

# MBC-DG-LAB

## Continuously Tunable Modulator Bias Controller

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 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 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 FFTU 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
- Autotest

### APPLICATIONS

- LiNbO<sub>3</sub>, InP, GaAs modulators
- Digital NRZ, RZ, DPSK, PAM,...
- Low duty cycle, 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
Autotest mode	MIN, MAX, QUAD-, QUAD+			-
Locking range	-	360	-	Degree
Locking accuracy at Quad*	-	90 ± 0.5	-	Degree
Extinction ratio at MIN mode	-	50 <sup>(1)</sup> ± 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	$\Delta V_{bias}$	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
Dither amplitude	$V_{dither}$	by 1 mV amplitude step	5	-	1000	mV

### Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>At Photodiode input port (MBC-DG-LAB version A0 &amp; B0)</b>						
Wavelength	$\lambda$	MBC-DG-LAB-A0	900	-	1600	nm
		MBC-DG-LAB-B0	600	-	900	nm
Input optical power	OP	MBC-DG-LAB-A0 <sup>(1)</sup> - measured at 1550 nm	-20	-10	-3	dBm
		MBC-DG-LAB-A0 <sup>(2)</sup> - measured at 1310 nm	-19	-10	-2	dBm
		MBC-DG-LAB-A0 <sup>(3)</sup> - measured at 1060 nm	-18	-8	-0.8	dBm
		MBC-DG-LAB-B0 <sup>(4)</sup> - measured at 850 nm	-17	-7	0.5	dBm
<b>At tap-Coupler input port (MBC-DG-LAB version A1, A2, A3, B1, B2)</b>						
Wavelength	$\lambda$	-	760	-	1600	nm
Input optical power	OP	MBC-DG-LAB-A1 <sup>(1)</sup> - $\lambda$ range 1550 nm $\pm$ 20nm	0	10	17	dBm
		MBC-DG-LAB-A2 <sup>(2)</sup> - $\lambda$ range 1310 nm $\pm$ 20nm	0.5	13	18	dBm
		MBC-DG-LAB-A3 <sup>(3)</sup> - $\lambda$ range 1060 nm $\pm$ 20nm	2.5	11.5	19	dBm
		MBC-DG-LAB-A4 <sup>(4)</sup> - $\lambda$ range 950 nm $\pm$ 20nm	2.5	11.5	19	dBm
		MBC-DG-LAB-B1 <sup>(5)</sup> - $\lambda$ range 850 nm $\pm$ 20nm	2.8	12.5	20	dBm
		MBC-DG-LAB-B2 <sup>(6)</sup> - $\lambda$ range 780 nm $\pm$ 20nm	2.8	12.5	20	dBm

<sup>(1)</sup>Measured @ 1550 nm - <sup>(2)</sup>Measured @ 1310 nm - <sup>(3)</sup>Measured @ 1060 nm - <sup>(4)</sup>Measured @ 950 nm - <sup>(5)</sup>Measured @ 850 nm - <sup>(6)</sup>Measured @ 780 nm

### Bias Control Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Timing</b>						
Autotest (MIN, MAX, QUAD $\pm$ )	Auto	Automatic scan	25	30	40	s
Initialisation	-	After an autotest	-	10	-	s
Start up	-	-	10	-	30	s
<b>QUAD+, QUAD-</b>						
Locking accuracy	-	At QUAD $\pm$	89.5	90	90.5	Degree
Locking stability	-	Over 2h and modulator temperature controlled	-0.1	-	+0.1	Degree
<b>Min &amp; Max Bias Performances</b>						
Extinction Ratio	ER	Modulator with ER > 50 dB & tap coupler	-	-	50	dB
Locking stability	$\Delta$ ER	-	-	$\pm$ 0.05	-	dB

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## Continuously Tunable Modulator Bias Controller

Different digital modulation formats (NRZ, RZ, DPSK, PAM) 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
- A1: integrated coupler 1550 nm ± 20 nm
- A2: integrated coupler 1310 nm ± 20 nm
- A3: integrated coupler 1060 nm ± 20 nm
- B1: integrated coupler 850 nm ± 10 nm
- B2: integrated coupler 780 nm ± 20 nm

## 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.

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