

RAL-KEB03

Setup Guide

Rev. 1.0 01/Feb./2016

RATOC Systems, Inc.



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Osaka, Japan

Made for



iPod



iPhone



iPad

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iPod, iPad, iPhone, MacOS X are registered trade mark of Apple Inc.

1. Introduction

Thank you for purchasing RAL-KEB03 portable USB_DAC. We are confident that you will enjoy listening Hi-Res music at anywhere, outdoors and in home with your PC audio system, Mac Book, iPhone, iPad, iPod, Android phones and WALKMAN. RAL-KEB03 receives High-Resolution digital audio data stream through USB High Speed mini-B port. KEB03 accepts LPCM format up to 24bit/384kHz from 16bit/44.1kHz and DoP(DSD over PCM Standard 1.1 compatible) format DSD digital music stream up to DSD11.2MHz. KEB03 passes the DSD stream to DSD Direct enabled DAC (ESS ES9018K2M) and creates clear and natural sound. RAL-KEB03 is fully compatible with iOS USB Host mode Audio. The Host mode enables Lightning Direct connection with Lightning to mini-B cable (*note 1), without Apple Lightning USB Camera Adapter. The Host mode also enable to play back High-Res and DSD native music with popular Music Player Applications, such as Audirvana Plus on MacOS X, foobar2000 with foo_asio_dsd, JRiver Music Center , HQPlayer and JPLAY on Windows PC,' music' AP and ONKYO HF Player on iOS devices, Android phones and tablets.

RAL-KEB03 also has Optical(Toslink) input port and accepts S/PDIF Digital Optical music stream from Digital Audio Players or CD Players. It accepts 2ch. PCM 16bit/32, 44.1, 48, 88.2, 96, 176.4 and 192kHz, 24bit/32, 44.1, 48, 88.2, 96, 176.4 and 192kHz. (* note 2)

*note 1 : Must use bundled Lightning to mini-B cable or moon-audio Lightning to min-B cable.

KEB03 does not work properly with other cable.

*note 2: Signal quality of high sampling rate such as 96kHz or higher depends on Optical cable quality. Must use high quality cable.

- "Made for iPod", "Made for iPhone" and "Made for iPad" mean that an electronic accessory has been designed to connect specifically to iPod, iPhone, or iPad, respectively, and has been certified by the developer to meet Apple performance standards. Apple is not responsible for the operation of this device or its compliance with safety and regulatory standards. Please note that the use of this accessory with iPod, iPhone, or iPad may affect Wireless performance
- AirPlay, iPad, iPhone, iPod, iPod classic, iPod nano, iPod touch, and Retina are trademarks of Apple inc., registered in the U.S. and other countries. iPad Air, iPad mini, and Lightning are trademarks of Apple inc. The trademark "iPhone" is used with a license from Aiphone K.K.
- "RAL" is a Registered Trade Mark of RATOC Systems, Inc. in Japan, USA and Taiwan.
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1-1 Features:

USB_DAC mode

- Fully compatible with USB 2.0 (HS 480Mbps) Specifications.
- Fully compatible with USB Audio Class 2.0.
- Accepts DoP Standard 1.1 compliant DSD 11.2896/5.6448/2.8224MHz data and L-PCM 24bit/16bit:
384kHz/352.8kHz/192kHz/176.4kHz/96kHz/88.2kHz/48kHz/44.1kHz (2ch).
- Fully compatible with MFi iOS USB Host mode Audio specification.
*** This mode requires Lightning equipped iOS device and Lightning to mini-B cable.
- Compatible with:
 - iOS devices with Lightning connector.
 - Lightning connector models.
 - iPod touch (5th generation)
 - iPhone 5, iPhone 5C, iPhone 5S, iPhone 6, iPhone 6 Plus
 - iPad (4th generations), iPad mini, iPad mini 2, iPad mini 3
 - iPad Air, iPad Air 2
 - Digital Audio streaming format.
 - L-PCM 16/24/32 bit, 44.1kHz, 48kHz, 88.2kHz, 96kHz, 176.4kHz
192kHz, 352.8kHz, 384kHz
 - DSD64:2.8MHz, DSD128:5.6MHz, DSD256:11.2MHz (DoP 1.1 format)
 - * Player Application (ex. ONKYO HFplayer) is required for playing back music files of 88.2kHz or upper sampling frequencies and DSD (DoP format).
 - Mac OSX 10.8 or newer.
 - Mac Book Pro, Mac Book Air, New Mac Book, Power Mac and iMac.
 - Windows PC
 - Windows 10, Windows 8.1, 8, Windows 7.
 - ** USB Audio Class 2 Driver must be installed to use RAL-KEB03.
Download the driver at
www.ratocsystems.com/english/audio/dl/
 - Android phone or tablet.
 - Android 5.0 or newer.
 - USB Audio Class 2 driver must be included and USB high-Speed(480MHz) base OTG must be equipped.

Optical Digital Input mode

- Optical(Toslink) Digital Audio input.
- Accepts S/PDIF L-PCM 2ch. format.
- 16bit/24bit 32kHz, 44.1kHz, 48kHz, 88.2kHz, 96kHz, 176.4kHz and 192kHz.
 - *** High-quality optical cable required to playback Hi-Rez music over 96kHz.
 - *** KEB03 might not play back properly Hi-Sampling rate music with Low-quality cable.
- Automated detection and configuration. Remove USB mini-B cable, connect Optical cable and turn on KEB03. KEB03 will start Optical Digital Input mode.

DAC, amp and Output.

- Includes ESS SABRE32™ ES9018K2M Audio file class DAC.
- Fully balanced circuit and three balanced earphone output.
 - RAL original mode(two monaural 2.5mm).
 - Astell&Kern AK240/Ak120II mode(2.5mm 4P)
 - SONY PHA-3 compatible mode(two 3P monaural.)
 - two SONY PC-262S 2.5<->3.5 adapter required.
- Fully independent Stereo 3.5mm mini earphone output.

Other

- Includes reliable 3.7V/3000mAh Li-Polymer Battery.
- Quick Charging time (4.5hr) and 14hr operating time.
- 32bit Multi Thread processor and three independent X-Tal oscillator modules (24.576MHz, 22.5792MHz and 80MHz) are included.

The silicon and oscillators brings Low jitter accurate Audio Master Clock for ES9018 DAC and brings clear sound.

2. System requirements

2-1. PC running on Windows 10, 8.1, 8, 7 32/64bits

- One USB 2.0 HS(480Mbps) enabled Host port.
- Internet access to download USB Audio 2.0 Driver for Windows.
- RAL USB Audio Class 2.0 Driver installation required.
 - *** RAL USB Audio Class 2 Driver was updated on 10/Feb./2016 to support Windows10, 8.x and 7.
- User's Guide, Setup Guide and Grade up Guide are available for download from RAL_Audio site.

Note) The knowledge and experience regarding 'Control Panel' for 'Sound Audio Device', 'Device Manager', Audio Music Player application such as foobar, MediaPlayer, iTunes and CD Ripping applications are required to use RAL-KEB03. Refer to the User Guide, Instruction Guide or Online Help of these Applications.

