

Test & Measurement

Prof. Steven S. Saliterman

Introductory Medical Device Prototyping

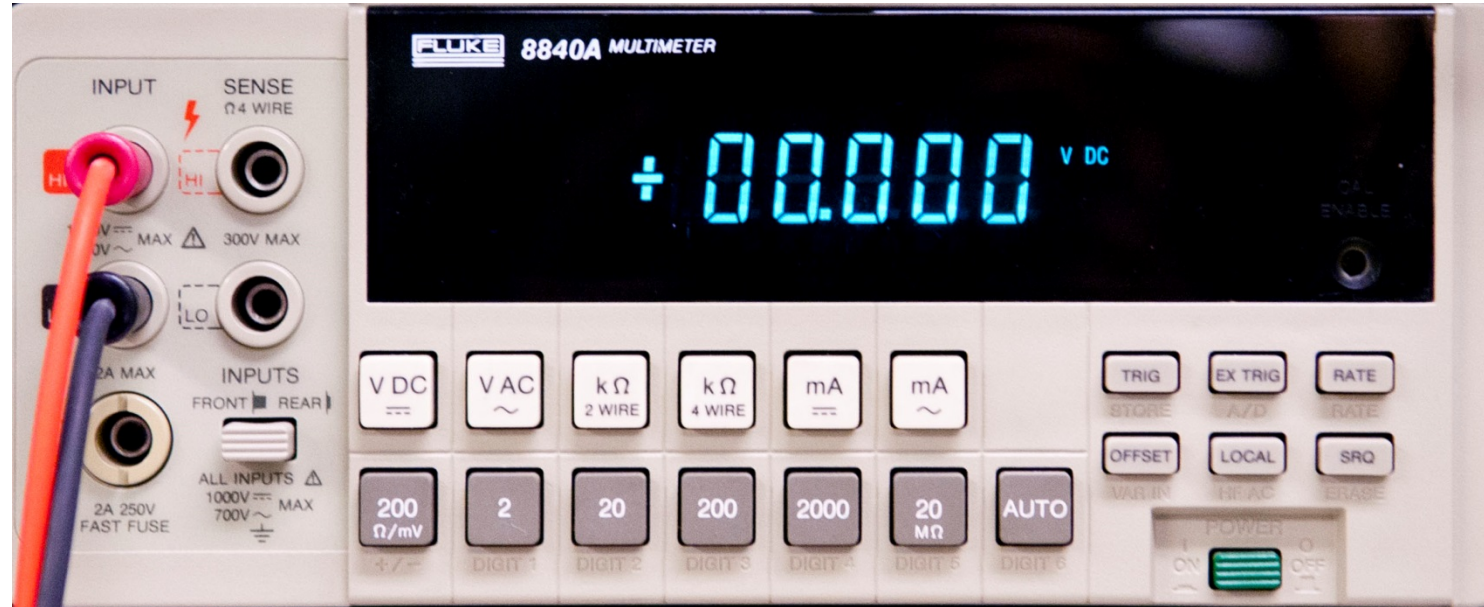
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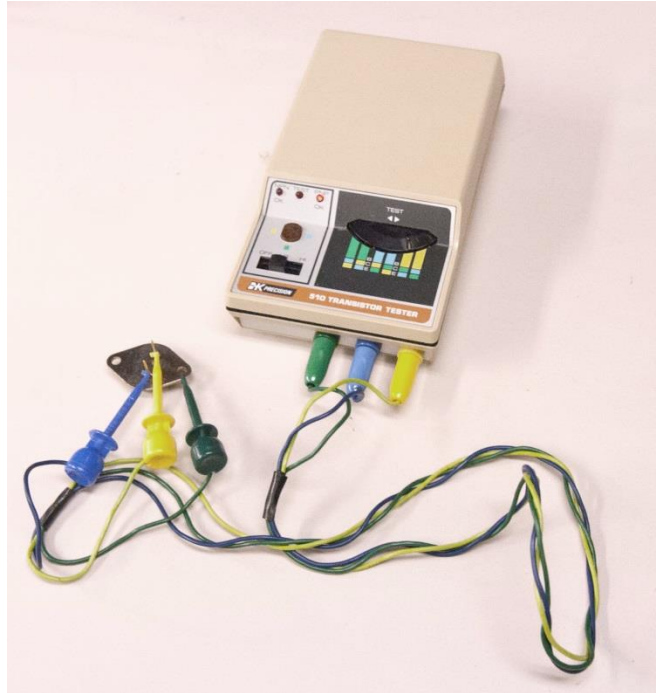
Instruments

- ▶ Multimeters
- ▶ Transistor tester
- ▶ Oscilloscopes & probes
- ▶ Power supplies
- ▶ Function generators
- ▶ LRC meters
- ▶ Sensitive voltmeters and power supplies
- ▶ Variable AC supply, isolation and power monitoring
- ▶ Laser diode controllers
- ▶ Frequency meters & counters
- ▶ Sweep generators
- ▶ Spectrum analyzers
- ▶ Power meters
- ▶ Noise figure meter
- ▶ Pressure manometer
- ▶ Temperature
- ▶ Calibration and standards

