



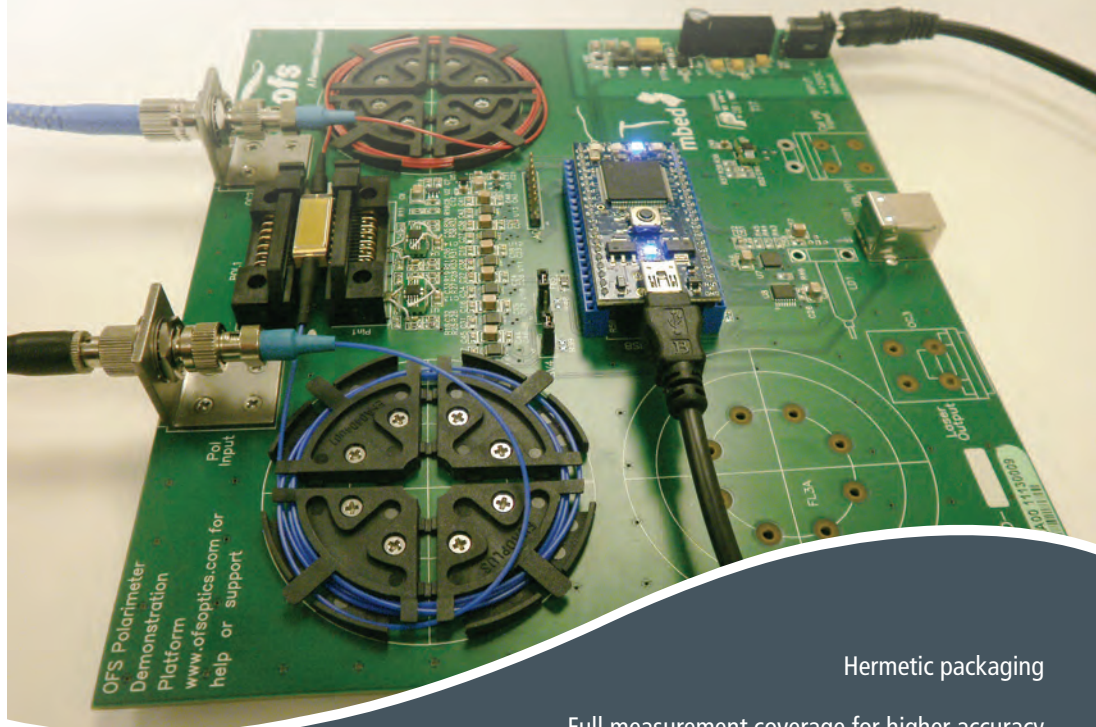
A Furukawa Company

Specialty Photonics Division

Your **telecom** Optical Fiber Solutions Partner

TruePhase® IPLM Inline Polarimeter Platform

Small form factor, inline, high speed and all fiber module



Hermetic packaging

Full measurement coverage for higher accuracy

Polarization analysis with PMD, OSNR monitoring

Low insertion loss and PDL

Optical signal monitoring has become all the more important to ensure reliable operation of complex, high speed optical networks. Therefore, real-time measurement of the state of polarization (SOP) and degree of polarization (DOP) of optical signals is a compelling need in optical transmission systems. Such polarization measurement is required to accurately monitor polarization dependent loss (PDL), polarization-mode dispersion (PMD) and optical signal to noise ratio (OSNR).

OFS Fitel LLC now offers the industry's smallest form factor, all fiber module, which provides high-speed polarization characterization without compromising the data traffic. System vendors can now easily integrate this specialized building block into their system electronics for optical channel monitoring.

OFS Fitel LLC

OFS Specialty Photonics is an industry leader for optical innovation as a world-leading designer, manufacturer and provider of specialty optical fibers, fiber-based devices, gratings, optical connectivity and specialty photonics products. The TruePhase IPLM Inline Polarimeter module is another patented innovation that leverages OFS competencies in fiber technologies, optical fiber design, fiber gratings and lasers.

Applications

- Test & Measurement (T&M)
- Optical system line cards
- Optical channel monitors
- EDFA module integration
- Field diagnostic tools and handhelds
- Sensors

OFS TruePhase® IPLM Inline Polarimeter

The OFS TruePhase IPLM Inline Polarimeter is an all fiber module with no moving parts that enables customers to perform high speed polarization characterization of light passing through the module. Its small form factor is ideal for integration into PCB designs in telecom systems, T&M, and diagnostic applications. Figure 1 shows the design architecture of the TruePhase® IPLM.

