



# Iris Python Debug Scripting

Version 1.0

## User Guide

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# Iris Python Debug Scripting

## User Guide

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# 1. Introduction

This book describes the `iris.debug` Python module.

## 1.1 Conventions

The following subsections describe conventions used in Arm documents.

### Glossary

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See the Arm Glossary for more information: [developer.arm.com/glossary](https://developer.arm.com/glossary).

Convention	Use
<i>italic</i>	Citations.
<b>bold</b>	Terms in descriptive lists, where appropriate.
monospace	Text that you can enter at the keyboard, such as commands, file and program names, and source code.
monospace <u>underline</u>	A permitted abbreviation for a command or option. You can enter the underlined text instead of the full command or option name.
<and>	Encloses replaceable terms for assembler syntax where they appear in code or code fragments.  For example: <div>MRC p15, 0, &lt;Rd&gt;, &lt;CRn&gt;, &lt;CRm&gt;, &lt;Opcode_2&gt;</div>
SMALL CAPITALS	Terms that have specific technical meanings as defined in the <i>Arm® Glossary</i> . For example, <b>IMPLEMENTATION DEFINED</b> , <b>IMPLEMENTATION SPECIFIC</b> , <b>UNKNOWN</b> , and <b>UNPREDICTABLE</b> .



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Your system requires the following. If you do not follow these requirements your system will not work.





You are at risk of causing permanent damage to your system or your equipment, or of harming yourself.

---



This is important information and needs your attention.

---



A useful tip that might make it easier, better or faster to perform a task.

---



A reminder of something important that relates to the information you are reading.

---

## 1.2 Other information

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Arm® product resources	Document ID	Confidentiality
<i>Fast Models Tools User Guide</i>	109415	Non-Confidential
<i>Iris User Guide</i>	101196	Non-Confidential
<i>MxScript v1.3 for Fast Models Reference Manual</i>	DUI 0840	Non-Confidential
<i>Python Debug Scripting for Fast Models Reference Manual</i>	DUI 0851	Non-Confidential

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Python™	-	Python Software Foundation



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## 2. Getting started

This chapter describes setting up Iris Python Debug Scripting and using it to run a model.

### 2.1 Setting up the environment

You first need to set up your environment before using the `iris.debug` Python module.

`iris.debug` requires an existing installation of Python 3.\*. Python is available from <https://www.python.org/getit>.

To use `iris.debug`, you first need to tell the Python interpreter where to find it. Add the directory that contains `iris.debug` to the `PYTHONPATH` environment variable. For example, on Linux:

- sh:

```
export PYTHONPATH=$IRIS_HOME/Python:$PYTHONPATH
```

- tcsh:

```
setenv PYTHONPATH $IRIS_HOME/Python:$PYTHONPATH
```

This step is done for you by the Fast Models setup scripts for Linux.

On Windows:

```
set PYTHONPATH=%IRIS_HOME%\Python;%PYTHONPATH%
```

Alternatively, add the directory that contains `iris.debug` to the Python path from within your script, before importing the module, as follows:

```
import sys, os
sys.path.append(os.path.join(os.environ['IRIS_HOME'], 'Python'))
import iris.debug
```

### 2.2 Connecting to and running a model

This example shows how to connect to a model, load an application, and run the model.

You can connect to a model by creating a `NetworkModel` instance, passing the IP address or hostname, and port number.



- `iris.debug` only supports ISIM executables. It does not support models that have been built as shared libraries. This is a change in behavior from the `fm.debug` module which `iris.debug` replaces.

- 
- If you are connecting to a Fast Model, specify `--iris-connect` when launching the model, to start the Iris server. For more information, see [FVP command-line options](#).
- 

The model is composed of multiple targets which represent the components in the system. A `Target` object can be obtained by calling `Model.get_target(name)` on an instantiated model, passing it the name of the target. A convenience method `Model.get_cpus()` is also provided, which returns a list of `Target` objects for all targets for which `componentType == 'Core'`, or that have the `executesSoftware` flag set.

This example assumes that the model has started an Iris server locally, listening to port 7100:

```
import iris.debug
model = iris.debug.NetworkModel("localhost", 7100)
cpu = model.get_cpus()[0]
cpu.load_application("/path/to/application.axf")
model.run()
```

The code creates two variables:

**model**

A `Model` object which represents the entire simulated system. It is composed of various targets including cores and memories. The model object can be used to access these targets and to start, stop, and step the model.

**cpu**

A `Target` object, in this case the first CPU in the model. It can be used to read and write the memory and registers of the core and to set and clear breakpoints.

For documentation of the operations that can be performed on models and targets, see [5.4 class Model](#) on page 22 and [5.5 class Target](#) on page 26.



Some example scripts that demonstrate how to use `iris.debug` are located in `$PVLIB_HOME/Iris/Python/examples/`.

---

## Related information

[Iris examples](#)

## 3. Migrating from fm.debug to iris.debug

`fm.debug` is a deprecated Python client interface to Fast Models that was implemented using CADI. To continue using a Python client with Fast Models, users of `fm.debug` must migrate to the Iris Python client, `iris.debug`.

### 3.1 Changes when connecting to a model

If you previously used `fm.debug` with a model that was implemented as a shared library, `iris.debug` no longer supports this type of model.