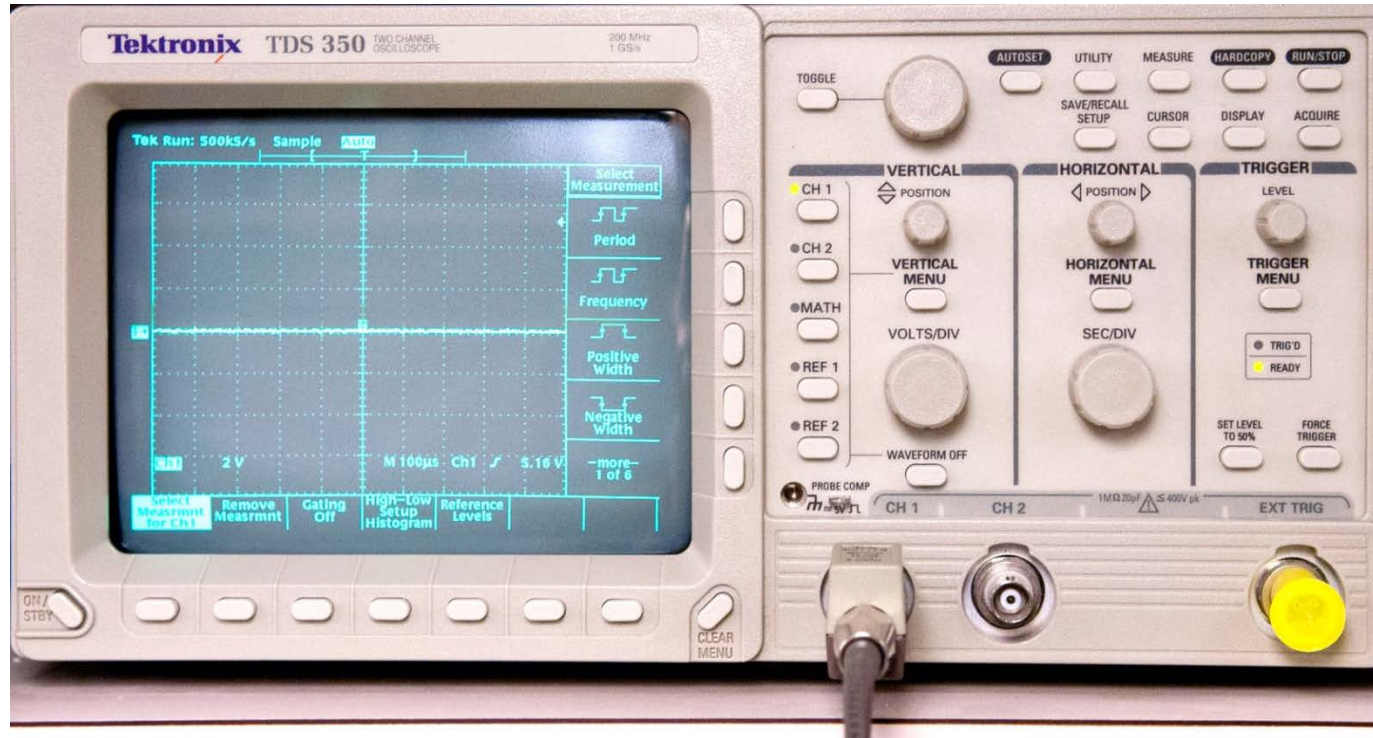
Multimeter



Transistor Tester



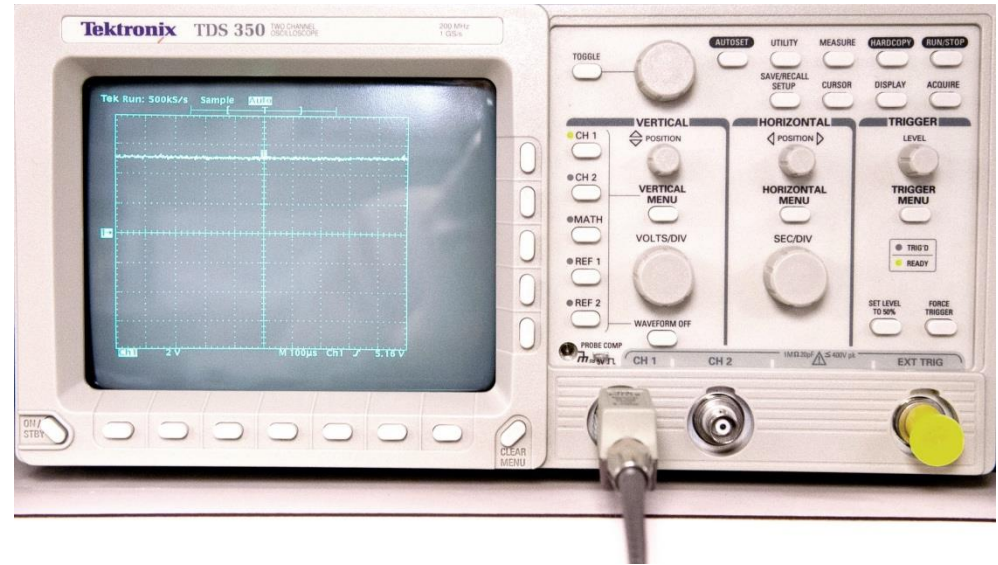
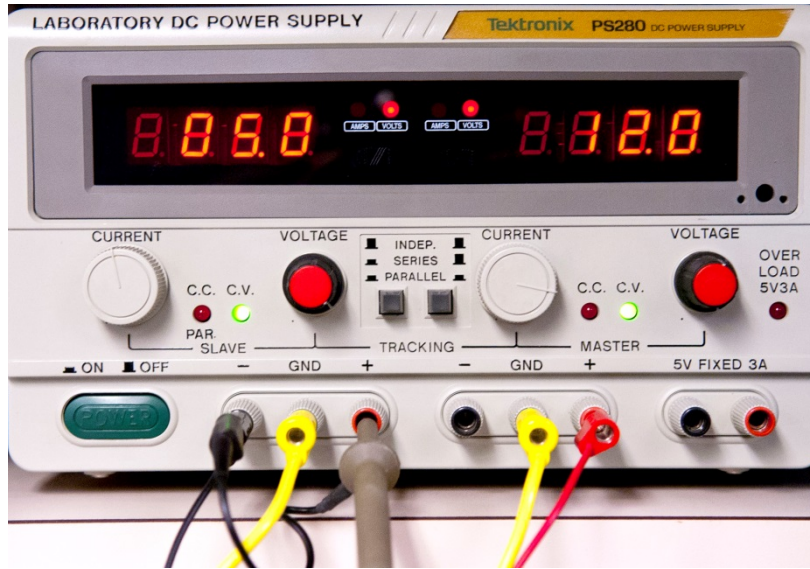
Oscilloscope



Oscilloscope Probe...

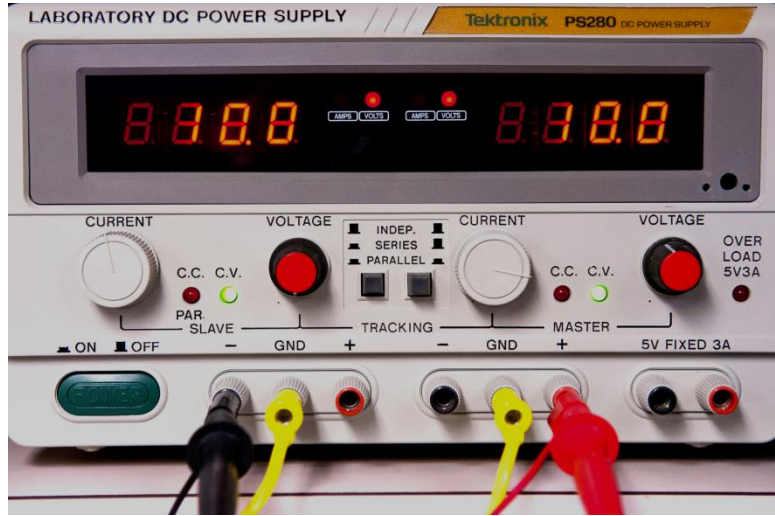


DC Power Supply & Oscilloscope...



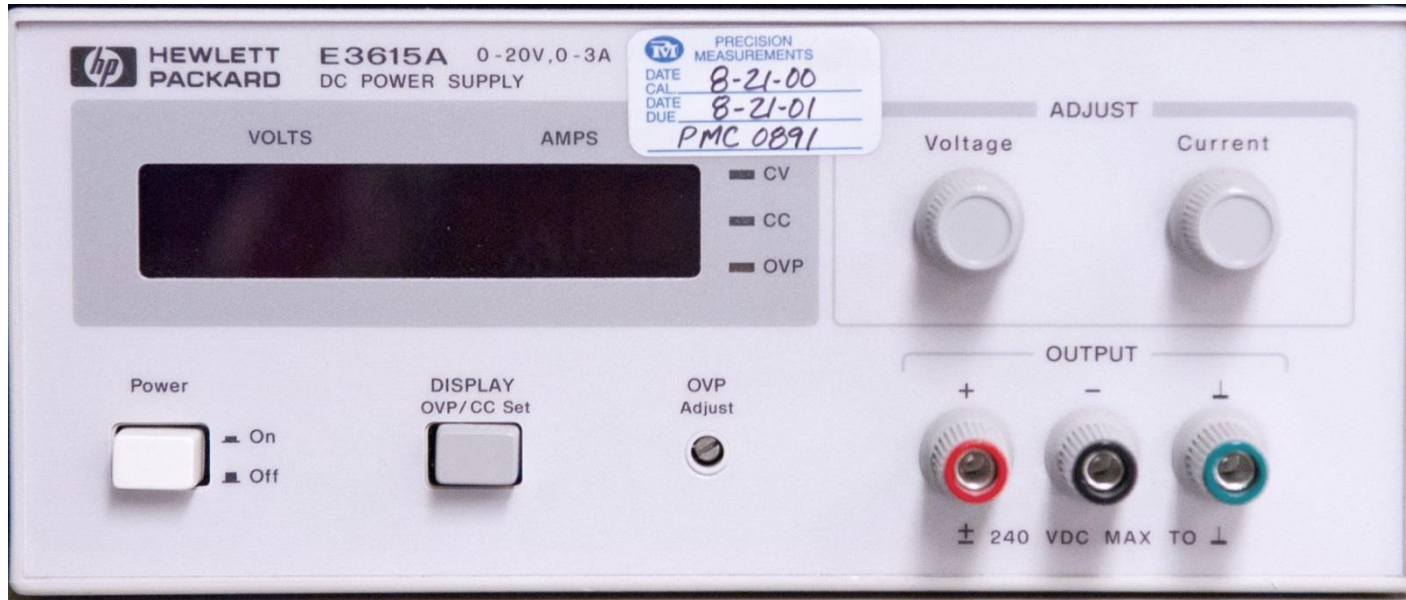
Dual power supply set up independently with 5.0 and 12.0 Vdc. At 2 V/div, 5 Vdc is shown as 2 ½ large boxes up from ground on the scale.

