

QDesign Music Encoder 2

Professional Edition

User's Guide

Version 1.0 Issue 1

For Mac OS and Windows 9x/NT

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QDesign Music Encoder 2 - Professional Edition User's Guide.

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1. Installation

1.1 For Mac OS

Minimum System Requirements

1. Power Macintosh (100 MHz or greater recommended).
2. QuickTime 4.
3. QuickTime Pro 4 (www.apple.com/quicktime), Media Cleaner Pro 4.0 (www.terran.com), or any other application which can access the export functionality of QuickTime 4.

Installation

1. Launch the "QDesign Installer" application.
2. Follow the instructions provided in the installer.
3. You must restart your Macintosh before the software will be available.

Authorization

1. Launch the application you use to compress audio (e.g. MoviePlayer Pro or Media Cleaner Pro 4.0).
2. Select "QDesign Music Pro 2" from the list of available compressors.
3. The following dialog box will appear.

A screenshot of a Mac OS-style dialog box titled "QDesign Registration". It contains three text input fields: "Name" with the text "Manual Writer", "Organization" with the text "QDesign Corporation", and "Serial Number" with the text "F9901-200-QD000-123456789". At the bottom of the dialog are two buttons: "Cancel" and "OK".

Name	Manual Writer
Organization	QDesign Corporation
Serial Number	F9901-200-QD000-123456789
Cancel OK	

4. Enter your name, organization, and serial number. The serial number may be found on the bottom, right corner on the back cover of the User's Guide.
5. Once the required information is entered, press the OK button and your copy of the QDesign Music Encoder 2 - Professional Edition is now authorized.

1.2 For Windows 9x/NT

Minimum System Requirements

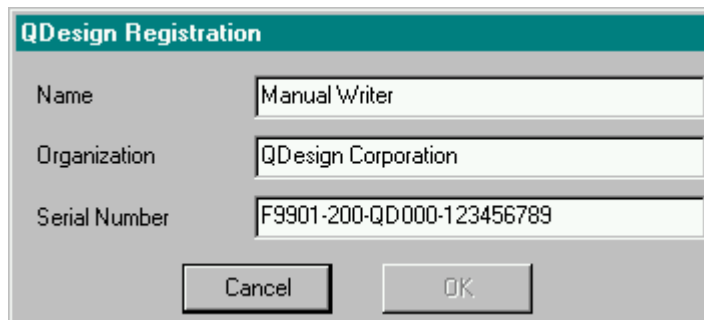
1. Pentium (133 MHz or greater recommended).
2. QuickTime 4.
3. QuickTime Pro 4 (www.apple.com/quicktime), Media Cleaner Pro 4.0 (www.terrان.com) or any other application which can access the export functionality of QuickTime 4.

Installation

1. Launch the "QDesign Installer" application.
2. Follow the instructions provided in the installer.

Authorization

1. Launch the application you use to compress audio (e.g. MoviePlayer Pro or Media Cleaner Pro 4.0).
2. Select "QDesign Music Pro 2" from the list of available compressors.
3. The following dialog box will appear.

A screenshot of a Windows-style dialog box titled "QDesign Registration". It has a teal header bar. Below the header, there are three text input fields. The first field is labeled "Name" and contains the text "Manual Writer". The second field is labeled "Organization" and contains the text "QDesign Corporation". The third field is labeled "Serial Number" and contains the text "F9901-200-QD000-123456789". At the bottom of the dialog, there are two buttons: "Cancel" on the left and "OK" on the right.

4. Enter your name, organization, and serial number. The serial number may be found on the bottom, right corner on the back cover of the User's Guide.
5. Once the required information is entered, press the OK button and your copy of the QDesign Music Encoder 2 - Professional Edition is now authorized.

2 Introduction to the QDesign Music Codec 2

The QDesign Music Codec 2 for QuickTime 4 is the next generation of the QDesign Music Codec technology incorporated in QuickTime 3. New technology that has been incorporated into QDesign Music Codec 2 results in a substantial improvement in quality, performance, ease of use, and robustness against network errors. With the QDesign Music Codec 2, you now have the most comprehensive audio coding solution for producing the highest quality audio for the Web, CD-ROM and Internet music distribution.

