

Innovation for the next generation

PON Test Set

30G BERT | Clock Recovery |
12G Optical Scope | GUI-selectable
PON Filters

Jitter Analysis and calibration | Eye Measurements |
Eye Mask Test | Advanced Pattern Acquisition | Pre-emphasis
Measurement | Automated J2/J9 measurements | 1.25, 2.5, &
10.3125 Gbps H/W filters | High-voltage option 4 Vpp



Summary

The ML4003BX carries with it half a decade of MultiLane's test and measurement expertise. A field tested, high-value PON tester, containing a BERT, Digital Sampling Oscilloscope and an optional optical scope all integrated into a single chassis. A longstanding MultiLane instrument, the 4003BX has proven its continued relevance time and time again.

This latest iteration includes a revamped enclosure, GUI switchable hardware filters – applicable to both MultiLane and 3rd party GUIs – and a digital display which provides the instrument's status, IP address, firmware revision, selected filter, PLL status, etc. at a glance.

ML4003BX

Fully Modular BERT, Scope, SFP28 and XFP

Introduction

As per the MultiLane standard, the ML4003BX is made to measure to meet specific customer needs. The instrument can be ordered as a 16G BERT with a 32 GHz DSO and can be expanded to include a 10G / 25 GHz Optical sampling scope. The complete setup consists of a 30G BERT and an optical sampling oscilloscope of up to 25 GHz. The PPG has an output swing up to 800 mVpp differential. The HV option will give you adjustable levels between 2 and 4 V pk-pk at 25 Gbps. All iterations of the 4003BX contain hardware switchable Gaussian filters compliant to IEEE mandates and the PON standard.

Key Features

BERT

- BERT data rates: Any rate from 1 to 16 to 30 Gbps
- CTLE auto-tune function for each receiver
- Automated J2/J9 measurements
- Eye Contour measurements
- Bathtub and vertical bathtub

DSO Features

- NRZ and PAM4 measurements
- 800 mV amplitude resolution
- Eye opening, height and width, eye amplitude, top, base, Hi, Lo, max, min, peak to peak.
- Rise/ Fall Time, Crossing percentage.
- Zooming, markers, X and Y histogram overlays, statistics over multiple measurements.
- Eye & pattern measurements on specific properties of the pattern.
- Pre-emphasis positive and negative (amplitude and width) measurements.

- SW filters applicable include PTB, CTLE, FFE, De- Embedding, Moving Averages
- Total jitter and jitter decomposition
- Mask margin testing

HV Option

- Nominal HV output is 4 to 8 V peak-peak differential
- The input range of the error detector is limited to 1.2 Vpp. Do not loop back an HV signal directly to the error detector. Use 18 dB attenuators

PAM4 Measurements
Symbol Levels
Vertical Eye Amplitudes
Vertical Eye Openings
Horizontal Eye Openings
Vertical Eye Closure (dB)
Openings by BER
Max, Min, Peak-to-Peak...

