

## ModBox-1310nm-1550nm-NRZ

1310nm & 1550 nm , 28 Gb/s, 44 Gb/s Reference Transmitters

ModBox



### FEATURES

- 1310nm & 1550nm Reference Transmitter
- Up to 28 Gb/s, 44 Gb/s
- Reliable & reproducible measurements
- High eye diagram stability

### APPLICATIONS

- Transmission system test
- Components characterization
- Production test
- R&D laboratories

### OPTIONS

- Tunable C-band laser
- Receiver stage
- Multi-Channel
- 850 nm, O-band, C-band, 1  $\mu$ m

The ModBox-1310nm-1550nm-NRZ series is a family of Reference Transmitters that generate at 1310 nm and 1550 nm excellent quality NRZ optical data streams up to 28 Gb/s, 44 Gb/s. These Transmitters offer very clean eye diagram with high SNR, low rise and fall times.

The ModBox-1310nm-1550nm-NRZ series provides R&D and Production engineers with a user friendly turn-key instrument delivering state of the art performance. It is being used in optical telecommunications laboratories and production test beds.

The equipment incorporates a modulation stage based on a chirp-free LiNbO<sub>3</sub> Mach-Zehnder modulator, coupled with a high performance RF driver and an automatic bias control circuitry. It also integrates two internal DFB lasers and an optional window photodetector stage.

In addition to the ModBox-1310nm-1550nm-NRZ, iXblue offers reference transmitters in the O-Band, C-band, 1  $\mu$ m region and at 850 nm.

### Performance Highlights

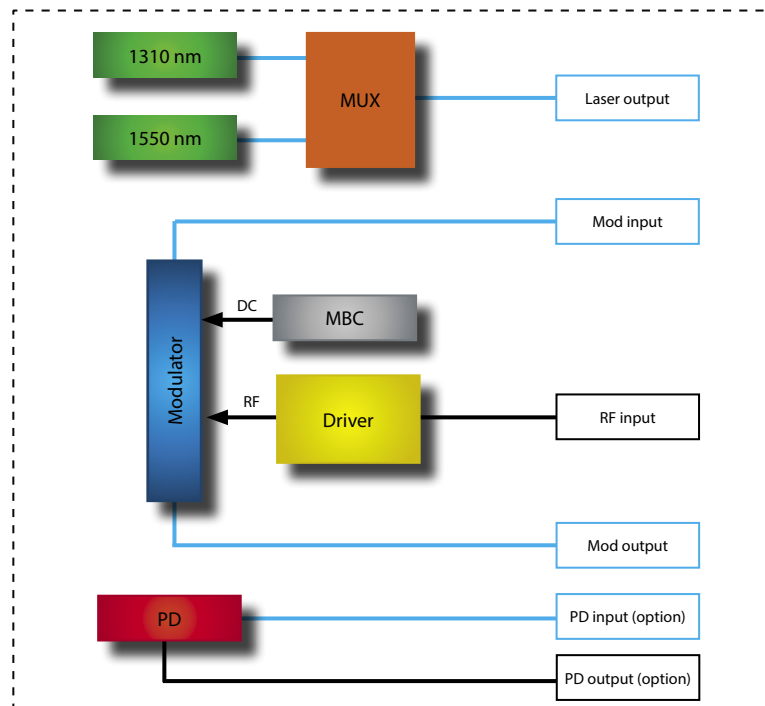
Parameter	Min	Typ	Max
Operating wavelength	1310 nm & 1550 nm		
Modulation format	NRZ		
Modulation bandwidth	28 Gb/s, 44 Gb/s		
Modulated output power @1310 nm	2 dBm	-	-
Modulated output power @1550 nm	5 dBm	-	-

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### Functional Block Diagram



### The ModBox-1310nm-1550nm-NRZ series feature:

- A chirp-free X-cut LiNbO<sub>3</sub> (Lithium Niobate) Mach-Zehnder Intensity modulator. It is selected for its wide optical bandwidth, and its high electro-optic bandwidth and flat, low ripple, electro-optic response curve.
- A high bandwidth limiting RF driver with gain and crossing levels adjustment for eye diagram optimization.
- A modulator bias controller. The internal LiNbO<sub>3</sub> modulator is a X-cut device with very low drift. However an automatic bias control circuit is provided to lock the operating point of the modulator at the quadrature point whatever the environmental conditions. The MBC ensures a highly stable output optical signal to provide reliable and reproducible measurements.
- Two 1310 nm and 1550 nm low RIN lasers are integrated by default (C-Band tunable laser in option). For convenience, the two lasers are multiplexed and an external patch cord is delivered to connect the laser output to the modulator input optical port. Wavelength selection (1310 nm or 1550 nm) and laser power are tunable through the front panel controls or the ModBox software interface.
- An optional high bandwidth dual-window photodetector (PD).

The ModBox-1310nm-1550nm-NRZ is controlled from the front panel via the Smart interface with a simple rotary knob and keypad. The Smart manual interface allows for bias control circuit, driver gain and laser settings. It comes also with a simple GUI solution, Windows based and implemented through the USB interface of the user PC.