In order to accommodate these improvements, the QDesign Music Codec 2 required a redefinition of the QDesign bitstream so, unfortunately, the QDesign Music Codec 2 is not backwards compatible. This means that QDesign Music Codec 2 encoded files will not be able to playback with QuickTime 3. However, files encoded using the original version of the QDesign Music Codec will playback with QuickTime 4.

Based on the same fundamentally new approaches to audio coding used in the original version of the QDesign Music Codec, the QDesign Music Codec 2 enables you to reduce files to as little as one percent of its original size while maintaining full-bandwidth stereo sound. Unlike previous generation audio coding technologies, based purely on psychoacoustic modeling of human hearing, such as MPEG or AC-3, the QDesign Music Codec 2 introduces “to be patented” algorithmic techniques which achieve a level of audio quality, at modem bitrates, which older technologies were simply not designed to accommodate.

2.1 What's New in 2

The QDesign Music Codec 2 is all about QUALITY and PERFORMANCE. It has been improved to enable higher quality audio, faster encoding speed, on-demand and “live” streaming, and robustness to Internet packet loss while streaming.

These improvements result from the integration of two new technologies, the QDesign “Packetizer” and “AutoPilot” technologies. The QDesign Packetizer has been incorporated as a standard feature to QuickTime 4, making streaming QDesign encoded files very robust against network errors. The QDesign AutoPilot technology encapsulates the intelligence necessary in order to dynamically adapt and adjust perceptual coding parameters to maximize encoded audio results depending on the input source. This has removed the need to manually adjust advanced perceptual coding parameters, making optimizing encoded audio quality far less time intensive. In summary:

Quality

Better than MP3-quality at ALL compression levels, up to 128 kbits/s. Store MORE high quality audio using LESS disk space. Stream higher quality audio at lower data-rates.

Extended data-rates make the Professional Edition the most complete audio compression solution for streaming web audio and for Internet music distribution.

Ease of Use

New “AutoPilot” technology intelligently and dynamically optimizes audio quality so producing the best results is effortless.

Speed

Encodes up to 3X faster than the first version of the QDesign Music Codec – Professional Edition.

Real-time encoding for “live” QuickTime streaming.

3 Using the QDesign Music Encoder 2 – Professional Edition

3.1 Creating Great Music for the Web

Entertainment is the number one reason users access the Internet. While there are still significant challenges to overcome in delivering high quality Internet video over a 28K modem, this is NOT true for publishing high quality audio. The QDesign Music Codec 2 enables users to publish broadcast-quality sound for real-time distribution on the Web. Because the QDesign Music Codec 2 is the Internet audio compression solution for QuickTime 4, producers can add QDesign Music 2 files to any media type supported by QuickTime 4, including video, graphics, interactive VR, animation, and more to create a truly compelling multimedia experience.

The following section offers step-by-step instruction on how media professionals are able to take advantage of the QDesign Music Codec 2 using leading applications that support QuickTime 4.

3.2 Encoding Audio with QuickTime 4 MoviePlayer

To encode audio using the Professional Edition of the QDesign Music Encoder 2 and the MoviePlayer application that comes with QuickTime 4 Pro, follow the instructions below. Any application that supports the standard QuickTime 4 export interface will also be able to follow the same process for creating QDesign Music 2 files for QuickTime.

