

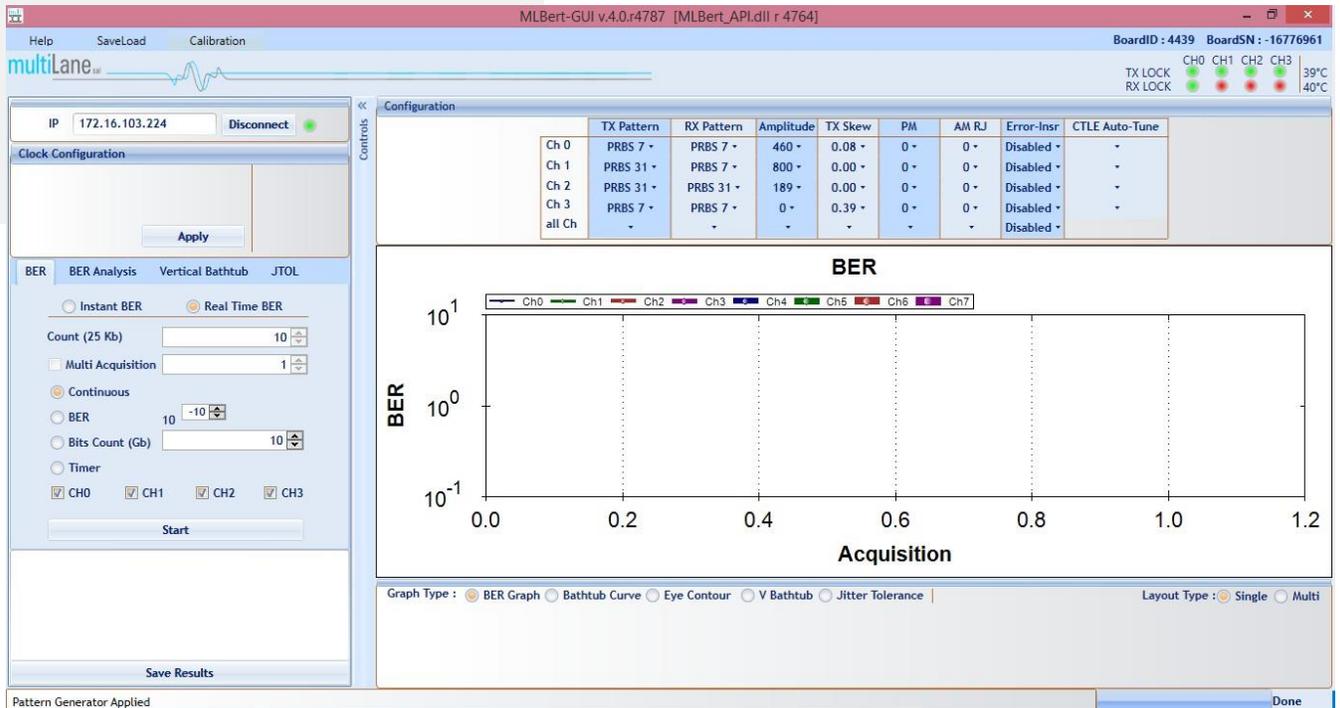
# ML4039B ML4039B-JIT ML4039B-EQL

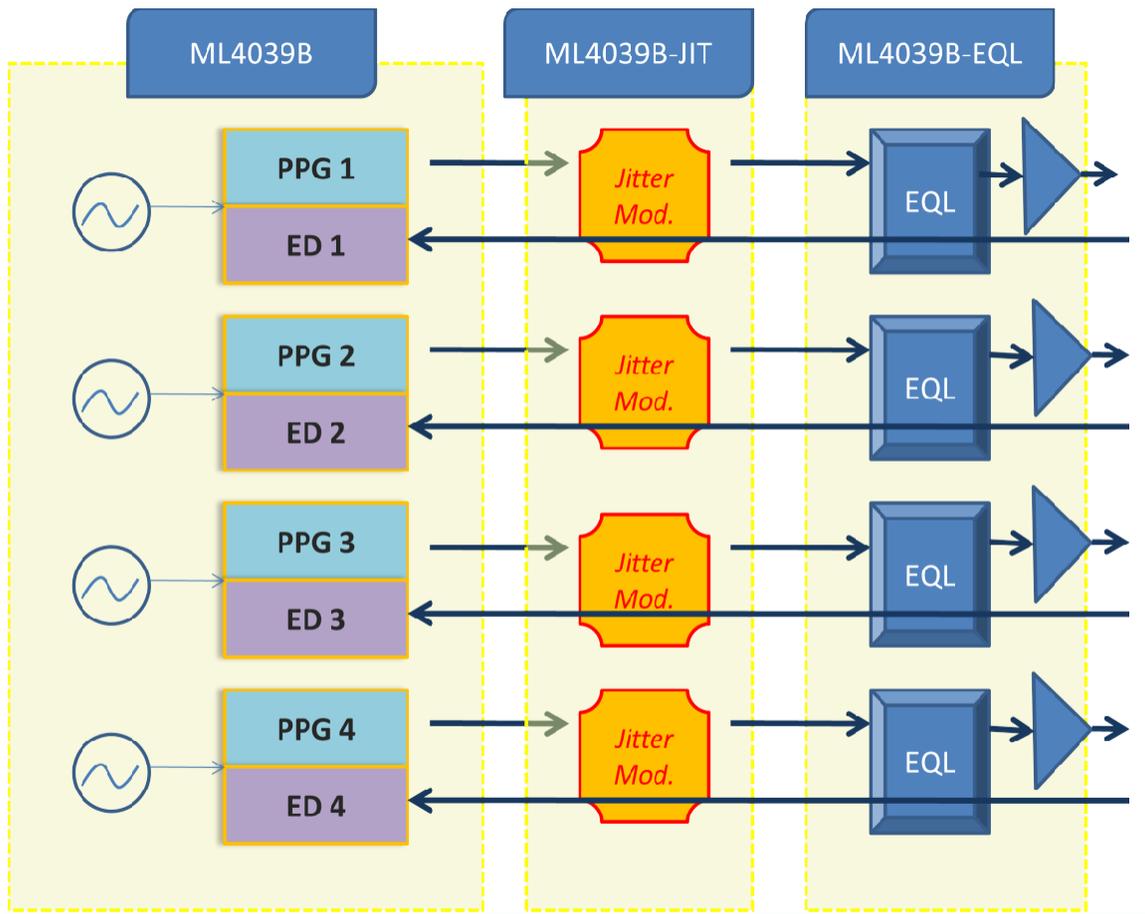
## User Operation Manual

[www.multilaneinc.com](http://www.multilaneinc.com)

ML4039B

4 Lane 1-30 Gbps BERT





## User Manual Revision 2.7

GUI Version 2.8.r2119 and above



Some of the features described in this document are not supported in older GUI version. Please always make sure you install the latest release from the multiLane SAL website.

Copyright © MultiLane SAL. All rights reserved. Licensed software products are owned by MultiLane SAL or its suppliers and are protected by United States copyright laws and international treaty provisions.

Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013, or subparagraphs (c)(1) and (2) of the Commercial Computer Software -- Restricted Rights clause at FAR 52.227-19, as applicable.

MultiLane SAL products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specifications and price change privileges reserved.

MultiLane, S.A.L., Houmal Technology Park, Houmal, Mount Lebanon.

ML4039-JIT software, hardware and documentations are registered trademarks of MultiLane, S.A.L.

## Table of Contents

General Safety Precautions .....	1
Preface .....	2
Product Description .....	4
Model and Package Content.....	4
Overview .....	4
Key Features.....	5
BER and measurement suite.....	5
Target Applications.....	5
Product Software.....	6
Minimum PC Requirements.....	7
Instrument Ports .....	8
Installation.....	9
System Start-up .....	9
Line Rate Configuration .....	10
PRBS Pattern Configuration .....	11
PRBS Pattern Verification .....	12
Eye Shaping .....	12
BER .....	15
Real Time BER.....	16
Bit Error Ratio analysis.....	17
The Bathtub Plot .....	17
Bathtub configuration .....	18
Jitter measurements .....	18
Eye Contour .....	19
Eye Contour Configuration .....	19
Eye Contour measurements .....	19
Mask test.....	21
Vertical Bathtub .....	22
Log file System.....	22
How to connect this instrument .....	23
Connecting Through an Ethernet cable .....	23
Connecting Through USB cables .....	24
USB Driver Installation.....	25
USB Driver Installation on Windows XP, Windows 7 and 8 platforms .....	25
Firmware Upgrade.....	27
Instructions to upgrade the Firmware .....	27
Related Products .....	30
Ordering Information .....	30