#### About this task

With `iris.debug`, you must use an ISIM executable instead and follow these steps:

#### Procedure

1. Run the ISIM with the additional option `--iris-connect` to start the Iris server. For more information, see [FVP command-line options](#).
2. Use the Python client to connect to the model through the network, as follows:

```
import iris.debug
model = iris.debug.NetworkModel('localhost', <port_number>)
```

### 3.2 Changes to methods defined in Model.py and in Target.py

`iris.debug` is designed to work in the same way as `fm.debug`, but there are differences in how some methods are called.



All `Model` and `Target` class methods defined in `fm.debug`, apart from those listed here, are available in `iris.debug` and are unchanged.

#### **`save_state()` and `restore_state()`**

These methods are defined in `Model.py` and in `Target.py`. In `fm.debug`, the input argument `checkpoint_dir` could either be a checkpoint directory or a stream object. In `iris.debug`, this argument can only be a checkpoint directory, which means that it must be a string and not a stream object.

#### **`reset()`**

In the `fm.debug` implementation, this method is called from a `Target` object. `iris.debug` implements this method in the `Model` class, which means that you can call `model.reset()` but can no longer call `target.reset()`.

## 4. Upgrading MxScripts to Python

Arm deprecates the MxScript language. Use Python Debug Scripting instead. This chapter describes the major differences between the MxScript and Python, and gives the `iris.debug` equivalents to various MxScript functions for interacting with a model.

### 4.1 Major differences between MxScript and Python

The main differences are as follows:

- Each Python script that uses `iris.debug` must have the following line near the top:

```
from iris.debug import *
```

- In MxScript, comment lines begin with `//`, whereas in Python they begin with `#`.
- In Python, indentation, not curly braces, is used to represent scope. Therefore, your indentation must be correct and consistent, and curly braces must not be used to represent scope.
- In Python, statements are not required to be delimited with semicolons. Instead, a new line is sufficient.
- In Python, flow control statements, for example `if`, `for`, and `while`, end with a colon, and the block of code that they apply to is indented. If necessary, an empty block can be created using the `pass` statement. To check for multiple conditions, only one of which is true, the `elif` statement can be used. For example:

```
if foo < 5:
    bar = 3
elif foo >= 17:
    bar += 2
else:
    bar = 7
```

- In Python, `for` loops always iterate over a list. To create a list of integers, the `range` function is used. For example:

```
>>> range(3)
[0, 1, 2]
```

The following two loops are equivalent. This loop is written in MxScript:

```
for (int i = 0; i < 3; i++) {
    // do nothing
}
```

This one is written in Python:

```
for i in range(3):
```

```
pass
```

- `while` loops behave similarly to their MxScript equivalents. However, they use the Python syntax rule of ending a flow control statement with a colon, and use indentation to represent scope. For example:

```
while i > 1:
    i /= 2
```

- Python does not have an equivalent to the MxScript `do ... while` loop.
- In Python, the logical operators `and`, `or`, and `not` are used instead of `&&`, `||`, and `!`.
- In Python, variables are not explicitly typed, so the following examples are equivalent. This code is written in MxScript:

```
int a = 5;
string b = "hello";
```

This is written in Python:

```
a = 5
b = "hello"
```

- Unlike MxScript, Python does not have a preprocessor. Instead, the `import` statement can be used to access code from another file. This statement has the following forms:

```
import iris.debug
```

Loads the `iris.debug` module, and adds `iris.debug` to the current namespace.

```
from iris.debug import NetworkModel
```

Loads the `iris.debug` module and adds `NetworkModel` to the current namespace, without making `iris.debug` or any of its other contents available.

```
from iris.debug import *
```

Adds the entire contents of the `iris.debug` module to the current namespace.

## 4.2 Model connection and configuration

MxScript has the concepts of the current model, and the current target in that model. All functions operate on the current model or target, and the `selectTarget()` function switches between targets.

In contrast, `iris.debug` uses an object-oriented design, in which objects represent models and targets. These objects provide methods to interact with them. This design makes it much more practical to work with multiple targets or models. An example of where this design is useful is debugging a multi-processor system, where it is necessary to interact with multiple CPU targets.

The following table shows the MxScript functions that connect to and configure models, and their `iris.debug` equivalents:

**Table 4-1: Model connection and configuration functions**

MxScript function	iris.debug equivalent
<code>connectToModel(port)</code>	<code>model = NetworkModel(host, port)</code> <b>Note:</b> This function does not select the target.
<code>closeModel()</code>	<code>model.release()</code>
<code>debugIsim(isim)</code>	Not implemented
<code>debugSystemC(simulation)</code>	Not implemented
<code>getParameter(name)</code>	<code>target.parameters["name"]</code>
<code>setParameter(name, value)</code>	<code>target.parameters["name"] = value</code>
<code>getTargetList(filename)</code>	<code>model.get_target_info()</code>
<code>getTargetName()</code>	<code>target.instance_name</code>
<code>selectTarget(name)</code>	Either of the following: <ul style="list-style-type: none"> <li><code>target = model.get_target(name)</code></li> <li><code>cpus = model.get_cpus()</code></li> </ul>
<code>loadApp(filename)</code>	<code>target.load_application(filename)</code>
<code>saveState(filename)</code>	Not implemented
<code>restoreState(filename)</code>	Not implemented
<code>saveSession(filename)</code>	Not implemented
<code>openSession(filename)</code>	Not implemented
<code>setStateFile(filename)</code>	Not implemented

## 4.3 Execution control

`iris.debug` is not a full debugger. Therefore, it does not implement higher-level functions, such as those that require loading the source files or debug symbols that correspond to an application.

