Copyright ©2006 by Creative Technology Limited
All rights reserved.

Trademarks and Service Marks
Creative, Sound Blaster, Sound Blaster X-Fi, and the Creative logo are registered trademarks, and Environmental Audio, EAX, and the Environmental Audio Extensions logo are trademarks of Creative Technology Ltd. in the United States and/or other countries.

All other brands and product names listed are trademarks or registered trademarks of their respective holders.

Acknowledgments
Documentation written by Garin Hiebert. Additional input by Keith Charley, Jean-Marc Jot, Daniel Peacock, Jean-Michel Trivi, and Carlo Vogelsang.

Revision History
Revision 1.0 October 2005 Garin Hiebert
Revision 1.1 July 2006 Garin Hiebert

Licensing
Please refer to the End User License Agreement ("EULA") for this SDK. Agreement to the terms and conditions of the EULA was required to download and use this OpenAL-EX SDK. The EULA is also included in this document for ease of reference. In order to redistribute the OpenAL32.dll and other components of OpenAL, you must download and agree to the OpenAL License included in the installer. A copy of this OpenAL License is also included in this document. If there are further questions on legal issues, please contact your Creative representative or email devrelgaming@creativelabs.com.

OpenAL License
NO WARRANTY
ANY USE BY YOU OF THE SOFTWARE IS AT YOUR OWN RISK. THE SOFTWARE IS PROVIDED FOR USE "AS IS" WITHOUT WARRANTY OF ANY KIND. TO THE MAXIMUM EXTENT PERMITTED BY LAW, CREATIVE DISCLAIMS ALL WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CREATIVE IS NOT OBLIGATED TO PROVIDE ANY UPDATES OR UPGRADES TO THE SOFTWARE.

No other entity or person is authorized to expand or alter this warranty or any other provisions herein. Creative does not warrant that the functions contained in the Software will meet your requirements or that the operation of the Software will be uninterrupted or error-free or free from malicious code. For purposes of this paragraph, "malicious code" means any program code designed to contaminate other computer programs or computer data, consume computer resources, modify, destroy, record, or transmit data, or in some other fashion usurp the normal operation of the computer, computer system, or computer network, including viruses, Trojan horses, droppers, worms, logic bombs, and the like.

You assume full responsibility for the selection of the Software to achieve your intended results, and for the downloading, use and results obtained from the Software. You also assume the entire risk as it applies to the quality and performance of the Software.

IN NO EVENT WILL CREATIVE'S LIABILITY TO YOU OR ANY OTHER PERSON EVER EXCEED THE AMOUNT PAID BY YOU TO USE THE SOFTWARE, REGARDLESS OF THE FORM OF THE CLAIM.
# Table of Contents

TABLE OF CONTENTS .................................................................................................................. 3

ABOUT THIS DOCUMENT ........................................................................................................... 6

1. INTRODUCTION .......................................................................................................................... 6
2. INTENDED AUDIENCE ............................................................................................................... 6
3. OTHER OPENAL RESOURCES .................................................................................................... 6

4. INTRODUCTION TO OPENAL .................................................................................................. 7
   4.1 OBJECTS .................................................................................................................................... 7
   4.2 DEVICE ENUMERATION .......................................................................................................... 8
   4.3 INITIALIZING/EXITING ......................................................................................................... 10
   4.4 LISTENER PROPERTIES ....................................................................................................... 11
   4.5 BUFFER PROPERTIES ......................................................................................................... 12
   4.6 SOURCE PROPERTIES ......................................................................................................... 13
   4.7 QUEUING BUFFERS ON A SOURCE ..................................................................................... 15
   4.8 DOPPLER SHIFT .................................................................................................................... 16
   4.9 ERROR HANDLING ............................................................................................................... 17
   4.10 EXTENSIONS ....................................................................................................................... 18

5. CORE OPENAL FUNCTIONS ..................................................................................................... 19
   5.1 BUFFER-RELATED .................................................................................................................. 19
   5.2 SOURCE-RELATED ................................................................................................................ 20

alSourcePlay .......................................................................................................................... 46
alGetSourceiv......................................................................................................................... 45
alGetSource3i.......................................................................................................................... 44
alGetSourcei............................................................................................................................. 43
alGetSourcefv.......................................................................................................................... 42
alGetSourcef............................................................................................................................. 41
alSource3i................................................................................................................................ 40
alSourcei.................................................................................................................................. 39
alSourcefv............................................................................................................................... 38
alSourcef.................................................................................................................................. 37
alIsSource............................................................................................................................... 36
alDeleteSources ....................................................................................................................... 35
alGenBuffers........................................................................................................................... 34
alBufferData............................................................................................................................ 33
alIsBuffer ................................................................................................................................ 32
alDeleteBuffers....................................................................................................................... 31
alGenBuffers........................................................................................................................... 30
alSourcefv............................................................................................................................... 29
alSource3i................................................................................................................................ 28
alSourcei.................................................................................................................................. 27
alSourcefv............................................................................................................................... 26
alSource3f................................................................................................................................ 25
alSourcef.................................................................................................................................. 24
alGetBufferiv........................................................................................................................... 23
alGetBuffer3f .......................................................................................................................... 22
alGetBufferi............................................................................................................................. 21
alGetBufferfv.......................................................................................................................... 20
alGetBufferfv.......................................................................................................................... 19
alGetBufferi............................................................................................................................. 18
alGetBufferfv.......................................................................................................................... 17
alGetBufferi............................................................................................................................. 16
alGetBufferfv.......................................................................................................................... 15
alGetBufferi............................................................................................................................. 14
alSourcefv............................................................................................................................... 13
alSource3i................................................................................................................................ 12
alSourcei.................................................................................................................................. 11
alSourcefv............................................................................................................................... 10
alSource3f................................................................................................................................ 9
alSourcei.................................................................................................................................. 8
alSourcefv............................................................................................................................... 7
alSource3i................................................................................................................................ 6
alSourcei.................................................................................................................................. 5
alSourcefv............................................................................................................................... 4
alSource3i................................................................................................................................ 3
alSourcei.................................................................................................................................. 2
alSourcefv............................................................................................................................... 1

- 3 -
<table>
<thead>
<tr>
<th>Function</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>alcGetError</td>
<td>97</td>
</tr>
<tr>
<td>alcGetContextsDevice</td>
<td>96</td>
</tr>
<tr>
<td>alcGetCurrentContext</td>
<td>95</td>
</tr>
<tr>
<td>alcDestroyContext</td>
<td>94</td>
</tr>
<tr>
<td>alcSuspendContext</td>
<td>93</td>
</tr>
<tr>
<td>alcProcessContext</td>
<td>92</td>
</tr>
<tr>
<td>alcCreateContext</td>
<td>91</td>
</tr>
<tr>
<td>alcMakeContextCurrent</td>
<td>90</td>
</tr>
<tr>
<td>alGetError</td>
<td>86</td>
</tr>
<tr>
<td>alIsExtensionPresent</td>
<td>87</td>
</tr>
<tr>
<td>alGetProcAddress</td>
<td>88</td>
</tr>
<tr>
<td>alGetEnumValue</td>
<td>89</td>
</tr>
<tr>
<td>alSpeedOfSound</td>
<td>85</td>
</tr>
<tr>
<td>alTargetHRT</td>
<td>84</td>
</tr>
<tr>
<td>alListeneri</td>
<td>79</td>
</tr>
<tr>
<td>alListenerfv</td>
<td>78</td>
</tr>
<tr>
<td>alListener3f</td>
<td>77</td>
</tr>
<tr>
<td>alListener3i</td>
<td>76</td>
</tr>
<tr>
<td>alListenerf</td>
<td>75</td>
</tr>
<tr>
<td>alListener3fv</td>
<td>74</td>
</tr>
<tr>
<td>alListener3iv</td>
<td>73</td>
</tr>
<tr>
<td>alGetBoolean</td>
<td>72</td>
</tr>
<tr>
<td>alGetDouble</td>
<td>71</td>
</tr>
<tr>
<td>alGetFloat</td>
<td>70</td>
</tr>
<tr>
<td>alGetIntegerv</td>
<td>69</td>
</tr>
<tr>
<td>alGetFloatv</td>
<td>68</td>
</tr>
<tr>
<td>alGetDoublev</td>
<td>67</td>
</tr>
<tr>
<td>alGetInteger</td>
<td>66</td>
</tr>
<tr>
<td>alGetFloat</td>
<td>65</td>
</tr>
<tr>
<td>alGetBooleanv</td>
<td>64</td>
</tr>
<tr>
<td>alIsEnabled</td>
<td>63</td>
</tr>
<tr>
<td>alDisable</td>
<td>62</td>
</tr>
<tr>
<td>alEnable</td>
<td>61</td>
</tr>
<tr>
<td>alIsEnabled</td>
<td>60</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>59</td>
</tr>
<tr>
<td>alGetListener3fv</td>
<td>58</td>
</tr>
<tr>
<td>alGetListener3iv</td>
<td>57</td>
</tr>
<tr>
<td>alGetListenerf</td>
<td>56</td>
</tr>
<tr>
<td>alGetListenerf3f</td>
<td>55</td>
</tr>
<tr>
<td>alGetListenerf3v</td>
<td>54</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>53</td>
</tr>
<tr>
<td>alGetListeneri</td>
<td>52</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>51</td>
</tr>
<tr>
<td>alGetListenerf</td>
<td>50</td>
</tr>
<tr>
<td>alGetListenerf3f</td>
<td>49</td>
</tr>
<tr>
<td>alGetListenerf3v</td>
<td>48</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>47</td>
</tr>
<tr>
<td>alGetListener3f</td>
<td>46</td>
</tr>
<tr>
<td>alGetListeneri</td>
<td>45</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>44</td>
</tr>
<tr>
<td>alGetListenerf</td>
<td>43</td>
</tr>
<tr>
<td>alGetListenerf3f</td>
<td>42</td>
</tr>
<tr>
<td>alGetListenerfv</td>
<td>41</td>
</tr>
<tr>
<td>alGetListener3iv</td>
<td>40</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>39</td>
</tr>
<tr>
<td>alGetListenerf</td>
<td>38</td>
</tr>
<tr>
<td>alGetListenerf3f</td>
<td>37</td>
</tr>
<tr>
<td>alGetListenerf3v</td>
<td>36</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>35</td>
</tr>
<tr>
<td>alGetListeneri</td>
<td>34</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>33</td>
</tr>
<tr>
<td>alGetListenerf</td>
<td>32</td>
</tr>
<tr>
<td>alGetListenerf3f</td>
<td>31</td>
</tr>
<tr>
<td>alGetListenerf3v</td>
<td>30</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>29</td>
</tr>
<tr>
<td>alGetListenerf</td>
<td>28</td>
</tr>
<tr>
<td>alGetListenerf3f</td>
<td>27</td>
</tr>
<tr>
<td>alGetListenerf3v</td>
<td>26</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>25</td>
</tr>
<tr>
<td>alGetListeneri</td>
<td>24</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>23</td>
</tr>
<tr>
<td>alGetListenerf</td>
<td>22</td>
</tr>
<tr>
<td>alGetListenerf3f</td>
<td>21</td>
</tr>
<tr>
<td>alGetListenerf3v</td>
<td>20</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>19</td>
</tr>
<tr>
<td>alGetListeneri</td>
<td>18</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>17</td>
</tr>
<tr>
<td>alGetListenerf</td>
<td>16</td>
</tr>
<tr>
<td>alGetListenerf3f</td>
<td>15</td>
</tr>
<tr>
<td>alGetListenerf3v</td>
<td>14</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>13</td>
</tr>
<tr>
<td>alGetListeneri</td>
<td>12</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>11</td>
</tr>
<tr>
<td>alGetListenerf</td>
<td>10</td>
</tr>
<tr>
<td>alGetListenerf3f</td>
<td>9</td>
</tr>
<tr>
<td>alGetListenerfv</td>
<td>8</td>
</tr>
<tr>
<td>alGetListener3iv</td>
<td>7</td>
</tr>
<tr>
<td>alGetListener3f</td>
<td>6</td>
</tr>
<tr>
<td>alGetListenerf</td>
<td>5</td>
</tr>
<tr>
<td>alGetListenerf3f</td>
<td>4</td>
</tr>
<tr>
<td>alGetListenerf3v</td>
<td>3</td>
</tr>
<tr>
<td>alGetListener3i</td>
<td>2</td>
</tr>
<tr>
<td>alGetListeneri</td>
<td>1</td>
</tr>
</tbody>
</table>

**ALC FUNCTIONS**

- **CONTEXT-RELATED**
  - alcCreateContext
  - alcMakeContextCurrent
  - alcProcessContext
  - alcSuspendContext
  - alcDestroyContext
  - alcGetCurrentContext
  - alcGetcontextsDevice

- **ERROR-RELATED**
  - alcGetError

- **DEVICE-RELATED**
  - alcGetError

- **ALC FUNCTIONS**

  - alcSourcePlayv
  - alcSourcePause
  - alcSourcePausev
  - alcSourceStop
  - alcSourceStopv
  - alcSourceRewind
  - alcSourceRewindv
  - alcSourceQueueBuffers
  - alcSourceUnqueueBuffers

- **LISTENER-RELATED**
  - alListeneri
  - alListener3i
  - alListenerf
  - alListenerf3f
  - alListenerfv
  - alListener3fv

- **STATE-RELATED**
  - alEnable
  - alDisable
  - alIsEnabled
  - alGetBoolean
  - alGetDouble
  - alGetFloat
  - alGetIntegerv
  - alGetFloatv
  - alGetDoublev
  - alGetInteger
  - alGetEnumValue

- **ERROR-RELATED**
  - alcGetError
About this Document

Introduction
OpenAL is a cross-platform three-dimensional audio API. The API’s primary purpose is to allow an application to position audio sources in a three-dimensional space around a listener, producing reasonable spatialization of the sources for the audio system (headphones, 2.1 speaker output, 5.1 speaker output, etc.) Through extensions, Creative Labs has also enhanced OpenAL with EAX and other capabilities. OpenAL is appropriate for many audio applications, but was designed to be most appropriate for gaming audio.

Intended Audience
This reference guide is most appropriate for a programmer. Experience with C or C++ is not required to learn the concepts in OpenAL, but will make understanding the OpenAL source as well as sample code easier. Since there are several sample applications included with the OpenAL SDKs as well as with the source distribution, it is recommended that interested programmers take advantage of those resources.

