Reset-Free Polarization Tracker – PolaStay™

The PolaStay™ polarization tracker automatically adjusts the state of polarization (SOP) towards a reference SOP, counteracting continuous input SOP variations as fast as 0.7 ms with no resets. The reference SOP is determined by a feedback signal which can be provided either internally or externally. The internal feedback version (POS-002-I) consists of a fiber squeezer polarization controller, in-line polarization monitor, digital and analog circuits, and proprietary algorithm. The error signal from the polarization monitor is fed back to the polarization controller to maintain a linear SOP at the output. The external feedback version (POS-002-E) replaces the internal polarization monitor with an external analog electrical feedback signal of the user's choice, such as a voltage proportional to the degree of polarization (DOP) measured by a polarimeter, the bit-error rate (BER) from a BER chip, the RF spectrum of a detected signal, or the optical power after a polarizer. The output fiber can be either single mode fiber or PM fiber with the SOP aligned to its slow axis. This module can be used for PMD compensation, polarization division demultiplexing, elimination of polarization fading in coherent detection and fiber sensor systems, suppression of noise figure in optical amplifiers, and reduction of PDL effects.

Specifications:

Operating Wavelength Range[1]	1310 or 1550 ± 50 nm
SOP Recovery Time	< 2 ms (0.7 ms typical)
SOP Rotation Tracking Speed (Reset Free)	47 π/s
SOP Accuracy[2]	< 0.1 dB
Repeatability[2]	< 0.1 dB
Insertion Loss	Internal feedback: 0.8 dB typical, 1.2 dB max. External feedback: < 0.1 dB
Return Loss	> 50 dB
Isolation in Orthogonal Polarization	20 dB
Optical Input Power	-20 dBm to 20 dBm standard (low power option available) for internal feedback version
External Feedback Voltage	0 to 4.6 volts for external feedback version
Optical Power Handling	20 dBm max., higher possible
Optical Power Damage Threshold	300 mW
Operating Temperature	0 to 70 ˚C
Storage Temperature	-20 to 70 ˚C
Power Supply	+12 VDC / 0.5A - 12 VDC / 0.15A
Communications Interface[3]	RS-232
Dimensions	0.75" (H) x 3.8" (W) x 7.25" (L)

Notes: Unless otherwise noted, specifications listed above are for the standard configuration with internal feedback option without connectors; specs may be different for instruments with different wavelength or input power ranges.
1. Other wavelengths and control algorithms may be available upon request.
2.The output power fluctuation caused by SOP fluctuation after passing through a polarizer.
3. Requires a special cable (included).

Features:

· Reset free operation
· 0.7 ms recovery time
· 47 π/s tracking speed
· Plug and play

Applications:

· PMD compensation
· Polarization demultiplexing
· Elimination of polarization fading
· Coherent detection

Tech Info: p. 100, 215
FAQ: p. 228

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Typical Performance Data:

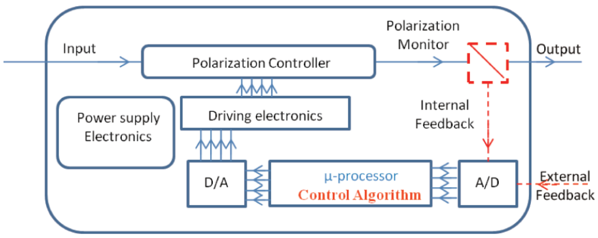

Figure 1. PolaStay™ polarization tracker function diagram. Either internal or external feedback can be used. Diagram shows structure for internal feedback.

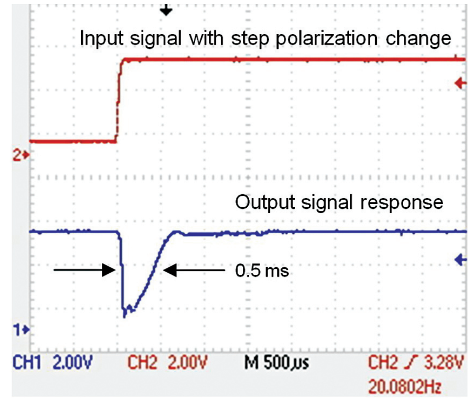

Figure 2 POS-002-I compensation for a step polarization change.

