

Documentation for the Conversion Editor of the FRAMEwork System (FRAMES)

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Introduction

This documentation provides information on a component of Version 2.x of the FRAMEwork System (FRAMES), which is a software platform that allows for the linking of various modules into complete assessment systems ([Whelan et al. 1997](#) PNNL-11748). Documentation includes requirements, design and specifications or formulations, and quality assurance and testing.

Portions of this documentation may have been previously issued in reports from the Pacific Northwest National Laboratory (PNNL), operated by Battelle for the U.S. Department of Energy. All PNNL reports are issued a tracking number. Numbers on the title page of this documentation indicate these previous reports.

This documentation can be used by software engineers and testers to ensure that each component functions properly. The information can also be used by analysts and managers to better understand the component's use within FRAMES.



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Requirements of the FRAMES Conversion Editor

The FRAMEwork System (FRAMES) is configured, managed, and viewed through a suite of editors, each with its own documentation:

- [Conversion Editor](#), which manages measures and units used by dictionaries and datasets to automatically convert between different mediums
- [Dictionary Editor](#), which creates and edits dictionaries used by FRAMES to categorize data
- [Module Editor](#), which creates and manages the modules that manipulate data by specifying dictionaries
- [Domain Editor](#), which organizes a palette of modules
- [Simulation Editor](#), which sets up and runs a simulation.

This documentation is for the Conversion Editor. The Conversion Editor provides an interface for creating, modifying, and deleting conversions. All changes are stored in the convert.csv file located in the same directory as FRAMES. Conversions provide FRAMES with the capability to convert units from or to any desired unit as long as the units' conversion ratios have both been defined. This flexibility provides modelers with the ability to produce data in any desired format without having to consider input factors for other models.

Conversions in FRAMES 2.0 make use of two identifying properties, measures and units. A measure categorizes a collection of units that inherit the same measuring properties. A unit describes the scaling properties between other related units within the same measure. The Conversion Editor speaks directly to the FRAMES system control. Therefore, all conversions must be defined before any references to a unit can be made within any editor of FRAMES 2.0.

This section summarizes requirements for the Conversion Editor. Those interested in setting up a risk scenario and analyzing data should refer to the start up documentation for additional information. Those interested in importing a module into FRAMES should refer to the importation documentation for additional information.

The Conversion Editor has the following requirements:

1. Operate using the FRAMES 2.0 Application Programming Interface (API) under Windows 98 or higher
2. Provide an interface for creating, editing, and deleting conversions
3. Require that all conversions make use of two identifying properties: measures and units
4. Allow for conversions that use scaling and offset factors
5. Not allow the user to delete a base unit for a measure on the Conversion Editor tab
6. Require the user to enter a unique name for each measure or unit
7. Update the convert.csv file upon selecting "Save" and/or "Save and Exit" from the FRAMES user interface File menu.



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Design of the FRAMES Conversion Editor

The Conversion Editor is designed to function with measures and units. The following sections describe these in more detail.

Measures

A measure categorizes a collection of units that inherit the same measuring properties. For example, **Time** is a measure, with seconds, minutes, hours, and days being related units. In FRAMES 2.0, each measure has a base unit that all other units must relate their scaling properties back to. Using **Time** as a measure, seconds is a logical choice for the base unit. Every unit within the measure **Time** needs to base its scaling properties on how many seconds per minute, hour, days, etc. Once a unit has been added and the scaling properties defined down to the base unit, the unit is capable of converting to every related unit. For example, if millisecond was added to the collection of **Time** and scaled to the base unit (seconds), with seconds, minutes, hours, and days already in the collection, then milliseconds could be converted to or from any other unit in **Time**. This approach reduces the complexity in defining relationships between units because not every combination of units needs to be defined.

Defining Base Units

Each measure must have a base unit defined. Therefore, the Conversion Editor automatically prompts the user to define a base unit after adding a measure. When converting units, the base unit is used as a scaling link between all other units within the measure.

Adding a Measure

To add a measure, the FRAMEwork Development Environment must know not only the name of the measure but also the base unit to which every other unit will base its calculations. Therefore, the Conversion Editor requires that the user provide both name and base-unit name for the new measure.

