ROTEL

RDD-1580

DIGITAL-TO-ANALOG CONVERTER

Technical Highlights

Introduction

The purpose of this document is to provide in depth background information about the Rotel RDD-1580 Digital to Analogue Convertor and its features.

We shall cover a range of related subjects. Much of the information is obtainable elsewhere however it is unlikely that you will be able to find all of this information appropriate to the RDD-1580 in one place.

Product Overview

The RDD-1580 is an audiophile quality DAC (digital to analogue convertor) designed to take full advantage of the digital audio sources available today and then convert these signals to very high quality stereo analogue signals for connection to a stereo amplifier or pre-amplifier/power amplifier combination. The product also contains all of the key electronic circuits and connections to interface with a wide range of digital signal sources.

The heart of the product contains two stereo specialist integrated circuit DACs configured to use one for each channel. Each internal DAC feeds custom designed filter and output stage circuits to provide XLR (balanced) or standard phono outputs.

These days most people are familiar with the iPod™ and audio content on smartphones, all of which use digital music files. Here you have two options to greatly enhance the audible fidelity obtainable from these devices. Firstly, you can connect your device directly wired to the USB socket on the front panel. Secondly, this USB socket can also be used for Bluetooth operation between your device (Android or Apple based) and the RDD-1580. (A dongle is provided for just this purpose). This is a great way to play audio content stored 'in the cloud' – for example via the Amazon cloud player, which is available in many countries.

Another benefit of the RDD-1580 is its ability to dramatically improve TV sound from either a flat-screen display or a satellite/terrestrial set-top box. A flat-screen display will often feature tiny speakers about the same size as in a pair of headphones. Fortunately, these products typically feature a digital signal output of some kind, either as a 'phono' type socket (known as S/PDIF - after Sony/Philips Digital Interface); or more likely a 'Toslink' (aka Toshiba Link) optical cable socket. The RDD-1580 is equipped with both kinds of socket on the rear panel – in fact, there are two of each making it easy to connect to your TV or set top box – and/or your CD or DVD player – refer to 1 and 2 below.

If you have not noticed it before it is likely that your CD player and your DVD player will be equipped with a digital audio output socket – very often the S/PDIF type. (This uses a phono-type socket.) The CD player will connect directly with no further adjustment being required and this is a fine way to enhance reproduction from CD recordings using an older player.

The DVD player may be a little trickier. It will feature either socket and this would normally connect to some kind of movie sound processor. However, if you do not have a surround processor there is no problem in connecting this socket to one of the appropriate inputs of the RDD-1580. You must remember to configure the menu of the DVD player to down-mix the movie soundtrack to stereo from the original multi-channel audio mix. In the absence of a movie sound processor, this is a great way to get excellent wide-band movie sound.

Finally, for the digital audio enthusiast there is a PC/USB input, which is also on the rear panel – 3 below. This ultra wide-band input makes use of an asynchronous design to maximise digital signals recorded up to 24-bit 192 kHz sampling frequency. As you might expect from the name this socket and its circuits are intended to be directly connected to one of the USB sockets of your computer.

Connecting your computer via the PC/USB feature enables you to replay tracks stored on a computer hard drive using media software programs such as iTunes and Windows Media Player to do so. You might also consider the use of more sophisticated software that offers greater compatibility of digital audio file formats, such as Asset, JRiver or Media Monkey. Such programs make use of file formats that can reproduce signals of much higher resolution than those available from iTunes or Windows Media Player. We shall discuss these later in the document.
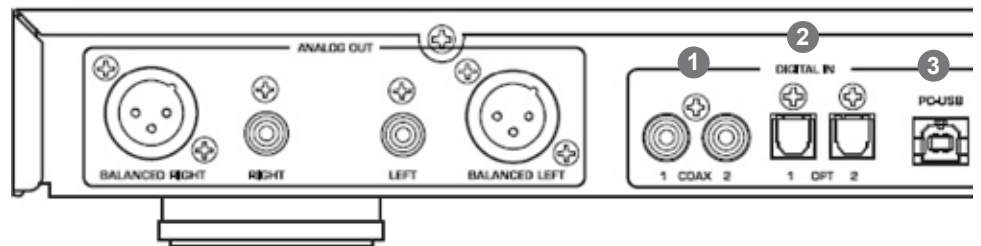
Digital Audio Formats

There is much discussion about the appropriate choice of digital audio file format. There are a number of different types available, generally offering similar functionality however with different levels of resolution – in other words aural fidelity. If you are unfamiliar with digital audio, there are a number of processes and opportunities that you need to be aware of.

