ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Keysight / Agilent 86105A* at our website: *Click HERE*

infiniium DCA

Agilent 86100A Wide-Bandwidth Oscilloscope

Technical Specifications



- **Modular platform for testing waveforms up to 40 Gb/s**
- **Easier to use through a simplified user interface**
- **Faster measurement throughput**
- **Improved measurement accuracy and repeatability**
- **Compatible with Agilent 83480A-series and 54750-series modules**

Agilent Technologies

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Three Instruments in One

For basic oscilloscope operation there is easy front panel access with that familiar analog-look and feel. A Windows®-based system let's you easily navigate through the user-interface. The 86100A Infiniium DCA can be viewed as three high-performance instruments in one. It's a general-purpose repetitive sampling oscilloscope. It's a digital communications analyzer. It's a time domain reflectometer. Just select the instrument mode and start making measurements.

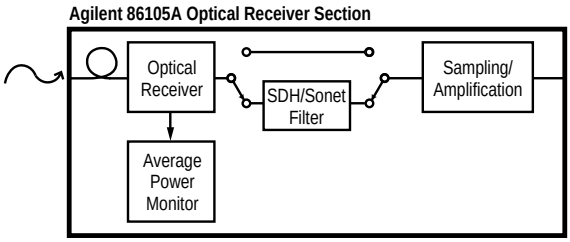
Digital Communications Analysis

Accurate eye-diagram analysis is essential for characterizing the quality of transmitters used from 100 Mb/s to 40 Gb/s. The 86100A was designed specifically for the complex task of analyzing digital communications waveforms. Compliance mask and parametric testing no longer require a complicated sequence of setups and configurations. If you can press a button, you can perform a complete compliance test. The important measurements you need are right at your fingertips, including:

- industry standard mask testing with built-in margin analysis,
- extinction ratio measurements with improved accuracy and repeatability, and
- eye measurements: crossing %, eye height and width, '1' and '0' levels, jitter, rise or fall times and more.

The key to accurate measurements of lightwave communications waveforms is the optical receiver. The 86100A has a broad range of precision receivers integrated within the instrument.

- Built-in photodiodes, with flat frequency responses, yield the highest waveform fidelity. This provides high accuracy for extinction ratio measurements.
- Standards-based transmitter compliance measurements require filtered responses. The 86100A has a broad range of filter combinations. Filters can be automatically and repeatably switched in or out of the measurement channel remotely over GPIB or with a front panel button. The frequency response of the entire measurement path is calibrated, and will maintain its performance over long-term usage.
- The integrated optical receiver provides a calibrated optical channel. With the accurate optical power meter built into the module, optical signals are accurately measured and displayed in optical power units. Switches or couplers are not required for an average power measurement. Signal routing is simplified and signal strength is maintained.



The integrated optical channel can be used as a fully calibrated SONET/SDH/Gigabit Ethernet or Fibre Channel reference receiver or as a wide-bandwidth receiver.

Eye Diagram Mask Testing

The 86100A provides efficient, high-throughput waveform compliance testing with a suite of standards based eye-diagram masks. The test process has been streamlined into a minimum number of keystrokes for testing at industry standard data rates.

Standard Masks

- 1X Gigabit Ethernet
- 2X Gigabit Ethernet
- 10X Gigabit Ethernet
- Fibre Channel 0133
- Fibre Channel 0266
- Fibre Channel 1063
- Fibre Channel 2125
- STM0/OC1
- STM1/OC3
- STM4/OC12
- STM16/OC48
- STM64/OC192
- STS1 EYE
- STS3 EYE

Other eye-diagram masks are easily created through scaling those listed above. In addition, mask editing allows for new masks either by editing existing masks, or creating new masks from scratch. The mask data can be entered or modified on an external PC using a text editor such as Notepad, then can be transferred to the instrument's hard drive using LAN or the A: drive. Once in the instrument, the mask can be used for mask test.

Perform these mask conformance tests with convenient user-definable measurement conditions, such as mask margins for guardband testing, number of waveforms tested, and stop/limit actions.

Measurement Speed

Measurement speed has been increased with both fast hardware and a user-friendly instrument. In the lab, don't waste time trying to figure out how to make a

Windows is a U.S. registered trademark of Microsoft Corporation.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

measurement. With the simple-to-use 86100A, you don't have to relearn how to make a measurement each time you use it. In manufacturing, it is a battle to continually reduce the cost per test. Solution: Fast PC-based processors, resulting in high measurement throughput and reduced test time.

Measure

Standard Measurements/Features

The following measurements are available from the tool bar, as well as the pull down menus. Measurements available are dependent on the DCA operating mode.

Oscilloscope Mode

Time
Rise Time, Fall Time, Jitter RMS, Jitter p-p, Period, Frequency, + Pulse Width, - Pulse Width, Duty Cycle, Delta Time, [T_{max}, T_{min}, T_{edge}—remote commands only]

Amplitude
Overshoot, Average Power, V amptd, V p-p, V rms, V top, V base, V max, V min, V avg

Eye/Mask Mode

NRZ Eye Measurements
Extinction Ratio, Jitter RMS, Jitter p-p, Average Power, Crossing Percentage, Rise Time, Fall Time, One Level, Zero Level, Eye Height, Eye Width, Signal to Noise (Q-Factor), Duty Cycle Distortion, Bit Rate, Eye Amplitude

RZ Eye Measurements
Extinction Ratio, Jitter RMS, Jitter p-p, Average Power, Rise Time, Fall Time, One Level, Zero Level, Eye Height, Eye Amplitude, Opening Factor, Eye Width, Pulse Width, Signal to Noise (Q-Factor), Duty Cycle, Bit Rate, Contrast Ratio

Mask Test
Open Mask, Start Mask Test, Exit Mask Test, Filter, Mask Test Margins, Mask Test Scaling

TDR/TDT Mode

Quick TDR, TDR/TDT Setup, Normalize, Response, Rise Time, Fall Time, Δ Time

Standard Functions

Standard functions are available through pull down menus and soft keys, and some functions are also accessible through the front panel knobs

Markers

Two vertical and two horizontal, user selectable

TDR Markers

Horizontal - seconds or meter
Vertical - volts, ohms or Percent Reflection
Propagation - Dielectric Constant or Velocity

Limit Tests

Acquisition Limits
Limit Test Run Until Conditions - Off, # of Waveforms, # of Samples

Report Action on Completion - Save waveform to memory or disk, Save screen image to disk

