Manufacturer:
VIAVI

Product Name:
MAP-Series PCX Basic all-band high speed pol scrambler SMF FC/APC

Manufacturer Part Number:
MPCX-C11SBA-M100-MFA-MO

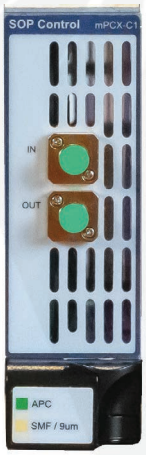
Data Sheet

VIAVI

Polarization Controller (mPCX-C1)

MAP Series high speed polarization scrambler, controller and stabilizer

The Multiple Application Platform (MAP-Series) Polarization Control Module (mPCX-C1) is a single slot high-speed polarization scrambler, controller and stabilizer. 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 interacts 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. Based on Lithium-Niobate, the electro-optic wave-plates have the response time required by the most demanding polarization management applications. 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.

Key Features

- High-speed polarization scrambler, rate programmable from 1.00 rad/s to 3.00 Mrad/sec
- Operation in C/L, O and All-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
- Compact single slot module

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)

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Functional Description

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.

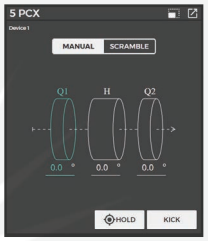

Figure 1 – MAP-300 Manual polarization control GUI

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.

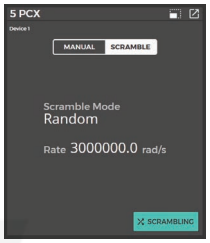

Figure 2 – MAP-300 Scrambling polarization control GUI

An intuitive graphic user interface (GUI) is optimized for use in either a laboratory or a manufacturing environment. Efficient transition between summary and detailed views (figure 3 and figure 4) allow users to operate at a system level or access the full power of a module.

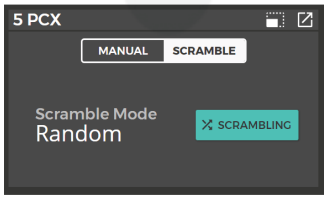

Figure 3 – mPCX MAP-300 summary view GUI

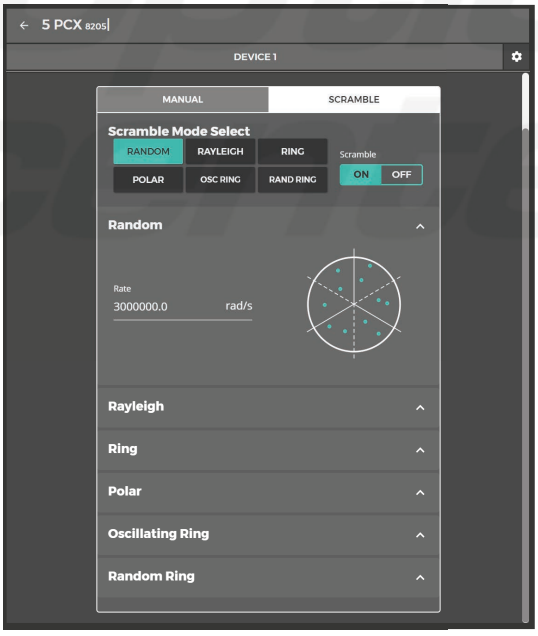

Figure 4 – mPCX MAP-300 detailed view GUI

Contact the professionals at Fiber Optic Center for a quote or to get more details.

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Chassis and Modular Family

The VIAVI Multiple Application Platform (MAP) is a modular, rack mountable or benchtop, optical test and measurement platform with chassis' that can host 2, 3 or 8 application modules. The LightDirect family of modules are characterized by their simple control and single function nature. Individually or together they form the foundation of a diverse array of optical test applications. The web enabled multiuser interface is simple and intuitive. LXI compliant with a full suite of SCPI based automation drivers and PC based management tools, the VIAVI MAP is optimized for both the lab to manufacturing environments.

The mPCX is part of the LightDirect module family. Alongside the many other modules, such as light sources, variable attenuators, power meters, and spectrum analyzers, the MAP series is the ideal, modular platform for photonic system and module testing.

The mPCX is compatible with all current MAP-300 and MAP-200 chassis.

