

# Application Note

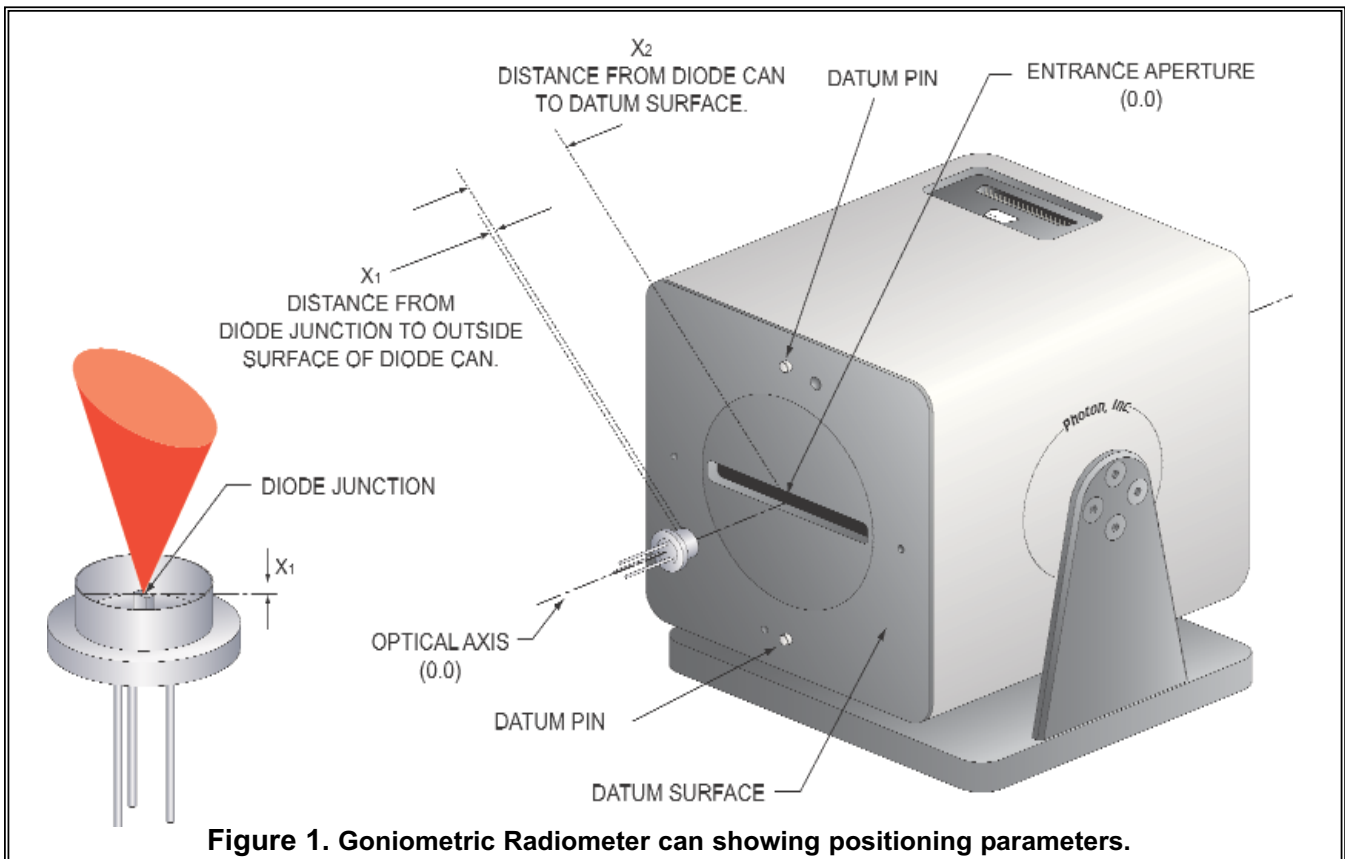
## Interfacing with Models *LD 8900/LD 8900R*™

### Introduction

The Goniometric Radiometer Models LD 8900 and LD 8900R enable the user to characterize the angular radiation intensity of a wide range of light-emitting sources, including VCSELs, laser diodes, optical fibers and optical waveguides. In order to achieve accurate characterization, the light source in question must be positioned in a way that is both measured and repeatable. This application note suggests methods for adapting the LD 8900 and LD 8900R to accommodate the positioning of the light source in your application.

