

The ModBox-IQ is a high performance modulation unit that allows telecommunication engineers and research scientists to produce optical signals with complex modulation schemes (QPSK, DPSK). The ModBox-IQ is easy to use and finds its place in production test beds, development laboratories and scientific setups.

The high bandwidth and low harmonic distortion of the ModBox-IQ allow to generate particularly clean DPSK and QPSK optical signals up to 32 Gb/s and 32 Gbaud respectively.

## FEATURES

- Data-rate up to QPSK 64 Gbaud
- Data-rate up to DPSK 32 Gb/s
- High SNR
- Automatic / Manual control

## APPLICATIONS

- Transmission system test
- Components characterization
- R&D Datacom/Telecom
- Telecom laboratories

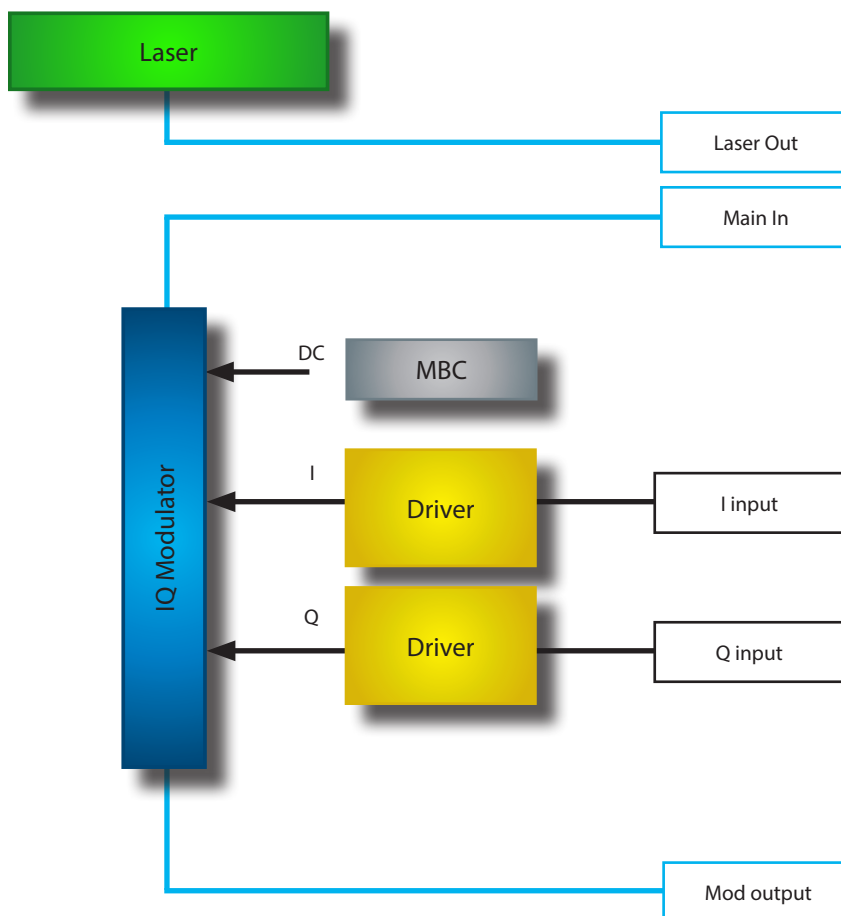
## OPTIONS

- Dual Polarization
- C, L bands operation
- Multi-Channel
- DFB and tunable lasers

## Performance Highlights

Parameter	Min	Typ	Max
Operating wavelength	C-band, L band		
Modulation format	DPSK, QPSK		
Data-rate QPSK	-	-	32 Gbaud
Data-rate DPSK	-	-	32 Gb/s
Insertion loss	-	7 dB	8 dB

## Functional Block Diagram



The ModBox-CBand-QPSK is designed around a Dual Parallel Mach-Zehnder Modulator (single drive and X-cut design), an automatic bias control circuitry and limiting RF amplifiers. The embedded bias controller is designed to stabilize three operating bias points of a dual parallel nested modulator. It is fully automated and uses a reduced dither signal level to provide a rock stable setpoint of your phase delays over time and environmental conditions.

The equipment operates with a user supplied RF signal. The ModBox embeds a high purity C-band tunable laser source. The modulator input port is available and external laser can be used.

The user has access to these operating modes from the front panel using the embedded computer software and / or remotely from a Graphical User Interface (GUI) that is provided.