Other OpenAL Resources
The two most important resources for additional information on OpenAL are the websites at www.openal.org and http://developer.creative.com. The main OpenAL site hosts the specification, the open source implementations, and sample code. The Creative developer site has a section dedicated to OpenAL with SDKs showing how to use OpenAL as well as various extensions.
Introduction to OpenAL

Use of OpenAL revolves around the use of three fundamental objects – Buffers, Sources, and a Listener. A buffer can be filled with audio data, and can then be attached to a source. The source can then be positioned and played. How the source is heard is determined by its position and orientation relative to the Listener object (there is only one Listener). Creating a number of sources and buffers and a single listener and then updating the positions and orientations of the sources and listener dynamically can present a convincing 3D audio world.

Objects

Here is a diagram showing the fundamental OpenAL objects and their relationships to the context and device objects:

When initializing OpenAL, at least one device has to be opened. Within that device, at least one context will be created. Within that context, one listener object is implied, and a multitude of source objects can be created. Each source can have one or more buffers objects attached to it. Buffer objects are not part of a specific context – they are shared among all contexts on one device.

Device Enumeration

How does an application know what devices are available to open? An OpenAL application can open a “default” device if it wishes, by specifying NULL for the device string when opening a device. An application that wants more control over which device is opened – or that wants to present the user with optional devices to open – can also enumerate the names of the available input and output devices (and explore some capabilities of each device as well).
Device enumeration revolves around the `alcGetString` call. If an application calls `alcGetString` with a NULL device specified and asks for `ALC_DEVICE_SPECIFIER`, a pointer is returned to a string which is actually a *list* of devices separated by NULL characters and terminated by two NULL characters. If an application calls `alcGetString` and asks for `ALC_DEFAULT_DEVICE_SPECIFIER`, then the string returned will be the default output device for the system. Retrieving the device list and the default device name allows an application to present the end user with a menu of available output devices.

Additional filtering can be done on the returned list by asking each device what specification version it supports as well as what extensions it supports (using `alIsExtensionPresent` or `allsExtensionPresent`).

**Initializing/Exiting**

As described above, the first step to initializing OpenAL is to open a device. Once that is successfully done, then a context is opened on that device. Now the fundamental OpenAL objects can be managed – the listener, various sources, and various buffers.

To generate a set of buffers for use, use `alGetError` to reset the error state, call `alGenBuffers` to generate the number of buffers desired, and then use `alGetError` again to detect if an error was generated.

Fill the buffers with PCM data using `alBufferData`.

To generate a set of sources for use, use `alGetError` to reset the error state, call `alGenSources` to generate the number of sources desired, and then use `alGetError` again to detect if an error was generated.

Buffers are attached to sources using `alSourcei`.

Once a buffer has been attached to a source, the source can play the buffer using `alSourcePlay`.

Source and Listener properties can be updated dynamically using property set and get calls such as `alGetListenerfv`, `alListener3f`, `alSourcei`, and `alGetSource3f`.

Example:

```c
// Initialization
Device = alcOpenDevice(NULL); // select the "preferred device"
if (Device) {
    Context=alcCreateContext(Device,NULL);
    alcMakeContextCurrent(Context);
}

// Check for EAX 2.0 support
g_bEAX = alIsExtensionPresent("EAX2.0");

// Generate Buffers
alGetError(); // clear error code
alGenBuffers(NUM_BUFFERS, g_Buffers);
if ((error = alGetError()) != AL_NO_ERROR)
{
    DisplayALError("alGenBuffers :", error);
    return;
}
```
// Load test.wav
loadWAVFile("test.wav", &format, &data, &size, &freq, &loop);
if ((error = alGetError()) != AL_NO_ERROR)
{
    DisplayALError("alutLoadWAVFile test.wav : ", error);
    alDeleteBuffers(NUM_BUFFERS, g_BUFFERS);
    return;
}

// Copy test.wav data into AL Buffer 0
alBufferData(g_BUFFERS[0], format, data, size, freq);
if ((error = alGetError()) != AL_NO_ERROR)
{
    DisplayALError("alBufferData buffer 0 : ", error);
    alDeleteBuffers(NUM_BUFFERS, g_BUFFERS);
    return;
}

// Unload test.wav
unloadWAV(format, data, size, freq);
if ((error = alGetError()) != AL_NO_ERROR)
{
    DisplayALError("alutUnloadWAV : ", error);
    alDeleteBuffers(NUM_BUFFERS, g_BUFFERS);
    return;
}

// Generate Sources
alGenSources(1, source);
if ((error = alGetError()) != AL_NO_ERROR)
{
    DisplayALError("alGenSources 1 : ", error);
    return;
}

// Attach buffer 0 to source
alSourcei(source[0], AL_BUFFER, g_BUFFERS[0]);
if ((error = alGetError()) != AL_NO_ERROR)
{
    DisplayALError("alSourcei AL_BUFFER 0 : ", error);
}

// Exit
Context=alcGetCurrentContext();
Device=alcGetContextsDevice(Context);
alcMakeContextCurrent(NULL);
alcDestroyContext(Context);
alcCloseDevice(Device);

Listener Properties
For every context, there is automatically one Listener object. The alListener[f, 3f, fv, i] and alGetListener[f, 3f, fv, i] families of functions can be used to set or retrieve the following listener properties:
### Property Data Type Description

<table>
<thead>
<tr>
<th>Property</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_GAIN</td>
<td>f, fv</td>
<td>“master gain”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>value should be positive</td>
</tr>
<tr>
<td>AL_POSITION</td>
<td>fv, 3f, iv, 3i</td>
<td>X, Y, Z position</td>
</tr>
<tr>
<td>AL VELOCITY</td>
<td>fv, 3f, iv, 3i</td>
<td>velocity vector</td>
</tr>
<tr>
<td>AL_ORIENTATION</td>
<td>fv, iv</td>
<td>orientation expressed as “at” and “up” vectors</td>
</tr>
</tbody>
</table>

Example:

```c
ALfloat listenerPos[]={0.0,0.0,0.0};
ALfloat listenerVel[]={0.0,0.0,0.0};
ALfloat listenerOri[]={0.0,0.0,-1.0, 0.0,1.0,0.0};

// Position ...
alListenerfv(AL_POSITION,listenerPos);
if ((error = alGetError()) != AL_NO_ERROR)
{
    DisplayALError("alListenerfv POSITION : ", error);
    return;
}

// Velocity ...
alListenerfv(AL_VELOCITY,listenerVel);
if ((error = alGetError()) != AL_NO_ERROR)
{
    DisplayALError("alListenerfv VELOCITY : ", error);
    return;
}

// Orientation ...
alListenerfv(AL_ORIENTATION,listenerOri);
if ((error = alGetError()) != AL_NO_ERROR)
{
    DisplayALError("alListenerfv ORIENTATION : ", error);
    return;
}
```

### Buffer Properties

Each buffer generated by `alGenBuffers` has properties which can be retrieved. The `alGetBufferf, i` functions can be used to retrieve the following buffer properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_ FREQUENCY</td>
<td>i, iv</td>
<td>frequency of buffer in Hz</td>
</tr>
<tr>
<td>AL_ BITS</td>
<td>i, iv</td>
<td>bit depth of buffer</td>
</tr>
<tr>
<td>AL_ CHANNELS</td>
<td>i, iv</td>
<td>number of channels in buffer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 1 is valid, but buffer won’t be positioned when played</td>
</tr>
<tr>
<td>AL_ SIZE</td>
<td>i, iv</td>
<td>size of buffer in bytes</td>
</tr>
<tr>
<td>AL_DATA</td>
<td>i, iv</td>
<td>original location where data was copied from</td>
</tr>
<tr>
<td></td>
<td></td>
<td>generally useless, as was probably freed after buffer creation</td>
</tr>
</tbody>
</table>

Example:

```c
// Retrieve Buffer Frequency
alBufferi(gBuffers[0], AL_FREQUENCY, iFreq);
```
**Source Properties**
Each source generated by `alGenSources` has properties which can be set or retrieved. The `alSource[3f, 3f, fv, i]` and `alGetSource[3f, 3f, fv, i]` families of functions can be used to set or retrieve the following source properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_PITCH</td>
<td>f, fv</td>
<td>pitch multiplier, always positive</td>
</tr>
<tr>
<td>AL_GAIN</td>
<td>f, fv</td>
<td>source gain, value should be positive</td>
</tr>
<tr>
<td>AL_MAX_DISTANCE</td>
<td>f, fv, i, iv</td>
<td>used with the Inverse Clamped Distance Model to set the distance where there will no longer be any attenuation of the source</td>
</tr>
<tr>
<td>AL_ROLLOFF_FACTOR</td>
<td>f, fv, i, iv</td>
<td>the rolloff rate for the source, default is 1.0</td>
</tr>
<tr>
<td>AL_REFERENCE_DISTANCE</td>
<td>f, fv, i, iv</td>
<td>the distance under which the volume for the source would normally drop by half (before being influenced by rolloff factor or AL_MAX_DISTANCE)</td>
</tr>
<tr>
<td>AL_MIN_GAIN</td>
<td>f, fv</td>
<td>the minimum gain for this source</td>
</tr>
<tr>
<td>AL_MAX_GAIN</td>
<td>f, fv</td>
<td>the maximum gain for this source</td>
</tr>
<tr>
<td>AL_CONE_OUTER_GAIN</td>
<td>f, fv</td>
<td>the gain when outside the oriented cone</td>
</tr>
<tr>
<td>AL_CONE_INNER_ANGLE</td>
<td>f, fv, i, iv</td>
<td>the gain when inside the oriented cone</td>
</tr>
<tr>
<td>AL_CONE_OUTER_ANGLE</td>
<td>f, fv, i, iv</td>
<td>outer angle of the sound cone, in degrees, default is 360</td>
</tr>
<tr>
<td>AL_POSITION</td>
<td>fv, 3f</td>
<td>X, Y, Z position</td>
</tr>
<tr>
<td>AL_VELOCITY</td>
<td>fv, 3f</td>
<td>velocity vector</td>
</tr>
<tr>
<td>AL_DIRECTION</td>
<td>fv, 3f, iv, 3i</td>
<td>direction vector</td>
</tr>
<tr>
<td>AL_SOURCE_RELATIVE</td>
<td>i, iv</td>
<td>determines if the positions are relative to the listener, default is AL_FALSE</td>
</tr>
<tr>
<td>AL_SOURCE_TYPE</td>
<td>i, iv</td>
<td>the source type – AL_UNDETERMINED, AL_STATIC, or AL_STREAMING</td>
</tr>
<tr>
<td>AL_LOOPING</td>
<td>i, iv</td>
<td>turns looping on (AL_TRUE) or off (AL_FALSE)</td>
</tr>
<tr>
<td>AL_BUFFER</td>
<td>i, iv</td>
<td>the ID of the attached buffer</td>
</tr>
<tr>
<td>AL_SOURCE_STATE</td>
<td>i, iv</td>
<td>the state of the source (AL_STOPPED, AL_PLAYING, ...)</td>
</tr>
<tr>
<td>AL_BUFFERS_QUEUED*</td>
<td>i, iv</td>
<td>the number of buffers queued on this source</td>
</tr>
<tr>
<td>AL_BUFFERS_PROCESSED*</td>
<td>i, iv</td>
<td>the number of buffers in the queue that have been processed</td>
</tr>
<tr>
<td>AL_SEC_OFFSET</td>
<td>f, fv, i, iv</td>
<td>the playback position, expressed in seconds</td>
</tr>
<tr>
<td>AL_SAMPLE_OFFSET</td>
<td>f, fv, i, iv</td>
<td>the playback position, expressed in samples</td>
</tr>
<tr>
<td>AL_BYTE_OFFSET</td>
<td>f, fv, i, iv</td>
<td>the playback position, expressed in bytes</td>
</tr>
</tbody>
</table>

* Read Only (alGetSource)

Example:
```
alGetError(); // clear error state
alSourcef(source[0], AL_PITCH, 1.0f);
if ((error = alGetError()) != AL_NO_ERROR)
    DisplayALError("alSourcef 0 AL_PITCH : \n", error);

alGetError(); // clear error state
alSourcef(source[0], AL_GAIN, 1.0f);
if ((error = alGetError()) != AL_NO_ERROR)
    DisplayALError("alSourcef 0 AL_GAIN : \n", error);
```
alGetError(); // clear error state
alSourcefv(source[0],AL_POSITION,source0Pos);
if ((error = alGetError()) != AL_NO_ERROR)
    DisplayALError("alSourcefv 0 AL_POSITION : \n", error);

alGetError(); // clear error state
alSourcefv(source[0],AL_VELOCITY,source0Vel);
if ((error = alGetError()) != AL_NO_ERROR)
    DisplayALError("alSourcefv 0 AL_VELOCITY : \n", error);

alGetError(); // clear error state
alSourcei(source[0],AL_LOOPING,AL_FALSE);
if ((error = alGetError()) != AL_NO_ERROR)
    DisplayALError("alSourcei 0 AL_LOOPING true: \n", error);

## Queuing Buffers on a Source

To continuously stream audio from a source without interruption, buffer queuing is required. To use buffer queuing, the buffers and sources are generated in the normal way, but `alSourcei` is not used to attach the buffers to the source. Instead, the functions `alSourceQueueBuffers` and `alSourceUnqueueBuffers` are used. The program can attach a buffer or a set of buffers to a source using `alSourceQueueBuffers`, and then call `alSourcePlay` on that source. While the source is playing, `alSourceUnqueueBuffers` can be called to remove buffers which have already played. Those buffers can then be filled with new data or discarded. New or refilled buffers can then be attached to the playing source using `alSourceQueueBuffers`. As long as there is always a new buffer to play in the queue, the source will continue to play.

Although some 1.0 implementations of OpenAL may not enforce the following restrictions on queuing, it is recommended to observe the following additional rules, which do universally apply to 1.1 implementations:

1) A source that will be used for streaming should not have its first buffer attached using `alSourcei` – always use `alSourceQueueBuffers` to attach buffers to streaming sources. Any source can have all buffers detached from it using `alSourcei(..., AL_BUFFER, 0)`, and can then be used for either streaming or non-streaming buffers depending on how data is then attached to the source (with `alSourcei` or with `alSourceQueueBuffers`).

2) All buffers attached to a source using `alSourceQueueBuffers` should have the same audio format.

