Automatic Mach Zehnder BIAS Control

Extended Data Sheet

Features

- ✓ software configurable support of single & dual-pol IQ or Intensity Mach Zehnder Modulators
- ✓ **No dependency on applied modulation format and RF amplitude**
- ✓ supporting all higher level modulation formats
- ✓ Single Power supply voltage
- ✓ No user tweaking for optimal setting required
- ✓ Fast and simple switching between modulation formats
- ✓ Zero Noise feature
- ✓ No external Tap Photodiode required
- ✓ Customer defined maximum Voltage range; differential output up to +/-15V
- ✓ Extremely wide dynamic range of feedback tap
- ✓ User analog and digital I/O's provided
- ✓ Easy-to-Use GUI provided
- ✓ USB, Ethernet & UART interface for remote control
- ✓ SCPI Style remote control command set, LabView® drivers supplied

Applications

- ✓ LiNbO3, InP, GaAs modulators
- ✓ Generation of advanced modulation formats (QPSK, 8-PSK, 16-QAM, …)

The ID Photonics automatic bias controller (ABC) is designed to lock the operating point of Mach-Zehnder modulators to ensure stable optimal performance over time and environmental conditions.

It covers a wide variety of applications from single polarization Intensity Modulators to polarization multiplexed IQ Modulators by simple user reconfiguration in software with a single hardware variant.

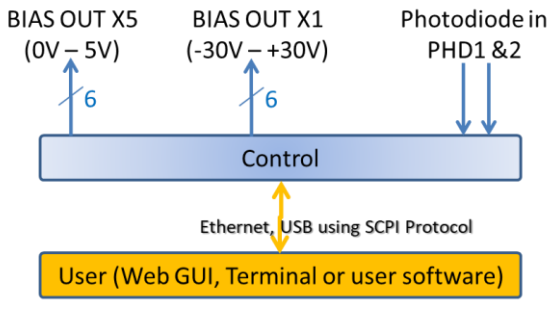
For IQ modulators, this unique design provides a **stable tracking of optimal operating point for arbitrary RF input signals** such as QPSK, QAM-xx or Nyquist shaped signals without requiring manual tweaking of parameters. This enables stable operation especially when switching between modulation formats.

A zero noise feature allows achieving optimal and repeatable performance.

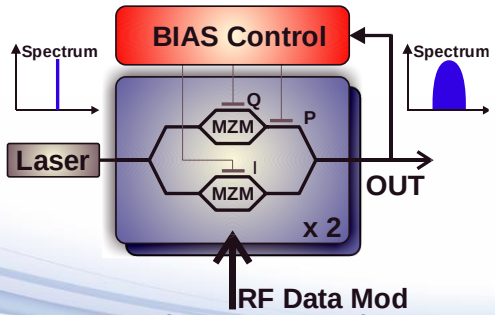
A GUI is provided for instant access and a SCPI style command set provides extensive control status information and configurations such as locking status.