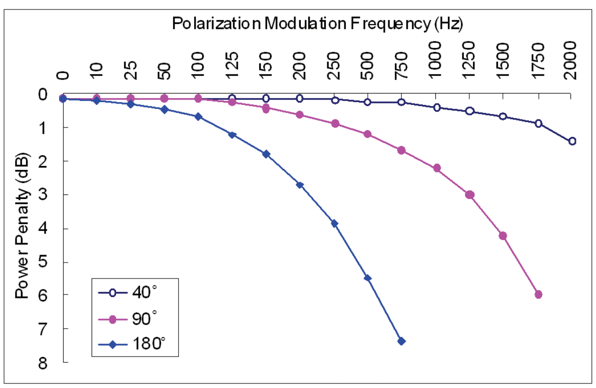

Figure 3. POS-002-I tracking of sinusoidal polarization modulation.

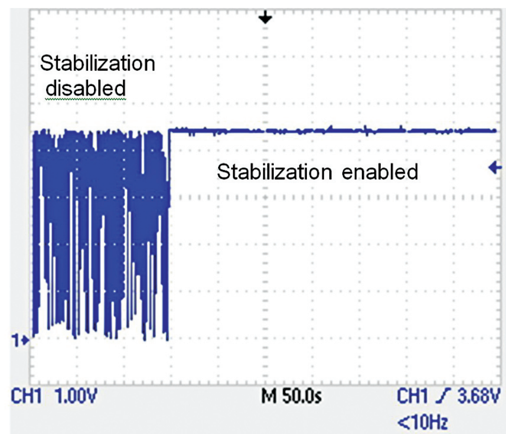

Figure 4. POS-002-I tracking of half-wave plate rotation at 45π rad/s.

Ordering Information:

POS — 002 — □ — □ □ — □ □ — □ □ □

Feedback Option:
I = internal
E = external

Output Fiber:
SM
PM

Wavelength:
13 = 1310 nm
15 = 1550 nm

Connector Type:
FC/PC, FC/APC,
SC/PC, SC/APC
Others specify

Accessories:

NoTail™ Isolator p. 91
NoTail™ Polarizer p. 90
NoTail™ Coupler p. 85
NoTail™ PM Couplers p. 86
NoTail™ PBC/S p. 87
NoTail™ Circulator p. 92

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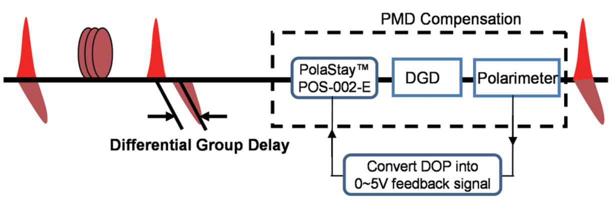
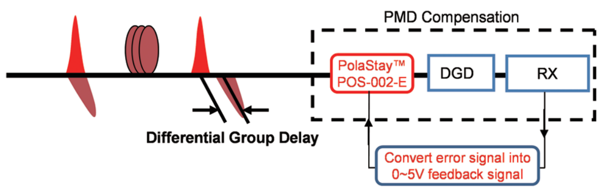
Application examples:

PMD compensation

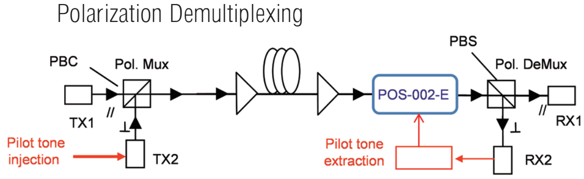


Scheme 1: Using a polarimeter to obtain feedback signal. In this scheme, a polarimeter is used to detect the degree of polarization (DOP) of the signal to indicate the PMD effect on the signal. The DOP will be maximized when the PMD is properly compensated. The user constructs a simple circuit to convert DOP into an analog signal between 0~5V and feeds this signal back to the POS-002-E. The polarization tracker then automatically maximizes DOP to achieve PMD compensation.