## Doppler Shift

The Doppler effect depends on the velocities of source and listener relative to the medium, and the propagation speed of sound in that medium. The application might want to emphasize or de-emphasize the Doppler effect as physically accurate calculation might not give the desired results. The amount of frequency shift (pitch change) is proportional to the speed of listener and source along their line of sight.

The Doppler effect as implemented by OpenAL is described by the formula below. Effects of the medium (air, water) moving with respect to listener and source are ignored.

\[
SS: \text{AL\_SPEED\_OF\_SOUND} = \text{speed of sound (default value 343.3)} \\
DF: \text{AL\_DOPPLER\_FACTOR} = \text{Doppler factor (default 1.0)} \\
vls: \text{Listener velocity scalar (scalar, projected on source-to-listener vector)} \\
vss: \text{Source velocity scalar (scalar, projected on source-to-listener vector)}
\]
f: Frequency of sample
f’: effective Doppler shifted frequency

Graphic representation of vls and vss:

3D Mathematical representation of vls and vss:

Mag(vector) = sqrt(vector.x * vector.x + vector.y * vector.y + vector.z * vector.z)
DotProduct(v1, v2) = (v1.x * v2.x + v1.y * v2.y + v1.z * v2.z)
SL = source to listener vector
SV = Source Velocity vector
LV = Listener Velocity vector

vls = DotProduct(SL, LV) / Mag(SL)
vss = DotProduct(SL, SV) / Mag(SL)

Dopper Calculation:

vss = min(vss, SS/DF)
vls = min(vls, SS/DF)
f’ = f * (SS - DF*vls) / (SS - DF*vss)

There are two API calls global to the current context that provide control of the speed of sound and Doppler factor. AL_DOPPLER_FACTOR is a simple scaling of source and listener velocities to exaggerate or deemphasize the Doppler (pitch) shift resulting from the calculation.

void alDopplerFactor(ALfloat dopplerFactor);

A negative value will result in an AL_INVALID_VALUE error, the command is then ignored. The default value is 1. The current setting can be queried using alGetFloat{v} and AL_DOPPLER_FACTOR.

AL_SPEED_OF_SOUND allows the application to change the reference (propagation) speed used in the Doppler calculation. The source and listener velocities should be expressed in the same units as the speed of sound.

void alSpeedOfSound(ALfloat speed);

A negative or zero value will result in an AL_INVALID_VALUE error, and the command is ignored. The default value is 343.3 (appropriate for velocity units of meters and air as the propagation medium). The current setting can be queried using alGetFloat{v} and AL_SPEED_OF_SOUND.
Distance and velocity units are completely independent of one another (so you could use different units for each if desired). If an OpenAL application doesn't want to use Doppler effects, then leaving all velocities at zero will achieve that result.

**Error Handling**

The error state of OpenAL can be retrieved at any time using `alGetError`. `alGetError` clears the error state of OpenAL when it is called, so it is common for an OpenAL application to call `alGetError` at the beginning of a critical operation to clear the error state, perform the critical operation, and then use `alGetError` again to test whether or not an error occurred.

Error Codes:

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_NO_ERROR</td>
<td>there is not currently an error</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>a bad name (ID) was passed to an OpenAL function</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>an invalid enum value was passed to an OpenAL function</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>an invalid value was passed to an OpenAL function</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>the requested operation is not valid</td>
</tr>
<tr>
<td>AL_OUT_OF_MEMORY</td>
<td>the requested operation resulted in OpenAL running out of memory</td>
</tr>
</tbody>
</table>

Example:

```c
alGetError(); // Clear Error Code

// Generate Buffers
alGenBuffers(NUM_BUFFERS, g_Buffers);
if ((error = alGetError()) != AL_NO_ERROR)
{
    DisplayALError("alGenBuffers :", error);
    exit(-1);
}
```

**Extensions**

OpenAL has an extension mechanism that can be used by OpenAL vendors to add new features to the API. Creative Labs have added a number of extensions including EAX, X-RAM, Multi-Channel Buffer playback, and most recently an Effect Extension (EFX). To determine if an extension is available the application can use either `alIsExtensionPresent` or `alcIsExtensionPresent` depending on the type of extension. The Appendices contain more details about some of Creative’s extensions to OpenAL.
Core OpenAL Functions

Buffer-Related

alGenBuffers

Description

This function generates one or more buffers, which contain audio data (see alBufferData). References to buffers are ALuint values, which are used wherever a buffer reference is needed (in calls such as alDeleteBuffers, alSourcei, alSourceQueueBuffers, and alSourceUnqueueBuffers).

```c
void alGenBuffers(
    ALsizei n,
    ALuint *buffers
);
```

Parameters

- `n`  
  the number of buffers to be generated

- `buffers`  
  pointer to an array of ALuint values which will store the names of the new buffers

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The buffer array isn't large enough to hold the number of buffers requested.</td>
</tr>
<tr>
<td>AL_OUT_OF_MEMORY</td>
<td>There is not enough memory available to generate all the buffers requested.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

If the requested number of buffers cannot be created, an error will be generated which can be detected with alGetError. If an error occurs, no buffers will be generated. If `n` equals zero, alGenBuffers does nothing and does not return an error.

See Also

alDeleteBuffers, alIsBuffer
alDeleteBuffers

Description

This function deletes one or more buffers, freeing the resources used by the buffer. Buffers which are attached to a source cannot be deleted. See alSourcei and alSourceUnqueueBuffers for information on how to detach a buffer from a source.

```c
void alDeleteBuffers(
    ALsizei n,
    ALuint *buffers
);
```

Parameters

- `n` the number of buffers to be deleted
- `buffers` pointer to an array of buffer names identifying the buffers to be deleted

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>The buffer is still in use and cannot be deleted.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>A buffer name is invalid.</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The requested number of buffers cannot be deleted.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

If the requested number of buffers cannot be deleted, an error will be generated which can be detected with alGetError. If an error occurs, no buffers will be deleted. If `n` equals zero, alDeleteBuffers does nothing and will not return an error.

See Also

alGenBuffers, alIsBuffer
**alIsBuffer**

**Description**

This function tests if a buffer name is valid, returning AL_TRUE if valid, AL_FALSE if not.

```c
ALboolean alIsBuffer(
    ALuint buffer
);
```

**Parameters**

- `buffer` a buffer name to be tested for validity

**Possible Error States**

None

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

The NULL buffer is always valid (see alSourcei for information on how the NULL buffer is used).

**See Also**

alGenBuffers, alDeleteBuffers
alBufferData

Description

This function fills a buffer with audio data. All the pre-defined formats are PCM data, but this function may be used by extensions to load other data types as well.

```c
void alBufferData(
    ALuint buffer,
    ALenum format,
    const ALvoid *data,
    ALsizei size,
    ALsizei freq
);
```

Parameters

- **buffer** buffer name to be filled with data
- **format** format type from among the following:
  - AL_FORMAT_MONO8
  - AL_FORMAT_MONO16
  - AL_FORMAT_STEREO8
  - AL_FORMAT_STEREO16
- **data** pointer to the audio data
- **size** the size of the audio data in bytes
- **freq** the frequency of the audio data

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_OUT_OF_MEMORY</td>
<td>There is not enough memory available to create this buffer.</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The size parameter is not valid for the format specified, the buffer is in use, or the data is a NULL pointer.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified format does not exist.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

8-bit PCM data is expressed as an unsigned value over the range 0 to 255, 128 being an audio output level of zero. 16-bit PCM data is expressed as a signed value over the range -32768 to 32767, 0 being an audio output level of zero. Stereo data is expressed in interleaved format, left channel first. Buffers containing more than one channel of data will be played without 3D spatialization.
alBufferf

Description

This function sets a floating point property of a buffer.

```
void alBufferf(
    ALuint buffer,
    ALenum param,
    ALfloat value
);
```

Parameters

- `buffer` buffer name whose attribute is being retrieved
- `param` the name of the attribute to be set
- `value` the ALfloat value to be set

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified buffer doesn't have parameters (the NULL buffer), or doesn't exist.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

There are no relevant buffer properties defined in OpenAL 1.1 which can be affected by this call, but this function may be used by OpenAL extensions.

See Also

alBuffer3f, alBufferfv, alGetBufferf, alGetBuffer3f, alGetBufferfv
**alBuffer3f**

**Description**

This function sets a floating point property of a buffer.

```c
void alBuffer3f(
   ALuint buffer,
   ALenum param,
   ALfloat v1,
   ALfloat v2,
   ALfloat v3
);
```

**Parameters**

- **buffer**
  buffer name whose attribute is being retrieved
- **param**
  the name of the attribute to be set
- **v1, v2, v3**
  the ALfloat values to be set

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified buffer doesn't have parameters (the NULL buffer), or doesn't exist.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.1 or higher

**Remarks**

There are no relevant buffer properties defined in OpenAL 1.1 which can be affected by this call, but this function may be used by OpenAL extensions.

**See Also**

[alBufferf](#), [alBufferfv](#), [alGetBufferf](#), [alGetBuffer3f](#), [alGetBufferfv](#)
alBufferfv

Description

This function sets a floating point property of a buffer.

```c
void alBufferfv(
    ALuint buffer,
    ALenum param,
    ALfloat *values
);
```

Parameters

- **buffer**: buffer name whose attribute is being retrieved
- **param**: the name of the attribute to be set
- **values**: a pointer to the ALfloat values to be set

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified buffer doesn't have parameters (the NULL buffer), or doesn't exist.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

There are no relevant buffer properties defined in OpenAL 1.1 which can be affected by this call, but this function may be used by OpenAL extensions.

See Also

alBufferf, alBuffer3f, alGetBufferf, alGetBuffer3f, alGetBufferfv
alBufferi

Description

This function retrieves an integer property of a buffer.

```c
void alBufferi(
    ALuint buffer,
    ALenum param,
    ALint value
);
```

Parameters

- `buffer` buffer name whose attribute is being retrieved
- `param` the name of the attribute to be set
- `value` a pointer to an ALint to hold the retrieved data

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified buffer doesn't have parameters (the NULL buffer), or doesn't exist.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

There are no relevant buffer properties defined in OpenAL 1.1 which can be affected by this call, but this function may be used by OpenAL extensions.

See Also

- alBuffer3i, alBufferiv, alGetBufferi, alGetBuffer3i, alGetBufferiv
alBuffer3i

Description

This function sets a floating point property of a buffer.

```c
void alBuffer3i(
    ALuint buffer,
    ALenum param,
    ALint v1,
    ALint v2,
    ALint v3
);
```

Parameters

- `buffer` buffer name whose attribute is being retrieved
- `param` the name of the attribute to be set
- `v1, v2, v3` the ALint values to be set

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified buffer doesn't have parameters (the NULL buffer), or doesn't exist.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

There are no relevant buffer properties defined in OpenAL 1.1 which can be affected by this call, but this function may be used by OpenAL extensions.

See Also

alBufferi, alBufferiv, alGetBufferi, alGetBuffer3i, alGetBufferiv
alBufferiv

Description
This function sets a floating point property of a buffer.

```c
void alBufferiv(
    ALuint buffer,
    ALenum param,
    ALint *values
);
```

Parameters

- **buffer**: buffer name whose attribute is being retrieved
- **param**: the name of the attribute to be set
- **values**: a pointer to the ALint values to be set

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified buffer doesn't have parameters (the NULL buffer), or doesn't exist.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

There are no relevant buffer properties defined in OpenAL 1.1 which can be affected by this call, but this function may be used by OpenAL extensions.

See Also

alBufferi, alBuffer3i, alGetBufferi, alGetBuffer3i, alGetBufferiv
**alGetBufferf**

**Description**

This function retrieves a floating point property of a buffer.

```c
void alGetBufferf(
    ALuint buffer,
    ALenum pname,
    ALfloat *value
);
```

**Parameters**

- `buffer` buffer name whose attribute is being retrieved
- `pname` the name of the attribute to be retrieved
- `value` a pointer to an ALfloat to hold the retrieved data

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified buffer doesn't have parameters (the NULL buffer), or doesn't exist.</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified value pointer is not valid.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

There are no relevant buffer properties defined in OpenAL 1.1 which can be retrieved by this call, but this function may be used by OpenAL extensions.

**See Also**

alBuffer, alBuffer3f, alBufferfv, alGetBuffer3f, alGetBufferfv
alGetBuffer3f

Description

This function retrieves a floating point property of a buffer.

```c
void alGetBuffer3f(
    ALuint buffer,
    ALenum pname,
    ALfloat *v1,
    ALfloat *v2,
    ALfloat *v3
);
```

Parameters

- `buffer`: buffer name whose attribute is being retrieved
- `pname`: the name of the attribute to be retrieved
- `v1`, `v2`, `v3`: pointers to a ALfloat values to hold the retrieved data

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified buffer doesn't have parameters (the NULL buffer), or doesn't exist.</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified value pointer is not valid.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

There are no relevant buffer properties defined in OpenAL 1.1 which can be retrieved by this call, but this function may be used by OpenAL extensions.

See Also

- [alBufferf](#), [alBuffer3f](#), [alBufferfv](#), [alGetBufferf](#), [alGetBufferfv](#)
alGetBufferfv

Description

This function retrieves a floating point property of a buffer.

```c
void alGetBufferfv(
    ALuint buffer,
    ALenum pname,
    ALfloat *values
);
```

Parameters

- **buffer**: buffer name whose attribute is being retrieved
- **pname**: the name of the attribute to be retrieved
- **values**: pointer to an ALfloat vector to hold the retrieved data

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified buffer doesn't have parameters (the NULL buffer), or doesn't exist.</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified value pointer is not valid.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

There are no relevant buffer properties defined in OpenAL 1.1 which can be retrieved by this call, but this function may be used by OpenAL extensions.