Firstly, there is the process of 'ripping' your CD to a digital format. You might already be familiar with iTunes or Windows Media Player that do provide the means to convert your CD tracks to a digital equivalent using a PC or Mac.

Secondly, there is the choice of digital audio file format to consider. You might be familiar with file format names such as mp3, AAC and FLAC however, which one would be best for you?

Thirdly, there is the subject of 'metadata'. This is additional information about the song that you wish to play – such as the artist, author, and/or album etc. Sometimes this metadata will be added to the file when it is ripped, in other programs the data are held in a different folder making it difficult to copy and paste data from one drive to another, or to display the details if you intend to use a media server attached to your home network. The data are used extensively to provide the album, artist, track name etc. in all media players such as iTunes. WMP etc.

Fourthly, we should consider storage space requirements. A CD ripped to your computer will require 500 to 700 MB of storage space on the hard drive, so a 1,000 CD library will need a minimum of 500 GB of storage space. It is quite possible to reduce the space requirements by choosing a codec that deliberately looses information to reduce the size of the digital audio file. (A CODEC is an algorithm or program that COMpresses and DECompresses data – in this case our music track). However, once lost the information is gone forever which leaves you with no opportunity to change your mind and revise your needs. Fortunately, the cost of hard drives has fallen to the point where the availability of enough storage space for the files is not of prime consideration and most modern computers are manufactured with adequately sized drives for a 1000 disc library.

Resolution, sampling and digital audio file types

The first stages in converting an analogue audio signal to a digital version involves sampling the signal at a number of pre-defined levels (the bit level) and doing so as many times as possible (the sample frequency)

CD signals are created as 16 bit at a sample rate of 44.1 KHz. Imagine a sine wave signal, sampled at 65,536 levels per second. Then repeat taking the samples at 44,100 times each second. (In a 16-bit system 16 bits equals 2 to the power of 16 and when you calculate that it equals 65,536!) This set of numbers defines that the data stream for CD is 1.41 million bits per second (16 bits/sample x 44,100 samples/second x 2 (channels))

The snag is that whilst a CD can be read and copied by a computer, the resultant digital files do not contain any track information about the song or the artist etc.

Fortunately a number of computer programs are available which will rip (that is record) and convert CD tracks into different digital formats and file compression levels. The programs that we are are aware of will be discussed later; meanwhile here is a list of some the digital file types to consider for your digital storage and retrival system.

mp3 (MPEG-1/MPEG-2 Audio Layer 3) – one of the earliest digital audio formats to become available for computer and player use. Now standardised as a lossy encoder, it offers small file sizes at the expense of file content reduction and therefore sonic quality. Metadata can be attached to the files to provide information about the artist, album etc.

WAV (Waveform Audio File format) creates full resolution, full size files. The files are not compressed so consume storage space (not a concern for most of us) but are easily transferred to other platforms.The one drawback is that metadata (song information including track names and album art) do not attach to the music files automatically, so if you move the files you need to find and move the metadata as well.

AIFF (Audio Interchange File Format) is Apple's version of WAV. It is also uncompressed, full resolution and full file size, so it consumes storage space. Metadata remain associated with AIFF files. iTunes and dbpoweramp (a ripper and file conversion program) can easily convert (transcode) AIFF to WAV if you ever want to do that.

FLAC (Free Lossless Audio Codec) is a (free – no licence to pay) lossless format so will generate full sized files, like WAV. It was originally developed to offer compression of the audio file without loss of musical information and can compress files to about 50% of their uncompressed size. Like ALE below when uncompressed the file is identical to a full-size file. Due to this and the convenience of adding metadata to the file this codec has become the de-facto standard for audiophile recording.