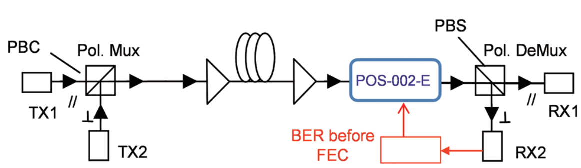


Scheme 2: Using the receiver to obtain the feedback signal. In this scheme, the error signal indicating the PMD effect can be a clock signal from the receiver's photodetector or a BER detected before FEC inside the receiver. The user converts the error signal into an analog signal between 0~5 volts and feeds it back to the POS-002-E. The polarization tracker then either maximizes or minimizes the error signal to achieve PMD compensation.

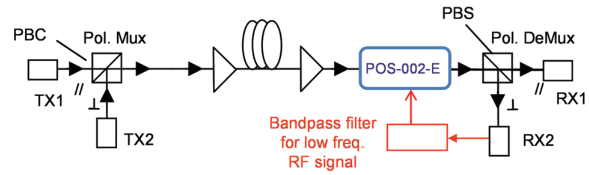
Polarization Demultiplexing



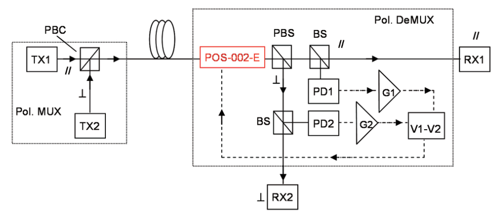
Scheme 1: Pilot tone detection. A low frequency pilot tone around 100 kHz is injected at one of the transmitters. At the receiving end, a pilot tone extraction circuit can be used to detect the strength of the pilot tone and convert it into a 0~5V feedback signal for the POS-002-E. The detected pilot tone will be maximized when the two polarization channels are properly separated. The polarization tracker then automatically maximizes the feedback signal to separate the two polarization channels.



Scheme 2: BER detection. The bit-error rate (BER) before the forward error correction (FEC) in the receiver is detected as the error signal for polarization demultiplexing. The BER will be minimized when the two polarization channels are properly separated. A simple circuit can be used to convert the BER into a 0~5V feedback signal for the POS-002-E: the bigger the voltage, the smaller the BER. The polarization tracker then automatically maximizes the feedback signal to effectively separate the two polarization channels.

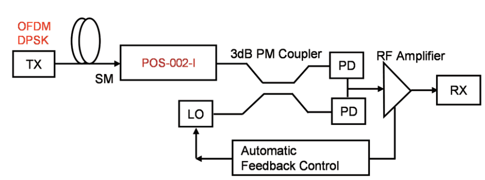


Scheme 3: Low frequency RF detection. The low frequency correlation noise between two polarization channels is an indication of the channel crosstalk. The noise will be minimized when the two polarization channels are properly separated. A low frequency photodetector followed by a bandpass filter can be used to detect the noise level. A simple circuit can be used to convert the noise level into a 0~5V feedback signal for the POS-002-E: the bigger the noise, the smaller the feedback signal. The polarization tracker then automatically maximizes the feedback signal to effectively separate the two polarization channels.



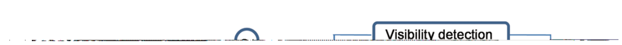
Scheme 4: Power imbalance detection. The two polarization channels are set at different power levels and the detected power difference is an indication of polarization channel separation. A simple circuit can be used to convert the noise channel power difference into a 0~5V feedback signal for the POS-002-E. The polarization tracker then automatically maximizes the feedback signal to effectively separate the two polarization channels.

Coherent Detection



In a coherent detection system, the states of polarization of the signal and local oscillator must be the same in order to maximize signal to noise ratio. A POS-002-I can be used to stabilize the SOP of the signal after it propagates through the transmission fiber. The SOP of the output of the polarization tracker is linear and aligned with the slow axis of the PM fiber pigtail and will beat with the local oscillator.

Polarization Tracking for Sensor System



In an interferometric sensor system, the detection sensitivity is directly related to the SOPs of the two interfering signals. A POS-002-E can be used to obtain the maximum detection sensitivity. In this application, the visibility of the sensor can be monitored with a phase modulator and can be converted into an analog signal of 0-5 volts to be fed back to the POS-002-E. The polarization tracker then automatically maximizes the visibility for stable, optimized detection sensitivity.