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UNIT CONVERTER REFERENCE MANUAL

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1. Introduction

Quad-Lock Unit Converter is a freeware tool that can take care of all your unit conversions even when offline. It contains more than 1000 units commonly encountered while solving engineering or everyday conversion problems. Its features include a function to quickly search for units, support for adding custom units, and a smart input box that evaluates complex expressions. The program is completely free of any spy-ware or mal-ware (and will not connect to the internet unless you click on the links or logos). Compared to other unit reference and conversion software packages, Quad-Lock Unit Converter freeware implements the following *distinctive features*:

1. Simple, clean and user-friendly interface makes the learning curve non-existent, even for inexperienced computer users.
2. Fast and time efficient. There is no need for an installation package, no splash screen, and no buttons to push. The program is launched in less than a second, and conversions are performed instantly while you type the input (even on old and obsolete computers). A Find function lets you search for your units within seconds.
3. Small file size (less than 300 kB) compared to the norm of 5 – 10 MB setup packages. The smaller file size is beneficial for internet distribution to people with slow or expensive internet connection. The small file size also makes it easy to distribute among friends and co-workers.
4. The program can be run from a USB drive as a completely portable application, without leaving any personal data or registry settings behind.

This manual describes all the features of the program in detail, and will provide you with most of the know-how on how to use it effectively.

2. Getting Started

Launch the program by double-clicking on the executable file UnitConverter.exe.

Some versions of Operating Systems (e.g. Windows XP or Vista) will ask for confirmation to allow the program to run. You can usually select not to be asked again for this file and confirm.



Figure 1 Windows Security Warning

The main window is presented as shown in Figure 2. To perform a conversion, first **select a category** (such as area, charge, temperature, mass, density, etc.) from the drop down list on the top left corner of the window. The input and output list boxes (on the left and right side of the dialog window respectively) are populated with all available units within the chosen category. The units and categories always appear sorted alphabetically in ascending order. Scroll bar will appear on the right hand side of a list box if more units are present than can fit in the visible part of the list box window. Click the appropriate rows in the input and output list boxes to select the source (input) and target (output) units respectively. Your selected units (along with the corresponding abbreviations where available) are updated at the bottom of the window. Type the number or expression in the smart input box at the bottom left of the window. You can enter the input in one of several formats:

Decimal, e.g. 1.75

Exponent, e.g. 1.2e-5

Partial Fraction, e.g. 7/8

Mixed Fraction, e.g. 2+3/4 (for 2¾)

Mixed Expression, e.g. $\sin(-50.01+10^{\sin(-0.1/21.11)}-(\cos(12)^{0.1})^3.11)$ that evaluates to 0.35866.

Available functions are sin, cos, tan, cosec, sec, cot, arcsin, arccos, arctan, sqrt, log10 (logarithm base 10), and log (logarithm base e).

The result is displayed instantly in the box at the bottom right window. You can interchange the input and output units by clicking on the “invert” icon located between the two list boxes, using the menu item Edit >> Invert Units, or by using the keyboard shortcut key Ctrl + I.