2-2. MacOS X 10.7 or newer

- One USB 2.0 HS(480Mbps) enabled Host port.
 - or USB 3.x port which supports High-Speed Isochronous transfer mode.
- MacOS X 10.7 or newer.
 - *** These versions already include USB Audio Class 2 Driver.
You don't need to download and install the driver.

2-3. iOS Devices, iPhone, iPad and iPod

Must use Lightning equipped iOS device and connect it to KEB03 with bundled Lightning to mini-B cable. KEB03 will not work properly with other cable.

compatible with:

- Lightning connector models.

iPod touch (5th generation)

iPhone 5, iPhone 5C, iPhone 5S, iPhone 6, iPhone 6 Plus

iPad(4th generations), iPad mini, iPad mini 2, iPad mini 3

iPad Air, iPad Air 2

*** iAP such as "ONKYO HF Player" is required to play back High-Res and DSD music.

2-4. Android device

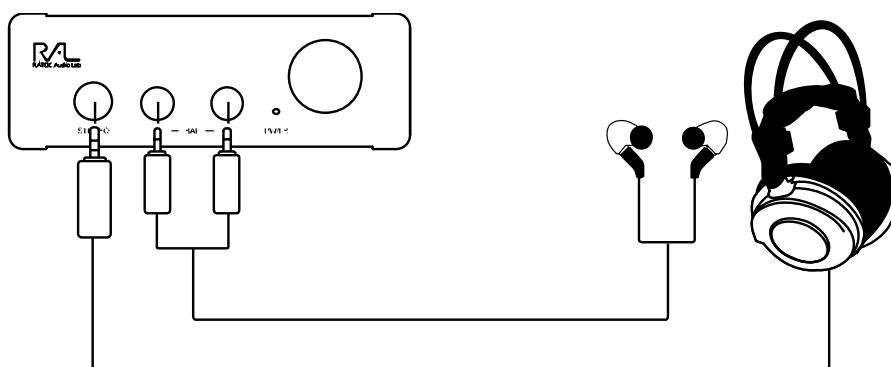
- USB OTG equipped USB high-speed port.
- Android 5.0 or newer but USB Audio Class 2 driver must be included. Please check vendor's HP of your device.
- OTG cable (micro to mini-B) or OTG exchange adapter (micro to USB-A female) is required to connect KEB03.

2-5. Stereo Earphone

- Stereo earphone equipped with Standard 3.5mm mini Stereo Phone Plug.
- Stereo earphone equipped with balanced cable and Standard 2.5mm mini-mini phone plug.(RAL compatible mode).
- Stereo earphone equipped with balanced cable and Standard 2.5mm mini-mini 4-P phone plug.(Astell & Kern AK240 compatible mode).
- Impedance 8-Ohm to 110-Ohm

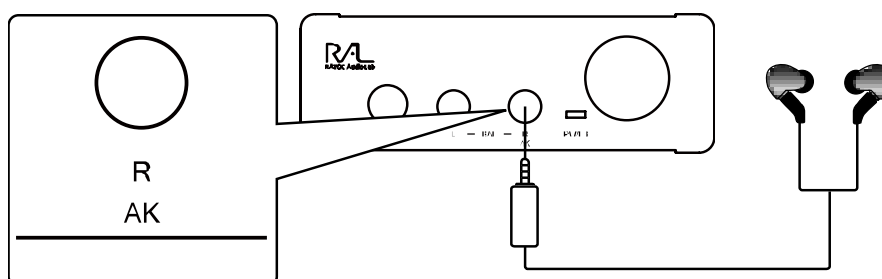
[*Important notice***]**

- *1. The 2.5mm balanced output is not available at 3.5mm plug is being plugged in. KEB03 shuts down the power to the balanced amplifiers while 3.5mm stereo plug is plugged in. You must remove 3.5mm plug to use 2.5mm balanced output. KEB03 is designed to save energy by cutting power to idling circuits.



- *** 3.5mm Stereo Single End Output has a priority to 2.5mm Balanced output. 2.5mm balanced outputs are disabled while 3.5mm plug is being plugged in.

- *2. Plug AK240 Compatible 2.5mm/4-P cable to R/AK marked jack. And must not plug any 2.5mm plug to L jack. L jack must be OPENed when you use AK240 compatible cable.



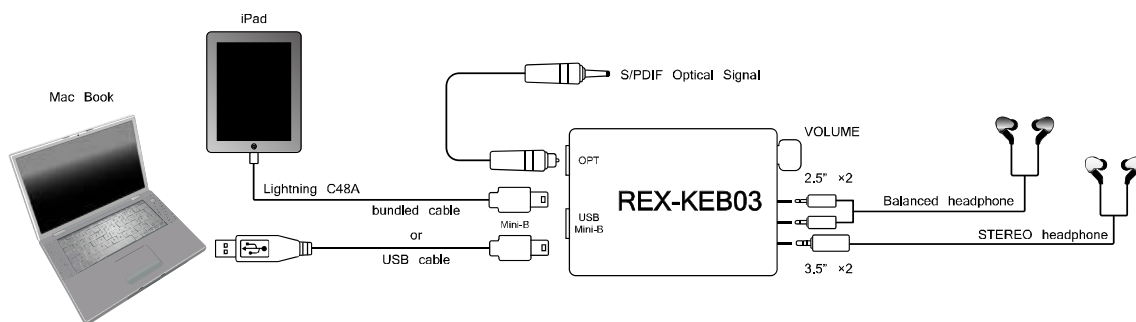
- *** Must open both 3.5mm jack and 2.5mm balanced output L ch. Jack to use 2.5mm / 4-P AK240 compatible balanced cable

3. Package contents

RAL-KEB03 package includes:

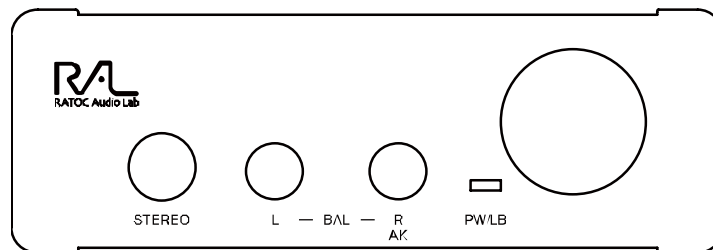
- RAL-KEB03 : 1pcs.
 - USB 2.0 Cable (USB-A to mini-B) for USB_DAC mode : 1pcs.
 - USB-A to micro-B Cable for charging : 1pcs.
 - micro-B to mini-B USB OTG cable for Android device : 1pcs. (0.1m)
 - Lightning to mini-B cable (0.1m) for iOS device : 1pcs.
 - Silicon Band to bundle iPod/iPhone with KEB02iP.
- ** AC adapter (DC +5V/1A) is not included in the package, sold separately.