The following table shows the MxScript functions that control model execution, and their `iris.debug` equivalent:

**Table 4-2: Execution control functions**

MxScript function	iris.debug equivalent
<code>run()</code>	Either of the following: <ul style="list-style-type: none"> <li><b><code>model.run()</code></b> This function blocks until the target stops.</li> <li><b><code>model.run(blocking=False)</code></b> This function is nonblocking.</li> </ul>
<code>runUntil(&lt;address&gt;)</code>	Not implemented
<code>runToLine(&lt;file&gt;, &lt;line&gt;)</code>	Not implemented
<code>stop()</code>	<code>model.stop()</code>



MxScript function	iris.debug equivalent
<code>getCurrentSourceFile()</code>	Not implemented
<code>getCurrentSourceLine()</code>	Not implemented
<code>getCurrentSourceColumn()</code>	Not implemented
<code>hardReset()</code>	<code>model.reset()</code>
<code>reset()</code>	<code>model.reset()</code>  <code>target.load_application(&lt;filename&gt;)</code>
<code>pause()</code>	Not implemented
<code>cont()</code>	Not implemented
<code>getStopCond()</code>	Either of the following: <ul style="list-style-type: none"> <li><code>target.get_hit_breakpoints()</code></li> <li>Return value of blocking <code>model.run()</code></li> </ul>
<code>isSimStopped()</code>	<code>not target.is_running</code>
<code>restart()</code>	<code>model.reset()</code>  <code>target.load_application(&lt;filename&gt;)</code>
<code>goToMain()</code>	Not implemented
<code>step()</code>	Not implemented
<code>stepOver()</code>	Not implemented
<code>stepOut()</code>	Not implemented
<code>istep(&lt;count&gt;)</code>	<code>model.step()</code>
<code>getInstCount()</code>	Not implemented
<code>cycleStep(&lt;cycles&gt;)</code>	Not implemented
<code>enableStepBack(&lt;bool&gt;)</code>	Not implemented
<code>sleep(&lt;seconds&gt;)</code>	<code>import time</code>  <code>time.sleep(&lt;seconds&gt;)</code>
<code>msleep(&lt;milliseconds&gt;)</code>	<code>import time</code>  <code>time.sleep(&lt;milliseconds * 1000&gt;)</code>
<code>getCycleCount()</code>	Not implemented

## 4.4 Breakpoints

The following table shows the MxScript functions that relate to breakpoints and their `iris.debug` equivalent:

**Table 4-3: Breakpoints functions**

MxScript function	iris.debug equivalent
<code>bpAdd(address)</code>	<code>bp = target.add_bpt_prog(address)</code>
<code>bpAdd(file, line)</code>	Not implemented

MxScript function	iris.debug equivalent
<code>bpAddReg (reg_name)</code>	<code>bp = target.add_bpt_reg (reg_name)</code>
<code>bpAddMem (address)</code>	<code>bp = target.add_bpt_mem (address)</code>
<code>bpRemove (id)</code>	<code>bp.delete ()</code>
<code>bpRemoveAll ()</code>	<pre>for bp in target.breakpoints.values():     bp.delete()</pre>
<code>bpEnable (id)</code>	<code>bp.enable ()</code>
<code>bpDisable (id)</code>	<code>bp.disable ()</code>
<code>bpEnableAll ()</code>	<pre>for bp in target.breakpoints.values():     bp.enable()</pre>
<code>bpDisableAll ()</code>	<pre>for bp in target.breakpoints.values():     bp.disable()</pre>
<code>bpList ()</code>	<code>target.breakpoints</code>
<code>bpSetTriggerType ()</code>	Not implemented
<code>bpSetIgnoreCount ()</code>	Not implemented
<code>bpSetCond ()</code>	Not implemented
<code>bpIsHit (id)</code>	<code>bp.is_hit</code>

## 4.5 Model resource access

The following table shows the MxScript functions that access model resources, and their `iris.debug` equivalent:

**Table 4-4: Resource access functions**

MxScript function	iris.debug equivalent
<code>regWrite (name, value)</code>	<code>target.write_register (name, value)</code>
<code>regRead (name)</code>	<code>target.read_register (name)</code>
<code>memWrite (memspace, address, value)</code>	<code>target.write_memory (address, value[, memspace])</code> If <i>memspace</i> is not specified, the current memory space is used.
<code>memRead (memspace, address, count)</code>	<code>target.read_memory (address, count[, memspace])</code> If <i>memspace</i> is not specified, the current memory space is used.
<code>disassemble (address)</code>	<code>target.disassemble (address)</code>
<code>memStoreToFile (...)</code>	<pre>with open("tempmem.bin", "wb") as f:     mem = cpu.read_memory(0, count=1024)     f.write(mem)</pre>
<code>memLoadFromFile (...)</code>	<pre>with open("tempmem.bin", "rb") as f:     mem = bytearray(f.read(1024))     cpu.write_memory(0, mem)</pre>

## 5. API reference

This chapter describes the public interface of `iris.debug`. Any members whose name starts with an underscore are internal and have not been documented.