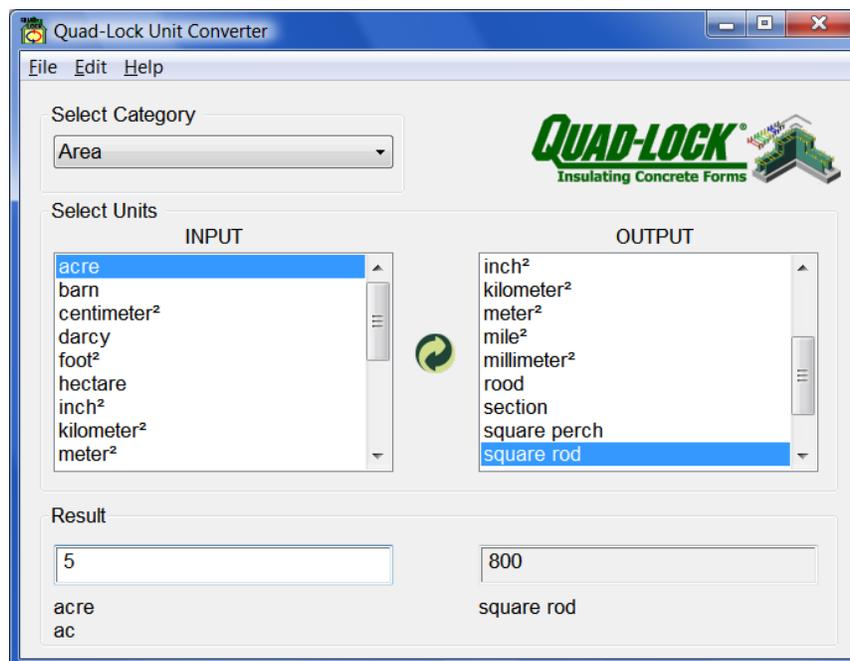


Figure 2 Quad-Lock Unit Converter main program window

The following steps show an example conversion:

1. Select “Area” from the category drop down list
2. From the input list box, select “acre”.
3. Scroll down the output list box and select “square rod”.
4. Type “5” in the input box. The result “800” appears in the output box.
5. Click on the “invert” icon. The input and output list box selection is switched, and you should see “0.03125” in the output window.

3. Navigating the Main Menu

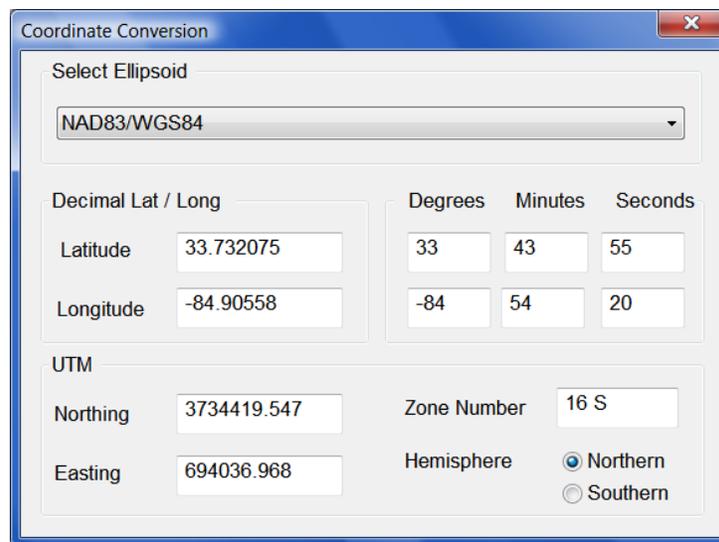
The main menu and sub-menu items, along with their corresponding functions, are summarized below in Table 1.

Table 1 Main menu items and their functions

	File >> Launch Calculator	Launch the standard Windows calculator. Shortcut key: Ctrl+L
	File >> Coordinate Converter	Launch the coordinate conversion tool that converts from latitude/longitude to Universal Transverse Mercator (UTM) mapping system.
	File >> Exit	Exit the unit converter program.
	Edit >> Copy Output	Copy the conversion result from the output box to the windows clipboard. Shortcut key: Ctrl+C
	Edit >> Find	Launch dialog box to search for units or categories. Shortcut key: Ctrl+F
	Edit >> Invert Units	Interchange the input (source) and output (target) units. Shortcut key: Ctrl+I
	Edit >> Units	Add or remove custom units
	Edit >> Categories	Add or remove custom categories
	Edit >> Preferences	Change general program options, result format and category visibility options. Shortcut key: Ctrl+P
	Help >> Contents	Launches the program reference manual. If the reference manual file is not found, a dialog box is shown with concise documentation. Shortcut key: F1
	Help >> About	Displays the About dialog containing program version and author information.
	Help >> Check for updates or Donate	Go online to check for updates to the program or donate to the author for continued development of this program.