DC Power Supply & Multimeter...

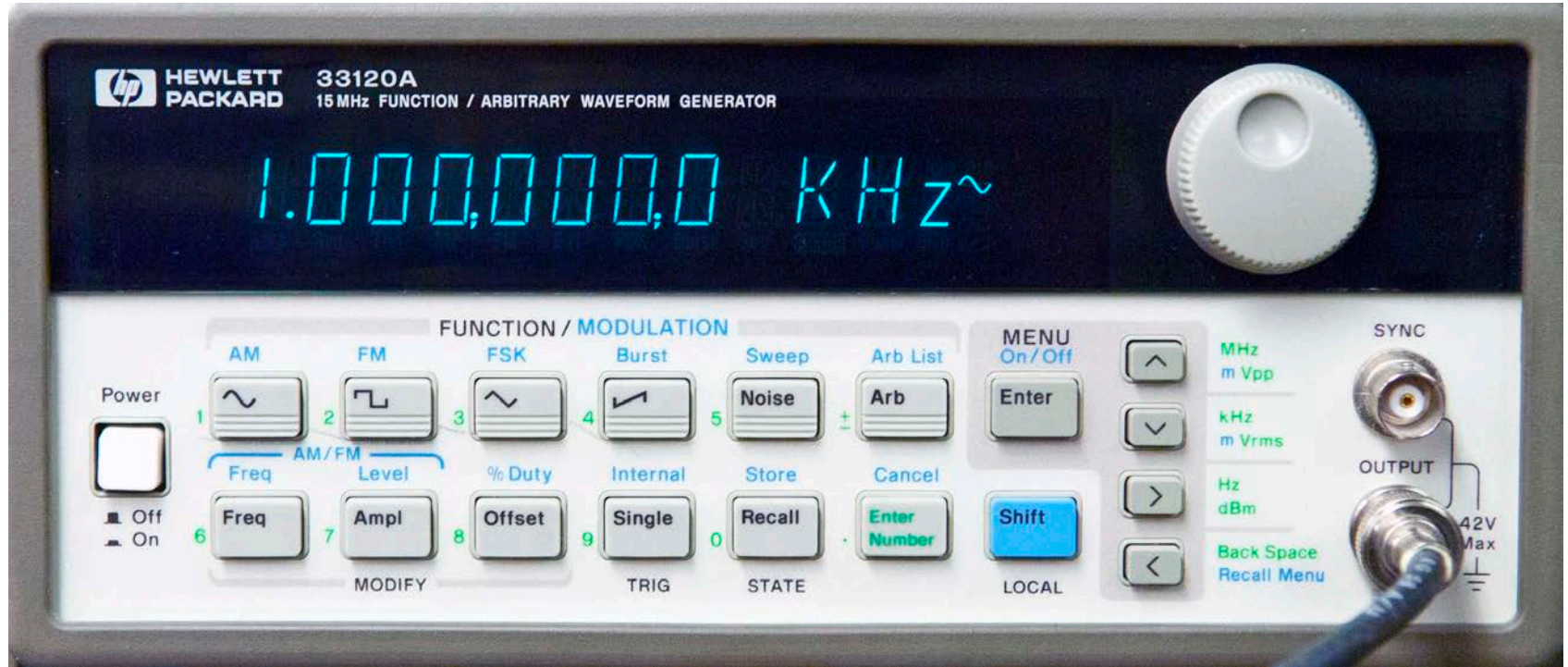


Dual power supply set up in series with 10 Vdc each, measured as 20 Vdc across the supply on the multimeter.

HP Single DC Power Supply...

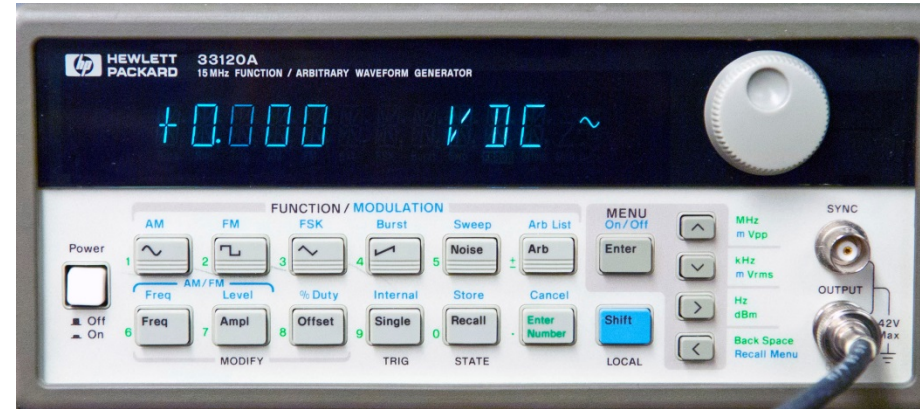


Function Generator



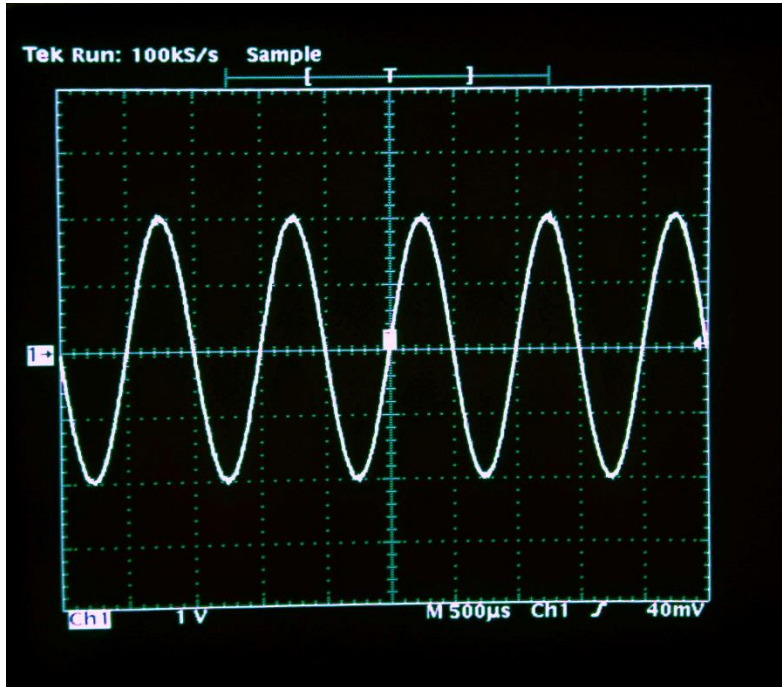
1.0000000 KHz sine wave.

Example Settings...

