Contents

Metrication

This software (SICon) is intended to give some guidance in applying the International System of Units, also referred to as the modernized metric system. This system was developed and is maintained by the General Conference on Weights and Measures (acronym - CGPM, which comes from the French name Conference Generale des Poids et Mesures). The name International System of Units and the accepted abbreviation SI were adopted by the Eleventh CGPM in 1960. This software is intended to aid in the conversion from non-SI to SI units and vice versa. It is possible to make over **30,000** different conversions with SICon.

There are two methods of making a conversion to metric, hard and soft. A soft conversion is an exact conversion from one system to another. For instance, a soft conversion for 12 feet would be exactly 3.658 metres. A hard conversion, however, is a more approximate conversion. For instance, a hard conversion for 12 feet could be 3.6 metres. It may seem that the usage of the terms hard and soft are reversed, but that's the way it is.

Conversion Class

SICon will perform many different types of conversions. This selection window allows the user to narrow the conversion selection field by picking the general classification of the conversion to be made. For instance, if you know that you want to make a speed conversion, you would first make a selection for "Speed" or "Velocity" in this window. You will then be presented with all of the available 'speed' conversions in the next window.

Some of the classes shown in the Conversion Class window are duplications. For instance, selecting Bending Moment will give a Convert From . . . dialog window with the same list of units as selecting the Torque per Unit Length class. This is done because some classes are commonly known by different descriptive titles and duplicating the classes makes it easier for the user who may not be familiar with one form of the term.

The user first selects a class of conversion from this window and the CONVERT FROM. . dialog window appears so the unit to convert from can be selected. Then the CONVERT TO . . . dialog window appears to allow selection of the unit to convert to.

After selection from the CONVERT TO . . . dialog window, the CALCULATION dialog window appears to allow entry of the value to convert.

The Conversion Classes are:

Acceleration
Angle
Area
Bending Moment
Capacity
Concentration
Density
Electricity/Magnetism
Energy
Energy per Unit Area Time
Flow
Force
Force per Unit Area
Force per Unit Length
Heat
Length
Light
Mass
Mass per Unit Area
Mass per Unit Capacity
Mass per Unit Length
Mass per Unit Time
Mass per Unit Volume

Calculation Window

The calculation dialog window appears after the CONVERT FROM . . . unit has been selected.   This window contains a number of elements.

At the upper left part of the window is the edit window which allows for entry of the actual numerical value to convert from.   Just below this edit window is the unit description for the unit that was selected in the CONVERT FROM . . .   selection window.

At the lower part of the window is another edit type window which displays the converted value.   Just below this edit window is the unit description for the unit that was selected in the CONVERT TO . . .   selection window.

At the lower edge of the calculation dialog window are five buttons.   The **Print** button prints the result of the conversion shown in the window to the Windows default printer.   If the printer is not ready to print, you will be presented with a dialog window which will allow you to correct the problem and try again or to cancel the print job.   The **Clear** button is used to erase the value in the edit window. Once the value is erased, you may enter a new value for conversion.   Also, double-clicking the value shown in the entry window will select (highlight) the value shown there.   If you begin to enter a new value, the old value will be automatically cleared.   The **Exit** button exits the dialog immediately and returns to the Conversion Class selection window.   The **Copy** button copies the converted result to the clipboard and to the file CONVERT.TXT.   The **Help** button takes the user to this help system.

Convert From/To . . . Dialog Window

The "CONVERT FROM dialog window prompts for possible units from which to convert.   The entries shown in this list depend upon which Conversion Class was selected in the first window.   This window should be displayed in the color cyan.

Immediately after making a selection from this window, the CONVERT TO . . . dialog window will appear. The "CONVERT TO" window gives possible units to convert the units that were selected in the CONVERT FROM . . . dialog window .   The units displayed in   this window will depend upon which units you have selected to convert from.   This window should be displayed in the color aqua.

This window will often contain fewer units to select from because the unit that was selected in the CONVERT FROM . . . dialog window will sometimes limit the possibilities for the conversion.

Convert From . . . Dialog Window

The "CONVERT FROM" dialog window prompts for possible units from which to convert.   The entries shown in this list depend upon which Conversion Class was selected in the first window.   This window should be displayed in the color cyan.

Convert To . . . Dialog Window

Immediately after making a selection from the CONVERT FROM . . . dialog window window, the CONVERT TO . . . dialog window will appear. The "CONVERT TO" window gives possible units that the units that were selected in the CONVERT FROM . . . dialog window may be converted to. The units displayed in this window will depend upon which units you have selected to convert from. This window should be displayed in the color aqua.

