

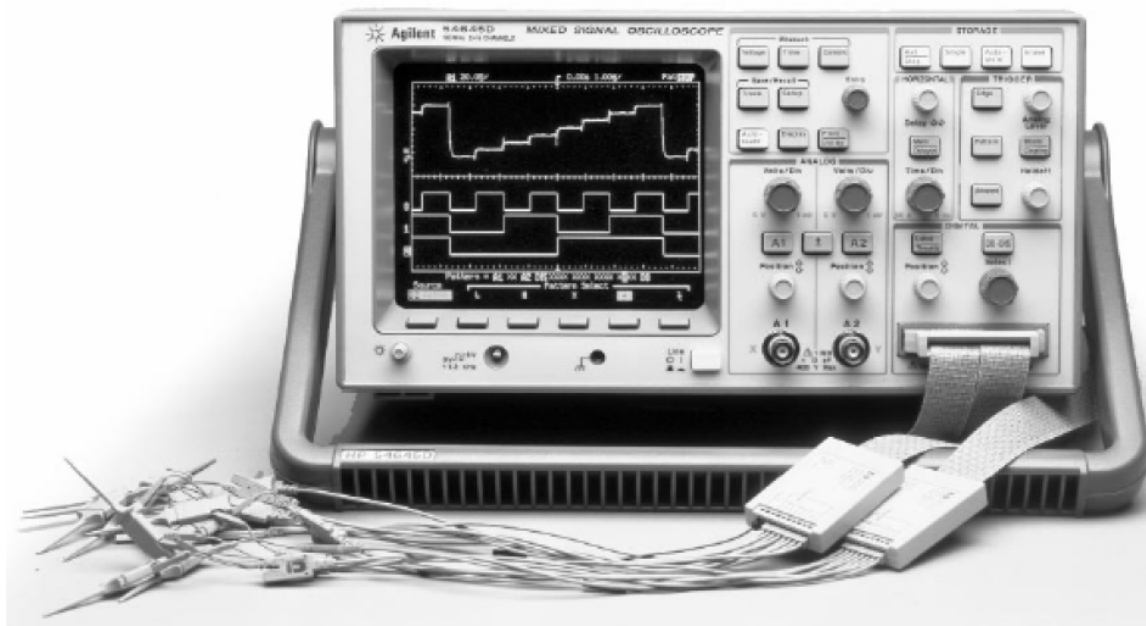
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Oscilloscopes