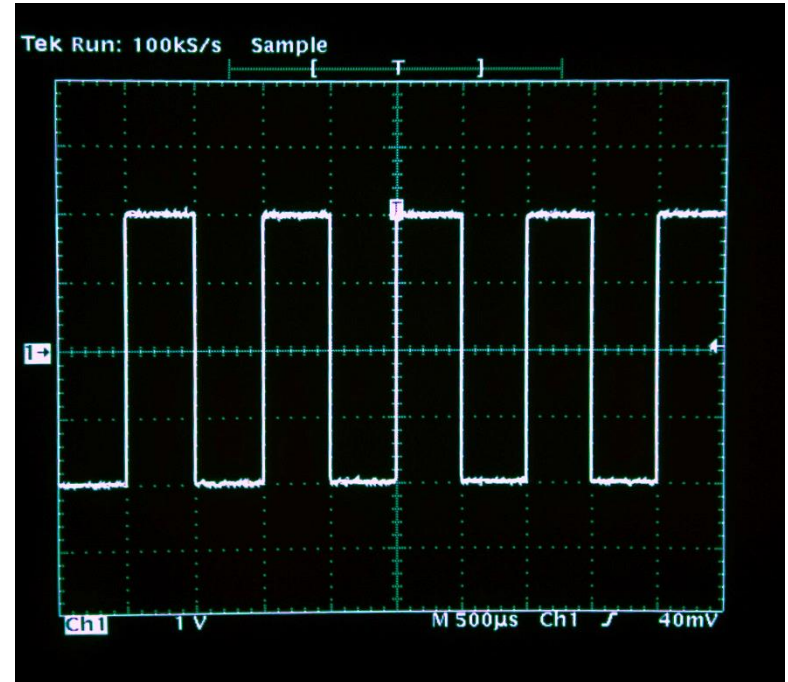


- 2 volt peak, with zero volt offset.
- Voltage will swing between 2 and -2 volts.

Oscilloscope Displays...

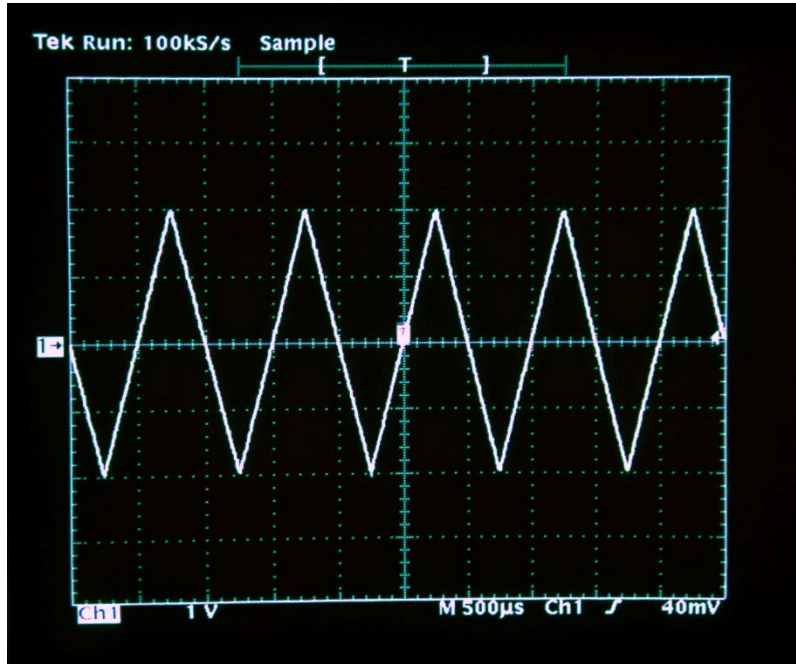


Sine wave.

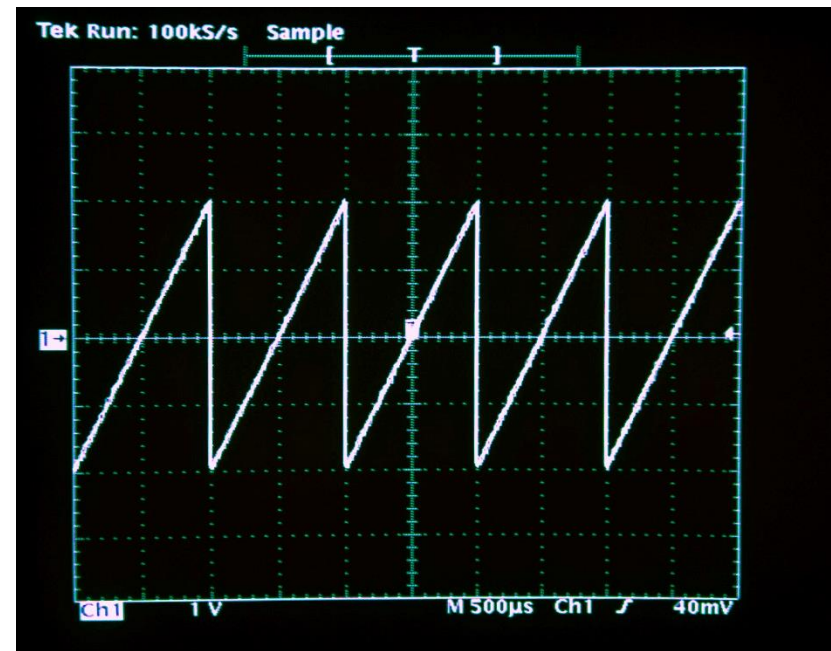


Square wave.

Oscilloscope Displays...

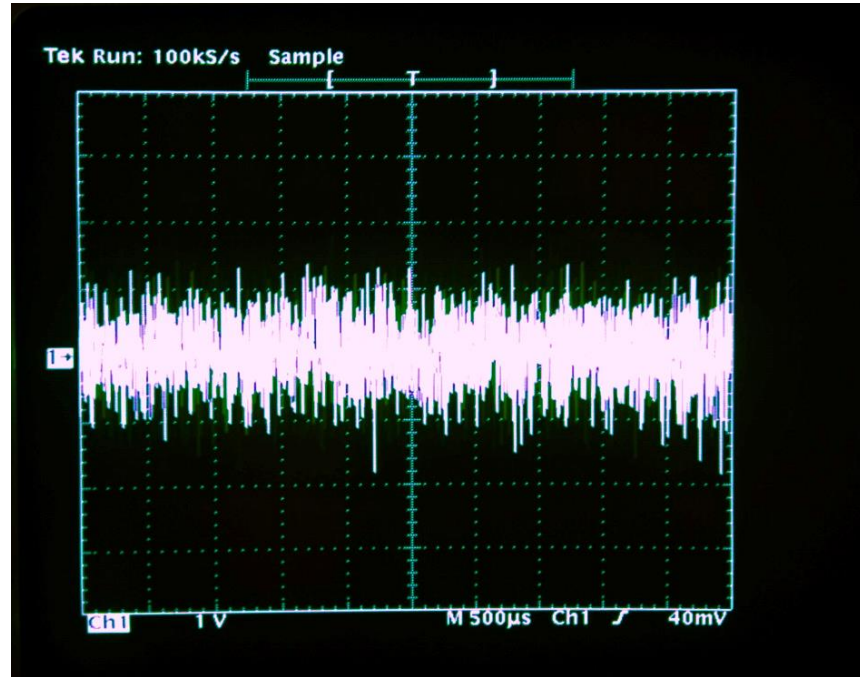


Triangle wave.



Saw tooth wave.

Oscilloscope Displays...