## List of Figures

Figure 1: Eye Display .....	5
Figure 2: ML4039B-EQLBERT GUI .....	6
Figure 3: ML4039B-EQL cPCI Front Panel .....	8
Figure 4: Connect Via Ethernet .....	9
Figure 5: Ethernet Configuration .....	10
Figure 6: Line Rate Configuration .....	11
Figure 7: PRBS Channel Configuration .....	11
Figure 8: PM Frequency .....	13
Figure 9: Eye Shaping Sliders.....	14
Figure 10: Error Insertion .....	14
Figure 11: Channels' LEDs.....	15
Figure 12: BER Configuration.....	15
Figure 13: BER Graph.....	16
Figure 14: Bathtub Graph .....	17
Figure 15: Bathtub Configuration .....	18
Figure 16: Jitter Measurements .....	18
Figure 17: Eye Configuration .....	19
Figure 18: Single Channel Eye Contour.....	20
Figure 19: 4 Channels Eye Contour.....	20
Figure 20: Eye Mask .....	21
Figure 21: X and Y values.....	21
Figure 22: Check Mask.....	21
Figure 23: Vertical Bathtub.....	22
Figure 24: ML4039B-EQLconnected to PC via Ethernet.....	23
Figure 25: ML4039B-EQLconnected with Ethernet crossover cable .....	23
Figure 26: ML4039B-EQLconnected to PC via Wireless .....	24
Figure 27: ML4039B-EQLwith USB connection .....	24
Figure 28: USB Driver Not Installed .....	25
Figure 29: Scan for Hardware Changes.....	25
Figure 30: Scanning for Plugs .....	26

Figure 31: Bootloader Software..... 27  
Figure 32: Connect Bootloader Software ..... 28  
Figure 33: Select Hex File..... 28  
Figure 34: Erase Program Verify ..... 29

**List of Tables**

Table 1: ML4039B-EQL cPCI Ports ..... 8  
Table 2: Order Information ..... 30

## General Safety Precautions

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the General Safety Summary in other system manuals for warnings and cautions related to operating the system.



**To Avoid Fire or Personal Injury**

**Use Proper Power Cord.** Only use the power cord specified for this product and certified for the country of use.

**Observe All Terminal Ratings.** To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal that exceeds the maximum rating of that terminal.



**Do Not Operate Without Covers.**

Do not operate this product with covers or panels removed.

**Avoid Exposed Circuitry.** Do not touch exposed connections and components when power is present.

**Do Not Operate With Suspected Failures.**

If you suspect there is damage to this product, have it inspected by qualified service personnel.

**Do Not Operate in Wet/Damp Conditions.**

**Do Not Operate in an Explosive Atmosphere.**

**Keep Product Surfaces Clean and Dry.**



**Provide adequate cooling** to the board to avoid damaging any part of it specifically for the ATE version of the board. Refer to the power section to know the power dissipation values.

## Preface

This is the user operation manual for the **ML4039B** family of BERTs. It covers the following information:

- Describes the capabilities of the instrument: how to install it and its software
- Explains how to operate the instrument for: Pattern generation, Error Detection; how to control the clocking system, inputs/outputs and all the available measurements

## Contact MultiLane SAL

**M**ultiLane SAL is an engineering services company and an OEM supplier of specialty

*test and communication equipment for the semiconductor and optical transport industries. Multilane delivers ultra-compact test instruments of the highest value and performance for high speed communication and signal integrity applications. The Company has a large engineering team and a fully equipped lab with state of the art equipment, having recently moved to a 6000sq foot facility in **Houmal Technology Park (HTP)**.*

**MultiLane SAL** customers can leverage great flexibility and capability in product customization thanks to our team in depth expertise in high speed I/O, Signal Integrity, and access advanced development and test tools. MultiLane has the resources and know-how to meet customer’s product development and design requirements. Our R&D has a proven track record in delivering leading edge products and development tool kits to the Automated Test market while applying the production processes to deliver high quality products on schedule and within budget.

**MultiLane SAL’s** team is composed of experienced and disciplined engineers offering products and turnkey solutions of modules and systems for high speed IO, Signal Integrity, SOC development and optical communication from verbal requirements (Architecture, PRD, HW/FW/SW design implementation and characterization).

Address	MultiLane SAL Houmal Technology Park Askarieh Main Road Houmal Lebanon
Web site	<a href="http://www.multilaneinc.com">www.multilaneinc.com</a>
Sales support	<a href="mailto:sales@multilaneinc.com">sales@multilaneinc.com</a>
Support	<a href="mailto:support@multilaneinc.com">support@multilaneinc.com</a>

If any further help is needed, please contact MultiLane SAL, by sending general enquiries to [info@multilaneinc.com](mailto:info@multilaneinc.com).

## Product Description

This chapter describes your instrument, operating under Windows.

- *Installation* shows you how to configure and install the instrument, as well as how to install the system software included with the product.
- *Incoming Inspection* provides a procedure for verifying basic operation and functionality
- *Accessories and Options* lists the instrument options available and the standard and optional accessories for this product.

## Model and Package Content

This manual supports the instrument [ML4039B / -JIT /-EQL \(cPCI\)](#)

### User Guide Manual

Manual containing user operation guide, software installation and start up procedure.

### Software package and documentations:

- Main [ML4039B](#) GUI.
- USB driver. The Ethernet interface is controlled though the API version 7.0 that includes the Ethernet package.

## Overview

[Four Channel 30G BERT](#) is a low cost, simple to use, fully integrated, ultra compact, USB/Fast Ethernet controlled instrument that combines the functions and features of a signal generator, bit error-ratio tester and data analysis system with Post Emphasis and Pre Emphasis capabilities, Jitter injection (-JIT and -EQL) and equalization (-EQL). The [ML4039B](#) family of 4-lane BERTs instrument comes in a cPCI card format that fits into the [ML4000 series](#) MultiLane 6U cPCI Chassis.

**Key Features**

- Available in cPCI form factors
- 1-30 Gbps data rates
- External reference clock input
- Low intrinsic jitter
- Automated J2/J9 measurement
- Integrated synthesizer
- Eye contour measurement
- Intuitive comprehensive GUI
- Window and Linux API functions
- Repeatable traceable measurement

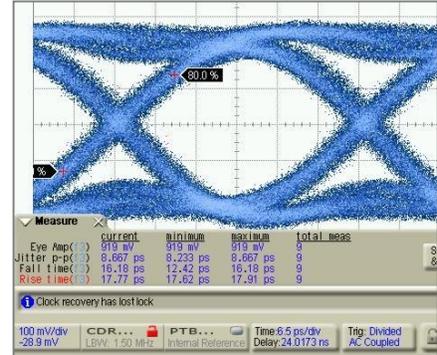


Figure 1: Eye Display

**BER and measurement suite**

- Low cost simple to use 4 channel BERT
- Support all basic BERT functions
- Complete BERT measurement capability (eye contour and bathtub curve)

**Target Applications**

- Interconnect testing, CFP2, CFP4, QSFP28
- Backplane testing
- Interference and crosstalk testing
- Receiver sensitivity testing
- Receiver jitter tolerance testing equalizer characterization
- Electro-optical module testing
- Electrical stressed eye testing for 100 Gbps Ethernet, MLD/CAUI application, OIF CEI-28G-VSR, CPPI-4, CAUI-4, 32G Fiber Channel chip to module

**Product Software**

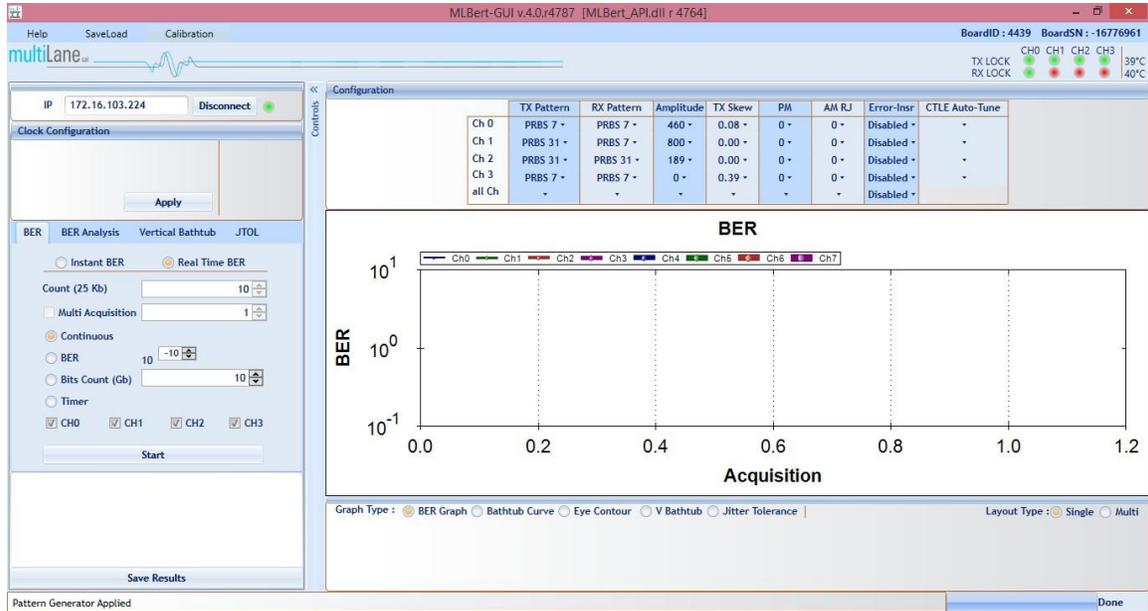


Figure 2: ML4039B-EQL BERT GUI

The instrument includes the following software:

- **ML4039B GUI.**
- **MultiLane ML4039 USB driver.**
- **ML4039B ETH Configuration Software.**
- **ML Configuration GUI**

Instrument GUI runs on Windows XP (32/64 bit), Windows 7 and 8.

