Bare Fiber Holder Eases Positioning for Optical Measurements

Measurements are accurate and repeatable from device to device and user to user.

ILX Lightwave Corporation, Bozeman, Montana

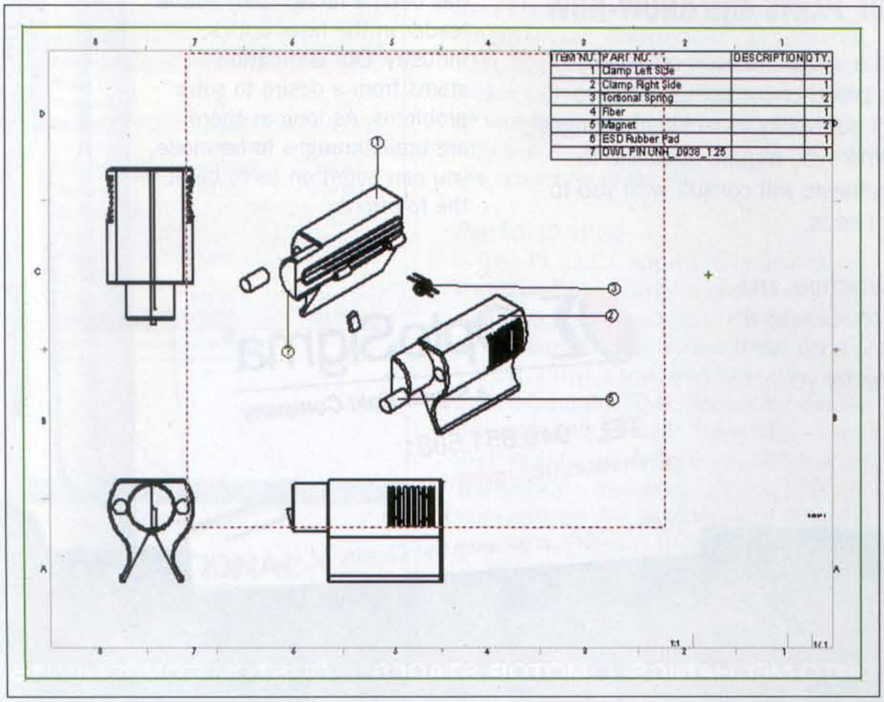
Bare fiber measurements are common in optical component manufacturing before the device under test (DUT) is connectorized and final tested. Insertion loss and polarization dependent loss are typical measurements on passive components before they are connectorized. The precision of these measurements is high, on the order of ±0.01 dB, and repeatability of the measurements is critical in determining the ultimate throughput of the process and devices. With small fiber cores, 8 to 62.5 µm, handling bare fiber for measurements is difficult because the fiber core is easily susceptible to breakage.

A patented bare fiber holder design has been developed to ease the difficulty of making accurate and repeatable bare fiber measurements. This unique design incorporates a clamshell style holder consisting of left and right injection-molded, interlocking halves with an internal, opposing V-groove. There are eight and nine V-grooves in each half, respectively. In the closed position, the tolerance between opposing V-grooves is 0.003 inches. The two halves are connected with a locating pin and torsional spring to maintain a normally closed position.

When the clamshell is closed, V-grooves gather the bare fiber into an accurate, repeatable placement while preventing damage to the fiber through bending or breaking. The opposing V-groove design also ensures there is no excess pressure on the fiber, thereby avoiding polarization changes in the light due to fiber distortion.

Figure 1. **Bare Fiber Holder** incorporates clamshell style holder with an internal, opposing V-groove.

A ten percent glass-filled polycarbonate was chosen for the bare fiber holder's material for its light weight, strength, high impact resistance, and high heat deflection temperature. The glass fill reduced the thermal expansion and increased the tensile strength and stiffness. Injection molding was chosen as the most cost effective way to maintain the tight dimensional tolerances on the interlocking V-grooves.



ITEM NO.	PART NO.	DESCRIPTION	QTY.
1	Clamp Left Side		1
2	Clamp Right Side		1
3	Torsional Spring		2
4	Fiber		1
5	Magnet		2
6	ESD Rubber Pad		1
7	DWL PIN UNH_D938_125		1

Figure 2. **Design Schematic** of clam shell style bare fiber holder.

