Manuals+ — User Manuals Simplified.

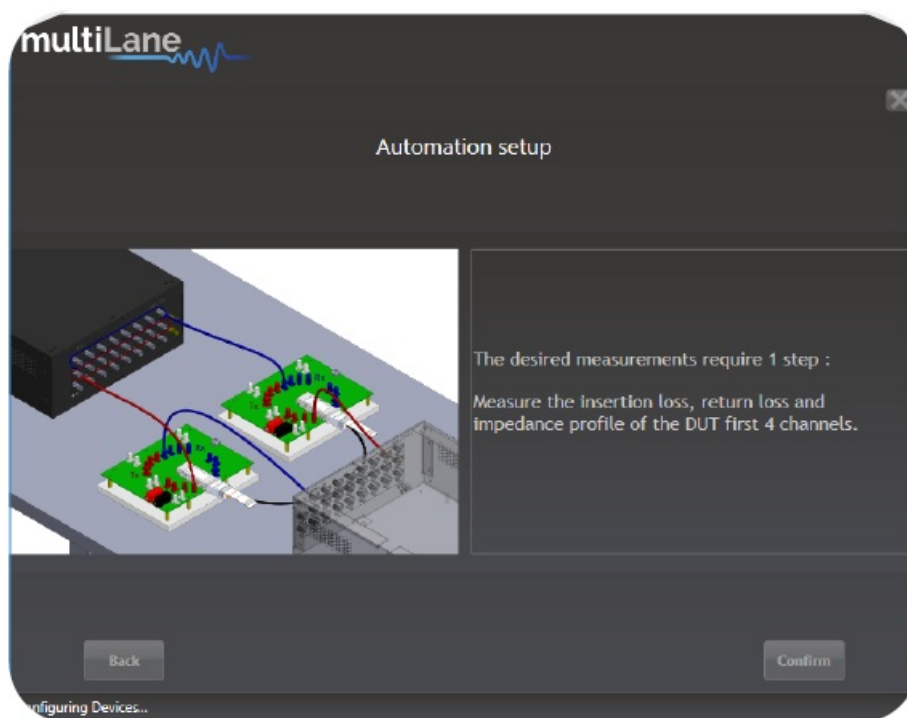# multiLane ML1105 Automated DAC Testing Software User Guide

Contents

multiLane ML1105 Automated DAC Testing Software

Notices:

General Safety Summary

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.
- **Caution** statements identify conditions or practices that could result in damage to this product or other property.
- Electro static sensitive device. Operate in ESD supervised and controlled areas.

Revision Control

Revision number	Description	Release Date
2.0	§ Initial Release, SW rev. 2.0	13/9/2019
4.3.1	§ SW rev. 4.3.1	12/7/2021

List of Acronyms

Acronym	Definition
BW	Bandwidth
BERT	Bit Error Rate Tester
Conf	Configuration
DUT	Device Under Test
FEC	Forward Error Correction
FW	Firmware
GBd	Giga Baud
Gbps	Gigabits per second
GUI	Graphical User Interface
HW	Hardware
ISI	Inter-symbol Interference
JTOL	Jitter Tolerance
NRZ	Non-Return to Zero
PAM4	Pulse Amplitude Modulation (4-level)
SI	Signal Integrity
SNR	Signal-to-Noise Ratio
Sim	Simulation
SW	Software

Introduction

The rapid growth of cloud computing economies demands the need for stable and high-speed data center interconnect solutions. With the widespread adoption of 400G – and move towards 800G and beyond – errors have become an integral part of any HSIO system. Success now lies not only in identifying where errors occur, but also in determining which errors are critical to correct. A key player in the test and measurement industry, MultiLane provides an essential high-value instrumentation that ensures vendors can keep up with demand and bring their designs to market.

The ML4035 is a 3-in-1 400G BERT, 35GHz electrical scope and time domain reflectometer. It enables 400G BER measurements, NRZ and PAM4 eye diagram characterization as well as TDR and S-parameters evaluation. Our ML1105 Automated DAC Testing Software, resides on the 16-port simultaneous measurements of the ML4035 to evaluate 10G-800G cables' impedance profile and perform tests including insertion loss, return loss, Far & Near-

End Crosstalk, Integrated Crosstalk Noise, COM and Effective Return Loss, then generates a report with Pass/Fail criteria. In this revised version of the ML4035 – ML1105 user guide, MultiLane provides a full detailed and revised user guide to operate the ML4035 from the connection to the calibration and measurements.

ML4035: TDR|BERT|DSO

The ML4035 is a 3-in-1 400G BERT, 35GHz electrical digital sampling oscilloscope (DSO), and Time Domain Reflectometer (TDR). On its faceplate, user can detect three main rows of connectors (4-channel differential each). When operating in DSO mode, the first row of connectors acts as a DSO input. Whereas when the TDR mode is chosen, the first row is a TDR input/output for TDR capture. The BERT section of the faceplate is a combination of 4-channel Pulse Pattern Generator (PPG) on the TX-side and 4-channel Error Detector (ED) on the RX-side. For signals synchronizations, the Clock input and output are at the disposal of the users for accurate and high-precision measurements.

To install and start using the ML4035 for testing, run the ML1105 installer file provided by the support after your purchase, follow this step-by-step installation guide (with pictures) below:

1. Open the ML1105 setup file.
2. Install ML1105
3. Connect the ML4035 to the local network.
4. Launch the ML1105 GUI.
5. Start the measurements.

Installation

After downloading the ML1105 setup file, select run and follow this easy step-by-step setup installation procedure:
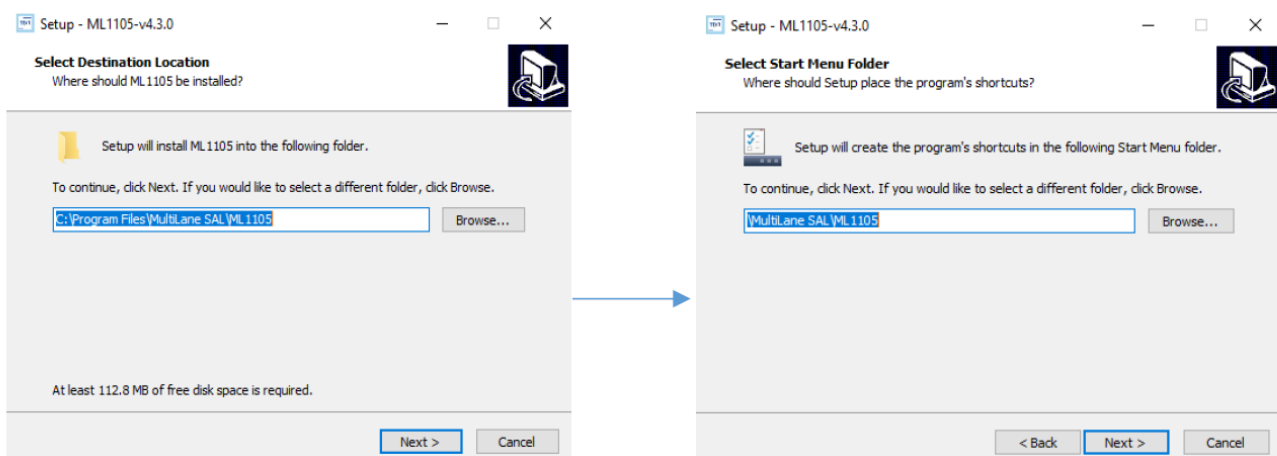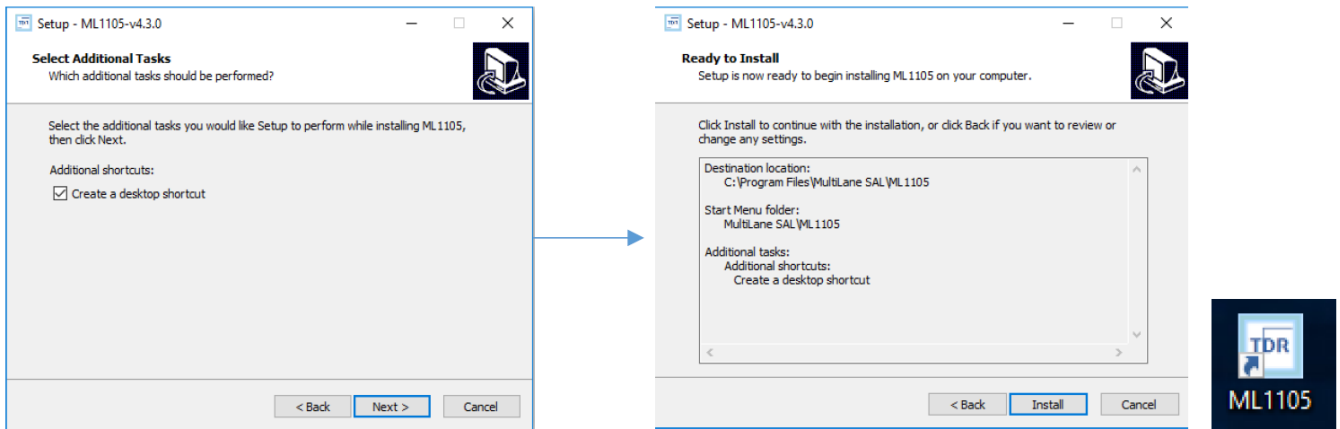
Figure 1: Setup installation procedure

