GB ENHANCED+ USER MANUAL

Version 1.0
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1. Foreword

This manual will attempt to cover all the functions users may encounter while operating GB Enhanced+. The information contained herein doubles as both an operating guide and reference to the emulator's various features.

GB Enhanced+ is the successor to the original GB Enhanced project (note the shiny "+"). It is a Game Boy, Game Boy Color, and Game Boy Advance emulator that aims to provide as many enhancements as reasonably possible. Although there is much work to be done in later releases, such as cheat code support, emulation of the GB Camera and Printer, and implementing pixel shaders, GBE+ is dedicated to pursuing these types of things.

Perhaps most importantly, GBE+ supports an emerging emulation technique for 2D games, what the project refers to as **Custom Graphics**, or **CGFX** for short. Like HD textures for N64 games, CGFX lets users replace in-game graphics with their own pixels, from simple recolors to full-blown high-definition versions. While replacing graphics for 2D systems is not common among other emulators, GBE+ is proud to push the boundaries in this field of emulation.

What started as an idle dream to make my own NDS emulator has become something much more than the humble project I founded in 2012. GBE+ is still in early development, despite its 1.0 release. Many, many rough edges remain. There is still a lot more to go through before I can see my vision completed, however, I believe this project is on the right path. In the coming years, we'll see where the road takes this emulator. In the meantime, I hope this manual will give users an insight to how the programs works, what it's capable of, and where it's going.

D.S. Baxter - aka Shonumi

2. Getting Started

Getting started with GBE+ is relatively simple. The emulator does not have many requirements to build from source, and installation should be simple for most operating systems. Please consider, however, that GBE+ has not been tested on OS X in any way, shape, or form. This is due to the lack of access to the operating system. Users can still build it themselves on OS X.

Currently, GBE+ has minimal hardware requirements. Any recent computer should be able to run the emulator just fine. Certain tasks, such as processing large amounts of CGFX, require more single-threaded processing power. Under some circumstances CGFX may also benefit from more RAM. Generally, however, these scenarios are reserved for intense use of HD graphics. Otherwise GBE+ is not a demanding emulator.

It should be noted, however, that as of 1.0, GBA games in general eat up a lot of CPU resources. This is due to inefficiencies in the GBA core that will be addressed in the very near future.

GBE+ aims to build and run with minimal software dependencies. The recommended minimum version of OpenGL is 2.1. Any computer released in the past decade should support this without any trouble. Future versions of GBE+ will move to OpenGL 3.3 (for backward compatibility) and Vulkan.

Currently, GBE+ supports both 32-bit and 64-bit systems. For the foreseeable future, this will remain the case. For CPU emulation, any dynamic recompilers added to later releases, will only target x64 systems. Nevertheless, GBE+ will technically continue support 32-bit systems at that time through CPU interpreters.

For a general roadmap of where GBE+ will go from here, please see the FAQ in **Section 6** for more details.

2.1 Obtaining, Compiling, & Installing GBE+

For Windows users who do not want to build from source code, please visit the project's GitHub page and check out the 1.0 release on the Release page. Download the zip file and extract it. Simply double-click the executable file *gbe_plus_qt.exe* to run the GUI version of the emulator. For those interested in the command-line version of GBE+, run the *gbe_plus.exe* file from the command prompt. The majority of this manual focuses on the Qt version of GBE+, however, please refer to **Section 2.2** for more details about running the command-line version.

Linux users have to compile the source code themselves. Compiling from source requires prior installation of the following programs and libraries:

- GIT
- CMake
- SDL 1.2
- OpenGL
- Qt4 or Qt5 (optional)

CMake will check to make sure it can find all of the necessary dependencies before the build process begins. Before that happens, however, GIT must retrieve the source, or the source tarball from the Release page must be downloaded and extracted. The following terminal instructions detail how to download the source code through GIT, compile it, and install the emulator:

```
git clone https://github.com/shonumi/gbe-plus.git
cd gbe-plus
mkdir build && cd build
cmake ..
make && make install
```

Note that this will install the very latest source code. GIT can check out specific revisions based on the hash of that commit. Consult the GIT documentation for checking out revisions and the GBE+ GitHub repository for the appropriate hash. Once CMake installs GBE+, the emulator can be called via *gbe_plus* for the command-line version, or *gbe_plus_qt* for the Qt version.

