

HP 83430A Lightwave Digital Source

Product Overview

**SDH/SONET Compliant
DFB laser source for
digital, WDM, and
analog test up to 2.5 Gb/s**



- 52 Mb/s STM-0/OC-1
- 155 Mb/s STM-1/OC-3
- 622 Mb/s STM-4/OC-12
- 2488 Mb/s STM-16/OC-48

- User adjustable extinction ratio
- User selectable wavelengths:
 - 1310 nm
 - 1535 nm
 - 1539 nm
 - 1543 nm
 - 1546.2 nm
 - 1550 nm
 - 1553.4 nm
 - 1557 nm
 - 1560.5 nm



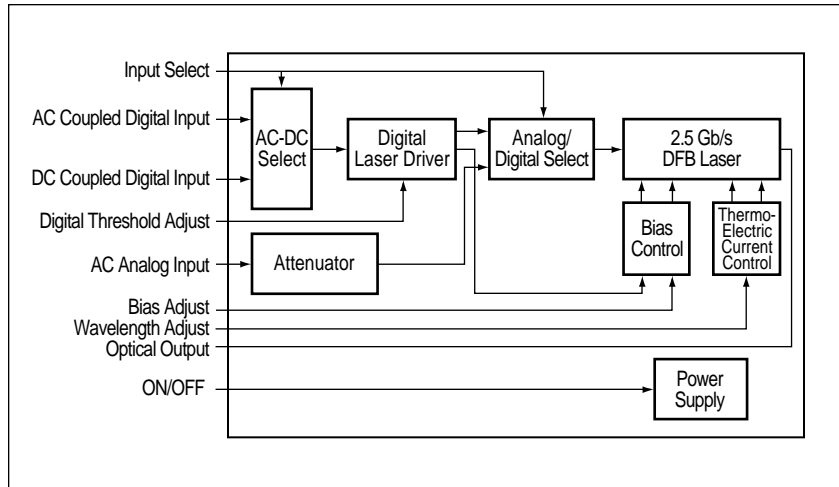


Figure 1. HP 83430A block diagram

The HP 83430A is a SDH/SONET compliant transmitter designed for evaluating the performance of high-speed TDM (time division multiplexed) and WDM (wavelength division multiplexed) optical receivers and systems. It can be used for SDH/SONET "STM-0"/OC-1 (51.84 Mb/s) through STM-16/OC-48 (2.488 Gb/s) testing.

The block diagram of the HP 83430A is shown in Figure 1. The instrument has three separate modulation input ports. The AC coupled analog input provides a general-purpose input for direct modulation of the DFB laser. The AC and DC coupled digital inputs convert ECL compatible input signals to a preset optical output level that is SDH/SONET compliant.

The digital input threshold is user adjustable so that the desired symmetry of optical one and zero levels may be obtained. The HP 83430A has a user adjustable extinction ratio so that a wide range of optical signals can be simulated.

The standard product has a 1550 nm center wavelength. There are eight optional center wavelength versions including 1310 nm and seven wavelengths between 1535 nm and 1560.5 nm. The center wavelength of the HP 83430A can be adjusted by means of a front panel temperature control.

Parametric Test System

With the HP 83430A and 83446A/B, Hewlett-Packard offers complete optical parametric test systems for test needs up to 2.5 Gb/s. A complete high-performance optical parametric test system consists of the HP 71603A Error Performance Analyzer with the 83430A Lightwave Digital Source and the 83446A Lightwave Clock/Data Receiver. Measurements such as optical receiver sensitivity and dispersion power penalty of single-mode fiber can be made using such a system.

The HP 83430A can be combined with the 83480A Digital Communications Analyzer to provide transceiver waveform testing such as filtered conformance mask testing, extinction ratio and eye-diagram measurements.

Wavelength Selection and Tunability

The HP 83430A wavelength adjustment gives you the ability to select a preset wavelength or to tune the wavelength to some specific value within ± 1.25 nm of the center wavelength. This is accomplished by adjusting the temperature of the laser $\pm 10^\circ\text{C}$ about 25°C . Figure 2 shows the upper limit of the tunable range of the standard 1550 nm HP 83430A, the nominal wavelength and the lower limit of the range measured on the HP 71450B Optical Spectrum Analyzer.

