# MULTI: Scripting


**Green Hills Software**
**30 West Sola Street**
**Santa Barbara, California 93101**
**USA**
**Tel: 805-965-6044**
**Fax: 805-965-6343**
**www.ghs.com**

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# Contents

# Preface

## Contents

This preface discusses the purpose of the manual, the MULTI documentation set, and typographical conventions used.

## About This Book

This book contains information about creating MULTI scripts and about the MULTI-Python integration. It is divided into the following parts:

- *Part I: MULTI Scripting* describes how to use MULTI's built-in scripting language. See Part I. MULTI Scripting on page 1.
- *Part II: MULTI-Python Scripting* describes how to use MULTI's integration with Python. It also contains tutorials that demonstrate how to use the MULTI-Python integration to control MULTI IDE components. See Part II. MULTI-Python Scripting on page 13.
- *Part III: MULTI-Python API Reference* describes all the Python functions provided in the MULTI-Python API. See Part III. MULTI-Python API Reference on page 77.
- *Part IV: Appendix* contains license and copyright information for third-party tools shipped with MULTI. See Part IV. Appendix on page 339.

### Note

New or updated information may have become available while this book was in production. For additional material that was not available at press time, or for revisions that may have become necessary since this book was printed, please check your installation directory for release notes, **README** files, and other supplementary documentation.

## The MULTI 6 Document Set

The primary documentation for using MULTI is provided in the following books:

- *MULTI: Getting Started* — Provides an introduction to the MULTI Integrated Development Environment and leads you through a simple tutorial.
- *MULTI: Licensing* — Describes how to obtain, install, and administer MULTI licenses.
- *MULTI: Managing Projects and Configuring the IDE* — Describes how to create and manage projects and how to configure the MULTI IDE.
- *MULTI: Building Applications* — Describes how to use the compiler driver and the tools that compile, assemble, and link your code. Also describes the Green Hills implementation of supported high-level languages.
- *MULTI: Configuring Connections* — Describes how to configure connections to your target.
- *MULTI: Debugging* — Describes how to set up your target debugging interface for use with MULTI and how to use the MULTI Debugger and associated tools.
- *MULTI: Debugging Command Reference* — Explains how to use Debugger commands and provides a comprehensive reference of Debugger commands.
- *MULTI: Scripting* — Describes how to create MULTI scripts. Also contains information about the MULTI-Python integration.

For a comprehensive list of the books provided with your MULTI installation, see the **Help → Manuals** menu accessible from most MULTI windows.

Most books are available in the following formats:

- A printed book (select books are not available in print).
- Online help, accessible from most MULTI windows via the **Help → Manuals** menu.
- An electronic PDF, available in the **manuals** subdirectory of your IDE or Compiler installation.

## Conventions Used in the MULTI Document Set

All Green Hills documentation assumes that you have a working knowledge of your host operating system and its conventions, including its command line and graphical user interface (GUI) modes.

Green Hills documentation uses a variety of notational conventions to present information and describe procedures. These conventions are described below.

| Convention | Indication | Example |
|---|---|---|
| **bold** type | Filename or pathname | **C:\MyProjects** |
| | Command | **setup** command |
| | Option | **-G** option |
| | Window title | The **Breakpoints** window |
| | Menu name or menu choice | The **File** menu |
| | Field name | **Working Directory:** |
| | Button name | The **Browse** button |
| *italic* type | Replaceable text | **-o *filename*** |
| | A new term | A task may be called a *process* or a *thread* |
| | A book title | *MULTI: Debugging* |
| `monospace` type | Text you should enter as presented | Type `help` *`command_name`* |
| | A word or words used in a command or example | The **wait** [-global] command blocks command processing, where `-global` blocks command processing for all MULTI processes. |
| | Source code | `int a = 3;` |
| | Input/output | `> print Test`<br>`Test` |
| | A function | `GHS_System()` |
| ellipsis (...)<br>(in command line instructions) | The preceding argument or option can be repeated zero or more times. | **debugbutton** [*name*]... |

| Convention | Indication | Example |
|---|---|---|
| greater than sign ( > ) | Represents a prompt. Your actual prompt may be a different symbol or string. The > prompt helps to distinguish input from output in examples of screen displays. | `> print Test`<br>`Test` |
| pipe ( \| )<br>(in command line instructions) | One (and only one) of the parameters or options separated by the pipe or pipes should be specified. | **call** *proc* \| *expr* |
| square brackets ( [ ] )<br>(in command line instructions) | Optional argument, command, option, and so on. You can either include or omit the enclosed elements. The square brackets should not appear in your actual command. | `.macro` *`name`* `[`*`list`*`]` |

The following command description demonstrates the use of some of these typographical conventions.

**gxyz** [-*option*]... *filename*

The formatting of this command indicates that:

- The command **gxyz** should be entered as shown.
- The option `-option` should either be replaced with one or more appropriate options or be omitted.
- The word `filename` should be replaced with the actual filename of an appropriate file.

The square brackets and the ellipsis should not appear in the actual command you enter.

# Part I

# MULTI Scripting

# Chapter 1

# Using MULTI Scripts

## Contents

This chapter describes the basic conventions for writing, editing, and running scripts.

## Script Overview

A script is a list of commands and expressions in a file. MULTI reads and executes this file as if you entered each command and expression individually in the Debugger command pane. Most script files end in an **.rc** extension and can be run as startup files. For more information, see "Using Script Files" in Chapter 7, "Configuring and Customizing MULTI" in the *MULTI: Managing Projects and Configuring the IDE* book.

Scripts can automate common tasks and regression testing. For example, a script file can compare a program variable to a constant value and then perform some action based on the result. A script file can also execute parts of a program and then check to see whether the process ran correctly. You can use such a script to verify that your process still runs as expected even after you change the program.

Scripts can contain macros (see "Using Macros" on page 5) and flow control statements, such as `if (expr) { ... } else { ... }` or `while(expr) { ... }`. You can use these types of statements to control the execution of specific commands within a script.

You can use board setup scripts to configure your target board automatically before you download and debug code. Board setup scripts end in an **.mbs** extension. For information about using and editing board setup scripts, see Chapter 6, "Configuring Your Target Hardware" in the *MULTI: Debugging* book.

# Creating a MULTI Script

You can create a script in either of the following ways:

- Enter the **> [*file*]** command to record commands entered in the MULTI Debugger command pane. For more information, see Chapter 15, "Scripting Command Reference" in the *MULTI: Debugging Command Reference* book.
- Use a text editor.

For commands that are particularly useful for writing scripts, see Chapter 15, "Scripting Command Reference" in the *MULTI: Debugging Command Reference* book. You can also use debug server commands in your script if they are preceded by the **target** command. For more information about the **target** command, see "General Target Connection Commands" in Chapter 18, "Target Connection Command Reference" in the *MULTI: Debugging Command Reference* book. For a list of debug server commands, see the documentation about Green Hills debug server scripts and commands in the *MULTI: Configuring Connections* book for your target processor family. Additionally, the debug server that supports your specific target may accept other commands. For additional debug server commands, see the relevant chapter in the *MULTI: Configuring Connections* book for your target processor family.

## Using Macros

Use the **define** command to create macros that you can include in MULTI scripts. (See the **define** command in "Command Manipulation and Macro Commands" in Chapter 15, "Scripting Command Reference" in the *MULTI: Debugging Command Reference* book.) The **define** command is similar to the C preprocessor directive `#define`. It gives you the ability to create a macro inside MULTI. You can later run that macro from the Debugger command pane or from a script. For an example of a script that references **define** macros, see Example 1.1. Regression Testing on page 6.

## Example Scripts

The following examples show ways in which you can use scripts to automate common tasks.

### Example 1.1. Regression Testing

The following regression test example consists of a program that converts Fahrenheit temperatures to Celsius.

Suppose the source file, **temp.c**, of the program you are debugging contains the code:

```
#include <stdio.h>
#define CONV (5.0/9.0)
extern int mytotal;
int celsius (int fahrenheit) {
   int rval = (int) ((fahrenheit - 32) * CONV);
   return rval;
}
void main (void) {
   int some_degrees;
   int some_celsius;
LABEL:
   some_celsius = celsius(some_degrees);
   printf("some_celsius = %i", some_celsius);
}
```

You define a script file, **temp.rc**, that MULTI loads every time you debug **temp**. The **temp.rc** file contains:

```
debugbutton RegTest1 c="<regtest.rc" i="letter_r"
define check_celsius(arg) {
   if (some_celsius != arg) {
      print "Failed!"
      printf ("Failed!\n actual:%d\n expected:%d\n", some_celsius, arg);
   } else {
      print "Pass";
      printf ("Pass!\n actual:%d\n expected:%d\n", some_celsius, arg);
   }
}
```

In a script file named **regtest.rc**, you define the commands that MULTI runs when you click the **RegTest1** button. The **regtest.rc** file contains:

```
b main##LABEL
rb
some_degrees = 45;
S
```

```
wait
check_celsius(7);
cb
```

Now, when you start the MULTI Debugger on **temp**, MULTI runs the script **temp.rc** automatically. The script creates a button with the name **RegTest1** and the built-in icon **letter_r** with the shape of the letter "R." The script also defines the macro `check_celsius`. When you click the **RegTest1** button, MULTI runs the commands in **regtest.rc** as if you entered them directly in the Debugger command pane. You must be connected to a target before running these commands.

The following features are demonstrated in this example:

- MULTI uses commands such as **b** as if you entered them directly in the Debugger command pane.
- The example references program variables and **define** macros. The macro defined by **temp.rc** displays the results of the regression test. For more information, see "Using Macros" on page 5.
- From your script, you can call functions that are linked into your program, such as `printf()`.
- MULTI evaluates C-like expressions such as `if() {} else {}`.

### Example 1.2. Collecting and Printing Execution Information

The following example script single-steps 100 times and writes executed lines to the MULTI command pane, allowing you to see exactly what lines of source code and which instructions were executed. This process is similar to collecting and analyzing trace data, but is much slower and requires manual analysis. As a result, it is typically only useful if your target does not support trace.

This script works well for stepping through code that you do not have the source to (library code, for example). It does not work well if your program has timing requirements or if your program requires that interrupts be enabled.

```
$i = 100;
while ($i > 0){
  $i--;
  si;
  printline;
```

```
  wait;
}
```

You can insert other commands into the loop, as shown below:

```
$i = 100;
while ($i > 0) {
  $i--;
  si;
  wait;
  $r3;
  printline;
  wait;
}
```

In addition to single-stepping 100 times and writing executed lines to the MULTI command pane, the preceding script reads and prints register `r3` at each step, allowing you to easily track its value.

For greater flexibility, you can define a macro such as the following:

```
> define step_and_record($n){$m = $n; while ($m > 0) {
eval si; wait; printline; eval $m=$m-1 } }
> step_and_record(1000)
```

#### Example 1.3. Updating the Source Pane During Execution

Rather than printing execution information as the preceding example does, the following script updates the source pane as MULTI steps through source code (press **Esc** to abort).

```
while(1){
  s;
  wait;
  E;
  update;
  wait -time 100;
}
```

#### Example 1.4. Reading from and Writing to a Variable in Memory

The following script reads from and writes to a variable in memory. You can also use the MULTI commands **memread** and **memwrite** to do this. For information

about these commands, see "General Memory Commands" in Chapter 10, "Memory Command Reference" in the *MULTI: Debugging Command Reference* book.

```
> $a = *(unsigned int *)0x8000f0000
> *(unsigned int *)0x8000f0000 = $a + 1
```

### Example 1.5. Performing a toupper() on a String

The following script gets the uppercase version of a string and prints the string to the command pane:

```
define $m_toupper($str) {
     eval $i=0;
     while (( *($str+$i) ) !=0 ){
       eval ($func_char = (*($str+$i)));
       if (($func_char>='a') && ($func_char<='z')) {
           eval ((*($str+$i)) = $func_char + ('A'-'a'));
       }
       eval $i++;
     }
     mprintf("%s\n",$str);
}
```

### Example 1.6. Advanced: Using Strings in MULTI Scripts

By default, strings that you use are stored in target memory. This can be quite useful when you are debugging because it allows you to do things like make a command line procedure call, passing in as an argument a variable you invent during run time.

However, at times you may want to use a string that does not exist on the target but that you can use in the course of a script or other debug action. To work around the default behavior, you can define a macro that returns a string. Because you cannot actually allocate a string, use the **mprintf** command to simply echo the string to the screen (see the **mprintf** command in Chapter 8, "Display and Print Command Reference" in the *MULTI: Debugging Command Reference* book). Then use the **substitute** command to make use of the echoed value. The **substitute** command replaces the expression `%EVAL{command}` with the output of `command`. (See the **substitute** command in "Command Manipulation and Macro Commands" in Chapter 15, "Scripting Command Reference" in the *MULTI: Debugging Command Reference* book.)

Taken together, you have:

```
define ip_addr() {mprintf("192.100.168.2")};
substitute debugbutton "connect_mpserv" \
c="connect mpserv %EVAL{ip_addr()}" \
h="connect to %EVAL{ip_addr()}"
```

This script uses `ip_addr()` as a string variable and creates a Debugger button with two occurrences of `ip_addr()` in it.

## Checking the Syntax of Your Script

It can be time consuming to test all the elements of a script by hand. Instead of attempting to do this manually, you can use MULTI, which provides a syntax checking feature. This feature validates a script's command syntax without interacting with the target or changing system settings. You can access the syntax checking feature via the **sc** command, which checks your script to ensure it has correct syntax and valid object references. For more information, see "Syntax Checking" in Chapter 14, "Using Expressions, Variables, and Procedure Calls" in the *MULTI: Debugging* book.

### Note

Use the **bpSyntaxChecking** configuration option to control whether MULTI checks the syntax of the commands associated with breakpoints. By default, MULTI checks the syntax of a breakpoint's command list when the breakpoint is set and also when you enter the **sc** command. For more information about the **bpSyntaxChecking** configuration option, see Chapter 8, "Configuration Options" in the *MULTI: Managing Projects and Configuring the IDE* book.

The **sc** command has three limitations, as follows.

1. When you use the **bu** command to set a breakpoint, the **sc** command cannot check syntax errors in commands associated with the breakpoint. The **bu** command sets up-level breakpoints; the context of the breakpoint depends on dynamic execution. For example, if you enter `bu { print varA }`, MULTI cannot determine the up-level procedure until it actually encounters the **bu** command while running the script. When syntax checking the script, MULTI has no way to check if the variable `varA` is a valid reference.

2. The **sc** command cannot check for syntax errors in the body of a macro.
3. The **sc** command treats all local variable references that are not located in a breakpoint command as errors. The following script contains an example of this.

```
b main#10 {if (argc>2) {print argc+i;} else {print "Too few arguments"}};
print argc+i;
print global_var;
```

   If the procedure `main` contains the number variables `argc` and `i`, and there is a global variable `global_var`, the **sc** command accepts the first and the third lines. However, the **sc** command treats the second line as an error because MULTI cannot determine the context in which it performs the `print argc+i` statement.

## Running a Script

To run a script, you can:

- Enter the **<** command followed by the *`file`* argument. For more information, see Chapter 15, "Scripting Command Reference" in the *MULTI: Debugging Command Reference* book.
- Enter the **-rc** option when starting MULTI from the command line. For more information, see Appendix C, "Command Line Reference" in the *MULTI: Debugging* book.
- Create a button or menu item that uses the **<** command to execute the script. For information, see "Configuring and Customizing Toolbar Buttons" in Chapter 7, "Configuring and Customizing MULTI" in the *MULTI: Managing Projects and Configuring the IDE* book.
- Save the script as one of the following types of startup scripts, which MULTI runs automatically at specific times:
  - User script file (**multi.rc**)
  - Program script file (***executable_name*.rc**)

  For more information about these file types, their locations, and the order in which they run at startup, see "Using Script Files" in Chapter 7, "Configuring

and Customizing MULTI" in the *MULTI: Managing Projects and Configuring the IDE* book.

- (For board setup scripts) Use the **Connection Editor** or the **connect setup=*setup_file*** command to specify an **.mbs** file to run before you download and debug code. For more information, see "Using MULTI (.mbs) Setup Scripts When Connecting to Your Target" in Chapter 6, "Configuring Your Target Hardware" in the *MULTI: Debugging* book.

# Part II

# MULTI-Python Scripting

# Chapter 2

# Introduction to the MULTI-Python Integration

## Contents

The documentation for the MULTI-Python integration assumes that you have a basic knowledge of Python. To learn more about Python, see the Python Web site [http://www.python.org].

The MULTI-Python integrated system allows you to use Python code to drive all MULTI IDE components, including the MULTI Project Manager, Debugger, and Editor.

The MULTI-Python integrated system includes the following extensions to standard Python:

- Classes enabling you to access the functions of each MULTI IDE component
- Classes enabling you to access the functions of many MULTI IDE windows
- A general MULTI IDE window class that provides common functions for windows
- Python utility functions and variables for the MULTI IDE
- GUI and non-GUI interfaces in which to run MULTI-Python statements

## Python Installation

The MULTI IDE installation contains a complete Python 2.3.3 installation for your platform. After you have installed MULTI, you should be able to use Python immediately. Alternatively, you may use a customized Python installation. The following sections provide more information about installations.

**Note**

A few Python script files in the Python installation that is shipped with the IDE have been modified to fix bugs.

### The Default Python Installation

Python 2.3.3 is located in the top-level directory of your MULTI IDE installation.

MULTI-Python integration code is located in the following subdirectory of the IDE installation:

- Windows — **defaults\python**

- Linux/Solaris — **defaults/python**

### Installing Additional Python Modules (Windows only)

You may want to install additional Python modules to the default Python installation to ease scripting and analysis. Before installing an official Python module, you must register the Python installation in the Windows Registry so that the Python module installer can find it. To register the Python installation, run the **regedit** command to open the Windows Registry and add the following keys:

```
HKEY_LOCAL_MACHINE\Software\Python\PythonCore\2.3\InstallPath
```

```
HKEY_LOCAL_MACHINE\Software\Python\PythonCore\2.3\PythonPath
```

Set each key's value to:

*ide_install_dir*`\python`

## Using a Customized Python Installation

You can use a customized Python installation by setting the following environment variables:

- `PYTHONHOME` — Stores the top-level directory of your Python installation.
- `PYTHONPATH` — Contains paths to enable searching for Python modules. Paths are kept in the `sys.path` Python variable. You can list them from the standard Python command line interpreter or from the standard Python GUI.

To ensure that the variables take effect, do one of the following:

- In your current MULTI session, set the variables before starting any component of the MULTI IDE.
- If you have already started a component of the MULTI IDE, set the variables and then exit the IDE by selecting **File → Exit All** from the Launcher. Then restart the MULTI IDE from the environment (such as an xterm) where the `PYTHONHOME` and `PYTHONPATH` environment variables are refreshed.

## MULTI-Python Compatibility

MULTI-Python's customized Python interpreter is intended for the Python 2.3.3 release.

At present, MULTI is not compatible with Python 2.4 and later because many changes, including syntax extensions, have been incorporated. For example, the following syntax:

```
from module import (name1, name2)
```

is new in Python 2.4 and is used in basic modules such as **os.py**. MULTI will be integrated with a newer Python release in the future.

## Overview of MULTI-Python Classes

### GHS_IdeObject Attributes

`GHS_IdeObject` is the base class of all MULTI-Python service classes, window classes, and Debugger object classes. It contains the following attributes. Many of the attributes refer to *services*. Each MULTI IDE component is usually implemented as a service.

- `serviceName` — Stores the MULTI IDE service name (applicable to some MULTI-Python classes).
- `service` — Stores the MULTI service object (if any).
- `wd` — Stores the working directory of the MULTI service object.
- `maxSecToWaitForNewWindow` — Stores the maximum number of seconds to wait for a MULTI window to appear.
- `checkInterval` — Stores the number of seconds that elapse before Python checks MULTI's status again. By default, the interval between status checks is set to 0.5 seconds, but each component and user can change the interval for each object based on the environment.

The following four `GHS_IdeObject` attributes are related to command execution. At present, only MULTI Editor commands and MULTI Debugger commands are documented. We suggest that you do not access or directly run the commands of

other MULTI services or windows because these undocumented commands are not guaranteed to be compatible with future MULTI IDE releases.

- `cmdExecStatus` — Stores the command execution status of the corresponding MULTI IDE service or window. Usually, a one (`1`) indicates success and a zero (`0`) indicates failure.
- `cmdExecOutput` — Stores the command execution output of the corresponding MULTI IDE service or window.
- `cmdExecObj` — Stores the MULTI-Python object (if any) created by the command execution of the corresponding MULTI IDE service or window.
- `cmdExecPath` — Stores the executed command and indicates how it was executed. This attribute is for debugging purposes.

For `GHS_IdeObject` functions, see "GHS_IdeObject Functions" on page 88.

## MULTI-Python Service Classes

Each MULTI IDE component is usually implemented as a *service*, and each MULTI service is represented in a Python class. The following table lists the services supported in the MULTI-Python integrated system.

| Python Class | MULTI Service | Service Description |
|---|---|---|
| `GHS_CoBrowse` | MULTI Checkout Browser | Provides a graphical, version-controlled checkout. |
| `GHS_Debugger` | MULTI Debugger | Provides debugging tools. |
| `GHS_DiffView` | MULTI Diff Viewer | Compares two file versions and displays the results in a graphical window. |
| `GHS_Editor` | MULTI Editor | Provides text edit functions. |
| `GHS_EventAnalyzer` | MULTI EventAnalyzer | Displays and analyzes events. |
| `GHS_Launcher` | MULTI Launcher | Allows you to manage MULTI workspaces. |
| `GHS_ProjectManager` | MULTI Project Manager | Allows you to manage and build projects. |
| `GHS_PythonGui` | MULTI Python GUI | Provides a stand-alone GUI from which you can easily run Python statements. |

| Python Class | MULTI Service | Service Description |
|---|---|---|
| GHS_Terminal | MULTI Serial Terminal | Connects to serial ports and simulates terminals. |
| GHS_WindowRegister | MULTI Window Register | Tracks all MULTI IDE windows and routes commands to them. |

For information about the functions defined for a MULTI-Python class (if any), see Part III. MULTI-Python API Reference on page 77.

## GHS_Window Attributes

The MULTI-Python class GHS_Window, which is derived from the GHS_IdeObject class, can represent all MULTI windows.

The following list describes the attributes of class GHS_Window:

- component — Stores the identifier string for the corresponding Debugger component (only applicable to some Debugger-related classes, such as GHS_DebuggerWindow, GHS_DebugServer, and GHS_Task).
- windowName — Stores the name that is registered for the window. This name may not be the same as the name shown on the window's title bar.
- windowId — Stores the window's internal ID.
- winClassName — Stores the window's class. For a list of window classes, see “MULTI-Python Window Classes” on page 21.
- winRegSvcName — Stores the internal ID of the component to which the window belongs. You can use the value of this attribute with some functions, but you should not change it.
- modalDialogName — Stores a constant string for the name of all modal dialog boxes. MULTI uses this information internally to identify modal dialog boxes. You should not change the value of this attribute.

For GHS_Window functions, see Chapter 7, “Window Functions” on page 91 and Chapter 8, “Widget Functions” on page 133.

## MULTI-Python Window Classes

You can launch one or more GUI windows from a MULTI service. Some services, such as the Launcher, launch a window whenever they are created. Other services, such as the Debugger, do not. The former type of service usually shuts down when you close its corresponding GUI window. The Python classes for these services usually have `GHS_Window` as their parent class.

The MULTI-Python integrated system provides Python classes for select MULTI windows. The following table lists these Python classes, which are referred to as *window classes*, and the corresponding MULTI windows.

| Python Window Class | Corresponding MULTI Window |
|---|---|
| `GHS_CoBrowseWindow` | Checkout Browser |
| `GHS_ConnectionOrganizerWindow` | Connection Organizer (used in the Debugger) |
| `GHS_DebuggerWindow` | Debugger |
| `GHS_DiffViewWindow` | Diff Viewer |
| `GHS_EditorWindow` | Editor |
| `GHS_EventAnalyzerWindow` | EventAnalyzer |
| `GHS_HelpViewerWindow` | Help Viewer |
| `GHS_LauncherWindow` | Launcher |
| `GHS_OsaWindow` | OSA Explorer (used in the Debugger) |
| `GHS_ProjectManagerWindow` | Project Manager |
| `GHS_PyGuiWindow` | Python GUI |
| `GHS_TaskManagerWindow` | Task Manager (used in the Debugger) |
| `GHS_TerminalWindow` | MTerminal |
| `GHS_TraceWindow` | Trace List (used in the Debugger) |

For information about the functions defined for a MULTI-Python class (if any), see Part III. MULTI-Python API Reference on page 77.

## MULTI-Python Debugger Object Classes

The MULTI-Python integrated system also provides Python classes for Debugger objects. The following table lists these Python classes.

| Python Class | Class Description |
|---|---|
| `GHS_DebuggerApi` | Implements general functions for the MULTI Debugger. |
| `GHS_DebugServer` | Implements functions for debug server connections. |
| `GHS_Task` | Implements functions for debugging tasks or threads in RTOS run-mode debugging environments. |

For information about the functions defined for a MULTI-Python class, see Part III. MULTI-Python API Reference on page 77.

## MULTI-Python Utility Classes

The MULTI-Python integrated system contains utility classes for class `GHS_LauncherWindow` and for class `GHS_Window`. The following tables list these utility classes.

For information about the functions defined for a MULTI-Python class, see Part III. MULTI-Python API Reference on page 77.

### Utility Classes for GHS_LauncherWindow

| Python Class | Class Description |
|---|---|
| `GHS_Action` | Stores information for an action. |
| `GHS_ActionSequence` | Stores information for an action sequence. |
| `GHS_Variable` | Stores information for a Launcher variable. |
| `GHS_Workspace` | Stores information for a workspace. |

### Utility Class for GHS_Window

| Python Class | Class Description |
|---|---|
| `GHS_MslTree` | Stores the content of an `MScrollList` widget as a parsed tree and provides mechanisms to search for tree nodes, enabling easier access to MULTI `MScrollList` widgets. |

## MULTI-Python Miscellaneous Classes

The MULTI-Python integrated system contains the following miscellaneous classes.

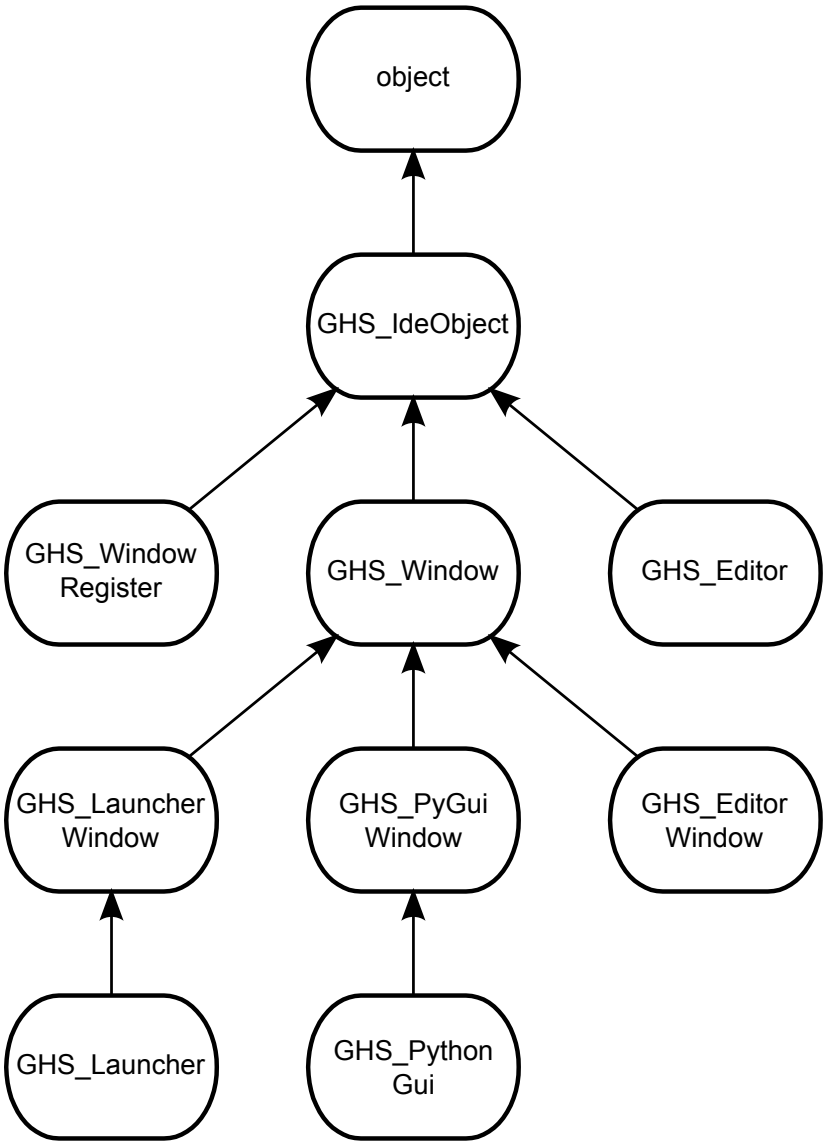
| Python Class | Class Description |
|---|---|
| `GHS_AbortExecFile` | Aborts file script execution via the utility function `GHS_ExecFile()`. |
| `GHS_AbortExecOnSignal` | Aborts Python execution on signal. |
| `GHS_Exception` | Describes MULTI-Python exceptions. |
| `GHS_OsTypes` | Stores the IDs of MULTI-supported operating systems. |
| `GHS_TargetIds` | Stores the Debugger's target IDs. |
| `GHS_WindowClassNames` | Stores MULTI window class names. |

For information about the functions defined for a MULTI-Python class, see Part III. MULTI-Python API Reference on page 77.

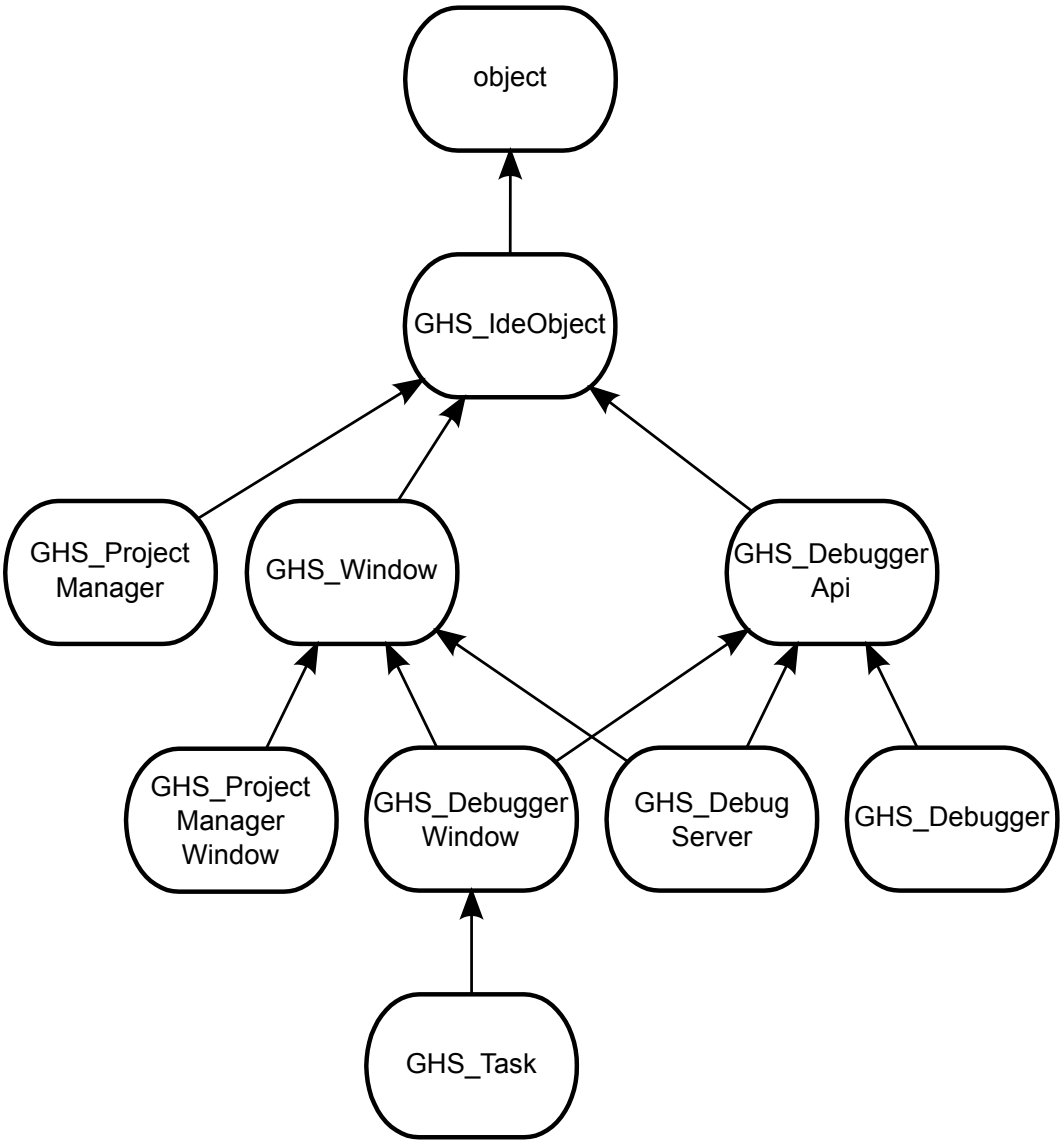
## MULTI-Python Class Hierarchy

The following five diagrams represent the MULTI-Python class hierarchy (not all classes are included). Notice that `object`, which is a built-in Python class and is directly followed by class `GHS_IdeObject`, tops all five hierarchies. The classes are divided into five separate diagrams due to space constraints. Given enough space, they could make up one large diagram. Some class names wrap to a new line because of space constraints. In actuality, class names are always comprised of one continuous text string.

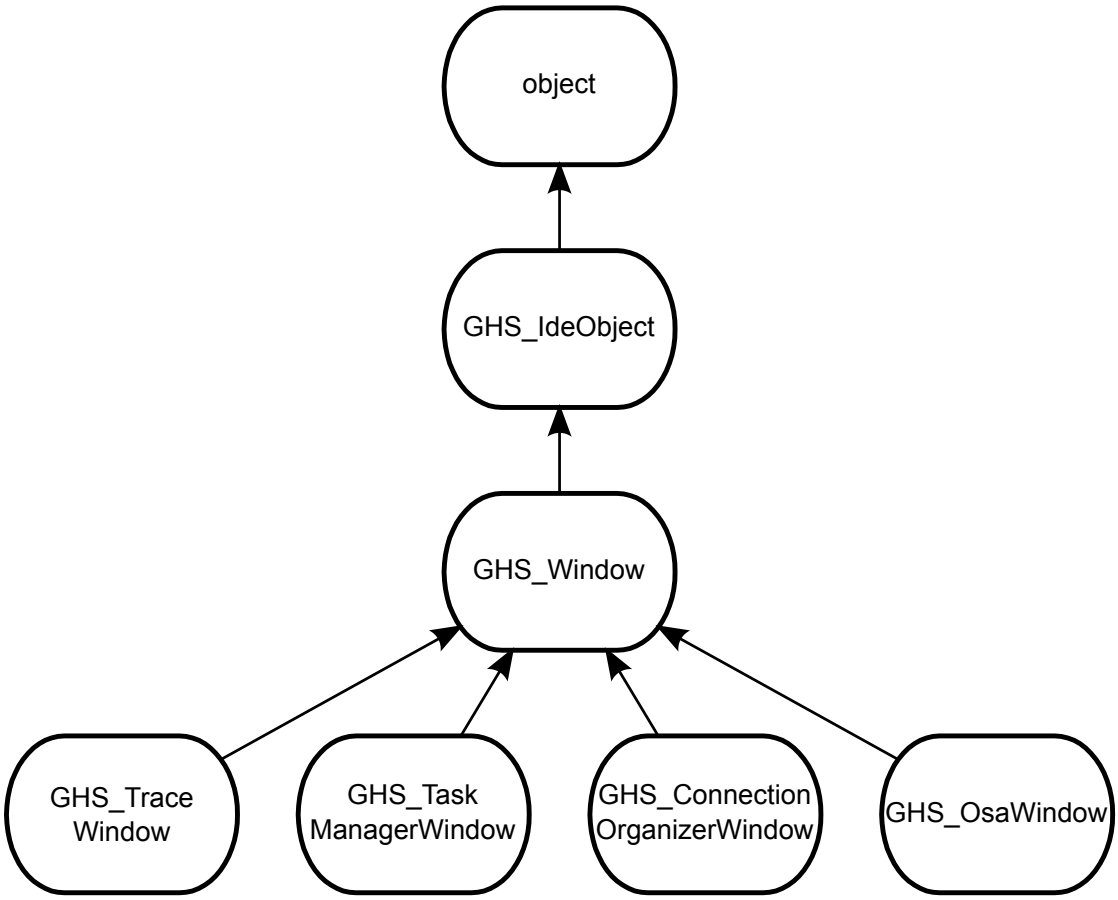
The following diagram includes classes related to MULTI windows, the Editor, the Launcher, and the Python GUI.



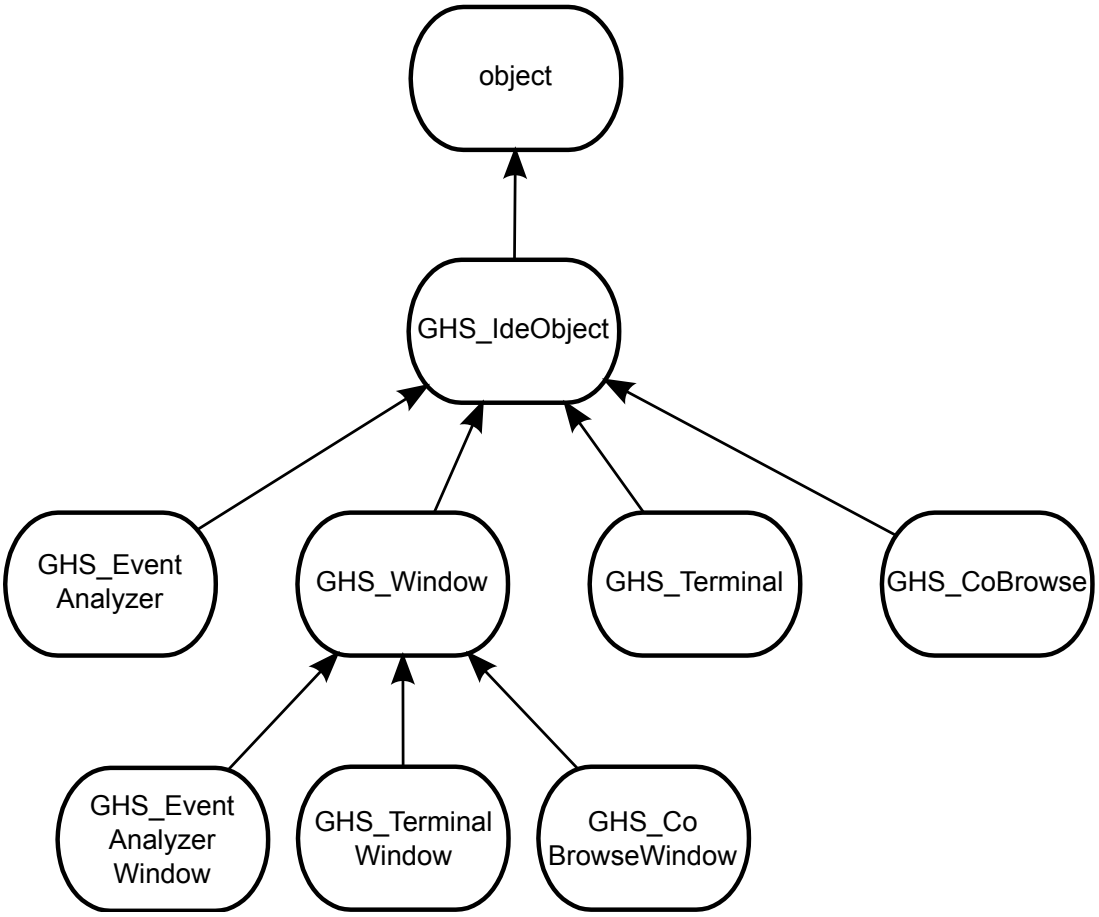
The following diagram includes classes related to the Project Manager, MULTI windows, the Debugger, debug servers, and tasks.



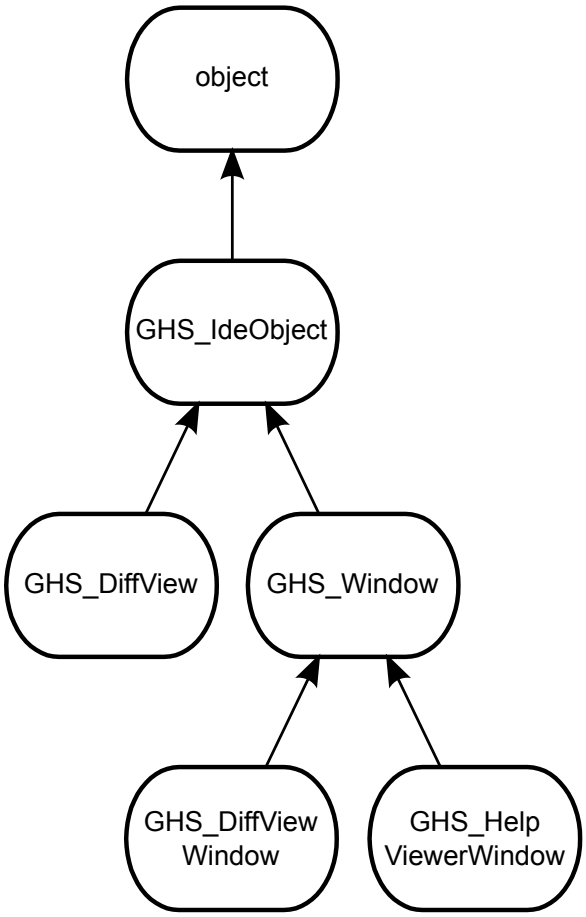
The following diagram includes classes related to MULTI windows, the Trace List, the Task Manager, the Connection Organizer, and the OSA Explorer.



The following diagram includes classes related to the EventAnalyzer, MULTI windows, the Serial Terminal, and the Checkout Browser.



The following diagram includes classes related to the Diff Viewer, MULTI windows, and the Help Viewer.



## MULTI-Python Utility Functions

MULTI-Python provides a number of utility functions. You can use these utility functions directly in your Python statements or scripts if you execute them in the MULTI-Python environment. See also “Utility Function Prototypes” on page 82.

**Note**

Utility functions are documented in mixed case for readability, but you may also enter them in *all* lowercase letters. For example, `GHS_ExecFile()` and `ghs_execfile()` are equivalent and are both valid.

