audiophilleo

perceive the world through hearing

Owner Manual

audiophilleo1 & audiophilleo2

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Document History

Date	Revision	Change
July 26 2010	1.1	1. Added information on "Defaulted Settings" and "Defaulted Remote." Messages. 2. Added information on "Waiting for computer" message. 3. Added information on "Invert Phase" feature added in v1.05.
February 11 2011	1.2	Added clarifications to firmware update procedure.
April 4 2011	1.3	Added LLSLL & LLSSLL LED error codes.
April 28 2011	1.4	Updated jitter specs
May 4, 2011	1.5	Updated LED codes
June 1, 2011	1.6	Update BitPerfect info

Introduction

T hank you for purchasing the audiophilleo1 or audiophilleo2 USB to SPDIF transport. These devices are designed to be the strongest link in your audio chain, giving you peace of mind and allowing you to focus on other aspects of improving your audio system.

Box Contents

The audiophilleo1 and audiophilleo2 ship with the following items:

- One BNC male to BNC male adapter. Use this adapter for direct attachment to a BNC fitted DAC.

- One BNC male to RCA male adapter. Use this adapter for direct attachment to an RCA fitted DAC. Note that BNC connection is better than RCA connection.

- One 6 foot USB cable. This cable has been tested to produce optimal SPDIF output. You may feel free to substitute your own cable but there should be no audible differences. Note that USB supports cables up 5.0 meters (16.4 feet). However, if you don't use hubs in the signal path you can probably achieve longer cable runs without causing any problems.

- Quick start guide.

The audiophilleo1 ships with the following additional items:

- One 12V International power adapter for use with the 12V trigger feature

- One infrared remote receiver cable with 2.5mm audio connector

- One 3.5mm stereo audio to dual mono adapter for 12V trigger outputs

Getting Started

There is no need for installations or configuration on supported operating systems (Linux, OSX, and Windows XP/Vista/7, iPad). Just plug it in and the default USB audio operating system drivers should install automatically.

Note that under XP, Linux and OSX sample rates of 44.1, 48, 88.2, 96, 176.4 and 192 are available by default. Under Windows Vista/7 sample rates of 176.4 and 192 are only available with our custom driver. Also note that only bit depths of 24 are available. SPDIF is effectively always 24 bits. 16 bit audio simply only uses the upper 16 of those 24 bits. 44/16 and 48/16 are supported because this is required by the iPad.

Note: The audiophilleo1 acts like a multimedia keyboard so that it can send play/pause/next/previous commands to the computer just like a keyboard would. Since OS X thinks the audiophilleo1 is a keyboard and audio device, it will ask you to press keys on the keyboard in order to identify the keyboard layout. You can press these keyboard keys in the audiophilleo1 "settings->keyboard" menu. After this, the identify window will never come back.

For information on configuring your computer for BitPerfect audio, please see our http://audiophilleo.com/articles.aspx page.

Connections

Figure 1 shows how to connect the audiophilleo1. The audiophilleo2 is identical except that it misses the OLED display, joystick, 12V power supply input, 12V Trigger outputs, and infrared remote receiver input.

Note: Please do not plug in or unplug the 12V power supply, 3.5mm stereo adapter, or infrared remote receiver while the audiophilleo1 is powered up.

Note: When first plugging in the audiophilleo1, it will use a volume setting of -72dB for safety. Please increase the volume to the desired level.

Figure 1. Connections (Items not to scale)

Audiophilleo1 user interface

The audiophilleo1 has several additional features such as BitPerfect, volume control, infrared remote receiver and 12V trigger, and includes a joystick and OLED display to configure those and other features. The joystick supports five directions: left, right, up, down, click. After powering up, the main screen is displayed.

When in the main screen, joystick up, down, and click will perform volume up, down, and mute respectively. Pushing the joystick to the right enters a sub-menu. Pushing to the left goes back to the parent menu (or main screen). The on-screen arrows always tell you whether you can push the joystick left and/or right. Note that clicking the joystick and holding it for 1 second will display help on the current screen or item. Because of this online help system we do not document all the individual screens in this manual. Simply read the short help pages built right into the audiophilleo1.

To get familiar with the main screen, please plug in your device and press and hold the joystick for help on the main screen.