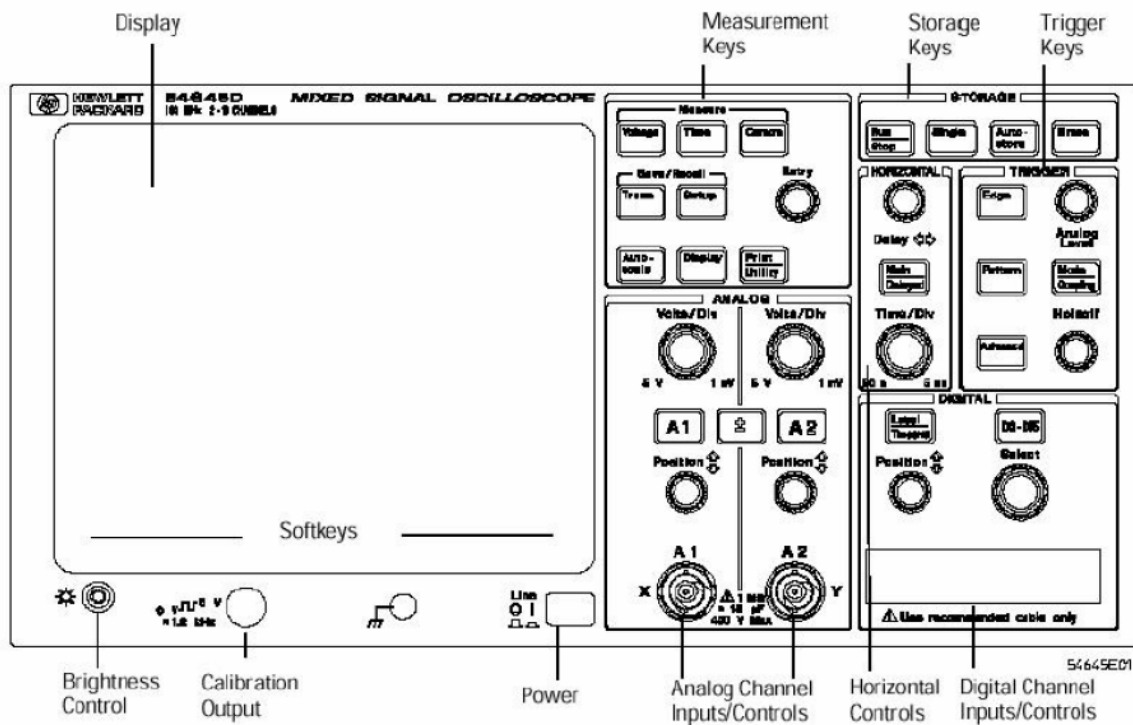
EECS 100

Multimeters are convenient to check supply voltages and currents, bias levels, and other constant (or very slowly varying) signals. However, many interesting signals processed by electronic circuits change with time and are best represented in a graph showing signal amplitude versus time. Measuring such a signal requires taking a reading e.g. every $1\mu\text{s}$ and then reporting the results in a graph. Aside from the fact that taking a measurement in only $1\mu\text{s}$ is impossible for humans, the process would also be utterly laborious.



Oscilloscopes are made just for this purpose: they are essentially fast (and relatively low precision) voltmeters with a display for reporting the result. For example, the oscilloscope used in EE100 can take up to 200 million measurements per second. The fastest scopes currently available take 40 billion measurements per second!

Most oscilloscopes have a myriad of buttons. Fortunately only few of those are needed for basic measurements. The figure above shows the panel of the oscilloscope used in the EE100 lab. It has two identical analog input channels A1 and A2. Having two channels is useful when comparing different signals, e.g. a clock and data signal.



To take a quick tour, power on the scope and connect a probe from input A1 to the calibration output. After pressing Autoscale (measurement keys) you should see a squarewave (follow the tutorial on the website for more detailed instructions if you have problems). Next play with the Volts/Div and Position keys to set the vertical scale and position. Time/Div and Delay do the same for the horizontal axis.

These instructions should get you going quickly with most scopes, including the one in the EE100 lab. To gain practice, experiment with the waveform generator as the input of the oscilloscope and consult the web tutorial or manual for more detail and on using features not discussed here.

Printing from the Oscilloscope

You can use LABVIEW to printout a screenshot from the oscilloscope.

1. Download the HP54645 library from the EE100 lab homepage. Download all files (or the zip file and unzip) to your U:\ network drive. **Note: Anything saved to your desktop will be deleted when you logoff.**
2. LABVIEW communicates with your instruments using the GPIB bus (General Purpose Input Output bus). First, you need to figure out the address of your oscilloscope on the GPIB bus. To do this:
 - I. Turn on the oscilloscope.



- II. Double click on the Measurement and Automation (MAX) icon on your desktop. Figure 3 will pop up.