Key Features

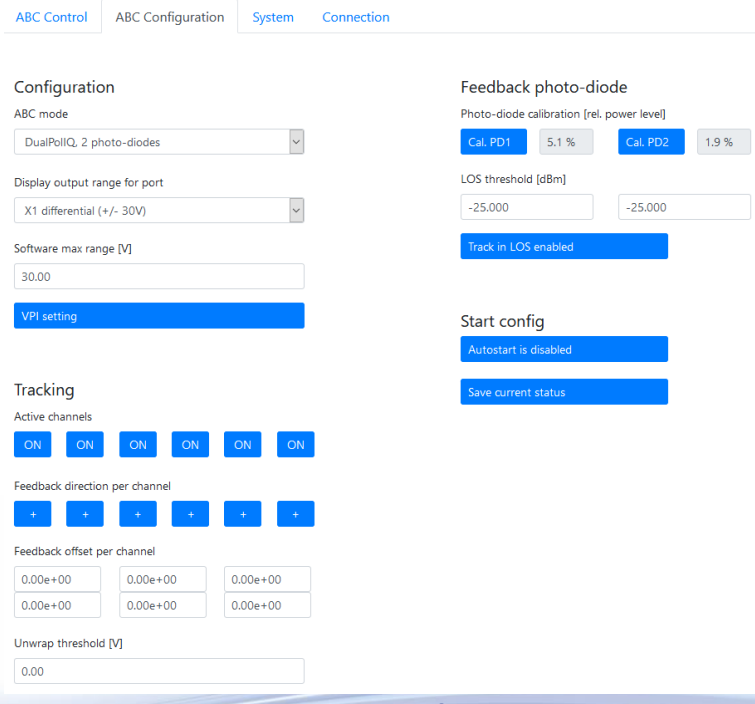
- **Independent of RF input signals for IQ Modulators**
  Unlike other solutions, our unique BIAS control does not rely on RF feedback signals derived from the data signal to control the phase electrode in IQ Mach-Zehnder structures but uses internally generated feedback signals to identify and track the optimal BIAS setting providing a number of advantages
  - The control is stable and independent of the RF Input signal; supports all modulation formats
  - Almost zero average quadrature error of constellation for IQ modulated signals
  - No bulky, expensive external Photodiode or coupler required; In-package Photodiodes are supported; low detector bandwidth requirement
  - Operates without any RF signal applied to modulator data inputs
  - No manual tweaking by user of control loop parameters such as offset values required
- **Zero noise feature**
  This feature will mute signals used for the automatic BIAS control and freeze its current status to achieve optimum performance. Once disabled again, the automatic control will continue optimizing.
- **High-end full Digital Signal processing (DSP)**
  All feedback extraction and processing is done using digital DSP Technologies ensuring maximum of performance possible close to theoretical limits. Customized algorithms can be easily implemented by Software changes. A locking status indicator gives users certainty about current status of the control.
- **Software based configuration**
  All customization such as Modulator type, control Target setting, maximum BIAS Voltage range, number of Feedback Photodiodes, starting point etc. is done via software parameters that are stored permanently. Tracking can be en- and disabled separately for each electrode.
- **Easy to use Graphical User Interface (GUI) and Remote control**
  A comprehensive installation free, browser based GUI allows setting up, control and monitoring the board within minutes. Remote control via Ethernet and USB gives a maximum of flexibility connecting to the board. The SCPI style interface allows to easily implement custom remote control software.