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### Input Electrical Specifications User supplied, not a ModBox specification

Parameter	Symbol	Condition	Min	Typ	Max	Unit	
Data-rate	PRBS	ModBox-1310nm-1550nm-NRZ-28Gb/s	0.1	-	28	Gb/s	
		ModBox-1310nm-1550nm-NRZ-44Gb/s	0.1	-	44	Gb/s	
Input voltage	$V_{IN}$	AC coupled - 50 $\Omega$ - Single ended	0.400	0.450	0.500	Vpp	
Jitter	$J_{RMS}$	-	-	1	1.2	ps	
Rise / fall time	$t_r / t_f$	20 % - 80 %	28Gb/s	-	13	18	ps
			44 Gb/s	-	8	10	ps

### Input Optical Specifications User supplied, not a ModBox specification

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Operation	$\lambda$	CW	1310	1550	1565	nm
Polarization	-	-	Linear and controlled			-
Power	P	-	-	15	-	dBm
Side Mode Supression Ratio	SMSR	-	30	-	-	dB
Spectrum linewidth	$\Delta\lambda$	FWHM	-	1	-	MHz
Relative Intensity Noise	RIN	0.2 GHz - 3 GHz	-	-150	-	dB/Hz

### Output Optical Specifications Specifications below are given with embedded 1310 nm and 1550 nm lasers.

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Data-rate	PRBS	ModBox-1310nm-1550nm-28Gb/s-NRZ	0.1	-	28	Gb/s
		ModBox-1310nm-1550nm-44Gb/s-NRZ	0.1	-	44	Gb/s
Added RMS jitter	$J_{RMS}$	$\sqrt{J_{RMS}^2 = J_{RMS-total}^2 - J_{RMS-source}^2}$	-	1	1.2	ps
Dynamic Extinction Ratio	DER	-	-	12	18	dB
Dynamic Signal to Noise Ratio	SNR	-	15	20	-	-
Rise / fall time	$t_r / t_f$	ModBox-1310nm-1550nm-28Gb/s-NRZ	-	10	12	ps
		ModBox-1310nm-1550nm-44Gb/s-NRZ	-	8	10	ps
Cross point	-	-	45	50	55	%
Eye cross point variation	-	-	-5	-	5	%
Electrical Return loss	ERL	-	-	-10	-	dB
Average output power	$P_{Out}$	With embedded laser @1310 nm	2	3	-	dBm
		With embedded laser @1550 nm	5	6	-	dBm

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### 1310 nm & 1550 nm DFB Lasers Specifications

The laser 1310 nm & 1550 nm lasers are embedded by default.

Parameter	Symbol	Condition	Min	Typ	Max	Unit	
Lasers type	-	-	DFB			-	
Wavelength	$\lambda$	Embedded by default	1310 nm & 1550 nm			-	
Wavelength laser tuning range	-	Diode chip temperature control	-	0.8	1	nm	
Optical output power	-	CW	1310 nm	13	-	-	dBm
			1550 nm	16	-	-	dBm
Optical output power adjustment	-	Diode Injection current control	0	-	100	%	
Spectrum linewidth	$\Delta\lambda$	FWHM	1	2	-	MHz	
Side Mode Suppression Ratio	SMSR	-	35	-	-	dB	
Optical Return Loss	ORL	-	30	-	-	dB	

### Tunable C-Band Laser Specifications Option

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Wavelengths laser tuning range	$\lambda$	-	1527.60	-	1565.50	nm
Optical output power	-	CW	-	15	-	dBm
Optical output power adjustment	-	Diode Injection current control	0	-	100	%
Spectrum linewidth	$\Delta\lambda$	FWHM, instantaneous	-	100	-	kHz
Side Mode Suppression Ratio	SMSR	-	40	55	-	dB
Optical Return Loss	ORL	-	30	-	-	dB

### Optical Photodiode Specifications

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Detector type	-	Single ended	PIN			-
Operating wavelength range	$\lambda$	-	1270	-	1330	nm
Data-rate	-	-	45	50	-	Gb/s
Average optical input power	$P_{in}$	CW or NRZ	-	-	10	dBm
DC responsivity	R	@1310 nm	-	0.45	-	A/W
		@1550 nm	-	0.65	-	A/W
Optical Return Loss	ORL	@1310 nm	24	-	-	dB
		@1550 nm	27	-	-	dB

### Absolute Maximum Ratings

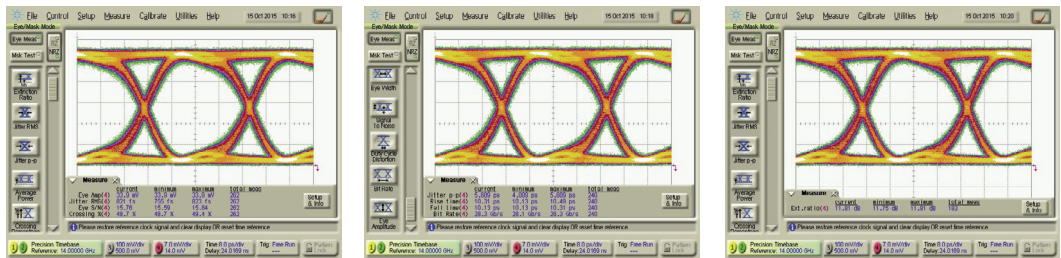
Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
Input voltage	$V_{IN}$	-	1	Vpp
Optical input power	$OP_{in}$	-	20	dBm