PAM4 scope measurements are currently following the OIF contribution: 2014.051.0

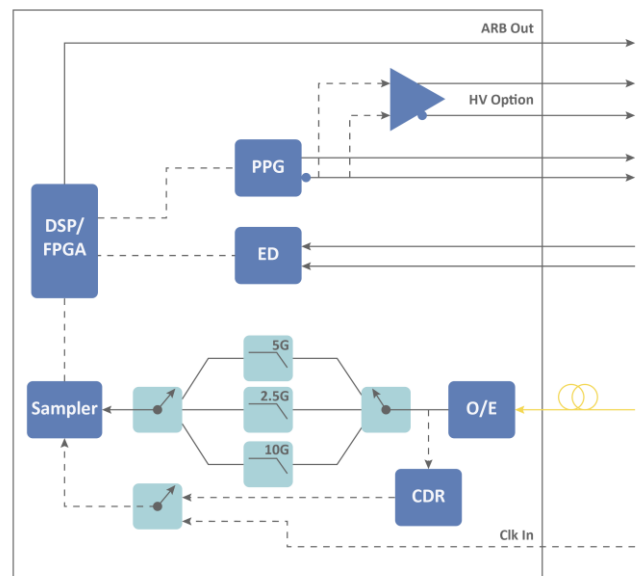


Figure 1: ML4003BX Block Diagram

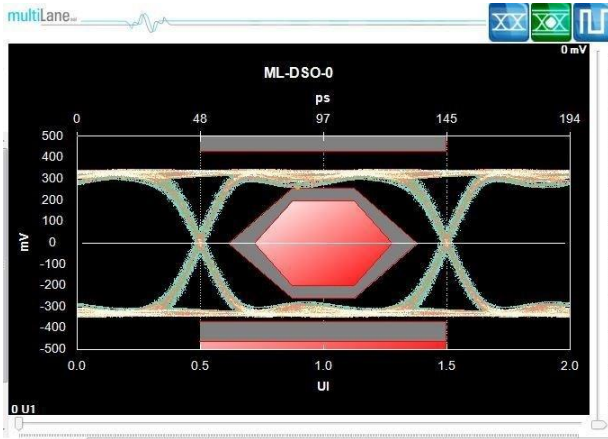


Figure 2: Mask Test on a 10G Signal

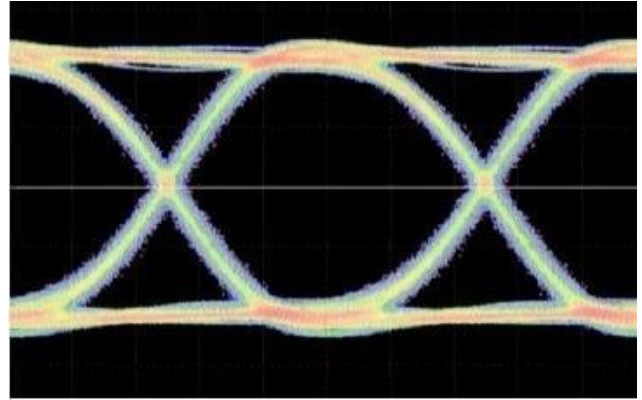


Figure 6: NRZ Eye Diagram

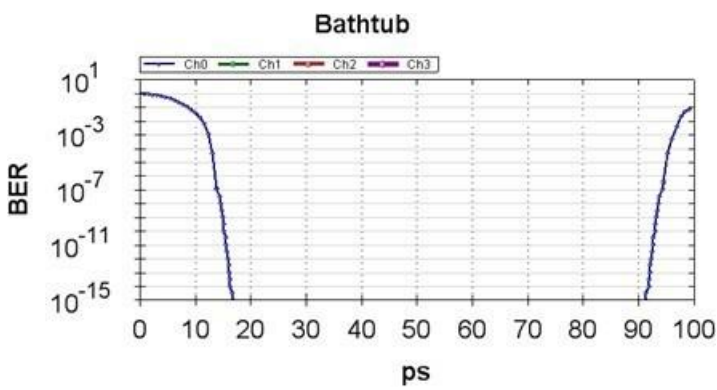


Figure 3: Bathtub Curves

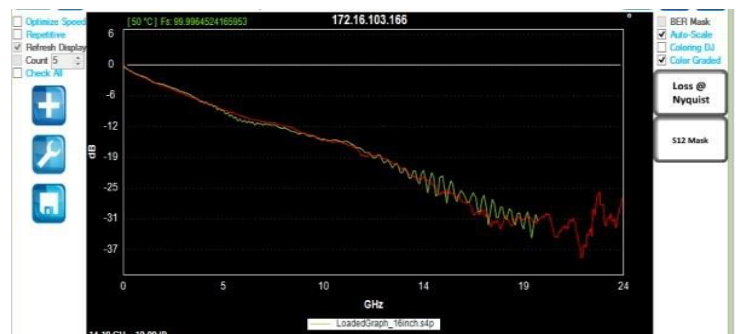


Figure 7: S21 measurement correlation with VNA (green)