Block Diagram

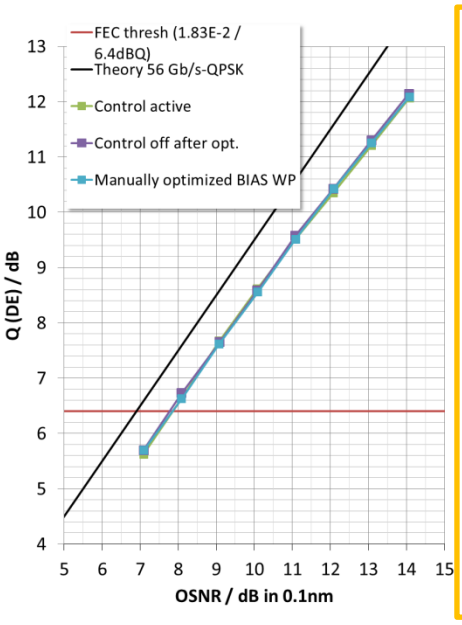


Application Example

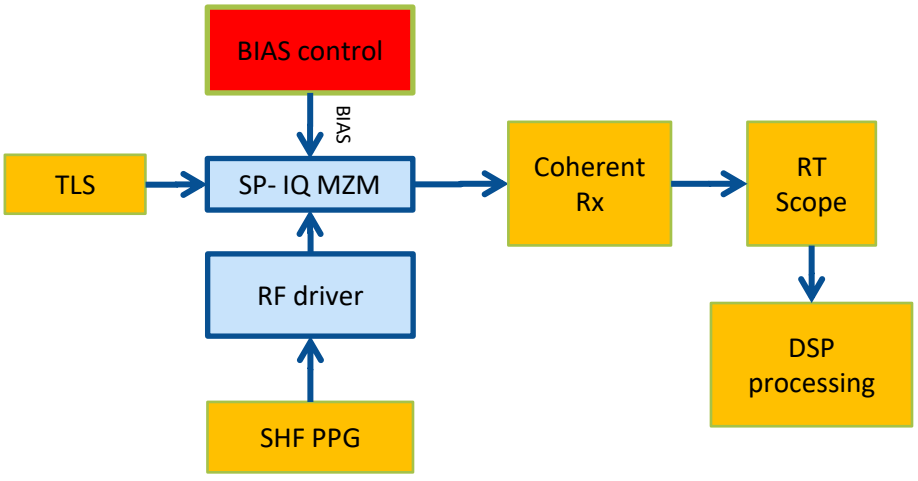


Browser Based GUI

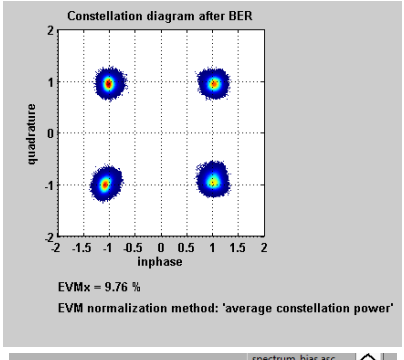
Application Example
56Gb/s SP-QPSK

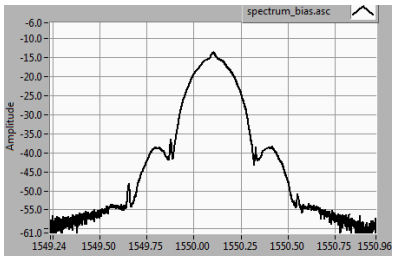


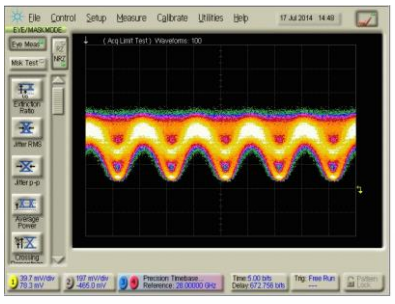
