PART # SP1 7Z02493. REV 01

User Notes

OPHIR IS1.5-IRG-FPD-800 (P/N 7Z02493)

1.5" High Speed Response, Multi-functional Integrating Sphere

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Ophir IS1.5-IRG-FPD-800 User Notes

OVERVIEW

The IS1.5-IRG-FPD-800 is a multifunctional integrating sphere that enables simultaneous measurement of multiple laser parameters including:

- Power
- Pulse Characteristics
- Spectrum

The IS1.5-IRG-FPD-800 contains 2 photodiodes: a calibrated photodiode for precise power measurement using Ophir meters and a fast photodiode with integral reverse bias circuit for temporal characterization using third-party instrumentation such as oscilloscopes and spectrum analyzers. Its small, 1.5" internal diameter preserves the temporal shape of pulses down to 6 nsec. An SMA fiber optic connector is provided for connection to a spectrometer. The large, 20 mm input aperture allows for wide acceptance angles and long working distances, making the IS1.5-IRG-FPD-800 well suited for testing VCSELs and other types of laser diodes in the spectral range of 940 nm to 1640 nm with average power output up to 3W.
This product is targeted towards VCSEL and other pulsed laser diode applications.

CALIBRATED PHOTODIODE

When measuring pulsed laser sources with low duty cycles at frequencies below 200 Hz, the Low Frequency Power mode should be used. On meters with a maximum frequency setting of 100 Hz, set the frequency on the meter to one half of the actual laser frequency. The measurement scale should be selected manually and set to the smallest scale in which measurements to not produce an "Over" message.

FAST PHOTODIODE

The fast photodiode circuit provides a reverse bias voltage. 12 VDC must be connected to the unit in order for this to operate. Instrumentation connected to the fast photodiode output must have 50Ω input impedance.

CALIBRATING THE FAST PHOTODIODE TO MAKE POWER MEASUREMENTS

The analog signal output by the FPD will correspond to the instantaneous power level of the laser. (Within the limits of the response speed of course.) So, in theory, the peak signal output should correspond to the peak power output of the laser. This is correct so long as the laser pulse shape does not vary at all with its power level.

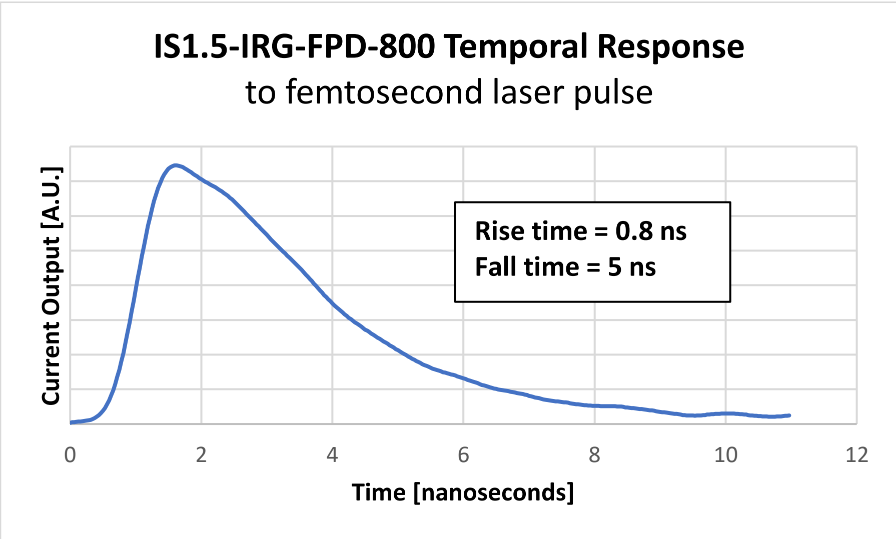
In practice, the customer should verify this under his working conditions. We highly recommend that the customer compare the analog signal output from the fast photodiode to the power reading from the calibrated photodiode at several different power levels over the power range of interest. If it is found that the peak current signal is linear with the power, then it can be used to represent the pulse power.

A measurement method that is more robust than measuring the peak current level is to integrate the analog signal over the entire pulse width. This integrated value will correspond well to the laser pulse energy. If there is any uncertainty, for any reason, as to the true zero level of the signal, it is recommended to select a threshold level (5% - 20% or higher depending on the pulse shape) above which the integral is calculated.

INTEGRATING SPHERE

Pulse Stretching

Light entering an integrating sphere bounces around inside many times. This causes short pulse widths to be stretched. This phenomenon is not symmetric, it affects the pulse falling edge much more than the rising edge. In the IS1.5-IRG-FPD-800, the effective rise time is 0.8 ns and the fall time is 5 ns. The graph below shows the response of the IS1.5-IRG-FPD-800 to a pulse that is much shorter than its rise and fall times.



DUT SOURCE REFLECTANCE

In any integrating sphere measurement setup in which the device under test (DUT) is located in close proximity to the sphere input port, light exiting the input port may be reintroduced to the sphere by the reflectance of the DUT. If the amount of light returned to the sphere is significant, it will impact the sphere calibration.

Before making any power measurements, the customer should test whether his laser source effects the sphere calibration.

This is accomplished by the following procedure:

1. Illuminate the sphere through the fiber optics port with an auxiliary light source that has the same wavelength as the laser of interest.
2. Measure the power from the auxiliary light source without the DUT or any other object located near the input port.
   This is the true power level of the light source (P aux).
3. Place the DUT in front of the input port in the position it will be in when it is being measured. Do not turn the laser on.
4. Measure the power reading from the auxiliary light source with the DUT in place and turned off. This is the power level with the influence of the laser to test (($P_{aux, DUT}$).
5. If the ratio P_{aux} / $P_{aux, DUT}$ is:
   a) = 1, the presence of the DUT at the input port does not influence the power readings and measurements can be performed normally
   b) < 1, all power readings of the DUT will need to be multiplied by the ratio P_{aux} / $P_{aux, DUT}$ in order to correct them for the influence of the laser reflectance
   c) >1, then there is a problem with the setup. There may be background light that enters the sphere when the DUT is not present and blocked when the DUT is present.

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