- `GHS_ExecFile()` — Runs a Python script just as the `execfile()` built-in Python function does. However, you can raise a `GHS_AbortExecFile()` exception at any place (inside the script file or in one of the nested script files) to abort the execution normally.

  When a Python script is executed via the **mpythonrun** utility program or via the MULTI Debugger **python** command, the script is actually run with the `GHS_ExecFile()` function.

- `GHS_PrintObject()` — Prints the given `list`, `tuple` or `dictionary` object in better format than the standard **print** statement. This utility function prints one element per line and indents nested objects.

- `GHS_RunShellCommands()` — Executes shell commands, captures their status, grabs output from **stdout** and/or **stderr** on request (grabbing output from **stderr** is supported only in POSIX environments), and returns a `tuple` such as the following:

  ```
  (exitCode, stdoutOutput, stderrOutput)
  ```

  If `GHS_RunShellCommands()` does not grab the output from **stdout** or **stderr**, the corresponding attributes—`stdoutOutput` and `stderrOutput`—are empty strings (`""` or `''`). The corresponding output is displayed on the console (Windows) or in the xterm (Linux/Solaris).

- `GHS_System()` — Executes shell commands, grabs output from **stdout** and **stderr** on request, and returns a string containing the requested output. Grabbing output from **stderr** is supported only in POSIX environments. If `GHS_System()` grabs the output from **stderr**, it appends the output from **stderr**

to the output from **stdout** in the returned string. `GHS_System()` is a simpler version of `GHS_RunShellCommands()`.

## MULTI-Python Variables

### Pre-Set Variables

The MULTI-Python integrated system includes the following pre-set variables.

- `__ghs_display_height` — Specifies the screen's height in pixels.
- `__ghs_display_width` — Specifies the screen's width in pixels.
- `__ghs_user_name` — Specifies your user name.
- `__ghs_major_version` — Specifies the major version number of MULTI. 1 is the major version number in MULTI 1.2.3.
- `__ghs_minor_version` — Specifies the minor version number of MULTI. 2 is the minor version number in MULTI 1.2.3.
- `__ghs_micro_version` — Specifies the micro version number of MULTI. 3 is the micro version number in MULTI 1.2.3.
- `__ghs_multi_dir` — Specifies the MULTI IDE installation directory.
- `__ghs_site_config_dir` — Specifies the IDE installation's site configuration directory.
- `__ghs_site_default_dir` — Specifies the IDE installation's default site configuration directory.
- `__ghs_tools_dir` — Specifies the Green Hills Compiler installation directory.
- `__ghs_tools_site_config_dir` — Specifies the Compiler installation's site configuration directory.
- `__ghs_tools_site_default_dir` — Specifies the Compiler installation's default site configuration directory.
- `__ghs_user_config_dir` — Specifies your personal configuration directory.
- `__ghs_user_ver_config_dir` — Specifies your personal configuration directory for the current MULTI IDE version.

- `__ghs_site_default_python_dir` — Specifies the MULTI-Python integration directory that resides in the IDE installation's default site configuration directory.
- `__ghs_user_config_python_dir` — Specifies the MULTI-Python integration directory that resides in your personal configuration directory.
- `__ghs_user_ver_config_python_dir` — Specifies the MULTI-Python integration directory for the current MULTI IDE version. The directory resides in your personal configuration directory.
- `__ghs_python_class_dir` — Specifies the directory containing binary files compiled from MULTI-Python classes.

## Reserved Variable Names

The following table lists object names reserved for particular MULTI-Python classes. You should not assign an arbitrary value to a reserved object name, but you can create an object with the reserved name if one does not already exist.

The third column in the table notes whether the specified object has been pre-created. If an object is pre-created, you can use it immediately in Python statements or scripts that are executed in the MULTI-Python environment. If an object is not pre-created, its value is `None`.

| Python Class | Object Name | Object Description |
|---|---|---|
| `GHS_Debugger` | `debugger` | Only pre-created in the Debugger's **Py** pane and **Py Window**. |
| `GHS_DebuggerWindow` | `self_dbw` | Only pre-created in the Debugger's **Py** pane and **Py Window**. |
| `GHS_DebugServer` | `self_dbs` | Only pre-created for the debug server associated with the Debugger window. When the Debugger window is not associated with any debug server connection, this variable's value is `None`. Its value adjusts dynamically when a debug server connection is established or terminated. |

| Python Class | Object Name | Object Description |
|---|---|---|
| GHS_Editor | editor<br>emacs<br>vi | None pre-created by default. |
| GHS_MemorySpaces | msIds | Always pre-created.<br>This object specifies the commonly used memory spaces supported by the MULTI Debugger. |
| GHS_ObjectMasks | objMasks | Always pre-created.<br>This object specifies the masks for the MULTI IDE objects that can be pre-created. The \| result of these masks is kept in __ghs_precreate_ide_objects, which controls whether the projmgr, debugger, editor, emacs, vi, and winreg reserved objects are pre-created by default. You can change the object's value in your customized MULTI-Python integration initialization script. |
| GHS_OsTypes | osTypes | Always pre-created.<br>This object specifies the operating system IDs recognized by the MULTI Debugger. |
| GHS_ProjectManager | projmgr | Not pre-created by default. |
| GHS_TargetIds | targetIds | Always pre-created.<br>This object specifies the target IDs used by the MULTI Debugger. |
| GHS_WindowClassNames | winClassNames | Always pre-created.<br>This object specifies names for MULTI IDE window classes. |
| GHS_WindowRegister | winreg | Pre-created by default. |

## Extending the MULTI-Python Environment

Before a new MULTI-Python context is initialized, the following Python scripts are executed (if they exist) in the order that they are listed below:

1. The Python script kept in the environment variable `BEFORE_GHS_STARTUP_PYTHON`
2. The Python script **before_ghs_startup.py** located in the user configuration Python directory (`__ghs_user_config_python_dir`)
3. The Python script **before_ghs_startup.py** located in the user configuration Python directory for the current MULTI IDE version (`__ghs_user_ver_config_python_dir`)
4. The Python script **before_ghs_startup.py** located in the current working directory

After the MULTI-Python context is initialized, the following Python scripts are executed (if they exist) in the order listed:

1. The Python script kept in the environment variable `AFTER_GHS_STARTUP_PYTHON`
2. The Python script **after_ghs_startup.py** located in the user configuration Python directory (`__ghs_user_config_python_dir`)
3. The Python script **after_ghs_startup.py** located in the user configuration Python directory for the current MULTI IDE version (`__ghs_user_ver_config_python_dir`)
4. The Python script **after_ghs_startup.py** located in the current working directory

You can also extend the MULTI-Python environment by running Python statements or scripts via the interfaces described in the next section.

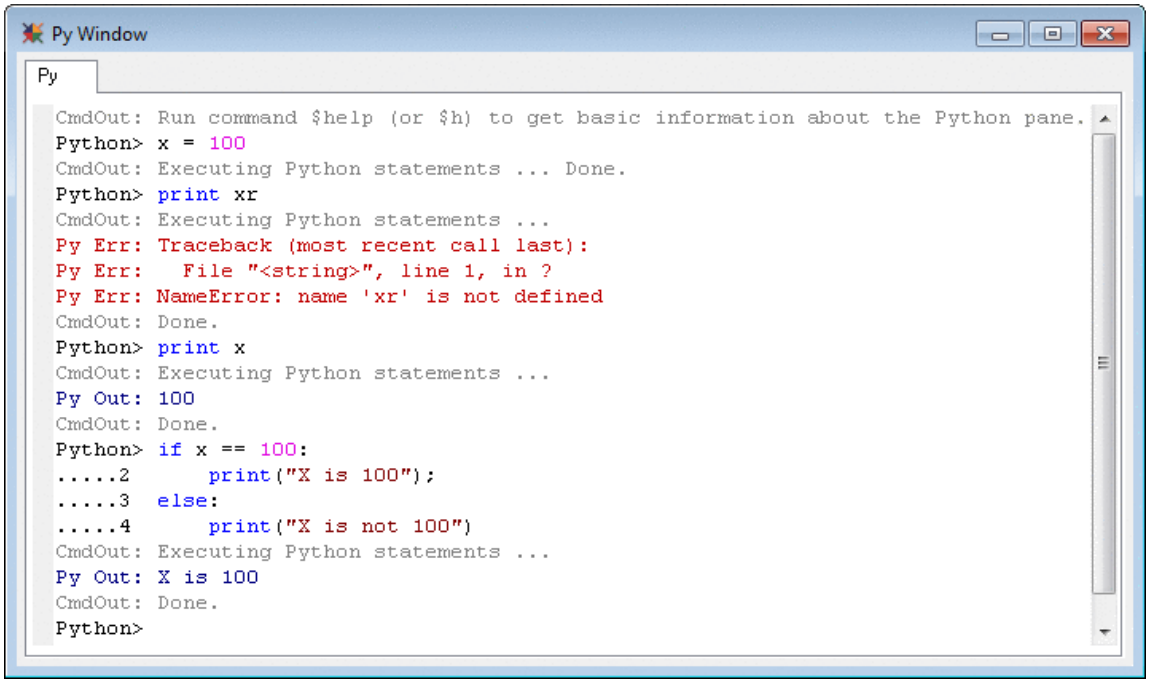
## MULTI-Python Interfaces

MULTI provides the following interfaces from which you can execute Python statements:

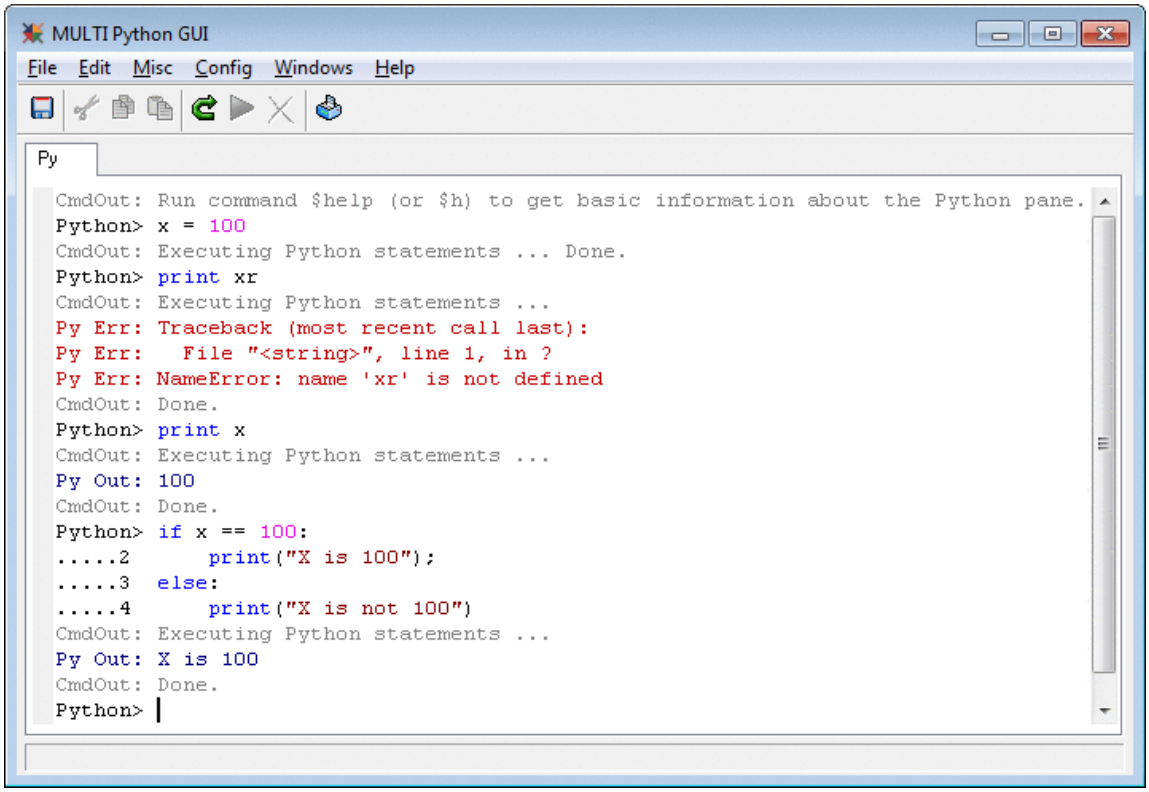
- The Debugger's **Py** pane, which you can access by clicking the **Py** tab located at the bottom of the Debugger window.

```
CmdOut: Run command $help (or $h) to get basic information about the Python pane.
Python> x = 100
CmdOut: Executing Python statements ... Done.
Python> print xr
CmdOut: Executing Python statements ...
Py Err: Traceback (most recent call last):
Py Err:   File "<string>", line 1, in ?
Py Err: NameError: name 'xr' is not defined
CmdOut: Done.
Python> print x
CmdOut: Executing Python statements ...
Py Out: 100
CmdOut: Done.
Python> if x == 100:
.....2      print("X is 100");
.....3  else:
.....4      print("X is not 100")
CmdOut: Executing Python statements ...
Py Out: X is 100
CmdOut: Done.
Python>
Cmd  Py  Tfc                                                    NO PROCESS
```

- The **Py Window**, which you can launch by right-clicking in any of the Debugger's panes and selecting **Show Separate Py Window**.



- The stand-alone **Python GUI**, which you can open from the Launcher by selecting **Components → Open Python GUI** or from the host machine's command line by running **mpythongui**.




In addition to executing Python statements via one of the preceding interfaces, you can:

- Run the **python** command in the Debugger command pane. This command can accept a Python statement string or a Python script. For information about the **python** command, see Chapter 15, “Scripting Command Reference” in the *MULTI: Debugging Command Reference* book.
- Add a **Python Statement** or **Python Script** action to your workspace. For information about creating actions, see “Creating or Modifying an Action” in Chapter 3, “Managing Workspaces and Shortcuts with the Launcher” in the *MULTI: Managing Projects and Configuring the IDE* book.
- Send Python statements (via your program or a third-party tool such as `telnet`) to the socket servers provided by the **mpythonrun** program. See “The mpythonrun Utility Program” on page 41.

## Interface Comparison

The stand-alone **Python GUI** and the Debugger's **Py** pane and **Py Window** provide similar interfaces where you can run Python statements. A comparison between the **Python GUI** and the Debugger's **Py** pane/**Py Window** follows.

### Note

The **Py Window** provides more space than the **Py** pane, but they are otherwise the same.

| Py Pane & Py Window | Python GUI |
|---|---|
| Contain a Python pane | Contains a Python pane |
| Do not contain a menu bar or toolbar | Contains a menu bar and toolbar |
| Launched from the Debugger | Stand-alone |
| Begin a new Python history with every Debugger window | Begins a new Python history with every launch |
| Share Python context, statement history, and output within the same Debugger window | Separate Python context, statement history, and output |

The **Py** pane, which is present in the Debugger window, the **Py Window**, and the **Python GUI** provide the following features:

- Syntax coloring and automatic indentation. You can manually adjust indentation by using the keystrokes provided later in this section.
- Line numbers in the command prompt for:
  - Compound statement blocks containing multiple lines.
  - Statements pasted into the **Py** pane.

  If an error occurs on one of these lines, the Python interpreter reports the line number so that you can easily find the error location.
- The commands and keyboard shortcuts described in the next section.

## Py Pane Commands and Keyboard Shortcuts

The **Py** pane and **Py Window** support the following commands, which are always preceded by the dollar sign (`$`). All these commands, with the exception of the **$verbose** command, are also available to socket server clients started via the **mpythonrun** utility. For more information, see "Starting Socket Servers" on page 44.

The following table lists an equivalent alias with each command, and it lists keyboard shortcuts where applicable.

### Note

These commands are recognized only when no other text precedes them on the command line. Spaces or tabs preceding the commands are okay.

| |
|---|
| **$clear** [-pane]<br>**$c** [-pane]<br>Clears buffered Python statements if you do *not* specify the `-pane` option. Clears the content of the **Py** pane if you do specify the `-pane` option. |
| **$display** [-new]<br>**$d** [-new]<br>Displays Python statements that have already executed. If you specify the `-new` option, this command displays Python statements that have not yet executed. |
| **$execute**<br>**$e**<br>Executes buffered Python statements immediately.<br>By default, this command is bound to:<br>• **Ctrl+Enter** |
| **$getinteractive**<br>**$gi**<br>Prints whether interactive mode is enabled (`On`) or disabled (`Off`). |

**$help** *arguments*

**$h** *arguments*

Displays help information in the **Py** pane or in the Help Viewer. The `arguments` that you pass to the command determine where the help appears. For a list of available arguments, run the **$help** command without any arguments.

By default, this command is bound to:

- **Ctrl+h**

**$interactive** [ -on | -off ]

**$i** [ -on | -off ]

Toggles the Python interpreter's support of interactive mode. The optional arguments `-on` and `-off` enable and disable interactive mode, respectively. By default, interactive mode is enabled (`-on`).

In interactive mode, the Python interpreter echoes the value of the object that results from the executed Python statement.

**$restart**

**$r**

Restarts the underlying Python interpreter. The old context is discarded.

**$save** [*filename*] [-open]

**$s** [*filename*] [-open]

Saves buffered Python statements in the file `filename`. If you do not specify a filename, a file chooser prompting you to select a file appears. If you specify the `-open` option, the saved file opens in the MULTI Editor.

With this command, you can easily save Python statements into a file and then replay them later.

By default, **$save** is bound to:

- **Ctrl+s**

By default, **$save -open** is bound to:

- **Ctrl+Shift+s**

| |
|---|
| **$verbose** [ -on \| -off ]<br>**$v** [ -on \| -off ]<br>Toggles verbose mode on and off. The optional arguments `-on` and `-off` enable and disable verbose mode, respectively. By default, it is enabled (`-on`).<br>In verbose mode, the Python pane prints a message to indicate that it is executing Python statements. |

The **Py** pane and **Py Window** support the following keyboard shortcuts, which are bound to the preceding commands.

| |
|---|
| **Ctrl+h**<br>Prints available arguments to the **Py** pane.<br>By default, this keyboard shortcut is bound to:<br>• **$help** |
| **Ctrl+i**<br>Indents the defined number of spaces. **Indent size** is configured in the **Options** window. For more information about the **Indent size** option, see "MULTI Editor Configuration Options" in Chapter 8, "Configuration Options" in the *MULTI: Managing Projects and Configuring the IDE* book. |
| **Ctrl+Shift+i**<br>Un-indents the defined number of spaces. **Indent size** is configured in the **Options** window. For more information about the **Indent size** option, see "MULTI Editor Configuration Options" in Chapter 8, "Configuration Options" in the *MULTI: Managing Projects and Configuring the IDE* book. |
| **Ctrl+Enter**<br>Executes buffered Python statements immediately.<br>By default, this keyboard shortcut is bound to:<br>• **$execute** |
| **Esc**<br>Aborts execution of pending Python statements. |

| |
|---|
| **Ctrl+s**<br>Saves buffered Python statements in the file you specify.<br>By default, this keyboard shortcut is bound to:<br>• **$save** |
| **Ctrl+Shift+s**<br>Saves buffered Python statements in the file you specify and opens the saved file in the MULTI Editor.<br>By default, this keyboard shortcut is bound to:<br>• **$save -open** |

## The mpythonrun Utility Program

With the **mpythonrun** utility program, you can control MULTI by running Python statements or scripts from:

- The host operating system's command line (see “Running Python Statements and Scripts” on page 43)
- A telnet socket or plain socket connection (see “Starting Socket Servers” on page 44)

To start **mpythonrun** from the host operating system's command line, enter the path to **mpythonrun.exe**. The **mpythonrun** executable is located in your MULTI IDE installation. For a complete list of **mpythonrun** command line options, see the next section.

### mpythonrun Command Line Options

The following table describes available **mpythonrun** command line options.

**Note**

For examples and for more information about many of the following command line options, see “Running Python Statements and Scripts” on page 43 and “Starting Socket Servers” on page 44.

| |
|---|
| **-args *Python_script_arguments* [-]**<br>Specifies Python script arguments.<br>The end of the Python script arguments is indicated either with a dash (-) or by the end of the argument list. For more information, see "Running Python Statements and Scripts" on page 43.<br>This option is valid only when it follows a Python script specification. See also the **-script** option later in this table. |
| **-cr**<br>Pads the carriage return (CR) before a new line (LF) when a message is sent to the socket client. |
| **-global**<br>Allows network-wide socket availability. This is the default behavior. See also the **-local** option later in this table. |
| **-help**<br>**-h**<br>Displays the usage information for **mpythonrun**. |
| **-local**<br>Allows socket availability on the local host only. This option disables connections from other hosts and is useful for security purposes. See also the **-global** option earlier in this table. |
| **-noconsole**<br>Determines where output is sent. If this option is specified before a Python statement or script, **mpythonrun** prints the output (if any) to `stdout` or `stderr` instead of to a console. Otherwise, **mpythonrun** prints the output (if any) to a console on Windows.<br>If **mpythonrun** is run as a stand-alone program, this option is not useful. However, if another program calls **mpythonrun** to run Python scripts and/or statements, and the program must grab the output from **mpythonrun**, this option is necessary.<br>This option is only valid on Windows and is off by default. |
| **-prompt on\|off\|*string***<br>Turns prompt display on or off, or specifies a customized prompt string. The default prompt string is **GHS-Py>**. |
| **-script *Python_script(s)***<br>**-f *Python_script(s)***<br>Specifies the Python script(s) to be run. See also the **-args** option earlier in this table. |
| **-socket *port***<br>Specifies the plain socket server. If you do not specify a port number, the system automatically allocates one and prints it out. See also the **-telnet** option later in this table. |

| |
|---|
| **-statement** ***Python_statement(s)***<br>**-s** ***Python_statement(s)***<br>Specifies the Python statement(s) to be run. |
| **-telnet** ***port***<br>Specifies the telnet socket server. If you do not specify a port number, the system automatically allocates one and prints it out. See also the **-socket** option earlier in this table. |
| **-verbose yes\|no**<br>Turns on/off verbose mode. In verbose mode (the default), extra messages are printed to separate output from Python statements or scripts given on the command line. |

## Running Python Statements and Scripts

To enter command line Python statements with the **mpythonrun** utility program:

- Begin Python statement strings with the **-statement** or **-s** command line option.

For example:

```
mpythonrun -s "import time" -s "print('Current Time:'); print time.asctime()"
```

### Note

In the MULTI-Python GUI environment, you can abort an executing Python statement by pressing **Esc**. You cannot abort an executing Python statement in the **mpythonrun** utility program; you can only kill the process. As a result, you should be careful not to submit Python statements containing infinite loops.

To enter command line Python scripts:

- Preface Python scripts with the **-script** or **-f** command line option.
- To transfer arguments to a Python script, begin the argument list with **-args** and end the argument list in one of the following ways:
  - With the end of the argument list (for a single Python script and argument list)
  - With a single dash (-) (for multiple Python scripts and arguments lists or for a single Python script and argument list)

For example, to run a single script and argument list, you could enter:

```
mpythonrun -f pr.py -args haha -a -9 --
```

or

```
mpythonrun -f pr.py -args haha -a -9 -- -
```

where `haha`, `-a`, `-9`, and `--` are arguments of **pr.py**.

To run two scripts, one with an argument list, you could enter:

```
mpythonrun -f pr.py -args haha -a -9 -- - -f pr.py
```

If you specify multiple Python statements or Python script files on the command line, they execute sequentially.

## Starting Socket Servers

The **mpythonrun** utility program can start a maximum of two network socket servers. From the command line, you can start a socket server in one of the following ways:

- Plain sockets — Enter the **-socket** command line option followed by a port number. If you do not specify a port number after this option, the system dynamically allocates one and prints it to the console (Windows) or to **stdout** (Linux/Solaris).
- Telnet sockets — Enter the **-telnet** command line option followed by a port number. If you do not specify a port number after this option, the system dynamically allocates one and prints it to the console (Windows) or to **stdout** (Linux/Solaris).

### Note

The **mpythonrun** telnet socket server supports well-programmed telnet clients. (A well-programmed telnet client should be able to adjust its settings to work with the telnet socket server.) The Windows telnet client and some others are not well supported. A plain socket is not meant to support telnet protocol, but should work well if your program treats it as a normal socket.

The following example uses a telnet socket to run MULTI-Python statements. It assumes that the telnet socket server on port `2011` of the host `bison` has been started by **mpythonrun**. Each Python statement is immediately preceded by the prompt `GHS-Py>`, and follows its explanation (`# comment`). Output is not listed in the example.

```
1351) telnet bison 2011
Trying 192.168.102.195...
Connected to bison.ghs.com.
Escape character is '^]'.
# Create a GHS_Debugger object.
GHS-Py> debugger = GHS_Debugger()
# Debug an INTEGRITY kernel.
GHS-Py> dbw = debugger.DebugProgram("/integrity_dir/sim800/kernel")
# Connect to a freeze-mode debug server.
GHS-Py> dbw.ConnectToTarget("isimppc")
# Keep the freeze-mode debug server object in a Python varible.
GHS-Py> isim = dbw.cmdExecObj;
# Run the INTEGRITY kernel.
GHS-Py> isim.Resume()
# After a while, halt the INTEGRITY kernel.
GHS-Py> isim.Halt()
# Open an OSA Explorer for the INTEGRITY kernel.
GHS-Py> isim.RunCmd("osaexplorer")
# Keep the OSA Explorer window object in a Python variable.
GHS-Py> osaw = isim.cmdExecObj
# Close the OSA Explorer window.
GHS-Py> osaw.CloseWin()
# Resume the INTEGRITY kernel.
GHS-Py> isim.Resume()
# Connect to the rtserv2 run-mode debug server.
GHS-Py> dbw.ConnectToRtserv2()
# Keep the run-mode debug server object in a Python varable.
GHS-Py> rtserv2 = dbw.cmdExecObj;
# Load a dynamic download module to the target.
GHS-Py> rtserv2.RunCmd("load /integrity_dir/sim800/pizza")
# Run all tasks on the target via the run-mode connection.
GHS-Py> rtserv2.RunCmd("groupaction -r @All")
```

If you establish two socket servers at the same time, they share the same Python context. Python statements coming from the two sockets are executed sequentially, but the socket order is not specified. Any Python statements or Python script files

that you specify on the command line execute first. The **mpythonrun** utility program uses the resulting execution context to execute Python statements from the sockets.

## Socket Server Commands

Socket servers accept any Python commands sent to them. All the commands described in "Py Pane Commands and Keyboard Shortcuts" on page 38, with the exception of the **$verbose** command, are also available to socket servers. In addition to these commands, the following MULTI-Python socket server commands, which are always preceded by the dollar sign (`$`), are available.

The following table lists an equivalent alias for each command.

### Note

These commands are recognized only when no other text precedes them on the command line. Spaces or tabs preceding the commands are okay.

| |
|---|
| **$prompt** [ -on \| -off \| *string* ]<br>**$p** [ -on \| -off \| *string* ]<br>Toggles the prompt display, where:<br>• `-on` — [default] Enables prompt display.<br>• `-off` — Disables prompt display.<br>• *`string`* — Changes the prompt to *`string`* and enables prompt display. The default prompt string is **GHS-Py>**.<br>If you do not specify any argument, prompt display is toggled. |
| **$quit**<br>**$q**<br>Shuts down the socket server(s) and quits **mpythonrun**. |

## Creating a Graphical Interface

The MULTI-Python integrated system provides basic mechanisms that allow for interactive user operations. These mechanisms can ask the user to:

- Give confirmation via an alert dialog box
- Choose between *Yes* and *No*
- Select a value from a given list
- Type a value into a dialog box
- Choose a directory path
- Choose a filename

For examples of these operations, see “Manipulating Windows” on page 50.

Using these mechanisms, you can write an interactive script to drive the MULTI IDE. However, if you are trying to create a complex GUI, the basic mechanisms that MULTI-Python provides may not be sufficient. In this case, you can use a Python GUI package, such as the Tcl/Tk GUI package. For information about this package, see the Python Web site [http://www.python.org].

The Python GUI package for Tcl/Tk requires extra third-party tools, including Tcl/Tk and, for Linux on x86, the `BLT` extension. The MULTI IDE installation contains the following third-party tools for your convenience:

- Windows — Tcl/Tk 8.4 (which is a part of Python's standard installation on Windows) located at ***ide_install_dir*\python\tcl**
- Linux on x86 — Tcl/Tk 8.4.11 and `BLT` 2.4 located at ***ide_install_dir*/python/tcl_tk**
- Solaris SPARC — Tcl/Tk 8.4.12 located at ***ide_install_dir*/python/tcl_tk**

You should install any additional required software in your environment.

To view a simple GUI demo that was created with Tcl/Tk, run the following Python statement:

```
execfile(__ghs_site_default_python_dir+os.sep+"ghs_guidemo.py")
```

For more information, see “Using Tcl/Tk to Create a Graphical Interface” on page 75.

## Troubleshooting

- The MULTI-Python integrated system does not support Python input functions (such as `input()` and `raw_input()`) or getting input from **stdin**. MULTI-Python provides its own set of functions to handle input. See “GHS_Window Interactive Functions” on page 100.
- If, when you are executing Python statements from the MULTI-Python integration context, you get an error message for the undefined symbol `PyUnicodeUCS2_FromUnicode` or `PyUnicodeUCS4_FromUnicode`, install Python 2.3.3 from the Python Web site [http://www.python.org]. Follow the Python installation instructions, but give the argument:

  ```
  --enable-unicode=ucs2
  ```

  or

  ```
  --enable-unicode=ucs4
  ```

  to the **configure** command.

  The Python installation included with the MULTI IDE installation is compiled with `ucs4`.

# Chapter 3

# MULTI-Python Tutorials

## Contents

The following examples demonstrate how to use MULTI-Python to access the MULTI IDE.

Because these examples were run in the MULTI **Py** pane, the **Python>** prompt is listed before each Python statement.

## Manipulating Windows

The following sequential examples demonstrate how to use MULTI-Python to manipulate windows. Many of the examples use the context created by a preceding example. Where this is the case, the appropriate example is referenced.

### Note

The following are only examples. You may see different results in your MULTI environment.

#### Example 3.1. Listing All MULTI IDE Windows

This example lists all the MULTI windows that are currently open.

```
Python> winreg.ShowWins(False)
Py Out: Index   Class Name      Window Name
Py Out: =====   ==========      ===========
Py Out: 0       Debuggers       mpythonrun.exe
Py Out: 1       Debuggers       me.exe
Py Out: 2       None            Py Window
Py Out: 3       None            References of pySystem
Py Out: 4       Python GUI      MULTI Python GUI
Py Out: 5       Editors         multi_ide_script.xml
Py Out: 6       Editors         ghs_window.py
Py Out:
Py Out: Total number of windows: 7
```

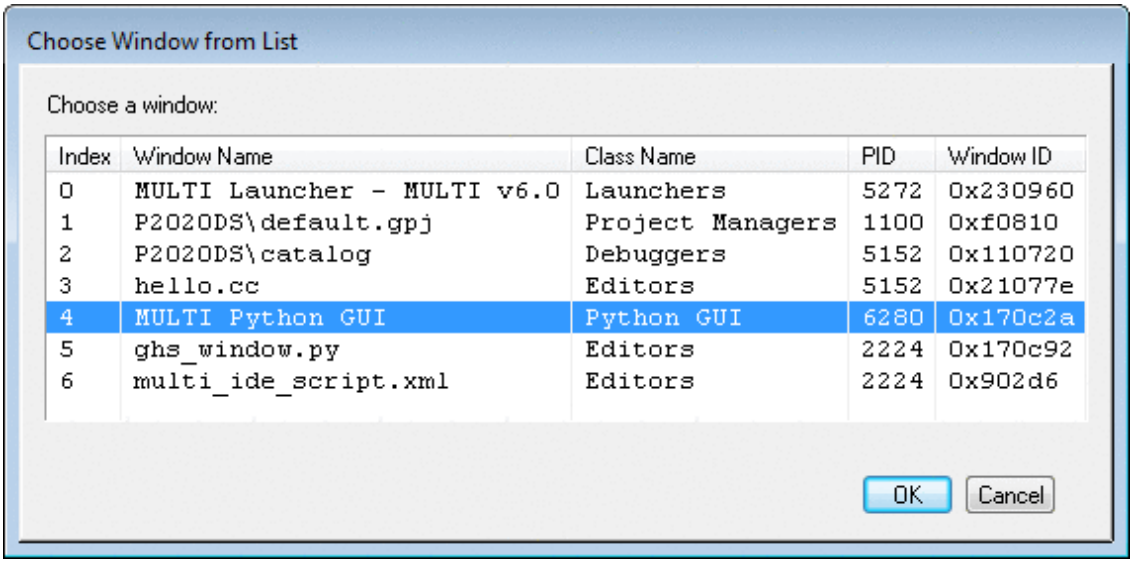
where:

- `winreg` is a pre-created object for class `GHS_WindowRegister`. See “Reserved Variable Names” on page 31.
- `ShowWins()` lists the open windows in the current MULTI IDE session. For more information, see “ShowWindowList()” on page 196.

- The argument `False` that is passed to `ShowWins()` hides the Process ID column that would otherwise appear. For more arguments to `ShowWins()`, see "ShowWindowList()" on page 196.

### Example 3.2. Selecting a Window for Display

This example opens a modal dialog box that allows the user to select a window for display. In this example, the stand-alone **Python GUI** was selected.




```
Python> w = winreg.ChooseWin()
Python> print w.windowName
Py Out: MULTI Python GUI
```

where:

- The variable `w` stores the Python object of class `GHS_Window` for the selected window.
- `winreg` is a pre-created object for class `GHS_WindowRegister`. See "Reserved Variable Names" on page 31.
- `ChooseWin()` allows you to choose a window from a window list and then returns an object for the chosen window. For more information, see "ChooseWindowFromGui()" on page 199.
- The operation `print w.windowName` prints the name of the returned Python object (which is kept in the variable `w`).

- `MULTI Python GUI` is the name of the window represented by the Python object.

### Example 3.3. Creating a `GHS_Window` Object By Window Index

This example creates a window object for the window with index `5` in Example 3.1. Listing All MULTI IDE Windows on page 50.

```
Python> w = winreg.GetWinByIdx(5)
Python> print w.windowName
Py Out: multi_ide_script.xml
```

where:

- The variable `w` stores the Python object of class `GHS_EditorWindow` for the specified Editor window.
- `winreg` is a pre-created object for class `GHS_WindowRegister`. See "Reserved Variable Names" on page 31.
- `GetWinByIdx()` gets a `GHS_Window` object from an entry in a window list and returns the created `GHS_Window` object. For more information, see "GetWindowByIndex()" on page 195.
- The argument `5` specifies that the window object is created for the window indexed as `5` in Example 3.1. Listing All MULTI IDE Windows on page 50. For more arguments to `GetWinByIdx()`, see "GetWindowByIndex()" on page 195.
- The operation `print w.windowName` prints the name of the returned Python object (which is kept in the variable `w`).
- `multi_ide_script.xml` is the name of the window represented by the Python object, which is an instance of class `GHS_EditorWindow`. Refer to Example 3.1. Listing All MULTI IDE Windows on page 50: the window indexed as `5` belongs to the class `Editors`.

### Example 3.4. Creating a `GHS_Window` Object By Window Type

This example creates a `GHS_Window` object for an existing MULTI Debugger window. You can also create `GHS_Window` objects for MULTI Project Manager windows, Editor windows, MTerminal windows, etc. For a complete list of the window types available, see "GHS_WindowRegister Get Window Functions" on page 189.

```
Python> w = winreg.GetDebugger()
Python> print w.windowName
Py Out: mpythonrun.exe
```

where:

- The variable `w` stores the Python object of class `GHS_DebuggerWindow` for the Debugger window.
- `winreg` is a pre-created object for class `GHS_WindowRegister`. See "Reserved Variable Names" on page 31.
- `GetDebugger()` gets a MULTI Debugger window and returns the created `GHS_DebuggerWindow` object. For more information, see "GetDebuggerWindow()" on page 190.
- The operation `print w.windowName` prints the name of the returned Python object (which is kept in the variable `w`).
- `mpythonrun.exe` is the name of the window represented by the Python object, which is an instance of class `GHS_DebuggerWindow`.

#### Example 3.5. Creating a `GHS_Window` Object By Window Name

This example creates a `GHS_Window` object for the MULTI window whose name contains `multi`.

```
Python> w = winreg.GetWin("multi")
Python> print w.windowName
Py Out: multi_ide_script.xml
```

where:

- The variable `w` stores the Python object of class `GHS_EditorWindow` for the window whose name contains `multi`.
- `winreg` is a pre-created object for class `GHS_WindowRegister`. See "Reserved Variable Names" on page 31.
- `GetWin()` gets a MULTI IDE window from its name, which is a regular expression, and returns the created `GHS_Window` object. For more information, see "GetWindowByName()" on page 195.
- The argument `multi` is the name of the existing window for which the object is created. For more arguments to `GetWin()`, see "GetWindowByName()" on page 195.

- The operation `print w.windowName` prints the name of the returned Python object (which is kept in the variable `w`).
- `multi_ide_script.xml` is the name of the window represented by the Python object, which is an instance of class `GHS_EditorWindow`. Refer to Example 3.1. Listing All MULTI IDE Windows on page 50: the window named `multi_ide_script.xml` belongs to the `Editors` class.

### Example 3.6. Bringing a Window to the Foreground

This example brings the specified window to the foreground. Within the context of these sequential examples, the `GHS_Window` object `w` specifies the window named **multi_ide_script.xml** gotten in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.

```
Python> w.RestoreWin()
```

where:

- `w` is the Python object of class `GHS_EditorWindow` created in the preceding example (Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53).
- `RestoreWin()` brings the window to the foreground. For more information, see “RestoreWindow()” on page 130.

### Example 3.7. Moving a Window By a Delta

This example moves the specified window right 100 pixels and down 200 pixels. Within the context of these sequential examples, the window object `w` specifies the window named **multi_ide_script.xml** gotten in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.

```
Python> w.MoveWin(100, 200)
```

where:

- `w` is the Python object of class `GHS_EditorWindow` created in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.
- `MoveWin()` moves the window by a delta or to an absolute position on the current screen. For more information, see “MoveWindow()” on page 128.

- The arguments `100` and `200` specify the number of pixels to move the window. For more arguments to `MoveWin()`, see "MoveWindow()" on page 128.

### Example 3.8. Moving a Window to an Absolute Position

This example positions the left side of the window in the middle of the screen and the top side 100 pixels from the top of the screen. Within the context of these sequential examples, the window object `w` specifies the window named **multi_ide_script.xml** gotten in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.

```
Python> w.MoveWin(__ghs_display_width/2, 100, False)
```

where:

- `w` is the Python object of class `GHS_EditorWindow` created in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.
- `MoveWin()` moves the window by a delta or to an absolute position on the current screen. For more information, see "MoveWindow()" on page 128.
- The argument `__ghs_display_width` is a pre-set MULTI-Python variable that specifies the screen's width in pixels. See "Pre-Set Variables" on page 30.
- The argument `100` specifies the window's y coordinate.
- `False` indicates that the preceding two arguments are coordinates within the current screen.

### Example 3.9. Resizing a Window

This example resizes the specified window so that its width is one-third of the screen and its height is one-half of the screen. Within the context of these sequential examples, the window object `w` specifies the window named **multi_ide_script.xml** gotten in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.

```
Python> w.ResizeWin(__ghs_display_width/3,
.....2          __ghs_display_height/2, False)
```

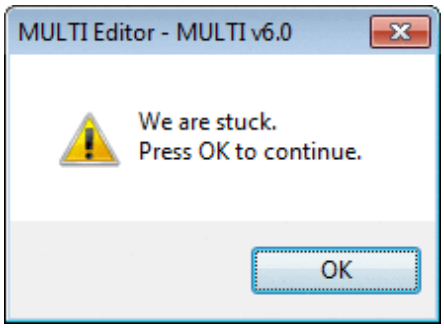
where:

- `w` is the Python object of class `GHS_EditorWindow` created in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.

- `ResizeWin()` resizes the window by the specified deltas or to the specified dimensions. For more information, see “ResizeWindow()” on page 130.
- The arguments `__ghs_display_width` and `__ghs_display_height` are pre-set MULTI-Python variables that specify the screen's width and height in pixels. See “Pre-Set Variables” on page 30.
- The argument `False` indicates that the preceding two arguments are absolute dimensions rather than deltas to the window's existing dimensions.

### Example 3.10. Displaying an Alert Dialog Box

This example displays a modal dialog box that prompts the user for confirmation.



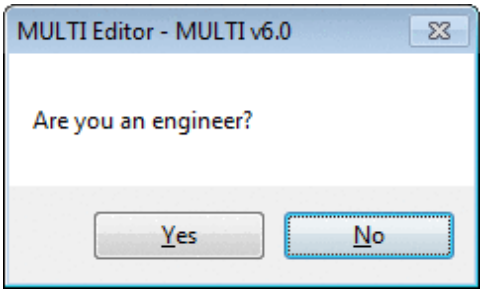

```
Python> w.ShowMsg("We are stuck.\nPress OK to continue.",
.....2          True)
```

where:

- `w` is the Python object of class `GHS_EditorWindow` created in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.
- `ShowMsg()` displays the specified message in the window or in a dialog box. For more information, see “ShowMessage()” on page 104.
- The string enclosed in quotation marks is the message that the dialog box displays.
- `True` indicates that the message should be shown in a modal dialog box rather than in the window.

### Example 3.11. Displaying a Yes/No Dialog Box

This example displays a modal dialog box that prompts the user to choose between **Yes** and **No**. In this example, **Yes** was clicked.



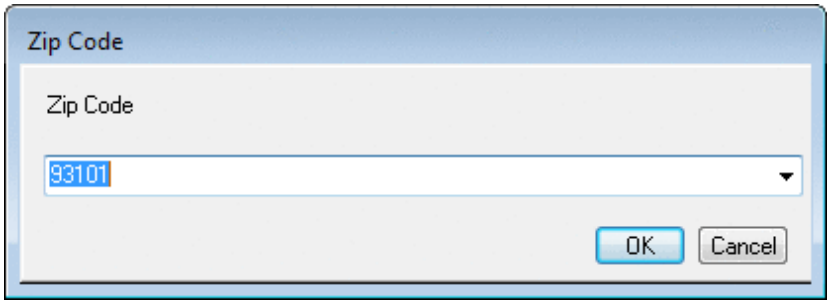

```
Python> ret = w.YesNo("Are you an engineer?")
Python> print ret
Py Out: True
```

where:

- The variable `ret` stores your choice (`True` for **Yes** and `False` for **No**).
- `w` is the Python object of class `GHS_EditorWindow` created in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.
- `YesNo()` displays the specified message in a modal dialog box that prompts the user to choose between **Yes** and **No**. This function returns `True` for **Yes** and `False` for **No**. For more information, see “ChooseYesNo()” on page 103.
- The string enclosed in quotation marks is the message that the dialog box displays. For more arguments to `YesNo()`, see “ChooseYesNo()” on page 103.
- The operation `print ret` prints the returned value.
- `True` is the returned value and indicates that the dialog's **Yes** button was clicked.

