

UNIT CONVERTER

HP Prime Calculator — PPL Program

User Manual

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1. Overview

Unit Converter is a PPL program for the HP Prime graphing calculator that provides fast, accurate unit conversions across 21 dimensions and more than 350 units. The program is designed to integrate naturally with the HP Prime workflow: when you exit, the last converted value is returned directly to the Home screen, ready for further calculations. Some ideas and commands were taken and improved from other similar programs.

2. Key Features

- 21 unit dimensions selectable from a single dropdown menu.
- 350+ units organized per dimension, in alphabetical order within each list (base unit always at the top).
- Session memory: the program remembers the last dimension and units used, so re-opening it resumes exactly where you left off.
- Home-screen integration: when the program exits (ESC), the last result is returned to the HP Prime Home screen for use in subsequent calculations.
- HP Prime unit format: for units recognized by the HP Prime catalog (e.g. m, kg, Pa, °F), the result is returned as a native quantity with unit (e.g. 212_°F). For units not in the catalog or composite units, the numeric value is returned without unit annotation.
- High-precision conversion factors: factors are expressed as exact arithmetic expressions where possible (e.g. 0.9144*22 for chain, 231*0.0254^3 for galUS) to avoid floating-point truncation.
- Temperature handled separately: non-linear conversions (°C, °F, K, °R, °Re) are computed with explicit formulas rather than a multiplication factor.

3. Dimensions and Units

The table below lists all 21 dimensions, their base unit, and the units available in each dropdown list.

#	Dimension	Base Unit	Units Available
1	Length	m	m, Å, am, au, chain, cm, fermi, ft, fath, furlong, in, km, league, link, lyr, mil, mm, µm, miUS, nm, nmi, pc, planck, rod, twip, yd
2	Area	m²	m², a, acre, b, chain², cm², dm², ft², ha, homestead, in², km², mil², mm², miUS², rod², rood, section, shed, strema, twp, yd²
3	Volume	m³	m³, bbl, bu, buUS, cc, cm³, cu, drop, fbm, ft³, galUK, galUS, gi, in³, l, λ, ml, µl, ozUK, ozfl, pk, ptUK, liqpt, qt, st, tbsp, tsp, yd³
4	Mass	kg	kg, ct, cwt(UK), cwt(US), dwt, g, grain, kip, lb, lbt, mg, µg, oz, ozl, slug, stone, t, tonne, tonUK, tonUS, u
5	Force	N	N, dyn, gf, J/cm, J/m, kgf, kg·m/s², kip, kN, lbf, lb·ft/s², MN, ozf, pdl, tonf(UK), tonf(US)
6	Energy	J	J, boe, Btu, cal, erg, eV, ft·lbf, GJ, kcal, kg·m²/s², kiloton, kJ, kWh, lep, MeV, m·kgf, MJ, MWh, Nm, thermUK, thermUS, tec, toe, Wh, Ws
7	Power	W	W, Btu/h, cal/h, CV, erg/s, ft·lbf/s, hp, J/s, kcal/h, kgf·m/s, kg·m²/s³, kW, MBH, MW, PS, Ton(Ref)
8	Pressure	Pa	Pa, atm, bar, dyn/cm², inH₂O, inHg, kgf/cm², kgf/m², kPa, mbar, mmH₂O, mmHg, MPa, N/m², psi, tonf/cm², tonf/in², tonf/m², torr, tsi
9	Temperature	°C	°C, °F, K, °R, °Re
10	Time	s	s, cy, d, dec, fortin, h, lust, mill, min, mon, ms, µs, quinq, shake, wk, yr, yr(leap), yr(mean), yr(sidereal), yr(tropical)