1. Launch MoviePlayer Pro.
2. Under the "File" menu, select "Open..." and select the audio file that you wish to compress. This file may be in any format that is supported by QuickTime 2 (e.g. MOV, AIFF, WAV, etc.).
3. Ensure that the audio file open and selected is the one you wish to compress.
4. Under the "File" menu, select "Export..."
5. Locate the folder in which you wish to save the compressed audio file and name that file.
6. Although you may create a QDesign Music Encoder 2 compressed audio file in AIFF format, QDesign highly recommends that you use the QuickTime MOV format. In the Export pull-down menu, underneath the file name, select "Movie to QuickTime Movie". Press the "Options..." button on the right side of the dialog box.
7. This "Movie Settings" dialog box contains three sections: "Video", "Sound", and "Prepare For Internet Streaming". Under the "Sound" section, press the "Settings" button.
8. The "Sound Settings" dialog box is where you choose which type of audio compression you intend to use. In the "Compressor" pull-down menu select "QDesign Music Pro 2".
9. Set the "Rate" to the **sample rate** (in kHz) that you would like the compressed file to use (see the Tips section for suggestions). The "Size" must remain at 16 bit. Set the "Use" to stereo or mono, whichever is appropriate (see the Tips section for suggestions). Press the "Options..." button in the bottom left of the "Sound Settings" dialog box.
10. The QDesign Music Encoder 2 - Professional Edition contains all the controls outlined below (see "Professional Encoder Controls"). For the purposes of this example let's assume we are compressing a pop music sample for delivery over the web to 28.8K modem users.
11. Set the **Bitrate** to 24 kbits/s. (see "**Bitrate**" under "Professional Encoder Controls").
12. Choose to Optimize for Quality (see "Optimize" under "Professional Encoder Controls").
13. At this point you may choose to activate and change the Advanced Settings (see "Professional Encoder Controls"). For the purposes of this example we will simply use the default settings by not activating the controls.
14. Press "OK" to return to the "Sound Settings" dialog box.
15. Press "OK" to return to the "Movie Settings" dialog box.
16. Press "OK" to return to the export dialog box.
17. Press "Save."

18. A status bar will be displayed showing the encoding process. Depending on the length of the audio file being encoded and the parameter settings, (e.g. "Rate", "Use") the QuickTime progress bar may not instantly appear. Your machine has NOT crashed. If you wait, the progress bar will eventually appear confirming your encoding progress.
19. The resulting MOV file is playable on any computer with QuickTime 4 installed.

3.3 Encoding Audio For Streaming

QuickTime 4 enables media producers to use two types of streaming – HTTP streaming (progressive download) and RTSP streaming (true streaming).

In HTTP streaming, the audience receives the media as the data gets progressively downloaded. QuickTime will begin playing the media when it detects that enough data exists so the entire file can be played through to the end without interruption. This method of streaming has many advantages including no server required, the ability to cache and replay the content, and media can be streamed at a higher quality or data-rate than what the network throughput might support.

Its limitations are handled by a method of streaming referred to as RTSP streaming. This method of streaming requires a server that handles the delivery of media in real-time whether that media is captured live or is stored on disk. The server provides a constant stream of media at a data-rate that is consistent with the actual throughput of the network. The audience is able to have more control over the media in RTSP streaming because the server manages and controls how the media is delivered.

For example, a one-hour program would need to be RTSP streamed for several reasons: 1) you would need to have a lot of available disk space to cache a one-hour program, and 2) you may want to skip segments of the program which are uninteresting, in which case, you can seek to a certain segment of the program without having to download previous segments to disk.

RTSP streaming is most suitable for live broadcast events and lengthy programs, which needs to offer audience some level of control over the playback of the content. The limitations of RTSP streaming is that a server is required and guaranteed network throughput is required for smooth playback of the content.

Here's how you can produce HTTP and RTSP streaming QDesign Music Codec 2 files within QuickTime 4:

HTTP Streaming

Preparing QDesign Music Codec 2 audio for HTTP streaming is very simple and is done during the compression process outline above in section 3.2.

1. In section 3.2, stop at step # 7.
2. Select "Prepare For Internet Streaming".
3. From the pull down menu select "Fast Start – Compress Movie Header".
4. Return to step #7 in section 3.2 and continue.

RTSP Streaming

Preparing QDesign Music Codec 2 audio for RTSP streaming is quite easy, but requires more work than HTTP streaming.

