

Innovation for the next generation



ML4025-BTP-gen2

Electrical Sampling Oscilloscope |
4 channels

35 GHz | Supports 400GAUI PAM4 Transmitter
qualification | High throughput | High sensitivity | Cost
effective

Summary

The characterization of Ethernet transceivers introduces a myriad of test and measurement challenges. For instance, precise validation of 26 GBaud PAM4 optical transmitters requires prohibitively expensive instrumentation setups for production applications. MultiLane introduces the ML4025-BTP-gen2 Digital Sampling Oscilloscopes as a well-correlated alternative to incumbent solutions at a high-value price point.

The ML4025-BTP-gen2 is a four channel DSO that supports NRZ and 400GAUI PAM4 signal detection required for 100 GbE measurements. It is ideally suited for the production testing of systems, components, and electrical modules. It supports the required test patterns defined by IEEE and OIF.

ML4025-BTP-gen2

35 GHz Electrical DSO

Introduction

The ML4025-BTP-gen2 is a fully featured, cost effective four channels equivalent time sampling oscilloscope. It can be configured to have an analog bandwidth of 35 GHz.

Typical Applications

- General time domain measurements of high-speed digital communication signals
- High-speed SerDes testing
- High port count burn-in testing
- Transceiver manufacturing test
- Transceiver evaluation and validation
- Qualification of PAM-N and NRZ drivers.
- TP1-a stress calibration

Key Features

The ML4025-BTP-gen2 DSO is truly powerful, boasting an extensive set of features and functions that are unique in the industry. These include:

- Up to 100 MHz sampling rate
- Less than 5 seconds TDECQ on a SSPRQ pattern
- Fast pattern capture and DSP thanks to an FPGA-based architecture
- An extensive library of built-in DSP filters such as Bessel-Thomson, CTLE, DFE, FFE, de-embedding and component emulation, all available free of charge in the standard GUI.
- User-writable calibration constants
- Can be calibrated up to the DUT to include losses of test fixtures and cables

- Built-in standard masks library
- A complete set of APIs and sample code to speed up integration

Specifications (Typical)

Parameter	Specifications
Data format support	NRZ and PAM4
Intrinsic jitter	200 fs rms
Input Swing Max	1200 mVppd
Rise/Fall Time	9.5 ps
Vertical resolution	14 bits
Electrical channel bandwidth	35 GHz
Electrical channel connectors	2.92 mm
Clock input bandwidth	0.1 – 6.6 GHz
Clock input swing	355 ~ 1800 mVpp
Clock input connector	SMA (f), 50 Ω
Sampling frequency	70 - 100 MHz
Memory	256x16 MSa (shared between 4 channels)
Pattern Capture	Up to PRBS16 and SSPRQ
SFDR (sine wave) 50 mVpp 1 GS/s	-58 dBc at 10 GHz -53 dBc at 30 GHz
Power Rating	120/240 V, 1.5 A/0.9 A
Control Interface	GbE
Weight	~ 1.5 kg

Supported Measurements

Coding	Measurement
PAM-4	TDECQ
	SNDR
	RLM
	Eye Height by BER
	Eye Width by BER
NRZ	Top & Base
	Min & Max
	One & Zero
	Transition Time
	Crossing %
	Mask Margin
	Peak to Peak
	Eye Amplitude
	Eye Height
	Eye Width
	Jitter
	SNR
	ER
	VEC
	Vrms
	DJ & RJ
	Noise

Applying Filters

Several filters including FFE, DFE, CTLE, Bessel-Thomson, etc. are available in NRZ as well as PAM mode. Concatenation of several filters is also possible, and the effect of each filter is shown immediately on the eye or pattern.

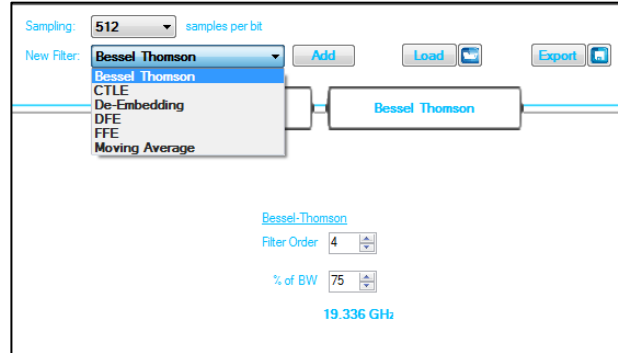


Figure 1: Applying Filters

One may also import s2p or s4p files to de-embed fixtures.

A very useful function in determining the ideal CTLE gain for a given trace or the FFE number of taps for a certain target amplitude is the adaptive equalization feature available in the DSO.