#	Dimension	Base Unit	Units Available
11	Speed	m/s	m/s, c, cm/s, ft/s, in/s, km/h, km/s, kph, knot, mach, m/h, m/min, mile/h, mile/s, mph, yd/h, yd/s
12	Acceleration	m/s ²	m/s ² , cm/h ² , cm/s ² , ft/h ² , ft/s ² , grav, Gal, in/h ² , in/s ² , km/h ² , km/s ² , m/h ² , mile/h ² , mile/s ² , yd/h ² , yd/s ²
13	Density	kg/m ³	kg/m ³ , g/cm ³ , g/l, g/ml, g/m ³ , kg/l, lb/ft ³ , lb/galUS, lb/in ³ , mg/cm ³ , mg/l, oz/ft ³ , oz/gal, oz/in ³ , slug/ft ³
14	Viscosity (Dyn)	Pa·s	Pa·s, cP, dyn·s/cm ² , kg/(m·s), kgf·s/m ² , lbf·s/ft ² , lbf·s/in ² , lbm/ft·s, mPa·s, μPa·s, N·s/m ² , P, reyn
15	Concentration	mol/l	mol/l, g/cm ³ , g/l, g/ml, g/m ³ , grain/galUS, kg/m ³ , kmol/m ³ , lb/ft ³ , lb/galUS, lb/in ³ , mg/cm ³ , mg/l, mmol/l, mol/cm ³ , mol/m ³ , μmol/l, %, ppb, ppm, oz/galUS
16	Flow	m ³ /s	m ³ /s, bbl/d, bbl/h, cm ³ /h, cm ³ /s, ft ³ /h, ft ³ /min, ft ³ /s, gal/h, gal/min, gal/s, l/h, l/min, l/s, m ³ /h, m ³ /min, SCFM
17	Angle	rad	rad, circle, deg, arcmin, arcs, gon, grad, mil, mrad, μrad, % of circle, octant, quadrant, rev, sextant, sign, tr
18	Torque	N·m	N·m, dyn·cm, dyn·m, gf·cm, gf·m, kgf·cm, kgf·m, kN·m, lbf·ft, lbf·in, N·cm, ozf·ft, ozf·in
19	Current	A	A, abA, biot, EMU, ESU, kA, MA, mA, μA, statA
20	Light (Illumin.)	lx	lx, cm-cd, flame, ft-cd, lm/cm ² , lm/ft ² , lm/m ² , m-cd, nox, ph, W/cm ²
21	Radiation	Bq	Bq, Ci, dpm, dps, GBq, kBq, kCi, mBq, MBq, mCi, μCi, Rd

4. Installation

Transfer the program file Unit_Converter.hpprgm to the HP Prime using one of the following methods:

4.1 Via HP Connectivity Kit (Windows / Mac)

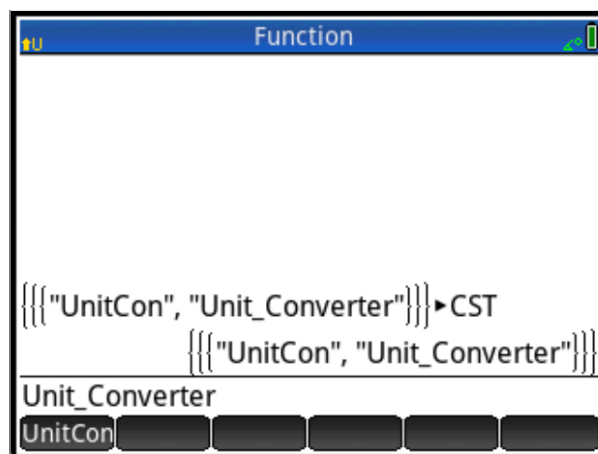
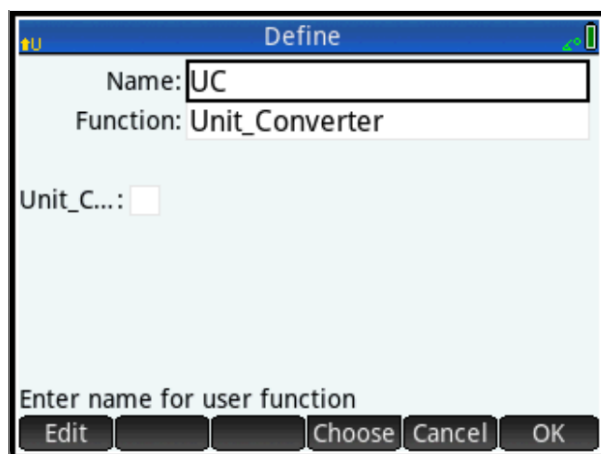
1. Connect the HP Prime to the computer using the USB cable.
2. Open HP Connectivity Kit and wait for the calculator to appear.
3. Drag and drop Unit_Converter.hpprgm into the Programs section.
4. Click Send to transfer the file.

