

BASIC ELECTRICAL MEASUREMENTS

DC Voltage measurements:-

- Electromechanical DC Voltmeters

- D' Arsonval DC Voltmeters

 - Permanent magnet moving coil voltmeter

 - steady state current

 - $V_{FS} = R_T I_{MFS}$

The Capacitor or electrostatic Voltmeter:-

- dc or line frequency ac

- square law meter movement

The electrodynamicometer:-

- sensitivity range 10-50 Ohms/volt

Electronic DC Voltmeters:-

- thermal equilibrium

Static electric fields and the potential of charged surfaces measurement:-

- field sensor

- electro-optical approach

- Pockels effect

DC Current measurements:-

- Electromechanical DC Ammeters

 - Range (1 to 10,000 A)

 - Shunt resistor

Electronic DC Ammeter :-

 - Range(10^{-15} to $50\mu A$)

Error analysis of the shunt picoammeter :-

- calibration error

- resistor thermal noise

Error analysis of feedback picoammeter:-

DC Voltage measurements:-

Electromechanical AC Voltmeters:-

- The dynamometer AC Voltmeter:-

- frequency(20 to 133Hz)

- Accuracy(1% of full scale voltage)

Iron Vane voltmeter:-

Rectifier/D'Arsonval AC Voltmeters:-

- Range (3VRMS to over 1Kvrms)

Vacuum thermocouple/ D'Arsonval AC Voltmeters:-

- Range(15-20 Hz to 50 MHz)

Analog electronic AC Voltmeters:-

AC Amplifier-Rectifier AC Voltmeters:-

- Accurately known gain

- Operational amplifiers

Peak reading electronic AC Voltmeters:-

- low capacitance diode

- two common types

True RMS AC Voltmeters of the feedback type:-

- vacuum thermocouples

- attenuation

True RMS AC Voltmeters using the direct conversion approach:-

- ICs

Measurement of amplifier noise voltages , noise factor and figure:-

- coherent interface

- RMS

- Band pass filter

- low pass filter

AC Current measurements:-

Electromechanical (Analog) AC Ammeters:-

- current transformer

- Clamp-on ammeter

- Compensated thermocouple

Electronic and Magneto-Optical AC Ammeters:-

- measurement of magnetic field around the conductor to measure AC current in the conductor

- Faraday magneto-optic sensor

Magnetic field measurements:-

- magnetic flux density

- Analog Hall effect sensors

- Superconducting Quantum Interference Device (SQUID)

- gradiometer coil

Phase measurements:-

- Analog and digital systems

- Analog phase measurements

 - Lissajous' figure

 - NAND gate flip-flop phase detector

- exclusive NOR gate

- Digital phase detectors

- Phase shift

Frequency and period measurements:-

- average and instantaneous frequency

- zero beat method

- wien bridge

- Rubidium frequency standards

Resistance measurements:-

- volt-ammeter method

- shunt ohmmeter

- electronic ohmmeter circuits

Capacitive measurements:-

- Use of Q-meter for capacitance measurement

- Q-meter

- RF current

