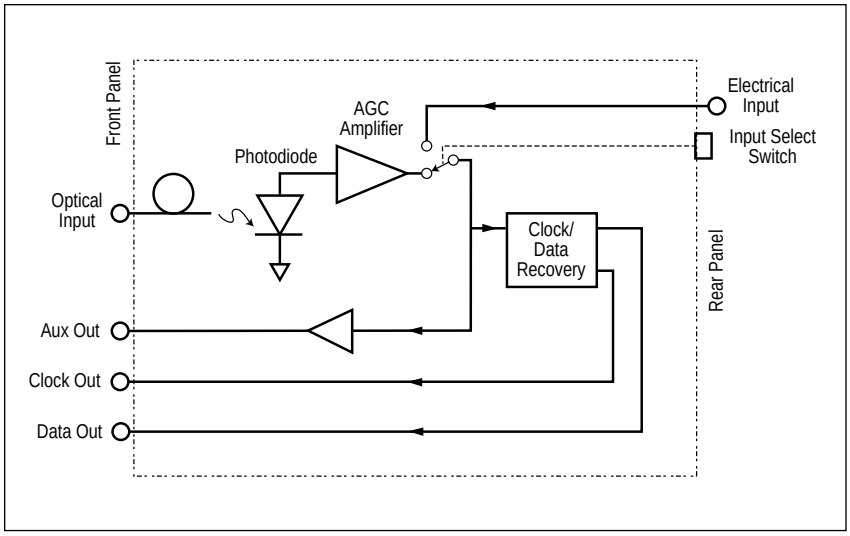
HP 83446A/B Lightwave Clock/Data Receiver

Product Overview

High gain optical receiver for recovering clock and data directly from optical fiber

- ***OC-48/STM-16 data rate (2.48832 Gb/sec) or OC-12/STM-4 data rate (622.08 Mb/sec)***
- ***Operates over full range of power levels specified in SONET/SDH standards***
- ***1310/1550 nm operation***
- ***Auxiliary input recovers clock and data from 2.48832 Gb/sec or 622.08 Mb/sec electrical signals***



Hewlett-Packard's 83446A/B Lightwave Clock/Data Receivers are designed to extract clock and data information from digitally modulated lightwave signals. The HP 83446A is for use with OC-48/STM-16 (2.48832 Gb/sec) signals, the HP 83446B is for use with OC-12/STM-4 (622.08 Mb/sec) signals. The HP 83446A/B incorporates a high-gain avalanche photodiode (APD), gain-controlled amplifier, and clock/data recovery hybrid to deliver clean, error-free outputs from optical signals with powers as low as -28 dBm at either 1310 or 1550 nm wavelengths. The HP 83446A/B is designed especially for use with high speed bit-error-ratio testers (BERTs) such as the HP 71603B. By connecting the HP 83446A/B clock and data outputs to the corresponding inputs on the BERT's error detector, bit-error-ratio analysis can be performed directly on optical signals, making it easy to do system acceptance and BER floor analysis.

The high sensitivity of the HP 83446A/B assures accurate results over the full range of optical powers specified in SONET/SDH standards such as ITU G.957 and Bellcore TA-NWT-000253. The HP 83446A/B can also be useful for optical eye diagram analysis on sampling oscilloscopes. In situations where no separate clock signal is available, the HP 83446A/B's clock output can be used to trigger the oscilloscope. Unlike schemes that use the data pattern as the trigger source, triggering from a recovered clock assures that the eye diagram is an accurate representation of all possible bit combinations on the incoming data stream.

For analog monitoring of unconditioned data, the HP 83446A/B provides an auxiliary electrical output. This high-gain AGC controlled output is useful for general diagnostic analysis of the incoming waveform. (Because its frequency response does not meet the stringent requirements for eye mask compliance testing defined in SONET/SDH standards, mask tests should be done with an appropriate reference receiver such as the HP 8344X series.)

Another feature of the HP 83446A/B is a rear-panel input for recovering clock and data from an electrical waveform. A rear panel switch selects between either the front optical input or the rear electrical input. (The electrical input bypasses the internal high-gain amplifier, so external amplification must be used when operating on low power signals to achieve a level sufficient for proper operation.) The HP 83446A/B uses a 50 µm fiber core diameter which is compatible with either single-mode or multimode fibers. The optical input incorporates a universal adapter for use with any of the connector interfaces in the HP 81000 series. The standard instrument includes an FC/PC connector interface. Option 010 deletes the FC/PC connector. Interfaces for other optical connector types must be ordered separately.

