DMR to Analog-FM Repeater Interface

Al Duncan – VE3RRD (26 Dec 2025)

An interface for the club VE3RAG 2m FM repeater was built to enable DMR network users to transmit through our local analog FM repeater on 147.000, and to allow repeater users to communicate with DMR users on the Brandmeister network. A number of hams are using “hotspots” to access the DMR network, so this interface gives them another option for local communication.

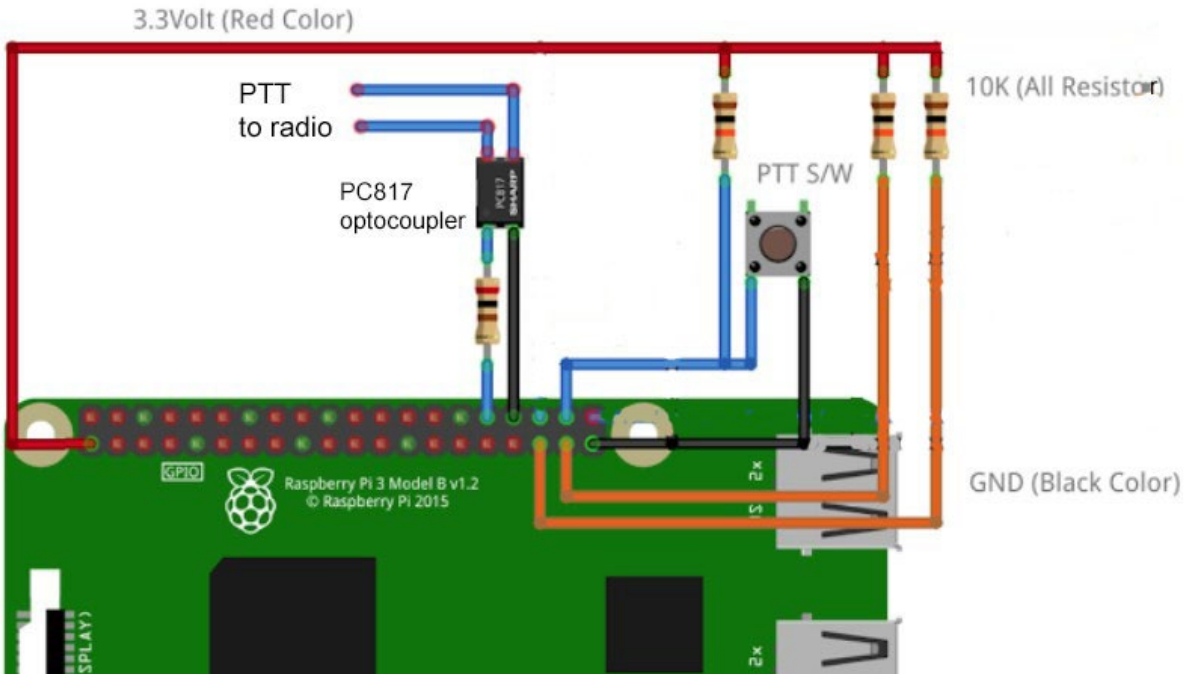
A Radio ID was obtained for the club repeater call sign, which was then registered on the Brandmeister network. This interface to a repeater qualifies as a link - not a repeater, on the DMR network.

