FIBER-OPTICS TEST

FO Connector Types Affect Power Measurements

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You may think that one type of fiber-optic connector is just as good as another. And you may think the same about vendors: A connector from one is the same as a connector from another. According to our research, though, the types of connectors you use *can* make a difference in power measurements—up to 10% in some cases. To make accurate power readings, be sure to calibrate your optical power meters with the same type of connector you'll use in your measurements.

The graph in **Figure 1** shows the variation in power (normalized to our standard) that we measured in an experiment in which we compared connector types from one vendor. In that experiment, the relative power differences, or offset, from one type of connector to another ranged from 3% to –0.5%. The graph in **Figure 2** illustrates how one type of connector from several vendors affected our power measurements. That graph shows a variation of the offset of from about 5% to 0.5%.

Our experiments show that power offsets can be repeatable. So, if you calibrate a power meter with one type of fiber-optic connector and then switch to another type of connector for your measurements, you may get repeatable, but erroneous, power readings. (Although we used four types of power meters in our experiments, the graphs show only those results for a power meter with an InGaAs detector and fiber pigtails.)

The magnitude of the variations we found depends on wavelength, too. The effects are smaller when a connector has a non-reflecting surface or if the power meter's sensor is angled. A connector with a highly reflecting surface often causes a

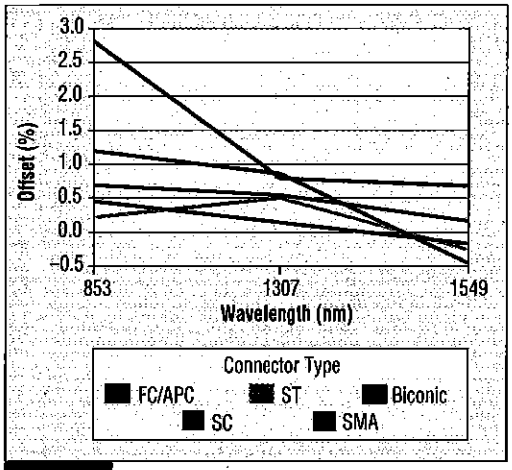

FIGURE 1. A plot for five types of connectors from one vendor shows an offset error that ranges from about 3% to –0.5%. Measurements were referenced to an FC/PC connector (0 offset at the three wavelengths), and the test meter employed an InGaAs detector.

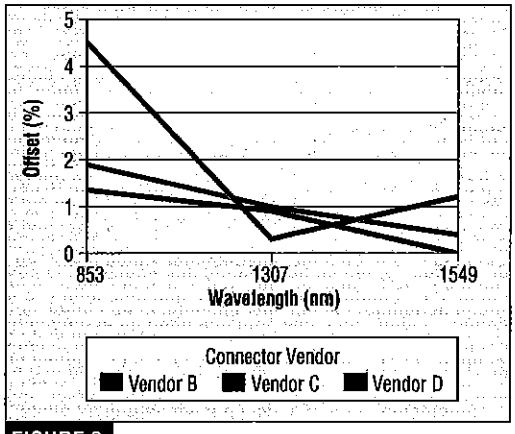

FIGURE 2. The plot for an ST-type connector from three vendors shows an offset error that ranges from about 5% to 0.5%. Measurements were referenced to an ST-type connector from a fourth vendor (0 offset at the three wavelengths), and the test meter employed an InGaAs detector.

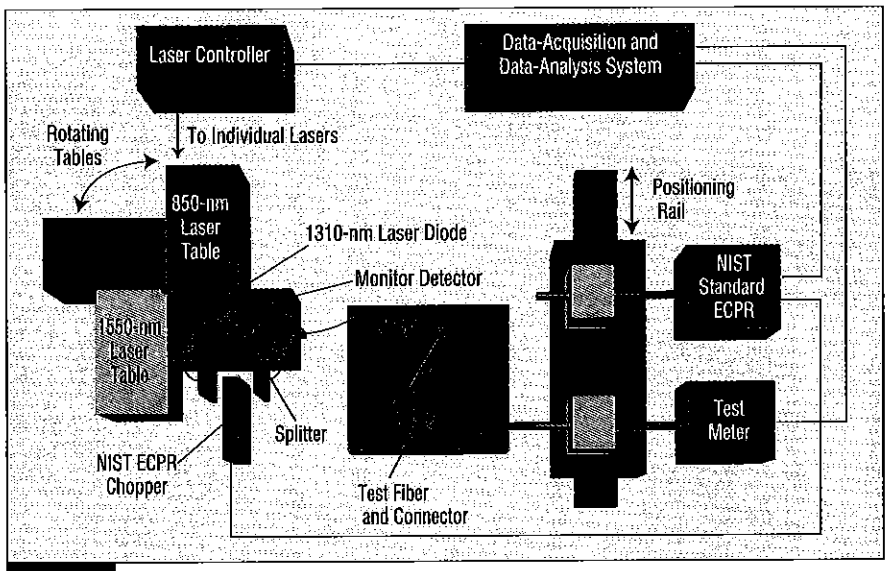

FIGURE 3. The experimental setup provides three lasers on a turntable and two power meters on a positioning rail. We took power measurements using a NIST standard power meter and four commercial power meters, one at a time.

power meter to read incorrectly, usually giving a higher-than-expected power reading.

Test at Several Wavelengths

During our tests we made measurements at three standard wavelengths that are used in communication systems—850 nm, 1310 nm, and 1550 nm. We ran experiments with six common types of connectors (FC/PC, FC/APC, ST, biconic, SC, and SMA), and we bought connectors from four vendors we chose at random.

Our experimental setup (**Fig. 3**) included three lasers and two optical power meters. We used a commercially available electrically calibrated pyroelectric radiometer (ECPR) that we calibrated at NIST as a reference. The second power meter was one of the four we used to take the experimental data. Thus, we could compare the power measured by a carefully calibrated meter to the power measured by any of the test meters.

During the course of our experimental run, we tried several types of commercially available power meters with different types of photodetectors. A data-acquisition and analysis system controlled the equipment. During a run, we measured the power by placing a fiber and its connectors between the laser sources and the power meters.

To make connections easy and reproducible, we put the laser sources on a rotating table. And we put the power meters on a sliding rail so we could move them into position without changing the position of the test fiber. During a run, we took five sets of data for each measurement, and the data show that our power measurements are repeatable and that each connector's offset is consistent. *T&MW*

FOR FURTHER READING

1. Vayshenker, I., X. Li, D. Keenan, and T.R. Scott, "Errors Due to Connectors in Optical Fiber Power Meters," *NIST Special Publication 905*, NIST, Boulder, CO, pp. 49-52, 1996.

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