Appendix B
Unit Tables

Mathcad comes with four built-in systems of units and uses the SI system by default. You can select a system of units by choosing **Options** from the **Math** menu as discussed in Chapter 9, "Units and Dimensions."

Once you make a selection, several dozen variable names are automatically reserved for unit definitions unique to whatever system of units you chose. This appendix lists the unit definitions associated with each of the available unit systems.

If you choose a system of units, you should try not to use the predefined variables listed in this appendix as anything but units.

This appendix includes the following sections:

SI units
CGS units
U.S. customary units
MKS units
Alphabetical list of units

SI units

Base units

m (meter), *length* | kg (kilogram), *mass* | s (second), *time*

A (ampere), *current* | K (kelvin), *temperature* | cd (candela), *luminosity*

mole, *substance*

Angular measure

$rad = 1$ | $deg = \frac{\pi}{180} \cdot rad$ | $str = 1 \cdot str$

Length

$cm = 0.01 \cdot m$ | $km = 1000 \cdot m$ | $mm = 0.001 \cdot m$

$ft = 0.3048 \cdot m$ | $in = 2.54 \cdot cm$ | $yd = 3 \cdot ft$

$mi = 5280 \cdot ft$

Mass

$gm = 10^{-3} \cdot kg$ | $tonne = 1000 \cdot kg$ | $lb = 453.59237 \cdot gm$

$mg = 10^{-3} \cdot gm$ | $ton = 2000 \cdot lb$ | $slug = 32.174 \cdot lb$

$oz = \frac{lb}{16}$

Time

$min = 60 \cdot s$ | $hr = 3600 \cdot s$ | $day = 24 \cdot hr$

$yr = 365.2422 \cdot day$

Area, Volume

$hectare = 10^4 \cdot m^2$ | $acre = 4840 \cdot yd^2$ | $L = 0.001 \cdot m^3$

$mL = 10^{-3} \cdot L$ | $fl\_oz = 29.57353 \cdot cm^3$ | $gal = 128 \cdot fl\_oz$

Velocity, Acceleration

$mph = \frac{mi}{hr}$ | $kph = \frac{km}{hr}$ | $g = 9.80665 \cdot \frac{m}{s^2}$

Force, Energy, Power

$N = kg \cdot \frac{m}{s^2}$ | $dyne = 10^{-5} \cdot N$ | $lbf = g \cdot lb$

$kgf = g \cdot kg$ | $J = N \cdot m$ | $erg = 10^{-7} \cdot J$

$cal = 4.1868 \cdot J$ | $kcal = 1000 \cdot cal$ | $BTU = 1.05506 \cdot 10^3 \cdot J$

$W = \frac{J}{s}$ | $kW = 1000 \cdot W$ | $hp = 550 \cdot \frac{ft \cdot lbf}{s}$

Pressure, Viscosity

$Pa = \frac{N}{m^2}$ $psi = \frac{lbf}{in^2}$ $atm = 1.01325 \cdot 10^5 \cdot Pa$

$in\_Hg = 3.38638 \cdot 10^3 \cdot Pa$ $torr = 1.33322 \cdot 10^2 \cdot Pa$ $stokes = 10^{-4} \cdot \frac{m^2}{s}$

$poise = 0.1 \cdot Pa \cdot s$

Electrical

$C = A \cdot s$ $V = \frac{J}{C}$ $mV = 10^{-3} \cdot V$

$KV = 10^3 \cdot V$ $\Omega = \frac{V}{A}$ $k\Omega = 10^3 \cdot \Omega$

$M\Omega = 10^6 \cdot \Omega$ $S = \frac{1}{\Omega}$ $mho = \frac{1}{\Omega}$

$H = \frac{V}{A} \cdot s$ $\mu H = 10^{-6} \cdot H$ $mH = 10^{-3} \cdot H$

$\mu A = 10^{-6} \cdot A$ $mA = 10^{-3} \cdot A$ $kA = 10^3 \cdot A$

$F = \frac{C}{V}$ $pF = 10^{-12} \cdot F$ $nF = 10^{-9} \cdot F$

$\mu F = 10^{-6} \cdot F$ $Wb = V \cdot s$

$Oe = \frac{1000}{4 \cdot \pi} \cdot \frac{A}{m}$ $T = \frac{Wb}{m^2}$ $gauss = 10^{-4} \cdot T$