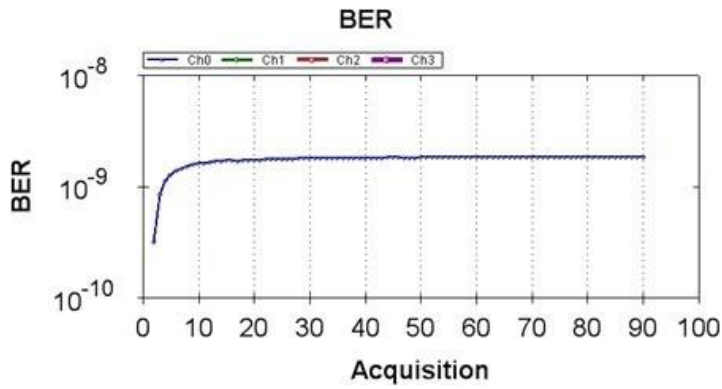


Figure 4: BER Measurements

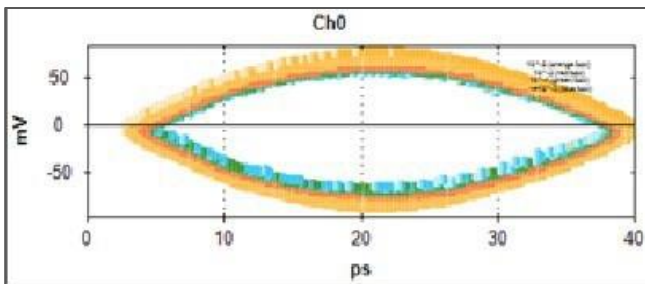


Figure 5: Eye Contour

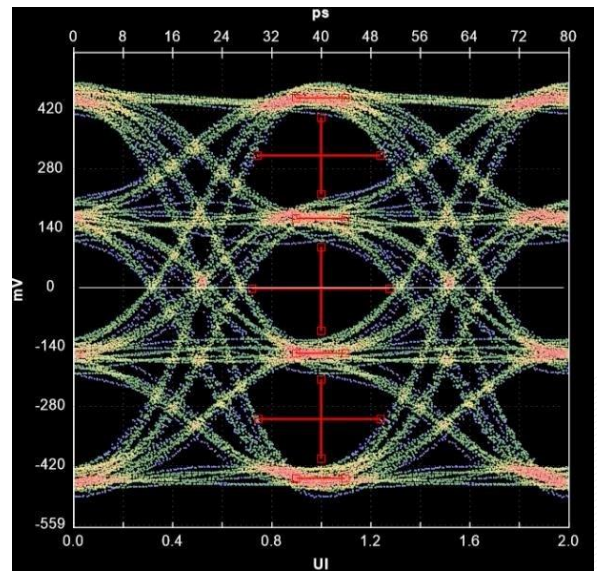


Figure 8: PAM4 Eye Diagram

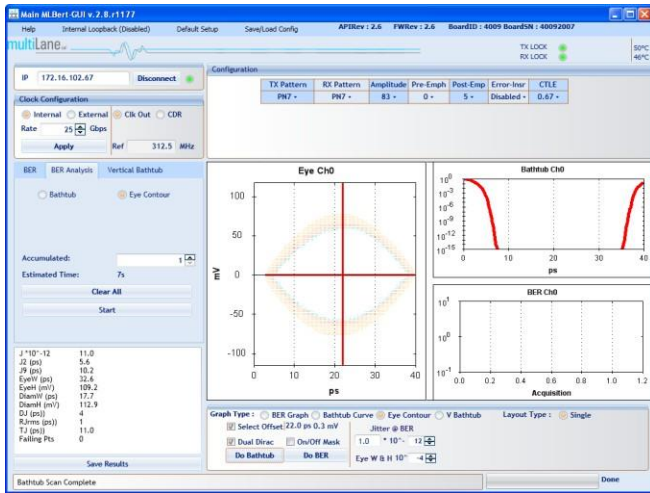


Figure 9: BERT Application

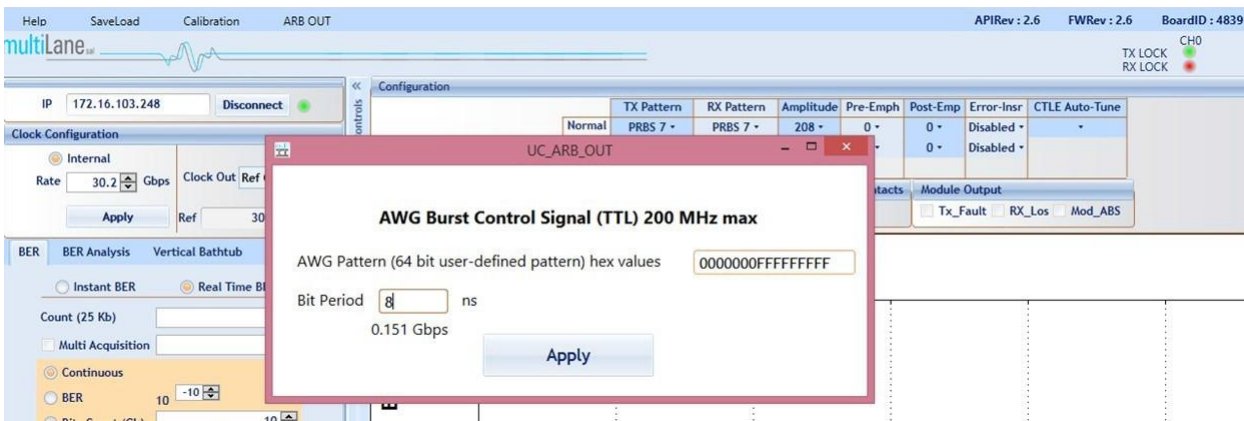


Figure 10: Burst Control AWG for PON Applications

The application allows you to put the BERT and Scope GUIs side by side.