Measurement Limit Test
Specify Number of Failures to Stop Limit Test

When to Fail Selected Measurement - Inside Limits, Outside Limits, Always Fail, Never Fail

Report Action on Failure - Save waveform to memory or disk, Save screen image to disk, Save summary to disk

Mask Limit Test
Specify Number of Failed Mask Test Samples

Report Action on Failure - Save waveform to memory or disk, Save screen image to disk, Save summary to disk

Configure Measurements

Thresholds
10%, 50%, 90% or 20%, 50%, 80% or Custom

Eye Boundaries
1 and 2

Format Units for
Duty Cycle Distortion - Time or Percentage
Extinction Ratio - Ratio, Decibel or Percentage
Eye Height - Amplitude or Decibel (dB)
Eye Width - Time or Ratio
Average Power - Watts or Decibels (dB)

Top Base Definition
Standard or Custom

Δ Time Definition
First Edge Number, Edge Direction, Threshold
Second Edge Number, Edge Direction, Threshold

Quick Measure Configuration

4 User Selectable Measurements for Each Mode

Eye/Mask Mode Default Settings
Extinction Ratio, Jitter RMS, Average Power, Crossing Percentage

Oscilloscope Mode Default Settings
Rise Time, Fall Time, Period, V amptd

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Histograms

Configure
Histogram State
Histogram Axis
Histogram Window

Window
Adjustable Window via Marker Knobs

Scale
1 to 8 divisions

Axis

Math Measurements

4 User Definable Functions
Operator - Magnify, Invert, Subtract, Versus, Min, Max

Source - Channel, Function, Memory, Constant, Response (TDR)

Set up and Info

Annotate Measurements
Algorithm
Configuration

Calibrate

All Calibrations

Vertical (Amplitude)
Horizontal (Time Base)
Extinction Ratio
Probe
Optical Channel

Front Panel Calibration Output Level

User Selectable –2V to 2V

Horizontal Skew Adjustment

Per Channel, User Selectable

Utilities

Set Time and Date

Show Time and Date

Remote Interface

Set GPIB Interface

Touch Screen Configuration

Calibration
Display
TouchSurround
Buttons
Interface

Upgrade Software

Upgrade Mainframe
Upgrade Module

Help

Content

About 86100A

Mainframe Serial Number
Module Serial Number
Software Revision and date
Hard Disk free space



Configurable to Meet Your Needs

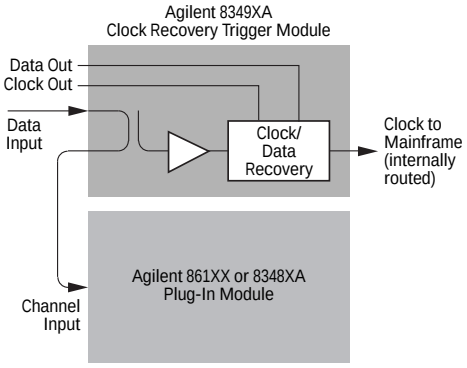
The 86100A supports a wide range of plug-ins for testing both optical and electrical signals. Select plug-ins to get the specific bandwidth, filtering, and sensitivity you need.

Built-in Information System

The 86100A has a context-sensitive on-line manual providing immediate answers to your questions about using the instrument. Links on the measurement screen take you directly to the information you need. There is no need for a large paper manual consuming your shelf space.

File Sharing and Storage

Use the internal 5.5 GB hard drive or 3.5 inch, 120 MB SuperDisk™ floppy disk drive to store instrument setups, waveforms, or screen images. Images can be stored in formats easily imported into



SuperDisk is a trademark of Imation Corporation.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

various programs for documentation and further analysis. LAN interface is also available for network file management and printing.

Powerful Display Modes

Use gray scale and color graded trace displays to gain insight into device behavior. Waveform densities are mapped to color or easy-to-interpret gray shades. These are infinite persistence modes where shading differentiates the number of times data in any individual screen pixel has been acquired.

Internal Triggering Through Clock Recovery

Very high-speed oscilloscopes are not capable of triggering directly on the signal under test. Typically an external timing reference is used to synchronize the oscilloscope to the test signal. In cases where a trigger signal is not available, clock recovery modules are available to derive a timing reference directly from the waveform to be measured. The Agilent 8349XA series of clock recovery modules cover the three most popular transmission media used today—electrical lines, multimode, and single-mode fiber. A built-in coupler reduces external hardware requirements. All four modules have excellent jitter performance to ensure accurate measurements. Each clock recovery module is designed to synchronize to a variety of common transmission rates.

Improved Autoscaling

Autoscaling has been significantly improved to provide quick horizontal and vertical scaling of both pulse and eye-diagram (RZ and NRZ) waveforms.

Time Domain Reflectometer (TDR)

TDR measurements are focused on high-speed applications where it is necessary to optimize electrical system components, such as microstrip lines, PC board traces, SMA edge launchers and coaxial cables where imperfections cause signal distortion and reflections. Signal integrity is a critical requirement in high-speed digital signal transmission.

Gated Triggering

Trigger gating port allows easy external control of data acquisition for circulating loop or burst-data experiments. Use TTL-compatible signals to control when the instrument does and does not acquire data.

Easier Calibrations

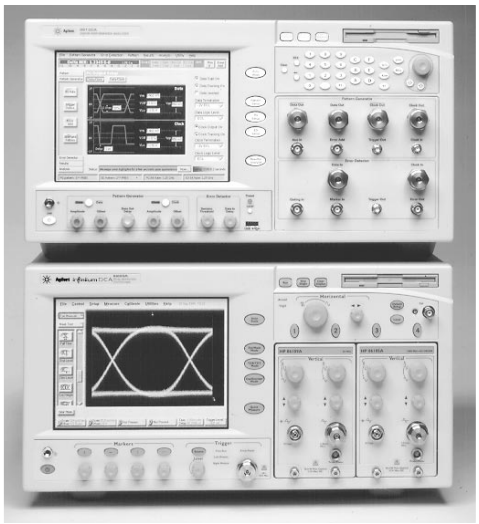
Calibrating your instrument has been simplified by placing all the performance level indicators and calibration procedures in a single high-level location. This provides greater confidence in the measurements made and saves time in maintaining equipment.

Stimulus Response Testing Using the Agilent 86130A BitAlyzer®

Error performance analysis represents an essential part of digital transmission test. The Agilent 86100A and 86130A BitAlyzer error performance analyzer share a common interface and together create a powerful test solution.