Frequency, Activity

$Hz = \frac{1}{s}$ $kHz = 10^3 \cdot Hz$ $MHz = 10^6 \cdot Hz$

$GHz = 10^9 \cdot Hz$ $Bq = \frac{1}{s}$

Temperature

$R = 0.556 \cdot K$

Dose

$Gy = \frac{J}{kg}$ $Sv = \frac{J}{kg}$

Luminous flux, illuminance

$lm = cd \cdot str$ $lx = \frac{cd \cdot str}{m^2}$

CGS units

Base units

cm (centimeter), *length*

gm (gram), *mass*

sec (second), *time*

coul (coulomb), *charge*

K (kelvin), *temperature*

Angular measure

$rad = 1$

$deg = \frac{\pi}{180} \cdot rad$

Length

$m = 100 \cdot cm$

$km = 1000 \cdot m$

$mm = 0.1 \cdot cm$

$ft = 30.48 \cdot cm$

$in = 2.54 \cdot cm$

$yd = 3 \cdot ft$

$mi = 5280 \cdot ft$

Mass

$kg = 1000 \cdot gm$

$tonne = 1000 \cdot kg$

$lb = 453.59237 \cdot gm$

$mg = 10^{-3} \cdot gm$

$ton = 2000 \cdot lb$

$slug = 32.174 \cdot lb$

$oz = \frac{lb}{16}$

Time

$min = 60 \cdot sec$

$hr = 3600 \cdot sec$

$day = 24 \cdot hr$

$yr = 365.2422 \cdot day$

Area, Volume

$hectare = 10^4 \cdot m^2$

$acre = 4840 \cdot yd^2$

$liter = 1000 \cdot cm^3$

$mL = cm^3$

$fl\_oz = 29.57353 \cdot cm^3$

$gal = 128 \cdot fl\_oz$

Velocity, Acceleration

$mph = \frac{mi}{hr}$

$kph = \frac{km}{hr}$

$g = 980.665 \cdot \frac{cm}{sec^2}$

$c = 2.997925 \cdot 10^{10} \cdot \frac{cm}{sec}$

$c\_ = c \cdot \frac{sec}{m}$

Force, Energy, Power

$dyne = gm \cdot \frac{cm}{sec^2}$ $newton = 10^5 \cdot dyne$ $lbf = g \cdot lb$

$kgf = g \cdot kg$ $erg = dyne \cdot cm$ $joule = 10^7 \cdot erg$

$cal = 4.1868 \cdot 10^7 \cdot erg$ $BTU = 1.05506 \cdot 10^{10} \cdot erg$ $kcal = 1000 \cdot cal$

$watt = \frac{joule}{sec}$ $kW = 1000 \cdot watt$ $hp = 550 \cdot \frac{ft \cdot lbf}{sec}$

Pressure, Viscosity

$Pa = 10 \cdot \frac{dyne}{cm^2}$ $psi = \frac{lbf}{in^2}$ $atm = 1.01325 \cdot 10^5 \cdot Pa$

$in\_Hg = 3.38638 \cdot 10^3 \cdot Pa$ $torr = 1.33322 \cdot 10^2 \cdot Pa$ $stokes = \frac{cm^2}{sec}$

$poise = 0.1 \cdot Pa \cdot sec$

Electrical

These are CGS-esu units, based only on mass, length, and time. The “stat” units are defined in terms of dyne, cm, and sec.

