Digital Multimeter

What are Digital Instruments?

A digital instrument is the type of measuring instrument which represents the output in the form of digits on a screen (LCD or LED). The working principle of a digital instrument is based on the binary number system where, two binary digits (0 and 1) are used to denote two distinct values. The digital instruments are made by solid state devices such as diodes, transistors, MOSFETs, LED, etc. The results shown by the digital instruments are very easy to understand and more accurate. Some common examples of digital instruments are digital multimeter, digital ammeter and voltmeter, digital energy meter, digital speedometer, etc.

Comparison of analog and digital instruments

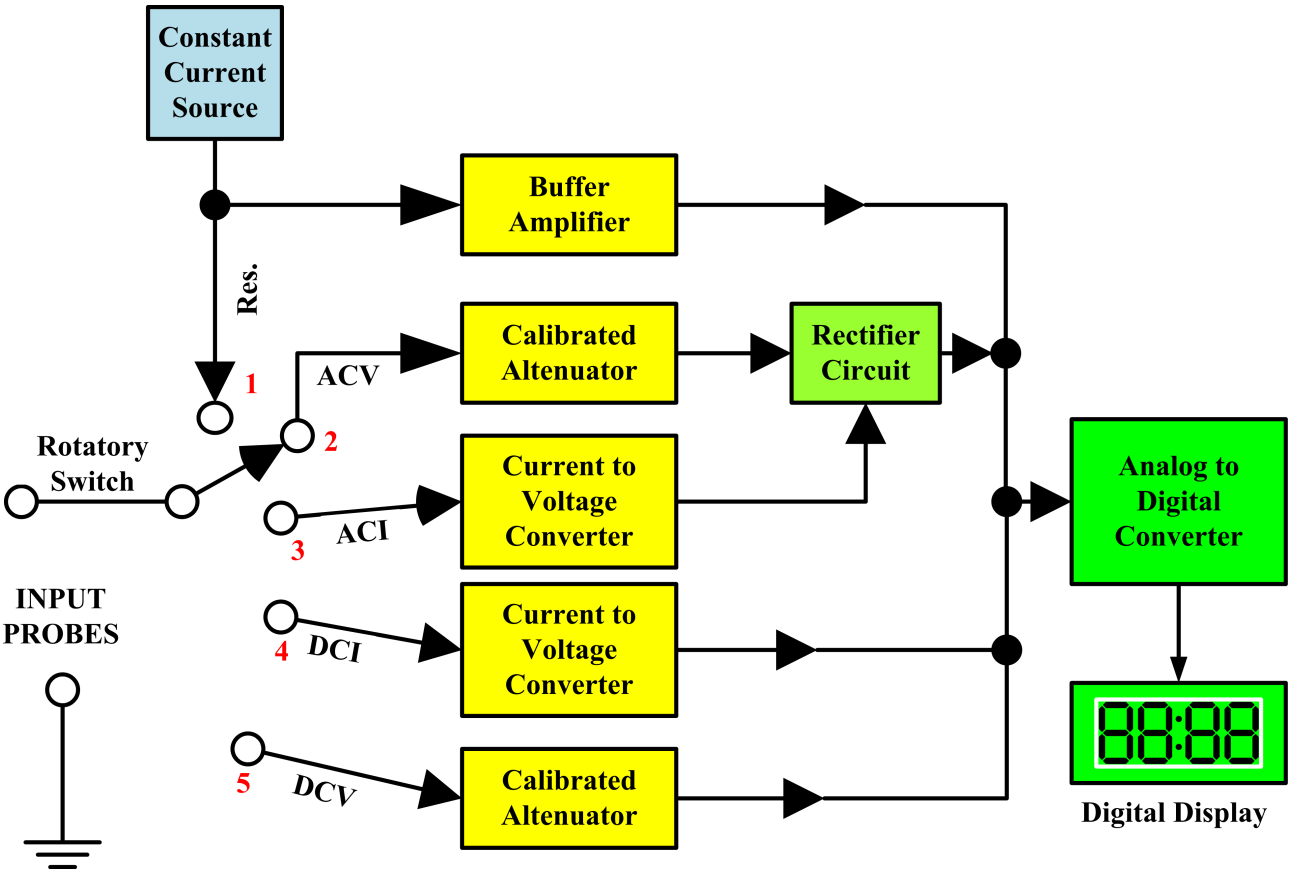
Basis of Difference	Analog Instrument	Digital Instrument
Definition	The type of instrument which works on electromagnetic effects and produces the output in analog form (wave or deflection of pointer) is called an analog instrument.	The type of instrument which consists of solid state components and shows the results in the digital form (digits on a screen) is known as digital instrument.
Construction	The construction of an analog instrument is simple and direct reading type, involves the use of magnet (permanent or electromagnet) and a coil.	The construction of digital instrument is little complex than analog instrument, as it uses electronics and converter circuit for analog to digital conversion and vice-versa.
Output	Analog instruments show the output by the deflection of a pointer on a dial or scale.	Digital instrument shows the output on a digital display screen as a text or number.
Environmental conditions	Analog instruments can be used in any type of environmental conditions.	Since digital instrument involves electronic devices which requires proper environmental conditions to function.
Moving parts	In analog instruments, moving parts are present.	There is no moving parts present in the digital instruments.
Change in output	Analog instruments can show the change in output by the movement of pointer.	Digital instruments do not show the change in output quantity.