4.2 Via HP Prime Virtual Calculator

Open the Unit_Converter.hpprgm file in the HP Prime Virtual Calculator (PC/Mac app) and use the Send to Device option.

4.3 Launching the Program

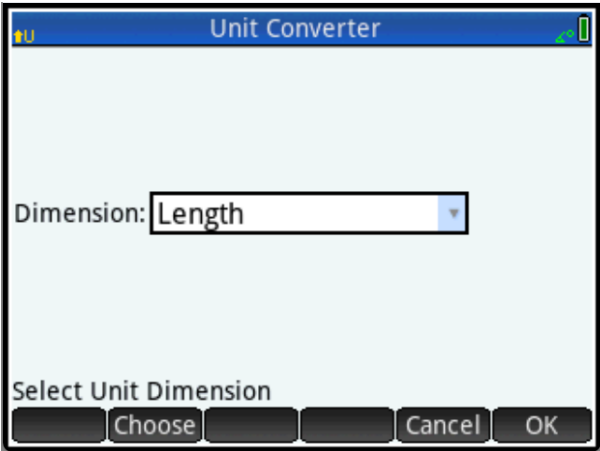
On the HP Prime from the Home screen type Unit_Converter and press Enter. Alternatively, you can create your own function using the DEFINE functionality, use a short name as UC, type Unit_Converter in the Function field and then OK. Run the program by typing UC on the entry line in Home screen. Other option is using the program CSTMENU from hpcalc.org (<https://www.hpcalc.org>), to create a custom menu with a soft key named UnitCon to run Unit_Converter.



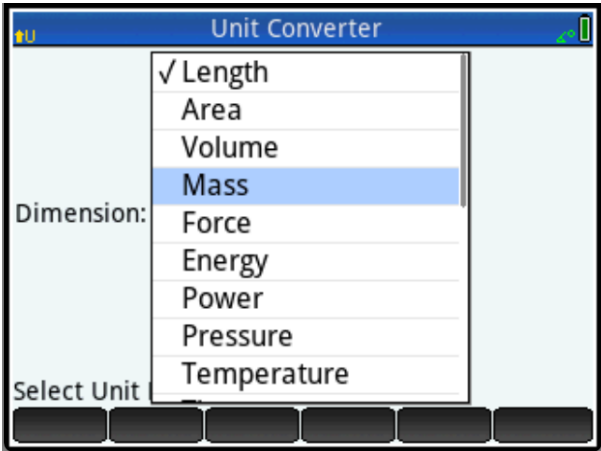
5. How to Use

5.1 Select a Dimension

In the dimension menu a dropdown list shows all 21 dimensions. Touch to scroll or use the arrow keys, then press OK (Enter). The last used dimension is pre-selected automatically



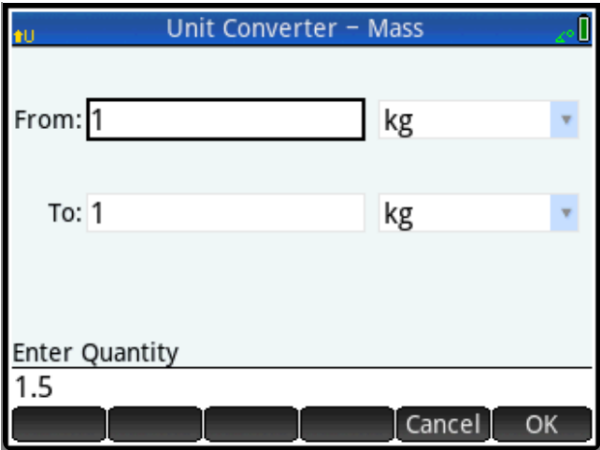
The screenshot shows the 'Unit Converter' application window. The title bar is blue with a yellow icon on the left and a green icon on the right. The main area has a light blue background. A label 'Dimension:' is followed by a dropdown menu showing 'Length'. Below this, the text 'Select Unit Dimension' is displayed. At the bottom, there are four buttons: 'Choose', 'Cancel', and 'OK'.