4. Using the Coordinate Conversion Tool

The coordinate conversion tool (shown in Figure 3) can convert geographic coordinates between latitude/longitude and Universal Transverse Mercator (UTM) map projection. A description of the UTM system can be found in U.S. Geological Survey Professional Paper [1] and U. S. Army Technical Manual [2]. Changing the number in any of the input boxes automatically updates all the other input boxes. To convert latitude/longitude to UTM, you can either use decimal format or degree, minute, second format. To convert UTM to latitude/longitude, you must enter northing, easting, and whether the hemisphere is northern or southern (you do not need to enter the zone number). The conversions are based on a reference ellipsoid (used to model the shape of the earth) that you can choose from the drop down list box at the top. The most common datum are NAD83 and WGS84.



The screenshot shows a window titled "Coordinate Conversion" with a close button (X) in the top right corner. The window contains the following elements:

- Select Ellipsoid:** A dropdown menu currently showing "NAD83/WGS84".
- Decimal Lat / Long:** Two input fields: "Latitude" with the value "33.732075" and "Longitude" with the value "-84.90558".
- Degrees Minutes Seconds:** Three input fields: "Degrees" with "33", "Minutes" with "43", and "Seconds" with "55".
- UTM:** Two input fields: "Northing" with "3734419.547" and "Easting" with "694036.968".
- Zone Number:** An input field with the value "16 S".
- Hemisphere:** Two radio buttons: "Northern" (selected) and "Southern".

Figure 3 Quad-Lock Unit Converter main program window

5. Finding Units and Categories

The "Find" feature can help you find any unit or category. This feature is especially useful if you are uncertain about the category of the desired unit. For example, suppose you wanted to convert from "terabyte" to "megabyte" and you are unsure if the unit would be found under "Data", "Data Transfer", or some other category (or perhaps the correct category in this case is hidden from the main window category list). You could use the find function to quickly take you to the correct category and unit. Under Edit menu, click on Find, or use shortcut key Ctrl + F to quickly open the Find dialog box, as shown in Figure 4.

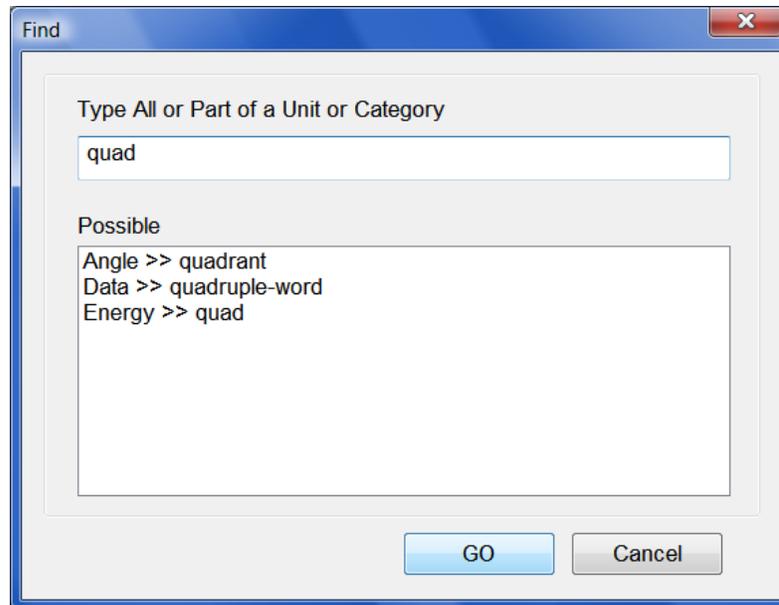


Figure 4 Find dialog box can quickly locate a unit or category

Before you start typing, the list box on this dialog displays all available units and categories (including custom units and the units in hidden categories). Type the desired unit or category into the input box to narrow the list of possible matches that are displayed in the list box below. Double click any unit in the list box or click the Go button to dismiss the find box, and jump to that category and unit in the main window. If you select a unit that belongs to a category not visible in the main window, the category will become visible and will be added to the list in the main program window. You may change the visibility of categories using the method described in Section 7.3.