Error	With the analog instruments, there is a possibility of considerable observational errors like parallax error.	Digital instruments are free from observational errors.
Effect of electronic noise	Analog instruments are more susceptible to the electronic noise.	Digital instruments are less affected by the electronic noise.
Technology used	Analog instrument uses continuous variation of the signal and records its waveforms.	Digital instruments use sampling techniques for the conversion of input signal into binary signal (or digital signal).
Time needed for reading the output	In analog instruments, time required to observe the output is more.	Time required for observing the output is very less in case of digital instruments.
Requirement of extra power supply	Analog instruments do not require extra (or auxiliary) power supply.	An extra source of power is required in the digital instruments.
Accuracy	Analog instruments are less accurate.	Digital instruments are more accurate.
Sensitivity	The sensitivity of analog instruments is more.	Digital instruments are less sensitive.
Cost	The cost of analog instruments is less.	Digital instruments are costlier than analog instruments.
Size	The size of an analog instruments is normally larger than a digital instrument.	Digital instruments are comparatively smaller than analog instruments.
Presence of display screen	Analog instruments do not use display screen (LCD or LED) to show the output.	Digital instruments use a display screen to show the output.
Resolution	The resolution of analog instruments is less.	Digital instruments have high resolution.
Examples	The common examples of analog instruments are Permanent magnet moving coil instrument, galvanometer, needle type speedometer of automobile, moving iron instrument, mercury thermometer, etc.	Some examples of digital instruments are digital multimeter, digital ammeter and voltmeter, clamp-meter, etc.

What is a Digital Multimeter?

A digital multimeter (DMM) is a measuring instrument used to measure various electrical quantities. The standard measurements that are performed by a DMM are current, voltage and resistance. Apart from these, a digital multimeter can also measure frequency, capacitance, continuity, transistor gains etc.

Block diagram of digital multimeter



**** ACV : AC Voltage, ACI: AC Current, DCI: DC Current, DCV: DC Voltage**

Principle of measurement of I, V, C

Accuracy and resolution of measurement

1. ***Resolution:*** The resolution of a DMM is often specified in the number of digits. DMMs will be specified in terms of the number of digits in the display. Typically this

will be a number consisting of an integer and a half, e.g. 3 1/2 digits. By convention a half digit can display either a zero or 1. This a three and a half digit meter could display up to 1999. Sometimes a three quarters digit may be used. This can display a number higher than one, but less than nine.

2. ***Accuracy:*** The accuracy of the meter is different to the display resolution. This represents the uncertainty of the reading due to inaccuracies in the DMM.