ML1105 is now installed, a shortcut icon is located on the Desktop and ready to be used.

Connecting to the Instrument

To connect to the instrument, follow this sequence of steps:

- Install the ML1105 Automated GUI software.
- Connect the power cable to the power jack of the ML4035 and plug it into an AC outlet. The power cable is already included in the package accessories.
- Power Up the ML4035.
- Connect the device to the network* using a RJ45/LAN cable. LAN connection can be validated with a ping to the static instrument IP.
- Run ML1105 software.
- Choose the instruments model to be used (ML_4035_TDR/ML_4025).
- Connect using the IP address of the target instrument(s) (Figure 2). The IP address is printed on the back side of the instrument.
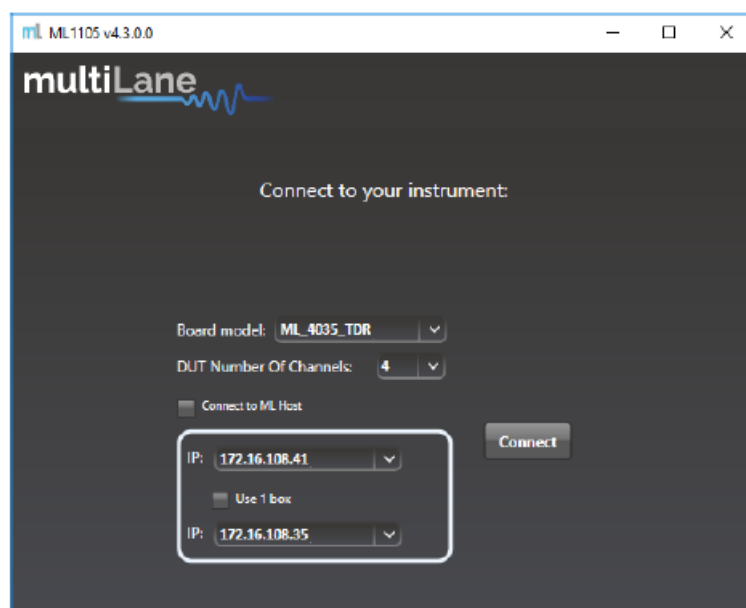

Figure 2: Connection box

- The previously connected IP addresses will appear in the drop-down list next to the type box.
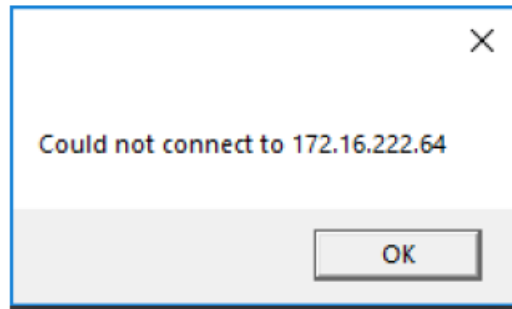- In the case of a connection failure, a pop-up message will appear indicating a connection error (Figure 3).

Figure 3: Connection failure notification

*To add the device to the network, consult Appendix I at the end of this manual.

Launching the GUI
After establishing connection to the ML4035, the GUI is initialized immediately, and all the features are ready for use. The general display of the ML1105 GUI will appear and the user can begin testing.

ML1105 provides end users the ability to choose the desired measurements, to be evaluated and reported such as:

- Impedence profile (TDR)
- Return Loss (Sdd11)
- Insertion Loss (Sdd21)
- Far End Crosstalk (FEXT)
- Near End Crosstalk (NEXT)
- Integrated Crosstalk (ICN)
- Channel Operating Margin (COM)

A. Mask type, the specs based on which the DUT will be assessed as a pass or fail.
B. DUT sides, to be measured. When both sides are selected the measurements are done from both ends (ports).
C. Measurements, the criteria to be evaluated and assessed.
D. Save results, the user can choose to save the results once obtained or not.
E. Results directory, the user can choose where to save the automatically generated results.
F. Results format, the user can choose the format in which the results will be saved.
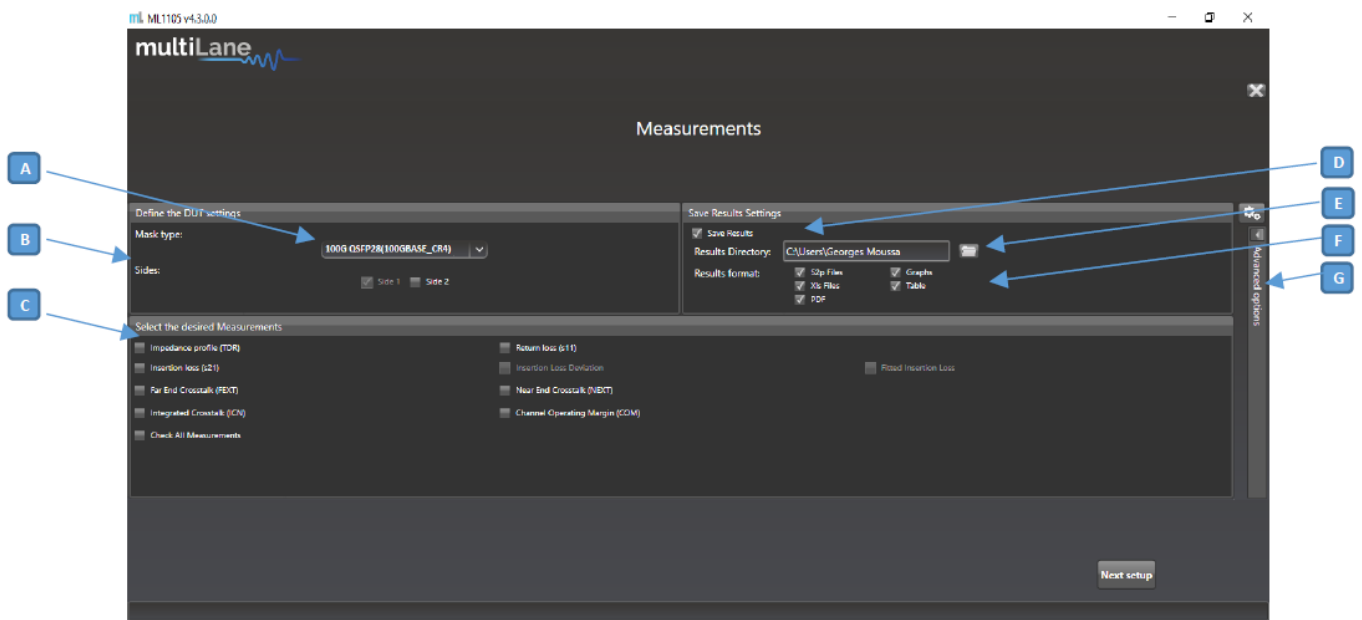**G**. Additional Options, to enter manually the S-parameters maximal values.