6. Custom Units and Categories

Although Quad-Lock Unit Converter comes with more than 1000 units in 45 different categories, in the unlikely case you do not find the desired unit, you can add an unlimited number of custom units and categories. For Custom units and preferences to be stored, a small file named `UnitConverter.INI` is created by the program. The location of this file is the `%APPDATA%\UnitConverter` folder when you are using a PC. However, if the program is run from a USB drive (such as `F:\`), then the INI file will be created in the root drive (`F:\UnitConverter.INI`). This enables you to run the program from a USB drive, as a completely portable application, without leaving any personal data behind. You may transfer `UnitConverter.INI` file to other computers to transfer your customizations.

6.1 Adding and Removing Custom Units

Custom units can be added to pre-existing categories built into the executable of the program, or by first adding a new custom category as described in Section 6.2. To add a new unit, click on the “Edit” menu item at the top of the program window, and then select “Units” from the sub-menu that drops down. A new dialog box will appear, as shown in Figure 5.

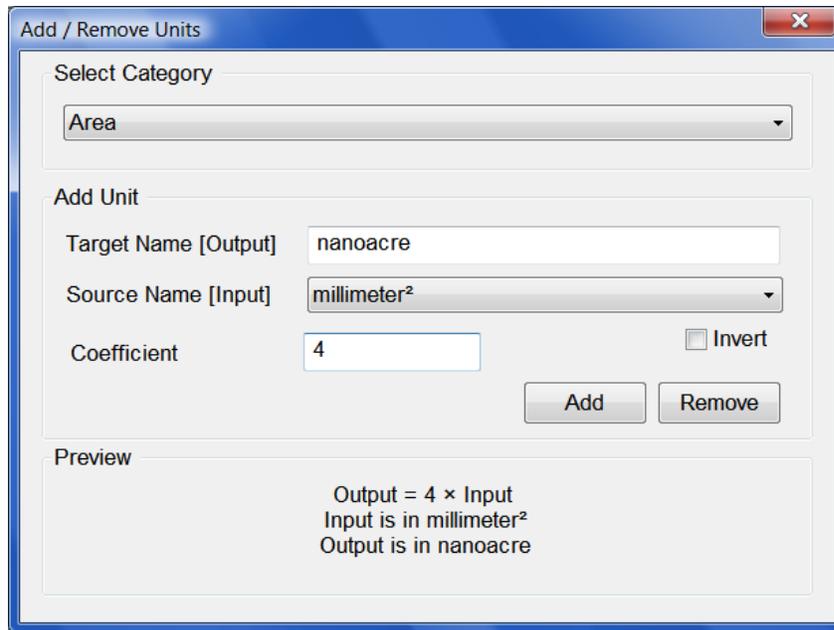


Figure 5 Adding custom units to the program

Select a category from the drop down box at the top of the dialog. This drop down box contains an alphabetically sorted list of all available categories, including any previously defined custom categories and any invisible categories not shown in the main window. As an example, we will add a new unit called nanoacre in the area category. A nanoacre is a unit (about 4 mm², 2.01168 mm on each side) of real estate on a microelectronics chip. After selecting area as the category, the drop down box labeled “Source Name [Input]” is automatically populated with all the units present in the area category. This alphabetically sorted list of units contains all existing units, including any previously defined custom units. In order to add the new unit, it is necessary to know the value of conversion factor between the new unit and one of the existing units. For our case, we choose millimeter² as the source unit, since we know that 1 nanoacre is roughly equal to 4.0 millimeter². Type this conversion factor in the input box labeled “Coefficient”, and type “nanoacre” (without quotes) in the input box labeled “Target Name [Output]”. The preview at the bottom is updated automatically to reflect the changes. After entering all the necessary information, click on the “Add” button (**Note:** If you are adding the first unit in a category, then the source name dropdown, the coefficient input box, and the invert check boxes are all disabled. In that case, simply type into the target name box, and then click “Add”). A message box is shown with the message “Unit name [nanoacre] was successfully added to [Area]”. The dialog box is automatically dismissed if the unit was successfully added. If the main window displays the category to which the new unit was added, you should see the new unit in the list after the custom units dialog box is dismissed.