**NOTE.** These applications requires the Microsoft .NET Framework 3.5.  
 If the Microsoft.NET Framework 3.5 is needed, it can be downloaded through this link:  
<http://download.microsoft.com/download/2/0/e/20e90413-712f-438c-988e-fdaa79a8ac3d/dotnetfx35.exe>.

For more products updates, check the following webpage:  
[www.multilaneinc.com/products.html](http://www.multilaneinc.com/products.html)

### **Minimum PC Requirements**

The Windows PC properties for the **ML4039B/-JIT/-EQL GUI** application must meet the following specifications:

- Windows XP SP3 or greater
- Minimum 1 GB RAM
- 1 Ethernet card to establish connection with the device
- USB Connector
- Pentium 4 processor 2.0 GHz or greater
- .NET Framework 3.5 sp1

---

**NOTE.** *It is recommended to connect the BERT via Ethernet to one PC only to prevent conflict from multiple user commands.*

---

**Instrument Ports**

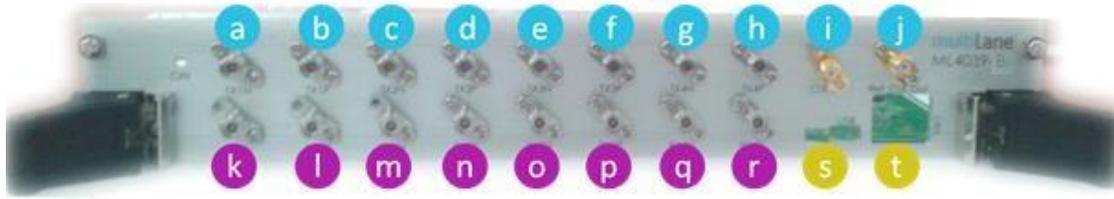


Figure 3: ML4039B/-JIT/-EQL cPCI Front Panel

Port Name	Description
<b>a</b>	<b>TX1N</b> Negative TX Channel number 1 Amplitude range: 250 -1000mV Differential. Bit rate 1-32 Gbps – Electric interface (same for all the TX channels)
<b>b</b>	<b>TX1P</b> Positive TX Channel number 1
<b>c</b>	<b>TX2N</b> Negative TX Channel number 2
<b>d</b>	<b>TX2P</b> Positive TX Channel number 2
<b>e</b>	<b>TX3N</b> Negative TX Channel number 3
<b>f</b>	<b>TX3P</b> Positive TX Channel number 3
<b>g</b>	<b>TX4N</b> Negative TX Channel number 4
<b>h</b>	<b>TX4P</b> Positive TX Channel number 4
<b>i</b>	<b>Clock In</b> Reference Clock Input, input values should be: a. Clock = Line Rate/16, for Line Rate between 1-4 Gbps b. Clock = Line Rate/32, for Line Rate between 4.1-20 Gbps c. Clock = Line Rate/64, for Line Rate between 20.1-32 Gbps
<b>j</b>	<b>Ref CLK-Out</b> Frequencies output are a function of the Line rate as follows: • Clock = Line Rate/16, for Line Rate between 1-4 Gbps • Clock = Line Rate/32, for Line Rate between 4.1-20 Gbps • Clock = Line Rate/64, for Line Rate between 20.1-32 Gbps
<b>k</b>	<b>RX1N</b> Negative RX Channel number 1 Amplitude range: 250 -1000mV. Bit rate 1-32 Gbps – Electric interface (same for all the RX channels)
<b>l</b>	<b>RX1P</b> Positive RX Channel number 1
<b>m</b>	<b>RX2N</b> Negative RX Channel number 2
<b>n</b>	<b>RX2P</b> Positive RX Channel number 2
<b>o</b>	<b>RX3N</b> Negative RX Channel number 3
<b>p</b>	<b>RX3P</b> Positive RX Channel number 3
<b>q</b>	<b>RX4N</b> Negative RX Channel number 4
<b>r</b>	<b>RX4P</b> Positive RX Channel number 4
<b>s</b>	Mini-B USB port
<b>t</b>	RJ 45 port

Table 1: ML4039B/-JIT/-EQL cPCI Ports

## Installation

This chapter covers installation of the instrument, addressing the following topics:

- System Start-up
- How to connect to the instrument

### System Start-up

To use the [ML4039B/-JIT/-EQL GUI](#) under Windows XP, Windows 7 and 8, it is important that the correct start-up sequence is followed:

- Make sure you have Microsoft *.NET Framework 3.5* installed. If not installed, refer to the Note in the [Product Software](#) section.
- Install the [ML4039B/-JIT/-EQL](#) software.
- After installation, open it with a double click on the software icon or from your PC main menu.
- A new window will appear titled [ML4039B/-JIT/-EQL](#); this is the main software interface.
- The board is now powered up (the green Led on the front panel is turned on).
- 2 ways to connect to the instrument, through Ethernet or via USB:
  - a. **Connect through Ethernet:**

Connect the PC to the front panel via the RJ45 connector located on the front panel through an Ethernet cable to be able to control it.

In order to connect via Ethernet the IP address of the board is required. To learn more options on how to connect the Ethernet cable go to the section [Connect Through an Ethernet Cable](#).

    - Select the **Ethernet Mode** radio button.
    - Note that no drivers are required; you only have to know the current board IP address, you need to enter it in the text box next to the **IP** label shown in the below picture, then click on the **connect** button.

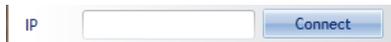


Figure 4: Connect Via Ethernet

- You are now connected.
- Once connected the **Connect** button turns into **Disconnect**.
- To make sure that you are connected, you can also ping your device.
- When you are connected to the board, the GUI will check the previous settings saved on the PC. If there is none, it will generate a default settings file. Then these settings will be applied. It includes 4 line rate configuration, amplitude and PRBS pattern configuration, and EQL taps settings.
- To change the IP address of the board, you need to install the USB drivers (refer to section [USB Driver Installation](#)).
- Install the Ethernet configuration software that allows you to read, write the **IP** address, **Mask** and **Gateway** of the instrument.

- The Serial Number is **4039BXXXX**

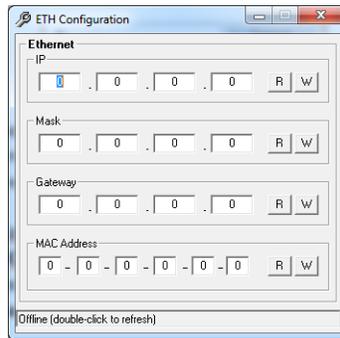


Figure 5: Ethernet Configuration

b. **Connect through USB:**

If you have failed to connect via Ethernet, and if the Internet is not down in your lab, and you are not able to ping the instrument, then it could be an Ethernet Configuration error; then try to connect via USB to change the board IP to fit in the network range. Refer to the next section below [Connect through USB](#).

---

**NOTE.** This section is intended to control the instrument via USB but this feature is not available with this GUI version 2.0. The USB driver installation currently only helps for using the Ethernet Configuration software so you can change the IP address of the instrument.

---

The instrument is now powered up and connected through the right IP address. Next, you need to configure the signal generated.

