Welcome to the API Reference for the Lightning game engine. This document hopefully provides you with everything you need to develop games using the engine and to utilise the engine to its maximum potential.

Any comments about the documentation should be directed to Starfrost#9088 on Discord.

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1. General Overview  
1.1. Lightning API Style**The Lightning API is based on the concept of windows, asset managers (see Chapter 1.5)) and, optionally, scenes.  
  
Each Window is a rendering context that allows you to use Managers.   
Managers are the various parts of Lightning that allow specific rendering operations, such as rendering lighting or input, to occur. It is generally required to pass the current Window being used to any rendering APIs that you call.

A scene is simply an “area” of a game and is an optional construct – the Scene Manager can be turned off with the **DontUseSceneManager** GlobalSetting. It provides ready-made basic handling of startup and shutdown as well as some very basic event handling.

Exceptions are implemented using a custom exception class, **NCException**.

**1.2. Namespaces**

**LightningGL**Provides all of the primary rendering APIs.  
**LightningPackager**Provides all of the packaging APIs.  
**NuCore.SDL2**Provides access to unmanaged SDL2, SDL2\_image, SDL2\_mixer, SDL2\_ttf, and my fork of SDL2\_gfx APIs and functions.  
**NuCore.Utilities**ProAvides utility APIs.

**1.3. Standard .NET types used**

**System.Drawing.Color**Defines an ARGB-formatted color.  
**Documentation**: <https://docs.microsoft.com/en-us/dotnet/api/system.drawing.color?view=net-6.0>

**System,Numerics.Vector2**Defines a two-dimensional vector.  
**Documentation:** <https://docs.microsoft.com/en-us/dotnet/api/system.numerics.vector2?view=net-6.0>

**1.4. The Renderable class**

Any renderable object is expected to inherit from the Renderable class and override its Draw method – this provides the object with a few basic properties, such as position and size, that can be manipulated in order to make drawing the object easier for the programmer. UI elements are extended by inheriting from the Gadget class.

**Properties:**

**Position**The position of this renderable. If **SnapToScreen** is false. Can be changed at runtime.

**Size**The Size of this Renderable.

**SnapToScreen**Determines if the Renderable will be drawn in world-relative space or camera-relative space.

Methods:

**Draw**

Draws the Renderable.

The Renderable class can be extended to add your own properties (any .NET class is supported, including any custom classes) and drawing code, like so:

public class MyRenderable : Renderable  
{  
 public bool MyRenderableProperty { get; set; }

public override void Draw(Window cWindow)  
{

PrimitiveRenderer.DrawText(cWindow, “This is MyRenderable”, new(100, 100), Color.Yellow);

}

}

**new()** can be used as a shorthand to omit the class name and any required **using** statements for the namespace the class is in. References to assemblies are still required using this syntax.

**1.5. Asset Managers**

Asset Managers are the third primary facet of Lightning. Put simply, asset managers load, unload, store, and manage a particular class of object. Lightning provides asset managers for scenes, textures (experimental), lighting, UI, audio, and various other aspects of the engine API. The asset managers provide a fairly consistent API with similar method names and usage, although they do not conform to a specific base class yet.

**2. Getting Started**

**2.1. Setting Up using the Scene Manager**

The Lightning game engine includes Visual Studio templates to allow you to get started quickly. For more information, refer to the **Quickstart.docx** document.

**2.2. If you don’t want to use the Scene Manager: Creating a Window Manually using WindowSettings**

Lightning also supports use without the Scene Manager. To do this, add **DontUseSceneManager=true** to the **[General]** section of the **Content\Engine.ini** in your project**.**

Then, you have to create a window.

Window window = new Window();

Then, configure the WindowSettings manually.

**WindowSettings**

**string Title**The window title of the Window. Can be modified at runtime. Optional.

**Vector2 Position**The position of the Window on the screen. The default value is the value of **GlobalSettings::PositionX** for width and **GlobalSettings::PositionY** for height, which is set based on the screen resolution in such a way as to position the window in the middle of the screen

**Size**The window size. Must be between 192x48 and the current screen resolution. Default is (960, 640). Can be changed at runtime.

**WindowFlags**SDL\_WindowFlags for the window. See <https://wiki.libsdl.org/SDL_WindowFlags>. Default is the content of **GlobalSettings::WindowFlags**, which is **SDL\_WINDOW\_SHOWN**.

