

The ModBox-1550nm-44Gbps-NRZ is an optical modulation unit that generates high performance NRZ optical data streams. The equipment incorporates a modulation stage based on a high data rate LiNbO<sub>3</sub> Mach-Zehnder modulator, coupled with a high performance 44 Gb/s RF driver and an automatic bias control circuitry. It can also receive an internal laser source (DFB, ITLA...) and a photodetection stage.

The ModBox-1550nm-40Gbps-NRZ provides R&D and production engineers with state of the art performance and the peace of mind of a turn-key instrument. It can be used as a reference transmitter in optical telecommunications laboratories, or in production test beds.

In addition to the traditional 1550 nm wavelength range, it is also available at 1310 nm, 1060 nm and 850 nm.

### FEATURES

- 100 Mb/s up to 44 Gb/s
- Short rise and fall time
- High SNR
- High stability

### APPLICATIONS

- Telecom laboratories
- Components characterization
- Transmission system test
- Production test

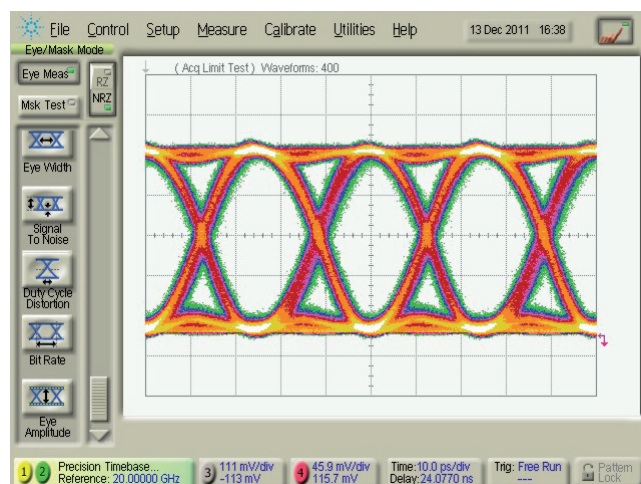
### OPTIONS

- DFB or tunable laser(s)
- Photodetector(s)
- Multi-channels version
- NRZ 12.5 Gb/s, 28 Gb/s version
- 1310 nm, 1060 nm, 850 nm
- Stressed eye 100 GbE version
- Alternative modulation formats RZ, QPSK, DPSK,...

