lightwave Component Analyzer

Standard configuration requires an HP 8702B, an RF interface kit, a lightwave source, lightwave receiver, and fiber cable. For reflection measurements, a lightwave coupler is required.

#### HP 8702B Accessories

**Lightwave Source Modules**

All with directly modulated Fabret-Perot lasers.

HP 83400A, 300 kHz-3 GHz, 1300 nm, 9/125 um fiber
HP 83401A, 300 kHz-3 GHz, 1300 nm, 50/125 um fiber
HP 83402A, 300 kHz-6 GHz, 1300 nm, 9/125 um fiber
HP 83403A, 300 kHz-3 GHz, 1550 nm, 9/125 um fiber
HP 83404A, 300 kHz-3 GHz, 850 nm, 50/125 um fiber

**Lightwave Receiver Modules**

All with PIN photodiodes.

HP 83410B, 300 kHz-3 GHz, 1300/ 1550 nm, 62.5/125 um fiber
HP 83411A, 300 kHz-6 GHz, 1300/ 1550 nm, 9/125 um fiber
HP 83411B, 300 kHz-6 GHz, 1300/ 1550 nm, 9/125 um fiber
HP 83412A, 300 kHz-3 GHz, 850 nm, 62.5/125 um fiber

**Lightwave Directional Couplers**

A 3-port, directional coupler for making reflection measurements and monitoring transmission signals. The couplers have a nominal 3 dB coupling factor.

HP 11890A 9/125 um fiber
HP 11891A 50/125 um fiber

**RF Interface Kit**

HP 11889A

This kit contains the RF accessories required to operate the HP 8702 when a test set is not used. Contains a power splitter, a 20 dB pad, SMA accessories and adapters for the analyzer.

**High Frequency Probe**

HP 85024A

Performs in-circuit measurements. It's high impedance (.7 pF in shunt with 1 megaohm) permits high frequency probing without adversely loading the circuit under test. See Page 230 for more information.

**S Parameter Test Set**
HP 85046A 300 kHz-3 GHz
HP 85047A 300 kHz-6 GHz

These test sets provide the capability to measure impedance and transmission characteristics of two port electrical devices in either forward or reverse direction with a single connection. The HP 85047A is required for 6 GHz operation.

**Calibration Kit**
HP 85033C 3.5 mm

Contains precision 3.5 mm standards used to calibrate the HP 8702 for electrical measurements of components with 3.5 mm or SMA connectors.

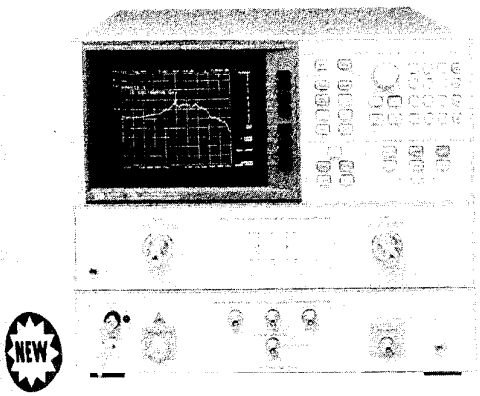
**Fiber Optic Cable**
HP 11871A PC Fiber Cable, 9/125 um, 1 meter
HP 11871B ST Fiber Cable, 9/125 um, 1 meter
HP 11871C Biconic Fiber Cable, 9/125 um, 1 meter
HP 11886A Interconnect Cable Kit, 9/125 um
HP 11887A Interconnect Cable Kit, 50/125 um

**Upgrade Kit**
HP 11876A

For upgrading an HP 8753A network analyzer to an HP 8702A lightwave component analyzer.