1. Encode the audio material with the QDesign Music Codec 2 – Professional Edition as described in section 3.2.
2. With the encoded audio selected, choose "Export" under the "File" menu.
3. Locate the folder in which you wish to save the RTSP streaming-ready audio file and name that file.
4. In the Export pull-down menu, underneath the file name, select "Movie to Hinted Movie". Press the "Options..." button on the right side of the dialog box.
5. Select "Make Movie Self Contained" and "QDesign Music 2 Sounds" and press the "Track Hints Settings ..." button.

6. For this example we will leave all the settings at their default values (see Section 4.4 “Tips for Optimizing RTSP Streaming”)
7. Press “OK” to return to the Hinter Export Settings dialog.
8. Press “OK” to return to the export dialog box.
9. Press “Save”
10. The resulting MOV file is streamable using a QuickTime 4 RTSP streaming server and is playable on any computer with QuickTime 4 installed.

Live RTSP Streaming

To create live RTSP streaming content with the QDesign Music Codec 2 you require a live streaming application such as the Sorenson Broadcaster from Sorenson Vision (www.sorensonbroadcaster.com).

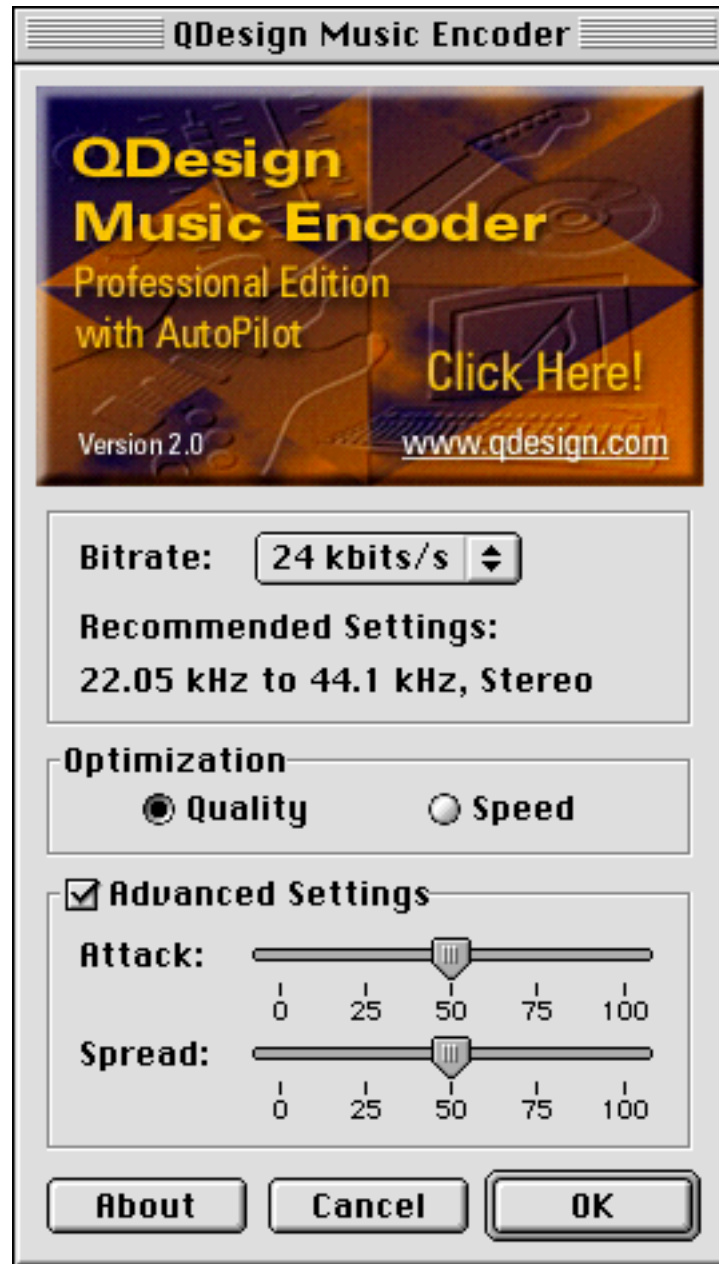
3.4 Encoding Audio for QuickTime 3

In order to accommodate improvements, the QDesign Music Codec 2 required a redefinition of the QDesign bitstream so, unfortunately, the QDesign Music Codec 2 is not backwards compatible. This means that QDesign Music Codec 2 encoded files will not be able to playback with QuickTime 3. However, files encoded using the original version of the QDesign Music Codec will playback with QuickTime 4.