Figure 4: General GUI display using 2 ML4035 boxes

Setup Calibration

After choosing the Mask type, the sides to be evaluated, the file directory where the results will be saved, and the losses limit, the user can click on Next Setup.
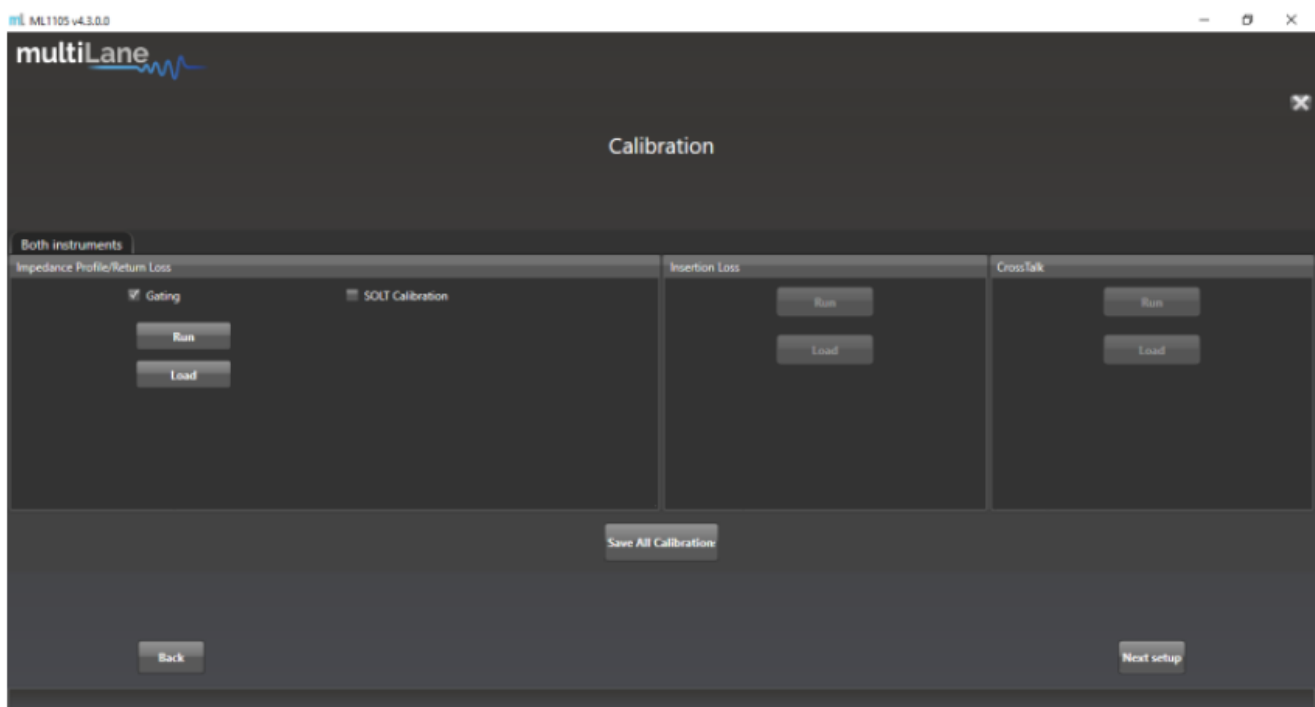

Figure 5: ML1105 Calibration Paths

Before running any measurement, the instrument(s) in use need to be calibrated to maximize the performance and obtain accurate measurements. Therefore, based on the chosen measurements the calibration paths are detected and can be run immediately and saved for later use or can be loaded from previous calibration sessions.

When all the measurements are being selected for evaluation, you must perform the following calibration processes:

- Return Loss Calibration

- Insertion Loss Calibration
- Crosstalk Calibration

Impedance Profile Gating Calibration
Gating is the default calibration method for return loss measurements, and the one that should be used when the DUT is followed by unwanted system components such as MCB traces, connectors, etc. The calibration wizard uses TDR to allow the user to locate the DUT's boundaries, set markers and apply gating.
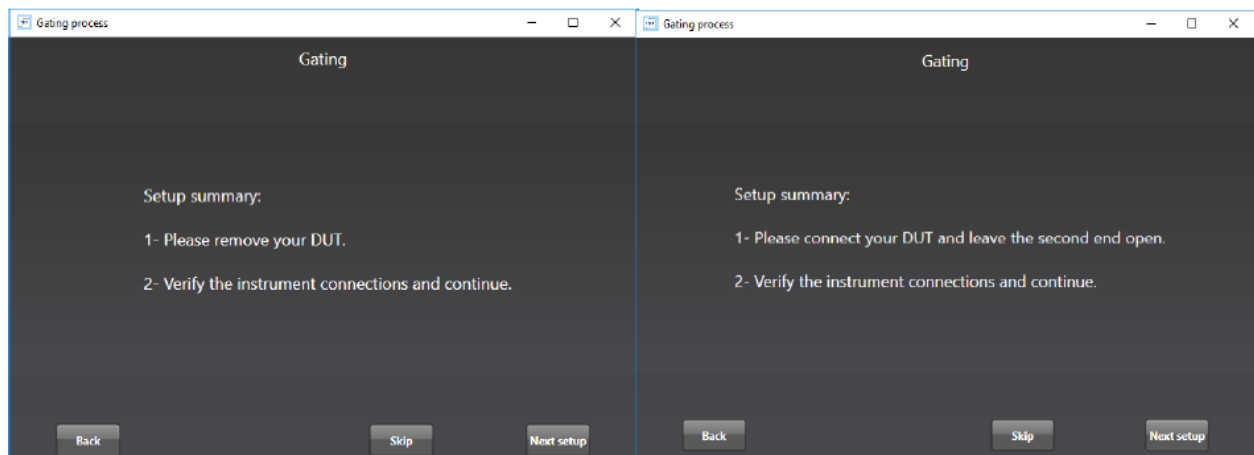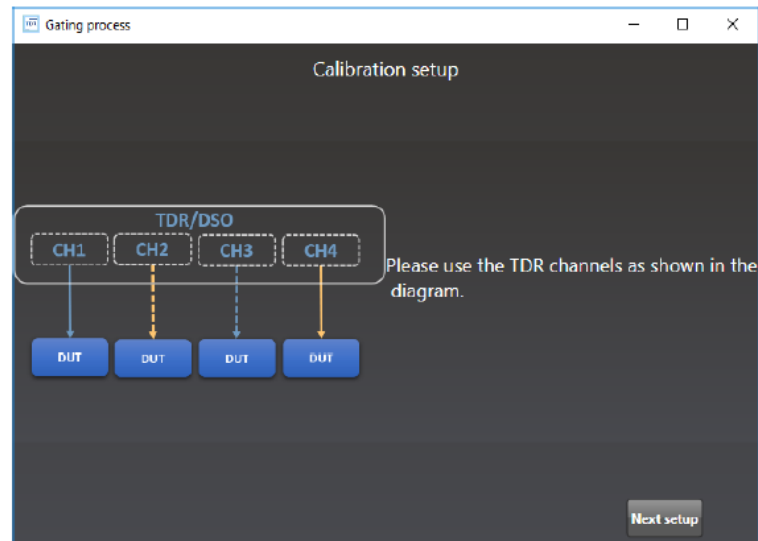
- Disconnect the DUT and press "Next Setup".
- Connect the DUT from the near-end1 and leave it disconnected from the far-end2.
- Connect the DUT from the far-end and press "Confirm". • Apply markers at the points of difference between the main setup's impedance profile and the other two and press "Apply Gating". The first marker specifies the index of variation between the MCB1 curve and MCB1+DAC+MCB2 curve. The second marker specifies the index of variation between MCB1+DAC curve and MCB1+DAC+MCB2 curve.

