



We use them everyday to find out the hours and minutes, how fast we drive our cars, and whether or not a store is open. They can also show us measured differences of electric potential, or voltage, using a voltmeter or digital (LED) voltmeter.



Right: LED display of a speedometer and analog fuel gauge.

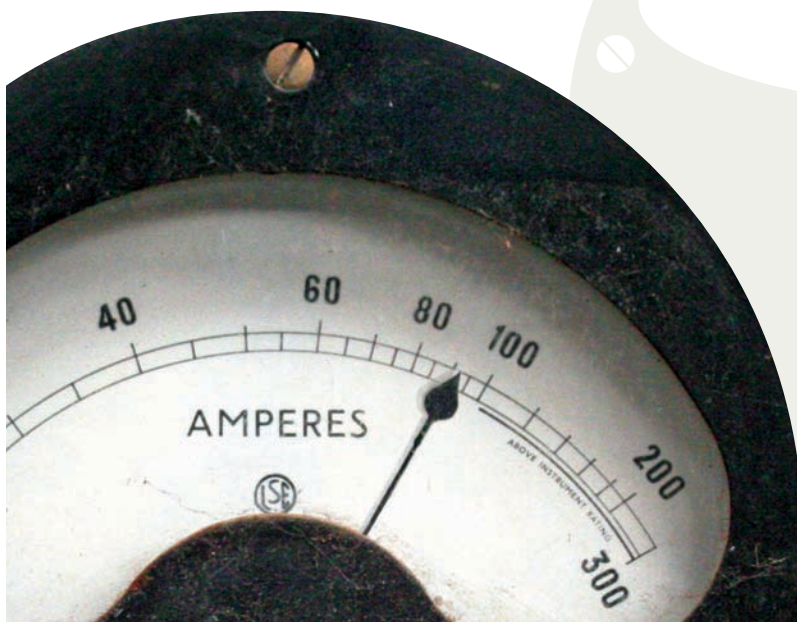
Analog Voltmeter

One of the design functions of an analog voltmeter is to create the least amount of contact with a current. The voltage is measured by allowing the current to pass from one point to another in an electric circuit. When there is an electrical current, the indicator rotates and compresses a small spring that moves the analog pointer.

The earliest design of a voltmeter was the galvanometer, made by Arsene D'Arsonval in the late 19th century. The galvanometer uses a small coil of fine wire wrapped around a compass, attached to the base of a needle, and surrounded by a circular magnet. This is known as the *D'Arsonval movement*, and is still used today in analog meters.



Above: Inside view of a voltmeter's wrapped coil and analog needle. Left: Analog voltmeter that reads amperes.



The first digital (LED) voltmeter was invented by Andrew Kay in 1954. His voltmeter uses an electrical circuit that processes several signals by increasing the output voltage when input voltage is at a constant level. The readout display is on an LED screen which is a semiconductor device that emits a narrow spectrum of light.

