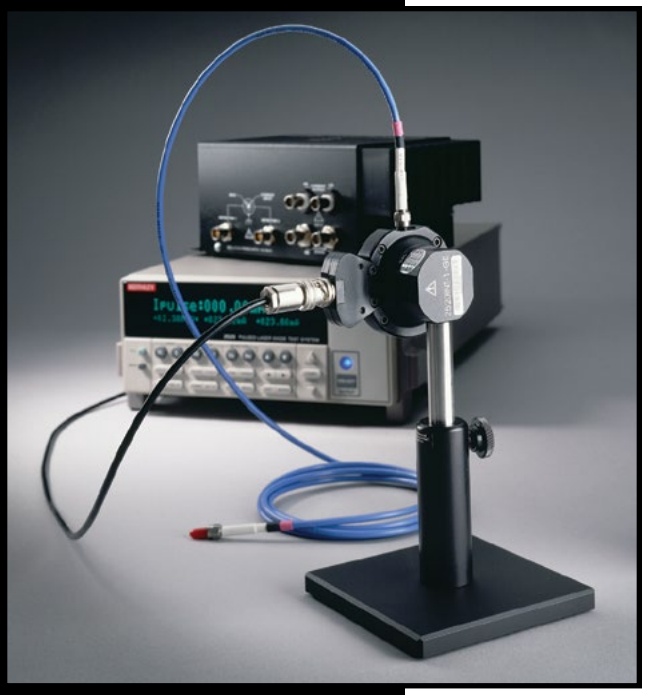
Simplifies pulsed measurements of optical power

SEMICONDUCTOR

# 2520INT

# Integrating Sphere for Pulsed Measurements



- **Optimized for laser diode pulse testing**
- **Suitable for production and laboratory environments**
- **Built-in germanium detector**
- **Works seamlessly with the Model 2520 Pulsed Laser Diode Test System**

The Model 2520INT Integrating Sphere is designed to optimize the Model 2520 Pulsed Laser Diode Test System's optical power measurement capabilities. It allows the testing of devices with pulse widths as short as 500ns. The short pulses of the Model 2520 combined with the speed of the Model 2520INT make them ideal for measuring the optical power of laser diodes at the bar or chip level, before these devices are integrated into temperature-controlled modules. When connected to the Model 2520 via a low noise triax cable, the Model 2520INT allows the Model 2520 to make direct, high accuracy measurements of a laser diode's optical power. The results are expressed in milliwatts.

## Designed Specifically for Pulsed Laser Diode Testing

Keithley developed the Model 2520INT to address the challenges specific to pulse testing laser diodes, which include short pulse periods and fast rise times. For example, when testing laser diodes in pulse mode, the optical head used must provide a response that's fast enough to measure light pulses as short as 500ns. Many optical power detectors are hampered by long rise times, so they can only measure a portion of the laser diode's light output. Even when using a "fast" detector, many detectors are not good for analog signal measurement. By linking the Model 2520 with the optimum combination of sphere and detector characteristics, Keithley provides the low-level sensitivity needed to ensure accurate pulse measurements.

## Easier Laser Diode Power Measurements

An integrating sphere is inherently insensitive to variations in the beam profile produced by a device under test (DUT). The Model 2520INT's interior is highly reflective Spectralon, which scatters, reflects, and diffuses the source beam the DUT produces. This spreads the light from the DUT uniformly over the sphere's interior surface with minimal absorption loss. The detector, which reads the amount of optical power produced by the DUT, is mounted on the interior surface. Due to the multiple diffuse reflections within the sphere, the amount of optical radiation that strikes the detector is the same as that which falls on any other point on the sphere's interior. To convert the attenuated signal measured by the detector into an accurate optical power measurement, the sphere and detector are calibrated as a unit.

## Simplifies Beam Alignment

In a typical laser diode manufacturing line, the laser diode is not coupled to an optical fiber until the final stages of the packaging process. Therefore, any pulse testing performed on a laser diode at the bar- or chip-level would require a difficult and time-consuming beam alignment process in order to focus all of the diode's output on the optical detector.

To ensure acceptance of the complete beam with maximum divergence angles, the sphere can be located up to 3 millimeters from the DUT, positioned so the diode's light output enters the ¼-inch port on the sphere's side. Any light that enters the sphere is captured in the measurement taken by the Model 2520.

