multiLane

DATASHEET

Innovation for the next generation

ML4004-JIT

Time Domain Analyzer with Jitter generation: BERT + DSO

Jitter Injection and Analysis | Eye Measurements | Eye Mask Test | Advanced Pattern Acquisition | Pre-emphasis Measurement | J2/J9 measurements | Scope with integrated CDR

Summary

With the accelerated growth of hyperscale datacenters, performance demands on Ethernet network infrastructure increasing exponentially, and customer expectation at an all-time high; accurate, responsive testing is essential for an effective and seamless operation. Bit Error Rate Testers (BERTs) have emerged as a cornerstone for physical layer testing, from qualifying bit transmission for fiber optic and copper-wire digital data transmission lines to testing signal integrity. In the modern data center, BERTs and oscilloscopes working in tandem are key to getting the clearest picture of your system.

The ML4004-JIT is a state-of-the-art combination of a differential 30G BERT and a Digital Sampling Oscilloscope in one compact design. The DSO automatically performs accurate eye-diagram analysis at 32 or 50 GHz bandwidth to characterize the quality of transmitters, implementing a statistical under-sampling technique with comprehensive software libraries used for eye measurements, jitter analysis and processing of NRZ/PAM4 data.

ML4004-JIT

BERT and Sampling Scope with Jitter injection

Introduction

The ML4004-JIT is a state-of-the-art BERT and Digital Sampling Oscilloscope in one compact design.
The BERT features two differential channels, one for AM and PM jitter injection and the other for classical BERT applications.
The DSO performs accurate eye-diagram analysis to characterize the quality of transmitters.
The instrument is optimized for high speed data analysis and is controlled through Ethernet.

The ML4004-JIT DSO implements a statistical under sampling technique and features comprehensive software libraries and APIs. It performs various eye and pattern measurements, mask margin tests and jitter analysis on NRZ or PAM4 data.

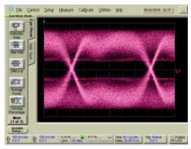
Key Features

PPG and ED

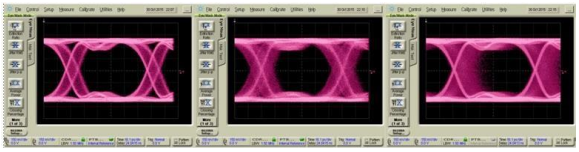
- Data Rates: 3.2-5, 6.5-15 and 19-30 Gbps
- Automated J2/J9 measurements
- High input BW achieved with industry leading sample-and-hold amplifiers
- Eye Contour measurements above 9 Gbps
- API library with intuitive and simple GUI
- Instant and Real time BER (Bit Error Rate)
- Vertical and horizontal bathtub measurement above 9 Gbps
- PRBS 7, 9, 15, 23, 31 and user-defined pattern generation (up to 40 bits)
- Windows and Linux APIs are provided, allowing users to develop their own automated tests

Jitter Generation

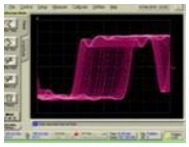
- Typically needed for stressed receiver tests.
- Vertical and Horizontal eye closure
- Amplitude random jitter injection (RJ AM)

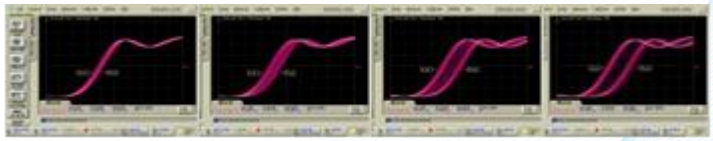


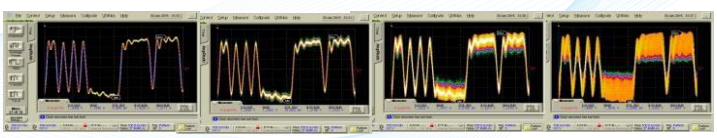
- Sinusoidal and random jitter injection (SJ, RJ PM)



- Phase shifting







Digital Sampling Oscilloscope

- 1200 mVppd maximum input amplitude
- Equipped with a CDR (Clock Data Recovery) circuit, sampling a signal without input clock.

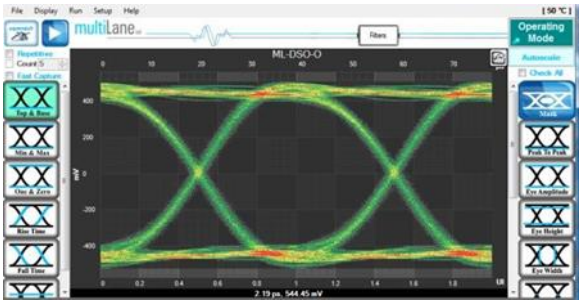


Figure 1: Eye Diagram Mode

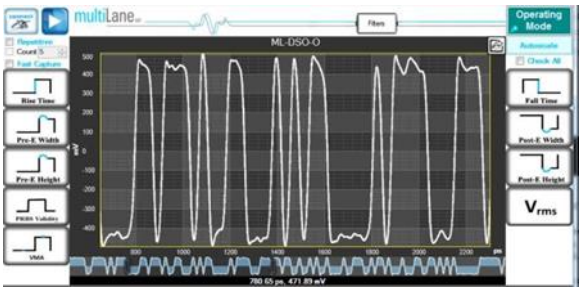


Figure 2: Pattern Lock Mode

- Eye opening, height and width, eye amplitude, top, base, Hi, Lo, max, min, etc.