Advanced Features

These features are available in the audiophilleo1 only. The following information is intended to augment the audiophilleo1 online help system.

Dithered Volume Control

The audiophilleo1 support volume attenuation of 0dB to -72dB. Setting the volume is done using the computer volume control. Our volume control uses a sub nyquist dither noise in order to decrease audible hiss.

For safety the user may configure the maximum allowed volume. The computer will think that the volume can be set to 0dB but the audiophilleo1 will only allow it to go up to the desired maximum.

The user may also lock the volume at the current setting. This can be useful when using an external analog volume control. The computer will think that it can set the audiophilleo1 volume but the audiophilleo1 will simply ignore it.

Note: The computer remembers the last used volume level when rebooting or re-plugging a USB audio device. Under windows there is a bug which causes this to not happen when one un-plugs and re-plugs the audiophilleo1 too quickly. In this case the audiophilleo1 will always set the volume to -72dB for safety.

Note: Changing the volume using the remote control feature simply sends a volume up/down command to the computer. It is up to the computer what volume steps size to use. Therefore, different operating systems will exhibit different volume step sizes.

12V Trigger

Most integrated receivers have 12V trigger outputs. These provide a very convenient method for powering up your amplifiers or other equipment via remote. Unfortunately, in the world of the audiophile, it can be difficult to create a system which can be turned on/off via your remote. It would be nice to have a system that is simpler to use and can be controlled completely via remote.

The audiphilleo1 provides 2 independently controlled 12V trigger outputs which can be configured to (1) turn on and off automatically when playing music and (2) turn on and off via your infrared remote control. No more forgetting to turn off your amps! You can also use these to trigger a retractable screen or curtain. If your amps do not have 12V trigger inputs, then you can use a variety of triggerable power strips/conditioners such as the HTS1000 MKII. A variety of higher end conditioners with trigger inputs is also available.

For more information, please see the online "IR Remote" and "12V Trigger" menus.

Note: Connection of the 3.5mm stereo to mono adapter and 12V power supply is only necessary when using the 12V triggers. Please attach all cables and power supply before powering up the audiophilleo1.

BitPerfect

BitPerfect allows the audiophilleo1 to confirm that the audio stream is being passed to it without modification by the computer's audio stack or software. All computer setups, regardless of media player used, will produce the same optimal sound as long as the audio stream is BitPerfect and as long as no volume control is employed by the media player software being used.

To confirm BitPerfect operation, follow these steps:

1. Download the BitPerfect files from http://audiophilleo.com/support.aspx.

2. Using the joystick, enter the BitPerfect menu and then follow the on-screen instructions to play the WAV file. The sample rate of the BitPerfect file must match the sample rate being played.

Note: As a safeguard, the test files are designed to not cause excessive noise, and the SPDIF output is automatically disabled when in this menu. However, we recommend that you turn off your stereo when doing BitPerfect testing.

Note: Please make sure that all volume controls (except that of the audiophilleo1) are set to 100%. Also, you must set the sample rate of your media player to be the same as that of the BitPerfect file you are playing.

Note: iTunes needs to be "quit" from the menu and restarted every time the sample rate is changed in the Audio MIDI Panel. Otherwise iTunes resamples audio.

Remote Control

The audiophilleo1 is a programmable remote control receiver. It can learn commands such as "Play" and "Next" and "Volume Up". Then, when it detects these remote control commands, it will send the command to the computer. To the computer, the audiophilleo1 looks like multimedia keyboard whose media buttons are being pressed.

Note that a media player has to be designed to respond to these commands. If you want to know whether your media player supports this, simply press the media buttons on your keyboard. If the media player responds to that then it will respond to the audiophilleo1.

You can also use the remote to enter the "JitterSim" and "VirtualCable" menus and change their levels remotely. This allows you to perform listening tests from your listening position. Because of this we recommend that you program the "JitterSim", "VirtualCable" and 0 through 5 commands using your remote.

VirtualCable

VirtualCable allows the audiphilleo1 to change the edge transition speed of the SPDIF electrical signal between <700ps and 15ns in 5 steps. This is similar to changing SPDIF cables for the purpose of affecting the sound.