ALE (Apple Lossless Encoder) aka ALAC – (Apple Lossless Audio Codec) uses lossless compression to save storage space. Once uncompressed for playback, the file is bit for-bit identical to a full size AIFF or WAV file. Like AIFF or FLAC, metadata are attached to these files. Traditionally referred to as Apple Lossless.

WMA (Windows Media Audio) was developed by Microsoft as an alternative to mp3. Like mp3, it is a lossy codec and can sample signals up to 48 kHz; it has become a popular choice with internet radio stations. Over time, it has spawned a number of variants and changes in structure and the PRO version can create files of up to 24bit 96 kHz.

Ogg Vorbis is not a name for a codec that easily springs to mind! It is a lossy format developed as a cost-free alternative to mp3 and AAC and thus offers similar opportunities for file-size reduction and bit rates up to about 500 kHz.

AAC (Advanced Audio Codec) was designed to be the successor to mp3 and although it is another lossy codec, pundits say that the aural results are superior to mp3 at the same bit rate. This is a standardised codec and has been adopted for use for DAB+ and a wide range of portable audio devices such as the iPod and its derivatives.

LPCM (Linear Pulse-Code Modulation) is not a codec; it is a method of digitally encoding audio signals. It is the standard form of digital audio widely used for CD, DVD, Blue-ray and HDMI. It is important to us because this is the raw, uncompressed format of digital audio signals that are applied to the RDD-1580 via the S/PDIF, Toslink and PC-USB inputs.

This means that the RDD-1580 is future-proofed against developments and changes in file codecs or encoders as any changes only involves a software update in your computer; not a hardware change in your DAC.

Summary

When a lossless compression codec is used such as ALAC (Apple Lossless Audio Codec) or FLAC (Free Lossless Audio Codec), a saving of up to 50% of the storage space can be achieved. The compression and decompression of the audio file is made, as the name "Lossless" implies, without any loss of information. Therefore, the same 1 TB hard disc drive containing 2,000 uncompressed CDs can now hold about 3,200 CD's in lossless format.

Lossy compression algorithms such as mp3 are not really optimized for high fidelity applications because in the compression process, a significant portion (about 90%) of the musical information, interpreted as non-essential, is actually removed from the file to minimize storage space. As a result, lossy files can take up to 10 times less space however despite the loss of information can produce surprisingly good aural results.

On a high-resolution DAC such as the RDD-1580, lossy files should be considered in relation to your objectives. Even if you do a file conversion from mp3 to let us say FLAC, what will be transcoded will be the exact content of your low-resolution file – not the original. Any information removed by using a lossy codec is lost forever and cannot be retrieved later. The lossy codec will reduce of the size of the file at the expense of the quantity of information, which will have a negative influence on the sonic performance.

If we are not too worried about storage, we can focus on the best type of digital audio codec to use for our system. Leaving aside such parameters such as bit depth and sample frequencies the major factors are the provision of meta data and the ubiquity of the type of file.

At the time of writing, the 'best' codecs for superior audio resolution are WAV, FLAC, AIFF and Apple Lossless. AIFF and Apple Lossless are Apple encoders so can be used on a Mac and do retain meta data. WAV can be used on Macs or Windows based computers however can be difficult to use with media players because of the limited or non-existing availability of metadata. Finally, there is FLAC, currently reckoned the number one choice of audiophiles. The final choice is yours, however, a safe decision would be FLAC, particularly as high resolution audio files are beginning to be made available over the internet from a number of sources in this format. For MAC users FLAC files will require conversion and we can suggest the use of a program known as 'X Lossless Decoder', which is available via the internet.

Media Player Software

For ripping (recording) your CDs you have the choice of many software media player programs and although we cannot possibly mention all of them, we can describe a few with which we are familiar. The software will normally replay tracks recorded in compatible formats.

iTunes
ITunes has become a popular software program due to its success in Apple devices. It is equally at home on a PC or Mac and as the interface is well known, we will not discuss it further. However, when ripping CDs to the hard drive of your computer we recommend that you retain the CD's native sample rate of 44.1 kHz and use the error correction system. The rationale for this to avoid too much computer processing and to make accurate copies. iTunes will encode CD's to AIFF or ALE (Apple Lossless Encoder); both of which are Apple compatible; or to mp3 or AAC.