Setup



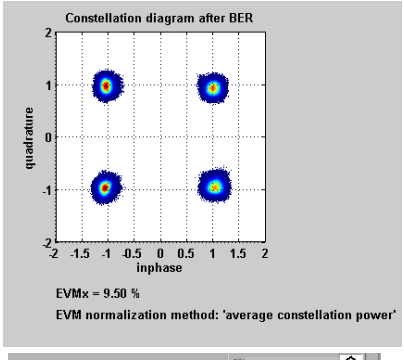
BIAS control active

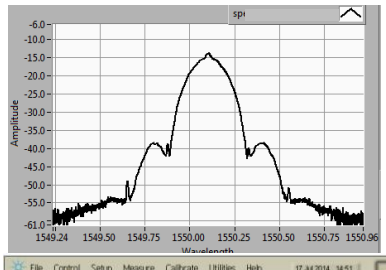


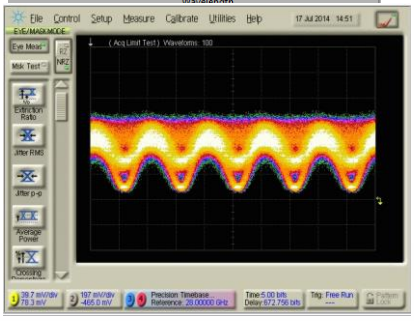




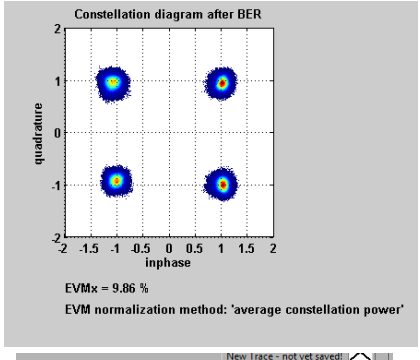
BIAS control off after optimization

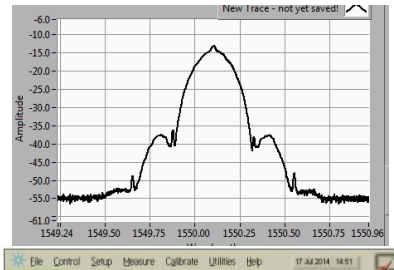