See Also

- alBufferf
- alBuffer3f
- alBufferfv
- alGetBufferf
- alGetBuffer3f
alGetBufferi

Description

This function retrieves an integer property of a buffer.

```c
void alGetBufferi(
    ALuint buffer,
    ALenum pname,
    ALint *value
);
```

Parameters

- `buffer`: buffer name whose attribute is being retrieved
- `pname`: the name of the attribute to be retrieved:
  - AL_FREQUENCY
  - AL_BITS
  - AL_CHANNELS
  - AL_SIZE
  - AL_DATA
- `value`: a pointer to an ALint to hold the retrieved data

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified buffer doesn't have parameters (the NULL buffer), or doesn't exist.</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified value pointer is not valid.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

None

See Also

alBufferi, alBuffer3i, alBufferiv, alGetBuffer3i, alGetBufferiv
alGetBuffer3i

Description

This function retrieves a floating point property of a buffer.

```c
void alGetBuffer3i(
    ALuint buffer,
    ALenum pname,
    ALint *v1,
    ALint *v2,
    ALint *v3
);
```

Parameters

- `buffer` buffer name whose attribute is being retrieved
- `pname` the name of the attribute to be retrieved
- `v1`, `v2`, `v3` pointers to ALint values to hold the retrieved data

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified buffer doesn't have parameters (the NULL buffer), or doesn't exist.</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified value pointer is not valid.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

There are no relevant buffer properties defined in OpenAL 1.1 which can be retrieved by this call, but this function may be used by OpenAL extensions.

See Also

- `alBufferi`
- `alBuffer3i`
- `alBufferiv`
- `alGetBufferi`
- `alGetBufferiv`
### alGetBufferiv

**Description**

This function retrieves a floating point property of a buffer.

```c
void alGetBufferiv(
    ALuint buffer,
    ALenum pname,
    ALint *values
);
```

**Parameters**

- **buffer**: buffer name whose attribute is being retrieved
- **pname**: the name of the attribute to be retrieved:  
  - AL_FREQUENCY  
  - AL_BITS  
  - AL_CHANNELS  
  - AL_SIZE  
  - AL_DATA
- **values**: pointer to an ALint vector to hold the retrieved data

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
</tbody>
</table>
| AL_INVALID_NAME        | The specified buffer doesn't have parameters  
  (the NULL buffer), or doesn't exist.                 |
| AL_INVALID_VALUE       | The specified value pointer is not valid.            |

**Version Requirements**

OpenAL 1.1 or higher

**Remarks**

None

**See Also**

[alBufferi, alBuffer3i, alBufferiv, alGetBufferi, alGetBuffer3i]
Source-Related

alGenSources

Description

This function generates one or more sources. References to sources are ALuint values, which are used wherever a source reference is needed (in calls such as alDeleteSources and alSourcei).

```c
void alGenSources(
    ALsizei n,
    ALuint *sources
);
```

Parameters

- `n` the number of sources to be generated
- `sources` pointer to an array of ALuint values which will store the names of the new sources

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_OUT_OF_MEMORY</td>
<td>There is not enough memory to generate all the requested sources.</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>There are not enough non-memory resources to create all the requested sources, or the array pointer is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no context to create sources in.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

If the requested number of sources cannot be created, an error will be generated which can be detected with alGetError. If an error occurs, no sources will be generated. If n equals zero, alGenSources does nothing and does not return an error.

See Also

alDeleteSources, alIsSource
alDeleteSources

Description

This function deletes one or more sources.

```c
void alDeleteSources(
    ALsizei n,
    Aluint *sources
);
```

Parameters

- **n**  the number of sources to be deleted
- **sources** pointer to an array of source names identifying the sources to be deleted

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_NAME</td>
<td>At least one specified source is not valid, or an attempt is being made to delete more sources than exist.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

If the requested number of sources cannot be deleted, an error will be generated which can be detected with **alGetError**. If an error occurs, no sources will be deleted. If `n` equals zero, alDeleteSources does nothing and will not return an error.

A playing source can be deleted – the source will be stopped and then deleted.

See Also

alGenSources, alIsSource
allIsSource

Description

This function tests if a source name is valid, returning AL_TRUE if valid and AL_FALSE if not.

```c
boolean allIsSource(
    ALuint source
);
```

Parameters

- `source` - a source name to be tested for validity

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

None

See Also

allGenSources, allDeleteSources
**alSourcef**

**Description**

This function sets a floating point property of a source.

```c
void alSourcef(
    ALuint source,
    ALenum param,
    ALfloat value
);
```

**Parameters**

- `source`  
  source name whose attribute is being set

- `param`  
  the name of the attribute to set:
  - `AL_PITCH`
  - `AL_GAIN`
  - `AL_MIN_GAIN`
  - `AL_MAX_GAIN`
  - `AL_MAX_DISTANCE`
  - `AL_ROLLOFF_FACTOR`
  - `AL_CONE_OUTER_GAIN`
  - `AL_CONE_INNER_ANGLE`
  - `AL_CONE_OUTER_ANGLE`
  - `AL_REFERENCE_DISTANCE`

- `value`  
  the value to set the attribute to

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value given is out of range.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

None

**See Also**

- `alSource3f`, `alSourcefv`, `alGetSourcef`, `alGetSource3f`, `alGetSourcefv`
alSource3f

Description

This function sets a source property requiring three floating point values.

```c
void alSource3f(
    ALuint source,
    ALenum param,
    ALfloat v1,
    ALfloat v2,
    ALfloat v3
);
```

Parameters

- `source`: source name whose attribute is being set
- `param`: the name of the attribute to set:
  - `AL_POSITION`
  - `AL_VELOCITY`
  - `AL_DIRECTION`
- `v1`, `v2`, `v3`: the three `ALfloat` values which the attribute will be set to

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value given is out of range.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

- OpenAL 1.0 or higher

Remarks

This function is an alternative to `alSourcef`.

See Also

- `alSourcef`, `alSourcefv`, `alGetSourcef`, `alGetSource3f`, `alGetSourcefv`
**alSourcefv**

**Description**

This function sets a floating point-vector property of a source.

```c
void alSourcefv(
    ALuint source,
    ALenum param,
    ALfloat *values
);
```

**Parameters**

- **source**: source name whose attribute is being set
- **param**: the name of the attribute being set:
  - AL_POSITION
  - AL_VELOCITY
  - AL_DIRECTION
- **values**: a pointer to the vector to set the attribute to

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value given is out of range.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

This function is an alternative to `alSource3f`.

**See Also**

`alSourcef`, `alSource3f`, `alGetSourcef`, `alGetSource3f`, `alGetSourcefv`
**alSourcei**

**Description**

This function sets an integer property of a source.

```c
void alSourcei(
    ALuint source,
    ALenum param,
    ALint value
);
```

**Parameters**

- **source**: source name whose attribute is being set
- **param**: the name of the attribute to set:
  - AL_SOURCE_RELATIVE
  - AL_CONE_INNER_ANGLE
  - AL_CONE_OUTER_ANGLE
  - AL_LOOPING
  - AL_BUFFER
  - AL_SOURCE_STATE
- **value**: the value to set the attribute to

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value given is out of range.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

The buffer name zero is reserved as a "NULL Buffer" and is accepted by `alSourcei(…, AL_BUFFER, …)` as a valid buffer of zero length. The NULL Buffer is extremely useful for detaching buffers from a source which were attached using this call or with `alSourceQueueBuffers`.

**See Also**

`alSource3i`, `alSourceiv`, `alGetSourcei`, `alGetSource3i`, `alGetSourceiv`
alSource3i

Description
This function sets an integer property of a source.

```c
void alSourcei(
    ALuint source,
    ALenum param,
    ALint v1,
    ALint v2,
    ALint v3
);
```

Parameters

- **source**: source name whose attribute is being set
- **param**: the name of the attribute to set:
  - AL_POSITION
  - AL_VELOCITY
  - AL_DIRECTION
- **v1, v2, v3**: the values to set the attribute to

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value given is out of range.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks
None

See Also
alSourcei, alSourceiv, alGetSourcei, alGetSource3i, alGetSourceiv
alSourceiv

Description

This function sets an integer property of a source.

```c
void alSourceiv(  
    ALuint source,  
    ALenum param,  
    ALint *values
);
```

Parameters

- **source**: source name whose attribute is being set
- **param**: the name of the attribute to set:
  - AL_POSITION
  - AL_VELOCITY
  - AL_DIRECTION
- **values**: the values to set the attribute to

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value given is out of range.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

None

See Also

alSourcei, alSource3i, alGetSourcei, alGetSource3i, alGetSourceiv
alGetSourcef

Description

This function retrieves a floating point property of a source.

```c
void alGetSourcef(
    ALuint source,
    ALenum param,
    ALfloat *value
);
```

Parameters

- **source**: source name whose attribute is being retrieved
- **param**: the name of the attribute to retrieve:
  - AL_PITCH
  - AL_GAIN
  - AL_MIN_GAIN
  - AL_MAX_GAIN
  - AL_MAX_DISTANCE
  - AL_ROLLOFF_FACTOR
  - AL_CONE_OUTER_GAIN
  - AL_CONE_INNER_ANGLE
  - AL_CONE_OUTER_ANGLE
  - AL_REFERENCE_DISTANCE
- **value**: a pointer to the floating point value being retrieved

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

- OpenAL 1.0 or higher

Remarks

- None

See Also

- alSourcef, alSource3f, alSourcefv, alGetSource3f, alGetSourcefv
alGetSource3f

Description

This function retrieves three floating point values representing a property of a source.

```c
void alGetSource3f(
    ALuint source,
    ALenum param,
    ALfloat *v1,
    ALfloat *v2,
    ALfloat *v3
);
```

Parameters

- `source` source name whose attribute is being retrieved
- `param` the name of the attribute being retrieved:
  - AL_POSITION
  - AL_VELOCITY
  - AL_DIRECTION
- `v1`, `v2`, `v3` pointers to the values to retrieve

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

None

See Also

alSourcef, alSource3f, alSourcefv, alGetSourcef, alGetSourcefv
alGetSourcefv

Description

This function retrieves a floating point-vector property of a source.

```c
void alGetSourcefv(
    ALuint source,
    ALenum param,
    ALfloat *values
);
```

Parameters

- **source**: source name whose attribute is being retrieved
- **param**: the name of the attribute being retrieved:
  - AL_POSITION
  - AL_VELOCITY
  - AL_DIRECTION
- **values**: a pointer to the vector to retrieve

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

None

See Also

alSourcef, alSource3f, alSourcefv, alGetSourcef, alGetSource3f
**alGetSourcei**

**Description**

This function retrieves an integer property of a source.

```c
void alGetSourcei(
    ALuint source,
    ALenum pname,
    ALint *value
);
```

**Parameters**

- **source**: source name whose attribute is being retrieved
- **pname**: the name of the attribute to retrieve:
  - AL_SOURCE_RELATIVE
  - AL_BUFFER
  - AL_SOURCE_STATE
  - AL_BUFFERS_QUEUED
  - AL_BUFFERS_PROCESSED
- **value**: a pointer to the integer value being retrieved

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

None

**See Also**

`alSourcei`, `alSource3i`, `alSourceiv`, `alGetSource3i`, `alGetSourceiv`
alGetSource3i

Description

This function retrieves an integer property of a source.

```c
void alGetSource3i(
    ALuint source,
    ALenum param,
    ALint *v1,
    ALint *v2,
    ALint *v3
);
```

Parameters

- `source` source name whose attribute is being retrieved
- `param` the name of the attribute to retrieve:
  - AL_POSITION
  - AL_VELOCITY
  - AL_DIRECTION
- `v1, v2, v3` pointers to the integer values being retrieved

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

None

See Also

alSourcei, alSource3i, alSourceiv, alGetSourcei, alGetSourceiv
alGetSourceiv

Description
This function retrieves an integer property of a source.

```c
void alGetSourceiv(
    ALuint source,
    ALenum param,
    ALint *values
);
```

Parameters
- **source**: source name whose attribute is being retrieved
- **param**: the name of the attribute to retrieve:
  - AL_POSITION
  - AL_VELOCITY
  - AL_DIRECTION
- **values**: pointer to the integer values being retrieved

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements
- OpenAL 1.1 or higher

Remarks
None

See Also
- alSourcei, alSource3i, alSourceiv, alGetSourcei, alGetSource3i
alSourcePlay

Description

This function plays a source.

```c
void alSourcePlay(
    ALuint source
);
```

Parameters

- `source` the name of the source to be played

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

The playing source will have its state changed to AL_PLAYING. When called on a source which is already playing, the source will restart at the beginning. When the attached buffer(s) are done playing, the source will progress to the AL_STOPPED state.

See Also

- `alSourcePlayv`
- `alSourcePause`
- `alSourcePausev`
- `alSourceRewind`
- `alSourceRewindy`
- `alSourceStop`
- `alSourceStopv`
**alSourcePlayv**

**Description**

This function plays a set of sources.

```c
void alSourcePlayv(
    ALsizei n,
    ALuint *sources
);
```

**Parameters**

- `n` the number of sources to be played
- `sources` a pointer to an array of sources to be played

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

The playing sources will have their state changed to AL_PLAYING. When called on a source which is already playing, the source will restart at the beginning. When the attached buffer(s) are done playing, the source will progress to the AL_STOPPED state.

**See Also**

`alSourcePlay`, `alSourcePause`, `alSourcePausev`, `alSourceRewind`, `alSourceRewindy`, `alSourceStop`, `alSourceStopv`
**alSourcePause**

**Description**

This function pauses a source.

```c
void alSourcePause(
    ALuint source
);
```

**Parameters**

- `source` the name of the source to be paused

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

The paused source will have its state changed to AL_PAUSED.

**See Also**

alSourcePlay, alSourcePlayv, alSourcePausev, alSourceRewind, alSourceRewindy, alSourceStop, alSourceStopv
alSourcePausev

Description

This function pauses a set of sources.

```c
void alSourcePausev(
    ALsizei n,
    ALuint *sources
);
```

Parameters

- `n` the number of sources to be paused
- `sources` a pointer to an array of sources to be paused

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

The paused sources will have their state changed to AL_PAUSED.

See Also

- alSourcePlay
- alSourcePlayv
- alSourcePause
- alSourceRewind
- alSourceRewindy
- alSourceStop
- alSourceStopv
alSourceStop

Description

This function stops a source.

```c
void alSourceStop(
    ALuint source
);
```

Parameters

- `source` the name of the source to be stopped

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

The stopped source will have its state changed to AL_STOPPED.

See Also

alSourcePlay, alSourcePlayv, alSourcePause, alSourcePausev, alSourceRewind, alSourceRewindv, alSourceStopv
alSourceStopv

Description

This function stops a set of sources.

```c
void alSourceStopv(
    ALsizei n,
    ALuint *sources
);
```

Parameters

- `n` the number of sources to stop
- `sources` a pointer to an array of sources to be stopped

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

The stopped sources will have their state changed to AL_STOPPED.