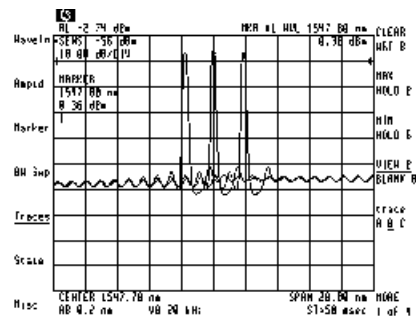


Figure 2. Wavelength tunability of HP 83430A as shown on HP OSA

The wavelength tunability feature of the HP 83430A gives you the ability to tune any of the wavelength options to the nearest ITU grid wavelength for WDM applications. You can select the desired center wavelength to test WDM system component performance with the HP 83430A.

Option 130	1310 ± 20 nm
Option 350	1535 ± 1 nm
Option 390	1539 ± 1 nm
Option 430	1543 ± 1 nm
Option 462	1546.2 ± 1 nm
Option 534	1553.4 ± 1 nm
Option 570	1557 ± 1 nm
Option 605	1560.5 ± 1 nm

Special Wavelengths

Other specific wavelengths in the 1550 nm region are available upon request as special ordering options.

A combination of one or more HP 83430As and DWDM transmitters may be used to evaluate WDM MUX/DEMUX alignment and channel-to-channel cross-talk (interference). The HP 83430A's wavelength tunability feature allows determination of cross-talk as a function of transmitter wavelength.

SDH/SONET Compliant Source

The HP 83430A may be used as a reference for comparing multiple transmitters because in its preset condition the HP 83430A meets the requirements for SDH/SONET compliance. In both DC and AC coupled digital preset mode the HP 83430A laser output eye mask performance conforms to Bellcore GR-253 and ITU-T G.957 requirements at OC-1, STM-1/OC-3, STM-4/OC-12 and STM-16/OC-48.

The preset condition of the HP 83430A sets the extinction ratio to 10 dB. The front panel bias control can be adjusted to simulate a wide range of signal performance by varying the

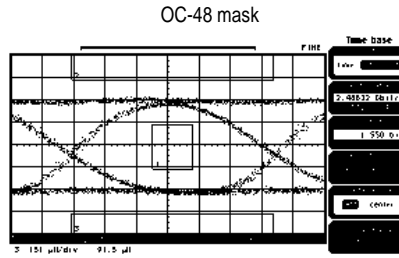


Figure 3. HP 83430A SDH/SONET STM-16/OC-48 Eye Mask Conformance

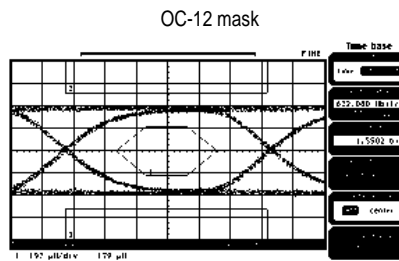


Figure 4. HP 83430A SDH/SONET STM-4/OC-12 Eye Mask Conformance

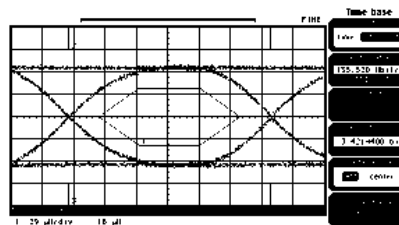


Figure 5. HP 83430A SDH/SONET STM-1/OC-3 Eye Mask Conformance

extinction ratio. Extinction ratio can be adjusted to less than 8.2 dB and greater than 13 dB. Figure 6 shows the extinction ratio tuning

range of one HP 83430A at its extreme and nominal values.

The front panel digital threshold adjustment feature of the HP 83430A allows the user to set the ECL decision threshold to optimize eye symmetry for a range of ECL signals from the drive circuitry.

General-Purpose Optical Source

The HP 83430A is also a general-purpose optical source. Its internal DFB laser is optically isolated and is thermo-electrically temperature stabilized. It has good input return loss characteristics and a flat frequency response over its operating bandwidth. A characteristic frequency response can be seen in Figure 7.