We only care about overlapping waves when the DAC is measuring the digital signal level transition. So, if there is a reflection that is causing a problem at that particular instant, we can move this transition in time, away from the reflection. The DAC can then measure the transition perfectly without interference from the reflection, allowing it to recover a less jitter clock. Most importantly, you can make these changes instantly via remote control so that you can hear any difference immediately from your listening position.

The VirtualCable feature is in the settings->SPDIF->VirtualCable menu. The joystick may be pushed up/down in order to select any of the following levels:

Level	Edge Transition Time
0	<700ps transitions
1	1.2ns transitions

2	4ns transitions
3	7ns transitions
4	11ns transitions
5	15ns transitions

Note that a faster edge transition makes it easier for the DAC to recover a jitter-free clock. We therefore recommend setting 0 as the optimal setting. However, it is possible that reflection problems may cause settings 1 through 5 to sound better.

You may access this menu directly from the remote with the "VirtualCable" command. Most importantly, while in this menu, you can set the level instantly via remote control buttons 0 through 5 so that you can hear any difference immediately from your listening position.

JitterSimulator

JitterSimulator gives you a way of hearing what jitter would sound like in your system. The JitterSimulator feature is in the settings->SPDIF->JitterSim menu. The joystick may be pushed up/down in order to select the setting. The audiophilleo1 supports 2 jitter levels:

Level	Jitter
0	Normal operation with <8ps RMS period jitter and <8ps RMS phase jitter integrated from 10Hz to 100Khz. This is the default and best setting without synthesized jitter and should be used for normal listening.
1	~250ps RMS period jitter and ~1200ps RMS phase jitter integrated from 10Hz to 100Khz (better than most integrated computer audio SPDIF outputs or the Bel Canto USB Link, but worse than some other SPDIF transports on the market.)

You may access this menu directly from the remote with the "JitterSim" command. Most importantly, while in this menu, you can set the jitter level instantly via remote control buttons 0 and 1 so that you can hear any difference immediately from your listening position.

Note: Level 1 (jitter) is only available when using sample rates 44.1, 88.2, and 176.4. Also, this setting is not saved.

Other features

The audiophilleo1 has various other capabilities that include:

- Putting the computer to sleep and waking the computer from sleep via remote control.

- Swapping L/R channels for easier wiring.

- Phase Inversion allows for phase inversion of the audio signal. This is identical to reversing the plus/minus terminals on both speakers. This is available in the "settings->Volume->Invert Phase" menu, and can also be done via remote control from your listening position.

- Optionally connect USB ground and DAC ground.

- Generate clock signals from .7056Mhz to 12.288Mhz

Troubleshooting and Status LED

T he audiophilleo1 and 2 are equipped with an LED which provides various status messages to the user. In addition, the audiophilleo1 may temporarily display status or error messages in lieu of the volume display on the main screen. Note that under normal operating conditions these messages and LED patterns may be ignored.

LED Codes

When first plugging in the device, the LED will immediately flash very briefly. After this first flash, the LED will display status or error messages.

The LED is normally off and displays codes by flashing (much like Morse code). There are 2 flash durations:

- L=long (1 seconds)
- S=short (.3 seconds)

A message is displayed by producing a sequence of L and S flashes.

The LED is normally off. When no LED codes are being displayed, the LED will do an S, SS, or SSS flash once every ~5 seconds. This is the device heart beat and signifies normal operation. The meaning of these is:

- S   - Audio is playing

- SS   - The output stage is active and SPDIF signal is generated.

- SSS   - The output stage is inactive and no SPDIF signal is generated.

If the computer is in a sleep state, then the LED will be permanently on.

All status messages start with one L flash. All error messages start with two L flashes.