Windows Media Player
A version of WMP has been commonly supplied with Windows-based computers for many years and will be another familiar program. It currently supports WMA, MP3 and WAV digital audio file types.

The RDD-1580 will play digital audio files using either of these two programs and initially we would recommend that new users start with these programs and the USB connections to gain familiarity.

In addition to the two programs outlined above, there are programs that can do lots more. Two that we are aware of and can be downloaded from the internet are as follows. (After an introductory period, you will be invited to purchase the software.)

dbpoweramp (dbpoweramp.com)
This software suite is straightforward to install and use, yet provides many features and has an easy to use interface.

- **Digitally** rip audio CDs without quality loss,

- **Encoders** practically every type of audio compression supported.

- **Metadata** track names, composers and high resolution album artwork,

- **PerfectMeta™** uses 5 meta data providers (AMG, GD3, SontaDB, Musicbrainz & freedb)

- **DSP Effects** such as ReplayGain, Volume Normalize, or Graphic EQ [Power Pack Option],

- **Multi-CPU Aware** every last ounce of CPU horsepower is used [Reference Option],

- **Profiles** store complete configuration settings with profiles [Reference Option],

- **[Multi Encoder]** encode to two formats at the same time,

- **All Windows** from Windows XP, Vista and Windows 7, all supported.

Amongst those listed above and on their website there are two important features relative to the accuracy and aural quality of the ripped music track or CD:

1. As your CD is ripped, the content is checked on line with 'Accurate Rip' to ensure that the personal copy you make is as accurate as possible

2. Metadata including cover art is attached to your files and can be verified from five different sources – you are able to select this just prior to ripping.

Figure 1 is an example of the kind of screen shot you can expect to see, much of which is self-explanatory.

The upper section lists the tracks that you are about to rip (copy); the lower left box provides the facility to select the encoder that you wish to use, along with your choice of folder and naming schemes. The lower middle box gives you the opportunity to adjust the encoder settings and the lower right box will provide options for Meta data and album art.

dbpoweramp provides an excellent introduction to the world of digital music.

For more advanced (or brave!) users we can suggest JRiver Media Center, which is a much more complex program featuring many additional functions including video replay. This software is designed to be the focal point for all media that is audio, pictures, images and video on your computer. We shall concentrate on audio aspects.

At the time of writing this guide, the most recent version of the Media Centre is Version 18. The download comes with a free 30-day trial period.

This Media Centre has a built-in feature called WASAPI; this is a new audio software interface between the operating system and the music player. It bypasses many unnecessary Windows software layers and keeps the signal path as direct and short as possible. It is mentioned here because the software has been specially developed for Windows 7 and Vista to optimize data transfer between Windows and an asynchronous DAC. Media Center 18 version is well suited to be used with a RDD-1580 because the RDD-1580 uses asynchronous DAC technology for the PC/USB input.

In line with dbpoweramp, Media Center 18 can easily import your existing music libraries. (If you are already using iTunes because you own an iPod or iPhone you could still rip (copy) your CDs using iTunes and import your files to JRiver. In such a set-up, iTunes would still be used to download to your portable devices and JRiver (or dbpoweramp) to feed your RDD-1580).

JRiver Media Center will decode Apple files or other types of files such as FLAC, APE, etc. and will automatically read high-resolution files.