To create content for QuickTime 3 and 4 systems, you should use the QDesign Music Encoder – Professional Edition. To create content for QuickTime 4 only systems, you should use the QDesign Music Encoder 2 – Professional Edition. Please note that all RTSP streaming content requires QuickTime 4 and thus should be created using the QDesign Music Encoder 2 – Professional Edition.

3.5 Professional Encoder Interface

The Professional Edition of the QDesign Music Encoder 2 Options dialog box is featured below. All applications supporting QuickTime 4 will provide you access to this user interface. Some applications, such as Media Cleaner Pro 4.0 from Terran, have integrated the advanced features shown on this screen directly into their application.



3.6 Professional Encoder Controls



Bitrate:

This is the total per second data rate of the audio file. The **bitrate** indicates the amount of information, in bits per second, used for encoding the source audio. The lower the **bitrate**, the higher the compression ratio. The higher the **bitrate**, the higher the audio quality.

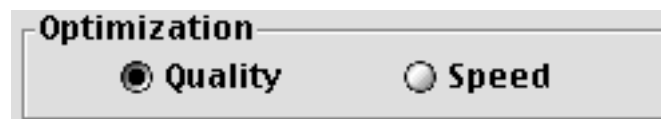
The Professional Edition of the QDesign Music Encoder 2 supports user selectable bitrates from **8 to 128 kbits/s**. The ideal choice of **bitrate** depends largely on the target delivery platform for the material.

For example, a 28.8K modem handles data at a maximum **bitrate** of 28.8 kbits/s. Therefore the highest **bitrate** you would use to ensure real-time streaming of the audio over a 28.8K modem is 28 kbits/s (although 24 or 20 kbits/s would be more appropriate to accommodate TCP/IP overhead and data rate fluctuations). Note that 8 bits equals 1 byte so that at 24 kbits/s (as illustrated above) the data rate is equivalent to 3 KB/s.

Recommended:

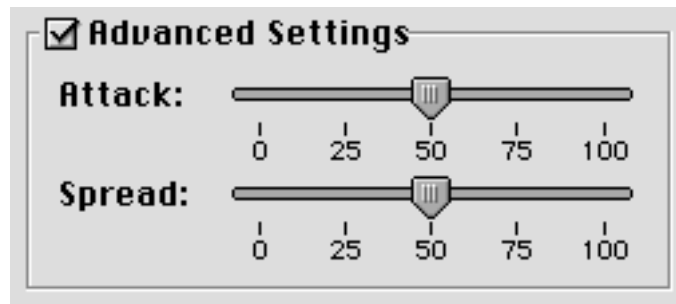
This provides a range of recommended Sound Settings at the selected **bitrate**. Although the QDesign Music Codec 2 will support any combination of Sound Settings and **bitrate**, the recommended settings typically will provide the best results.

For example, at 24 kbits/s the recommended Sound Settings are 22.05 to 44.1 kHz, Stereo. For music content where imaging and frequency response are important 44.1 kHz, Stereo would be appropriate. For voice with background ambience 22.05 kHz, Mono would be more appropriate. The setting should ultimately reflect the source material and target audience. For more information see the Tips section.



Optimization:

This allows the user to optimize the QDesign Music Encoder 2 for Quality or Speed. There are certain situations, where it is necessary to sacrifice some quality in order to be able to encode content at higher speed (i.e. live streaming). For these situations, choosing the Speed Optimization can speed up the encoding process by as much as 40% although there will be a small sacrifice in quality of the encoded audio file.