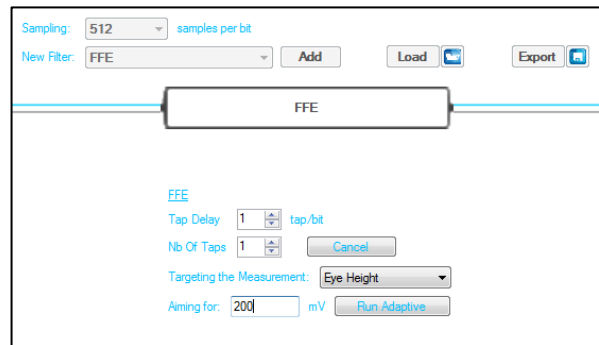


Figure 2: FFE Filter

Supported DSP Functions

- CTLE Adaptive/manual
- FFE Adaptive/manual
- DFE Adaptive/manual
- De-embedding S4P
- Emulating S4P
- Normalizing Filter
- Moving average

Measuring Insertion Loss

In combination with a source, such as an ML BERT, insertion loss (S21) of the DUT can be measured using the DSO. The available dynamic range is 70 dB. The user is guided through the process by a wizard.

Annex A: PAM4 and NRZ Sample Measurements



Figure 3: S Parameter Mode

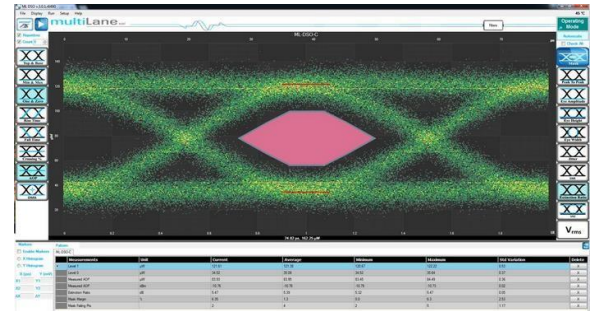


Figure 5: Mask Margin

Spectrum Analysis view & THD

The DSO uses DFT to derive the spectral content of the signal present at the input. It also calculates the Total Harmonic Distortion figure.

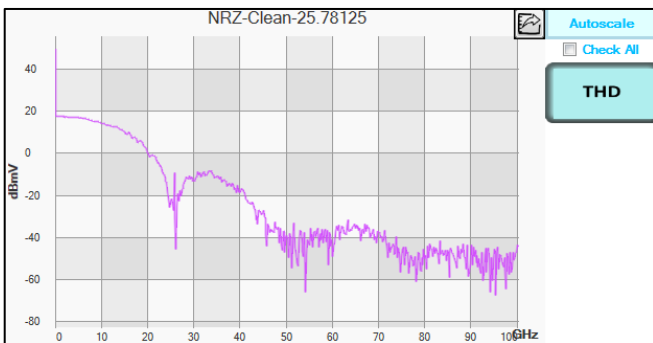


Figure 4: Frequency Domain Mode

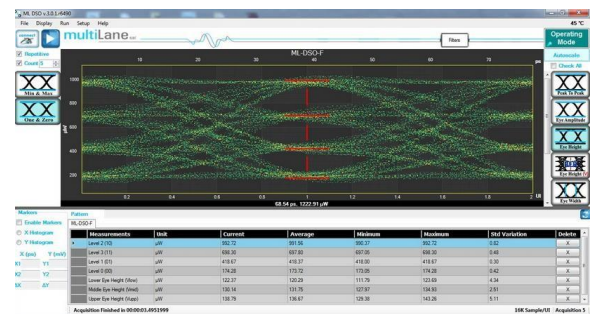


Figure 6: PAM4

Mechanical Dimensions

The ML4025-BTP-gen2 is a benchtop instrument that also fits in a 19-inch 2U rack. It has a ruggedized Enigma enclosure with improved mechanical rigidity. Two ML4025-BTP-gen2s arranged side by side comprise one 2U slot in the rack. MultiLane also supplies the needed bracket.



Ordering Information

Part Number	Description
ML4025-BTP-gen2	4 channels 35 GHz Digital Sampling Oscilloscope
3YW	3-year warranty
CAL	Single calibration
3YWC	Total 3-year warranty with 3 annual calibrations

Ordering Information

Instruments	Recommended <i>Phase matched cable pairs</i>	Alternative <i>Phase matched cable sets</i>	Comments
ML4025-BTP-gen2	4x MLCBPM-2.92-30/60	1x MLCBPM-2.92-30/60-8	2.92 mm connector 1x8 channel 30/60 cm

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