| Ordering Information | Price |
|---|---|
| **HP 8702B** Lightwave Component Analyzer | $32,800 |
| **Opt 006** 6 GHz receiver operation | +$3,000 |
| **Opt 011** Delete time domain | −$4,800 |
| **Opt 802** Add Disk Drive & Cable | +$1,495 |
| **HP 83400A** Lightwave Source | $12,700 |
| **HP 83401A** Lightwave Source | $12,700 |
| **HP 83402A** Lightwave Source | $14,700 |
| **HP 83403A** Lightwave Source | $12,700 |
| **HP 83404A** Lightwave Source | $12,700 |
| **HP 83410B** Lightwave Receiver | $5,000 |
| **HP 83411A** Lightwave Receiver | $3,900 |
| **HP 83411B** Lightwave Receiver | $12,000 |
| **HP 83412A** Lightwave Receiver | $5,000 |
| **HP 11890A** Lightwave Coupler | $3,900 |
| **HP 11891A** Lightwave Coupler | $3,900 |
| **HP 11871A** PC fiber cable | $150 |
| **HP 11871B** ST fiber cable | $150 |
| **HP 11871C** Biconic fiber cable | $150 |
| **HP 11886A** Interconnect cable kit | $1,200 |
| **HP 11887A** Interconnect cable kit | $1,200 |
| **HP 11889A** RF Interface Kit | $1,500 |
| **HP 85024A** High Frequency Probe | $1,900 |
| **HP 85046A** S parameter test set | $8,000 |
| **HP 85047A** S parameter test set | $9,800 |
| **HP 11876A** Upgrade Kit | $3,500 |

**HP 8703A lightwave component analyzer**
- 130 MHz to 20 GHz Modulation Frequency
- 1300 and 1550 nm operation

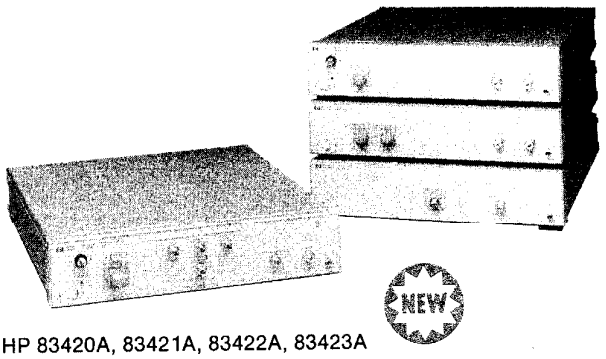



HP 8703A

## HP 8703A Lightwave Component Analyzer

Standard configuration includes an internal 1300 nm Fabre-Perot (FP) laser and one 1300/ 1550 nm receiver. The external lightwave source input is used with the HP 83424A or 83425A Lightwave CW Sources for additional 1550 or 1300 nm DFB capability.

**HP 8703A Accessories**
**20 GHz lightwave test set**




HP 83420A, 83421A, 83422A, 83423A

**HP 83420A Lightwave Test Set**

Includes a 1300 nm FP laser, modulator, receiver, and directional coupler. Basic lightwave component analyzer tests from 130 MHz-20 GHz can be made when combined with an external controller and an HP 8510 microwave analyzer system.

**20 GHz lightwave accessories**
HP 83421A Lightwave Source
HP 83422A Lightwave Modulator
HP 83423A Lightwave Receiver

For stand alone applications, these accessories all have modulation bandwidths of 130 MHz-20 GHz.

| Ordering Information | Price |
|---|---|
| **HP 8703A** Lightwave Component Analyzer | $104,000 |
| **Opt 01X** Select optical connector | $0 |
| **Opt 100** External lightwave source input | +$2,800 |
| **Opt 210** 1550 nm DFB laser | +$15,000 |
| **Opt 220** 1300 nm DFB laser | +$10,500 |
| **Opt 300** Additional lightwave receiver | +$10,900 |
| **Opt 802** Add Disk Drive & Cable | +$1,495 |
| **Opt 830** Add HP 3.5mm Cal Kit & Cable | +$5,100 |
| **HP 83424A** Lightwave CW Source- 1550 nm | $27,500 |
| **Opt 100** External lightwave source input | +$2,800 |
| **HP 83425A** Lightwave CW Source | $24,100 |
| **Opt 100** External lightwave source input | +$2,800 |
| **HP 83420A** Lightwave Test Set | $47,500 |
| **Opt 01X** Connector option | $0 |
| **Opt 100** External lightwave source input | +$2,800 |
| **Opt 210** 1550 nm DFB laser | +$15,000 |
| **Opt 220** 1300 nm DFB laser | +$10,500 |
| **HP 83421A** Lightwave Source | $29,500 |
| **Opt 01X** Connector option | $0 |
| **Opt 100** External lightwave source input | +$2,800 |
| **Opt 210** 1550 nm DFB laser | +$15,000 |
| **Opt 220** 1300 nm DFB laser | +$10,500 |
| **HP 83422A** Lightwave Modulator | $20,000 |
| **Opt 01X** Connector option | $0 |
| **HP 83423A** Lightwave Receiver | $13,500 |
| **Opt 01X** Connector option | $0 |
| **Opt 300** Additional lightwave receiver | +$10,900 |