This window will often contain fewer units to select from because the unit that was selected in the CONVERT FROM . . . dialog window will sometimes limit the possibilities for the conversion.

Classes of Units

SI units are grouped into three general classes:

- Base Units
- Supplementary Units
- Derived Units

Base Units

The Base Units in SI are based on seven well-defined units that, by agreement, are regarded as dimensionally independent. The Base Units are shown in the following table:

Quantity	Unit	Symbol
amount of chemical substance	mole	mol
electric current	ampere	A
length	metre	m
luminous intensity	candela	cd
mass	kilogram	kg
thermodynamic temperature	kelvin	K
time	second	s

Supplementary Units

The Supplementary Units class consists of just two units; the radian and the steradian are considered to be dimensionless Derived Units . This is because the plane angle is usually expressed as a ratio between two lengths and the solid angle is usually expressed as a ratio between an area and the square of length. The radian and the steradian may be used or omitted from expressions for Derived Units. The Supplementary Units are shown in the following table:

Quantity	Unit	Symbol
plane angle	radian	rad
solid angle	steradian	sr

Derived Units

The Derived Units are formed by combining the Base Units , the Supplementary Units , and other Derived Units using algebraic relations to link the quantities. The symbols used for the Derived Units are obtained by using the standard mathematical operator signs for multiplication, division, and exponents. For example, the SI unit for Density is kilogram per cubic metre (kg/m^3). There are a number of Derived Units that have special names and symbols. These 'special' units have been approved by the CGPM and are shown in the following table:

Quantity	Unit	Symbol
absorbed dose	gray	Gy
activity (radionuclide)	becquerel	Bq
capacitance (electric)	farad	F
Celsius temperature	Celsius	ºC
conductance (electric)	siemens	S
dose equivalent	sievert	Sv
electric potential (EMF)	volt	V
energy/work, amount of heat	joule	J
force	newton	N
frequency	hertz	Hz
illuminance	lux	lx
inductance	henry	H
luminous flux	lumen	lm
magnetic flux	weber	Wb
magnetic flux density	tesla	T
power, radiant flux	watt	W
pressure/stress	pascal	Pa
quant. of electricity	coulomb	C
resistance (electric)	ohm	

SI Prefixes

The SI prefixes are used to indicate orders of magnitude. Using the prefixes eliminates leading zeros and non-significant digits in decimal fractions. Also, prefixes can often be used to eliminate the use of E-notation as is used in mathematical computation. For example,

98000 mA = 98 A or
9.80E+0004 m = 98 km or

The following table lists the accepted SI prefixes to be used to create names and symbols of the decimal multiples of the SI units (except for kilogram). These prefixes (or symbols) are to be used by attaching the prefix directly to the front of the unit's name or symbol to form multiples of the units. It should be noted that it is common practice to refer to multiples of the SI units, formed by the use of prefixes, as SI Units . Strictly speaking, they should be referred to as "multiples of SI units ".

Multiplication Factor	Prefix	Symbol
0.000 000 000 000 000 001 (E-18)	atto	a
0.000 000 000 000 001 (E-15)	femto	f
0.000 000 000 001 (E-12)	pico	p
0.000 000 001 (E-9)	nano	n
0.000 001 (E-6)	micro	µ
0.001 (E-3)	milli	m
0.01 (E-2)	centi	c
0.1 (E-1)	deci	d
10 (E+1)	deka	da
100 (E+2)	hecto	h
1 000 (E+3)	kilo	k
1 000 000 (E+6)	mega	M
1 000 000 000 (E+9)	giga	G
1 000 000 000 000 (E+12)	tera	T
1 000 000 000 000 000 (E+15)	peta	P
1 000 000 000 000 000 000 (E+18)	exa	E

The kilogram (the SI Unit of mass) is the only SI Unit whose name contains a prefix, and this was done by the CGPM purely for historical reasons. The decimal multiple of the unit of mass is created by attaching the appropriate prefix to the word gram (g).

Rules for Writing

A number of rules have been established for writing SI Unit names and symbols.

1) Unit symbols should not be followed by a period unless they come at the end of a sentence.

2) Unit symbols should never be pluralized.

3) The unit symbols are always written in lower case unless the unit name comes from a proper name, in which case the first letter of the symbol should be capitalized, as in Pa for Pascal. The exception is the symbol for litre, L.

