MAP-200 Polarization Controller Module, MPCX-C1

The Multiple Application Platform (MAP-200) Polarization Control Module (mPCX-C1) is a single slot high-speed polarization scrambler, controller and stabilizer. Based on Lithium-Niobate, the electro-optic wave-plates have the response time required by the most demanding polarization management applications. With the rise of coherent modulation formats and polarization multiplex systems, there is a new premium on understanding the way the polarization state of these signals interact with single-mode fiber. The mPCX-C1 module is designed to enable these tests, not only in the laboratory, but also in the transition of these tests to a manufacturing environment.

At its core, the mPCX-C1 cascades eight quarter wave-plates; each calibrated over the C+L band. These wave-plates can be rotated at high speed and are reset-free (endlessly rotatable) to control the state of polarization (SOP). Simple, predefined, rate-programmable, and polarization scrambling modes are provided which can achieve rates up to 3M rad/s. Alternatively, user-defined tables can be uploaded for custom scrambling patterns. With the proprietary SOP feedback option, two features are unlocked. The first enables an identified state to hold while the mPCX-C1 counteracts normal environmental drift and the second simplifies the automatic generation of unique diagnostic scrambling modes.

Features and Benefits

- High-speed polarization scrambler, rate programmable from 1.00 rad/s to 3.00 Mrad/sec
- Operation in C+L band with less than 3dB of Insertion Loss
- Uniform scrambling by design, independent of input state of polarization
- Six advanced scrambling modes including Rayleigh, Random and Ring
- Polarization stabilization and return-to-state capability with proprietary SOP feedback option
- Manual polarization control via classic waveplates

Applications

- Photonic communication test automation
- 100G+ coherent interface testing
- Temporal depolarizer for loss, gain and PDL min/max measurements
- Stabilization and tracking of target SOP

Compliance

- CE, CSA/UL/IEC61010-1, and LXI Class C requirements (when installed in a MAP chassis)

Light Direct

The mPCX-C1 module, as part of the MAP-200 family, is an Ethernet or GPIB-controlled modular instrument that can be directly managed from your PC-based automation system. A member of the LightDirect Family of MAP-200 modules, the mPCX-C1 can be deployed in the compact MAP-220C 2-slot chassis or the larger 3 and 8 slot rack-mount chassis systems (MAP-230B or MAP-280). Alongside many other modules, such as amplifiers, precision attenuators, power meters and spectrum analyzers; the MAP-200 is the ideal, modular photonics test platform for 100G+ test applications.

MAP-200 LightDirect Family of modules

Basic Operation and Control

The mPCX-C1 has two basic operational modes:

Direct Wave-plate Control

In wave-plate mode, the angles of individual wave-plates can be controlled directly. Static angles or rotational velocities can be set. The user can select between two control modes; two quarter wave-plates (Q-Q configuration) or two quarter waveplates separated by a half-wave-plate (Q-H-Q configuration). Full control over each element is provided and user settings can be saved and recalled as presets.

Scrambling

Six predefined scrambling patterns are provided as well as one user definable mode. Scrambling modes are differentiated by three outcomes; the rate at which the SOP changes, the distribution of angle changes (as viewed on the Poincare sphere) and finally the coverage of the Poincare sphere.

The MPCX-C1 GUI is simple and intuitive. All commands can be executed by SCPI as an alternative

SOP Feedback Option

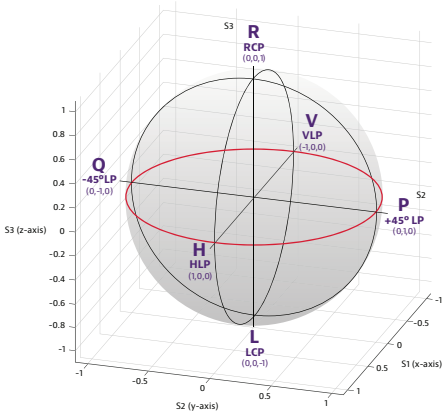
SOP Feedback is the option that enables monitoring of the output state of polarization. While not a full polarimeter, several key features are enabled in a very cost effective manner.

Automated Ring Alignment

A great circle through the equator is a unique and powerful scrambling mode. It does however require a very specific input polarization state. With SOP Feedback enabled, the mPCX-C1 automatically adjusts itself to ensure this pattern is achieved with no manual intervention or external feedback.