### Example 3.12. Displaying an Input Dialog Box

This example displays a modal dialog box that asks for user input. In the dialog box that appears, the user can enter a value or select one from the given list. In this example, **93117** was selected from the list of pre-defined values.



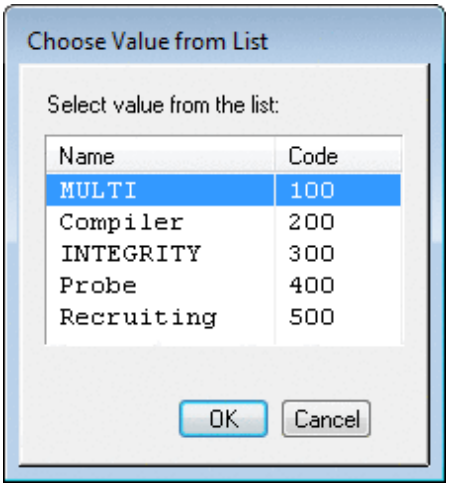

```
Python> ret = w.GetInput("", [93101, 93117, 93118], False,
.....2          "Zip Code")
Python> print ret
Py Out: 93117
```

where:

- The variable `ret` stores the string that you choose from the given list or that you type in.
- `w` is the Python object of class `GHS_EditorWindow` created in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.
- `GetInput()` displays the specified values in a modal dialog box and returns user input or an empty string (`""`) upon failure or cancellation. For more information, see “GetInput()” on page 104.
- The empty string (`""`) indicates that the dialog box does not contain a default value.
- `93101, 93117, 93118` specify the dialog box's pre-defined values.
- `False` indicates that in addition to choosing from the list of pre-defined values, the user can enter their own value.
- `Zip Code` is the prompt that is given in the dialog box. Because no title is specified for the dialog box, the `Zip Code` prompt is also used for the title.
- The operation `print ret` prints the returned value.
- `93117` is the returned value.

### Example 3.13. Displaying a Multiple-Column List

This example displays a modal dialog box that prompts you to choose a value from a two-column list.




When you select a value in a multiple-column list, the value from the first column is returned. In this example, the **Recruiting** entry was selected.

```
Python> ret = w.ChooseFromList(0,
.....2          ["MULTI#100", "Compiler#200", "INTEGRITY#300",
.....3          "Probe#400", "Recruiting#500"],
.....4          "#", ["Name", "Code"])
Python> print ret
Py Out: Recruiting
```

where:

- The variable `ret` stores the string from the first column of the row you choose.
- `w` is the Python object of class `GHS_EditorWindow` created in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.
- `ChooseFromList()` displays the specified list values in a modal dialog box and returns the string selected from the list, or it returns an empty string (`""`) upon failure or cancellation. For more information, see “ChooseFromList()” on page 102.
- The argument `0` specifies the index of the default value.
- `MULTI#100`, `Compiler#200`, `INTEGRITY#300`, `Probe#400`, and `Recruiting#500` are the pre-defined values present in the dialog box.

- `#` is used as a column separator. For example, for `MULTI#100`, **MULTI** appears in one column and **100** in another.
- `Name` and `Code` are column names.
- The operation `print ret` prints the value chosen in the dialog box.
- `Recruiting` is the returned value.

### Example 3.14. Selecting a File

This example displays a file chooser.

```
Python> ret = w.ChooseFile()
Python> print ret
Py Out: /home/puma/devl/src/indgen.cc
```

where:

- The variable `ret` stores the path for the file you choose.
- `w` is the Python object of class `GHS_EditorWindow` created in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.
- `ChooseFile()` allows you to select a file path via MULTI's file chooser. This function returns the selected file path or an empty string (`""`) upon failure or cancellation. For more information, see “ChooseFile()” on page 101.
- The operation `print ret` prints the path to the selected file.
- `/home/puma/devl/src/indgen.cc` is the returned value.

### Example 3.15. Selecting a Directory

This example displays a directory chooser.

```
Python> ret = w.ChooseDir()
Python> print ret
Py Out: /home/puma/devl
```

where:

- The variable `ret` stores the path for the directory you choose.
- `w` is the Python object of class `GHS_EditorWindow` created in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.

- `ChooseDir()` allows you to choose a directory via MULTI's directory chooser. This function returns the selected directory or an empty string (`""`) upon failure or cancellation. For more information, see "ChooseDir()" on page 101.
- The operation `print ret` prints the path to the selected directory.
- `/home/puma/devl` is the returned value.

### Example 3.16. Calling an Interactive Function on winreg

There are a parallel set of interactive, control-related functions in the `GHS_WindowRegister` class (for detailed information, see "GHS_WindowRegister Interactive Functions" on page 197). This example calls an interactive function on the pre-created `winreg` object.

```
Python> ret = winreg.ChooseFromList(0,
.....2          ["MULTI#100", "Compiler#200", "INTEGRITY#300",
.....3          "Probe#400", "Recruiting#500"],
.....4          "#", ["Name", "Code"])
Python> print ret
Py Out: Recruiting
```

where:

- The variable `ret` stores the string from the first column of the row you choose.
- `winreg` is a pre-created object for class `GHS_WindowRegister`. See "Reserved Variable Names" on page 31.
- `ChooseFromList()` returns the string selected from the list or returns an empty string (`""`) upon failure or cancellation. For information about the arguments, see Example 3.13. Displaying a Multiple-Column List on page 59. For more information about the function, see "ChooseFromList()" on page 199.

### Example 3.17. Listing a Window's Widgets

This example lists a window's widgets. You can use a widget name to view and change the widget's value. See Example 3.18. Displaying the Value of a PullDown Widget on page 63.

```
Python> w.Widgets()
Py Out: EditMenuBar:    MenuBar
Py Out: :               Rectangle
Py Out: EditBtns:       ButtonSet
```

```
Py Out:     Open:       Button
Py Out:     Save:       Button (dimmed)
Py Out:     -:          Button
Py Out:     Cut:        Button (dimmed)
Py Out:     Copy:       Button (dimmed)
Py Out:     Paste:      Button
Py Out:     Find:       Button
Py Out:     Goto:       Button
Py Out:     -:          Button
Py Out:     Undo:       Button (dimmed)
Py Out:     Redo:       Button (dimmed)
Py Out:     -:          Button
Py Out:     Prev:       Button (dimmed)
Py Out:     Next:       Button (dimmed)
Py Out:     -:          Button
Py Out:     Done:       Button
Py Out:     Close:      Button (dimmed)
Py Out: pulldown:       PullDown (invisible)
Py Out: FilePD:         PullDown
Py Out: ProcPD:         PullDown
Py Out: LineNum:        TextField
Py Out: Status:         Status
Py Out: stReadOnly:     Status
Py Out: stMVC:          Status
Py Out: stMOD:          Status
Py Out: EditPane:       Edit
Py Out: stLnCol:        Status
Py Out: tx_dummy:       Text (invisible)
Py Out: ln_height_errorwin_novis:   Line
Py Out: ln_height_errorwin_vis:     Line
Py Out: ov_errorwin:                OmniView (invisible)
Py Out: ln_height_errorwin_curr:    Line
Py Out: sp_errorwin:                Splitter (invisible)
Py Out: adjustForErrorWin:          Rectangle
```

where:

- `w` is the Python object of class `GHS_EditorWindow` created in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.
- `Widgets()` dumps information about all widgets in the window. For more information, see “ShowWidgets()” on page 144.

### Example 3.18. Displaying the Value of a PullDown Widget

This example displays the value of the `PullDown` widget that appears in Example 3.17. Listing a Window's Widgets on page 61.

```
Python> print w.GetPdVal("pulldown")
Py Out: multi_ide_script.xml
```

where:

- `print` prints out the value of `pulldown`.
- `w` is the Python object of class `GHS_EditorWindow` created in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.
- `GetPdVal()` gets the value of a `PullDown` widget that is defined in the window and returns a string with the widget's value. For more information, see "GetPullDownValue()" on page 171.
- `pulldown` is the name of the `PullDown` widget. See Example 3.17. Listing a Window's Widgets on page 61.

### Example 3.19. Closing a Window

This example closes the specified window. Within the context of these sequential examples, the window object `w` specifies the window named **multi_ide_script.xml**. See Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.

```
Python> w.CloseWin()
Python> winreg.ShowWins(False)
Py Out: Index   Class Name      Window Name
Py Out: =====   ==========      ===========
Py Out: 0       Debuggers       mpythonrun.exe
Py Out: 1       Debuggers       me.exe
Py Out: 2       None            Py Window
Py Out: 3       None            References of pySystem
Py Out: 4       Python GUI      MULTI Python GUI
Py Out: 5       Editors         ghs_window.py
Py Out:
Py Out: Total number of windows: 6
```

where:

- `w` is the Python object of class `GHS_EditorWindow` created in Example 3.5. Creating a `GHS_Window` Object By Window Name on page 53.
- `CloseWin()` closes the window named **multi_ide_script.xml**. For more information, see "CloseWindow()" on page 126.
- `winreg.ShowWins(False)` lists all the MULTI windows that are currently open. (See also Example 3.1. Listing All MULTI IDE Windows on page 50.) Note that the window named **multi_ide_script.xml** is not listed.

## Manipulating the Editor

The following sequential examples demonstrate how to use MULTI-Python to perform basic operations in the MULTI Editor. Many of the examples use the context created by a preceding example. Where this is the case, the appropriate example is referenced.

### Example 3.20. Creating an Editor Service Object

This example creates an Editor service object.

```
Python> if not editor or not editor.IsAlive():
.....2      editor = GHS_Editor()
```

For information about specifying the service name and working directory of the Editor service object, see "__init__()" on page 262.

### Example 3.21. Opening a File in the Editor

This example opens the specified file (**test.gpy**) in the MULTI Editor.

```
Python> ew = editor.OpenFile("test.gpy")
```

where:

- The variable `ew` stores the Python object of class `GHS_EditorWindow` for the open file.
- `editor` is the object created in Example 3.20. Creating an Editor Service Object on page 64.

- `OpenFile()` loads a file into the MULTI Editor and returns a `GHS_EditorWindow` object for the MULTI Editor window. For more information, see "EditFile()" on page 262.
- The argument `test.gpy` is the name of the file that the Editor opens. For more arguments to `OpenFile()`, see "EditFile()" on page 262.

### Example 3.22. Selecting Text

This example selects text from line 1, column 2 to line 10, column 7 (both line and column numbers start at 1). Within the context of these sequential examples, the `GHS_EditorWindow` object `ew` specifies the **test.gpy** Editor window. See Example 3.21. Opening a File in the Editor on page 64.

```
Python> ew.Select(1, 2, 10, 7)
```

where:

- The variable `ew` is the Python object of class `GHS_EditorWindow` created in Example 3.21. Opening a File in the Editor on page 64.
- `Select()` selects a range. For more information, see "SelectRange()" on page 271.
- `1`, `2`, `10`, and `7` specify the range of selection. For more information, see "SelectRange()" on page 271.

### Example 3.23. Copying a Selection

This example copies the existing selection to the clipboard.

```
Python> ew.Copy()
```

where:

- The variable `ew` is the Python object of class `GHS_EditorWindow` created in Example 3.21. Opening a File in the Editor on page 64.
- `Copy()` copies the selected string to the clipboard. For more information, see "Copy()" on page 264.

### Example 3.24. Moving the Cursor

This example moves the cursor to the end of the file.

```
Python> ew.MoveTo(-1, -1)
```

where:

- The variable `ew` is the Python object of class `GHS_EditorWindow` created in Example 3.21. Opening a File in the Editor on page 64.
- `MoveTo()` moves the cursor to the specified position. For more information, see “MoveCursor()” on page 270.
- `-1, -1` specifies the end of the file. For more arguments to `MoveTo()`, see “MoveCursor()” on page 270.

### Example 3.25. Pasting a Selection

This example pastes the clipboard selection to the current cursor position.

```
Python> ew.Paste()
```

where:

- The variable `ew` is the Python object of class `GHS_EditorWindow` created in Example 3.21. Opening a File in the Editor on page 64.
- `Paste()` pastes clipboard contents to the cursor's location. For more information, see “Paste()” on page 266.

### Example 3.26. Undoing a Previous Change

This example undoes the last change to the current file. In the context of these sequential examples, the paste operation is undone.

```
Python> ew.Undo()
```

where:

- The variable `ew` is the Python object of class `GHS_EditorWindow` created in Example 3.21. Opening a File in the Editor on page 64.
- `Undo()` reverses the last change made to the current file. For more information, see “Undo()” on page 266.

## Manipulating the Debugger

The following sequential examples demonstrate how to use MULTI-Python to access the MULTI Debugger, the debug server, and some debugging windows. Many of the examples use the context created by a preceding example. Where this is the case, the appropriate example is referenced.

### Example 3.27. Creating a Debugger Service Object

This example creates a Debugger service object.

```
Python> if not debugger or not debugger.IsAlive():
.....2      debugger = GHS_Debugger()
```

For information about specifying the working directory of the Debugger service object, see “__init__()” on page 221.

### Example 3.28. Debugging a Program

This example opens the Debugger on an INTEGRITY sim800 BSP kernel.

```
Python> dw = debugger.DebugProgram("/rtos/sim800/kernel")
```

where:

- The variable `dw` stores the returned Python object of class `GHS_DebuggerWindow` for the Debugger window.
- `debugger` is the object created in Example 3.27. Creating a Debugger Service Object on page 67.
- `DebugProgram()` opens a program in the Debugger and returns a `GHS_DebuggerWindow` object. For more information, see “DebugProgram()” on page 235.
- The argument `/rtos/sim800/kernel` specifies the path of the program to be debugged. For more arguments to `Debug()`, see “DebugProgram() on page 235.

### Example 3.29. Connecting to a Target

This example connects to **isimppc** from the MULTI Debugger window.

```
Python> fm = dw.Connect("isimppc")
```

where:

- The variable `fm` stores the returned Python object of class `GHS_DebugServer` for the debug server.
- The variable `dw` is the Python object of class `GHS_DebuggerWindow` created in Example 3.28. Debugging a Program on page 67.
- `Connect()` connects to a target with the specified debug server and returns a `GHS_DebugServer` object for the established debug server connection. For more information, see "ConnectToTarget()" on page 210.
- The argument `isimppc` specifies the name of the debug server. For more arguments to `Connect()`, see "ConnectToTarget()" on page 210.

### Example 3.30. Running the Program

This example runs the program currently being debugged on the target (here the kernel program).

```
Python> dw.Run()
```

where:

- The variable `dw` is the Python object of class `GHS_DebuggerWindow` created in Example 3.28. Debugging a Program on page 67.
- `Run()` runs the program currently being debugged in the Debugger window. For more information, see "Resume()" on page 239.

### Example 3.31. Extracting a Variable's Value

This example accesses the value of `ASP_Log2PageSize` from the program being debugged on the target.

```
Python> dw.RunCmd('mprintf("%d", ASP_Log2PageSize)', True, False)
Python> valint = int(dw.cmdExecOutput, 0)
```

where:

- The variable `dw` is the Python object created in Example 3.28. Debugging a Program on page 67.
- `RunCmd()` executes a MULTI Debugger command. For more information, see "RunCommands()" on page 247.

- The argument `mprintf("%d", ASP_Log2PageSize)` is the MULTI command executed. See the **mprintf** command in Chapter 8, "Display and Print Command Reference" in the *MULTI: Debugging Command Reference* book. `ASP_Log2PageSize` is a global variable in the INTEGRITY kernel.
- `True` indicates that `RunCmd()` is executed in blocked mode and that MULTI grabs the output (if any).
- `False` specifies that the grabbed output should not be printed.
- The operation `valint = int(dw.cmdExecOutput, 0);` converts the string value of the `cmdExecOutput` attribute, which stores the Debugger command output, into an integer value kept in the object `valint`. The function execution results of all MULTI-Python integration objects are kept in the objects' command execution attributes (see "GHS_IdeObject Attributes" on page 18).

### Example 3.32. Connecting to a Run-Mode Debug Server

This example establishes a run-mode connection between the local host and the **rtserv** debug server.

```
Python> rm = dw.Rtserv()
```

where:

- The variable `rm` stores the returned Python object of class `GHS_DebugServer`.
- The variable `dw` is the Python object of class `GHS_DebuggerWindow` created in Example 3.28. Debugging a Program on page 67.
- `Rtserv()` connects to an RTOS target with the `rtserv` debug server, and it returns a `GHS_DebugServer` object. For more information, see "ConnectToRtserv()" on page 209.

### Example 3.33. Loading a Module

This example loads the `pizza` demo module to the target.

```
Python> rm.LoadModule("/rtos/sim800/pizza")
```

where:

- The variable `rm` is the Python object of class `GHS_DebugServer` created in Example 3.32. Connecting to a Run-Mode Debug Server on page 69.

- `LoadModule()` loads a Dynamic Download module to the target. For more information, see "LoadProgram()" on page 213.
- The argument `/rtos/sim800/pizza` specifies the path of the module to be loaded. For more arguments to `LoadModule()`, see "LoadProgram() on page 213.

### Example 3.34. Displaying the Task Manager

This example displays the Task Manager.

```
Python> tw = rm.ShowTaskWindow()
```

where:

- The variable `tw` stores the returned Python object of class `GHS_TaskManagerWindow`.
- The variable `rm` is the debug server object created in Example 3.32. Connecting to a Run-Mode Debug Server on page 69.
- `ShowTaskWindow()` displays the Task Manager (if any) for the debug server, and it returns an object of class `GHS_TaskManagerWindow`. For more information, see "ShowTaskManagerWindow()" on page 214.

### Example 3.35. Selecting the Task Manager's Flat View

This example changes the Task Manager display from hierarchy view (the default) into flat view. See also Example 3.36. Selecting the Task Manager's Hierarchy View on page 71.

```
Python> tw.SelectMenu("&View", "F&lat View", True)
Py Out: You can't switch to a customized group in flat view mode.
```

where:

- The variable `tw` is the Python object of class `GHS_TaskManagerWindow` created in Example 3.34. Displaying the Task Manager on page 70.
- `SelectMenu()` selects a menu item in the window. For more information, see "SelectMenu()" on page 113.
- The arguments `&View` and `F&lat View` specify the Task Manager menu selection that activates flat view. (The **Flat View** menu item toggles between flat view and hierarchy view.) An ampersand (`&`) must be included before any

letter that is underlined in the GUI. For more information about ampersand placement, see “GHS_Window Menu Functions” on page 105.

- `True` indicates that `SelectMenu()` is executed in blocked mode and that MULTI grabs Task Manager output and prints it to the **Py** pane. For more arguments to `SelectMenu()`, see “SelectMenu()” on page 113.

### Example 3.36. Selecting the Task Manager's Hierarchy View

This example changes the Task Manager display back to hierarchy view. See also Example 3.35. Selecting the Task Manager's Flat View on page 70.

```
Python> tw.SelectMenu("&View", "F&lat View", True)
```

where:

- The variable `tw` is the Python object of class `GHS_TaskManagerWindow` created in Example 3.34. Displaying the Task Manager on page 70.
- `SelectMenu()` selects a menu item in the window. For more information, see “SelectMenu()” on page 113.
- The arguments `&View` and `F&lat View` specify the Task Manager menu selection that disables flat view. (The **Flat View** menu item toggles between flat view and hierarchy view.) An ampersand (`&`) must be included before any letter that is underlined in the GUI. For more information about ampersand placement, see “GHS_Window Menu Functions” on page 105.
- `True` indicates that `SelectMenu()` is executed in blocked mode and that MULTI grabs Task Manager output and prints it to the **Py** pane. For more arguments to `SelectMenu()`, see “SelectMenu()” on page 113.

### Example 3.37. Dumping the Task List

This example dumps the task list.

```
Python> tw.DumpWidget("Obj_List")
Py Out: MSL: Obj_List
Py Out: -pizzahut
Py Out: >Initial 0x705000 0x01f8/0x1000 Halted 127
Py Out: -information
Py Out: >Initial 0x73f000 0x01f8/0x1000 Halted 127
Py Out: -engineer
Py Out: >Initial 0x779000 0x01f8/0x1000 Halted 127
```

```
Py Out: -phonecompany
Py Out: >Initial 0x7b3000 0x01f8/0x1000 Halted 127
Py Out: -kernel
Py Out: >LoaderTask 0x7f0000 0x03e8/0x0800 Pended 254
Py Out: >ResourceManager 0x7f2000 0x0224/0x0600 Pended 254
Py Out: >Idle 0x7f3000 - Running 0
```

where:

- The variable `tw` is the Python object of class `GHS_TaskManagerWindow` created in Example 3.34. Displaying the Task Manager on page 70.
- `DumpWidget()` dumps the contents of a widget in the window. For more information, see "DumpWidget()" on page 141.
- The argument `Obj_List` specifies the name of the widget whose contents will be dumped. For more arguments to `DumpWidget()`, see "DumpWidget()" on page 141.

Use `GHS_MslTree` to dump and display a better-formatted task list. In this example, the **Stack** column is hidden so that the output fits onto one page, and the environment is different from that of the previous example, so task IDs do not match those shown above.

```
Python> mt = tw.GetMslTree("Obj_List")
Python> mt.Dump()
Py Out: Row#   Contents of Obj_List (Expansion Name: [Column0] [Column1]...)
Py Out: 0      - pizzahut:  [pizzahut]  []  []  []
Py Out: 1      |_  Initial:  [Initial]  [0x705000]  [Halted]  [127]
Py Out: 2      - information:  [information]  []  []  []
Py Out: 3      |_  Initial:  [Initial]  [0x73f000]  [Halted]  [127]
Py Out: 4      - engineer:  [engineer]  []  []  []
Py Out: 5      |_  Initial:  [Initial]  [0x778000]  [Halted]  [127]
Py Out: 6      - phonecompany:  [phonecompany]  []  []  []

Py Out: 7      |_  Initial:  [Initial]  [0x7b1000]  [Halted]  [127]
Py Out: 8      - kernel:  [kernel]  []  []  []
Py Out: 9      |   LoaderTask:  [LoaderTask]  [0x7f0000]  [Pended]  [254]
Py Out: 10     |   ResourceManager:  [ResourceManager]  [0x7f2000]  [Pended]  [254]
Py Out: 11     |_  Idle:  [Idle]  [0x7f3000]  [Running]  [0]
```

where:

- The variable `mt` is the returned Python object of class `GHS_MslTree` for the contents of the `Obj_List` widget.

### Example 3.38. Creating a Task Object

This example creates a task object.

```
Python> eng = GHS_Task(rm.component, "engineer", "Initial")
```

where:

- The variable `eng` stores the created Python object of class `GHS_Task`.
- `GHS_Task` implements functions for debugging tasks or threads in RTOS run-mode debugging environments.
- `rm.component` stores the identifier string for the debug server component.
- The argument `engineer` specifies the AddressSpace.
- The argument `Initial` specifies the task name.

### Example 3.39. Running a Task Without Attaching

This example runs the task without attaching to it.

```
Python> eng.Run()
```

where:

- The variable `eng` is the Python object of class `GHS_Task` created in Example 3.38. Creating a Task Object on page 73.
- `Run()` runs the task. For more information, see “Resume()” on page 258.

### Example 3.40. Attaching to a Task

This example attaches to the task created in Example 3.38. Creating a Task Object on page 73.

```
Python> eng.Attach()
Py Out: Target cpu: PowerPC 860 (PowerQUICC)
```

where:

- The variable `eng` is the Python object of class `GHS_Task` created in Example 3.38. Creating a Task Object on page 73.

- `Attach()` attaches to the task. For more information, see "Attach()" on page 256.

### Example 3.41. Setting a Breakpoint

This example sets a breakpoint on the task at `main#10`.

```
Python> eng.SetBp("main#10")
```

where:

- The variable `eng` is the Python object of class `GHS_Task` created in Example 3.38. Creating a Task Object on page 73.
- `SetBp()` sets a software breakpoint at the specified location. For more information, see "SetBreakpoint()" on page 248.
- The argument `main#10` specifies the location where the breakpoint is set. For more arguments to `SetBp()`, see "SetBreakpoint()" on page 248.

### Example 3.42. Terminating a Run-Mode Connection

This example terminates the run-mode connection established in Example 3.32. Connecting to a Run-Mode Debug Server on page 69.

```
Python> rm.Disconnect()
```

where:

- The variable `rm` is the Python object of class `GHS_DebugServer` created in Example 3.32. Connecting to a Run-Mode Debug Server on page 69.
- `Disconnect()` disconnects the debug server connection. For more information, see "Disconnect()" on page 213.

### Example 3.43. Terminating a Freeze-Mode Connection

This example terminates the freeze-mode connection established in Example 3.29. Connecting to a Target on page 67.

```
Python> fm.Disconnect()
```

where:

- The variable `fm` is the Python object of class `GHS_DebugServer` created in Example 3.29. Connecting to a Target on page 67.
- `Disconnect()` disconnects the debug server connection. For more information, see "Disconnect()" on page 213.

**Example 3.44. Closing the Debugger Window**

This example closes the **kernel** Debugger window opened in Example 3.28. Debugging a Program on page 67.

```
Python> dw.CloseWin()
```

where:

- The variable `dw` is the Python object of class `GHS_DebuggerWindow` created in Example 3.28. Debugging a Program on page 67.
- `CloseWin()` closes the window. For more information, see "CloseWindow()" on page 126.

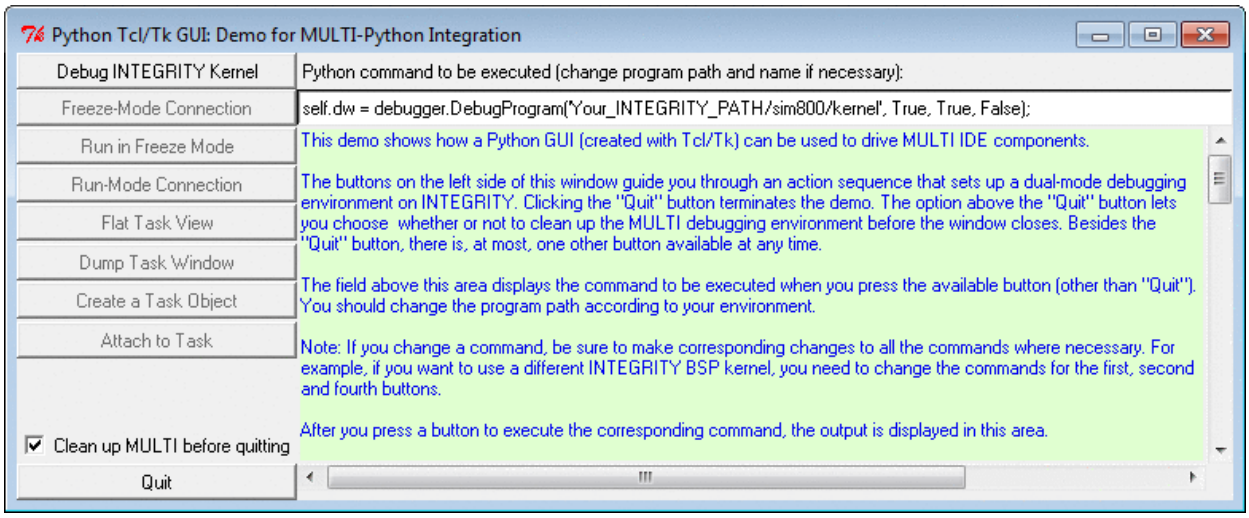
## Using Tcl/Tk to Create a Graphical Interface

A simple GUI demo is included with your MULTI IDE installation. The demo shows how a Python GUI that is created with Tcl/Tk can be used to drive MULTI IDE components.

To view the demo, run the following Python statement:

```
execfile(__ghs_site_default_python_dir+os.sep+"ghs_guidemo.py")
```

The resulting demo window contains a number of buttons, a text field for Python statements, and a pane that displays instructions and output.




The window's buttons guide you through an action sequence that sets up a dual-mode debugging environment (freeze mode and run mode) on INTEGRITY. If you do not have an INTEGRITY installation, you can debug and run a stand-alone program instead. Apart from the **Quit** button, one other button (at most) is available at any given time.

The text field displays the Python statement that is executed when you click the button (other than **Quit**) that is available. Some statements require user adjustments, such as a change to a program path or name. If you debug and run a stand-alone program instead of debugging on INTEGRITY, you must change the statements for the first three buttons.

After you click a button to execute a statement, the output is displayed in the window.

To view the demo's source code, run the following Python statements:

```
if not editor: editor = GHS_Editor()
tkew = editor.EditFile(__ghs_site_default_python_dir+
    os.sep+"ghs_guidemo.py")
```

For more information, see “Creating a Graphical Interface” on page 47.

# Part III

# MULTI-Python API Reference

Chapter 4

# General Notes on Using Functions

- Functions and aliases are documented in mixed case, but you may also enter them in *all* lowercase letters (except where it is noted otherwise). For example, `ShowWindowList()` and `showwindowlist()` are equivalent and are both valid.
- Many argument descriptions refer to *blocked mode*. In blocked mode, Python waits for a MULTI operation to finish before continuing on to the next Python statement. In non-blocking mode, Python sends a request to MULTI and then continues immediately to the next statement.

# Chapter 5

# MULTI-Python Utility Function Prototypes

## Contents

This chapter provides information about MULTI-Python utility function prototypes. You can use these utility functions directly in your Python statements or scripts if you execute them in the MULTI-Python environment.

## Utility Function Prototypes

The utility function prototypes are listed below. For information about a function, see the page referenced.

- `GHS_ExecFile()` — See "GHS_ExecFile()" on page 82.
- `GHS_PrintObject()` — See "GHS_PrintObject()" on page 83.
- `GHS_RunShellCommands()` — See "GHS_RunShellCommands()" on page 83.
- `GHS_System()` — See "GHS_System()" on page 84.

### GHS_ExecFile()

```
GHS_ExecFile(fileName, gd={}, ld={})
```

Executes the specified Python script file. This function is similar to Python's built-in `execfile()` function. However, as illustrated below, `GHS_ExexFile()` allows you to raise a `GHS_AbortExecFile()` exception at any place (inside the script file or in one of the nested script files) to abort the execution normally.

```
if exitCode != 0:
    raise GHS_AbortExecFile("Exit code: " + str(exitCode));
```

Arguments are:

- `fileName` — Specifies the Python script file to execute.
- `gd` — Specifies the global dictionary that is used as a global namespace to execute the Python script. If empty [default], `GHS_ExecFile()` uses the global dictionary from the MULTI-Python integration environment.
- `ld` — Specifies the local dictionary that is used as a local namespace to execute the Python script. If you omit the local dictionary, it defaults to the `gd` dictionary.

## GHS_PrintObject()

```
GHS_PrintObject(obj, printIdx=True)
```

Prints the given `list`, `tuple`, or `dictionary` object in better format than the standard **print** statement. This utility function prints one element per line, indents correctly, etc.

Arguments are:

- `obj` — Specifies the object to print.
- `printIdx` — If `True`, prints element indexes for `list`, `tuple`, and `dictionary` objects. If `False`, does not print element indexes.

The alias is: `GHS_PrintObj()`

## GHS_RunShellCommands()

```
GHS_RunShellCommands(commands, grabStdout=True,
grabStderr=False, printErrMsg=True)
```

Executes the specified shell commands, captures their status, grabs output from **stdout** and/or **stderr** on request (grabbing output from **stderr** is supported only in POSIX environments), and returns a `tuple` such as the following:

```
(exitCode, stdoutOutput, stderrOutput)
```

If `GHS_RunShellCommands()` does not grab the output from **stdout** or **stderr**, the corresponding attributes—`stdoutOutput` and `stderrOutput`—are empty strings (`""` or `''`). The corresponding output is displayed on the console (Windows) or in the xterm (Linux/Solaris).

Arguments are:

- `commands` — Specifies the shell commands to execute.
- `grabStdout` — If `True`, grabs output from **stdout** and returns it as a `tuple`. If `False`, does not grab output from **stdout**, but instead displays it on the console (Windows) or in the xterm (Linux/Solaris).

- `grabStderr` — If `True`, grabs output from **stderr** and returns it as a `tuple`. (This is supported only in POSIX environments.) If `False`, does not grab output from **stderr**, but instead displays it on the console (Windows) or in the xterm (Linux/Solaris).
- `printErrMsg` — If `True`, prints an error message when the exit code is not zero (0). If `False`, does not print an error message when the exit code is not zero (0).

Aliases are: `GHS_RunShellCmds()`, `GHS_ShellCmds()`, `GHS_Shell()`

## GHS_System()

```
GHS_System(commands, grabStdout=True, grabStderr=False,
printErrMsg=True)
```

Executes the specified shell commands, grabs output from **stdout** and **stderr** on request, and returns a string containing the requested output. If `GHS_System()` does not grab the output from **stdout** or **stderr**, the corresponding output is displayed on the console (Windows) or in the xterm (Linux/Solaris).

Grabbing output from **stderr** is supported only in POSIX environments. If `GHS_System()` grabs output from **stderr**, it appends it to the output from **stdout** in the returned string.

This function is a simpler version of `GHS_RunShellCommands()`. This function is also similar to the `system()` function in the `os` module; however, `GHS_System()` is able to grab output.

Arguments are:

- `commands` — Specifies the shell commands to execute.
- `grabStdout` — If `True`, grabs output from **stdout** and returns it as a string. If `False`, does not grab output from **stdout**, but instead displays it on the console (Windows) or in the xterm (Linux/Solaris).
- `grabStderr` — If `True`, grabs output from **stderr** and returns it as a string. (This is supported only in POSIX environments.) If `False`, does not grab output from **stderr**, but instead displays it on the console (Windows) or in the xterm (Linux/Solaris).

- `printErrMsg` — If `True`, prints an error message when the exit code is not zero (0). If `False`, does not print an error message when the exit code is not zero (0).

# Chapter 6

# Basic Functions

## Contents

This chapter documents the `GHS_IdeObject` class, which is the base class of all MULTI-Python service classes, window classes, and Debugger object classes (see "Overview of MULTI-Python Classes" on page 18).

For information about the attributes of class `GHS_IdeObject`, see "GHS_IdeObject Attributes" on page 18.

## GHS_IdeObject Functions

The following sections describe functions from class `GHS_IdeObject`.

### CleanCmdExecVariables()

```
CleanCmdExecVariables(status=1, output="", obj=None,
cmdPath="")
```

Modifies the attributes related to command execution. The default values of the arguments are the default values of the attributes.

Arguments are:

- `status` — Stores the command execution status of the corresponding MULTI IDE service or window. Usually, a one (`1`) indicates success, and a zero (`0`) indicates failure.
- `output` — Stores the command execution output of the corresponding MULTI IDE service or window.
- `obj` — Stores the MULTI-Python object (if any) created by the command execution of the corresponding MULTI IDE service or window.
- `cmdPath` — Stores the executed command and indicates how it was executed. This attribute is for debugging purposes.

## IsAlive()

```
IsAlive()
```

Checks if the corresponding MULTI IDE service (if any) of a Python object is alive (that is, not down).

The alias is: `Alive()`

# Chapter 7

# Window Functions

## Contents

This chapter documents functions from class `GHS_Window`. Class `GHS_Window` inherits from class `GHS_IdeObject` and implements the general functions of MULTI IDE windows. You can route any command to the corresponding MULTI IDE component via a `GHS_Window` object.

The `GHS_Window` functions are divided into the following sections:



**Note**

This chapter documents only a subset of the functions from class `GHS_Window`. For information about other `GHS_Window` functions, see Chapter 8, "Widget Functions" on page 133.

For information about the attributes of class `GHS_Window`, see "GHS_Window Attributes" on page 20.

**Note**

`level` is an argument of some `GHS_Window` functions. This argument specifies the nested level of a modal dialog box and is only applicable if the argument `dialog` is set to `True`. Each MULTI IDE window and dialog box has a name and an internal ID, which MULTI-Python uses to identify the window. Modal dialog boxes are identified by the name `ModalDialog` and by a number that represents their nested level in a sequence of MULTI IDE commands. The most recent modal dialog box has a nested level of zero (0), the second most recent has a nested level of one (1), and so on. MULTI-Python ignores a nested level of zero (0) in a modal dialog box's name. As a result, `ModalDialog` and `ModalDialog0` are equivalent; both of them identify the most recent modal dialog box.

# GHS_Window Basic Functions

The following sections describe basic functions from class `GHS_Window`. For information about the attributes of the `GHS_Window` class, see “GHS_Window Attributes” on page 20.

## GetCwd()

```
GetCwd()
```

Gets the current working directory of the window's process and returns a string containing the directory.

The alias is: `Cwd()`

## GetInfo()

```
GetInfo(printOut=True)
```

Returns a string containing window information.

The argument is:

- `printOut` — If `True`, prints the string. If `False`, does not print the string.

## GetPid()

```
GetPid()
```

Gets the process ID (PID) of the window's process. This function returns the PID as an integer, or it returns `0` (zero) upon error.

The alias is: `Pid()`

## IsSameWindow()

```
IsSameWindow(winObj)
```

Determines whether the current window object is the same as the specified window object. This function returns `True` if the window objects are the same, and `False` otherwise.

The argument is:

- `winObj` — Specifies a `GHS_Window` object to compare against.

Aliases are: `IsSameWin()`, `SameWin()`

## IsWindowAlive()

```
IsWindowAlive(clearIfNotAlive=True)
```

Determines whether the window for the object still exists and returns `True` if yes, and `False` otherwise.

The argument is:

- `clearIfNotAlive` — If `True` and if the window does not exist, clears window information kept in the window object. If `False`, does not clear window information.

## RunCommands()

```
RunCommands(cmd, block=True, printOutput=True)
```

Runs the specified command(s) in the corresponding MULTI IDE component. The output (if any) is kept in the window object's `cmdExecOutput` attribute.

Arguments are:

- `cmd` — Specifies the command(s) to execute. Acceptable commands include documented commands specific to the environment, such as MULTI Editor commands and MULTI Debugger commands. You can directly run these commands with the function.

- `block` — If `True`, executes `RunCommands()` in blocked mode and grabs the output, if any. If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

Aliases are: `RunCommand()`, `RunCmd()`, `RunCmds()`

## GHS_Window Configuration Functions

The following sections describe the functions from class `GHS_Window` that relate to configuration of the MULTI IDE. For information about MULTI configuration, see Part II, "Configuring the MULTI IDE" in the *MULTI: Managing Projects and Configuring the IDE* book.

### ClearDefaultConfigFile()

```
ClearDefaultConfigFile(block=True, printOutput=True)
```

Removes MULTI's default user configuration file. This function returns `True` on success and `False` on failure.

For more information, see "Clearing Configuration Settings" in Chapter 7, "Configuring and Customizing MULTI" in the *MULTI: Managing Projects and Configuring the IDE* book.

Arguments are:

- `block` — If `True`, executes `ClearDefaultConfigFile()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

Aliases are: `ClearDftConfigFile()`, `ClearConfigFile()`

## LoadConfigFile()

```
LoadConfigFile(fileName="", block=True, printOutput=True)
```

Loads the MULTI IDE configuration from a file. This function returns `True` on success and `False` on failure.

Arguments are:

- `fileName` — Specifies the file to be read. If `filename` is empty, a MULTI file chooser appears so that you can select a file to be read.
- `block` — If `True`, executes `LoadConfigFile()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

## SaveConfig()

```
SaveConfig(fileName="", saveToDftFile=False, block=True,
printOutput=True)
```

Saves the current MULTI IDE configuration to a file and returns `True` on success and `False` on failure.

Arguments are:

- `fileName` — Specifies the file to save to. If `fileName` is an empty string (`""`) and `saveToDftFile` is `False` (both are defaults), a MULTI file chooser appears so that you can select a file.
- `saveToDftFile` — If `True`, saves the MULTI IDE configuration to the default configuration file (this is effective only when `fileName` is an empty string). If `False`, you must either specify `fileName` or choose a file from the file chooser. For more information, see “Saving Configuration Settings” in Chapter 7, “Configuring and Customizing MULTI” in the *MULTI: Managing Projects and Configuring the IDE* book.

- `block` — If `True`, executes `SaveConfig()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

### ShowConfigWindow()

```
ShowConfigWindow(block=True, printOutput=True)
```

Displays the **Options** dialog box, which provides access to many MULTI configuration settings. This function returns `True` on success and `False` on failure. The window object for the **Options** dialog box is kept in the host object's `cmdExecObj` attribute.

Arguments are:

- `block` — If `True`, executes `ShowConfigWindow()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

The alias is: `ShowConfigWin()`

## GHS_Window Directory Functions

The following sections describe the directory functions from class `GHS_Window`.

### GetIntegrityDistributionDir()

```
GetIntegrityDistributionDir()
```

Gets the INTEGRITY distribution directory and returns a string with the directory or returns an empty string (`""`) upon failure or cancellation.

Aliases are: `GetIntDistDir()`, `GetIntDir()`

## SetIntegrityDistributionDir()

```
SetIntegrityDistributionDir(newDir)
```

Sets the INTEGRITY distribution directory. This function returns a string for the old INTEGRITY distribution directory, or it returns an empty string (`""`) upon error.

The argument is:

- `newDir` — Specifies the full path to the new INTEGRITY distribution directory.

Aliases are: `SetIntDistDir()`, `SetIntDir()`

## GetUvelosityDistributionDir()

```
GetUvelosityDistributionDir()
```

Gets the u-velOSity distribution directory and returns a string with the directory or returns an empty string (`""`) upon failure or cancellation.

Aliases are: `GetUvelDistDir()`, `GetUvelDir()`

## SetUvelosityDistributionDir()

```
SetUvelosityDistributionDir(newDir)
```

Sets the u-velOSity distribution directory. This function returns a string for the old u-velOSity distribution directory, or it returns an empty string (`""`) upon error.

The argument is:

- `newDir` — Specifies the full path to the new u-velOSity distribution directory.

Aliases are: `SetUvelDistDir()`, `SetUvelDir()`

## GetLatestDir()

```
GetLatestDir(dirType="?")
```

Gets the latest value for a directory type maintained by the MULTI IDE. This function returns the directory that was most recently used for the specified directory type, or it returns an empty string (`""`) upon error.

The argument is:

- `dirType` — Specifies the directory type. Supported directory types are:
  - BuildFileDir
  - ConfigFileDir
  - ConnectionFileDir
  - EditFileDir
  - EventFileDir
  - ExecutableDir
  - GeneralFileDir
  - IntegrateFileDir
  - LMAdminFileDir
  - MemFilterFileDir
  - PlacerFileDir
  - TargetFileDir
  - TraceFileDir

  The argument `?` specifies any directory type.