4) Always write 123 cm, NOT 123cm. In other words, leave a space between the numerical value and the symbol. An exception is made when writing the symbols for degree Celsius, and degree, minute, and second of plane angle. Write 123ºC NOT 123 ºC.

5) Do not use a space between a unit symbol and its prefix. In other words, write km NOT k m.

6) Use symbols, not abbreviations, e.g., write ºC NOT deg C.

7) When a quantity written as a number and a unit is used as an adjective, use a hyphen between the number and the unit symbol. For instance, write '40-cm length of rope' or 'two-litre pail'.

Using SICon

SICon is easy to use.   When you first start the program, you are presented with a window titled 'Conversion Class' .   This window is used to enter the general class of conversion that you wish to make.   For instance, if you wish to convert centimetres to feet, you would select the 'Length' item.   A selection is made by either using the arrow keys to move the highlight bar to the item you wish to select and pressing <**enter**>, or by clicking on the item with the left mouse button. Anytime you are presented with a pick list window, selections are made in the same manner.

Once you have selected a Conversion Class , you will be presented with a pick window titled 'CONVERT FROM . . . which shows possible conversions for that class. Select one of the units shown in this window.

You will then be presented with a window titled 'CONVERT TO . . . .   This window contains the possible units that the unit first selected may be converted to. Depending upon what unit was chosen in the CONVERT FROM . . . window, the CONVERT TO . . . window will show only the valid units that you may convert to. Select one of the units shown in this window.

You are next presented with the Conversion dialog window in which the conversion takes place.   A value may be entered in the edit field in the upper left of this window.   If the blinking cursor is not in the edit window, click in the window with the left mouse button or press the **Tab** key repeatedly until it is.   Once the cursor is in the edit window, the value to be converted may be entered.   As each digit of the value is entered, the result window in the lower portion of the window will be updated with the result of the conversion.   If you make a mistake entering the value, backspace and enter the correct value.   Notice that the unit chosen to convert from is shown just below the edit window and the unit chosen to convert to is shown just below the result window.

At any time that you wish to clear the value entered in the edit window, press the **Clear** button.   This action erases the value in the edit window.   You may then enter a new value for conversion.   Alternatively, by double-clicking on the value shown in the edit window, the value can be *selected*.   Once *selected*, if you begin entering a new value, the old value will be automatically deleted and the new value will take its place.

The result of any unit conversion can be sent to the Windows default printer by clicking on the **Print** button.   Even after exiting the Calculation window, the result of the most recent conversion can be printed by clicking on the **Print** speed menu button at the upper left of the main window.

At any time you may return to the Conversion Class window   Simply press the **Exit** button to exit the calculation dialog window and return to the Conversion Class window.

Why Metric?

The decimal system of units was originally developed in the 16th century. Then, in 1790, the French Academy of Sciences worked out a system that would be suitable for the entire world. The system, based on the metre for length and the gram for mass, was adopted in commerce and, eventually, it was also adopted in the scientific community. The standardization of weights and measures continued over the years and eventually the system was expanded to include a unit for time (the second) in 1881. The ampere was added in 1935 to include a unit for electrical current. The degree Kelvin as a unit of temperature and the candella as a unit of luminous intensity were added in 1954. In 1960 the system was officially given the title, International System of Units, which is abbreviated "SI" in all languages. In 1971, the seventh base unit, the mole, was added. The SI system has evolved into a rationalized system of seven base units for which precise definitions, along with symbols and names, have been established.

The first questions asked by many people when they hear that the United States is going to metric are, "Why?", "Do we have to?", or "Says who?". This country is 'going metric' primarily because the U.S. Congress has decided that it is time for us to do so. Nearly all other industrialized countries have already made the commitment to convert or are already converted to the metric system. This puts the U.S. at a disadvantage in the world market. Congress has told larger government agencies, such as the Department of Transportation, to be prepared to accept bids only in metric by 1996. This order appears in the Omnibus Trade Act of 1991. Since the Department of Transportation doles out many billions of dollars in federal aid, this has the effect of forcing a myriad of other agencies and corporations to make the conversion to metric also. The net effect is cascading, forcing more and more companies to convert as orders move down through the supply chain.