Advanced Settings:

There is always source content that requires special attention in order to produce the highest quality result. The Advanced Settings allow users to finely tune the encoding process for this source material at low bitrates. By activating the Advanced Settings the AutoPilot technology will use the selected values as its new “center”, or “home”, and will encode the audio material accordingly. For most users, in most situations, it is unnecessary to activate the Advanced Settings as the AutoPilot technology will handle the fluctuations in source material.

Attack:

Attack Sensitivity controls the transient response of the codec. This parameter scales from 0 to 100. A higher setting allows the codec to respond more quickly to instantaneous changes in signal energy most often found in percussive sounds, but may cause longer, more tonal sounds to sound truncated or granular. A lower setting will allow the codec to focus on long, smooth tones such as those found in horns or piano, but may cause attacks to sound imprecise or blurred.

Note that this feature does not function in the same manner as the attack time setting on a **compressor/limiter**.

Spectral:

Spectral Spread is a measure of the tonal versus 'noise-like' nature of the input signal.

In general, a lower setting will result in clear, but sometimes metallic audio. A higher setting will result in warmer, but noisier audio. Simple signals such as pure tones or synthetic instruments normally require a low setting for this parameter, while more complex signals such as percussive instruments benefit from a higher setting.

4 Tips

4.1 Tips for Optimizing Encoded Audio Quality

There are many ways to optimizing the quality of your encoded files using the Professional Edition of the QDesign Music Encoder 2:

- Always use the highest **bitrate** possible for your application. For instance, for 28.8K modem streaming audio use 20 or 24 kbits/s. For CD-ROM applications usually **bitrates** between 64 and 128 kbits/s are more appropriate. The higher the **bitrate**, the better the quality, but the larger the file.
- Unless encoding speed is very important, always set the Optimization to Quality.
- *Choose the Sound Settings carefully.* Start by setting the Sound Settings to the **Recommended sample rate** and mode (*do not set the Rate higher than the source file **sample rate** and if the source is mono do not set the Use to Stereo*). If the audio is missing too many high frequencies, increase the Rate (i.e. from 22.05 kHz to 32 kHz). If the audio contains too many artifacts (chirps, distortions, etc.) reduce the Rate (i.e. from 44.1 kHz to 22.05 kHz) and/or reduce the Use from Stereo to Mono.
- Ensure the source material is of highest quality before encoding. Previously encoded (i.e. IMA) or 8 bit audio is usually unsuitable for re-encoding. "Garbage In – Garbage Out".

4.2 Tips for Minimizing Encode Time and Decode CPU Usage.

There are several ways to reduce the amount of time required to encode audio files and reduce the amount of CPU required to decode the files:

1. Setting the Optimization to Speed will reduce the amount of time required to encode the audio file by up to 40%. Note: this will have no effect on the amount of CPU required for decoding and playing back the encoded audio file and will result in some quality loss (see "Optimization" in "Professional Encoder Controls").
2. Reducing the **sample rate** (e.g. from 44.1 kHz to 22.05 kHz) will halve the amount of time required to encode the audio file. This will also half the required amount of CPU for decoding and playing back the encoded audio file. Note that this will result in the loss of higher frequencies (see "Tips for Optimizing Encoded Audio Quality").
3. Encoding the audio file as mono, instead of stereo, will reduce the amount of time required to encode the audio file by approximately a factor of 2. It will also reduce the required amount of CPU for decoding and playing back the encoded audio file by approximately a factor of 2. Note that this will result in the loss of the stereo image.

