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## The Instrument at a Glance

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## The Agilent 83481A Optical/Electrical Plug-In Module

The Agilent 83481A optical/electrical plug-in module is one of several plug-in modules available for the Agilent 83480A, 54750A mainframes. Its main features are:

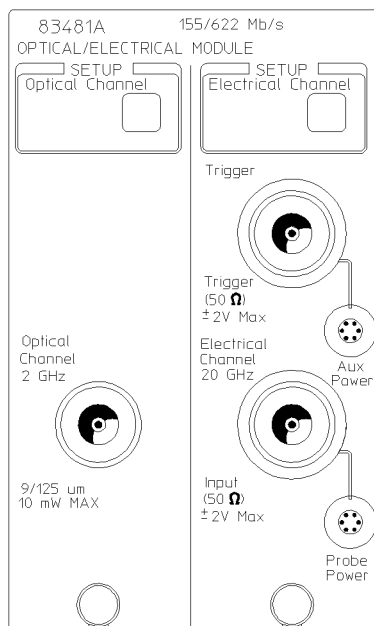
- Integrated, calibrated optical channel.
- Optical channel includes switchable SONET/SDH filters.
- Electrical measurement channel.
- 2.5 GHz trigger channel.
- Electrical measurement channel has user-selectable bandwidths of 12.4 or 20 GHz.
- Optical channel has 2.85 GHz unfiltered bandwidth.
- 3.5 mm (m) connectors on electrical measurement channel and trigger channel.
- One probe power connector.
- One auxiliary power connector.
- Optical channel has an Agilent Technologies universal adapter for 9/125  $\mu\text{m}$  single-mode fiber input.

### **NOTE**

If you wish to use the Agilent 83481A 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 Instrument at a Glance

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**Figure 1-1. Front panel of the plug-in module.**

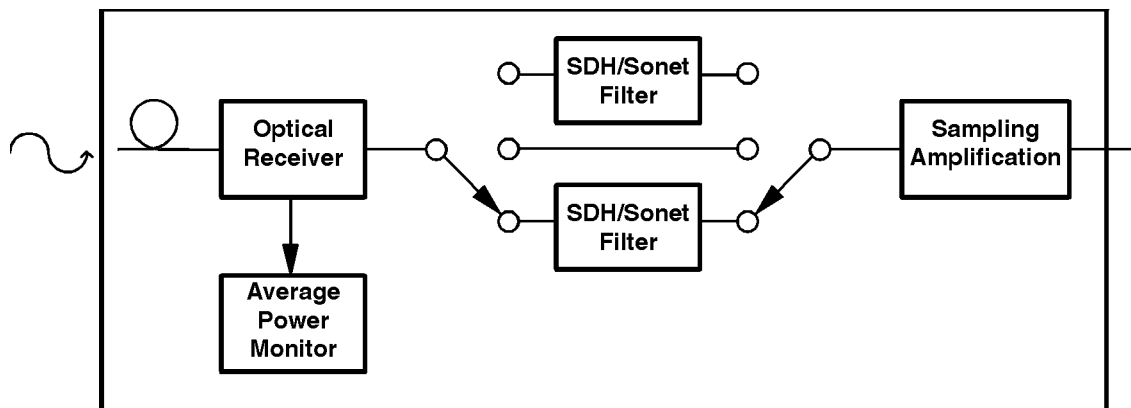


Figure 1-2. Block diagram of the plug-in module.

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## Specifications and Characteristics

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## Specifications and Characteristics

This chapter lists the system specifications and characteristics of the Agilent 83481A optical/electrical plug-in module when it is combined with either the Agilent 83480A or Agilent 54750A mainframes. The specifications and characteristics for the mainframe are in the *Agilent 83480A, 54750A User's Guide*. Specifications apply over the temperature range +15° C to +35° C (unless otherwise noted) after the instrument's temperature has been stabilized after 60 minutes of continuous operation.

### **Specifications**

Specifications described warranted performance. Unless otherwise noted, corrected limits are given when specifications are subject to minimization with error-correction routines.

### **Characteristics**

Characteristics provide useful, nonwarranted, information about the functions and performance of the instrument. Characteristics are printed in italics.

### **Calibration cycle**

Agilent Technologies designs instruments to meet specifications over the recommended calibration interval provided that the instrument is operated within the specified operating environment. To maintain specifications, periodic recalibrations are necessary. We recommend that the plug-in module be calibrated at an Agilent Technologies service facility every 12 months. Users are encouraged to adjust the calibration cycle based on their particular operating environment or measurement accuracy needs.

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## Specifications

The following are specifications used to test the Agilent 83481A plug-in module. Specifications are valid after a 1 hour warm-up period. See the *Agilent 54701A Active Probe Service Guide* for complete probe specifications.

