

Review of fundamentals of electrical measurements

The scientific and technological progress of any nation depends on its ability to measure, calculate and finally, estimate the unknown. Also, the success of an engineer or technician is judged by his ability to measure precisely and to correctly interpret the circuit performance. There are three ways of making such measurements:

- (a) by mechanical means like measuring gas pressure by Bourdon pressure gauge.
- (b) by electrical means like measuring potential difference with an electrical voltmeter.
- (c) By electronic means which is a very sensitive way of detecting the measured quantity

The electronic instruments generally have higher sensitivity, faster response and greater flexibility than mechanical or electrical instruments in indicating, recording

Analog and Digital Instruments

The deflection type instruments with a scale and movable pointer are called analog instruments. The deflection of the pointer is a function of the value of the electrical quantity being measured.

Digital instruments are those which use logic circuits and techniques to obtain a measurement and then display it in numerical-reading (digital) form. The digital readouts employ either LED displays or liquid crystal displays (LCD).

Some of the advantages of digital instruments over analog instruments are as under:

1. easy readability
2. greater accuracy
3. better resolution

Classification of Electronics Instruments

The electronics instruments may be classified into the following three categories:

1. **Indicating Instruments.** These are the instruments which indicate the instantaneous value of quantity being measured, at the time it is being measured. The indication is in the form of pointer deflection (analog instruments) or (digital instruments). Ammeters and voltmeters are examples of such instruments.
2. **Recording Instruments.** Such instruments provide a graphic record of the variations in the quantity being measured over a selected period of time.
3. **Controlling Instruments.** These are widely used in industrial processes. Their function is to control the quantity being measured with the help of information feed back to them by monitoring devices. This class of electronic instruments forms the basis of automatic control systems (automation) which are extensively employed in the field of engineering.

Main Elements of an Electronic Instrument

Most of the electronic instruments have the following main three elements: (i) transducer (ii) signal modifier and (iii) indicating device. The block diagram of electronic instruments is shown in Fig.

below. They are discussed below:

1. **Transducer.** It is the first sensing element and is required only when measuring a non- electrical quantity, say, temperature or pressure. Its function is to convert the non-electrical physical quantity into an electrical signal.
2. **Signal Modifier.** It is the second element and its function is to make the incoming signal suitable for application to the indicating device. For example, the signal may need amplification before it can be properly displayed. Other types of signal modifiers are: voltage dividers for reducing the amount of signal applied to the indicating device or wave shaping circuits such as filters, etc.
3. **Indicating Device.** For general purpose instruments like voltmeters, ammeters or ohm meters, the indicating device is usually a deflection type meter . In digital readout instruments; the indicating device is of digital design.

