



## FEATURES

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

## APPLICATIONS

- LiNbO<sub>3</sub>, InP, GaAs modulators
- Digital NRZ, RZ, DPSK,...
- Pulse applications
- Analog applications

## OPTIONS

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

The ixblue MBC-DG-LAB is a family of automatic bias controllers specially designed to lock the operating point of LiNbO<sub>3</sub> 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. ixblue MBC-DG series controllers are especially well suited for digital and pulse applications.

The ixblue 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 AUTOSSET 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 ixblue 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.

## 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 <sup>±</sup>	-	90 ± 0.5	-	Degree
Extinction ratio at MIN mode	-	50 <sup>1</sup> ± 0.05	-	dB

<sup>1</sup> 50 dB: from modulator nominal Extinction Ratio value

### Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
DC bias voltage	$V_{bias}$	-	-10	-	+10	V
Bias Voltage step	$\Delta V_{bias}$	Manual mode	0.001	-	0.1	mV
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	-	1 400	Hz
Dither amplitude	$V_{dither}$	by 1 mV amplitude step	5	-	1 000	mV

### Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
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At Photodiode input port (MBC-DG-LAB version A0 & B0)

Wavelength	$\lambda$	MBC-DG-LAB-A0	900	-	1 600	nm
		MBC-DG-LAB-B0	600	-	900	
Input optical power	OP	MBC-DG-LAB-A0 <sup>1</sup> - Measured @1550 nm	-20	-10	-3	dBm
		MBC-DG-LAB-A0 <sup>2</sup> - Measured @1310 nm	-19	-10	-2	dBm
		MBC-DG-LAB-A0 <sup>3</sup> - Measured @1060 nm	-18	-8	-0.8	dBm
		MBC-DG-LAB-B0 <sup>4</sup> - Measured @850 nm	-17	-7	0.5	dBm

At Tap-Coupler input port (MBC-DG-LAB version A1, A2, A3, B1, B2)

Wavelength	$\lambda$	-	760	-	1 600	nm
Input optical power	OP	MBC-DG-LAB-A1 <sup>1</sup> - $\lambda$ range 1550nm±20nm	0	10	17	dBm
		MBC-DG-LAB-A2 <sup>2</sup> - $\lambda$ range 1310nm±20nm	0.5	13	18	dBm
		MBC-DG-LAB-A3 <sup>3</sup> - $\lambda$ range 1060nm±20nm	2.5	11.5	19	dBm
		MBC-DG-LAB-B1 <sup>4</sup> - $\lambda$ range 850nm±10nm	2.8	12.5	20	dBm
		MBC-DG-LAB-B2 <sup>5</sup> - $\lambda$ range 780nm±20nm	2.8	12.5	20	dBm

<sup>1</sup> Measured @1550 nm - <sup>2</sup> Measured @1310 nm - <sup>3</sup> Measured at 1060 nm - <sup>4</sup> Measured at 850 nm - <sup>5</sup> Measured at 780 nm

### Bias Control Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
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Timing

Autoset (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	-	Standard deviation, over 2 hours, and modulator temperature controlled	-0.1	-	+0.1	Degree

MIN & MAX Bias performances

Extinction Ratio	ER	Modulator with ER > 50 dB & tap coupler	-	-	50	dB
Locking stability	$\Delta ER$	-	-	±0.05	-	dB

## MBC-DG-LAB

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)	100-120 V / 220-240 V automatic switch, 50-60 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, 900nm to 1600nm  
MBC-DG-LAB-B0: No coupler, 600nm to 900nm  
MBC-DG-LAB-A1: Integrated coupler 1550nm  $\pm$ 20nm  
MBC-DG-LAB-A2: Integrated coupler 1310nm  $\pm$ 20nm  
MBC-DG-LAB-A3: Integrated coupler 1060nm  $\pm$ 20nm  
MBC-DG-LAB-B1: Integrated coupler 850nm  $\pm$ 10nm  
MBC-DG-LAB-B2: Integrated coupler 780nm  $\pm$ 20nm

## About us

iXBlue Photonics produces specialty optical fibers and Bragg gratings based fiber optics components and provides optical modulation solutions based on the company lithium niobate (LiNbO<sub>3</sub>) modulators and RF electronic modules.

iXBlue Photonics serves a wide range of industries: sensing and instruments, defense, telecommunications, space and fiber lasers as well as research laboratories all over the world.