Installation is easy and straightforward and does not require third party software; everything is included.
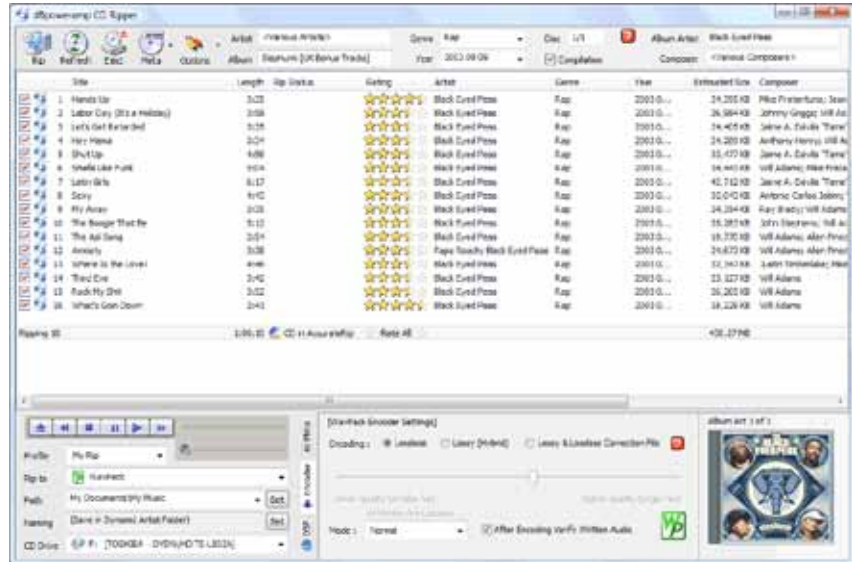

Figure 1

Figure 2

Once downloading of Media Centre 18 is completed open the application and on the task bar and select Tools, Options. In the new window select (highlight) CD, DVD, and BD. Under the CD Ripping section, tab select from the drop-down menu Copy Mode: Secure. This is a very important adjustment. If you use JRiver to rip your CD's this setting will give you a secure copy; in other words, a bit-for-bit copy.

With this feature activated, your computer will be given permission to read the information on your CD as many times as required until the whole content of the copied file is an exact replica of the original.

Finally, with regard to audio replay you might wish to set the output format under 'Audio -Settings – DSP & output format'. Here you will be able to have the output changed 'on the fly'. This is another area for experimentation however since you have gone to all the trouble of ensuring that you have a great copy of your music the default options will be fine.

Selecting your preferred encoder (Codec) is made under Options – Encoding – Encoder where you may select from a dropdown list.

Figure 2 is an example of a screen shot; the program is provided with helpful links built into the software itself, so can guide you as you use it.
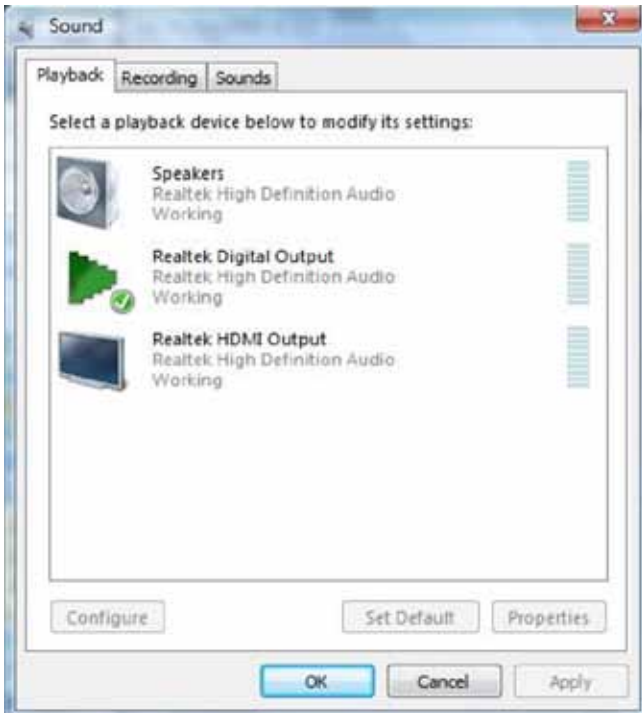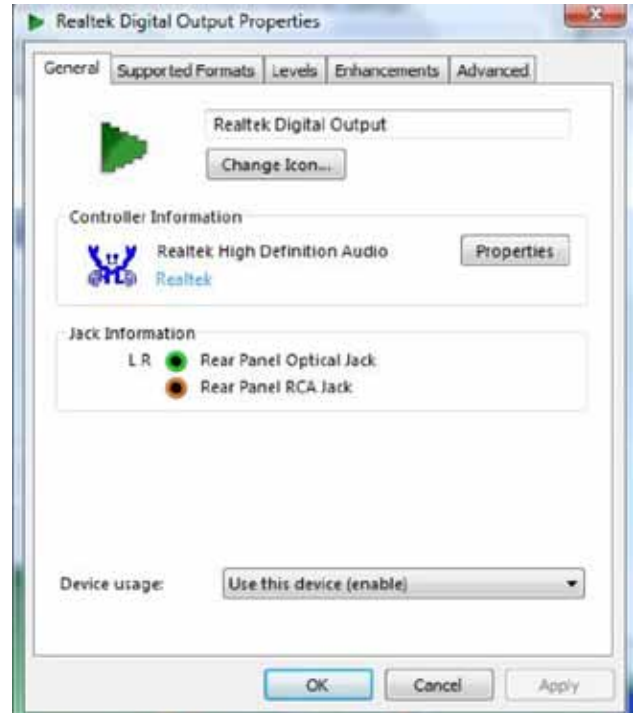
Figure 3