See Also

alSourcePlay, alSourcePlayv, alSourcePause, alSourcePausev, alSourceRewind, alSourceRewindv, alSourceStop
alSourceRewind

Description

This function stops the source and sets its state to AL_INITIAL.

```c
void alSourceRewind(
    ALuint source
);
```

Parameters

- `source` the name of the source to be rewound

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

None

See Also

alSourcePlay, alSourcePlayv, alSourcePause, alSourcePausev, alSourceRewindv, alSourceStop, alSourceStopv
**alSourceRewindv**

**Description**

This function stops a set of sources and sets all their states to AL_INITIAL.

```c
void alSourceRewindv(
    ALsizei n,
    ALuint *sources
);
```

**Parameters**

- `n` the number of sources to be rewound
- `sources` a pointer to an array of sources to be rewound

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

None

**See Also**

alSourcePlay, alSourcePlayv, alSourcePause, alSourcePausev, alSourceRewind, alSourceStop, alSourceStopv
alSourceQueueBuffers

Description

This function queues a set of buffers on a source. All buffers attached to a source will be played in sequence, and the number of processed buffers can be detected using an alSourcei call to retrieve AL_BUFFERS_PROCESSED.

```c
void alSourceQueueBuffers(
    ALuint source,
    ALsizei n,
    ALuint* buffers
);
```

Parameters

- `source` the name of the source to queue buffers onto
- `n` the number of buffers to be queued
- `buffers` a pointer to an array of buffer names to be queued

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_NAME</td>
<td>At least one specified buffer name is not valid, or the specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context, an attempt was made to add a new buffer which is not the same format as the buffers already in the queue, or the source already has a static buffer attached.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

When first created, a source will be of type AL_UNDETERMINED. A successful alSourceQueueBuffers call will change the source type to AL_STREAMING.

See Also

- alSourceUnqueueBuffers
**alSourceUnqueueBuffers**

**Description**

This function unqueues a set of buffers attached to a source. The number of processed buffers can be detected using an `alSourcei` call to retrieve `AL_BUFFERS_PROCESSED`, which is the maximum number of buffers that can be unqueued using this call.

```c
void alSourceUnqueueBuffers(
    ALuint source,
    ALsizei n,
    ALuint* buffers
);
```

**Parameters**

- **source**
  - the name of the source to unqueue buffers from
- **n**
  - the number of buffers to be unqueued
- **buffers**
  - a pointer to an array of buffer names that were removed

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>At least one buffer can not be unqueued because it has not been processed yet.</td>
</tr>
<tr>
<td>AL_INVALID_NAME</td>
<td>The specified source name is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

- OpenAL 1.0 or higher

**Remarks**

The unqueue operation will only take place if all `n` buffers can be removed from the queue.

**See Also**

- `alSourceQueueBuffers`
**Listener-Related**

**alListenerf**

**Description**

This function sets a floating point property for the listener.

```c
void alListenerf(
    ALenum param,
    ALfloat value
);
```

**Parameters:**

- `param` the name of the attribute to be set:
  - `AL_GAIN`

- `value` the ALfloat value to set the attribute to

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

None

**See Also**

- alListener3f, alListenerfv, alGetListener, alGetListener3f, alGetListenerfv
**alListener3f**

**Description**

This function sets a floating point property for the listener.

```c
void alListener3f(
    ALenum param,
    ALfloat v1,
    ALfloat v2,
    ALfloat v3
);
```

**Parameters**

- `param` the name of the attribute to set:
  - AL_POSITION
  - AL_VELOCITY
- `v1`, `v2`, `v3` the value to set the attribute to

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

None

**See Also**

alListenerf, alListenerfv, alGetListenerf, alGetListener3f, alGetListenerfv
**alListenerfv**

**Description**

This function sets a floating point-vector property of the listener.

```c
void alListenerfv(
    ALenum param,
    ALfloat *values
);
```

**Parameters**

- **param** the name of the attribute to be set:
  - AL_POSITION
  - AL_VELOCITY
  - AL_ORIENTATION

- **values** pointer to floating point-vector values

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

None

**See Also**

alListenerf, alListener3f, alGetListenerf, alGetListener3f, alGetListenerfv
alListeneri

Description

This function sets an integer property of the listener.

```c
void alListeneri(
    ALenum param,
    ALint value
);
```

Parameters

- `param` the name of the attribute to be set
- `value` the integer value to set the attribute to

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

There are no integer listener attributes defined for OpenAL 1.1, but this function may be used by an extension.

See Also

alListener3i, alListeneriv, alGetListeneri, alGetListener3i, alGetListeneriv
alListener3i

Description

This function sets an integer property of the listener.

```c
void alListener3i(
    ALenum param,
    ALint v1,
    ALint v2,
    ALint v3
);
```

Parameters

- **param** the name of the attribute to be set:
  - AL_POSITION
  - AL VELOCITY
- **v1, v2, v3** the integer values to set the attribute to

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

None

See Also

alListener, alListeneriv, alGetListener, alGetListener3i, alGetListeneriv
alListeneriv

Description

This function sets an integer property of the listener.

```c
void alListeneriv(
    ALenum param,
    ALint *values
);
```

Parameters

- **param** the name of the attribute to be set
  - AL_POSITION
  - AL_VELOCITY
  - AL_ORIENTATION
- **values** pointer to the integer values to set the attribute to

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

None

See Also

alListeneri, alListener3i, alGetListeneri, alGetListener3i, alGetListeneriv
alGetListenerf

Description

This function retrieves a floating point property of the listener.

```c
void alGetListenerf(
    ALenum param,
    ALfloat *value
);
```

Parameters

- **param**  
  the name of the attribute to be retrieved:
  - AL_GAIN

- **value**  
  a pointer to the floating point value being retrieved

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

None

See Also

alListenerf, alListener3f, alListenerfv, alGetListener3f, alGetListenerfv
alGetListener3f

Description

This function retrieves a set of three floating point values from a property of the listener.

```c
void alGetListener3f(
    ALenum param,
    ALfloat *v1,
    ALfloat *v2,
    ALfloat *v3
);
```

Parameters

- `param` the name of the attribute to be retrieved
  - AL_POSITION
  - AL_VELOCITY
- `v1`, `v2`, `v3` pointers to the three floating point being retrieved

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

None

See Also

alListenerf, alListener3f, alListenerfv, alGetListenerf, alGetListenerfv
alGetListenerfv

Description

This function retrieves a floating point-vector property of the listener.

```c
void alGetListenerfv(
    ALenum param,
    ALfloat *values
);
```

Parameters

- `param` the name of the attribute to be retrieved
  - AL_POSITION
  - AL_VELOCITY
  - AL_ORIENTATION

- `values` a pointer to the floating point-vector value being retrieved

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

None

See Also

alListener, alListener3f, alListenerf, alGetListenerf, alGetListener3f
alGetListeneri

Description

This function retrieves an integer property of the listener.

```c
void alGetListeneri(
    ALenum param,
    ALint *value
);
```

Parameters

- `param` the name of the attribute to be retrieved
- `value` a pointer to the integer value being retrieved

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

There are no integer listener attributes defined for OpenAL 1.1, but this function may be used by an extension.

See Also

[alListeneri], [alListener3i], [alListeneriv], [alGetListener3i], [alGetListeneriv]
alGetListener3i

Description

This function retrieves an integer property of the listener.

```c
void alGetListener3i(
    ALenum param,
    ALint *v1,
    ALint *v2,
    ALint *v3
);
```

Parameters

- `param` the name of the attribute to be retrieved
  - `AL_POSITION`
  - `AL_VELOCITY`
- `v1`, `v2`, `v3` pointers to the integer values being retrieved

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

None

See Also

- `alListeneri`
- `alListener3i`
- `alListeneriv`
- `alGetListeneri`
- `alGetListeneriv`
alGetListeneriv

Description

This function retrieves an integer property of the listener.

```c
void alGetListeneriv(
    ALenum param,
    ALint *values
);
```

Parameters

- `param` the name of the attribute to be retrieved
  - AL_POSITION
  - AL_VELOCITY
  - AL_ORIENTATION
- `values` a pointer to the integer values being retrieved

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The value pointer given is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

None

See Also

alListeneri, alListener3i, alListeneriv, alGetListeneri, alGetListener3i
**State-Related**

**alEnable**

**Description**

This function enables a feature of the OpenAL driver.

```c
void alEnable(
    ALenum capability
);
```

**Parameters**

- **capability** the name of a capability to enable

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified capability is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

There are no capabilities defined in OpenAL 1.1 to be used with this function, but it may be used by an extension.

**See Also**

-alDisable, alIsEnabled
alDisable

Description

This function disables a feature of the OpenAL driver.

```c
void alDisable(
    ALenum capability
);
```

Parameters

- `capability`: the name of a capability to disable

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified capability is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

- OpenAL 1.0 or higher

Remarks

There are no capabilities defined in OpenAL 1.1 to be used with this function, but it may be used by an extension.

See Also

- `alEnable`, `allIsEnabled`
**alIsEnabled**

**Description**

This function returns a boolean indicating if a specific feature is enabled in the OpenAL driver.

```c
ALboolean alIsEnabled(
    ALenum capability
);
```

**Parameters**

- `capability` the name of a capability to enable

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified capability is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

Returns AL_TRUE if the capability is enabled, AL_FALSE if the capability is disabled. There are no capabilities defined in OpenAL 1.1 to be used with this function, but it may be used by an extension.

**See Also**

alEnable, alDisable
**alGetBoolean**

**Description**

This function returns a boolean OpenAL state.

```c
ALboolean alGetBoolean(
    ALenum  param
);
```

**Parameters**

- `param` the state to be queried:
  - `AL_DOPPLER_FACTOR`
  - `AL_SPEED_OF_SOUND`
  - `AL_DISTANCE_MODEL`

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

The boolean state described by `param` will be returned.

**See Also**

- `alGetBooleanv`
- `alGetDouble`
- `alGetDoublev`
- `alGetFloat`
- `alGetFloatv`
- `alGetInteger`
- `alGetIntegerv`
alGetDouble

Description

This function returns a double precision floating point OpenAL state.

```c
Aldouble alGetDouble(
    ALEnum  param
);
```

Parameters

- `param` the state to be queried:
  - AL_DOPPLER_FACTOR
  - AL_SPEED_OF_SOUND
  - AL_DISTANCE_MODEL

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

The double value described by param will be returned.

See Also

`alGetBoolean, alGetBoolenv, alGetDoublev, alGetFloat, alGetFloatv, alGetInteger, alGetIntegerv`
alGetFloat

Description

This function returns a floating point OpenAL state.

```c
ALfloat alGetFloat(
    ALenum param
);
```

Parameters

- `param` the state to be queried:
  - `AL_DOPPLER_FACTOR`
  - `AL_SPEED_OF_SOUND`
  - `AL_DISTANCE_MODEL`

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

The floating point state described by param will be returned.

See Also

- `alGetBoolean`
- `alGetBooleanv`
- `alGetDouble`
- `alGetDoublev`
- `alGetFloat`
- `alGetFloatv`
- `alGetInteger`
- `alGetIntegerv`
### alGetInteger

**Description**

This function returns an integer OpenAL state.

```c
Alint alGetInteger(
    ALenum  param
);
```

**Parameters**

- `param`  
  the state to be queried:
  - `AL_DOPPLER_FACTOR`
  - `AL_SPEED_OF_SOUND`
  - `AL_DISTANCE_MODEL`

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

The integer state described by `param` will be returned.

**See Also**

- `alGetBoolean`
- `alGetBooleanv`
- `alGetDouble`
- `alGetDoublev`
- `alGetFloat`
- `alGetFloatv`
- `alGetIntegerv`
**alGetBooleanv**

**Description**

This function retrieves a boolean OpenAL state.

```c
void alGetBooleanv(
    ALenum param,
    ALboolean *data
);
```

**Parameters**

- **param**
  the state to be returned:
  - AL_DOPPLER_FACTOR
  - AL_SPEED_OF_SOUND
  - AL_DISTANCE_MODEL

- **data**
  a pointer to the location where the state will be stored

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified data pointer is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

None

**See Also**

- alGetBoolean
- alGetDouble
- alGetDoublev
- alGetFloat
- alGetFloatv
- alGetInteger
- alGetIntegerv
alGetDoublev

Description

This function retrieves a double precision floating point OpenAL state.

```c
void alGetDoublev(
    ALenum param,
    ALdouble *data
);
```

Parameters

- `param` the state to be returned:
  - `AL_DOPPLER_FACTOR`
  - `AL_SPEED_OF_SOUND`
  - `AL_DISTANCE_MODEL`

- `data` a pointer to the location where the state will be stored

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified data pointer is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

None

See Also

alGetBoolean, alGetBooleanv, alGetDouble, alGetFloat, alGetFloatv, alGetInteger, alGetIntegerv
alGetFloatv

Description

This function retrieves a floating point OpenAL state.

```c
void alGetFloatv(
    ALenum param,
    ALfloat *data
);
```

Parameters

- `param` the state to be returned:
  - AL_DOPPLER_FACTOR
  - AL_SPEED_OF_SOUND
  - AL_DISTANCE_MODEL
- `data` a pointer to the location where the state will be stored

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified data pointer is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

None

See Also

**alGetIntegerv**

**Description**

This function retrieves an integer OpenAL state.

```c
void alGetIntegerv(
    ALenum param,
    ALint *data
);
```

**Parameters**

- **param**
  The state to be returned:
  - AL_DOPPLER_FACTOR
  - AL_SPEED_OF_SOUND
  - AL_DISTANCE_MODEL

- **data**
  A pointer to the location where the state will be stored

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified data pointer is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

None

**See Also**

- alGetBoolean
- alGetBooleanv
- alGetDouble
- alGetDoublev
- alGetFloat
- alGetFloatv
- alGetInteger
alGetString

Description

This function retrieves an OpenAL string property.

```c
const ALchar * alGetString(
    ALenum param
);
```

Parameters

- `param` The property to be returned
  - `AL_VENDOR`
  - `AL_VERSION`
  - `AL_RENDERER`
  - `AL_EXTENSIONS`

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
</tbody>
</table>

Version Requirements

- OpenAL 1.0 or higher

Remarks

- Returns a pointer to a null-terminated string.
**alDistanceModel**

**Description**

This function selects the OpenAL distance model – AL_INVERSE_DISTANCE, AL_INVERSE_DISTANCE_CLAMPED, AL_LINEAR_DISTANCE, AL_LINEAR_DISTANCE_CLAMPED, AL_EXPONENT_DISTANCE, AL_EXPONENT_DISTANCE_CLAMPED, or AL_NONE.