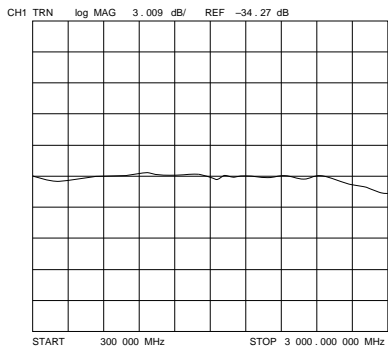


Figure 7. HP 83430A frequency response

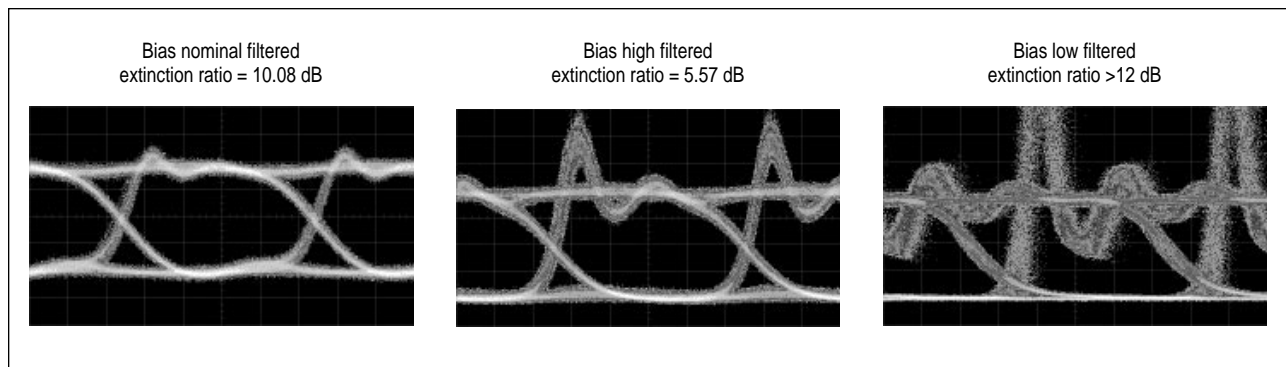


Figure 6. HP 83430A extinction ratio versus waveform fidelity at 2.48832 Gb/s

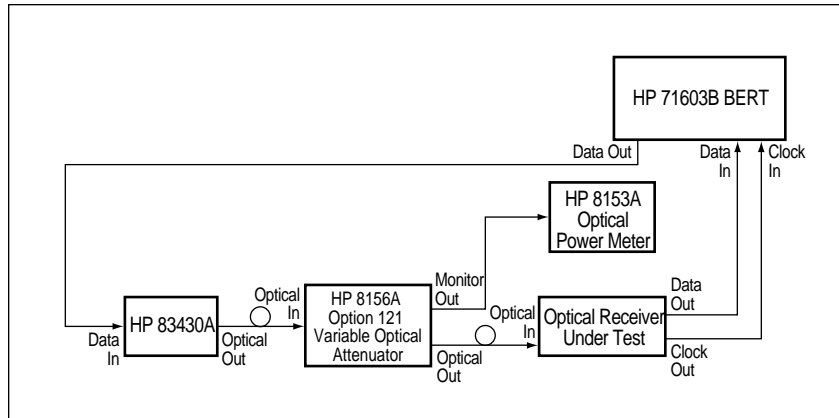


Figure 8. Setup to measure optical receiver sensitivity

Example Uses of the HP 83430A

Optical Receiver Sensitivity

The HP 83430A in conjunction with a 71603B Error Performance Analyzer, the 8156A option 121 High-performance Optical Attenuator with optical monitor output, and the 8153A Optical Power Meter can determine the minimum sensitivity for optical receivers. A setup for this measurement is found in Figure 8. The BER is monitored as the power to the optical receiver is reduced. The minimum sensitivity limit is found when the BER increases to some pre-determined level above which the receiver performance is unacceptable. Because the HP 83430A is a SDH/SONET compliant transmitter in its preset state, the measured BER performance (1×10^{-10} for SDH/SONET system) determines the sensitivity limits of the optical receiver.