**Line Rate Configuration**

- Write the bit rate value next to the **Line Rate** label. The value entered must be in between 1 and 30 Gbps per lane.
- Press **Apply** to enter the line rate values.
- Channel 1 and channel 2 share the same clock configuration, channel 3 and channel 4 also share the same clock configuration. So channel 1 depends on channel 2, and channel 3 depends on channel 4.  
To start we begin with channel 2 and channel 4, and then a list of Line Rates will be displayed in channel 1 and channel 3.
- **Ref** will be automatically generated indicating the **Ref CLK-Out** that will be generated by the [ML4039B/-JIT/-EQL](#)
- In case the clock is **External** "inserted to the [ML4039B/-JIT/-EQL](#)", values of **Ref-CLK-In** should be the following in order for the signal to be generated properly:
  - a. Clock = Line Rate/16, for Line Rate between 1-4 Gbps
  - b. Clock = Line Rate/32, for Line Rate between 4.1-20 Gbps

c. Clock = Line Rate/64, for Line Rate between 20.1-32 Gbps

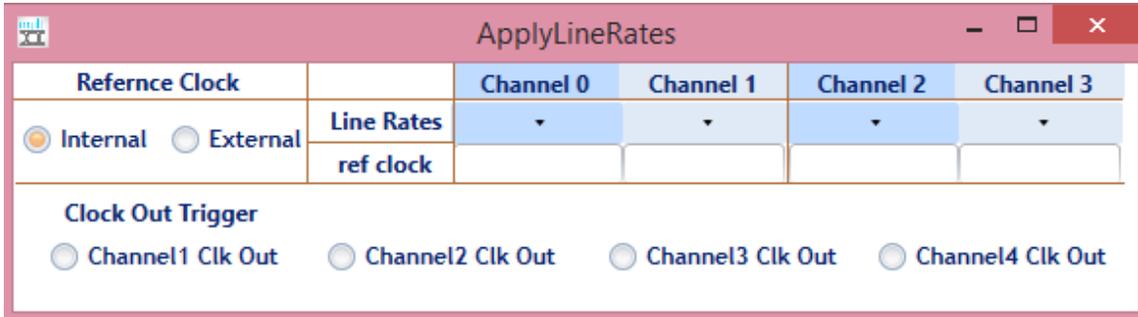


Figure 6: Line Rate Configuration

**PRBS Pattern Configuration**

- In the **PRBS Configuration** group box, select the pattern required; the available patterns are 7, 9, 15, 23, 31 and sinusoidal in addition to the 80 bits user pattern. TX Pattern tab is used for Configuring Generated signal, RX Pattern tab is used for pattern verification
- To use the **User defined** capability, first select it from the **Pattern** combo box list, then in the text box specified for the **User Defined** write the sequence of bits you want.
- To make the TX off , choose the **TX OFF**
- In case the test engineer wired the positive TX channel to the negative RX channel by mistake, the software can compensate for this error by clicking on the invert button.

The specified generator now starts generating a clean signal. If you would like to inject jitter to the signal generated to start shaping the eye diagram, you have to adjust the slide bars existing in the Eye Shaping group box (refer to the section **Eye Shaping**).

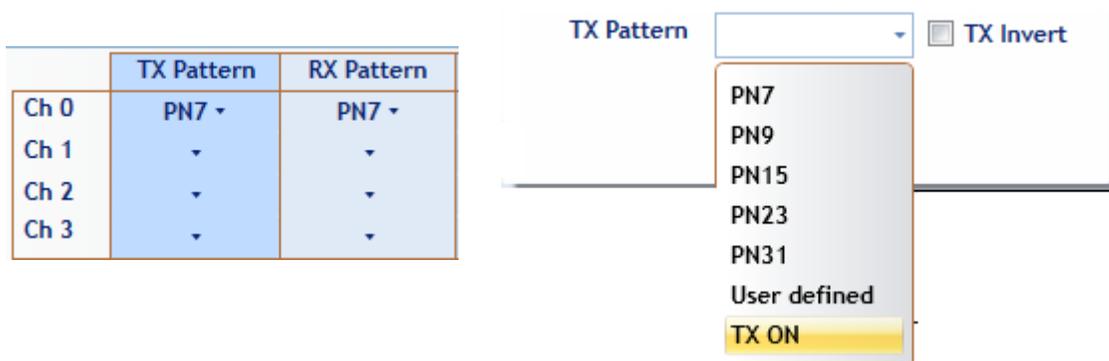


Figure 7: PRBS Channel Configuration

**PRBS Pattern Verification**

PRBS Verification option checks if the data received at RX is recognizable by the ML4039B/-JIT/-EQL

- In case the User manually selects the pattern and checked the invert button, the LED indicates that the channel is locked by turning green. Channel will be locked if the data received at RX matches the selected pattern

**Eye Shaping**

This instrument includes 3 sliders to shape the form of the eye diagram, Amplitude, PM and skew. All sliders values and other configurations are saved in the EPROM:

- **Amplitude:** TX output amplitude is between 0mV and 800mV.
- **TX Skew:** Skew Control for both legs simultaneously from 0 to 140ps within 4096 steps.
- **PM (Phase-modulated jitter injection):** PM consists of SJ (Sinusoidal Jitter) and RJ (Random Jitter). The values of SJ and RJ can be set on a scale of 0 to 4095 if the jitter on the given channel hasn't been calibrated beforehand. In the menu bar (starting with release 2.8.r2119) there is a calibration menu that enables you to turn the jitter scale into meaningful picoseconds values. For this to happen, you first have to connect TX and RX with a cable for the channel you're calibrating, and then run the calibration routine. It takes around 2 minutes to calibrate one channel; afterwards, the calibration values are saved in the EEPROM and can be loaded anytime. If loading the jitter calibration doesn't occur automatically, you can activate it manually by checking the tick for "Optimized" under the "TX Skew" menu of the channel in question.
- **AM RJ:** This is a combination between a DC that changes from 0 to 4095 steps, and RJ signal that has a Gaussian distribution, to create noisy reference amplitude for the main signal.



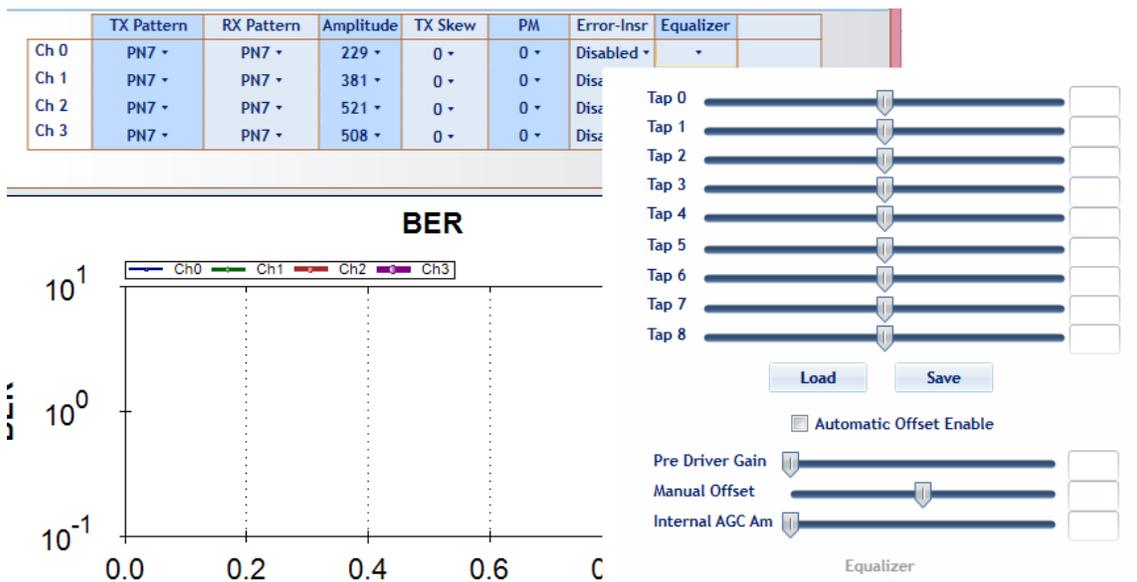
Figure 8: PM Frequency

	TX Pattern	RX Pattern	Amplitude	TX Skew	PM	Error-Insr	Equalizer
Ch 0	PN7 ▾	PN7 ▾	229 ▾	0 ▾	0 ▾	Disabled ▾	▾
Ch 1	PN7 ▾	PN7 ▾	381 ▾	0 ▾	0 ▾	Disabled ▾	▾
Ch 2	PN7 ▾	PN7 ▾	521 ▾	0 ▾	0 ▾	Disabled ▾	▾
Ch 3	PN7 ▾	PN7 ▾	508 ▾	0 ▾	0 ▾	Disabled ▾	▾

Figure 9: Eye Shaping Sliders

### EQL Taps

“EQL” is a 9 taps equalizer on the TX path that changes the Eye Shape of the ML4039B-EQL Eye.



The tabs contain predefined IEEE stress conditions; The FFE (Feed Forward Equalizer) taps can shape the output signal according to the taps values. They provide superior modal dispersion compensation and enable full control of the signal.