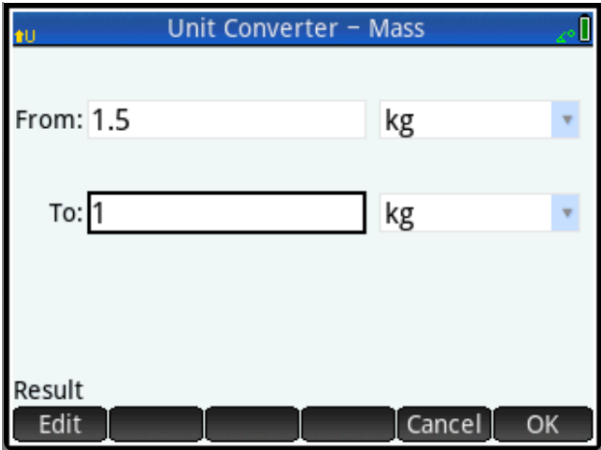
The screenshot shows the 'Unit Converter' application window with the 'Dimension:' dropdown menu open. The menu lists 21 dimensions: Length (checked), Area, Volume, Mass (highlighted), Force, Energy, Power, Pressure, and Temperature. Below the menu, the text 'Select Unit' is displayed. At the bottom, there are four buttons: 'Choose', 'Cancel', and 'OK'.

5.2 Enter From Value

In the conversion screen, type the numeric value you want to convert in the top-left field From: (Enter Quantity), then press OK. Dimension name is displayed in the title bar



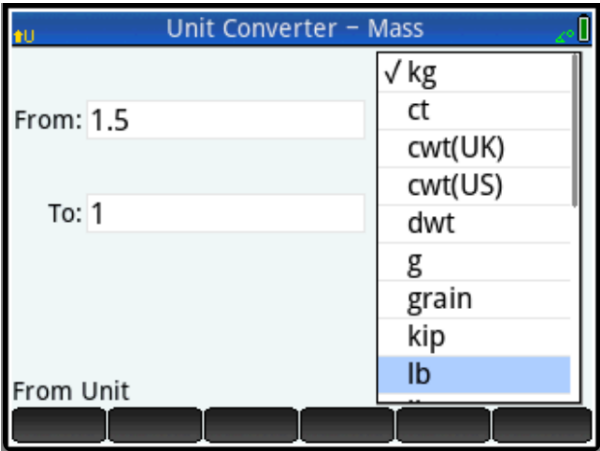
The screenshot shows the 'Unit Converter - Mass' application window. The title bar is blue with a yellow icon on the left and a green icon on the right. The main area has a light blue background. The 'From:' field contains the value '1' and the unit 'kg'. The 'To:' field contains the value '1' and the unit 'kg'. Below these fields, the text 'Enter Quantity' is displayed. At the bottom, there are four buttons: 'Cancel' and 'OK'.



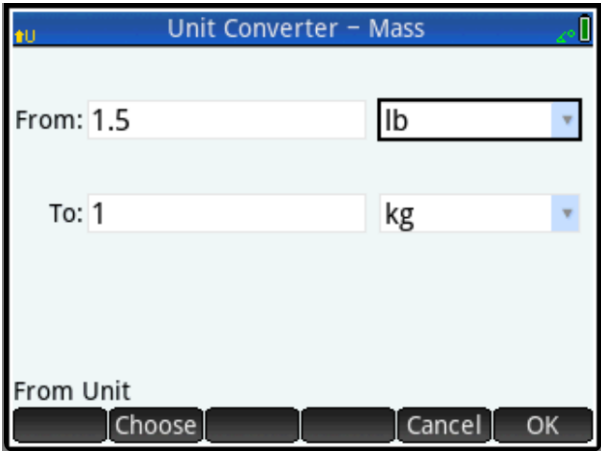
The screenshot shows the 'Unit Converter - Mass' application window. The title bar is blue with a yellow icon on the left and a green icon on the right. The main area has a light blue background. The 'From:' field contains the value '1.5' and the unit 'kg'. The 'To:' field contains the value '1' and the unit 'kg'. Below these fields, the text 'Result' is displayed. At the bottom, there are four buttons: 'Edit', 'Cancel', and 'OK'.

