

iPod interface to Apple 1 Cassette Board

Wendell Sander February 16, 2010

An iPod can be used as the audio recorder and player for the Apple 1 or Apple II Cassette interface. The simplest interface is through the 3.5 mm 4 conductor Audio plug on the iPod. Figure 1 shows the pin diagram of the iPod Audio plug. There are a number of cables available that go from this 4 pin format to 3 RCA plugs.

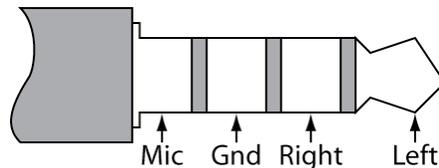


Figure 1

Any plug that brings out lines at the Left, Right and Mic positions will work but there are some cables that have the Gnd in different locations on the plug and they will not work so look carefully. One common cable configuration is an AV cable for a number of Camcorders and although they define the pins differently (Figure 2) the Gnd pin is in the right place so the cable can be used.

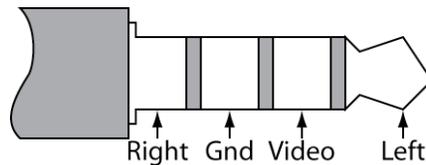


Figure 2

Not all iPods have microphone support which is needed to record from the Apple 1. To see which ones have microphone support go to

<http://support.apple.com/kb/HT3310>

Another problem with some cables is that the metal at the shoulder of the plug can short out to the case of some iPods, particularly the Touch and iPhone. This will cause the Mic line to be shorted to Gnd. A cable that will work without shorting is NXG Technology NXS 0325i. The color coding is shown in Figure 3. If shorting on your cable is a problem it can be solved by strategically placed tape on the Touch or iPhone.

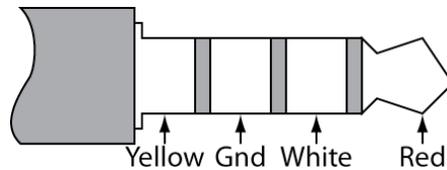


Figure 3

For operation, either of the Left or Right signals can be connected directly to the “From Cassette” connection on the Apple 1 Cassette board. The connection from the “To Cassette” plug on the Apple 1 to the iPod mic pin requires a simple circuit as shown in

Figure 4.

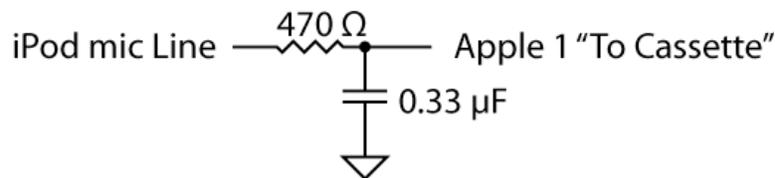


Figure 4

The 0.33 uF limits the bandwidth of the recording so that on later playback there is less ringing. If you plan to always post-process the recording to limit the bandwidth then the 0.33 uF is not needed. The 470Ω resistor biases the mic line for proper recording and is required. The RCA plug will need an adapter to mate with the miniplug jack on the iPod Cassette board so one place to put the network is to build it into the adapter cable.

The next problem is to get a recording in lossless format. The built-in recording application on most iPods and iPhones is compressed and when played back this makes the digital recording have noisy levels. Audio compression is for music not digital signals. The simplest way to use an iPod Touch or iPhone is with a Recording app that does lossless recording. The App “Recorder” will do that and the recordings can be played back for loading at about 60% to 80% volume with good success. A disadvantage of this app is that it is not as convenient as the built-in app to get the file back into iTunes if that is desired. The recording from the “Recorder” App can be transferred to a computer either by email or by a WiFi connection whereas the built-in app will transfer the recording automatically when connected to the computer.

If a compressed record is used (from a Nano or the Touch or iPhone Built-In app) the best thing to do is to post-process the recording to improve the quality. These recordings can be directly reloaded into the Apple 1 from the iPod but the volume setting is much more critical. Properly processed recordings load into the Apple 1 very reliably. The recording can be processed with a free PC or MAC application called “Audacity”. In this application you Amplify the recording by about 20 dB and

allow clipping to get a thresholded wave form. Then Amplify by -6dB to cut the size in half and finally Low Pass Filter with a Rolloff of 12dB and Cutoff Frequency of 8000. Export the file as a wav or aiff file. This will generate a file that will load reliably at about 90% volume. If you can look at the iPod output with an oscilloscope you can check the volume level. I was able to load successfully over a p-p voltage range of 0.4V to 2V. Note that the LED indicator on the cassette interface will not light up even at 2 volts so if the light is on the volume is too high.

Figure 5 shows the iPod output waveform on the lower trace and the waveform on the other side of the 0.01u input capacitor on the upper trace. Note that the Cassette read works on a differentiated signal so the circuit is very sensitive to high frequency noise. It is best to keep the Play amplitude on the low side.

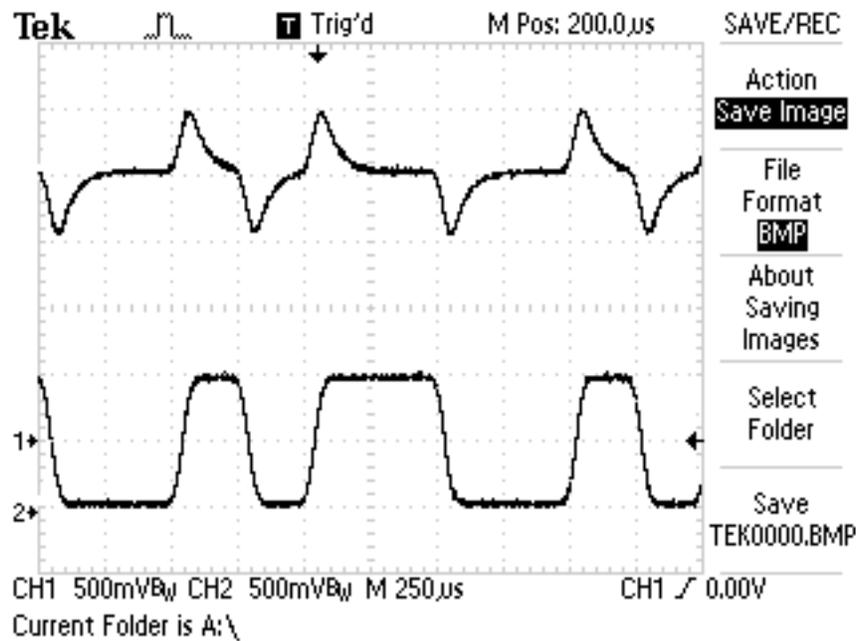


Figure 5

The only difference between the Apple 1 Cassette recording and and Apple II Cassette recording is that on the Apple II a checksum byte is added to the recording and checked when read.

http://support.apple.com/kb/TA40730?viewlocale=en_US

http://support.apple.com/kb/TA40737?viewlocale=en_US

If you read an Apple 1 tape on an Apple II the reading will appear to not complete because it is looking for the added byte. There are clearly a lot of ways to get around all that and move recordings between the two. The Apple II Cassette read circuit is a little more reliable than the Apple 1. For the Apple 1 the best way to

determine if a recording has loaded correctly is to check the value of the last two bytes of the recording. Since the tape format is variable length it is very unlikely the last two bytes will be correct if there has been an error. On an existing recording the last two bytes can be read manually by looking at the pattern in Audacity. If you are making a recording it would be wise to make a record of the last two bytes to check when loading the file later. The bytes should be recorded for each file if more than one file is loaded at a time.