The ML4039B-EQL has the following features:

- The Equalizer that contains:
  - Internal AGC Amplitude: set the Amplitude Gain Control
  - Manual offset: set the offset of the signal (eye)
  - Pre Driver Gain: set the Gain of the eye(signal)
  - 9 taps to change the Eye shape

The manual offset correction dynamic range changes with the AGC gain with the total correction being +/- 60mV for maximum AGC gain. For minimum AGC gain, the

correction dynamic range increases to +/-180mV, and the minimum step for the adjustment increases to 6mV/step.

The values entered can be saved and loaded.

The Pre Driver Gain, Manual Offset and Internal AGC Amplitude can be enabled automatically by checking the **Automatic Offset Enable**

### Error Insertion

**Error-Insr** tab allows configuring signal error insertion. **Rate** select list allows the user to choose the amount of error bits. Rate will vary between 1 and 40 bits.

**Continuous** checkbox allows continuously inserting error to the generated signal.

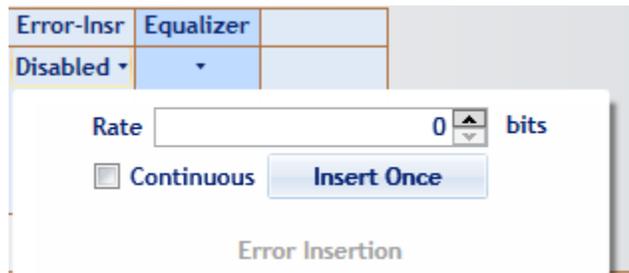


Figure 10: Error Insertion

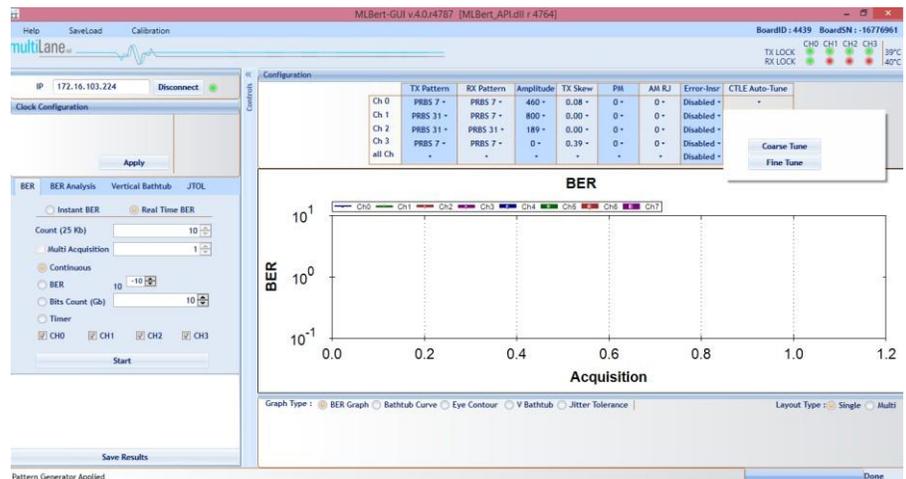
### CTLE Tuning

In ML4039B, ML4039B-JIT and ML4039B-EQL that contains Avago chip, the user has the ability to adjust the eye opening using 2 different options of CTLE tuning:

- Fine Tune
- Coarse Tune

To be able to use them, these steps are required:

- 1- Adjust settings to get lock
- 2- Apply Line rate
- 3- Apply Coarse CTLE Tuning
- 4- Apply Fine CTLE Tuning



### Bit Error Ratio Reading

To be able to start BER measurements, the instrument ports should be in the loopback mode, which means TX port should be connected to the RX port and the **Start All Channels** button must be selected.

To monitor the BER function, we have dedicated an LED to make sure it is locked.

- If the LED is green that means the RX is locked to the incoming data.
- If the LED is red that means the RX is not locked to the incoming data, which means there is a possibility that the cables are not connected correctly, thus try the invert function at the TX and RX sides; if the problem persists check the connections of your cables. The patterns of the Detector are automatically modified when you change the generator pattern value.

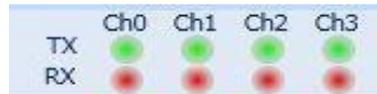


Figure 11: Channels' LEDs

### BER

BER test has the following configuration:

**Count (25kbit):** Number of packets to be collected

**Repeat Count:** if selected it allows you to choose the number of acquisitions.

The measurements will be for the preceding configuration.

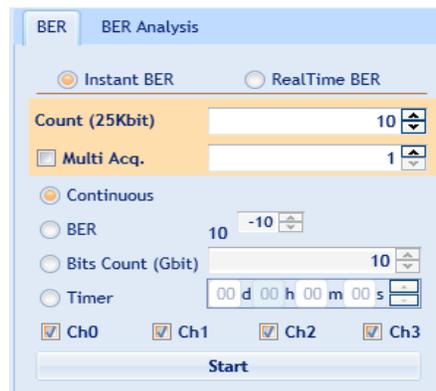


Figure 12: BER Configuration

## Real Time BER

This feature allows the BERT to collect Real Time BER.

Configuration

**Count (25kbit):** Number of packets to be collected.

**Repeat Count:** if selected it allows you to choose the number of acquisitions.

**Continuous BER:** the BER value is repeated after each set the packet counts.

**BER:** The BER test will run till it reaches the amount of BER selected.

**Timer:** The BER test will run for the specified amount of time.

## BER Graph

Plots BER values collected on the graph

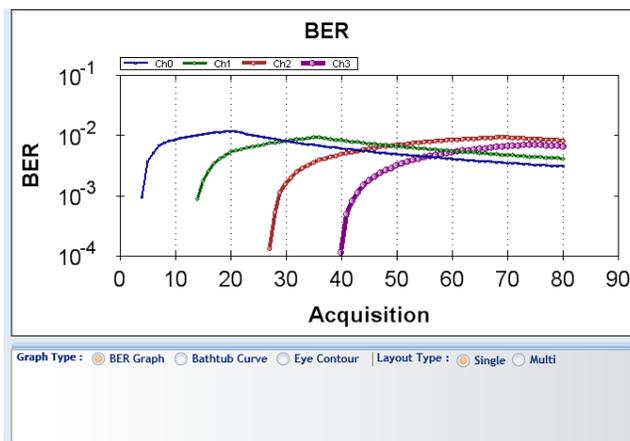


Figure 13: BER Graph

## Bit Error Ratio analysis

### The Bathtub Plot

A viewpoint of jitter is provided by a *bathtub plot*, so named because its characteristic curve looks like the cross section of a bathtub. It is a graph of BER versus sampling point throughout the unit interval. It is typically shown with a log scale, which illustrates the functional relationship of sampling time to bit error ratio.

When the sampling point is at or near the transition points, the BER is 0.5 (equal probability for success or failure of a bit transmission). The curve is fairly flat in these regions, which are dominated by deterministic jitter mechanisms.

As the sampling point moves inward from both ends of the unit interval, the BER drops off precipitously.

These regions are dominated by random jitter mechanisms and the BER is determined by the sigma of the Gaussian processes producing the random jitter. As expected, the center of the unit interval provides the optimum sampling point. Note that there is BER measured for the middle sampling times.

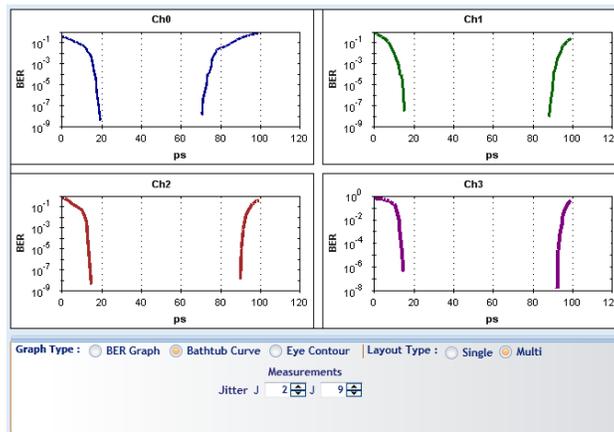


Figure 14: Bathtub Graph

Plotting the points on a graph of BER versus sampling location in time results in a curve that resembles the cross section of a bathtub, hence the term bathtub curve. A bathtub curve can be created either by software extrapolation from voltage over time measurement done by an oscilloscope, or by actually sampling the bits as done by a BERT.

For development engineers, the final proof of performance of a component or subsystem is the direct measurement of BER at optimized timing and threshold levels employing error detection on every transmitted bit. However the speed of the BER measurement is a function of the BER to be measured and the desired statistical confidence factor for the result.

**NOTE.** *This software version only supports the Horizontal Bathtub plot.*

**Bathtub configuration**

To run the bathtub you should set the following configuration:

**Target BER:** Select which level the Bathtub will reach. Upon selection, estimation of the time will be given.

**Full sweep (disabled):** Read the BER at every point and allow the user to choose the start and stop time for the scan(time in PS).

