Appendix 1 Conversion Factors Between Systems of Units

The system of units in this text, and in much of applied electromagnetics, is the SI system,[1] which is a rationalized meter-kilogram-second (MKS) system. Since the additional basic electric unit is selected as the ampere, it is also designated the MKSA system. The classical or gaussian CGS system is still used in much of the scientific literature. In this, electrical quantities are based upon the electrostatic system of units (ESU) and designated statcoulombs, statvolts, and so on. Current may be in this system (statampere) or in the electromagnetic system of units (EMU) system (abamperes), as may be some of the circuit quantities, resistance, inductance, and so on. Conversions are consequently given in the following table to both systems for certain selected quantities.

The factor given is the number of gaussian units required to equal one SI unit. A result in SI units would thus be multiplied by this number to obtain the equivalent answer in gaussian units. For example, if length is l_m meters, it will be $100l_m$ centimeters. For simplicity, velocity of light is taken as 3×10^8 m/s; for more accurate work, all multipliers of 3 should be replaced by 2.997925. Additional details and conversions are given in the references.[1,2]

[1] *E. A. Mechtly, "The International System of Units—Physical Constants and Conversion Factors," Publication SP-7012, National Aeronautics and Space Administration, 1973. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.*

[2] *"ASTM Standard Metric Practice Guide," Designation E 380-70, American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103, 1970.*

Physical Quantity	Symbol	SI Unit	Factor	Gaussian
Length	l	meter (m)	10^2	centimeter (cm)
Mass	m	kilogram (kg)	10^3	gram
Time	t	second (s)	1	second
Frequency	f	hertz (Hz)	1	hertz
Force	F	newton (N)	10^5	dyne
Energy	U	joule (J)	10^7	erg
Power	W	watt (W)	10^7	erg/s
Charge	Q	coulomb (C)	3×10^9	statcoulomb
Charge density	ρ	C/m^3	3×10^3	$statcoul/cm^3$
Current	I	ampere (A)	3×10^9	statampere
Current	I	ampere (A)	$1/10$	abampere
Potential, voltage	Φ, V	volt (V)	$(1/3) \times 10^{-2}$	statvolt
Potential, voltage	Φ, V	volt (V)	10^8	abvolt
Electric field	E	V/m	$(1/3) \times 10^{-4}$	statvolt/cm
Electric flux density	D	C/m^2	$4\pi(3 \times 10^5)$	$statcoul/cm^2$
Electric polarization	P	C/m^2	3×10^5	dipole moment/cm^3
Magnetic field	H	A/m	$4\pi \times 10^{-3}$	oersted
Magnetization	M	A/m	10^{-3}	magnetic moment/cm^3
Magnetic flux	ψ_m	weber (Wb)	10^8	maxwell
Magnetic flux density	B	tesla (T)	10^4	gauss
Capacitance	C	farad (F)	$(3)^2 \times 10^9$	statfarad
Inductance	L	henry (H)	$(3)^{-2} \times 10^{-11}$	stathenry
Inductance	L	henry (H)	10^9	abhenry
Resistance	R	ohm (Ω)	$(3)^{-2} \times 10^{-11}$	statohm
Resistance	R	ohm (Ω)	10^9	abohm
Conductivity	σ	siemens/meter (S/m)	$(3)^2 \times 10^9$	$(\text{statohm cm})^{-1}$
Conductivity	σ	siemens/meter (S/m)	10^{-11}	$(\text{abohm cm})^{-1}$