Other considerations in the design include completely encapsulating the bare fiber, blocking any ambient light that would affect the measurement. Finger grips are integrated into the design so that single-handed positioning and placement of the holder into the power meter are possible. Nickel-plated neodymium magnets on both the inside and fiber exit tip ensure that the holder closes completely and is held in place once inserted into the power meter, drawing it into the adapter and holding it flush. Electrically conductive compression pads are included to eliminate static build-up on the holder, which eliminates electrostatic movement of the fiber upon insertion or removal.

The result is a very lightweight bare fiber holder that requires minimal thumb and finger pressure to hold open while positioning the bare fiber. Releasing the pressure on the thumb and finger tabs gently encloses the bare fiber, positioning it between the halves and locating it at the center of the holder.

This type of device can be used in any production or R&D environment requiring accurate and repeatable bare fiber measurements. A new precision fiber optic power meter, the FPM-8210, was developed in conjunction with the bare fiber holder. The FPM-8210 has a patented integrating sphere design that reduces polarization-dependent response of the meter as well as the sensitivity of measurement accuracy to axial placement of the bare fiber end, with respect to the integrating sphere.

Bare fiber testing with the holder and several ILX FPM-8210 power meters exhibited excellent repeatability in power measurements against rotational changes in the fiber and linear extension of the fiber from the tip of the holder. These factors, both of which are important in production testing of optical components, reduce the effort of an operator to position the bare fiber correctly to minimize measurement errors. This ultimately reduces the uncertainty in the measurement system. As shown in Figure 3, rotational repeatability ranged

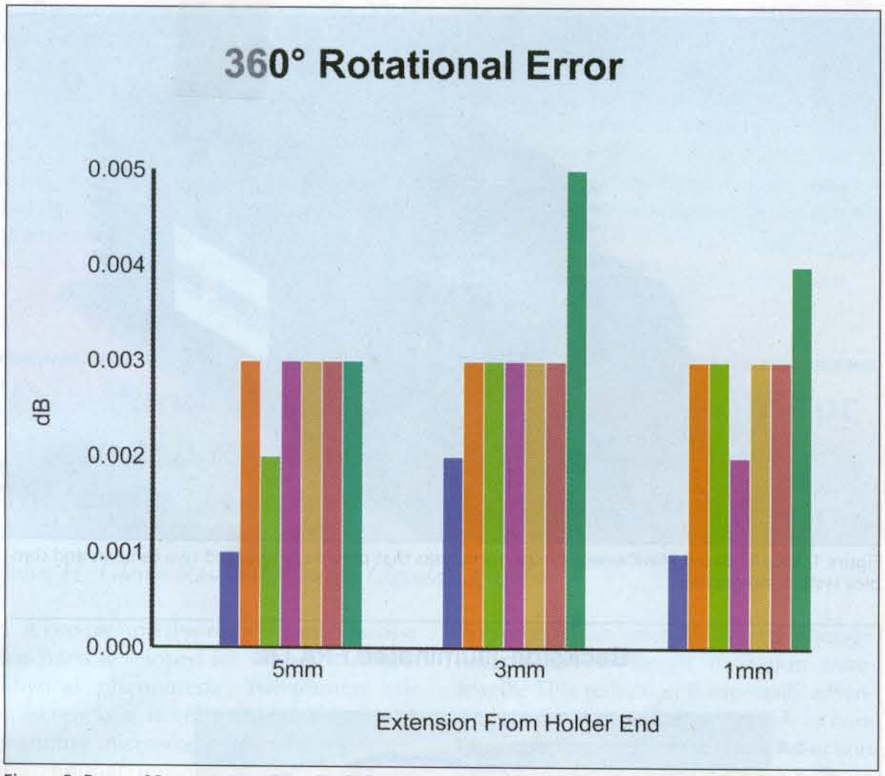


Figure 3. **Power Measurement Error** in dB by rotating the fiber 360∞ at 5, 3, and 1mm extension from the holder tip.

from 0.001 to 0.004 dB, while linear extension, 1 to 5 mm from the tip of the holder, exhibited a measurement repeatability of 0.001 to 0.003 dB. A statistical analysis for rotational and linear extension led to a three sigma specification of 0.003 dB power measurement repeatability. These errors are on the order of 0.0007% in the measurement.

