

RADIO HOTSPOT BUILD PROJECT



KD3RVR
27 FEB 2025



WHY BUILD A RADIO HOTSPOT?

- Can be more cost effective than buying pre-configured if you already have a raspberry Pi to use
- May live in an HOA or assisted living with no antenna's
- Want to get into digital radio communications and work the world with your new Technicians license.

For Me:

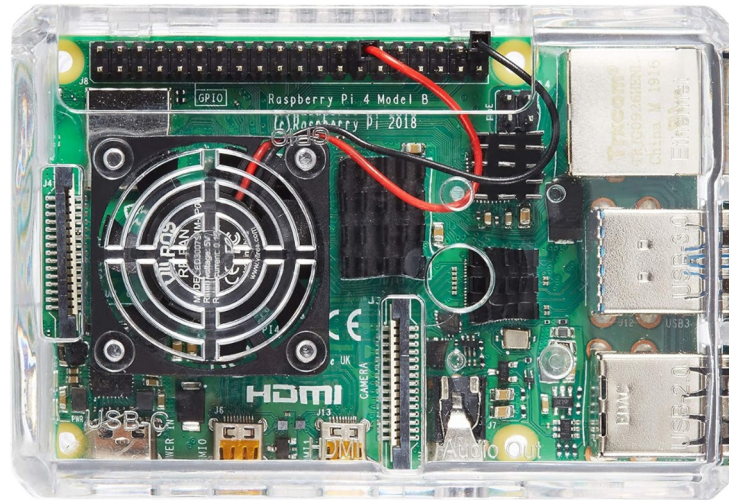
- Wanted to try WPSD Radio Hotspot Interface
- Had a couple of Raspberry Pi4b's on the shelf

CHALLENGES

- Heat generated by the Pi 4b can be high
- Case with Fan and Access to 40 Pin GPIO Header
- Connecting fan power and mounting MMDVM on same set of pins
- Finding a supported MMDVM Hat for Pi 4b

THE CASE

Vilros Raspberry Pi 4 Compatible Case with Built in Fan (Clear Transparent)