4.3 Tips for Recording or Mastering for the QDesign Music Encoder

When recording or mastering an audio track that will be compressed using the Professional Edition of the QDesign Music Encoder 2 there are a few techniques which can improve the quality of the encoded audio:

1. Ensure the audio is not **clipping** at any point in the audio file. The distortions caused by **clipping** can cause additional problems when compressed.
2. Use **compression/limiting** very sparingly. Too much **compression** can cause excess noise and **artifacts** in the compressed audio file, especially for voice tracks.
3. When mastering voice-only audio for compression with the QDesign Music Encoder 2 it may be possible to reduce **artifacts** in the encoded audio file by first processing the audio with a **de-esser** or notch filter. Removing some of the **sibilance** from the voice track may reduce **artifacts** in the encoded audio file.

4.4 Tips for Optimizing RTSP Streaming

When preparing material for RTSP streaming there are a number of settings which will affect the streaming performance of the audio material. Below are a few guidelines to follow when preparing such material:

1. Ensure the RTP Payload Encoding is always set to x-QDM (QStream technology) otherwise the stream robustness will be significantly reduced.
2. Packet Size Limit and Packet Duration Limit should generally set quite large. This will create encoded bitstreams which will contain lower streaming overhead (lower total bitrate). At the same time, the higher these settings, the less accurately you can seek within an encoded file.
3. In general, the lower the bitrate, the higher the Packet Size and Packet Duration Limit should be set. As the bitrate increases, these values can be lowered to improve seeking.

5 Technical Support

5.1 Troubleshooting for Mac OS

The QDesign Music 2 is not in the list of available compressors.

1. Ensure that QuickTime 4 is installed. This requires that you have the following extensions in your "Extensions" folder:
 - QuickTime 4.0
 - QuickTime Power Plug 4.0
 - Sound Manager 3.4
2. Make sure that you are exporting the file as an AIFF or QuickTime Movie file. The QDesign Music Encoder 2 may only be used to create AIFF or QuickTime Movie files.

I have installed the Professional Edition of the QDesign Music Encode 2, but when I go to select "QDesign Music Pro 2" from the list of compressors I see "QDesign Music 2" and can only access the Basic Edition of the QDesign Music Encoder 2.

1. Ensure that the "QDesign Music 2 Pro" extension is installed in the "Extensions" folder in the startup drive's "System" folder.
2. Restart the computer.

When I try to encode an audio file with the QDesign Music Encoder 2 I receive an error.

1. Ensure that the correct version of the "Sound Manager" extension, version 3.4, is installed in the "Extensions" folder in the "System" folder on the startup drive.
2. Try increasing the memory allocated to the application that you are using to encode audio files (e.g. MoviePlayer or Media Cleaner Pro 4.0).
3. Reboot with only the following extensions installed:
 - System extensions
 - QuickTime 4.0
 - QuickTime Power Plug 4.0
 - Sound Manager 3.4
 - QDesign Music Encoder 2 Pro

I exported a file using the QDesign Music Encoder 2 and nothing happens for a very long time. Am I doing something wrong?

You're not doing anything wrong. This can occur when exporting AIFF files. QuickTime does not pop up the progress bar dialog until a certain percentage of the file has been processed. For long AIFF files this can require some patience. The encoder is still processing even though progress is not displayed. This is less of a problem when working with Movie files, as the progress bar is displayed much faster when exporting Movie (.MOV) files than when exporting to AIFF (.AIF) files.

The encoded audio doesn't sound like the source audio.

1. See the various tips and instructions listed above for improving audio quality.

None of these solutions have fixed my problem!

Contact the technical support staff at QDesign or QDesign's authorized resellers.

5.2 Troubleshooting for Windows 9x/NT

The QDesign Music Encoder 2 is not in the list of available compressors.

1. Ensure that QuickTime 4 is installed. This can be verified by opening QuickTime in the Control Panel. The About QuickTime section of this Control Panel will contain your QuickTime version number. You should have version 4 or greater.
2. Make sure that you are exporting the file as an AIFF or QuickTime Movie file. The QDesign Music Encoder may only be used to create AIFF or QuickTime Movie files.

I have installed the Professional Edition of the QDesign Music Encoder 2, but when I go to select "QDesign Music Pro 2" from the list of compressors I see "QDesign Music 2" and can only access the Basic Edition of the QDesign Music Encoder 2.