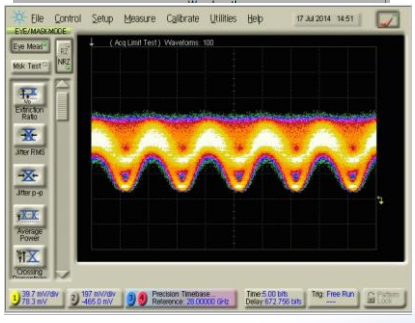




Manual optimization

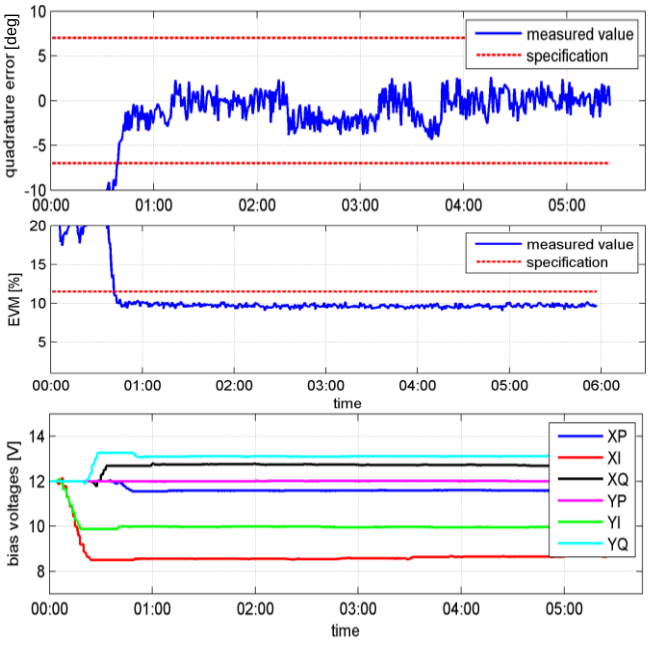




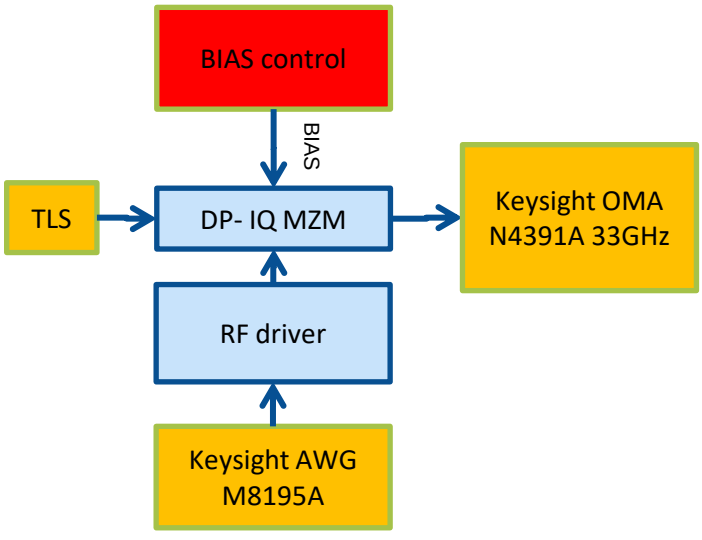


Application Example
128Gb/s DP-QPSK

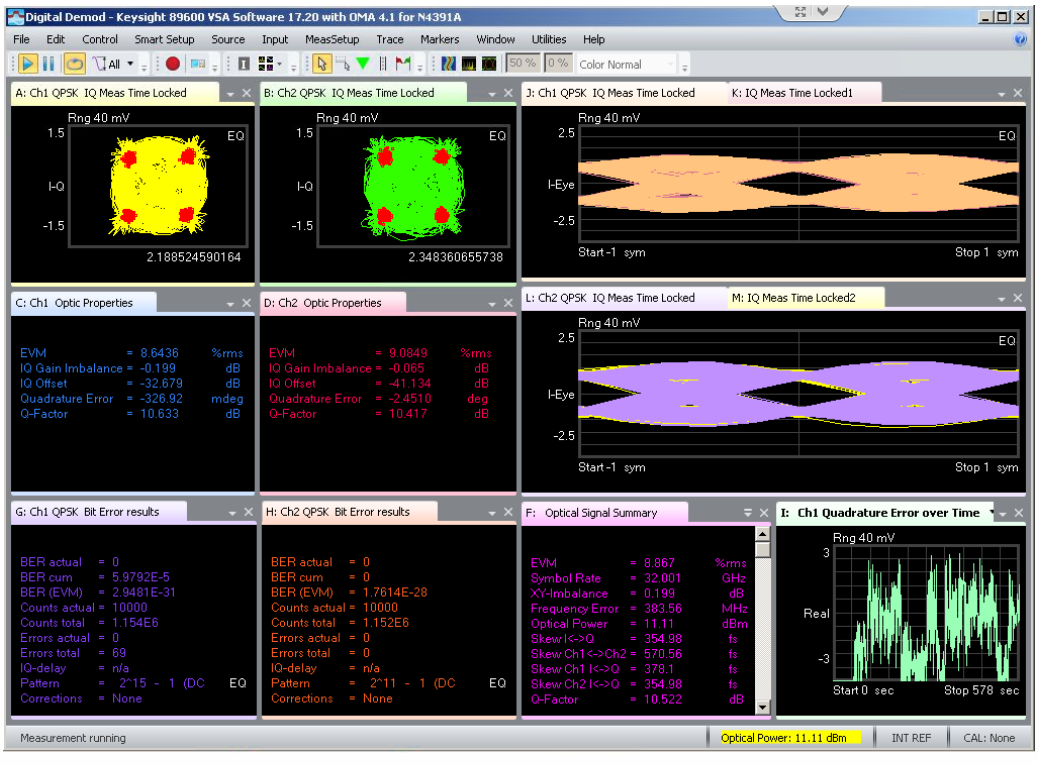
Data shows speed of initialization and performance achieved after 5 Minutes