### Positioning Parameters

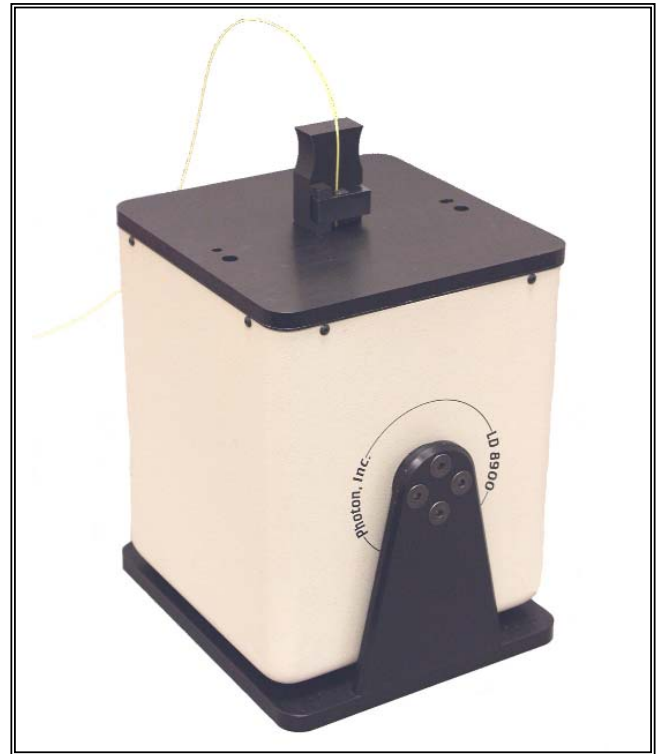
The front face of the Goniometric Radiometer is a datum surface precision-engineered to be perpendicular to the system's optical axis (see Figure 1 below). Light-source positioning is defined relative to this surface and can be described by two parameters: its orientation to the optical axis and its distance from the datum surface.



### Aperture-Source Distance

The distance between the source and the datum reference plane is called the aperture-source distance. For accurate measurements, this distance *must* be measured and the value entered into the software. The exact location of the source depends on the type of light source and the packaging. For example, for low-divergence diodes, the source location is the same as the chip location. For highly divergent diodes where light reflects from the package walls, the apparent source location is approximately at the end of the package. It is up to the user to define the source location and hence the aperture-source distance for each source to be measured.

In the example shown in Figure 1 the aperture-source distance of a low-divergence diode is calculated. The distance from the diode can to the datum surface  $X_2$  is obtained by careful measurement using calipers or a precision scale. The additional distance from the diode can surface to the diode chip  $X_1$  is then added to obtain the total aperture-source distance.



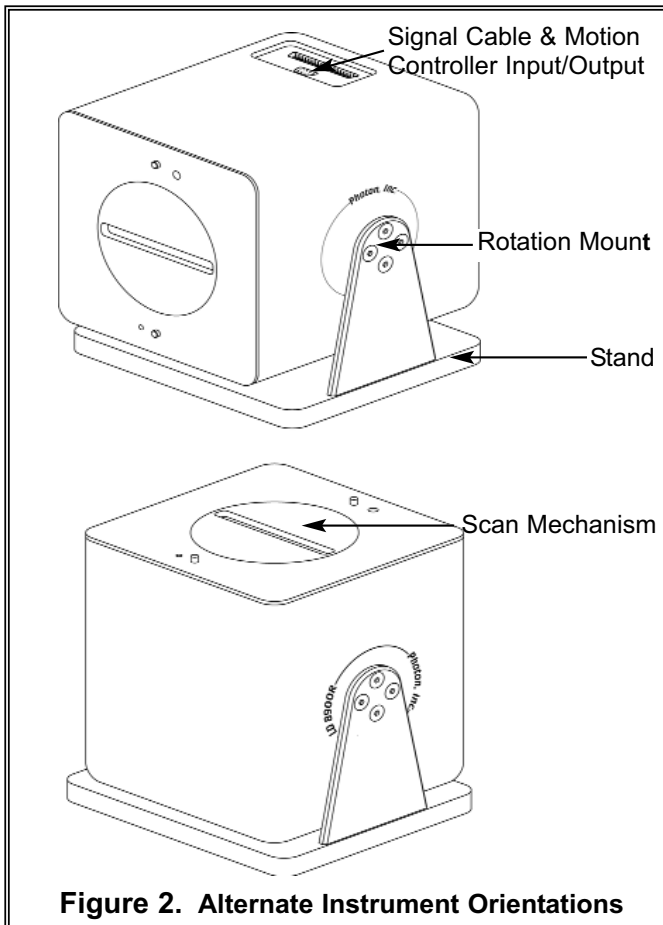
**Figure 3. Model LD 8900 with bare fiber adapter**