Will the conversion be easy? That depends upon what business you are in. An engineer or a chemist, for instance, won't have a very difficult time making the conversion because they have already been trained in the use of metric. For a carpenter or a plumber, the transition will be more difficult. The same goes for and industry faced with converting to metric. It will be much easier for an industry that already has a long track record of supplying to foreign markets to make the transition; many have already done so in order to remain competitive in world markets. It will be much more difficult for the lumber industry, for instance, to convert. Lumber products have traditionally been marketed in the United States using the Imperial (English) system, so the conversion in this industry will require a reeducation of many people down through the supply chain. How about real estate industry? Since the United States has been keeping property records, in the form of abstracts, for example, the surveyor's measure has been in Imperial (English units). Do we attempt to go back and change all of this data over to metric? Some of these questions remain to be answered. It has been said that a complete conversion in a society will take at least one generation, so our adoption of the metric system won't come quickly. However, it WILL come. The METRIC software will help to ease the transition for anyone faced with making the change.

Most agree that the metric system is far superior to the Imperial (English) system (commonly referred to as the inch-pound system).   One of the most obvious benefits is the absence of fractions in the metric system.   This is one of the reasons that most industrialized countries have already converted to metric.   The metric system is based on tens; a kilometre is 1000 metres, a metre is 100 centimetres, a centimetre is 10 millimetres.   Unlike teaspoons and tons, its volumes and weights can be related to one another.   A liter of water weighs a kilogram.   The metric temperature scale, Celsius, sets the freezing point of water at 0 degrees and the boiling point at 100 degrees.

As a final note, there is some misunderstanding as to the proper term to use when referring to making the change to the metric system.   The act of making the conversion is called 'metrication', NOT metrification, as is often used.

Accuracy?

Most of the conversion factors used in SICon use seven significant figures. This must be kept in mind when using the results of a conversion. Often, the results are given in the Calculation dialog window to more significant figures that this. The user must decide what is required in the result and round to only as many significant figures as is mathematically correct. The conversion factors used in SICon were drawn from a number of sources and are the latest that the author could obtain. Keep in mind that, in some cases, there is some disagreement among the experts in the various fields covered by the Conversion Classes as to the exact factor to be applied for a given conversion.

When results are shown, SICon uses fixed format (standard notation) to convert to the shortest possible decimal string. If the converted value exceeds these limits, the result will be shown in scientific notation or E-notation. Trailing zeros are removed from the resulting string, and a decimal point appears only if necessary. The resulting string uses fixed point format if the number of digits to the left of the decimal point in the value is less than or equal to 18 places, and if the value is greater than or equal to 0.00001. Otherwise the resulting value uses scientific format. The minimum number of digits in the exponent is four.

SICon will not convert from or to numerical values greater than 1E+450 or less than -1E450. If you attempt to enter a value for conversion that do not meet these requirements, you will be presented with an error message and the conversion will not be completed. Also, if the value that you enter in the edit window converts to a value that does not fall within these limits, you will be presented with an error message and the conversion will not take place.

SI Units

AREA

The square metre (m^2) is the SI Unit of area. When referring to large land masses or bodies of water, it is acceptable to use the hectare (ha) or square kilometre (km^2).

ENERGY

The SI Unit of energy is the joule (J).

MASS

The Unit of mass is the kilogram (kg). It is acceptable to use this unit or one of its related units formed as a multiple of the unit gram (g) by attaching one of the multiplier prefixes. Instead of referring to the 'ton', as has been common practice, it is preferred to express these quantities of mass as the megagram (Mg). It is also acceptable to use the term metric ton, as long as its use is restricted to commercial references.

PLANE ANGLE

The SI Unit for plane angle is the radian. It is acceptable to use the degree or its multiples if the radian is not convenient. The use of the second and minute is not recommended.

PRESSURE/STRESS

The SI Unit of pressure or stress is the pascal (Pa).

TIME

The SI Unit of time is the second and should be used if it's at all practical to do so. This is particularly true when used in a technical context. Some judgment is required when this unit is used in referring to times that relate to life style or to the calendar. In these cases it may be advisable to use weeks, days, hours, or minutes rather than second. A good example would be when referring to the speed limit as kilometres per hour.

VOLUME

The SI Unit of volume is the cubic metre (m^3). The cubic metre or one of its multiples formed by the addition of a prefix is preferred (for instance, cubic millimetre [mm^3]). The cubic decimetre (dm^3) has been assigned the 'special' name of litre (L) by the CGPM. The litre should be used only for volumetric capacity, the measure of gasses and liquids, and for dry measure. In addition, only the prefixes milli- or micro- are allowed with litre.

Acceleration

Acceleration defines the time rate of change of velocity in speed or direction. Also defined as the rate of change in velocity (speed), either increase (positive acceleration) or decrease (negative acceleration). The International System of Units (SI) derived unit for acceleration is metre per second squared (m/s^2).