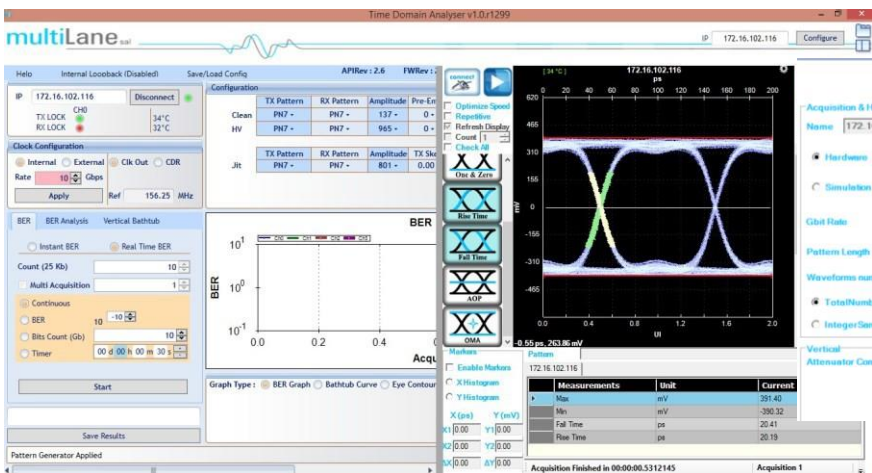


Figure 11: Composite BERT / Scope GUI

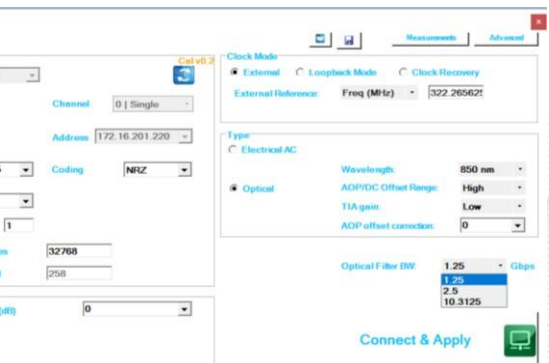


Figure 12: Switching between HW filters

Electrical Specifications

	Bit Rates	1 – 16 Gbps or 1 – 30 Gbps
	TX Amplitude Differential	250-800 mV
	Patterns	PRBS 7/9/15/23/31 User Pattern 80 bits
PPG	Pre-Emphasis	10 dB
	Pre-Emphasis Resolution	10 steps
	Equalizing Filter Spacing	1 UI
	Random Jitter RMS	<300 fs @25.78125 Gb/s
	Rise/ Fall Time (20–80%)	14 ps
	TX Skew control range	N/A
	TX Skew control	N/A
	Output Return Loss up to 10 GHz	< -12 dB
	Output Return Loss (10-25 GHz)	< -8 dB
	Error Detector Phase Margin	5 ps
	Error Detector Maximum Input	1200 mVpp Diff
	Error Detector Sensitivity	30 mVpp @ bitrates <12 Gb/s
ED		50 mVpp @ bitrates >12 Gb/s
	Phase Scan Resolution	6 Bits
	Vertical Scan Resolution	8 Bits
	TX/RX connectors	2.92 mm connectors
	Reference clock output amplitude	550 – 850 mVpp
	Reference clock output rate	62.5 - 750 MHz
	CTLE support	Auto-tune
	Wavelength Range	750 – 1650 nm
	Bandwidth (-3 dB electrical)	9.5 GHz
	Sensitivity @ 850 nm	-15 dBm
	Sensitivity @ 1310 nm	-19 dBm
	Overload	+2 dBm
	Conversion Gain @ 1310 nm	450 V/W
DSO	Connector Type	FC
	Clock Input Range	50 - 125 MHz
	Clock Input Amplitude	200 - 1000 mV
	Clock Input Impedance	50 Ω
	Intrinsic Jitter (excluding DDJ)	200 fs
	Amplitude Error	5 mV
	Data Format Support	NRZ / PAM4
PRBS Pattern Capture	up to PN13	

Spurious-Free Dynamic Range	-58 dBc at 10 GHz, 500 mVpp, 1 GS/s -53 dBc at 30 GHz, 500 mVpp, 1 GS/s
Temperature range	0-65° C
Power Requirements	100 V to 240 V – 50/60 Hz
Memory Depth	256k samples
Hardware Filters	Shape: Bessel Thomson 4th order 1.25G Filter 3 dB loss: 0.93 GHz 2.5G Filter 3 dB loss: 1.87 GHz 10.3125G Filter 3 dB loss: 7.73 GHz

Mechanical Dimensions

The ML4003BX is a 19-inch 2U instrument with 43.7 x 8.9 x 30 cm dimensions.



Ordering Information

Option	Description
ML4003BX	
Option B16	1-16 Gbps BERT dual-channel
Option 010	10 GHz ref optical receiver + DSO
Option 025	25 GHz reference optical receiver + DSO
Option B32	31.5 Gbps BERT
Option HV	High Voltage Output (4 to 8 Vpp differential)

Please contact us at sales@multilaneinc.com.