

# Signal Measurements 12 hrs

- Units and Standards of Measurements

# Units

## **Units:**

To specify and perform calculations with physical quantities, the physical quantities must be defined both in kind and magnitude.

The standard measure of each kind of physical quantity is the unit.

In science and engineering , two kinds of unit namely

# Units

## **Fundamental units:**

Measure of physical quantities in length, mass and time.

(a) Length (l) -meter (m) - [L]

(b) Mass (m) -kilogram (kg) - [M]

(c) Time (t) -second (s) - [T]

(d) Electric current -Ampere (A) - [I]

(e) Luminous intensity ( $\theta$ ) -candela (cd) - [ ]

# Units

## Derived units:

All other units which can be expressed in terms of fundamental unit are called derived unit.

**Table 2. Examples of SI derived units**

DERIVED QUANTITY	NAME	SYMBOL
Area	square meter	m <sup>2</sup>
Volume	cubic meter	m <sup>3</sup>
Speed	meter per second	m/s
Velocity	meter per second	m/s
Acceleration	meter per second squared	m/s <sup>2</sup>
Force	newton	N
Pressure	Pascal OR newton per meter squared	Pa or N/m <sup>2</sup>
Torque	newton meter	N-m
Work	joule OR newton meter	J or N-m
Energy	joule OR newton meter	J or N-m
Power	Watt OR joule per second	W or J/s

# Units

**Conversion of units:-**  
**Abbreviated power of ten:-**

<b>Name</b>	<b>Symbol</b>	<b>Equivalent</b>
Tera	T	$10^{12}$
Giga	G	$10^9$
Mega	M	$10^6$
Kilo	k	$10^3$
Hector	h	$10^2$
Decal	d	10
Deco	d	$10^{-1}$
Cent	c	$10^{-2}$
Mille	m	$10^{-3}$
Micro	$\mu$	$10^{-6}$
Nana	n	$10^{-9}$
Picot	p	$10^{-12}$
Tempt	f	$10^{-15}$
Atom	a	$10^{-18}$

# Standards of Measurements

A physical representation of a unit of measurement.

For example,

the fundamental unit of mass in international unit(SI) is kilogram; defined as the mass of a cubic decimeter of water as its temperature of maximum density of 4°C.

# Types of Standards of Measurements

Four types based on their function and application namely:

- International Standards
- Primary Standards
- Secondary Standards and
- Working Standards

# Types of Standards of Measurements

## **International Standards:**

- Defined on the basis of international agreement.
- Periodically evaluated and check by absolute measurements in terms of fundamental unit.
- Maintained at the International Bureau of Weights and Measures.
- Not available for the ordinary users for the propose of comparison or calibration.
- Higher possible accuracy.



# Types of Standards of Measurements

## **Primary Standards:**

- Maintained by national standard laboratories in different parts of the world.
- Independently calibrated by absolute measurements at each of the national laboratories.
- Not available for use outside the national laboratories.
- One of the main functions is the verification and calibration of secondary standards.

# Types of Standards of Measurements

## **Secondary Standards:**

- Are the basic reference standards used in industrial measurement laboratories.
- Maintained by the particular involved industry .
- Checked locally against other reference standards in the area.
- The responsibility for maintenance and calibration of secondary standards lies entirely with the industrial laboratory itself.

# Types of Standards of Measurements

## **Secondary Standards:**

- Sent to the national standards laboratory on a periodic basis for the calibration and comparison against the primary standards.
- Then returned to the industrial user with a certification of their measured value in terms of the primary standards.

# Types of Standards of Measurements

## **Working Standards:**

- Principle tools of a measurement laboratory.
- Used to check and calibrate general laboratory instruments for accuracy and performance .
- Or to perform comparison measurements in industrial applications.

# IEEE Standards

- Slightly different types of standard.
- Published and maintained by the Institute of Electrical and Electronics Engineers, an engineering society whose headquarter is in New York.
- Are not physical items that are available for comparison and checking of secondary standards but are the standard procedures, nomenclature, definition etc.
- Gives the standard test method for testing and evaluating various electronics system and components.
- Specify test equipment.
- For examples, similar arrangements of knobs and function of oscilloscope manufactured by different manufactures and same names for the same function for the common laboratory oscilloscope.
- Standard schematic and logic symbols are defined so that engineering drawings can be understood by all engineers.

# Measuring Instruments

A device for determining the magnitude of a physical quantity being measured.

Measurement is the process by which one can convert physical parameters to numerical value.

The methods of measurements can be direct and indirect.