Angle

Angle defines the ratio of the arc and the radius of the arc. The units of the angle are the radian, which is the angle subtended by an arc that is equal to the radius, and the degree, which is 1/360th part of the total angle about a point. The International System of Units (SI) standard unit for angle is the radian (rad).

SYNONYMS: phase

Area

Area is defined as the total outside surface of an object, as measured in square units. The International System of Units (SI) standard unit for area is the square metre (m^2). The hectare (ha) is a special designation for the square hectometre (hm,). Land masses and large areas of water are generally expressed as either hectares (ha) or as square kilometres (km^2).

Bending Moment

Bending Moment is defined as the product of a force and the perpendicular distance to a turning axis. The International System of Units (SI) unit for bending moment is the Newton metre (Nm). The SI unit for bending moment per unit length is the Newton metre per metre (Nm/m).

SYNONYMS: torque, force moment

Capacity

Capacity is defined as the amount of space occupied in three dimensions; cubic contents or cubic magnitude. The International System of Units (SI) standard unit for capacity is the cubic metre (m^3).

SYNONYMS: volume, bulk

Concentration

Concentration is defined as the amount of substance in weight, moles or equivalents contained in a unit volume. The International System of Units (SI) derived unit for mass per unit volume is the kilogram per cubic metre (kg/mƒ). Concentration is a more loosely defined quantity which can include various other measures, such as parts per million (ppm), percent (%), moles per litre, etc.

SYNONYMS: mass per unit volume, density, moles per litre, percent, ppm, parts per million

Density

Density is defined as the concentration of matter, measured by the mass per unit volume.   The International System of Units (SI) derived unit for density is the kilogram per cubic metre (kg/m^3).

The specific gravity, often confused with density, is actually defined as the ratio of the mass of a body compared to the mass of an equal volume of water at 4ºC or another specified temperature.   Specific gravity is unitless.

SYNONYMS: mass capacity , concentration, mass per unit volume , mass per unit capacity

Electricity/Magnetism

Electricity is a loosely defined term that, in general, denotes a form of energy generated by friction, induction, or chemical change and having chemical, magnetic, and radiant effects. The base International System of Units (SI) standard unit for electricity is the ampere. Others shown are derived SI units. Electrical energy is subdivided into the following:

Ampere -
Electrical current is rate of transfer of electricity. The International System of Units (SI) standard unit for current is the ampere (A). The ampere is defined as that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross section, and placed one meter apart in a vacuum, would produce between these conductors a force of 2E-07 newton per metre of length. The ampere is the base SI unit for this class.

Coulomb -
The coulomb is defined as the quantity of electricity that must flow through a circuit to deposit 0.0011180 grams of silver from a solution of silver nitrate. The coulomb (C) is an SI unit of the International System of Units.

Farad -
Capacitance is measured by the charge which must be transferred to a body to raise its potential one unit. The farad (F) is defined as the capacitance of a capacitor between the plates of which there appears a difference of potential of one volt when the capacitor is charged by a quantity of electricity equal to one coulomb. The farad (F) is an SI unit of the International System of Units.

Henry -
Inductance is measured by the electrical force induced in a conductor by a unit rate of variation of the current. The henry is defined as the inductance of a closed circuit in which an electromotive force of one volt is produced when the electric current in the circuit is varied uniformly at a rate of one ampere per second.

Siemens -
Conductance is the reciprocal of resistance and is measured by the ratio of the current flowing through a conductor to the difference in potential between its ends. The SI unit is the siemens (S) (equal to the mho) and is defined as the electric conductance of a conductor in which one ampere of current is produced when the potential difference equals one volt.

Ohm -
Resistance is a property of electrical conductors which depends on the type of material, their dimensions, and the temperature. The SI unit of resistance is the ohm and is defined as the electrical resistance between two points of a conductor when a constant difference of potential of one volt, applied between the two points, produces in the conductor a current of one ampere, assuming the conductor is not the source of any electromotive force.

Volt -

The volt is the difference in electrical potential between two points on a conductor carrying a constant current of one ampere, when the power dissipated between the two points is equal to one watt.   The volt (V) is the SI unit .

Weber -

The weber is a measure of magnetic flux and is defined as the magnetic flux which, linking a circuit of one turn, produces in the circuit an electromotive force of one volt as the flux is reduced to zero at a uniform rate in one second.

Tesla -

Magnetic flux density is measured as the strength of a magnetic field per unit area. It is defined as the magnetic flux density given by a magnetic flux of one weber per square metre.