The AL_INVERSE_DISTANCE model works according to the following formula:

\[
\text{gain} = \frac{\text{AL\_REFERENCE\_DISTANCE}}{\text{AL\_REFERENCE\_DISTANCE} + \text{AL\_ROLLOFF\_FACTOR} \times (\text{distance} - \text{AL\_REFERENCE\_DISTANCE})};
\]

The AL_INVERSE_DISTANCE_CLAMPED model works according to the following formula:

\[
\text{distance} = \max(\text{distance}, \text{AL\_REFERENCE\_DISTANCE});
\]
\[
\text{distance} = \min(\text{distance}, \text{AL\_MAX\_DISTANCE});
\]
\[
\text{gain} = \frac{\text{AL\_REFERENCE\_DISTANCE}}{\text{AL\_REFERENCE\_DISTANCE} + \text{AL\_ROLLOFF\_FACTOR} \times (\text{distance} - \text{AL\_REFERENCE\_DISTANCE})};
\]

Here is a graph showing the inverse distance curve:

![Graph showing the inverse distance curve](image)

The AL_LINEAR_DISTANCE model works according to the following formula:
distance = \min(\text{distance, AL_MAX\_DISTANCE}) \ // \ \text{avoid negative gain}
gain = (1 - \text{AL\_ROLLOFF\_FACTOR} \times (\text{distance - AL\_REFERENCE\_DISTANCE}) / (\text{AL\_MAX\_DISTANCE - AL\_REFERENCE\_DISTANCE}))

The AL_LINEAR\_DISTANCE\_CLAMPED model works according to the following formula:

distance = \max(\text{distance, AL\_REFERENCE\_DISTANCE})
distance = \min(\text{distance, AL\_MAX\_DISTANCE})
gain = (1 - \text{AL\_ROLLOFF\_FACTOR} \times (\text{distance - AL\_REFERENCE\_DISTANCE}) / (\text{AL\_MAX\_DISTANCE - AL\_REFERENCE\_DISTANCE}))

Here is a graph showing the linear distance curve:

The AL_EXPONENT\_DISTANCE model works according to the following formula:

gain = (\text{distance / AL\_REFERENCE\_DISTANCE}) ^ (-\text{AL\_ROLLOFF\_FACTOR})

The AL_EXPONENT\_DISTANCE\_CLAMPED model works according to the following formula:

distance = \max(\text{distance, AL\_REFERENCE\_DISTANCE})
distance = \min(\text{distance, AL\_MAX\_DISTANCE})
gain = (\text{distance / AL\_REFERENCE\_DISTANCE}) ^ (-\text{AL\_ROLLOFF\_FACTOR})

Here is a graph showing the exponent distance curve:
The AL_NONE model works according to the following formula:

\[ \text{gain} = 1; \]

```c
void alDistanceModel(
    ALenum value
);
```

**Parameters**

- `value` the distance model to be set:
  - AL_INVERSE_DISTANCE
  - AL_INVERSE_DISTANCE_CLAMPED
  - AL_LINEAR_DISTANCE
  - AL_LINEAR_DISTANCE_CLAMPED
  - AL_EXPONENT_DISTANCE
  - AL_EXPONENT_DISTANCE_CLAMPED
  - AL_NONE

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified distance model is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher
Remarks

The default distance model in OpenAL is AL_INVERSE_DISTANCE_CLAMPED.
alDopplerFactor

Description
This function selects the OpenAL Doppler factor value.

```c
void alDopplerFactor(
    ALfloat value
);
```

Parameters

- `value`: the Doppler scale value to set

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified value is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

The default Doppler factor value is 1.0.
**alSpeedOfSound**

**Description**

This function selects the speed of sound for use in Doppler calculations.

```c
void alSpeedOfSound(
    ALfloat value
);
```

**Parameters**

- `value` the speed of sound value to set

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified value is not valid.</td>
</tr>
<tr>
<td>AL_INVALID_OPERATION</td>
<td>There is no current context.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.1 or higher

**Remarks**

The default speed of sound value is 343.3.
**Error-Related**

**alGetError**

**Description**

This function returns the current error state and then clears the error state.

```c
ALenum alGetError(ALvoid);
```

**Parameters**

None

**Possible Error States**

None

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

Returns an Alenum representing the error state. When an OpenAL error occurs, the error state is set and will not be changed until the error state is retrieved using alGetError. Whenever alGetError is called, the error state is cleared and the last state (the current state when the call was made) is returned. To isolate error detection to a specific portion of code, alGetError should be called before the isolated section to clear the current error state.
**Extension-Related**

**alIsExtensionPresent**

**Description**

This function tests if a specific extension is available for the OpenAL driver.

```c
ALboolean alIsExtensionPresent(
    const ALchar *extname
);
```

**Parameters**

*extname*  
a null-terminated string describing the desired extension

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL_INVALID_VALUE</td>
<td>The specified extension string is not a valid pointer.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

Returns AL_TRUE if the extension is available, AL_FALSE if the extension is not available.

**See Also**

* alGetProcAddress, alGetEnumValue
alGetProcAddress

Description

This function returns the address of an OpenAL extension function.

```c
void * alGetProcAddress(
    const ALchar *fname
);
```

Parameters

- `fname` a null-terminated string containing the function name

Possible Error States

None

Version Requirements

OpenAL 1.0 or higher

Remarks

The return value is a pointer to the specified function. The return value will be NULL if the function is not found.

See Also

`alIsExtensionPresent`, `alGetEnumValue`
**alGetEnumValue**

**Description**

This function returns the enumeration value of an OpenAL enum described by a string.

```c
ALenum alGetEnumValue(
    const ALchar *ename
);
```

**Parameters**

*ename* a null-terminated string describing an OpenAL enum

**Possible Error States**

None

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

Returns the actual ALenum described by a string. Returns NULL if the string doesn’t describe a valid OpenAL enum.

**See Also**

[alIsExtensionPresent](#), [alGetProcAddress](#)
**ALC Functions**

*Context-Related*

**alcCreateContext**

**Description**

This function creates a context using a specified device.

```c
ALCcontext * alcCreateContext(
    ALCdevice *device,
    ALCint* attrlist
);
```

**Parameters**

- `device` : a pointer to a device
- `attrlist` : a pointer to a set of attributes:
  - ALC_FREQUENCY
  - ALC_REFRESH
  - ALC_SYNC

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_VALUE</td>
<td>An additional context can not be created for this device.</td>
</tr>
<tr>
<td>ALC_INVALID_DEVICE</td>
<td>The specified device is not a valid output device.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

Returns a pointer to the new context (NULL on failure).

**See Also**

- `alcDestroyContext`
- `alcMakeContextCurrent`
**alcMakeContextCurrent**

**Description**

This function makes a specified context the current context.

```
ALCboolean alcMakeContextCurrent(
    ALCcontext *context
);
```

**Parameters**

- `context` a pointer to the new context

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_CONTEXT</td>
<td>The specified context is invalid.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

Returns ALC_TRUE on success, or ALC_FALSE on failure.

**See Also**

[alcCreateContext](#), [alcDestroyContext](#)
alcProcessContext

Description

This function tells a context to begin processing.

```c
void alcProcessContext(
    ALCcontext *context
);
```

Parameters

- `context` a pointer to the new context

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_CONTEXT</td>
<td>The specified context is invalid.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

When a context is suspended, changes in OpenAL state will be accepted but will not be processed. `alcSuspendContext` can be used to suspend a context, and then all the OpenAL state changes can be applied at once, followed by a call to `alcProcessContext` to apply all the state changes immediately. In some cases, this procedure may be more efficient than application of properties in a non-suspended state. In some implementations, process and suspend calls are each a NOP.

See Also

- `alcSuspendContext`
**alcSuspendContext**

**Description**

This function suspends processing on a specified context.

```c
void alcSuspendContext(
    ALCcontext *context
);
```

**Parameters**

- `context`: a pointer to the context to be suspended

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_CONTEXT</td>
<td>The specified context is invalid.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

When a context is suspended, changes in OpenAL state will be accepted but will not be processed. A typical use of alcSuspendContext would be to suspend a context, apply all the OpenAL state changes at once, and then call `alcProcessContext` to apply all the state changes at once. In some cases, this procedure may be more efficient than application of properties in a non-suspended state. In some implementations, process and suspend calls are each a NOP.

**See Also**

- `alcProcessContext`
**alcDestroyContext**

**Description**
This function destroys a context.

```c
void alcDestroyContext(
    ALCcontext *context
);
```

**Parameters**

- `context` a pointer to the new context

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_CONTEXT</td>
<td>The specified context is invalid.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

A context which is not current can be destroyed at any time (all sources within that context will also be deleted). `alcMakeContextCurrent` should be used to make sure the context to be destroyed is not current (NULL is valid for `alcMakeContextCurrent`).

**See Also**

- `alcCreateContext`
- `alcMakeContextCurrent`
**alcGetCurrentContext**

**Description**

This function retrieves the current context.

```c
ALCcontext * alcGetCurrentContext( ALCvoid );
```

**Parameters**

None

**Possible Error States**

None

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

Returns a pointer to the current context.

**See Also**

[alcGetContextsDevice](#)
**alcGetContextsDevice**

**Description**  
This function retrieves a context's device pointer.

```c
ALCdevice * alcGetContextsDevice( ALCcontext *context );
```

**Parameters**

- `context` a pointer to a context

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_CONTEXT</td>
<td>The specified context is invalid.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

Returns a pointer to the specified context's device.

**See Also**

- `alcGetCurrentContext`
**Error-Related**

**alcGetError**

**Description**

This function retrieves the current context error state.

```c
ALCenum alcGetError( ALCdevice *device );
```

**Parameters**

- `device` a pointer to the device to retrieve the error state from

**Possible Error States**

None

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

None
Device-Related

alcOpenDevice

Description

This function opens a device by name.

```c
ALCdevice *alcOpenDevice(
    const ALCchar *devicename
);
```

Parameters

- `devicename` a null-terminated string describing a device

Possible Error States

The return value will be NULL if there is an error.

Version Requirements

OpenAL 1.0 or higher

Remarks

Returns a pointer to the opened device. Will return NULL if a device can not be opened.

See Also

- `alcCloseDevice`
**alcCloseDevice**

**Description**

This function closes a device by name.

```c
ALCboolean alcCloseDevice(
    ALCdevice *device
);
```

**Parameters**

- **device** a pointer to an opened device

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_DEVICE</td>
<td>The specified device name doesn't exist.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

ALC_TRUE will be returned on success or ALC_FALSE on failure. Closing a device will fail if the device contains any contexts or buffers.

**See Also**

- [alcOpenDevice](#)
**Extension-Related**

**alcIsExtensionPresent**

**Description**

This function queries if a specified context extension is available.

```c
ALCboolean alcIsExtensionPresent(
    ALCdevice *device,
    const ALCchar *extName
);
```

**Parameters**

- **device**: a pointer to the device to be queried for an extension
- **extName**: a null-terminated string describing the extension

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_VALUE</td>
<td>The string pointer is not valid.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

Returns ALC_TRUE if the extension is available, ALC_FALSE if the extension is not available.

**See Also**

- [alcGetProcAddress](#)
- [alcGetEnumValue](#)
**alcGetProcAddress**

**Description**

This function retrieves the address of a specified context extension function.

```c
void * alcGetProcAddress(
    ALCdevice *device,
    const ALCchar *funcName
);
```

**Parameters**

- **device**  
  a pointer to the device to be queried for the function

- **funcName**  
  a null-terminated string describing the function

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_VALUE</td>
<td>The string pointer is not valid.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

Returns the address of the function, or NULL if it is not found.

**See Also**

alcIsExtensionPresent, alcGetEnumValue
**alcGetEnumValue**

**Description**

This function retrieves the enum value for a specified enumeration name.

```c
ALCenum alcGetEnumValue(
    ALCdevice *device,
    const ALCchar *enumName
);
```

**Parameters**

- **device** a pointer to the device to be queried
- **enumName** a null terminated string describing the enum value

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_VALUE</td>
<td>The string pointer is not valid.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

Returns the enum value described by the enumName string. This is most often used for querying an enum value for an ALC extension.

**See Also**

[alcIsExtensionPresent](#), [alcGetProcAddress](#)
State-Related

alcGetString

Description

This function returns pointers to strings related to the context.

```c
const ALCchar * alcGetString(
    ALCdevice *device,
    ALenum param
);
```

Parameters

- `device` - a pointer to the device to be queried
- `param` - an attribute to be retrieved:
  - `ALC_DEFAULT_DEVICE_SPECIFIER`
  - `ALC_CAPTURE_DEFAULT_DEVICE_SPECIFIER`
  - `ALC_DEVICE_SPECIFIER`
  - `ALC_CAPTURE_DEVICE_SPECIFIER`
  - `ALC_EXTENSIONS`

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>ALC_INVALID_ENUM</code></td>
<td>The specified parameter is not valid.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.0 or higher

Remarks

- `ALC_DEFAULT_DEVICE_SPECIFIER` will return the name of the default output device.
- `ALC_CAPTURE_DEFAULT_DEVICE_SPECIFIER` will return the name of the default capture device.
- `ALC_DEVICE_SPECIFIER` will return the name of the specified output device if a pointer is supplied, or will return a list of all available devices if a NULL device pointer is supplied. A list is a pointer to a series of strings separated by NULL characters, with the list terminated by two NULL characters.
- `ALC_CAPTURE_DEVICE_SPECIFIER` will return the name of the specified capture device if a pointer is supplied, or will return a list of all available devices if a NULL device pointer is supplied.
- `ALC_EXTENSIONS` returns a list of available context extensions, with each extension separated by a space and the list terminated by a NULL character.
**alcGetIntegerv**

**Description**

This function returns integers related to the context.

```c
void alcGetIntegerv(
    ALCdevice *device,
    ALCenum param,
    ALCsizei size,
    ALCint *data
);
```

**Parameters**

- **device** a pointer to the device to be queried
- **param** an attribute to be retrieved:
  - ALC_MAJOR_VERSION
  - ALC_MINOR_VERSION
  - ALC_ATTRIBUTES_SIZE
  - ALC_ALL_ATTRIBUTES
- **size** the size of the destination buffer provided
- **data** a pointer to the data to be returned

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_VALUE</td>
<td>The specified data pointer or size is not valid.</td>
</tr>
<tr>
<td>ALC_INVALID_ENUM</td>
<td>The specified parameter is not valid.</td>
</tr>
<tr>
<td>ALC_INVALID_DEVICE</td>
<td>The specified device is not valid.</td>
</tr>
<tr>
<td>ALC_INVALID_CONTEXT</td>
<td>The specified context is not valid.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.0 or higher

**Remarks**

The versions returned refer to the specification version that the implementation meets.
Capture-Related

alcCaptureOpenDevice

Description

This function opens a capture device by name.

```
ALCdevice * alcCaptureOpenDevice(
    const ALCchar *devicename,
    ALCuint frequency,
    ALCenum format,
    ALCsizei buffersize
);
```

Parameters

- devicename: a pointer to a device name string
- frequency: the frequency that the data should be captured at
- format: the requested capture buffer format
- buffersize: the size of the capture buffer

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_VALUE</td>
<td>One of the parameters has an invalid value.</td>
</tr>
<tr>
<td>ALC_OUT_OF_MEMORY</td>
<td>The specified device is invalid, or can not capture audio.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

Returns the capture device pointer, or NULL on failure.