The table below lists all possible LED status codes:

Flashes	Meaning
LS	44.1Khz sample rate set
LSS	48hz sample rate set
LSSS	88.2hz sample rate set
LSSSS	96hz sample rate set
LSSSSS	176.4hz sample rate set
LSSSSSS	192hz sample rate set
LSL	Windows operating system detected (displayed after plugging in)
LSSL	Windows custom driver detected (displayed after plugging in)
LSSSL	Linux operating system detected (displayed after plugging in)
LSSSSL	Apple OSX operating system detected (displayed after plugging in)
Firmware upgrade codes	
LSSSSSL	Unknown operating system detected (displayed after plugging in)
LSLL	Firmware Updated (displayed after successful firmware upgrade after the device reboots)
LSSLL	Firmware already up to date (displayed after successfully reading a firmware file but determining that the same firmware is already loaded and no upgrade is necessary)
LSSSLL	Firmware file is bad (displayed after the downloaded firmware file is corrupt because the computer modified the audio stream too much)
LSSSSLL	Firmware upgrade mode initiated (displayed on ap1 after firmware->update menu is entered or on ap2 when firmware file detected in audio stream.

The table below lists all possible LED error codes. Because they are fatal errors, these error codes are repeated indefinitely once they occur. Under normal usage these codes should never occur. If you see these errors, please contact technical support.

Flashes	Meaning
LLS	The computer is a not a high speed USB host. Please connect the device to a high speed USB port
LLSS	Flash memory polling error
LLSSS	Flash erase error
LLSSSS	Flash write error
LLSSSSS	SPDIF buffer problem
LLSSSSSS	SPDIF interrupt problem
LLSL	SPDIF underflow
LLSSL	Menu Find ID problem
LLSSSL	No empty remote control set found
LLSSSSL	Problem rebooting device
LLSSSSSL	Serial number invalid
LLSLL	Power supply missing
LLSSLL	USB CRC error (audio buffer corruption)

Note: The audiophilleo1 may display the message "Waiting for computer" after being plugged in. This means that the computer is not configuring the audiophilleo1 in a reasonable amount of time.

Chapter

4

Firmware Update

Our devices are designed with modular firmware that is easily updated. Updates will be released based on feature requests and bug reports. Please let us know if you have any requests. We will try to include any reasonable requests in the next firmware update.

Firmware files are simply special 44.1/24 audio files in WAV format. For updates to work, the playback sample rate must be 44.1 KHz 24 bit. Also, media player and computer volume should be 100% and any EQ or sound effects should be disabled. To prevent loud noises from your speakers, please disconnect the audiophilleo output from your system when performing these updates. For updates please check http://audiophilleo.com/support.aspx.

Note: Never power down the computer or unplug the device during a firmware update. Doing so may result in corruption and make the device unusable. The device will always reboot itself at the end of a firmware upgrade. No unplug and re-plug procedure is required. However, this procedure should never take more than a minute after starting to play the firmware file and within seconds of starting playback the LED message LSSSSLL should be displayed, indicating that firmware update has started.

Note: The USB Audio device name is "audiophilleo1 v1.09". When the firmware is updated the device name will change to show the new firmware version and your software or drivers may have to be reconfigured to use the new device name. MS Windows does not fully probe a USB audio device each time it is powered up, so you will have to uninstall the device and then plug it back in before you can see the new version number in the name. You may follow the procedure "To Uninstall a device" found here: http://technet.microsoft.com/en-us/library/cc753699(WS.10).aspx. There is no need to check the "Delete the driver software for this device" box. Under OSX, the device name will be updated immediately so you can see that the new firmware was installed.

Note: When using OS X: You should not play the firmware.wav file directly from Safari. You should save the file and use iTunes. However, iTunes resamples the output when changing the sample rate while it is open. You must quit iTunes from the menu bar and restart it after you set the sample rate to 44.1/24.

Audiophilleo1 Update Procedure

The firmware->about screen will show the currently running firmware version. To update, simply go to the firmware->update screen and follow the directions. You will play back our firmware file and the update will happen automatically. After the audiophilleo1 reboots it will show the status message "Firmware Updated". Additionally, the messages "Defaulted Settings" and "Defaulted Remote" mean that the settings or learned remote control codes have been reset to defaults. This is done only when the new firmware requires it. You may also use the about screen to verify the new firmware version.

Note: If there are errors during firmware upload it likely means that that the computer is modifying the audio stream. Please exit and re-enter the firmware->update menu before playing the firmware file again.

Note: The ability to perform a firmware update does not mean that your audio stream is BitPerfect. The firmware file is encoded in a way that allows it to survive limited modifications to the stream.

Audiophilleo2 Update Procedure

The audiophilleo2 does not have an OLED screen so you need to pay close attention to the LED codes in order to follow the progress of the update. Please see the section on LED codes for details on the codes.