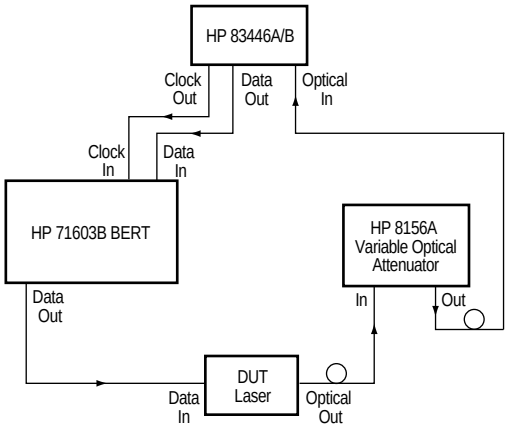
Special options of the HP 83446A/B can be ordered for use at a wide variety of other data rates from 425 Mb/s to 3 Gb/s. Contact your HP sales representative for additional information.

Example uses of the HP 83446A/B

Laser Transmitter Optimization

The HP 83446A/B, in conjunction with an HP 71603B Error Performance Analyzer and HP 8156A High-performance Optical Attenuator, can help determine the optimum bias setting for laser transmitters. The optimum bias is found when the improvement in BER, due to higher extinction ratio, is balanced by degradation due to increased nonlinear waveform distortion effects. BER floors are easily identified by monitoring the error rate as the input power level to the HP 83446A/B is increased. The HP 83446A/B operates error-free at input powers above -28 dBm, so any residual errors at higher input powers can be associated with the transmitter under test.

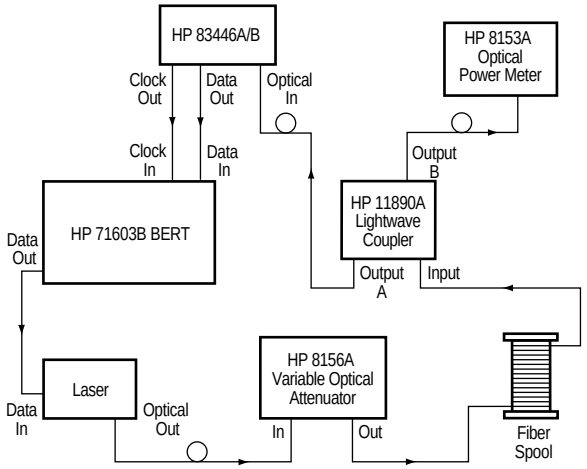
Setup For Optimizing Laser Transmitter Extinction Ratio



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. This is a particular concern when 1550 nm lasers are used with fiber optimized for transmission at 1300 nm. To evaluate the dispersion power penalty of a system, the HP 83446A/B can be used in conjunction with the HP 71603B Error Performance Analyzer. By testing the error performance of the laser when used with a long length of the intended fiber, the power penalty due to dispersion can easily be evaluated.

Setup to Measure Dispersion Power Penalty of Single-Mode Fiber



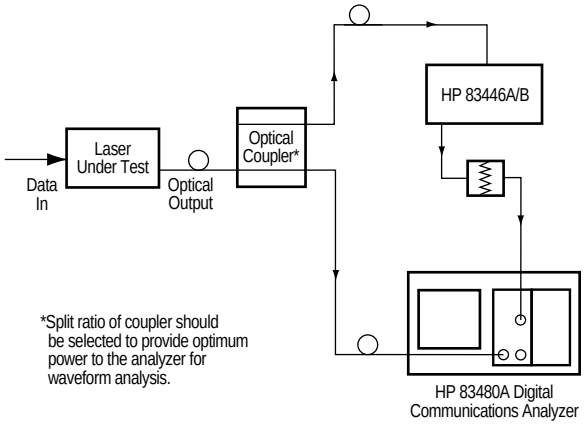
Waveform Test: Example of Measuring Eye Diagram With Recovered Clock Signal As a Trigger

Eye diagrams are important tools for characterizing the waveform performance of a laser source. An eye diagram is generated on an oscilloscope by observing the data output from the laser while triggering the oscilloscope from a separate signal at the clock frequency.

