

# The UDUNITS-2 Package

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# 1 Introduction

The UDUNITS-2 package provides support for units of physical quantities. Its three main components are: 1) [Section “a C library” in `udunits2lib`](#) for units of physical quantities; 2) [Section “a utility” in `udunits2prog`](#); for obtaining the definition of a unit and for converting numeric values between compatible units; and 3) an [Chapter 6 \[extensive database of units\]](#), [page 8](#).

## 2 How This Package Differs from the Original UDUNITS Package

The UDUNIT-2 package differs from the UDUNITS-1 package in the following ways:

- **Support for non-ASCII characters:** The UDUNITS-1 package only supports the ASCII character set. The UDUNITS-2 package supports the following character sets: ASCII, ISO 8859-1 (Latin-1), and the UTF-8 encoding of ISO 10646 (Unicode). This means that unit string specifications like "F" are now supported (your viewer must support UTF-8 to display this string correctly).
- **Support for logarithmic units:** The unit string specification "0.1 lg(re 1 mW)" specifies a deciBel unit with a one milliwatt reference level. Such units are fully integrated into the package and all meaningful operations and conversions are supported.
- **Persistent value converters:** It is now possible to obtain a *converter* data-object, which can be used to convert numeric values in one unit to numeric values in another, compatible unit. The values can be `float`, `double`, or one-dimensional arrays of `floats` or `doubles`.
- **Improved API:** Due to the above changes, it was not possible to keep the application programming interface (API) of the UDUNITS-1 package. The new interface, however, is easily understood and easy to use. To support backward compatibility, the package does contain a version 1 C API, which uses the version 2 library.
- **XML unit database:** The unit database is encoded using human-readable XML rather than a custom format. The XML parser included in the package supports an *<import>* element to allow easy and convenient customization.
- **No Fortran or Perl API:** Interfaces for these languages have not yet been created. Contact [support-udunits@unidata.ucar.edu](mailto:support-udunits@unidata.ucar.edu) if you are interested in helping to create these interfaces.

One thing that has not changed is that almost all unit string specifications understood by the UDUNITS-1 package are also understood by the UDUNITS-2 package. One exception is the symbol `g`, which in version 1 of the package was associated with standard free fall (a unit of acceleration) but which is associated with the unit gram in version 2 of the package.

## 3 Installing this Package

### 3.1 Installing from a Binary Distribution

#### 3.1.1 64-bit CentOS 6.4

If your operating system is compatible with 64-bit CentOS 6.4 (e.g., your system is 64-bit CentOS, Fedora, or RedHat), then create the file `/etc/yum.repos.d/unidata.repo` with the following contents:

```
[unidata]
name=Unidata Repository
baseurl=http://www.unidata.ucar.edu/repos/yum/CentOS/6/$basearch
enabled=1
```

You should then be able to install this package in the usual manner. For example,

```
su -
yum install udunits
```

#### 3.1.2 32-bit Ubuntu 12

If your operating system is compatible with 32-bit Ubuntu 12 (precious pangolin) (e.g., your system is 32-bit Debian or Ubuntu), then add the following line to the file `/etc/apt/sources.list` or `/etc/apt/sources.list.d/unidata.list`:

```
deb http://www.unidata.ucar.edu/repos/apt i386/
```

You should then be able to install this package in the usual manner. For example,

```
su -
apt-get update
apt-get install udunits
```

### 3.2 Installing from a Source Distribution

#### 3.2.1 Prerequisites for This Package

The Expat library and header-files must be installed. Look for the library "libexpat" and the header-file "expat.h".

If this package is to be tested (which is optional), then the CUnit library and header-files must be installed. Look for the library "libcunit" and the header-files "CUnit/CUnit.h" and "CUnit/Basic.h".

If this package is to be built on a Windows system, then the CMake and MinGW packages must be installed. Look for the utility "cmake" and the directory/folder "MinGW".

#### 3.2.2 Obtaining this Package

Get the source for this package from its download-page at <ftp://ftp.unidata.ucar.edu/pub/udunits/> and unpack it in an appropriate place. For example,

```
su -
cd /usr/local/src
wget -O - ftp://ftp.unidata.ucar.edu/pub/udunits/udunits-2.2.26-Source.tar.gz |
gunzip -c | pax -r
```

### 3.2.3 Unix Installation Instructions

#### 3.2.3.1 Autoconf-based Installation

Short instructions:

```
./configure [--prefix=root] [--disable-shared] [CC=path]
make
make check          # optional; requires CUNIT installation
make install        # also installs INFO documentation
make install-html install-pdf # optional
make clean
```

By default, the installation root is `/usr/local`.

Long instructions:

1. Go to the top-level source-directory of this package, e.g.,  

```
cd udunits-2.2.26
```
2. If necessary, clean-up from a previous installation attempt by making the `distclean` target using the `make` utility from step 2:

```
make distclean
```

The option `--disable-shared` causes the build process to create a static library only: a sharable library is not created. This option is necessary if the `libtool` utility that's included in this package can't build a sharable library using the given compiler.

3. Execute the `configure` script. Specify the installation prefix, the compiler from the previous step, and any required option. For example, if you are on an HP-UX system and want to use the `/bin/c89` compiler and install under `/opt`, then the following command is appropriate:

```
./configure --prefix=/opt --disable-shared CC=/bin/c89
```

If the installation prefix is not specified, then the default is to install under `/usr/local`.

If the compiler isn't specified, then the default is to use `gcc`.

4. Build this package by making the default target using the `make` utility from step 2:  

```
make
```
5. If you wish to verify that this package works correctly, then make the `check` target using the `make` utility from step 2:

```
make check
```

This step is only effective if the `configure` script found an installed CUNIT unit-testing package. If that package wasn't found, then the above command will quickly exit without testing this package.

6. Install the [Section “library” in `udunits2lib`](#), [Section “utility” in `udunits2prog`](#), header-files, units-database, and INFO documentation files by making the `install` target using the `make` utility from step 2:

```
make install
```

7. If desired, install the HTML and PDF documentation files by making one or more of the following targets using the `make` utility from step 2:

```
make install-html install-pdf
```

8. Clean up by making the `clean` target using the *make* utility from step 2:

```
make clean
```

### 3.2.3.2 CMake-based Installation

```
cmake
make all [test] install [install_test]
```

where the arguments in square brackets are optional.

### 3.2.4 Windows Installation Instructions

Currently, only a 32-bit **MinGW**-based installation is supported:

```
cmake -G "MinGW Makefiles"
cmake --build . [-DCMAKE_INSTALL_PREFIX=dir] -- all [test] install [install_test]■
```

where arguments in square brackets are optional.

The default installation-prefix is "C:\Program Files (x86)\udunits-2.*minor.bug*", where *minor* and *bug* are the minor version and bug-fix level, respectively.



## 4 Unit Library

See [Section “UDUNITS Library”](#) in `udunits2lib`, for details on this package’s unit library.

## 5 Unit Utility

See [Section “UDUNITS Utility”](#) in `udunits2prog`, for details on this package’s unit utility.

## 6 The Units Database

The database for the UDUNITS-2 package comprises one XML file containing unit prefixes and four XML files containing unit definitions:

- SI unit prefixes
- SI base units
- SI derived units
- Units accepted for use with the SI
- Non-SI units

## 7 Support for this Package

The home-page for this package can be found at <http://www.unidata.ucar.edu/software/udunits/>.

Bug reports should be sent to [support-udunits@unidata.ucar.edu](mailto:support-udunits@unidata.ucar.edu).

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