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COMMON ENGINEERING UNIT CONVERSIONS - BASIC UNITS

Parameter (Basic Units)	SI Units	English/American Units
mass (m)	kilogram (kg)	pound mass (lbm)
length - distance (L)	meter (m)	foot or inch (ft or in)
time (t)	second (s)	
current (I)	Ampere (A)	

DERIVED UNITS

Parameter (Derived Units)	SI Units	English/American Units
Force - weight (F or W)	Newton (N)	pound or ounce (lbf or oz)
Torque (T)	Newton-meter (Nm)	foot-pound (ft-lb or in-lb)
Work - energy (W or E)	Joule (J)	foot-pound (ft-lb or in-lb
Power (P)	Watt (W)	horsepower (hp or W)
Voltage, EMF (V)	Volt (V)	
Resistance (R)	ohms (Ω)	
Inertia (J)	kilogram-meter^2 (kg-m^2)	inch-pound-second^2 (in-lb-s^2)
plane angle (α, β, γ, etc.)	radian (rad)	degree or radian (deg or rad)
rotation (Θ)	revolution (rev)	
velocity - linear (v)	meter per sec. (m/s)	inch per second (in/s)
acceleration (a)	meter per second^2 (m/s^2)	inch per second^2 (in/s^2)
velocity - angular (ω)	rad per second (rad/s)	
velocity - rotational (ω)	rev per minute (rpm)	
accel - angular (α)	rad per second^2 (rad/s^2)	

BASIC DEFINITIONS & FORMULAE

Parameter Formula	SI Units Formula	English/American Units Formula
Force - accel (F = m * a)	1 N = 1 kg * 1 m / s^2	1 lbf = 1 lbf / (386 in / s^2) * 386 in / s^2
Torque - accel (T = J * α)	1 Nm = 1 kg-m^2 * 1 rad / s^2	1 in-lb = 1 in-bl-s^2 * 1 rad / s^2
Voltage, EMF (V = I * R)	1 V = 1 A * 1 Ω	
Work - Energy (E = F * L)	1 J = 1 N * 1 m	1 in-lb = .113 Nm = .113 Ws = .113 J
Energy - elect (E = V * I * t)	1 J = 1 V * 1 A * 1 s	
Power (P = F * v)	1 W = 1 N * 1 m / s	1 hp = 550 ft-lb / s = 745.7 W
Power (P = T * ω)	1 W = 1 Nm * 1 rad / s	(note: radians have no units)
Power (P = V * I)	1 W = 1 V * 1 A	
Power (P = E / t)	1 W = 1 J / 1 s	
Power (P = I^2 * R)	1 W = 1 A^2 * 1 Ω	

MOTOR CONSTANTS

Parameter Formula	SI Units Formula	English/American Units Formula
Torque const (K_t = T / I)	K_t = Nm / A	K_t = in-lb / A
Voltage const (K_e = V / ω)	K_e = V / (rad / s)	K_e = V / krpm

SERVO MOTOR FORMULAE

Parameter Formula	SI Units Formula	English/American Units Formula
Current Draw (I + T / K_t)	1 A = 1 Nm / (Nm / A)	1 A = 1 in-lb / (in-lb / A)
Voltage Required (V = IR_a + K_e * ω)	1 V = AΩ + V / (rad / s) * (rad / s)	1 V = AΩ + V / (krpm) * (krpm)

CONVERSIONS:

To convert from units of A to units of B, find the value at the intersection of A and B, then multiply your number by this value. *Example: to convert from cm to microns, multiply value in cm by 1.00E+04.*

LENGTH CONVERSION

A (below) B (right)	micron (µm)	mm	cm	m	in	ft
micron (µm)	1	0.001	1.00E-04	1.00E-06	3.94E-05	3.28E-06
mm	1000	1	0.1	0.001	0.03937	3.28E-03
cm	1.00E+04	10	1	0.01	0.3937	0.03281
m	1.00E+06	1000	100	1	39.37	3.281
in	2.54E+04	25.4	2.54	0.0254	1	0.0833
ft	3.05E+05	304.8	30.48	0.3048	12	1

MASS CONVERSION

A (below) B (right)	g	kg	slug	oz_m	lb_m
g	1	0.001	6.85E-05	0.0353	2.20E-03
kg	1000	1	6.85E-02	35.274	2.2046
slug	1.46E+04	14.59	1	514.78	32.17
oz_m	28.35	0.0284	1.94E-03	1	0.0625
lb_m	453.6	0.4536	0.0311	16	1

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FORCE CONVERSION

A (below) B (right)	N	kg_f	g_f	oz_f	lb_f
N	1	0.102	101.97	3.596	0.225
kg_f	9.81	1	1000	35.274	2.205
g_f	9.81E-03	0.001	1	0.0353	2.21E-03
oz_f	0.28	0.0283	28.35	1	0.0625
lb_f	4.45	0.4536	453.6	16	1