In many cases a separate clock signal is not readily accessible. To generate a valid eye diagram, clock must be recovered from the data waveform and used to trigger the oscilloscope. The HP 83446A/B are ideal for generating this recovered clock. In addition, the waveform from the HP 83446A/B's AUXILIARY OUT port is often adequate as the data input to generate the eye diagram.

Certain industry standards such as SONET and Fibre Channel require that the eye diagram be measured through a reference receiver having a carefully-controlled frequency response. In this case the HP 83446A/B can be used to recover the clock and a separate reference receiver used to display the eye

Setup for Measuring Eye Diagram by Triggering From Recovered Clock



Technical Data

Specifications describe the instrument's warranted performance over the 0°C to 55°C temperature range, except where noted. Characteristics provide information about non-warranted instrument performance in the form of nominal values. All amplitude specifications are in optical power units unless noted by an asterisk (*).

Where there are differences in performance between the HP 83446A and the 83446B, the HP 83446B value is listed in parentheses ( ).

Specifications/Characteristics

Operating Data Rate:	2.48832 GHz (622.08 MHz) ±0.5%, NRZ coding
Sensitivity (Notes 1, 2, 4, 5):	-27 dBm (-28 dBm) min
Wavelength Range (Characteristic):	1200 to1600 nm
Data Out Amplitude (Note 3):	0.5 v pk-pk
Clock Out Amplitude:	0.5 v pk-pk
Max Operating Input Power: (Notes 1, 4):	-9 dBm min Input
Optical Return Loss (Note 7):	27 dB
Output Electrical Return Loss: (all electrical outputs, Characteristic)	12 dB* @ 1 GHz 9 dB* @ 2 GHz 6 dB* @ 2.5 GHz
Max Safe Optical Input Power (Characteristic):	+10 dBm
RMS Jitter On Clock/Data Outputs (Note 6, Characteristic):	5 degrees
Auxiliary Out Bandwidth (electrical, Characteristic):	0.1 to 1500 MHz
Electrical Clock Recovery Input Sensitivity (Characteristic):	200 mv pk-pk
Max Safe Electrical Clock Recovery Input (Characteristic):	2 v pk-pk
Auxiliary Output (Optical Input, Characteristic):	0.5 v pk-pk for >-24 dBm input (AGC Stabilized) 0.25 v pk-pk for >-27 dBm input
Auxiliary Output (Electrical Input, Characteristic):	<6 dB* down from input signal level

General

Environmental

Temperature Range:	Operational: 0° to +55°C Storage: -40° to +70°C
EMI:	Conducted and radiated emissions are in compliance with the requirements of CISPR Publication 11 and EN 55011 Group 1, Class A
Power Requirements:	100,120,220, or 240 volts (±10%), 47 to 63 Hz
Power consumption:	<75VA
Weight:	
Dimensions:	102 mm (4.02 in.) height 213 mm (8.39 in.) width 368 mm (14.49 in.) length

Notes

*Refers to electrical power units.

1. Better than 1E-10 bit error ratio with 2^23-1 PRBS pattern, 50% mark density.
2. Sensitivity may be degraded if signals are applied simultaneously to both front optical input and rear electrical input.
3. Non-inverting output.
4. Source extinction ratio ≥ 8.2 dB at eye center.
5. Sensitivity specification applies over temperature range of 25±5°C
6. Clock edges nominally aligned with data transitions to ±0.25 unit interval.
7. Measured using single mode fiber from source.

Ordering Information

HP 83446A Lightwave Clock/Data Receiver (includes FC/PC connector interface)
Option 010 Delete FC/PC connector interface

HP 83446B Lightwave Clock/Data Receiver (includes FC/PC connector interface)
Option 010 Delete FC/PC connector interface

Related Accessories

HP 83480A Digital Communications Analyzer
HP 10086A ECL Terminator
HP 83441A/B SONET/SDH Reference Receivers
HP 83440B/C/D Lightwave Converters
HP 71603B Error Performance Analyzer
HP 8156A Optical Attenuator
HP 11980A Lightwave Directional Coupler

For more information, call your local HP sales office listed in your telephone directory or an HP regional office listed below for the location of your nearest sales office.

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Printed in U.S.A. 8/95
5964-1682E