**RenderFlags**SDL\_RendererFlags for the renderer. See <https://wiki.libsdl.org/SDL_RendererFlags> Default is the content of **GlobalSettings::RenderFlags**, which is **0.**

**ID**Internal only, used for storing the SDL window ID of the window.

**WindowHandle**Pointer to unmanaged memory containing the SDL\_Window struct of the window.

**RendererHandle**Pointer to unmanaged memory containing the SDL\_Renderer struct of the renderer.

**Camera**Camera used for this window. See chapter 6.

**BackgroundColour**The background colour of the window.

**2.4. Delta Time & Framerate Management**

Not all of Lightning is currently set up to use delta time. This will be repaired in the next release. The delta time is stored in the **Window::DeltaTime** property. To use delta-time for velocity calculations, simply multiply the value you are using by it, like so:

double realVelocity = velocity \* window.DeltaTime;

You must be using a method that receives a Window as a parameter currently in order to use delta time. To set a maximum framerate, use the **MaxFPS** global setting. A value of 0 or lower will turn off the frame limiter.

**3. Modules**

Lightning modules are independent sections of the engine that provide specific functionality. There are currently two modules, although more will be added in future releases. Documentation for all modules is contained within this manual.

**3.1. LightningGL:**   
This module provides graphical rendering capabilities and is the primary area of the Lightning Game Engine.

**3.2. LightningPackager:**

Provides WAD file packaging functions.

**4. Scenes**

Scenes are an “area” of a game. An area of a game could be something such as the menu, the main game, options, mini-games, etc. A scene is defined in Lightning by adding a class that inherits from **LightningGL::Scene**

**4.1: The Scene Manager**

The Scene Manager is the Lightning asset manager responsible for managing scenes. It provides utilities for sending events to scenes, handles the main loop of the scene window (any scene can also handle events passed to the window), and starting and shutting down scenes and the engine. Using the Scene Manager allows you to not write some of the required boilerplate code.

To use the Scene Manager, it is required to set a startup scene. This is done by setting the StartupScene GlobalSetting to the class name (or Name property if it is set) of your scene. An error will be thrown if no scene is initialised.

**4.2: Creating Scenes**

To create a scene, simply add a class to your game assembly that inherits from the Scene class. No file modification is required; the Scene Manager will automatically initialise every scene that inherits from Scene.

To create a scene, you must implement five methods:

**Start():** Called at the startup of the scene.

**Render(Window cWindow):** Called each frame.

**SwitchTo(Scene oldScene):** The scene is about to be switched to. **oldScene** is the scene that is about to be switched away from.

**SwitchAway(Scene newScene):** The scene is about to be switched away from. **newScene** is the scene that is about to be switched to.

**Shutdown():** Called at engine shutdown.

Optionally, you can also override **Name** and set a name for a scene that is used in SceneManager calls. If this is not done, the class name of the scene will be used for its name.

This is an example scene class, reproduced verbatim from the BasicScene example available in the Lightning2.Examples solution (which can be accessed from the Start Menu):

using LightningGL;

using static NuCore.SDL2.SDL;

using System.Drawing;

using System.Numerics;

namespace BasicScene

{

public class MainScene : Scene

{

public override void Start()

{

}

public override void Shutdown()

{

}

public override void SwitchTo(Scene oldScene)

{

}

public override void SwitchAway(Scene newScene)

{

}

public override void Render(Window cWindow)

{

PrimitiveRenderer.DrawText(cWindow, "Hello from MainScene", new Vector2(300, 300), Color.Red);

// change the scene

if (cWindow.EventWaiting)

{

if (cWindow.LastEvent.type == SDL\_EventType.SDL\_KEYDOWN) SceneManager.SetCurrentScene("Scene2");

}

}

}

}

**4.3. Scene Management**

Scenes can be managed by calling public methods in **SceneManager**.

To acquire a **Scene** object, call **SceneManager::GetScene** with the name of the Scene you wish to acquire (by default, its class name). It will return the Scene object if a Scene exists with that name, or **null** if it is not present.

To set the current scene, call **SceneManager::GetCurrentScene** with either a Scene object obtained via **GetScene** or the name of the scene to switch to. This method will throw an error if the scene does not exist. If it does, it will call **SwitchAway** on the old scene, **SwitchTo** on the new scene, and then switch to the new scene.

**Example:**

SceneManager.SetCurrentScene(“Scene2”); // if scene2 does not exist will throw error

// not recommended  
Scene scene = SceneManager.GetScene(“Scene2”);

SceneManager

**4.4. Scene Shutdown**

On shutdown, any assets loaded in **Init** MUST be unloaded, or errors will occur on shutdown. This goes for all types of assets that are loaded using the Lightning APIs.