See Also

alcCaptureCloseDevice
**alcCaptureCloseDevice**

**Description**

This function closes the specified capture device.

```c
ALCboolean alcCaptureCloseDevice(
    ALCdevice *device
);
```

**Parameters**

- `device` a pointer to a capture device

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_DEVICE</td>
<td>The specified device is not a valid capture device.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.1 or higher

**Remarks**

Returns ALC_TRUE if the close operation was successful, ALC_FALSE on failure.

**See Also**

[alcCaptureOpenDevice](#)
alcCaptureStart

Description

This function begins a capture operation.

```c
void alcCaptureStart(
    ALCdevice *device
);
```

Parameters

device a pointer to a capture device

Possible Error States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_DEVICE</td>
<td>The specified device is not a valid capture device.</td>
</tr>
</tbody>
</table>

Version Requirements

OpenAL 1.1 or higher

Remarks

alcCaptureStart will begin recording to an internal ring buffer of the size specified when opening the capture device. The application can then retrieve the number of samples currently available using the ALC_CAPTURE_SAMPLES token with alcGetIntegerv. When the application determines that enough samples are available for processing, then it can obtain them with a call to alcCaptureSamples.

See Also

alcCaptureStop, alcCaptureSamples
**alcCaptureStop**

**Description**

This function stops a capture operation.

```c
void alcCaptureStop(
    ALCdevice *device
);
```

**Parameters**

- **device** a pointer to a capture device

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_DEVICE</td>
<td>The specified device is not a valid capture device.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.1 or higher

**Remarks**

None

**See Also**

alcCaptureStart, alcCaptureSamples
**alcCaptureSamples**

**Description**

This function completes a capture operation, and does not block.

```c
void alcCaptureSamples(
    ALCdevice *device,
    ALCvoid *buffer,
    ALCsizei samples
);
```

**Parameters**

- **device**: a pointer to a capture device
- **buffer**: a pointer to a data buffer, which must be large enough to accommodate `samples` number of samples
- **samples**: the number of samples to be retrieved

**Possible Error States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALC_INVALID_VALUE</td>
<td>The specified number of samples is larger than the number of available samples.</td>
</tr>
<tr>
<td>ALC_INVALID_DEVICE</td>
<td>The specified device is not a valid capture device.</td>
</tr>
</tbody>
</table>

**Version Requirements**

OpenAL 1.1 or higher

**Remarks**

None

**See Also**

[alcCaptureStart](#), [alcCaptureStop](#)
ALC and AL Function Lists

Functions new to OpenAL 1.1 are *italicized* and **boldface**.

**ALC Functions**

```
alcCreateContext
alcMakeContextCurrent
alcProcessContext
alcSuspendContext
alcDestroyContext
alcGetCurrentContext
alcGetContextsDevice
alcOpenDevice
alcCloseDevice
alcGetError
alcIsExtensionPresent
alcGetProcAddress
alcGetEnumValue
alcGetString
alcGetIntegerv
alcCaptureOpenDevice
alcCaptureCloseDevice
alcCaptureStart
alcCaptureStop
alcCaptureSamples
```

**AL Functions**

```
alEnable
alDisable
alIsEnabled
alGetString
alGetBooleanv
alGetIntegerv
alGetFloatv
alGetDoublev
alGetBoolean
alGetInteger
alGetFloat
alGetDouble
alGetError
alIsExtensionPresent
alGetProcAddress
alGetEnumValue
alListenerf
alListener3f
alListenerfv
alListeneri
alListener3i
alListeneriv
alGetListenerf
alGetListeneri
alGetListener3f
```
Creative Labs’ Extensions to OpenAL

Creative has introduced a number of extensions to OpenAL to take advantage of the unique features of their soundcards. The “X-RAM” extension allows a developer to utilize on-board audio RAM for storing OpenAL buffers. The “Multi-Channel Buffers” extension allows a developer to play multi-channel buffers (e.g. 5.1). Finally, the generic “Effects Extension (EFX)” allows an application to use effects such as reverb and low-pass filters to create realistic 3D aural worlds.
**X-RAM**

With the introduction of the Sound Blaster X-Fi™ series of audio cards, Creative has launched a range of products that include on-board RAM. ‘X-RAM’ is provided on the top-end Sound Blaster X-Fi solutions (Sound Blaster X-Fi Fatal1ty™ FPS and Sound Blaster X-Fi Elite Pro). These products feature 64MB of X-RAM that can only be used for audio purposes. With the availability of X-RAM, developers can now improve performance issues related to playing audio in their applications and increase the overall quality of their sound when X-RAM is available.

**X-RAM Usage Scenarios**

Detecting the presence of X-RAM offers new possibilities to application developers. As a fixed resource dedicated to storing audio samples, an application can use X-RAM to improve the performance and quality of an application.

When X-RAM could be used: -

**Improving Quality**

An application that detects X-RAM can use higher quality audio assets that it might not be able to use otherwise.

**Improving Performance**

A game that detects X-RAM can decompress compressed audio samples at load time into the X-RAM so that the application does not have to spend precious processor cycles decompressing data during runtime.

When X-RAM should not be used: -

**Streaming**

There is an overhead involved with uploading data to the memory which means that X-RAM is not recommended for storing AL Buffers, whose contents will be constantly changing, e.g. when queuing buffers on an Open AL Source.
X-RAM Modes

The X-RAM extension to Open AL has two modes of operation – an ‘automatic’ mode (the default) and a ‘managed’ mode. In automatic mode an application does not need to make any function calls, or even query for any extensions, and Open AL buffers will automatically be loaded into X-RAM if it is found and has enough storage space. In managed mode the application developer has complete control over which Open AL Buffers are uploaded to X-RAM or not. Modes are set on individual Open AL Buffers and must be set before audio data is copied to the buffer. Attempts to change the Mode on a buffer that already has audio data will fail.

Automatic Mode (AL_STORAGE_AUTOMATIC)

The default buffer mode allows legacy applications to take advantage of the on-board memory. In automatic mode, the first call to alBufferData after a Buffer has been generated, will attempt to allocate the memory in X-RAM. If there is not enough memory available then an attempt to allocate system memory is made. If there is not enough system memory then the AL error AL_OUT_OF_MEMORY will be set as per the OpenAL 1.0 specification.

If a future alBufferData call is made on a buffer in automatic mode, the driver will assume that the application is using the AL Buffer for streaming (requiring regular updates to the audio data in the buffer), and the sample data will be moved from X-RAM to host memory. If there is not enough system memory then the AL error AL_OUT_OF_MEMORY will be set as per the OpenAL 1.0 specification.

Manual Mode – Hardware (AL_STORAGE_HARDWARE)

In hardware mode a buffer will be uploaded to X-RAM. A buffer in this mode is expected to be used as a single shot or looping sound, but can be reloaded if desired.

If an alBufferData call is made on a buffer in hardware mode an attempt to allocate X-RAM storage for the buffer data is made. If there is not enough X-RAM then the AL error AL_OUT_OF_MEMORY will be set as per the OpenAL 1.0 specification.

Manual Mode – Accessible (AL_STORAGE_ACCESSIBLE)

In accessible mode a buffer is to be placed where the overhead of loading the buffer is minimal. Currently this is assumed to be system memory but in future products, with potentially faster busses, the buffer will be allocated wherever is most applicable. When a buffer is put in this mode it is expected that it will be reloaded numerous times as in a streaming situation.

If an alBufferData call is made on a buffer in accessible mode an attempt to allocate system memory is always made. If there is not enough system memory then the AL error AL_OUT_OF_MEMORY should be set as per the OpenAL 1.0 specification.
Detecting X-RAM
To query for the presence of an audio card with X-RAM, use the Open AL `alIsExtensionPresent` function call and the name "EAX-RAM".

```c
if (alIsExtensionPresent("EAX-RAM") == AL_TRUE)
    // X-RAM Found
```

If the extension is found, an application that wishes to change Buffer Modes should query for the X-RAM extension functions using `alGetProcAddress`.

```c
EAXSetBufferMode g_eaxSetMode;
EAXGetBufferMode g_eaxGetMode;

g_eaxSetMode = (EAXSetBufferMode)
    alGetProcAddress("EAXSetBufferMode");
g_eaxGetMode = (EAXGetBufferMode)
    alGetProcAddress("EAXGetBufferMode");
```

The `EAXSetBufferMode` and `EAXGetBufferMode` function definitions are defined in xram.h.

The final step in preparing an application to use X-RAM functionality is to query for the values of the X-RAM enumerations using `alGetEnumValue`. `AL_EAX_RAM_SIZE` and `AL_EAX_RAM_FREE` are used with `alGetInteger` to retrieve the total amount of X-RAM and the amount of free X-RAM. `AL_STORAGE_AUTOMATIC`, `AL_STORAGE_HARDWARE` and `AL_STORAGE_ACCESSIBLE` are used with the `EAXSetBufferMode` and `EAXGetBufferMode` functions.

```c
ALenum g_eXRAMSize, g_eXRAMFree;
ALenum g_eXRAMAuto, g_eXRAMHardware, g_eXRAMAccessible;
g_eXRAMSize = alGetEnumValue("AL_EAX_RAM_SIZE");
g_eXRAMFree = alGetEnumValue("AL_EAX_RAM_FREE");
g_eXRAMAuto = alGetEnumValue("AL_STORAGE_AUTOMATIC");
g_eXRAMHardware = alGetEnumValue("AL_STORAGE_HARDWARE");
g_eXRAMAccessible = alGetEnumValue("AL_STORAGE_ACCESSIBLE");
```

To query for the total amount or available X-RAM on the soundcard, an application can use the `alGetInteger` function with the `AL_EAX_RAM_SIZE` and `AL_EAX_RAM_FREE` enum values.
ALint iRAMSizeMB;
ALint iRAMFreeMB;

iRAMSizeMB = alGetInteger(g_eXRAMSize) / (1024*1024);
iRAMFreeMB = alGetInteger(g_eXRAMFree) / (1024*1024);
EAXSetBufferMode

The EAXSetBufferMode function is used to set the storage Mode of an array of Open AL Buffers.

```c
ALboolean EAXSetBufferMode(
    ALsizei n,
    ALuint *buffers,
    ALint value
);
```

Parameters

- **n**
  The number of Open AL Buffers pointed to by `buffers`.

- **buffers**
  An array of Open AL Buffer handles.

- **value**
  The storage mode that should be used for all the given buffers. Should be the value of one of the following enum names: -

  - `AL_STORAGE_AUTOMATIC`
  - `AL_STORAGE_HARDWARE`
  - `AL_STORAGE_ACCESSIBLE`

Return Values

- AL_TRUE if all the AL Buffers were successfully set to the requested storage mode,
- AL_FALSE otherwise.

Remarks

None.

See Also

- EAXGetBufferMode
EAXGetBufferMode

The EAXGetBufferMode function is used to retrieve the storage Mode of a particular Open AL Buffer.

```c
ALenum EAXGetBufferMode(
    ALuint buffer,
    ALint *pReserved
);
```

**Parameters**

- `buffer`:
  The handle of an Open AL Buffer.

- `pReserved`:
  Should be set to NULL.

**Return Values**

The Storage Mode assigned to this Open AL Buffer. One of the following enum names:

- `AL_STORAGE_AUTOMATIC`
- `AL_STORAGE_HARDWARE`
- `AL_STORAGE_ACCESSIBLE`

**Remarks**

None.

**See Also**

EAXSetBufferMode
Enumeration Names

**AL_EAX_RAM_SIZE**
Use with `alGetInteger` to retrieve the total amount of X-RAM in bytes.

**AL_EAX_RAM_FREE**
Use with `alGetInteger` to retrieve the amount of free X-RAM in bytes.

**AL_STORAGE_AUTOMATIC**
See X-RAM Modes.

**AL_STORAGE_HARDWARE**
See X-RAM Modes.

**AL_STORAGE_ACCESSIBLE**
See X-RAM Modes.
Multi-Channel Buffers

The multi-channel extension provides a mechanism to play multi-channel data via OpenAL. A variety of formats are supported. Multi-channel buffers can be attached or queued on a source. Note that when using the “Generic Software” device, the multi-channel buffers are mixed down to a stereo output. On a hardware device (such as the “Generic Hardware” device or a native device), each channel of a buffer requires a hardware voice. So, for example playing a buffer using the AL_FORMAT_51CHN16 format will require 6 free hardware voices. If the hardware resources are unavailable, the call to alSourceQueueBuffers or alSourcei will fail.

Formats supported:

- 4 channels, 16 bit data
- 6 channels (5.1), 16 bit data
- 7 channels (6.1), 16 bit data
- 8 channels (7.1), 16 bit data

Before using any of the different multi-channel buffers, use alGetEnumValue to check if the format is supported.

```c
ALenum eBufferFormat = 0;
eBufferFormat = alGetEnumValue("AL_FORMAT_51CHN16");
if (!eBufferFormat)
{
    printf("No support for 5.1 playback!\n");
    return 0;
}
```

AL_FORMAT_QUAD16

This describes a 4 channels buffer of 16 bit samples.

Data organisation:

- Sample 1, front left speaker
- Sample 1, front right speaker
- Sample 1, back left speaker
- Sample 1, back right speaker

Then

- Sample 2, front left speaker
- Sample 2, front right speaker
- Sample 2, front right speaker...