Traces during initialization period



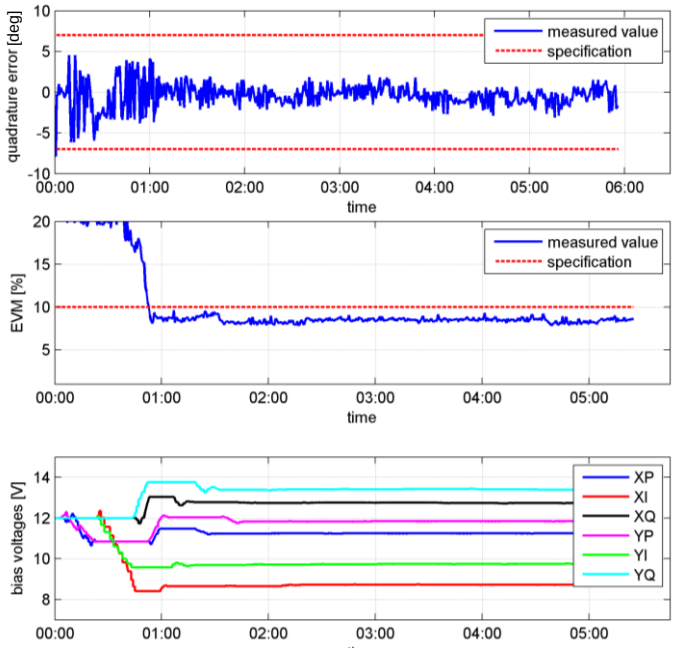
Setup



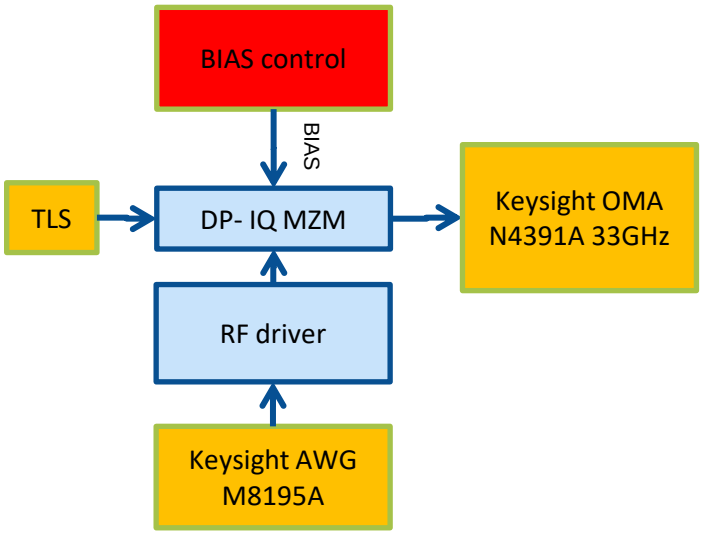
OMA Screen shot after 5 Minutes

Application Example
256Gb/s DP-QAM-16

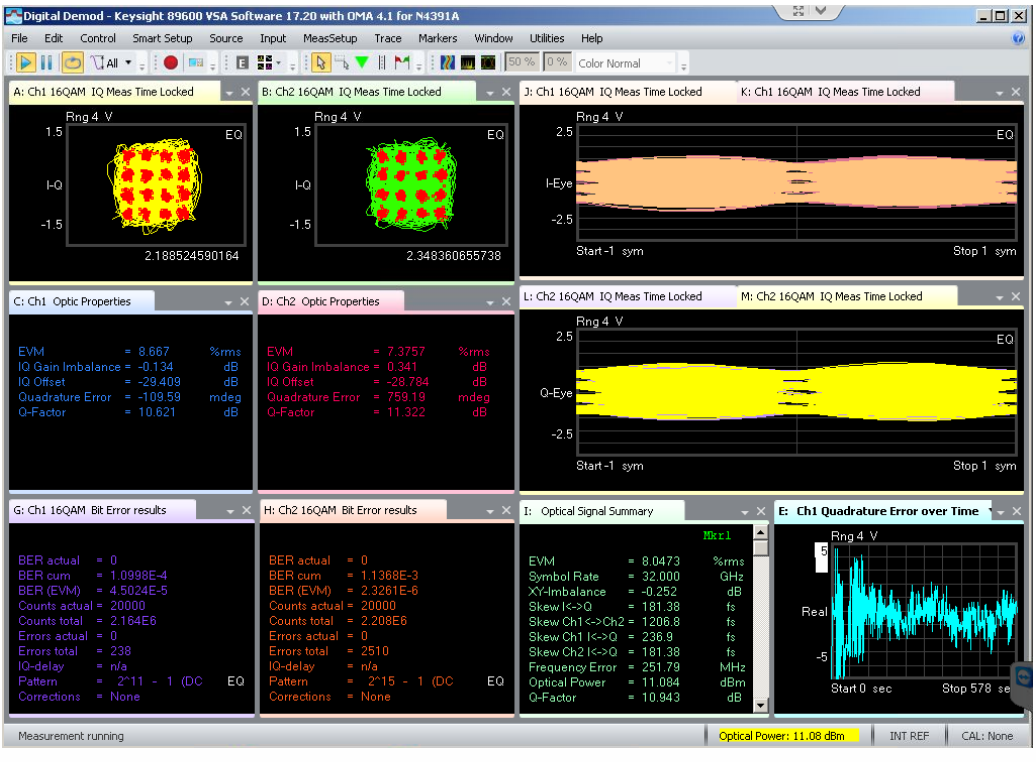
Data shows speed of initialization and performance achieved after 5 Minutes