LightDirect

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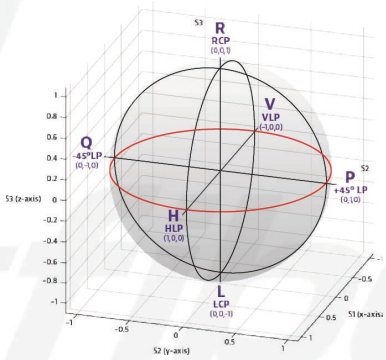
SOP Feedback Option

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.

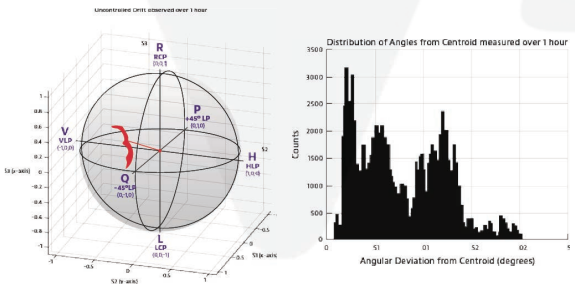


State Tracking and Return

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.

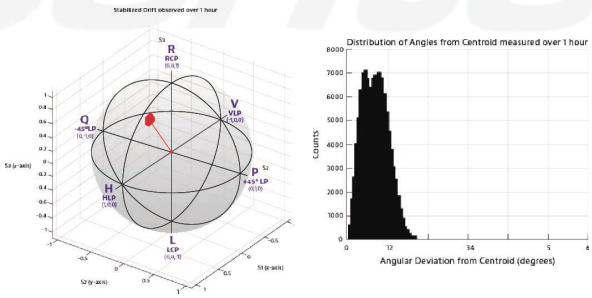
Drift (Uncontrolled)

60 min



Drift (Stabilized)

60 min



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

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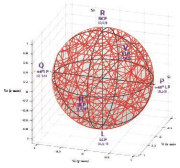
Scrambling Dynamics

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.

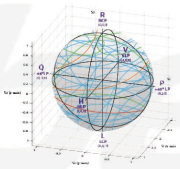
Random

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.



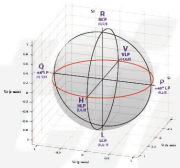
Rayleigh Distribution

This mode has full sphere coverage. The instantaneous rate of change follows a Rayleigh distribution 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.



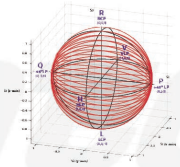
Ring (ideally used with SOP Feedback)

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.



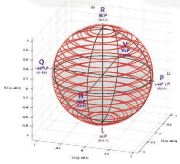
Polar Ring Pattern (ideally used with SOP Feedback)

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.



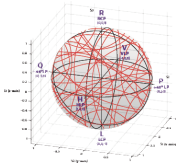
Oscillating Ring Pattern (ideally used with SOP Feedback)

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.

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Specifications

Specifications	C/L Band	O-Band	All Band
Basic Optical Specifications[1]			
Wavelength range[2]	1520 to 1620 nm	1265 to 1365 nm	1265 to 1620 nm
Maximum input power	+20 dBm		
Insertion Loss[3]	≤ 3.0 dB no feedback, SMF ≤ 3.5 dB with feedback, SMF ≤ 3.5 dB no feedback, PMF ≤ 4.0 dB with feedback, PMF	≤ 3.5 dB no feedback, SMF ≤ 4.0 dB with feedback, SMF ≤ 4.0 dB no feedback, PMF ≤ 4.5 dB with feedback, PMF	≤ 3.5 dB
Polarization dependent loss	≤ 0.2 dB	≤ 0.25 dB no feedback, SMF ≤ 0.30 dB with feedback, SMF ≤ 0.25 dB no feedback, PMF ≤ 0.30 dB with feedback, PMF	≤ 0.25 dB
Return Loss	≥ 40 dB		
Manual Waveplate Mode[1]			
Control modes	[QWP + QWP] or [QWP + HWP + QWP]		N/A
Waveplate rotation	Continuous (reset-free)		N/A
Waveplate angle setting resolution	0.01 °		N/A
Maximum waveplate rotation frequency	40 kHz		N/A
Rotation frequency setting resolution	0.01 Hz		N/A
Scrambling Modes[1]			
Random			
Maximum scrambling rate range (Poincaré-space)	1.0 rad/s to 3.0 Mrad/s		
Minimum scrambling rate resolution (Poincaré-space)	0.1 rad/s		
Maximum scrambling rate accuracy (Poincaré-space)	± 1 % of most significant digit		
Rayleigh[4]			
Mode Scrambling rate range (Poincaré-space)	350 krad/s to 1.0 rad/s		N/A
Maximum scrambling rate accuracy (Poincaré-space)	± 1 % of most significant digit		N/A