### Field of View

The aperture-source distance determines the instrument field of view. The maximum field of view of  $\pm 72^\circ$  is when the aperture-source distance is zero, i.e., the source is positioned at the datum reference plane. As the source is moved away from the reference datum, the field of view decreases. Table 1 gives the field of view for different aperture-source distances

**Table 1. The effect of aperture-source distance on the Field of View**

Aperture-Source Distance (cm)	Field of View (degrees)
0	$\pm 72.01$
0.2	$\pm 69.99$
0.4	$\pm 68.02$
1.0	$\pm 62.45$
2.0	$\pm 54.30$
3.0	$\pm 45.35$
4.0	$\pm 35.84$
5.0	$\pm 29.84$
10.0	$\pm 16.51$
20.0	$\pm 8.79$



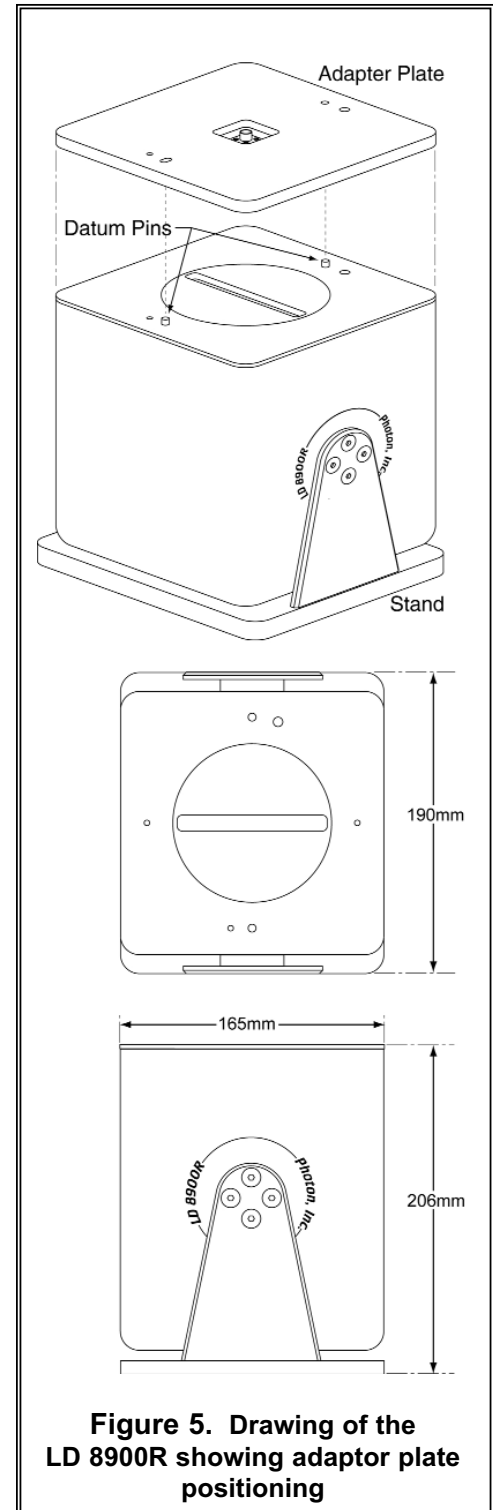
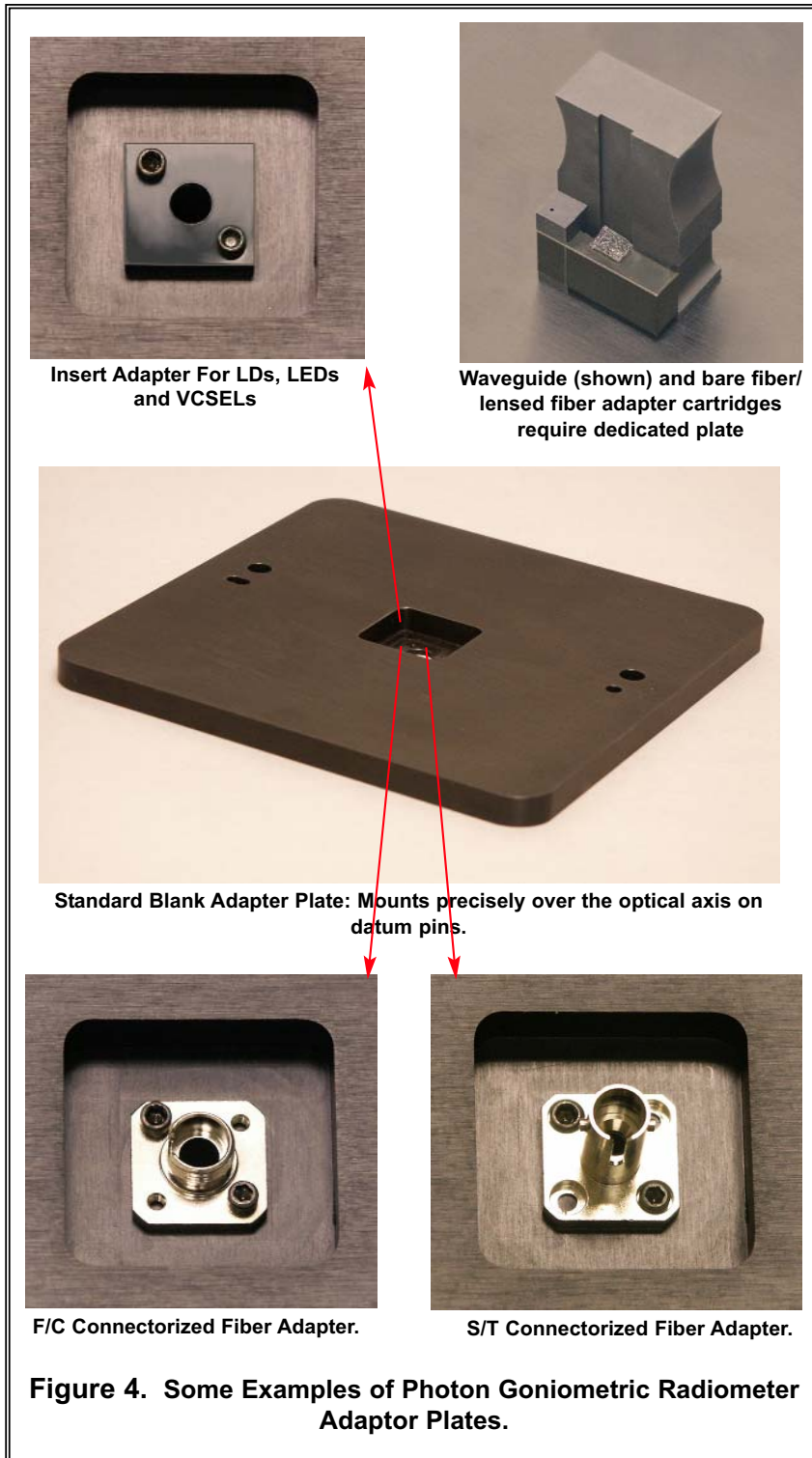
**Figure 2. Alternate Instrument Orientations**