`iris.debug` does not support the `fm.debug` class `LibraryModel`, which is used to access a CADI model.

An existing model can be connected to by creating a new `NetworkModel`, passing either the IP address or hostname, and port number.

The model is comprised of multiple targets which represent the components in the system.

A `Target` object can be obtained by calling `Model.get_target(name)` on an instantiated model, passing it the name of the target.

A convenience method `Model.get_cpus()` is also provided which returns a list of `Target` objects for all targets for which `componentType == 'Core'` or that have the `executesSoftware` flag set. For example:

```
>>> model = NetworkModel(host = 'localhost', port = 7100)
>>> cpus = model.get_cpus()
>>> cpus[0].read_register("CPSR")
>>> model.run()
```

### 5.1 class NetworkModel

```
iris.debug.NetworkModel(host='localhost', port=0, timeoutInMs=5000,
client_name='client.iris_debug', verbose=False)
```

An Iris model that is connected to an Iris server.

#### Parameters

**host**

Hostname or IP address of the computer running the model.

**port**

Port number that the model is listening on. If 0, it scans the port range 7100-7109 for Iris servers and connects to the first one found.

**timeoutInMs**

Time limit in milliseconds for the connection to wait for a response from the server. By default, 5000ms.

**client\_name**

Hierarchical name of the client instance.

**verbose**

If True, extra debugging information is printed.

## 5.2 class NetworkModelInitializer

```
class iris.NetworkModelInitializer(server_startup_command=None, host='localhost',  
port=None, timeout_in_ms=1000, synchronous=False, verbose=False)
```

The `NetworkModelInitializer` class represents an established or pending connection between an Iris model debugger, accessible through the class `NetworkModel`, and an Iris server which is embedded either in an ISIM or in a simulation that uses an ISIM as a library.

Use the `NetworkModelFactory` class to create an instance of this class. After it is created, you can use it in one of two ways:

- In the following example, `network_model` is an instance of `NetworkModel`. All resources are automatically deallocated at the end of the `with` statement context:

```
with NetworkModelFactory.CreateNetworkToHost(host, port) as network_model:  
    network_model.get_targets()
```

- In the following example, `network_model` is an instance of `NetworkModel`. Resources are not automatically deallocated so you need to handle exceptions and force deallocation manually:

```
network_model_initializer = NetworkModelFactory.CreateNetworkToHost(host, port)  
network_model = network_model_initializer.start()  
try:  
    network_model.get_targets()  
finally:  
    network_model_initializer.close()
```

A full working example is provided in `$PVLIB_HOME/Iris/Python/Examples/DemoNetworkInitializer.py`.

## 5.3 class NetworkModelFactory

```
class iris.NetworkModelFactory
```

Allows the creation of `NetworkModelInitializers`. It contains only class methods.

### 5.3.1 CreateNetworkFromCommand()

```
CreateNetworkFromCommand(command_line, timeout_in_ms=1000)
```

Create a network model initializer for an Iris server to be started using a command line.

#### Parameters

**command\_line**

The command line to launch the Iris server.

**timeout\_in\_ms**

Timeout in milliseconds for the connection between the client and the Iris TCP server.

#### Related information

[class NetworkModelInitializer](#) on page 20

### 5.3.2 CreateNetworkFromIsim()

```
CreateNetworkFromIsim(isim_filename, parameters=None, timeout_in_ms=1000)
```

Create a network model initializer for an ISIM that is not yet running.

#### Parameters

**isim\_filename**

Full path of the ISIM to launch.

**parameters**

Parameters to pass to the ISIM.

**timeout\_in\_ms**

Timeout in milliseconds for the connection between the client and the Iris TCP server.

#### Related information

[class NetworkModelInitializer](#) on page 20

### 5.3.3 CreateNetworkFromLibrary()

```
CreateNetworkFromLibrary(simulation_command, library_filename, parameters=None,  
timeout_in_ms=1000)
```

Create a network model initializer for a simulation application that uses an ISIM as a library and is not yet running.

#### Parameters

**simulation\_command**

The command to launch the simulation application.

**library\_filename**

Full path to the library.

**parameters**

Parameters to pass to the simulation.

**timeout\_in\_ms**

Timeout in milliseconds for the connection between the client and the Iris TCP server.

**Related information**

[class NetworkModelInitializer](#) on page 20

### 5.3.4 CreateNetworkToHost()

```
CreateNetworkToHost(hostname, port, timeout_in_ms=1000)
```

Create a network model initializer for an Iris server that is already running and is accessible at the given hostname and port.

**Parameters****hostname**

Hostname that the Iris server is running on.

**port**

Port number that the Iris server is listening on.

**timeout\_in\_ms**

Timeout in milliseconds for the connection between the client and the Iris server.

**Related information**

[class NetworkModelInitializer](#) on page 20

## 5.4 class Model

```
iris.debug.Model(client, verbose)
```

This class wraps an Iris model.

### 5.4.1 get\_cpus()

```
get_cpus()
```

Return all targets that have `executesSoftware` set or have `componentType = 'Core'`.

## 5.4.2 get\_target()

```
get_target(instance_name)
```

Obtain an interface to a target.

### Parameters

**instance\_name**

The instance name that corresponds to the target.

## 5.4.3 get\_target\_info()

```
get_target_info()
```

Return an iterator over named tuples that contain information about all of the target instances contained in the model.