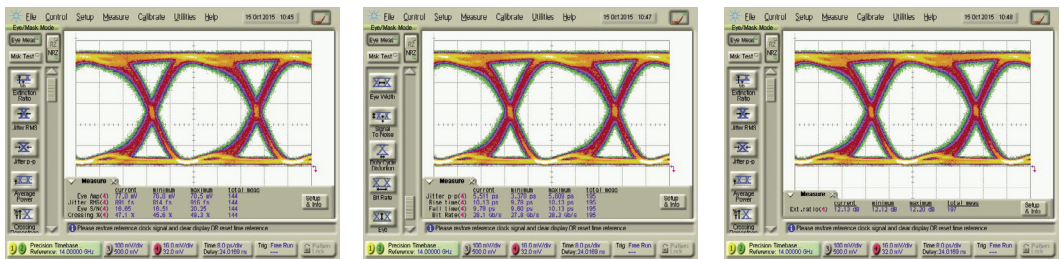
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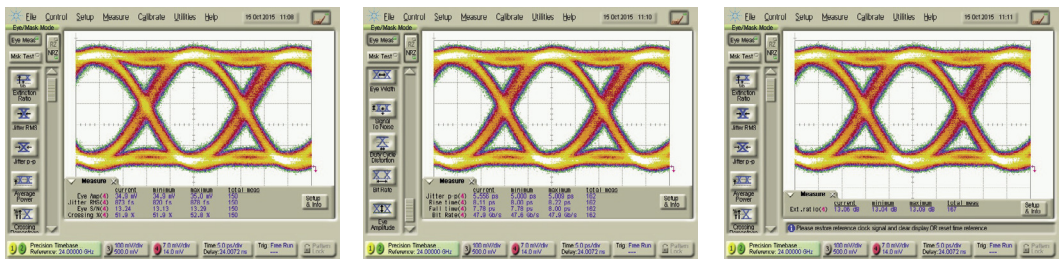
### Eye Diagrams - 28 Gb/s - 1310 nm - From ModBox-1310nm-1550nm-28Gb/s-NRZ



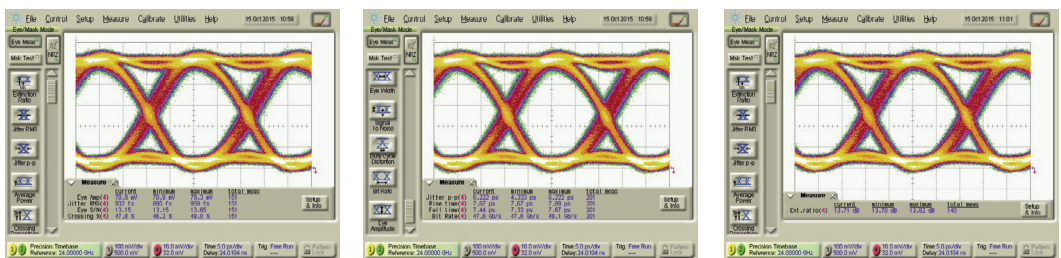
### Eye Diagrams - 28 Gb/s - 1550 nm - From ModBox-1310nm-1550nm-28Gb/s-NRZ



### Eye Diagrams - 44 Gb/s - 1310 nm - From ModBox-1310nm-1550nm-44Gb/s-NRZ



### Eye Diagrams - 44 Gb/s - 1550 nm - From ModBox-1310nm-1550nm-44Gb/s-NRZ



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### Interfaces, Dimensions and Compliance

Interfaces	
Optical	Polarization maintaining fiber PM1300 - FC/APC (by default, other connectors type in option)
RF input	Single 1.85 mm female RF connector - 50 Ω
Control	Smart Interface (front panel), GUI (USB typeB)
Power supply	100-120V/220-240 automatic switch 50-60Hz (Rear panel)
EMC and optical norms	EN61326-1 Ed. 2006 / NF EN 60825-1 & EN 60825-2 Ed.2014
Dimensions / Weight	Rack 19" x 3U, Depth=375mm / 3 kg



### Ordering information

#### ModBox-1310nm-1550nm-XXGbps-NRZ

1310nm-1550nm = 1310 nm & 1550 nm operation, embedded lasers  
 XX = Data-rate: 28Gb/s up to 28 Gb/s - 44 Gb/s up to 44 Gb/s

#### Opt-TunC

TunC = Full C-Band Tunable laser  
 This laser comes instead of embedded DFB 1550 nm laser

#### Opt-YY

YY = Output connectors, FA : FC/APC - FC : FC/UPC - SA : SC/APC - SC : SC/UPC

### 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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