



FEATURES

- Full O-Band Reference Transmitter
- NRZ Clean & Stressed Eye up to 28 Gb/s
- 100 GbE IEEE 802.3ba std compliant
- 1310 nm laser embedded (ITU-T G694.1)
- Reliable & reproducible measurements
- High eye diagram stability

APPLICATIONS

- 100 GbE testing
- Manufacturing and R&D receiver testing
- Fibre channel dispersion penalty testing
- Industrial production test
- R&D laboratories

OPTIONS

- C-WDM: 1270 nm, 1290 nm, 1330 nm
- Multi-Channel
- 850 nm, C-band ModBox versions

The ModBox-OBand-28Gb/s-NRZ-SE provides production and R&D engineers a solution for Stress Receiver Sensitivity test & measurements in the O-Band.

This optical transmitter delivers the possibility to add variable stress to the high-quality NRZ clean eye diagram.

This O-band optical transmitter operates with data-rates from 155 Mb/s up to 28 Gb/s, and provides an independent solution for tunable stress magnitudes in both horizontal (jitter) and vertical (interference) eye axis (Stressed Eye).

It is primarily aimed at photoreceivers stressed sensitivity testing according to the 100 GbE IEEE 802.3ba standard. This unit is also used to test communication links and may be integrated to various telecommunication tests set-ups.

The ModBox-OBand-28Gb/s-NRZ-SE is a turn-key instrument delivering state of the art performance. It is being used in optical telecommunications laboratories and industrial production test beds.

This equipment embeds a modulation stage based on a chirp-free LiNbO₃ Mach-Zehnder modulator, coupled with a high performance RF driver and an automatic bias control circuitry. It also integrates a 1310 nm DFB laser source, and optional C-WDM lasers lanes.

In addition to the O-band, iXblue offers transmitters in the C-band and at 850 nm.

Performance Highlights

| Parameter | Min | Typ | Max |
|------------------------------------|------------------------------------|---------|---------|
| Operating wavelength | 1270 nm | 1310 nm | 1330 nm |
| Modulation format | NRZ Reference & Stressed eye modes | | |
| Modulation bandwidth | Up to 28 Gb/s | | |
| Modulated output power (option HP) | 6 dBm | - | - |

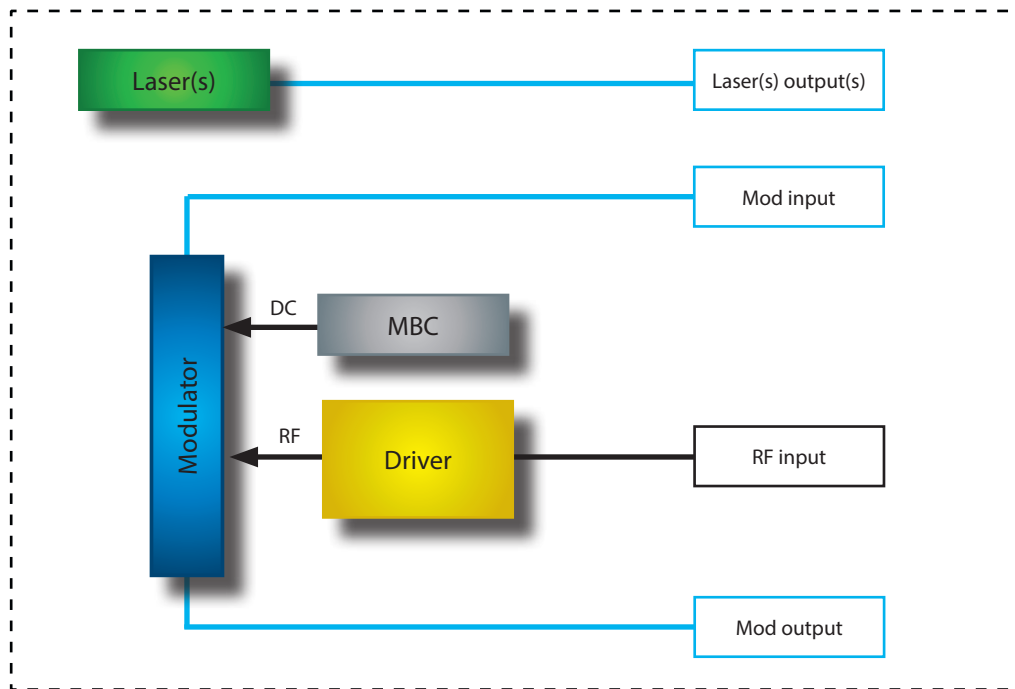
Ordering Information:



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Fax orders to: 800-878-7282

Functional Block Diagram



The ModBox-OBand-28Gb/s-NRZ-SE features:

- A chirp-free X-cut LiNbO₃ (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 RF driver.
- A modulator bias controller. The internal LiNbO₃ 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 1310 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-OBand-28Gb/s-NRZ-SE 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.

From the RF input port, the user may add stress components to the base signal in order to produce stressed optical signals at the ModBox output. For example in the case of joint use with an Anritsu PRBS (type MP1900A), the user may add sinusoidal jitter, gaussian noise and a set of sinusoidal interference signals. The frequency and amplitude of each stress signals shall be chosen so that the optically stressed output signal complies with the 802.3ba standard for stressed receiver sensitivity testing.