SYNONYMS: electric charge, potential difference, electromotive force, capacitance, resistance, conductance, magnetic flux, magnetic flux density, inductance, electric current, current density, charge density, field strength

Energy

Energy (which also includes work) is measured by the capability of doing work. Energy is generally divided into potential energy, which is energy due to the position of one body in relation to another or to relative parts of the same body, and kinetic energy, which is energy due to motion of a body. The erg is defined as the energy expended when a force of one dyne acts through a distance of one centimetre. The International System of Units (SI) standard unit for energy/work is the Joule (J), and is defined as the work done when the point of application of a force of one newton is displaced a distance of one metre in the direction of the force. The Joule is equal to 1E+07 ergs.

SYNONYMS: potential energy, kinetic energy; work

Energy per Unit Area Time

Energy per unit area time is defined as watts per square meter. Watt per square metre (W/m^2) is the International System of Units (SI) derived unit for energy per unit area time.

Flow

Flow is measured by the quantity of matter, in mass or volume, which moves past a given point during a given period of time. For mass flow the generally accepted units are defined as mass per unit time and are the kilogram per pascal second square metre ($kg/(Pasm^2)$) or the kilogram per second (kg/s). For volume flow the unit is the cubic metre per second (m^3/s).

SYNONYMS: Mass per unit time , volume per unit time

Force

The newton is defined as the force that, when applied to a body having a mass of one kilogram gives it an acceleration of one metre per second squared (m/s^2). The SI unit of force is the newton (N).

Force per Unit Area

Force per unit area is defined as the force applied to or distributed over an area. Force per unit area is commonly referred to as pressure and is often also referred to as stress. Pressure is further divided into Absolute Pressure and Gauge Pressure. Absolute pressure is measured with respect to zero pressure; gauge pressure is pressure measured with respect to atmospheric pressure. The International System of Units (SI) derived unit for force per unit area is the pascal (P) which is the newton per square metre.

Synonyms: pressure , stress

Force per Unit Length

The International System of Units (SI) derived unit for force per unit length is the newton per metre (N/m).

Heat

Heat is the common term used to refer to various forms of thermodynamic energy and is more properly referred to as energy. However, the term is often used to refer to quantities of energy per unit weight, energy per unit volume, energy per unit time, etc.

Length

Length refers to the units denoting distance. The International System of Units (SI) standard unit for length is the metre (m). The metre is defined to be the length of the path traveled by light in a vacuum during the time interval of 1/299,792,458 of a second.

Light

Light, more properly referred to a illuminance, is defined as the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540E+12 hertz and that has a radiant intensity in that direction of 1/683 watt per steradian.   A related derived SI unit is the lumen which is defined as the illuminance produced by a luminous flux of one lumen, uniformly distributed over a surface of one square metre.   The International System of Units (SI) standard unit for light is the candella (cd).

Mass

Mass is the quantity of matter. The International System of Units (SI) standard unit is the kilogram (kg). The kilogram is defined as the mass of the International prototype of the kilogram.

Mass per Unit Area

Mass per unit area is defined in the metric system as kilogram per square metre (kg/m^2).

Mass per Unit Capacity

Mass per unit capacity is defined as the concentration of matter, measured as the mass per unit volume. Mass per unit capacity is more commonly referred to as the density. The International System of Units (SI) derived unit for density is the kilogram per cubic metre (kg/mƒ).

SYNONYMS: density , concentration, mass per unit volume

Mass per Unit Length

Mass per unit length is defined in the metric system as kilogram per metre (kg/m).

Mass per Unit Time

Mass per unit time is measured as the quantity of mass which moves past a given point during a given period of time.   The generally accepted units for mass per unit time (also referred to as flow) are the kilogram per pascal second square metre (kg/(Pasm^2)) or
the kilogram per second (kg/s).

SYNONYMS: flow

Mass per Unit Volume

Mass per unit volume is defined as the concentration of matter. Mass per unit volume is more commonly referred to as the density. The International System of Units (SI) derived unit for density is the kilogram per cubic metre (kg/m^3).

SYNONYMS: density, concentration, mass per unit capacity, mass capacity

Mass Capacity

Mass capacity is defined as the concentration of matter. Mass capacity is more commonly referred to as the density . The International System of Units (SI) derived unit for density is the kilogram per cubic metre (kg/m^3).