$statamp = dyne^{0.5} \cdot cm \cdot sec^{-1}$ $statcoul = dyne^{0.5} \cdot cm$ $statvolt = dyne^{0.5}$

$statohm = sec \cdot cm^{-1}$ $statsiemens = cm \cdot sec^{-1}$ $statfarad = cm$

$statweber = dyne^{0.5} \cdot cm$ $stathenry = sec^2 \cdot cm^{-1}$ $statesla = dyne^{0.5} \cdot cm \cdot sec^{-2}$

Frequency

$Hz = \frac{1}{sec}$ $KHz = 10^3 \cdot Hz$ $MHz = 10^6 \cdot Hz$

$GHz = 10^9 \cdot Hz$

Temperature

$R = 0.556 \cdot K$

Conversions to SI Units

$amp = \frac{c}{10} \cdot statamp$ $volt = \frac{watt}{amp}$ $ohm = \frac{volt}{amp}$

$coul = amp \cdot sec$ $farad = \frac{coul}{volt}$ $henry = volt \cdot \frac{sec}{amp}$

U.S. customary units

Base units

ft (foot), *length* | lb (pound), *mass* | sec (second), *time*

coul (coulomb), *charge* | K (kelvin), *temperature*

Angular measure

$rad = 1$ | $deg = \frac{\pi}{180} \cdot rad$

Length

$in = \frac{ft}{12}$ | $m = \frac{ft}{0.3048}$ | $yd = 3 \cdot ft$

$cm = 0.01 \cdot m$ | $mi = 5280 \cdot ft$ | $km = 1000 \cdot m$

$mm = 0.001 \cdot m$

Mass

$slug = 32.174 \cdot lb$ | $oz = \frac{lb}{16}$ | $ton = 2000 \cdot lb$

$kg = \frac{lb}{0.45359237}$ | $tonne = 1000 \cdot kg$ | $gm = 10^{-3} \cdot kg$

$mg = 10^{-3} \cdot gm$

Time

$min = 60 \cdot sec$ | $hr = 3600 \cdot sec$ | $day = 24 \cdot hr$

$yr = 365.2422 \cdot day$

Area, Volume

$acre = 4840 \cdot yd^2$ | $hectare = 10^4 \cdot m^2$ | $fl\_oz = 29.57353 \cdot cm^3$

$liter = (0.1 \cdot m)^2$ | $mL = 10^{-3} \cdot liter$ | $gal = 128 \cdot fl\_oz$

Velocity, Acceleration

$mph = \frac{mi}{hr}$ | $kph = \frac{km}{hr}$ | $g = 32.174 \cdot \frac{ft}{sec^2}$

Force, Energy, Power

$lbf = g \cdot lb$ | $newton = kg \cdot \frac{m}{sec^2}$ | $dyne = 10^{-5} \cdot newton$

$kgf = g \cdot kg$ | $joule = newton \cdot m$ | $erg = 10^{-7} \cdot joule$

$cal = 4.1868 \cdot joule$ | $kcal = 1000 \cdot cal$ | $BTU = 1.05506 \cdot 10^3 \cdot joule$

$watt = \frac{joule}{sec}$ | $hp = 550 \cdot \frac{ft \cdot lbf}{sec}$ | $kW = 1000 \cdot watt$

Pressure, Viscosity

$psi = \frac{lbf}{in^2}$ $Pa = \frac{newton}{m^2}$ $atm = 1.01325 \cdot 10^5 \cdot Pa$

$in\_Hg = 3.38638 \cdot 10^3 \cdot Pa$ $torr = 1.33322 \cdot 10^2 \cdot Pa$ $stokes = \frac{cm^2}{sec}$

$poise = 0.1 \cdot Pa \cdot sec$

Electrical

$volt = \frac{watt}{amp}$ $mV = 10^{-3} \cdot volt$ $KV = 10^3 \cdot volt$

$ohm = \frac{volt}{amp}$ $mho = \frac{1}{ohm}$ $siemens = \frac{1}{ohm}$

$\Omega = ohm$ $K\Omega = 10^3 \cdot ohm$ $M\Omega = 10^6 \cdot ohm$

$henry = \frac{weber}{amp}$ $\mu H = 10^{-6} \cdot henry$ $mH = 10^{-3} \cdot henry$