**5. Settings (Global & Local)**

Lightning provides two types of Settings APIs, one for global, engine-level settings and one for local settings used for your game.

**5.1. Global Settings Overview  
GlobalSettings** is the class that implements engine settings in Lightning; it is loaded from an INI file, which should always be present in the **Content** folder, called **Engine.ini.** This file is not intended for game developer use, and should **NOT** be used to store game settings. It is only used for settings that affect the entire engine instead of specific games.

It stores various types of settings, such as settings governing package information, graphics settings, if the Scene Manager is to be used or not, and various other aspects of the engine.

It is highly recommended that you recommend to the users of your game that this file not be modified except in ways that are accessible through the game, such as graphics settings, as modifying the settings in an incorrect manner could make the game unbootable.

**5.2. Global Settings Values**

**5.2.1: General Section**

**GLOBALSETTINGS\_PATH**

Internal static value used to store the path to the Global engine settings. Read-only.

**Language**

The language to use. Must correspond to a valid language INI file in the **Content\Localisation** folder.

**ProfilePerf**

Determines if the **Performance Profiler** is enabled – see *Chapter* *18.3. Performance Profiler* for further information on the Performance Profiler.

**EngineAboutScreenOnShiftF9**

Determines if the Engine About screen will be available when **Shift+F9** is pressed. Defaults to **true.**

**DeleteUnpackedFilesOnExit**

Ignored if **PackageFile** is not set, or a package file was not passed using the **-packagefile** command line option. Deletes files unpacked using LightningPackager at start on exit. Defaults to **false.**

**LocalSettingsPath**

Path to the Local Settings file. Defaults to **null,** which will disable the Local Settings API.

**PackageFile**

A package (**.WAD**) file containing game content (except Engine.ini, which must always be uncompressed and is banned from being included in packages by the **MakePackage** tool) to extract on startup.

**ContentFolder**

The content folder to extract game content to. Regardless of this setting, **Engine.ini** must always be in the **Content** folder under the game root. Ignored if **PackageFile** is not set.

**DontUseSceneManager**

Determines if the Scene Manager will be used or not. If it is not used (this value is set to **true**), you will not be able to use Scenes and will have to initialise the engine manually. See *Chapter 2.2: If you don’t want to use the Scene Manager: Creating a Window Manually using WindowSettings* for further information on this topic.

**5.2.2: Graphics section**

**MaxFPS**

The maximum number of frames per second to render. The engine will use a stopwatch to delay until the frametime required for the framerate if the frame took under the required frametime. Set to 0 or lower to run as fast as possible.

**ShowDebugInfo**

Show the current framerate and frame number at the top-left corner of the screen, as well as red warning text shown when you are running below **MaxFPS.**

**WindowFlags**

The **SDL\_WindowFlags** of the window. See <https://wiki.libsdl.org/SDL_WindowFlags> for more information on how to use this setting. The string values of the the enum can be used in Engine.ini, as well as the numeric values. The default is **SDL\_WINDOW\_SHOWN.**

To set the window as fullscreen, use **SDL\_WINDOW\_FULLSCREEN\_DESKTOP**, not **SDL\_WINDOW\_FULLSCREEN**. This is because **SDL\_WINDOW\_FULLSCREEN** forces the operating system to give semi-exclusive control of the window to your application, as well as forces a video mode to a non-native monitor resolution if the **ScreenResolutionX** and **ScreenResolutionY** GlobalSettings are less than the primary monitor’s native resolution, causing severe compatibility issues with ALT+TAB and some overlay programs.

**RenderFlags**

The **SDL\_RendererFlags** of the window. See <https://wiki.libsdl.org/SDL_RendererFlags> for more information on how to use this setting. The string values of the the enum can be used in Engine.ini, as well as the numeric values. The default is **0**, with no flags set**.**

**ResolutionX**

The initial width of the main game window. Will be ignored if **SDL\_RendererFlags** contains the **SDL\_WINDOW\_FULLSCREEN\_DESKTOP** flag. The default value is 960 pixels. Can be changed after startup by modifying the value of the window’s **WindowSettings.Size.X.**

**ResolutionY**

The initial height of the main game window. Will be ignored if **SDL\_RendererFlags** contains the **SDL\_WINDOW\_FULLSCREEN\_DESKTOP** flag. The default value is 640 pixels. Can be changed after startup by modifying the value of the window’s **WindowSettings.Size.Y.**

