

# Voltmeter Encyclopedia Article

## Voltmeter

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# Voltmeter

A voltmeter is a device that measures the voltage difference between two points. Voltmeters come in four basic types: moving coil, moving iron, electrostatic, and digital.

The principal behind the voltmeter was established by Danish physicist Hans Christian Oersted (1777-1851) in 1820 when he discovered that an electric current in a wire produced a magnetic field around it. The moving coil and moving iron voltmeters, both of which are similar to ammeters, make use of this discovery. The moving coil voltmeter has a rectifier within its circuitry to ensure that direct current (DC) flows through it. When current flows, it sets up a magnetic field that causes the coil to turn; an indicator needle, attached to the coil, moves over a graduated scale, allowing the voltage to be read. In the moving iron version, it is a small magnet with an attached needle that moves.

The problem with the moving coil and moving iron voltmeters is they require current from the very circuit they are measuring in order to operate, so any measurement will miss at least part of the current it is trying to measure. This problem can be lessened if an amplifier is used as part of the circuit.

An ammeter can be turned into a voltmeter by including a high resistance in series, (in accordance with Ohm's law), which increases accuracy. A highly sensitive ammeter is known as a galvanometer, which was used by, André Ampère (1775-1836) in 1820 to measure electric current.

An electrostatic voltmeter operates on the principal that unlike charges attract each other. When an electric current flows through the voltmeter, moving vanes are drawn in toward fixed plates. The rotating parts are controlled by a spring, and so the electrostatic voltmeter is able to measure voltage without drawing any current.

Modern electronics, semiconductors, and integrated circuits have made the digital voltmeter possible. This instrument compares the measured voltage with its own internal "reference" voltage. The difference between the two voltages controls a digital display. While the digital voltmeter is more expensive to build than its moving coil and moving iron cousins, it offers greater accuracy, sensitivity, and resolution. Digital voltmeters are now the preferred instrument for almost all AC and DC measurements. A voltmeter is an integral part of a multimeter, a multi-range test instrument that also measures current and resistance.