Traces during initialization period



Setup



OMA Screen shot after 5 Minutes

Specification

Parameter		Specification
Supported modulator Types		(Single & Dual Pol.) - IQ or Intensity Mach Zehnder, see table on next page
Supported modulation formats		All, No dependency
Max. BIAS Voltage, differential symmetric Single ended low voltage, high current output		+/- 30V, 330 Ohm impedance +/- 5V, 100 Ohm impedance Software Voltage limit customer settable
Number of BIAS Control channels		6
Mach-Zehnder Modulator connector		IQM direct: to OIF-PMQ-TX-01.1 standard Cable: Samtec EHF108 (diff. symmetric out) Samtec EHF105 (single ended out)
Startup time automatic BIAS Control until settled		< 5 Minutes, 1 Minute typical
Quadrature error* [deg],	averaged mean 99% confidence in >4hrs	< +/-0.5 < +/- 3
Feedback detector type		optical tap detector after MZM component
Feedback detector current range [uA] (electrical in) Feedback detector current range [uA] (optical in at max. Transmission of MZM)		1 – 2000 -10 to +4 dBm
Feedback detector dynamic range [dB]		26
Required feedback detector bandwidth, 3dB [kHz]		>100
User Interfaces		USB, Ethernet, 5V UART
Operating Temperature		+5 to +60°C; non-condensing
Storage Temperature		-20°C to 60°C
Size of device (H x W x D), weight		140 x 53 x 215 mm (5.5 x 2.1 x 8.5 inch) 1kg (2.2 lbs)
Power Supply		Primary 12VDC, 3A, 20 Watt Included AC Adaptor 100-240 VAC, 0.8A, 50/60Hz
Connector type		FC/APC (optical feedback versions)

* Applies to IQ Modulators; Characterized using Keysight AWG M8195A AWG signal source; ID Photonics ; Keysight OMA N4391A for analysis

Ordering Information

ABC	-BPC	-XX	-X
Article	-	Type	AC adaptor cable type
Automatic BIAS control	-	13: benchtop version, 1 optical feedback channel 14: benchtop version, 2 optical feedback channels 15: benchtop version, 2 electrical feedback channels	C: Europe A: US, Asia D: UK

Each set includes: ABC unit, AC Power supply, Sub-D Cable, Sub-D to MZM Adaptor Board (ABC-BPC-ACC-AD-11)