**PositionX**

The initial horizontal position of the main game window on the screen. Will be ignored if **SDL\_RendererFlags** contains the **SDL\_WINDOW\_FULLSCREEN** or **SDL\_WINDOW\_FULLSCREEN\_DESKTOP** flag. The default valued is the value of the mathematical expression **(SystemInfo.Resolution.X / 2) – (GlobalSettings.Resolution.X).** Can be changed after startup by modifying the value of the window’s **WindowSettings.Position.X.**

**PositionY**

The initial vertical position of the main game window on the screen. Will be ignored if **SDL\_RendererFlags** contains the **SDL\_WINDOW\_FULLSCREEN** or **SDL\_WINDOW\_FULLSCREEN\_DESKTOP** flag. The default valued is the value of the mathematical expression **(SystemInfo.Resolution.Y / 2) – (GlobalSettings.Resolution.Y).** Can be changed after startup by modifying the value of the window’s **WindowSettings.Position.Y.**

**WindowTitle**

Optional. The initial title (also known as caption text) of the main window. Can be changed after startup by modifying the value of the window’s **WindowSettings.Title.**

**6. Cameras**

**7. Input & Collision**

**8. Textures (and Atlases)**

**9. Animations**

**10. Lighting**

**11. Particle Effects**

**12. UI**

**13. Text Rendering & Font Management**

**14. Localisation**

**15. Audio**

**16. System Information & Enforcing System Requirements**

**17. Packaging**

**18. Debugging**

**19. Advanced Usage**

**20. Error Message Reference**

**Error Code 0**

An error occurred initialising SDL2.

**Error Code 1**

An error occurred initialising SDL2\_image.

**Error Code 2**

An error occurred initialising SDL2\_ttf.

**Error Code 3**

An error occurred initialising SDL2\_mixer.

**Error Code 5**

NCLogging::NCLoggingSettings was null when calling NCLogging::Init. This is almost certainly an engine bug.

**Error Code 6**

NCLogging::NCLoggingSettings::LogFileName was null when calling NCLogging::Init. This is almost certainly an engine bug.

**Error Code 7**

A null WindowSettings was passed to Window::Start.

**Error Code 8**

An SDL error occurred during window creation in Window::Start.

**Error Code 9**

Attempted to load a Texture with a Path property corresponding to an invalid file.

**Error Code 10**

An SDL error occurred while loading a Texture. Refer to the error cause for more detailed error information.

**Error Code 11**

There was an internal error locking pixels for modification. This may be an engine bug.

**Error Code 12, 14**

Texture::GetPixel was called with an invalid x and y position. Modify the call to GetPixel such that the x and y positions are at least 0 and less than the texture size.

**Error Code 13**

An SDL error occurred while allocating a texture format for a Texture. Refer to the error cause for more detailed error information.

**Error Code 15, 17**

Texture::SetPixel was called with an invalid x and y position. Modify the call to SetPixel such that the x and y positions are at least 0 and less than the texture size.

**Error Code 18**

Attempted to draw a line with a thickness of below 1. Change the call to PrimitiveRenderer::DrawText.

**Error Code 19**

An SDL error occurred in NCMessageBox::Show.

**Error Code 21**

Attempted to load a nonexistent INI file.

**Error Code 22**

An unknown error occurred loading an INI file. View the error cause for exception information.

**Error Code 23**

An INI item does not have a value. Add a value to parse correctly.

**Error Code 24**

An INI section name was not terminated with a ] character.

**Error Code 25**

An invalid INI section entry was found. INI Section entries start with [ and are ended with ].

**Error Code 26**

An INI value was not within an INI section.

**Error Code 28**

Engine.ini failed to load.

**Error Code 29**

Engine.ini does not have a Localisation section.

**Error Code 30**

Engine.ini’s Localisation section does not have a valid Language value.

**Error Code 31**

An attempt to load an invalid localisation file occurred. There is likely an error in the localisation file.

**Error Code 32**

A loaded localisation file does not have a Metadata section.

**Error Code 33**

A loaded localisation file does not have a Strings section.

**Error Code 34**

Attempted to load a nonexistent font file. Adjust your call to Font::Load to specify an actually extant font or font file. Please note that system fonts must use the font names in c:\windows\fonts.

**Error Code 35**

Attempted to load an invalid localisation string.

**Error Code 36**

Attempted to load a non-TrueType font. Only TrueType fonts are supported.

**Error Code 37**

Attempted to load an invalid font size. Font size must be at least 1.