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Data Input Specifications						
Source type	-	CW	DFB, tunable laser			
Wavelength	$\lambda$	C-band, L-band	1527	1550	1608	nm
Input power	$P_{CW}$	CW	1	-	20	mW
Polarization	P	-	Linear and controlled			

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input electrical termination	-	-	Single ended			-
QPSK modulation scheme						
Modulation Format	-	I, Q	NRZ			-
Data-rate	-	I, Q	-	-	32	Gbaud
Input signal amplitude	V <sub>IN</sub>	50 Ω	-	600	-	mVpp
DPSK modulation scheme						
Modulation Format	-	-	NRZ			-
Data-rate	-	-	-	-	32	Gb/s
Input signal amplitude	V <sub>IN</sub>	50 Ω	-	600	-	mVpp

## Optical Output Specifications

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Data-rate	-	QPSK	1	-	32	Gbaud
	-	DPSK	1	-	32	Gb/s
Insertion loss	IL	At maximum transmission	-	7	8	dB
Chirp	$\alpha$	-	-0.1	0	0.1	-
Optical return loss	ORL	-	-45	-50	-	dB
Static extinction ratio	ER	-	20	25	-	dB
RF gain adjustment	$\Delta G$	Smart	-	3	-	dB
Bias Control	MBC	Smart	Automatic / Manual			-

Automatic bias control from 5 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
RF input power	$EP_{in}$	-	+2	dBm
Optical input power	$OP_{in}$	-	20	dBm

The ModBox can integrate up to 4 DFB or tunable lasers. The ModBox Smart Interface allows the user to control laser power and wavelength. In case of several DFB lasers, the ModBox is optimised for each individual wavelength. An interferometer and a delay line were used for the demodulation.

### Optional C-L 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	-	20*	-	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 panel & GUI	0	-	20	mW
Wavelength laser tuning range	-	Front panel & GUI	-	0.8	1	nm

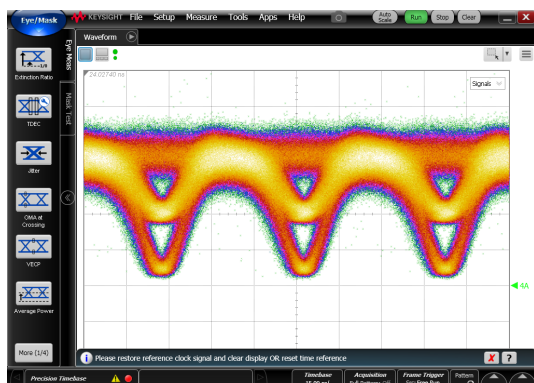
\* Other ITU-Channel on request.

### C-Band Tunable Laser Specifications (C-Band embedded by default, L-band in option)

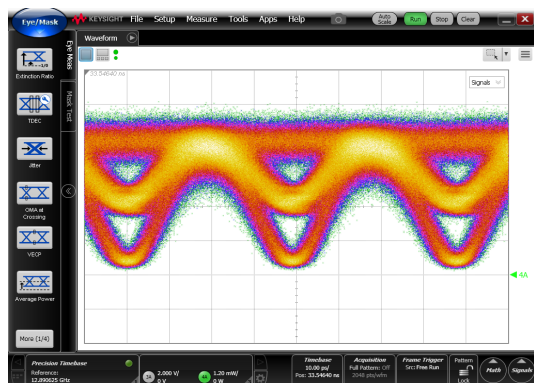
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Optical wavelength range	$\lambda$	C-band version	1527.60	-	1565.50	nm
Optical wavelength range	$\lambda$	L-band version (optional)	1570.01	-	1608.76	nm
Optical output power	$P_{CW}$	CW	-	20	-	mW
Frequency fine tune resolution	FTF	-	-	1	-	MHz
Optical output power accuracy	$P_{CW-acc}$	-	-1	-	1	dB
Wavelength accuracy	$\Delta\lambda_{acc}$	-	-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	$\Delta P_{CW}$	Front panel & GUI	5	-	20	mW

## Eye Diagrams

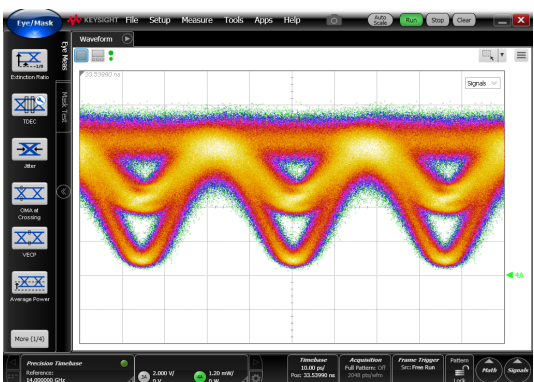
The following equipment was used in obtaining these results with the Pulse Pattern Generator Anritsu MP1800A and the the oscilloscope Agilent 86100B with time base precision module 86107A.