$amp = \frac{coul}{sec}$ $\mu A = 10^{-6} \cdot amp$ $mA = 10^{-3} \cdot amp$

$KA = 10^3 \cdot amp$ $farad = \frac{coul}{volt}$ $pF = 10^{-12} \cdot farad$

$nF = 10^{-9} \cdot farad$ $\mu F = 10^{-6} \cdot farad$ $weber = volt \cdot sec$

$oersted = \frac{1000}{4 \cdot \pi} \cdot \frac{amp}{m}$ $tesla = \frac{weber}{m^2}$ $gauss = 10^{-4} \cdot tesla$

Frequency

$Hz = \frac{1}{sec}$ $KHz = 10^3 \cdot Hz$ $MHz = 10^6 \cdot Hz$

$GHz = 10^9 \cdot Hz$

Temperature

$R = 0.556 \cdot K$

MKS units

Base units

m (meter), *length* | kg (kilogram), *mass* | sec (second), *time*

coul (coulomb), *charge* | K (kelvin), *temperature*

Angular measure

$rad = 1$ | $deg = \frac{\pi}{180} \cdot rad$

Length

$cm = 0.01 \cdot m$ | $km = 1000 \cdot m$ | $mm = 0.001 \cdot m$

$ft = 0.3048 \cdot m$ | $in = 2.54 \cdot cm$ | $yd = 3 \cdot ft$

$mi = 5280 \cdot ft$

Mass

$gm = 10^{-3} \cdot kg$ | $tonne = 1000 \cdot kg$ | $lb = 453.59237 \cdot gm$

$mg = 10^{-3} \cdot gm$ | $ton = 2000 \cdot lb$ | $slug = 32.174 \cdot lb$

$oz = \frac{lb}{16}$

Time

$min = 60 \cdot sec$ | $hr = 3600 \cdot sec$ | $day = 24 \cdot hr$

$yr = 365.2422 \cdot day$

Area, Volume

$hectare = 10^4 \cdot m^2$ | $acre = 4840 \cdot yd^2$ | $liter = (0.1 \cdot m)^3$

$mL = 10^{-3} \cdot liter$ | $fl\_oz = 29.57353 \cdot cm^3$ | $gal = 128 \cdot fl\_oz$

Velocity, Acceleration

$mph = \frac{mi}{hr}$ | $kph = \frac{km}{hr}$ | $g = 9.80665 \cdot \frac{m}{sec^2}$

Force, Energy, Power

$newton = kg \cdot \frac{m}{sec^2}$ | $dyne = 10^{-5} \cdot newton$ | $lbf = g \cdot lb$

$kgf = g \cdot kg$ | $joule = newton \cdot m$ | $erg = 10^{-7} \cdot joule$

$cal = 4.1868 \cdot joule$ | $kcal = 1000 \cdot cal$ | $BTU = 1.05506 \cdot 10^3 \cdot joule$

$watt = \frac{joule}{sec}$ | $kW = 1000 \cdot watt$ | $hp = 550 \cdot \frac{ft \cdot lbf}{sec}$

Pressure, Viscosity

$Pa = \frac{newton}{m^2}$ $psi = \frac{lbf}{in^2}$ $atm = 1.01325 \cdot 10^5 \cdot Pa$

$in\_Hg = 3.38638 \cdot 10^3 \cdot Pa$ $torr = 1.33322 \cdot 10^2 \cdot Pa$ $stokes = 10^{-4} \cdot \frac{m^2}{sec}$

$poise = 0.1 \cdot Pa \cdot sec$

Electrical

$volt = \frac{watt}{amp}$ $mV = 10^{-3} \cdot volt$ $KV = 10^3 \cdot volt$

$ohm = \frac{volt}{amp}$ $mho = \frac{1}{ohm}$ $siemens = \frac{1}{ohm}$

$\Omega = ohm$ $K\Omega = 10^3 \cdot ohm$ $M\Omega = 10^6 \cdot ohm$

$henry = \frac{weber}{amp}$ $\mu H = 10^{-6} \cdot henry$ $mH = 10^{-3} \cdot henry$

