

# 48-Hour Contest Recorder Using a Raspberry Pi

Why buy an expensive recorder or tie up a device for 2 days when a low-cost Raspberry Pi can do the job? Although I am a “little pistol,” I do what I can when I can. Over the summer, I spent considerable time trying to dig out call signs and QSOs from the noise on 40 and 80. In October, I decided to put up an inverted L for 160. This combination of listening and digging made me wish that I had a way to record what I was hearing, so that I could use that as practice to develop my skills. One of my other ham activities is to teach in the CWOps CW Academy program. I like to have the group listen in on solid QSOs that are being conducted, but you can’t always find that when you need it. To accomplish this, I decided to build a recorder using a Raspberry Pi with a touch-screen interface.

In June, I represented the SouthWest Ohio DX Association at the Milford ARC Hamfest. Several SWODXA members were present and most of them are contesters at some level. The discussion quickly turned to contesting, and one of the more prolific contesters asked about the best way to record audio during long contests. CQ-sponsored contest rules address this issue; ARRL-sponsored contests contain no rules requiring recordings for possible adjudication among top finishers. I’ll never be in that category, but a challenge is a challenge, and I decided to build a recorder that would:

- ◆ Record multi-channel audio for an extended period.

- ◆ Provide the user with a granular set of files representing the recorded audio — in this case, one file every 30 minutes.

- ◆ Have a simple interface.
- ◆ Have a small footprint.

The rule for CQ-sponsored contests, <https://cqww.com/blog/new-recording-rule/>, states:

*XII.C. Audio Recordings: Any single operator entrant (see V.A.1) competing for a top three finish at the (a) World, (b) Continent, or (c) USA levels, must record the transmitted and received audio as heard by the operator for the duration of the contest operation.*

*The recording must be in a common format (e.g., mp3) and should include the audio to each ear as a separate channel.*

*The recording may be requested by the Committee within 90 days after the log deadline to help adjudicate the log. The recording files must be provided by the entrant within 5 days of the request.*

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*If no recording is made available, the Committee may reclassify or disqualify the entry.*

## The Raspberry Pi 3 (RP3) and Components

**Computer:** The RP3 motherboard has four USB ports, an HDMI port, an audio out port, a network port, and a USB mini port for power, all on a 2.3 × 3.5 circuit

board. The RP3 even has wireless network capability built in.

**Keyboard and Mouse:** During setup, you may want to connect a USB keyboard and mouse, although a USB wireless keyboard and mouse or a Bluetooth keyboard and mouse can be used. The finished product has a user interface through the attached touch screen, so you won’t need a keyboard and mouse after you are finished. Also, you can connect to the unit via a Secure SHell (SSH) connection over the network from your existing PC.

**Network:** You can use the onboard RJ45 connection for an Ethernet connection, or you can use the onboard wireless connection (or a wireless USB dongle) to provide network access. I use a wired connection to maintain a faster connection when it is needed, but both will work.

**Memory Card:** Most of the complete kits you purchase for the RP3 come with a 32 GB SD memory card. You will need a 64 GB card for this project. After 48 hours of recording, you will use up approximately 32 GB of data. You will want the extra space provided by the 64 GB card.

**LCD Display:** The LCD display I chose was a KOOKYE 3.5” LCD Touch Screen display with case. The display fits directly over the RP3, and the entire unit can be housed in the accompanying case.

**Audio Adapter:** The onboard audio connector is audio out only, so you need a mic or line input. I chose the Adafruit audio-



Figure 1 — The card with a 3.5-inch LCD touch screen with the Raspberry Pi on the back in a Plexiglass case.



Figure 2 — The Adafruit audio/USB interface.

to-USB adapter (see Figure 2). The audio that feeds your headset can also be sent to this interface, perhaps by a splitter cable.

**Software:** You will need to load the Raspbian operating system (OS), a flavor of *Unix* that has been tailored to this hardware platform. The program to record and store the sound files is written in *Python* ver 3, and the user interface was created with *tKinter*. A more detailed description of the OS process is at [raspberrypi.org/documentation/installation](http://raspberrypi.org/documentation/installation). Other files referenced can be downloaded via [www.aj8b.com/NCJ\\_Recorder](http://www.aj8b.com/NCJ_Recorder).

### How It Works

This may be the simplest software you will ever pull together for a project. When the record function is running, every 30 minutes a file that contains the audio from the previous 30 minutes is created and left on the device. At the end of the contest, you will have 48 hour-long files, each starting at the top of an hour. If you need to review a QSO from a specific time period, it's easy to do. A description of the basic functions is below with the corresponding file name in parentheses. Each file should be placed in a directory named `/home/pi/NCJ/` on your RP3.

The user interface, or GUI, is a simple window that appears on startup. A status message appearing at the top of the display indicates the IP address assigned to the unit. This makes it very easy to connect to the unit via an SSH connection. If no network connection is found, the status will indicate that. There are four "soft" buttons along the bottom of the GUI (`NCJ_gui.py`).

The first soft button is the Reset App button. Since there is limited file storage, pressing this will delete all the previously stored sound files and reset all the system parameters. You will be notified of the "danger" of going forward, but it will set up the unit for a clean recording session (`NCJ_Reset.sh`).

The second soft button is the Record Audio button. Pressing this will initiate recording of the audio present at the mic jack on the USB/audio dongle. Every 30 minutes, a file will be stored in the Files directory (`/home/pi/NCJ/Files`). This is a standard .mp3 file that can be played back as desired after being moved to a PC or other device (`NCJ_Start.sh`).

The third soft button is the Stop Recording button. Pressing this will stop the recording and the current open audio file will be closed and saved (`NCJ_Stop.sh`).

The fourth soft button is the Shutdown button. Pressing this will stop the recording, save the current open audio, and shut the unit down. It will *not* turn power off to the display. This needs to be done manually (`NCJ_Shutdown.sh`).

What makes it all work is a task that runs every 30 minutes once the Record button has been pressed. The script (`NCJ_Status.sh`) is saved in the same directory as the other files.

Any time you would like to access the stored audio files, you just need to view the `/home/pi/NCJ/Files` directory. The file name of each recorded hour session is `NCJ_YYYY_MM_DD_HH_MM_SS.mp3`. In this way, the files can easily be tied to a

time frame. It is important that the RP3 be configured with UTC, so that the log time and the file time correlate.

### Configuring the Unit

You should have a working RP3 unit to proceed. It is important to have the Raspbian Operating System loaded on the 64 GB card, so there will be room for the OS and files. More information on building the OS can be found at [www.raspberrypi.org/documentation/installation](http://www.raspberrypi.org/documentation/installation).

Connect a standard monitor, USB keyboard, USB mouse and an Ethernet cable to the PR3. (We will install the touch screen later) Apply power to the unit. You should see a variety of messages scrolling by and then finally a graphic desktop.

Specific instructions for programming the unit are on the *NCJ* website, [ncjweb.com](http://ncjweb.com) or on my website at [www.aj8b.com/NCJ\\_Recorder](http://www.aj8b.com/NCJ_Recorder).

### Let's Go!

Once the unit is programmed, you should now be able to reboot and off we go. The GUI should appear with the four buttons at the bottom of the screen and the IP address message at the top. At this point, you can start recording. Look in `/home/pi/NCJ/Files`, and you should see a file starting with "NCJ" and ending in ".mp3." I'll be working on a couple of tweaks, such as accessing the files created directly over the network via a *Windows* PC and playing files back on the unit. I'll post updates on my website via "What's New" at [www.aj8b.com/NCJ\\_Recorder.htm](http://www.aj8b.com/NCJ_Recorder.htm).

### Components

The parts used to build this unit were acquired on Amazon. There are other sources, but, I'm a big fan of one-stop shopping (see Table 1).

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Table 1 — List of components

Component	Amazon Search Info	Cost
Raspberry Pi 3	Raspberry Pi 3 Model B Motherboard	\$36.99
3.5" LCD Screen, Case	KOOKYE 3.5" Touch Screen LCD Display Monitor with Transparent Case	\$26.99
Power Supply	CanaKit 5 V, 2.5 A Raspberry Pi 3 B+ Power Supply / Adapter	\$9.99
Heat Sinks	LoveRPi 5-Pack Performance Heat Sink Set	\$10.99
64 GB micro SD Card	SanDisk Ultra 64GB Micro SDXC	\$11.99
USB Audio Adapter	Adafruit USB Audio Adapter [ADA1475]	\$3.94
<b>Total</b>		<b>\$100.89</b>