Transitioning from the Agilent 83480A to the 86100A

The 86100A has been designed to be a virtual drop-in replacement for the Agilent 83480A digital communications analyzer and Agilent 54750A wide-bandwidth oscilloscope. All modules used in the Agilent 83480A and 54750A can also be used in the 86100A. The remote programming command set for the 86100A has been designed for direct compatibility with software written to control the 83480A and 54750A. (Due to improvements and updates in performance, a small set of remote commands may need minor modifications to control the 86100A.) Due to a significantly faster processor and improved measurement algorithms, tests run on the 86100A should require less time than those performed with the 83480A or 54750A.



Modules for the 86100A Infiniium DCA

The 86100A has a large family of plug-in modules designed for a broad range of data rates for optical and electrical waveforms. The 86100A can hold up to 2 modules for a total of 4 measurement channels.

The Agilent 86101A module and 86103A has two measurement channels, one optical and one electrical. The electrical channel

BitAlyzer is a U.S. registered trademark of SyntheSys Research, Inc.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

has two selectable bandwidth settings. The 12.4 GHz bandwidth mode provides the best oscilloscope noise performance. The 20 GHz mode allows greater fidelity for high-speed signals. The calibrated, integrated optical channel has over 2.85 GHz bandwidth for easy, precise single mode and multimode optical measurements. The 86101A and 86103A utilize switchable reference filters for transceiver compliance testing at OC-3, OC-12, OC-48, Fibre Channel 1063 Mb/s, and Gigabit Ethernet 1250 Mb/s data rates. The 86101A operates over the 750 nm to 860 nm wavelength range, and the 86103A operates over the 1000 nm to 1600 nm wavelength range.

The Agilent 86105A module has two measurement channels, one optical and one electrical. The electrical channel has two selectable bandwidth settings. The 12.4 GHz bandwidth mode provides the best oscilloscope noise performance. The 20 GHz mode allows greater fidelity for high-speed signals. The calibrated, integrated optical channel has 20 GHz bandwidth for single mode optical measurements. The 86105A utilizes switchable reference filters for transceiver compliance testing at OC-3, OC-12, OC-48 or OC-192 data rates.

The Agilent 86106B module has a 28 GHz optical channel and 40 GHz electrical channel. Both channels have a reduced bandwidth setting of 20 GHz for improved noise performance. The calibrated, integrated optical channel has a switchable reference filter for transceiver compliance testing at OC-192 (9.953 Gb/s).

The Agilent 86109A module has a 30 GHz optical measurement channel and a 40 GHz electrical channel. The electrical channel also has a reduced bandwidth setting of 18 GHz for improved noise performance. The optical channel frequency response is designed to minimize distortion of the displayed optical pulse and does not include any provision for switching a SDH/SONET filter into the channel.

The Agilent 86112A electrical module provides two electrical measurement channels with user selectable bandwidths. The 12.4 GHz bandwidth mode provides excellent oscilloscope noise performance for accurate measurement of small signals. The 20 GHz bandwidth mode provides high fidelity display and measurement of very high-speed waveforms.

The Agilent 83484A electrical module provides two electrical measurement channels with user selectable bandwidths. The 26.5 GHz bandwidth mode provides excellent oscilloscope noise performance for accurate measurement of small signals. The 50 GHz bandwidth mode provides high fidelity display and measurement of very high-speed waveforms.

The Agilent 83494A single-mode clock recovery plug-in module is an integrated solution for high-speed digital transmission test. When a separate trigger source is not available, the 83494A can derive a timing reference directly from the signal under test. The 83494A can synchronize to all SONET/SDH transmission rates through 10 Gb/s with exceptional jitter performance that ensures an accurate display of the test waveform.

The Agilent 8349xA series of clock recovery modules provide a recovered clock trigger and recovered data output, and the ability to trigger on data for slower non-standard rates. The 83491A accepts electrical inputs, the 83492A accepts multimode fiber inputs, and the 83493A accepts single mode fiber inputs. All three clock recovery modules support standard telecom and enterprise data rates.

The Agilent 54753A single-ended TDR module has TDR step generator built into channel one. The bandwidth of the TDR/vertical channel is 18 GHz. The bandwidth of channel two is 20 GHz.

The Agilent 54754A differential TDR module has two independent vertical channels and two step generators. The bandwidth of both channels is 18 GHz. The step generators may be operated singly, simultaneously but independently, differentially, or as common-mode stimulus. The TDR results may be viewed as common mode or differentially and displayed simultaneously. Once selected, the display mode is computed automatically, freeing the user from setting up mathematical functions. Included with each of these TDR modules is a TDR demo board, programmers guide, 2 50Ω terminations, APC-3.5 (m), and one short, APC-3.5 (m).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Specifications

Specifications describe warranted performance over the temperature range of +10°C to + 40°C (unless otherwise noted). The specifications are applicable for the temperature after the instrument is turned on for one (1) hour. This period of continuous operation must occur while self-calibration is valid. Many performance parameters are enhanced through frequent, simple user calibrations. ***Characteristics*** *provide useful, non-warranted information about the functions and performance of the instrument. Characteristics are printed in italic typeface.*

Factory Calibration Cycle -For optimum performance, the instrument should have a complete verification of specifications once every twelve (12) months.

General Specifications

This instrument meets Agilent Technologies' environmental specifications (section 750) for class B-1 products with exception as described for temperature and condensation. Contact your local field engineer for complete details.