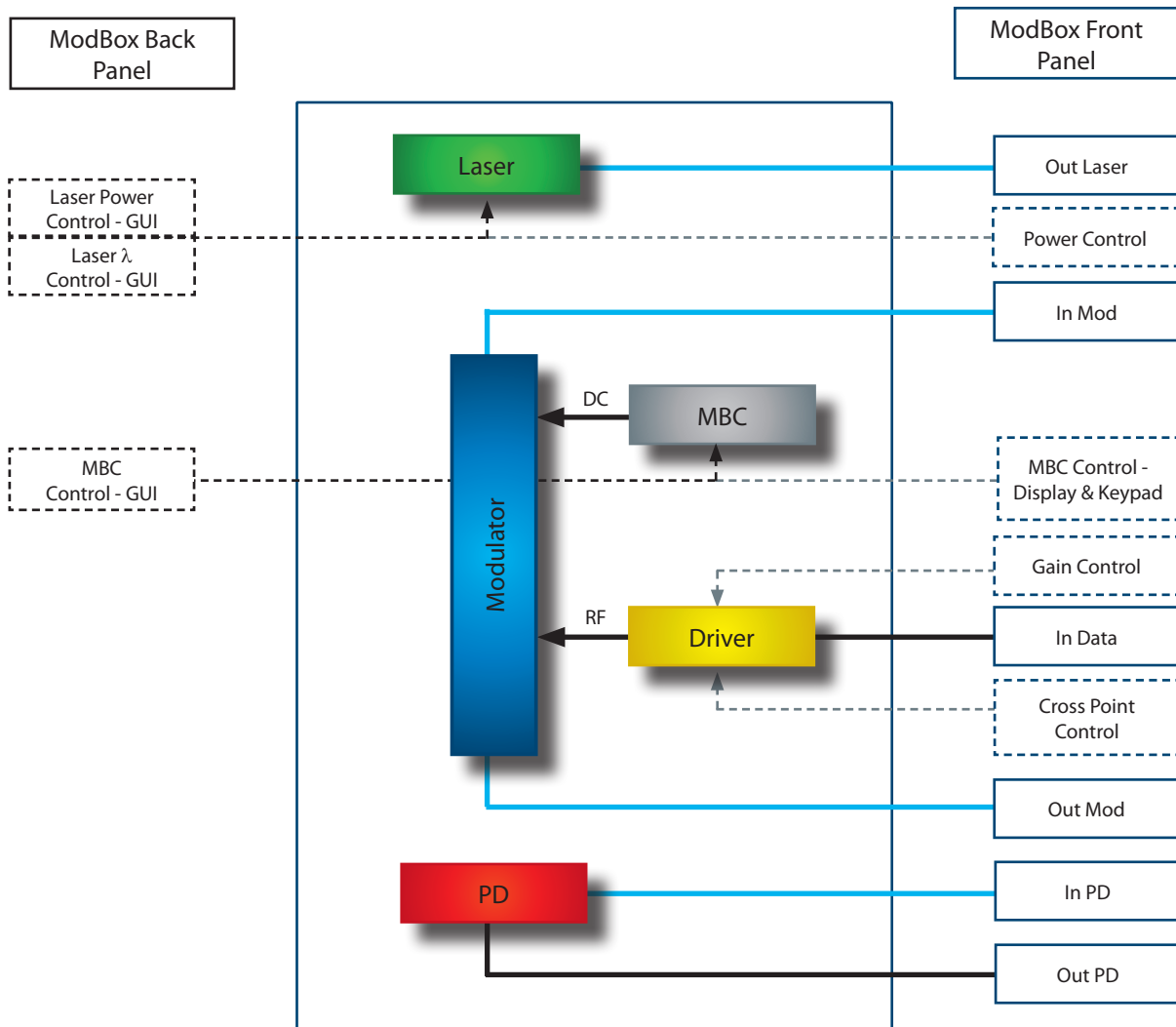
### Performance Highlights

Parameter	Min	Typ	Max	Unit
Optical wavelength range	C, L bands			
Modulation format	NRZ			
Rise / fall time	-	8	-	ps
RMS added jitter	-	1	-	ps
S/N	-	13	-	dB

### 40 Gb/s Eye diagram



## Functional Block Diagram



The ModBox-1550nm-44Gbps-NRZ integrates :

- a high bandwidth, chirp-free, X-cut LiNbO<sub>3</sub> Mach-Zehnder modulator,
- a high bandwidth NRZ RF driver with gain and crossing level adjustment for eye diagram optimization,
- a bias control circuit to lock the Mach-Zehnder modulator in quadrature mode and ensure a highly stable output optical signal,
- an optional laser source, DFB or tunable type, with its high precision driver that allows control of output power and wavelength,
- an optional high bandwidth photodetector.

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input electrical data-rate	-	Single ended	0.1	-	44	Gb/s
Modulation format	-	Single ended	NRZ			-
Rise / fall time	$t_r / t_f$	20 % - 80 %	-	8	10	ps
Impedance matching	$Z_{IN}$	-	-	50	-	$\Omega$
Input signal amplitude	$V_{IN}$	Single ended	-	0.5	-	$V_{pp}$

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Laser type	-	CW	DFB or tunable			-
Optical wavelength range *	$\lambda_{band}$	C,L bands version	1527	-	1608	nm
Polarization	-	-	Linear and controlled			-
Power	$P_{IN}$	CW	1	20	100	mW

\* Performance is optimized for one wavelength.

**Output Optical Specifications**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Insertion loss	IL	At maximum modulator transmission	-	4	6	dB
DC extinction ratio	$ER_{DC}$	-	20	23	-	dB
Return loss	ORL	-	-40	-45	-	dB
Chirp	$\alpha$	-	-0.1	0	0.1	-

**Output Modulated Signal** - Measured with Photodiode U<sup>2</sup>T XPDV5120R

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output data-rate	-	Single ended	0.1*	-	44	Gb/s
Driver gain variation	G	Adjustable	-	3	-	dB
Driver cross point	-	Adjustable	45	50	55	%
Rise / fall time	$t_r / t_f$	20 % - 80 %	-	8	10	ps
Added jitter	$J_{RMS}$	$\sqrt{J_{RMS}^2 = J_{RMS-total}^2 - J_{RMS-source}^2}$	-	1	1.3	ps
S/N	SN	-	15	20	-	-
Electrical return loss	$S_{11}$	-	-	-10	-	dB

\* Automatic Bias Control is warranted from 5 Gb/s up to 44 Gb/s.

