MBC

MBC-DG-LAB

Continuously Tunable Modulator Bias Controller

The Exail MBC-DG-LAB is a family of automatic bias controllers specially designed to lock the operating point of $LiNbO_3$ Mach-Zehnder modulators and to ensure a stable operation over time and environmental conditions.

The MBC-DG-LAB controllers are continuously tunable bias controllers, meaning they allow operation of the modulator at any point of its transfer function and thus can be used for a large variety of applications. They are easy to implement, and are available as bench top instruments and OEM boards. Exail MBC-DG series controllers are especially well suited for digital and pulse applications.

The Exail MBC-DG-LAB shows a very low noise sensitivity yielding a significant reduction of the required dither voltage amplitude. This new version is characterized by an enhanced stability. The electronic board benefits of an AUTOSET operation for the QUAD/MIN/MAX modes resulting in a simplified use. The user parameters are stored and can be recovered after switched off. An USB communication and a Graphical User Interface (GUI) are introduced for ease of use.

Principle

The Exail MBC-DG-LAB controllers are dither signal based: a low amplitude, low frequency tone signal is superimposed to the modulation signal. The resulting optical modulation is then detected and a digital signal processing based on a FFT analysis principle allows to lock the operating point at the desired position.

Features

- MIN, MAX, QUAD+, QUAD-
- Any other operating point
- Continuous tuning of bias point
- USB remote control
- High stability and sensitivity
- Autoset

Applications

- $LiNbO_3$, InP, GaAs modulators
- Digital NRZ, RZ, DPSK, PAM,...
- Low duty cycle pulse train, PPM
- Pulse applications
- Analog applications

Options

- Internal photodiode and tap coupler
- Benchtop and board versions
- Ditherless version

Performance Highlights

Parameter	Min	Typ	Max	Unit
DC bias voltage	-10	-	+10	V
Autoset mode	MIN, MAX, QUAD-, QUAD+			-
Locking range	-	360	-	Degree
Locking accuracy at QUAD[1]	-	90 ± 0.5	-	Degree
Extinction ratio at MIN mode	-	50[1] ± 0.05	-	dB

[1] 50 dB: from modulator nominal Extinction Ratio value

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Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
DC Bias Voltage	V_{bias}	-	-10	-	+10	V
Bias Voltage step	DV_{bias}	Manual mode	0.001	-	0.1	V
Automatic locking point	-	Transfer level	MIN (0%), MAX (100%), QUAD- (-50%), QUAD+ (+50%) and other transfer level value			
Dither frequency	f_{dither}	by 40 Hz frequency step	400	-	1400	Hz
Diither amplitude	V_{dither}	by 1 mV amplitude step	5	-	1000	mV

Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
At Photodiode input port (MBC-DG-LAB version A0, B0 & C0)						
Wavelength	λ	MBC-DG-LAB-A0	900	-	1600	nm
		MBC-DG-LAB-B0	600	-	900	nm
		MBC-DG-LAB-C0	1950	-	2050	nm
Input optical power	OP	MBC-DG-LAB-A0 - measured at 1550 nm	-20	-10	-3	dBm
		MBC-DG-LAB-A0 - measured at 1310 nm	-19	-10	-2	dBm
		MBC-DG-LAB-A0 - measured at 1060 nm	-18	-8	-0.8	dBm
		MBC-DG-LAB-B0 - measured at 850 nm	-17	-7	0.5	dBm
		MBC-DG-LAB-C0 - measured at 2004 nm	-20	-10	-3	dBm
At tap-coupler input port (MBC-DG-LAB version A1, A2, A3, B1, B2 & C1)						
Wavelength	λ	-	760	-	1600	nm
Input optical power	OP	MBC-DG-LAB-A1[1] - λ range 1550 nm ± 20 nm	0	10	17	dBm
		MBC-DG-LAB-A2[2] - λ range 1310 nm ± 20 nm	0.5	13	18	dBm
		MBC-DG-LAB-A3[3] - λ range 1060 nm ± 20 nm	2.5	11.5	19	dBm
		MBC-DG-LAB-A4[4] - λ range 950 nm ± 20 nm	2.5	11.5	19	dBm
		MBC-DG-LAB-B1[5] - λ range 850 nm ± 20 nm	2.8	12.5	20	dBm
		MBC-DG-LAB-B2[6] - λ range 780 nm ± 20 nm	2.8	12.5	20	dBm
		MBC-DG-LAB-C1[7] - λ range 2000 nm ± 40 nm	0	10	17	dBm

[1]Measured @ 1550 nm - [2]Measured @ 1310 nm - [3]Measured @ 1060 nm - [4]Measured @ 950 nm - [5]Measured @ 850 nm - [6]Measured @ 780 nm - [7]Measured @ 2004 nm

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Bias Control Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
		Timing				
Autotest (MIN, MAX, QUAD±)	Auto	Automatic scan	25	30	40	s
Initialisation	-	After an autoset	-	10	-	s
Start up	-	-	10	-	30	s
		QUAD+, QUAD-				
Locking accuracy	-	At QUAD±	89.5	90	90.5	Degree
Locking stability	-	Over 2h and modulator temperature controlled	-0.1	-	+0.1	Degree
		Min & Max Bias Performances				
Extinction ratio	ER	Modulation with ER > 50 dB & tap coupler	-	-	50	dB
Locking stability	DER	-	-	±0.05	-	dB

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Different digital modulation formats (NRZ, RZ, DPSK) require specific operating points and bias control parameters.
That is also true for pulse signals with different duty cycles. The MBC-LAB through its intuitive GUI offers pre-set (Autoset) bias setting for MIN, MAX, and QUAD for fast and easy modulator operation.

Dimensions	
Dimensions (W x H x D)	220 mm x 220 mm x 52 mm
Power supply (rear panel)	100 V - 120 V / 220 V - 240 V automatic switch, 50 Hz - 60 Hz
Interfaces	
Photodiode Input / coupler input	FC/APC connector
Bias output	BNC Female connector
Communication	USB
Remote control	
Minimum computer requirements	Windows XP SP3
Computer configuration	Recommended Windows XP-SP3, W7, W8

Ordering information

MBC-DG-LAB-□

- A0: no coupler, 900 nm to 1600 nm
- B0: no coupler, 600 nm to 900 nm
- C0: no coupler, 1950 nm to 2050 nm
- A1: integrated coupler 1550 nm ± 20 nm
- A2: integrated coupler 1310 nm ± 20 nm
- A3: integrated coupler 1060 nm ± 20 nm
- A4: integrated coupler 950 nm ± 20 nm
- B1: integrated coupler 850 nm ± 20 nm
- B2: integrated coupler 780 nm ± 20 nm
- C1: integrated coupler 2000 nm ± 40 nm

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