

---

## The Agilent 83486A—At a Glance

The Agilent 83486A is one of several plug-in modules available for the Agilent 83480A, 54750A mainframes. The main features of the Agilent 83486A are:

- Integrated, calibrated optical channel.
- 2.5 GHz optical channel bandwidth and user selectable 12.4 or 20 GHz electrical channel bandwidth.
- 1000 nm to 1600 nm wavelength range.
- Optical channel has switchable 155/622 Mb/s SONET/SDH filters or 1063/1250 Mb/s datacom filters.
- 62.5/125  $\mu\text{m}$  (maximum) multimode, user selectable optical input connector option.
- Electrical measurement channel.
- Trigger channel input to the mainframe.
- 3.5 mm (m) connectors on the electrical measurement channel and trigger channel.
- One probe power connector.
- One auxiliary power connector.

**NOTE**

If you wish to use the Agilent 83486A optical plug-in module in an Agilent 54750A digitizing oscilloscope, a firmware upgrade must first be installed. Order the Agilent 83480K communications firmware kit and follow the installation instructions.

The purpose of the plug-in module is to provide measurement channels, including sampling, for the mainframe. The plug-in module scales the input signal, sets the bandwidth of the system, and allows the offset to be adjusted so the signal can be viewed. The output of the plug-in module is an analog signal that is applied to the ADCs on the acquisition boards inside the mainframe. The plug-in module also provides a trigger signal input to the time base/trigger board inside the mainframe.

For GPIB programming information, refer to the *Agilent 83480A, 54750A Programmer's Guide* supplied with the mainframe.

## Measurement Accuracy

To ensure that you obtain the specified accuracy, you must perform a plug-in module vertical calibration. The calibration must also be performed when you move a plug-in module from one slot to another, or from one mainframe to another. Refer to Chapter 3, “Calibration Overview” for information on performing a plug-in module vertical calibration.

---

### CAUTION

The Agilent 83486A input circuitry can be damaged when the *total* input power levels exceed +10 dBm (10 mW) on the optical channel or  $\pm 2$  V + peak ac (+16 dBm) on the electrical channel. To prevent input damage, this specified level must not be exceeded.

#### **Measurement accuracy—it's up to you!**

Fiber-optic connectors are easily damaged when connected to dirty or damaged cables and accessories. The Agilent 83486A's front-panel 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 83486A, refer to “Cleaning Connections for Accurate Measurements” on page 5-9.

The Agilent 83486A optical/electrical plug-in module provides:

- 2.85 GHz, integrated, calibrated optical channel with sensitivity to below  $-20$  dBm
- 12.4 GHz and 20 GHz electrical channel
- Trigger channel input to the mainframe
- Switchable reference filters for transceiver compliance testing
- Compliance testing at 155 and 622 Mb/s or FC 1063 and Gigabit Ethernet rates
- Measurement capability for single-mode or multimode optical signals

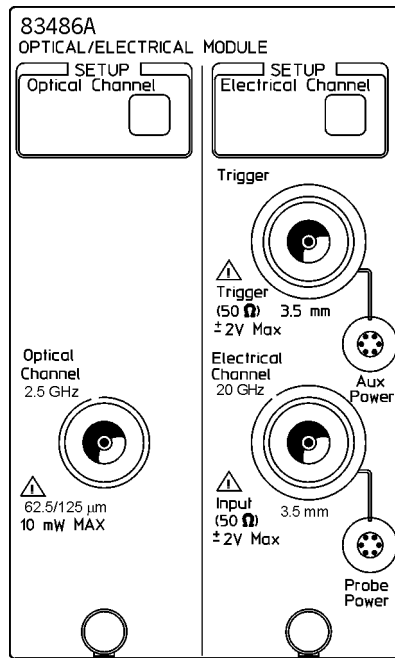
---

## Front panel of the plug-in module

The plug-in module takes up two of the four mainframe slots. The optical channel provides calibrated measurement of optical waveforms in power units. The electrical channel provides calibrated measurement of electrical signals in volts. Bandwidths are selectable on both channels to optimize sensitivity and bandwidth. The front panel of the plug-in module has two channel inputs and an external trigger input. The front panel also has a Probe Power connector for Agilent 54700-series probes, an Aux Power connector for general purpose use, and a key for each channel that displays the softkey menu. The softkey menu allows you to access the channel setup features of the plug-in module.

The front-power Probe Power connector allows automatic channel scaling and probe calibration with Agilent 54700 series probes. The front-panel Aux Power connector provides only power to Agilent 54700 series probes for use as a trigger input. Probe calibration and scaling are not required for a trigger input.