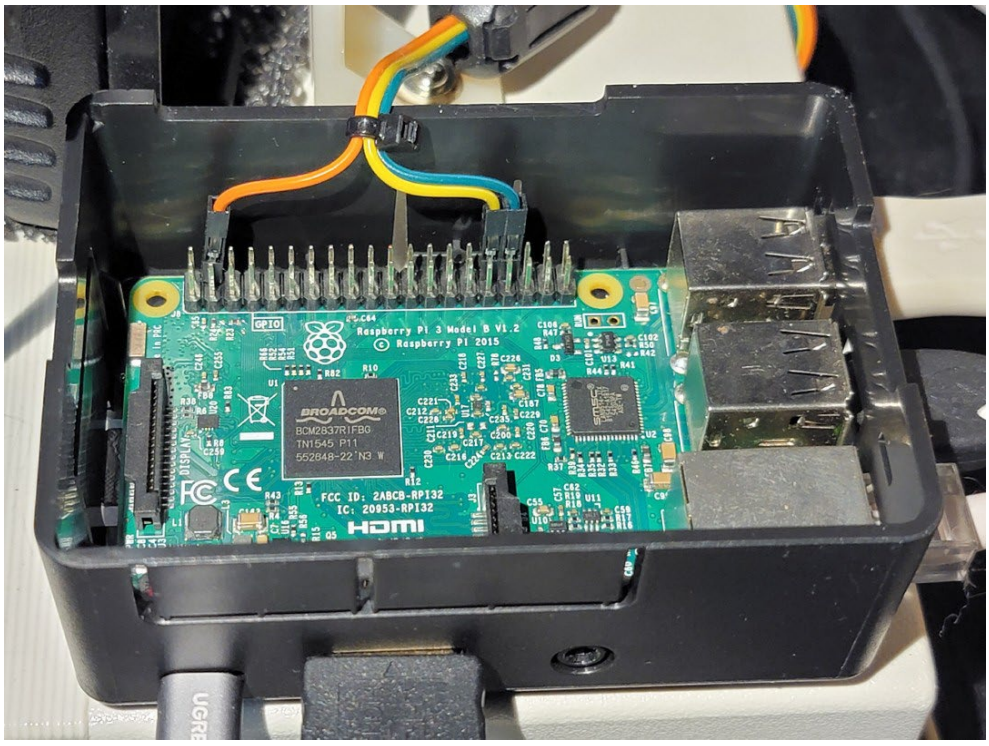
The project was made possible by Raspberry Pi software called DVPi from KD8CEC found at http://www.hamskey.com/search/label/dvpi .

Above is the DVPi display you will see when an HDMI monitor is connected to the Pi. A Windows program called DVPi Manager is used to configure the DVPi software.

The list of stations on the right are those who transmitted on the repeater DMR TG 3026925.

The DVPi software was found to work best on RPi models 2 or 3 and does not work on a model 4 or 5. I also couldn’t get it to work on a model 1. You will notice that the most recent version v1.03 is from 2021, but the author hasn’t issued any updates but it is working well on our Raspberry Pi 3B.



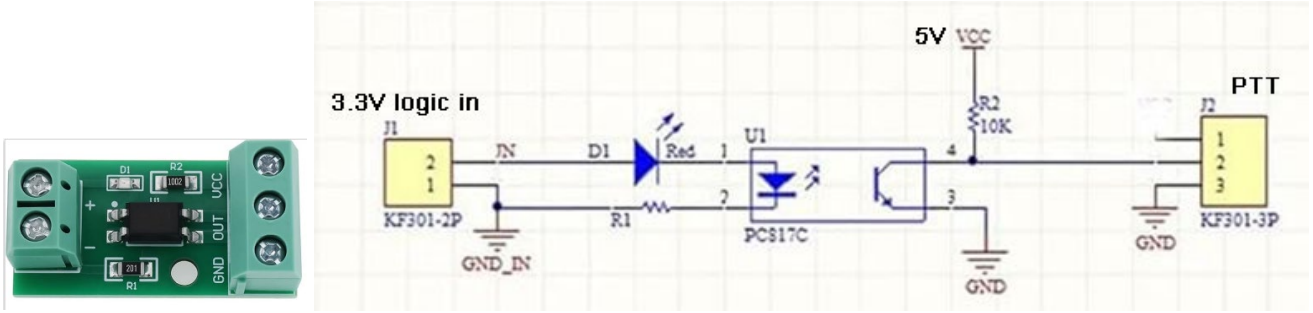


The local PTT switch is not needed for the repeater interface. The transceiver is keyed through an optocoupler attached to GPIO 12 (pin 32) on the Raspberry Pi. In the picture above, the blue wire is ground, yellow wire is PTT, and orange wire is +5V for use by other circuitry such as the optocoupler. Note that the Raspberry Pi GPIO uses 3.3V logic, not 5V.