The new unit name must be unique, and is case sensitive. For example, you can add “gALILeO” in the category acceleration, but not the already existing “galileo”. It is recommended the names follow the NIST guidelines for international system of units [3]. If the chosen name for the new unit already exists within the category, or if the name is less than 2 characters or greater than 25 characters, a message box is shown with the appropriate error message. In this case, the unit name

is not added to the database, and the custom units dialog window will stay open. You can either revise the name, or click on the close button on the top right corner to exit without adding a new unit.

Starting with version 5.4, Quad-Lock Unit Converter allows you to add non-linear custom units to the program. This can be achieved by checking the invert button located below the source unit name drop down box. For example, to add “liter/500-kilometer” to the fuel consumption category, select kilometer/liter as the source unit, check the invert box, and enter 0.002 as the coefficient.

To remove a unit, select that unit from the source unit drop down box, and click on the “Remove” button. You may only remove units that you previously added. The removed unit is permanently deleted and cannot be recovered. The units built into the program executable cannot be removed.

6.2 Adding and Removing Custom Categories

To add a new category, click on the “Edit” menu item at the top of the program window, and then select “Category” from the sub-menu that drops down. A new dialog box will appear, as shown in Figure 6.

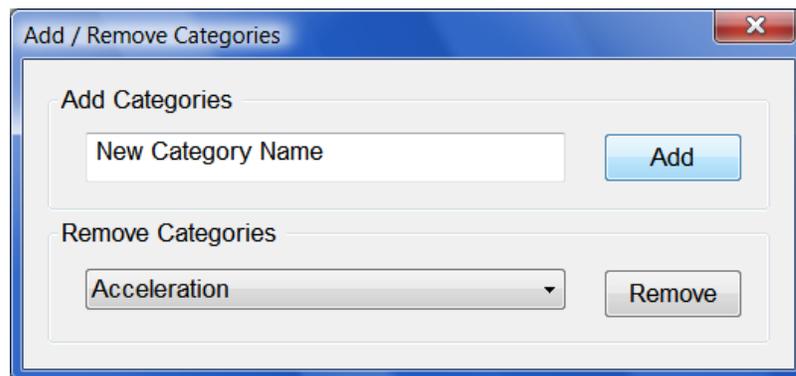


Figure 6. Adding custom categories to the program

The new category name must be unique, and is case insensitive. For example, you cannot add “CuRREnT” as a new category, due to the already existing category “Current”. When you click on “Add”, the name of the custom category is automatically converted to lower case, except the first letter that is capitalized. If the chosen name for the new category already exists, or if the name is less than 2 characters or greater than 25 characters, a message box is shown with the appropriate error message. In this case, the category name is not added to the database, and the custom category dialog window will stay open. You can either revise the name, or click on the close button on the top right corner to exit without adding a new category. If the new category is successfully added, the dialog box is dismissed, and the category name is added to the drop down list in the main program window. By default, new categories are visible, but you may change its visibility using the method described in Section 7.3.

To remove a category, select it from the drop down list, and click on the “Remove” button. You may only remove categories that you previously added. The removed category is permanently deleted and cannot be recovered. The categories built into the program executable cannot be removed.

7. Editing Program Preferences

To edit the program preferences, click on the “Edit” menu item at the top of the program window, and then select “Preferences” from the sub-menu that drops down. This will launch the preferences dialog box that has tabs for editing the general program options, format of the conversion output, and the visibility of categories. You can also launch this dialog box using the shortcut key Ctrl + P.

7.1 Editing General Options

The dialog page (shown in Figure 7) allows you to edit the general program options and behavior.