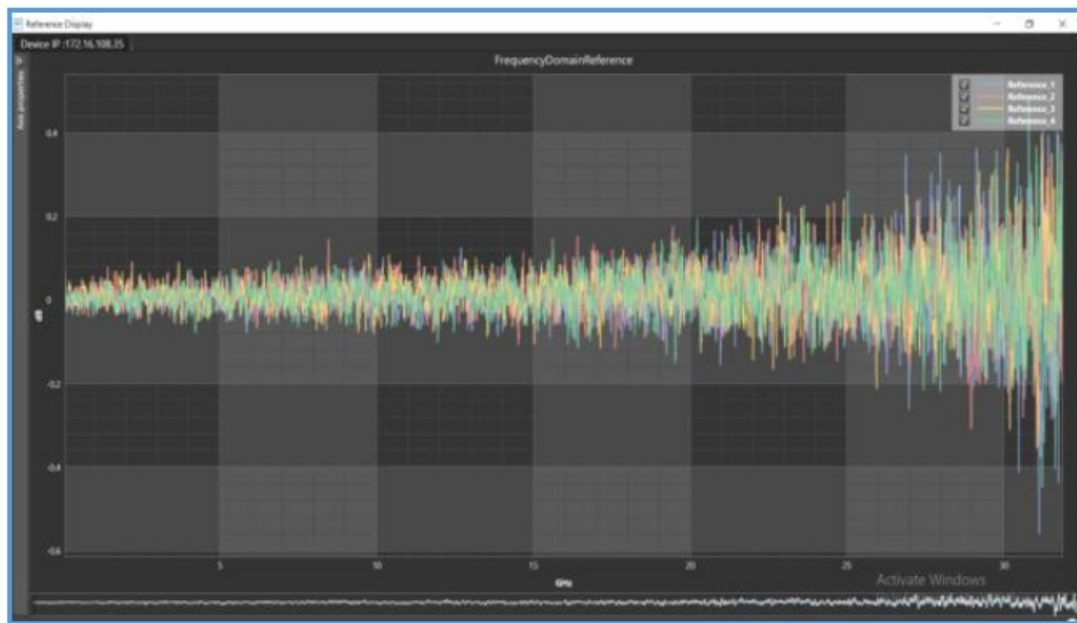- Close the page to exit the calibration wizard.

Insertion Loss Calibration

As a time-domain measurement technique is used to evaluate the insertion loss, the calibration that needs to be performed consists of connecting the reference setup (setup including all components except the DUT) and normalizing its insertion loss at zero. When the user runs the insertion loss calibration, a wizard explains each step and shows a diagram explaining the reference circuit connection:

- Connect the ML4035's selected PPG channels (labeled "TX") to the reference circuit's inputs and the DSO channels (labeled "CH") to their respective outputs

- Press "Confirm".
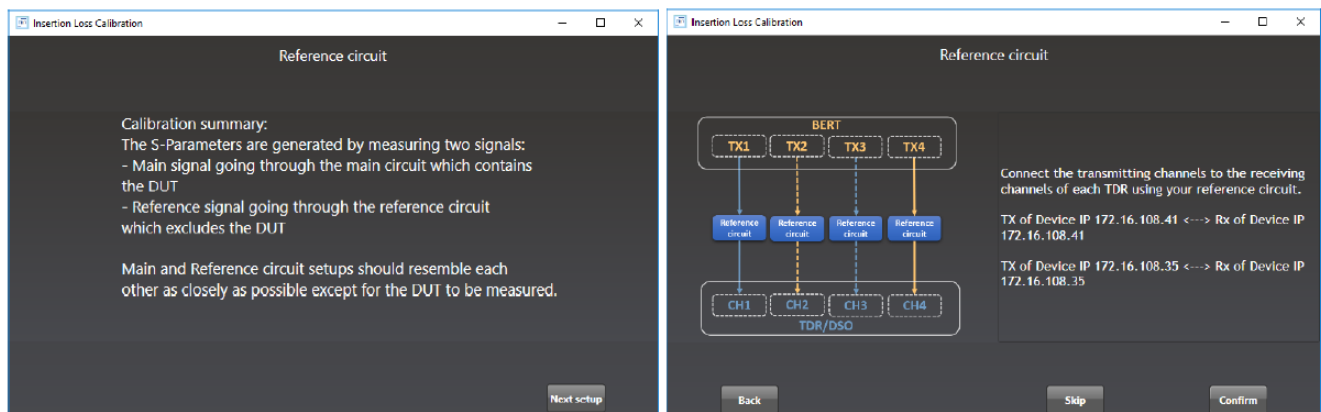
The simplest example, for a reference circuit would be connecting cables coming out of the TX channels to cables going into the DSO channels using 2.92mm Female-to Female K/SMA connectors. After this calibration, anything that replaces the Female-to-Female connector between the cables is considered the DUT. The reference insertion loss is shown at the end for the customer to review the calibration process.

Note that the reference circuit has around 0 dB loss.

- Close the page to exit the calibration wizard.
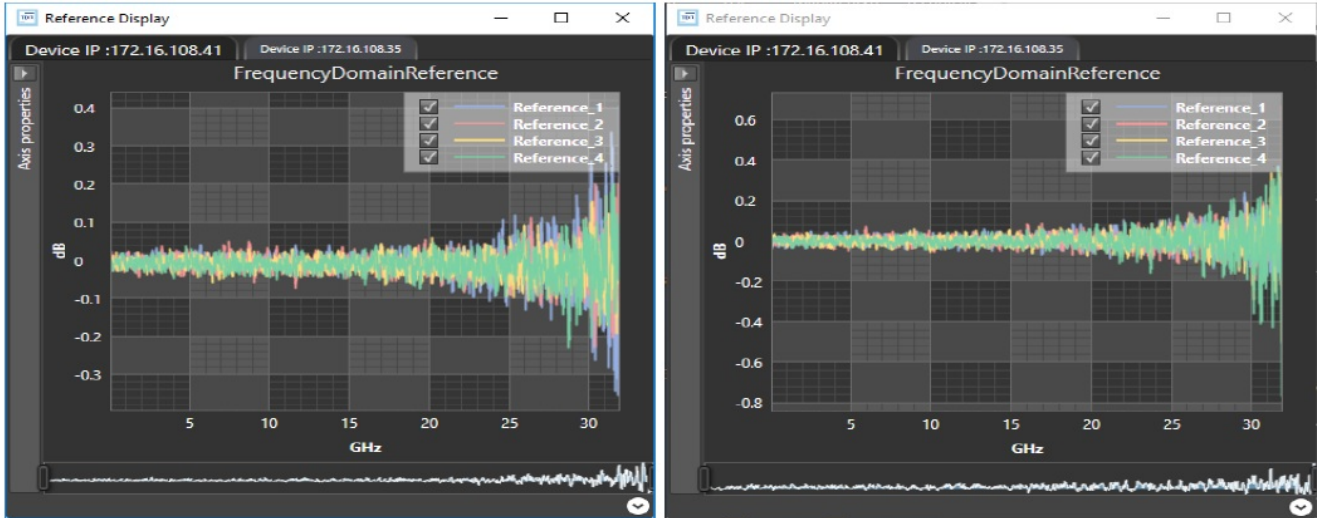
Crosstalk Calibration
The Crosstalk Calibration is an important step for NEXT and FEXT measurements to evaluate the crosstalk between the channels of each ML4035 and between the channels of the different ML4035 units. A two-step, detailed and guided wizard will start the Crosstalk calibration process:
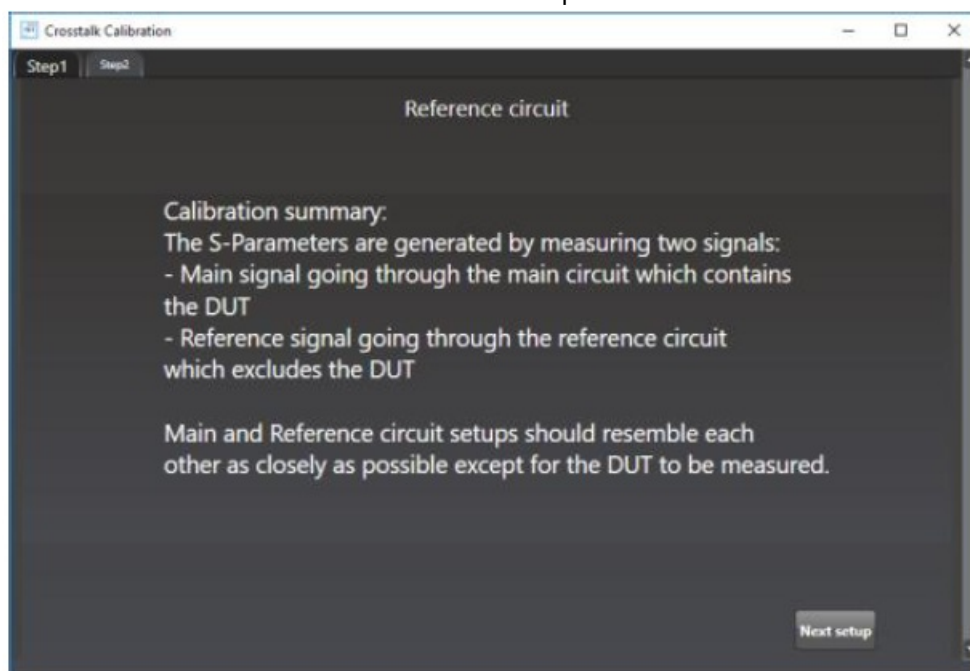
- **Step 1:**
    - Connect the TX1 to CH2, TX2 to CH1, TX3 to CH4 and TX4 to CH3 of each unit and press on Next Setup.
    - Connect the TX1 to CH3, TX2 to CH4, TX3 to CH1 and TX4 to CH2 of each unit and press on Next Setup.
    - Connect the TX1 to CH4, TX2 to CH3, TX3 to CH2 and TX4 to CH1 of each unit and press on Next Setup.
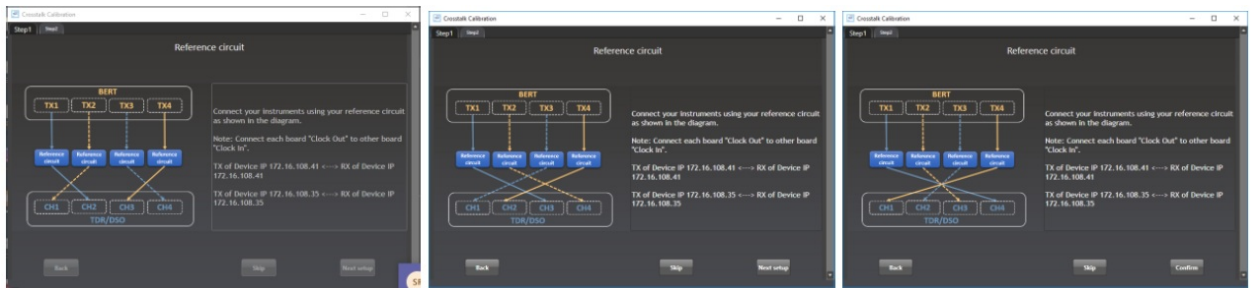
- Close the shown reference insertion losses and proceed to the next step

