



The ModBox-CBand-28Gbaud-PAM4 is a full C+L bands Linear Reference Transmitter that generates excellent quality optical data streams PAM-4 up to 28 Gbaud and NRZ up to 28 Gb/s. The transmitter produces very clean eye diagrams with high SNR and fast rise and fall times. It also provides the flexibility of adjusting the extinction ratio for vertical eye closure.

The ModBox-CBand-28Gbaud-PAM4 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 a 1550 nm DFB laser source, and an optional 1490 nm laser.

In addition to the C+L-bands, ixblue offers reference transmitters in the O-band and at 850 nm.

## FEATURES

- C + L Bands Reference Transmitter
- PAM-4 up to 28 Gbaud
- NRZ up to 28 Gb/s
- 1550 nm laser embedded by default
- Reliable & reproducible measurements
- High eye diagram stability
- Extinction Ratio Adjustable

## APPLICATIONS

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

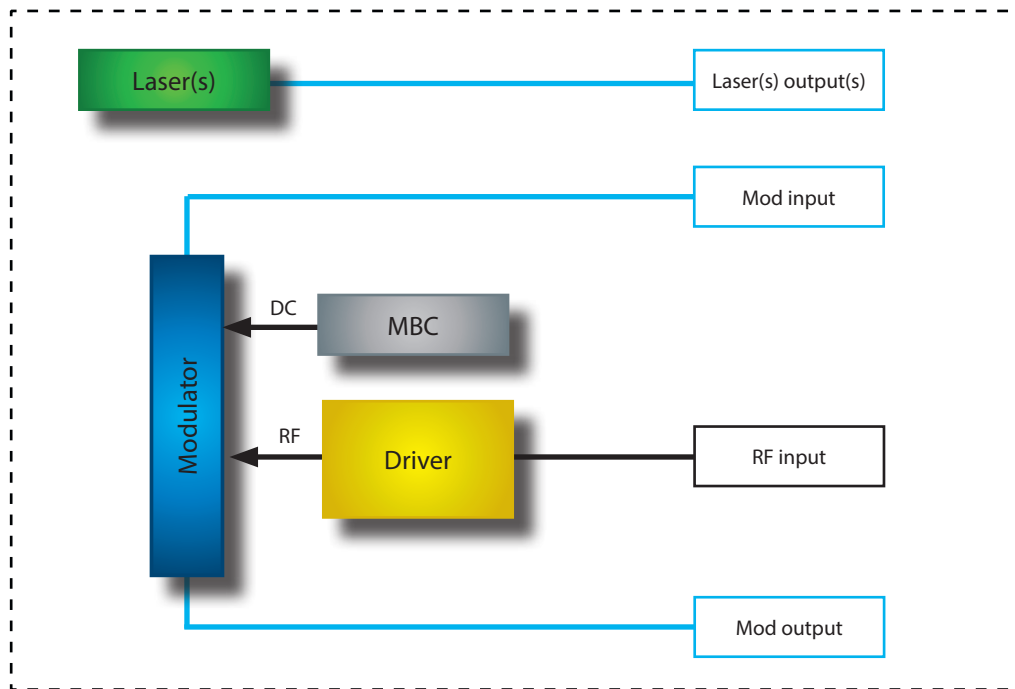
## OPTIONS

- Laser 1490 nm
- Multi-Channel
- 850 nm, O-band

## Performance Highlights

Parameter	Min	Typ	Max
Operating wavelength	C + L bands		
Modulation format	PAM-4, NRZ		
Modulation bandwidth	PAM-4 up to 28 Gbaud, NRZ up to 28 Gb/s		
Modulated output power @1550 nm	6 dBm	-	-

### Functional Block Diagram



The ModBox-CBand-28Gbaud-PAM4 features:

- A chirp-free X-cut LiNbO<sub>3</sub> (Lithium Niobate) Mach-Zehnder Intensity modulator. It is selected for its high electro-optic bandwidth with flat and low ripple electro-optic response curve.
- A high bandwidth and highly linear RF driver.
- 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 and optical (laser power and wavelength) conditions. The MBC ensures a highly stable optical output signal to provide reliable and reproducible measurements.
- A 1550 nm low RIN laser is integrated by default. For convenience, an external patch cord is delivered to connect the laser output to the optical input of the modulation stage. Wavelength and power are tunable through the front panel controls or the ModBox software interface.