You can select a channel at a time to measure the Bathtub.

**Dual Dirac:** Doesn't allow the user to choose the start and stop time for the scan

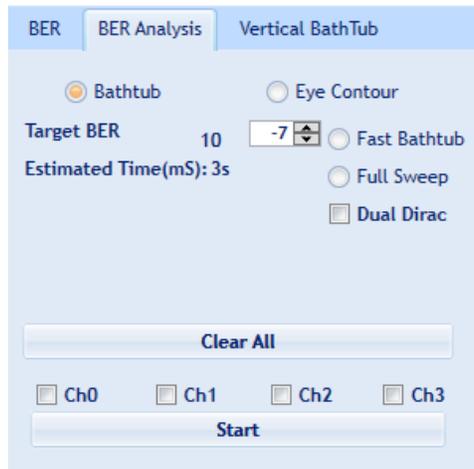


Figure 15: Bathtub Configuration

Multiple channels can run in parallel to do the Bathtub at the same time.

**Jitter measurements**

J2 and J9 is a measure of the eye width at  $2.5 \times 10^{-2}$  and  $2.5 \times 10^{-9}$ .

J2 gives a measure of the DJ.

J9 gives a measure of the RJ.

The [ML 4039B-EQL GUI](#) allows BER Level selection for measurements.



Figure 16: Jitter Measurements

## Eye Contour

### Eye Contour Configuration

To run the Eye Contour you should set the following configuration:

**Accumulated:** Select the number of data acquisitions. Upon selection, estimation of the time will be given.

Multiple channels can run in parallel to do the Eye Contour measurements at the same time.

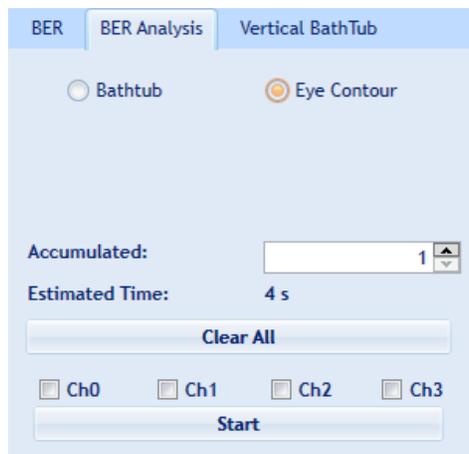


Figure 17: Eye Configuration

### Eye Contour measurements

The eye opening is a key characteristic of a device. The BER is displayed as a function of sampling delay and sampling threshold.

Bit Error Rate Contour Measurement is part of the Physical Layer option. This analysis computes the bit error rate around the perimeter of the eye opening and fits these results to the expected bit error rate response curves predicted by additive noise. The depth of the contours can then be extrapolated to lower levels than the actual measurement would allow.

BER contours are used to identify how much headroom may be present in a system after considering the amount of decision-point variation that might occur.

You can press the Eye Scan button to draw the overall eye contour.

In case of single channel Select Offset checkbox will allow to specify a point to read Bathtub and BER in range of Picoseconds X-axis and mill volt Y- axis.

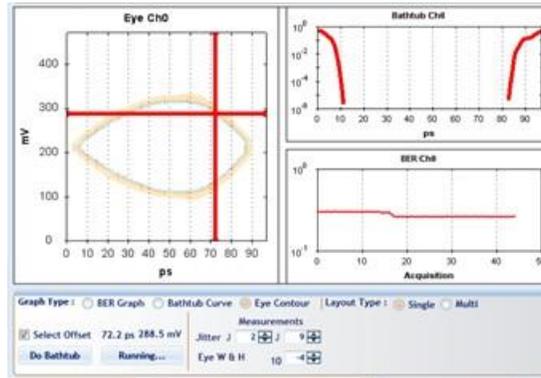


Figure 18: Single Channel Eye Contour

Do **Bathtub** button displays the Bathtub curve and shows Jitter measurements.

Do **BER** button displays BER graph and shows BER results.

These featured are not applicable in 4-Channel mode; the graph will display 4 Eye contour.

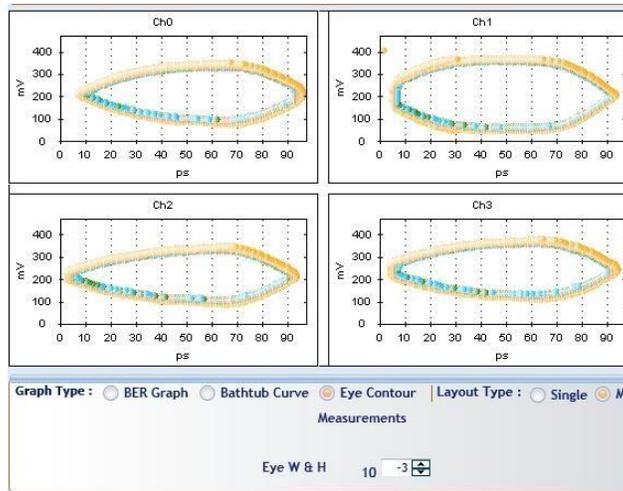


Figure 19: 4 Channels Eye Contour

**Mask test**

Masks typically represent an area in the eye opening that you want to ensure unit intervals do not fall within.

The mask test is highly efficient since it quantifies both time and amplitude parameters in one measurement.

The user should check the checkbox of the MASK to view the failing points, after specifying the X and Y values of every point in the mask.

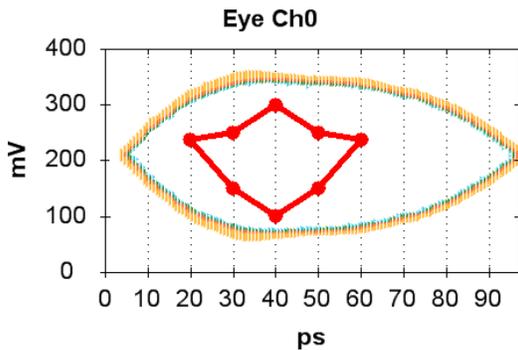


Figure 20: Eye Mask

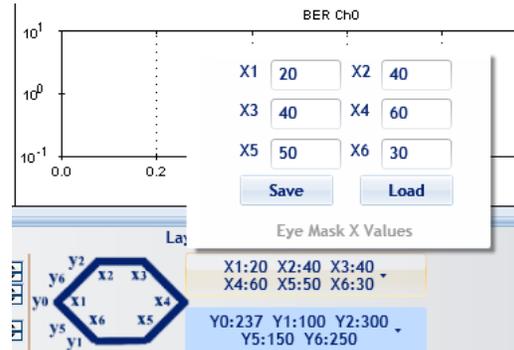


Figure 21: X and Y values

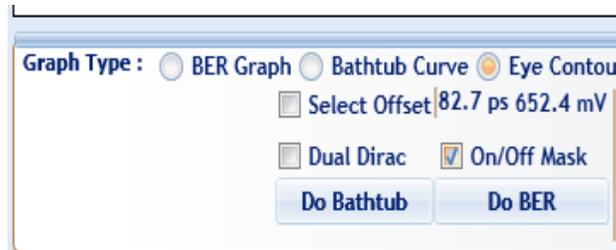


Figure 22: Check Mask

**Vertical Bathtub**

The V Bathtub allows the user to get the vertical Bathtub of a specific channel.

The value entered in the textbox must be between 0 and 255 steps, and according to the estimated time 2 s, the curve will be drawn

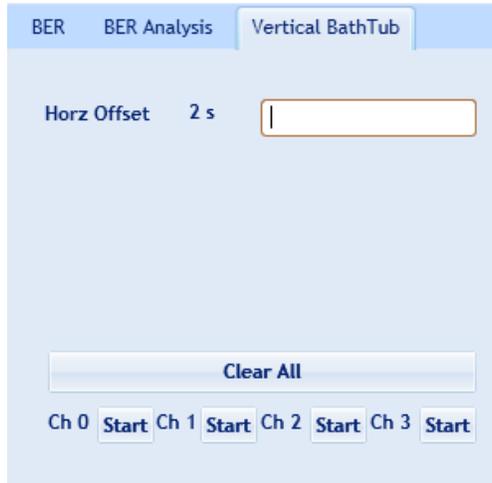


Figure 23: Vertical Bathtub

**Log file System**

In the [ML4039B/-JIT/-EQL](#) BERT there is a log file system, where every exception handled or unhandled by the GUI will be saved. After the first run, the GUI creates a file in the main directory/exception log, and saves all the existed exceptions. In case the user had a problem with software, he can send the exception file to our team.

Note: the exception file will be deleted automatically after every 1 week of work.