A USB sound card (Plugable USB Audio Adapter) plugged into the Pi is used for transmit and receive audio interfacing for the 2m FM transceiver which is set to the repeater frequency. For our configuration, we are using a 5W handheld transceiver (a Yaesu FT-270) with both TX and RX tone set to the repeater tone of 156.7 Hz. The DVPi software includes a VOX function for receive audio from the transceiver, so It is important to have RX tone enabled to prevent noise and other interference

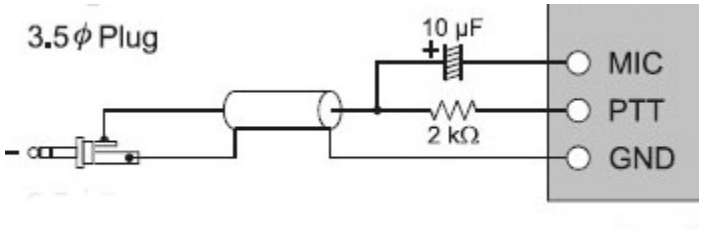
from triggering the software VOX function of the DVPi software. Any audio occurring on the club repeater and received by the FM transceiver will key the software VOX and be sent over the repeater DMR TG.

I found an inexpensive optocoupler on Amazon.ca rated for 3 to 5V that works well for the PTT circuit.



The input of the optocoupler is directly connected to GPIO pins 32 and 34.

Handhelds like the FT-270 require that the PTT be connected to the mic audio input. A 2K0 resistor and 10 uf electrolytic capacitor are used for this.



Additionally, the FT-270 (and some other Yaesu/Vertex handhelds) uses a unique waterproof screw-in 3.5mm TRRS plug for an external mic/headset (a regular TRRS plug does not work). Luckily, RadioWorld carries an adapter cable to connect the Heil Traveler headset (part number HTH-ADY) which terminates in a regular TRS jack. This allowed me to connect the combined mic/PTT and access the receive audio which is fed to the USB soundcard input. The mic audio is from the USB soundcard output. Note that the DVPi audio input and output is mono, so you only have to wire to one channel (either left or right).

In the original build I noticed problems with digital noise and possible RF getting into the audio. I added snap-on RF chokes to all wires and isolated the USB sound card plus the PTT/mic circuit in a separate metal enclosure. I also now use an antenna located some distance away from the DVPi. These steps seem to have completely cured the noise problem.

I also found that connecting the Raspberry Pi directly to the internet router via Ethernet cable is much more stable than using a Wi-Fi connection.

Getting the audio input and output levels set correctly can take some experimentation. You want the radio receiver output level going to the soundcard set so it is not too high or low. Adjusting the DVPi levels are done using the Manager software. You want DMR users to sound about as loud as those using the repeater, and repeater users to be about the same volume on the DMR TG as other DMR users. Also the soundcard A/D and D/A converter has an optimum range, too high an audio level will sound distorted.

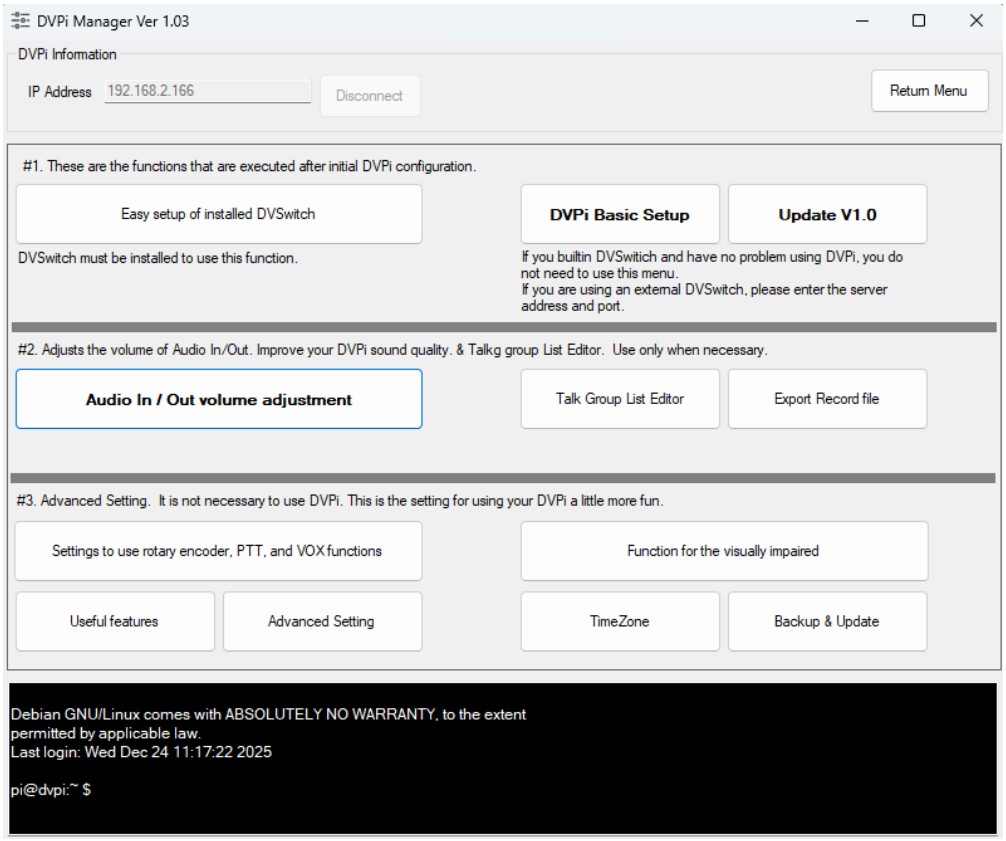
To Install DVPi, first download both “dvpi_103.zip” and “dvpimanager_103.zip”. You may have to disable your virus checker real time scanning if it gives a false positive and blocks the download (my McAfee antivirus did).

