# 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 7.

# 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 comptibility, 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 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 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 Installing from a Binary Distribution

Currently, only an RPM binary distribution is supported.

Download the distribution by browsing to the Unidata UDUNITS RPM repository at https://artifacts.unidata.ucar.edu/service/rest/repository/browse/rpm-udunits/udunits/ or by executing, for example, the following commands:

```
cd ~/Downloads
wget https://artifacts.unidata.ucar.edu/repository/rpm-udunits/udunits/udunits-2.2.28-
```

Install the distribution. For example,

```
sudo rpm --install [--prefix=/opt/udunits] ~/Downloads/udunits-2.2.28-x86_64.rpm
```

where the argument in square brackets is optional. The default installation directory is `/usr/local`.

## 3.3 Installing from a Source Distribution

### 3.3.1 Installing from source on Unix

Download the source by browsing to the Unidata UDUNITS source repository at https://artifacts.unidata.ucar.edu/service/rest/repository/browse/downloads-udunits/ or by executing, for example, the following commands:

```
cd ~/Downloads
curl -O https://artifacts.unidata.ucar.edu/repository/downloads-udunits/udunits-2.2.28
```

Unpack the distribution in an appropriate place. For example,

```
cd /opt
sudo pax -rz < ~/Downloads/udunits-2.2.28.tar.gz
```

Build and install the package. For example

```
cd udunits2-2.2.28
./configure [--prefix=install_prefix] >&configure.log
make all [check] install [install-html] [install-pdf]
```

where the arguments in square brackets are optional. The default installation prefix is the parent directory of the source directory.

### 3.3.2 Installing from source on Windows

Download the source by browsing to the Unidata UDUNITS source repository at https://artifacts.unidata.ucar.edu/service/rest/repository/browse/downloads-udunits/ or by executing, for example, the following commands:

```
cd C:\Users\current_user\Downloads
curl -O https://artifacts.unidata.ucar.edu/repository/downloads-udunits/udunits-2.2.28
```

Unpack the distribution by opening the downloaded file and extracting the contents to, for example, the user's "Downloads" folder. Note that, by default, the extractor might create an extra top-level folder with a duplicate name. Remove the extra folder from the destination path if this is the case – either before or after extraction.

Build and install the package using cmake(1). For example

```
cd C:\Users\current_user\Downloads\udunits2-2.2.28
mkdir build
cd build
cmake [-D CMAKE_INSTALL_PREFIX=install_prefix] ..
make all install
```

where the argument in square brackets is optional. The default installation folder is the parent folder of the source folder.

# 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.

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