## 5.4.4 get\_targets()

```
get_targets()
```

Generator function to iterate over all targets in the simulation.

## 5.4.5 release()

```
release(shutdown=False)
```

End the simulation and release the model.

### Parameters

**shutdown**

If True, the simulation is shut down and any other scripts or debuggers must disconnect.

If False, a simulation might be kept alive after disconnection.

## 5.4.6 reset()

```
reset(allow_partial_reset=False)
```

Reset the simulation to exactly the same state it had after instantiation.

## Parameters

### **allow\_partial\_reset**

If true, perform a partial simulation reset for simulations that do not support a full reset. This might be because only the Fast Models components in a SystemC platform simulation can be reset. By setting `allow_partial_reset` to True, you acknowledge that not all components will be reset and accept the consequences.

For an ISIM model, which is built purely from Fast Models components, the whole platform can be reset.

## 5.4.7 `restore_state()`

```
restore_state(stream_directory, restore_all=True)
```

Restore the state of the simulation. Returns True if all components are restored successfully.

## Parameters

### **stream\_directory**

String that is treated as the name of the directory from which to restore the simulation state.

### **restore\_all**

If True, restore the state of the simulation and all targets in it that support checkpointing. If False, only restore the simulation state. This parameter defaults to True.

## Exceptions

### **NotImplementedError**

If `restore_all` is False, and the simulation does not support checkpointing.

## 5.4.8 `run()`

```
run(blocking = True, timeout = None)
```

Start executing the model.

## Parameters

### **blocking**

If True, this call blocks until the model stops executing, typically due to a breakpoint.

If False, this call returns when the target starts executing.

### **timeout**

If None, this call waits indefinitely for the target to enter the correct state.

If set to a float or int, this parameter gives the maximum number of seconds to wait.



## Exceptions

### **TimeoutError**

The timeout expired.

### **TargetBusyError**

The model is already running.

## 5.4.9 save\_state()

```
save_state(stream_directory, save_all=True)
```

Save the state of the simulation. Returns True if all components are saved successfully.

### Parameters

#### **stream\_directory**

String that is treated as the name of the directory to which to save the simulation state.

#### **save\_all**

If True, save the state of the simulation and all targets in it that support checkpointing. If False, only save the simulation state. This parameter defaults to True.

## Exceptions

### **NotImplementedError**

`save_all` is False, and the simulation does not support checkpointing.

## 5.4.10 step()

```
step(count=1, timeout=None)
```

Step all cores in the system for `count` instructions each, blocking.

Cores are stepped individually and sequentially. The first core is stepped for `count` instructions. When that completes, the second core is stepped for `count` instructions and so on. This is intrusive debugging as it permutes the scheduling order of the cores and it generally lets more simulation time pass than indicated by `count`. Also, the number of steps executed is independent of the relative clock speeds of the CPUs.

Only cores that have `get_execution_state() == True` are processed by this function. Therefore it is possible to select which cores should be stepped by calling `set_execution_state()` beforehand.



Note

This is an exotic stepping function. Use `core.set_steps()` or `model.run()` for normal non-intrusive stepping.

## Parameters

**count**

The number of processor instructions to execute.

**timeout**

If None, this call waits indefinitely for the target to enter the correct state.

If set to a float or int, this parameter gives the maximum number of seconds to wait.

## Exceptions

**TimeoutError**

The timeout expired.

**TargetBusyError**

The model is running.

**ValueError**

No CPUs are present or not all CPUs support per-instance execution control.

### 5.4.11 stop()

```
stop(timeout = None)
```

Stop the model executing.

Silently returns if the model is already stopped.

## Parameters

**timeout**

If None, this call waits indefinitely for the target to enter the correct state.

If set to a float or int, this parameter gives the maximum number of seconds to wait.

## Exceptions

**TimeoutError**

The timeout expired.

## 5.5 class Target

```
iris.debug.Target(instInfo, model)
```

Wraps an Iris object, providing a simplified interface to common tasks.

You can access memory, registers, and breakpoints using methods defined in this class, for example:

```
cpu.read_memory(0x1234, count=8)
cpu.write_register("Core.R5", 1000)
cpu.add_bpt_mem(0x1234, memory_space="Secure", on_read=False)
cpu.add_bpt_reg("Core.CPSR")
```

The breakpoint-related methods return `Breakpoint` objects, which allow you to enable, disable, and delete the breakpoint. You can access the breakpoints that are set by using the dictionary `Target.breakpoints`, which maps from breakpoint numbers to `Breakpoint` objects.

### 5.5.1 add\_bpt\_mem()

```
add_bpt_mem(address, memory_space=None, on_read=True, on_write=True, on_modify=None)
```

Set a new data breakpoint which is hit when the specified memory location is accessed.

#### Parameters

**address**

The address to set the breakpoint on.

**memory\_space**

The name of the memory space that `address` is in. If `None`, the current memory space of the core is used.

**on\_read**

If `True`, the breakpoint is triggered when the memory location is read from.

**on\_write**

If `True`, the breakpoint is triggered when the memory location is written to.

**on\_modify**

Deprecated. If `True`, the breakpoint is triggered when the memory location is modified.

### 5.5.2 add\_bpt\_prog()

```
add_bpt_prog(address, memory_space=None)
```

Set a new code breakpoint which is hit when program execution reaches the specified memory address.