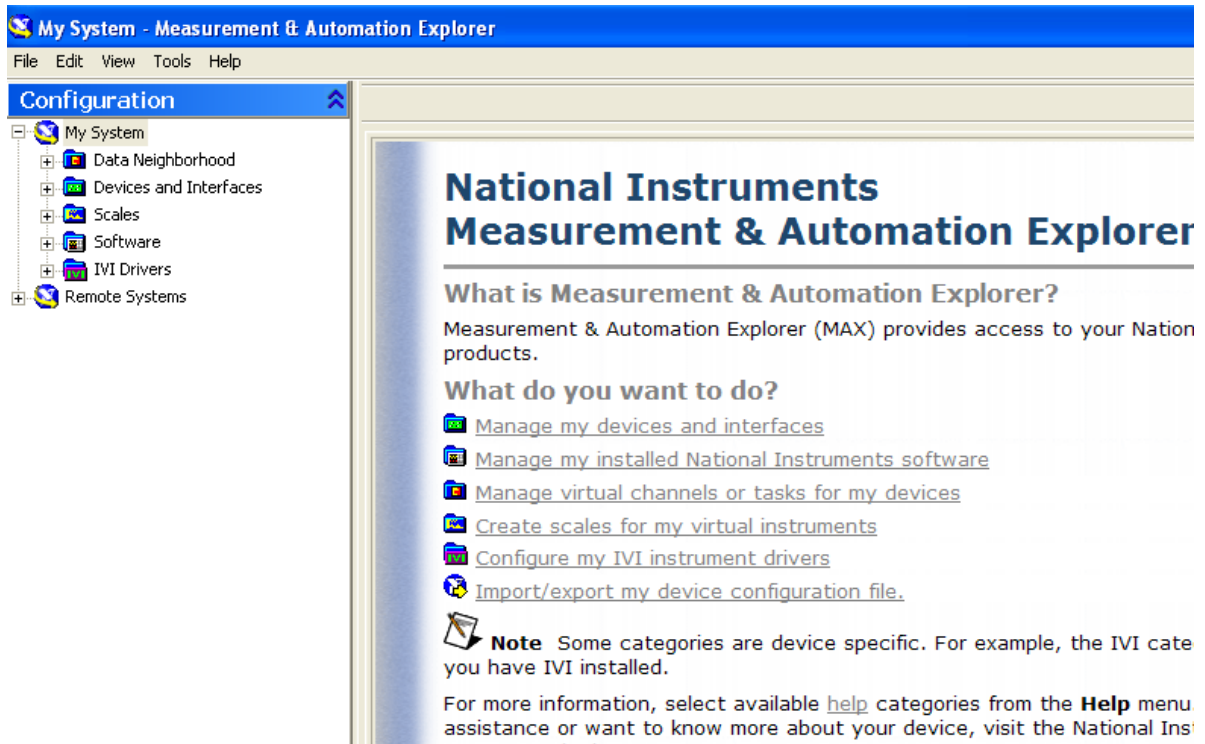


Figure 3. MAX main window

- III. Left-Click on the “+” next to Devices and Interfaces in the Configuration bar to the left.
- IV. Left-Click on GPIBO (PCI-GPIB). Figure 4 will pop up.

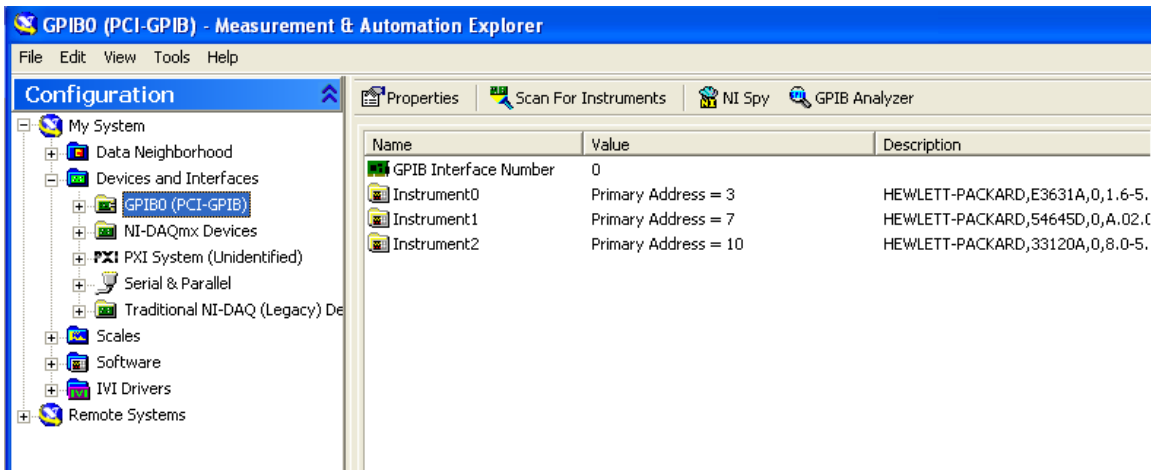


Figure 4. GPIB instrument addresses

V. Depending on the number of instruments you have switched on, MAX will display their addresses. Left-Click Scan For Instruments to make sure the address displayed by MAX is updated. **Remember the address of the oscilloscope – The Hewlett-Packard, 54645D.**