Figure 4

Configuration of the PC digital audio output configuration

The digital audio section of a Windows based PC requires configuration to take advantage of the high resolution PC-USB input of the RDD-1580. This applies regardless of the media player that you choose to use.

As Windows and computers vary in construction and version, the advice given below may not be identical to that on your PC; however, similar steps do need to be carried out for optimum performance.

Assuming that your computer is running, please follow the following advice:

- In the lower left corner of the screen, click on the Windows logo.

- Click on Control Panel.

- Select the Sound icon (speaker) or Sound listing; you will be presented with a screen similar to Figure 3.

Figure 3 shows that we have already selected the digital output as the default. Highlight the Digital Output section and then Properties. Key enter.

You may select an alternative icon via the Properties menu, however do make sure that Devise usage is set to 'Use this device (enable)'. (Figure 4)

After selecting Supported Formats, you will get access to the sampling rate window. (Figure 5) From this window, you will be able to adjust the sampling rate of the music files that will be sent to your RDD-1580.

The default parameter displayed will vary according to your computer and there is a choice here to consider.

1. If you have elected to rip all of your music to one sample frequency such as 44.1 kHz (which is that native to CD), then you are best advised to set the same output sample frequency.

2. If your music library contains songs that have been ripped to various sample frequencies then our advice would be to set the sample rate to the highest rate used in your library. Songs recorded at lower sample rates will be transposed to the higher setting by the computer. This is not always a good idea as it adds another layer of processing.

3. If you have songs natively recorded at 96 kHz or 192 kHz then you have no choice but to select one of these two sampling frequencies, if available in the computer. Keep in mind that for 192 kHz you should install the Rotel PC-USB special Driver software, which is supplied on a CD Rom with the RDD-1580.

Do not select any of the Encoded formats. (Figure 5)

After selecting 'Advanced', you will gain access to the sampling rate window. (Figure 6) From this window you will be able to adjust the sampling rate of the music files that will be delivered to your RDD-1580

