

**GLOSSARY OF
TERMS ON
ELECTRIC AND
MAGNETIC FIELDS**

Glossary of Terms on Electric and Magnetic Fields

Reprinted by permission of the publisher from Edwin Carstensen,
Ph.D., *Biological Effects of Transmission Line Fields*, pp. xi-xvii.
Copyright 1987 by Elsevier Science Publishing Co., Inc.

GLOSSARY

Admittance (Y^*). A ratio of current to voltage which includes information on the relative phase of these quantities. The complex sum of the conductance and the susceptance of a circuit. The reciprocal of the impedance.

Ampere (A). The M.K.S. unit of current, a flow of one coulomb of electric charge per second.

Anisotropy. Having a property which depends upon direction with respect to the structure of the material.

Anode. The positive electrode. The electrode from which positive ions are formed or negative ions are discharged.

Antinode. The position of maximum amplitude in a standing wave.

Arc. A discharge of electricity through a gas.

Beats. Periodic variations that result from the superposition of waves having different frequencies.

Benign Tumor. A noncancerous or nonmalignant growth.

Biphasic. Changing from positive to negative.

Capacitance. The property of a system of conductors and dielectrics which permits the storage of electric charge and electric energy when potential differences exist between the conductors.

Glossary of Terms on Electric and Magnetic Fields

Capacitor. An object which stores electric charge and electric energy.

Charge, Electric. Like mass, length, and time, electric charge is a fundamental quantity required to explain measurable forces and is the fundamental unit from which other electromagnetic quantities are developed.

Charge Density. Charge per unit area.

Conductance. The ratio of current to voltage in a circuit which absorbs but does not store electric energy. The reciprocal of resistance. The real part of the admittance. The part of the admittance which is related to loss of electric power.

Conductivity, Real. A property of material which when multiplied by the electric field gives the free current density.

Conductivity, Complex. A property of material which gives the ratio between current density and electric field and includes the phase difference between the two field quantities. When written in polar form ($\sigma^* = \Sigma e^{j\phi}$), Σ is the ratio of the magnitudes of the current density and the electric field and ϕ is the phase difference between them. When expressed in rectangular form ($\sigma^* = \sigma + j\omega\epsilon$), the real part (the first term) is the real conductivity and the imaginary term (preceded by $j = \sqrt{-1}$) is the angular frequency $\omega = 2\pi f$ multiplied by the permittivity ϵ of the material.

Conductivity, Effective Homogeneous. The conductivity of an object viewed as though its dielectric properties were uniform throughout.

Conductor. An object which allows a current of electricity to pass continuously. A wire or combination of wires suitable for carrying current.

Glossary of Terms on Electric and Magnetic Fields

Continuous Wave. A time dependent function of constant amplitude, not gated or pulsed.

Corona. A luminous discharge due to ionization of the air surrounding a conductor which occurs when the local electric field exceeds the dielectric strength of air.

Coulomb (C). The M.K.S. unit of electric charge—the basic electrical quantity.

Counterion. A free charge which is held near a fixed or immobilized charge by the requirement of electroneutrality.

Current, Electric. The flow of electric charge.

Current Density. Current per unit area.

dB. Decibel, ten times the logarithm to the base 10 of a power ratio.

Dielectric Constant. A property of material which when multiplied by the permittivity of free space determines the electric energy stored per unit volume per unit electric field.

Dipole. Positive and negative charge bound together in such a way that the center of gravity of the positive charge is separated in space from the center of gravity of the negative charge.

Dipole Moment. The product of charge and separation of charge centers in a dipole.

Discharge. The release of stored charge from a capacitor or a battery.

Dispersion. Frequency dependence—frequently in a quantity which, to a first order, can be considered to be a constant, e.g., the velocity of propagation of electromagnetic waves.

Glossary of Terms on Electric and Magnetic Fields

Displacement, Electric (D). A field quantity whose source is in net free charge which has been created by separation of charge.

Electric Field (E). The force at a point in space which would be experienced by a unit electric charge. The gradient (space rate of change) of the work required to move a unit electric charge from one position to a nearby position.

Electrode. An electric conductor for the transfer of charge between an external circuit and a medium.

Electroosmosis. The movement of a charged fluid as the result of the application of an electric field.

Electrophoresis. The movement on ions—usually colloidal ions or cells with net electric surface density—in an electric field.

Electrophosphene. A sensation of light which results from electrical stimulation of the eye.

Electrostatic. A condition in which the electric charges are at rest.

Electromagnetic Interference (EMI). Disturbance in the operation of an electronic device which results from the presence of undesired local electric or magnetic fields.

Epidemiology. The study of the incidence of disease in its natural setting.

Equipotential. A line or surface characterized by a single electric potential or voltage.

Extra-High-Voltage (EHV). When pertaining to transmission lines, values ranging from 240 - 800 kilovolts.

Glossary of Terms on Electric and Magnetic Fields

Extremely-Low-Frequency (ELF). In the most limited sense, the frequency range from 30 - 300 Hz. In this work, extremely low frequency has been used for any frequency above zero and less than 300 Hz.

Farad (F). The M.K.S. unit of capacitance.

Ferromagnetic. Having a field dependent permeability somewhat greater than air. Usually ferromagnetic materials have relatively high permeabilities and exhibit hysteresis.

Flashover. Arcing between conductors when the local electric fields exceed the dielectric strength of air.