** S/PDIF Optical cable, earphone cable and Headphone cable are not bundled in the box.



4. Front Panel, Rear Panel Layout

4-1. Front Panel



4-1-1. Power & Volume Level

Power off : Turn Counter Clock wise to 7 O'clock position and check Click sound and lighting off PW/LB LED.

Power on: Turn Clock wise from 7 O'clock position and check Click sound and lighting on PW/LB LED.

Volume level control: adjust Headphone output level to your favorite level.

4-1-2. PW/LB LED

Light on to indicate the operating state. Green light indicates Battery level is over 3.4V and Red light indicates Low Battery state below 3.4V. In this case, charging is required.

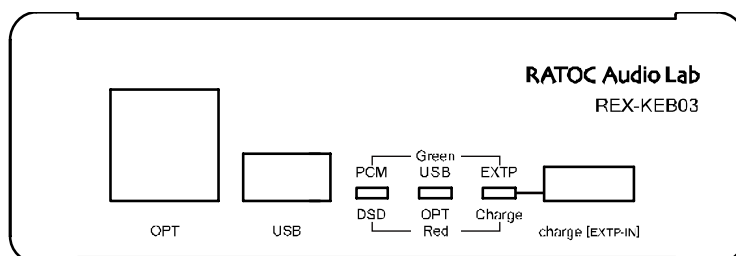
4-1-3. 3.5mm mini Jack

Stereo analog audio output for headphones. Supports 8 Ohm to 60 Ohm impedance.

4-1-4. 2.5mm micro jack (L –BAL – R/AK)

Analog Audio Balanced amp output to drive 4-wire (2 wire for L, 2wire for R or AK240 compatible 4-P) type earphone.

4-2. Rear panel



4-2-1. USB Digital Audio Stream Input

USB mini-B Connector : Compliant with USB 2.0 High-Speed(480Mbps) Spec. and USB Audio Class 2 Audio Spec.. KEB03 also works as iAP2 and USB Audio Class 2 compatible High Speed (480Mbps) device with iPod/iPad/iPhone. (*Must use the bundled Lightning cable). In this case, iOS device works as an USB Host and supports USB Host mode Digital Audio.

*KEB03 does not use USB Bus Power through Pin #1 at USB mini-B connector and does not provide charging power to other device through the pin.

4-2-2. DC+5V power input for charging

USB micro-B Connector : Must connect DC+5V(+0.25V, -0.25V, 0.5A minimum) Power supply unit to charge internal battery with USB-A to micro USB-B cable.

4-2-3. S/PDIF optical input

Use this connector to receive S/PDIF Digital Audio stream from Digital Audio source device such as AK100. KEB03 firmware sets up S/PDIF input mode as a default after Power-ON starting up. To use this S/PDIF input mode, don't connect any USB Host device such as iOS devices, Mac or PC after Power ON and connect optical Digital Audio cable to this connector. This port supports PCM 16/24bit, 44.1kHz to 192kHz. Does not support DSD(DoP) , PCM 352.8kHz and 384kHz PCM.

4-2-4. LEDs

4-2-4-1 USB(Green)/ OPT(Red)

Lights on Red when succeeded to detect OPTICAL S/PDIF Digital Data input.

Lights on Green when KEB03 is configured successfully and ready to work as USB Audio Device.

4-2-4-2 PCM(Green)/DSD(Red)

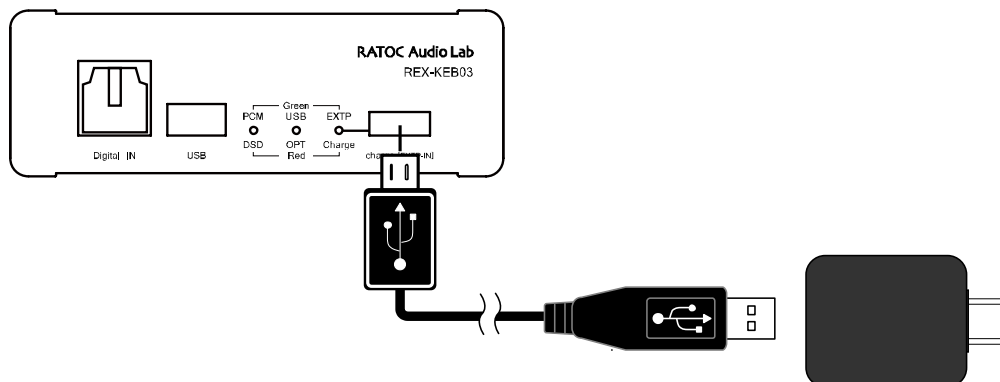
Lights on Red when receiving DSD(Dop) stream from Host.

Lights on Green when receiving PCM stream from HOST.

4-2-4-3 EXTP(Green)/ Charge(Red)

Green indicates External DC+5V Power source is being supplied and KEB02iP is working by the external power source.

Red indicates internal battery is being charged with the external power.



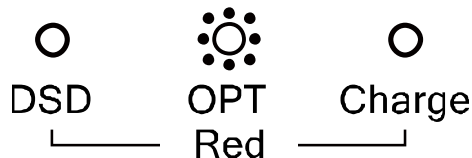
* Use DC+5V(+0.25V -0.25V)/1 to 2A Switching type AC adaptor or USB port of PC/Mac.

4-3. Select USB-DAC mode or OPTICAL input mode.

KEB03 has automated Mode Selection function to select Digital input source, USB or OPTICAL S/PDIF signal. The operation mode is selected as an OPTICAL Digital Input mode at Power ON default status.

4-3-1. Use Optical Digital input mode.

Connect Digital Audio device which has Optical output such as CD Player, Digital Audio Player or MD player to KEB03 with OPTICAL Digital Cable. Don't connect any USB Host device to mini-B USB input. And then turn Power on.

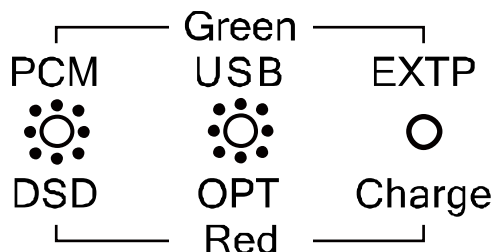


Once Optical input mode is selected and enabled, OPT LED lights on RED.

4-3-2. Use USB input mode.

Don't connect OPTICAL cable to OPTICAL Digital input port. Connect KEB03 to USB host such as PC or Mac with USB-A to mini-B cable. Or iOS device with Lightning to mini-B cable. Or Android device with micro-A to mini-B (USB OTG) cable. And then turn Power on KEB03. KEB03 works as an USB DAC/HPA.

If you would like to switch to OPTICAL input mode, turn Power off, remove USB cable, connect OPTICAL output equipped device with OPTICAL cable and turn Power on again.



Once USB DAC mode is selected and configured by USB Host successfully, USB LED lights on Green.

5. Setting up Mac/MacOS X

5-1. Connecting RAL-KEB03 to Mac USB port

Getting started with setting up your Mac/MacOS X 10.7 or newer.

- (1) Turn off Power and confirm OPTICAL cable is removed. And then turn on Power.
- (2) Connect RAL-KEB03 to Mac USB port with USB-A to mini-B cable.

