VIAVI Solutions

Application Note

Using the Integrating Sphere in the Multiple Application Platform (MAP-200)

Introduction

This application note details the specifications, properties, and potential applications of the integrating sphere. It also provides information on how to order the integrating sphere from VIAVI.

The Multiple Application Platform (MAP-200) is a flexible instrumentation platform used for optical or electro-optical test and measurement applications in a production or lab environment.

The MAP-200 can be configured as a benchtop instrument or as a rack-mount system and can be controlled locally or remotely. The MAP-200 is a General Purpose Interface Bus (GPIB)-, and Ethernet-enabled device that supports the latest test equipment interface standard, local area network (LAN) extension interface for instrumentation (LXI).

The MAP-200 can be configured in a number of ways to various applications. To facilitate this, the MAP-200 comes with several accessories, one of which is the integrating sphere.

The Integrating Sphere (VIAVI Part Number AC330) is an accessory used to obtain high power measurements with the MAP-200 Power Meter Module (mOPM-A1).

The specially designed AC330 integrating sphere ensures accurate power measurement regardless of the fiber type or cleave conditions. Each sphere has been individually tested and characterized and a calibration data sheet accompanies the unit.

Potential Applications

The major application of the integrating sphere is conducting high power measurements. It provides constant, high loss at any wavelength, thus converting the input into a power range that can be measured accurately. Loss can be calibrated at any wavelength, and measurement uncertainties from variations due to humidity and temperature are minimal, as shown in Table 1. Prior to shipping, each integrating sphere is calibrated at seven wavelengths, and a calibration sheet accompanies each unit.

The measured power of any wavelength can be corrected using the calibration sheet data. The user can also perform a calibration at any desired wavelength, if desired, using the procedure supplied in this application note.

The integrating sphere can collect all light falling on it irrespective of the incident angle. Extremely useful in applications that require good measurement repeatability, because it provides the means, even using bare-fiber adapters.

Another important property of the integrating sphere is the complete loss of polarization when light passes through it, thus very little PDL is present in power measurements using integrating spheres. It can, therefore, be used to reduce the effects of detector PDL to increase the accuracy and repeatability of PDL and IL measurements. The residual PDL in power measurements is shown in Table 1.

	Specifications	**Comments**
Attentuation at reference	30.7 ±0.8 dB	Measured with wavelength of 1550 nm at 23 ±5°C and RH = 50% with flat connector
Spectral range	800-1650 nm	
Wavelength flatness	<±1.5 dB	From 850-1650 nm, with respect to the attenuation at a wavelength of 1310 nm
Return loss	>65 dB (typical)	Measured at 1310 and 1550 nm with single-mode fiber and FC/APC connector
Relative uncertainty	<±0.05 dB	At reference condition,with 8 degree angled connector, due to residual PDL and interference
Residual PDL	<0.005 dB	Measured at 1550 nm
Maximum power	+33 dBm (2W)	CW laser
Warm-up time	30 minutes	
Operation conditions	10 to 40°C	RH 15 to 60%
Storage conditions	–40 to +70°C	RH 15 to 95% non-condensing

Unpacking and Inspection

The AC330 accessory package includes the following items:

- Integrating sphere
- Adapters for bare fiber connectors
- Dust caps for connector adapters
- Calibration data sheet

Please make sure that all items are present and in good condition.

Using the Integrating Sphere

Connecting to the Power Meter

The AC330 accessory can be directly screwed onto the front panel of the MAP-200 Optical Power Meter Module, as shown in Figure 1.

Figure 1 Installing the Integrating Sphere

Fiber Preparation

As stated earlier, the integrating sphere can be used to measure high power using a bare fiber adapter. Always use care when working with high power sources. In particular, when working with bare fiber, ensure that cleaves are straight. Also, clean the ends of the fiber thoroughly to ensure that dirt does not scatter the light.

Caution: Clean the connector thoroughly before connecting to the high power source.

