

Global User-defined RPL Functions - User Guide

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This document describes the use of a new RiverWare 5.1 feature: *Global User-defined RPL Functions*. These are user-defined RPL Functions globally accessible to all applications of RPL within a RiverWare session.

1 Overview

Global RPL Functions exist within Global Functions Sets (a new type of RPL Set), organized in Global Function Groups (Utility Groups). Multiple Global Function Sets can be opened within a RiverWare session.

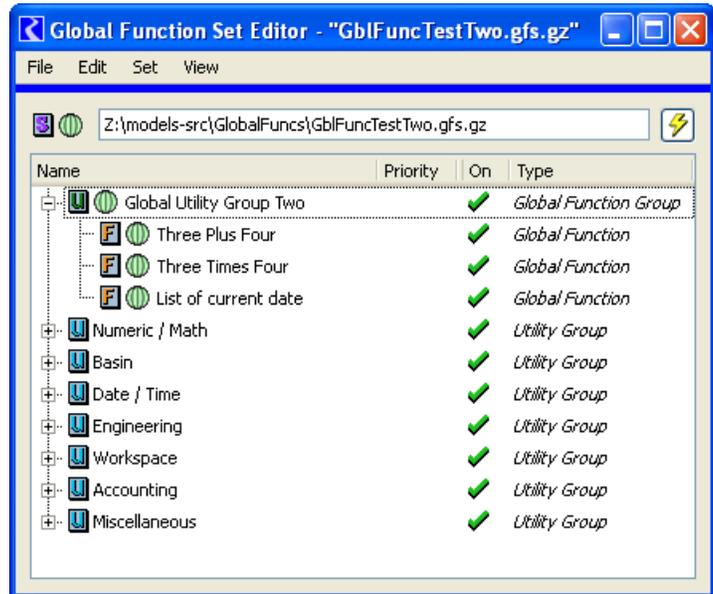
Any RPL Set File can be loaded as a Global Function RPL Set. (Only the RPL Set's Utility Groups -- and not its Policy Groups -- are relevant in Global Function Sets).

Global RPL Functions can be called from RPL Functions and Rules (and other forms of RPL Blocks) in any open RPL Set within the RiverWare session, including RBS Rulesets, Optimization Policy Sets, the Object Level Accounting Method Set, MRM Rules, and Series or Scalar Slots with RPL Expressions. Global Functions can call other Global Functions, either in the same Global Function Set, or a different Global Function Set.

The Global RPL Functions in the opened Global RPL Sets appear in the RPL Palette, on the User-Defined Functions Tab. Within the function list in that tab, global functions are annotated with a "globe" icon.

During evaluation of a Global RPL Function, "RPL Application"-specific behavior is consistent with the caller's RPL Application. For example, "@t" (the current timestep) represents the Rulebased Simulation Controller's current timestep when the function is called from an RBS Rule. But when called from a Series Slot with RPL Expression, "@t" (current timestep) represents a particular series timestep date/time.

Only one instance of a utility group or function can occur within all loaded RPL sets and Global Function Sets. For example, you cannot have a function named "GetMinimumFlow" in a utility group in your ruleset and in a Global Function Set. An error will occur in this case.

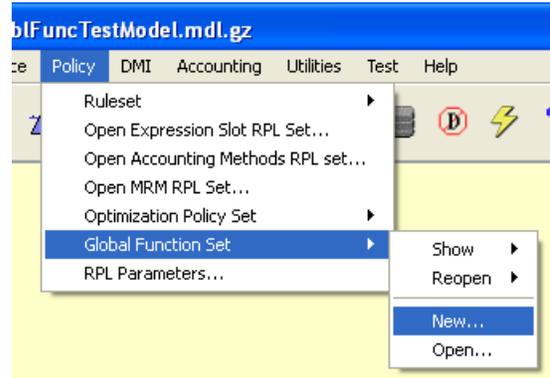
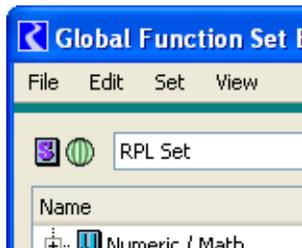


2 Creating a new Global RPL Function Set

A new Global RPL Function Set can be created from the RiverWare Workspace Menu, with this menu item:

Policy >> Global Function Set >> New...