The ModBox-CBand-28Gbaud-PAM4 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, RF driver and laser settings. It comes also with a simple GUI solution, Windows based and implemented through the USB interface of the user PC.

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Data-rate	-	PAM-4 electrical input signal	0.1	-	28	Gbaud
		NRZ electrical input signal	0.1	-	28	Gb/s
Input voltage	$V_{IN}$	AC coupled - 50 $\Omega$ SE - Linear operation	-	0.200	0.300	Vpp
Jitter	$J_{RMS}$	-	-	1	1.2	ps
Rise / fall time	$t_r / t_f$	20 % - 80 %	-	13	18	ps
Corss-point	-	NRZ mode	45	50	55	%

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Operation	$\lambda$	CW	1490 nm, C + L Bands			-
Polarization	-	-	Linear and controlled			-
Power	$OP_{IN}$	-	-	16	-	dBm
Side Mode Supression Ratio	SMSR	-	30	-	-	dB
Spectrum linewidth	$\Delta\lambda$	FWHM	-	0.5	1	MHz
Polarization Extinction ratio	PER	-	-	19	-	dB

## Output Optical Specifications

Specifications below are given with embedded 1550 nm laser, unless differently specified.

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Embedded Laser	$\lambda$	DFB integrated by default	1550.12 nm - ITU-CH34			-
Data format	-	-	PAM-4 & NRZ			-
Data-rate	-	PAM-4 electrical input signal	0.1	-	28	Gbaud
		NRZ electrical input signal	0.1	-	28	Gb/s
Output modulated power	$OP_{OUT}$	1550 nm laser	6	7	-	dBm
		Option: Tunable C-Band Laser	6	7	-	dBm
		Option: Tunable L-Band Laser	6	7	-	dBm
		Option: 1490 nm	2	3	-	dBm
Jitter	$J_{RMS}$	RMS Jitter, NRZ mode	-	0.8	-	ps
	$J_{PP}$	Peak-to-Peak Jitter, NRZ mode	-	5	-	ps
Minimum dynamic extinction ratio	$DER_{MIN}$	By NRZ data input level adjustment	0	-	-	dB
Maximum dynamic extinction ratio	$DER_{MAX}$	By NRZ data input level adjustment	0	10	13	dB
Dynamic Signal to Noise Ratio	SNR	NRZ mode	-	12	-	dB
Rise / fall time	$t_r / t_f$	NRZ mode	-	15	-	ps
Crosspoint	-	NRZ mode	45	50	55	%
Optical return loss	ORL	-	-40	-45	-	dB

## SMART Interface and GUI

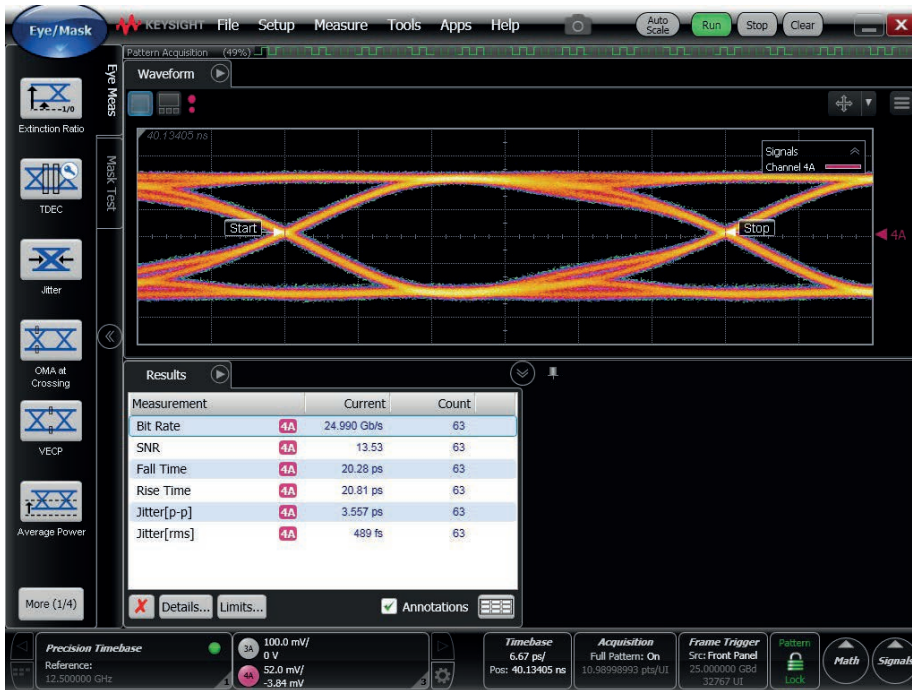
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Wavelength laser tuning range	$\delta\lambda$	Diode chip temperature control	-	0.8	1	nm
Optical output power adjustment	$\delta OP_{OUT}$	Diode Injection current control	0	-	100	%
Eye amplitude adjustment	$\delta ER$	-	-	3	-	dB
Eye crosspoint adjustment	-	-	-4	-	4	%

