A Raspberry Pi Touch Screen Tablet Computer for Field Day

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The Search for a Better Field Day Computer

For years I had been searching for a better Field Day computer for logging QSOs and checking for duplicate contacts. If the computer could generate CW and key a transmitter, that would be a huge plus.

I lugged heavy Windows-based laptops that weighed more than my radios and had the heft of a lead-acid battery. I tried small netbooks that were lighter in weight but lacked computing power for all but the most basic tasks. Performing a periodic Windows and anti-virus update would render the netbook useless for hours. I considered bringing a MacBook Pro, but they are frightfully expensive and damaging one would put my photography business at risk. I found an inexpensive, lightweight, and rugged laptop designed for schools for $239 but the USB interface was very noisy on the 20M band. I was able to reduce the rf noise to "not-so-bad" by wrapping the USB cable around a large ferrite toroid.

In 2019 I attended the HamSci convention held at Case Western Reserve University in Cleveland and saw a small device used by WA2DFI Scott to operate an SDR. It was small and light with a beautiful full-color display. I asked Scott for more info. He said it was a tablet computer built from a Raspberry Pi 3. This seemed like it was worth investigating for my Field Day computer.

Building the Pi Tablet

I had heard of Raspberry Pi's and started looking into them. They are a line of small and inexpensive single board computers produced by the Raspberry Pi Foundation in the UK. Their primary market is education but Pi's have become very popular in industrial embedded computing. I purchased the latest model at the time, a Raspberry Pi 3B+ with 1GB of RAM for $35 and a plastic case for $10. I connected a USB power supply, keyboard, HDMI display, and mouse and I started exploring it.

The Raspberry Pi runs a Linux distribution named Raspberry Pi OS (formerly known as Raspian). I used to work as a system administrator and software developer in a Linux environment, so it felt comfortable to me. In not too much time I had downloaded, compiled, and built Fldigi and Flrig and was using those programs to operate HF digital modes and control my HF rig.

I was now looking for a way to make my Raspberry Pi portable. I found a 7-inch touchscreen display produced by the Raspberry Pi foundation for $70 and a case for the Pi and touchscreen for $19. The Pi 3B+ simply screwed onto the back of the touchscreen's graphics card with four screws. Two small wires provided power from the Pi to the graphics card. A ribbon cable connected the Pi to the graphics card. I hooked up the Pi to a USB power supply, and the

display came to life. I added a wireless keyboard and mouse and now had a small inexpensive tablet computer.

Fldigi is the Swiss Army Knife of a Ham's Toolbox

I used Flrig to connect to my portable HF station and connected a USB soundcard to the Raspberry Pi so Fldigi could decode and encode data coming to and from my transceiver. But I wasn't done yet. I needed a way to automate sending CW and to log contacts.

When hams hear of Fldigi, they immediately think of a digital emergency communications tool used by many ARES groups. However, the developers of Fldigi realize we don't spend all of our time in emergency drills or deployed to disasters. Part of the Fldigi philosophy is to provide functions for recreational hamming so we can be using Fldigi between drills and deployments so we keep our skills sharp with the program and ensure our equipment remains operational.

One Fldigi tool for recreational hamming is the ability to use a transceiver's remote-control commands (CAT) to generate and key a radio for CW through a USB cable. This can be done with many Icom, Yeasu, and Elecraft transceivers. You can also connect an external keyer such a K1EL Winkeyer or nanoIO to a computer running Fldigi and have it key your radio.

You can copy CW with Fldigi, even under the crowded conditions of Field Day. This is a major aid to CW ops who are still working on increasing their code speed. Fldigi also has the ability to center a CW signal in the "sweet spot" of your radio's bandpass filtering with the push of a "QSY" button.

Fldigi has a powerful macro language, so you can create macro buttons to perform functions like call CQ or send a contest exchange. Fldigi's macro buttons are touch sensitive, so to send say, "1B WPA", you just need to press the macro button on the touchscreen you've programmed for your exchange and it will be sent.

Built into Fldigi is the ability to log many popular contests including ARRL Field Day. You can select the period of time over which duplicate contacts will be checked. You can also export logs in either ADIF or Cabrillo format.

Success!

I used my Raspberry Pi tablet at the Field Day of Mercer County, PA ARC in 2019 for 80 contacts running 5W CW. Due to the pandemic in 2020 I operated on my own and made over 100 QSOs in the 1B class.

Field Day rules govern only how a radio is powered, not computers. You are permitted to use commercial power for your computer, but I think this is not in keeping in the spirit of Field Day which is to simulate a major disaster. In a real emergency, we would need to keep our

computers running off-grid in addition to our radios. So, I was very interested in power consumption of my tablet.

