4.12 Magnetic Quantities and Units

The literature on magnetic fields refers to two different unit-systems: The MKSA-system as proposed by Giorgi and the CGSA-System.

The **MKSA-system** emanates from the four basic units *Meter, Kilogram, Second* and *Ampere* (SI-units, Système International). All other units are derived from them and occasionally linked with the names of outstanding scientists:

1 N	= 1 Newton = 1 kg m / s^2	1 J	= 1 Joule = 1 N m
1 W	= 1 Watt = 1 N m / s = 1 VA	1 Wb	= 1 Weber = 1 V s
1 T	= 1 Tesla = 1 Wb / m^2	1 V	= 1 Volt = 1 m^2 kg /(A s^3)

The **CGSA-system** uses the four basic units *Centimeter*, *Gram*, *Second* and *Ampere* and derives further units from them:

1 dyn	= 1 g cm / s^2	1 erg	= 1 dyn cm
1 Gb	= 1 Gilbert = 1 Oe cm	1 Oe	= 1 Oerstedt = 1 Gb / cm
1 Mx	= 1 Maxwell = 1 G cm^2	1 G	= 1 Gauß = 1 Mx / cm^2

The following table enables the conversion between both systems:

B	Flux Density Induction	T = V s / m^2	1 G = 10^{-4} T
H	Magn. Field Strength	A / m	1 Oe = 1000 / 4π · A/m = 79.577 A/m
BH	Specific Energy	W s / m^3	1 MGOe = 7.9577 kJ/m^3
Φ	Magn. Flux	Wb = V s	1 Mx = 10^{-8} V s
Θ	Amperes	A	1 Gb = 10 A / 4π = 0.79577 A
F	Force	N = kg m / s^2	1 dyn = 10^{-5} N
P	Power	W = VA = N m / s	1 erg / s = 10^{-7} W
E	Energy	J = N m = W s	1 erg = 10^{-7} J
R_m	Magn. Resistance Reluctance	1 / H = A / (V s)	1 Gb/Mx = 7.9577·10^7 1/H
Λ	Magn. Conductivity Permeance	H = Henry = V s / A Instead of H also Hy for Henry	1 Mx/Gb = 1.2566·10^{-8} H
μ_0	Abs. Permeability of the Vacuum	= 4π·10^{-7} H / m	= 1 G / Oe

4π = 12.566; 10 / 4π = 0.79577.