5.3 Select From Unit

Choose the source unit from the dropdown list (From Unit). Units are listed alphabetically; the base unit is always at the top



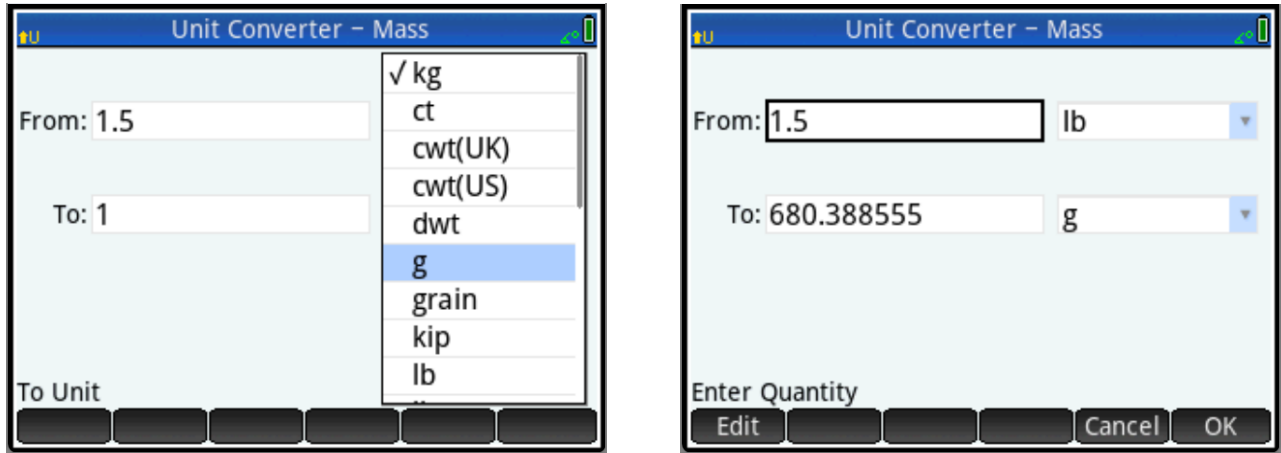
The screenshot shows the 'Unit Converter - Mass' application window. The title bar is blue with a yellow icon on the left and a green icon on the right. The main area has a light blue background. The 'From:' field contains the value '1.5'. The 'To:' field contains the value '1' and the unit 'kg'. Below these fields, the text 'From Unit' is displayed. A dropdown menu is open showing a list of units: kg (checked), ct, cwt(UK), cwt(US), dwt, g, grain, kip, and lb (highlighted). At the bottom, there are four buttons: 'Choose', 'Cancel', and 'OK'.



The screenshot shows the 'Unit Converter - Mass' application window. The title bar is blue with a yellow icon on the left and a green icon on the right. The main area has a light blue background. The 'From:' field contains the value '1.5' and the unit 'lb'. The 'To:' field contains the value '1' and the unit 'kg'. Below these fields, the text 'From Unit' is displayed. At the bottom, there are four buttons: 'Choose', 'Cancel', and 'OK'.