Gamma. One nanotesla.

Gauss (G). The c.g.s. unit of magnetic field. Replaced by the M.K.S. tesla. One tesla = 10^4 gauss.

Harmonic. An integral multiple of a fundamental frequency.

Hertz (Hz). The unit for frequency—the number of complete cycles of the quantity per second (cycles/second).

Homogeneous. Spatially uniform material properties.

Impedance (Z^+). A ratio of voltage to current which includes information on the relative phase of these quantities. The complex sum of the resistance and the reactance of a circuit. The reciprocal of the admittance.

Induced Currents. Currents which flow in an object as a result of exposure to an electric or magnetic field.

Inhomogeneous. Material properties which are not everywhere the same.

Glossary of Terms on Electric and Magnetic Fields

Insulator. A nonconducting material.

Ion. An electrically charged atom or chemical radical.

Joule. Newton-meter, the M.K.S. unit of work.

k. Kilo- If prefixed to a symbol, it means one thousand (i.e., multiply by 10^3).

Kilovolt/meter (kV/m). One thousand volts per meter.

Meter (m). The M.K.S. unit of length.

m. Milli- If prefixed to a symbol, it means multiply by 10^{-3} .

M. Mega- If prefixed to a symbol, it means multiply by 10^6 .

Magnetic Field (B). A vector quantity which describes the forces of interaction between electric currents and includes contributions of both macroscopic and microscopic (atomic level) currents.

Magnetic Field Intensity (Magnetic Field Strength) (H). A vector quantity which describes the forces of interaction of macroscopic electric currents.

Mechanism. A quantitative or qualitative model or concept which explains a set of experimental observations.

M.K.S. Meter-kilogram-second, the generally accepted basic units for electromagnetic fields from which all other units are derived.

Monopole. A particle with a single charge.

Monotonic. A function whose slope is either positive or negative but not both.

MV/m. One million volts per meter, megavolts per meter.

Glossary of Terms on Electric and Magnetic Fields

n. Nano- If prefixed to a symbol, it means multiply by 10^9 .

Negated. Used here to describe a reported biological effect which was not confirmed on subsequent tests in an independent laboratory.

Newton. The M.K.S. unit of force (one kilogram centimeter per second per second).

Normal. Perpendicular to.

Norton Equivalent Circuit. Representation of an electric circuit as a single current source and shunt impedance.

Oblate. A flattened sphere—in the extreme a disk shaped object.

Octave. A factor of two in frequency.

Ohm. The M.K.S. unit of resistance. One volt across an object with a resistance of one ohm will pass a current of one ampere.

Order of Magnitude. Roughly a factor of ten.

p. Pico- If prefixed to an electrical unit, it means multiply by 10^{-12} .

p. If prefixed to a chemical symbol, it implies a logarithmic expression of concentration.

Parallel Circuit. An arrangement of circuit elements such that each has the same voltage.

Phase. The measure of the progression of a periodic waveform in time or space from a chosen instant or position. Most high voltage, a.c. transmission lines have three conductors or conductor bundles with the phase of the voltage in each advanced 120° or one-third of a cycle relative to the others. In the vernacular, a conductor is sometimes referred to as a “phase” as in “the outer phase of the line.”

Glossary of Terms on Electric and Magnetic Fields

Permeability. A property of a material which if multiplied by the magnetic field intensity H gives the magnetic field B .

Permittivity. A property of a material which if multiplied by the electric field E gives the electric displacement D .

Perturbed Electric Field. Modification of an electric field by the presence in it of a conducting object.

Piezoelectricity. A property of certain asymmetric crystalline materials that relates the electric field to the mechanical strain.

Postulate (Hypothesis). A mechanistic predication of the outcome of an experiment. A suggested explanation for a set of observations.

Pressure. Force per unit area.

Potential, Electric. The work required to transport a unit electric charge from a reference position to another position.

Prolate. An elongated sphere—a cigar shaped object.

Relaxation. A process that can be described as an exponential function of time.

Resistance. The ratio of the voltage across an object to the current flowing through it.

Saw-Tooth Wave. A time-dependent function consisting of a series of alternating increasing and decreasing ramps.

Series Circuit. An arrangement of circuit elements such that each has the same current.

Siemen (Siemen/meter). The M.K.S. unit of conductance (conductivity).

Glossary of Terms on Electric and Magnetic Fields

Short-Circuit. Loaded with zero resistance or impedance.

Square Wave. A time-dependent function consisting of a series of discontinuous changes.

Susceptance. The ratio of current to voltage in a nondissipative circuit. That part of the admittance which is related to the storage of electric energy.

Tesla (T). The M.K.S. unit of magnetic field.

Thevenin Equivalent Circuit. The representation of a circuit as a single voltage source and series resistance.

Ultra-High-Frequency (UHF). 300-3000 MHz.

Ultra-High-Voltage (UHV). Above 800,000 volts.

Vector. A quantity which has both direction and magnitude.

Very High Frequency (VHF). 30-300 MHz

Volt (V). The M.K.S. unit of voltage or potential.

Volt/meter (V/m). The M.K.S. unit of electric field.

Voltage—Voltage Difference. The electric potential—the work required to transport a unit electric charge from one point to another.

Watt. One joule per second, the M.K.S. unit of power.

μ. Micro-. If prefixed to a symbol, it means one-millionth (i.e., multiply by 10^{-6}).

≠. Not equal to.