Input Electrical Specifications User supplied, not a ModBox specification

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|------------------|-------------|---------------------------------------|-------|-------|-------|------|
| Data-rate | - | NRZ electrical input signal | 0.1 | - | 28 | Gb/s |
| Input voltage | V_{IN} | AC coupled - 50 Ω Single Ended | 0.100 | 0.250 | 0.400 | Vpp |
| Rise / fall time | t_r / t_f | 20 % - 80 % - NRZ @25.78125 Gb/s | 13 | 15 | 18 | ps |
| Corss-point | - | - | 45 | 50 | 55 | % |

Input Optical Specifications User supplied, not a ModBox specification

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|-------------------------------|-----------------|-----------|-----------------------|-----|------|------|
| Operation | λ | CW | 1270 | - | 1330 | nm |
| Polarization | - | - | Linear and controlled | | | - |
| Power | OP_{IN} | - | - | 10 | - | dBm |
| Side Mode Supression Ratio | SMSR | - | 30 | - | - | dB |
| Spectrum linewidth | $\Delta\lambda$ | FWHM | - | 1 | - | MHz |
| Polarization Extinction ratio | PER | - | - | 20 | - | 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 | δOP_{OUT} | Diode injection current control | 0 | - | 100 | % |
| Eye amplitude adjustment | - | - | - | 3 | - | dB |
| Eye crosspoint adjustment | - | - | -5 | - | 5 | % |

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 |

Output Optical Specifications

Specifications below are given with embedded 1310 nm laser, unless differently specified.

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|-------------|------------------------------------|-----|-----|-----|------|
| NRZ Reference mode (Unstressed eye diagram) | | | | | | |
| Jitter | J_{RMS} | RMS Jitter | - | 0.8 | - | ps |
| | J_{PP} | Peak-to-Peak Jitter | - | 5 | - | ps |
| Minimum dynamic extinction ratio | DER_{MIN} | By NRZ data input level adjustment | 2 | - | - | dB |
| Maximum dynamic extinction ratio | DER_{MAX} | By NRZ data input level adjustment | - | 10 | 13 | dB |
| Dynamic Signal to Noise Ratio | SNR | - | - | 12 | - | dB |
| Rise / fall time | t_r / t_f | - | 8 | - | 10 | ps |
| Crosspoint | - | - | 45 | 50 | 55 | % |

| | | | | | | |
|--------------------------------------|-------------|------------------------------------|----|------|-----|----|
| NRZ Stressed eye mode ⁽¹⁾ | | | | | | |
| Duty cycle distortion | DCD | - | 0 | - | 0.1 | % |
| Vertical eye closure penalty | VECP | @ 25.78125 Gb/s | - | 1.9 | - | dB |
| Jitter | J_2 | @ 25.78125 Gb/s | - | 0.33 | - | ps |
| | J_4 | @ 25.78125 Gb/s | - | 0.48 | - | ps |
| Dynamic extinction ratio | DER | By NRZ data input level adjustment | - | 10 | - | dB |
| Dynamic Signal to Noise Ratio | SNR | - | - | 10 | - | dB |
| Rise / fall time | t_r / t_f | NRZ mode | 8 | - | 10 | ps |
| Crosspoint | - | NRZ mode | 45 | 50 | 55 | % |