### APPLICATIONS

**Bar- or chip-level LIV production testing of:**

- **980 or 1480 EDFA pump lasers**
- **Raman amplifiers**
- **Telecommunication laser diodes**
- **High power telecommunication VCSELs**

### ACCESSORIES REQUIRED

| | |
|---|---|
| 2520 | Pulsed Laser Diode Test System |
| 7078-TRX | Low Noise Triax Cable |

# 2520INT

# Integrating Sphere for Pulsed Measurements

## Ordering Information

**2520INT-1-Ge**
1 inch Integrating Sphere with Germanium Detector

**2520/KIT1**
Pulsed Laser Diode Measurement Package (Includes 2520, 2520INT, and 3-foot triax cable)

## Accessories Supplied

**Quick Start Guide, calibration data (supplied as a printed chart and in CSV format on a floppy diskette), base and 1/4–20 post for mounting**

### Attenuation of Laser Diode Output

Detectors usually have a maximum power limit of a few milliwatts before the detector is over-saturated. The Model 2520INT Integrating Sphere's highly reflective Spectralon interior surface eliminates the problem of detector saturation. This coating reflects and diffuses the light output from the DUT uniformly over the interior surface of the sphere, which inherently attenuates the level of power read by the built-in detector. The power level at any point on the sphere's interior surface is far less than the power level of a beam that falls directly on the detector. This allows testing much higher power devices without risking detector damage. The Model 2520INT's design attenuates the power output of a laser diode by approximately 100:1.

### Optimized for Telecommunications Wavelengths

The Model 2520INT's germanium detector is capable of detecting wavelengths from 800–1700nm. The detector and the sphere are calibrated as a unit in 10nm increments at wavelengths that are of particular interest for laser diode testing (950–1010nm and 1280–1620nm). Calibration constants are provided in printed form as well as in CSV format on a floppy diskette to simplify programming them into a test system. When combined with the Model 2520INT, the Model 2520 Pulsed Laser Diode Test system is capable of measuring power ranging from 14.5mW to 7W, depending on the wavelength (see the specifications for power ranges by wavelengths of interest).

### Fiber Tap for Additional Measurements

The Model 2520INT offers production test engineers the flexibility to decrease overall testing time by supporting multiple optical measurements simultaneously. An additional port on the sphere is compatible with an SMA connector; together, the port and fiber tap can be used to output a fraction of the measured light to an external instrument (such as a spectrometer) via a multimode fiber for additional optical measurements.

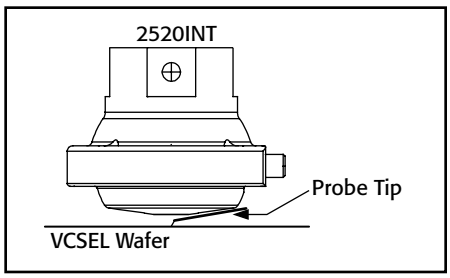
### Eliminates Back Reflections

During testing, the stability of a laser diode can be significantly affected by back reflections from objects in the optical path. The geometry of the Model 2520INT and the diffusing properties of its reflective interior help prevent back reflection and ensure greater device stability during testing.

### Production or Laboratory Environments

A slight curvature on the face of the sphere makes Model 2520INT easier to integrate into an automated test system. This curvature allows additional room to connect the sphere to the DUT electrically and simplifies integration with other system components.

The Model 2520INT is designed with four strategically located mounting holes for flexible mounting on laboratory tables or in automated test fixtures. Two of the holes are sized to accommodate metric fixtures, while the other two are designed for use with English fixtures. The Model 2520INT comes with a 1/4–20 base and post.




**A slight curvature on the face of the sphere allows additional room to connect the DUT electrically in close quarters, such as in wafer probing.**

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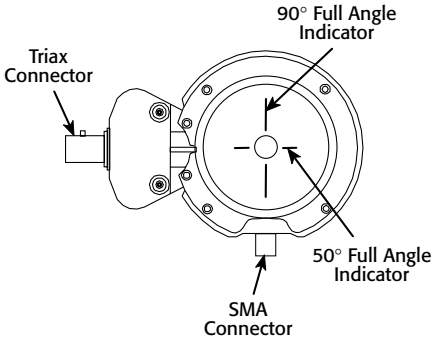
## Specifications