The alias is: `GetMruDir()`

### SetLatestDir()

```
SetLatestDir(dirType="?", newDir="")
```

Sets the latest value for a directory type maintained by the MULTI IDE. This function returns a string with the existing, most recently used directory of the specified directory type, or it returns an empty string (`""`) upon error.

Arguments are:

- `dirType` — Specifies the directory type. For a list of supported directory types, see "GetLatestDir()" on page 99.
- `newDir` — Specifies a new directory for the directory type.

The alias is: `SetMruDir()`

## GHS_Window Interactive Functions

The following sections describe the interactive functions from class `GHS_Window`.

### Beep()

```
Beep(count=1, block=False)
```

Beeps the specified number of times and returns `True` on success and `False` on failure.

Arguments are:

- `count` — Specifies the number of beeps.
- `block` — If `True`, executes `Beep()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.

## ChooseDir()

```
ChooseDir(dftDir="", prompt="Choose directory:",
title="Directory Chooser")
```

Allows you to choose a directory via MULTI's directory chooser. This function returns the selected directory, or it returns an empty string (`""`) upon failure or cancellation.

Arguments are:

- `dftDir` — Specifies the default directory.
- `prompt` — Specifies the prompt string to display in the directory chooser.
- `title` — Specifies the title of the modal directory chooser. If `title` is an empty string (`""`), the value of `prompt` is used as the title.

The alias is: `DirChooser()`

## ChooseFile()

```
ChooseFile(dftFile="", dftDir="", label="OK", forOpen=True,
existingFile=False, extension="", fileTypes="",
eraseFilenameWhenDirChange=False, title="File Chooser")
```

Allows you to choose a file path via MULTI's file chooser. This function returns the selected file path, or it returns an empty string (`""`) upon failure or cancellation.

Arguments are:

- `dftFile` — Specifies the default filename.
- `dftDir` — Specifies the default directory.
- `label` (Linux/Solaris only) — Specifies the label of the action button in the file chooser.
- `forOpen` — If `False`, provides file protection by prompting you before allowing you to overwrite an existing file. If `True`, does not prompt you.
- `existingFile` — If `True`, the selected file must already exist. If `False`, the user may create a new file.
- `extension` — Specifies the extension for the selected file.

- `fileTypes` — Specifies the file's MULTI IDE file type.
- `eraseFilenameWhenDirChange` — If `True`, erases the filename located in the file chooser when the directory changes. If `False`, does not erase the filename when the directory changes.
- `title` — Specifies the title of the modal file chooser. If `title` is an empty string (`""`), `File Chooser` is used as the title.

The alias is: `FileChooser()`

## ChooseFromList()

```
ChooseFromList(dftValueIdx=0, valList=[], colValueSep="",
colNames=[], prompt="Select value from the list:",
title="Choose Value from List", helpkey="")
```

Allows you to choose a value from a list displayed in a modal dialog box. This function returns the string selected from the list, or it returns an empty string (`""`) upon failure or cancellation. New lines are not permitted in string values.

Arguments are:

- `dftValueIdx` — Specifies the index of the list's default value.
- `valList` — Specifies a list of pre-defined values. Each string in `valList` may contain a set of column values separated by `colValueSep`. The returned string is the value of the first column.
- `colValueSep` — Specifies a column-value separator. If `colValueSep` is an empty string (`""`), `#` is used as the separator by default. The separator cannot be a newline character (`\n`).
- `colNames` — Specifies the column names. This should be a list of strings.
- `prompt` — Specifies the prompt string to display.
- `title` — Specifies the title of the modal dialog box. If `title` is an empty string (`""`), the value of `prompt` is used as the title.
- `helpkey` — Specifies a string for a MULTI help key.

## ChooseWindowFromGui()

```
ChooseWindowFromGui(msg="Choose a window:", title="Choose
Window from List", wins=None)
```

Allows you to choose a window from a window list displayed in a modal dialog box. This function returns an object for the chosen window, or it returns `None` upon failure or cancellation.

Arguments are:

- `msg` — Specifies the prompt string to display.
- `title` — Specifies the title of the modal dialog box. If `title` is an empty string (`""`), the value of `msg` is used as the title.
- `wins` — Specifies a list of windows from which you can choose. If you do not specify a window list or if `wins` is an empty string (`""`), the current MULTI IDE windows in the system are used.

Aliases are: `ChooseWindow()`, `ChooseWin()`

## ChooseYesNo()

```
ChooseYesNo(msg, dftChoice=0, printOutput=True)
```

Displays the specified message in a modal dialog box that prompts you to choose between **Yes** and **No**. This function returns `True` for **Yes** and `False` for **No**.

Arguments are:

- `msg` — Specifies the prompt message to display. The message should be a yes/no question.
- `dftChoice` — If `0`, the default choice is **No**. If `1`, the default choice is **Yes**.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

Aliases are: `YesOrNo()`, `YesNo()`

## GetInput()

```
GetInput(dftValue="", valList=[], onlyFromList=False,
prompt="Your input", title="", helpkey="")
```

Gets user input via a modal dialog box. This function returns the input string, or it returns an empty string (`""`) upon failure or cancellation.

Arguments are:

- `dftValue` — Specifies the default value to return.
- `valList` — Specifies a list of pre-defined values to include in the modal dialog box.
- `onlyFromList` — If `True`, you can only choose from the list of pre-defined values. If `False`, you can choose from the list of pre-defined values, or you can enter your own value.
- `prompt` — Specifies the prompt string to display.
- `title` — Specifies the title of the modal dialog box. If `title` is an empty string (`""`), the value of `prompt` is used as the title.
- `helpkey` — Specifies a string for a MULTI help key.

## ShowMessage()

```
ShowMessage(msg, inDialog=False, error=False, permanent=False)
```

Displays the specified message in the window or in a dialog box and returns `True` on success and `False` on failure.

Arguments are:

- `msg` — Specifies the message to display.
- `inDialog` — If `True`, displays the message in a modal dialog box. If `False`, displays the message in the window.
- `error` — If `True`, displays the message as an error (if the corresponding window supports the concept). If `False`, does not display the message as an error.

- `permanent` — If `True`, displays the message as a permanent message (if the corresponding window supports the concept). If `False`, does not display the message as a permanent message.

Aliases are: `ShowMsg()`, `DisplayMessage()`, `DisplayMsg()`

### Wait()

```
Wait(timeout, local=True, block=False)
```

Blocks the corresponding MULTI IDE component from accepting any commands for the specified amount of time. This function returns `True` on success and `False` on failure.

Arguments are:

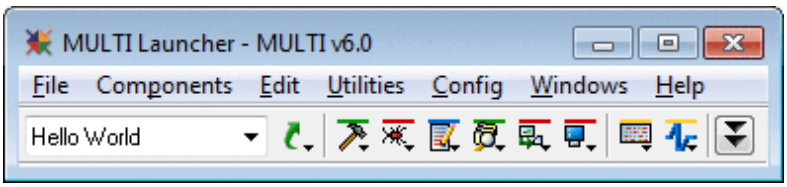
- `timeout` — Specifies the amount of time (in milliseconds) that commands are blocked.
- `local` — This argument is not supported at present.
- `block` — If `True`, executes `Wait()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.

## GHS_Window Menu Functions

The following sections describe the menu functions from class `GHS_Window`.

**Note**

Many of the following functions require that you specify a menu name, submenu name, menu item, etc. When you do so, place an ampersand (`&`) before any letter that is underlined in the GUI. For example, given the following graphic, the **Components** menu would be typed as `Com&ponents`.




On Windows, press the **Alt** key to see underlined letters. On Linux/Solaris, underlining is always displayed. To list menu names containing appropriately placed ampersands, enter the `DumpMenu()` function with no arguments. To list a menu's submenu names, menu entries, etc. with appropriately placed ampersands, use `DumpMenu()` and specify the desired menu. See “DumpMenu()” on page 106.

## DumpMenu()

```
DumpMenu(menu="", block=True, printOutput=True)
```

Dumps a menu that is defined in the window and returns `True` on success and `False` on failure. The string containing the menu is kept in the window object's `cmdExecOutput` attribute.

Arguments are:

- `menu` — Specifies the name of the menu to dump. For more information, see the note at the beginning of “GHS_Window Menu Functions” on page 105.
- `block` — If `True`, executes `DumpMenu()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

## DumpMenuBar()

```
DumpMenuBar(block=True, printOutput=True)
```

Dumps the window's menu bar and returns `True` on success and `False` on failure. The string containing the menu bar is kept in the window object's `cmdExecOutput` attribute.

Arguments are:

- `block` — If `True`, executes `DumpMenuBar()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

## GetCommandToDumpMenu()

```
GetCommandToDumpMenu(menu="", dialog=False, level=0)
```

Gets the command that dumps the specified menu of the window or of a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `menu` — Specifies the name of the menu to dump. For more information, see the note at the beginning of "GHS_Window Menu Functions" on page 105.
- `dialog` — If `True`, specifies that the menu is defined in a modal dialog box. If `False`, specifies that the menu is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 7, "Window Functions" on page 91).

The alias is: `CmdToDumpMenu()`

## GetCommandToDumpMenuBar()

```
GetCommandToDumpMenuBar(dialog=False, level=0)
```

Gets the command that dumps the menu bar of the window or of a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `dialog` — If `True`, specifies that the menu bar is located in a modal dialog box. If `False`, specifies that the menu bar is located in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 7, "Window Functions" on page 91).

The alias is: `CmdToDumpMenuBar()`

## GetCommandToSelectMenu()

```
GetCommandToSelectMenu(menuName, menuItemName, dialog=False,
level=0)
```

Gets the command that selects a menu item defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `menuName` — Specifies the menu name.
- `menuItemName` — Specifies the menu item name.
- `dialog` — If `True`, specifies that the menu item is defined in a modal dialog box. If `False`, specifies that the menu item is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 7, "Window Functions" on page 91).

For more information about specifying `menuName` and `menuItemName`, see the note at the beginning of "GHS_Window Menu Functions" on page 105.

The alias is: `CmdToSelMenu()`

## GetCommandToSelectMenuPath()

```
GetCommandToSelectMenuPath(menuPath, dialog=False, level=0)
```

Gets the command that selects a menu item defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `menuPath` — Specifies the path (formatted as a Python list) to the menu item. Begin with the main menu and proceed to the menu item. For more information, see the note at the beginning of "GHS_Window Menu Functions" on page 105.
- `dialog` — If `True`, specifies that the menu item is defined in a modal dialog box. If `False`, specifies that the menu item is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 7, "Window Functions" on page 91).

The alias is: `CmdToSelMenuPath()`

## GetCommandToSelectSubMenu()

```
GetCommandToSelectSubMenu(menuName, subMenuName, menuItemName,
dialog=False, level=0)
```

Gets the command that selects a submenu item defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `menuName` — Specifies the menu name.
- `subMenuName` — Specifies the submenu name.
- `menuItemName` — Specifies the menu item name.

- `dialog` — If `True`, specifies that the submenu item is defined in a modal dialog box. If `False`, specifies that the submenu item is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 7, "Window Functions" on page 91).

For more information about specifying `menuName`, `subMenuName`, and `menuItemName`, see the note at the beginning of "GHS_Window Menu Functions" on page 105.

The alias is: `CmdToSelSubMenu()`

## GetCommandToSelectSubSubMenu()

```
GetCommandToSelectSubSubMenu(menuName, subMenuName,
subSubMenuName, menuItemName, dialog=False, level=0)
```

Gets the command that selects a sub-submenu item defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `menuName` — Specifies the menu name.
- `subMenuName` — Specifies the submenu name.
- `subSubMenuName` — Specifies the sub-submenu name.
- `menuItemName` — Specifies the menu item name.
- `dialog` — If `True`, specifies that the sub-submenu item is defined in a modal dialog box. If `False`, specifies that the sub-submenu item is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 7, "Window Functions" on page 91).

For more information about specifying `menuName`, `subMenuName`, `subSubMenuName` and `menuItemName`, see the note at the beginning of "GHS_Window Menu Functions" on page 105.

The alias is: `CmdToSelSubSubMenu()`

## IsMenuItemActive()

```
IsMenuItemActive(menuName, menuItemName)
```

Determines whether the specified menu item is active (not dimmed) or inactive (dimmed). This function returns `True` if the menu item is active and `False` if it is inactive.

Arguments are:

- `menuName` — Specifies the menu name.
- `menuItemName` — Specifies the menu item name.

For more information about specifying `menuName` and `menuItemName`, see the note at the beginning of "GHS_Window Menu Functions" on page 105.

The alias is: `IsMenuEntryActive()`

## IsMenuItemTicked()

```
IsMenuItemTicked(menuName, menuItemName)
```

Determines whether the specified menu item is ticked. This function returns `True` if the menu item is ticked and `False` if it is not ticked.

Arguments are:

- `menuName` — Specifies the menu name.
- `menuItemName` — Specifies the menu item name.

For more information about specifying `menuName` and `menuItemName`, see the note at the beginning of "GHS_Window Menu Functions" on page 105.

The alias is: `IsMenuEntryTicked()`

## IsSubMenuItemActive()

```
IsSubMenuItemActive(menuName, subMenuName, menuItemName)
```

Determines whether the specified submenu item is active (not dimmed) or inactive (dimmed). This function returns `True` if the menu item is active and `False` if it is inactive.

Arguments are:

- `menuName` — Specifies the menu name.
- `subMenuName` — Specifies the submenu name.
- `menuItemName` — Specifies the menu item name.

For more information about specifying `menuName`, `subMenuName`, and `menuItemName`, see the note at the beginning of "GHS_Window Menu Functions" on page 105.

The alias is: `IsSubMenuEntryActive()`

## IsSubMenuItemTicked()

```
IsSubMenuItemTicked(menuName, subMenuName, menuItemName)
```

Determines whether the specified submenu item is ticked. This function returns `True` if the submenu item is ticked and `False` if it is not ticked.

Arguments are:

- `menuName` — Specifies the menu name.
- `subMenuName` — Specifies the submenu name.
- `menuItemName` — Specifies the menu item name.

For more information about specifying `menuName`, `subMenuName`, and `menuItemName`, see the note at the beginning of "GHS_Window Menu Functions" on page 105.

The alias is: `IsSubMenuEntryTicked()`

## SelectMenu()

```
SelectMenu(menuName, menuItemName, block=True,
printOutput=True)
```

Selects a menu item defined in the window and returns `True` on success and `False` on failure. The string containing the menu item selection is kept in the window object's `cmdExecOutput` attribute.

Arguments are:

- `menuName` — Specifies the menu name.
- `menuItemName` — Specifies the menu item name.
- `block` — If `True`, executes `SelectMenu()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

For more information about specifying `menuName` and `menuItemName`, see the note at the beginning of "GHS_Window Menu Functions" on page 105.

Aliases are: `SelMenu()`, `ChooseMenu()`

## SelectSubMenu()

```
SelectSubMenu(menuName, subMenuName, menuItemName, block=True,
printOutput=True)
```

Selects a submenu item defined in the window and returns `True` on success and `False` on failure. The string containing the submenu item selection is kept in the window object's `cmdExecOutput` attribute.

Arguments are:

- `menuName` — Specifies the menu name.
- `subMenuName` — Specifies the submenu name.

- `menuItemName` — Specifies the menu item name.
- `block` — If `True`, executes `SelectSubMenu()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

For more information about specifying `menuName`, `subMenuName`, and `menuItemName`, see the note at the beginning of "GHS_Window Menu Functions" on page 105.

Aliases are: `SelSubMenu()`, `ChooseSubMenu()`

## SelectSubSubMenu()

```
SelectSubSubMenu(menuName, subMenuName, subSubMenuName,
menuItemName, block=True, printOutput=True)
```

Selects a sub-submenu item defined in the window and returns `True` on success and `False` on failure. The string containing the menu item selection is kept in the window object's `cmdExecOutput` attribute.

Arguments are:

- `menuName` — Specifies the menu name.
- `subMenuName` — Specifies the submenu name.
- `subSubMenuName` — Specifies the sub-submenu name.
- `menuItemName` — Specifies the menu item name.
- `block` — If `True`, executes `SelectSubSubMenu()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

For more information about specifying `menuName`, `subMenuName`, `subSubMenuName`, and `menuItemName`, see the note at the beginning of "GHS_Window Menu Functions" on page 105.

Aliases are: `SelSubSubMenu()`, `ChooseSubSubMenu()`

## WaitForMenuItem()

```
WaitForMenuItem(menuName, menuItemName, active=True,
duration=-1.0, interval=0.3)
```

Waits for a menu item to attain the specified status: active (not dimmed) or inactive (dimmed). This function returns `True` if the menu item has already attained the specified status or if it attains the specified status before the timeout; it returns `False` otherwise.

Arguments are:

- `menuName` — Specifies the menu name.
- `menuItemName` — Specifies the menu item name.
- `active` — If `True`, active is the awaited status. If `False`, inactive is the awaited status.
- `duration` — Specifies how long the function waits, if at all. The `duration` may be:
  - A negative number — Indicates that the function waits until the menu item attains the specified status.
  - `0.0` — Indicates that the function does not wait.
  - A positive number — Specifies the maximum number of seconds that the function waits.
- `interval` — Specifies the interval (in seconds) between status checks.

For more information about specifying `menuName` and `menuItemName`, see the note at the beginning of "GHS_Window Menu Functions" on page 105.

Aliases are: `WaitMenuItem()`, `WaitForMenuEntry()`, `WaitMenuEntry()`

## GHS_Window Modal Dialog Functions

To automate certain operations such as dumping the contents of a modal dialog box or changing the values of its widgets, you must register commands before the modal dialog box appears. The functions described in the following sections allow you to register commands. When a modal dialog box is nested to the specified number of levels, the commands are executed.

The most recent modal dialog box has a nested level of zero (0), the second most recent has a nested level of one (1), and so on. If you specify a negative number for the nested level, the commands are executed whenever the MULTI IDE executes modal dialog commands, regardless of the modal dialog nesting level.

Where applicable, the functions in the following sections also allow you to specify a `count`. With the `count` argument, you can register commands to execute a specified number of times (but only once per modal dialog), after which they are automatically removed. By specifying a negative number for the count, you can register commands to execute until you explicitly remove them. In this case, the commands are executed whenever the MULTI IDE executes registered modal dialog commands and they are applicable (determined by the modal dialog box nesting level).

### GetCommandToRegisterModalDialogCommands()

```
GetCommandToRegisterModalDialogCommands(cmdList, level=-1,
count=1)
```

Gets the command that registers modal dialog box commands. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `cmdList` — Specifies the list of commands to register.
- `level` — Specifies the modal dialog nesting level at which the commands are executed.
- `count` — Specifies the number of times that the commands are executed.

For more information about the `level` and `count`, see "GHS_Window Modal Dialog Functions" on page 116.

Aliases are: `CmdToRegDlgCmds()`, `CmdToRegDlgCmd()`

## RegisterModalDialogCommands()

```
RegisterModalDialogCommands(cmdList, level=-1, count=1)
```

Registers commands so that they execute whenever modal dialog boxes are nested to the specified level. This function returns `True` on success and `False` on failure.

Arguments are:

- `cmdList` — Specifies the list of commands to register.
- `level` — Specifies the modal dialog nesting level at which the commands are executed.
- `count` — Specifies the number of times that the commands are executed.

For more information about the `level` and `count`, see "GHS_Window Modal Dialog Functions" on page 116.

Aliases are: `RegDlgCmds()`, `RegDlgCmd()`

## RegisterModalDialogToChangePullDownValue()

```
RegisterModalDialogToChangePullDownValue(widgetName, value,
dlgLevel=0, level=-1, count=1)
```

Registers a command to change the value of a `PullDown` widget defined in a modal dialog box. This function returns `True` on success and `False` on failure.

Arguments are:

- `widgetName` — Specifies the name of the widget.
- `dlgLevel` — Specifies the nested level of the modal dialog box whose `PullDown` widget is changed.

- `level` — Specifies the modal dialog nesting level at which the command is executed.
- `count` — Specifies the number of times that the command is executed.

For more information about the `level` and `count`, see "GHS_Window Modal Dialog Functions" on page 116.

Aliases are: `RegChangePdValue()`, `RegChangePdVal()`

## RegisterModalDialogToClickButton()

```
RegisterModalDialogToClickButton(widgetName, dlgLevel=0,
level=-1, count=1)
```

Registers a command to simulate clicking a `Button` widget defined in a modal dialog box. This function returns `True` on success and `False` on failure.

Arguments are:

- `widgetName` — Specifies the name of the widget.
- `dlgLevel` — Specifies the nested level of the modal dialog box whose `Button` widget is "clicked".
- `level` — Specifies the modal dialog nesting level at which the command is executed.
- `count` — Specifies the number of times that the command is executed.

For more information about the `level` and `count`, see "GHS_Window Modal Dialog Functions" on page 116.

Aliases are: `RegClickButton()`, `RegClickBut()`

## RegisterModalDialogToDoubleClickMslCell()

```
RegisterModalDialogToDoubleClickMslCell(widgetName, row, col=0,
dlgLevel=0, level=-1, count=1)
```

Registers a command to simulate double-clicking a cell of an `MScrollList` widget defined in a modal dialog box. This function returns `True` on success and `False` on failure.

Arguments are:

- `widgetName` — Specifies the name of the widget.
- `row` — Specifies the index of the row to double-click. The index starts at 0 (zero). For more information, see "DoubleClickMslCell()" on page 154.
- `col` — Specifies the index of the column to double-click. The index starts at 0 (zero).
- `dlgLevel` — Specifies the nested level of the modal dialog box whose `MScrollList` widget is "double-clicked".
- `level` — Specifies the modal dialog nesting level at which the command is executed.
- `count` — Specifies the number of times that the command is executed.

For more information about the `level` and `count`, see "GHS_Window Modal Dialog Functions" on page 116.

The alias is: `RegDblClickMslCell()`

## RegisterModalDialogToDumpWidget()

```
RegisterModalDialogToDumpWidget(widgetName, option="",
dlgLevel=0, level=-1, count=1)
```

Registers a command to dump the contents of a widget defined in a modal dialog box. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the widget.

- `option` — Gives more information about what to be dumped if the widget has more items to be dumped. For more information, see "GetCommandToDumpWidget()" on page 142.
- `dlgLevel` — Specifies the nested level of the modal dialog box whose widget contents are dumped.
- `level` — Specifies the modal dialog nesting level at which the command is executed.
- `count` — Specifies the number of times that the command is executed.

For more information about the `level` and `count`, see "GHS_Window Modal Dialog Functions" on page 116.

The alias is: `RegDumpWidget()`

## RegisterModalDialogToDumpWindow()

```
RegisterModalDialogToDumpWindow(dlgLevel=0, level=-1, count=1)
```

Registers a command to dump the specified modal dialog box. This function returns `True` on success and `False` on failure.

Arguments are:

- `dlgLevel` — Specifies the nested level of the modal dialog box whose contents are dumped.
- `level` — Specifies the modal dialog nesting level at which the command is executed.
- `count` — Specifies the number of times that the command is executed.

For more information about the `level` and `count`, see "GHS_Window Modal Dialog Functions" on page 116.

The alias is: `RegDumpWin()`

## RegisterModalDialogToSelectMslCell()

```
RegisterModalDialogToSelectMslCell(widgetName, row, col=-1,
dlgLevel=0, level=-1, count=1)
```

Registers a command to select cells of an `MScrollList` widget defined in a modal dialog box. This function returns `True` on success and `False` on failure.

Arguments are:

- `widgetName` — Specifies the name of the widget.
- `row` — Specifies the index of the row to select. The index starts at 0 (zero). If the row number is less than 0 and the widget supports single-cell selection, the specified column is selected in all rows.
- `col` — Specifies the index of the column to select. The index starts at 0 (zero). If the column number is less than 0, all columns of the specified row are selected. If both the row and column numbers are less than 0, all cells of the widget are selected.
- `dlgLevel` — Specifies the nested level of the modal dialog box whose cells are selected.
- `level` — Specifies the modal dialog nesting level at which the command is executed.
- `count` — Specifies the number of times that the command is executed.

For more information about the `level` and `count`, see "GHS_Window Modal Dialog Functions" on page 116.

The alias is: `RegSelMslCell()`

## RegisterModalDialogToSelectMslCellByValue()

```
RegisterModalDialogToSelectMslCellByValue(widgetName,
cellValue, col=0, dlgLevel=0, level=-1, count=1)
```

Registers a command to select a cell of an `MScrollList` widget defined in a modal dialog box. This function returns `True` on success and `False` on failure.

Arguments are:

- `widgetName` — Specifies the name of the widget.
- `cellValue` — Specifies the cell's value.
- `col` — Specifies the index of the column whose cell values are searched for `cellValue`. The index starts at 0 (zero). The value specified should be a valid column index. A negative value results in selection failure.
- `dlgLevel` — Specifies the nested level of the modal dialog box whose cell is selected.
- `level` — Specifies the modal dialog nesting level at which the command is executed.
- `count` — Specifies the number of times that the command is executed.

For more information about the `level` and `count`, see "GHS_Window Modal Dialog Functions" on page 116.

The alias is: `RegSelMslCellByVal()`

## RegisterModalDialogToSelectPullDownMenu()

```
RegisterModalDialogToSelectPullDownMenu(widgetName, valIdx,
dlgLevel=0, level=-1, count=1)
```

Registers a command to select a menu item of a `PullDown` widget defined in a modal dialog box. This function returns `True` on success and `False` on failure.

Arguments are:

- `widgetName` — Specifies the name of the widget.
- `valIdx` — Specifies the index of the menu item. The index of the first menu item is 0 (zero).
- `dlgLevel` — Specifies the nested level of the modal dialog box whose menu item is selected.
- `level` — Specifies the modal dialog nesting level at which the command is executed.
- `count` — Specifies the number of times that the command is executed.

For more information about the `level` and `count`, see "GHS_Window Modal Dialog Functions" on page 116.

The alias is: `RegSelPdMenu()`

## RegisterModalDialogToShowWidgets()

```
RegisterModalDialogToShowWidgets(dlgLevel=0, level=-1, count=1)
```

Registers a command to display the widgets of a modal dialog box. This function returns `True` on success and `False` otherwise.

Arguments are:

- `dlgLevel` — Specifies the nested level of the modal dialog box whose widgets are displayed.
- `level` — Specifies the modal dialog nesting level at which the command is executed.
- `count` — Specifies the number of times that the command is executed.

For more information about the `level` and `count`, see "GHS_Window Modal Dialog Functions" on page 116.

The alias is: `RegShowWidgets()`

## RegisterModalDialogToSortMsl()

```
RegisterModalDialogToSortMsl(widgetName, col=0, dlgLevel=0,
level=-1, count=1)
```

Registers a command to sort an `MScrollList` widget defined in a modal dialog box. This function returns `True` on success and `False` on failure.

Arguments are:

- `widgetName` — Specifies the name of the widget.
- `col` — Specifies the column to sort.

- `dlgLevel` — Specifies the nested level of the modal dialog box whose `MScrollList` widget is sorted.
- `level` — Specifies the modal dialog nesting level at which the command is executed.
- `count` — Specifies the number of times that the command is executed.

For more information about the `level` and `count`, see "GHS_Window Modal Dialog Functions" on page 116.

The alias is: `RegSortMsl()`

## RemoveRegisteredModalDialogCommands()

```
RemoveRegisteredModalDialogCommands(level=-1, printOutput=True)
```

Removes commands registered at the specified modal dialog nesting level. This function returns `True` on success and `False` on failure.

Arguments are:

- `level` — Specifies the modal dialog nesting level at which commands are registered. If the level is negative, all commands registered to all modal dialog nesting levels are applicable. For more information, see "GHS_Window Modal Dialog Functions" on page 116.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

Aliases are: `RmDlgCmds()`, `RmDlgCmd()`

## ShowRegisteredModalDialogCommands()

```
ShowRegisteredModalDialogCommands(level=-1, printOutput=True)
```

Displays commands registered at the specified modal dialog nesting level. This function returns `True` on success and `False` on failure.

Arguments are:

- `level` — Specifies the modal dialog nesting level at which commands are registered. If the level is negative, all commands registered to all modal dialog nesting levels are applicable. For more information, see "GHS_Window Modal Dialog Functions" on page 116.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

Aliases are: `ShowDlgCmds()`, `ShowDlgCmd()`

## GHS_Window Record Functions

The following section describes the function from class `GHS_Window` that records GUI operations.

### RecordGuiOperations()

```
RecordGuiOperations(fileName="", append=False, block=True,
printOutput=True)
```

Records the Python command equivalents of certain GUI operations executed from the window or from all windows, or stops recording.

Examples of GUI operations that can be recorded include: selecting a menu from a menu bar, selecting a `Tab` widget, clicking a `Button` or `MScrollList` widget, or modifying a `PullDown` or `TextField` widget. Many other operations, such as selecting a menu option from a right-click menu, or clicking in the Debugger source pane, cannot be recorded.

Arguments are:

- `fileName` — Specifies the file to record commands to. An empty string (`""`) stops any ongoing recording.
- `append` — If `True`, adds recorded commands after any pre-existing text in the specified file. If `False`, overwrites pre-existing information when recording.

- `block` — If `True`, executes `RecordGuiOperations()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

The alias is: `RecGuiOps()`, `RecGuiOp()`

## GHS_Window Window Attribute and Manipulation Functions

The following sections describe the functions from class `GHS_Window` that relate to window attributes and window manipulation.

### CloseWindow()

```
CloseWindow(block=True, printOutput=True)
```

Closes the window and returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `CloseWindow()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

The alias is: `CloseWin()`

### GetDimension()

```
GetDimension(printOutput=True)
```

Gets the window's dimensions. This function returns the dimensions as a tuple such as (width, height), or it returns `None` upon error.

The argument is:

- `printOutput` — If `True`, prints the output, which contains the dimension string. If `False`, does not print the output.

The alias is: `GetDim()`

## GetName()

```
GetName(printOutput=True)
```

Gets the window's registered name. The registered name is the name that MULTI uses internally; it may not be the name shown on the window's title bar. This function returns the window's name as a string, or it returns an empty string (`""`) upon error.

The argument is:

- `printOutput` — If `True`, prints the output, which contains the registered window name. If `False`, does not print the output.

## GetPosition()

```
GetPosition(printOutput=True)
```

Gets the window's position. This function returns the position as a tuple such as `(x, y)`, or it returns `None` upon error. The position `(0, 0)` is in the upper-left corner of the display.

The argument is:

- `printOutput` — If `True`, prints the output containing the position string. If `False`, does not print the output.

The alias is: `GetPos()`

## IconifyWindow()

```
IconifyWindow(block=True, printOutput=True)
```

Minimizes the window and returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `IconifyWindow()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

Aliases are: `IconifyWin()`, `IconWindow()`, `IconWin()`, `MinimizeWindow()`, `MinWin()`

## IsIconified()

```
IsIconified(printOutput=True)
```

Determines whether the window is minimized and returns `True` if yes, and `False` otherwise.

The argument is:

- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

Aliases are: `IsMinimized()`, `IsMin()`

## MoveWindow()

```
MoveWindow(x, y, relative=True)
```

Moves the window by the specified deltas or to the specified position in the display. This function returns `True` on success and `False` on failure.

Arguments are:

- `x` — Specifies the `x`-delta or the `x`-coordinate. Whether a delta is specified or a coordinate is specified depends on the argument `relative`.
- `y` — Specifies the `y`-delta or the `y`-coordinate. Whether a delta is specified or a coordinate is specified depends on the argument `relative`.
- `relative` — If `True`, indicates that the given values are deltas to the window's current coordinates. If `False`, indicates that the given values are coordinates in the display, where `(0, 0)` is in the upper-left corner.

The alias is: `MoveWin()`

## RenameWindow()

```
RenameWindow(winName, winTitle="", iconTitle="")
```

Allows you to rename the window. This function returns `True` on success and `False` on failure.

Arguments are:

- `winName` — Specifies the window's new registered name. The registered name is the name that MULTI uses internally, and it is the name that is displayed in the **Windows** menu of many MULTI tools. The registered name may not be the name shown on the window's title bar.
- `winTitle` — Specifies the name that is displayed in the window's title bar. If you do not specify `winTitle`, the value of `winName` is displayed in the title bar.
- `iconTitle` (Linux/Solaris only) — Specifies the name of the window icon. If you do not specify `iconTitle`, the value of `winName` is used for the window icon.

The alias is: `RenameWin`

## ResizeWindow()

```
ResizeWindow(width, height, relative=True)
```

Resizes the window by the specified deltas or to the specified dimensions. This function returns `True` on success and `False` on failure.

Arguments are:

- `width` — Specifies the change in the window's current width or specifies the window's width dimension. Whether a delta is specified or a dimension is specified depends on the argument `relative`.
- `height` — Specifies the change in the window's current height or specifies the window's height dimension. Whether a delta is specified or a dimension is specified depends on the argument `relative`.
- `relative` — If `True`, indicates that the given values are deltas to the window's existing dimensions. If `False`, indicates that the given values are dimensions.

You can use the `__ghs_display_width` and `__ghs_display_height` global variables in the `width` and `height` argument expressions. See “Pre-Set Variables” on page 30.

The alias is: `ResizeWin()`

## RestoreWindow()

```
RestoreWindow(block=True, printOutput=True)
```

Brings the window to the foreground and returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `RestoreWindow()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

Aliases are: `RestoreWin()`, `RaiseWindow()`, `RaiseWin()`

## ShowAttributes()

`ShowAttributes(printOutput=True)`

Displays window attributes such as window position, window dimensions, whether the window is minimized or not, and window name. This function returns `True` on success and `False` on failure. The string containing the window attributes is kept in the window object's `cmdExecOutput` attribute.

The argument is:

- `printOutput` — If `True`, prints the output, which contains the attributes. If `False`, does not print the output. Even if the attributes are printed, the corresponding output string is kept in the window object's `cmdExecOutput` attribute.

The alias is: `ShowAttr()`

# Chapter 8

# Widget Functions

## Contents

This chapter documents functions from the following utility class:

- `GHS_MslTree` — Stores the content of an `MScrollList` widget as a parsed tree and provides mechanisms to search for tree nodes, enabling easier access to MULTI `MScrollList` widgets. You can use the `GetMslTree()` function in class `GHS_Window` (see "GetMslTree()" on page 165) to return the tree, which you should not change. Each node in the tree is represented as a `GHS_MslTree` object.

  This class inherits from `object` and is a utility class for `GHS_Window`. See "GHS_MslTree Attributes and Functions" on page 135.

This chapter also covers functions from class:

- `GHS_Window` — Implements the general functions of MULTI IDE windows. You can route any command to the corresponding MULTI IDE component via a `GHS_Window` object. This class inherits from class `GHS_IdeObject`.

  The `GHS_Window` functions are divided into the following sections:
  - "GHS_Window Basic Widget Functions" on page 141
  - "GHS_Window Button Widget Functions" on page 146
  - "GHS_Window ColumnHeader Widget Functions" on page 150
  - "GHS_Window Edit and Terminal Widget Functions" on page 152
  - "GHS_Window MScrollList Widget Functions" on page 153
  - "GHS_Window PullDown Widget Functions" on page 167
  - "GHS_Window Tab Widget Functions" on page 172
  - "GHS_Window Text Widget Functions" on page 177
  - "GHS_Window TextCell Widget Functions" on page 179
  - "GHS_Window TextField Widget Functions" on page 180

**Note**

This chapter documents only a subset of the functions from class `GHS_Window`. For information about other `GHS_Window` functions, see Chapter 7, "Window Functions" on page 91.

For information about the attributes of class `GHS_Window`, see "GHS_Window Attributes" on page 20.

**Note**

`level` is an argument of some `GHS_Window` functions. This argument specifies the nested level of a modal dialog box and is only applicable if the argument `dialog` is set to `True`. Each MULTI IDE window and dialog box has a name and an internal ID, which MULTI-Python uses to identify the window. Modal dialog boxes are identified by the name `ModalDialog` and by a number that represents their nested level in a sequence of MULTI IDE commands. The most recent modal dialog box has a nested level of zero (0), the second most recent has a nested level of one (1), and so on. MULTI-Python ignores a nested level of zero (0) in a modal dialog box's name. As a result, `ModalDialog` and `ModalDialog0` are equivalent; both of them identify the most recent modal dialog box.

## GHS_MslTree Attributes and Functions

Class `GHS_MslTree` stores the content of an `MScrollList` widget as a parsed tree and provides mechanisms to search for tree nodes, enabling easier access to MULTI `MScrollList` widgets. For more information, see the beginning of this chapter (Chapter 8, "Widget Functions" on page 133).

For information about the related `MScrollList` widget functions of class `GHS_Window`, see "GHS_Window MScrollList Widget Functions" on page 153.

The following list describes the attributes of this class:

- `nodeName` — Stores the name of the node represented by the object. The name is the value of the column (usually column 0) on which the `MScrollList` tree is built.
- `columnValues` — Stores a list of column values for the `MScrollList` widget node represented by the object.
- `parent` — Stores the `GHS_MslTree` object representing the enclosing node in the `MScrollList` tree.
- `depth` — Stores the depth of the node in the `MScrollList` tree.

- `row` — Stores the row index of the node in the `MScrollList` tree.
- `children` — Stores a list of `GHS_MslTree` objects representing the direct children of the node in the `MScrollList` tree.
- `expandMark` — Stores whether the tree node is, or can be, expanded. The `expandMark` attribute may be:
  - `"+"` — Indicates that the node can be expanded.
  - `"-"` — Indicates that the node is expanded.
  - `""` — Indicates that the node does not expand.

The following sections describe the functions from class `GHS_MslTree`.

## DumpTree()

```
DumpTree(recursive=True, treeLine=True, printHead=True,
printRow=True)
```

Dumps the content of `GHS_MslTree`.

Arguments are:

- `recursive` — If `True`, the dump continues until the operation has no effect. If `False`, this function only dumps the content of the current node.
- `treeLine` — If `True`, lines such as `|` and _ are printed to show the hierarchy of the dumped information. If `False`, the lines are not printed. For an example, see “DumpTree()” on page 287.
- `printHead` — If `True`, prints the header in the dumped content. If `False`, does not print the header.
- `printRow` — If `True`, prints the row number in the dumped content. If `False`, does not print the row number.

The alias is: `Dump()`

## GetChildrenNumber()

```
GetChildrenNumber(directChildren=False)
```

Gets the number of children (direct or all descendants) of the node.

The argument is:

- `directChildren` — If `True`, only gets the number of direct children of the node. If `False`, gets the number of all descendents of the node.

The alias is: `GetChildNum()`

## IsExpandable()

```
IsExpandable()
```

Determines whether the `GHS_MslTree` node is expandable. This function returns `True` if the node is expandable (that is, if the `MScrollList` tree node contains a + or – sign), and `False` otherwise.

The alias is: `Expandable()`

## IsExpanded()

```
IsExpanded()
```

Determines whether the `GHS_MslTree` node is expanded. This function returns `True` if the node is expanded (that is, if the `MScrollList` tree node contains a – sign), and `False` otherwise.

The alias is: `Expanded()`

## IsTopTree()

```
IsTopTree()
```

Determines whether the `GHS_MslTree` node is the top node. This function returns `True` if the `GHS_MslTree` object represents the abstract top node of the

`MScrollList` tree, and `False` otherwise. The abstract top node of the `MScrollList` tree logically contains the nodes in the `MScrollList` as its children.

The alias is: `IsTop()`

## SearchByColumnValue()

```
SearchByColumnValue(value, column=-1, match=False, all=False,
recursive=True)
```

Searches by column value for one or more nodes within the current tree (includes the node and its children).

Arguments are:

- `value` — Specifies the column value, which can be a regular expression.
- `column` — Specifies the column to search. If `column` is a negative number, all columns are searched.
- `match` — If `True`, uses Python's regular expression `match()` function to check the specified value. If `False`, uses Python's regular expression `search()` function.
- `all` — If `True`, this function returns a list of all qualified nodes upon success. Upon failure, it returns an empty list. If `False`, this function returns the first qualified node upon success. Upon failure, it returns `None`.
- `recursive` — If `True`, searches all descendants of the `MScrollList` node, if necessary. If `False`, only checks the current node's column values.

The alias is: `SearchByColVal()`

## SearchByName()

```
SearchByName(nodeName, match=False, all=False, recursive=True)
```

Searches by name for one or more nodes within the current tree (includes the node and its children).

Arguments are:

- `nodeName` — Specifies the name of the node, which can be a regular expression.
- `match` — If `True`, uses Python's regular expression `match()` function to check the specified name. If `False`, uses Python's regular expression `search()` function.
- `all` — If `True`, this function returns a list of all qualified nodes upon success. Upon failure, it returns an empty list. If `False`, this function returns the first qualified node upon success. Upon failure, it returns `None`.
- `recursive` — If `True`, searches all descendants of the `MScrollList` node, if necessary. If `False`, only checks the current node's name.

## SearchChildByColumnValue()

```
SearchChildByColumnValue(value, column=-1, match=False,
all=False, recursive=True)
```

Searches by column value for one or more child nodes of the current tree.

Arguments are:

- `value` — Specifies the column value, which can be a regular expression.
- `column` — Specifies the column to search. If `column` is a negative number, all columns are searched.
- `match` — If `True`, uses Python's regular expression `match()` function to check the specified value. If `False`, uses Python's regular expression `search()` function.
- `all` — If `True`, this function returns a list of all qualified nodes upon success. Upon failure, it returns an empty list. If `False`, this function returns the first qualified node upon success. Upon failure, it returns `None`.
- `recursive` — If `True`, searches all descendants of the `MScrollList` node, if necessary. If `False`, only searches the direct children of the `MScrollList` node.

The alias is: `SearchChildByColVal()`

## SearchChildByName()

```
SearchChildByName(nodeName, match=False, all=False,
recursive=True)
```

Searches by name for one or more child nodes.

Arguments are:

- `nodeName` — Specifies the name of the node, which can be a regular expression.
- `match` — If `True`, uses Python's regular expression `match()` function to check the specified name. If `False`, uses Python's regular expression `search()` function.
- `all` — If `True`, this function returns a list of all qualified nodes upon success. Upon failure, it returns an empty list. If `False`, this function returns the first qualified node upon success. Upon failure, it returns `None`.
- `recursive` — If `True`, searches all descendants of the `MScrollList` node, if necessary. If `False`, only searches the direct children of the `MScrollList` node.

## SearchRow()

```
SearchRow(row)
```

Searches within the current tree (includes the node and its children) for a node on the specified row.

The argument is:

- `row` — Specifies the row.

# GHS_Window Basic Widget Functions

The following sections describe the basic widget functions from class `GHS_Window`.

**Tip**

Many of the following functions require you to specify a widget name. You can list widget names with the `ShowWidgets()` function. See "ShowWidgets()" on page 144.

## DumpAll()

```
DumpAll(block=True, printOutput=True)
```

Dumps the content of the window and returns `True` on success and `False` on failure. The string containing the window content is kept in the window object's `cmdExecOutput` attribute.