The tablet draws only 250 mA when connected to a 13.8 VDC supply. When keying a radio for CW, the current spikes to 500 mA while the Raspberry Pi holds down the key. Generating audio for soundcard modes like PSK31 or Olivia causes the current drain to increase to 600 mA. With modern modest-sized LiFePO4 cells and solar panels, you should be able to operate a CW QRP station using this tablet all of Field Day. To encourage powering Field Day computers from non-commercial power sources, I'd like to see ARRL grant 100 bonus points to each Field Day transmitter whose computer does not use commercial power. If you're running say class 6A, and none of your computers use commercial power, you'd earn a sweet 600 bonus points.

The Raspberry Pi tablet generates very little RF noise. In fact, I do not need to take any anti-rf measures with the USB cable that was a huge headache with my previous laptop. This is surprising because the Pi cost only $35 and the case is plastic with no shielding.

Moving Ahead

Since last Field Day I have purchased an Icom IC-705. This ought to be a wonderful radio for Field Day. It's power consumption on receive on the HF bands is around 240 mA and it interfaces to the Raspberry Pi tablet through a single USB cable. I no longer need to carry several audio cables, a USB sound card, a specialized USB control cable, and an amplified speaker.

The IC-705 has a built-in GPS receiver. This is an important feature because the Raspberry Pi has no internal Real Time Clock (RTC). Typically, the Raspberry Pi sets it's time from a computer network. But if you're in an isolated Field Day location or at a SOTA or POTA deployment, you may not have access to a network. If that's the case, you can access the GPS time signal from the IC-705 through the USB connection and use Linux's GPS and time-keeping services to set the Pi's time. Not only will the time stamps in your logs be accurate, you can also operate "WSJT-X" modes like FT8 that require precise time.

Fldigi Needs You!

Fldigi's volunteer software development team is led by Dave Freese W1HKJ. Dave is always in need of more developers, particularly those with experience in C++ on all popular platforms including Linux, Windows, and MacOS. If you'd like to help, please contact Dave at w1hkj@bellsouth.com .

References and Acknowledgements

I'd like to thank Dave Freese W1HKJ and his team of volunteers for Fldigi and the entire family of associated software known as Narrow Band Emergency Messaging System (NBEMS). Key developers included Stelios Bounanos M0GLD and Skip Teller KH6TY. Many of Fldigi's modems are based upon those developed in gmfsk by Tomi Manninen OH2BNS.

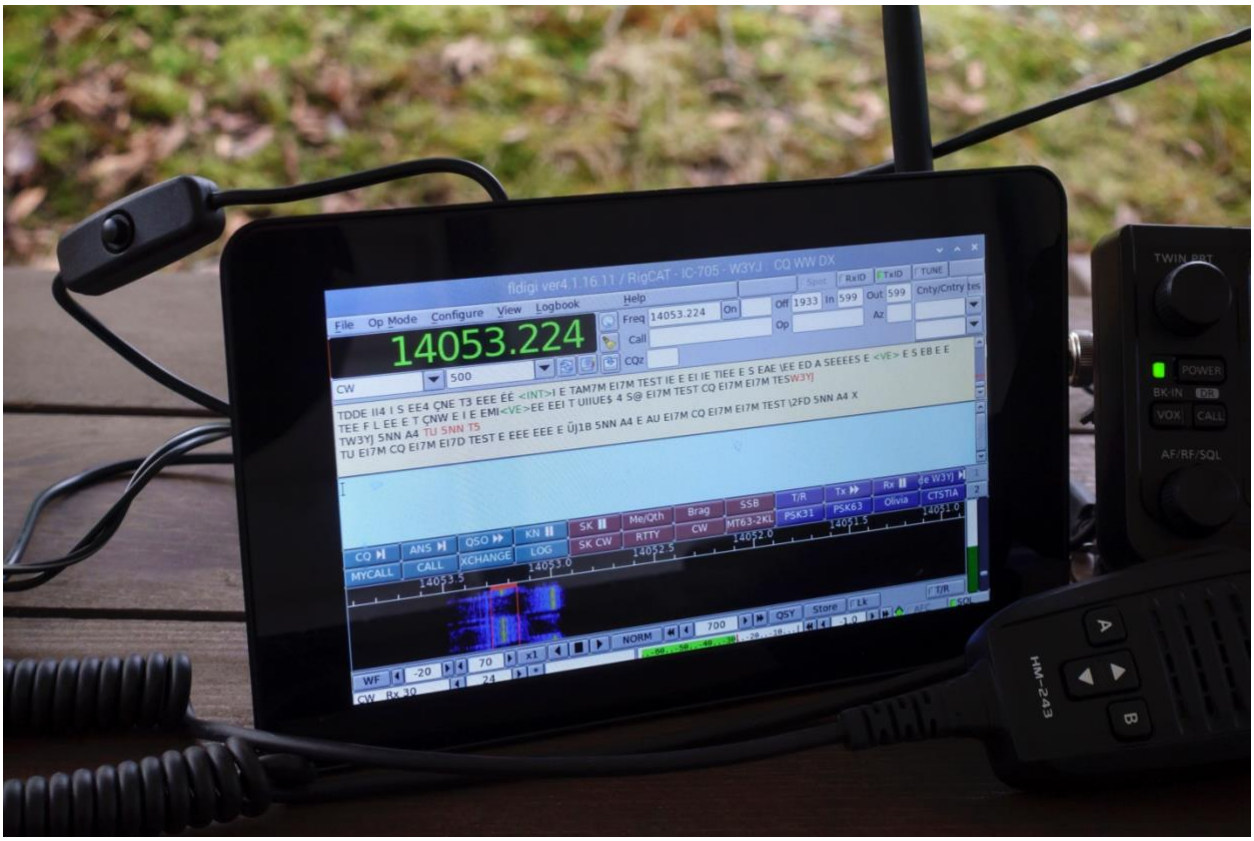
Detailed instructions for installing Fldigi and configuring it for contests, CW and logging may be found at http://www.w1hkj.com .