TORQUE CONVERSION

A (below) B (right)	g-cm	kg-cm	kg-m	N-m	oz-in	lb-in	lb-ft
g-cm	1	0.001	1.00E-05	9.81E-05	0.014	8.68E-04	7.23E-05
kg-cm	1000	1	0.01	0.098	13.89	0.868	0.072
kg-m	1.00E+05	100	1	9.81	1389	86.8	7.23
N-m	1.02E+04	10.2	0.102	1	141.6	8.85	0.738
oz-in	72.01	0.072	7.21E-04	7.06E-03	1	0.063	5.21E-03
lb-in	1.15E+03	1.152	0.012	0.113	16	1	0.083
lb-ft	1.38E+04	13.83	0.138	1.356	192	12	1

POWER CONVERSION

A (below) B (right)	Watts	kW	Horsepower	in-lb/s	ft-lb/s
Watts	1	100E-03	1.34E-03	8.85	0.74
kW	1000	1	1.34	8851	738
Horsepower	746	0.746	1	6600	550
in-lb/s	0.113	1.13E-04	1.52E-04	1	0.083
ft-lb/s	1.35	1.36E-03	1.82E-03	12	1

LINEAR VELOCITY CONVERSION

A (below) B (right)	mm/s	cm/s	m/s	in/s	ft/s	in/min	ft/min
mm/s	1	0.1	0.001	0.0394	3.28E-03	2.362	0.1968
cm/s	10	1	0.01	0.394	0.0328	23.62	1.97
m/s	1000	100	1	39.37	3.281	2362.2	196.9
in/s	25.4	2.54	0.0254	1	0.083	60	5
ft/s	304.8	30.48	0.3048	12	1	720	60
in/min	0.423	0.0423	4.23E-04	0.0167	1.39E-03	1	0.0833
ft/min	5.08	0.508	5.08E-03	0.2	0.0167	12	1

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ANGULAR VELOCITY CONVERSION

A (below) B (right)	deg/s	rad/s	rpm	rps
deg/s	1	0.0175	0.167	2.78E-03
rad/s	57.3	1	9.55	0.159
rpm	6	0.105	1	0.0167
rps	360	6.28	60	1

ROTARY INERTIA CONVERSION

A (below) B (right)	$g\text{-}cm^2$	$kg\text{-}cm^2$	$g\text{-}cm\text{-}s^2$	$kg\text{-}cm\text{-}s^2$	$kg\text{-}m^2$	$lb\text{-}in\text{-}s^2$	$lb\text{-}ft\text{-}s^2$	$lb\text{-}in^2$	$lb\text{-}ft^2$	$oz\text{-}in^2$	$oz\text{-}in\text{-}s^2$
$g\text{-}cm^2$	1	0.001	0.001	1.02E-06	1.00E-07	8.85E-07	7.38E-08	3.42E-04	2.37E-06	5.50E-03	1.42E-05
$kg\text{-}cm^2$	1000	1	1.02	0.001	0.0001	8.85E-04	7.38E-05	0.342	2.40E-03	5.47	0.014
$g\text{-}cm\text{-}s^2$	981	0.981	1	0.001	9.81E-05	8.68E-04	7.23E-05	0.335	2.30E-03	5.36	0.014
$kg\text{-}cm\text{-}s^2$	9.81E+05	981	1000	1	0.0981	0.868	0.072	335.1	2.33	5362	13.89
$kg\text{-}m^2$	1.00E+07	10000	10190	10.19	1	8.85	0.738	3417.74	23.734	54675	141.6
$lb\text{-}in\text{-}s^2$	1.13E+06	1130	1.15E+03	1.152	0.113	1	0.083	386.1	2.68	6177	16
$lb\text{-}ft\text{-}s^2$	1.36E+07	1.36E+04	1.38E+04	13.83	1.36	12	1	4633	32.2	7.41E+04	192
$lb\text{-}in^2$	2926	2.93	2.98	0.003	2.93E-04	2.60E-03	2.16E-04	1	6.90E-03	16	0.041
$lb\text{-}ft^2$	4.21E+05	421.4	429.7	0.43	0.0421	0.373	0.031	144	1	2304	5.97
$oz\text{-}in^2$	182.9	0.183	0.187	1.87E-04	1.83E-05	1.62E-04	1.35E-05	0.0625	4.34E-04	1	2.60E-03
$oz\text{-}in\text{-}s^2$	7.06E+04	70.62	72	0.072	0.007	0.063	5.20E-03	24.13	0.168	386.1	1