Noise

LCR Meters – HP LCR

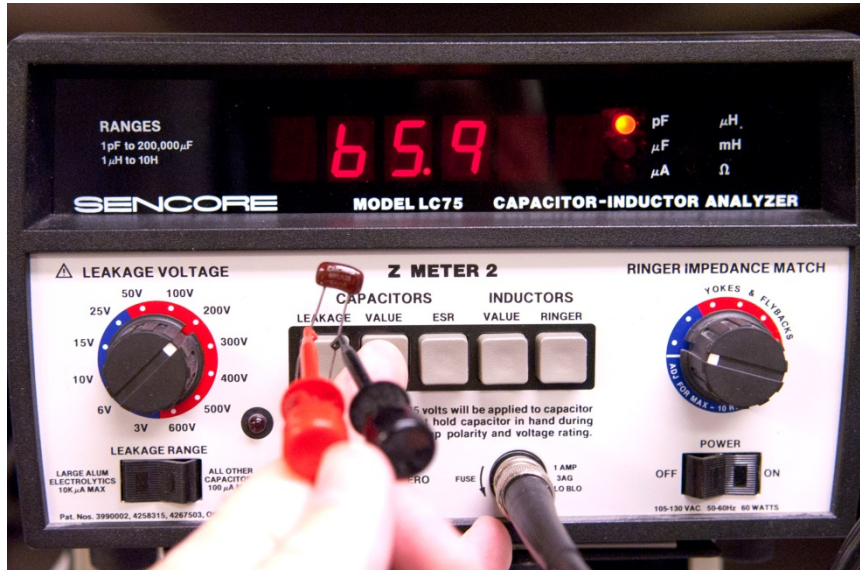


Resistor

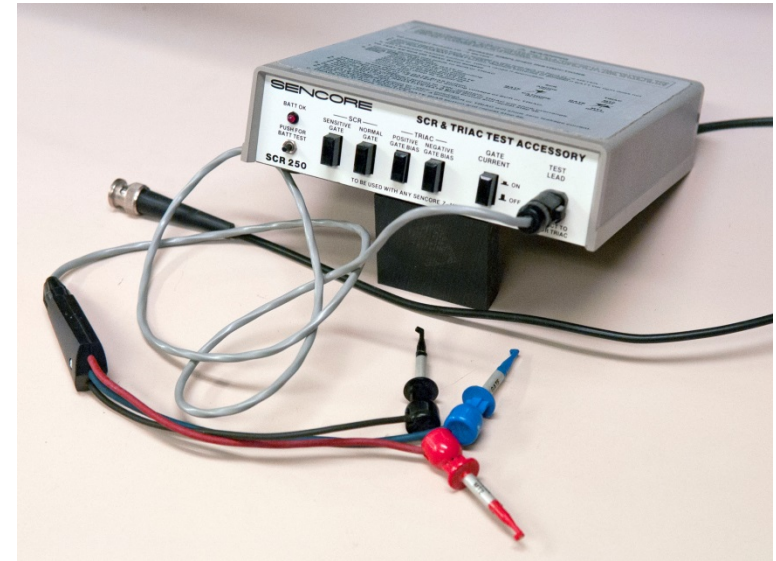


Capacitor

Sencore CL & SCR/Triac Accessory...



Capacitor & inductor tester.

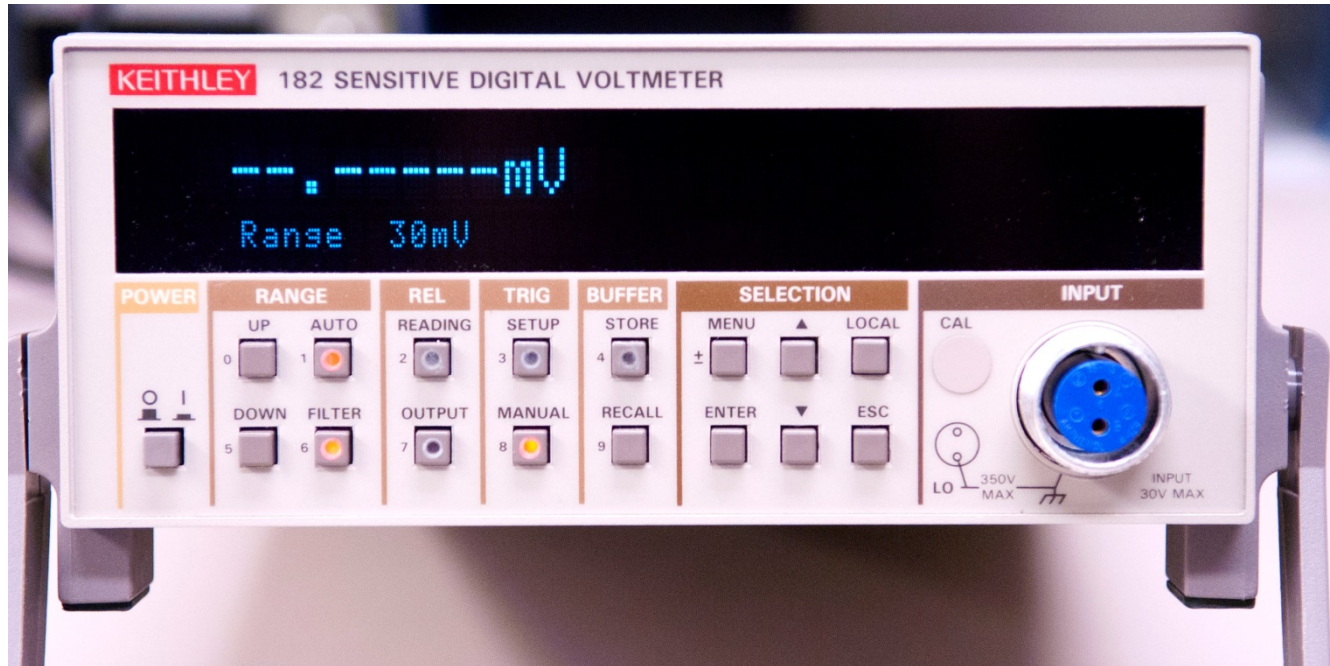


Silicon controlled rectifier & triac accessory.

GenRad RLC Digibridge...



High Sensitivity Meters & Sources



Keithley Sensitive Digital Voltmeter

Keithley Picoammeter/Voltage Source...



Keithley Voltage & Current Source...



Power Supply Tester



Variable Isolated AC Supply



Provides AC line isolation, current limiting and variable voltage.

Digital Wattmeter...



Monitors load voltage, current and power (W) draw.

Laser Diode Driver

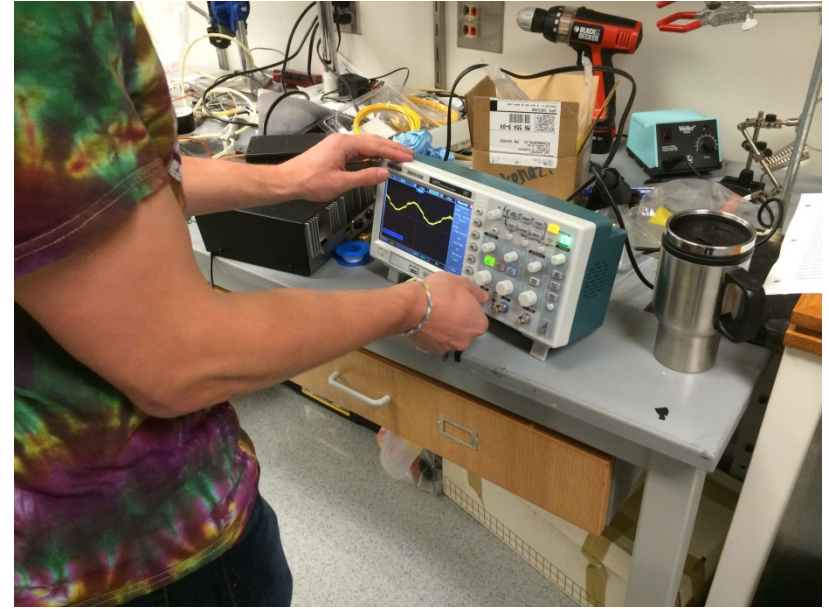
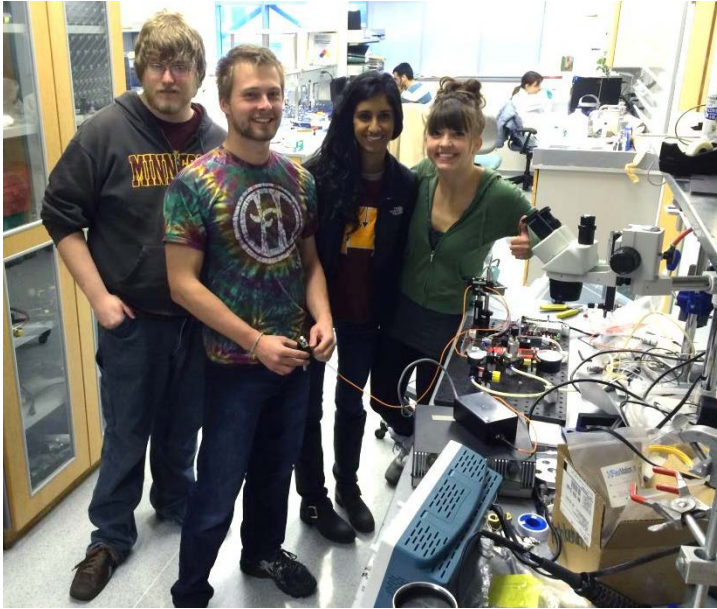


Current regulated power supply.