1. Click on the Default Format tab and, from the dropdown menu, select your preferred option.

2. Check both boxes in the exclusive mode section.

3. Click on 'Apply' then on OK.

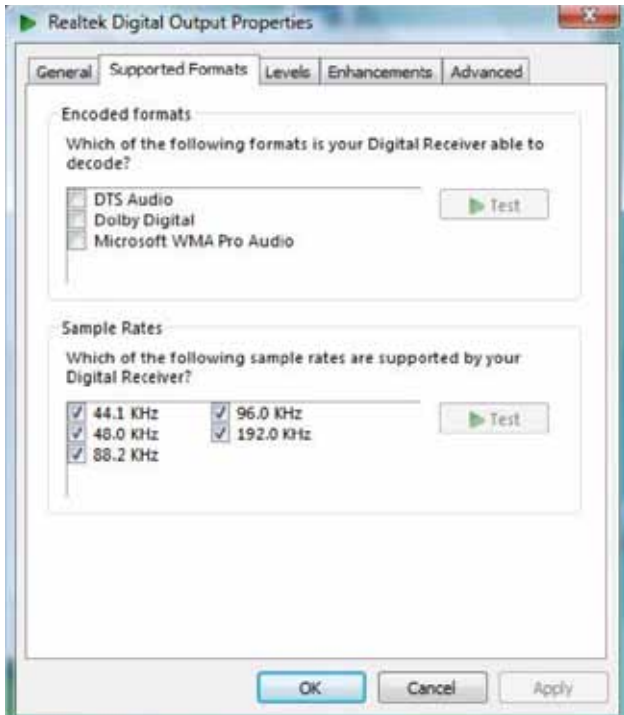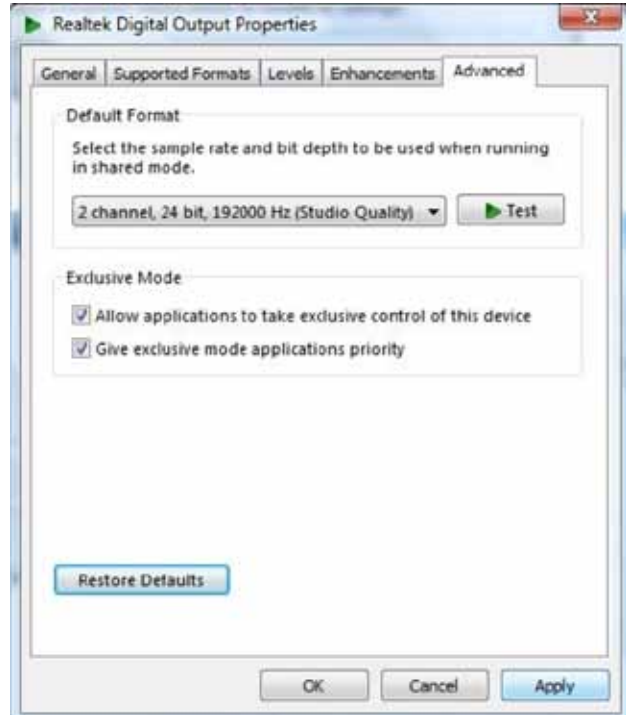Close all windows, your PC is now configured and ready to play your music files.

Figure 5

Figure 6

Conclusions

Audio Outputs
Once signals are internally converted to ana-
logue, they are applied to two different output
circuits. One is known as 'XLR' or 'balanced',
the other in technically known as single-ended
however commonly referred to as 'RCA' or
'phono'. Both types are identified on the rear
panel of the product. These outputs are dupli-
cated; only use one or the other according to
the input facilities provided by your amplifier
or preamplifier. We would normally advocate
using the balanced output if you have balanced
inputs available to you.

As there is no control of the output volume,
do not connect either output direct to the inputs
of a power amplifier.

In this advisory document, we have covered
many aspects of the operation of the RDD-
1580. Its prime purpose is to extract superb
sound from your digital audio sources such
as TVs, DVD or CD players and files stored
on a computer; plus those stored on portable
devices such as Apple or Android tablets.
Tablet computers are fast becoming a gateway
for remote storage of digital music services,
such as the amazon cloud and its associated
cloud player; digital audio files can be sent
from these devices to the RDD-1580
via Bluetooth.

We have also covered input connection
methods – Bluetooth, Toslink/co-axial and
PC-USB and have advised the advantages
and use of each type – for TV sound, iPod
and similar devices and DVD players, plus
digital audio signals played on your computer.

Various kinds of digital files have been
explored and comparisons made between
file size, storage implications and resolution;
we have recommended FLAC because of
its flexibility in terms of file size, attachment
of metadata and use in high resolution
downloads.

We have then identified a couple of media
players to experiment with and finally covered
the essential need to configure the sound stag-
es of your computer, if it is Windows based.

We hope that some of the information has
cleared up a few doubts about digital audio
and most importantly will enable you to
maximize your enjoyment when using the
RDD-1580.

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