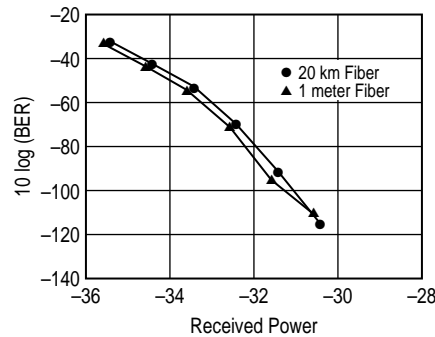


Figure 9. 83430A BER versus received power

Dispersion Power Penalty Testing

Signal degradation due to fiber dispersion can have a major impact on the maximum distance over which optical data can reliably be sent. The dispersion power penalty of a system can

be tested with the measurement setup illustrated in Figure 10. The system is first tested with a 1 meter length of fiber. The attenuator is used to adjust the received power until the desired BER is measured. A long length of fiber is then substituted for the 1 meter fiber and the attenuator is adjusted to achieve the desired BER. The difference in received power is the dispersion power penalty. The HP 83430A can be used as a reference source to isolate system component causes of undesired dispersion power penalty results.

The HP 83430A is an excellent choice for this as it has a very narrow modulated spectral width (low chirp) and meets the SDH/SONET dispersion power penalty requirement at 1200 ps/nm. (Lower dispersion power penalty lasers available upon request as special options.)

Jitter Tolerance of Recovered Clock and Data

High-speed digital receivers are often required to receive or regenerate data using a clock signal that is recovered or extracted from the data waveform. Variation in the data rate, commonly

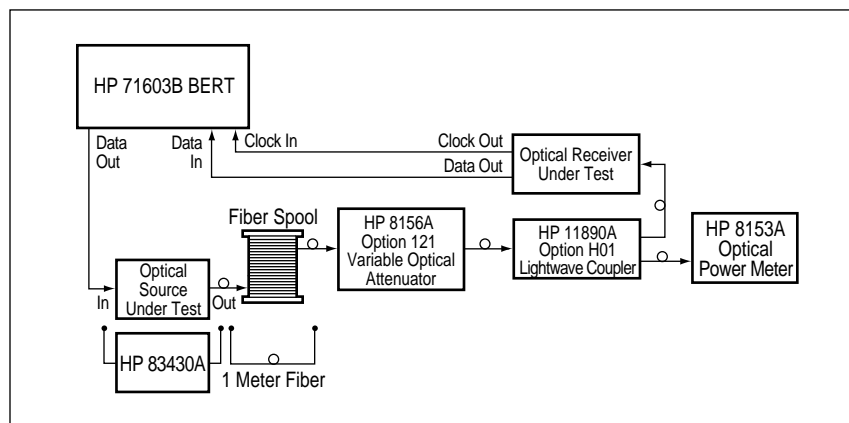


Figure 10. Setup to measure dispersion power penalty of single-mode fiber

HP 83430A

Performance Specifications and Characteristics

Specifications describe the instrument's warranted performance over the 0 to 55°C temperature range, except where noted. **Characteristics** provide information about non-warranted instrument performance in the form of nominal values.

Input Modulation

	Digital AC Coupled	Digital DC Coupled	Analog AC Coupled
Maximum Input Level	2 Volts pk-pk	-4.5 to 0 Volts	2 Volts pk-pk
Bit Rate	50 to 2500 Mb/s ²	DC to 2500 Mb/s	0.1 to 2500 MHz ³
Pulse Pattern¹	40 to 60% ones density	0 to 100% ones density	
Polarity	Non-inverting	Non-inverting	Inverting
Input Level	0.7 to 1.5 Volts pk-pk	-1.7 V low, -0.9 V high (ECL levels)	2 Volts pk-pk maximum ⁴
Digital Threshold Adjustment Range¹	±0.2 Volts	±0.2 Volts	
Impedance¹	50 ohms	50 ohms to -2 V DC	50 ohms
Input Return Loss¹			
0.1 to 1 GHz	12 dB	12 dB	12 dB
1 to 2 GHz	8.5 dB	8.5 dB	9 dB
2 to 2.5 GHz	6 dB	6 dB	6 dB

Optical Output

Center Wavelength					
Standard	1550 ±1 nm	Option 390	1539 ±1 nm	Option 534	1553.4 ±1 nm
Option 130	1310 ±20 nm	Option 430	1543 ±1 nm	Option 570	1557 ±1 nm
Option 350	1535 ±1 nm	Option 462	1546.2 ±1 nm	Option 605	1560.5 ±1 nm

Wavelength Adjustment Range:⁵

±1.25 nm (±1.8 nm typical)