## How to connect this instrument

This session covers the connection options of the instrument, addressing the following topic:

- **ML4039B/-JIT/-EQL** BERT Fast Ethernet / USB Connections method.

---

**NOTE.** This release supports Ethernet connection for the software applications (note that the IP<sup>1</sup> should be in the same range of the network).

---

### Connecting Through an Ethernet cable

To establish an Ethernet connection between the **ML4039B/-JIT/-EQL** panel and the PC, connect an Ethernet **straight** cable between the panel and the Router or Switch, and sure you can connect your PC to the router via cable or wireless. Or instead use a **crossover** cable directly between the panel and the PC. The device can be pinged to verify that a connection has been established.

Make sure to have the correct IP address

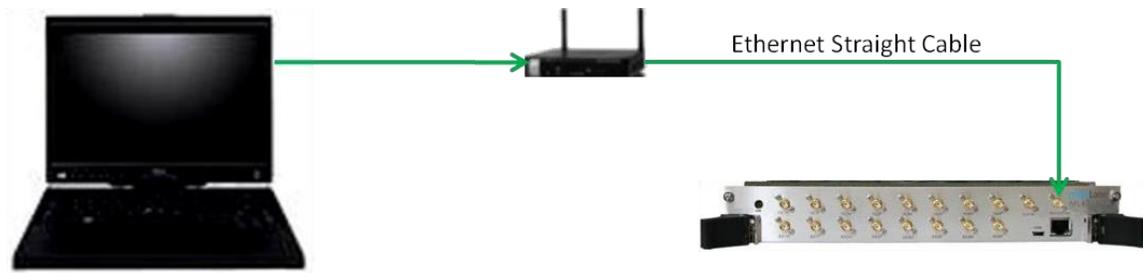


Figure 24: **ML4039B/-JIT/-EQL** connected to PC via Ethernet



Figure 25: **ML4039B-EQL** connected with Ethernet crossover cable

<sup>1</sup>[http:// en.wikipedia.org/wiki/IP\\_address](http://en.wikipedia.org/wiki/IP_address)

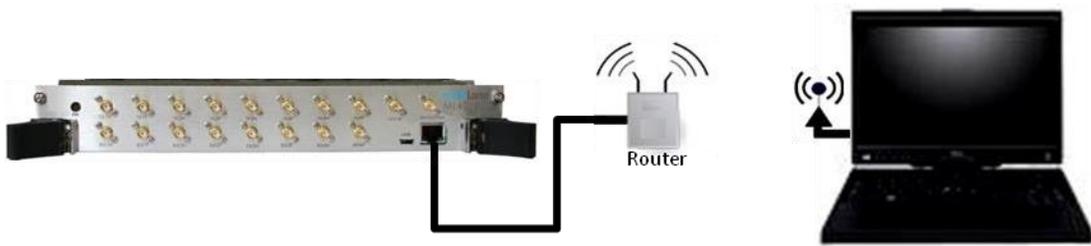


Figure 26: ML4039B/-JIT/-EQL connected to PC via Wireless

### Connecting Through USB cables

Connect a USB cable between the panel and the PC.

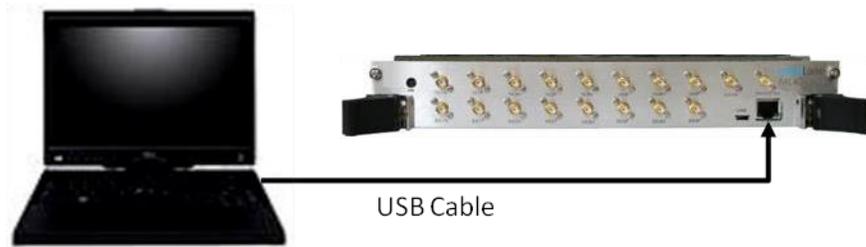


Figure 27: ML4039B/-JIT/-EQL with USB connection

## USB Driver Installation

During the MultiLane’s software installation, the USB drivers of a specific instrument should normally be installed automatically. If for any reason this step couldn’t be completed, or any error window similar to the below picture appears, it is recommended to install the USB drivers manually, after you press on cancel and continue the installation process.

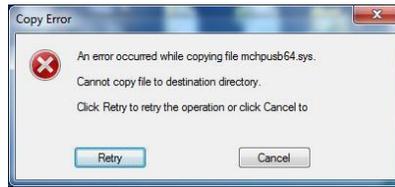


Figure 28: USB Driver Not Installed

USB software drivers’ names:

- **ML4039B/-JIT/-EQL USB driver**

The following instructions are applicable for a manual USB driver installation using Windows XP, Windows 7 and 8.

- Power on the instrument.
- Plug-in the USB cable into the PC and connect it to the panel, refer to the section [Connect through USB cables](#).

### USB Driver Installation on Windows XP, Windows 7 and 8 platforms

- Ignore the messages *new hardware found* or *driver software not successfully installed* by pressing **cancel** or **close**.
- Go to the device manager via a right click on **My Computer**:
  - Click on **Manage**.
  - Click on **Device Manager**.
- Right click on the top level tab (Here multilane-PC) and select “**Scan for hardware changes**”.

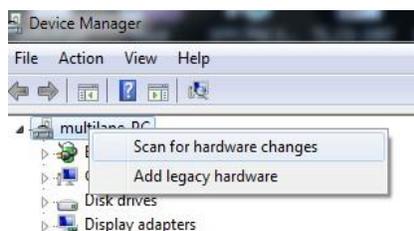


Figure 29: Scan for Hardware Changes

- A message appears stating: **“Scanning Plug and Play compliant hardware”**.

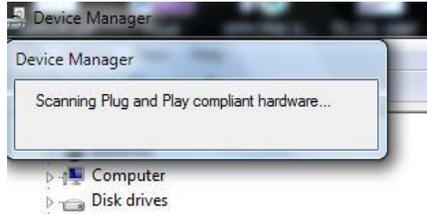


Figure 30: Scanning for Plugs

- In the **Other Devices** tab, the **ML4039B/-JIT/-EQL USB Device** description appears.
- In the **Other Devices** tab, right-click on the **ML4039B/-JIT/-EQL USB Device** and select **“Update Driver Software”**
- A dialog box appears asking for the method to search for the driver software. Select **“Browse my computer for driver software”**.
- A dialog box appears asking for the Driver software path. Enter the path and click **“Next”**.
- A security dialog box appears, select **“Install this driver software anyway”**.
- The PC commences Driver software installation.
  - A Windows message appears (after some time) saying that you have successfully updated your driver software.
- Press close.
- In the Device Manager, a new tab appears named **MultiLane SAL Devices**. Expanding it reveals **“MultiLane SAL ML4039B/-JIT/-EQL USB Device”**.
- You are now connected via USB and you can control the instrument.

## Firmware Upgrade

The PIC32 Boot loader program automatically runs when the ML4039B/-JIT/-EQL GUI detects incorrect or outdated firmware. The following software is needed to load the firmware:

- ML Configuration GUI

### Instructions to upgrade the Firmware

1. When connecting to an instrument with outdated/incorrect firmware, the board LEDs 1 and 2 start blinking and Boot loader Software pops up automatically (Figure )

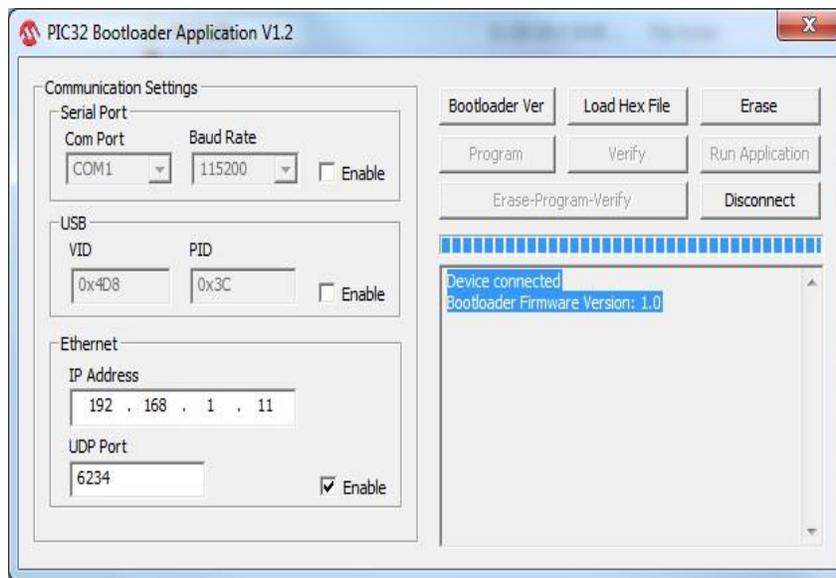


Figure 31: Boot loader Software

2. User has the option for loading the new firmware.
3. Set IP at 192.168.1.11 and UDP port at 6234, press on “Enable”, check box in the Ethernet Tab and then press “Connect” button. If connection is successful, the software will display “Device connected Boot loader Firmware Version: 2.0”
4. Otherwise, attach a USB cable to the board and press “Enable” check box in the USB tab of the GUI then press on “Connect” as shown.