Use BalenaEtcher (https://etcher.balena.io/) to write the dvpi_103.zip image to an SD card - don’t unzip it, BalenaEtcher does that. I recommend SanDisk Ultra SD cards for the Pi, they work very reliably. A 16 GB card is big enough for this application.

Connect a keyboard, mouse, display, sound card and internet to the Pi, insert the SD card and power it up. After the dvpi software has initialized, it is necessary to install “DV Switch” onto the Pi. Click on “Menu” and Close DVPi. Select “Terminal” from the Pi desktop (If logging in remotely with Putty, then user=pi, password=dvpi). Next execute the following:

```
wget http://dvswitch.org/buster
chmod +x buster
sudo ./buster
sudo apt-get install -y dvswitch
```

After a reboot, DVPi should start up automatically and is ready to configure with DVPi Manager. This Windows program runs from the folder it was unzipped in. You can now enter your RadioID, Brandmeister Network password and location by clicking the “Easy setup …”, and then also select the correct time zone.



KD8CEC’s webpages explain many of the settings needed in DVPi Manager.

For repeater use, the default maximum 180 second TX time-out is too short. This must be changed in the DVPi code.

From the command line:

```
sudo su
sudo nano /boot/dvpi.ini

[OTHERS]
TX_TIMEOUT=180          change to: TX_TIMEOUT=600          (10 minutes)
```

Ten minutes should exceed the timeout value of most repeaters. If another person on the repeater starts talking directly after the first unkeys, the DVPi VOX will consider it one long transmission which can easily exceed the default 180 seconds.

With the timeout increased to 10 minutes, the VOX delay can be increased to 1.6 seconds or more in DVPi Manager. This will help prevent the software VOX from toggling if the speaker using the repeater has longer gaps between words (some of the old-timers on our repeater are slow thinkers and talkers).

Since transceiver RX tone squelch is used, the VOX level sensitivity (Mic RMS) can be reduced to 250 or even less. This will help prevent loss of the start of a softly spoken word which can fail to trigger the software VOX.

Also in the Manager, make sure “use low pass filter” is not checked. Using DSP is OK.

Another problem I had with DVPi was the random disconnection from our talk group, it would display TG 9 which was a disconnected state. I had added our TG as a static TG on the Brandmeister website. My solution was to create a Cron Job to reboot the Pi at 3:15 AM every day. This disconnecting and reconnecting to the Brandmeister Network every 24 hours seems to have fixed the problem

A good source of info on creating a cron job https://bc-robotics.com/tutorials/setting-cron-job-raspberry-pi

Use “sudo su” before entering “crontab –e” to bring up the editor. I like using the nano editor.