#### Parameters

**address**

The address to set the breakpoint on.

**memory\_space**

The name of the memory space that `address` is in. If `None`, the current memory space of the core is used.

### 5.5.3 add\_bpt\_reg()

```
add_bpt_reg(reg_name, on_read=True, on_write=True, on_modify=None)
```

Set a new register breakpoint which is hit when the specified register is accessed.

#### Parameters

**reg\_name**

The name of the register to set the breakpoint on. The name can be in any of the following formats:

- `"group.register"`
- `"group.register.field"`
- `"register"`
- `"register.field"`

The last two forms can only be used if the register name is unambiguous.

**on\_read**

If True, the breakpoint is triggered when the register is read from.

**on\_write**

If True, the breakpoint is triggered when the register is written to.

**on\_modify**

Deprecated. If True, the breakpoint is triggered when the register is modified.

### 5.5.4 add\_event\_callback()

```
add_event_callback(event_name, func, fields=None)
```

Add a callback function for the named event. This function is called when the event fires.

#### Parameters

**event\_name**

The name of the event.

**func**

A callback to be called when the event fires.

**fields**

A list of event fields that the callback provides.

### 5.5.5 clear\_bpts()

```
clear_bpts()
```

Clear all breakpoints.

### 5.5.6 disassemble()

```
disassemble(address, count=1, mode=None, memory_space=None)
```

Disassemble instructions.

If `count=1` this method returns a 3-tuple of `addr`, `opcode`, `disass`, where:

<b>addr</b>	is the address of the instruction.
<b>opcode</b>	is a string containing the instruction opcode at that address.
<b>disass</b>	is a string containing the disassembled representation of the instruction.

If `count > 0`, this method behaves like a generator function that yields one 3-tuple for each disassembled instruction.

#### Parameters

**address**

Address to start disassembling from.

**count**

Number of instructions to disassemble. Default is 1. This method might yield fewer than `count` results if an error occurs during disassembly.

**mode**

Disassembly mode to use. Must be either `None`, in which case the target's current mode is used, or one of the values returned by `get_disass_modes()`. Default is `None`.

**memory\_space**

Memory space for `address`. Must be the name of a valid memory space for this target or `None`. If `None`, the current memory space is used. Default is `None`.

#### Exceptions

**ValueError**

The target does not support disassembly.

### 5.5.7 get\_disass\_modes()

```
get_disass_modes()
```

Return the disassembly modes for this `target`.

### 5.5.8 `get_event_info()`

`get_event_info(name=None)`

Retrieve information about the event sources provided by this `Target`.

It is used in the following ways:

**`get_event_info(name)`**

Return the information for the named event and its fields.

**`get_event_info()`**

Act as a generator and yield information about all events.

#### Parameters

**`name`**

The name of the event to provide information for. If `None`, yields information about all events.

### 5.5.9 `get_execution_state()`

`get_execution_state()`

Return `True` if execution state is enabled.

#### Exceptions

**`ValueError`**

It cannot get the execution state.

### 5.5.10 `get_hit_breakpoints()`

`get_hit_breakpoints()`

Return the list of breakpoints that were hit the last time the `Target` was running.

### 5.5.11 `get_instruction_count()`

`get_instruction_count()`

Return the current instruction count of the `Target`.

### 5.5.12 `get_pc()`

`get_pc()`

Return the current value of the program counter.

### 5.5.13 `get_register_info()`

`get_register_info(name=None)`

Retrieve information about the registers that are present in this `Target`.

It is used in the following ways:

**`get_register_info(name)`**

Return the information for the named register.

**`get_register_info()`**

Act as a generator and yield information about all registers.

#### Parameters

**`name`**

The name of the register to provide information for. If `None`, it yields information about all registers. It follows the same rules as the `name` parameter of `read_register()` and `write_register()`.

### 5.5.14 `get_steps()`

`get_steps(unit='instruction')`

Return the remaining number of steps.

#### Parameters

**`unit`**

Steps unit. Must be either:

**`'instruction'`**

A step is one executed instruction. This is the default.

**`'cycle'`**

A step is one cycle.

#### Exceptions

**`ValueError`**

Cannot get the remaining steps.

### 5.5.15 get\_table\_info()

```
get_table_info(name=None)
```

Retrieve information about the tables that are present in this `Target`.

It is used in the following ways:

**get\_table\_info(name)**

Return the information for the named table and its columns.

**get\_table\_info()**

Act as a generator and yield information about all tables.

#### Parameters

**name**

The name of the table to provide information for. If `None`, yields information about all tables.

### 5.5.16 handle\_semihost\_io()

```
handle_semihost_io()
```

Request that semihosted input and output are handled for this `Target` by this Iris client.

### 5.5.17 has\_register()

```
has_register(name)
```

Return `True` if the named register exists and has an unambiguous name, `False` otherwise.

#### Parameters

**name**

The name of the register. It follows the same rules as the `name` parameter of `read_register()` and `write_register()`.

### 5.5.18 has\_table()

```
has_table(name)
```

Return `True` if the `Target` has the named table.

#### Parameters

**name**

The name of the table.



### 5.5.19 load\_application()

```
load_application(filename, loadData=None, verbose=None, parameters=None)
```

Load an application to run on the model.

#### Parameters

**filename**

The filename of the application to load.

**loadData**

Deprecated.

If set to True, the target loads data, symbols, and code.