I've written a cheat sheet on configuring a Raspberry Pi to use the GPS receiver in an IC-705 as a time standard. This document is available at http://www.w1hkj.com/W3YJ/Pi_IC-705_GPS

Help with Fldigi and related software on the Raspberry Pi may be found at the linuxham@groups.io mailing list.

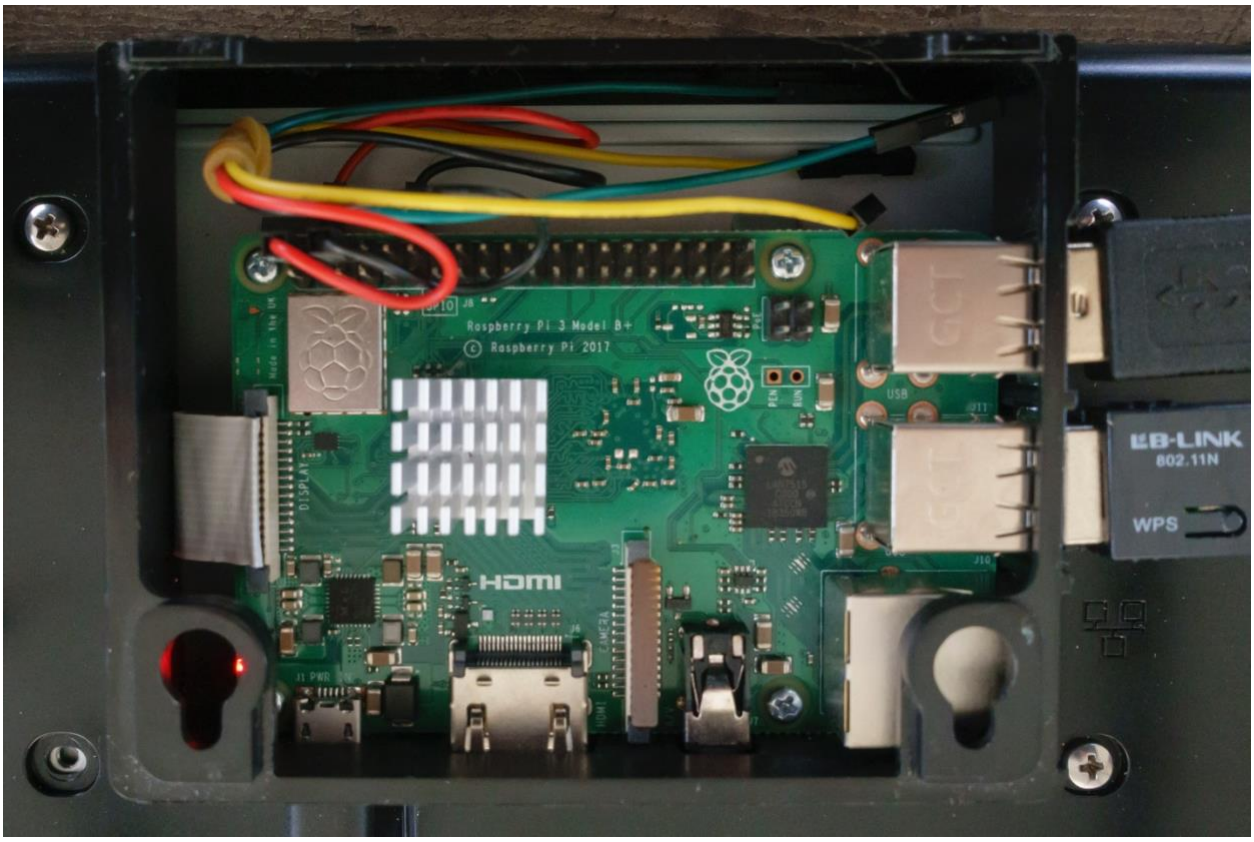
More info about the Raspberry Pi's 7-inch touchscreen I'm using may be found at https://www.raspberrypi.org/products/raspberry-pi-touch-display/?resellerType=home