DB25 pin interface.

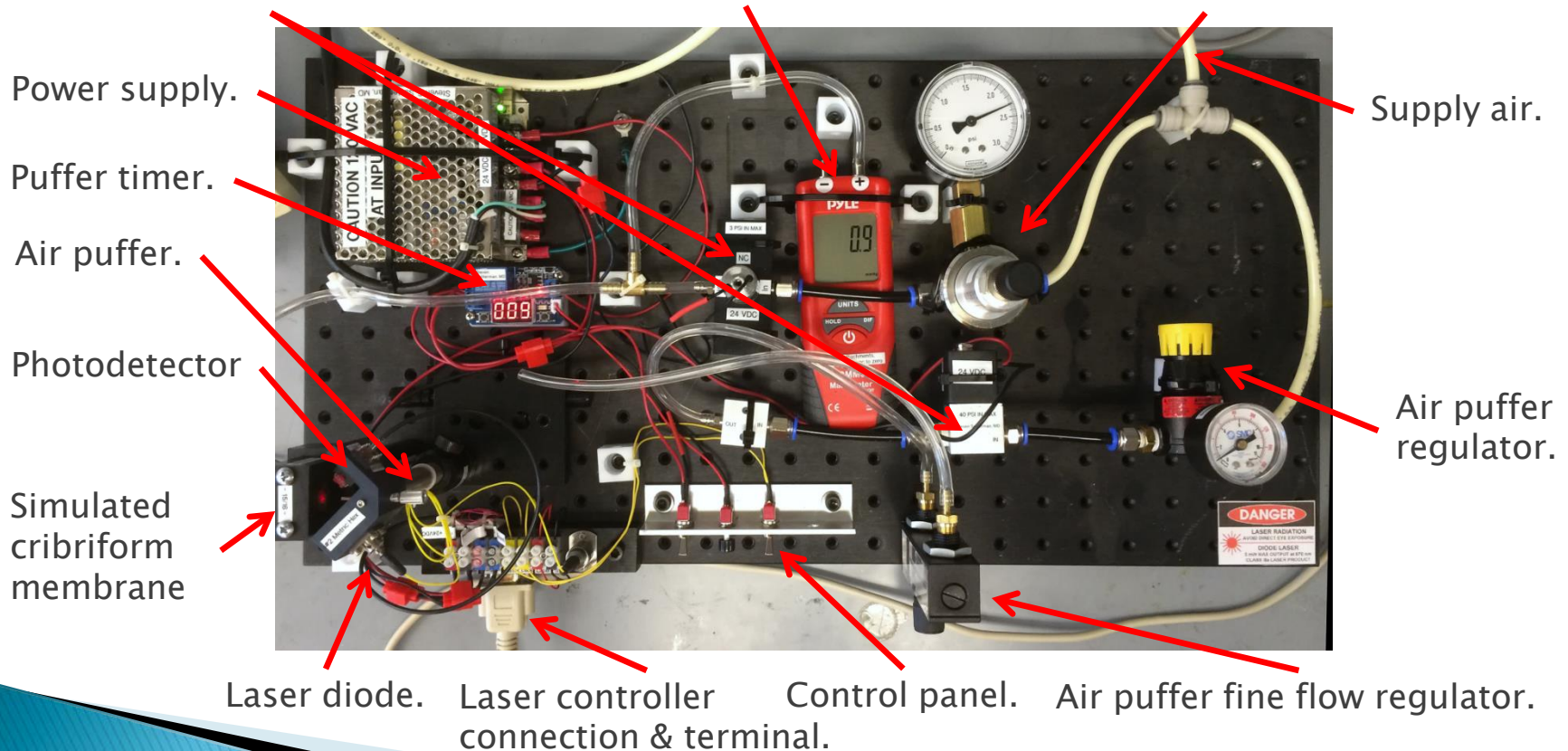
Senior Design Project with Laser Diode...



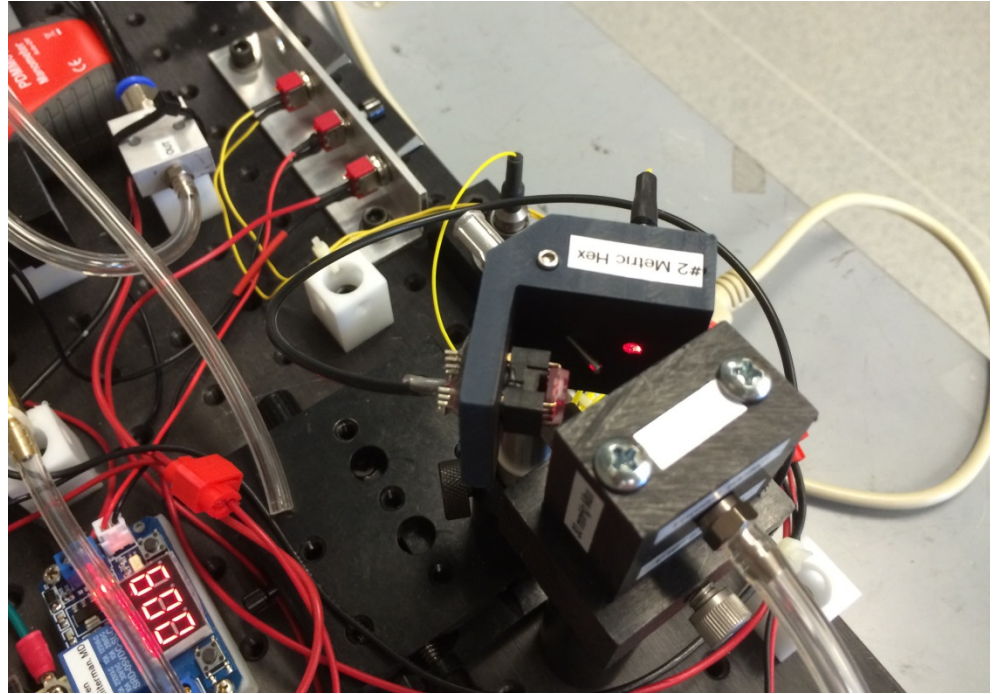
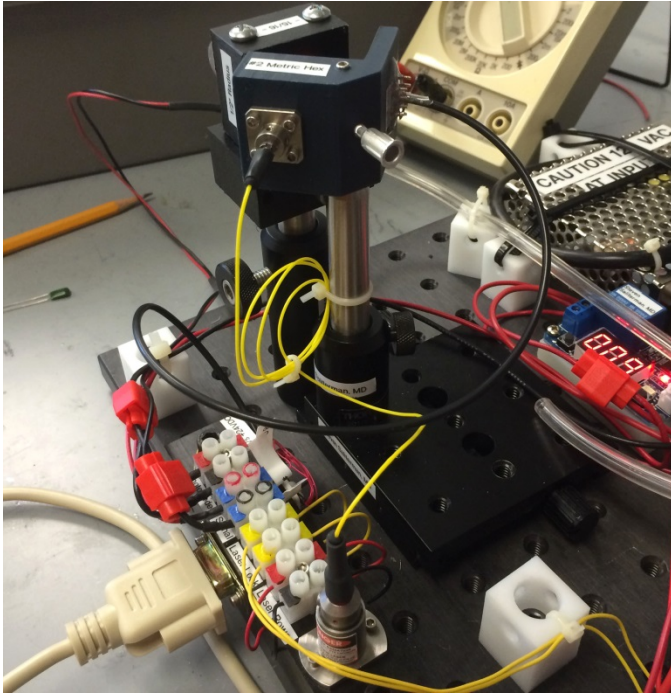
Simulating cribriform membrane and intracranial pressure (ICP) as model for testing non-invasive ICP monitoring.