$amp = \frac{coul}{sec}$ $\mu A = 10^{-6} \cdot amp$ $mA = 10^{-3} \cdot amp$

$KA = 10^3 \cdot amp$ $farad = \frac{coul}{volt}$ $pF = 10^{-12} \cdot farad$

$nF = 10^{-9} \cdot farad$ $\mu F = 10^{-6} \cdot farad$ $weber = volt \cdot sec$

$oersted = \frac{1000}{4 \cdot \pi} \cdot \frac{amp}{m}$ $tesla = \frac{weber}{m^2}$ $gauss = 10^{-4} \cdot tesla$

Frequency

$Hz = \frac{1}{sec}$ $KHz = 10^3 \cdot Hz$ $MHz = 10^6 \cdot Hz$

$GHz = 10^9 \cdot Hz$

Temperature

$R = 0.556 \cdot K$

Alphabetical list of units

Unless otherwise specified, all units are available in the SI, CGS, U.S., and MKS systems.

Unit	Measures...	Available in . . .
A	current	SI
acre	area	
amp	current	
atm	pressure	
Bq	activity	
BTU	energy	
c	velocity	CGS
c_	dimensionless	CGS
C	charge	SI
cal	energy	
cd	luminous intensity	
cm	length	
coul	charge	
day	time	
deg	angle	
dyne	force	
erg	energy	
F	capacitance	SI
farad	capacitance	
fl_oz	volume	
ft	length	
g	acceleration	
gal	volume	
gauss	magnetic flux density	SI, U.S., MKS
GHz	frequency	
gm	mass	
Gy	dose	
H	inductance	SI
hectare	area	
henry	inductance	
hp	power	

Unit	Measures...	Available in . . .
hr	time	
Hz	frequency	
in	length	
in_Hg	pressure	
J	energy	SI
joule	energy	
K	temperature	
kA	current	SI
KA	current	
kcal	energy	
kg	mass	
kgf	force	
kHz	frequency	SI
KHz	frequency	
km	length	
kph	velocity	
kV	potential	SI
KV	potential	
kW	power	
kΩ	resistance	SI
L	volume	SI
lb	mass	
lbf	force	
liter	volume	
lm	luminous flux	
lx	illuminance	
µA	current	
µF	capacitance	
µH	inductance	
m	length	
MΩ	resistance	
mA	current	
mg	mass	
mH	inductance	
mho	conductance	

Unit	Measures...	Available in . . .
MHz	frequency	
mi	length	
min	time	
mL	volume	
mm	length	
mole	substance	
mph	velocity	
mV	potential	
N	force	SI
newton	force	
nF	capacitance	
Oe	magnetic field strength	SI
oersted	magnetic field strength	MKS, U.S., SI
ohm	resistance	
oz	mass	
Pa	pressure	
pF	capacitance	
poise	viscosity (dynamic)	
psi	pressure	
R	temperature	
rad	angle	
s	time	SI
S	conductance	SI
sec	time	
siemens	conductance	MKS, U.S., SI
slug	mass	
statamp	current	CGS
statcoul	charge	CGS
statfarad	capacitance	CGS
stathenry	inductance	CGS
statohm	resistance	CGS
statsiemens	conductance	CGS
stattesla	magnetic flux density	CGS
statvolt	potential	CGS
statweber	magnetic flux	CGS

Unit	Measures...	Available in . . .
stokes	viscosity (kinematic)	
str	angle	
Sv	dose	
T	magnetic flux density	SI
tesla	magnetic flux density	MKS, U.S., SI
ton	mass	
tonne	mass	
torr	pressure	
V	potential	SI
volt	potential	
Ω	resistance	
W	power	SI
watt	power	
Wb	magnetic flux	SI
weber	magnetic flux	MKS, U.S., SI
yd	length	
yr	time	

Note: For certain units that have many different definitions—such as hp, cal, BTU, and Hz—Mathcad adopts one common definition but allows you to choose from among several alternatives in the Insert Unit dialog box.