This opens up a Global Function Set editor. This is a RPL Set Editor for Global Function Sets, distinguished with a *green globe* icon in the upper-left area of the editor dialog:



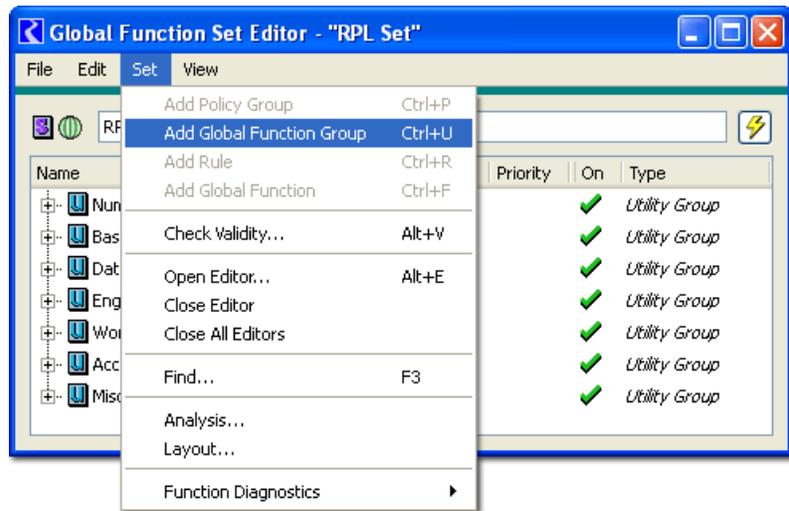
The RPL Set will be empty (except for the Predefined Function Utility Groups which are automatically added to all RPL Sets and are optionally shown with a toggle under the View menu).

As with all RPL Sets, a Utility Group must first be added before new user-defined RPL Functions can be defined. In a Global RPL Function Set, this is done from the Rpl Set Editor's menu item:

Set >> Add Global Function Group.

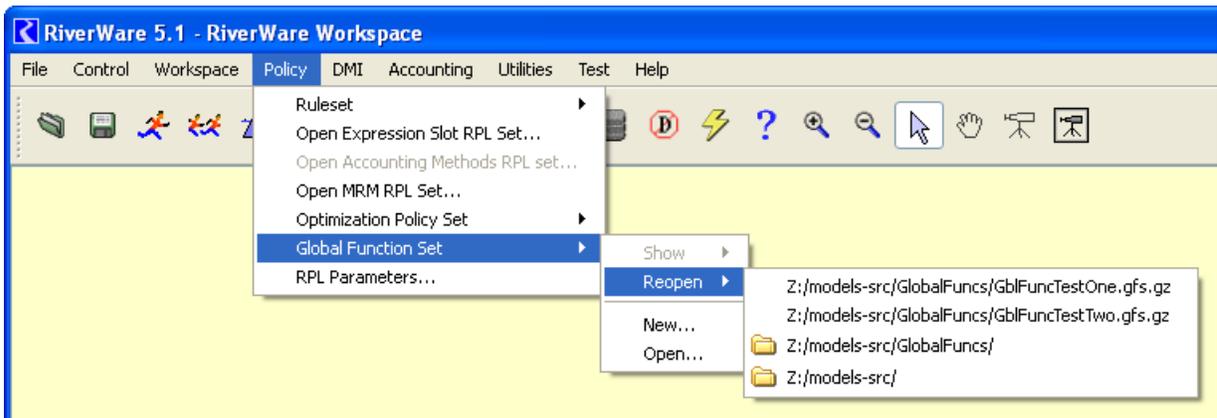
Any function added to the new Global Function Group is, by definition, a Global Function. A Global Function can be created in any of the following ways (not illustrated):