The cable should be compliant with USB High-Speed(480Mbps) certification.

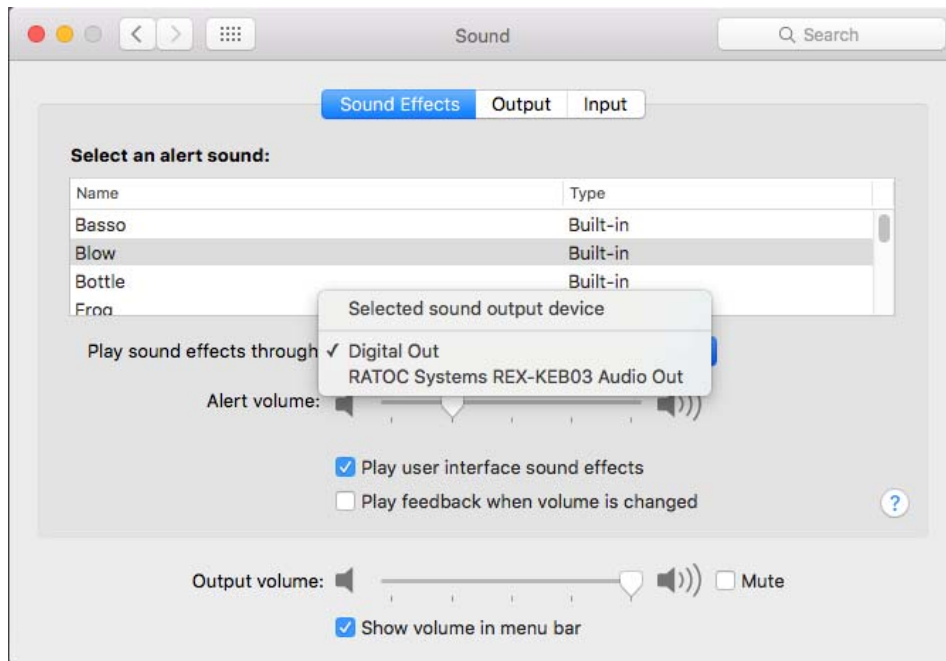
- (3) MacOS X will detect and recognize RAL-KEB03.
- (4) Click on the "System Preferences" app on Dock.
- (5) Click on the "Sound" icon at the **Hardware** row.



5-2. Setting 'Sound Effects' output to Internal Speakers

Click on the "Sound Effects" tab to prevent alerts and effect sounds such as "e-mail received notification sound" from being routed to Audio System.

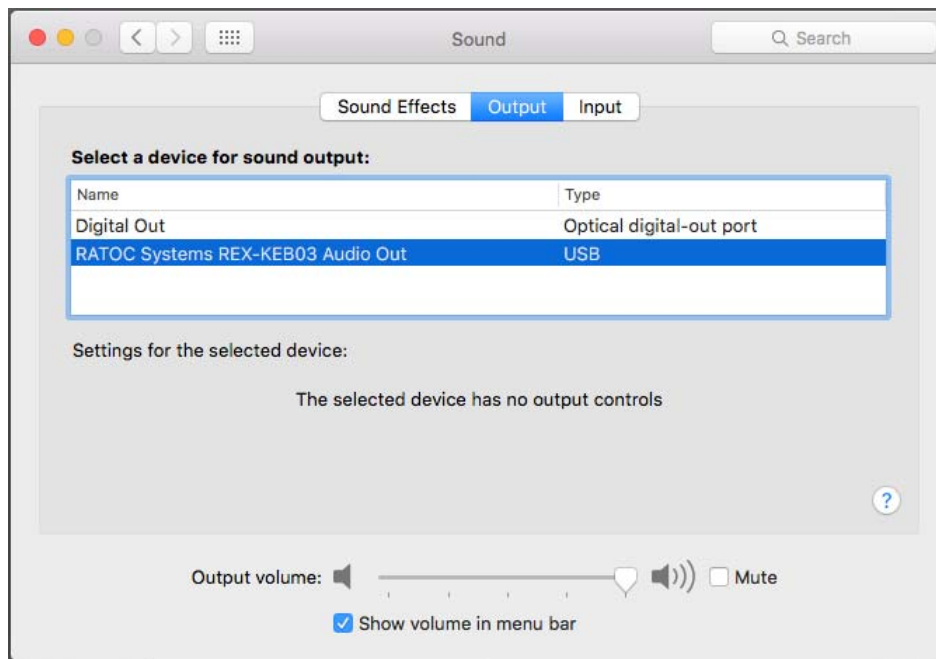
Set Play sound effects through 'Internal Speakers' or 'Digital Out'.



5-3. Setting RAL-KEB03 as an Audio Output

Click on the "Output" tab and select "RATOC RAL_KEB03 Audio Out".

This selection will route the sound from iTunes or other Audio Applications to your Audio system.



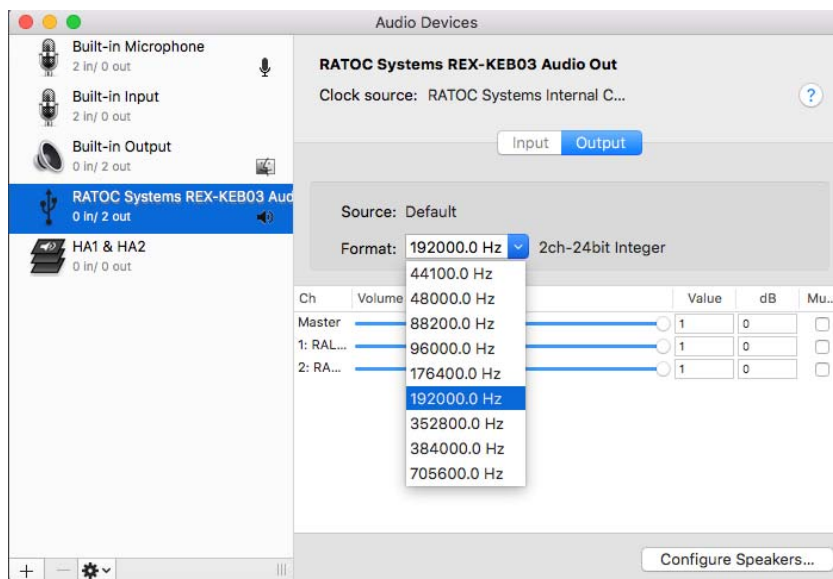
5-4. Setting up 'Audio MIDI Setup' Application

- (1) If "Audio MIDI Setup" application is not found on Dock, open the Hard Disk icon and open the "Applications" folder.

You can find the "Audio MIDI Setup" application at the "Utilities" folder.

- (2) Open the "Audio MIDI Setup" application and select "Audio Devices".
- (3) Click on "Output" tab. Select "RATOC RAL_KEB03 Audio Out" for the "Default Output" to send the sounds from iTunes or other applications to Audio system.
- (4) Select "Built-in Output" for the "System Output" to route system alert sound such as "new mail received" sound to built-in speaker.
- (5) Select "RATOC RAL_KEB03 Audio Out" and then select your desired sample rate such as 192000 Hz. at "Format".
- (6) Important notice for Mac OS X 10.9.x or newer.