The Agilent 83486A Optical/Electrical Plug-In Module



front

Front panel of the plug-in module.

## Specifications

**Table 4-1. HP 83486A Electrical Channel Vertical Specifications**

Bandwidth (–3 dB)	dc to 12.4 GHz or 20 GHz, user selectable
dc Accuracy—single voltage marker <sup>a</sup>	
12.4 GHz	$\pm 0.4\%$ of full scale $\pm 2$ mV $\pm 1.5\%$ (reading – channel offset) $\pm (2\%/^{\circ}\text{C}) (\Delta T_{\text{cal}}^{\text{b}})$ (reading) – 0.4%/hr ( $\Delta \text{Time}_{\text{cal}}^{\text{c}}$ ) (reading)
20 GHz	$\pm 0.4\%$ of full scale $\pm 2$ mV $\pm 3\%$ (reading – channel offset) $\pm (2\%/^{\circ}\text{C}) (\Delta T_{\text{cal}}^{\text{b}})$ (reading) – 0.4%/hr ( $\Delta \text{Time}_{\text{cal}}^{\text{c}}$ ) (reading)
dc Difference—two marker accuracy on same channel <sup>a</sup>	
12.4 GHz	$\pm 0.8\%$ of full scale $\pm 1.5\%$ of delta marker reading $\pm (2\%/^{\circ}\text{C}) (\Delta T_{\text{cal}}^{\text{b}})$ (reading) – 0.4%/hr ( $\Delta \text{Time}_{\text{cal}}^{\text{c}}$ ) (reading)
20 GHz	$\pm 0.8\%$ of full scale $\pm 3\%$ of delta marker reading $\pm (2\%/^{\circ}\text{C}) (\Delta T_{\text{cal}}^{\text{b}})$ (reading) – 0.4%/hr ( $\Delta \text{Time}_{\text{cal}}^{\text{c}}$ ) (reading)
<i>Transition Time (10% to 90%)</i>	
<i>calculated from <math>T=0.35/\text{BW}</math>, characteristic</i>	
12.4 GHz	$\leq 28.2$ ps
20 GHz	$\leq 17.5$ ps
<i>Maximum RMS Noise</i>	
12.4 GHz	$\leq 0.5$ mV (0.25 mV characteristic)
20 GHz	$\leq 1$ mV (0.5 mV characteristic)
Scale Factor (full scale is eight divisions)	
Minimum	1 mV/div

**Specifications**

**Table 4-1. HP 83486A Electrical Channel Vertical Specifications (Continued)**

Maximum	100 mV/div
dc Offset Range	±500 mV
Nominal Impedance	50 Ω
Connector	3.5 mm (m)
Reflections	≤5% for 30 ps rise time
Dynamic Range	±400 mV relative to channel offset
<i>Maximum Safe Input Voltage</i>	<i>16 dBm peak ac ±2V dc</i>

- It is recommended that a user vertical calibration be performed after every 10 hours of continuous use or if the temperature has changed by greater than 2°C from the previous vertical calibration.
- Where  $\Delta T_{cal}$  represents the temperature change in Celsius from the last user vertical calibration. Note that the temperature term goes to zero upon execution of a vertical calibration.
- Where  $\Delta Time_{cal}$  represents the time since the last user vertical calibration. The uncertainty due to time typically stabilizes after 24 hours. This term goes to zero upon execution of a vertical calibration.

**Table 4-2. HP 83486A Optical Channel Vertical Specifications**

Bandwidth (–3 dB)	dc to 2.85 GHz ( <i>dc to 3.0 GHz characteristic</i> )
Maximum Specified Peak Input Power <sup>a</sup>	
Continuous Wave	0.6 mW (–2.2 dBm)
Modulated	0.4 mW (–4 dBm)
dc Accuracy (single marker <sup>b</sup> ) <sup>c</sup>	±0.4% of full scale ±6 μW ±3% (reading – channel offset) ± (2%/°C) ( $\Delta T_{cal}$ <sup>d</sup> ) (reading) – 0.4%/hr ( $\Delta Time_{cal}$ <sup>e</sup> ) (reading)
dc Difference (two marker accuracy, same channel <sup>b</sup> ) <sup>c</sup>	±0.8% of full scale ±3% of delta marker reading ± (2%/°C) ( $\Delta T_{cal}$ <sup>d</sup> ) (reading) – 0.4%/hr ( $\Delta Time_{cal}$ <sup>e</sup> ) (reading)
<i>Transition Time (10% to 90%), calculated from <math>T=0.48/\text{bandwidth}</math>, optical</i>	<i>&lt;160 ps, unfiltered mode</i>
<i>RMS Noise, filtered mode</i>	
Option 040	<i>Characteristic: &lt; 1.0 μW Maximum: &lt; 1.5 μW</i>
Option 041	<i>Characteristic: &lt; 1.5 μW Maximum: &lt; 2.5 μW</i>