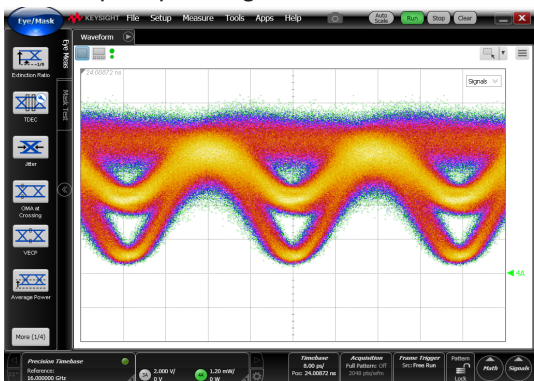
Output optical signal - QPSK 20 Gbaud



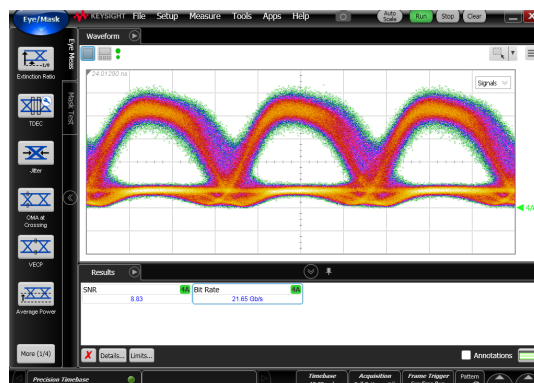
Output optical signal - QPSK 25 Gbaud



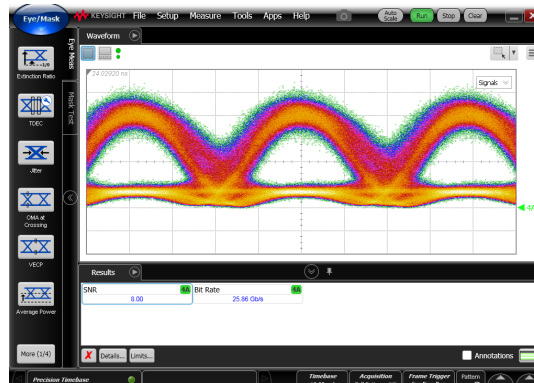
Output optical signal - QPSK 28 Gbaud



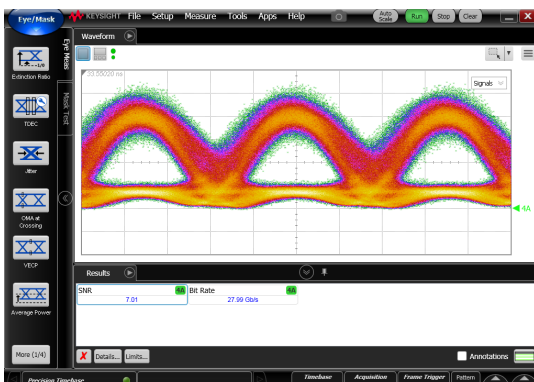
Output optical signal - QPSK 32 Gbaud



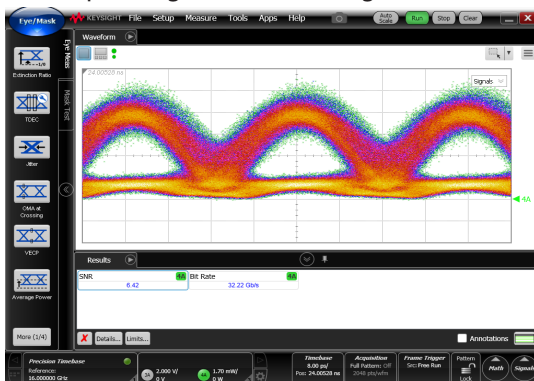
Corresponding demodulated signal at 20 Gb/s



Corresponding demodulated signal at 25 Gb/s



Corresponding demodulated signal at 28 Gb/s



Corresponding demodulated signal at 32 Gb/s

## Front Panel

Interfaces	
Optical	Front-Panel: FC/APC - Polarization maintaining fiber, Corning PM 15-U25D
RF	Front-panel - SMA - Female
Control	Touch screen Smart Interface (front panel), GUI (Ethernet) - Windows 10
Power supply	100 V - 120 V / 220 V - 240 V automatic switch 50-60 Hz (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 = 495 mm / 8 kg



## Ordering Information

### ModBox-CBand-IQ-32Gbaud-XX

XX = Input / Output connectors, FA : FC/APC - FC : FC/UPC - SC : SC/UPC

## About us

ixBlue Photonics produces specialty optical fibers and Bragg gratings based fiber optics components and that 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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