MacOS X 9.x or newer set this sample rate to 705600 Hz at the first time, but KEB03 does not support L-PCM 705.6 kHz. This sample rate must be set below 384000 Hz prior to start playing back music.



If sample rate which is not identical to the sample rate of original music file itself is selected, MacOS X Audio driver will execute sample rate conversion. As this conversion will affect audio quality, we recommend to select adequate sample rate which is identical to one of music file at this field.

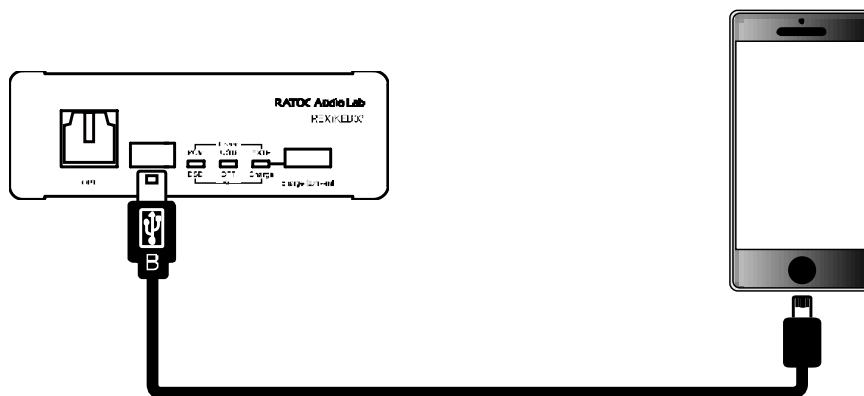
5-5. Launch and play iTunes or other Music Player application

Launch iTunes or other Music Player application. Start it and select Music file. You will listen and enjoy fine and clear sound from your Audio system. To learn more about Music Player application, refer to User Guide or Online Help of the application.

6. iPhone, iPad, iPod with Lightning to mini-B cable.

Connections and Operating instructions

1. Check PW/LB LED of the front panel is lit off and confirm KEB03 is in Power_OFF state.
2. Connect Headphone/earphone to Audio Out jacks at front panel.
 - * 3.5mm Single-end Stereo output jack and 2.5mm balanced Stereo output jacks are not enabled at the same time to save battery energy.
 - * 2.5mm balanced output is disabled when Single-end stereo headphone is connected to 3.5mm Jack.
3. Turn Volume Knob clockwise to turn Power ON.
If PW/LB LED does not light on, turn Volume Knob counter clockwise to set Power off and connect DC+5V Power Adaptor to Micro-USB connector at Rear panel. Turn Power ON again and check PW/LB LED lights on.
4. Hook up iPod/iPhone/iPad with the bundled Lightning to mini-B cable.



5. Check KEB03 is being recognized and configured by iOS device.
Touch and select 'Settings' -> 'General' -> 'About'. The string, 'Portable USB-DAC/HPA' will be shown up. If this string is not shown up, remove the cable and turned off KEB03. After a couple of seconds, turn Power KEB03 ON and connect Lightning cable again.
6. Launch and start 'Music' player application on iOS device and select music.

7. Setting up Windows PC Windows PC.

This chapter describes the driver installation and setting on Windows 7 as an example, these process is almost same on Windows 10, 8.1 or 8.0.

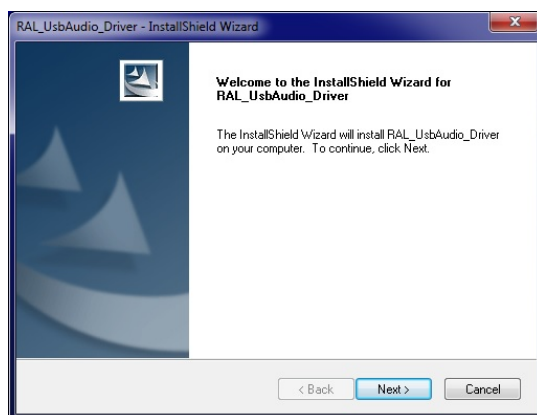
Getting started with setting up Windows 7 (32bit or 64bit) PC.

6-1. Installation of USB Audio 2.0 Class Driver

RAL-KEB03 requires USB Audio Class 2.0 Driver. You need to install it prior to use.

If you forgot it or failed to install the driver, RAL-KEB03 would not be configured properly as an USB Audio Device.

- (1) Turn on power of KEB03.
- (2) Check PW/LB LED at the front panel, and wait step (9) below.
- (3) Log in as an Administrator. You must log in as an Administrator to install USB Audio Class 2.0 Driver.
- (4) Download RATOC Audio Lab DAC Windows10 Driver (ral_win10_driver.zip) from http://www.ratocsystems.com/english/download/driver/ral_win10_driver.html and follow the instructions at the site and install the driver.
*** If you had downloaded and installed any previous USB Audio Driver for RAL/REX USB Audio devices, you must remove them before installing new RAL USB Audio Class 2 Driver for Windows10 by using "Program and Features" at "Control Panel" .
- (5) Click "RAL USB Audio 0330-Driver-Setup.exe", extract all files and run it. User Account Control window will appear and show RATOC Systems, Inc. as the Verified publisher name. Click 'Yes' to go to next step.
- (6) "RAL-KEB03 installer" will start automatically. Click 'Next' to start installation.

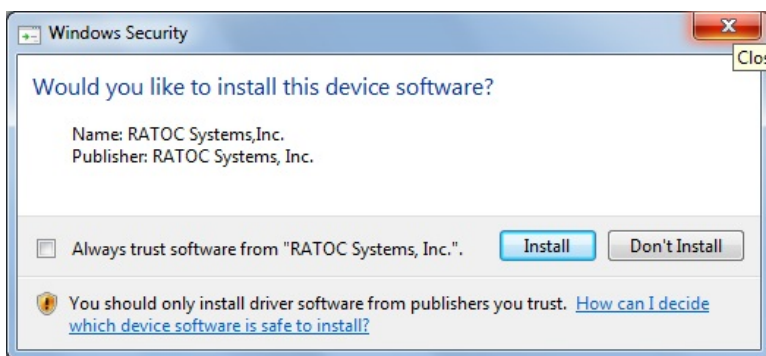


InstallShield will start and show status.

- (7) Click 'Install' button at 'Windows Security' dialog box below and continue installing the driver.



- (8) Windows Security dialog box may be shown up again, if so, click 'Install' to continue the installation.