SYNONYMS: density , concentration , mass per unit volume , mass per unit capacity

Material Density

The Material Density class gives the approximate density of various materials, some common, some not so common.   There are over 500 materials listed in the class. Each material is shown with its mass per unit volume and volume per unit mass in both metric and imperial units.   All of the density values in this listing are approximate since many of the materials listed have no exact density value, but rather, have a range of density values depending upon the physical form of the material.

The data shown in the material Density window can be printed on the Windows default printer by clicking on the **Print** button.   Alternatively, the data can be copied to the Windows clipboard and to the file CONVERT.TXT by selecting the **Copy** button.

Power

Power is measured as the process which gives rise to the production of energy at the rate of one joule per second. The International System of Units (SI) standard unit for power is the watt (W). The watt is a derived unit of the International System.

Pressure

Pressure is measured as the quantity of force applied per unit area. The International System of Units (SI) standard unit for pressure is the pascal (Pa) (newton per square metre).

Synonyms: force per unit area , stress

Radiation

Radiation is represented in the metric system by two units, the gray and the sievert. The gray (Gy) is defined as the absorbed dose when the energy per unit mass imparted to matter by ionizing radiation in one joule per kilogram.   The sievert (Sv) is the dose equivalent when the absorbed dose of ionizing radiation multiplied by the dimensionless factors Q, which is a quality factor, and N, which is the product of any other multiplying factors, stipulated by the International Commission on Radiological Protection is one joule per kilogram.

Stress

Stress is measured as the quantity of force applied per unit area. The International System of Units (SI) derived unit for stress is the pascal (Pa) (newton per square metre).

Synonyms: force per unit area, pressure

Temperature

Temperature is defined in the modernized metric system by the thermodynamic temperature kelvin (K). This is the proper unit to use to express thermodynamic temperatures and temperature intervals. The degree Celsius (ºC) is used widely for expressing Celsius temperature and temperature intervals. The Celsius scale, which was formerly called the centigrade temperature scale, is the proper SI scale to use to express temperatures and temperature intervals in Celsius.

Time

The International System of Units (SI) standard unit for time is the second (s). The minute, hour, day, week, month, etc., may be necessary when the expression of time is related to calendar cycles or life customs.

Torque

Torque is defined as the product of a force and the perpendicular distance to a turning axis. The International System of Units (SI) unit for torque is the Newton metre (Nm)

SYNONYMS: bending moment , force moment

Torque per Unit Length

The International System of Units (SI) standard unit for torque per unit length is derived as the newton metre per metre (Nm/m).

Velocity

Velocity is measured as the distance traveled per unit time.   Velocity is defined in the metric system using the derived unit metre per second (m/s).

Synonyms: speed

Viscosity

Viscosity or the resistance to flow is exhibited by all fluids and many solids. There are two derived unit in the International System of Units (SI) for viscosity. They are the pascal second (Pas) for expressing dynamic viscosity and the square metre per second (m^2/s) used for expressing kinematic viscosity.

Volume

Volume is defined as the amount of space occupied in three dimensions, cubic contents or cubic magnitude.   The International System of Units (SI) standard unit for volume is the cubic metre (m^3).

SYNONYMS: capacity

Volume per Unit Time

Volume per unit time is measured by the quantity of matter, in mass or volume, which moves past a given point during a given period of time. For mass flow the generally accepted units are defined as mass per unit time and are the kilogram per pascal second square metre (kg/(Pasm^2) or the kilogram per second (kg/s). For volume flow the unit is the cubic metre per second (m^3/s).

Synonyms: flow , mass per unit time

Work

The International System of Units (SI) standard unit for energy/work is the Joule (J), and is defined as the work done when the point of application of a force of one newton is displaced a distance of one metre in the direction of the force. The Joule is equal to 1E+07 ergs.

SYNONYMS: potential energy, kinetic energy, energy

Installation

SICon, the metric conversion utility, is installed to your system by SETUP.EXE. When Setup first starts, it will show the Directory Dialog to prompt for the directories the SICon is to be installed from and the directory SICons files will be installed into.

Normally, the directory to install from is shown in the Installing from window. This will usually be one of your floppy drives, e.g., A:\ or B:\. There is usually no reason to change the default that is shown in this window.

The destination directory is shown in the Installing to window. The default location is C:\SICON, but may be changed to any location you prefer. If you do not want to install SICon to the default directory, you may type a new location path directly into the Installing to edit window. If the location you set does not exist, Setup will create the directory path as it installs the files, provided the path up to the directory you enter is valid.

Once you have the installation directory information correct, clicking on the OK button will begin the installation process. A small window will appear that will show the progress of the file copying process.