**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
Optical input power	$OP_{in}$	-	20	dBm
RF input power	$EP_{in}$	-	5	dBm

### Optional C-Band DFB Laser Specifications

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Wavelength	$\lambda$	Other wavelength on request	1550.12 nm - ITU CH 34 *			-
Laser type	-	-	DFB			-
Optical output power	-	CW	-	40*	-	mW
Spectrum linewidth	$\Delta\lambda$	FWHM	-	-	1	MHz
Optical return loss	ORL	-	30	35	-	dB
Side mode suppression ratio	SMSR	-	30	-	-	dB
Optical output power adjustment	$P_{CW}$	Front & back panels with GUI	20	-	40	mW
Wavelength laser tuning range	-	Back panel with GUI	-	0.8	1	nm

\* Other ITU-Channel and power laser on request.

### Optional C-Band & L-Band Tunable Laser Specifications

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Optical wavelength range	$\lambda_{C\text{-band}}$	C-band version	1527.60	-	1565.50	nm
Optical wavelength range	$\lambda_{L\text{-band}}$	L-band version	1570.01	-	1608.76	nm
Optical output power	$P_{CW}$	CW	5	-	35	mW
Frequency fine tune resolution	FTF	-	-	1	-	MHz
Optical output power accuracy	$P_{CW\text{-acc}}$	-	-1	-	1	dB
Wavelength accuracy	$\Delta\lambda_{\text{acc}}$	-	-1.5	-	1.5	GHz
Spectrum linewidth	$\Delta\lambda$	FWHM @-3 dB, instantaneous	-	-	100	kHz
Side Mode Suppression Ratio	SMSR	-	40	55	-	dB
RIN	$RIN_7$	For 7 dBm output power	-	-	-140	dB/Hz
	$RIN_{13}$	For 13 dBm output power	-	-	-145	
Optical output power adjustment	$\Delta P_{CW}$	Back panel with GUI	5	-	35	mW

### Optional Photodetector Specifications

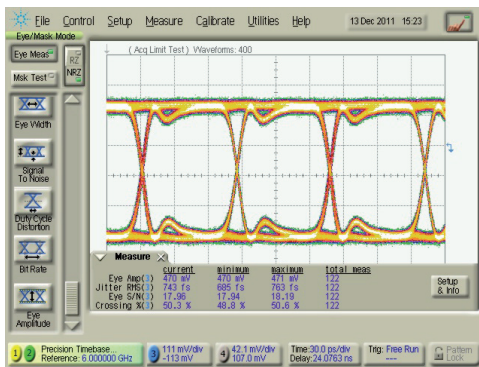
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Photodetector type	-	-	APD			-
Operating wavelength range	$\lambda$	-	1480	-	1620	nm
Operating optical input range	$P_{\text{opt}}$	-	-20	-	13	dBm
3dB cut-off frequency	$f_{3\text{dB}}$	NRZ eye diagram & BER at 40 Gb/s	33	40	-	GHz
Optical return loss	ORL	-	27	-	-	dB
Photodiode DC responsivity	R	Optimum polarisation	0.5	0.65	-	A/W
Maximum optical input power	$P_{\text{opt}}$	Average - NRZ	-	-	16	dBm
Maximum output peak voltage	$V_{\text{Peak}}$	-	-	-	1.5	V

## Eye Diagrams

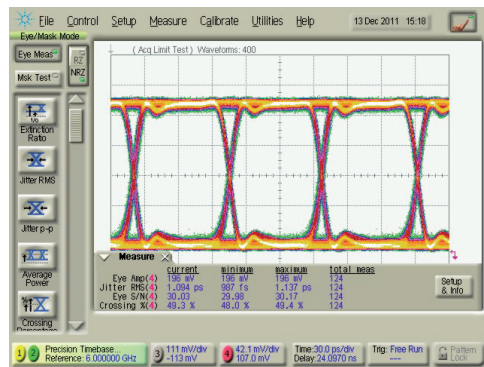
The following equipment was used in obtaining these results :

- Pulse Pattern Generator : Anritsu MP1800 with Mux Centellax MS451V2M
- Oscilloscope Agilent 86100B with time base precision 86107A
- Photodiode U<sup>2</sup>T XPDV2150R