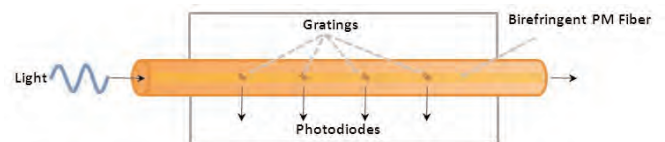


Figure 1 | OFS Polarimeter Architecture

As seen in the design architecture, the TruePhase IPLM utilizes birefringent fiber together with fabricated gratings and photodiodes. As light propagates through the fiber, the gratings couple light out to the photodiodes, which in turn then generate electrical signals. These signals are used to measure the polarization state of the light in the optical fiber.

The measurements can be used to determine DOP, SOP and Optical Power. These measurements can be used to determine other key network performance parameters such as OSNR and PMD.

Stokes Vector and Poincaré Sphere

The TruePhase IPLM device allows measurement of the full Stokes vector, which is a four-element vector (S_0 , S_1 , S_2 , and S_3). This vector describes the amplitude and phase information of a lightwave. Typically, the Stokes vector is displayed using the Poincaré Sphere, which is an intuitive graphical tool that allows a convenient description of polarized signals.

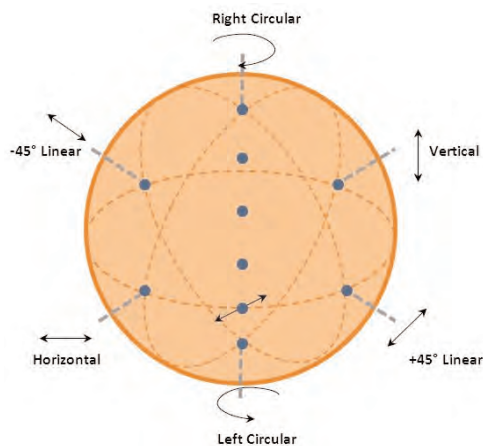


Figure 2 | Poincaré Sphere

As seen in Figure 2, any state of polarization is represented by a point on a unit sphere centered on a Cartesian coordinate system (x,y,z). This co-ordinate in 3D space is defined by the three normalized Stokes parameters S_1 , S_2 and S_3 .

Ruggedized Packaging

The TruePhase IPLM is a hermetically packaged device. It has been designed to pass Telcordia GR-468 reliability qualification. Hermetically sealed devices are much more resilient to harsh environmental conditions, as they are impervious to the elements.

Approach Advantages

The all fiber design of the TruePhase IPLM module removes the need for bulk optics due to many of the associated disadvantages such as complexity, large form, temperature sensitivity, high costs and alignment problems. The result is a small form factor package that is more flexible for easier integration and better optimization of system design.

In addition, the fiber gratings approach has several advantages over other techniques, which can terminate, split or tap light. Another feature of the module is the simultaneous measurement of all four Stokes parameters compared to sequential approaches.

The inline module has low insertion loss (IL), less than 0.8dB, without compromising any of the data traffic passing through the module. The module has good return loss (RL). The resulting benefits are to maximize the light transmitted through the module, minimize the interference with the light source, minimize bit error rates (BER) and maximize OSNR.

As discussed earlier, full coverage of the Poincaré Sphere indicates higher accuracy in SOP and DOP measurements.

“Due to a variety of factors, PMD is a complex phenomenon that is difficult for standard telecom equipment to measure quantitatively. Left unchecked or decisions based on ad-hoc testing, PMD occurrence significantly limits the bandwidth of the optical fiber in the telecommunication network. Therefore, PMD characterization for monitoring and compensation purposes is critical in the optical infrastructure as deployment to 40Gb/s and 100Gb/s accelerates.”

Software and Calibration Data

Each TruePhase IPLM module has its own calibration data, which covers the full C-band and can be expanded to cover wavelengths as desired. Software is also provided for visually displaying polarization measurements on a Poincaré Sphere as well as power. Therefore, a separate device for power measurements is not required. Figure 3 shows an example of the Polarization Ellipse, which indicates the polarization state.