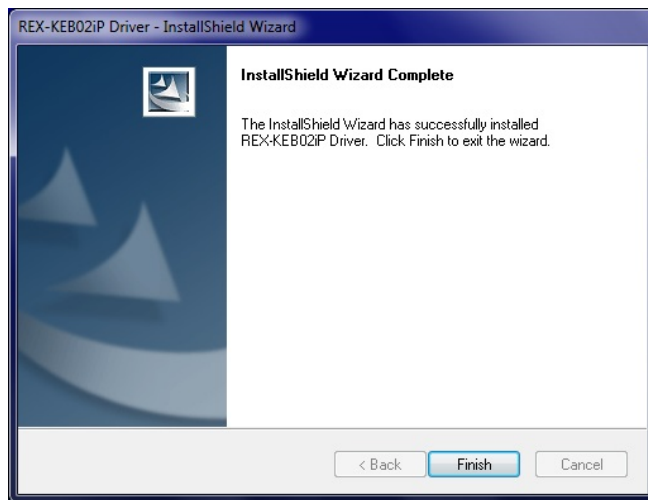


- (9) Connect RAL-KEB03 to your PC when the dialog box below is shown up. Click 'OK' after the connection is completed. InstallShield Wizard will check system, prepare and start the installation.

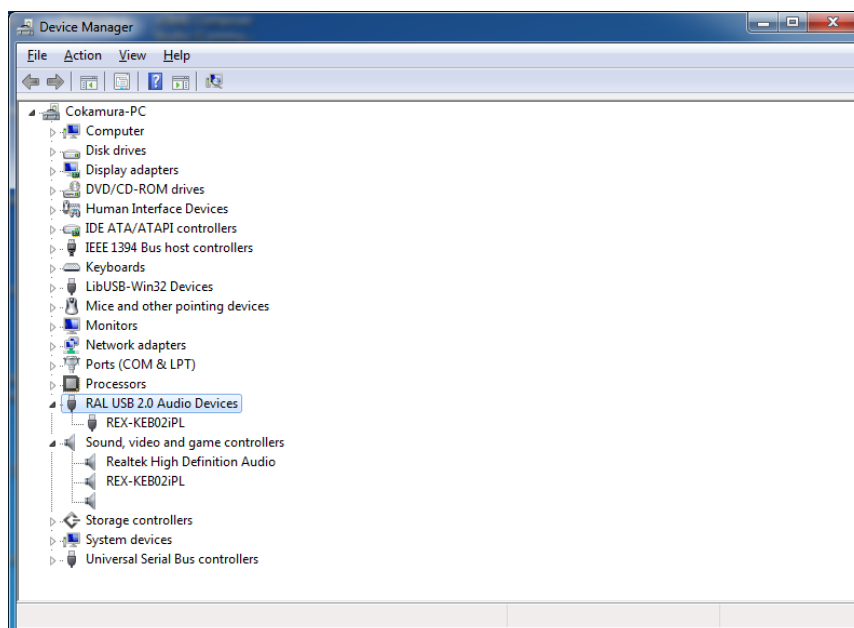


*** It may take few minutes for searching Windows update by Windows device manager.
This activity is depends on Windows OS, please wait until InstallShield will complete.

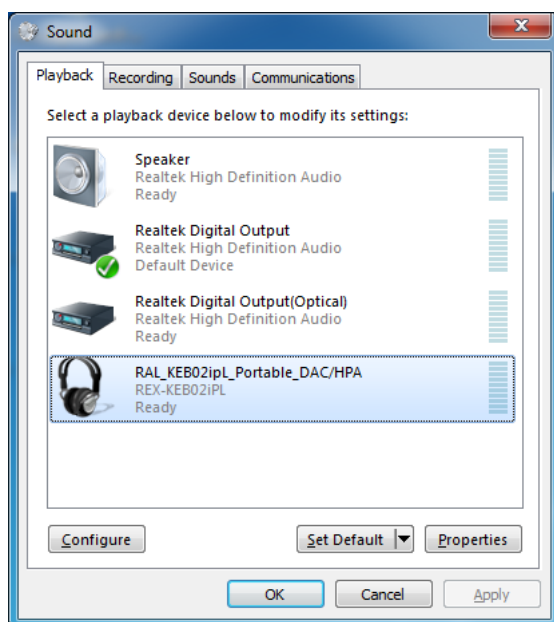
(10) InstallShield Wizard will complete. Click "Finish".



(11) Open Device Manager Window and check "RAL USB 2.0 Audio Devices".
Audio Devices REX-KEB03' will be shown up.



Open "Sound" at "Control Panel", RAL_KEB02iPL will be shown up.

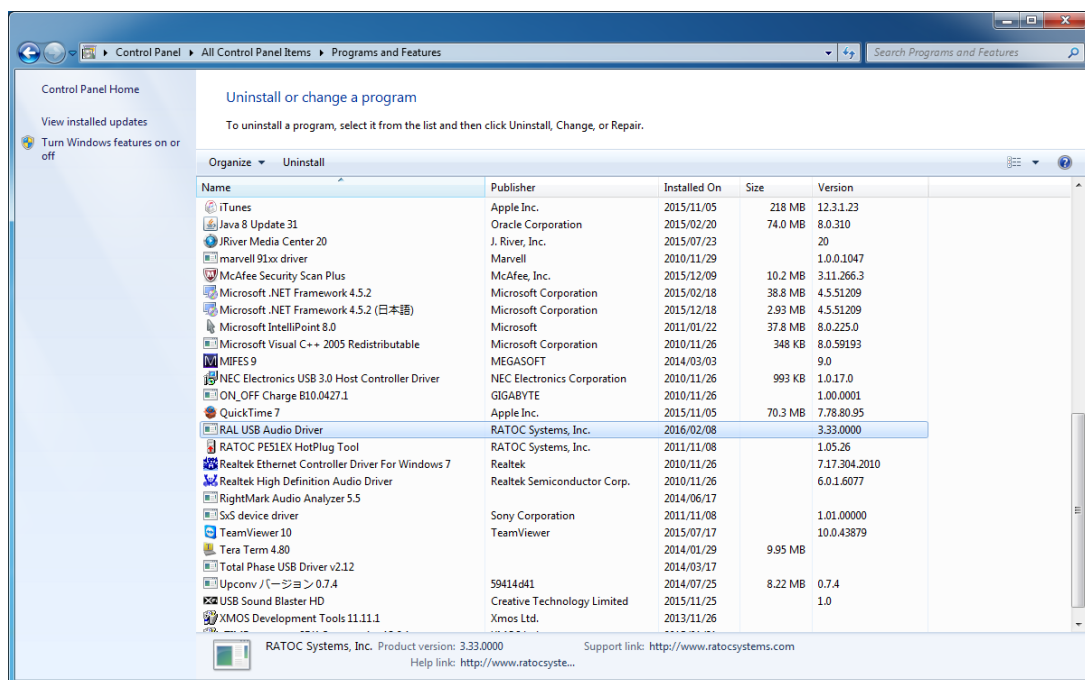


-2. Uninstall RAL-KEB03 Device Driver

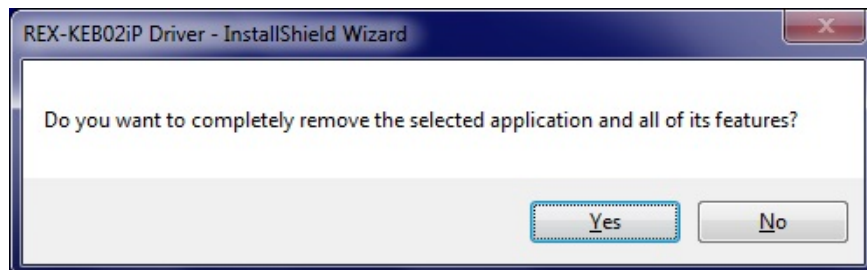
If you failed in RAL-KEB03 Driver installation or desire to remove it from your Windows PC, uninstall it and re-install again.