VI. Close MAX.

3. Select Start → Programs → National Instruments LabVIEW 8.2 to start LABVIEW. Figure 5 will pop up.

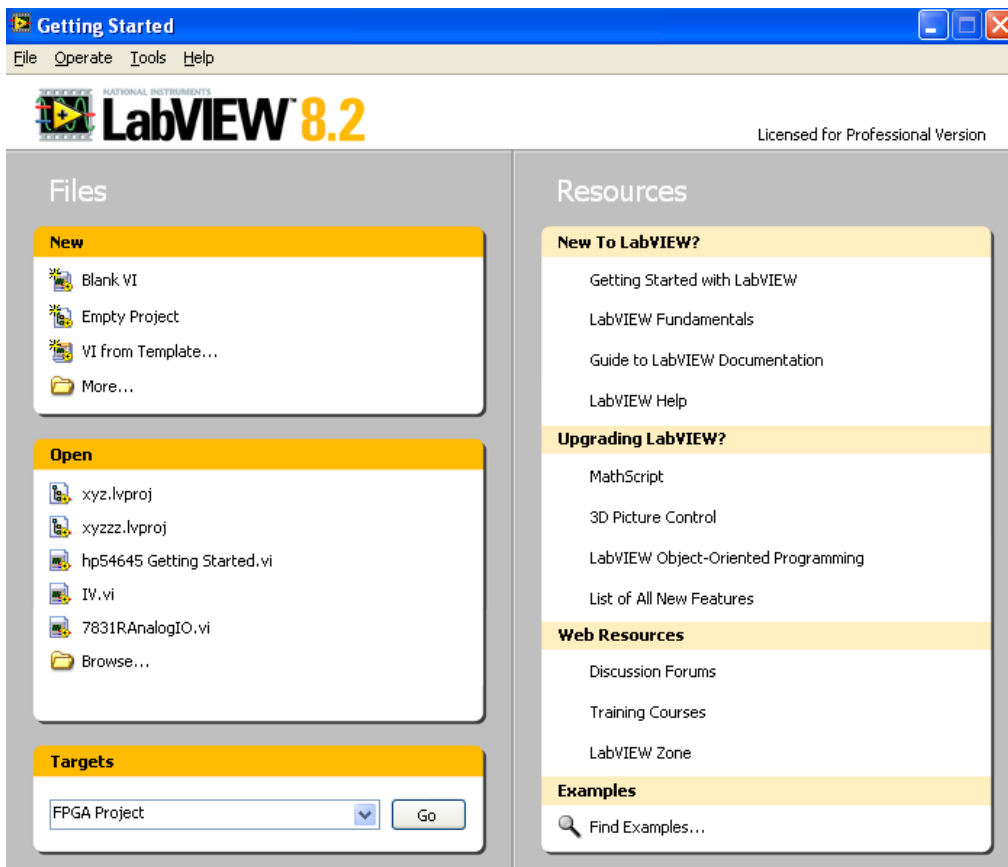




Figure 5. LabVIEW startup screen

4. Left-Click  Browse...
5. Navigate to the HP54645 folder you downloaded in your U: drive. Double-click on the folder and double click on the Hp54645 library.
6. Left-Click on  hp54645 Getting Started.vi and then Left-Click OK. Figure 6 should appear.

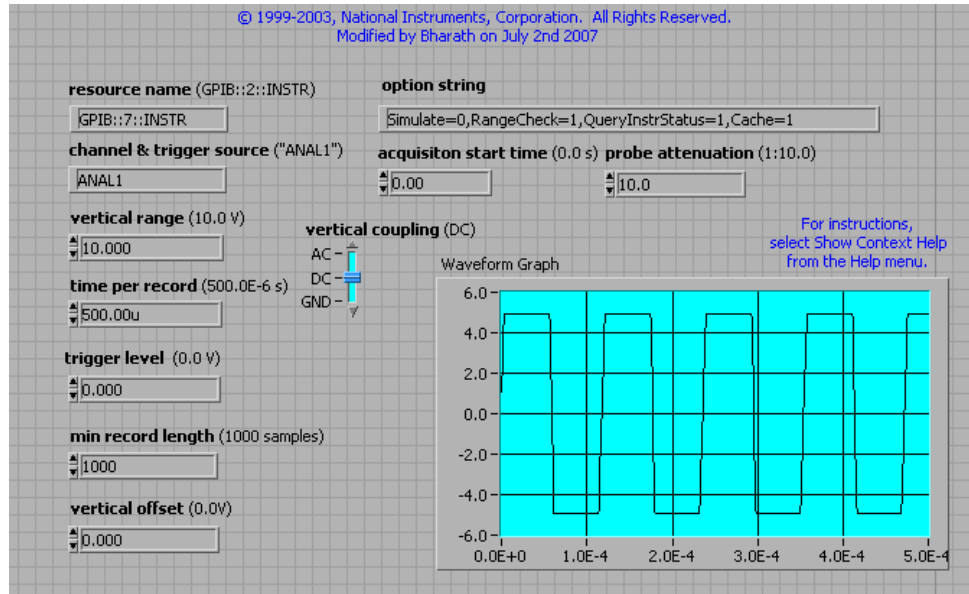

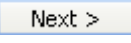
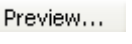
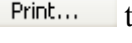


Figure 6. LABVIEW scope interface

7. **Make sure that the correct GPIB address appears under “resource name” on your VI. Make sure your circuit is powered up and scope probe A1 is connected to your circuit.**
8. Left-Click the  Run icon. LABVIEW will capture the scope data.

If you are having trouble getting the desired output on your Waveform Graph, try some of the following:

- Changing various settings, such as *time per record*, *vertical range*, or *acquisition start time*.
- Manually changing the values of the X and Y axes of the graph (by default, they should be set to automatically scale to your simulation)

9. To print the screen, Left-Click File and then Left-Click Print.
10. You can keep the defaults (Left-Click  to go through the screens). Once you get to the last screen (you cannot click next), Left-Click  to make sure that you get the output you want.
11. On the last screen, Left-Click  to send output to the 140 Cory printer.