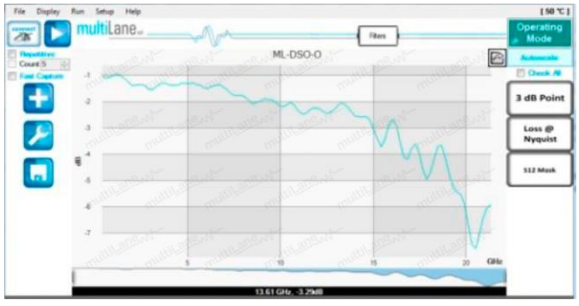


Figure 3: FFT Mode Displays Frequency Domain Measurements & Enables Importing & Exporting Touchstone Files

- Total jitter measurement and jitter decomposition
- 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 and Post -emphasis positive and negative (amplitude and width) measurements.
- DSP filters suite includes Bessel-Thomson, CTLE, FFE, DFE, De-embedding, Moving Averages and Normalizing filters.
- The DSO can be set to continuously capture and save data in an external csv file for later processing.
- Repeatable traceable measurements.
- Capability to save statistical measurements & data files for multiple DSOs simultaneously.
- Optional BW of 32 or 50 GHz
- S-parameters supported

Target Applications

- Compliance testing e.g. OIF-CEI 03.1 and IEEE 802.3bm – the ML4004-JIT features an automated JTOL function.
- Interconnect testing, SFP, SFP28, CFP, CFP2, CFP4, QSFP, QSFP28, SFP-DD, QSFP-DD, OSFP, etc.
- Backplane testing
- Interference and Crosstalk testing
- Receiver sensitivity testing

Electrical Specifications

	Parameter	Specifications
	Power rating	12 VDC, 1.2 A
	Operating temperature range	10 – 40 °C
PPGI	Bit Rates	3.2-5 and 6.5-15 and 19.0-30 Gbps
	TX Amplitude Differential	125-800 mV
	Patterns	PRBS 7/9/15/23/31 User Pattern 40 bits
	TX Amplitude Adjustment	100 mV on the clean output
	Pre-Emphasis	6 dB
	Pre-Emphasis Resolution	10 steps
	Equalizing Filter Spacing	1 UI
	Random Jitter RMS	250 fs
	Rise/ Fall Time (20–80%)	17 ps
	Output Return Loss up to 10GHz	-10.7 dB
EDI	Error Detector Phase Margin	5 ps
	Error Detector Maximum Input	1200 mV differential
	Phase Scan Resolution	7 Bits
	Vertical Scan Resolution	8 Bits
	Input CTLE Dynamic Range	10 dB
	TX/RX and clock connectors	2.92 mm Connectors
	Reference clock Output	Rate / 64, LVPECL ~ 1300 mV
PPG2 JIT	Bit Rates	3.2-5 and 6.5-15 and 19.0-30 Gbps
	TX Amplitude Differential	0-2000 mV
	Patterns	PRBS7/9/15/23/31 User Pattern 40 bits
	TX Amplitude Adjustment	2 mV
	Sinusoidal Phase Modulation	>90 ps
	Sinusoidal Jitter Frequency	0.1 to 80 MHz
	Random Jitter RMS	360 fs
	Rise/ Fall Time (20–80%)	16 ps
	TX Skew control	>90 ps
	Output Return Loss up to 10GHz	-14 dB
	ESD Rating	>6 Gbps io 1000 V HBM, 250 V CDM <6 Gbps io 2000 V HBM and 500 V CDM

	Power Adapter specifications	12 V/1.2 A 2.1 x 5.5 mm Centre Positive
DSO	Input Bandwidth	32 GHz (50 GHz optional)
	Input Amplitude	AC: Differential Specifications of 1200 mVpp
	Input Rise / Fall Time	15 ps
	Diff. Input Return Loss	< 12 dB
	Vertical Resolution	14 bits
	Clock Input Range (Normal Mode)	50 - 550 MHz
	Clock Input Amplitude	200 - 1000 mV
	Input Impedance	50 Ω
	Intrinsic Jitter (excluding DDJ)	250 fs
	Amplitude Error	10 mV
	Data Format Support	NRZ and PAM4
	PRBS Pattern Capture	up to PRBS-13
	Spurious-Free Dynamic Range	46 dBc at 10 GHz 500 mVppd input
	Memory Depth	256K sample
	Weight	~ 1.5 kg

Mechanical Dimensions

The ML4004-JIT is a benchtop instrument that fits in a 19-inch 2U rack. Two BERTs arranged side by side comprise one 2U slot in the rack. MultiLane supplies the needed brackets.

Ordering Information

Option	Description
ML4004-JIT	NRZ BERT + 32 GHz DSO with Jitter Generation
Option 50	NRZ BERT + 50 GHz DSO with Jitter Generation

Recommended Accessories

Instruments	Recommended *Phase matched cable pairs*	Alternative *Phase matched cable sets*	Comments
ML4004-JIT	4x MLCBPM-2.92-30	1x MLCBPM-2.92-30-8	2.92 mm connector 1x8 channel 30 cm
ML4004-JIT	4x MLCBPM-2.92-60	1x MLCBPM-2.92-60-8	2.92 mm connector 1x8 channel 60 cm

Please contact us at sales@multilaneinc.com.