- **Step 2:**

  Repeat the same procedure, following the Wizard steps to calibrate the FEXT crosstalk using the TX of the first instrument and the CH of the second instrument as explained. Example: TX1 of box 1 to CH2 of box 2, and TX1 of box 2 to CH2 of box 1.

Testing the setup

The user is asked to connect the full setup as shown. In this example, we are only using two boxes for an 800G OSFP DAC, which will run the test for 8 channels only (unidirectional test). You will have to enter the SN and the Manufacturing number of the DUT cable. A barcode scanning option is available which will give the tester agility and rapidity during testing.

After instruments configuration, the GUI will show the desired measurements before proceeding to the test. The user will have to confirm before starting the measurements.
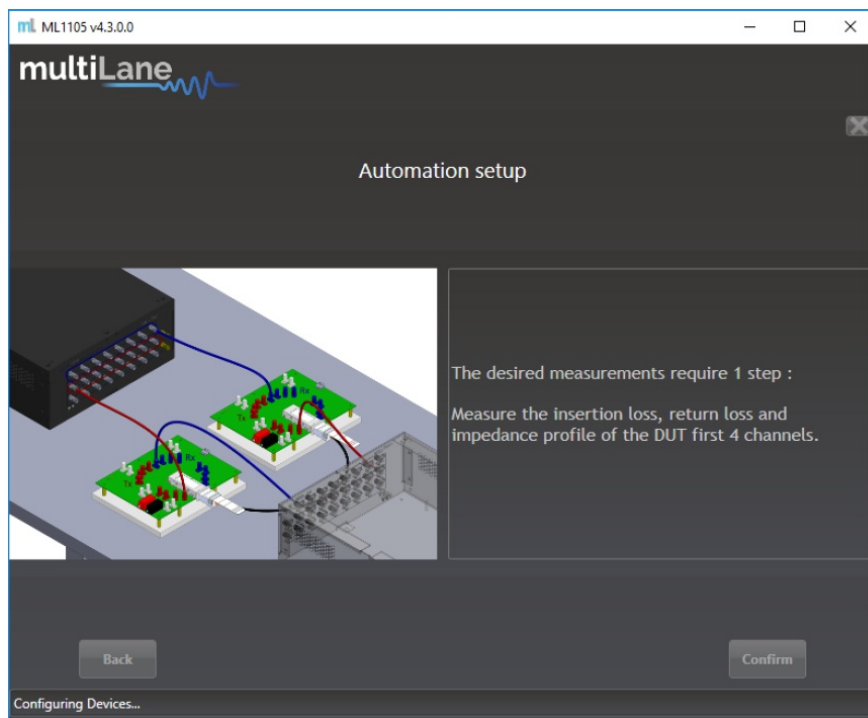
When both sides are done being tested, the user is asked whether he would like to proceed with measuring a new DUT. Press "Yes, measure next DUT" to measure a new cable, or "No, continue" to stop and go directly to the results
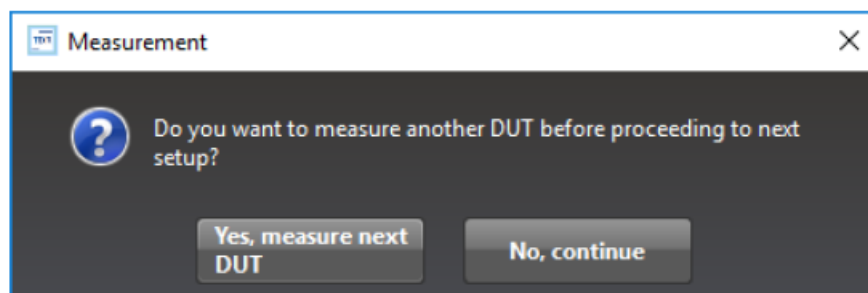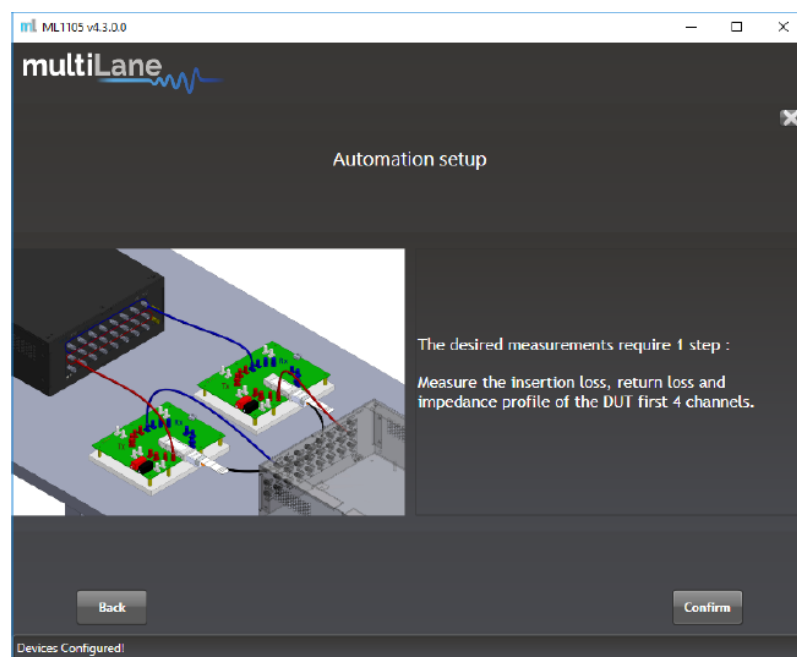
Results