Follow the instructions below.

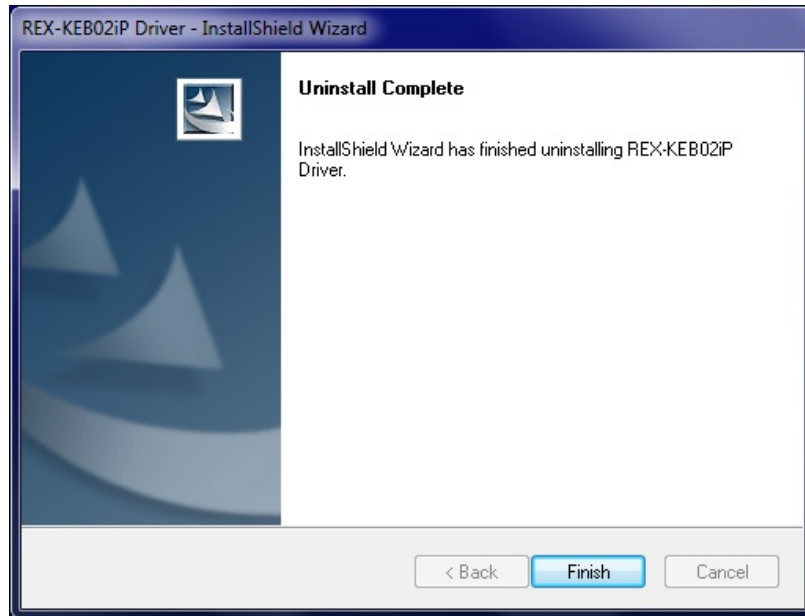
- (1) Open 'Control Panel' and select 'Programs and Features' icon.
- (2) Select and click 'REX-KEB03 Driver'.



- (3) InstallShield will start and show dialog box below. Just in case, make sure you will start to uninstall. And then click 'Yes.'



(4) Click "Finish" at InstallShield Wizard below.



8. Grade up setting for Windows

This chapter describes how to improve sound quality and tune up your PC to listen high fidelity and pure sound.

Before installation of Music Player application or additional drivers:

- Check Compatibility and Combination of Sound Drivers and Applications. And select most suitable one for your PC/Mac Audio system. You also need some setting at Device Manager Window to use the application or add-on drivers.

- Set disable to route "System Sound" to your Audio system. Follow steps below:

(1) Launch "Control Panel" and click on "Sound".

(2) Select "Built-in Sound card" at the "Playback" tab. Click "Set Default" button to route system sound such as "new mail received" to built-in speaker.

(3) Select "RAL-KEB03" at the "Playback" tab and click "Properties" button.

(4) Click "Advanced" tab. And set check mark at both "Allow applications to take exclusive control of this device" and "Give exclusive mode applications priority".

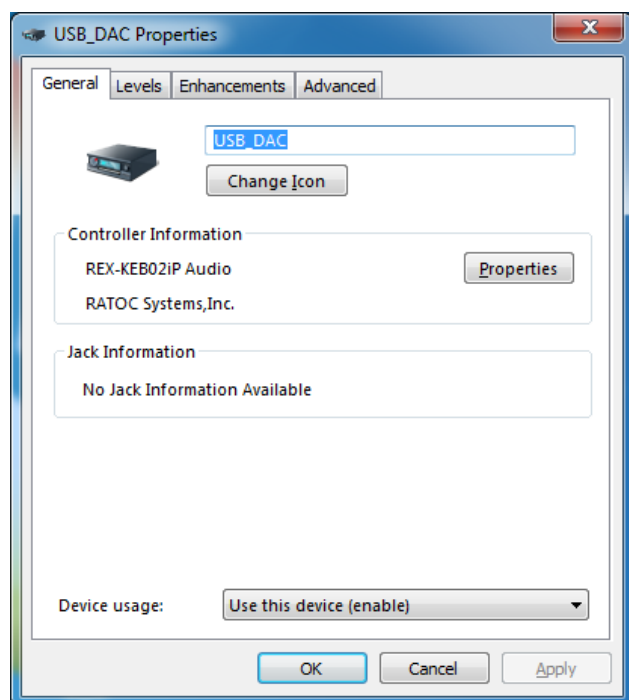
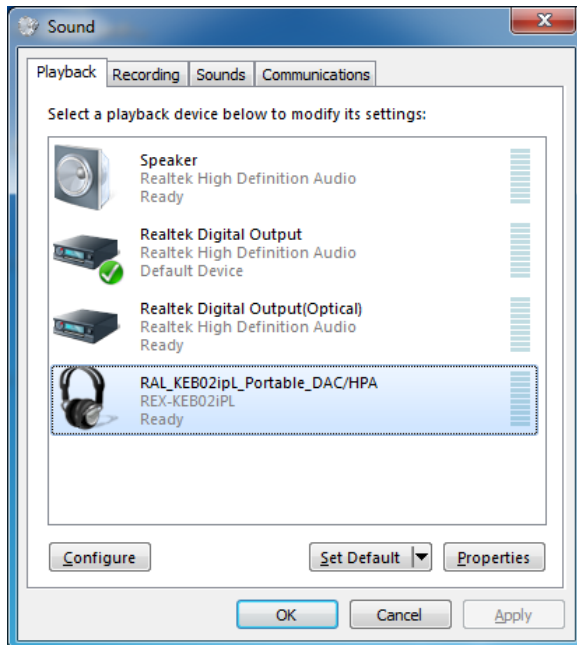
These two setting must be set to use our driver, Kernel Streaming or

WASAPI mode with Music Player applications. If you would like to use Media

Player or iTunes, these applications use Direct Sound or QuickTime Player.

8-1.Listen HD Music with Direct Sound and Kernel Mixer

(1) Double click "RAL-KEB03 Audio" at "Playback" tab. Click "Properties" button.