1. From the RPL Set editor, with the desired Global Function Group selected, using the Set >> Add Global Function (Ctrl+F) menu item.
2. From the RPL Set editor, using the Context Menu (right-click) on the desired Global Function Group item, Add >> Global Function.
3. From the Global Function Group Editor, using the Group >> Add Global Function (Ctrl+F) menu item.
4. From the Global Function Group Editor, using the Context Menu (right-click) anywhere within the function list, Add >> Global Function.
5. By Copying a Function from another RPL Group or RPL Set, and Appending into the Global Function Group, using Context Menu operations.



6. By Dragging a Function from another RPL Group or RPL Set into the Global Function Group. *NOTE:* The Drag-and-Drop functionality currently implemented in the RPL Set and RPL Group editors has some limitations, including the availability of that operation only if the target function list already has at least one function.
7. By importing Utility Groups from a RPL Set file. This is done from the RPL Set editor, File >> Import Set... menu item.

3 Opening an Existing Global Function Set



The RiverWare Workspace Policy menu supports the opening of a RPL Set as a Global Function Set in ways similar to opening other RPL Set files.

Any RPL Set file can be loaded as a Global Function Set, however only the Utility Groups within the RPL Sets loaded as Global Function RPL Sets are usable -- *Rules (or other forms of RPL Blocks) within the set's Policy Groups are not.* If a RPL Set file containing Policy Groups is opened as a Global Function Set, the illustrated warning dialog is shown, and a similar warning message is written to the RiverWare diagnostics output.



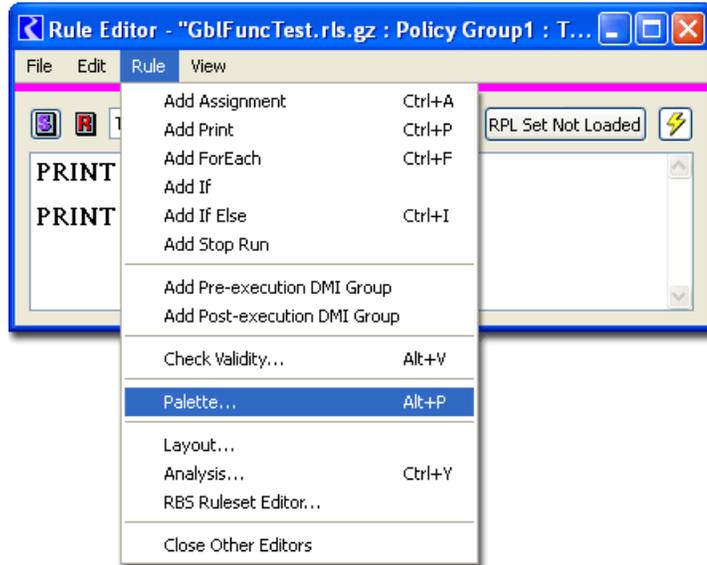
It is important to open any Global Function Sets before trying to load a ruleset that uses functions in a global set..

A distinct file and directory “history” for opening and saving is maintained for Global Functions Sets. This history is saved in user login-based settings (implemented with Qt QSettings). When a file dialog is shown for loading or saving a Global Function Set, the default filename filter shows files with the “.gfs” or “.gfs.gz” (gzipped) file extensions. These are only recommendations for filename extensions for Global Function Set files -- the user can use any filename extension for Global Function Set files.

4 Using Global RPL Functions

When editing a RPL Expression, any Global Function in any Global RPL Set can be called. The standard way of adding a call to any user defined function is via the RPL Palette's User-Defined Functions tab.