2.2 Command-Line Options

The command-line version of GBE+ accepts several parameters. Below are all the valid arguments for the emulator along with a short description of what they do:

-b or **--bios [FILE]:**
This instructs GBE+ to boot a system's BIOS or Boot ROM with the provided file when loading a game. The second argument is the exact path for the BIOS or Boot ROM on the user's computer.

-d or **--debug:**
This starts GBE+ in debug mode. It will pull up the command-line debugger. See **Section 5.7** for details on how to use properly use this version of the debugger.

--opengl:
This forces GBE+ to use OpenGL for all drawing/blitting operations instead of SDL.

--2x, --3x, --4x, --5x, --6x:
Scales the screen by a given factor. Only applicable when OpenGL is enabled.

--sys-auto:
Sets the emulated system type to AUTO. In this mode, GBE+ will automatically determine what system to emulate based on the game.

--sys-dmg:
Sets the emulated system type to DMG (old black and white Gameboy). This option is not valid when running GBA games and is ignored by the emulator.

--sys-gbc:
Sets the emulated system type to GBC. This option is not valid when running GBA games and is ignored by the emulator. DMG games will run as if on a GBC.

--sys-gba:
Sets the emulated system type to GBA. DMG/GBC games will run as if on a GBC, however, like a real GBA, the screen can be stretched horizontally by pressing the L and R triggers.

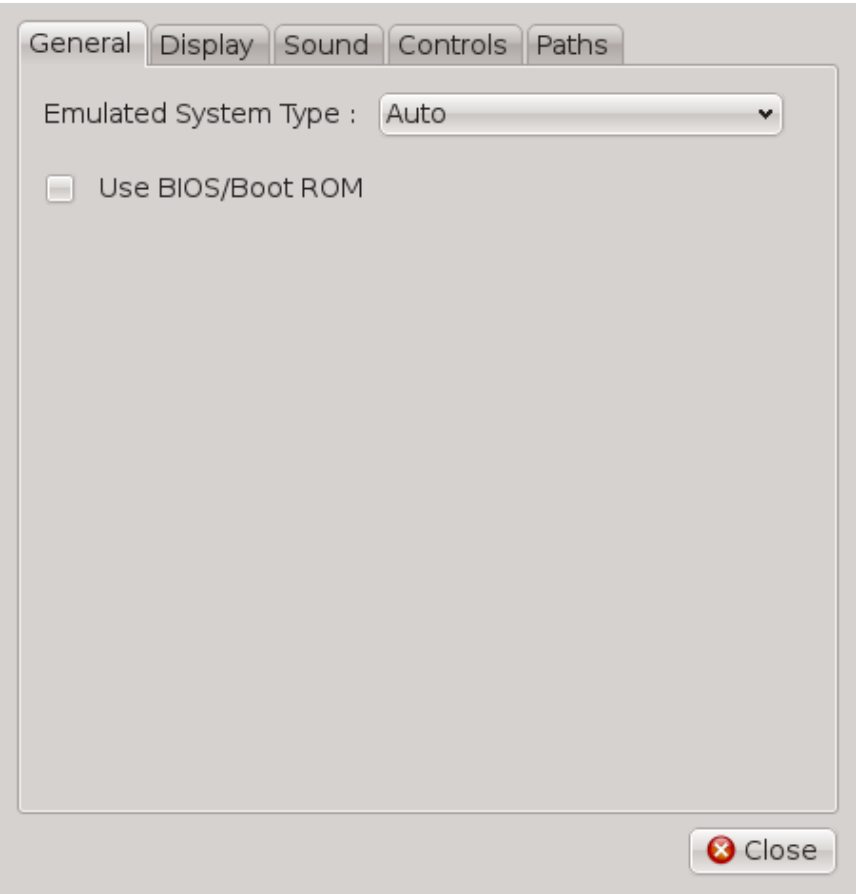
--h, or **--help:**
Displays a brief help message explaining all of the above options.

