

# Hands-on MicroLAB

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## **Abstract**

*A lot of universities and companies offer modern hardware and software solutions for instrumentation “hands-on” training. In this paper we present our development idea based on myDAQ (launched by National Instruments) and AX-1 (from Innovative Experiment) combined in one easy to use MicroLAB device. This MicroLAB device will be used in the laboratory and home training to develop the electronics and instrumentation understanding of the students from Physical Engineering at University “Transylvania” of Brasov. All the presented applications were implemented in LabVIEW – the main software used by Physical Engineering specialization.*

**Key words:** Instrumentation, LabVIEW, MicroLAB

## **Introduction**

Educators around the world can use the National Instruments Educational Laboratory Virtual Instrumentation Suite (NI ELVIS) and LabVIEW to teach concepts in circuit design, instrumentation, physics, etc. In the last year NI launched a similar smallest device myDAQ ([www.ni.com/myDAQ](http://www.ni.com/myDAQ)) well suited for hands-on training.

MyDAQ device together with LabVIEW use the same application launcher like NI ELVIS and by this way students can work in laboratory with NI ELVIS and at home or anywhere) with myDAQ. This new and good quality DAQ offer to our Physical Engineering students the facility to:

- Compact and portable device for anywhere-anytime use
- Provides eight Plug-and-Play Computer-Based Lab Instruments
- Audio Input and Output for Mixing and Manipulating Audio signals (iPhone compatible connectivity)

Looking at the Creativity Laboratory for a versatile easy to handle and portable hands-on device like the NI ELVIS laboratory system we put together the myDAQ NI card and the low cost AX-1 digital experimental board from Innovative Experiment (INEX) Company. The economical digital circuit experiment board AX-1 ([www.inexglobal.com](http://www.inexglobal.com)) contains the necessary tools for supporting basic experiments:

- DC supply +5V (regulated)
- Clock generator with 4 frequencies 1Hz, 10Hz, 100Hz and 1kHz

- Logic switch and logic monitor with 8 channels
- 1 channel Binary decoder to BCD and LED display
- Pulse switch 2 channels
- Supply voltage input +9V (obtained from external DC switched adapter)
- Breadboard 2.5 x 3.5 inches. 390 contact points.

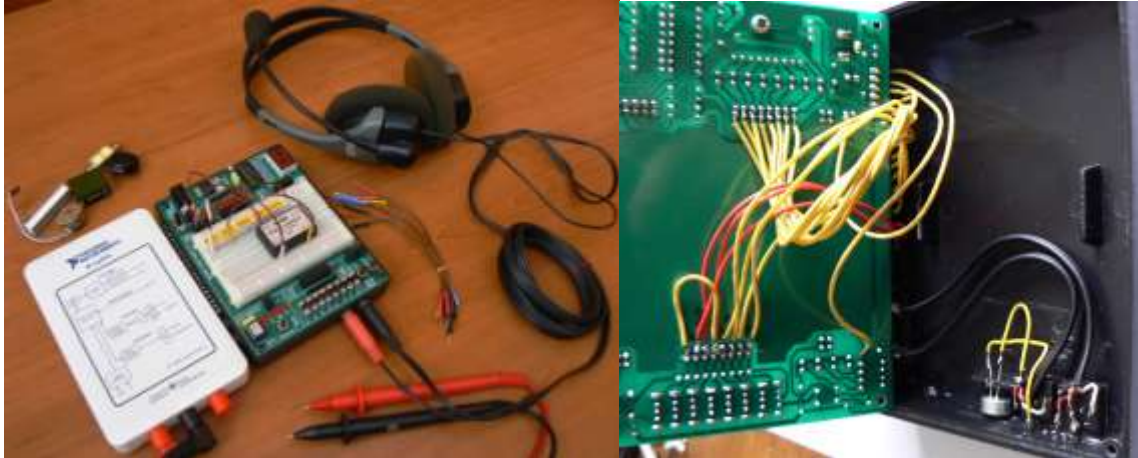
This compound device (myDAQ coupled with AX-1) we named MicroLAB and have improved performances and low price for a lot of Hand-on experiments.