Calibration

Need for Calibration

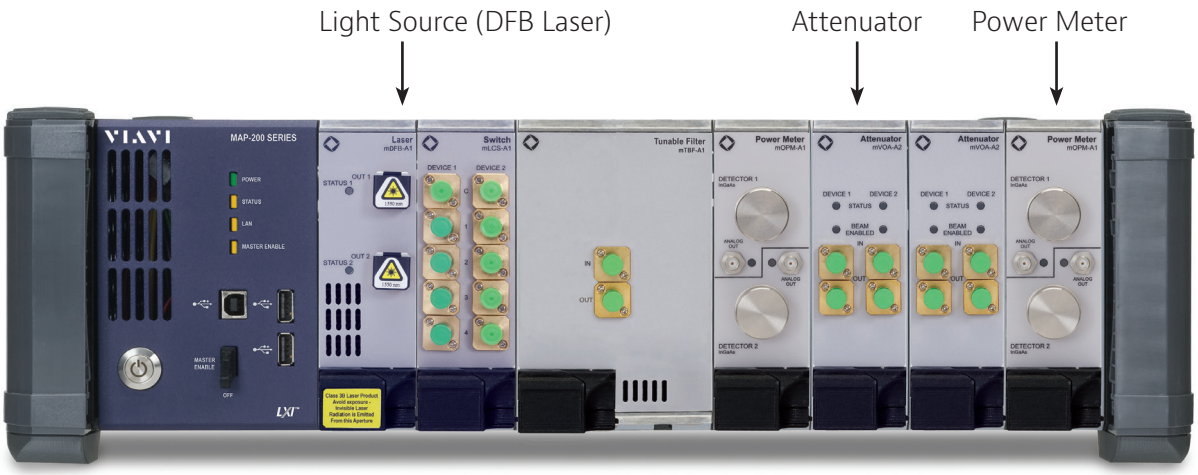
The AC330 comes with its own calibration data. Each AC330 is calibrated with a CW laser diode at, or near, the following wavelengths: 980, 1310, 1480, 1550, and 1625 nm at the ambient temperature of 25°C at 50 percent relative humidity. Refer to the testing sheet for further details. If the measurement is within ±20 nm of the calibrated wavelength, customer calibration is not required. The measurement accuracy is guaranteed.

However, if the measurement is performed significantly away from a calibrated wavelength (>20 nm), an on-site customer calibration is recommended.

Calibration Procedure

Make sure the cable connector and adapters are clean. Refer to the MAP-200 Optical Power Meter Module User Manual for proper connector cleaning. Set up the equipment as shown in Figure 2. Set the laser power to –10 dBm. If the power can be set only to a higher value, use a proper attenuator, for example a MAP-200 Variable Optical Attenuator (mVOA) to achieve the desired power level.

From the MAP-200 interface, set the power meter wavelength to that which the AC330 is to be calibrated.



Calibration Procedure continued

1. Connect the laser directly to the power meter without the integrating sphere, select appropriate channel, and take the power reading P1.
   Note: Please include three digits after the decimal point when recording the power reading, for example, –9.885 dBm.
2. Screw the integrating sphere onto the power meter head adapter.
   Note: Make sure the integrating sphere is properly tightened.
3. Connect the fiber to the integrating sphere fiber adapter and take the power reading, P2.
   Note: Please include three digits after the decimal point when recording the power reading, for example, –39.674 dBm.
4. Subtract power reading P2 from P1 to obtain the integrating sphere attenuation at the measured wavelength and environmental condition, ΔP = P1 – P2, as in above example, ΔP = –9.885 – (–39.674) = 29.79 dB.
5. From the MAP-200 interface, set the power offset on the power meter to the value of ΔP, 29.79 dB in the example. If the power is now measured, the power displayed on the MAP controller is the absolute power of the input light. Refer to the OPM manual for further details on using the power meter

Calibration Data

Serial Number AC330-123-456	**Measured Valuew**		**Comments**
Attentuation	***Wavelength (nm)***	***Attenuation (dB)***	
	850	28.26	
	975	28.51	
	1311	29.43	
	1483	30.31	
	1548	30.33	
	1624	30.41	
Uncertainty	±1%		
Return loss	>65 dB		Measured at 1310 and 1550 nm with FC/APC connector
Maximum power	+33 dBm (2W)		CW laser
Operation conditions	10 to 40°C, RH 15 to 60%		Non-condensing
Storage conditions	–40 to +70°C, RH 15 to 95%		Non-condensing

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