Extinction Ratio:^{5,6} 10 dB ±1 dB

Bias/Extinction Ratio Adjustment Range:¹

from less than 8.2 dB to greater than 13 dB

Peak Coupled Power: (Digital mode)⁷

1.3 mW minimum (+ 1 dBm)

Average Coupled Power: (Analog mode)⁷

0.63 mW minimum (-2 .0 dBm)

Relative Intensity Noise:

(RIN) @ 1 GHz¹ -145 dB/Hz

Spectral Width:⁸ 0.3 nm maximum at -3 dB

1 nm maximum at -20 dB

Dispersion Power Penalty:^{1,9} < 2.0 dB

Side-mode Suppression Ratio:⁸ 33 dB minimum

Jitter Generation:¹⁰ 0.05 maximum UI pk-pk

0.005 maximum UI rms

Eye Mask Performance: Conforms to Bellcore GR-253 and ITU-T G.957 at OC-1, STM-1/OC-3, STM-4/OC-12, STM-16/OC-48

¹ Characteristic value (not warranted).

² Tested with 2²³- 1 PRBS pattern.

³ 3 dB frequency.

⁴ Voltage swing required to reach 80% peak modulation in preset bias condition.

⁵ Valid only over 25 ±10°C ambient temperature range.

⁶ Measured at OC-48/STM-16 rate in instrument preset condition.

⁷ In preset bias condition.

⁸ Measured with digital modulation at 2.5 Gb/s with SONET reflection conditions.

⁹ Measurement conditions:

2.5 Gb/s, 2²³- 1 PRBS, NRZ, preset bias condition, dispersion = 1200 ps/nm, 1 X 10⁻¹⁰ BER.

¹⁰ Measured per GR-253 and ITU-T G.958, 12 kHz-20 MHz filter, SDH/SONET pattern.

General

Input Connectors: Type N female

Optical Interface: Diamond HMS-10/HP with universal interface adapter

Connector Interface: FC/PC standard, other connectors available - see Ordering Information

Output Fiber: 9/125 μm , single-mode

Laser Safety: 21 CFR 1040.10 Class 1, IEC 825-1 Class 1

Power: 90 to 132 V or 198 to 264 V AC, 47 to 63 Hz, 50 W

Operating Temperature: 0 to 55°C

Storage Temperature: -40 to 70°C

Weight: 3.6 kg (8 lbs)

Dimensions:¹¹ 102 mm (4.02 in) height, 213 mm (8.39 in) width, 368 mm (14.49 in) length

EMI: Radiated and conducted emissions are in compliance with the requirements of CISPR Publication 11 and EN 55011 Group 1, Class A

Ordering Information

HP 83430A Lightwave Digital Source
Standard instrument has 1550 nm center wavelength

Options to replace standard 1550 nm laser. One wavelength option may be ordered per instrument.

Option 130 1310 nm center wavelength

Option 350 1535 nm center wavelength

Option 390 1539 nm center wavelength

Option 430 1543 nm center wavelength

Option 462 1546.2 nm center wavelength

Option 534 1553.4 nm center wavelength

Option 570 1557 nm center wavelength

Option 605 1560.5 nm center wavelength

Connector options to replace the standard FC/PC connector interface of the HP 83430A. For additional connector interfaces order the HP 81000XI series.

Option 011 HMS-10/HP connector

Option 013 DIN 47256 connector

Option 014 ST connector

Option 017 SC connector

Related Products

HP 83446A/B Lightwave Clock/Data Receiver

HP 83480A Digital Communications Analyzer

HP 83440B/C/D Lightwave Converters

HP 87441A/B/C/D SONET/SDH Filters

HP 8156A Optical Attenuator

HP 11890A Lightwave Directional Coupler

HP 11982A Amplified Lightwave Converter

HP 10086A ECL Terminator

HP 71603B Error Performance Analyzer

HP 71604B Pattern Generator

HP 71501C Jitter Analysis System

¹¹ HP System II half-width case.



For more information on Hewlett-Packard Test and Measurement products, applications, or services, please call your local Hewlett-Packard sales office. A current listing is available via the World-wide Web through AccessHP at <http://www.hp.com>. If you do not have access to the internet please contact one of the HP centers listed below and they will direct you to your nearest HP representative.

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