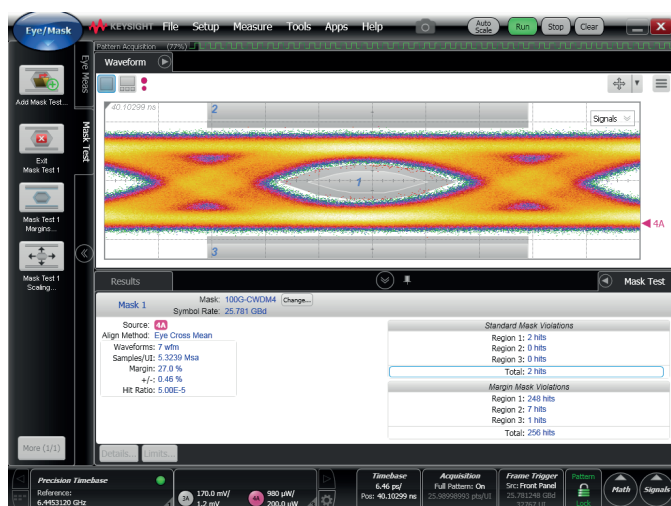
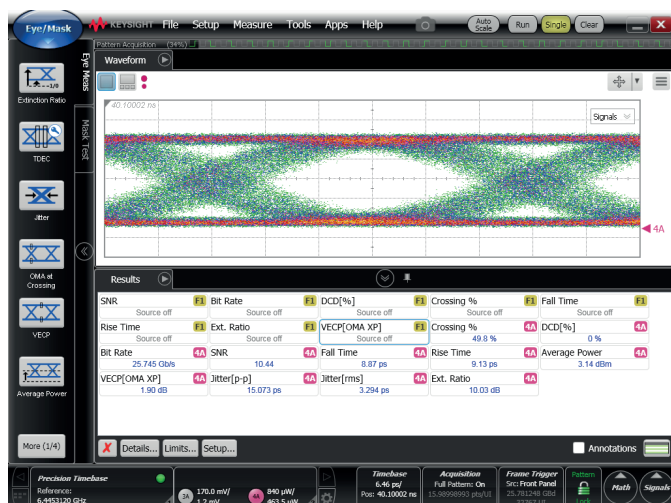
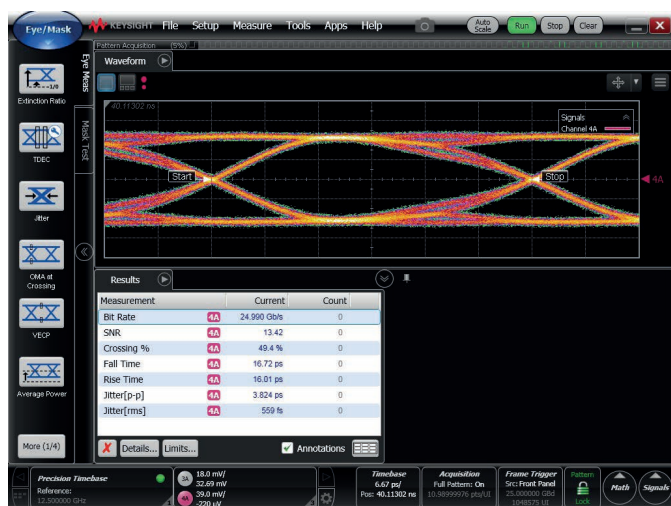
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|------------------------|------------|-----------------------------------|------------------------------------|-----|----|------|
| General Specifications | | | | | | |
| Data format | - | - | NRZ Reference & Stressed eye modes | | | - |
| Data-rate | - | NRZ electrical input signal | 0.1 | - | 28 | Gb/s |
| Output modulated power | OP_{OUT} | With embedded 1310 nm laser | 2 | 3 | - | dBm |
| | | High output power option @1310 nm | 6 | 7 | - | dBm |
| | | Option: 1270 nm, 1290 nm, 1330 nm | 2 | 3 | - | dBm |
| Optical return loss | ORL | - | -40 | -45 | - | dB |
| Electrical Return loss | ERL | RF modulation in | - | -10 | - | dB |

| | | | | | | |
|-------------------------------|-----------|-------------------------------|------------------|------|---|-------|
| Embedded laser Specifications | | | | | | |
| Embedded Laser | λ | DFB integrated by default | - | 1310 | - | nm |
| | | CWDM DFB integrated in option | 1270, 1290, 1330 | | | nm |
| Side mode suppression ratio | SMSR | - | 30 | - | - | dB |
| Relative intensity noise | RIN | - | - | -150 | - | dB/Hz |

(1): A certain type of electrical noise (time and amplitude) is added from the PRBS to achieve stressed output optical signal.

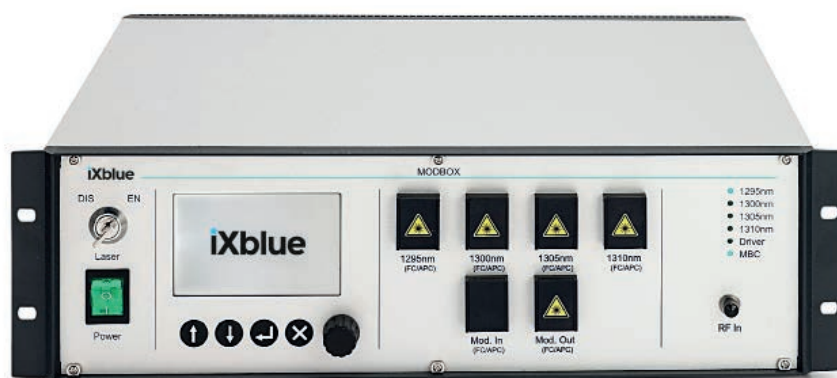
Measurements & Related equipments

In this setup, the MP1900A from Anritsu generates electrically stressed signals displayed on a Keysight oscilloscope with a 50 GHz sampling module. The ModBox-OBand-28Gbps-NRZ-SE generates the optically referenced and stressed eyes. The scope is triggered by the MP1900A using a non jittered clock to allow for the optical signal jitter investigation. The scope embeds a jitter analysis software that allows us to spread the jitter data into individual constituents. We may then derive essential jitter metrics for the evaluation of the stress applied to the optical signal. In the following graphs you may notice the effect of adding a certain type of stress to the output optical signal.



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 - 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 / 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 |



LAN-WDM Laser ModBox example - Front panel

Ordering information

ModBox-OBand-28Gbps-NRZ-SE

OBand = Full band of operation, embeds laser, 1310 nm laser embedded by default
28Gbps = Data-rate: NRZ up to 28 Gb/s

Opt-DFB-XX

DFB laser option

XX = Optional additional laser - CWDM Wavelength in 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 (LiNbO₃) 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.