Temperature	
Operating	10°C to +40°C (50°F to + 104°F)
Non-operating	–40°C to +70°C (–40°F to +158°F)
Humidity	
Operating	Up to 90% humidity (non-condensing) at +40°C (+104°F)
Non-operating	Up to 95% relative humidity at +65°C (+149°F)
Altitude	
Operating	Up to 4,600 meters (15,000 ft)
Non-operating	Up to 15,300 meters (50,000 ft)
Vibration	
Operating	Random vibration 5–500 Hz, 10 minutes per axis, 2.41 g (rms)
Non-operating	Random vibration 5–500 Hz, 10 minutes per axis, 0.3 g (rms); Resonant search, 5–500 Hz swept sine, 1 octave/min sweep rate, 0.75 g, 5 minute resonant dwell at 4 resonances/raxis
Power Requirements	
Voltage	90–132 or 198–264 Vac, 48–66 Hz
Power (including modules)	545 VA; 375 W
Weight	
Without modules	12.7 kg (28 lb)
Each Module	1.2 kg (2.6 lb)
Dimensions (excluding handle)	
Without front connectors and rear feet	215.1 mm H x 425.5 mm W x 521 mm D (8.47 in x 16.75 in x 20.5 in)
With front connectors and rear feet	215.1 mm H x 425.5 mm W x 584 mm D (8.47 in x 16.75 in x 23.0 in)

Mainframe Specifications

HORIZONTAL SYSTEM (Time Base)	
Scale Factor	Full scale is ten divisions.
Minimum	2 ps/div
Maximum	1 s/div
Delay	Time offset relative to the front panel trigger input on the instrument mainframe.
Minimum	≥24 ns (Standard), 28 ns (Option 001)
Maximum	1000 screen diameters or 10 s, whichever is smaller
Time Interval Accuracy	≤8 ps + 0.1% of reading (dual marker measurement performed at a temperature within ±5°C of horizontal calibration temperature) 8 ps + 0.1% + 0.5 ps/°C to (5 < absolute temperature value <15°C)
Time Interval Resolution	≤ (screen diameter)/(record length) or 62.5 fs, whichever is larger
Display Units	Bits or time
VERTICAL SYSTEM (Channels)	
Number of Channels	4 (simultaneous acquisition)
Vertical Resolution	12 bit A/D converter (up to 15 bits with averaging)
Full Resolution Channel Scales	Adjusts in a 1-2-5-10 sequence for coarse adjustment or fine adjustment resolution from the front panel knob
Adjustments	Scale, offset, activate filter

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Mainframe Specifications (continued)

	Standard (Direct Trigger)	Option 001 (Divided Trigger)
Trigger Modes:		
Internal Trigger[1]	Freerun	
External Direct Trigger[2]		
Limited Bandwidth[3]	DC to 100 MHz	
Full Bandwidth	DC to 2.75 GHz	
External Divided Trigger		2 to 12 GHz (1 to 15 GHz)
Jitter		
Characteristic	1.0 ps RMS + 5*10E-5 of delay setting[4]	1.2 ps RMS for time delays less than 100 ns
Maximum	1.5 ps RMS + 5*10E-5 of delay setting[4]	1.7 ps RMS for time delays less than 100 ns
Sensitivity	200 m Vpp (sinusoidal input or 200 ps minimum pulse width)	200 m Vpp sinusoidal input from 2 to 12 GHz
Trigger Configuration		
Trigger Level Adjustment	–1 V to + 1 V	AC coupled
Edge Select	Positive or negative	
Hysteresis[5]	Normal or high sensitivity	
Trigger Gating:		
Gating Input Levels (TTL compatible)	*Disable: 0 to 0.6 V* *Enable: 3.5 to 5 V* *Pulse width >500 ns, period >1 µs*	
Gating Delay	*Disable: 627 ns + trigger period +* *Max time displayed* *Enable: 100 ns*	
Trigger Impedance:		
Nominal Impedance	*50Ω*	
Reflection	*10% for 100 ps rise time*	
Connector Type	3.5 mm (male)	
Maximum Trigger Signal	±2 V + 2 Vac peak (+16 dBm)	

[1] The freerun trigger mode internally generates an asynchronous trigger that allows viewing the sampled signal amplitude without an external trigger signal but provides no timing information. Freerun is useful in troubleshooting external trigger problems.

[2] The sampled input signal timing is recreated by using an externally supplied trigger signal that is synchronous with the sampled signal input.

[3] The DC to 100 MHz mode is used to minimize the effect of high frequency signals or noise on a low frequency trigger signal.

[4] Measured at 2.5 GHz with the triggering level adjusted for optimum trigger.

[5] High Sensitivity Hysteresis Mode improves the high frequency trigger sensitivity but is not recommended when using noisy, low frequency signals that may result in false triggers without normal hysteresis enabled.

Computer System and Storage

CPU	300 MHz Microprocessor
Disk Drive	5.5 GByte internal hard drive and 3.5" MS-DOS® compatible 120 MB SuperDisk floppy disk drive. Store and recall setups, waveforms, and screen images to both the hard drive and the floppy drive. Storage capacity is limited only by disk space.
File Types/Management	Setup files .SET Waveform files .WFM (internal) Color grade gray scale files .CGS
Waveforms	Internal, verbose,Y values
Images	bmp, eps , gif, pcx, ps, jpeg, tif
Operating System	Microsoft Windows 98
Waveform Store	4 nonvolatile waveform memories Waveform memory setup (for each channel) (vertical scale, offset, horizontal scale, position)
Printer	Configure Printer Options Waveform only Include instrument setup info Monochrome Invert waveform background color Add printer
DISPLAY	
Display Area	170.9 mm x 128.2 mm (8.4 inch diagonal color active matrix LCD module incorporating amorphous silicon TFTs)
Active Display Area	171mm x 128 mm (21,888 square mm) 6.73 in x 5.04 in (33.92 square inches)
Waveform Viewing Area	103 mm x 159 mm (4.06 in x 6.25 in)
Entire Display Resolution	640 pixels horizontally x 480 pixels vertically
Graticule Display Resolution	451 pixels horizontally x 256 pixels vertically

MS-DOS is a U.S. registered trademark of Microsoft Corporation.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Mainframe Specifications (continued)

DISPLAY (continued)	
Waveform Colors	Select from 100 hues, 0–100% saturation and 0–100% luminosity
Persistence Modes	Gray scale, color grade, variable, infinite
Waveform Overlap	When two waveforms overlap, a third color distinguishes the overlap area
Connect-the-dots	On/Off selectable
Persistence	Minimum, Variable (100 ms to 40 s), Infinite
Graticule	On/Off
Grid Intensity	0 to 100%
Backlight Saver	2 to 8 hrs, enable option
Dialog Boxes	Opaque or transparent

FRONT AND REAR PANEL INPUTS AND OUTPUTS	
Cal	BNC (female) and test clip, banana plug
Trigger	APC 3.5 mm, 50Ω, ±2 V maximum
GPIB	Fully programmable, complies with IEEE 488.2
RS-232	Serial Printer, 9 pin D-sub (male)
Centronics	Parallel Printer port, 25 pin D-sub (female)
+15 V Bias	100 ma, 15 V, SMB
Mouse	PS/2
Gated Trigger Input	TTL compatible
Keyboard	IBM 5 pin (female) (for optional keyboard)
LAN	A keyboard must be used to setup LAN connectivity
Video Output	VGA, full color, 15 pin D-sub (female)