Arguments are:

- `block` — If `True`, executes `DumpAll()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

Aliases are: `DumpWindow()`, `DumpWin()`

## DumpWidget()

```
DumpWidget(widgetName="", option="", block=True,
printOutput=True)
```

Dumps the content of a widget defined in the window and returns `True` on success and `False` on failure. The string containing the widget's content is kept in the window object's `cmdExecOutput` attribute.

Arguments are:

- `widgetName` — Specifies the name of the widget.

- `option` — Gives additional information about what to dump if the widget has more items to be dumped. The following list gives available `options` for some widget types:
  - `MScrollList` — `selection`, `highlight`, or `value`
  - `PullDown` — `menu` or `value`
  - `TabControl` — `selection`, `content`, or `value`
  - `OmniView` — `selection` or `value`
- `block` — If `True`, executes `DumpWidget()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

## GetCommandToDumpWidget()

```
GetCommandToDumpWidget(widgetName="", option="", dialog=False,
level=0)
```

Gets the command that dumps the contents of a widget defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the widget.
- `option` — Gives additional information about what to dump if the widget has more items to be dumped. For more information, see “DumpWidget()” on page 141.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

The alias is: `CmdToDumpWidget()`

## GetCommandToDumpWindow()

```
GetCommandToDumpWindow(dialog=False, level=0)
```

Gets the command that dumps the contents of the window or of a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `dialog` — If `True`, gets the command that dumps the contents of a modal dialog box. If `False`, gets the command that dumps the contents of the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

Aliases are: `CmdToDumpWin()`, `CmdToDumpAll()`

## GetCommandToShowWidgets()

```
GetCommandToShowWidgets(dialog=False, level=0)
```

Gets the command that displays information about all widgets defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `dialog` — If `True`, gets the command that displays information about a modal dialog box's widgets. If `False`, gets the command that displays information about the window's widgets.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

The alias is: `CmdToShowWidgets()`

## ShowWidgets()

```
ShowWidgets(block=True, printOutput=True)
```

Displays information about all widgets defined in the window and returns `True` on success and `False` on failure. The string containing the information is kept in the window object's `cmdExecOutput` attribute.

Arguments are:

- `block` — If `True`, executes `ShowWidgets()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

The following `ShowWidgets()` example lists the widgets of a MULTI Editor window in which a C file is loaded.

```
Python> ew.ShowWidgets()
Py Out: EditMenuBar:    MenuBar
Py Out: :               Rectangle
Py Out: EditBtns:       ButtonSet
Py Out:     Open:       Button
Py Out:     Save:       Button (dimmed)
Py Out:     -:          Button
Py Out:     Cut:        Button (dimmed)
Py Out:     Copy:       Button (dimmed)
Py Out:     Paste:      Button
Py Out:     Find:       Button
Py Out:     Goto:       Button
Py Out:     -:          Button

Py Out:     Undo:       Button (dimmed)
Py Out:     Redo:       Button (dimmed)
Py Out:     -:          Button
Py Out:     Prev:       Button (dimmed)
Py Out:     Next:       Button (dimmed)
Py Out:     -:          Button
Py Out:     Done:       Button
Py Out:     Close:      Button (dimmed)
Py Out: pulldown:       PullDown (invisible)
Py Out: FilePD:         PullDown
```

```
Py Out: ProcPD:          PullDown
Py Out: LineNum:         TextField
Py Out: Status:          Status
Py Out: stReadOnly:      Status
Py Out: stMVC:           Status
Py Out: stMOD:           Status
Py Out: EditPane:        Edit
Py Out: stLnCol:         Status
Py Out: tx_dummy:        Text (invisible)
Py Out: ln_height_errorwin_novis:   Line
Py Out: ln_height_errorwin_vis:     Line
Py Out: ov_errorwin:                OmniView (invisible)
Py Out: ln_height_errorwin_curr:    Line
Py Out: sp_errorwin:                Splitter (invisible)
Py Out: adjustForErrorWin:          Rectangle
```

Information about each widget is displayed in the following format:

`WidgetName: WidgetType [(ExtraInformation)]`

where:

- *`WidgetName`* — Specifies the widget's name, which is used for `widgetName` in related `GHS_Window` functions. Note that widget names are case-sensitive.
- *`WidgetType`* — Specifies the widget's type, such as `Button`, `MScrollList`, or `PullDown`.
- *`ExtraInformation`* — Provides other information (if any), such as whether the widget is invisible, whether a `Button` widget is dimmed, etc.

The alias is: `Widgets()`

## GHS_Window Button Widget Functions

The following sections describe the functions from class `GHS_Window` that relate to `Button` widgets.

### Tip

Many of the following functions require you to specify a widget name. You can list widget names with the `ShowWidgets()` function. See "ShowWidgets()" on page 144.

### DumpButton()

```
DumpButton(widgetName, block=True, printOutput=True)
```

Dumps the status of a button defined in the window. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `Button` widget.
- `block` — If `True`, executes `DumpButton()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

The alias is: `DumpBut()`

### GetCommandToClickButton()

```
GetCommandToClickButton(widgetName, dialog=False, level=0)
```

Gets the command that simulates clicking a button. The button may be defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `Button` widget.
- `dialog` — If `True`, specifies that the button is defined in a modal dialog box. If `False`, specifies that the button is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, "Widget Functions" on page 133).

Aliases are: `CmdToClickButton()`, `CmdToClickBut()`

## GetCommandToDumpButton()

```
GetCommandToDumpButton(widgetName, dialog=False, level=0)
```

Gets the command that dumps the value of a button defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `Button` widget.
- `dialog` — If `True`, specifies that the button is defined in a modal dialog box. If `False`, specifies that the button is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, "Widget Functions" on page 133).

Aliases are: `CmdToDumpButton()`, `CmdToDumpBut()`

## IsButtonDimmed()

```
IsButtonDimmed(widgetName)
```

Determines whether a button in the window is dimmed. This function returns `True` if the button is dimmed or if the button does not exist, and it returns `False` otherwise.

The argument is:

- `widgetName` — Specifies the name of the `Button` widget.

The alias is: `IsBtnDimmed()`

## IsButtonDown()

```
IsButtonDown(widgetName)
```

Determines whether a button in the window is in the "on" state (that is, you have clicked the mouse over the button graphic so that the button appears to be pushed down, or the command to simulate this action has been executed successfully). This function returns `True` if the button is pushed down. It returns `False` if the button is not pushed down or if the button does not exist.

The argument is:

- `widgetName` — Specifies the name of the `Button` widget.

The alias is: `IsBtnDown()`

## SelectButton()

```
SelectButton(widgetName, block=True, printOutput=True)
```

Simulates clicking the specified button and returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `Button` widget.
- `block` — If `True`, executes `SelectButton()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

The alias is: `PressButton()`

## WaitButtonInStatus()

```
WaitButtonInStatus(widgetName, dimmed, isDown=False,
duration=-1.0, checkInterval=0.5, verbose=True)
```

Waits until the specified button reaches the specified status. This function returns `True` if the button has reached the specified status, and it returns `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `Button` widget.
- `dimmed` — Indicates that the function waits until the button is dimmed.
- `isDown` — If `True`, indicates that the function waits until the button is in the "on" state (that is, you have clicked the mouse over the button graphic so that the button appears to be pushed down, or the command to simulate this action has been executed successfully). If `False`, indicates that the function waits until the button is in the "off" state (that is, it appears to have popped up).
- `duration` — Specifies how long the function waits, if at all. The `duration` may be:
  - A negative number — Indicates that the function waits until the button reaches the specified status.
  - `0.0` — Indicates that the function does not wait.
  - A positive number — Specifies the maximum number of seconds that the function waits.
- `checkInterval` — Specifies the interval (in seconds) between status checks.
- `verbose` — If `True`, prints detailed error information, if any. If `False`, does not print error information.

## GHS_Window ColumnHeader Widget Functions

The following sections describe the functions from class `GHS_Window` that relate to `ColumnHeader` widgets.

**Tip**

The following functions require you to specify a widget name. You can list widget names with the `ShowWidgets()` function. See "ShowWidgets()" on page 144.

### GetCommandToGetColumnsOfColumnHeader()

```
GetCommandToGetColumnsOfColumnHeader(widgetName, dialog=False,
level=0)
```

Gets the command that gets the columns of a `ColumnHeader` widget. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `ColumnHeader` widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, "Widget Functions" on page 133).

The alias is: `CmdToGetColsOfCh()`

## GetColumnIndexInColumnHeader()

```
GetColumnIndexInColumnHeader(widgetName, columnName,
warningOnError=False)
```

Gets the index of a column in a `ColumnHeader` widget.

Arguments are:

- `widgetName` — Specifies the name of the `ColumnHeader` widget.
- `columnName` — Specifies the name of the column.
- `warningOnError` — If `True`, prints a warning message if the specified column is not found. If `False`, does not print a warning message.

The alias is: `GetColIdxInCh()`

## GetColumnsOfColumnHeader()

```
GetColumnsOfColumnHeader(widgetName, warningOnError=False)
```

Gets the columns of a `ColumnHeader` widget. This function returns a list of column names or an empty list upon error.

Arguments are:

- `widgetName` — Specifies the name of the `ColumnHeader` widget.
- `warningOnError` — If `True`, prints a warning message if the value of `widgetName` is invalid. If `False`, does not print a warning message.

The alias is: `GetColsOfCh()`

## GHS_Window Edit and Terminal Widget Functions

The following sections describe the functions from class `GHS_Window` that relate to `Edit` and `Terminal` widgets.

### Tip

Many of the following functions require you to specify a widget name. You can list widget names with the `ShowWidgets()` function. See "ShowWidgets()" on page 144.

### GetEditTextLines()

```
GetEditTextLines(widgetName, removeCrs=True)
```

Returns a list of strings for the text in an `Edit` or `Terminal` widget. Each string in the list is a separate line of text. An empty list is returned upon error.

Arguments are:

- `widgetName` — Specifies the name of the `Edit` or `Terminal` widget.
- `removeCrs` — If `True`, removes carriage return characters (if any). If `False`, does not remove carriage return characters.

Aliases are: `EditTextLines()`, `EditLines()`, `GetTermTextLines()`, `TermTextLines()`, `TermLines()`

### GetEditTextString()

```
GetEditTextString(widgetName)
```

Returns a single string for the text in an `Edit` or `Terminal` widget. An empty string (`""`) is returned upon error.

The argument is:

- `widgetName` — Specifies the name of the `Edit` or `Terminal` widget.

Aliases are: `EditTextString()`, `EditTextStr()`, `GetTermTextString()`, `TermTextString()`, `TermTextStr()`

# GHS_Window MScrollList Widget Functions

The following sections describe the functions from class `GHS_Window` that relate to `MScrollList` widgets.

**Tip**

Many of the following functions require you to specify a widget name. You can list widget names with the `ShowWidgets()` function. See "ShowWidgets()" on page 144.

For information about the related functions of class `GHS_MslTree`, see "GHS_MslTree Attributes and Functions" on page 135.

## ChangeMslTree()

```
ChangeMslTree(widgetName, row, col=-1, expand=True, block=True,
printOutput=True)
```

Expands or shrinks the sub-tree of an `MScrollList` widget cell. This function returns `True` on success and `False` on failure.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `row` — Specifies the index of the row to expand/collapse. The index starts at 0 (zero). If the row number is negative, the operation is applied to the first row of the current selection.
- `col` — Specifies the index of the column to expand/collapse. The index starts at 0 (zero).
- `expand` — If `True`, expands the sub-tree. If `False`, collapses the sub-tree.
- `block` — If `True`, executes `ChangeMslTree()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

## ChangeWholeMslTree()

```
ChangeWholeMslTree(widgetName, col=-1, expand=True,
recursive=False)
```

Expands or contracts all nodes in the tree of an `MScrollList` widget cell. This function returns `True` on success and `False` on failure.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `col` — This argument has no effect at present.
- `expand` — If `True`, expands the tree. If `False`, contracts the tree.
- `recursive` — If `True`, the expansion/contraction continues until the operation has no effect. If `False`, only expands/contracts the current tree.

## DoubleClickMslCell()

```
DoubleClickMslCell(widgetName, row, col, block=True,
printOutput=True)
```

Simulates double-clicking one or more cells of an `MScrollList` widget defined in the window. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `row` — Specifies the index of the row to double-click. The index starts at 0 (zero). If the row number is less than 0, the first row of the current selection is double-clicked.
- `col` — Specifies the index of the column to double-click. The index starts at 0 (zero).
- `block` — If `True`, executes `DoubleClickMslCell()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

The alias is: `DblClickMslCell()`

## DoubleClickMslCellByValue()

```
DoubleClickMslCellByValue(widgetName, cellValue, col,
block=True, printOutput=True)
```

Double-clicks the `MScrollList` widget cell with the specified value. This function returns `True` on success and `False` on failure.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `cellValue` — Specifies the value of the cell to double-click.
- `col` — Specifies the index of the column to double-click. The index starts at 0 (zero).
- `block` — If `True`, executes `DoubleClickMslCellByValue()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

Aliases are: `DblClickMslCellByValue()`, `DblClickMslCellByVal()`

## DumpMslHighlight()

```
DumpMslHighlight(widgetName, block=True, printOutput=True)
```

Dumps the contents of an `MScrollList` widget defined in the window and indicates which cells are highlighted. This function returns `True` on success and `False` otherwise. The dumped contents are kept in the object's `cmdExecOutput` attribute.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `block` — If `True`, executes `DumpMslHighlight()` in blocked mode and grabs the output. If `False`, neither executes the function in blocked mode nor grabs the output.

- `printOutput` — If `True`, prints the output. If `False`, does not print output.

The alias is: `DumpMslHl()`

## DumpMslSelection()

```
DumpMslSelection(widgetName, block=True, printOutput=True)
```

Dumps selected cells of an `MScrollList` widget defined in the window. This function returns `True` on success and `False` otherwise. The dumped contents are kept in the object's `cmdExecOutput` attribute.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `block` — If `True`, executes `DumpMslSelection()` in blocked mode and grabs the output. If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print output.

The alias is: `DumpMslSel()`

## DumpMslValue()

```
DumpMslValue(widgetName, block=True, printOutput=True)
```

Dumps the contents of an `MScrollList` widget defined in the window. This function returns `True` on success and `False` otherwise. The dumped contents are kept in the object's `cmdExecOutput` attribute.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `block` — If `True`, executes `DumpMslValue()` in blocked mode and grabs the output. If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print output.

The alias is: `DumpMsl()`

## ExtendMslSelection()

```
ExtendMslSelection(widgetName, row, col=-1, block=True,
printOutput=True)
```

Extends the selection in an `MScrollList` widget. This function returns `True` on success and `False` on failure.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `row` — Specifies the index of the row to extend the selection to. The index starts at 0 (zero). If the row number is less than 0, the specified column is selected in all rows.
- `col` — Specifies the index of the column to extend the selection to. The index starts at 0 (zero). If the column number is less than 0, all columns of the specified row are selected.
- `block` — If `True`, executes `ExtendMslSelection()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

If both the row and column numbers are less than 0, all cells of the `MScrollList` widget are selected.

### Note

This function simulates the behavior of the **Ctrl**+**left-click** operation, which clears existing selections (if any) on applicable cells.

The alias is: `ExtMslSel()`

## GetCommandToChangeMslTree()

```
GetCommandToChangeMslTree(widgetName, row, col, expand=True,
dialog=False, level=0)
```

Gets the command that expands or collapses the sub-tree associated with an `MScrollList` widget cell. The widget may be defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `row` — Specifies the index of the row to expand/collapse. The index starts at 0 (zero). If the row number is negative, the operation is applied to the current selection.
- `col` — Specifies the index of the column to expand/collapse. The index starts at 0 (zero).
- `expand` — If `True`, specifies to expand the sub-tree. If `False`, specifies to collapse the sub-tree.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

The alias is: `CmdToChangeMslTree()`

## GetCommandToDoubleClickMslCell()

```
GetCommandToDoubleClickMslCell(widgetName, row, col,
dialog=False, level=0)
```

Gets the command that double-clicks one or more cells of an `MScrollList` widget defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `row` — Specifies the index of the row to double-click. The index starts at 0 (zero).
- `col` — Specifies the index of the column to double-click. The index starts at 0 (zero).
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, "Widget Functions" on page 133).

The alias is: `CmdToDblClickMslCell()`

## GetCommandToDoubleClickMslCellByValue()

```
GetCommandToDoubleClickMslCellByValue(widgetName, cellValue,
col, dialog=False, level=0)
```

Gets the command that double-clicks the `MScrollList` widget cell with the specified value. The widget may be defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `cellValue` — Specifies the value of the cell to double-click.
- `col` — Specifies the index of the column to double-click. The index starts at 0 (zero).
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, "Widget Functions" on page 133).

Aliases are: `CmdToDblClickMslCellByValue()`, `CmdToDblClickMslCellByVal()`

## GetCommandToDumpMsl()

```
GetCommandToDumpMsl(widgetName, dialog=False, level=0)
```

Gets the command that dumps the contents of an `MScrollList` widget defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

The alias is: `CmdToDumpMsl()`

## GetCommandToDumpMslHighlight()

```
GetCommandToDumpMslHighlight(widgetName, dialog=False, level=0)
```

Gets the command that dumps the contents of an `MScrollList` widget defined in the window or in a modal dialog box and that indicates which cells are highlighted. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.

- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

The alias is: `CmdToDumpMslHl()`

## GetCommandToDumpMslSelection()

```
GetCommandToDumpMslSelection(widgetName, dialog=False, level=0)
```

Gets the command that dumps selected cells of an `MScrollList` widget defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

The alias is: `CmdToDumpMslSel()`

## GetCommandToExtendMslSelection()

```
GetCommandToExtendMslSelection(widgetName, row, col=-1,
dialog=False, level=0)
```

Gets the command that extends the selection in an `MScrollList` widget. The widget may be defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `row` — Specifies the index of the row to extend the selection to. The index starts at 0 (zero). If the row number is less than 0, the specified column is selected in all rows.
- `col` — Specifies the index of the column to extend the selection to. The index starts at 0 (zero). If the column number is less than 0, all columns of the specified row are selected.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, "Widget Functions" on page 133).

If both the row and column numbers are less than 0, all cells of the `MScrollList` widget are selected.

**Note**

The command simulates the behavior of the **Ctrl**+**left-click** operation, which clears existing selections (if any) on applicable cells.

The alias is: `CmdToExtMslSel()`

## GetCommandToSelectMslCell()

```
GetCommandToSelectMslCell(widgetName, row, col=-1,
dialog=False, level=0)
```

Gets the command that selects cells of an `MScrollList` widget defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.

- `row` — Specifies the index of the row to select. The index starts at 0 (zero). If the row number is less than 0 and the widget supports single-cell selection and multiple-row selection, the specified column is selected in all rows.
- `col` — Specifies the index of the column to select. The index starts at 0 (zero). If the column number is less than 0, all columns of the specified row are selected.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, "Widget Functions" on page 133).

The alias is: `CmdToSelMslCell()`

## GetCommandToSelectMslCellByValue()

```
GetCommandToSelectMslCellByValue(widgetName, cellValue, col=0,
dialog=False, level=0)
```

Gets the command that selects an `MScrollList` widget cell by value. The widget may be defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `cellValue` — Specifies the value of the cell to select.
- `col` — Specifies the index of the column whose cell values are searched for `cellValue`. The index starts at 0 (zero). The value specified should be a valid column index. A negative value results in selection failure.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, "Widget Functions" on page 133).

Aliases are: `CmdToSelMslCellByValue()`, `CmdToSelMslCellByVal()`

## GetCommandToSortMsl()

```
GetCommandToSortMsl(widgetName, col, dialog=False, level=0)
```

Gets the command that sorts an `MScrollList` widget defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `col` — Specifies the index of the column to sort. The index starts at 0 (zero). The value specified should be a valid column index; a negative value is invalid.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

The alias is: `CmdToSortMsl()`

## GetMslRowNumber()

```
GetMslRowNumber(widgetName)
```

Gets the number of rows in an `MScrollList` widget.

The argument is:

- `widgetName` — Specifies the name of the `MScrollList` widget.

The alias is: `GetMslRowNum()`

## GetMslTree()

```
GetMslTree(widgetName, treeNodeColumn=0)
```

Dumps the content of an `MScrollList` widget and parses it into a `GHS_MslTree` object. For information about `GHS_MslTree`, see Chapter 8, “Widget Functions” on page 133.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `treeNodeColumn` — Specifies the column on which the tree in the `MScrollList` widget is built. Usually, the tree in an `MScrollList` widget is built on column 0 (zero).

## SelectMslCell()

```
SelectMslCell(widgetName, row, col=-1, block=True,
printOutput=True)
```

Selects cells of an `MScrollList` widget defined in the window. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `row` — Specifies the index of the row to select. The index starts at 0 (zero). If the row number is less than 0 and the widget supports single-cell selection and multiple-row selection, the specified column is selected in all rows.
- `col` — Specifies the index of the column to select. The index starts at 0 (zero). If the column number is less than 0, all columns of the specified row are selected.
- `block` — If `True`, executes `SelectMslCell()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

The alias is: `SelMslCell()`

## SelectMslCellByValue()

`SelectMslCellByValue(widgetName, cellValue, col=0, block=True, printOutput=True)`

Selects an `MScrollList` widget cell by value. The widget should be defined in the window. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `cellValue` — Specifies the value of the cell to select.
- `col` — Specifies the index of the column whose cell values are searched for `cellValue`. The index starts at 0 (zero). The value specified should be a valid column index. A negative value results in selection failure.
- `block` — If `True`, executes `SelectMslCellByValue()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

The alias is: `SelMslCellByValue()`

## SortMslByColumn()

`SortMslByColumn(widgetName, col, block=True, printOutput=True)`

Sorts an `MScrollList` widget by a column. The widget should be defined in the window. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `MScrollList` widget.
- `col` — Specifies the index of the column whose values are sorted. The index starts at 0 (zero). The value specified should be a valid column index. A negative value is invalid.

- `block` — If `True`, executes `SortMslByColumn()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

Aliases are: `SortMslByCol()`, `SortMsl()`

## GHS_Window PullDown Widget Functions

The following sections describe the functions from class `GHS_Window` that relate to `PullDown` widgets.

**Tip**

Many of the following functions require you to specify a widget name. You can list widget names with the `ShowWidgets()` function. See "ShowWidgets()" on page 144.

### ChangePullDownValue()

```
ChangePullDownValue(widgetName, value)
```

Changes the value of a `PullDown` widget defined in the window and returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `PullDown` widget.
- `value` — Specifies the widget's new value.

Aliases are: `ChangePdValue()`, `ChangePdVal()`

### DumpPullDownMenu()

```
DumpPullDownMenu(widgetName, block=True, printOutput=True)
```

Dumps the name, menu, etc. of a `PullDown` widget defined in the window and returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `PullDown` widget.
- `block` — If `True`, executes `DumpPullDownMenu()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

The alias is: `DumpPdMenu()`

## DumpPullDownValue()

```
DumpPullDownValue(widgetName, block=True, printOutput=True)
```

Dumps the name, value, etc. of a `PullDown` widget defined in the window and returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `PullDown` widget.
- `block` — If `True`, executes `DumpPullDownValue()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

The alias is: `DumpPdValue()`

## GetCommandToChangePullDownValue()

```
GetCommandToChangePullDownValue(widgetName, value,
dialog=False, level=0)
```

Gets the command that changes the value of a `PullDown` widget defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `PullDown` widget.
- `value` — Specifies the new value of the widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

Aliases are: `CmdToChangePdValue()`, `CmdToChangePdVal()`

## GetCommandToDumpPullDownMenu()

```
GetCommandToDumpPullDownMenu(widgetName, dialog=False, level=0)
```

Gets the command that dumps a `PullDown` widget's menu. The widget may be defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `PullDown` widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

Aliases are: `CmdToDumpPdMenu()`

## GetCommandToDumpPullDownValue()

```
GetCommandToDumpPullDownValue(widgetName, dialog=False,
level=0)
```

Gets the command that dumps the value of a `PullDown` widget defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `PullDown` widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

Aliases are: `CmdToDumpPdValue()`, `CmdToDumpPdVal()`

## GetCommandToSelectPullDownMenu()

```
GetCommandToSelectPullDownMenu(widgetName, valIdx,
dialog=False, level=0)
```

Gets the command that selects a `PullDown` widget's menu item. The widget may be defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `PullDown` widget.
- `valIdx` — Specifies the index of the menu item. The index of the first menu item is 0 (zero).
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.

- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

The alias is: `CmdToSelPdMenu()`

## GetPullDownMenu()

```
GetPullDownMenu(widgetName)
```

Gets the menu entries of a `PullDown` widget defined in the window. This function returns the widget's menu entries as a list, or it returns an empty list upon error.

The argument is:

- `widgetName` — Specifies the name of the `PullDown` widget.

The alias is: `GetPdMenu()`

## GetPullDownValue()

```
GetPullDownValue(widgetName)
```

Gets the value of a `PullDown` widget defined in the window. This function returns the widget's value as a string, or it returns an empty string (`""`) upon error.

The argument is:

- `widgetName` — Specifies the name of the `PullDown` widget.

Aliases are: `GetPdValue()`, `GetPdVal()`

## SelectPullDownValue()

```
SelectPullDownValue(widgetName, valIdx)
```

Selects a `PullDown` widget's value from the value list (menu) in the window. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `PullDown` widget.
- `valIdx` — Specifies the index of the value.

Aliases are: `SelPdValue()`, `SelPdVal()`

## GHS_Window Tab Widget Functions

The following sections describe the functions from class `GHS_Window` that relate to `Tab` widgets.

**Tip**

Many of the following functions require you to specify a widget name. You can list widget names with the `ShowWidgets()` function. See "ShowWidgets()" on page 144.

### DumpTabContents()

```
DumpTabContents(widgetName="", block=True, printOutput=True)
```

Dumps the current tab contents of a `Tab` widget defined in the window. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `Tab` widget.
- `block` — If `True`, executes `DumpTabContents()` in blocked mode and grabs the output, if any. If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

The alias is: `DumpTab()`

## DumpTabSelection()

```
DumpTabSelection(widgetName="", block=True, printOutput=True)
```

Dumps the current tab name of a `Tab` widget defined in the window. As shown in the following example output, the tab name is preceded by a short description:

```
Py Out: Selected tab name: Debugger
```

If you only want the tab name (and not the description), use `GetTabSelection()` instead. See "GetTabSelection()" on page 176.

This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `Tab` widget.
- `block` — If `True`, executes `DumpTabSelection()` in blocked mode and grabs the output, if any. If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

The alias is: `DumpTabSel()`

## DumpTabValue()

```
DumpTabValue(widgetName="", block=True, printOutput=True)
```

Dumps the tab names of a `Tab` widget defined in the window. This function returns a string for the tab names. As shown in the following example output, the tab names are preceded by a short description:

```
Py Out: Tabs: General, Project Manager, Debugger
```

If you only want the tab names (and not the description), use `GetTabNames()` instead. See "GetTabNames()" on page 176.

Arguments are:

- `widgetName` — Specifies the name of the `Tab` widget.

- `block` — If `True`, executes `DumpTabValue()` in blocked mode and grabs the output. If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

The alias is: `DumpTabVal()`

## GetCommandToDumpTab()

```
GetCommandToDumpTab(widgetName, dialog=False, level=0)
```

Gets the command that dumps the contents of a `Tab` widget's current page. The widget may be defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `Tab` widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

The alias is: `CmdToDumpTab()`

## GetCommandToDumpTabSelection()

```
GetCommandToDumpTabSelection(widgetName, dialog=False, level=0)
```

Gets the command that dumps a descriptive string and the current tab name of a `Tab` widget. The widget may be defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases. For more information about the descriptive string, see “DumpTabSelection()” on page 173.

Arguments are:

- `widgetName` — Specifies the name of the `Tab` widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, "Widget Functions" on page 133).

The alias is: `CmdToDumpTabSel()`

## GetCommandToDumpTabValue()

```
GetCommandToDumpTabValue(widgetName, dialog=False, level=0)
```

Gets the command that dumps the tab names of a `Tab` widget that is defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `Tab` widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, "Widget Functions" on page 133).

The alias is: `CmdToDumpTabVal()`

## GetCommandToSelectTab()

```
GetCommandToSelectTab(widgetName, tabName, dialog=False,
level=0)
```

Gets the command that selects a tab of a `Tab` widget defined in the window or in a modal dialog box. This function returns a string for the command. The command

that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `Tab` widget.
- `tabName` — Specifies the name of the tab (page) to select.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

The alias is: `CmdToSelTab()`

## GetTabNames()

```
GetTabNames(widgetName)
```

Gets the tab names of a `Tab` widget defined in the window. This function returns a list of tab names or an empty list upon error.

The argument is:

- `widgetName` — Specifies the name of the `Tab` widget.

See also “DumpTabValue()” on page 173.

## GetTabSelection()

```
GetTabSelection(widgetName)
```

Gets the name for the current tab of a `Tab` widget defined in the window. This function returns a string for the current tab or an empty string (`""`) upon error.

The argument is:

- `widgetName` — Specifies the name of the `Tab` widget.

See also “DumpTabSelection()” on page 173.

Aliases are: `GetTabSel()`, `GetCurrentTab()`, `GetCurTab()`

### SelectTab()

`SelectTab(widgetName, tabName, block=True, printOutput=True)`

Selects the tab of a `Tab` widget by name. The widget should be defined in the window. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `Tab` widget.
- `tabName` — Specifies the name of the tab (page) to be selected.
- `block` — If `True`, executes `SelectTab()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

The alias is: `SelTab()`

## GHS_Window Text Widget Functions

The following sections describe the functions from class `GHS_Window` that relate to `Text` widgets.

**Tip**

The following functions require you to specify a widget name. You can list widget names with the `ShowWidgets()` function. See “ShowWidgets()” on page 144.

## GetCommandToDumpText()

```
GetCommandToDumpText(widgetName, dialog=False, level=0)
```

Gets the command that dumps the value of a `Text` widget defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `Text` widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

See also “GetTextValue()” on page 178.

The alias is: `CmdToDumpTx()`

## GetTextValue()

```
GetTextValue(widgetName)
```

Gets the value of a `Text` widget defined in the window. This function returns the widget's value as a string, or it returns an empty string (`""`) upon error.

The argument is:

- `widgetName` — Specifies the name of the `Text` widget.

See also “GetCommandToDumpText()” on page 178.

The alias is: `GetTxVal()`

# GHS_Window TextCell Widget Functions

The following sections describe the functions from class `GHS_Window` that relate to `TextCell` widgets.

**Tip**

Many of the following functions require you to specify a widget name. You can list widget names with the `ShowWidgets()` function. See "ShowWidgets()" on page 144.

## DumpTextCellValue()

```
DumpTextCellValue(widgetName, block=True, printOutput=True)
```

Dumps the value, widget name, etc. of a `TextCell` widget defined in the window. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `TextCell` widget.
- `block` — If `True`, executes `DumpTextCellValue()` in blocked mode and grabs the output, if any. If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

See also "GetTextCellValue()" on page 179.

Aliases are: `DumpTcValue()`, `DumpTcVal()`

## GetTextCellValue()

```
GetTextCellValue(widgetName)
```

Gets the value of a `TextCell` widget defined in the window. This function returns the widget's value as a string, or it returns an empty string (`""`) upon error.

The argument is:

- `widgetName` — Specifies the name of the `TextCell` widget.

See also “DumpTextCellValue()” on page 179.

Aliases are: `GetTcValue()`, `GetTcVal()`

### IsTextCellReadOnly()

```
IsTextCellReadOnly(widgetName)
```

Checks if a `TextCell` widget defined in the window is read-only. This function returns `True` if yes or if the given widget is not a `TextCell`, and `False` otherwise.

The argument is:

- `widgetName` — Specifies the name of the `TextCell` widget.

The alias is: `IsTcReadOnly()`

## GHS_Window TextField Widget Functions

The following sections describe the functions from class `GHS_Window` that relate to `TextField` widgets.

**Tip**

Many of the following functions require you to specify a widget name. You can list widget names with the `ShowWidgets()` function. See “ShowWidgets()” on page 144.

### ChangeTextFieldValue()

```
ChangeTextFieldValue(widgetName, value, hitReturn=True,
block=True, printOutput=True)
```

Changes the value of a `TextField` widget defined in the window. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `TextField` widget.

- `value` — Specifies the new value of the widget.
- `hitReturn` — If `True`, simulates pressing **Enter** on the `TextField` widget. If `False`, does not simulate pressing **Enter**.
- `block` — If `True`, executes `ChangeTextFieldValue()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

Aliases are: `ChangeTfValue()`, `ChangeTfVal()`

## DumpTextFieldValue()

```
DumpTextFieldValue(widgetName, block=True, printOutput=True)
```

Dumps the value, widget name, etc. of a `TextField` widget defined in the window. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `TextField` widget.
- `block` — If `True`, executes `DumpTextFieldValue()` in blocked mode and grabs the output, if any. If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

See also “GetTextFieldValue()” on page 183.

Aliases are: `DumpTfValue()`, `DumpTfVal()`

## GetCommandToChangeTextFieldValue()

```
GetCommandToChangeTextFieldValue(widgetName, value,
hitReturn=True, dialog=False, level=0)
```

Gets the command that changes the value of a `TextField` widget defined in the window or in a modal dialog box. This function returns a string for the command.

The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `TextField` widget.
- `value` — Specifies the widget's new value.
- `hitReturn` — If `True`, simulates pressing **Enter** on the `TextField` widget. If `False`, does not simulate pressing **Enter**.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

Aliases are: `CmdToChangeTfValue()`, `CmdToChangeTfVal()`

## GetCommandToDumpTextField()

```
GetCommandToDumpTextField(widgetName, dialog=False, level=0)
```

Gets the command that dumps the value of a `TextField` widget defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `TextField` widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

The alias is: `CmdToDumpTf()`

## GetCommandToReturnOnTextField()

```
GetCommandToReturnOnTextField(widgetName, dialog=False,
level=0)
```

Gets the command that simulates pressing **Enter** on a `TextField` widget defined in the window or in a modal dialog box. This function returns a string for the command. The command that is returned is not documented and should not be relied upon between MULTI IDE releases.

Arguments are:

- `widgetName` — Specifies the name of the `TextField` widget.
- `dialog` — If `True`, specifies that the widget is defined in a modal dialog box. If `False`, specifies that the widget is defined in the window.
- `level` — Specifies the nested level of the modal dialog box. For more information, see the note at the beginning of this chapter (Chapter 8, “Widget Functions” on page 133).

Aliases are: `CmdToReturnOnTf()`, `CmdToRetOnTf()`

## GetTextFieldValue()

```
GetTextFieldValue(widgetName)
```

Gets the value of a `TextField` widget defined in the window. This function returns the widget's value as a string, or it returns an empty string (`""`) upon error.

Arguments are:

- `widgetName` — Specifies the name of the `TextField` widget.

See also “DumpTextFieldValue()” on page 181.

Aliases are: `GetTfValue()`, `GetTfVal()`

## IsTextFieldReadOnly()

```
IsTextFieldReadOnly(widgetName)
```

Checks if a `TextField` widget defined in the window is read-only. This function returns `True` if yes or if the given widget is not a `TextField`, and `False` otherwise.

The argument is:

- `widgetName` — Specifies the name of the `TextField` widget.

The alias is: `IsTfReadOnly()`

## ReturnOnTextField()

```
ReturnOnTextField(widgetName, block=True, printOutput=True)
```

Simulates pressing **Enter** on a `TextField` widget defined in the window. This function returns `True` on success and `False` otherwise.

Arguments are:

- `widgetName` — Specifies the name of the `TextField` widget.
- `block` — If `True`, executes `ReturnOnTextField()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

Aliases are: `ReturnOnTf()`, `RetOnTf()`

# Chapter 9

# Window Tracking Functions

## Contents

This chapter documents functions from class `GHS_WindowRegister`. Class `GHS_WindowRegister` inherits from class `GHS_IdeObject` and implements the mechanism for tracking MULTI IDE windows. All operations applied to MULTI IDE windows are dispatched to the corresponding MULTI IDE components via this mechanism.

The `GHS_WindowRegister` functions are divided into the following sections:



## GHS_WindowRegister Basic Functions

The following section describes the function from class `GHS_WindowRegister`.

### __init__()

```
__init__(workingDir="")
```

Initializes object attributes.

The argument is:

- `workingDir` — Stores the working directory of the MULTI IDE service. It is not used at present.

# GHS_WindowRegister Check Functions

The following sections describe the functions from class `GHS_WindowRegister` that check whether the specified window exists in the system or exists in the given window list.

## CheckWindow()

```
CheckWindow(winName, winId=0, winClass="", winRegSvcName="",
pid=0, fromWinList=None, notInWinList=None)
```

Checks that a MULTI IDE window is in one window list and not in another. If this is the case, this function returns a `GHS_Window` object; otherwise, it returns `None`.

Arguments are:

- `winName` — Specifies the name of the window. An empty string (`""`) matches any window name.
- `winId` — Specifies the internal ID of the window. A 0 (zero) matches any window ID.
- `winClass` — Specifies the class of the window. An empty string (`""`) matches any window class.
- `winRegSvcName` — Specifies the internal ID of the component to which the window belongs. An empty string (`""`) matches any internal ID.
- `pid` — Specifies the PID of the process to which the window belongs. A 0 (zero) matches any PID.
- `fromWinList` — Specifies the window list that should contain the given window. If an empty window list is given, the window list for the current system is used.
- `notInWinList` — Specifies the window list that should not contain the given window.

The alias is: `CheckWin()`

## CheckWindowObject()

```
CheckWindowObject(winObj)
```

Checks whether a specified `GHS_Window` object exists in the system. If yes, this function returns the `GHS_Window` object; otherwise, it returns `None`.

The argument is:

- `winObj` — Specifies the `GHS_Window` object to be checked.

Aliases are: `CheckWindowObj()`, `CheckWinObj()`

## IsWindowInList()

```
IsWindowInList(winList, winName, winId=0, winClass="", pid=0,
winRegSvcName="")
```

Checks whether the specified window exists in a window list. This function returns `True` if yes, and `False` otherwise.

Arguments are:

- `winList` — Specifies the window list to check against.
- `winName` — Specifies the name of the window. An empty string (`""`) matches any window name.
- `winId` — Specifies the internal ID of the window. A 0 (zero) matches any window ID.
- `winClass` — Specifies the class of the window. An empty string (`""`) matches any window class.
- `pid` — Specifies the PID of the process to which the window belongs. A 0 (zero) matches any PID.
- `winRegSvcName` — Specifies the internal ID of the component to which the window belongs. An empty string (`""`) matches any internal ID.

# GHS_WindowRegister Get Window Functions

The following sections describe the functions from class `GHS_WindowRegister` that get windows and return window objects. (A couple of the functions listed relate to getting and displaying window lists rather than windows.)

The following arguments are common to these functions:

- `winName` — Specifies a regular expression matching the name of the window. For example, `"^My Window$"` matches “My Window” exactly if there are multiple window names containing the string “My Window”. An empty string (`""`) matches any window name.
- `pid` — Specifies the PID of the process to which the window belongs. A 0 (zero) matches any PID.
- `fromWinList` — Specifies the window list that contains the given window. If this argument is `None` or empty, the window list for the current system is used.
- `notInWinList` — Specifies the window list that does not contain the given window.
- `warnIfNotFound` — If `True`, prints a warning message if the specified window is not found. If `False`, does not print a warning message.

## GetCheckoutBrowserWindow()

```
GetCheckoutBrowserWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI Checkout Browser window from the given window list and returns the created `GHS_CoBrowseWindow` object.

For argument descriptions, see “GHS_WindowRegister Get Window Functions” on page 189.

Aliases are: `GetCheckoutBrowser()`, `GetCoB()`

## GetConnectionOrganizerWindow()

```
GetConnectionOrganizerWindow(winName="", pid=0,
fromWinList=None, notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI Connection Organizer window from the given window list and returns the created `GHS_ConnectionOrganizerWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetConnectionOrganizer()`, `GetCo()`

## GetDebuggerWindow()

```
GetDebuggerWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI Debugger window from the given window list and returns the created `GHS_DebuggerWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetDebuggerWin()`, `GetDebugger()`

## GetDialogByName()

```
GetDialogByName(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI IDE dialog box by its name and returns the created `GHS_Window` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetDlgByName()`, `GetDialog()`, `GetDlg()`

## GetDiffViewerWindow()

```
GetDiffViewerWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI Diff Viewer window from the given window list and returns the created `GHS_DiffViewWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetDiffViewer()`, `GetDv()`

## GetEditorWindow()

```
GetEditorWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI Editor window from the given window list and returns the created `GHS_EditorWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetEditorWin()`, `GetEditor()`

## GetEventAnalyzerWindow()

```
GetEventAnalyzerWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI EventAnalyzer window from the given window list and returns the created `GHS_EventAnalyzerWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetEventAnalyzerWin()`, `GetMeaWindow()`, `GetMeaWin()`, `GetMea()`, `GetMev()`

## GetHelpViewerWindow()

```
GetHelpViewerWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI Help Viewer window from the given window list and returns the created `GHS_HelpViewerWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetHelpViewer()`, `GetHv()`

## GetLauncherWindow()

```
GetLauncherWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI Launcher window from the given window list and returns the created `GHS_LauncherWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetLauncherWin()`, `GetLauncher()`

## GetOsaExplorerWindow()

```
GetOsaExplorerWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI OSA Explorer window from the given window list and returns the created `GHS_OsaWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetOsaExplorer()`, `GetOsa()`

## GetProjectManagerWindow()

```
GetProjectManagerWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI Project Manager window from the given window list and returns the created `GHS_ProjectManagerWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetProjMgrWin()`, `GetBuilderWindow()`, `GetBuilderWin()`, `GetBuilder()`

## GetPythonGuiWindow()

```
GetPythonGuiWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a Python GUI window from the given window list and returns the created `GHS_PyGuiWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

The alias is: `GetPyGui()`

## GetResourceAnalyzerWindow()

```
GetResourceAnalyzerWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI ResourceAnalyzer window from the given window list and returns the created `GHS_ResourceAnalyzerWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetResourceAnalyzer()`, `GetMra()`, `GetMrv()`

## GetTaskManagerWindow()

```
GetTaskManagerWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI Task Manager window from the given window list and returns the created `GHS_TaskManagerWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetTaskManagerWin()`, `GetTm()`

## GetTerminalWindow()

```
GetTerminalWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets an MTerminal window from the given window list and returns the created `GHS_TerminalWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetTerminal()`, `GetTerm()`

## GetTraceWindow()

```
GetTraceWindow(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI Trace List window from the given window list and returns the created `GHS_TraceWindow` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

The alias is: `GetTrace()`

## GetWindowByIndex()

```
GetWindowByIndex(idx, winList=None)
```

Gets a `GHS_Window` object from an entry in a window list and returns the created `GHS_Window` object.