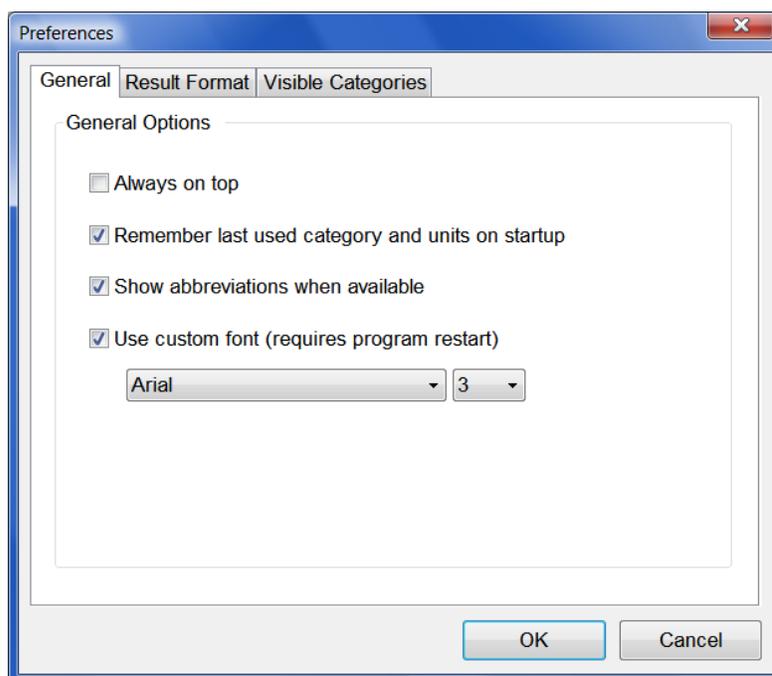


Figure 7. Editing general program options and behavior

Click to check the first box so that the main program window always stays on top of other windows (unless it is minimized using the minimize button on the title bar at the top) .

Click to check the second box so that the last conversion performed before exiting the program is restored when the program is started next time. For example, let’s assume the last conversion before program exit was from "hours" to "seconds". When the program is started next time, the

category will be restored to "time", the source unit is restored to "hours", and the target unit is restored to "seconds".

Click to check the third box if you want to see the abbreviations for the selected source and target units respectively. Not all units have abbreviations associated with them. When available, these abbreviations are displayed below the selected source and target units respectively (at the bottom of the main program window).

Click to check the fourth box if you would like to use a custom font type and size for the program. This enables the font name and the font size drop down lists. The default font is Verdana at size 1. The font name list detects all the fonts that are currently installed on your system. If you would like to add units and categories in another language, you may have to change the font accordingly. If all you see are boxes, you would need to use a unicode font (such as Arial Unicode MS) that has a full range of characters. The size of the dialog windows can be varied between 1 and 5, and the suitable size may depend on the choice of the font.

The changes are not applied until you dismiss the dialog box by clicking on "OK" button at the bottom of the dialog box. Changes in font are applied to all dialog windows and text in the program, after the program is restarted.

7.2 Editing Output Format

This dialog page (shown in Figure 8) allows you to select the format and precision for the unit conversion result.