Deleting a Measure

To delete a measure, the Conversion Editor includes a button to delete a measure. Once the user clicks the button, a message box seeks confirmation. When the user confirms the deletion by clicking "yes," the selected measure is removed.

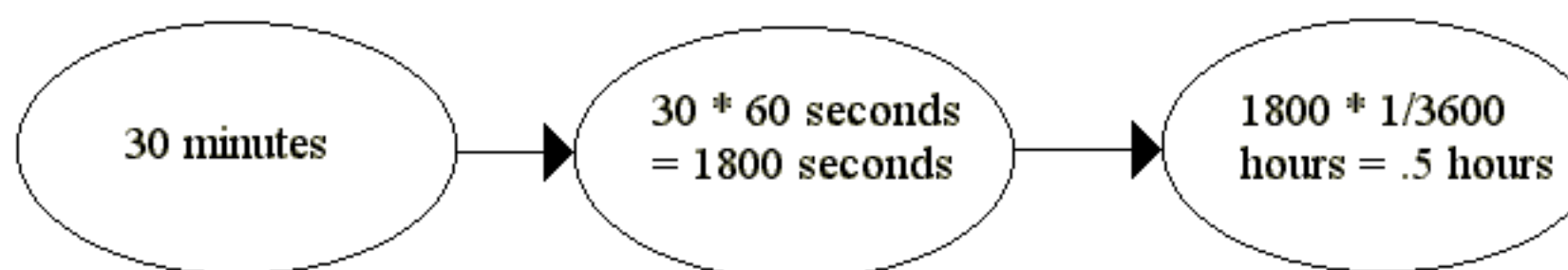
Units

A unit is an identifier with scaling properties. The scaling properties define how units are related to each other and converted from one unit to another.

Converting Values

Converting values is the process of changing values of data from one unit of measure to another. Converting values from the original unit to a designated unit is a two-step process:

1. The initial value associated with the original unit is converted to the base unit.
2. The value is converted from the base unit to the final unit (see figure below).



Example of Conversion

Adding a Unit

To add a unit, the user selects a measure from the list of measures, from which a panel displays the list of units belonging to that measure and the current properties of the selected measure. Clicking the "Add Unit" button allows the user to enter a name for the new unit. On confirmation, the user may enter a name for the abbreviated version of the new unit. On confirmation, the new unit appears with the list of all other units belonging to the measure in question.

Deleting a Unit

To delete a unit, the user selects a measure from the list of measures, from which a panel displays the list of units belonging to that measure and the current properties of the selected measure. After highlighting a unit, the user clicks on the "Delete Unit" button. On confirmation, the selected unit is removed from that list.

Scaling Properties

A unit's scaling properties describe how a unit is related to other units within a measure. The scaling properties consist of a factor scalar and an offset scalar. When defining a unit's factor and offset scalars, they are related directly to the base unit. The formula used for converting values to the base unit is

$$\text{Intermediate Value} = (\text{Initial Value} - \text{Initial Unit's Offset}) * \text{Initial Unit's Factor}$$

The formula used for converting values from the base unit to the final unit is

$$\text{Final Value} = (\text{Intermediate Value} / \text{Final Unit's Factor}) + \text{Final Unit's Offset}$$

A unit's factor value describes the number of base units per unit. For example, in the case of measure **Time** with unit *hour* and the base unit in *seconds*, the factor value should equal 3600 (the number of seconds within an hour).

A unit's offset value describes a conversion value to be added after factor conversion. Most units have an offset of zero; however, in the case of temperatures, an offset value is needed to convert values from and to Fahrenheit and Celsius.



Quality Assurance and Testing of the FRAMES Conversion Editor

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The FRAMES Conversion Editor was developed under a quality assurance (QA) program that looked at the software life cycle: requirements analysis, design, programming, modification, testing, and implementation. Part of the QA program involves testing each component to ensure that it satisfies its requirements. The [requirements](#) section of this documentation provides a list of requirements for the FRAMES Conversion Editor. A test plan was developed with a test case that addressed these requirements. An overview of quality assurance and testing for FRAMES can be found in the [system documentation](#).

An Approach to Ensuring Quality in Environmental Software ([Gelston et al., 1998](#) PNNL-11880)

- [Test Plan for the Conversion Editor](#)
- [Status Report for the Conversion Editor](#)
- [Test bed for the Conversion Editor](#)