If set to False, the target does not reload the application code to its program memory. This can be used, for example, to either:

- Forward information about applications that are loaded to a target by other platform components.
- Change command-line parameters for an application that was loaded by a previous call.

**verbose**

Set this to True to allow the target to print verbose messages.

**parameters**

Deprecated.

A list of command-line parameters to pass to the application, or None.

### 5.5.20 read\_memory()

```
read_memory(address, memory_space=None, size=1, count=1, do_side_effects=False)
```

Return a byte array of length `size*count`.

#### Parameters

**address**

Address to begin reading from.

**memory\_space**

Name of the memory space to read or None, which reads the core's current memory space.

**size**

Size of the memory access unit in bytes. Must be one of 1, 2, 4, or 8.



- Not all values are supported by all models.
- The data is always returned as bytes, so calling this function with `size=4`, `count=1` returns a byte array of length 4.

**count**

Number of units to read.

**do\_side\_effects**

Deprecated.

If `True`, the `target` must perform any side-effects that are normally triggered by the read, for example clear-on-read.

### 5.5.21 read\_all\_registers()

```
read_all_registers()
```

Read the current value of all registers. Returns a dictionary of register values keyed off register id.

#### Exceptions

**ValueError**

Failed to read a readable register.

### 5.5.22 read\_register()

```
read_register(name=None, side_effects=False, rscId=None)
```

Read the current value of a register.

#### Parameters

**name**

The name of the register to read from. This can take the following forms:

- `"group.register"`
- `"group.register.field"`
- `"register"`
- `"register.field"`

If `rscId` is provided, `name` is ignored.

**side\_effects**

Deprecated.

**rscId**

Resource id of the register to read from. If this is provided, `name` is ignored.

**Exceptions****ValueError**

The register name does not exist, or the group name is omitted and there are multiple registers in different groups with that name.

### 5.5.23 read\_table()

```
read_table(name, index=None, count=1)
```

Read the specified rows from the named table. The rows are returned as a dictionary, in the form:

```
{index : {<colname> : <value>, ...}, ...}
```

**Parameters****name**

The name of the table to read from.

**index**

Row from which to start reading. Default is `minIndex` of the table.

**count**

Number of rows to read, starting from `index`. Default is 1.

**Exceptions****ValueError**

The table `name` does not exist, or `count` is less than 1.

### 5.5.24 remove\_event\_callback()

```
remove_event_callback(event_name_or_func)
```

Remove an event callback function that was previously added to this `Target`.

**Parameters****event\_name\_or\_func**

Either the name of an event or a callable object that was previously added to this `Target` as an event callback.

### 5.5.25 remove\_bpt()

```
remove_bpt(bptId)
```

Delete a breakpoint.

#### Parameters

**bptId**

Breakpoint id of the breakpoint to delete.

#### Exceptions

**ValueError**

`bptId` does not exist, or the deletion failed.

### 5.5.26 restore\_state()

```
restore_state(checkpoint_directory)
```

Restore the state of this `Target` from a directory.

#### Parameters

**checkpoint\_directory**

Directory in which the target state was stored.

### 5.5.27 save\_state()

```
save_state(checkpoint_directory)
```

Save the state of this `Target` to a directory.

#### Parameters

**checkpoint\_directory**

Directory to which to save the target state.

### 5.5.28 set\_execution\_state()

```
set_execution_state(enable)
```

Set the execution state of this `Target`.

#### Parameters

**enable**

True to enable execution of instructions, false to disable it.

## Exceptions

### **ValueError**

Cannot set the execution state.

## 5.5.29 set\_steps()

```
set_steps(steps, unit='instruction')
```

Set the remaining number of steps.

### Parameters

#### **unit**

Steps unit, either:

#### **'instruction'**

A step is one executed instruction. This is the default.

#### **'cycle'**

A step is one cycle.

## Exceptions

### **ValueError**

Cannot set the remaining number of steps.

## 5.5.30 supports\_tables()

```
supports_tables()
```

Return True if the `target` has any tables.

## 5.5.31 write\_memory()

```
write_memory(address, data, memory_space=None, size=1, count=None,  
do_side_effects=False)
```

Write a byte array of length `size*count` to memory.

### Parameters

#### **address**

Address to begin writing to.

#### **data**

The data to write. If `count` is 1, this can be an integer. Otherwise it must be a byte array with length `>= size*count`.

**memory\_space**

The memory space to write to. The default is `None` which reads the core's current memory space.

**size**

Size of the memory access unit in bytes. Must be one of 1, 2, 4, or 8.



Not all values are supported by all models.

---

**count**

Number of units to write. If `None`, `count` is automatically calculated such that all data from the array is written to the target.

**do\_side\_effects**

Deprecated.

If `True`, the target must perform any side-effects normally triggered by the write, for example triggering an interrupt.

## 5.5.32 write\_register()

```
write_register(name=False, value=None, side_effects=False, rscId=None)
```

Write a value to a register.

### Parameters

**name**

The name of the register to write to. This can take the following forms:

- `"group.register"`
- `"group.register.field"`
- `"register"`
- `"register.field"`

If `rscId` is provided, `name` is ignored.

**value**

The value to write to the register.

**side\_effects**

Deprecated.

**rscId**

Resource id of the register to write to. If this is provided, `name` is ignored.

## Exceptions

### **ValueError**

Neither a register name nor a resource id were provided.