**Specifications****Vertical specifications**

<b>Electrical Channel</b>	
Bandwidth  —3 dB	dc to 12.4 or 20 GHz, user selectable
dc Accuracy—single voltage marker <sup>1</sup>	
12.4 GHz	$\pm 0.4\%$ of full scale $\pm 2 \text{ mV} \pm 1.5\%  \text{reading} - \text{channel offset} $ $\pm  2\%/^{\circ}\text{C}   \Delta T_{\text{cal}} ^2  \text{reading}  - 0.4\%/\text{hr}  \Delta \text{Time}^3   \text{reading} $
20 GHz	$\pm 0.4\%$ of full scale $\pm 2 \text{ mV} \pm 3\%  \text{reading} - \text{channel offset} $ $\pm  2\%/^{\circ}\text{C}   \Delta T_{\text{cal}} ^2  \text{reading}  - 0.4\%/\text{hr}  \Delta \text{Time}^3   \text{reading} $
dc Difference—two marker accuracy on same channel <sup>1</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}} ^2  \text{reading}  - 0.4\%/\text{hr}  \Delta \text{Time}^3   \text{reading} $
20 GHz	$\pm 0.8\%$ of full scale $\pm 3\%$ of delta marker reading $\pm  2\%/^{\circ}\text{C}   \Delta T_{\text{cal}} ^2  \text{reading}  - 0.4\%/\text{hr}  \Delta \text{Time}^3   \text{reading} $
<i>Transition Time (10%–90%)</i> <i>calculated from <math>T = 0.35/BW</math>, typical</i>	
12.4 GHz	$\leq 28.2 \text{ ps}$
20 GHz	$\leq 17.5 \text{ ps}$
<i>Maximum Noise (RMS)</i>	
12.4 GHz	$\leq 0.5 \text{ mV}$ (0.25 mV typical)
20 GHz	$\leq 1 \text{ mV}$ (0.5 mV typical)
Scale Factor  full scale is eight divisions	
Minimum	1 mV/div
Maximum	100 mV/div
dc Offset Range	$\pm 500 \text{ mV}$

<sup>1</sup> 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.

<sup>2</sup> 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.

<sup>3</sup> Where  $\Delta \text{Time}$  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.



Electrical Channel	
Nominal Impedance	50 $\Omega$
Connector	3.5mm  m
Reflections	$\leq 5\%$ for 30 ps rise time
Dynamic Range	$\pm 400$ mV relative to channel offset
<i>Maximum Safe Input Voltage</i>	<i>16 dBm peak ac <math>\pm 2V</math> dc</i>

**Specifications**

<b>Optical Channel</b>	
Bandwidth  —3 dB	dc to 2.85 GHz ( <i>dc to 3.0 GHz characteristic</i> )
Maximum Specified Peak Input Power <sup>1</sup>	
Continuous Wave	0.6 mW  —2.2 dBm
Modulated	0.4 mW  —4 dBm
dc Accuracy  single marker <sup>2</sup>   <sup>3</sup>	$\pm 0.4\%$ of full scale $\pm 6 \mu\text{W}$ $\pm 3\%$ of  reading — channel offset  $\pm  2\%/^{\circ}\text{C}   \Delta T_{\text{cal}} ^4   \text{reading}  - 0.4\%/\text{hr}  \Delta \text{Time}^5   \text{reading} $
dc Difference <sup>3</sup>  two marker accuracy, same channel <sup>2</sup>	$\pm 0.8\%$ of full scale $\pm 3\%$ of delta marker reading $\pm  2\%/^{\circ}\text{C}   \Delta T_{\text{cal}} ^4   \text{reading}  - 0.4\%/\text{hr}  \Delta \text{Time}^5   \text{reading} $
Transition Time (10%–90% calculated from $T = 0.49/\text{BW}$ optical)	$\leq 245 \text{ ps}$ , unfiltered mode
RMS Noise, 2 GHz or filtered mode	
Typical	$< 1.5 \mu\text{W}$
Maximum	$< 2.5 \mu\text{W}$
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	9/125 $\mu\text{m}$ single mode, user selectable connector option
Input Return Loss	33 dB  HMS-10 connector

<sup>1</sup> Exceeding the specified input power level will cause waveform distortion.

<sup>2</sup> Referenced to average power monitor.

<sup>3</sup> 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.

<sup>4</sup> 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.

<sup>5</sup> Where  $\Delta \text{Time}$  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.

Optical Channel	
Filtered Bandwidth	Measured response conforms to ITU-TS G.957 and GR-253-CORE for reference receivers for both STM-1/OC-3 and STM-4/OC-12 data rates
Calibrated Wavelengths	1310 nm and 1550 nm
Average Power Monitor	
Specified operating range	−30 dBm to −4 dBm [ $1\ \mu\text{W}$ to $400\ \mu\text{W}$ ]
Factory calibrated accuracy (20°C to 30°C)	$\pm 5\%$ of reading $\pm 100\ \text{nW}$ $\pm$ connector uncertainty
User calibrated accuracy <sup>1</sup> <5°C temp. change	$\pm 2\%$ of reading $\pm 100\ \text{nW}$ $\pm$ power meter uncertainty
Maximum Safe Input	10 mW peak
Wavelength Range	1000–1600 nm

<sup>1</sup> 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  $200 \pm 50\ \mu\text{W}$ .

Environmental specifications

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

Power requirements

Supplied by mainframe.

Weight

Net	approximately 1.2 kg [2.6 lb.]
Shipping	approximately 2.1 kg [4.6 lb.]

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## Characteristics

The following characteristics are typical for the Agilent 83481A optical/electrical plug-in module. See the *Agilent 54701A Active Probe Service Guide* for complete probe characteristics.

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### Trigger input characteristics

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

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