3. Configuration

GBE+ has many options that will affect how the program runs games. There are 5 major areas of configuration: General Settings, Display Settings, Sound Settings, Control Settings, and Paths. The following sections detail what these options do for the Qt version of the emulator.

3.1 General Settings

This section deals with miscellaneous settings that don't belong to any particular category.



Emulated System Type:

Forces GBE+ to emulate a certain system. The following options are:

Auto - In this mode, GBE+ will automatically determine what system to emulate based on the game.

Game Boy [DMG] - Emulates the DMG (old black and white Gameboy). This option is not valid when running GBA games and is ignored by the emulator.

Game Boy Color [GBC] - Emulates the GBC. This option is not valid when running GBA games and is ignored by the emulator. DMG games will run as if on a GBC.

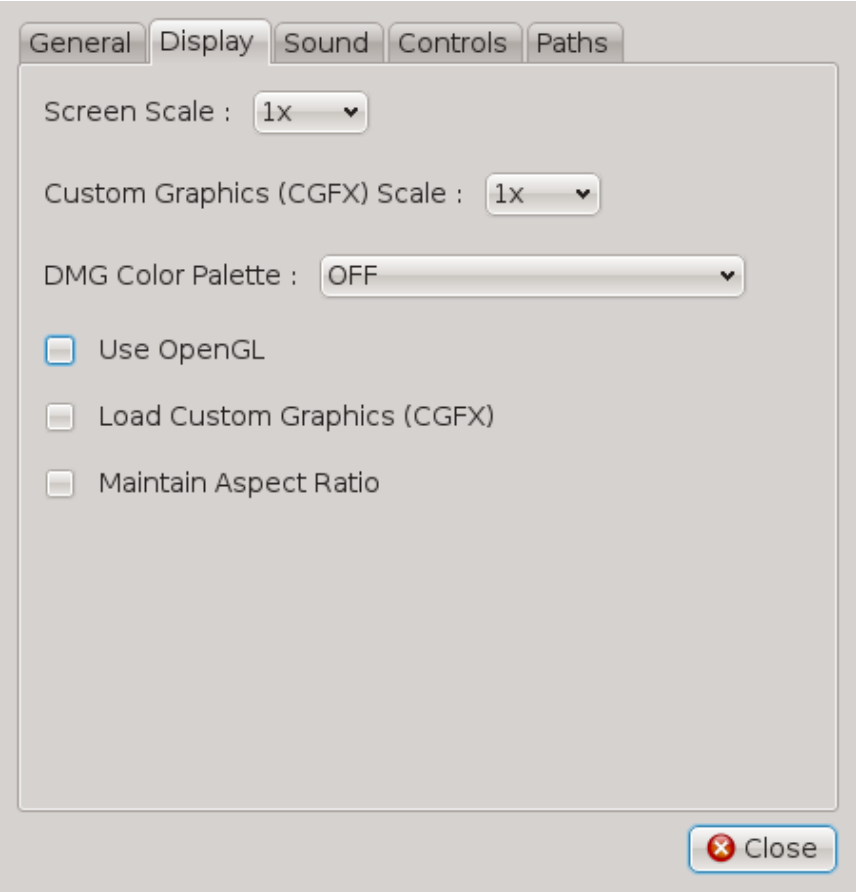
Game Boy Advance [GBA] - Emulates the GBA. DMG/GBC games will run as if on a GBC, however, like a real GBA, the screen can be stretched horizontally by pressing the L and R triggers.

Use BIOS/Boot ROM:

This instructs GBE+ to boot a system's BIOS or Boot ROM. When checking this option, users must ensure that the proper paths to the DMG, GBC, or GBA files are configured. See **Section 3.5** for more details on configuring BIOS and Boot ROM files.

