CHAPTER 10 ASCEND UNITS

10.1 THE MENU BAR

The Units Tool Set provides tools to allow the user to change the display units for variables.

Units vs dimensions

We distinguish between *units* and *dimensions* in ASCEND. The dimensions of acceleration, for example, are L/T^2, i.e., length/time squared. Units for acceleration are: m/s^2, ft/hr^2 and so forth. A chapter in the Howto book tells you how to enter dimensioned equations into ASCEND and includes a useful discussion on units and dimensions. Also see the ASCEND syntax document for a discussion.

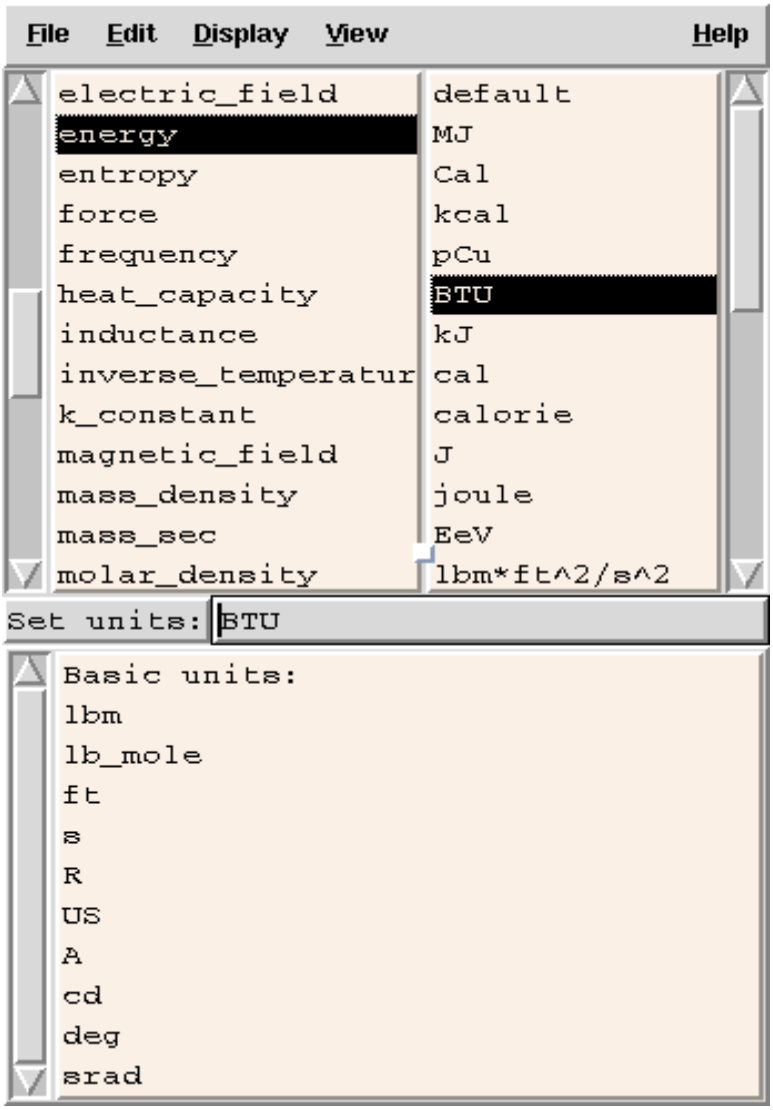
Typical use

The user will typically first pick the overall system of units such as SI, American Engineering or cgs. Alternatively the user may select to use the *default* display of units for some or all variable types. Displaying in default units means ASCEND will present the units in terms of the ten basic dimensions supported by ASCEND (length, time, temperature, etc.). The user can select the units to be used for each basic dimension. Whichever of these alternatives the user selects, he or she may then also choose the units ASCEND should use to display particular variable types. An example would be to select first SI units, then override the display of energy to be in default units and pressure to be in atm.

Once users have created their favorite choices for display units, they may save them to files for later restoration.

We describe here the various tools available within the Units tool set, as seen in

Figure 10-1 The Units of measure window



10.1.1 UNITS FILE MENU

Read file Reads in a file previously saved using the “Save file” command. Restores the display units to those previously saved.

Save file Writes out (in the current working directory) a plain text version of the user specified display units. Units which are defaulted are not written to this file. One can restore the display units to those currently set by reading this file back in later.

Close window Close this window. To reopen it, select Measuring units in the Tools menu of the Script or select the UNITS button on the Toolbox window.

Exit ASCEND Exit the ASCEND system. You will be asked to verify that you really wish to exit ASCEND.