This article was written by Thaddeus Orosz, Instrumentation Product Manager at **ILX Lightwave**. *For more information, call Thaddeus at (406)556-2559 or email him at torosz@ilxlightwave.com. ILX is online at www.ilxlightwave.com.*

Miniature Dual-Wavelength Camera Using InGaAs Focal Plane Arrays

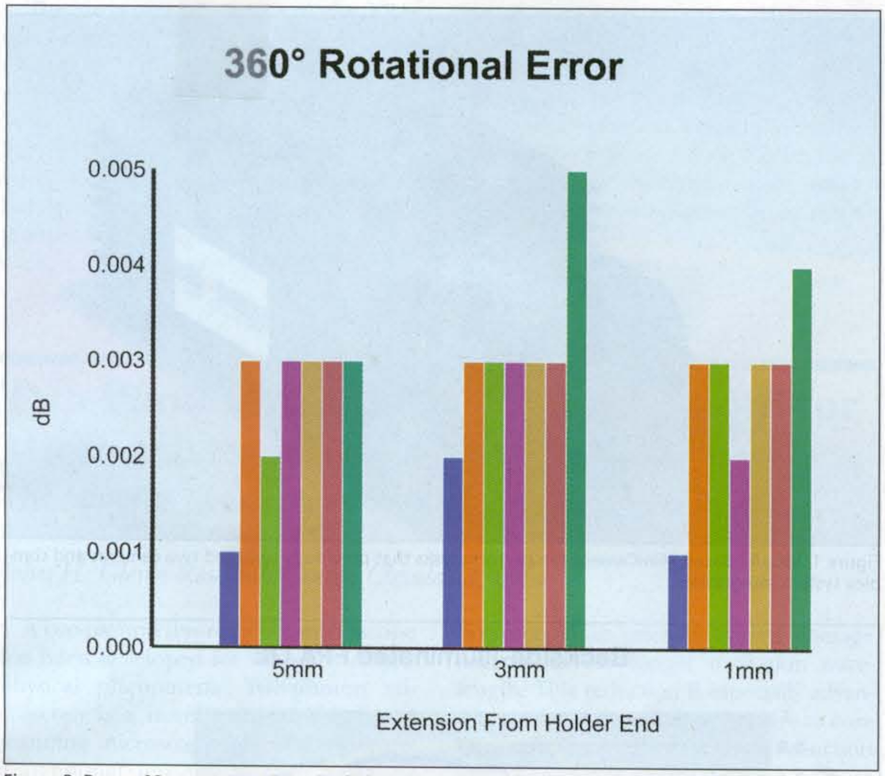
Camera simultaneously images visible and shortwave infrared light.

Sensors Unlimited Inc., Princeton, New Jersey

The recent development of indium gallium arsenide (InGaAs) focal plane arrays (FPAs) capable of imaging visible and shortwave infrared (SWIR) wavelengths has yielded a miniature dual-wavelength camera with no moving parts that weighs only 11 ounces, consumes less than 1.6 W of power, and operates at room temperature.

Capable of simultaneously imaging the visible and SWIR spectrum, the all solid-state camera can replace complex systems that previously required two cameras. Having a dual wavelength FPA in one camera decreases payload weight and size and simplifies image-fusion systems. The on-board non-uniformity corrections (NUCs) help make this compact imager simple to use and suitable for many applications in industrial machine vision, laser-beam profiling, and military imaging. Additionally, this camera outputs 12-bit digital RS-422 signals and EIA-170 analog video; the latter can be displayed on commercial TV monitors.

The camera's key element is a 320x240-pixel, backside-illuminated, substrate-removed, InGaAs photodiode array. In the traditional epitaxial structure for InGaAs PIN photodiodes, the absorption region is topped off with an InP cap. Unlike a frontside-illuminated format where light



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