**FULL ACCEPTANCE ANGLE[1]:** 90° vertical, 50° horizontal (max.).




**Frontal View of Integrating Sphere Showing Full Acceptance Angle Indicators**

**OPERATING WAVELENGTH RANGE:** 800–1700nm.

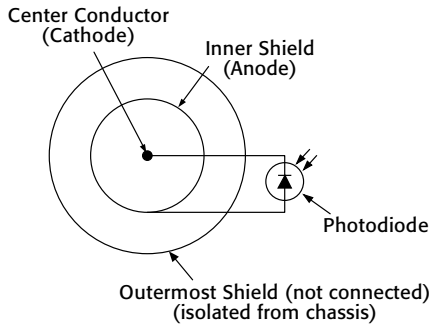
**CONTINUOUS WAVE (CW) CALIBRATION WAVELENGTH RANGE[2]:** 950–1010nm and 1280–1620nm.

| Wavelength (nm) | Measurable Optical Power Range [3] | Typical Responsivity [4] (mA/W) | Resolution [5] (mW) |
|---|---|---|---|
| 980 | 29mW–7W | 3.5 | 0.2 |
| 1310 | 17mW–4W | 6.0 | 0.1 |
| 1480 | 14.5mW–3.5W | 7.0 | 0.1 |
| 1550 | 13.5mW–3W | 7.5 | 0.1 |

**MAXIMUM REVERSE BIAS:** 5V (recommended).

**DARK CURRENT AT MAX REVERSE BIAS:** 4μA (typ.); 10μA (max.).

**PHOTODIODE ELECTRICAL CONNECTIONS ON 3 LUG TRIAX [6]:**




**PULSED OPERATION:** The 2520INT supports the pulse capabilities of the 2520 Pulsed Laser Diode Test System.

**FIBER TAP PORT: Connector Type:** SMA. **Numerical Aperature (NA):** 0.22 (typ.).

| Multi-Mode Patch Cord Core Diameter 7 (μm) | Typical Attenuation (dB) |
|---|---|
| 400 | 39.5 |
| 100 | 53 |
| 62.5 | 58.2 |
| 50 | 63 |

## GENERAL

**INPUT PORT DIAMETER:** 0.25 in (6.35mm).

**RECOMMENDED CALIBRATION CYCLE:** 1 year.

**OPERATING TEMPERATURE:** 0°–50°C.

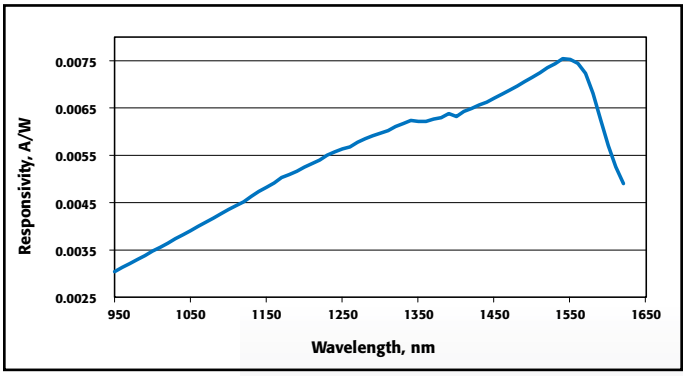
**STORAGE TEMPERATURE:** –25°C–65°C.

**DIMENSIONS [8]:** 60.0mm long × 86.4mm high × 45.7mm deep (2.36 in × 3.40 in × 1.80 in).

**WEIGHT [8]:** 0.15kg (0.33 lbs).

## NOTES

1 Maximum distance from input port to accept at full maximum acceptance angle: 3.1mm (0.12 in).
2 Calibration performed at 10nm wavelength intervals.
3 Based on detector being linear to up to 25mA photocurrent and on a signal to noise ratio (SNR) ≥ 100:1.
4 Calibration of the 2520INT is performed with an open fiber tap port. The power measurement will increase by approximately 1% with an SMA patch cord attached to the port.
5 Based on resolution of Model 2520 at 10mA (lowest) current measurement range.
6 This configuration MUST have a NEGATIVE (reverse) bias voltage applied. If a positive (forward) bias is applied, the detector (photodiode) will become damaged.
7 Use of single mode fiber is not recommended.
8 Only for integrating head, does not include post and base.




**Typical responsivity of the Model 2520INT**