Project Configuration...

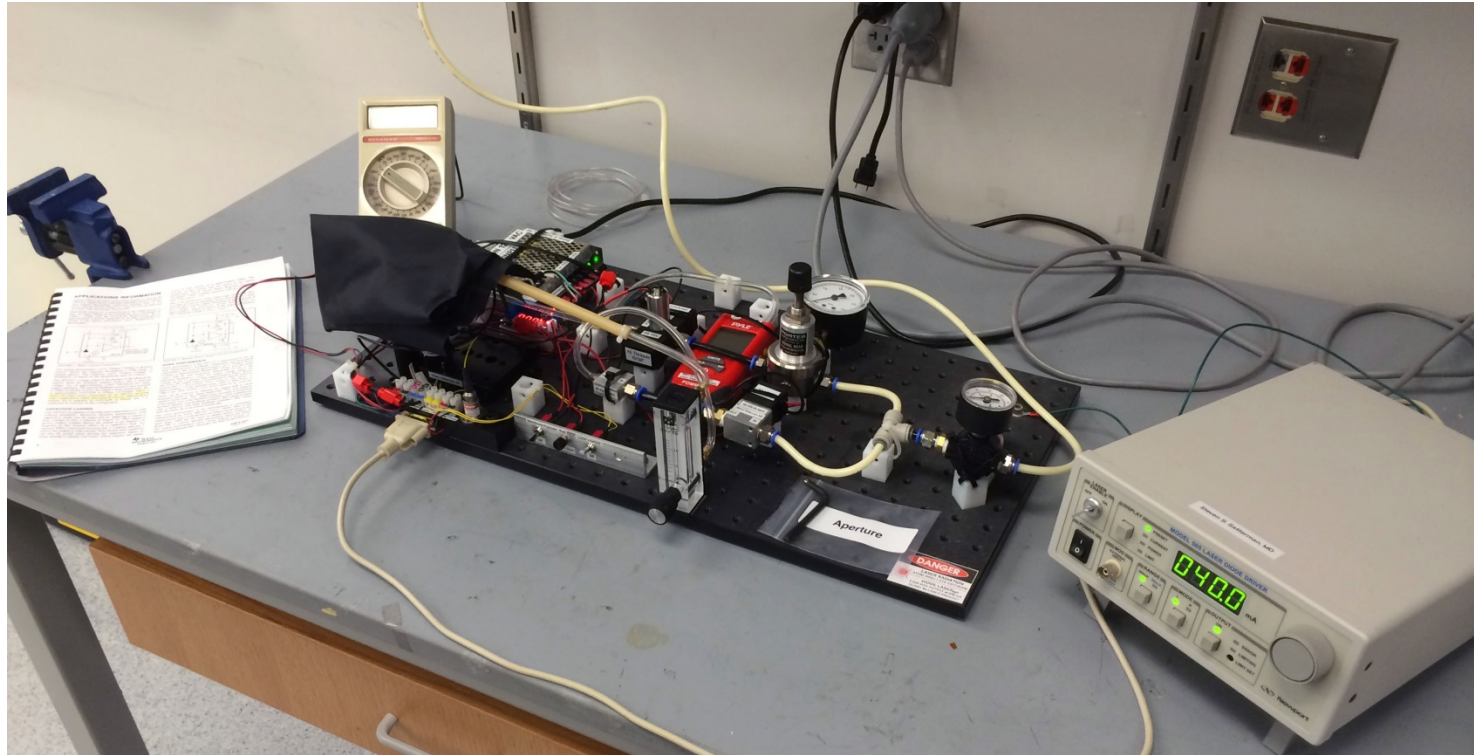
Electro-pneumatic valves. Membrane pressure monitor. Low pressure regulator.



Membrane and Laser Modules...



Final Test Apparatus...

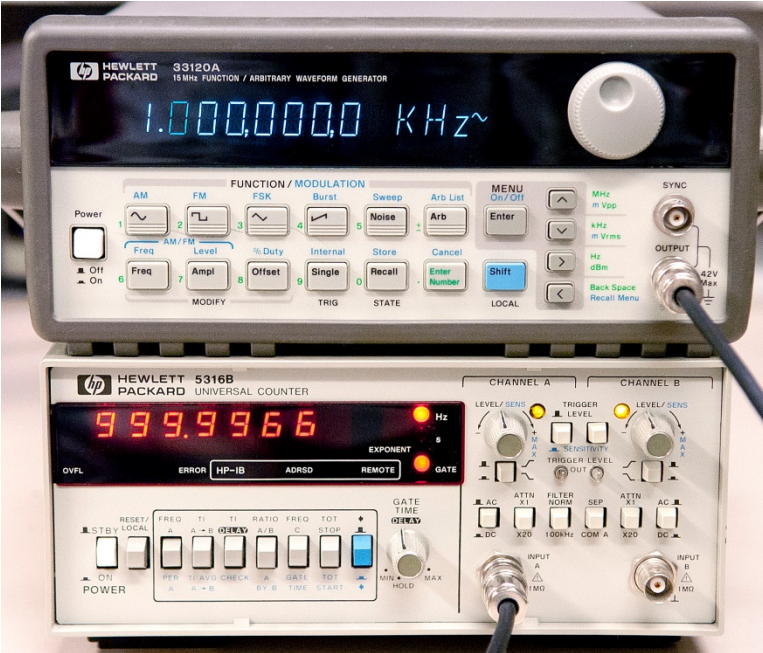


Advanced Laser Diode Controller...



Controls laser diode current and provides temperature regulation.

