

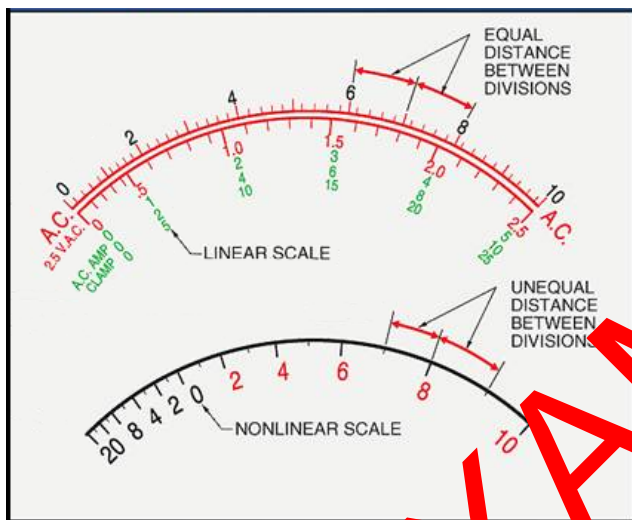
Information Sheet

INDT 110.0 Concepts of Electronics I

Analog Multimeters

Analog multimeters, like the digital meters can measure two or more electrical properties but instead of showing a digital readout of the measurement, analog meters display the measured properties along calibrated scales using a pointer. Most analog multimeters have several calibrated scales which correspond to the different selector switch settings and placement of the test leads into the appropriate jack. When reading a measurement on an analog meter the correct scale must be used. The most common measurements made with analog meters are voltage, current, and resistance. Analog meters may also include scales for measuring decibels (dB) and checking batteries.

An analog display is an electro-mechanical device that indicates a value by the position of a pointer on a scale. Analog scales may be either linear or nonlinear. A *linear* scale is divided into equally spaced segments. Voltage and current scales are usually linear. A *nonlinear* scale is a scale that is divided into unequally spaced segments. Resistance and decibels usually use nonlinear scales.



Analog scales are divided using primary divisions, secondary divisions, and subdivisions. A *primary division* has a listed value. A *secondary division* usually divides a primary division in half. A *subdivision* usually divides the secondary divisions into fifths. Secondary divisions and subdivisions do not have listed numerical values. When reading an analog scale, the primary, secondary, and subdivision readings need to be added together.

Note that the voltage/current scales are divided into 10 primary and secondary subdivisions. This corresponds to the values of 0 to 10, 0 to 50, and 0 to 250 in the following way.

Scale in use

0 to 10

0 to 50

0 to 250

The primary and secondary subdivisions are equal to:

1-2-3-4-5-6-7-8-9-10

0-5-10-15-20-25-30-35-40-45-50

0-25-50-75-100-125-150-175-200-225-250

Note that each of the primary and secondary marks is divided into five equal subdivisions.

Scale in use

10v

50v

250v

Each subdivision equals

0.2v ($2/10^{\text{th}}$ of a volt)

1.0v

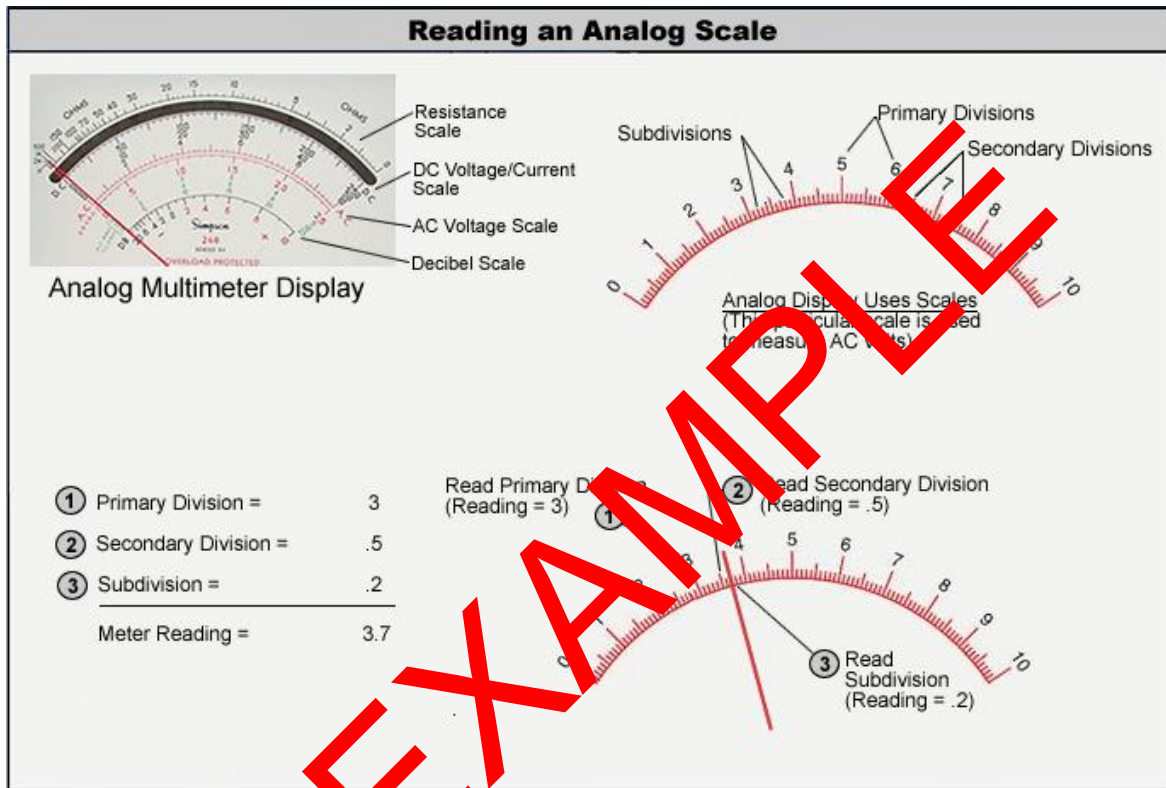
5.0v

When using the 2.5 volt scale, remember to use the divisions marked for the 250v scale. On the 2.5v scale each lighter mark equals 0.05v ($5/100^{\text{th}}$ of a volt).

Current uses the same scale as voltage and is multiplied as necessary depending on the range used.

To read an analog scale, apply the following procedure.

1. Locate the correct scale to use for what you are measuring.
2. Read the primary division.
3. Read the secondary division if the pointer moves past a secondary division.
4. Read the subdivision if the pointer is not directly on a primary or secondary division. Round the reading to the nearest subdivision if the pointer is not directly on a subdivision. Round the reading to the next highest subdivision if rounding to the nearest subdivision is unclear.
5. Finally add the primary and secondary divisions and the subdivisions to obtain the reading.



The scale used for resistance is usually the very top scale on an analog meter. Reading a resistance measurement is very similar to voltage and current. The primary, secondary, and subdivisions are still present and must still be read the same way except the value must be multiplied depending on the range selected. (R x 1 - R x 100 - R x 10,000)

For example: If the pointer on the resistance scale is measuring 3.2 and the VOM is in the “R x 100” range the resulting measurement would be 320 ohms.