Module Specifications

	Optical Channel						Electrical Channel	
	Number of Optical Channels	**Wavelength**	**Unfiltered Bandwidth GHz**	**Filter Option Data Rates (select one) Mb/s**	**Fiber Input**	**Sensitivity (smallest power for mask test)**	**Number of Electrical Channels**	**Bandwidth GHz**
86101A	1	750–860 nm	2.85	Option 201: OC-3/STM-1 & OC-12/STM-4 Option 202: Fibre Channel & Gigabit Ethernet	62.5/125 µm	–17 dBm	1	12.4/20
86103A	1	1000–1600 nm	2.85	Option 201: OC-3/STM-1 & OC-12/STM-4 Option 202: Fibre Channel & Gigabit Ethernet	62.5/125 µm	–20 dBm	1	12.4/20
86105A	1	1000–1600 nm	20	Option 101: OC-3/STM-1 Option 102: OC-12/STM-4 Option 103: OC-48/STM-16 Option 201: OC-12/STM-4 & OC-48/STM-16 Option 202: OC-48/STM-16 & OC-192/STM-64	9/125 µm	–8 dBm	1	12.4/20
86106B	1	1000–1600 nm	28	Standard: OC-192/STM-64 Option 410: OC-192/STM-64, 10 Gigabit Ethernet & OC-192/STM-64 FEC	9/125 µm	–7 dBm	1	18/40
86109A	1	1000–1600 nm	30	—	9/125 µm	N/A	1	18/40
83484A	0	—	—	—	—	—	2	26.5/50
86112A	0	—	—	—	—	—	2	20
54753A	0	—	—	—	—	—	1 TDR/ Elec. & 1 Elec.	12/18 & 12/20
54754A	0	—	—	—	—	—	2 TDR/ Elec.	12/18

TDR System	**Oscilloscope/TDR Performance**	**Normalized Characteristics**
Rise Time	40 ps nominal	Adjustable from larger of 10 ps or 0.08 x time/div Maximum: 5 x time/div
TDR Step Flatness	≤ ±1% after 1 ns from edge ≤ ±5%, -3% 1 ns from edge	≤0.1%
Low Level	0.00 V ±2 mV	0.00 V ±2 mV
High Level	±200 mV ± mV	±200 mV ± mV

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Module Specifications (continued)

Multi Mode and Single Mode Optical/Electrical Modules	**86101A**	**86103A**	**86105A**
OPTICAL CHANNEL SPECIFICATIONS			
Optical Channel Unfiltered Bandwidth	2.85 GHz (3 GHz typical)		20 GHz
Wavelength Range	750–860 nm	1000–1600 nm	
Calibrated Wavelengths	850 nm	1310 nm/1550 nm	1310 nm/1550 nm
Filtered Data Rates (Mb/s)	155, 622, 1063, 1250	155, 622, 1063, 1250	155, 622, 2488, 9953
Sensitivity (smallest avg. power for mask test)	*–17 dBm*	*–20 dBm*	*–8 dBm*
Transition Time (10% to 90% calculated from TR = 0.48/BW optical)			
Filtered	<190 ps/OC-48, <750 ps/OC-12, <3 ns/OC-3		
Unfiltered	160 ps or less		24 ps
RMS Noise			
Characteristic	*1.5 µW*	*1 µW, opt 201* *1.5 µW, opt 202*	*8 µW, 12.4 GHz* *15 µW, 20 GHz*
Maximum	2.5 µW	1.5 µW, opt 201 2.5 µW, opt 202	12 µW, 12.4 GHz 25 µW, 20 GHz
Scale Factor (per division)			
Minimum	5 µW		20 µW
Maximum	100 µW		500 µW
dc Accuracy (single marker, referenced to average power monitor, <50 µW/division)	±6 µW ±0.4% of full scale ±3% of (reading-channel offset)		±25 µW ±2% of (reading- channel offset), 12.4 GHz ±25 µW ±4% of (reading-channel offset), 20 GHz
dc Difference (two markers, referenced to average power monitor, 50 µW/division)	±0.8% of full scale ±3% of (reading-channel offset)		±2% of (reading-channel offset),12.4 GHz ±4% of (reading-channel offset), 20 GHz
dc Offset (referenced two divisions from screen bottom)	+0.2 mW to –0.6 mW		1 mW to –3 mW
Average Power Monitor (specified operating range)	–30 dBm to –2.2 dBm	–30 dBm to 0 dBm	–30 dBm to +3 dBm
Factory Calibrated Accuracy	±5% ±100 nW ±connector uncertainty, 20°C to 30°C		
User Calibrated Accuracy	±2% ±100 nW ±power meter uncertainty, <5°C change		
Maximum Input Power			
Specified	0.4 mW (–4 dBm) peak		2 mW (+3 dBm)
Maximum Peak	10 mW (+10 dBm)		
Fiber Input	62.5/125 µm, user selectable connector		9/125 µm single-mode
Input Return Loss (HMS-10 connector fully filled fiber)	20 dB		33 dB

ELECTRICAL CHANNEL SPECIFICATIONS	
Electrical Channel Bandwidth	12.4 and 20 GHz
Transition Time (10% to 90%, calculated from TR = 0.48/BW)	28.2 ps, 12.4 GHz 17.5 ps, 20 GHz
RMS Noise Characteristic	*0.25 mV, 12.4 GHz* *0.5 mV, 20 GHz*
Maximum	0.5 mv, 12.4 GHz 1 mV, 20 GHZ
Scale Factor	
Minimum	1 mV/division
Maximum	100 mV/division
dc Accuracy (single marker, referenced to average power monitor)	±0.4% of full scale ±2 mV ±1.5% of (reading-channel offset), 12.4 GHz ±0.4% of full scale ±2 mV ±3% of (reading-channel offset), 20 GHz
dc Difference (two markers, referenced to average power monitor, 50 µW/division)	±0.8% of full scale ±1.5% of delta, 12.4 GHz ±0.8% of full scale ±3% of delta, 20 GHz
dc Offset (referenced two divisions from screen bottom)	±500 mV
Input Dynamic Range (relative to channel offset)	±400 mV
Maximum Input Power	16 dBm ±2 Vdc
Nominal Impedance	50 ohm
Reflections (for 30ps rise time)	5%
Electrical Input	3.5 mm