## 5.5.33 write\_table()

```
write_table(name, table_records)
```

Write specified records to a table.

### Parameters

#### **name**

The name of the table to write to.

#### **table\_records**

A dictionary in the form:

```
{ index : rowdata, ... }
```

where:

#### **index**

The value of the row index where `rowdata` is written.

#### **rowdata**

The cells in dictionary form:

```
{ <col name> : <value>, ... }
```

The table record can have a subset of the cells in the row to which a write should take place.

This parameter has the same format as the return value of `read_table()`.

## Exceptions

### **ValueError**

The table does not exist.

## 5.5.34 Target properties

The `Target` class defines the following properties:

#### **component\_type**

The type of a target component as a string.

#### **description**

The description of a target.

**disass\_mode**

The current disassembly mode for this target.

**executes\_software**

True if the component supports executing instructions.

**instance\_name**

The instance name of the target.

**is\_running**

True if the target is currently running.

**stdin**

The target's semihosting stdin.

**stdout**

The target's semihosting stdout.

**stderr**

The target's semihosting stderr.

**target\_name**

The name of the target component.

## 5.6 class EventCallbackManager

```
class iris.debug.EventCallbackManager(client, target, verbose)
```

Manages user event callbacks for a particular target instance.

### 5.6.1 add\_callback()

```
add_callback(evSrcId, func, fields=None)
```

Create an event stream for the specified event source which will call back `func()`.

#### Parameters

**evSrcId**

Event source id of the event.

**func**

Name of the callback function for the event.

**fields**

List of string names of event source fields to receive in the callback function.



## Exceptions

### **ValueError**

Unknown event source id, or unknown event field.

### **Exceptions.TargetError**

Failed to add the event callback.

## 5.6.2 get\_evSrcId()

```
get_evSrcId(name)
```

Get the event source id for the named event.

### Parameters

#### **name**

Name of the event.

### Exceptions

#### **ValueError**

The target does not support the named event.

## 5.6.3 get\_info()

```
get_info()
```

Yield `EventSourceInfo` for all events that are supported by the target instance.

## 5.6.4 remove\_callback\_evSrcId()

```
remove_callback_evSrcId(evSrcId)
```

Remove a registered callback by event source id.

### Parameters

#### **evSrcId**

The event source id for the callback function to remove.

## 5.6.5 remove\_callback\_func()

```
remove_callback_func(func_to_remove)
```

Remove a registered callback function.

## Parameters

### **func\_to\_remove**

Callback function to remove.

## Exceptions

### **ValueError**

No event stream is registered with this callback function.

## 5.7 class Breakpoint

```
class iris.debug.Breakpoint(target, bpt_info)
```

Provides a high level interface to a breakpoint in an Iris target.

### 5.7.1 delete()

```
delete()
```

Remove the breakpoint from the target.

### 5.7.2 disable()

```
disable()
```

Disable the breakpoint if the model supports it.

### 5.7.3 enable()

```
enable()
```

Enable the breakpoint if the model supports it.

### 5.7.4 wait()

```
wait(timeout=None)
```

Block until the breakpoint is triggered or the timeout expires.

Return True if the breakpoint was triggered, False otherwise.

## 5.7.5 Breakpoint properties

The `Breakpoint` class defines the following properties:

### **address**

The memory address at which this breakpoint is set. Only valid for code and data breakpoints.

### **bpt\_type**

The name of the breakpoint type. Valid values are:

<b>Program</b>	Code breakpoint.
<b>Memory</b>	Data breakpoint.
<b>Register</b>	Register breakpoint.

### **enabled**

True if the breakpoint is currently enabled.

### **is\_hit**

True if the breakpoint was hit the last time the target was running.

### **memory\_space**

The name of the memory space in which this breakpoint is set.

Only valid for code and data breakpoints.

### **number**

Identification number of this breakpoint.

This number is the same as the key in the `Target.breakpoints` dictionary.

If the number is non-negative, it is equal to the `bptId` and the breakpoint is enabled. If the number is negative, the breakpoint is disabled.

This number is only valid until the breakpoint is deleted, and breakpoint numbers can be reused and modified.

### **on\_modify**

Deprecated. True if this breakpoint is triggered on modify. Only valid for register and memory breakpoints.

### **on\_read**

True if this breakpoint is triggered by reads. Only valid for register and memory breakpoints.

### **on\_write**

True if this breakpoint is triggered by writes. Only valid for register and memory breakpoints.

### **register**

The name of the register that this breakpoint is set on. Only valid for register breakpoints.

## 5.8 Exceptions

`iris.debug` defines the following exception classes:

### **`iris.debug.SecurityError`**

Method failed because an access was denied.

This could be caused by, for example, writing to a read-only register or reading memory with restricted access.

### **`iris.debug.SimulationEndedError`**

Attempted to call a method on a simulation that has ended.

### **`iris.debug.TargetBusyError`**

The call could not be completed because the target is busy.

Registers and memories, for example, might not be writable while the target is executing application code.

The debugger can either wait for the target to reach a stable state or enforce a stable state by, for example, stopping a running target. The debugger can then repeat the original call when the target has reached a stable state.

### **`iris.debug.TargetError`**

An error occurred while accessing the target.

### **`iris.debug.TimeoutError`**

Timeout expired while waiting for a target to enter the new state.