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Specifications	C/L Band	O-Band	All Band
Ring			
Ring Auto Align Time[5,6]	5s typical (with feedback only)		N/A
Half-waveplate rotational frequency rate range (Poincaré-space)	2.5 rad/s to 1 Mrad/s (with feedback only)		N/A
Half-waveplate rotational frequency range (Waveplate-space)	0.1 Hz to 40 kHz		N/A
Other supported ring modes	Oscillating, Random, Polar		N/A
Discrete (User Tables)			
Maximum table length	1000		N/A
Angle transition rate (Optical ΔSOP slew rate)	≤ 60 µs	≤ 60 µs	N/A
SOP-Tracking (only available with feedback)[1,7]			
Holding Accuracy (Typical Controlled Environment)[8]			
15 min. user defined SOP	≤ 5 ° (typical)	≤ 5 ° (typical)	N/A
15 min. mPCX determined fixed state	≤ 3 ° (typical)	≤ 3 ° (typical)	N/A
Response time to stabilize an input impulse ΔSOP[9]	≤ 0.3 s (typical)	≤ 0.3 s (typical)	N/A
Maximum input signal ΔSOP rate[9]	40 ° /s		N/A
Min / max input power range	-5 dBm to +20 dBm		N/A
Recall of user-defined SOP (QWP + QWP mode only)	100 ms		N/A
Environmental			
Warm up time	60 min.		
Operating Temperature	0°C to 50°C		
Storage Temperature	-30°C to 70°C		
Physical			
Size (W x H x D)	4.06 cm x 13.26 cm x 37.03 cm		
Weight (approximate)	0.95 kg (2.0 lbs)		
Other			
Recalibration Interval	2 years		

1. Guaranteed over 13°C to 33°C
2. CL-band calibration λ: 1550nm. O-band calibration λ: 1310nm. All-band calibration λ: 1550nm
3. Excludes the loss from one optical connector
4. Parameters specified as the mode, σ, of the Rayleigh distribution, where $R(f,\sigma) = (f/\sigma^2) * \exp(-1/2) / (f/\sigma)^2$
5. Large SOP excursions may require a two-step process to ensure original position is maintained
6. Software overhead not included
7. Requires stable optical power
8. 25°C ± 3°C, normal fiber management on benchtop
9. 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 with re-acquire the target within 0.3s (typical)

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Ordering Information

Part Number	Band	Description
MPCX-C11SFS-M100-Mxx	C/L-Band	SMF **High-speed polarization scrambler/controller** with SOP **Feedback Option**
MPCX-C11SF3-M100-Mxx	O-Band	SMF **High-speed polarization scrambler/controller** with SOP **Feedback Option**
MPCX-C11SBA-M100-Mxx	All-Band	Basic all-band **High-speed polarization scrambler/controller**

Table 1

XX Code	Connector Type
MFA	FC/APC

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Accessories

Accessories (Optional)	Product and description	
Inspection and cleaning tool	CleanBlastPRO	The patented VIAVI Solutions® CleanBlastPRO fiber end-face cleaning system provides a fast, effective, and cost-efficient solution for removing dirt and debris from connectors in most common applications. It is available in a benchtop and portable version.
	FiberChek probe microscope	One-button FiberChek Probe delivers a reliable, fully autonomous, handheld inspection solution for every fiber technician.
	P5000i fiber microscope	Automated Fiber Inspection and Analysis Probe provides PASS/FAIL capability to PC, laptops, mobile devices and VIAVI test solutions.
Replacement Parts	Mating sleeves	AC500;FC/PC-FC/PC Universal Connector Adapter
		AC501;FC/PC-SC/PC Universal Connector Adapter
		AC502;FC/APC-FC/APC Universal Connector Adapter
		AC503;FC/APC-SC/APC Universal Connector Adapter