Arguments are:

- `idx` — Specifies the index of the entry in the window list.
- `winList` — Specifies the window list. If an empty window list is given, the window list in the current system is used.

Aliases are: `GetWinByIdx()`, `WindowForIndex()`, `WinForIdx()`, `WinFIdx()`

## GetWindowByName()

```
GetWindowByName(winName="", pid=0, fromWinList=None,
notInWinList=None, warnIfNotFound=True)
```

Gets a MULTI IDE window by its name and returns the created `GHS_Window` object.

For argument descriptions, see "GHS_WindowRegister Get Window Functions" on page 189.

Aliases are: `GetWinByName()`, `GetWindow()`, `GetWin()`

## GetWindowList()

```
GetWindowList(showIt=False, showPid=True, showClassName=True,
showWinId=False, showServiceName=False, showParentWin=False,
showGuiClass=False)
```

Gets the window list for the current MULTI IDE session and returns a window list object.

Arguments are:

- `showIt` — If `True`, displays the window list. The remaining arguments control what items are displayed. If `False`, does not display the window list.

- `showPid` — If `True`, displays the windows' corresponding process IDs (PIDs). If `False`, does not display the PIDs.
- `showClassName` — If `True`, displays the windows' class names. If `False`, does not display the class names.
- `showWinId` — If `True`, displays the windows' internal IDs. If `False`, does not display internal IDs
- `showServiceName` — If `True`, displays the internal IDs of the components to which the windows belong. If `False`, does not display internal IDs.
- `showParentWin` — If `True`, displays the windows' parent window IDs. If `False`, does not display parent window IDs.
- `showGuiClass` — If `True`, displays windows' GUI class names. If `False`, does not display GUI class names.

  MULTI windows have two class names: one for their actual category, and another for the category they are shown as in the GUI (such as in menus). The two class names are usually the same, but they differ for some windows. For example, the MULTI Project Manager's progress window is a normal window but should be shown in menus as being part of the Project Manager category.

Aliases are: `GetWinList()`, `GetWindows()`, `GetWins()`, `Windows()`, `Wins()`

## ShowWindowList()

```
ShowWindowList(showPid=True, showClassName=True,
showWinId=False, showServiceName=False, showParentWin=False,
showGuiClass=False)
```

Displays the window list for the current MULTI session.

For argument descriptions, see “GetWindowList()” on page 195.

Aliases are: `ShowWindows()`, `ShowWins()`

# GHS_WindowRegister Interactive Functions

The following sections describe the interactive functions from class `GHS_WindowRegister`.

## Beep()

```
Beep(count=1, block=False, hostWin=None)
```

Beeps the specified number of times and returns `True` on success and `False` on failure.

Arguments are:

- `count` — Specifies the number of beeps.
- `block` — If `True`, executes `Beep()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `hostWin` — Specifies the host window to which the beep request is sent. For more information, see “ShowMessage()” on page 201.

## ChooseDir()

```
ChooseDir(dftDir="", prompt="Choose directory:",
title="Directory Chooser", hostWin=None)
```

Allows you to choose a directory via MULTI's directory chooser. This function returns the selected directory, or it returns an empty string (`""`) upon failure or cancellation.

Arguments are:

- `dftDir` — Specifies the default directory.
- `prompt` — Specifies the prompt string to display.
- `title` — Specifies the title of the modal directory chooser. If `title` is an empty string (`""`), the value of `prompt` is used as the title.

- `hostWin` — Specifies the host window from which the directory chooser is shown. If the argument is `None` or if it is not a `GHS_Window` object, a window is randomly selected as the host window.

The alias is: `DirChooser()`

## ChooseFile()

```
ChooseFile(dftFile="", dftDir="", label="OK", forOpen=True,
existingFile=False, extension="", fileTypes="",
eraseFilenameWhenDirChange=False, title="File Chooser",
hostWin=None)
```

Allows you to choose a file path via MULTI's file chooser. This function returns the selected file path, or it returns an empty string (`""`) upon failure or cancellation.

Arguments are:

- `dftFile` — Specifies the default filename.
- `dftDir` — Specifies the default directory.
- `label` (Linux/Solaris only) — Specifies the label of the action button in the file chooser.
- `forOpen` — Indicates whether the selected file can be read.
- `existingFile` — If `True`, the selected file must already exist. If `False`, the user may create a new file.
- `extension` — Specifies the extension for the selected file.
- `fileTypes` — Specifies the file's MULTI IDE file type.
- `eraseFilenameWhenDirChange` — If `True`, erases the filename located in the file chooser when the directory changes. If `False`, does not erase the filename when the directory changes.
- `title` — Specifies the title of the modal file chooser. If `title` is an empty string (`""`), `File Chooser` is used as the title.
- `hostWin` — Specifies the host window from which the file chooser is shown. If the argument is `None` or if it is not a `GHS_Window` object, a window is randomly selected as the host window.

The alias is: `FileChooser()`

## ChooseFromList()

```
ChooseFromList(dftValueIdx=0, valList=[], colValueSep="",
colNames=[], prompt="Select value from the list:",
title="Choose Value from List", helpkey="", hostWin=None)
```

Allows you to choose a value from a list displayed in a modal dialog box. This function returns the string selected from the list, or it returns an empty string (`""`) upon failure or cancellation. See also “ChooseFromList()” on page 102.

Arguments are:

- `dftValueIdx` — Specifies the index of the list's default value.
- `valList` — Specifies a list of pre-defined values.
- `colValueSep` — Specifies a column-value separator. If `colValueSep` is an empty string (`""`), `#` is used as the separator by default.
- `colNames` — Specifies the column names. This should be a list of strings.
- `prompt` — Specifies the prompt string to display.
- `title` — Specifies the title of the modal dialog box. If `title` is an empty string (`""`), the value of `prompt` is used as the title.
- `helpkey` — Specifies a string for a MULTI help key.
- `hostWin` — Specifies the host window from which the dialog box is shown. If the argument is `None` or if it is not a `GHS_Window` object, a window is randomly selected as the host window.

## ChooseWindowFromGui()

```
ChooseWindowFromGui(msg="Choose a window:", title="Choose
Window from List", wins=None, hostWin=None)
```

Allows you to choose a window from a window list displayed in a modal dialog box. This function returns an object for the chosen window, or it returns `None` upon failure or cancellation.

Arguments are:

- `msg` — Specifies the prompt string to display.
- `title` — Specifies the title of the modal dialog box. If `title` is an empty string (`""`), the value of `msg` is used as the title.
- `wins` — Specifies a list of windows from which you can choose. If you do not specify a window list or if `wins` is an empty string (`""`), the current MULTI IDE windows in the system are used.
- `hostWin` — Specifies the host window from which the dialog box is shown. If the argument is `None` or if it is not a `GHS_Window` object, a window is randomly selected as the host window.

Aliases are: `ChooseWindow()`, `ChooseWin()`

## ChooseYesNo()

```
ChooseYesNo(msg, dftChoice=0, printOutput=True, hostWin=None)
```

Displays the specified message in a dialog box that prompts you to choose between **Yes** and **No**. This function returns `True` for **Yes** and `False` for **No**.

Arguments are:

- `msg` — Specifies the prompt message to display. The message should be a yes/no question.
- `dftChoice` — If `0`, the default choice is **No**. If `1`, the default choice is **Yes**.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.
- `hostWin` — Specifies the host window from which the dialog box is shown. If the argument is `None` or if it is not a `GHS_Window` object, a window is randomly selected as the host window.

Aliases are: `YesOrNo()`, `YesNo()`

## GetInput()

```
GetInput(dftValue="", valList=[], onlyFromList=False,
prompt="Your input", title="", helpkey="", hostWin=None)
```

Gets user input via a modal dialog box. This function returns the input string, or it returns an empty string (`""`) upon failure or cancellation.

Arguments are:

- `dftValue` — Specifies the default value to return.
- `valList` — Specifies a list of pre-defined values to include in the modal dialog box.
- `onlyFromList` — If `True`, you can only choose from the list of pre-defined values. If `False`, you can choose from the list of pre-defined values, or you can enter your own value.
- `prompt` — Specifies the prompt string to display.
- `title` — Specifies the title of the modal dialog box. If `title` is an empty string (`""`), the value of `prompt` is used as the title.
- `helpkey` — Specifies a string for a MULTI help key.
- `hostWin` — Specifies the host window from which the dialog box is shown. If the argument is `None` or if it is not a `GHS_Window` object, a window is randomly selected as the host window.

## ShowMessage()

```
ShowMessage(msg, hostWin=None)
```

Displays the specified message in a dialog box and returns `True` on success and `False` on failure.

Arguments are:

- `msg` — Specifies the message to display.
- `hostWin` — Specifies the host window from which the dialog box is shown. If the argument is `None` or if it is not a `GHS_Window` object, a window is randomly selected as the host window.

Aliases are: `ShowMsg()`, `DisplayMessage()`, `DisplayMsg()`

## GHS_WindowRegister Window Manipulation Functions

The following sections describe the window manipulation functions from class `GHS_WindowRegister`.

### CloseAllWindows()

`CloseAllWindows()`

Closes all windows and returns `True` on success and `False` on failure.

Aliases are: `CloseWindows()`, `CloseWins()`

### IconifyAllWindows()

`IconifyAllWindows()`

Minimizes all windows and returns `True` on success and `False` on failure.

Aliases are: `IconifyWindows()`, `IconifyWins()`, `IconWins()`, `MinimizeWindows()`, `MinWins()`

### RestoreAllWindows()

`RestoreAllWindows()`

Restores all minimized windows and returns `True` on success and `False` on failure.

Aliases are: `RestoreWindows()`, `RestoreWins()`

# GHS_WindowRegister Wait Functions

The following sections describe the functions from class `GHS_WindowRegister` that wait for some specified event.

## WaitForWindow()

```
WaitForWindow(oldWinListInfo, duration=0.0, winClass="",
winRegSvcName="", winName="", winId=0, warnIfNotFound=False)
```

Waits for the specified MULTI IDE window to appear and register. This function returns a `GHS_Window` object for the given window, or it returns `None` if the window does not register before the specified timeout.

Arguments are:

- `oldWinListInfo` — Specifies a window list that the window is not in.
- `duration` — Specifies how long the function waits, if at all. The `duration` may be:
  - A negative number — Indicates that the function waits for the expected window until the window appears.
  - `0.0` — Indicates that the function does not wait.
  - A positive number — Specifies the maximum number of seconds that the function waits.
- `winClass` — Specifies the class of the window. An empty string (`""`) matches any window class.
- `winRegSvcName` — Specifies the internal ID of the component to which the window belongs. An empty string (`""`) matches any internal ID.
- `winName` — Specifies the name of the window. An empty string (`""`) matches any window name.
- `winId` — Specifies the internal ID of the window. A 0 (zero) matches any window ID.
- `warnIfNotFound` — If `True` and if the specified window does not show up before the timeout, prints a warning message. If `False`, does not print a warning message.

Aliases are: `WaitWindow()`, `WaitWin()`

## WaitForWindowFromClass()

```
WaitForWindowFromClass(oldWinListInfo, duration=0.0,
winClass="", winRegSvcName="", warnIfNotFound=False)
```

Waits for a MULTI IDE window from a certain class to show up and register. This function returns a `GHS_Window` object for the given window, or it returns `None` if the window does not register before the specified timeout.

This function is a wrapper of `WaitForWindow()`. For argument descriptions, see "WaitForWindow()" on page 203.

The alias is: `WaitWinFromClass()`

## WaitForWindowGoAway()

```
WaitForWindowGoAway(duration, winName, winId=0, winClass="",
winRegSvcName="", pid=0, notInWinList=None)
```

Waits for the specified MULTI IDE window to remove registration and disappear. This function returns `True` if the specified MULTI IDE window does not exist (that is, registration has been removed) when the function returns, and `False` otherwise.

Arguments are:

- `duration` — Specifies how long the function waits, if at all. The `duration` may be:
  - A negative number — Indicates that the function waits until the window disappears.
  - `0.0` — Indicates that the function does not wait.
  - A positive number — Specifies the maximum number of seconds that the function waits.
- `winName` — Specifies the name of the window. This may be a regular expression. An empty string (`""`) matches any window name.

- `winId` — Specifies the internal ID of the window. A 0 (zero) matches any window ID.
- `winClass` — Specifies the class of the window. An empty string (`""`) matches any window class.
- `winRegSvcName` — Specifies the internal ID of the component to which the window belongs. An empty string (`""`) matches any internal ID.
- `pid` — Specifies the PID of the process to which the window belongs. A 0 (zero) matches any PID.
- `notInWinList` — Specifies a window list that does not contain the window you are waiting for. Windows in the list are ignored when this function attempts to determine whether the specified window has disappeared.

The alias is: `WaitForWinGoAway()`

## WaitForWindowObjectGoAway()

```
WaitForWindowObjectGoAway(winObj, duration=0.0,
notInWinList=None)
```

Waits for the specified MULTI IDE window to remove registration and disappear. This function returns `True` if the specified MULTI IDE window does not exist (that is, registration has been removed) when the function returns, and `False` otherwise.

This function is a wrapper of `WaitForWindowGoAway()` (see "WaitForWindowGoAway()" on page 204).

Arguments are:

- `winObj` — Specifies the `GHS_Window` object for the window to be checked.
- `duration` — Specifies how long the function waits, if at all. The `duration` may be:
  - A negative number — Indicates that the function waits until the window disappears.
  - `0.0` — Indicates that the function does not wait.
  - A positive number — Specifies the maximum number of seconds that the function waits.

- `notInWinList` — Specifies a window list that does not contain the window you are waiting for. Windows in the list are ignored when this function attempts to determine whether the specified window has disappeared.

The alias is: `WaitForWinObjGoAway()`

# Chapter 10

# Connection Functions

## Contents

This chapter documents functions from the following classes:

- `GHS_DebuggerApi` — Exposes the functions of the MULTI Debugger. This abstract class inherits from class `GHS_IdeObject`.

  The `GHS_DebuggerApi` functions are divided into the following sections:
  - "GHS_DebuggerApi Target Connection Functions" on page 209
  - "GHS_DebuggerApi Window Display Functions" on page 211

  **Note**

  This chapter documents only a subset of the functions from class `GHS_DebuggerApi`. For information about other `GHS_DebuggerApi` functions, see Chapter 11, "Debug Functions" on page 219.

- `GHS_DebugServer` — Exposes the functions of the MULTI debug server. This class inherits from class `GHS_Window` and class `GHS_DebuggerApi` because a Task Manager appears for run-mode debug connections. See "GHS_DebugServer Functions" on page 212.
- `GHS_Terminal` (alias `ghs_terminal`) — Exposes the basic functions of the MULTI Serial Terminal service. This class inherits from class `GHS_IdeObject`. See "GHS_Terminal Functions" on page 215.
- `GHS_TerminalWindow` — Exposes additional functions of the MULTI Serial Terminal. This class inherits from class `GHS_Window`. See "GHS_TerminalWindow Functions" on page 215.

# GHS_DebuggerApi Target Connection Functions

The following sections describe the target connection functions from class `GHS_DebuggerApi`.

## ConnectToRtserv()

```
ConnectToRtserv(target="", setupScript="", setupScriptArgs="",
multiLog="", rtservLog="", moreOpts="", printOutput=True)
```

Connects to an RTOS target with the **rtserv** debug server. On success, this function returns a `GHS_DebugServer` object for the **rtserv** run-mode debug connection. Upon failure, it returns `None`.

Arguments are:

- `target` — Specifies the name of the target running the RTOS.
- `setupScript` — Specifies the board setup or connection initialization script filename.
- `setupScriptArgs` — Specifies arguments to the setup script. At present, only Python setup scripts can accept arguments.
- `multiLog` — Specifies a file with which to log the communication between MULTI and the debug server.
- `rtservLog` — Specifies a file with which to log the communication between the debug server and the RTOS target.
- `moreOpts` — Specifies other options for the debug server.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

Aliases are: `ConnectRtserv()`, `Rtserv()`

## ConnectToRtserv2()

```
ConnectToRtserv2(target="", setupScript="", setupScriptArgs="",
multiLog="", rtservLog="", moreOpts="", printOutput=True)
```

Connects to an RTOS target with the **rtserv2** debug server. On success, this function returns a `GHS_DebugServer` object for the **rtserv2** run-mode debug connection. Upon failure, it returns `None`.

For argument descriptions, see "ConnectToRtserv()" on page 209.

Aliases are: `ConnectRtserv2()`, `Rtserv2()`

## ConnectToTarget()

```
ConnectToTarget(dbserver, setupScript="", setupScriptArgs="",
multiLog="", stickToTheDebugger=True, moreOpts="",
printOutput=True)
```

Connects to a target with the specified debug server and options. On success, this function returns a `GHS_DebugServer` object for the established debug server connection. Upon failure, it returns `None`.

Arguments are:

- `dbserver` — Specifies the name of the debug server.
- `setupScript` — Specifies the board setup or connection initialization script filename.
- `setupScriptArgs` — Specifies arguments to the setup script. At present, only Python setup scripts can accept arguments.
- `multiLog` — Specifies a file with which to log the communication between MULTI and the debug server.
- `stickToTheDebugger` — If `True`, associates the established debug server connection with the current MULTI Debugger process. If `False`, does not create an association.
- `moreOpts` — Specifies other options for the debug server.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

Aliases are: `ConnectTarget()`, `Target()`, `Connect()`

### Disconnect()

```
Disconnect(printOutput=True)
```

Disconnects the debug server connection associated with the current MULTI Debugger process. This function returns `True` on success and `False` on failure.

The argument is:

- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

### IsConnected()

```
IsConnected()
```

Checks whether any debug server connection is established for the current MULTI Debugger process and returns `True` if yes and `False` otherwise.

The alias is: `Connected()`

## GHS_DebuggerApi Window Display Functions

The following section describes one of the window display functions from class `GHS_DebuggerApi`. Additional `GHS_DebuggerApi` window display functions are documented in Chapter 11, “Debug Functions” on page 219.

### ShowConnectionOrganizerWindow()

```
ShowConnectionOrganizerWindow(hardwareRegistryServer="",
printOutput=True)
```

Displays the **Connection Organizer**. On success, this function returns a `GHS_ConnectionOrganizerWindow` object. Upon failure, it returns `None`.

Arguments are:

- `hardwareRegistryServer` — This argument has no effect. It is included for backwards compatibility.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

Aliases are: `ShowConnectionOrganizer()`, `ShowCo()`

## GHS_DebugServer Functions

The following sections describe functions from class `GHS_DebugServer`.

### __init__()

```
__init__(component, winName="", winId="", winClassName="",
winRegSvcName="")
```

Initializes the object attributes.

Arguments are:

- `component` — Stores the Debugger component's identifier string for the debug server connection.
- `winName` — Stores the name that is registered for the window. This name may not be the same as the name shown on the window's title bar.
- `winId` — Stores the window's internal ID.
- `winClassName` — Stores the window's class. For a list of window classes, see “MULTI-Python Window Classes” on page 21.
- `winRegSvcName` — Specifies the internal ID of the component to which the window belongs.

## Disconnect()

```
Disconnect(printOutput=True)
```

Disconnects the debug server connection and returns `True` on success and `False` on failure.

The argument is:

- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

## GetComponent()

```
GetComponent()
```

Gets the MULTI Debugger component ID for the debug server connection. This function returns the debug server connection's component ID.

## LoadProgram()

```
LoadProgram(progName="", block=True)
```

Loads a dynamic download module to the target if this feature is supported and if the target was configured with a dynamic loader (for example, the LoaderTask on INTEGRITY). This function returns `True` on success and `False` on failure.

Arguments are:

- `progName` — Specifies the program name.
- `block` — If `True`, executes `LoadProgram()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

Aliases are: `LoadProg()`, `LoadModule()`, `Load()`

## RunCommands()

```
RunCommands(cmds, block=True, printOutput=True)
```

Executes MULTI Debugger commands in the context of the debug server connection. This function returns `True` on success and `False` on failure.

Arguments are:

- `cmds` — Specifies the MULTI Debugger commands to execute.
- `block` — If `True`, executes `RunCommands()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any) from the MULTI debug server. If `False`, does not print the output.

Aliases are: `RunCommand()`, `RunCmd()`, `RunCmds()`

## ShowTaskManagerWindow()

```
ShowTaskManagerWindow()
```

In a run-mode debugging environment, displays the Task Manager (if any) for the debug server. In a freeze-mode debugging environment, displays the **OSA Explorer** if the target is halted.

Upon success in a run-mode environment, this function returns a `GHS_TaskManagerWindow` object. Upon success in a freeze-mode environment, it returns a `GHS_OsaWindow` object. Upon failure, it returns `None`.

Aliases are: `ShowTaskWindow()`, `ShowTaskWin()`, `TaskWindow()`, `TaskWin()`

# GHS_Terminal Functions

The following sections describe functions from class `GHS_Terminal`.

## __init__()

```
__init__(workingDir="")
```

Initializes the object attributes.

The argument is:

- `workingDir` — Stores the working directory of the MULTI service object.

## MakeConnection()

```
MakeConnection(connectCommand="")
```

Connects to a serial port. On success, this function returns a `GHS_TerminalWindow` object for the MTerminal window. Upon failure, it returns `None`.

The argument is:

- `connectCommand` — Specifies the command for connecting to a serial port. If `connectCommand` is an empty string (`""`), a dialog box prompts you to select or create a serial terminal connection.

The alias is: `Connect()`

# GHS_TerminalWindow Functions

The following sections describe functions from class `GHS_TerminalWindow`.

## ChangeBaudRate()

```
ChangeBaudRate(value, block=False)
```

Changes the current baud rate and returns `True` on success and `False` on failure.

Arguments are:

- `value` — Specifies the value for the new baud rate.
- `block` — If `True`, executes `ChangeBaudRate()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

## Connect()

```
Connect(block=False)
```

Connects to a serial port and returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `Connect()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

## Disconnect()

```
Disconnect(block=False)
```

Disconnects the current connection and returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `Disconnect()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

## SendBreak()

```
SendBreak(block=False)
```

Sends a `break` to the serial port. This function returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `SendBreak()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

# Chapter 11

# Debug Functions

## Contents

This chapter documents functions from the following classes:

- `GHS_Debugger` (alias `ghs_debugger`) — Exposes the basic functions of the MULTI Debugger service. This class inherits from class `GHS_DebuggerApi`. See "GHS_Debugger Functions" on page 221.
- `GHS_DebuggerApi` — Exposes the functions of the MULTI Debugger. This abstract class inherits from class `GHS_IdeObject`.

  The `GHS_DebuggerApi` functions are divided into the following sections:

  - "GHS_DebuggerApi Debug Flag Functions" on page 222
  - "GHS_DebuggerApi Host Information Functions" on page 231
  - "GHS_DebuggerApi Memory Access Functions" on page 232
  - "GHS_DebuggerApi Run-Control Attributes and Functions" on page 234
  - "GHS_DebuggerApi Symbol Functions" on page 240
  - "GHS_DebuggerApi Target Information Functions" on page 241
  - "GHS_DebuggerApi Window Display Functions" on page 245

  **Note**

  Target connection functions and additional window display functions of class `GHS_DebuggerApi` are documented in Chapter 10, "Connection Functions" on page 207.

- `GHS_DebuggerWindow` — Exposes the functions of the MULTI Debugger. This class inherits from class `GHS_Window` and class `GHS_DebuggerApi`.

  The `GHS_DebuggerWindow` functions are divided into the following sections:

  - "GHS_DebuggerWindow Basic Functions" on page 247
  - "GHS_DebuggerWindow Breakpoint Functions" on page 247
  - "GHS_DebuggerWindow Print Functions" on page 250
- `GHS_MemorySpaces` — Defines the general memory space IDs used in the MULTI Debugger and debug servers. See "GHS_MemorySpaces Attributes and Functions" on page 251.
- `GHS_OsTypes` — Defines the operating system IDs supported in the MULTI Debugger. See "GHS_OsTypes Attributes and Functions" on page 252.

- `GHS_TargetIds` — Defines the target IDs supported in the MULTI Debugger. See "GHS_TargetIds Functions" on page 253.
- `GHS_Task` (alias `ghs_task`) — Exposes the functions of task debugging in an RTOS run-mode environment. Before a task is attached to, the object does not have `GHS_Window` attributes. However, you can still run some MULTI Debugger commands (such as run-control commands) on the object if the corresponding debug server supports them for unattached tasks.

  This class inherits from class `GHS_DebuggerWindow`.

  The `GHS_Task` functions are divided into the following sections:

  - "GHS_Task Basic Functions" on page 254
  - "GHS_Task Run-Control Functions" on page 256
- `GHS_TraceWindow` — Exposes the special functions of the MULTI Debugger's Trace List. This class inherits from class `GHS_Window`. See "GHS_TraceWindow Functions" on page 259.

## GHS_Debugger Functions

The following sections describe functions from class `GHS_Debugger`.

### __init__()

```
__init__(workingDir="")
```

Initializes the object attributes.

The argument is:

- `workingDir` — Stores the working directory of the MULTI service object.

### RunCommands()

```
RunCommands(cmds, block=True, printOutput=True)
```

Executes the specified MULTI Debugger commands and returns `True` on success and `False` on failure.

Arguments are:

- `cmds` — Specifies the MULTI Debugger commands to execute.
- `block` — If `True`, executes `RunCommands()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

Aliases are: `RunCommand()`, `RunCmd()`, `RunCmds()`, `ExecuteCmd()`, `ExecuteCmds()`, `ExecCmds()`, `ExecCmd()`

## GHS_DebuggerApi Debug Flag Functions

The following sections describe the functions from class `GHS_DebuggerApi` that relate to debug flags.

### ChangeBreakpointInheritance()

```
ChangeBreakpointInheritance(toggle=True, newStatus=False)
```

Enables or disables the option:

```
Inherit Software Breakpoint After Forking
```

for the current MULTI Debugger process. This option corresponds to the **P b** command. For more information, see the **P** command in Chapter 2, “General Debugger Command Reference” in the *MULTI: Debugging Command Reference* book.

This function returns `True` on success and `False` on failure.

Arguments are:

- `toggle` — If `True`, toggles the setting for the option, and ignores the new status. If `False`, does not toggle the setting.
- `newStatus` — If `True`, specifies that the option's new status is `On`. If `False`, specifies that the option's new status is `Off`.

Aliases are: `ChangeBpInheritance()`, `ChangeB()`

## ChangeDebugChildren()

```
ChangeDebugChildren(toggle=True, newStatus=False)
```

Enables or disables the option:

```
Debug Child Tasks/Processes
```

for the current MULTI Debugger process. This option corresponds to the **P c** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` on success and `False` on failure.

Arguments are:

- `toggle` — If `True`, toggles the setting for the option, and ignores the new status. If `False`, does not toggle the setting.
- `newStatus` — If `True`, specifies that the option's new status is `On`. If `False`, specifies that the option's new status is `Off`.

The alias is: `ChangeC()`

## ChangeDebugOnTaskCreation()

```
ChangeDebugOnTaskCreation(toggle=True, newStatus=False)
```

Enables or disables the option:

```
Debug on Task Creation
```

for the current MULTI Debugger process. This option corresponds to the **P d** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` on success and `False` on failure.

Arguments are:

- `toggle` — If `True`, toggles the setting for the option, and ignores the new status. If `False`, does not toggle the setting.
- `newStatus` — If `True`, specifies that the option's new status is `On`. If `False`, specifies that the option's new status is `Off`.

The alias is: `ChangeD()`

## ChangeHaltOnAttach()

```
ChangeHaltOnAttach(toggle=True, newStatus=False)
```

Enables or disables the option:

```
Halt on Attach
```

for the current MULTI Debugger process. This option corresponds to the **P h** command. For more information, see the **P** command in Chapter 2, “General Debugger Command Reference” in the *MULTI: Debugging Command Reference* book.

This function returns `True` on success and `False` on failure.

Arguments are:

- `toggle` — If `True`, toggles the setting for the option, and ignores the new status. If `False`, does not toggle the setting.
- `newStatus` — If `True`, specifies that the option's new status is `On`. If `False`, specifies that the option's new status is `Off`.

The alias is: `ChangeH()`

## ChangeInheritProcessBits()

```
ChangeInheritProcessBits(toggle=True, newStatus=False)
```

Enables or disables the option:

```
Inherit Process Bits in Child
```

for the current MULTI Debugger process. This option corresponds to the **P i** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` on success and `False` on failure.

Arguments are:

- `toggle` — If `True`, toggles the setting for the option, and ignores the new status. If `False`, does not toggle the setting.
- `newStatus` — If `True`, specifies that the option's new status is `On`. If `False`, specifies that the option's new status is `Off`.

The alias is: `ChangeI()`

## ChangeRunOnDetach()

```
ChangeRunOnDetach(toggle=True, newStatus=False)
```

Enables or disables the option:

```
Run on Detach
```

for the current MULTI Debugger process. This option corresponds to the **P r** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` on success and `False` on failure.

Arguments are:

- `toggle` — If `True`, toggles the setting for the option, and ignores the new status. If `False`, does not toggle the setting.
- `newStatus` — If `True`, specifies that the option's new status is `On`. If `False`, specifies that the option's new status is `Off`.

The alias is: `ChangeR()`

## ChangeStopAfterExec()

```
ChangeStopAfterExec(toggle=True, newStatus=False)
```

Enables or disables the option:

```
Stop After Exec
```

for the current MULTI Debugger process. This option corresponds to the **P e** command. For more information, see the **P** command in Chapter 2, “General Debugger Command Reference” in the *MULTI: Debugging Command Reference* book.

This function returns `True` on success and `False` on failure.

Arguments are:

- `toggle` — If `True`, toggles the setting for the option, and ignores the new status. If `False`, does not toggle the setting.
- `newStatus` — If `True`, specifies that the option's new status is `On`. If `False`, specifies that the option's new status is `Off`.

The alias is: `ChangeE`

## ChangeStopAfterFork()

```
ChangeStopAfterFork(toggle=True, newStatus=False)
```

Enables or disables the option:

```
Stop After Fork
```

for the current MULTI Debugger process. This option corresponds to the **P f** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` on success and `False` on failure.

Arguments are:

- `toggle` — If `True`, toggles the setting for the option, and ignores the new status. If `False`, does not toggle the setting.
- `newStatus` — If `True`, specifies that the option's new status is `On`. If `False`, specifies that the option's new status is `Off`.

The alias is: `ChangeF()`

## ChangeStopOnTaskCreation()

```
ChangeStopOnTaskCreation(toggle=True, newStatus=False)
```

Enables or disables the option:

```
Stop on Task Creation
```

for the current MULTI Debugger process. This option corresponds to the **P t** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` on success and `False` on failure.

Arguments are:

- `toggle` — If `True`, toggles the setting for the option, and ignores the new status. If `False`, does not toggle the setting.
- `newStatus` — If `True`, specifies that the option's new status is `On`. If `False`, specifies that the option's new status is `Off`.

The alias is: `ChangeT()`

## CheckBreakpointInheritance()

```
CheckBreakpointInheritance()
```

Checks if the option `Inherit Software Breakpoint After Forking` is enabled for the current MULTI Debugger process. This option corresponds to the **P b** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` if the option is enabled and `False` otherwise.

Aliases are: `CheckBpInheritance()`, `CheckB()`

## CheckDebugChildren()

```
CheckDebugChildren()
```

Checks if the option `Debug Child Tasks/Processes` is enabled for the current MULTI Debugger process. This option corresponds to the **P c** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` if the option is enabled and `False` otherwise.

The alias is: `CheckC()`

## CheckDebugOnTaskCreation()

```
CheckDebugOnTaskCreation()
```

Checks if the option `Debug on Task Creation` is enabled for the current MULTI Debugger process. This option corresponds to the **P d** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` if the option is enabled and `False` otherwise.

The alias is: `CheckD()`

## CheckHaltOnAttach()

```
CheckHaltOnAttach()
```

Checks if the option `Halt on Attach` is enabled for the current MULTI Debugger process. This option corresponds to the **P h** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` if the option is enabled and `False` otherwise.

The alias is: `CheckH()`

## CheckInheritProcessBits()

```
CheckInheritProcessBits()
```

Checks if the option `Inherit Process Bits in Child` is enabled for the current MULTI Debugger process. This option corresponds to the **P i** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` if the option is enabled and `False` otherwise.

The alias is: `CheckI()`

## CheckRunOnDetach()

```
CheckRunOnDetach()
```

Checks if the option `Run on Detach` is enabled for the current MULTI Debugger process. This option corresponds to the **P r** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` if the option is enabled and `False` otherwise.

The alias is: `CheckR()`

## CheckStopAfterExec()

```
CheckStopAfterExec()
```

Checks if the option `Stop After Exec` is enabled for the current MULTI Debugger process. This option corresponds to the **P e** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` if the option is enabled and `False` otherwise.

The alias is: `CheckE()`

## CheckStopAfterFork()

```
CheckStopAfterFork()
```

Checks if the option `Stop After Fork` is enabled for the current MULTI Debugger process. This option corresponds to the **P f** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` if the option is enabled and `False` otherwise.

The alias is: `CheckF()`

### CheckStopOnTaskCreation()

`CheckStopOnTaskCreation()`

Checks if the option `Stop on Task Creation` is enabled for the current MULTI Debugger process. This option corresponds to the **P t** command. For more information, see the **P** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.

This function returns `True` if the option is enabled and `False` otherwise.

The alias is: `CheckT()`

## GHS_DebuggerApi Host Information Functions

The following sections describe the functions from class `GHS_DebuggerApi` that relate to host information.

### GetHostOsName()

`GetHostOsName()`

Gets the host operating system name. This function returns a string for the host operating system name, or it returns an empty string (`""`) upon error.

The alias is: `HostOsName()`

### GetMultiVersion()

`GetMultiVersion(which=0)`

Gets the MULTI IDE's major, minor, or micro version and returns it. Versions are denoted in the following manner: *`major.minor.micro`*. For example, MULTI 1.2.3 indicates major version 1, minor version 2, and micro version 3.

The argument is:

- `which` — Specifies the version to return. You may specify:
  - 0 — Indicates the MULTI IDE's major version.

- 1 — Indicates the MULTI IDE's minor version.
- 2 — Indicates the MULTI IDE's micro version.

The alias is: `MultiVersion()`

## GHS_DebuggerApi Memory Access Functions

The following sections describe the memory access functions from class `GHS_DebuggerApi`.

### ReadIndirectValue()

```
ReadIndirectValue(addressPort, addressValue, valuePort,
addressSizeInBytes=4, valueSizeInBytes=4, printError=True)
```

Indirectly reads an integer from memory by writing a value to a memory location (`addressPort`) and then reading the value from another memory location (`valuePort`). This function returns the integer from memory, or it returns `0` upon error.

Arguments are:

- `addressPort` — Specifies the memory location where the value is written.
- `addressValue` — Specifies the value that is written to `addressPort`.
- `valuePort` — Specifies the memory location from which to read the value.
- `addressSizeInBytes` — Specifies the size of the value written to `addressPort`.
- `valueSizeInBytes` — Specifies the size of the value read from `valuePort`.
- `printError` — If `True`, prints error messages (if any). If `False`, does not print error messages.

Aliases are: `ReadIndirectInteger()`, `ReadIndirectInt()`, `ReadIndInt()`

## ReadIntegerFromMemory()

```
ReadIntegerFromMemory(address, sizeInBytes=4, printError=True)
```

Reads an integer from the specified memory location and returns the integer from memory or returns `0` upon failure.

Arguments are:

- `address` — Specifies the memory location.
- `sizeInBytes` — Specifies the size (in bytes) of the integer value. The supported sizes are: 1, 2 and 4.
- `printError` — If `True`, prints error messages (if any). If `False`, does not print error messages.

The alias is: `ReadInt()`

## ReadStringFromMemory()

```
ReadStringFromMemory(address, printError=True)
```

Reads a null-terminated string from the specified memory location and returns the string from memory or returns an empty string (`""`) upon failure.

Arguments are:

- `address` — Specifies the memory location.
- `printError` — If `True`, prints error messages (if any). If `False`, does not print error messages.

The alias is: `ReadStr`

## WriteIntegerToMemory()

```
WriteIntegerToMemory(address, value, sizeInBytes=4,
printError=True)
```

Writes an integer to the specified memory location and returns `True` on success and `False` on failure.

Arguments are:

- `address` — Specifies the memory location.
- `value` — Specifies the integer value to write.
- `sizeInBytes` — Specifies the size (in bytes) of `value`. The supported sizes are: 1, 2 and 4.
- `printError` — If `True`, prints error messages (if any). If `False`, does not print error messages.

The alias is: `WriteInt()`

### WriteStringToMemory()

```
WriteStringToMemory(address, stringValue, printError=True)
```

Writes a string to the specified memory location and returns `True` on success and `False` on failure.

Arguments are:

- `address` — Specifies the memory location.
- `stringValue` — Specifies the string value to write.
- `printError` — If `True`, prints error messages (if any). If `False`, does not print error messages.

Aliases are: `WriteString()`, `WriteStr()`

## GHS_DebuggerApi Run-Control Attributes and Functions

The following list describes class attributes for the status of MULTI Debugger processes:

- `status_nil` — Indicates that no program is loaded in the MULTI Debugger.
- `status_no_process` — Indicates that the program is not loaded on the target.
- `status_stopped` — Indicates that the program is stopped on the target.
- `status_running` — Indicates that the program is running on the target.

- `status_dying` — Indicates that the program is dying.
- `status_forking` — Indicates that the program is forking another process.
- `status_executing` — Indicates that the program just finished an `exec` operation.
- `status_continuing` — Indicates that the program is about to continue execution.
- `status_zombie` — Indicates that the program is zombied (that is, it has exited by calling `exit()`, but data structures describing the program still exist on the target).

The following sections describe the run-control functions from class `GHS_DebuggerApi`.

## DebugProgram()

```
DebugProgram(fileName, newWin=True, block=True,
printOutput=True, expandFileName=True)
```

Loads a program in the Debugger, replacing the currently selected target list entry or adding a new target list entry. On success, this function returns a `GHS_DebuggerWindow` object for the MULTI Debugger window. On failure, it returns `None`.

Arguments are:

- `fileName` — Specifies the program to be loaded in the Debugger.
- `newWin` — If `True`, adds a new target list entry. If `False`, replaces the currently selected target list entry.
- `block` — If `True`, executes `DebugProgram()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.
- `expandFileName` — If `True`, uses the Python context's current working directory to expand `fileName` into a complete file path. If `False`, directly transfers `fileName` to the corresponding service, which resolves the filename

with its current working directory if necessary. For more information, see the `expandFileName` description in “LoadWorkspaceFile()” on page 301.

Aliases are: `DebugProg()`, `Debug()`, `DebugFile()`

## GetPc()

```
GetPc()
```

Gets the PC value of the program being debugged. On success, this function returns the PC register's value. On error, it returns `-1`.

The alias is: `Pc()`

## GetProgram()

```
GetProgram()
```

Gets the name of the program being debugged and returns a string for the name, or returns an empty string (`""`) upon failure.

Aliases are: `DebuggedProgram()`, `ProgName()`

## GetStatus()

```
GetStatus()
```

Gets the MULTI process's status as a number and returns the number or returns `-1` upon error.

## GetTargetPid()

```
GetTargetPid()
```

Gets the ID of the process being debugged on the target. This function returns the ID, or it returns `0` upon error.

The alias is: `TargetPid()`

## Halt()

```
Halt(block=True, printOutput=True)
```

Halts the process currently being debugged on the target and returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `Halt()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

The alias is: `Stop()`

## IsHalted()

```
IsHalted()
```

Checks whether the process currently being debugged is halted on the target and returns `True` if yes, and `False` otherwise.

The alias is: `IsStopped()`

## IsRunning()

```
IsRunning()
```

Checks whether the process currently being debugged is running on the target and returns `True` if yes, and `False` otherwise.

## IsStarted()

```
IsStarted()
```

Checks whether the program being debugged has been loaded and started on the target. This function returns `True` if yes, and `False` otherwise.

The alias is: `HasChild()`

## Kill()

```
Kill(force=True, block=True, printOutput=True)
```

Kills the current process being debugged on the target. This function returns `True` on success and `False` on failure.

Arguments are:

- `force` — If `True`, forcefully kills the process. If `False`, does not forcefully kill the process.
- `block` — If `True`, executes `Kill()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

## Next()

```
Next(block=True, printOutput=True, stepIntoFunc=False)
```

Single-steps the process currently being debugged on the target, stepping over function calls by default. This function returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `Next()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.
- `stepIntoFunc` — If `True`, steps into functions when the current position is a function call. If `False`, steps over functions.

## Resume()

```
Resume(block=True, printOutput=True)
```

Resumes the process currently being debugged on the target. This function returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `Resume()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

The alias is: `Run()`

## Step()

```
Step(block=True, printOutput=True, stepIntoFunc=True)
```

Single-steps the process currently being debugged on the target, stepping into function calls by default. This function returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `Step()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.
- `stepIntoFunc` — If `True`, steps into functions when the current position is a function call. If `False`, steps over functions.

### WaitToStop()

```
WaitToStop(duration=-1.0, checkInterval=0.5)
```

Waits for the process being debugged to stop on the target. This function returns `True` if the process has stopped before the timeout, and it returns `False` otherwise.

Arguments are:

- `duration` — Specifies how long the function waits, if at all. The `duration` may be:
  - A negative number — Indicates that the function waits until the process is stopped on the target.
  - `0` — Indicates that the function does not wait at all.
  - A positive number — Specifies the maximum number of seconds that the function waits.
- `checkInterval` — Specifies the interval (in seconds) between status checks.

## GHS_DebuggerApi Symbol Functions

The following sections describe the functions from class `GHS_DebuggerApi` that relate to symbols.

### CheckSymbol()

```
CheckSymbol(symbolName="")
```

Checks whether a symbol exists in the MULTI Debugger process and returns `True` if yes and `False` otherwise.

The argument is:

- `symbolName` — Specifies the name of the symbol.

The alias is: `CheckSym()`

### GetSymbolAddress()

```
GetSymbolAddress(symbolName="")
```

Gets the memory address of a symbol in the MULTI Debugger process. This function returns the symbol's memory address, or it returns `0` upon error.

The argument is:

- `symbolName` — Specifies the name of the symbol.

The alias is: `GetSymAdr()`

### GetSymbolSize()

```
GetSymbolSize(symbolName="")
```

Gets a symbol's size if it exists. This function returns the size (in bytes) of the symbol, or it returns a `0` upon error.

The argument is:

- `symbolName` — Specifies the name of the symbol.

The alias is: `GetSymSize()`

## GHS_DebuggerApi Target Information Functions

The following sections describe the functions from class `GHS_DebuggerApi` that relate to target information.