AL_FORMAT_51CHN16

This describes a 5.1 (6 channels) buffer of 16 bit samples.

Data organisation:

- Sample 1, front left speaker
Sample 1, front right speaker
Sample 1, front center speaker
Sample 1, low frequency speaker
Sample 1, back left speaker
Sample 1, back right speaker

Then

Sample 2, front left speaker
Sample 2, front right speaker...

**AL_FORMAT_61CHN16**

This describes a 6.1 (7 channels) buffer of 16 bit samples.

Data organisation:

Sample 1, front left speaker
Sample 1, front right speaker
Sample 1, front center speaker
Sample 1, low frequency speaker
Sample 1, back left speaker
Sample 1, back right speaker
Sample 1, back center speaker

Then

Sample 2, front left speaker
Sample 2, front right speaker...

**AL_FORMAT_71CHN16**

This describes a 7.1 (8 channels) buffer of 16 bit samples.

Data organisation:

Sample 1, front left speaker
Sample 1, front right speaker
Sample 1, front center speaker
Sample 1, low frequency speaker
Sample 1, back left speaker
Sample 1, back right speaker
Sample 1, side left speaker
Sample 1, side right speaker

Then

Sample 2, front left speaker
Sample 2, front right speaker...
Effects Extension (EFX)

Information about the Effects Extension to OpenAL can be found in the “Effects Extension Guide”.
Creative End-User Software License Agreement for Software Development Kit

PLEASE READ THIS DOCUMENT CAREFULLY. YOU MUST AGREE TO THE TERMS OF THIS AGREEMENT BEFORE USING OR DOWNLOADING THE SOFTWARE AND/OR MANUAL FROM THE INTERNET. BY USING OR DOWNLOADING THE SOFTWARE AND/OR MANUAL, YOU AGREE TO BE BOUND BY THE TERMS OF THIS AGREEMENT. THIS AGREEMENT SHOULD BE PRINTED AND RETAINED FOR REFERENCE.

This is a legal agreement between you ("Licensee") and Creative Technology Ltd. and its subsidiaries ("Creative"). This Agreement states the terms and conditions upon which Creative offers to license the software and/or manual provided or downloaded from this website together with all related documentation and accompanying items including, but not limited to, the executable programs, drivers, libraries and data files associated with such programs (collectively, the "Software").

LICENSE

1. Grant of License
This License Agreement is your proof of license to exercise the rights granted herein and must be retained by you. As between you and Creative (and, to the extent applicable, its licensors), Creative retains all title to and ownership of the Software and reserves all rights not expressly granted to you. The license under this Section 1 is conditioned upon your compliance with all of your obligations under this Agreement. Creative grants to Licensee a non-exclusive, non-transferable, limited, royalty-free license to use the Software solely in accordance with the terms contained in this Agreement provided that:
   a. Licensee shall use the Software solely for the purpose of developing Licensee applications compatible with Creative’s products, unless otherwise agreed to by further written agreement from Creative.
   b. the Software is not distributed without execution of a separate distribution agreement between Creative and Licensee;
   c. the Software may NOT be modified except for the source code examples found under the "Samples" directory; and
   d. Creative’s BBS and FTP websites are the only on-line sites where Licensee may download electronic files containing the Software.
No other license is granted hereunder and any use not expressly provided for in this Agreement is prohibited.

2. Copyright and Intellectual Property Protection
The Software and all derivative works are owned by Creative and/or its licensors, and are protected by United States intellectual property laws and international treaty provisions. You may not remove the copyright notice from any copy of the Software or any copy of the written materials, if any, accompanying the Software and you must reproduce all copyright and other proprietary rights notices included in the originals of the Software on all products incorporating the Software or portions thereof.

3. One Archival Copy
You may make one (1) archival copy of the machine-readable portion of the Software for backup purposes only, provided that you reproduce on the copy all copyright and other proprietary rights notices included in the originals of the Software.

- 123 -
4. Limitations on Using and Copying the Software
Except to the extent expressly permitted by this Agreement or by any other developer agreement
agreed to in writing by Creative, you may not use or copy the Software for any purpose and shall keep
the Software confidential and not disclose the Software to any other person, firm or corporation.
Neither may you sub-license any of your rights under this Agreement. You may use the Software for
your personal use only, and absent a written agreement with Creative to the contrary, not for public
display of any kind.

5. Decompiling, Disassembling, or Reverse Engineering
You acknowledge that the Software contains trade secrets and other proprietary information of Creative
and its licensors. Except to the extent expressly permitted by this Agreement or by the laws of the
jurisdiction where you are located, you may not decompile, disassemble create derivative works or
otherwise reverse engineer the Software, or engage in any other activities to obtain underlying
information that is not visible to the user in connection with normal use of the Software.

In particular, you agree not to transmit the Software or display the Software's object code for any
purpose on any computer screen or to make any hardcopy memory dumps for any purpose of the
Software’s object code. If you believe you require information related to the interoperability of the
Software with other programs, you shall not decompile or disassemble the Software to obtain such
information, and you agree to request such information from Creative. Upon receiving such a request,
Creative shall determine whether you require such information for a legitimate purpose and, if so,
Creative will provide such information to you within a reasonable time and on reasonable conditions.

In any event, you will notify Creative of any information derived from reverse engineering or such other
activities, and the results thereof will constitute the confidential information of Creative that may be used
only in connection with the Software.

TERMINATION
The license granted to you is effective until terminated. You may terminate it at any time by destroying
the Software (including any portions or copies thereof) currently in your possession or control. The
license will also terminate automatically without any notice from Creative if you fail to comply with any
term or condition of this Agreement. You agree upon any such termination to destroy the Software
(including any portions or copies thereof). Upon termination, Creative may also enforce any and all
rights provided by law. The provisions of this Agreement that protect the proprietary rights of Creative
will continue in force after termination.

NO WARRANTY
ANY USE BY YOU OF THE SOFTWARE IS AT YOUR OWN RISK. THE SOFTWARE IS PROVIDED
FOR USE ONLY WITH CREATIVE'S HARDWARE AND RELATED SOFTWARE. THE SOFTWARE
IS PROVIDED FOR USE "AS IS" WITHOUT WARRANTY OF ANY KIND. TO THE MAXIMUM
EXTENT PERMITTED BY LAW, CREATIVE DISCLAIMS ALL WARRANTIES OF ANY KIND,
EITHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES
OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE OR
NONINFRINGEMENT. CREATIVE IS NOT OBLIGATED TO PROVIDE ANY UPDATES OR
UPGRADES TO THE SOFTWARE.

No distributor, dealer or any other entity or person is authorized to expand or alter this warranty or any
other provisions of this Agreement. Creative does not warrant that the functions contained in the
Software will meet your requirements or that the operation of the Software will be uninterrupted, error-
free, or free from malicious code. For purposes of this paragraph, “malicious code” means any
program code designed to contaminate other computer programs or computer data, consume
computer resources, modify, destroy, record, or transmit data, or in some other fashion usurp the
normal operation of the computer, computer system, or computer network, including viruses, Trojan
horses, droppers, worms, spyware, logic bombs, and the like.

Further, Creative shall not be liable for the accuracy of any information provided by Creative or third-
party technical support personnel, or any damages caused, either directly or indirectly, by acts taken or
omissions made by you as a result of such technical support.

Any representation, other than the warranties set forth in this Agreement, will not bind Creative. You
assume full responsibility for the selection of the Software to achieve your intended results, and for the
downloading, use and results obtained from the Software. You also assume the entire risk as it applies to the quality and performance of the Software. Should the Software prove defective, you (and not Creative, or its distributors or dealers) assume the entire liability of any and all necessary servicing, repair or correction.

This warranty gives you specific legal rights, and you may also have other rights, which vary from country/state to country/state. Some countries/states do not allow the exclusion of implied warranties, so the above exclusion may not apply to you. Creative disclaims all warranties of any kind if the Software was customized, repackaged, or altered in any way by any third party other than Creative.

IN NO EVENT WILL CREATIVE'S LIABILITY TO YOU OR ANY OTHER PERSON EVER EXCEED THE AMOUNT PAID BY YOU TO USE THE SOFTWARE, REGARDLESS OF THE FORM OF THE CLAIM.

NO LIABILITY FOR DAMAGES, INCLUDING WITHOUT LIMITATION CONSEQUENTIAL DAMAGES
In no event shall Creative or its Licensor's be liable for any damages whatsoever (including, without limitation, incidental, direct, indirect, special or consequential damages, damages for loss of business profits, business interruption, loss of business information, or other pecuniary loss) arising out of the use or inability to use this Software, even if Creative or its Licensor's have been advised of the possibility of such damages. Because some states/countries do not allow the exclusion or limitation of liability for consequential or incidental damages, the above limitation may not apply to you.

LICENSEE’S LIABILITY FOR DAMAGES
In the event that Licensee breaches this Agreement, Creative shall be entitled to damages in connection therewith. Licensee agrees to liquidated damages in the amount of no less than US$30,000 for each occurrence of any violation under this Agreement. Any violation by any third party under this Agreement shall be fully attributed to Licensee irrespective of supervision for purposes of this Paragraph.

INDEMNIFICATION BY YOU
Creative shall have no liability for, and Licensee shall defend, indemnify and hold Creative harmless from and against any claim, loss, demand, liability, obligation or expenses (including reasonable attorneys’ fees) based upon or arising out of any loss, costs, damage, or any claim, including but not limited to, any personal or property damages, arising out of, pertaining to, or resulting in any way from, the use or possession of the Software by Licensee and/or any of Licensee’s directors, officers, employees, representatives, agents, developers or contractors.

U.S. GOVERNMENT RESTRICTED RIGHTS
All Software and related documentation are provided with restricted rights. Use, duplication or disclosure by the U.S. Government is subject to restrictions as set forth in subdivision (b)(3)(ii) of the Rights in Technical Data and Computer Software Clause at 252.227-7013. If you are sub-licensing or using the Software outside of the United States, you will comply with the applicable local laws of your country, U.S. export control law, and the English version of this Agreement.

CONTRACTOR/MANUFACTURER
The Contractor/Manufacturer for the Software is:

Creative Technology Ltd.
31 International Business Park
Creative Resource
Singapore 609921

Safety & Regulatory Information
The following sections contain notices for various countries:

CAUTION: This device is intended to be connected by the user to a CSA/TUV/UL certified/listed IBM AT or compatible personal computers in the manufacturer's defined operator access area. Check the equipment operating/installation manual and/or with the equipment manufacturer to verify/confirm if your equipment is suitable for devices to be connected to it.
ATTENTION: Ce périphérique est destiné à être connecté par l'utilisateur à un ordinateur IBM AT certifié ou listé CSA/TUV/UL ou compatible, à l'intérieur de la zone d'accès définie par le fabricant. Consulter le mode d'emploi/guide d'installation et/ou le fabricant de l'appareil pour vérifier ou confirmer qu'il est possible de connecter d'autres périphériques à votre système.

GENERAL
This Agreement is binding on you as well as your employees, employers, contractors and agents, and on any successors and assignees. Neither the Software nor any information derived therefrom may be exported except in accordance with the laws of the U.S. or other applicable provisions. This Agreement is governed by the laws of the State of California (except to the extent federal law governs patents, copyrights and federally registered trademarks). This Agreement is the entire agreement between us relating to the subject matter hereof, and you agree that Creative will not have any liability for any untrue statement or representation made by it, its agents or anyone else (whether innocently or negligently) upon which you relied upon entering this Agreement, unless such untrue statement or representation was made fraudulently. This Agreement supersedes any other understandings or agreements, including, but not limited to, advertising, with respect to the Software.

If any provision of this Agreement is deemed invalid or unenforceable by any country or government agency having jurisdiction, that particular provision will be deemed modified to the extent necessary to make the provision valid and enforceable, and the remaining provisions will remain in full force and effect.

For questions concerning this Agreement, please contact Creative at the address stated above. For questions on product or technical matters, contact the Creative technical support center nearest you.

SPECIAL PROVISIONS APPLICABLE TO THE EUROPEAN UNION
If you downloaded the Software in the European Union (EU), the following provisions also apply to you. If there is any inconsistency between the terms of the Software License Agreement set out above and the following provisions, the following provisions shall take precedence.

 Decompilation
You agree not for any purpose to transmit the Software or display the Software's object code on any computer screen or to make any hard copy memory dumps of the Software's object code. If you believe you require information related to the interoperability of the Software with other programs, you shall not decompile or disassemble the Software to obtain such information, and you agree to request such information from Creative at the address listed above. Upon receiving such a request, Creative shall determine whether you require such information for a legitimate purpose and, if so, Creative will provide such information to you within a reasonable time and on reasonable conditions.

Limited Warranty
EXCEPT AS STATED ABOVE IN THIS AGREEMENT, AND AS PROVIDED BELOW UNDER THE HEADING “STATUTORY RIGHTS,” THE SOFTWARE IS PROVIDED AS-IS WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY, QUALITY AND FITNESS FOR A PARTICULAR PURPOSE.

Limitation of Remedy and Damages
THE LIMITATIONS OF REMEDIES AND DAMAGES IN THE SOFTWARE LICENSE AGREEMENT SHALL NOT APPLY TO PERSONAL INJURY (INCLUDING DEATH) TO ANY PERSON CAUSED BY CREATIVE’S NEGLIGENCE AND ARE SUBJECT TO THE PROVISION SET OUT BELOW UNDER THE HEADING “STATUTORY RIGHTS.”

Irish Statutory rights
Irish law provides that certain conditions and warranties may be implied in contracts for the sale of goods and in contracts for the supply of services. Such conditions and warranties are hereby excluded, to the extent such exclusion, in the context of this transaction, is lawful under Irish law. Conversely, such conditions and warranties, insofar as they may not be lawfully excluded, shall apply. Accordingly, nothing in this Agreement shall prejudice any rights that you may enjoy by virtue of Sections 12, 13, 14 or 15 of the Irish Sale of Goods Act 1893 (as amended).
General
This Agreement is governed by the laws of the Republic of Ireland. The local language version of this agreement shall apply to Software downloaded in the EU. This Agreement is the entire agreement between us and you agree that Creative will not have any liability for any untrue statement or representation made by it, its agents or anyone else (whether innocently or negligently) upon which you relied upon entering this Agreement, unless such untrue statement or representation was made fraudulently.