Once the files have been copied to the destination directory, Setup will present you with another window titled Program Manager Group Installation. This window prompts for the Program Manager Group into which the SICon icon will be installed. The default group window will be titled SICon but, if you prefer, you may enter a different name into the Program Manager Group edit window. Also, you may select an existing Program Manager group to install the SICon startup icon into by clicking on the down arrow to the right of the edit window and selecting one of the existing groups.

NOTE: Keep in mind that you may change the default values to anything you prefer (within reason) but it is usually better to let SETUP select the defaults. Any of the items selectable from the Program Manager Group Installation window may be changed from Program Manager later if you prefer.

The second item shown in the Program Manager Group Installation window is the command-line entry that will be used to start SICon from Program Manager. You may not alter the information shown in this widow.

The third item is the SICon icon description that will be shown beneath the SICon icon in Program Manager. If you do not like the default shown, you may change to anything you prefer. Just remember, it shouldnt be too long.

Once everything is shown as you prefer in the Program Manager Group Installation window, clicking on OK will create the Program Manager group, add the necessary icons and SETUP will terminate.

If, instead of selecting OK, you select EXIT, SETUP will terminate without installing the necessary Program Manager items for running SICon.   In this case, you must install these items manually from Program Manager.

At that point the installation process has been completed and you will be returned to Windows.   SICon is ready to run

Printing

The results of any conversion can be printed. When a conversion has been completed in the Calculation Window , clicking on the **Print** button will print the results of the conversion to the default Windows printer. Also, while viewing a Material Density data window, the data shown for the selected material can be printed by selecting the **Print** button in that window.

If you have multiple printers installed and configured in Windows, you may select a printer to receive the print job by selecting **Print-Printer setup** from the main menu. The printer setup dialog may also be accessed by clicking on the Printer setup button on the speed menu.

Menus

There are three types of menus used in SICon.

The first is the type of menu that all Windows users have become accustomed to. This is the familiar row of drop-down menu items that appear across the top of the window in each application. Selecting these menu items either produces a drop-down menu from which further selections may be made or, in the case where there is no drop-down menu for that item, the action indicated by the menu item is initiated immediately. These menu items may be selected by clicking on them with the left mouse button or by selecting them with an ALT-key combination from the keyboard. For instance, the Help item could be selected with the keyboard by holding down the ALT key and pressing the H key.

The second type of menu is the Speed Menu. The Speed Menu consists of a row of buttons in the upper left of the main window. Each button face contains a picture to represent the action of the button. The use of the speed menu is to allow the user to select many of the items contained in the main menu across the top of the window more quickly than can be done by using the main menu. For example, the far left speed button has a door on its face. The door represents the Exit command and can be used at any time to exit the program quickly. The use of each button can be determined by slowly moving the mouse cursor across the face of the buttons. As the cursor passes across the face of each button, a hint will appear to give the use of the button.

The third type of menu is the Pop-Up menu. The Pop-Up menu is selected by placing the mouse cursor in the active window and clicking the right mouse button. A small, floating window will appear which contains the commands available for that window. The Pop-Up window offers a speedy way to initiate menu actions. Note that you may exit SICon from nearly any place in the program by selecting the Exit command from a Pop-Up menu.

Calculator

SICon features a pop-up calculator. The calculator is easy to use and is very similar to the desktop calculators to which all of us have become accustomed. The SICon calculator has a couple of features not found in most software calculators. For one, it is a *tape* calculator. The left side of the calculator window consists of a *tape* with a function identical to a calculator with a paper tape. As each value is entered, the value appears on the *tape* and, as each calculation is performed, the result is shown on the *tape*. The *tape* may be cleared at any time and the entire *tape* may be printed or copied to the Windows clipboard. Note that only portions of the *tape* that have been *selected* can be printed or copied.

The calculator features a pop-up menu accessed by pressing the right mouse button while the mouse cursor is anywhere inside the calculator window.

Saving to File

The results of any conversion can be saved to file. When you are in the Calculation Window you may save the result of each conversion by clicking on the **Copy** button. Each time you select the button, the results of the conversion are saved to a file in the SICon directory called CONVERT.TXT and also copied to the Windows clipboard. CONVERT.TXT is a plain ASCII text file and may be loaded into a word processor for editing. As you make conversions and save them to file, the results are added to the end of the CONVERT.TXT file. The data shown in the Material Density dialog can be saved to file in the same manner. Note that each time you start SICon the results of the **prior** session are deleted from the file.

The Menu bar or the pop-up menu may also be used to copy the results of the last conversion to file.