### Positioning Your Source

The simplest and most effective way of ensuring that your source is correctly positioned is to use a simple mechanical fixture mounted to the datum surface. This fixture should be designed to position, point and secure your device for measurement. The Goniometric Radiometer datum surface features two location pins to aid in the positioning of your

fixture. The instrument's optical axis is perpendicular to its datum plane and its mechanical fabrication is guaranteed to within  $\pm 0.2^\circ$ . The optical axis is centered on a line between these two location pins.

For customers who don't wish to design their own fixtures, Photon manufactures adapter plates to accommodate a range of applications (see figure 4.).



### Questions About LD 8900/LD 8900R Applications:

**Question:** How sensitive is the measurement to device position with respect to the optical axis position 0,0?

**Answer:** If your device is off the true optical axis by 0.1 cm, it will cause a 0.68 degree pointing error. If your device is off the true optical axis by 0.01 cm, it will cause a 0.068 degree pointing error. A displacement of 0.025 cm will cause an angular width error of <0.1 degree.

**Question:** How sensitive is the device to datum distance?

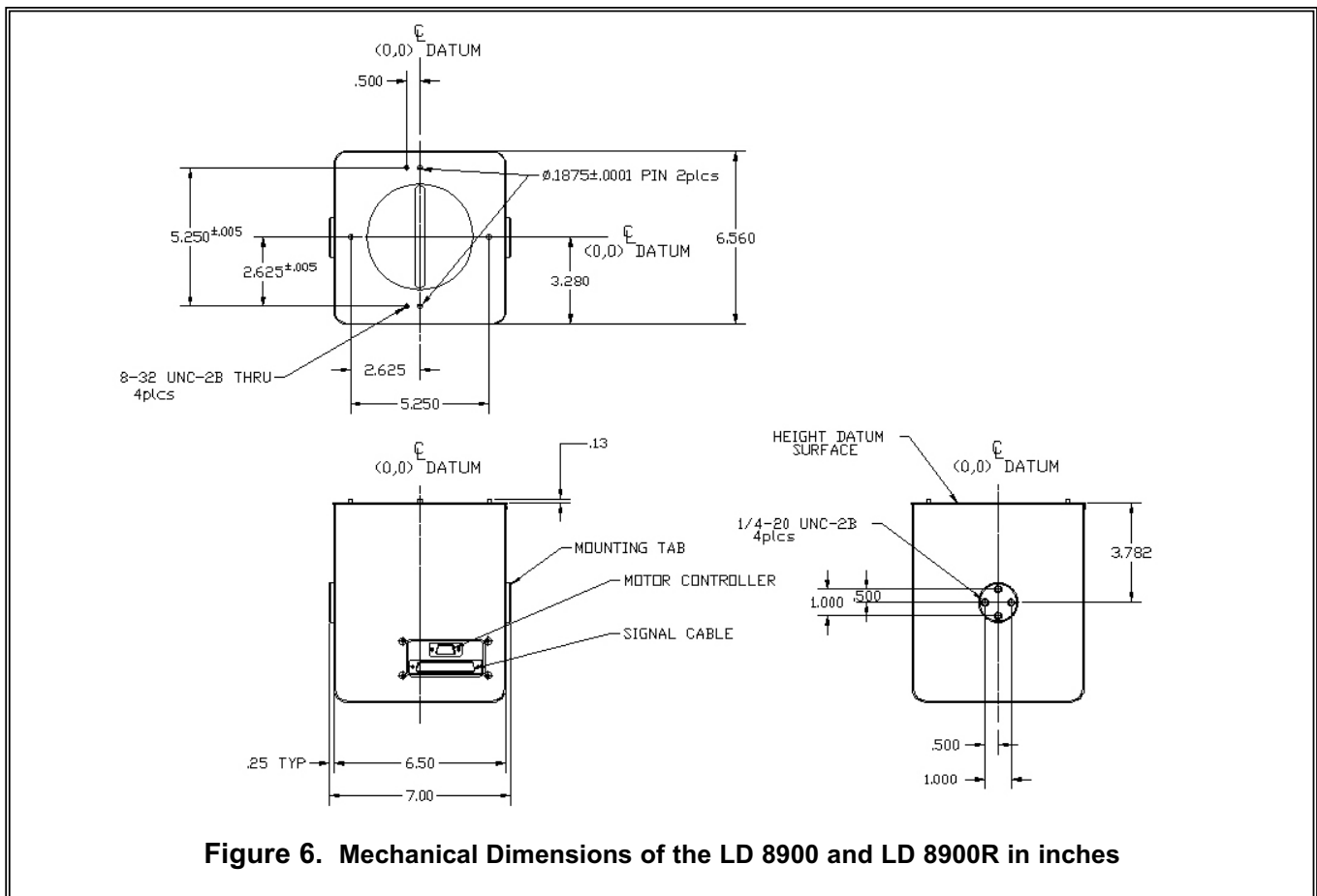
**Answer:** An error of a 0.1 cm in this distance results in approximately a 1% angular width error. This distance is input to the instrument software as the Aperture-Source distance in cm units. This distance controls the instrument angular field of view.

**Question:** My device points off the optical axis by a few degrees by design. How accurate is the measured angular width?

**Answer:** If you position the device on the optical axis 0,0 you will get good results using a full spherical measurement with at least 50 cuts and the centroid analysis. The more rapid XY orthogonal measurement mode will be somewhat in error because it assumes the beam centroid is coincident to the optical axis.

**Question:** Will Photon help with our mechanical designer's questions when we design our own mounting?

**Answer:** Yes. We want you to be successful using the instrument. Photon will provide reasonable support to your design department. When you are ready to begin your design, call for a copy of key chapters from the instrument



**Figure 6. Mechanical Dimensions of the LD 8900 and LD 8900R in inches**