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Module Specifications (continued)

High Bandwidth, Single Mode Optical/ Electrical Modules	**86106B**	**86109A**
OPTICAL CHANNEL SPECIFICATIONS		
Optical Channel Unfiltered Bandwidth	*28 GHz*	*30 GHz*
Wavelength Range	1000–1600 nm	
Calibrated Wavelengths	1310 nm and 1550 nm	
Filtered Data Rates (Mb/s)	9953	No internal filters
Sensitivity (smallest average power for mask test)	*–7 dBm*	N/A
Transition Time (10% to 90%, calculated from TR = 0.48/BW optical)	18 ps	16 ps
RMS Noise		
Characteristic	*10 µW (Filtered)* *18 µW (Unfiltered)*	*15 µW (Unfiltered)*
Maximum	15 µW (Filtered) 30 µW (Unfiltered)	30 µW (Unfiltered)
Scale Factor		
Minimum	20 µW/division	
Maximum	500 µW/division	
dc Accuracy (single marker, referenced to average power monitor)	±50 µW ±4% of (reading-channel offset)	
dc Difference (two markers, referenced to average power monitor, 50 µW/division)	±4% of delta	
dc Offset (referenced two divisions from screen bottom)	+1 mW to –3 mW	
Average Power Monitor (specified operating range)	–27 dBm to +3 dBm (2 µW to 2 mW)	
Factory Calibrated Accuracy	±5% ±100 nW ±connector uncertainty, 20°C to 30°C	
User Calibrated Accuracy	±2% ±100 nW ±power meter uncertainty, <5°C change	
Maximum Input Power		
Specified	2 mW (+3 dBm)	
Maximum Peak	10 mW (+10 dBm)	
Fiber Input	9/125 µm, user selectable	
Input Return Loss (HMS-10 connector fully filled fiber)	30 dB	

[1] Specified with 8 point moving average in frequency response

ELECTRICAL CHANNEL SPECIFICATIONS	
Electrical Channel Bandwidth	18 and 40 GHz
Transition Time (10% to 90%, calculated from TR = 0.35/BW)	19.5 ps, 18 GHz; 9 ps, 40 GHz
RMS Noise	
Typical	0.25 mV, 18 GHz; 0.5 mV, 40 GHz
Maximum	0.5m V, 18 GHz; 1.0 mV, 40 GHz
Scale Factor	
Minimum	1 mV/division
Maximum	100 mV/division
dc Accuracy (single marker, referenced to average power monitor)	±0.4% of full scale ±2 mV ±1.5% of (reading-channel offset), 18 GHz ±0.4% of full scale ±2 mV ±3% of (reading-channel offset), 40 GHz
dc Difference (two markers, referenced to average power monitor, 50 µW/division)	±0.8% of full scale ±1.5% of delta, 18 GHz ±0.8% of full scale ±3% of delta, 40 GHz
dc Offset (referenced two divisions from screen bottom)	±500 mV
Input Dynamic Range (relative to channel offset)	±400 mV
Maximum Input Power	16 dBm ±2 Vdc
Nominal Impedance	50 ohm
Reflections (for 20 ps rise time)	5%
Electrical Input	2.4 mm

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

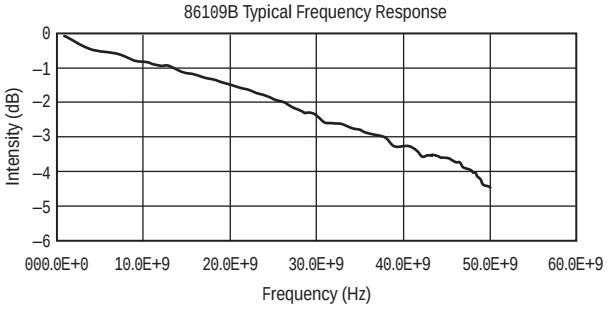
Module Specifications (continued)

Dual Electrical Channel Modules	**86112A**	**83484A**	**54753A**	**54754A**
Electrical Channel Bandwidth	12.4 and 20 GHz	26.5 and 50 GHz	12.4 and 20 GHz	12.4 and 18 GHz
Transition Time (10% to 90%, calculated from TR = 0.35/BW)	28.2 ps, 12.4 GHz; 17.5 ps, 20 GHz	13.2 ps, 26.5 GHz; 7 ps, 50 GHz	28.2 ps, 12.4 GHz; 17.5 ps, 20 GHz	28.2 ps, 12.4 GHz; 19.4 ps, 18 GHz
RMS Noise				
Characteristic	*0.25 mV, 12.4 GHz; 0.5 mV, 20 GHz*	*0.46 mV, 26.5 GHz; 0.92 mV, 50 GHz*	*0.25 mV, 12.4 GHz; 0.5 mV, 20 GHz*	*0.25 mV, 12.4 GHz; 0.5 mV, 18 GHz*
Maximum	0.5 mv, 12.4 GHz; 1 mV, 20 GHz	0.75 mV, 26.5 GHz 1.5 mV, 50 GHz	0.5 mv, 12.4 GHz; 1 mV, 20 GHz	0.5 mv, 12.4 GHz; 1 mV, 18 GHz
Scale Factor				
Minimum	1 mV/division			
Maximum	100 mV/division			
dc Accuracy (single marker, referenced to average power monitor)	±0.4% of full scale ±2mV ±1.5% of (reading-channel offset), 12.4 GHz ±0.4% of full scale ±2 mV ±3% of (reading-channel offset), 20 GHz	±0.4% of full scale ±2 mV ±1.2% of (reading-channel offset), 26.5 GHz ±0.4% of full scale ±2 mV ±2% of (reading-channel offset), 50 GHz	±0.4% of full scale or marker reading (whichever is greater) ±2 mV ±1.2% of (reading-channel offset)	
dc Difference (two markers, referenced to average power monitor, 50 µW/division)	±0.8% of full scale ±1.5% of delta, 12.4 GHz ±0.8% of full scale ±3% of delta, 20 GHz	±0.8% of full scale ±1.2% of delta, 26.5 GHz ±0.8% of full scale ±2% of delta, 50 GHz		
dc Offset (referenced two divisions from screen bottom)	±500 mV	±500 mV	±500 mV	
Input Dynamic Range (relative to channel offset)	±400 mV	±400 mV	±400 mV	
Maximum Input Power	16 dBm ±2 Vdc	16 dBm ±2 Vdc	16 dBm ±2 Vdc	
Nominal Impedance	50 ohm	50 ohm	50 ohm	
Reflections (for 30 ps rise time)	5%	5%	5%	
Electrical Input	3.5 mm	2.4 mm	3.5 mm	