### BigEndianTarget()

```
BigEndianTarget()
```

Checks whether the target is big endian or little endian. This function returns `True` if the target is big endian and `False` if it is little endian.

## GetCpuFamily()

```
GetCpuFamily(targetId=0)
```

Gets the target CPU family ID from the target ID. This function returns the target CPU family ID (see "GHS_TargetIds Functions" on page 253), or it returns `0` upon failure.

The argument is:

- `targetId` — Specifies the target ID. If `targetId` is `0`, the function gets the target ID by itself.

The alias is: `CpuFamily()`

## GetCpuMinor()

```
GetCpuMinor(targetId=0)
```

Gets the target CPU minor ID. This function returns the target CPU minor ID (see "GHS_TargetIds Functions" on page 253), or it returns `0` upon failure.

The argument is:

- `targetId` — Specifies the target ID. If `targetId` is `0`, the function gets the target ID by itself.

The alias is: `CpuMinor()`

## GetTargetCoProcessor()

```
GetTargetCoProcessor()
```

Gets the target coprocessor ID and returns the ID (see "GHS_TargetIds Functions" on page 253) or returns `0` upon failure.

The alias is: `CoProcessor()`

## GetTargetCpuFamilyName()

```
GetTargetCpuFamilyName()
```

Gets the target CPU family name, which is the same as the name used in the MULTI project file. This function returns the target CPU family name, or it returns an empty string (`""`) upon failure.

Aliases are: `GetCpuFamilyName()`, `GetCpuName()`, `CpuName()`

## GetTargetId()

```
GetTargetId()
```

Gets the target ID. This function returns the ID, or it returns a `0` upon failure. See the description of `_TARGET` in "System Variables" in Chapter 14, "Using Expressions, Variables, and Procedure Calls" in the *MULTI: Debugging* book.

## GetTargetOsMinorType()

```
GetTargetOsMinorType()
```

Gets the target operating system minor type. This function returns the minor type, or it returns a `0` upon error. For various minor types, see "GHS_OsTypes Attributes and Functions" on page 252.

Aliases are: `GetTargetOsMinor()`, `OsMinor()`

## GetTargetOsName()

```
GetTargetOsName(detail=True)
```

Gets the target operating system name, if any. This function returns the target operating system name, or it returns `"standalone"` for stand-alone programs. The returned string is the same as the name used in the MULTI project file.

The argument is:

- `detail` — If `True`, gets the detailed OS name, if any (for example, `linux`). If `False`, gets the generic OS name (for example, `unix`).

Aliases are: `GetOsName()`, `OsName()`

## GetTargetOsType()

```
GetTargetOsType()
```

Gets the target operating system type. This function returns the operating system type, or it returns `0` for stand-alone programs. For various operating system types, see "GHS_OsTypes Attributes and Functions" on page 252.

Aliases are: `GetTargetOs()`, `OsType()`

## GetTargetSeries()

```
GetTargetSeries()
```

Gets the target series ID. This function returns the ID, or it returns `0` upon failure.

Aliases are: `GetSeries()`, `Series()`

## IsFreezeMode()

```
IsFreezeMode()
```

Checks whether the MULTI Debugger is in a freeze-mode debugging environment and returns `True` if yes and `False` otherwise.

Aliases are: `IsStopMode()`, `StopMode()`

### IsNativeDebugging()

`IsNativeDebugging()`

Checks whether the program being debugged is for native debugging and returns `True` if yes and `False` otherwise.

Aliases are: `NativeDebugging()`, `NativeProg()`

### IsRunMode()

`IsRunMode()`

Checks whether the MULTI Debugger is in a run-mode debugging environment and returns `True` if yes and `False` otherwise.

Aliases are: `InRunMode()`, `RunMode()`

## GHS_DebuggerApi Window Display Functions

The following sections describe window display functions from class `GHS_DebuggerApi`. Additional `GHS_DebuggerApi` window display functions are documented in Chapter 10, “Connection Functions” on page 207.

### ShowOsaExplorerWindow()

`ShowOsaExplorerWindow(haltTargetIfNecessary=True, printOutput=True)`

Displays the **OSA Explorer**. On success, this function returns a `GHS_OsaWindow` object. Upon failure, it returns `None`.

Arguments are:

- `haltTargetIfNecessary` — If `True` and you are debugging in freeze mode, halts the target (launching the **OSA Explorer** in freeze mode requires that the target be halted via this argument setting). If `False` and you are debugging in freeze mode, this function fails. In run mode, this argument has no effect (the target is automatically halted if necessary).

- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

Aliases are: `ShowOsaExplorer()`, `ShowOsa()`

## ShowTaskManagerWindow()

```
ShowTaskManagerWindow()
```

In a run-mode debugging environment, displays the Task Manager (if any) for the debug server. In a freeze-mode debugging environment, displays the **OSA Explorer** if the target is halted.

Upon success in a run-mode environment, this function returns a `GHS_TaskManagerWindow` object. Upon success in a freeze-mode environment, it returns a `GHS_OsaWindow` object. Upon failure, it returns `None`.

Aliases are: `ShowTaskWindow()`, `ShowTaskWin()`, `TaskWindow()`, `TaskWin()`

## ShowTraceWindow()

```
ShowTraceWindow(printOutput=True)
```

Displays the **Trace List**. On success, this function returns a `GHS_TraceWindow` object. Upon failure, it returns `None`.

The argument is:

- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

The alias is: `ShowTraceWin()`

## GHS_DebuggerWindow Basic Functions

The following section describes the function from class `GHS_DebuggerWindow`.

### RunCommands()

```
RunCommands(cmds, block=True, printOutput=True)
```

Runs commands and returns `True` on success and `False` on failure.

Arguments are:

- `cmds` — Specifies the commands to be executed.
- `block` — If `True`, executes `RunCommands()` in blocked mode and grabs the output, if any. If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

Aliases are: `RunCommand()`, `RunCmd()`, `RunCmds()`

## GHS_DebuggerWindow Breakpoint Functions

The following sections describe the breakpoint functions from class `GHS_DebuggerWindow`.

### RemoveBreakpoint()

```
RemoveBreakpoint(location="", grabOutput=False)
```

Removes software breakpoint set at the specified location. If you do not specify a location, all software breakpoints set in the MULTI Debugger window are removed. This function returns `True` on success and `False` on failure.

Arguments are:

- `location` — Specifies the location of the breakpoint that is removed.

- `grabOutput` — If `True`, executes `RemoveBreakpoint()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.

Aliases are: `RemoveBp()`, `RmBp()`

## SetBreakpoint()

```
SetBreakpoint(location="", bpType="", grabOutput=False)
```

Sets a non-group software breakpoint at the specified location and returns `True` on success and `False` on failure.

Arguments are:

- `location` — Specifies the location where the breakpoint is set.
- `bpType` — Specifies a string such as `"at"` for the breakpoint type.
- `grabOutput` — If `True`, executes `SetBreakpoint()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.

The alias is: `SetBp()`

## SetGroupBreakpoint()

```
SetGroupBreakpoint(location="", hitGrp="", haltGrp="",
grabOutput=False)
```

Sets a group breakpoint at the specified location. (For information about group breakpoints, see “Group Breakpoints” in Chapter 25, “Run-Mode Debugging” in the *MULTI: Debugging* book.) This function returns `True` on success and `False` on failure.

Arguments are:

- `location` — Specifies the location where the breakpoint is set.

- `hitGrp` — Specifies the name of the group whose tasks are able to hit the breakpoint. If you do not specify a group, a group consisting only of the current task is used.
- `haltGrp` — Specifies the name of the group to halt. If you do not specify a group, a group consisting only of the current task is used.
- `grabOutput` — If `True`, executes `SetGroupBreakpoint()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.

The alias is: `SetGrpBp()`

## ShowBreakpoints()

```
ShowBreakpoints(block=True, printOutput=True)
```

Shows information about all software breakpoints visible in the MULTI Debugger window. This function returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `ShowBreakpoints()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `ShowBps()`

## ShowBreakpointWindow()

```
ShowBreakpointWindow(block=True)
```

Displays the **Breakpoints** window. If this function is executed successfully and the `block` argument is `True`, the function returns a `GHS_Window` object for the **Breakpoints** window. If this function fails or if the `block` argument is `False`, the function returns `None`.

The argument is:

- `block` — If `True`, executes `ShowBreakpointWindow()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.

The alias is: `ShowBpWin()`

## GHS_DebuggerWindow Print Functions

The following sections describe the print functions from class `GHS_DebuggerWindow`.

### DumpToFile()

```
DumpToFile(fileName="", block=True, printOutput=True)
```

Writes the contents of the Debugger's source pane into a text file. This function returns `True` on success and `False` on failure.

Arguments are:

- `fileName` — Specifies the name of the file to write to. If you do not specify a filename, the Debugger opens a file chooser from which you can select a file.
- `block` — If `True`, executes `DumpToFile()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

### PrintFile()

```
PrintFile(block=True, printOutput=True)
```

Prints the entire source file currently being viewed in the Debugger window. This function returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `PrintFile()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `Print()`

### PrintWindow()

```
PrintWindow(block=True, printOutput=True)
```

Prints the contents currently being viewed in the Debugger window. This function returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `PrintWindow()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `PrintWin()`

## GHS_MemorySpaces Attributes and Functions

Class `GHS_MemorySpaces` defines the general memory space IDs used in the MULTI Debugger and in debug servers.

The following list describes the attributes of this class:

- `MSPACE_DEFAULT` — Stores the ID for the default memory space.
- `MSPACE_TEXT_DEFAULT` — Stores the ID for the code's default memory space.
- `MSPACE_DATA_DEFAULT` — Stores the ID for the data's default memory space.

- `MSPACE_TEXT_PHYSICAL` — Stores the ID for the code's physical memory space.
- `MSPACE_DATA_PHYSICAL` — Stores the ID for the data's physical memory space.
- `MSPACE_DATA_RAWMEMORY` — Stores the ID for a special memory space that instructs the MULTI Debugger to bypass all caches and read/write directly from/to memory.

The following section describes the function from class `GHS_MemorySpaces`.

### __init__()

```
__init__()
```

Initializes object attributes.

## GHS_OsTypes Attributes and Functions

Class `GHS_OsTypes` defines the operating system IDs supported in the MULTI Debugger.

The following list describes the attributes of this class. Major OS types are:

- `OS_9K` — Stores the ID for the 9k real-time operating system.
- `OS_ALPHA` — Stores the ID for the Alpha operating system.
- `OS_GENERIC` — Stores the ID for generic real-time operating systems.
- `OS_INTEGRITY` — Stores the ID for the INTEGRITY real-time operating system.
- `OS_MERCURY` — Stores the ID for the Mercury real-time operating system.
- `OS_MULTICORE` — Stores the ID for the general multi-core system.
- `OS_NUCLEUS` — Stores the ID for the Nucleus real-time operating system.
- `OS_NULL` — Stores the ID for stand-alone programs.
- `OS_THREADX` — Stores the ID for the ThreadX real-time operating system.
- `OS_UNIX` — Stores the ID for the UNIX or UNIX-like operating system.

- `OS_VXWORKS` — Stores the ID for the VxWorks real-time operating system.
- `OS_WINDOWS` — Stores the ID for the Windows operating system.

Minor OS types are:

- `OS_MINOR_NUL` — Stores the ID for the trivial minor OS type.
- `OS_MINOR_UNIX_LINUX` — Stores the ID for the Linux operating system.
- `OS_MINOR_UNIX_LYNXOS` — Stores the ID for the LynxOS operating system.

The following section describes the function from class `GHS_OsTypes`.

### __init__()

```
__init__()
```

Initializes object attributes.

## GHS_TargetIds Functions

Class `GHS_TargetIds` defines the target IDs supported in the MULTI Debugger. About 500 such IDs exist. To view a complete list of target IDs and function names, enter the following statement:

```
Python> ghs_printobject(dir(targetIds))
```

You can use an ID to get its value. For example:

```
Python> hex(targetIds.XSCALE_IXP2350)
```

gets the value (in hex) for `XSCALE_IXP2350`.

**Note**

The values are constant; do not change them.

The following section describes the function from class `GHS_TargetIds`.

### __init__()

```
__init__()
```

Initializes object attributes.

## GHS_Task Basic Functions

The following sections describe the basic functions from class `GHS_Task`.

### __init__()

```
__init__(dbcomponent, addressSpace, taskIdOrName,
taskComponent="", wn="", wid="0", cn="", regSvcName="")
```

Initializes the object attributes.

Arguments are:

- `dbcomponent` — Stores the component name of the debug server.
- `addressSpace` — Stores the name of the address space that contains the task.
- `taskIdOrName` — Stores the ID or the name of the task.
- `taskComponent` — Stores the component name of the task.
- `wn` — Stores the name of the Debugger window in which the task is being debugged.
- `wid` — Stores the ID of the Debugger window in which the task is being debugged.
- `cn` — Stores the class name of the Debugger window in which the task is being debugged.
- `regSvcName` — Stores the register service name of the Debugger window in which the task is being debugged.

## RunCommands()

```
RunCommands(cmds, block=True, printOutput=True)
```

Executes MULTI Debugger commands via the corresponding Debugger window if the task is attached, or via the corresponding debug server otherwise. This function returns `True` on success and `False` on failure.

Arguments are:

- `cmds` — Specifies the MULTI Debugger commands.
- `block` — If `True`, executes `RunCommands()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

Aliases are: `RunCommand()`, `RunCmd()`, `RunCmds()`

## RunCommandsViaDebugServer()

```
RunCommandsViaDebugServer(cmds, block=True, printOutput=True)
```

Executes MULTI Debugger commands via the corresponding debug server. This function returns `True` on success and `False` on failure.

Arguments are:

- `cmds` — Specifies the MULTI Debugger commands.
- `block` — If `True`, executes `RunCommandsViaDebugServer()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

Aliases are: `RunCmdViaDebugServer()`, `RunCmdViaDbserv()`

## GHS_Task Run-Control Functions

The following sections describe the run-control functions from class `GHS_Task`.

### Attach()

```
Attach(flags="", block=True, printOutput=True)
```

Attaches to the task and returns a string for the task's component ID.

Arguments are:

- `flags` — Specifies options to the MULTI Debugger **attach** command. For available options, see the **attach** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book.
- `block` — If `True`, executes `Attach()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

### Detach()

```
Detach(flags="", block=False, printOutput=True)
```

Detaches from the task and returns `True` on success and `False` on failure.

Arguments are:

- `flags` — Specifies options to the MULTI Debugger **detach** command. For available options, see the **detach** command in Chapter 2, "General Debugger Command Reference" in the *MULTI: Debugging Command Reference* book
- `block` — If `True`, executes `Detach()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

## Halt()

```
Halt(block=True, printOutput=True)
```

Halts execution of the task. If the task is not attached and the debug server does not support halting without attaching, the operation fails. This function returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `Halt()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

The alias is: `Stop()`

## Next()

```
Next(block=True, printOutput=True, stepIntoFunc=False)
```

Single-steps the task, stepping over function calls by default. If the task is not attached and the debug server does not support resuming without attaching, the operation fails. This function returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `Next()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.
- `stepIntoFunc` — If `True`, steps into functions when the current position is a function call. If `False`, steps over functions.

## Resume()

```
Resume(block=True, printOutput=True)
```

Resumes execution of the task. If the task is not attached and the debug server does not support resuming without attaching, the operation fails. This function returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `Resume()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output. If `False`, does not print the output.

The alias is: `Run()`

## Step()

```
Step(block=True, printOutput=True, stepIntoFunc=True)
```

Single-steps the task, stepping into function calls by default. If the task is not attached and the debug server does not support resuming without attaching, the operation fails. This function returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `Step()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.
- `stepIntoFunc` — If `True`, steps into functions when the current position is a function call. If `False`, steps over functions.

# GHS_TraceWindow Functions

The following sections describe functions from class `GHS_TraceWindow`.

## FlushTraceBuffer()

```
FlushTraceBuffer(block=True)
```

Flushes the trace buffer on the target. This function returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `FlushTraceBuffer()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

The alias is: `FlushTraceBuf()`

## JumpToTrigger()

```
JumpToTrigger(block=True)
```

Jumps to the trigger and returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `JumpToTrigger()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

## StartTracing()

```
StartTracing(block=True)
```

Starts the collection of trace data and returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `StartTracing()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

Aliases are: `StartTrace()`, `TraceOn()`

## StopTracing()

`StopTracing(block=True)`

Stops the collection of trace data and returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `StopTracing()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

Aliases are: `StopTrace()`, `TraceOff()`

# Chapter 12

# Editor Functions

## Contents

This chapter documents functions from the following classes:

- `GHS_Editor` (alias `ghs_editor`) — Exposes the basic functions of the MULTI Editor service. This class inherits from class `GHS_IdeObject`. See "GHS_Editor Functions" on page 262.
- `GHS_EditorWindow` — Exposes additional functions of the MULTI Editor. This class inherits from class `GHS_Window`.

  The `GHS_EditorWindow` functions are divided into the following sections:
  - "GHS_EditorWindow Edit Functions" on page 264
  - "GHS_EditorWindow File Functions" on page 267
  - "GHS_EditorWindow Selection and Cursor Functions" on page 269
  - "GHS_EditorWindow Version Control Functions" on page 272

## GHS_Editor Functions

The following sections describe functions from class `GHS_Editor`.

### __init__()

```
__init__(serviceName="Editor.Multi", workingDir="")
```

Initializes the object attributes.

Arguments are:

- `serviceName` — Stores the MULTI IDE service name.
- `workingDir` — Stores the working directory of the MULTI service object.

### EditFile()

```
EditFile(fileName, reuseEditorWindow=True, expandFileName=True)
```

Loads a file into a MULTI Editor window. On success, this function returns a `GHS_EditorWindow` object for the MULTI Editor window. On failure, it returns `None`.

Arguments are:

- `fileName` — Specifies the name of the file. If `fileName` is an empty string (`""`), the MULTI Editor opens a file chooser from which you can select a file.
- `reuseEditorWindow` — If `True`, reuses an existing MULTI Editor window. If `False`, does not reuse an existing window. If the file is already loaded into a MULTI Editor window, the file becomes the current file in the window.
- `expandFileName` — If `True`, uses the Python context's current working directory to expand `fileName` into a complete file path. If `False`, directly transfers `fileName` to the corresponding service, which resolves the filename with its current working directory if necessary. For more information, see the `expandFileName` description in "LoadWorkspaceFile()" on page 301.

Aliases are: `OpenFile()`, `Open()`

## GotoLine()

```
GotoLine(fileName, lineNo, reuseEditorWindow=True,
expandFileName=True)
```

Loads a file into a MULTI Editor window and moves the cursor to the specified line. On success, this function returns a `GHS_EditorWindow` object for the MULTI Editor window. On failure, it returns `None`.

The argument that is unique to this function is:

- `lineNo` — Specifies the line number to go to.

For other argument descriptions, see "EditFile()" on page 262.

The alias is: `Goto()`

## GHS_EditorWindow Edit Functions

The following sections describe the edit functions from class `GHS_EditorWindow`.

### AddString()

```
AddString(dataStr="", pos=0)
```

Adds a text string to the file that is open in the Editor. This function returns `True` on success and `False` on failure.

Arguments are:

- `dataStr` — Specifies the text string to add.
- `pos` — Indicates the position where the string is added. This argument may be:
  - `-1` — Adds the string to the beginning of the file.
  - `0` — Adds the string to the current cursor position. If there is a selection, the selection is replaced by the string.
  - `1` — Adds the string to the end of the file.

The alias is: `AddStr()`

### Copy()

```
Copy(which=1)
```

Copies the selected string to the clipboard and returns `True` on success and `False` on failure.

The argument is:

- `which` — Indicates which clipboard to use. For more information, see "Clipboard Commands" in Appendix B, "Editor Commands" in the *MULTI: Managing Projects and Configuring the IDE* book.

## Cut()

```
Cut(which=1)
```

Cuts the selected string and stores it on the clipboard. This function returns `True` on success and `False` on failure.

The argument is:

- `which` — Indicates which clipboard to use. For more information, see "Clipboard Commands" in Appendix B, "Editor Commands" in the *MULTI: Managing Projects and Configuring the IDE* book.

## GetTextLines()

```
GetTextLines(removeCrs=True)
```

Returns a list of strings for the text in the Editor window. Each string in the list corresponds to a line in the Editor window. An empty list is returned upon error.

The argument is:

- `removeCrs` — If `True`, removes carriage return characters (if any). If `False`, does not remove carriage return characters.

Aliases are: `TextLines()`, `Lines()`

## GetTextString()

```
GetTextString()
```

Returns a string for the text in the Editor window. An empty string (`""`) is returned upon error.

Aliases are: `TextString()`, `TextStr()`

## Paste()

```
Paste(which=1, waitingTime=1.0)
```

Pastes the clipboard contents to the current cursor position. This function returns `True` on success and `False` on failure.

Arguments are:

- `which` — Indicates which clipboard to use. For more information, see "Clipboard Commands" in Appendix B, "Editor Commands" in the *MULTI: Managing Projects and Configuring the IDE* book.
- `waitingTime` — Specifies the maximum number of seconds to wait for the paste operation to finish.

  On Linux/Solaris, the MULTI Editor pastes a string in two parts:

  1. It asks the X server to convert the selection.
  2. It performs the paste on the X server's selection notification.

  The Editor's **Paste** command returns immediately after the first part is done, even when the function is executed in blocked mode. Specifying a wait period allows the second part of the paste to finish.

## Redo()

```
Redo()
```

Restores the edit that was reversed by `Undo()` (see "Undo()" on page 266). This function returns `True` on success and `False` on failure.

## Undo()

```
Undo()
```

Reverses the last change made to the current file and returns `True` on success and `False` on failure.

# GHS_EditorWindow File Functions

The following sections describe the file functions from class `GHS_EditorWindow`.

## CloseCurrentFile()

```
CloseCurrentFile()
```

Closes the file currently displayed in the MULTI Editor window and returns `True` on success and `False` on failure.

Aliases are: `CloseCurFile()`, `CloseFile()`

## GotoNextFile()

```
GotoNextFile()
```

Cycles to the next buffered file. The MULTI Editor keeps a circular list of loaded files, and you can navigate to each of them (that is, display the file in the MULTI Editor window). This function returns `True` on success and `False` on failure.

The alias is: `NextFile()`

## GotoPrevFile()

```
GotoPrevFile()
```

Cycles to the previous buffered file. The MULTI Editor keeps a circular list of loaded files, and you can navigate to each of them (that is, display the file in the MULTI Editor window). This function returns `True` on success and `False` on failure.

The alias is: `PrevFile()`

## OpenFile()

```
OpenFile(fileName="", newWindow=False, block=True)
```

Loads a file into a MULTI Editor window. On success, this function returns a `GHS_EditorWindow` object for the MULTI Editor window. On failure, it returns `None`.

Arguments are:

- `fileName` — Specifies the name of the file. If `fileName` is an empty string (`""`), the MULTI Editor opens a file chooser from which you can select a file.
- `newWindow` — If `True`, opens a new MULTI Editor window. If `False`, reuses an existing MULTI Editor window.
- `block` — If `True`, executes `OpenFile()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

Aliases are: `EditFile()`, `LoadFile()`, `Open()`

## SaveAsFile()

```
SaveAsFile(fileName="")
```

Saves the current file (including changes) to another file. This function returns `True` on success and `False` on failure.

The argument is:

- `fileName` — Specifies the name of the file to save to. If `fileName` is an empty string (`""`), the MULTI Editor saves changes to the current file into the same file (that is, it performs a save rather than a save as).

The alias is: `SaveAs()`

### SaveIntoFile()

```
SaveIntoFile()
```

Saves changes to the current file and returns `True` on success and `False` on failure.

Aliases are: `SaveFile()`, `Save()`

## GHS_EditorWindow Selection and Cursor Functions

The following sections describe the selection and cursor-related functions from class `GHS_EditorWindow`.

### FlashCursor()

```
FlashCursor()
```

Makes the location of the cursor obvious by flashing the line where it is located. This function returns `True` on success and `False` on failure.

The alias is: `Flash()`

### GetSelection()

```
GetSelection(printRes=False, getGuiPos=True)
```

Gets the selection range and returns a tuple with the following components:

```
(BeginLine, BeginColumn, EndLine, EndColumn)
```

The following tuple is returned upon error:

```
(-1, -1, -1, -1)
```

Line numbering starts at 1. Column numbering starts at 1 for GUI positions and at 0 for string positions.

Arguments are:

- `printRes` — If `True`, prints the selection range. If `False`, does not print the selection range.
- `getGuiPos` — If `True`, the `BeginColumn` and `EndColumn` values correspond to the one-based column positions displayed in the MULTI Editor status bar. A **Tab** is counted as the number of characters configured for the **Tab** width.

  If `False`, the `BeginColumn` and `EndColumn` values are string indices, which are zero-based. A **Tab** is counted as one character.

The alias is: `GetSel()`

## GetSelectedString()

```
GetSelectedString(printRes=False)
```

Gets the selected string. This function returns the string, or it returns an empty string (`""`) upon failure.

The argument is:

- `printRes` — If `True`, prints the selected string. If `False`, does not print the selected string.

The alias is: `GetSelStr()`

## MoveCursor()

```
MoveCursor(line=1, col=1, flash=True)
```

Moves the cursor to the specified position and returns `True` on success and `False` on failure.

Arguments are:

- `line` — Specifies the number of the line where you want to move the cursor. A 0 (zero) or a negative value indicates the end of the file.

- `col` — Specifies the number of the column where you want to move the cursor. The cursor is moved before the specified column. `col` is a GUI position (one-based, starting from the left-most column). A 0 (zero) or a negative value indicates the end of the line.

The alias is: `MoveTo()`

## SelectAll()

```
SelectAll()
```

Selects all the content in the MULTI Editor window and returns `True` on success and `False` on failure.

The alias is: `SelAll()`

## SelectRange()

```
SelectRange(beginLine=-1, beginCol=-1, endLine=-1, endCol=-1,
guiPos=True)
```

Selects a range and returns `True` on success and `False` on failure.

Arguments are:

- `beginLine` — Specifies the number of the line where the selection begins. A 0 (zero) or a negative value indicates the first line.
- `beginCol` — Specifies the number of the column where the selection begins. A 0 (zero) or a negative value indicates the first column.
- `endLine` — Specifies the number of the line where the selection ends. A 0 (zero) or a negative value indicates the end of the file.
- `endCol` — Specifies the number of the column where the selection ends. A 0 (zero) or a negative value indicates the end of the line.
- `guiPos` — If `True`, interprets `beginCol` and `endCol` as corresponding to the one-based column positions displayed in the MULTI Editor status bar. A **Tab** is counted as the number of characters configured for the **Tab** width.

If `False`, `beginCol` and `endCol` are interpreted as string indices, which are zero-based. A **Tab** is counted as one character.

Aliases are: `SelRange()`, `Select()`, `Sel()`

## GHS_EditorWindow Version Control Functions

The following sections describe the version control functions from class `GHS_EditorWindow`.

### Checkin()

`Checkin()`

Checks the current file into version control and returns `True` on success and `False` on failure.

### Checkout()

`Checkout()`

Checks the current file out of version control and returns `True` on success and `False` on failure.

### PlaceUnderVC()

`PlaceUnderVC()`

Places the current file under version control and returns `True` on success and `False` on failure.

The alias is: `PlaceIntoVC()`

# Chapter 13

# EventAnalyzer Functions

## Contents

This chapter documents functions from the following classes:

- `GHS_EventAnalyzer` (alias `ghs_eventanalyzer`) — Exposes the basic functions of the MULTI EventAnalyzer service. This class inherits from class `GHS_IdeObject`. See "GHS_EventAnalyzer Functions" on page 274.

  **Note**

  When all MULTI EventAnalyzer windows opened on an instance of the class are closed, the instance of the service automatically shuts down, even if a Python object holds a reference to it.

- `GHS_EventAnalyzerWindow` — Exposes additional functions of the MULTI EventAnalyzer. This class inherits from class `GHS_Window`.

  The `GHS_EventAnalyzerWindow` functions are divided into the following sections:

  
  - "GHS_EventAnalyzerWindow File Functions" on page 277
  - "GHS_EventAnalyzerWindow View and Selection Functions" on page 278
  - "GHS_EventAnalyzerWindow Miscellaneous Functions" on page 282
  

For more information about the EventAnalyzer, see the *EventAnalyzer User's Guide*.

## GHS_EventAnalyzer Functions

The following sections describe functions from class `GHS_EventAnalyzer`.

### __init__()

```
__init__(workingDir="")
```

Initializes the object attributes.

The argument is:

- `workingDir` — Stores the working directory of the MULTI service object.

## CloseFile()

```
CloseFile(dataFile)
```

Closes the MULTI EventAnalyzer window displaying the specified event data file. This function returns `True` on success and `False` on failure.

The argument is:

- `dataFile` — Specifies the name of the event data file.

## GetFileList()

```
GetFileList(showThem=True, onlyShowBaseName=False)
```

Gets a list of the data files displayed in MULTI EventAnalyzer windows. On success, this function returns a list of strings for the data files. On failure, it returns an empty list.

Arguments are:

- `showThem` — If `True`, displays the filenames. If `False`, does not display the filenames.
- `onlyShowBaseName` — If `True`, only displays the base names. If `False`, displays the full path to the filename.

Aliases are: `GetFiles()`, `Files()`

## OpenFile()

```
OpenFile(dataFile="", title=None, newWin=True, raiseWin=True,
reloadData=True)
```

Displays an event data file in the MULTI EventAnalyzer. On success, the function returns a `GHS_EventAnalyzerWindow` object for the MULTI EventAnalyzer window. On failure, it returns `None`.

Arguments are:

- `dataFile` — Specifies the name of the event data file.

- `title` — Specifies a title for the MULTI EventAnalyzer window.
- `newWin` — If `True`, displays the event data file in a new MULTI EventAnalyzer window. If `False`, reuses an existing MULTI EventAnalyzer window.
- `raiseWin` — If `True`, brings the reused EventAnalyzer to the foreground. If `False`, does not bring the EventAnalyzer to the foreground. This argument is only applicable if `newWin` is `False`.
- `reloadData` — If `True`, reloads the data file. If `False`, does not reload the data file. This argument is only applicable if `newWin` is `False`.

The alias is: `Open()`

## ScrollToPosition()

```
ScrollToPosition(dataFile, timeValue, newWin=True,
raiseWin=True, newWinIfNotExist=True, reloadData=True, oid=0)
```

Displays an event data file in the MULTI EventAnalyzer window and scrolls to the specified position. On success, this function returns a `GHS_EventAnalyzerWindow` object for the MULTI EventAnalyzer window. On failure, it returns `None`.

Arguments that are unique to this function are:

- `timeValue` — Specifies the time (in seconds or ticks) that you want to scroll to.
- `newWinIfNotExist` — If `True`, displays the event data file in a new MULTI EventAnalyzer window when the data file is not being shown in an existing MULTI EventAnalyzer window. If `False`, reuses an existing MULTI EventAnalyzer window.
- `oid` — Specifies the ID of the task, thread, etc. that you want to scroll to.

For other argument descriptions, see “OpenFile()” on page 275.

Aliases are: `ScrollTo()`, `MoveTo()`

# GHS_EventAnalyzerWindow File Functions

The following sections describe the file functions from class `GHS_EventAnalyzerWindow`.

## CloseFile()

```
CloseFile(block=True, printOutput=True)
```

Closes the file displayed in the MULTI EventAnalyzer window and returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `CloseFile()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

## OpenFile()

```
OpenFile(fileName="", block=True, printOutput=True)
```

Displays an event file in the MULTI EventAnalyzer window. This function returns `True` on success and `False` on failure.

Arguments are:

- `fileName` — Specifies the name of the file.
- `block` — If `True`, executes `OpenFile()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `LoadFile()`

## GHS_EventAnalyzerWindow View and Selection Functions

The following sections describe the functions from class `GHS_EventAnalyzerWindow` that relate to viewing and selecting information in the MULTI EventAnalyzer.

### GotoFirstView()

```
GotoFirstView(block=True, printOutput=True)
```

Displays the earliest view in the history and returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `GotoFirstView()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `FirstView()`

### GotoLastView()

```
GotoLastView(block=True, printOutput=True)
```

Displays the latest view in the history and returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `GotoLastView()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `LastView()`

## GotoNextView()

```
GotoNextView(block=True, printOutput=True)
```

Displays the next view in the history and returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `GotoNextView()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `NextView()`

## GotoPrevView()

```
GotoPrevView(block=True, printOutput=True)
```

Displays the previous view in the history and returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `GotoPrevView()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `PrevView()`

## SelectRange()

```
SelectRange(begin, end, unit="")
```

Selects a range in the MULTI EventAnalyzer window. This function returns `True` on success and `False` on failure.

Arguments are:

- `begin` — Specifies the range's starting time.
- `end` — Specifies the range's ending time.
- `unit` — Specifies the time unit used for the range. Valid `unit` values are:
  - `s` — seconds
  - `ms` — milliseconds
  - `us` — microseconds
  - `ns` — nanoseconds

  If you do not specify a time unit, `begin` and `end` are assumed to be in seconds unless the event data does not include timestamps. In this case, ticks are used.

Aliases are: `SelRange()`, `Select()`, `Sel()`

## ToggleFlatView()

```
ToggleFlatView(block=True, printOutput=True)
```

Toggles the object list between hierarchy and flat view. If the object list has no hierarchy, the operation has no effect. This function returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `ToggleFlatView()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `FlatView()`

## ViewRange()

```
ViewRange(begin, end, unit="")
```

Allows you to view a range in the MULTI EventAnalyzer window. This function returns `True` on success and `False` on failure.

Arguments are:

- `begin` — Specifies the range's starting time.
- `end` — Specifies the range's ending time.
- `unit` — Specifies the time unit used for the range. For more information, see "SelectRange()" on page 280.

The alias is: `View()`

## ZoomIn()

```
ZoomIn()
```

Zooms in on the MULTI EventAnalyzer window by a factor of 2. This function returns `True` on success and `False` on failure.

## ZoomOut()

```
ZoomOut()
```

Zooms out from the MULTI EventAnalyzer window by a factor of 2. This function returns `True` on success and `False` on failure.

## ZoomToSelection()

```
ZoomToSelection()
```

Zooms in on the current selection in the MULTI EventAnalyzer window. This function returns `True` on success and `False` on failure.

Aliases are: `ZoomToSel()`, `ZoomSel()`

## GHS_EventAnalyzerWindow Miscellaneous Functions

The following sections describe the miscellaneous functions from class `GHS_EventAnalyzerWindow`.

### AutoTimeUnit()

```
AutoTimeUnit(toggle=True, auto=True)
```

Changes how the time unit is determined. This function returns `True` on success and `False` on failure.

Arguments are:

- `toggle` — If `True`, toggles between automatically adjusting the time unit and requiring you to manually change the time unit. If `False`, does not toggle these settings.
- `auto` — If `True`, the EventAnalyzer automatically adjusts to an appropriate time unit whenever the view is changed. If `False`, you must manually set the time unit. This argument is only effective when `toggle` is `False`.

The alias is: `AutoUnit()`

### ChangeTimeUnit()

```
ChangeTimeUnit(unit="", gui=False)
```

Changes the time unit. This function returns `True` on success and `False` on failure.

Arguments are:

- `unit` — Specifies the time unit of the range. If you do not specify a time unit, `unit` is set to the next larger time unit. For more information, see "SelectRange()" on page 280.
- `gui` — If `True`, displays a dialog box from which you can choose a time unit. If `False`, does not display a dialog box.

Aliases are: `ChangeUnit()`, `Unit()`

## NewWindow()

```
NewWindow()
```

Opens a new MULTI EventAnalyzer window. On success, this function returns a `GHS_EventAnalyzerWindow` object for the MULTI EventAnalyzer window. On failure, it returns `None`.

The alias is: `NewWin()`

## SaveMevConfiguration()

```
SaveMevConfiguration(block=True, printOutput=True)
```

Saves configuration changes to the configuration file. This function returns `True` on success and `False` on failure.

Arguments are:

- `block` — If `True`, executes `SaveMevConfiguration()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `SaveMevConfig()`

## ShowLegend()

```
ShowLegend()
```

Displays the **Legend** window and returns `True` on success and `False` on failure.

The alias is: `Legend()`

# Chapter 14

# Launcher Functions

## Contents

This chapter documents functions from the following utility classes:

- `GHS_Action` — Stores information for an action. This class inherits from `object` and is a utility class for `GHS_LauncherWindow`. See "GHS_Action Attributes and Functions" on page 287.
- `GHS_ActionSequence` — Stores information for an action sequence. This class inherits from `object` and is a utility class for `GHS_LauncherWindow`. See "GHS_ActionSequence Attributes and Functions" on page 288.
- `GHS_Variable` — Stores information for a Launcher variable. This class inherits from `object` and is a utility class for `GHS_LauncherWindow`. See "GHS_Variable Attributes and Functions" on page 289.
- `GHS_Workspace` — Stores information for a workspace. This class inherits from `object` and is a utility class for `GHS_LauncherWindow`. See "GHS_Workspace Attributes and Functions" on page 290.

This chapter also covers functions from classes:

- `GHS_Launcher` (alias `ghs_launcher`) — Exposes the basic functions of the MULTI Launcher service. This class inherits from class `GHS_LauncherWindow` because the MULTI Launcher service is always associated with a GUI window. See "GHS_Launcher Functions" on page 294.
- `GHS_LauncherWindow` — Exposes the functions of the MULTI Launcher. This class inherits from class `GHS_Window`. The `GHS_LauncherWindow` functions are divided into the following sections:
  - "GHS_LauncherWindow Action Execution Functions" on page 294
  - "GHS_LauncherWindow Action Manipulation Functions" on page 297
  - "GHS_LauncherWindow Workspace Manipulation Functions" on page 299
  - "GHS_LauncherWindow Variable Functions" on page 304

# GHS_Action Attributes and Functions

Class `GHS_Action` stores information for an action.

The following list describes the attributes of this class:

- `name` — Stores the action type (for example, `Editor` or `Python Statement`). For more action types, see "Creating or Modifying an Action" in Chapter 3, "Managing Workspaces and Shortcuts with the Launcher" in the *MULTI: Managing Projects and Configuring the IDE* book.
- `args` — Stores action arguments. The validity of an argument depends on the value of `name`. For example, an `Editor` action may take a file path or a filename as an argument, while a `Python Statement` may accept a Python statement as an argument. For more information, see "Creating or Modifying an Action" in Chapter 3, "Managing Workspaces and Shortcuts with the Launcher" in the *MULTI: Managing Projects and Configuring the IDE* book.
- `enabled` — Stores the status of the action (that is, whether it's enabled or disabled). Disabled actions do not run when the action sequence containing them is executed.
- `parent` — Stores the GHS_ActionSequence object that contains the action object.

The following section describes the function from class `GHS_Action`.

## DumpTree()

```
DumpTree(treeLine=False)
```

Dumps the action type, action arguments, and whether the action is enabled or disabled. This function returns `True` on success.

The argument is:

- `treeLine` — If `True`, lines such as `|` and _ are printed to show the hierarchy of the dumped information. For example, one of the three lines below, beginning with `|`:

  ```
  Action Sequence
  | Editor     test.cc
  | Editor     test1.cc
  |_Python Statement     x = 1;
  ```

  If `False`, the lines are not printed.

The alias is: `Dump()`

## GHS_ActionSequence Attributes and Functions

Class `GHS_ActionSequence` stores information for an action sequence.

The following list describes the attributes of this class:

- `name` — Stores the name of the action sequence.
- `actions` — Stores a list of `GHS_Action` objects.
- `parent` — Stores the `GHS_Workspace` object that contains the action sequence object.

The following sections describe functions from class `GHS_ActionSequence`.

### DumpTree()

`DumpTree(treeLine=True)`

Dumps the action sequence's name and actions and returns `True` on success.

The argument is:

- `treeLine` — If `True`, lines such as `|` and _ are printed to show the hierarchy of the dumped information. If `False`, the lines are not printed. For an example, see “DumpTree()” on page 287.

The alias is: `Dump()`

### Search()

`Search(value, column=-1, match=False, all=False)`

Searches for one or more actions in an action sequence.

Arguments are:

- `value` — Specifies the value (action name or action argument) to search for. This can be a regular expression.
- `column` — Specifies whether action names, action arguments, or both names and arguments are searched. If `0`, names are searched. If `1`, arguments are searched. If `-1`, both names and arguments are searched.
- `match` — If `True`, uses Python's regular expression `match()` function to check the specified value. If `False`, uses Python's regular expression `search()` function.
- `all` — If `True`, a list of action objects satisfying the criteria is returned upon success. Upon failure, an empty list is returned. If `False`, the first action object satisfying the criteria is returned upon success. Upon failure, `None` is returned.

## GHS_Variable Attributes and Functions

Class `GHS_Variable` stores information for a Launcher variable.

The following list describes the attributes of this class:

- `name` — Stores the name of the variable.
- `value` — Stores the value of the variable.
- `type` — Stores the variable type. The `type` may be `local`, `global`, or `predefined`. For more information, see “Variable Types” in Chapter 3, “Managing Workspaces and Shortcuts with the Launcher” in the *MULTI: Managing Projects and Configuring the IDE* book.
- `parent` — Stores the `GHS_Workspace` object that contains the variable.

The following section describes the function from class `GHS_Variable`.

### DumpTree()

```
DumpTree(treeLine=True)
```

Dumps the variable's name and value and returns `True` on success.

The argument is:

- `treeLine` — If `True`, lines such as `|` and _ are printed to show the hierarchy of the dumped information. If `False`, the lines are not printed. For an example, see "DumpTree()" on page 287.

The alias is: `Dump()`

## GHS_Workspace Attributes and Functions

Class `GHS_Workspace` stores information for a workspace.

The following list describes the attributes of this class:

- `name` — Stores the name of the workspace.
- `workingDir` — Stores the workspace's working directory. The working directory is the directory from which action sequences are started.
- `localVariables` — Stores a list of variables local to the workspace.
- `globalVariables` — Stores a list of variables available to all workspaces.
- `predefinedVariables` — Stores a list of pre-defined Launcher variables. For more information, see "Variable Types" in Chapter 3, "Managing Workspaces and Shortcuts with the Launcher" in the *MULTI: Managing Projects and Configuring the IDE* book.
- `actionSequences` — Stores a list of the action sequences contained in the workspace.
- `dumpNameMask` (for constant `0x1`) — A flag for dumping the workspace name.
- `dumpWorkingDirMask` (for constant `0x2`) — A flag for dumping the working directory of the workspace.
- `dumpLocalVarsMask` (for constant `0x4`) — A flag for dumping the workspace's local variables.