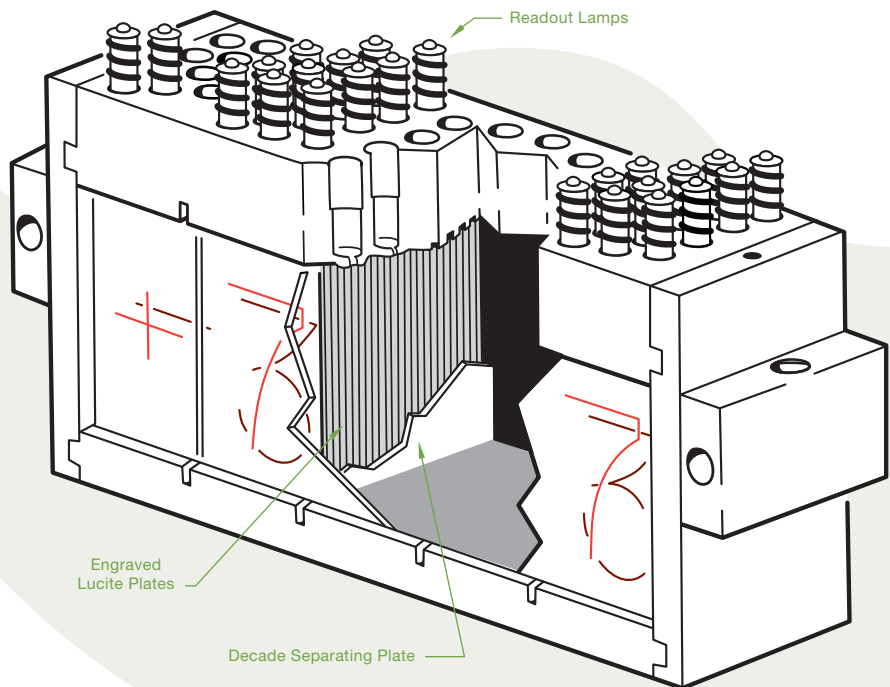


Digital Voltmeter

In 1952, Andrew Kay founded his company Non-Linear Systems and invented the digital-readout voltmeter (DVM) the same year. It utilizes a digital display based on stacks of edge-lit, engraved Lucite plates. Each stack (representing one digit) consists of 11 plates arranged so they recede from the viewer. Ten of the stacked plates have a numeral engraved on it (digits 0 through 9) while the eleventh plate has a decimal-point engraving.

A small grain-of-wheat incandescent lamp located along the edge of each plate illuminates its respective plate. When the lamp is lit, light travels down the plate which strikes on the plate's engraved character. The deep groove on the engraving interrupts the light as it travels down the Lucite plate and spreads towards the front of the instrument where an operator can read the lit numerals.

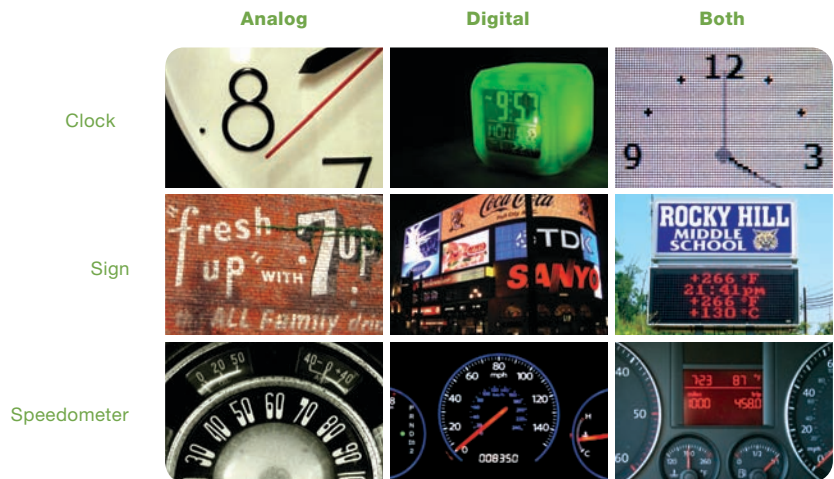
Below: Inside view of Non-Linear System's first digital voltmeter.



Various Displays

Several other types of displays have changed over time due to the influence of LED technology as seen from the digital voltmeter. In some ways it helps us read displays much easier and quickly, but in other instances we prefer the texture and physical form of what we grew up by, such as a ticking clock and a painted sign.

The diagram on the right illustrates comparisons between different types of displays in their analog and digital form, and the combination of the two.



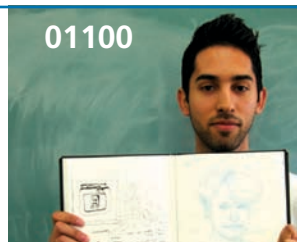
Above: Diagram of clocks, signs, and speedometers in analog and digital form, and the combination of analog with digital.

Sources:

Myers, Robert L. *Display Interfaces: Fundamentals & Standards*. John Wiley & Sons Ltd. England. 2002.
 Kaplan, Daniel M. *Hands-On Electronics: A Practical Introduction to Analog and Digital Circuits*. Cambridge University Press. New York, NY. 2003.
 Sherr, Sol. *Electronic Displays*. New York, NY. 1979.
<http://www.hp9825.com/html/dvms.html>
http://www.wikipedia.org/wiki/Digital_voltmeter
http://www.wikipedia.org/wiki/Display_device

Original voltmeter diagram courtesy of hp9825.com
 Photos courtesy of Flickr.com

Digital–Analog Design Punch Cards is a set of research cards designed and produced by the students of DSGD 186, Digital Applications Methodology, a third-year graphic design course at San Jose State University, Fall 2006. The set, composed of 1+26 cards, is by no means complete. Each topic was chosen and researched by the students, based on a theme presented by the instructor Pino Trogu, with help from Mauro Panzeri. This is card number 12 and it was designed by **Wilfred Castillo**.



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