## Absolute Maximum Ratings

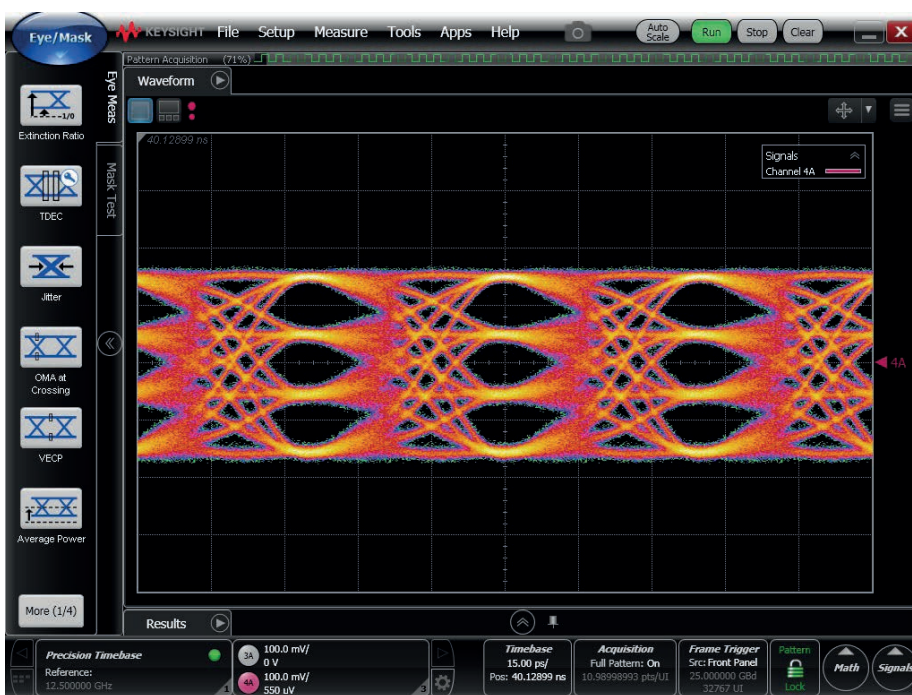
Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute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

Eye Diagrams - NRZ 25 Gb/s - 1550 nm - From ModBox-CBand-28Gbaud-PAM4



Eye Diagrams - PAM-4 25 Gbaud - 1550 nm - From ModBox-CBand-28Gbaud-PAM4



## Interfaces, Dimensions and Compliance

Interfaces	
Optical	Polarization maintaining fiber PM1550 - FC/APC (by default, other connectors type in option)
RF input	Single 1.85 mm - V 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



ModBox-CBand-28Gbaud-PAM4 - Front panel

## Ordering information

### ModBox-CBand-28Gbaud-PAM4

CBand = Full C & L bands of operation, 1550 nm laser embedded by default

28Gbaud = Data-rate: NRZ up to 28 Gb/s - PAM-4 up to 28 Gbaud

#### Opt-XXTun

Tunable laser option

XX = Optional additional laser band : C : C-Band - L : L-Band

#### Opt-DFB-1490nm

DFB laser option

Optional additional laser at 1490 nm

#### 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 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.