- `dumpGlobalVarsMask` (for constant `0x8`) — A flag for dumping the global variables.
- `dumpPredefinedVarsMask` (for constant `0x10`) — A flag for dumping the pre-defined MULTI Launcher variables.
- `dumpActionsMask` (for constant `0x20`) — A flag for dumping the workspace's actions.

The following sections describe functions from class `GHS_Workspace`.

## DumpTree()

```
DumpTree(treeLine=True, mask=0xff)
```

Dumps the workspace's name, working directory, local variables, global variables, pre-defined MULTI Launcher variables, action sequences, and actions; or dumps whichever of these elements you specify. This function returns `True` on success.

Arguments are:

- `treeLine` — If `True`, lines such as `|` and _ are printed to show the hierarchy of the dumped information. If `False`, the lines are not printed. For an example, see “DumpTree()” on page 287.
- `mask` — Controls what elements are dumped. You can specify any combination of the `dump*` flags listed in “GHS_Workspace Attributes and Functions” on page 290. If you specify multiple flags, use the OR operation to link them together. By default, this function dumps all elements of the workspace.

The alias is: `Dump()`

## SearchAction()

```
SearchAction(asName, value, column=-1, match=False, all=False)
```

Searches for one or more actions in the workspace.

Arguments are:

- `asName` — Specifies the name of the action sequence to search. This can be a regular expression. If `asName` is an empty string (`""`), all action sequences are searched.
- `value` — Specifies the value (action name or action argument) to search for. This can be a regular expression.
- `column` — Specifies whether action names, action arguments, or both names and arguments are searched. If `0`, names are searched. If `1`, arguments are searched. If `-1`, names and arguments are searched.
- `match` — If `True`, uses Python's regular expression `match()` function to check the specified action. If `False`, uses Python's regular expression `search()` function.
- `all` — If `True`, a list of action objects satisfying the criteria is returned upon success. Upon failure, an empty list is returned. If `False`, the first action satisfying the criteria is returned upon success. Upon failure, `None` is returned.

## SearchActionSequence()

```
SearchActionSequence(asName, match=False, all=False)
```

Searches for one or more action sequences in a workspace.

Arguments are:

- `asName` — Specifies the name of the action sequence. This can be a regular expression.
- `match` — If `True`, uses Python's regular expression `match()` function to check the specified action sequence name. If `False`, uses Python's regular expression `search()` function.
- `all` — If `True`, a list of action sequence objects satisfying the criteria is returned upon success. Upon failure, an empty list is returned. If `False`, the first `GHS_ActionSequence` object satisfying the criteria is returned upon success. Upon failure, `None` is returned.

The alias is: `SearchActionSeq()`

## SearchVariable()

```
SearchVariable(varType, value, column=-1, match=False,
all=False)
```

Searches for one or more variables in the workspace.

Arguments are:

- `varType` — Specifies the variable type. The `varType` may be:
  - `local` — Specifies that the variable is local to the workspace.
  - `global` — Specifies that the variable is available to all workspaces.
  - `predefined` — Specifies that the variable is a pre-defined Launcher variable. For more information, see “Variable Types” in Chapter 3, “Managing Workspaces and Shortcuts with the Launcher” in the *MULTI: Managing Projects and Configuring the IDE* book.
  - `""` — Specifies all variable types.
- `value` — Specifies the value (variable name or variable value) to search for. This can be a regular expression.
- `column` — Specifies whether variable names, variable values, or both names and values are searched. If `0`, names are searched. If `1`, values are searched. If `-1`, names and values are searched.
- `match` — If `True`, uses Python's regular expression `match()` function to check the specified variable. If `False`, uses Python's regular expression `search()` function.
- `all` — If `True`, a list of variable objects satisfying the criteria is returned upon success. Upon failure, an empty list is returned. If `False`, the first variable satisfying the criteria is returned upon success. Upon failure, `None` is returned.

The alias is: `SearchVar()`

## GHS_Launcher Functions

The following section describes the `__init__()` function from class `GHS_Launcher`.

### __init__()

```
__init__(workingDir="")
```

Initializes a `GHS_Launcher` object.

This function also gets the window's information for the created MULTI Launcher service and sets up the object with it.

The argument is:

- `workingDir` — Specifies the working directory of the MULTI IDE service.

## GHS_LauncherWindow Action Execution Functions

The following sections describe the functions from class `GHS_LauncherWindow` that relate to action execution.

### GetRunningActions()

```
GetRunningActions(show=True)
```

Gets a list of actions that are currently running. This function returns a list of strings, where each string corresponds to a running action.

The argument is:

- `show` — If `True`, displays the running actions (if any). If `False`, does not display running actions.

## RunAction()

```
RunAction(actionType, actionArgs="", workingDir="", wsName="",
waitPeriodToFinish=0.0)
```

Executes the specified ad hoc action. This function returns `True` on success and `False` on failure.

Arguments are:

- `actionType` — Specifies the type of the action to be executed. For a list of supported action types, see "Creating or Modifying an Action" in Chapter 3, "Managing Workspaces and Shortcuts with the Launcher" in the *MULTI: Managing Projects and Configuring the IDE* book.
- `actionArgs` — Specifies the argument(s) of the action.
- `workingDir` — Specifies the working directory from which to execute the action.
- `wsName` — Specifies the name of the workspace whose working directory is used to execute the action.
- `waitPeriodToFinish` — Specifies how long the function waits for the action(s) to finish, if it waits at all. This argument may be:
  - `0` or a negative number — Indicates that the function does not wait.
  - A positive number — Specifies the maximum number of seconds that the function waits. If the action has not finished before the timeout, the function returns `False`.

If `workingDir` is specified (that is, it is not an empty string), the action is executed from the directory specified. Otherwise, if `wsName` is specified (that is, it is not an empty string) and the workspace name exists, the action is executed from the corresponding workspace's working directory. If neither `workingDir` nor `wsName` is specified, the action executes from the working directory of the Launcher's current workspace.

## RunWorkspaceAction()

```
RunWorkspaceAction(workspaceName="", actionSequenceName="",
actionIndex=-1, waitPeriodToFinish=0.0)
```

Executes one or more actions in a workspace action sequence and returns `True` on success and `False` on failure.

Arguments are:

- `workspaceName` — Specifies the name of the workspace whose actions are executed. If no workspace name is given, the Launcher's current workspace is used.
- `actionSequenceName` — Specifies the name of the action sequence whose actions are executed. If `actionSequenceName` is an empty string (`""`), all enabled actions in the workspace are executed.
- `actionIndex` — Specifies the action's index in the action sequence. The index starts at 0 (zero). If `actionIndex` is negative number, all enabled actions in the corresponding action sequence are executed.
- `waitPeriodToFinish` — Specifies how long the function waits for the action(s) to finish, if it waits at all. This argument may be:
  - `0` or a negative number — Indicates that the function does not wait.
  - A positive number — Specifies the maximum number of seconds that the function waits. If the action has not finished before the timeout, the function returns `False`.

The alias is: `RunWsAction()`

## WaitForActionsToFinish()

```
WaitForActionsToFinish(oldActionList, duration=0.0,
warnIfNotFinish=False)
```

Waits for running actions to finish. This function returns `True` if the running actions are finished when the function returns, and `False` otherwise.

Arguments are:

- `oldActionList` — Specifies an action list whose actions are not to be considered (that is, the function can return `True` even if actions in this list are still running). The function waits for all running actions (not in the old action list) to finish or timeout. If this argument is `None` or empty, the function waits for all running actions to finish or timeout.
- `duration` — Specifies how long the function waits, if at all. The `duration` may be:
  - A negative number — Indicates that the function waits until the running actions finish.
  - `0.0` — Indicates that the function does not wait.
  - A positive number — Specifies the maximum number of seconds that the function waits.

  During the wait, the function checks the running actions every half second.
- `warnIfNotFinish` — If `True` and if the function returns when actions are still running, prints a warning message. If `False`, does not print a warning message.

Aliases are: `WaitToFinish()`, `Wait()`

## GHS_LauncherWindow Action Manipulation Functions

The following sections describe the functions from class `GHS_LauncherWindow` that relate to action manipulation.

### AddAction()

```
AddAction(actionType, actionArgs="",
actionSequenceName="Startup", indexInActionSequence=-1,
wsName="", workingDir="", block=True, printOutput=True)
```

Adds an action into a workspace and returns `True` on success and `False` on failure.

Arguments are:

- `actionType` — Specifies the action type. For the list of supported action types, see "Creating or Modifying an Action" in Chapter 3, "Managing Workspaces and Shortcuts with the Launcher" in the *MULTI: Managing Projects and Configuring the IDE* book.
- `actionArgs` — Specifies the argument(s) of the action.
- `actionSequenceName` — Specifies the name of the action sequence to which the action belongs.
- `indexInActionSequence` — Specifies the index of the position in the action sequence where the action is to be inserted. The index starts at 0 (zero). If you specify a negative value, the action is given the last position in the action sequence.
- `wsName` — Specifies the name of the workspace to which the action belongs.
- `workingDir` — Specifies the working directory of the workspace. This argument is used only when the specified workspace name does not exist (a new workspace is created in this case).
- `block` — If `True`, executes `AddAction()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

## DeleteAction()

```
DeleteAction(actionSequenceName="", indexInActionSequence=-1,
wsName="", block=True, printOutput=True)
```

Deletes the action(s) located at the specified position(s) from the given workspace action sequence. This function returns `True` on success and `False` on failure.

Arguments are:

- `actionSequenceName` — Specifies the name of the action sequence to which the action belongs. If `actionSequenceName` is an empty string (`""`), all actions in the workspace are deleted.

- `indexInActionSequence` — Specifies the action's index in the action sequence. The index starts at 0 (zero). If you specify a negative value, the entire action sequence is deleted.
- `wsName` — Specifies the name of the workspace to which the action belongs. If the workspace name is an empty string (`""`), the deletion is applied to the MULTI Launcher's current workspace.
- `block` — If `True`, executes `DeleteAction()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `DelAction()`

## GHS_LauncherWindow Workspace Manipulation Functions

The following sections describe the functions from class `GHS_LauncherWindow` that relate to workspace manipulation.

### CreateWorkspace()

```
CreateWorkspace(wsName="", workingDir="", block=True,
printOutput=True)
```

Creates a workspace and selects it as the current workspace. This function returns `True` on success and `False` on failure.

Arguments are:

- `wsName` — Specifies the name of the workspace.
- `workingDir` — Specifies the working directory of the workspace.
- `block` — If `True`, executes `CreateWorkspace()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

If both the workspace name and working directory are specified, the function creates an empty workspace with the given information. If the workspace name already exists, the workspace is selected into the current workspace, and the working directory (if it is specified) is applied to the existing workspace.

Aliases are: `CreateWs()`, `AddWorkspace()`, `AddWs()`

## DeleteWorkspace()

```
DeleteWorkspace(wsName="", delCurrentWs=True, block=True,
printOutput=True)
```

Deletes the specified workspace and returns `True` on success and `False` on failure.

Arguments are:

- `wsName` — Specifies the name of the workspace.
- `delCurrentWs` — If `True`, deletes the current workspace. If `False`, does not delete the current workspace. Deleting the current workspace is only effective when `wsName` is an empty string (`""`).
- `block` — If `True`, executes `DeleteWorkspace()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `DelWs()`

## GetWorkspaceInformation()

```
GetWorkspaceInformation(wsName="", original=True)
```

Gets a workspace's name, working directory, local variables, global variables, pre-defined MULTI Launcher variables, and actions. This function returns a `GHS_Workspace` object (a read-only workspace tree) on success, or it returns `None` upon failure.

Arguments are:

- `wsName` — Specifies the name of the workspace. If `wsName` is an empty string (`""`), this function gets information for the workspace currently displayed in the MULTI Launcher.
- `original` — If `True`, the variable values and action arguments are kept in the same format as in the MULTI Launcher workspace. If `False`, this function substitutes actual values for the variables nested in variable values and action arguments.

Aliases are: `GetWorkspaceInfo()`, `GetWsInfo()`

## GetWorkspaces()

```
GetWorkspaces()
```

Gets a list of workspace names and returns the list.

The alias is: `GetWses()`

## LoadWorkspaceFile()

```
LoadWorkspaceFile(fileName, block=True, printOutput=True,
expandFileName=True)
```

Loads a workspace file into the MULTI Launcher and selects the corresponding workspace as the current workspace. This function returns `True` on success and `False` on failure.

Arguments are:

- `fileName` — Specifies the filename of the workspace to be loaded.
- `block` — If `True`, executes `LoadWorkspaceFile()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

- `expandFileName` — If `True`, uses the Python context's current working directory to expand `fileName` into a complete file path. If `False`, directly transfers `fileName` to the MULTI Launcher service, which resolves the filename with its current working directory if necessary.

**Note**

In the MULTI-Python integrated system, filenames are passed by clients to MULTI services, which may expand them. Example clients are: the **mpythonrun** utility program, the stand-alone Python GUI, and the MULTI Debugger (the Debugger contains a **Py** pane and is capable of running Python statements via buttons, menu items, etc.). For more information about MULTI services or about clients from which you can execute Python statements, see Chapter 2, "Introduction to the MULTI-Python Integration" on page 15.

Aliases are: `LoadWorkspace()`, `LoadWsFile()`, `LoadWs()`

## SaveWorkspaceIntoFile()

```
SaveWorkspaceIntoFile(fileName="", wsName="", block=True,
printOutput=True, expandFileName=True)
```

Saves a workspace into a file and returns `True` on success and `False` on failure.

Arguments are:

- `fileName` — Specifies the filename of the workspace to be saved. If no filename is specified, the MULTI Launcher opens a file chooser from which you can select a filename.
- `wsName` — Specifies the name of the workspace to be saved. If `wsName` is an empty string (`""`), the current workspace is saved.
- `block` — If `True`, executes `SaveWorkspaceIntoFile()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

- `expandFileName` — If `True`, uses the Python context's current working directory to expand `fileName` into a complete file path. If `False`, directly transfers `fileName` to the MULTI Launcher service, which resolves the filename with its current working directory if necessary. For more information, see the `expandFileName` description in "LoadWorkspaceFile()" on page 301.

Aliases are: `SaveWsIntoFile()`, `SaveWs()`

## SelectWorkspace()

```
SelectWorkspace(wsName, block=True, printOutput=True)
```

Selects the specified workspace as the current workspace. This function returns `True` on success and `False` on failure.

Arguments are:

- `wsName` — Specifies the name of the workspace.
- `block` — If `True`, executes `SelectWorkspace()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `SelWs()`

## GHS_LauncherWindow Variable Functions

The following sections describe the functions from class `GHS_LauncherWindow` that relate to variables.

### AddVariable()

```
AddVariable(varName, varValue, globalVar=False, wsName="",
block=True, printOutput=True)
```

Adds a local variable to a workspace or a global variable to the system. If the variable already exists, its existing value is changed to the given value. This function returns `True` on success and `False` on failure.

Arguments are:

- `varName` — Specifies the name of the variable.
- `varValue` — Specifies the value of the variable.
- `globalVar` — If `True`, specifies that the variable is global. If `False`, specifies that it's local to a workspace.
- `wsName` — Specifies the name of the workspace to add the variable to. If `wsName` is an empty string (`""`), this function adds the variable to the workspace currently displayed in the MULTI Launcher. This argument is only applicable if `globalVar` is `False`.
- `block` — If `True`, executes `AddVariable()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `AddVar()`

## ChangeVariable()

```
ChangeVariable(varName, varValue, globalVar=False, wsName="",
block=True, printOutput=True)
```

Changes the value of a local workspace variable or a global system variable. If the variable does not exist, it is added to the workspace or to the system. This function returns `True` on success and `False` on failure.

Arguments are:

- `varName` — Specifies the name of the variable.
- `varValue` — Specifies the new value of the variable.
- `globalVar` — If `True`, specifies that the variable is global. If `False`, specifies that it's local to a workspace.
- `wsName` — Specifies the name of the workspace that the variable is local to. If `wsName` is an empty string (`""`), this function changes the specified variable belonging to the workspace currently displayed in the MULTI Launcher. This argument is only applicable if `globalVar` is `False`.
- `block` — If `True`, executes `ChangeVariable()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `ChangeVar()`

## DeleteVariable()

```
DeleteVariable(varName, globalVar=False, wsName="", block=True,
printOutput=True)
```

Deletes a local variable from a workspace or a global variable from the system. This function returns `True` on success and `False` on failure.

Arguments are:

- `varName` — Specifies the name of the variable.

- `globalVar` — If `True`, specifies that the variable is global. If `False`, specifies that it's local to a workspace.
- `wsName` — Specifies the name of the workspace to delete the variable from. If `wsName` is an empty string (`""`), this function deletes the specified variable from the workspace currently displayed in the MULTI Launcher. This argument is only applicable if `globalVar` is `False`.
- `block` — If `True`, executes `DeleteVariable()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print the output.

The alias is: `DelVar()`

# Chapter 15

# Project Manager Functions

## Contents

This chapter documents functions from the following classes:

- `GHS_ProjectManager` (alias `ghs_projectmanager`) — Exposes the basic functions of the MULTI Project Manager service. This class inherits from class `GHS_IdeObject`. See "GHS_ProjectManager Functions" on page 308.
- `GHS_ProjectManagerWindow` — Exposes additional functions of the MULTI Project Manager. This class inherits from class `GHS_Window`.

  The `GHS_ProjectManagerWindow` functions are divided into the following sections:

  - "GHS_ProjectManagerWindow Build Functions" on page 310
  - "GHS_ProjectManagerWindow Edit Functions" on page 313
  - "GHS_ProjectManagerWindow File Functions" on page 315
  - "GHS_ProjectManagerWindow Navigation Functions" on page 317
  - "GHS_ProjectManagerWindow Debug and Edit Functions" on page 318
  - "GHS_ProjectManagerWindow Tree Expansion/Contraction Functions" on page 319
  - "GHS_ProjectManagerWindow Selection Functions" on page 321

## GHS_ProjectManager Functions

The following sections describe functions from class `GHS_ProjectManager`.

### __init__()

```
__init__(workingDir="")
```

Initializes the object attributes.

The argument is:

- `workingDir` — Stores the working directory of the MULTI service object.

## GetTopProjectFiles()

```
GetTopProjectFiles(showList=False)
```

Gets top project files loaded in MULTI Project Manager windows and returns a list of the top project files.

The argument is:

- `showList` — If `True`, displays the top project files. If `False`, does not display them.

The alias is: `TopProjs()`

## OpenProject()

```
OpenProject(fileName, targetsToBuild="", hidden=False,
expandFileName=True)
```

Loads a MULTI project file into the MULTI Project Manager. On success, this function returns a `GHS_ProjectManagerWindow` object for the MULTI Project Manager window. Otherwise, it returns `None`.

Arguments are:

- `fileName` — Specifies the name of the project file. If the `fileName` is an empty string (`""`), the launched MULTI Project Manager window could be blank.
- `targetsToBuild` — Specifies a list of targets to be built.
- `hidden` — If `True`, hides the MULTI Project Manager window. If `False`, does not hide the window.
- `expandFileName` — If `True`, uses the Python context's current working directory to expand `fileName` into a complete file path. If `False`, directly transfers `fileName` to the corresponding service, which resolves the filename with its current working directory if necessary. For more information, see the `expandFileName` description in “LoadWorkspaceFile()” on page 301.

Aliases are: `OpenFile()`, `OpenProj()`, `LoadFile()`, `Open()`

## GHS_ProjectManagerWindow Build Functions

The following sections describe the build functions from class `GHS_ProjectManagerWindow`.

### BuildAllProjects()

```
BuildAllProjects(waitBuildFinish=False, duration=-1.0)
```

Builds all projects and returns `True` on success and `False` on failure.

Arguments are:

- `waitBuildFinish` — If `True`, waits for the build to finish. If `False`, does not wait.
- `duration` — Specifies how long the function waits, if at all. The `duration` may be:
  - A negative number — Indicates that the function waits until the build is done.
  - `0` — Indicates that the function does not wait at all.
  - A positive number — Specifies the maximum number of seconds that the function waits. If the build is not finished within the given period, the function returns `False`, as with function failure.

  During the wait, the function checks the status of the build approximately every 0.3 seconds.

Aliases are: `BuildAll()`, `BuildAllProj()`, `BuildAllProjs()`

### BuildFile()

```
BuildFile(optionsAndFileName, block=True, printOutput=True,
duration=-1)
```

Builds one or more of the files or projects in the Project Manager and returns `True` on success and `False` on failure.

Arguments are:

- `optionsAndFileName` — Specifies the names of the files and/or projects to build and, optionally, **gbuild** options to run. Specify this information in the same way that you would if you were entering it in the Project Manager's file shortcut bar (with **Build** selected). For more information, see "The File Shortcut Bar" in Chapter 10, "Project Manager GUI Reference" in the *MULTI: Managing Projects and Configuring the IDE* book.
- `block` — If `True`, executes `BuildFile()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.
- `duration` — Specifies how long the function waits, if at all. For more information, see the `duration` description in "BuildAllProjects()" on page 310.

The alias is: `Build()`

## BuildProjects()

```
BuildProjects(buildAll=False, waitBuildFinish=False,
duration=-1.0)
```

Builds all projects or builds the selected projects. This function returns `True` on success and `False` on failure.

Arguments are:

- `buildAll` — If `True`, builds all projects. If `False`, builds selected projects.
- `waitBuildFinish` — If `True`, waits for the build to finish. If `False`, does not wait.
- `duration` — Specifies how long the function waits, if at all. For more information, see the `duration` description in "BuildAllProjects()" on page 310.

Aliases are: `BuildProjs()`, `BuildProj()`

## BuildSelectedProjects()

```
BuildSelectedProjects(waitBuildFinish=False, duration=-1.0)
```

Builds selected projects and returns `True` on success and `False` on failure.

For argument descriptions, see “BuildAllProjects()” on page 310.

Aliases are: `BuildSelected()`, `BuildSelectedProjs()`, `BuildSelectedProj()`, `BuildSel()`

## GetStatus()

```
GetStatus()
```

Gets the status of the build. On success, this function returns a string with the status. Upon failure, it returns `None`.

## HaltBuild()

```
HaltBuild(waitHaltFinish=False, duration=-1.0)
```

Halts the build and returns `True` on success and `False` on failure.

Arguments are:

- `waitHaltFinish` — If `True`, waits for the build to halt. If `False`, does not wait.
- `duration` — Specifies how long the function waits, if at all. The `duration` may be:
  - A negative number — Indicates that the function waits until the build is halted.
  - `0` — Indicates that the function does not wait at all.
  - A positive number — Specifies the maximum number of seconds that the function waits. If the build has not halted within the given period, the function returns `False`, as with function failure.

  During the wait, the function checks the status of the build approximately every 0.3 seconds by default.

The alias is: `Halt()`

### WaitForBuildingFinish()

```
WaitForBuildingFinish(duration=-1.0, checkInterval=0)
```

Waits for the build to finish and returns `True` on success and `False` on failure.

Arguments are:

- `duration` — Specifies how long the function waits, if at all. For more information, see the `duration` description in "BuildAllProjects()" on page 310.
- `checkInterval` — Specifies the interval (in seconds) between status checks. A `0` or a negative value specifies that the default check interval value of the MULTI Project Manager window object is used. The default check interval value (attribute `checkInterval`) for the MULTI Project Manager window object is 0.3.

## GHS_ProjectManagerWindow Edit Functions

The following sections describe the edit functions from class `GHS_ProjectManagerWindow`.

### CopySelected()

```
CopySelected()
```

Copies the selected project tree entries to a clipboard specific to the MULTI Project Manager. This function returns `True` on success and `False` on failure.

The alias is: `CopySel()`

## CutSelected()

```
CutSelected()
```

Cuts the selected project tree entries and stores them on a clipboard specific to the MULTI Project Manager. This function returns `True` on success and `False` on failure.

The alias is: `CutSel()`

## DeleteSelected()

```
DeleteSelected()
```

Deletes the selected project tree entries. This function returns `True` on success and `False` on failure.

Aliases are: `DelSelected()`, `DelSel()`

## PasteAfterSelected()

```
PasteAfterSelected()
```

Pastes entries stored on the MULTI Project Manager clipboard after the selected entries. This function returns `True` on success and `False` on failure.

The alias is: `Paste()`

# GHS_ProjectManagerWindow File Functions

The following sections describe the functions from class `GHS_ProjectManagerWindow` that relate to project files.

## CloseProject()

`CloseProject()`

Closes the current project file in the MULTI Project Manager window. This function returns `True` on success and `False` on failure.

The alias is: `CloseProj()`

## NewWindow()

`NewWindow()`

Opens a new MULTI Project Manager window. On success, this function returns a `GHS_ProjectManagerWindow` object for the new MULTI Project Manager window. On failure, it returns `None`.

The alias is: `NewWin()`

## OpenProject()

`OpenProject(projName="", block=True, expandFileName=True)`

Loads a project file into the MULTI Project Manager window and returns `True` on success and `False` on failure.

Arguments are:

- `projName` — Specifies the name of the project file. If `projName` is an empty string (`""`), the MULTI Project Manager opens a file chooser from which you can select a project file.
- `block` — If `True`, executes `OpenProject()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

- `expandFileName` — If `True`, uses the Python context's current working directory to expand `projName` into a complete file path. If `False`, directly transfers `projName` to the corresponding service, which resolves the filename with its current working directory if necessary. For more information, see the `expandFileName` description in "LoadWorkspaceFile()" on page 301.

Aliases are: `OpenFile()`, `OpenProj()`, `LoadFile()`, `Open()`

## RevertFromFile()

```
RevertFromFile(block=True)
```

Reverts the contents of the MULTI Project Manager window to the corresponding file saved on disk. This function returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `RevertFromFile()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

The alias is: `Revert()`

## SaveChanges()

```
SaveChanges(block=True)
```

Saves changes made in the MULTI Project Manager window to the corresponding project file. This function returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `SaveChanges()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

Aliases are: `SaveChange()`, `Save()`

# GHS_ProjectManagerWindow Navigation Functions

The following sections describe the file navigation functions from class `GHS_ProjectManagerWindow`.

## FindFile()

```
FindFile(fileName, block=True, printOutput=True)
```

Locates an instance of the specified file or project in the Project Manager window and returns `True` on success and `False` on failure. This is analogous to searching for a file via the Project Manager's file shortcut bar when **Find** is enabled. For more information, see “The File Shortcut Bar” in Chapter 10, “Project Manager GUI Reference” in the *MULTI: Managing Projects and Configuring the IDE* book.

Arguments are:

- `fileName` — Specifies the name of the file or project to locate.
- `block` — If `True`, executes `FindFile()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

The alias is: `Find()`

## NextFile()

```
NextFile(fileName, block=True, printOutput=True)
```

Locates the next instance of the specified file or project in the Project Manager window and returns `True` on success and `False` on failure. This is analogous to searching for a file via the Project Manager's file shortcut bar when **Next** is enabled. For more information, see “The File Shortcut Bar” in Chapter 10, “Project Manager GUI Reference” in the *MULTI: Managing Projects and Configuring the IDE* book.

Arguments are:

- `fileName` — Specifies the name of the file or project to locate.

- `block` — If `True`, executes `NextFile()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.
- `printOutput` — If `True`, prints the output (if any). If `False`, does not print output.

The alias is: `Next()`

## GHS_ProjectManagerWindow Debug and Edit Functions

The following sections describe the functions from class `GHS_ProjectManagerWindow` that you can use to open projects in the MULTI Debugger or Editor.

### DebugSelectedProjects()

```
DebugSelectedProjects(block=False)
```

Debugs selected projects, if applicable. This function returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `DebugSelectedProjects()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

Aliases are: `DebugSelected()`, `DebugSelectedProjs()`, `DebugSelectedProj()`, `DebugSel()`

### EditSelectedProjects()

```
EditSelectedProjects(block=True)
```

Edits the selected project files. This function returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `EditSelectedProjects()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

Aliases are: `EditSelected()`, `EditSelectedProjs()`, `EditSelectedProj()`, `EditSel()`

## GHS_ProjectManagerWindow Tree Expansion/Contraction Functions

The following sections describe the GUI-related functions from class `GHS_ProjectManagerWindow`.

### ContractAll()

```
ContractAll(block=False)
```

Contracts the entire project tree and returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `ContractAll()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

### ContractSelected()

```
ContractSelected(block=False)
```

Contracts the selected project tree entries and returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `ContractSelected()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

The alias is: `ContractSel()`

## ExpandAll()

`ExpandAll(block=False)`

Expands the entire project tree and returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `ExpandAll()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

## ExpandSelected()

`ExpandSelected(block=False)`

Expands the selected project tree entries and returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `ExpandSelected()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

The alias is: `ExpandSel()`

## PrintAll()

`PrintAll(block=True)`

Prints the fully expanded project tree (that is, expands the project tree and then prints it). This function returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `PrintAll()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

The alias is: `Print()` (Note that `print()` is not a valid alias for this function.)

### PrintView()

```
PrintView(block=True)
```

Prints the parts of the project tree that have been expanded. This function returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `PrintView()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

## GHS_ProjectManagerWindow Selection Functions

The following sections describe the functions from class `GHS_ProjectManagerWindow` that relate to project selection.

### DoubleClickTreeRow()

```
DoubleClickTreeRow(row, block=True)
```

Simulates double-clicking the specified row in the project tree view. This function returns `True` on success and `False` on failure.

Arguments are:

- `row` — Specifies the index of the row to be double-clicked. The index starts at 0 (zero). If the row number is less than 0, all rows are selected.

- `block` — If `True`, executes `DoubleClickTreeRow()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.

The alias is: `DblClickTreeRow()`

## SelectAll()

```
SelectAll(block=True)
```

Selects the entire project tree and returns `True` on success and `False` on failure.

The argument is:

- `block` — If `True`, executes `SelectAll()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

The alias is: `SelAll()`

## SelectProject()

```
SelectProject(projName, block=True)
```

Selects an entry by its name. This function returns `True` on success and `False` on failure.

Arguments are:

- `projName` — Specifies the name of the entry to select.
- `block` — If `True`, executes `SelectProject()` in blocked mode and grabs and prints the output (if any). If `False`, neither executes the function in blocked mode nor grabs and prints the output.

The alias is: `SelProj()`

## SelectTreeRow()

```
SelectTreeRow(row, block=True)
```

Selects a row in the project tree view and returns `True` on success and `False` on failure.

Arguments are:

- `row` — Specifies the index of the row to be selected. The index starts at 0 (zero). If the row number is less than 0, all rows are selected.
- `block` — If `True`, executes `SelectTreeRow()` in blocked mode and grabs the output (if any). If `False`, neither executes the function in blocked mode nor grabs the output.

The alias is: `SelTreeRow()`

# Chapter 16

# Version Control Functions

## Contents

This chapter documents functions from the following classes:

- `GHS_CoBrowse` (alias `ghs_cobrowse`) — Exposes the basic functions of the MULTI Checkout Browser service. This class inherits from class `GHS_IdeObject`. See "GHS_CoBrowse Functions" on page 326.
- `GHS_DiffView` (alias `ghs_diffview`) — Exposes the basic functions of the MULTI Diff Viewer service. This class inherits from class `GHS_IdeObject`. See "GHS_DiffView Functions" on page 327.
- `GHS_DiffViewWindow` — Exposes additional functions of the MULTI Diff Viewer. This class inherits from class `GHS_Window`.

  The `GHS_DiffViewWindow` functions are divided into the following sections:

  - "GHS_DiffViewWindow Basic Functions" on page 329
  - "GHS_DiffViewWindow Display Functions" on page 330

## GHS_CoBrowse Functions

The following sections describe functions from class `GHS_CoBrowse`.

### __init__()

```
__init__(workingDir="")
```

Initializes the object attributes.

The argument is:

- `workingDir` — Stores the working directory of the MULTI service object.

### OpenCheckoutBrowserWindow()

```
OpenCheckoutBrowserWindow(checkoutDir="", scanNow=False)
```

Opens a MULTI Checkout Browser window on the given directory. On success, this function returns a `GHS_CoBrowseWindow` object for the MULTI Checkout Browser window. On failure, it returns `None`.

Arguments are:

- `checkoutDir` — Specifies the directory to examine.
- `scanNow` — If `True`, immediately scans the file checkout information. If `False`, does not immediately scan the file checkout information.

Aliases are: `OpenCheckoutBrowserWin()`, `OpenCoBrowserWindow()`, `OpenCoBrowserWin()`, `OpenCoBrowser()`, `OpenWindow()`, `OpenWin()`

## GHS_DiffView Functions

The following sections describe functions from class `GHS_DiffView`.

### __init__()

```
__init__(workingDir="")
```

Initializes the object attributes.

The argument is:

- `workingDir` — Stores the working directory of the MULTI service object.

## DiffFiles()

```
DiffFiles(fileName1, fileName2, reuse=False, append=False)
```

Compares two files and displays their differences in a MULTI Diff Viewer window. This function returns a `GHS_DiffViewWindow` object for the newly created MULTI Diff Viewer window, or it returns `None`.

Arguments are:

- `fileName1` — Specifies the name of the first file.
- `fileName2` — Specifies the name of the second file.
- `reuse` — If `True`, reuses an existing MULTI Diff Viewer window. If `False`, opens a new window.
- `append` — indicates if only to append an entry for the compared files into an existing MULTI Diff Viewer window without switching to show the differences of the compared files. This argument is effective only if `reuse` is `True`.

## OpenChooseWindow()

```
OpenChooseWindow(fileName1="", fileName2="", reuse=True)
```

Opens a dialog box in which you can specify two files for comparison. This function returns a `GHS_Window` object for the dialog box, or it returns `None` on failure.

Arguments are:

- `fileName1` — Specifies the first filename. If specified, the filename appears in the dialog box.
- `fileName2` — Specifies the second filename. If specified, the filename appears in the dialog box.
- `reuse` — If `True`, reuses an existing MULTI Diff Viewer window when you ask to compare the specified files. If `False`, opens a new Diff Viewer window.

The alias is: `OpenChooseWin()`

# GHS_DiffViewWindow Basic Functions

The following sections describe the basic functions from class `GHS_DiffViewWindow`.

## OpenDiff()

```
OpenDiff()
```

Opens a window so that you can specify files for comparison. When you click the **Diff** button in the window, the current MULTI Diff Viewer is reused to compare the specified files.

Returns a `GHS_Window` object for the window for you to specify files to compare and `None` on failure.

## OpenNewDiff()

```
OpenNewDiff()
```

Opens a dialog box in which you can specify two files for comparison. When you click the dialog box's **Diff** button, a new MULTI Diff Viewer window is created to compare the specified files. This function returns a `GHS_Window` object for the dialog box, or it returns `None` on failure.

## ShowCurrentDiff()

```
ShowCurrentDiff()
```

Repositions the MULTI Diff Viewer pane to display the current difference (this is useful if you lose your place while scrolling). This function returns `True` on success and `False` on failure.

The alias is: `ShowCurDiff()`

## GHS_DiffViewWindow Display Functions

The following sections describe the display functions from class `GHS_DiffViewWindow`.

### ToggleCaseSensitive()

```
ToggleCaseSensitive()
```

Toggles the flag for ignoring case differences between two lines. This function returns `True` on success and `False` on failure.

For more information about the flag, see **Case Insensitive** in "Diff Viewer Menus" in Chapter 12, "Version Control Tools GUI Reference" in the *MULTI: Managing Projects and Configuring the IDE* book.

The alias is: `Case()`

### ToggleCharDiff()

```
ToggleCharDiff()
```

Toggles the flag for displaying character changes. This function returns `True` on success and `False` on failure.

For more information about the flag, see **Display Changes Within Lines** in "Diff Viewer Menus" in Chapter 12, "Version Control Tools GUI Reference" in the *MULTI: Managing Projects and Configuring the IDE* book.

The alias is: `CharDiff()`

### ToggleIgnoreAllWhiteSpace()

```
ToggleIgnoreAllWhiteSpace()
```

Toggles the flag for ignoring all whitespace differences between two files. This function returns `True` on success and `False` on failure.

For more information about the flag, see **Ignore All Whitespace** in "Diff Viewer Menus" in Chapter 12, "Version Control Tools GUI Reference" in the *MULTI: Managing Projects and Configuring the IDE* book.

The alias is: `IgnoreAllSpace`

## ToggleIgnoreCWhiteSpace()

```
ToggleIgnoreCWhiteSpace()
```

Toggles the flag for ignoring C whitespace differences between two files. This function returns `True` on success and `False` on failure.

For more information about the flag, see **Ignore Whitespace for C** in "Diff Viewer Menus" in Chapter 12, "Version Control Tools GUI Reference" in the *MULTI: Managing Projects and Configuring the IDE* book.

The alias is: `IgnoreCSpace()`

## ToggleIgnoreWhiteSpaceAmount()

```
ToggleIgnoreWhiteSpaceAmount()
```

Toggles the flag for ignoring differences in the amounts of whitespace between two lines. This function returns `True` on success and `False` on failure.

For more information about the flag, see **Ignore Whitespace Amount** in "Diff Viewer Menus" in Chapter 12, "Version Control Tools GUI Reference" in the *MULTI: Managing Projects and Configuring the IDE* book.

The alias is: `IgnoreSpaceAmount()`

## ToggleLineupColumns()

```
ToggleLineupColumns()
```

Toggles the flag for lining up columns to determine differences within lines. This function returns `True` on success and `False` on failure.

For more information about the flag, see **Line up Columns for Changes Within Lines** in "Diff Viewer Menus" in Chapter 12, "Version Control Tools GUI Reference" in the *MULTI: Managing Projects and Configuring the IDE* book.

The alias is: `LineupCol()`

## ToggleNumber()

```
ToggleNumber()
```

Toggles the flag for ignoring number differences between lines. This function returns `True` on success and `False` on failure.

For more information about the flag, see **Ignore Changes in Numbers (0–9)** in "Diff Viewer Menus" in Chapter 12, "Version Control Tools GUI Reference" in the *MULTI: Managing Projects and Configuring the IDE* book.

Aliases are: `ToggleNum()`, `NumDiff()`

## ToggleWordDiff()

```
ToggleWordDiff()
```

Toggles the flag for displaying line differences word by word. This function returns `True` on success and `False` on failure.

For more information about the flag, see **Display Changes Word by Word Within Lines** in "Diff Viewer Menus" in Chapter 12, "Version Control Tools GUI Reference" in the *MULTI: Managing Projects and Configuring the IDE* book.

The alias is: `WordDiff()`

# Chapter 17

# Miscellaneous Functions

## Contents

This chapter documents functions from the following classes:

- `GHS_AbortExecFile` — Aborts file script execution via the utility function `GHS_ExecFile()` (see "GHS_ExecFile()" on page 82). This class inherits from class `GHS_Exception`. See "GHS_AbortExecFile and GHS_AbortExecFileWithStack Functions" on page 335.
- `GHS_AbortExecFileWithStack` — Aborts file script execution and prints the stack via the utility function `GHS_ExecFile()` (see "GHS_ExecFile()" on page 82). This class inherits from class `GHS_Exception`. See "GHS_AbortExecFile and GHS_AbortExecFileWithStack Functions" on page 335.
- `GHS_AbortExecOnSignal` — Aborts Python execution on signal. This class inherits from class `GHS_Exception`. See "GHS_AbortExecOnSignal Functions" on page 335.
- `GHS_Exception` — Describes MULTI-Python exceptions. This class inherits from the built-in Python class `Exception`. See "GHS_Exception Functions" on page 336.
- `GHS_WindowClassNames` — Defines the window class names supported in the MULTI IDE. See "GHS_WindowClassNames Attributes and Functions" on page 336.

**Note**

The `GHS_Exception`, `GHS_AbortExecFile`, `GHS_AbortExecFileWithStack`, and `GHS_AbortExecOnSignal` classes are all used to stop script execution. If the script is executed by `GHS_ExecFile`, it is handled more gracefully than if it is executed by the built-in Python function `execfile()`. If the script is executed by `execfile()`, the execution stack is dumped when execution stops.

## GHS_AbortExecFile and GHS_AbortExecFileWithStack Functions

The following section describes the `__init__()` function from classes `GHS_AbortExecFile` and `GHS_AbortExecFileWithStack`.

### __init__()

`__init__(value=None)`

Initializes the object attributes.

The argument is:

- `value` — Stores any value to be printed out when script execution stops. The value is commonly a string.

## GHS_AbortExecOnSignal Functions

The following section describes the `__init__()` function from class `GHS_AbortExecOnSignal`.

### __init__()

`__init__(value=None)`

Initializes the object attributes.

The argument is:

- `value` — Usually stores a signal name or number (but can store any value) to be printed out when script execution stops. If you store an integer, it is interpreted as a signal number and the signal name is printed out. Python trace information is always printed out.

## GHS_Exception Functions

The following section describes the `__init__()` function from class `GHS_Exception`.

### __init__()

`__init__(value=None)`

Initializes the object attributes.

The argument is:

- `value` — Stores any value to be printed out when script execution stops. The value is commonly a string.

## GHS_WindowClassNames Attributes and Functions

The class `GHS_WindowClassNames` defines window class names supported in the MULTI IDE.

The following list describes the attributes of this class:

- `coBrowser` — Stores the Checkout Browser window's class name.
- `connectionOrganizer` — Stores the Connection Organizer window's class name. The Connection Organizer is used in the Debugger.
- `debugger` — Stores the Debugger window's class name.
- `dialog` — Stores the dialog's class name.
- `diffView` — Stores the Diff Viewer window's class name.
- `editor` — Stores the Editor window's class name.
- `eventAnalyzer` — Stores the EventAnalyzer window's class name.
- `helpViewer` — Stores the Help Viewer window's class name.
- `launcher` — Stores the Launcher window's class name.
- `misc` — Stores class names for miscellaneous windows.

- `osaExplorer` — Stores the OSA Explorer window's class name. The OSA Explorer is used in the Debugger.
- `projectManager` — Stores the Project Manager window's class name.
- `pythonGui` — Stores the class name for the stand-alone **Python GUI** window.
- `resourceAnalyzer` — Stores the ResourceAnalyzer window's class name.
- `taskManager` — Stores the Task Manager window's class name. The Task Manager is used in the Debugger.
- `terminal` — Stores the Serial Terminal window's class name.
- `trace` — Stores the Trace List window's class name. The Trace List is used in the Debugger.

The following section describes the function from class `GHS_WindowClassNames`.

## __init__()

```
__init__()
```

Initializes the object.

# Part IV

# Appendix

# Appendix A

# Third-Party License and Copyright Information

## Contents

This appendix contains licensing and copyright information for third-party tools shipped with the MULTI IDE.

The following list contains information about the Python installation included with the MULTI IDE:

- The IDE installation does not contain the standard Python interpreter. Instead, it contains a Green Hills interpreter that extends the standard Python interpreter and supports communication with the Green Hills toolchain.
- A few Python script files in the Python installation that is shipped with the MULTI IDE have been modified to fix bugs.
- The Tcl/Tk Python module may contain files distributed under the terms of the GNU General Public License.

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