**Error Code 38**

An SDL2\_ttf error occurred during font loading.

**Error Code 39**

Attempted to draw text with an invalid font parameter. Change your call to DrawText or load the font you need to use.

**Error Code 41**

Engine.ini does not have a General section. Add one.

**Error Code 44**

Attempted to load an AnimatedTexture without a set Size property. Set it to at least 1 x 1 pixel.

**Error Code 45**

Attempted to load a TextureAtlas without a valid FrameSize property. Set it before calling TextureAtlas::Load.

**Error Code 46**

Attempted to load a TextureAtlas with a frame count under 1 in the X or Y direction. Set it before calling TextureAtlas::Load.

**Error Code 47**

Attempted to draw an invalid Index for a TextureAtlas. The index must be between zero and (TextureCount.X \* TextureCount.Y).

**Error Code 50**

You attempted to load an audio file with a path that does not exist.

**Error Code 51**

An SDL\_mixer error occurred while loading an audio file. See error description for the actual error.

**Error Code 54**

Attempted to load an AnimatedTexture property with an invalid Cycle. The cycle must have at least one frame.

**Error Code 56**

An error occurred initialising the audio device required for SDL2\_mixer.

**Error Code 61, 62, 124, 125**

Attempted to use the Light Manager without initialising it. The error code determines the called method.

**Error Code 70**

An exception occurred while initialising the Performance Profiler. No profiling will be performed.

**Error Code 80**

An SDL\_ttf error occurred while sizing text.

**Error Code 81, 82**

Attempted to call GetTextSize (80) or GetLargestTextSize (81) specifying an invalid Font parameter.

**Error Code 83**

Attempted to select an invalid ListBox SelectedIndex. SelectedIndex must be between 0 and the number of items in the list box – 1.

**Error Code 94**

A Texture Path was set, but the texture was not loaded.

**Error Code 95**

You attempted to shutdown Lightning without initialising it.

**Error Code 96**

Attempted to add a non-existent file to a PackageFileCatalog

**Error Code 98, 100**

Attempted to read a package file that does not exist.

**Error Code 99**

Attempted to read a non-package file as it does not have a package file magic.

**Error Code 100**

Attempted to read a package file with an incorrect version. Please update Lightning.

**Error Code 102**

A package file has an invalid file catalog magic and therefore is likely corrupt.

**Error Code 103**

Invalid command-line arguments were provided to the engine.

**Error Code 104, 128**

A fatal error occurred extracting a package. 104 indicates the error occurred during command-line option parsing, 128 indicates the error occurred during GlobalSettings parsing.

**Error Code 105**

A package file has an invalid header. It may be corrupted.

**Error Code 106**

Attempted to move a textbox cursor beyond the text length.

**Error Code 109**

An error occurred cleaning up the content directory when the GlobalSetting DeleteUnpackedFilesOnExit is set to true.

**Error Code 110**

An error occurred while writing to an INI.

**Error Code 111, 112, 113, 114**

These errors indicate the system requirements tests failed.

**Error Code 117**

Attempted to set a window to a window size of 191x47 or lower. The window width must be at least 192 pixels and the window height must be at least 48 pixels.

**Error Code 118**

Attempted to move a window to a position not on the current monitor.

**Error Code 119**

An SDL error occurred during texture creation. See error cause for more detailed error cause information.

**Error Code 120**

Attempted to draw a particle effect without loading it.

**Error Code 122**

Attempted to draw a UI element with no size. You will not be able to see it.

**Error Code 123**

Specified an SDL rendering backend that is not supported. SDL chose a different rendering backend listed in the error information.

**Error Code 127**

An attempt was made to initialise a Window when using the Scene Manager. Set the DontUseSceneManager GlobalSetting to true if you wish to do thi.

**Error Code 130**

Failed to initialise a scene. The specific scene that failed to initialise is in the error cause.

**Error Code 131**

No startup scene was set. Set the StartupScene GlobalSetting to set startup scenes.

**Error Code 132**

There are no scenes. Please set DontUseSceneManager to true in order to not use the Scene Manager, or define a scene by adding a class to your game assembly that inherits from the Scene class.

**Error Code 133**

Attempted to set a current scene name that does not correspond to a valid scene.

**Error Code 134**

An attempt was made to initialise a window before initialising the engine. Call Lightning::Init before using any Lightning methods.

**Error Code 57005 (0xDEAD)**

An unknown fatal error occurred during engine initialisation. This may indicate an error during your engine installation.