## 10 Gb/s data rate

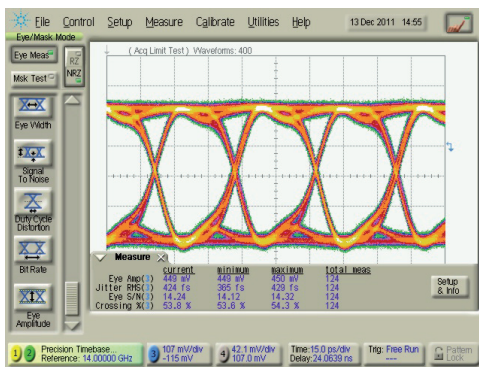


Input electrical signal

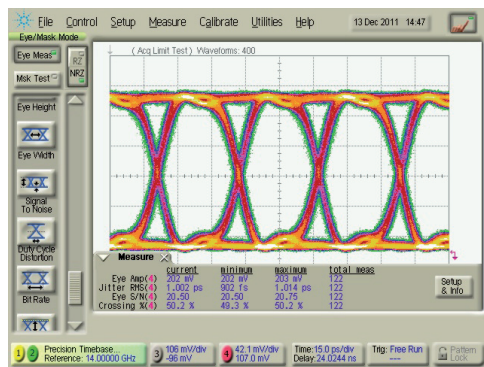


Output optical signal

## 28 Gb/s data rate

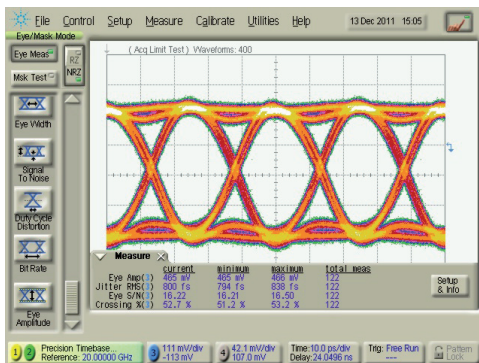


Input electrical signal

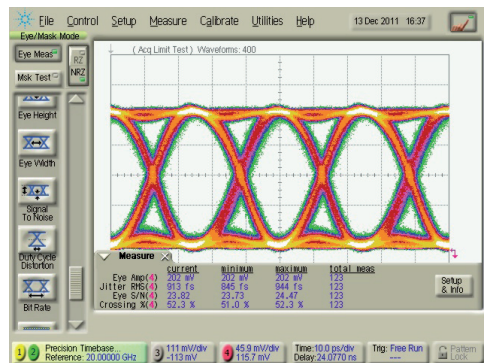


Output optical signal

## 40 Gb/s data rate



Input electrical signal



Output optical signal

## Dimensions - Interfaces - Compliance

Dimensions	
Dimensions	19 inches x 3U
Weight	3 kg - 6.6 pounds
Power supply (rear panel)	100 - 120 V / 220 - 240 V automatic switch, 50 - 60 Hz
Interfaces	
Optical connectors	FC/UPC - FC/APC - SC/UPC
RF connector	50 Ω - V female
Fiber	Polarization maintaining fiber, PM1550
Remote type	MBC - Laser - USB type B with Windows GUI
Compliance	
Safety	EN 60625-1
Marking	CE

## Ordering Information

## ModBox-W-DR-OL-ORx-XX

W = Wavelength range : 1550nm, 1310nm, 1060nm, 850nm  
 DR = maximum output Data-Rate : 12.5Gbps, 28Gbps, 44Gbps  
 OL = Laser Option, omit if no laser - CHX\* : CW ITU Channel - C or L Tunable laser : C-Tun or L-Tun  
 ORx = Photodetector Option, omit if no photodetector - Rx : Photodetector  
 XX = Input / Output connectors, FA : FC/APC - FC : FC/UPC - SC : SC/UPC  
 \* X is the ITU channel number, X = 34 by default

Example : ModBox-1550nm-44Gbps-CH34-Rx-FA is a modulation unit for 1550 nm, 100 Mb/s - 44 Gb/s NRZ opti-  
 modulated signal, with DFB laser at 1550.12 nm and photodetector, FC-APC connectors.

## About us

Photline Technologies is a provider of Fiber Optics Modulation Solutions based on the company LiNbO<sub>3</sub> modulators and high-speed electronics modules. Photline Technologies offers high speed and high data rate modulation solutions for the telecommunication industry and the defense, aerospace, instruments and sensors markets. The products offered by the company include : comprehensive range of intensity and phase modulators (800 nm, 1060 nm, 1300 nm, 1550 nm, 2000 nm), RF drivers and modules, transmitters and modulation units.

ZI Les Tilleroyes - Trépillot  
 16, rue Auguste Jouchoux - 25000 Besançon - FRANCE  
 tél. : +33 (0) 381 853 180 - fax : + 33 (0) 381 811 557

Photline Technologies reserves the right to change, at any time and without notice, the specifications, design, function or form of its products described herein. All statements, specification, technical information related to the products herein are given in good faith and based upon information believed to be reliable and accurate at the moment of printing. However the accuracy and completeness thereof is not guaranteed. No liability is assumed for any inaccuracies and as a result of use of the products. The user must validate all parameters for each application before use and he assumes all risks in connection with the use of the products.