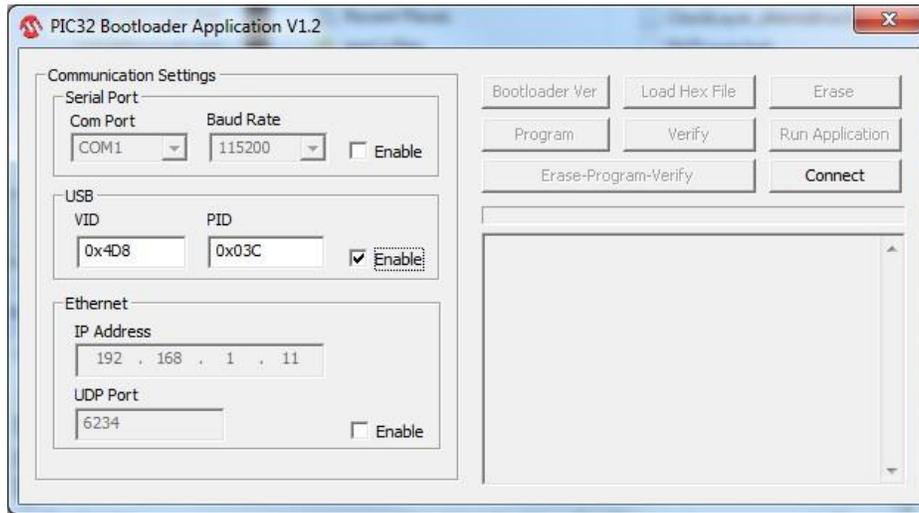


Figure 32: Connect Bootloader Software

5. Press “Load Hex File” then load the new ML4039B/-JIT/-EQL firmware and press “Open”. The path of the firmware file is C:/Program files/Multilane SAL/ML BERT/FWLoad.

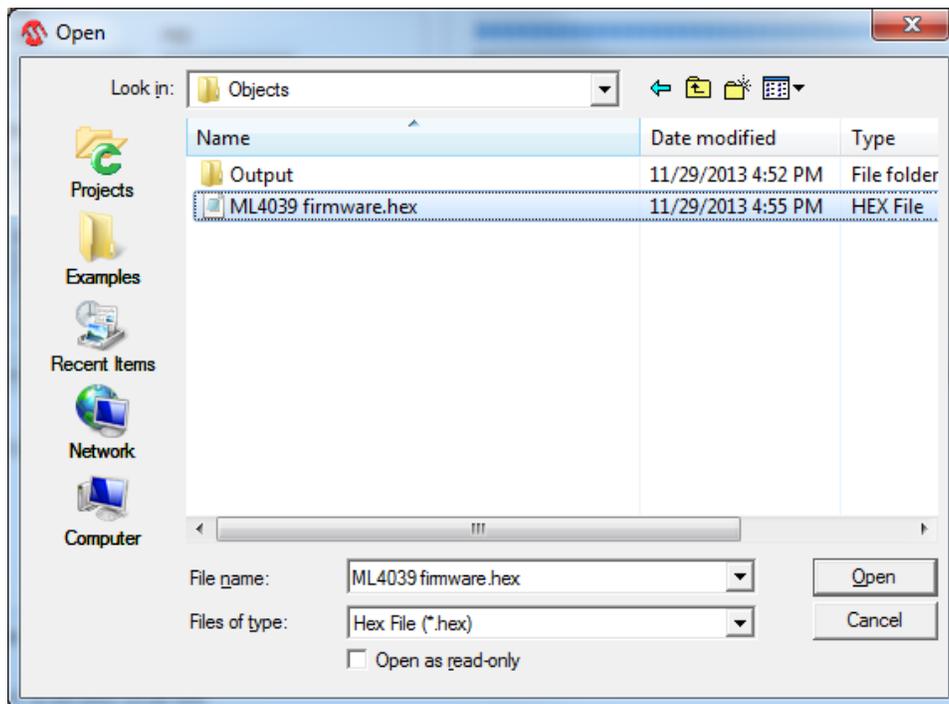


Figure 33: Select Hex File

6. Press “Erase-Program-Verify” button. Successful loading will be indicated by the bootloader software.

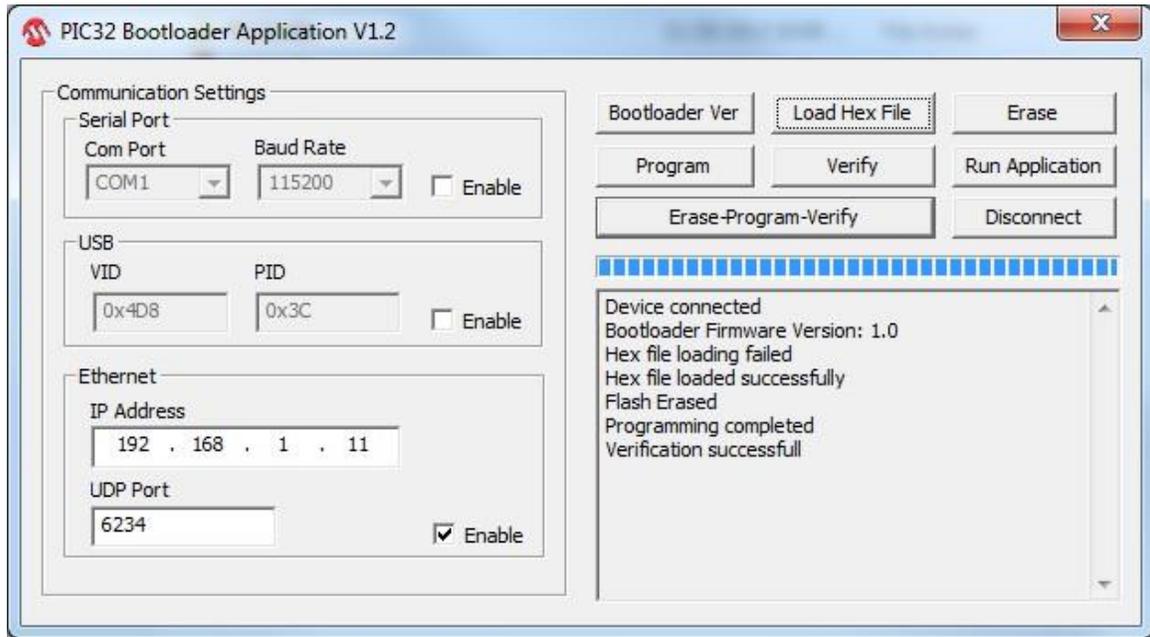


Figure 34: Erase Program Verify

7. power cycle the [ML4039B/-JIT/-EQL](#)
8. [ML4039B/-JIT/-EQL](#) is now ready for normal operation

In case the user lost the old IP (when upgrading the firmware or when changing the IP) or when the IP is mistakenly erased, he can always put a jumper and power cycle the board, this will initiate the board in the default IP which is 172.16.100.217

## Related Products

For a complete transmitter/receiver test solution, MultiLane offers the following products:

- **ML4009**: single Channel BERT for low cost production testing.
- **ML4039-JIT**: 4 Channel BERT with full jitter control for receiver sensitivity and jitter tolerance testing.
- **ML4039-EQL**: like ML4039-JIT but with independent time domains and 9-tap transversal filter per channel for equalization tolerance testing.
- **ML4009-JIT**: Single channel with full jitter control for receiver sensitivity and jitter tolerance testing in a standalone metal box.

## Ordering Information

Order No.	Description
ML4039	4 Channels 30 Gbps BERT
ML4039-HV	4 Channels 30 Gbps BERT with High Voltage output
ML4039-JIT	4 Channels 30 Gbps BERT with Jitter Generation
ML4039-EQL	4 Channels 30 Gbps BERT with independent time domain and 9-tap transversal filter per channel for equalization tolerance testing
ML4039-3W	3-Year Warranty
ML4000	6U cPCI Chassis
<ul style="list-style-type: none"> <li>• Please select <b>cPCI</b> form factor (5" x 6.5") form factor.</li> <li>• Standard Warranty - 1 Year</li> </ul>	
<p><i>For more information on this or other products, contact Multilane sales team by email at <a href="mailto:sales@multilaneinc.com">sales@multilaneinc.com</a></i></p>	

Table 2: Order Information

For more information on this or other products contact MultiLane sales team by email at [sales@multilaneinc.com](mailto:sales@multilaneinc.com).