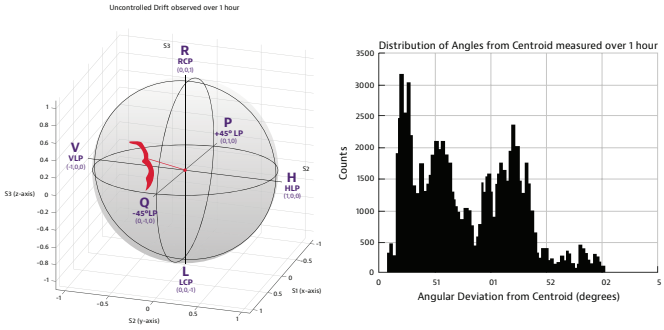
State Tracking and Return

Holding or returning to a specific SOP is also enabled. This can be very powerful when test cases require alternating between a specific SOP and scrambling or when longer term testing is required and drift of the SOP is not desirable.



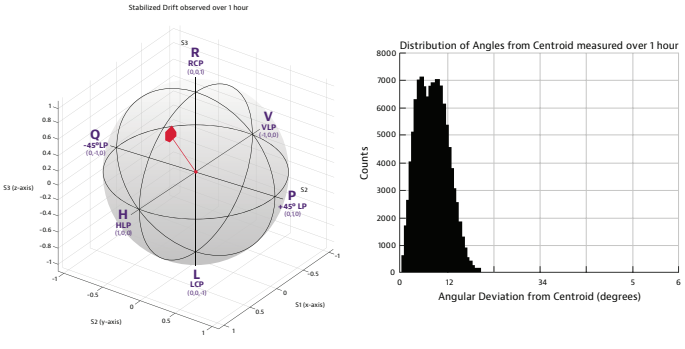
Drift (Uncontrolled)

60 min



Drift (Stabilized)

60 min



With the stabilization mode enabled, a tagged SOP can be held

Scrambling Dynamics

The mPCX-C1 has six pre-defined scrambling patterns available and one user defined mode. These patterns allow the user to tailor the level of complexity of the scrambling. Scrambling complexity is a function of the rate distributions and sphere coverage.

Random

Random scrambling is characterized by uniform coverage of the Poincaré sphere. The continuous evolution of the SOP can generate change rates of up to 3 Mrad/s and as low as 1 rad/s. For applications requiring rapid depolarization, this mode will generate a DOP of <5% in less than 10µs.

Rayleigh Distribution

This mode has full sphere coverage. The instantaneous rate of change follows a Rayleigh disribution which is biased towards lower rates but does occasionally have very high rates. This mode can be modified by changing the mean of the distribution. This pattern is often used for fiber emulation.

Ring (ideally used with SOP Feedback)

Ideal ring modes form great circles and orbit the Poincaré sphere. They generate a single constant ΔSOP frequency. For modules with SOP feedback, the ring trajectory can be auto-aligned to create a great circle pattern. Run open loop, the orientation of the ring will depend on the input SOP. This pattern is ideal for generating a depolarized signal with a constant ΔSOP signature.

Polar Ring Pattern (ideally used with SOP Feedback)

Starting from an auto-aligned ring pattern, an additional rotational component can be added to create the Polar Ring Pattern. This pattern maintains a constant ΔSOP signature, but has the advantage of fully covering all states of polarization as the great circles rotate.

Oscillating Ring Pattern (ideally used with SOP Feedback)

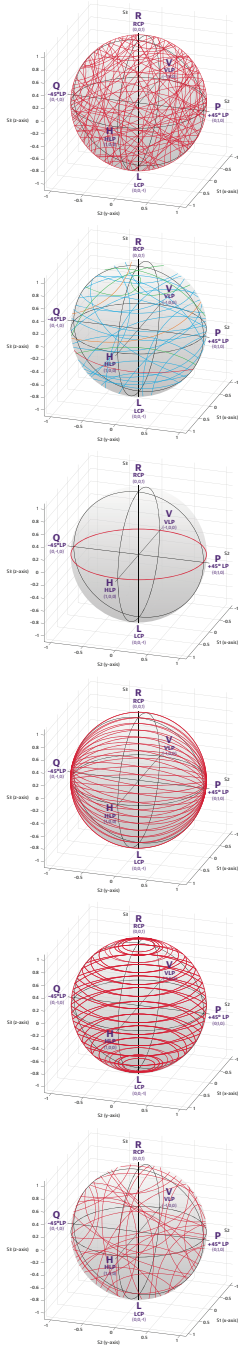
The oscillating ring pattern adds a rate component to a ring to transition from north-pole to south-pole. This mode also has complete sphere coverage, but adds the additional complexity as the ΔSOP rate changes with the diameter of the orbit.