A Pass/Fail verdict is assigned to all measurements on every channel of both sides of the DUT. The results can then be displayed by pressing "Display Results", saved by pressing "Save all results", and the table exported as an excel by pressing "Export Table". The "save all results" option can provide S2P files, xls files and/or

screenshots, depending on the user's choice using the checkboxes below the table.
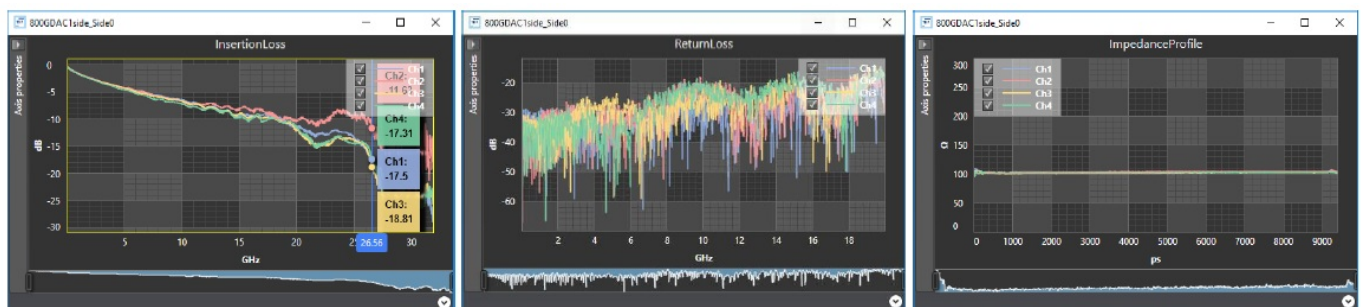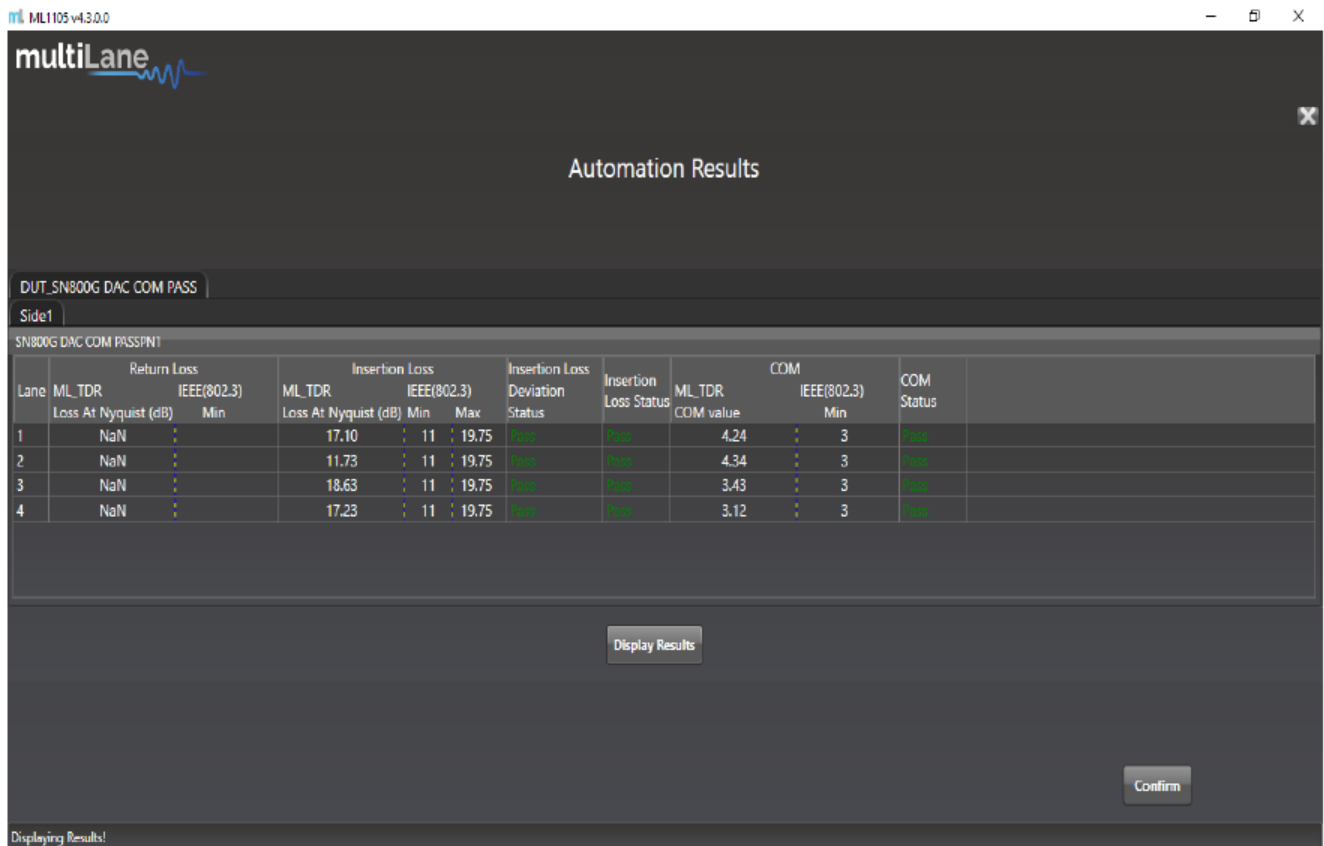

