Faraday Rotator Mirror

Introduction

General Photonics' Faraday Rotator Mirror (FRM) is a fiber optic polarization rotation mirror designed for fiber optic networks and measurement applications. The state of polarization (SOP) of the reflected light is rotated 90˚ from that of input light. One unique property of the FRM is that at any point along the fiber, the SOPs of the forward and backward optical wave are always orthogonal to each other, regardless of the birefringence of the fiber. Our epoxy free optical path Faraday Rotator Mirror offers low insertion loss, low PDL, and high temperature stability. The NoTail™ version is also available to eliminate the headaches of pigtail handling and unwanted optical path delay. This device is ideal for polarization control in fiber laser systems, fiber sensors, and fiber interferometers, as well as for polarization sensitivity elimination in bulk diffraction grating systems.

This application note is intended to offer guidance on the principle, construction, dimensions, performance, and applications of the device. For additional information, please contact General Photonics Corporation at (909) 590-5473.

Principle and Construction

The Faraday Rotator Mirror is a Faraday Effect device in which a non-reciprocal rotation of a polarization state occurs as it passes through a special optical medium under a magnetic field. Our FRM consists of a fiber collimator, Faraday rotator, and mirror, as shown in Figure 1.

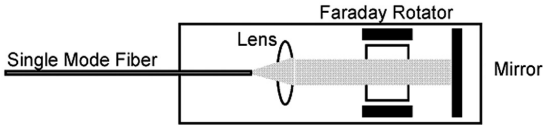

Fig. 1 Internal construction of Faraday Rotator Mirror

In single mode fiber systems, random birefringence due to stress or unevenness in the fiber core makes the SOP of an optical beam fluctuate along the fiber line. Installed at the end of an optical fiber, the Faraday Rotator Mirror is designed to rotate an input signal's SOP by 45°. When the signal is reflected back, it passes the Faraday rotator again. Since the Faraday Effect is non-reciprocal, the resultant SOP is rotated by 90° with respect to the original signal. The FRM thus functions as a phase conjugate mirror and cancels out all linear birefringent effects in this round trip.

Dimensions

The compact cylindrical package of this Faraday Rotator Mirror is easy for users to integrate into test and measurement systems, networks, fiber sensors, fiber interferometers, and fiber laser systems. The dimensions of the Faraday Rotator Mirror are illustrated in Figure 2.

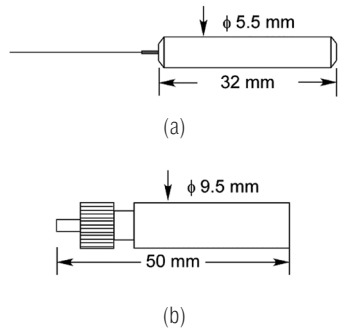

Fig. 2 Mechanical dimensions of the Faraday Rotator Mirror.
(a) Standard pigtailed package; (b) NoTail™ package

Applications

The Faraday Rotator Mirror has a wide range of applications in bulk grating systems, Erbium doped fiber amplifiers, tunable fiber lasers, fiber interferometers, and fiber sensors. Figure 3 shows some typical applications.

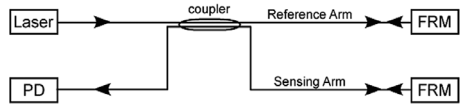

Fig. 3(a) Interferometric fiber sensor using Faraday Rotator Mirror

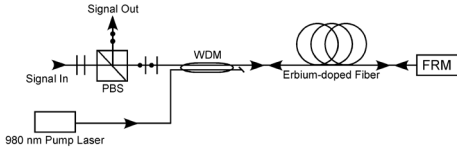

Fig. 3(b) Fiber amplifier using Faraday Rotator Mirror where signal can double pass the Erbium doped fiber to increase the efficiency.

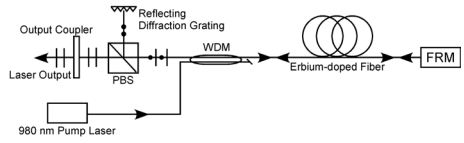

Fig. 3(c) Tunable Fiber laser using Faraday Rotator Mirror. Narrow linewidth and high power laser output can be achieved by changing the reflecting diffraction grating mirror setting.

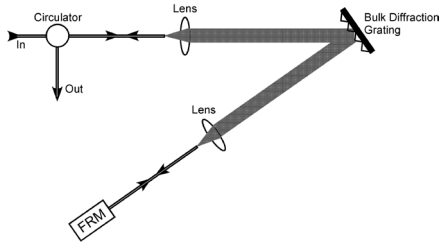

Fig. 3(d) PDL elimination in bulk diffraction grating systems using a Faraday Rotator Mirror.