Clock Recovery Single Mode, Multimode and Electrical Modules	**83491A**	**83492A**	**83493A**	**83494A**
Channel Type	Electrical	Multimode Optical	Single Mode Optical	Single Mode Optical
Clock Recovery Phase Locked Loop Bandwidth				
Internal Path Triggering	50 to 70 kHz			80 kHz
External Output	4 to 5 MHz			9 MHz
Data Rates (Mb/s)	155, 622, 1063, 1250, 2125, 2488, 2500	155, 622, 1063, 1250, 2125, 2488, 2500	155, 622, 1250, 2488, 2500	155, 622, 2488, 9953
Tracking/Acquisition Range	±0.1%			155, 622, 2488, ±0.1%; 9953 ±0.03%
Internal Splitter	50/50	50/50	10/90	10/90
Output Jitter	<0.0125 UI RMS			155, 622, 2488 0.02 UI RMS 9953 0.03 UI RMS
Input Power for Clock Recovery	–10 dBm to +3 dBm	750 to 860 nm, –10 to +3 dBm 1000 to 1600 nm, –13 to +3 dBm	–20 dBm to +3 dBm	–12 dBm to +3 dBm (155, 622, 2488 Mb/s) –8 dBm to +3 dBm (9953 Mb/s)
Input/Output Connectors	APC 3.5 mm, 50 ohm	FC/PC, 62.5/125 µm multimode	FC/PC, 9 /125 µm single mode	FC/PC 9/125 µm single mode
Auxiliary Recovered Clock and Regenerated Data Outputs	Type N with SMA adapters			
Input Return Loss	dc–1250 MHz, 20 dB 1250–2500 MHz, 15 dB	20 dB	28 dB	28 dB
Input Insertion Loss	dc–1250 MHz, 7 dB 1250–2500 MHz, 15 dB	5 dB Maximum	1.5 dB Maximum	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

86109B 40Gb/s Optical Receiver Module Specifications



Historically, the 3 dB channel bandwidth has been the primary specification used to describe the ability of an oscilloscope to accurately display a high-speed waveform. As today's communication signals often have significant frequency content well beyond an oscilloscopes 3 dB bandwidth, it now becomes important to consider the oscilloscope response beyond the nominal 3 dB rolloff. If the response rolls off too fast or has an erratic phase response, the displayed waveform may exhibit significant distortion even if the 3 dB bandwidth is extremely high. Smooth phase response is the key to good pulse fidelity.

Rather than building the Agilent 86109B to have the highest 3 dB bandwidth, the frequency response has instead been carefully designed to achieve both a very fast channel with a FWHM (full-width-half-maximum) impulse response of approximately 12 ps with pulse aberrations typically less than 10%. Increasing the bandwidth beyond 40 GHz for an improved specification is possible, but within this system, the FWHM speed performance does not improve while the pulse aberrations degrade significantly.

OPTICAL CHANNEL SPECIFICATIONS

Optical Channel Frequency Response[1] *(Characteristic)*	
Best Signal Integrity Mode	*30 GHz (–2.5 dB)* *40 GHz (–3.5 dB)* *50 GHz (–4.5 dB)*
Best Noise Performance Mode	*26 GHz (–3.0dB)*
Impulse Risetime (10%to 90% level measured from impulse response[2])	*8.5 ps*
Impulse Pulse Width (FWHM measured from impulse response[2])	*12.0 ps*
Pulse Aberrations (pk-pk distortion)	*<10 % pk-pk*
Polarization Dependence	*<0.5 dB*
Wavelength Range	1000 to 1600 nm
Calibrated Wavelengths	1310 nm and 1550 nm
Optical Conversion	
1550 nm	*10 V/W*
1310 nm	*12 V/W*
RMS Noise[3]	
Characteristic	*50 µW (best pulse integrity mode)* *15 µW (best noise performance mode)*
Maximum	70 µW (best pulse integrity mode) 30 µW (best noise performance mode)
Scale Factor	
Minimum	20 µW/division
Maximum	1.0 mW/division
dc Accuracy (single marker, referenced to average power monitor, ≤500 µW/division)	±50 µW ±4% of (reading- channel offset)
dc Difference (two markers, referenced to average power monitor, ≤500 µW/division)	±4% of delta
dc Offset (referenced two divisions from screen bottom)	–2 mW to +6 mW
Average Power Monitor (specified over operating wavelength range)	–23 dBm to + 9 dBm (5 µW to 8 mW)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

86109B 40Gb/s Optical Receiver Module Specifications (continued)

Factory Calibrated Accuracy	±5% ±100 nW ± connector uncertainty, 20°C to 30°C
User Calibrated Accuracy	±2% ±100 nW ± power meter uncertainty ± connector uncertainty, <5°C change
Maximum Input Power	
Maximum displayed peak[4]	8 mW (+9 dBm)
Maximum non-destruct peak	*50 mW (+17 dBm), or 0.25pJ per pulse*
Maximum non-destruct average	*10 mW (+10 dBm)*
Fiber Input	9/125 µm, user selectable connector type
Input Return Loss (HMS-10 connector fully filled single mode fiber)	30 dB

ELECTRICAL CHANNEL SPECIFICATIONS

Electrical Channel Bandwidth	26 and 50 GHz
Transition Time	
(10% to 90% calculated from TR = 0.35/BW)	*<14 ps, 26 GHz*
(Characteristic)	*7 ps, 50 GHz*
RMS Noise	
Characteristic	0.25 mV, 26 GHz 0.60 mV, 50 GHz
Maximum	0.50 mV, 26 GHz 1 mV, 50 GHz
Scale Factor (full height is eight divisions)	
Minimum	1 mV/division
Maximum	100 mV/division
dc Accuracy (single marker)	
26 GHz	±0.4% of full scale ±2 mV ±1.5% of (reading -channel offset)
50 GHz	±0.4% of full scale ±2 mV ±2% of (reading -channel offset)
dc Difference (two markers)	
26 GHz	±0.8% of full scale, ±1.5% of delta
50 GHz	±0.8% of full scale, ±2% of delta
dc Offset Range (referenced from center screen)	±500 mV
Input Dynamic Range (relative to channel offset)	±400 mV
Maximum Input Power	16 dBm ±2 Vdc
Nominal Impedance	50 ohm
Reflections - (for 30 ps rise time)	5%
Electrical Input Connector	2.4 mm