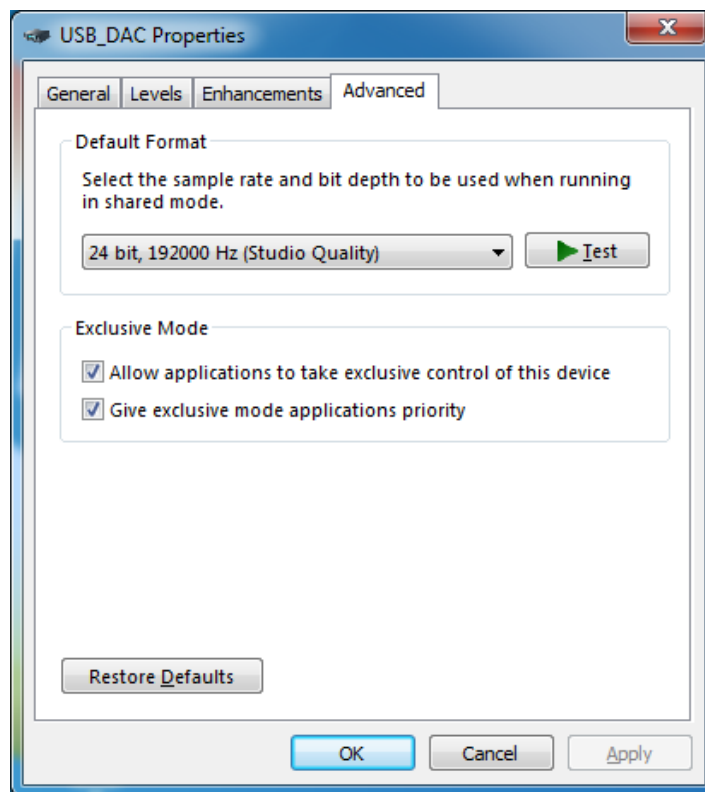


You can change icon and device name as you like.

(2) Click "Advanced" tab and select Sampling Rate/bit rate corresponding to property of music files you like at "Default Format" box.

Note) 24bit/88.2kHz, 24bit/176.4kHz, 24bit/352.8kHz and 24bit/384kHz are not shown up at the list box.

This is the known issue of Direct Sound Driver on Windows 10, 8.x. and 7.

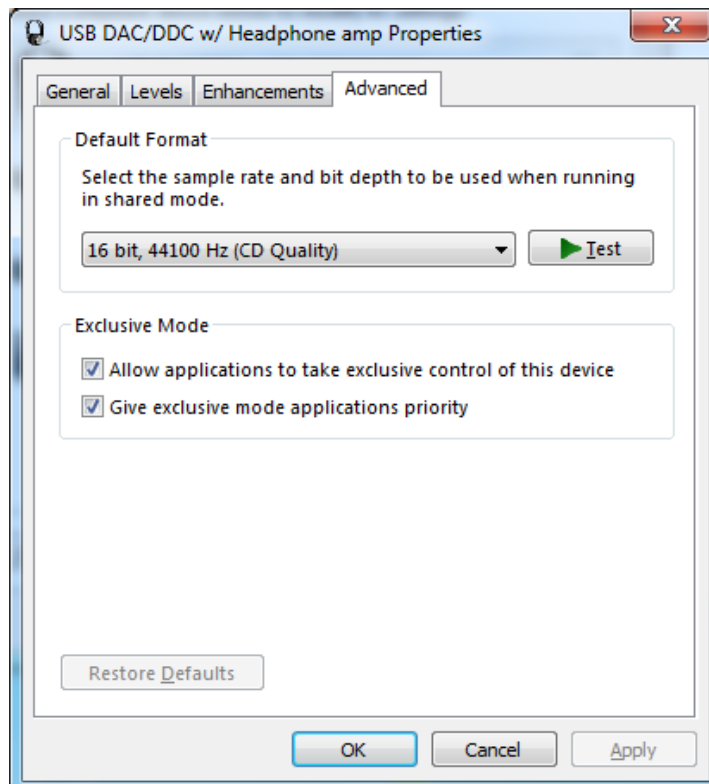


8-2. Using WASAPI mode, skip Kernel Mixer

Windows 7, 8, 8.1 and 10 includes this function. Once enabled, Windows Kernel Mixer is bypassed and Audio application can pass music data to Audio drivers directly.

** iTunes does not work with WASAPI setting on 64bit Windows 10, 8, 8.1, 7.

- (1) Click "Start" and launch "Control Panel".
- (2) Double click "Sound".
- (3) Double click "RAL-KEB03 Audio" at "Playback" tab. And click "Properties" button.
- (4) Click "Advanced" tab and mark Checkbox of both "Allow applications to take exclusive control of this device" and "Give exclusive mode applications priority" at "Exclusive Mode" box.
- (5) Download components suitable for your application such as foobar2000 from the application web site. Install it and follow instructions described at the web page.



9. Android device.

9-1) Connect Android device and KEB03 with OTG cable (micro to mini-B).

*** Android 5.0 or newer required. But implementation of USB Audio Class 2 compatible Driver is depend on the vendor's decision.

9-2)turn on KEB03.

9-3)Open 'Setting' and check KEB03 is assigned as an USB Audio Output Device.

9-4)Android standard Application 'Music' works with KEB03. But you need another AP such as ONKYO HF-Player to listen DSD native music or Hi-Rez music(up to 384kHz).

*** RAL-KEB03 is compatible with:

SONY Xperia Z3, Z4 and Z5 series phones and tablets.

Please ask vendor of your Android device whether it includes USB Audio Class 2 Driver(ALSA) and supports USB OTG HS mode.

10. Specifications

Name		DSD and High-Reso PCM ready portable USB DAC
Model Number		RAL-KEB03
Inputs	Terminals	USB mini-B for USB_DAC mode. OPTICAL Digital input (Toslink, S/PDIF compatible).
	Supported PC	Windows 10, 8.1, 8, 7.(64 bit versions are supported) Mac OS X 10.7 or later.
		USB DAC mode. USB Audio Class 2.0 (480Mbps required) Input Format (Hi-Speed mode is required) DSD 11.2896/5.6448/2.8224MHz (DoP standard 1.1 compliant). L-PCM24bit/16bit,384kHz/354.8kHz/192kHz /176.4kHz/96kHz/88.2kHz/48kHz/44.1kHz (2ch) *** 709.6kHz PCM is not supported. OPTICAL Digital input mode S/PDIF compatible. L-PCM 24bit/16bit, 192kHz/176.4kHz/ 96kHz/88.2kHz/48kHz/44.1kHz (2ch)
Outputs	Terminals	Analog Stereo 3.5 mini Jack. Analog balanced output, 2.5mm mini-mini jacks. AK240 balanced output compatible 2.5mm 4-P jack.
	Compatible earphones.	Un-balanced single end or L,R, balanced. Impedance 8Ω to 110Ω
	Frequency Characteristics	DC~90 kHz (24bit/192 kHz), 10 Hz to 40 kHz (24bit/96 kHz), 20 Hz to 20 kHz (16bit/44.1 kHz)
	Rated output	Balanced output (2.5 mini-mini): 131mW/ch. @22 ohm load. Stereo output (3.5mm mini) 38mW/ch. @68 ohm load.
Internal Battery		Li-Polymer 3.7V 1200mAh. USB charger required.
Unit Dimensions/Weight		69.2(W) x 138.0(L) x 23.4(H) mm. 2.72"(W) x 5.43"(L) x 0.92"(H). / 270g. / 9.51oz.

- External DC Power requirement:
DC +4.75V to 6.0V regulated 0.5A minimum.

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