3.2 Display Settings

Display settings deal with how GBE+ draws things on screen.



Screen Scale:

Determines what factor to scale the original game screen. Factors of 1x to 10x are applicable. Unlike the command-line version, the Qt version can scale the image regardless of whether OpenGL is used or not.

Custom Graphics (CGFX) Scale:

Determines what the input scale for CGFX is. *When loading CGFX into the emulator, this option must be set to the correct scale.* For example, if a user makes HD graphics that are 4x the size of the original graphics, this option must be set to 4x. Mismatching the scale will result in graphical errors when using CGFX. This scale is also multiplied by the Screen Scale to get the final screen size.

DMG Color Palette:

DMG games can be colorized with special palettes. **OFF** emulates standard grayscale colors. **DMG - Classic Green** emulates the old-school green LCD. The other options emulate palettes from the GBC Boot ROM.

Use OpenGL:

Use OpenGL for all drawing/blitting operations. This option is faster than using software, especially when increasing the Screen Scale.

Load Custom Graphics (CGFX):

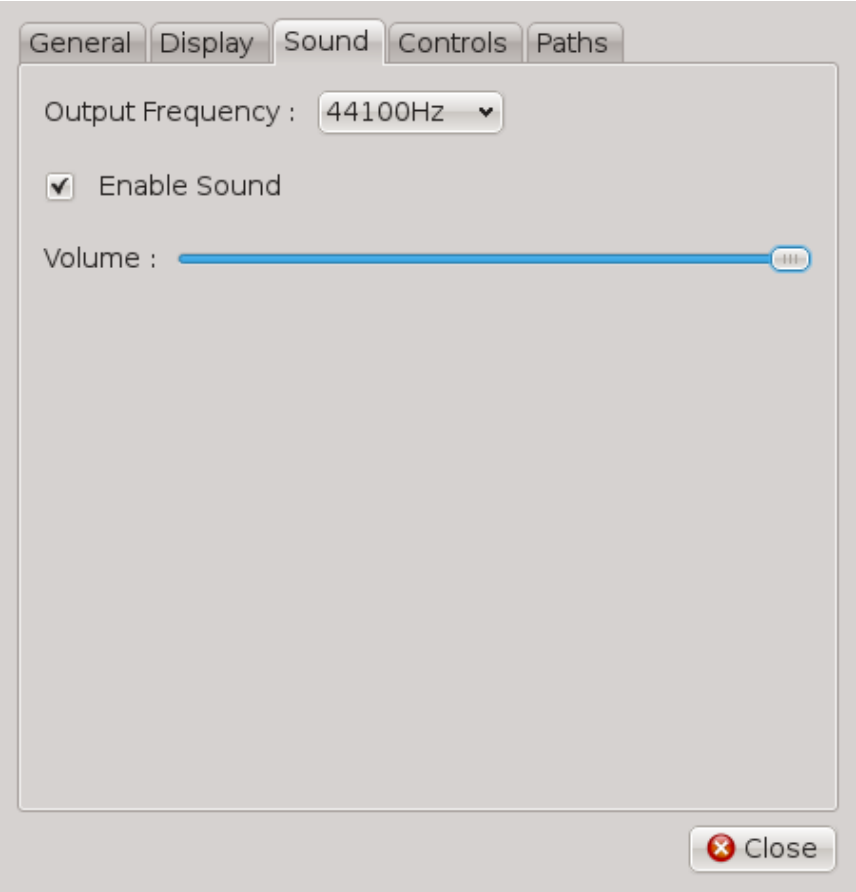
Loads Custom Graphics into the emulator. This option must be enabled in order to play using CGFX. Additionally, a manifest file must be selected in Paths. For full details on how to set up CGFX, refer to **Section 4.4**.

Maintain Aspect Ratio:

Forces GBE+ to maintain the same aspect ratio as the original system regardless of the window size. Leaving this option unchecked will let GBE+ fill in the available window space.

3.3 Sound Settings

Sound settings determine how GBE+ will process audio.