Counters / Frequency Meters



HP Universal Counter



Fluke High Resolution Counter

Sweep Generators



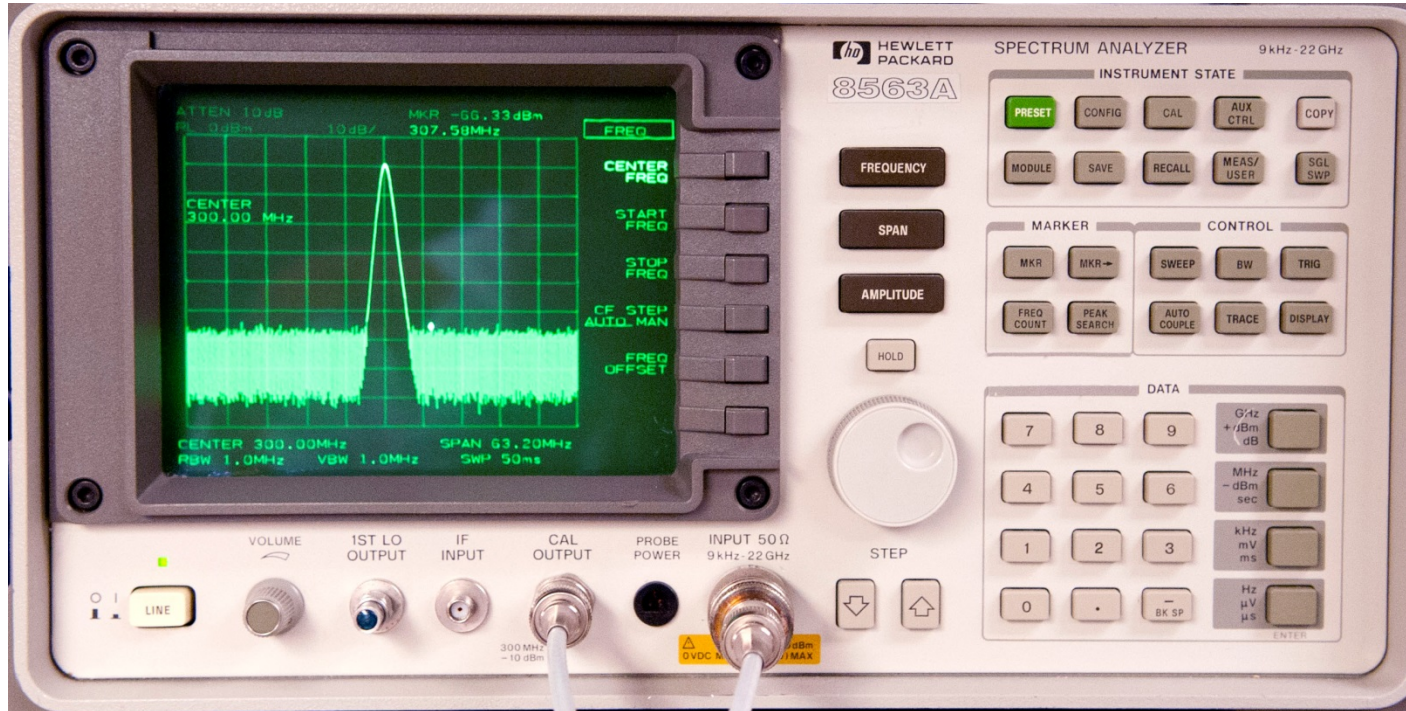
HP Sweep Oscillator .01 – 2.4 GHz

HP Sweep Generator...



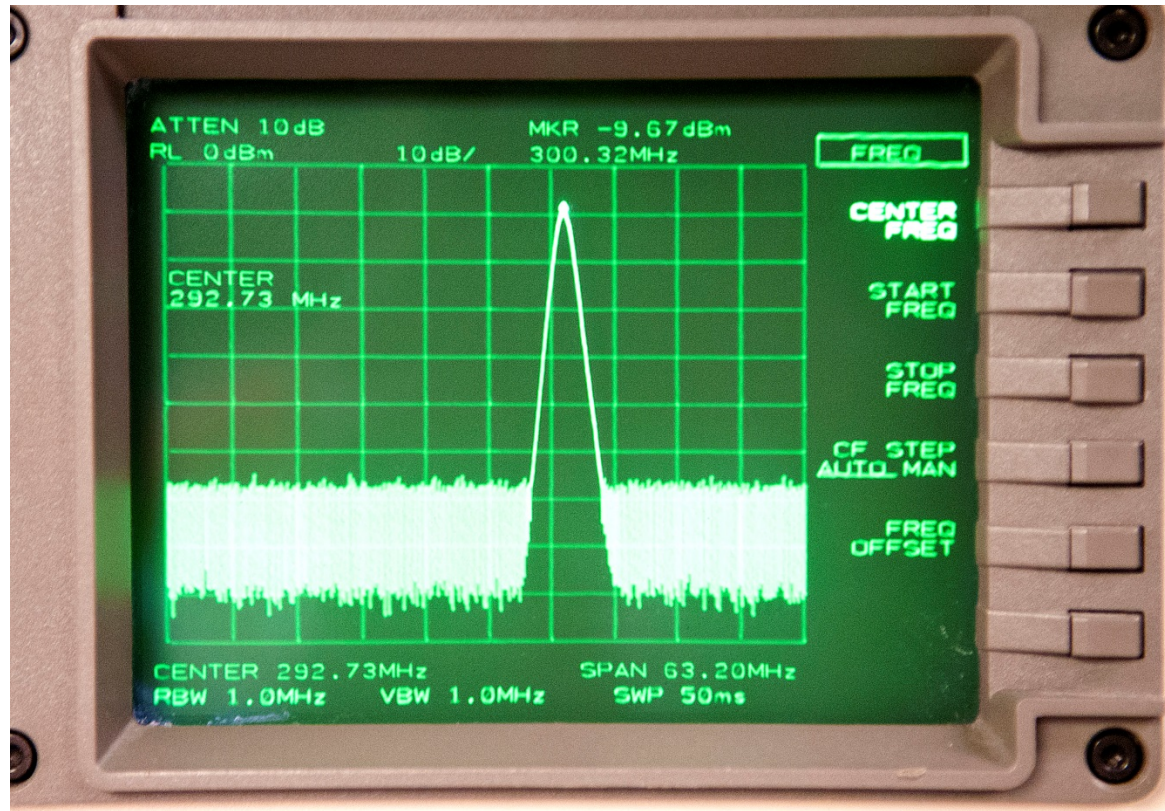
Able to sweep from 1 to 110 MHz

Spectrum Analyzer



HP 8563A displaying its own 300 MHz calibration signal. This unit can test from 9 kHz to 22 GHz!

Center Frequency and Span...



Optical Power Meter



RF Power Meter



For RF projects – use with appropriate sensor head.

RF Noise Figure Meter



For characterizing amplifier gain and noise.

Pressure Manometer



Gas Monitor



Temperature



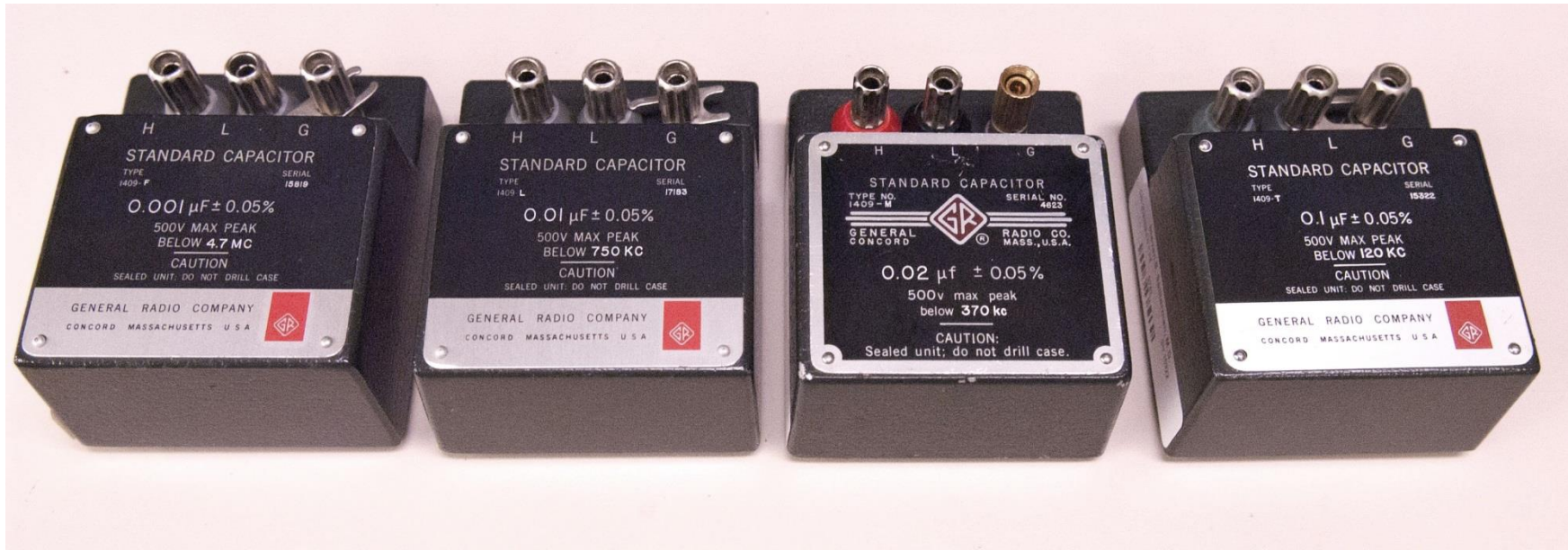
Digital Resistance Standard...



Resistor Standards...



Capacitor Standards...



Summary

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