Images

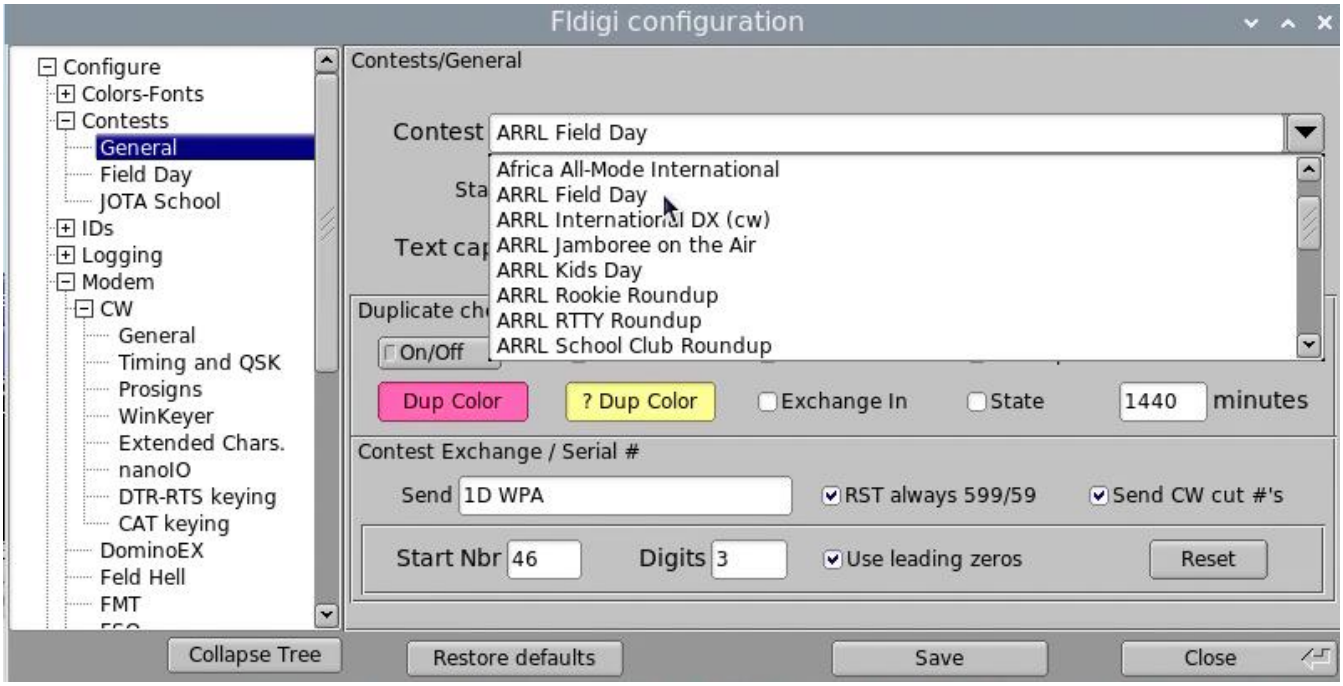


Fldigi running on a 7 inch touch screen tablet based upon a Raspberry Pi 3B+

Raspberry Pi 3B+ tablet with Icom IC-705 and N3ZN ZN-QRP CW paddle. The “rubber duck” antenna on the tablet is for wi-fi, the built-in wi-fi antenna on the Raspberry Pi 3 is very poor.



Rear view of the 7 inch tablet with the back cover removed showing a Raspberry Pi 3B+ mounted to the tablet's graphics card. Installation is very simple. You attach the Pi to the display's graphics card with a screw on each corner, obtain power for the graphics card using the card's red and black wires plugged into the Raspberry Pi's GPIO, and then plug in the ribbon cable from the graphics card on the left.



Configurating Fldigi for Field Day. A large number of popular contests are available.