From the crontab editor, the following line will reboot the Pi and restart DVPi every morning at 3:15 am:

```
15 3 * * * sudo reboot now
```

Since we are only interested in using one particular TG, you can use the “Talk Group List Editor” in DVPi Manager to modify the lists. I deleted the entries in “usertg1.txt”and entered the repeater TG, changed the TITLE and did a Save to save it as a list I titled “VE3RAG_TG” (name yours what you want). I deleted any other TG lists. By default, the screen will show Recently TG (recently used TG’s) and you only want the repeater one listed. On Pi reboot, DVPi will start up, will connect to the Brandmeister Network, and then select the recently used TG (after showing TG 9 for a few seconds).

You can edit the “recently.txt” file at /home/pi/dvpi/ to delete any unwanted TG’s.

Note that the DVPi image uses the old Buster OS, but my attempts to update or upgrade the Pi OS always seem to result in breaking the software, so “if it works – don’t fix it” seems to apply.

There is a considerable delay of 1 second or more in passing through the network each way. This may cause problems with “doubling” where the DMR user doesn’t hear the repeater user stop talking for 1 second and then the repeater user doesn’t hear the DMR user start talking for another 1 second.

How to Access the DMR Network

- Use a DMR capable transceiver to connect to a TG through a local DMR repeater. There may not be a DMR repeater close enough to use. DMR repeaters are usually on UHF frequencies.
- Use a DMR capable transceiver and a hotspot such as the Pi-Star MMDVM to connect through the internet. The latest Pi-Star software is at https://www.pistar.uk/ .
- Build a DVPi as a DMR internet transceiver. I have a Raspberry Pi 3B+ with a 3.5 in display and amplified speaker that I use for monitoring and communicating on the Brandmeister Network. I use a common electret microphone (or headset with boom mic) plugged into the soundcard..
- The simplest is an Android phone app called DroidStar (from the Play Store) which enables access to the DMR network. The required DroidStar vocoder plugins can be downloaded from http://pizzanbeer.net/droidstar/plugins/vocoder_plugin.android.arm64 This link needs to be entered on the Settings page where it says Vocoder URL, then click Download vocoder.
- You can monitor activity on various talk groups using Hoseline at https://hose.brandmeister.network/ . You can narrow it down by selecting “Canada” or “Americas Region” instead of “Everything”. A red box outline indicates transmission occurring, clicking on a box lets you listen to the conversation.
- You can check on what activity is occurring on DMR using the Brandmeister “Last Heard” page at https://brandmeister.network/?page=lh . Entering 302 in the search will reduce shown stations to mostly Canadian ones.

To get on DMR, you first need to request a Radio ID from https://www.radioid.net/ . This is a 7 digit number which in most cases will start with 302 in Canada. You only need one RadioID no mater how many DMR devices you have. A 2 digit suffix (called ESSID) from 01 to 99 is added to your RadioID so that each device has a unique number. For example I have a DMR hotspot, a DVPi and DroidStar on my cellphone. All 3 use my RadioID but with a different 2 digit suffix added at the end. The VE3RAG repeater DVPi is 302692505 for example.

When applying for a RadioID you will need to send them a scan of your amateur radio license.

To get on the Brandmeister Network, you will need to register at https://brandmeister.network/ .

The Brandmeister Canada webpage is found at https://wiki.brandmeister.network/index.php/Canada

My DVPi transceiver using a Pi 3B+ with 3.5 inch touch display and small JBL amplified speaker.

DVPi update – Feb 2026

There has been a major change since I wrote my article “DMR to Analog-FM Repeater Interface”. The program dvswitch needed for DVPi has been updated for new versions of Raspberry Pi OS, and the repository has been reconfigured. The four lines of code to install dvswitch into the Buster OS used with DVPi will no longer function.

I have passed the problem to the dvswitch repository maintenance team, but there is no indication that a work-around will ever happen since Buster is considered to be a very old Linux OS.

I have placed a zipped image file, made from the working copy of DVPi used on our club repeater, where it can be downloaded from Dropbox. You can use Balena Etcher to place this image onto a 16 GB SD card, insert it into your Pi, and then configure it with dvpimanager.

The zipped image is about 1.7 GB in size.

dvpi image nocall.zip https://tinyurl.com/bddxt735