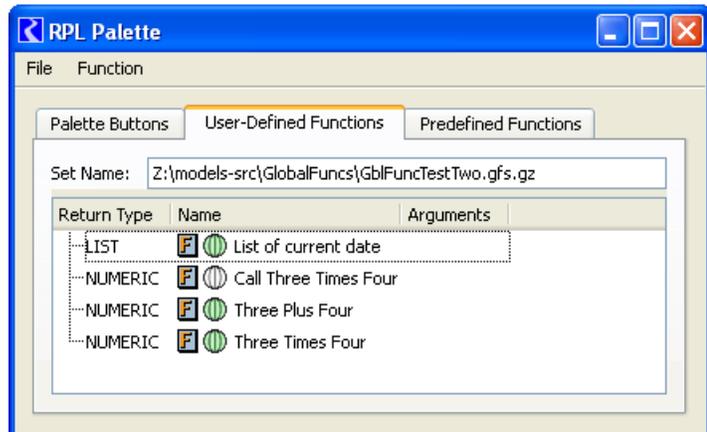
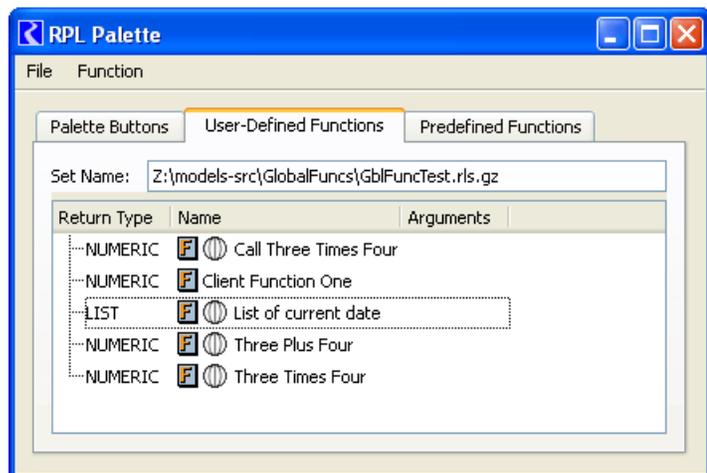
The RPL Palette can be shown from the Rule Editor's Rule Menu (as shown), or from the Function Editor's Function Menu.



In the user-defined function lists, only those functions with a return type appropriate for the RPL expression currently selected within the RPL editor are enabled for selection.

Within the User-Defined Function list, global functions are indicated with one of two *globe* icons:

- A **white globe** -- indicates an “external” Global Function ... i.e. a global function in a RPL Set other than the set containing the RPL expression being edited.
- A **green globe** -- indicates a “local” Global Function ... i.e. a global function within the same RPL Set as the one containing the RPL expression being edited.



5 Batch Mode (RCL) Support for Global RPL Functions

The RiverWare RCL batch scripting language was enhanced to support the opening of Global RPL Sets. Global RPL Sets must be opened before the policy set (the RBS Ruleset file) is loaded (assuming that the policy set includes calls to global functions in the Global RPL Set). Multiple Global RPL Sets can be opened.

The new RPL command for opening a Global Function Set is:

```
OpenGlobalSet <global RPL function set file>
```

Here is *an example* of a RiverWare RCL batch script using a Global RPL Function Set:

```
OpenWorkspace      Z: /models-src/GlobalFuncs/GblFuncTestModel.mdl.gz
OpenGlobalSet      Z: /models-src/GlobalFuncs/GblFuncTest.gfs.gz
LoadRules          Z: /models-src/GlobalFuncs/GblFuncTest.rls.gz
StartController
CloseWorkspace
```

6 RiverWare Command Line Support for Global RPL Functions

RiverWare supports loading models and rulesets and lots of other operations from the command line. A complete list of command line options can be viewed by invoking Riverware with the `--help` command line argument. On Windows, in a command line window (cmd), this looks like this:

```
riverware.exe --help
```

The command to open a Global RPL Function Set is:

```
--globalset <global RPL function set file>
```

This command can be repeated if multiple Global RPL Function Sets are to be opened. Unlike use of the similar RCL command discussed above, it is not necessary for the `globalset` command line command to occur before the `--ruleset` command (to load a RBS Ruleset).

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