**Table 4-2. HP 83486A Optical Channel Vertical Specifications (Continued)**

Scale Factor (full scale is eight divisions)	
Minimum	5 $\mu\text{W}/\text{div}$
Maximum	100 $\mu\text{W}/\text{div}$
dc Offset Range	+0.2 mW to -0.6 mW, referenced to two divisions above bottom of screen
Connector Type	62.5/125 $\mu\text{m}$ maximum multimode, user selectable connector option
<i>Input Return Loss</i>	
<i>single-mode</i>	33 dB (HMS-10 connector with 9 $\mu\text{m}$ fiber) (characteristic)
<i>multimode</i>	20 dB (HMS-10 connector with fully filled 62.5 $\mu\text{m}$ fiber) (characteristic)
Filtered Bandwidth	
Measured response conforms to:	
Option 040	ITU-TS G.957 and TANWT-000253 for reference receivers for both STM-1/OC-3 and STM-4/OC-12 data rates
Option 041	Reference receiver specifications for FC 1063 and Gigabit Ethernet.
Calibrated Wavelengths	1310 nm and 1550 nm
Average Power Monitor	
Specified operating range	-30 dBm to 0 dBm (1 $\mu\text{W}$ to 1 mW)
Factory calibrated accuracy (20°C to 30°C)	$\pm 5\%$ of reading $\pm 100$ nW $\pm$ connector uncertainty
User calibrated accuracy <sup>f</sup> (<5°C temp change)	$\pm 2\%$ of reading $\pm 100$ nW $\pm$ power meter uncertainty
Maximum Safe Input	10 mW peak
<i>Wavelength Range</i>	1000 to 1600 nm

- a. Exceeding the specified input power level will cause waveform distortion.
- b. Referenced to average power monitor.
- c. It is recommended that a user vertical calibration be performed after every 10 hours of continuous use or if the temperature has changed by greater than 2°C from the previous vertical calibration.
- d. Where  $\Delta T_{\text{cal}}$  represents the temperature change in Celsius from the last user vertical calibration. Note that the temperature term goes to zero upon execution of a vertical calibration.
- e. Where  $\Delta \text{Time}_{\text{cal}}$  represents the time since the last user vertical calibration. The uncertainty due to time typically stabilizes after 24 hours. This term goes to zero upon execution of a vertical calibration.
- f. A user calibration can be performed with average optical power levels from 100 to 400  $\mu\text{W}$ , however, the instrument optical accuracy specification is only valid for average optical calibration powers of 200  $\pm 50$   $\mu\text{W}$ .

**Specifications**

**Table 4-3. Electrical and Optical Channels**

Temperature	
Operating	15°C to +35°C
Non-operating	-40°C to +70°C
Humidity	
Operating	up to 90% relative humidity (non-condensing) at ≤35°C
Non-operating	up to 95% relative humidity (non-condensing) at ≤65°C

**Table 4-4. Power Requirements**

Supplied by mainframe.	
------------------------	--

**Table 4-5. Weight**

Net	approximately 1.2 kg (2.6 lb.)
Shipping	approximately 2.1 kg (4.6 lb.)



---

## Characteristics

The following characteristics are typical for the Agilent 83486A optical/electrical plug-in module. Refer to the *Agilent 54701A Active Probe Service Guide* for complete probe characteristics.

**Table 4-6. Trigger Input Characteristics for Electrical and Optical Channels**

---

<i>Nominal Impedance</i>	<i>50 <math>\Omega</math></i>
<i>Input Connector</i>	<i>3.5 mm (m)</i>
<i>Trigger Level Range</i>	<i><math>\pm 1</math> V</i>
<i>Maximum Safe Input Voltage</i>	<i><math>\pm 2</math> Vdc + ac peak (+16 dBm)</i>
<i>Percent Reflection</i>	<i><math>\leq 10\%</math> for 100 ps rise time</i>

Refer to the *Agilent 83480A, 54750A User's Guide* for trigger specifications.