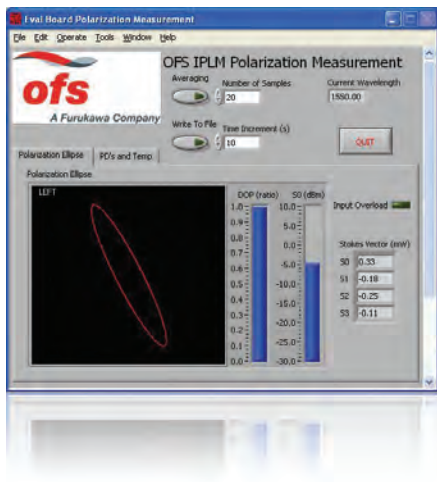


Figure 3 | IPLM Software Tools

Other tools that can be used are the Poincaré Sphere or Time Domain Charts, which can show the Stokes parameters over time.

Test Evaluation Board (TEB)

An optional test evaluation board is available with the TruePhase IPLM module. This can help product development engineers to rapidly perform qualification of the module, as the board electronics captures and forwards all the data to a computer via a USB interface. Figure 4 shows the TEB, with the TruePhase IPLM connected to measure polarization.

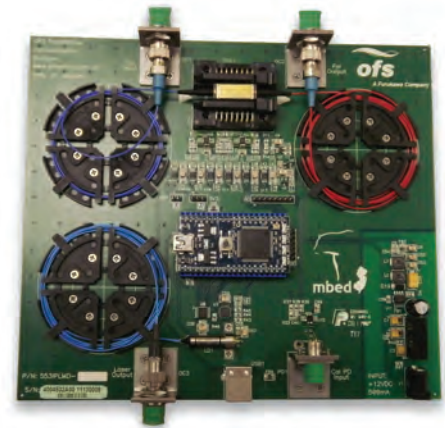


Figure 4 | Test Evaluation Board

“PMD characterization and mitigation requires a high performance monitor. The OFS TruePhase IPLM Inline Polarimeter is just such a device that measures polarization state changes through SOP and DOP in real-time, which can be used to calculate and measure PMD.”

“The TruePhase IPLM is the industry’s smallest form factor, all-fiber module that provides full real-time measurement. It can be easily integrated into electronic circuitry to utilize its versatile functionality.”

Summary

The TruePhase IPLM is the smallest form factor in the industry, primarily due to an innovative approach utilizing gratings in an all fiber device. With a more accurate mechanism of performing polarization measurements inline and at high speed, the module is ideal for integration into optical systems, T&M equipment, optical channel monitors, custom diagnostic tools and EDFA's. To learn about how the TruePhase IPLM module can be used in your application, contact your OFS Fitel Account Manager.

Ordering Information

Product Code	
IPLM-155G-G1-	SMS, SMP or PMP for fiber interface
IPLM-155G-G1-TEB	Test Evaluation Board

Specifications

Optical Parameters	Specification
Wavelength Range	C Band, 1550 ± 20 nm
Optical Input Power Range	-15 dBm to +5 dBm
Insertion Loss	<0.8 dB
Return Loss	>55 dB
Wavelength Dependent Variation	<0.1 dB
Poincaré Sphere	Full coverage
SOP Accuracy	<1% (calibration)
DOP Accuracy	± 1.5% (calibration)
PDL	0.15 dB max

Environment Parameters	Specification
Storage Temperature	-40°C to +85°C
Operating Temperature	-5°C to +75°C
Hermetic Package	Yes

Physical Parameters	Specification
Dimensions (mm)	20.5 x 7.37 x 4.28
Package	16-pin Mini-FLAT style
Fiber Interface	SM-SM, SM-PM and PM-PM
Pigtail Type	900 µm loose tube
Optical Connectors	FC-UPC

This document is for informational purposes only and is not intended to modify or supplement any OFS warranties or specifications relating to any of its products and services. Drawings are not to scale. OFS reserves the right to make changes at any time, without notice, to the products and specifications described in this document.

OFS products described herein may be subject to the U.S. Export Administration Regulations and may require approval from the U.S. Department of Commerce, Bureau of Industry & Security, prior to export.

TruePhase is a registered trademark of OFS Fitel, LLC.

Copyright © 2011 OFS Fitel, LLC.
All Rights Reserved.

0911 SPD



SPECIALTY PHOTONICS DIVISION

25 Schoolhouse Road
Somerset, NJ 08873

Phone: 1 732 748 7403
Toll Free: 1 888 438 9936
Email: Info@SpecialtyPhotonics.com
Web: www.SpecialtyPhotonics.com