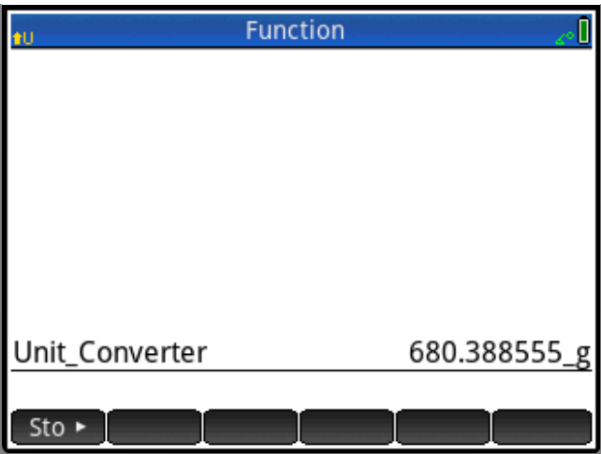
5.4 Select To Unit

Choose the target unit (To Unit). Press OK and the result appears immediately in the Result field To:



5.5 Continue or Exit

Press OK to perform another conversion in the same dimension (all fields remain filled). Press ESC to exit to the Home screen with the last result.



5.6 Session Memory

Every time you run the program; the last dimension selected (pre-highlighted in the dropdown) will appear in the dimension menu. By pressing OK, the last value and unit entered, as well as the last result and unit converted for that dimension will appear in the conversion screen.

Note: If you switch to a different dimension, the unit indices reset to their defaults (position 1) to prevent an "Invalid input" error.

6. Home Screen Integration

When you exit the program by pressing ESC at the conversion screen, the last converted value is returned to the HP Prime Home screen. This lets you use the result directly in calculations without retyping it.

6.1 Units Recognized by HP Prime

For units that are part of the HP Prime native catalog, the result is returned as a quantity with unit using the underscore notation:

Unit Converter – Temperature

From: 32 °C

To: 89.6 °F

Enter Temperature

Edit Cancel OK

Function

Unit_Converter 89.6_°F

Sto ►

Unit Converter – Pressure

From: 120 000 Pa

To: 900.074019245 mmHg

Enter Quantity

Edit Cancel OK

Function

Unit_Converter 900.074019245_mmHg

Sto ►

6.2 Units Not in HP Prime Catalog

Units that do not exist in the HP Prime catalog — or composite units with special characters (e.g. km/h, kg·m/s², N/m²) — cannot be expressed in the underscore notation. In these cases, the program returns only the numeric value:

Unit Converter – Volume

From: 1 m³

To: 8 453.50567546 gi

Enter Quantity

Edit Cancel OK

Function

Unit_Converter 8 453.50567546

Sto ►

7. Technical Notes

7.1 Temperature Conversions

Temperature is handled differently because the conversion is non-linear (involves an offset). The workflow is identical to other dimensions — enter value, select From Unit and To Unit — but the calculation uses explicit formulas rather than a single multiplication factor

7.2 Conversion Method

All non-temperature conversions use a single-row matrix (row 1) containing the factor that converts each unit to the base unit. This direct approach is more efficient than building a full $N \times N$ conversion matrix: only two matrix elements are accessed per conversion.

7.3 Precision

Conversion factors are defined as exact arithmetic expressions wherever possible. For example:

- Chain (length): 0.9144×22 (exact, avoids 20.1168 floating-point literal)
- US gallon: 231×0.0254^3 (exact cubic inch definition)
- UK gallon: $4.5460902819948 \times 10^{-3} \text{ m}^3$ (statutory definition)
- Planck length: $1.61622837297 \times 10^{-35} \text{ m}$

8. Troubleshooting

Issue	Solution
"Invalid input" error on dimension change	This is prevented automatically: switching dimensions resets unit indices to 1.
Result does not appear in the Home screen	If you run the program from the Program Catalog menu, the result will appear as Message Box. Program must be run on the Home screen as described in Section 4.
Result returns only a number, no unit	The unit is either not in the HP Prime catalog, or is a composite unit (e.g. km/h, N/m ²). This is expected behavior — use the numeric value directly.
Temperature result appears as 0	Ensure Temperature From: value has been entered before pressing OK. The calculation runs before opening the INPUT screen, so values must be set from a previous interaction.
Program does not appear in Programs menu	Verify the Unit_Converter.hpprgm file was transferred correctly. Try resending via HP Connectivity Kit.
Syntax error on load	Ensure the file was not modified in a text editor that changed special characters (π, Ε, Greek letters). Use the HP Connectivity Kit or HP Prime Virtual Calculator to transfer.