Appendix 1 – Adding the ML4035 to the Network

To create a local network connection, please follow these steps:
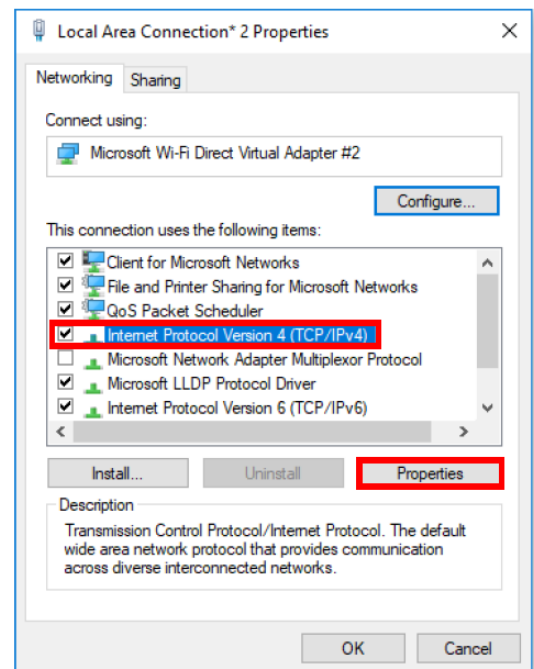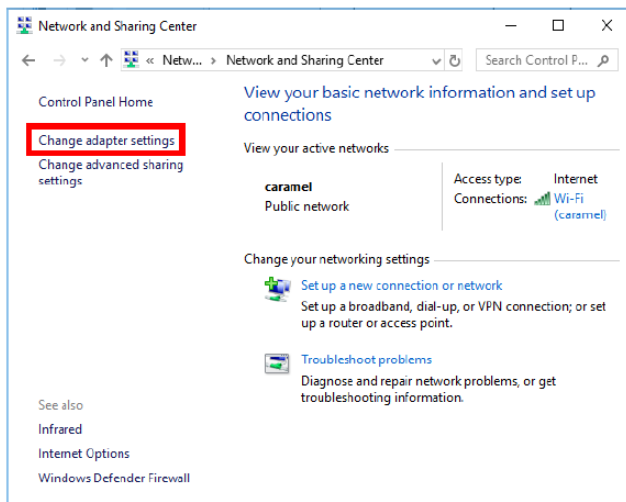
- Create a local network connection between the laptop and the ML4035 using Internet Protocol Version 4 (TCP/IPv4).
    - Open "Control Panel" and choose "Network and Internet".
   - Open "Network and Sharing Center".
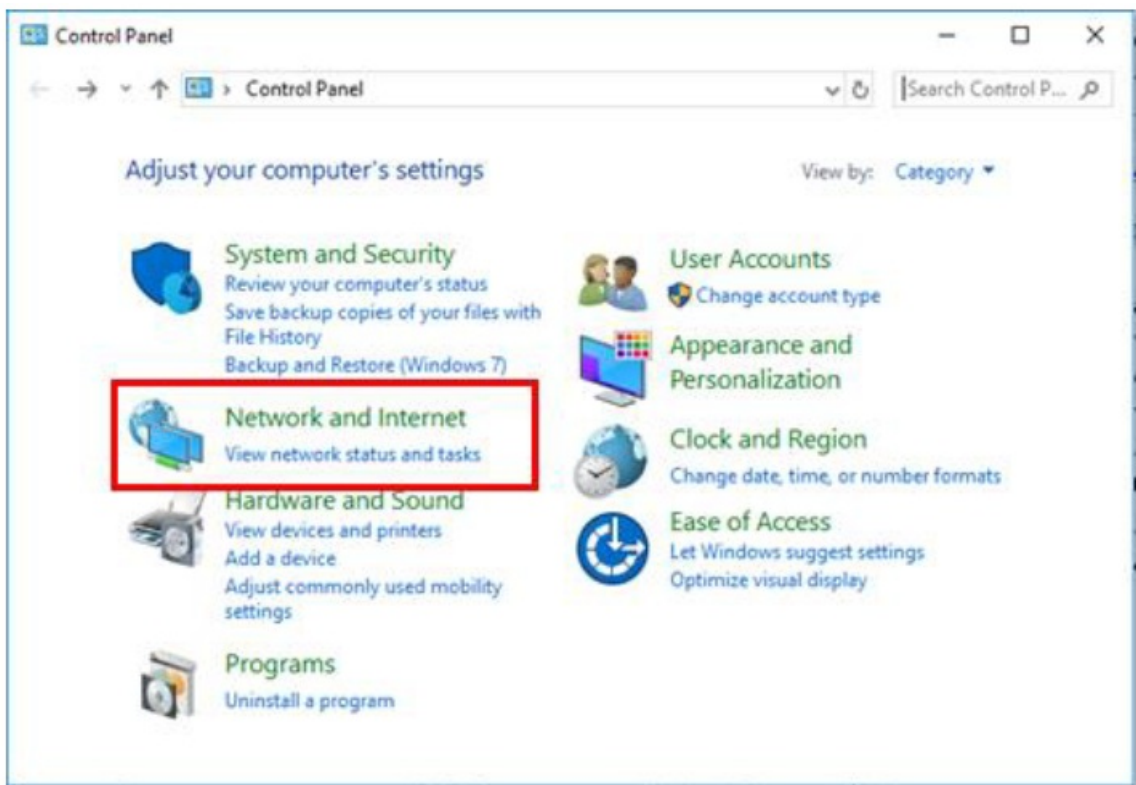
- Click on "Change Adapter Settings", then choose "Local Area Connection".
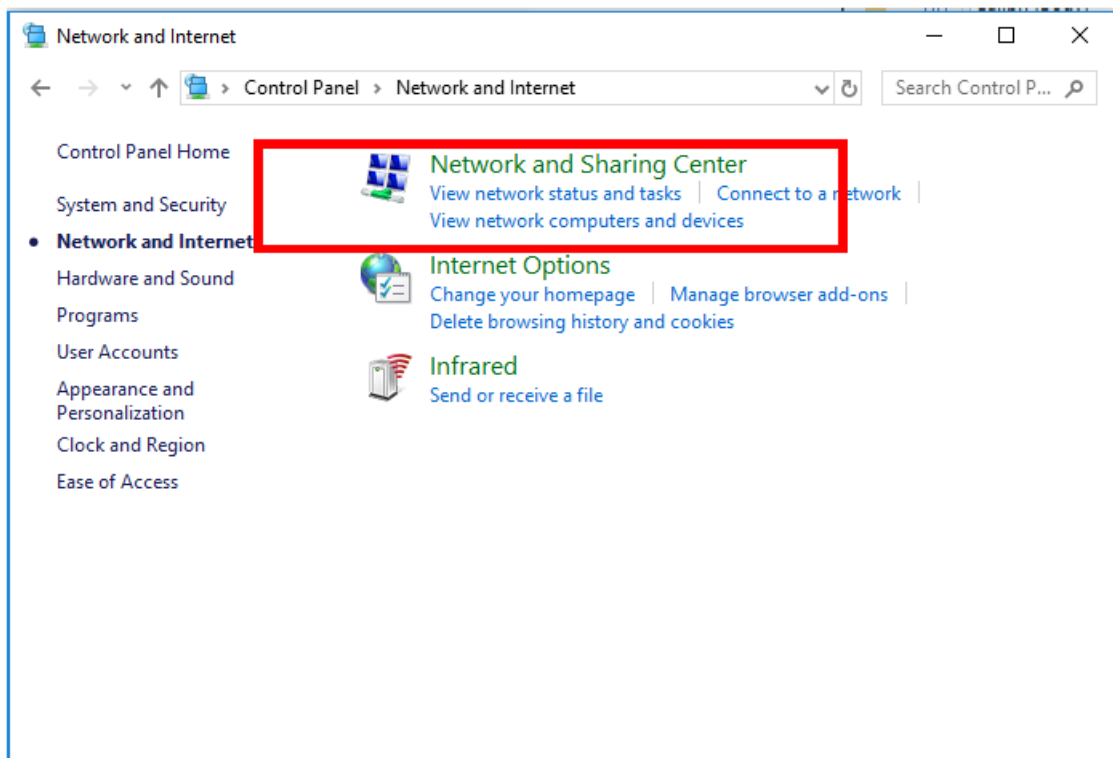
- In the Networking Tab, click on "Internet Protocol Version 4 (TCP/IPv4)" then "Properties".

- Add a similar IP Address that shares a subnet with the instrument IP in the Advanced tab. This will be used to ping the instrument once the IP Address is changed to match that of the network.
- Connect the laptop directly to the ML4035 using an Ethernet cable.
- Copy the IP Address found on the back of the unit.
- Ping the device to make sure that the connection is successful.
- Now a new local network has been successfully defined.
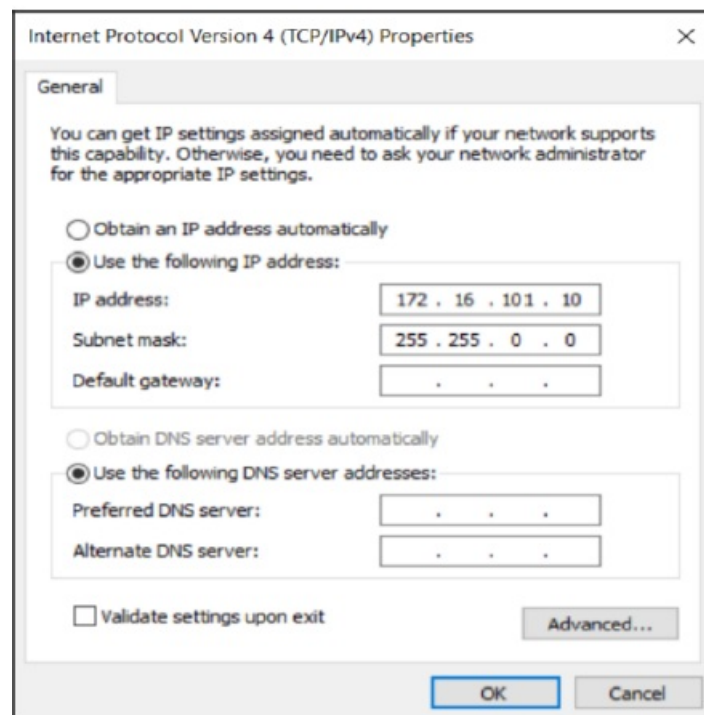
NOTE: These steps are illustrated using Windows 10. Kindly note that previous versions of Windows have a similar procedure with slight differences in tabs or folders' names.