Random Ring Pattern

The random ring pattern is a combination of the polar ring and the oscillating ring. It is very similar to a full random pattern. This mode is ideal for test cases where the SOP rate distribution complexity is being increased incrementally from an aligned ring state.

Discrete (User defined Scrambling)

User defined tables with up to 1000 entries can be created and stepped through. These selected states allow the user to create specific patterns



Specifications

	Standard	SOP Feedback Option
Basic Optical Specifications[1]		
Wavelength Range	1520 – 1620 nm	
Max Input Power	+20 dBm	
Insertion Loss[2]	< 3 dB	< 3.5 dB
Polarization Dependent Loss	< 0.2dB	
Return Loss	> 40 dB	
Manual Waveplate Mode[1]		
Control Modes	[QWP + QWP] or [QWP + HWP + QWP]	
Waveplate Rotation	Continuous (reset free)	
Waveplate Angle Setting Resolution	0.01°	
Maximum Waveplate Rotation Frequency	40 kHz	
Rotation Frequency Setting Resolution	0.01 Hz	
Scrambling Mode[1]		
Random		
Maximum Scrambling Rate Range (Poincaré space)	1.0 rad/s – 3.0 Mrad/s	
Maximum Scrambling Rate Resolution (Poincaré space)	± 1% of most significant digit	
Rayleigh[7]		
Mode Scrambling Rate Range (Poincaré space)	1.0 rad/s – 350 krad/s	
Maximum Scrambling Rate Resolution (Poincaré space)	± 1% of most significant digit	
Ring		
Ring Auto-Align Time	N/A	5 s (typical)
Half-Waveplate Rotational Frequency Range (Poincaré space)		2.5 rad/s – 1 Mrad/s
Half-Waveplate Rotational Frequency Range (Waveplate space)	0.1 Hz – 40 kHz	
Other Supported Ring modes	Oscillating, Random, Polar	
Discrete (User Tables)		
Maximum Table Length	1000	
Angle Transition Rate (Optical ΔSOP slew rate)[8]	< 60 µs	
SOP Tracking[1,4]		
Holding Accuracy (Typical Controlled Environment)[3]		
15 min User Defined SOP	N/A	< 5° (typical)
15 min mPCX Determined Fixed State		< 3° (typical)
Response Time to Stabilize an Input Impulse ΔSOP[5]		< 0.3 s (typical)
Maximum Input Signal ΔSOP rate[6]		40 °/s
Min / Max Input Power Range		-5 to 20 dBm
Recall of User Defined SOP (QWP+QWP mode only)		100 ms
Mechanical and Environmental		
Operating Temperature Range	0 to 50 °C	
Warm-up Time	60 min	
Storage Temperature	-30 to 70 °C	
Dimensions	4.06cm x 13.26cm x 37.03cm	
Weight	0.95 kg	

1. Guaranteed over 13 to 33°C
2. Excludes the loss from one optical connector
3. 25°C +/- 3°C, normal fiber management on benchtop
4. Requires stable optical power +/- 0.1dB to mPCX and signal with >30% DOP
5. Large SOP excursions may require a two-step process to ensure original position is maintained
6. During continuous ΔSOP variation momentary excursions from target are expected. 90% of the time excursions from target will be less than 20° during dynamic measurements. Once the input variation ceases the control loop will re-acquire the target within 0.3s (typical)
7. Parameters specified as the mode, σ, of the Rayleigh distribution, where R(f;σ)=(f/σ^2)*exp(-f^2 / (2*σ^2))
8. Software overhead not included

Part Numbers

Part Number	High-speed polarization scrambler/controller
MPCX-C11S0S-M100-MFA	FC/APC Connectors
MPCX-C11S0S-M100-MFP	FC/PC Connectors
MPCX-C11S0S-M100-MSC	SC/PC Connectors
MPCX-C11S0S-M100-MSU	SC/APC Connectors
Part Number	**High-speed polarization scrambler/controller SOP Feedback Option**
MPCX-C11SFS-M100-MFA	FC/APC Connectors
MPCX-C11SFS-M100-MFP	FC/PC Connectors
MPCX-C11SFS-M100-MSC	SC/PC Connectors
MPCX-C11SFS-M100-MSU	SC/APC Connectors

Contact Us **+1 844 GO VIAVI**
(+1 844 468 4284)

To reach the Viavi office nearest you,
visit viavisolutions.com/contacts.

mpcx-c1-ds-lab-nse-ae
30179950 900 1116