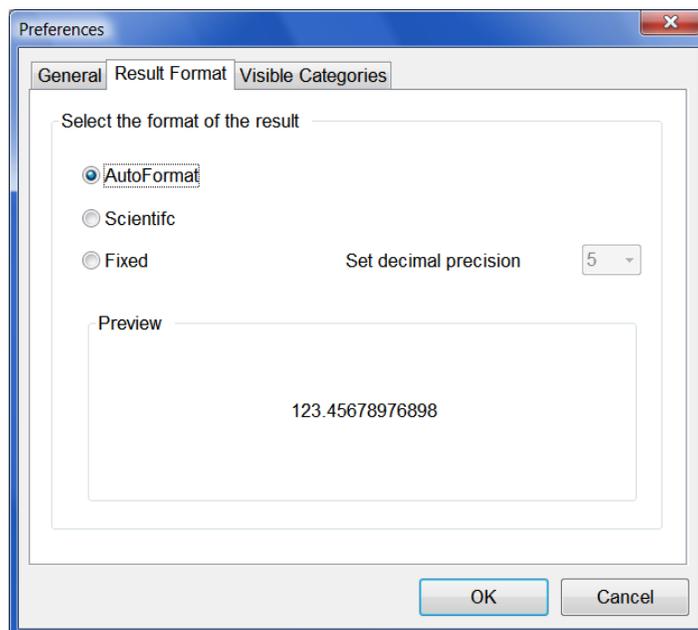


Figure 8. Selecting format and precision of the conversion output

Click on one of three radio buttons (Auto Format, Scientific, and Fixed) to select the result format. If you select the "Auto Format" option, the program will display conversion output using signed

floating point or signed scientific notation, whichever is shorter. In this case, the drop down box labeled “Set decimal precision” will remain disabled, since the program automatically chooses appropriate number of decimal places. Select the second format option to use the signed scientific notation, and the third format option to use the signed floating point notation. If you select the second or third format option, the number of decimals to display can be selected from the drop down list. The changes are not applied until you dismiss the dialog box by clicking on “OK” button at the bottom of the dialog box. Before committing to the changes, you can see a preview of the selected output format.

7.3 Editing Visibility of Categories

The list box on this dialog page contains an alphabetically sorted list of all categories, as shown in Figure 9. The list contains the built-in categories, and any custom categories that you may have added to the program. You can individually select or unselect a category by clicking and toggling the state of the check box that appears before the category name. You can quickly select or unselect all categories at once by clicking and toggling the “Display All Categories” check box at the bottom. Only categories that have a check box next to them will be visible in the drop down list in the main program window. The changes are not applied until you dismiss the dialog box by clicking on “OK” button at the bottom of the dialog box.

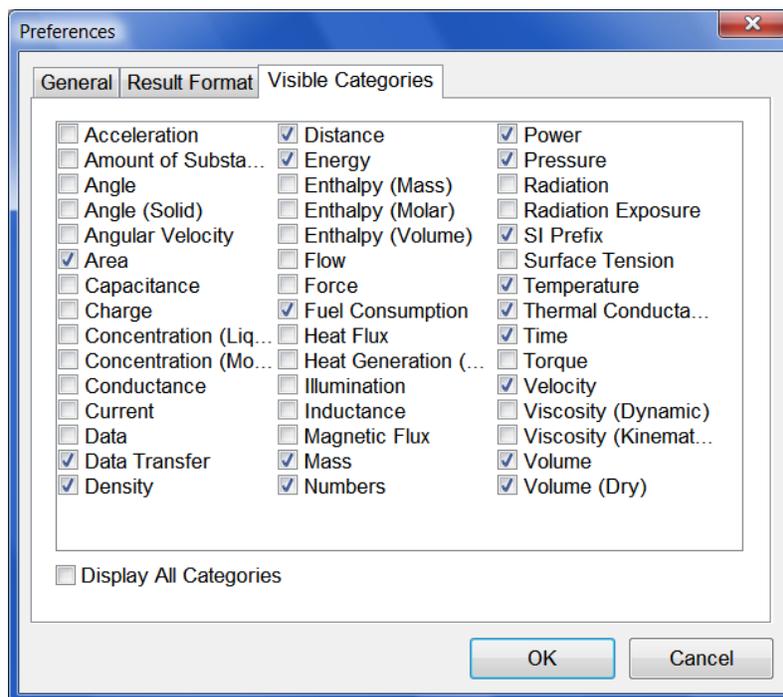


Figure 9. Changing the visibility of categories

8. Change Log

The program is always under active development to incorporate new units and categories, and enhance the user interface features. The following sections present the development history of the program.

