Electronic Measurements - II
Hand-held Measuring Devices

- Multimeter
- Oscilloscope
- Thermocoupler
- Thermal Imaging Camera (Android compatible)
- LCR Meter
Multimeter

- The most handy tool for any electrical engineer
- Measures Voltage, Current, Resistance, Capacitance, Diode and continuity
- Range/Resolution:
  - 600 V / 0.1 V (AC rms and DC)
  - 6 V / 0.001 V (AC rms and DC)
  - 6 A / 0.001 A (AC rms – 45 Hz to 500 Hz and DC)
  - 10 A / 0.01 A (AC rms – 45 Hz to 500 Hz and DC)
  - 600 Ω to 40 MΩ (varying resolution)
  - 1000 nF to 1000 µF (varying resolution)
  - 0 to 600 Ω of Continuity measurement
Multimeter

Features

- Provides low input impedance, prevents false readings due to ghost voltage
- Can measure up to 10 A and supports a 20 A overload for 30 seconds
- Measures max/min/average readings with elapsed time to record signal fluctuations
Hand-held Oscilloscope

- Also called scopemeters, they are useful for many test and field service applications.
- Like regular oscilloscopes, these devices generally have 2 input channels and sample analog input signals to digital signals.
- They can also function as a multimeter (ability to measure V, I, Frequency etc.)
Oscilloscope

Features and Usage

1. Screen options
2. Channel A measurement options
3. Channel B measurement options
4. Vertical and Horizontal scaling
5. Screen hold
6. Scope settings
7. Auto-scaling both axes
Oscilloscope

Features and Usage

Channel A can measure various features of input signal as can be seen in the image.

$V_{rms}$ and offset voltage measurement of input sinusoid.
Oscilloscope

Features and Usage

Channel input options include inverting signal, AC/DC input formatting.

Cursors help in measuring $V_{\text{max}}$ and $V_{\text{min}}$ (y-axis) or time difference between cursor points (x-axis).
Oscilloscope

Features and Usage

Frequency measurement of signal

Duty cycle measurement of square pulse
Thermocoupler

- Device that measures temperature
- Uses the concept of thermoelectric potential that is generated due to temperature differences between two metals (present in the probe)
- Can store up to 500 values of data and measure max, min and average voltages
- Measure temp in °C, °F and K
SeeK Thermal Imaging Camera

- Turns your Android phones into a thermal imager
- Camera powered by MicroUSB with a 206x156 pixel density
- Simple to use SeeK app available on PlayStore, supports multi-point temperature measurement (-40 °F to 626 °F)
- Camera offers 36° field of view and accurate readings up to 1000 feet distance
- Device also available for purchase for iPhones (but not yet with EIC)
LCR Meter

- This device predominantly measures inductances, capacitances and resistances up to varying degrees of scales
- Can also measure hFE (current gain) of NPN/PNP transistors and forward bias voltages of diodes