## MicroLAB

In the Figure 1 we present the new device MicroLAB build putting together myDAQ and the AX-1 system with the power and easy to use graphical programming language LabVIEW. This device combines all the facilities offered by LabVIEW control of myDAQ and AX-1 in a new powerful portable system.

All the Input-Output signals of myDAQ were connected in a simple way to the AX-1 card and by this the educational power of the system was well increased – easy to do analog and digital electronics experiments and instrumentation.

The myDAQ Audio IN and OUT connectors was also connected trough AX-1 at new frontal connectors. Inside the AX-1 box we connected at the Left Audio-In channel one microphone, god for acoustical signals measurement and analyze. When the user use the external Audio In channel the internal microphone will be automatically disconnected.



**Figure 1. The MicroLAB system builds from myDAQ and AX-1 digital card**

## Simple and complex MicroLAB applications

Now using the new developed MicroLAB device we can imagine a high number of simple application build on the base of our curricula at the Physical Engineering specialization (oriented on instrumentation) and we can sustain this new concept developing also more complex scientific applications.

In this paper we like also to present some preliminary application from both this two directions and we start with simple analog and digital laboratory works sustained by similar simple LabVIEW applications.

One first simple example we can control one Z-Power series LED designed for high current operation and high flux output applications (from Seoul Semiconductors) using myDAQ digital analog output. In the same time we can analyze the emitted light with on photo diode or phototransistor (see this control and signals in Figure 2).



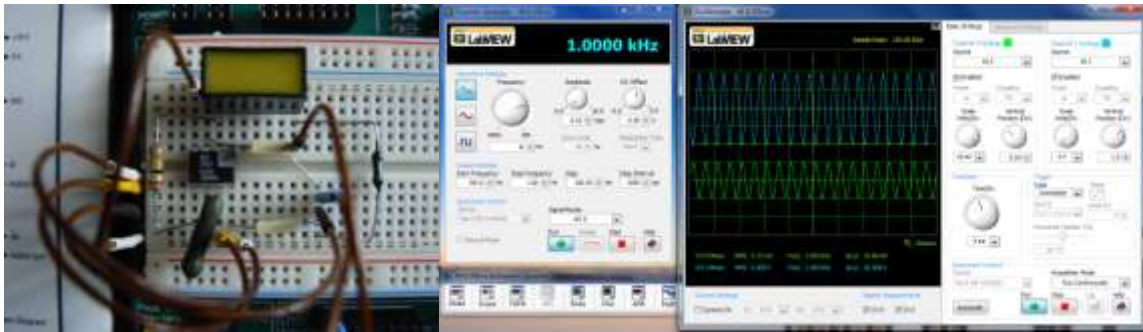
**Figure 2. The MicroLAB simple LED application**

After this simple experiment we can implement a power control of this LED (the W49180) using the special LED controller PLED-1200LF (from PEAK) able to offer 1200mA output. For this application presented in Figure 3 we use the same analog output to control the injected current in the power LED. With one of the myDAQ DIO or the AX-1 digital controllers we can enable or disable the PLED controller.



**Figure 3. The MicroLAB power LED control using PLED from PEAK**

Now we like to present how can do one research application using MicroLAB. First we investigate the noise characteristics for one AD797, a very low noise, and low distortion operational amplifier and after we use it to build one research preamplifier for our MicroLAB (Figure 4). This preamplifier will be used in noise reliability tester for power LED's.



**Figure 4. Test and build one low noise amplifier using AD797**

## Conclusions

The new MicroLAB idea and device can better satisfy the idea of “hand-on” experiments and extend outside of the laboratory the NI ELVIS applications

This MicroLAB, similar with NI ELVIS, can be easy remote controlled and can be the “low price” nucleus for easy to implement remote laboratories.

The myDAQ can be associated also with other small and low price experimental boards (like NX-100 plus, NX-877 plus II with microcontroller, etc.)

## ACKNOWLEDGEMENTS

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