After plugging in the device you have 30 seconds to play the firmware update file. Once the file plays you should see LED code LSSSSLL (it may be preceded by code LS since the 44.1 sample rate is also being set). This means that the firmware file is detected and being scanned. This is then followed by one of the following codes:

- LSLL means that the firmware update was successful and the device has rebooted using the new firmware. Because of the reboot, this code is preceded by a very brief flash.

- LSSLL means that the firmware file is identical to the already loaded firmware. No update is possible.

- LSSSLL means that the firmware file was corrupt. Most likely the computer is modifying the audio stream. Please check that you are using a 44.1 sample rate without re-sampling and other distortive effects happening on the computer.

Note: After a failed firmware update, unplug and re-plug the ap2 or re-enter the firmware menu with ap1. No updates will be possible without doing this.

Chapter

5

Windows Custom Device Driver

T he audiophilleo1&2 are compatible with the USB audio device driver included with windows XP/Vista/7. However, to achieve 176.4 and 192 KHz sample rates with Vista/7, you will need to install our custom driver. Windows XP does not require any driver for 192Khz support. For our 32/64 bit Windows Vista/7 driver please check http://audiophilleo.com/support.aspx.

Chapter

6

Specifications

Jitter

- **2.5 ps RMS phase <u>jitter</u> integrated from 10 Hz to 100 kHz**. This is measured using a TSC 5120A phase noise analyzer.

- **8 ps RMS phase <u>jitter</u> integrated from 1 Hz to 100 kHz**. This is measured using a TSC 5120A phase noise analyzer.

- **< 5 ps RMS period <u>jitter</u>** (< 15 ps peak-peak) This is measured using a WaveCrest DTS with a sample size of 8000.

Because we were unable to use the off-the-shelf SPDIF testers to test our devices, we came up with the following technique for obtaining measurements:

We used the TSC 5120A phase noise analyzer to generate phase noise plots from 1Hz to 100Khz. This tester is designed to measure clocks, not SPDIF signals. In order to use the 5120A we had to generate periodic clock signals instead of the BMC encoded SPDIF signals. Fortunately we generate all our signaling in software so in addition to outputting audio, our SPDIF output stage can output a clock signal as well. This uses the exact same hardware path and clocks as generating the SPDIF signal. To do this, we included an audiophilleo1 feature under settings->SPDIF->Advanced->Test Wave so that anyone can repeat these tests.

Using the 5120A we measured various carrier frequencies, calculated phase jitter measurements from 10Hz to 100Khz and 1Hz to 100Khz and took the worst case measurements to publish here. Although this test includes noise induced by the power supply, output stage, and crystal clocks, it does not measure data correlated jitter. We believe that this is not an issue because our design should have negligible data induced jitter.

When enabling the JitterSim feature on the audiophilleo1 in order to create jitter, jitter becomes ~250ps RMS period jitter and ~1200ps RMS phase jitter integrated from 10Hz to 100Khz

Compatibility

Windows XP/Vista/7, Apple OSX 10.5+, Linux Ubuntu 9+, and iPad iOS 4.2. There are many Linux distributions out there but because the USB audio driver in them is largely the same, they should all be compatible with our devices. XP, OSX, and Linux will support sample rates to 192Khz without any drivers. Under Vista/7, the native driver supports up to 96Khz, and our optional free custom driver provides support for up to 192Khz. Note that the iPad is limited to 16 bit 44 or 48Khz output (CD quality).

Sample Rates

44.1, 48, 88.2, 96, 176.4, and 192Khz sample rates are supported under Linux, Apple OSX, and MS Windows Vista/7. For 176.4 and 192Khz rates, our custom driver needs to be installed under MS Windows.

Dithered Volume Control

Max Level: 0dB

Min Level: -72dB

Step: 0.5dB

Physical

Dimensions: 3x2x0.75 Inches.

Weight: ~4 Ounces

Electrical

SPDIF output: +-300mV amplitude, minimal overshoot, and female BNC connector.

Edge transitions: <700ps (audiophilleo1 has programmable rates up to 15ns)

USB Bus Power: <500ma

Max USB Cable Length: 5m