Version 5.4 Change Log

1. Added ability to perform coordinate transformations from latitude/longitude to UTM (and vice-versa).
2. Added Heat Flux conversion category with 25 units
3. Added Magnetic Flux conversion category with 14 units
4. Added Volumetric Heat Generation category with 11 units
5. Added 6 new units to Fuel Consumption category (non-linear conversions such as Liters/100km to Miles/Gallon)
6. Corrected conversion factor in Amount of Substance; 1 mol = 1000 mmol, showed 1000000 mmol
7. Re-organized main menu. Also, added an icon next to each menu item.
8. Quad-Lock Converter now uses Unicode for the entire program (UI controls and the engine), enabling internationalization.
9. Removed restrictions such that users can now add an un-limited number of custom units and categories. Furthermore, users can also add non-multiplicative unit conversions (such as from Liters/100km to Miles/Gallon)
10. The settings of the program are stored in a small file called "UnitConverter.ini" that is created in the %APPDATA%\UnitConverter folder. However, if the program is run from a USB drive (such as F:\), then the INI file will be created in the root drive (F:\UnitConverter.INI).
11. User defined custom categories can now be rendered visible or invisible in the main window using Main Menu --> Edit --> Preferences
12. The conversion engine now uses a hash table to efficiently map the keys (unit names) to associated values (conversion factors). This should improve speed on old and obsolete computers (the difference may not be noticeable on fast modern computers)

Version 5.3 Change Log

1. Added ability to 'Find' units and categories (Ctrl + F)
2. Added ability to 'Invert Selected Units' (Ctrl + I or click middle icon)

3. Added ability to enter additional complex expressions in the Input Box, e.g. type: $\sin(4e-1)+\cos(\sqrt{7^3})$ The converter evaluates the expression to 1.3356883 before performing the conversion.
4. Added Data Transfer category with 169 units
5. Added Numbers category with 35 numerical base conversions
6. Added 3 Enthalpy categories (Mass, Molar, and Volume) with a total of 17 units
7. Added Fuel Consumption category with 12 units
8. Added Amount of Substance category with 4 units
9. Added 15 new units to Data Category
10. Added 6 new units to Torque category
11. Added 6 new units to Volume category
12. Added 3 new units to SI Prefix category
13. Added gram/liter to Density category
14. Corrected conversion factor for ton-force (2000 lbf) in Force category
15. Changed location of UnitConverter.ini (preferences file) to the root drive (usually C:)

Version 5.2 Change Log

1. Added unit abbreviations wherever applicable (displayed underneath the results)
2. Added 76 new units to "Distance" category
3. Added 33 new units in the "Time" category and changed the baseline unit to alleviate some inaccuracies
4. Added Gill (UK) and Gill (US) to "Dry Volume" category
5. Corrected the conversion factors for miles/hour-min in "Acceleration" and for hectare in "Area"
6. Changed all unit names to lowercase, except when the name is based on a proper noun
7. Updated the Quad-Lock logo
8. Added the link "Check for update or donate" under the Help Menu

Version 5.1 Change Log

1. Added input support for fractions (e.g. use $1+3/8$)
2. Revised Power Category - now over 70 units
3. Added SI Prefix Category - 15 new units
4. Added Data Category - 16 new units
5. Added Surface Tension Category - 11 new units
6. Added Concentration (Liquid) - 11 new units
7. Added Concentration (Molar) - 12 new units
8. Added Inductance - 21 new units
9. Added Radiation - 19 new units
10. Added Radiation Exposure - 11 new units
11. Added "Remember last used units" in addition to category on startup (enable under Preferences)

Version 5.0 Change Log

Version 5.0 is the original public release of the program.

9. References

1. Snyder, J. P., 1987; Map Projections - A Working Manual. U.S. Geological Survey Professional Paper 1395, 383 p.
2. Army, Department of, 1973; Universal Transverse Mercator Grid, U. S. Army Technical Manual TM 5-241-8, 64 p.
3. The NIST Reference on Constants, Units and Uncertainty, Accessed 21 May 2009
<<http://physics.nist.gov/cuu/Units/index.html>>