Output Frequency:

Determines the final output frequency of all sound. The available options are **11025Hz**, **22050Hz**, **44100Hz**, and **48000Hz**. With higher frequencies, GBE+ will produce better audio quality. Please note, changing this option only takes effect when booting or resetting a game. If unsure, please leave this option at its default setting.

Enable Sound:

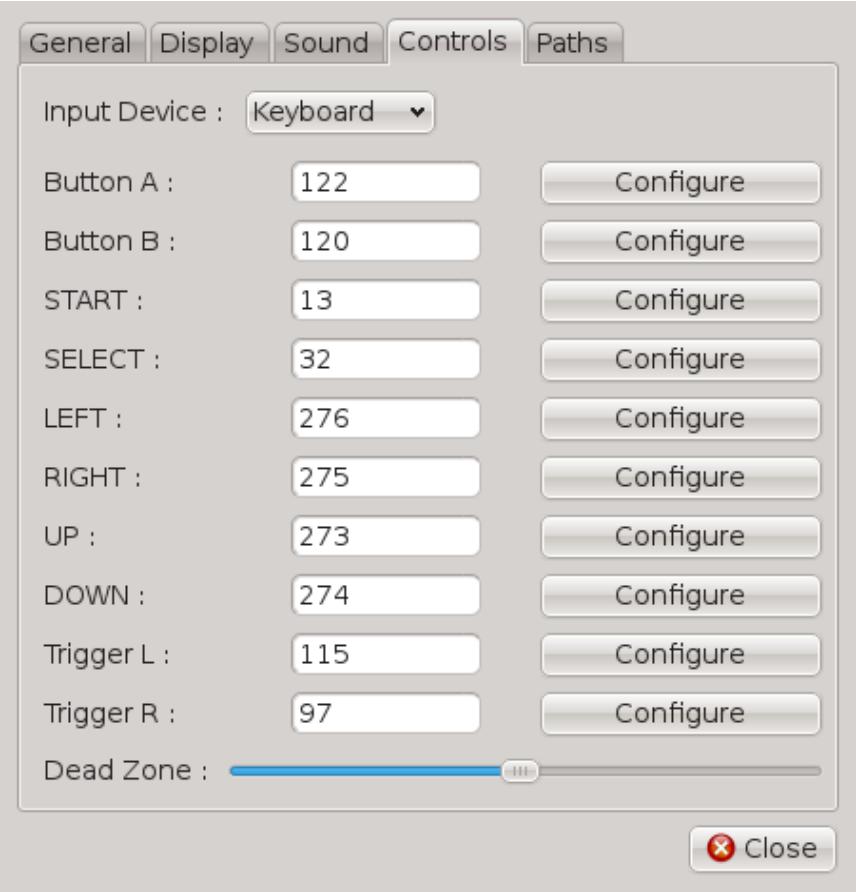
Checking this option enables sound output. Unchecking this option will mute any sounds from GBE+

Volume:

This slider controls the master volume for all sound output from GBE+. Turning it all the way down to zero will effectively mute the emulator.

3.4 Controls Settings

Controls settings allow users to configure input for the emulator via the keyboard or joysticks



Input Device:

Selects the input device to configure. Both keyboards and joysticks can be configured. This option will contain a list of all available joysticks GBE+ can detect. Please note that both keyboard and joysticks can be used at the same time, regardless of what this option is set to.

Buttons:

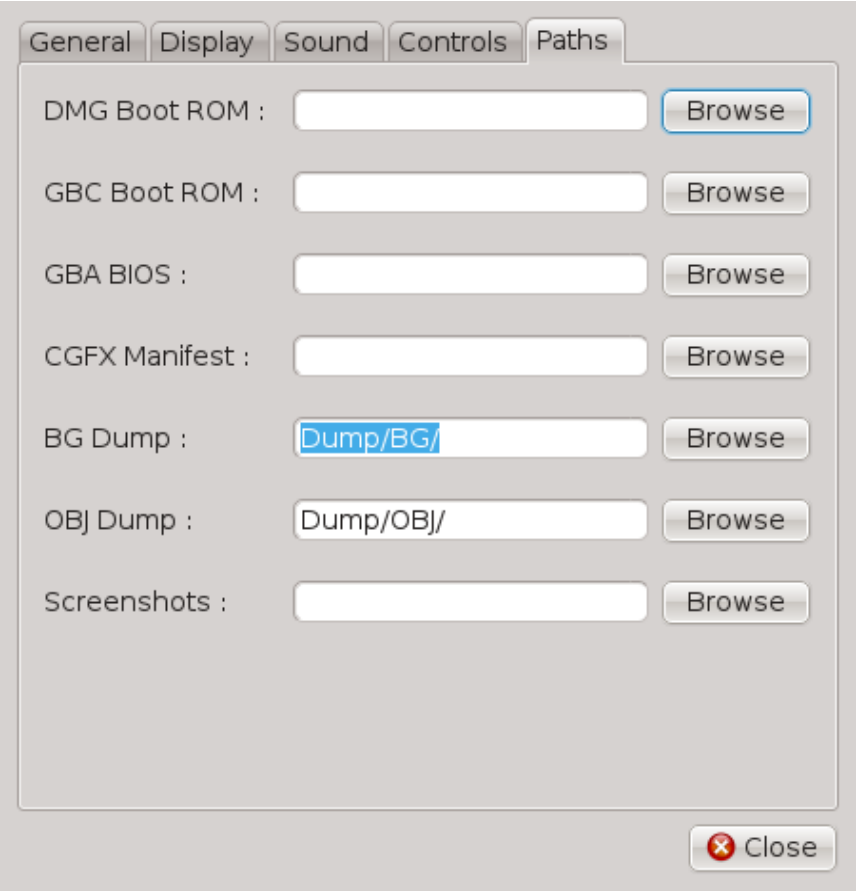
These are the individual buttons that can be configured. Press the **Configure** button for GBE+ to map input from a device. For joysticks, there is a 3 second delay before configuration is processed. During this time, please continue holding down on the joystick for GBE+ to finish mapping.

Dead Zone:

Configures the dead zone for joystick axes. A smaller dead zone means less tilt on an axis is needed to trigger an input. A larger dead zone means more tilt on an axis is needed to trigger an input. If unsure, please leave this option at its default setting.

3.5 Paths Settings

Paths settings determine the location GBE+ will look to for important files such a screenshot directories, or the location of BIOS or Boot ROMs. To set a location, click the **Browse** button and choose a folder or file from the pop-up.



DMG Boot ROM:

This is the original Game Boy's Boot ROM file. Although booting this will have no effect on overall emulation, this is will let users see the scrolling "Nintendo" logo.

GBC Boot ROM:

This is the Game Boy Color Boot ROM file. Booting up this will let users choose color palettes when running DMG games, and some DMG games (like *Metroid II: Return of Samus*) will have custom palettes.

GBA BIOS:

This is the Game Boy Advance BIOS file. Booting this up will let users see the GBA's "Nintendo" logo and the boot animation. Currently, all BIOS functions are high-level emulated, so GBE+ does not actually run the code from the GBA BIOS. In the future, low-level emulation of the BIOS will be possible.

CGFX Manifest:

This is the manifest file GBE+ will use when loading Custom Graphics or when dumping them via the Advanced Menu. See **Section 4** for more details about Custom Graphics.

BG Dump:

This is the folder GBE+ will look to when loading or dumping Background Tiles for Custom Graphics. By default, this is located in the **data** folder for GBE+. This folder *must* be located within the **data** folder for GBE+ to correctly find the image files.

OBJ Dump:

This is the folder GBE+ will look to when loading or dumping Sprite Tiles for Custom Graphics. By default, this is located in the **data** folder for GBE+. This folder *must* be located within the **data** folder for GBE+ to correctly find the image files.

Screenshots:

This is the folder GBE+ will use to store screenshots.