10.1.2 UNITS EDIT MENU

Set precision Use the slider switch for this tool to set the number of digits of precision for displaying variable values to between 4 and 16. Precision is the number of digit displayed when the number is displayed using scientific notation. For example, 0.12345678 e04 for 1234.5678 has a precision of 8 digits.

Set basic units Drops a cascading window in which are listed the ten basic dimensions for ASCEND. You can select in which units you wish to see each base dimenion to be displayed using this list.

10.1.3 UNITS DISPLAY MENU

Show all units Causes the Display window to open showing the extensive set of units conversions currently used in ASCEND. The list opens in the Display window.

10.1.4 UNITS VIEW MENU

SI(MKS) set Pushing this button makes the default display units SI units.

US Engineering set Pushing this button makes the default display units US Engineering units.

CGS set Pushing this button makes the default display units CGS units.

Font Opens the window that lets you reset the fonts for this window. You can select the type of font, the style (bold, etc.) and the size for the font.

Open automatically Toggles a switch which, if set, will cause the Browser window to open whenever anything is placed into it by an export command.

Save window appearance Saves the current settings for this window for font settings and window size and placement on your computer screen. These become the default settings for opening this window in the future. These settings are saved in a *.a4o* text file for this window which the sytem stores in the subdirectory *ascdata* in your “home” directory.

10.1.5 UNITS HELP MENU

Brings up a text description of where to look for help on this window (i.e., it points to the pdf version of this document on the WWW.) You may, of course, look into the section mentioned in any local (but perhaps outdated) copy of the documentation.

10.2 AN ESSAY ON UNITS VS DIMENSIONS

ASCEND stores all numbers in SI (MKS) units internally. The units associated with a dimensionality (as exemplified by some atom) will be used when displaying variables of that dimensionality. These units can be manipulated through the Units window.

Numbers with unrecognized dimensionality (higher derivatives, multipliers, residuals and what not) will be given units consistent with the display units defined for the 10 base dimensions. The display units for the 10 dimensions can be changed through the Units window Display menu if you prefer an alternate default set such as US engineering, and so forth.

We recognize 10 base dimensions in the compiler:

```
L    distance             meter     m
M    mass                 kilogram  kg
T    time                 second    s
E    e- current           ampere    A
Q    quantity             mole      mole
TMP  temperature          Kelvin    K
LUM  luminous intensity   candela   cd
P    plane angle          radian    rad
S    solid angle          steradian srad
C    currency             currency  CR
```

The units conversions are defined in $ASCENDDIST/compiler/units_input, which is not particularly restricted. Units_input is converted to an efficient binary form (unitsfile.uni) at the time ASCEND is installed.

It can be argued that C is not a fundamental dimension, from a physical standpoint. There is more to life than physics: there is economy, hence engineering, hence an Advanced System for Computations in ENgineering Design.

The dimensions P and S are ‘supplementary’ according to the General Conference, but their use makes the coding of ASCEND much cleaner and easier.

10.2.1 ON UNITS

The left box in the Units window lists a set of atom types, each having a unique dimensionality. Selecting an atom in the left box will fill the right box with different possible units that the system knows about to display this type of variable. Dimensionless atoms and wild dimensioned atoms are not shown since they do not have display units. If you do not see an atom you expect here, it is because ASCEND already found another atom of the same dimensionality, e.g. fugacity may show up instead of pressure.

Selecting a unit in the right box sets that unit as the display unit for all variables having the same dimensionality of the selected atom in the left box. Thus picking **atm** for fugaciy will also change pressure units to **atm**. Selecting ‘default’ will cause the display to be a combination of the *fundamental* units (a nice way to remind oneself of the fundamental units for energy, for example).

Fundamental units are the units corresponding to single dimensions. These units are chosen on the Display menu under the dimension choices. No atoms with fundamental units are listed in the left box. The current set of fundamental units is always shown at the very bottom of the units window. This set is used whenever a value is displayed which does not have a user specified units set associated with its dimensionality. The fundamental units are created via the units_input file mentioned above. If you do not find one you want, ask whoever compiled your version of unitsfile.uni to add the missing unit and rebuild the unitsfile.uni.

If converting the units for a variable makes the display of that number impossible (e.g., due to overflow). ASCEND will first attempt to display it using its fundamental units. If it still cannot be displayed, it will be displayed in SI units.

You may specify a new combination of existing units (e.g. Pa*s) using the **Set units** which is the line at the bottom of the window. Type in the combination desired and press RETURN.

Unit strings may not have parentheses in them. For example, kg/(m*s^2) is not allowed.