Contact information

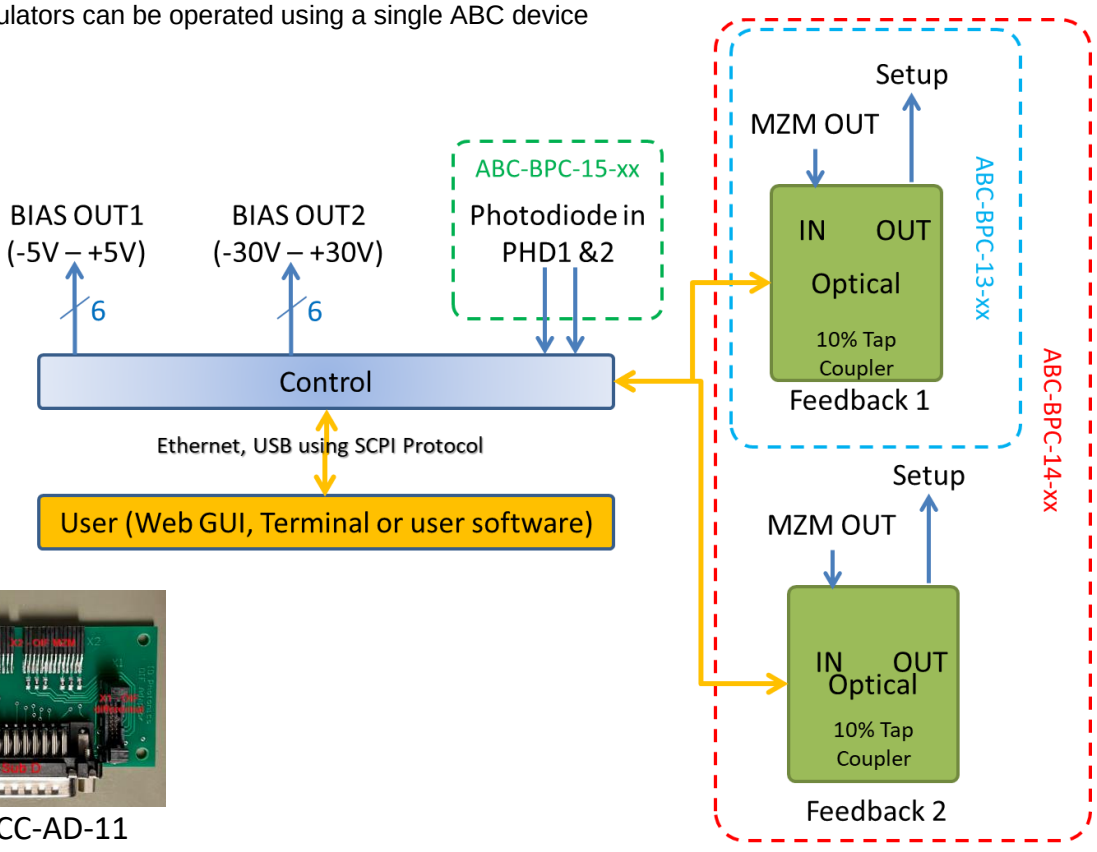
ID Photonics GmbH
Anton-Bruckner-Str. 6
85579 Neubiberg
GERMANY
Tel.: + 49 (0) 89 – 201 899 16

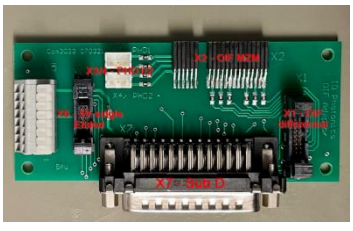
info@id-photonics.com
www.id-photonics.com

Supported configurations

MZM Type	Photodiodes in ABC device		External Photodiodes		Application example
	ABC-BPC-13-x	ABC-BPC-14-x	ABC-BPC-15-x		
	1	2	1	2	
Single Polarization IQ Modulator	✓ (1)	✓ (2)*	✓	-	SP-QPSK, SP-QAM32
Dual Polarization IQ Modulator	✓	✓	✓	(✓)	DP-QPSK, DP-QAM16
Single Polarization Intensity Modulator (*)	✓ (1)	✓ (2)*	✓	-	SP-OOK, SSB
Dual Polarization Intensity Modulator (*)	(-)	✓	✓	✓	DP-OOK, DP-Multi-Level

* Up to 2 Modulators can be operated using a single ABC device





ABC-BPC-ACC-AD-11

Ordering Information optional accessories

Order Code	Description
ABC-BPC-ACC-AD-11	MZM adaptor board for OIF standard compatible MZM, 1 included in ABC set
ABC-BPC-ACC-AD-12	MZM adaptor board SMA connector male output
ABC-BPC-ACC-AD-13	MZM adaptor board to 2x 14 Pin MZMs “Axenic”