1 Specified with 8 point moving average. The frequency step is 200 MHz.
2 Measured with optical pulses with 5 ps FWHM, 10Gb/s repetition rate, and 2 mW peak power.
3 Measured with modules set at 1310nm O/E conversion (responsivity) mode.
4 Maximum non-destruct power is related to the fill factor (duty cycle) of the RZ waveform. The factory specification is defined with using a 20% filled 40GB/s pulse train (i.e. 5ps FWHM and 25ps period). This concept can also be specified as maximum non-destruct pulse energy. The factory specification is specified with 5ps FWHM optical pulses and maximum non-destruct power providing that the individual pulse shape is square.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Ordering Information

86100A	Infiniium DCA Mainframe, Wide Bandwidth Digital Oscilloscope
Option 001	12 GHz Trigger Bandwidth
Option AX4	Rack Mount flange Kit
Option AXE	Rack Mount Flange Kit with Handles
Option UK6	Commercial Cal Certificate with Test Data
86101A	High Sensitivity, Multimode, 3 GHz, 850 nm Optical and 20 GHz Electrical Module
Option 201	OC-3/STM-1 (155 Mb/s), OC-12/STM-4 (622 Mb/s)
Option 202	FC (1.063 Gb/s), GBEN (1.25 Gb/s)
86103A	High Sensitivity, Multimode, 3 GHz, 1310/1550 nm Optical and 20 GHz Electrical Module
Option 201	OC-3/STM-1 (155 Mb/s), OC-12/STM-4 (622 Mb/s)
Option 202	FC (1.063 Gb/s), GBEN (1.25 Gb/s)
86105A	Single Mode, 20 GHz, 1310/1550 nm Optical and 20 GHz Electrical Module
Option 101	OC-3/STM-1 (155 Mb/s)
Option 102	OC-12/STM-4 (622 Mb/s)
Option 103	OC-48/STM-16 (2.488 Gb/s)
Option 201	OC-12/STM-4 (622 Mb/s), OC-48/STM-16 (2.488 Gb/s)
Option 202	OC-48/STM-16 (2.488 Gb/s), OC-192/STM-64 (9.953 Gb/s)
86106B	Single Mode, 28 GHz, 1310/1550 nm Optical with standard OC-192/STM-64 (9.953 Gb/s) filter
Option 410	OC-192/STM-64 (9.953 Gb/s), 10 Gigabit Ethernet (10.3125 Gb/s), OC-192/STM-64 FEC (10.664 Gb/s, 10.709 Gb/s)
86109A	Single Mode, 30 GHz, Optical and 40 GHz Electrical Module
86112A	Dual Channel 20 GHz Electrical Module
83484A	Dual Channel 50 GHz Electrical Module
83491A	Electrical Clock Recovery Module 155, 622, 1063, 1250, 2125, 2488, 2500 Mb/s
83492A	Multimode Clock Recovery Module 155, 622, 1063, 1250, 2125, 2488, 2500 Mb/s
83493A	Single Mode Clock Recovery Module 155, 622, 1250, 2488, 2500 Mb/s
83494A	Single Mode Clock Recovery Module 155, 622, 2488, 9953 Mb/s
83494A	Single Mode Clock Recovery Module
Option 106	155, 622, 2488, 2666, 10664 Mb/s
54753A	Single-ended TDR Module
54754A	Differential TDR Module

Warranty Options (for all products)

Option W30	3 years of customer return repair service
Option W32	3 years of customer return calibration service
Option W50	5 years of customer return repair service
Option W52	5 years of customer return calibration service

Optional Accessories

10086A	ECL Terminator
11667B	Power Splitter, DC to 26.5 GHz, APC-3.5 mm
11667C	Power Splitter, DC to 50 GHz, 2.4 mm
11898A	Plug-in Module Remote/Extender
11982A	High-Speed Lightwave Receiver
54006A	6 GHz Resistive Divider Probe Kit
54008B	24 ns Delay Line
54701A	2.5 GHz Active Probe
83430A	2.5 Gb/s Lightwave Transmitter (1550 nm)
83433A	10 Gb/s Lightwave Transmitter
83434A	10 Gb/s Lightwave Receiver
83440B/C/D	Optical-to-Electrical Converters (6/20/34 GHz)
83446A	Lightwave Clock and Data Receiver
83480A-KI6	Switch Matrix
83480A-KI7	RIMM Fixture
N1020A	6 GHz TDR Probe Kit (passive)
N1025A	1 GHz Active Differential Probe

Connector Options for All Optical Modules

Option 011	Diamond HMS-10 Connector Interface
Option 012	FC/PC Connector Adapter
Option 013	DIN Connector Adapter
Option 014	ST Connector Adapter
Option 017	SC Connector Adapter

Additional Connection Devices for Electrical Modules

11900B	2.4 mm (f-f) Adapter
11901B	2.4 mm (f) to 3.5 mm (f) Adapter
54124-24101	2.4 mm Termination
5061-5311	APC 3.5 mm (f-f) Adapter
1250-1158	SMA (f-f) Adapter
1810-0118	3.5 mm Termination

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Agilent Technologies'
Test and Measurement Support, Services, and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

By internet, phone, or fax, get assistance with all your test & measurement needs.

Online assistance:
www.agilent.com/comms/lightwave

Phone or Fax

United States:
(tel) 1 800 452 4844

Canada:
(tel) 1 877 894 4414
(fax) (905) 282 6495

China:
(tel) 800-810-0189
(fax) 1-0800-650-0121

Europe:
(tel) (31 20) 547 2323
(fax) (31 20) 547 2390

Japan:
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Korea:
(tel) (82-2) 2004-5004
(fax)(82-2) 2004-5115

Latin America:
(tel) (305) 269 7500
(fax) (305) 269 7599

Taiwan:
(tel) 080-004-7866
(fax) (886-2) 2545-6723

Other Asia Pacific Countries:
(tel) (65) 375-8100
(fax) (65) 836-0252
Email: tm_asia@agilent.com

Product specifications and descriptions in this document subject to change without notice.

© 2000, 2001 Agilent Technologies
Printed in USA June 29, 2001
5968-8546E



Agilent Technologies

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP