

Shopping/Planning Notes for Raspberry PI or other Computer Solutions to be used for HAM Digital Modes (FT8/FT4/JS8Call/APRS/WinLink, etc.)

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Before we get started notes:

- This is just a “Rough Guide” for what is needed to generally get on the air. Everyone has different radio applications, so this guide may be perfect for you or may just get you close and you will need to work things out to be on the air.
- Due to the verity of computer hardware, operating system versions and sound card type, it may be in good interest to get a second opinion from others online or in person who are using your same equipment. Using the internet search engines, you will probably find someone, somewhere has done what you are about to set out to do.
- Like most things in Radio. When you are about to get on the air for the first time, check with dummy load or start low power, on open frequency to test your setups.
- Please look at my ISSUES section at the end before choosing a method.

STEP #1 - Choose your platform

To get started with JS8Call, FT8, APRS or any of digital HAM radio modes, you need to start with choosing your platform. I will present three possibilities:

1. Use a Raspberry PI “Mini Computer”
2. Use a laptop or desktop computer. Chromebooks are not covered in this discussion.
3. Use a cell phone or tablet.

Using a Raspberry Pi

Advantages:

- Small and power efficient. About the size of a deck of cards. Runs from 5V USB plug.
- Affordable. Different models run the price range from \$25 to \$100.
- With the different free Linux based operating systems, this can become a full desktop computer, supporting two monitors.
- Four USB ports, Audio jack, Ethernet and WiFi/Bluetooth onboard.
- Power efficiency means you could probably run off of a battery power bank for quite some time. [3A@5V](#) is usual running under heavy load, <1A@5v idle.
- DigiPi ham software does not require it to have keyboard or monitor meaning you can tuck this tiny box back behind your radio stack if you want.
- There is even a Raspberry Pi that is embedded into a keyboard, bringing me back memories of old Commodore Computers!

Disadvantages:

- Operating systems are Linux based. You may have to learn new stuff coming from Windows. It is not difficult, everything is well documented, but some Windows things are not there, but their functions are usually replaced by something similar. Apple Mac users will find it easier as many of the commands under the hood of OSX are basically the same found in Linux.

- For the most part you cannot load a Windows Program. That said, people have run old DOS or Windows programs in Linux with emulators with success.

Using a Laptop or Desktop Computer

Advantages:

- You probably already have one... (and likely have already tried FT8)
- Using a laptop offers the flexibility of portable operation plus a screen and keyboard.
- Using a laptop also offers battery backup for those times when power goes out. Some laptop computers will charge/run from 12v battery without extra power inverter.
- Choose the operating system you like. Windows, MacOS, Linux, etc.
- Digital Mode software may automatically interface with the logging software you are using on your computer.
- Probably more powerful than the Raspberry Pi (Unless you are still running a 80386)
- Most PC's can run Windows or Linux or both. Some Apple Macs can run MacOS, Windows and Linux.

Disadvantages:

- Power hungry desktop computers. This may mean during power outages or emergency situations you may have a very limited runtime, if any. Laptop computers can solve this.

Using a Cell Phone or Tablet

Advantages:

- Small and power efficient.
- Portable use.

Disadvantages:

- Digital mode software for mobile devices is limited.
- You will likely need a phone or tablet with USB C connections
- You may need to install software by sideloading if it is not in your devices "Software Store"
- Apps are more picky about the phone/tablet OS versions. A lot of the older phones in your desk drawer or closet may not be new enough to run the software you need. Likewise your brand new iPhone 49 or Samsung Edge85s may be too new for the software.

→ ***** STEP 1a ***** <---

You may want to watch this video about **DigiPi**. It may change your thinking or at least give you a great introduction to what you may be about to get into:

<https://www.youtube.com/watch?v=6KAeJyEz8I8>

DigiPi is made by KM6LYW. Here is his YouTube channel <https://www.youtube.com/@KM6LYW>

If you choose DigiPi, you can probably skip this whole document and go follow his great guide on digipi.org *Note: DigiPi is not free, but he requests any amount of donation to his Patron to get the software download link. You can do everything DigiPi does in RaspberryPi OS for free, but you have to make each step work yourself... a little bit more work, but also more customizable to DIY.*

STEP #2 – Choose your radio interface

Here you have several ways to achieve the same goal. Listed in order of preference below:

1. If your radio has a built-in sound card, you are probably good to go. Skip to next section.
2. Highly recommended: DigiRig interface module with their cables made for your radio. These are great little modules and come from a good company that stands behind their products.
3. Use a AIOC by NA6D. This is a unique HAM solution for a radio interface.
4. Use a SignalLink or other digital sound interface module made for your radio
5. Most affordable solution: a USB sound card, along with cables to interface with your radio.
6. Use the internal sound card of your computer [works but not recommended by many]
(Raspberry Pi cannot be used this way as it does not provide a TRRS port, just audio headphone out)

NOTE: Some of the methods above may require creative cable adaption to go between your computer interface and your Rig. This is why DigiRig is popular, you can often find a cable set for your specific radio, and use one DigiRig with different cable sets for different radios. You can buy DigRig once and expand to other radios with new cables.

I have also found there are HAMS and companies that make custom made cables to go from one device to another. On eBay, I have purchased a custom cable for my FT-891 that will plug into any \$5 USB sound card. For less than \$30, I made a complete CAT/PPT/sound control system for my FT-891 going this route.

STEP #3 – Choose your Operating System

If you are just going to use your existing computer setup you already made this choice. BUT, if you are starting from scratch you have options.

Using a PC: Choose Linux or Windows

Using a MAC: Choose MacOS (OSX) or Windows, or Linux

Using a Raspberry Pi: Choose DigiPi or RaspberyPi OS (Raspbian), or Linux

If you are going to choose **Raspberry Pi running DigiPi**, then you do not have to worry about much. DigiPi is simply copied to a MicroSD memory card and after setup will provide the following packages already installed:

APRS WebChat Server, Direwolf sound modem and TNC, LinuxRMS Winlink server, Pat web-based winlik email client, AX.25 Networking, IP, ax25d services, WSJTX FT8, JS8Call, FLDigi SSTV, ARDOP modem for 300baud packet, Rig Control (rigctld) for CAT/audio on USB-connected radios and more!

Simply put, DigiPi offers a lot with little effort on getting going. You can also have all of these on Linux and probably Windows and MacOS but you will be installing each item individually. For some this is actually preferred.

You can also run all of this on **Raspberry Pi running Raspberry Pi OS**. Again individually installing the applications you wish. Why would you do this? You have complete control and probably more frequently updated security patches and software enhancements.

For **Linux** choices, you have many. But it is easiest to stick with the Debian family of Operating Systems. Recommended at this time is [Linux Mint](#), **Debian 13** and **Ubuntu**. Watch a few YouTube videos on each to see how they differ. Linux Mint is a “GOTO” for a lot of people because it traditionally “Just Works.” Debian is the base of which Mint and Ubuntu has added on to. Ubuntu is a long standing popular OS because they traditionally offered a long support period. For me, I have been using Debian and Linux Mint for years.

Now if you choose Linux, you also have a verity of Desktops to choose from. This is the “GUI” interface, how your desktop looks like and how the “start menu” operates. I recommend Cinnamon, MATE or KDE. You can even have all three (or more) in linux and switch between them. This is the beauty of Linux. Some people even theme their desktops to look like vintage computers or even the computer from Star Trek.

If you choose **Windows** or **MacOS**, well, there are no other choices to make! The choices are made for you :)

(And for those that know Linux, you may be saying you can also use FreeBSD, OpenBSD, etc. And yes those have good options for HAM operators and are probably the most stable Operating Systems on the planet, but they currently do not have a build solution to support JS8call. It is a long story.)

STEP #4 – Choose your software

This is a loaded question.... What do you want to do?

First of all, this is based on your Operating System. If you choose Raspberry Pi, and also choose the DigiPi OS, the software is already included and setup.

Most of the HAM software packages are “open source” and are FREE to use.

Most of the HAM software packages also are offered for easy install on Linux/Windows/MacOS.

Here is the list of what is generally used:

- **WSJT-X** for FT4/FT8, WSPR and most of the FSTx and JTx protocols
- **JS8Call**
- **FLDigi** + other FL software
- **WinLink**

If you choose the DigiPi route or are using 73linux (see below), you probably are all set. If you are doing any other method, you will need to install each one manually. Follow the instructions on each application website as sometimes the install process changes from version to version. What I write here today may not be valid for your Operating System tomorrow.

Bonus for linux users, specifically the Debian or Arch family of linux OS, many of the applications above are available as a simple install or may already be on your system. Many of them are provided for you so you do not have to go to the web and download a program from a website. For example in Debian, Mint and Ubuntu, the following command in a terminal window will install JS8Call:

```
sudo apt install js8call
```

BONUS TOPIC to be talked about soon during a club meeting: [73Linux](#) by KM4ACK. This is a package that adds a lot of functionality to Linux. It will get you almost everything you need with one install script for Debian/Ubuntu linux. It turns a linux computer into a HAM centric computer.

STEP #5 – Plug in, Configure, Get on the air!

Most of the software talked about in this document have nearly the same initial configuration process.

First connect your Radio, DigiRig/Soundcard/Interface and the computer together, then launch your desired application.

Typically on first use, the software application will ask you for:

- Your call sign, grid square, name, rig comments, etc.
- Rig control, CAT, VOX etc. Usually including COM port selection.
- Sound card or digital interface input and output (or labeled as mic and speakers).
- Sometimes optional links to you accounts on QRZ or other HAM websites.

There is always some sort of initial configuration before you can use the application. COM ports and Sound control are typically where most people need to figure out things and it can be confusing. Windows likes to move COM ports if you plug and unplug during the same session. You may have to use Windows Device Manager to figure out which COM port your radio and sound interfaces are on. Apple and Linux are usually pretty easy to pick the right COM port. “Usually” You will have to consult your radios settings in its menus and match your computer application settings for them to talk.

Radio RIG control is different for every RIG. For help I suggest searching YouTube for your radio and FT8 setup. You will likely find a good tutorial online for making your radio work. Some radios are “Plug-n-play” and others have deep menu settings to figure out (I am looking at you Yaesu!)

Most applications will have “TEST CAT” and “TEST PTT” buttons in the config screen under the radio section. If you have configured the right COM port and radio settings, click both of these buttons and they should turn green to let you know it is ready to work.

If you are using a RIG that does not have RIG Control or PTT control, choose “NONE” for RIG and VOX for PTT. You will have to set VOX and Squelch on your RIG. This is typically for older radios or for the “Handy-Talkies” to do digital VHF/UHF on a budget.

SAMPLE SHOPPING LISTS (should you decide you want to explore this more!):

IF you go the **Raspberry Pi + DigiPi** route. [DigiPi.org](https://digipi.org) has a great sample shopping list you may want to look at, probably better than I could put together for his use case. Scroll down to “Shopping list” on <https://digipi.org> Plus watch his great videos before you get going. He walks you step by step better than I can.

KM6LYW is suggesting lower power Pi Zero modules which are great, but I also would suggest thinking about using the newest “Pi 5” just in case you want to have a higher power computer to use for other things (in case you abandon DigiPi.) I like to purchase sometimes based on “what if” I want to use it for xyz in the future. The Pi Zero is popular with other things such as whole house music distribution and small internet servers, so Pi Zero is nothing to avoid. Rather, I like the bigger Pi 3b/4/5 computers because they have more ports, memory and processing power, and I sometimes use them for other applications outside of HAM radio. Pi models 3b still work great even though they are nearly approaching decade old (2016!) I would not purposely buy a Pi 2 or prior if you could even find them, just because of the advancements made. They would probably still work great though!

Try to get 4GB+ RAM. 2GB will work fine. But more RAM helps “future proof” your purchase.

Shopping for the Raspberry Pi route (if you did not use the DigiPi shopping list):

Shopping list with Amazon as a reference and I suggest you shop the stores you are comfortable with. For example GigaParts last week had the Pi 5 on sale for \$15 cheaper than Amazon. And in my experience, their “Free Saver Shipping” selection from GigaParts is the same FedEx 2day that they offer for \$15, at least for us in Alabama... Same FedEx truck shows up with the package.

Item	Amazon or OEM Link	GigaParts or Other Link	Estimated Cost
Raspberry Pi 5 w/4GB	https://www.amazon.com/gp/product/B0CK3L9WD3/ref=ewc_pr_img_3?smid=A1RP7E1H560QWQ	https://www.gigaparts.com/raspberry-pi-5-single-board-computer-4gb.html	\$70
Pi 5 Aluminum Case (you can use plastic cases with fans also, but they are nosier)	https://www.amazon.com/gp/product/B0CT93JZTR/ref=ewc_pr_img_2?smid=A1WFSDY1VLXO2A	Check eBay	\$13
Power Supply for Pi 5	https://www.amazon.com/gp/product/B0CLV6WB4L/ref=ewc_pr_img_1?smid=A8GZTQ9P9SC8J	https://www.gigaparts.com/official-raspberry-pi-27w-usb-c-power-supply-sc1158.html	\$15

Optional BTEC APRS-K1 PRO audio interface (for HTs)	https://www.amazon.com/gp/product/B0DF8GSB4C/ref=ewc_pr_img_4?smid=AA3MGRC7F9EI2	China based websites also sell this item. eBay has them used.	\$35
Optional DigiRig audio Interface (A must for HF RIGS, and nearly all HT).	Buy at digirig directly https://digirig.net/store/	Or buy from HRO, DX Eng. or GigaParts	Depends on your radio cable needs. \$30-\$100
Optional NA6D AIO audio interface (For HTs)	https://na6d.com		\$30
Optional USB Soundcard for DIY interface (known to work)	https://www.amazon.com/Sabrent-External-Adapter-Windows-AU-MMSA/dp/B00IRVQ0F8/ref=sr_1_2		\$8
Misc. Cables: Audio extensions, HDMI, etc.	?	?	?
Optional to the Raspberry Pi 5 above is the Raspberry Pi 400 computer inside a keyboard... LINK HERE I have never used this model but it looks cool.	https://www.microcenter.com/product/631204/raspberry-pi-400-personal-computer-kit?src=raspberrypi	https://www.gigaparts.com/raspberry-pi-400-computer-mainframe-only.html	\$80
Optional: Raspberry Pi 3 or 4 will work if you have them. I would not buy one when you can get newer generation for just a few \$ more.			
Total cost estimate w/ Pi Total cost if you use your existing computer and hardware.			\$90 - \$180 \$0-\$100

If you go the Desktop/Laptop Route:

Shopping list: Basically you need the computer of choice, and likely one of the optional sound Interface choices listed above in the Pi shopping list.

For computer choices, most desktops and laptops that are Windows Vista/Windows 8/10/11 will work great for Linux and HAM software. So for all those computers that get obsoleted because of OS changes (like Win11!! and MacOS Sequoia) converting to Linux can extend the life of those computers, sometimes for a decade or more to come!

One of my preferred small computers to use for this is the Apple Mac Mini from 2011-2016. They can be found for \$10-\$40 and are compact and made of quality hardware. They do require a lot of “Geek” work to get linux installed, that is the only downside.

Or one of the tinyPC’s offered by Lenovo or HP. Look for something like the “ThinkCentre M73”. I buy these on eBay sometimes for less than \$30 including shipping. Easy OS installs and they do not take up a lot of room.

My preferred laptop to use is the Thinkpad T460/T470. They are modern enough to have onboard hardware video decoders (not really needed for HAM, but great for games or video watching, or video editing), generally they have 8GB or 16GB RAM and usually a fast SSD. The best part about these models was that they are the last generations to have a removable/replaceable battery! And on top of that, there is also an internal battery, so you can hot-swap battery packs without rebooting. Usual price for a used T460 in great condition is \$80-\$120

Go the Phone/Tablet Route:

Shopping list: Basically you need the device of your choice, and likely one of the optional sound Interface choices listed above in the Pi shopping list that includes the interface plug to your device. I.E. USB-C, MicroUSB or Apple Lightning.

You will also likely need to download or purchase the HAM software from your devices software store. This article is not going to go into those specifics, but there are apps for FT8 and APRS for mobile devices.

I have only used APRSdroid software with the BTECH APRS K1-PRO cable tied to a Baofeng HT. It works great to enable APRS on a HT you may already have.

There are apps for other HAM digital modes such as FT8 for Apple and Android. I have not used them to date.

SOFTWARE LINKS

Digital Modes

- WSJT-X <https://wsjt.sourceforge.io/>
- JS8Call <http://js8call.com/>
- DigiPi <https://digipi.org/>
- FLDigi <https://www.w1hkj.org/>
- WinLink <https://winlink.org/>

Recommended Linux OS Distributions

- [Linux Mint](#)
- [Debian](#) Linux
- [Ubuntu Linux](#)
- [73Linux](#) (add on to one of the above) and will run on Raspberry Pi 4 or 5.

ISSUES:

What good is technology if there are no issues! :D Learn from my trials... please!

Currently I am observing 4 issues with these setups and you may want to understand these and avoid, or plan accordingly:

1. Using the BTECH APRS cables with BOTH my Raspberry Pi 3b and Raspberry Pi 4 in conjunction with my uSDX HF Transciever, the RaspberryPi randomly puts the RIG in TX mode with static for random amounts of time. Sometimes for tenths of a second, sometimes for 10 seconds or more. This is outside of operating any mode, and happens as soon as power is applied. This is not an issue with the same Raspberry Pi and Baofeng HT, nor is it an issue with the BTECH APRS cable and uSDX radio when used with a laptop or desktop computer. There seems to be a ground loop or RF feedback initiated by the Pi, its internal WiFi, bluetooth or USB grounding to the power circuit and something in the uSDX mic port circuit. I have worked for weeks on solving this issue and have not found a fix (using common grounds, battery power, shielding, ferrites, more shielding, more grounding, common power source...etc.)

AT THIS TIME, AVOID the combination of Pi + BTECH APRS Cable + uSDX transceiver.

Other combos work well and have been personally tested during months of use. I have rolled back my idea of running the DigiPi software and am now back to using a Linux laptop with this hardware combination.

2. Some USB sound cards sold on AMAZON do not transmit with proper timing to open squelch or VOX on radio. I have tried four different brands, out of the four, one I had to return because it could never be configured right with critical timing of the packet being broadcast.
3. If you plug and unplug your USB sound card/DigiRig/HF Radio in Windows 10/11, it will sometimes increment the COM port #, even though you have not left the software or rebooted. You may be expecting it to be on COM4 but by plugging it in again, it may now be on COM6 or something different. Some HF rigs present two COM ports, one for RIG control one for Sound. I think usually the one labeled "Enhanced Port" in Windows Device Manager is the RIG control port.
4. Going the HT route with the BTECH APRS K1 cable set, most HT's will not TX via VOX if squelch is at zero (open). For Digital Modes you want open squelch to hear faint signals. The tradeoff on most HT's is to run squelch=1, and VOX=1. This will usually allow louder/closer packets (such as APRS) to come through, and still allow you to TX. On radios that this is an issue, you will never be able to transmit with an open squelch setting. The VOX method for HT's is generally the only method for the "made in China" radios... your name brand radios may support PTT/Rig control and likely would not need this workaround.

There is a work around for some radios. In particular, I have seen some Beofeng and Radioddity HT's can have custom squelch levels reprogrammed by CHIRP. Not all Baofeng's have this ability, only some models. My tri-band had such a setting and basically what this did is make squelch level 1 to be super sensitive, just above open squelch, and this let me receive some of the fainter packets and allow TX through VOX.