

# Measuring Fiber Illuminator Output Flux

Fiber illuminators are critical components in many medical and mechanical visual and camera inspection systems. Gradual deterioration in the output of these illuminators is difficult to monitor visually, but can compromise the performance of the entire inspection process. The output of a fiber illuminator is often extremely divergent, sometimes approaching 90 degrees. Integrating spheres can be used in the design and quality control of fiber illumination systems to ensure proper optical power. An integrating sphere can also be a reliable flux-monitoring device to ensure that these continue to perform up to specification.



An integrating sphere-based device measures the flux output of a fiber illuminator and eliminates alignment sensitivity.

## Design

The sphere-detector combination is designed to measure flux introduced onto a wide area of the sphere surface (about half of the sphere) and to respond equally to flux introduced anywhere onto this region.

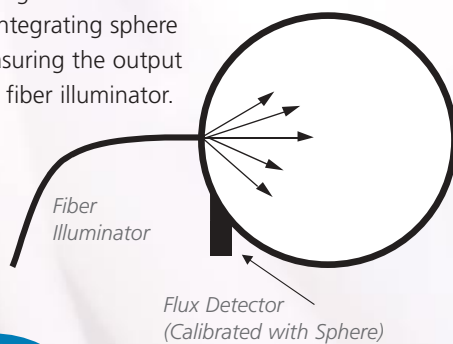
## Calibration

The detector and sphere are calibrated as a unit, using a source of known flux. This is usually achieved by a lamp standard of illuminance, at a precisely measured distance,

through a precision aperture of known area. This provides a known quantity of flux into the sphere. The detector signal is scaled to this calibrating flux.

## Measurement

The figure below shows an integrating sphere measuring the output of a fiber illuminator.



## Positioning and Alignment

In addition to responding to the divergent flux from a fiber illuminator, the integrating sphere is reasonably insensitive to positioning and alignment, making it an ideal solution for handheld instruments, and for frequent use in the field.

## Simultaneous Spectral Measurement

Besides deterioration in total output flux, the shape of the output spectrum can change. This can be critical where color is used as a key indicator in the inspection process. In addition to measuring flux, a second, spectral detector can be added to the sphere to simultaneously measure the spectrum. Since this spectral detector need not be calibrated for flux, it can be positioned nearly anywhere in the sphere as shown in the figure below. Or, if conditions permit, the spectral detector can be calibrated with the sphere, replacing the flux detector and making flux and spectral measurements with a single detector.