**Appendix 2 – Changing the IP Address to Suit a Corporate Network**

Multilane does not recommend changing the IP address of the instrument. However, this appendix will detail the steps for each operation. Before starting the IP address change operation, kindly contact IT department/support. User should be provided an available IP on the network. If the IP is the same as another device on the network, the user can ping the device but will not be able to use it. The process can be done using two different methods:

USB Driver Ethernet Configuration or using the MLIPChanger tool with Ethernet cable connection. Changing the IP Address of the instrument Using USB Driver Ethernet Configuration

- Download the USB driver and the Ethernet tool of the instrument from

  https://multilaneinc.com/product_category/bert/
- Connect the instrument to the PC using USB cable.
- Navigate to device manager. The device will appear as shown in the following figure.
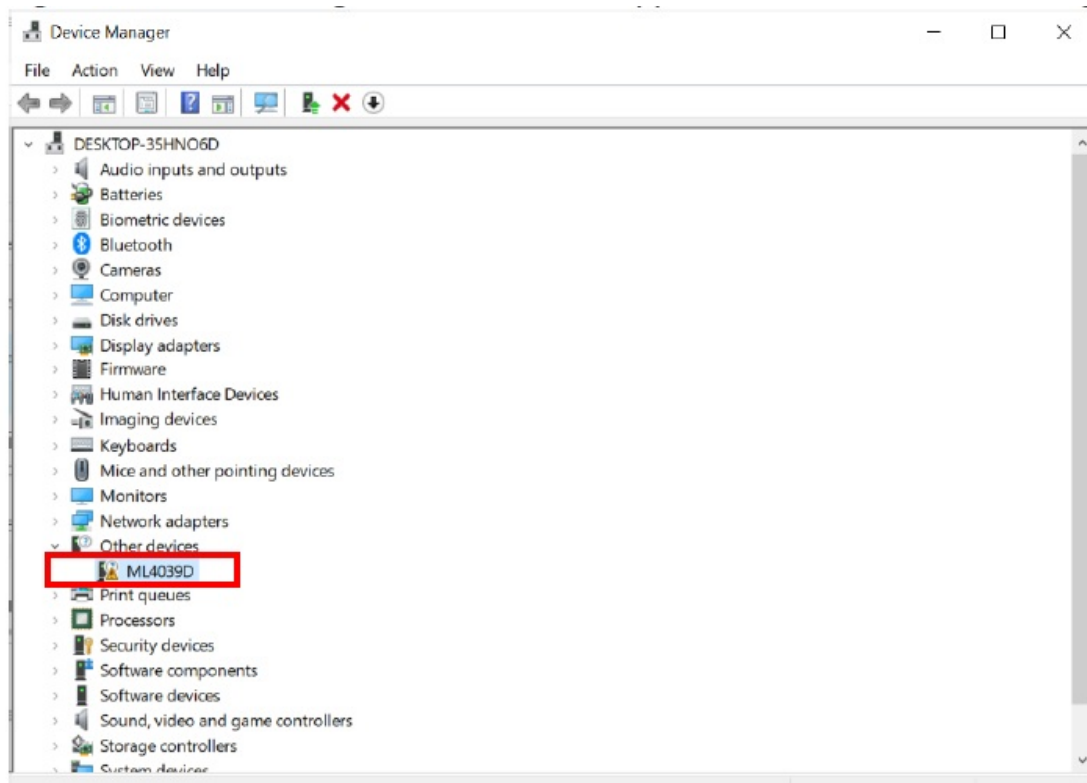
- Right click on the device and select update driver.
- Select "Browse my computer for driver software" and select the previously downloaded USB driver file.
- Open the Ethernet software downloaded previously (view the following figures).
- Change the IP, Mask or Gateway by writing the desired address and click on W (to write them).
- Power cycle the device.
- Click on R, to read the values and make sure they changed.
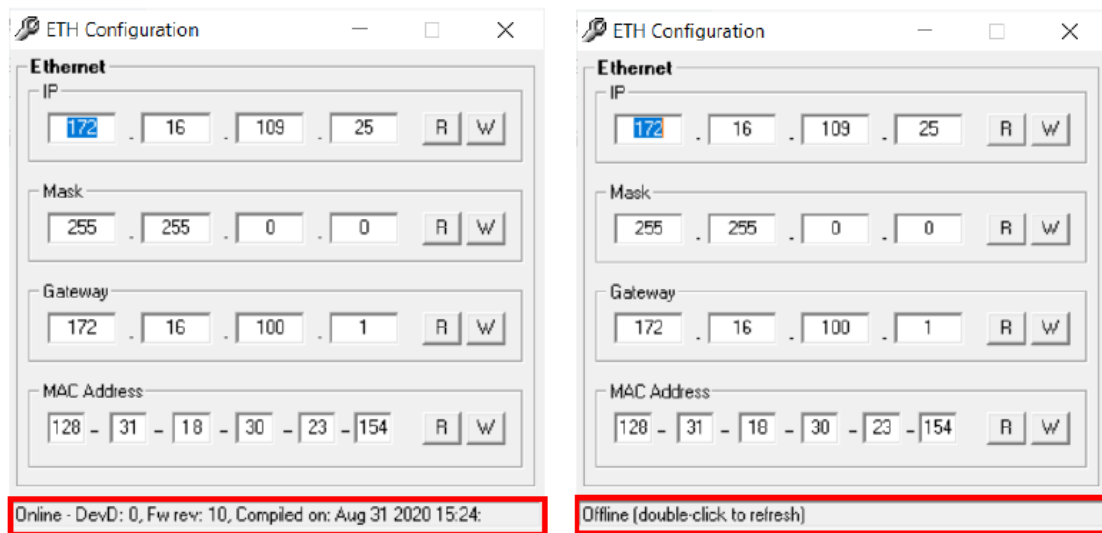
Ethernet configuration windows, when the device is connected and powered on (Online, left figure) and disconnected (Offline, right figure).

Changing the IP address using ML IPChanger

When the user wants to change the IP address using the ML IPChanger tool, they must make sure there is a local network between the unit and the PC using one single Ethernet cable with RJ45 connector at each end. The user should make sure that he the unit is powered on and has established a ping between the current factory IP and their PC by creating a Local Network Connection.

- Open MLIPChanger tool.
- Enter the IP Address in the highlighted field and click on "Connect"
- Once connected, click on IP Configuration.
- Click on read to display the current IP Address of the instrument.
- Enter the desired IP Address and click on Change.
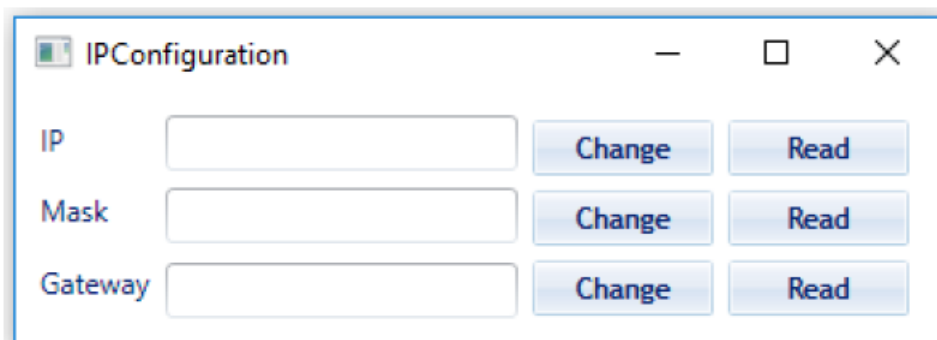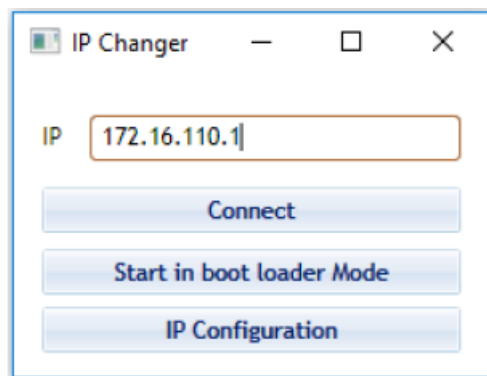
- Reboot the device.
- If the ping is successful, you can now connect to the instruments using the latest IP Address.
- If the ping is not successful, check the local network settings and make sure that they are in line with the instrument's latest IP Address you entered.

North America
48521 Warm Springs Blvd. Suite 310
Fremont, CA 94539
USA
+1 510 573 6388

Worldwide
Houmal Technology Park Askarieh Main Road Houmal, Lebanon
+961 81 794 455

Asia
14F-5/ Rm.5, 14F., No 295
Sec.2, Guangfu Rd. East Dist., Hsinchu City 300, Taiwan (R.O.C)
+886 3 5744 591

Documents / Resources

multiLane ML1105 Automated DAC Testing Software [pdf] User Guide
ML1105, Automated DAC Testing Software, ML1105 Automated, DAC Testing Software, ML110
5 Automated DAC Testing Software, Testing Software, Software

References

- **BERT | MultiLane**