1. Ensure that the "QDesign Music 2 Pro.qtx" is installed in the Windows/System folder for Windows 9x, or the WinNT/System32 folder for Windows NT. If it is not present in this folder, locate the file on the hard drive and move it to this folder, or run the QDesign Installer again..
2. Quit any QuickTime applications that may be running.

I exported a file using the QDesign Music Encoder2 and nothing happens for a very long time. Am I doing something wrong?

You're not doing anything wrong. This can occur when exporting AIFF files. QuickTime does not pop up the progress bar dialog until a certain percentage of the file has been processed. For long AIFF files this can require some patience. The encoder is still processing even though progress is not displayed. This is less of a problem when working with Movie files, as the progress bar is displayed much faster when exporting Movie (.MOV) files than when exporting to AIFF (.AIF) files.

The encoded audio doesn't sound like the source audio.

1. See the various tips and instructions listed above for improving audio quality.

None of these solutions have fixed my problem!

Contact the technical support staff at QDesign or QDesign's authorized resellers.

5.3 Contacts for Technical Support

QDesign seeks to be as responsive as possible to all technical enquiries. However, please contact your reseller first. If they are unable to answer your questions, QDesign is here to assist you. You will be requested to provide your serial number when contacting us for technical support.

Thank you for your co-operation.

Fax +1-604-688-1524
E-Mail techsupport@qdesign.com
WWW <http://www.qdesign.com>

6 Glossary

Amplitude: The strength of an audio signal. **Amplitude** is related to the volume of a sound and is measured in decibels (dB).

Artifact: A sound that occurs in an audio file that has been compressed with a codec (e.g. QDesign Music Encoder, MPEG, etc.) that was not present in the original uncompressed source.

Bitrate: The amount of information that is required to transmit 1 second of audio information. For example, a **bitrate** of 24 kbits/s indicates that the audio requires 24 kbits, or 3 KBytes, of information for 1 second of audio. To place the **bitrate** in context: a 28.8K Modem can handle a maximum of 28.8 kbits/s of information, while an audio CD-player reads data from a CD at a rate of 1411 kbits/s.

Clipping: When an audio signal contains maximum **amplitude** levels which are too high for the device which is receiving that signal, the input is said to be **clipping**. A **clipped** audio file may contain a great deal of **distortion** and as a result sound rough and harsh.

Compressor: An audio device which reduces the **amplitude** range of an audio track. The effect of the **compressor** is to make the loud parts of a signal softer and to make the very soft parts louder.

De-esser: A special type of **compressor** that operates only at high frequencies, usually above 3 or 4 kHz. It is used to reduce the effect of vocal **sibilant** sounds and is generally not used for non-vocal audio.

Distortion: When an audio file sounds different than it normally should it is said to be distorted. **Distortion** is often caused by **clipping** and can often produce audio that sounds overly rough or harsh.

Limiter: A special type of **compressor** which prevents the **amplitude** of an audio track from exceeding a certain preset level, no matter what the input **amplitude** may be. **Limiters** are sometimes used to prevent unexpected high-**amplitude** signals from causing large amounts of **distortion**.

Sample rate: Similar to the frame rate for a film, this represents the number of times, per second, that the audio signal is captured. In general, the higher the **sample rate**, the higher the sound quality of the resulting audio, but the larger the audio file. The **sample rate** is very important in determining what the highest frequency that can be captured is. The human ear can hear frequencies from 20 Hz to a maximum of 20,000 Hz. For a frequency to be captured in an audio file, the **sample rate** must be more than twice that frequency. For instance, the **sample rate** of CD audio is 44,100 Hz (44.1 kHz) so that the highest frequency it can represent is 22,050 Hz. This clearly covers the range of human hearing.

Sibilance: Voice recordings often contain excessive loudness of the voice **sibilants**, and this effect is sometimes called **sibilance**. The most difficult **sibilants** to reproduce accurately are the sounds "s" and "sh". This effect is reduced by the use of a **de-esser**.