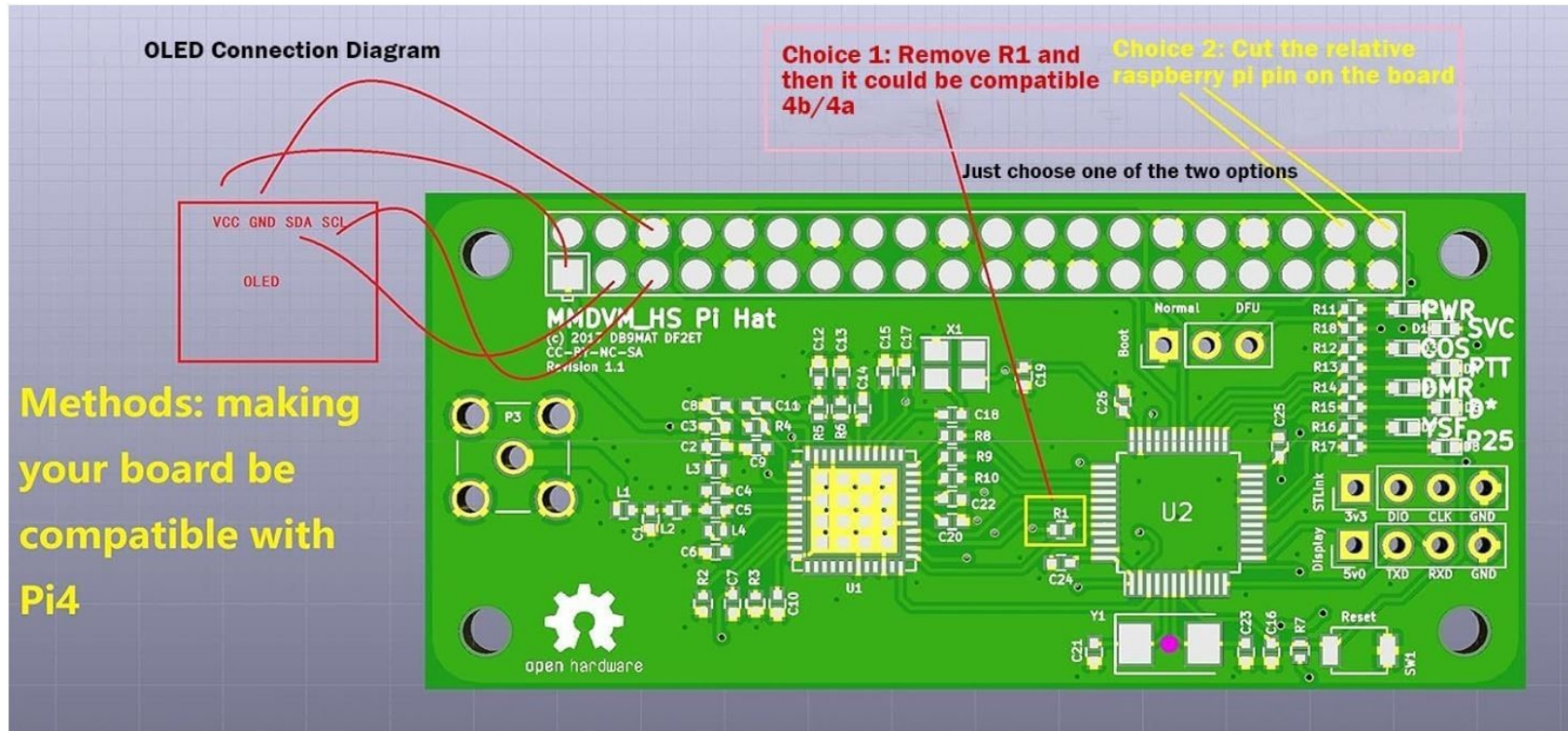


- Access to GPIO Pins
- Cooling fan

A SUPPORTED MMDVM HAT

AURSINC MMDVM Hotspot Board (V1.5.2) + Antenna Support UHF VHF Supports P25, DMR, YSF, DSTAR, NXDN, POCSAG for Raspberry Pi-Zero W, 2W, Pi 3, 3B, 3B+, 4, 5 (with OLED)

* Simplex Board with single antenna and 0.9 inch OLED



SUPPORTED MMDVM HAT DELETED PINS

3v3 Power	1	•	2	5v Power
GPIO 2 (I2C1 SDA)	3	•	4	5v Power
GPIO 3 (I2C1 SCL)	5	•	6	Ground
GPIO 4 (GPCLK0)	7	•	8	GPIO 14 (UART TX)
Ground	9	•	10	GPIO 15 (UART RX)
GPIO 17	11	•	12	GPIO 18 (CLK)
GPIO 27	13	•	14	Ground
GPIO 22	15	•	16	GPIO 23
3v3 Power	17	•	18	GPIO 24
GPIO 10 (SPI0 MOSI)	19	•	20	Ground
GPIO 9 (SPI0 MISO)	21	•	22	GPIO 25
GPIO 11 (SPI0 SCLK)	23	•	24	GPIO 8 (SPI0 CE0)
Ground	25	•	26	GPIO 7 (SPI0 CE1)
GPIO 0 (EEPROM SDA)	27	•	28	GPIO 1 (EEPROM SCL)
GPIO 5	29	•	30	Ground
GPIO 6	31	•	32	GPIO 12 (PWM0)
GPIO 13 (PWM1)	33	•	34	Ground
GPIO 19 (FS)	35	•	36	GPIO 16
GPIO 26	37	•	38	GPIO 20 (DIN)
Ground	39	•	40	GPIO 21 (DOUT)

[Browse pinouts for HATs, pHATs and add-ons »](#)

PCM - Pulse-code Modulation

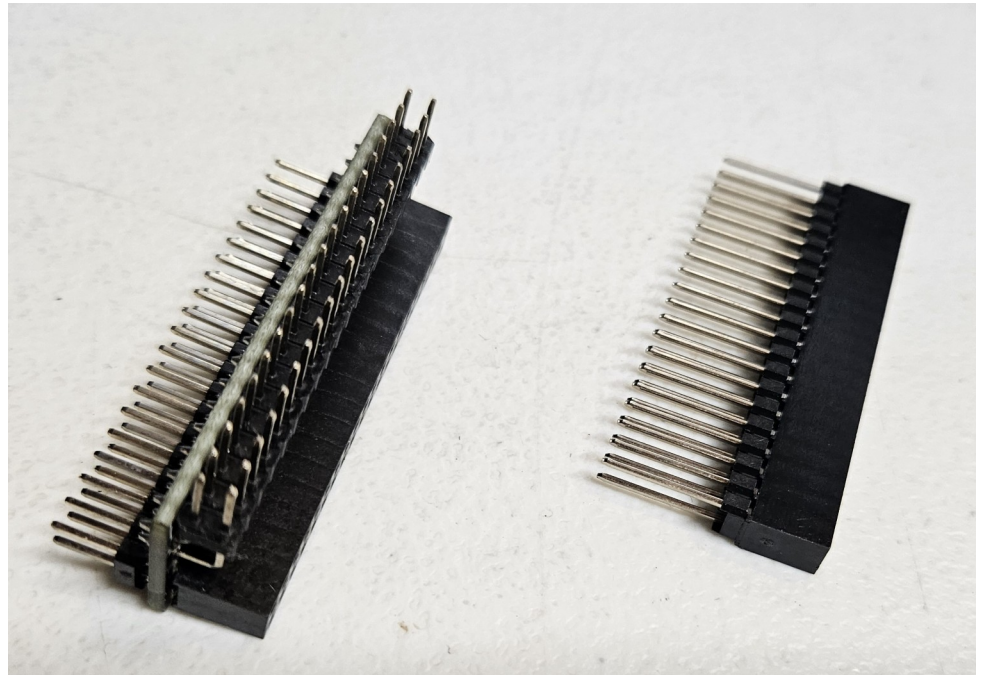
PCM (Pulse-code Modulation) is a digital representation of sampled analog. On the Raspberry Pi it's a form of digital audio output which can be understood by a DAC for high quality sound.

Details

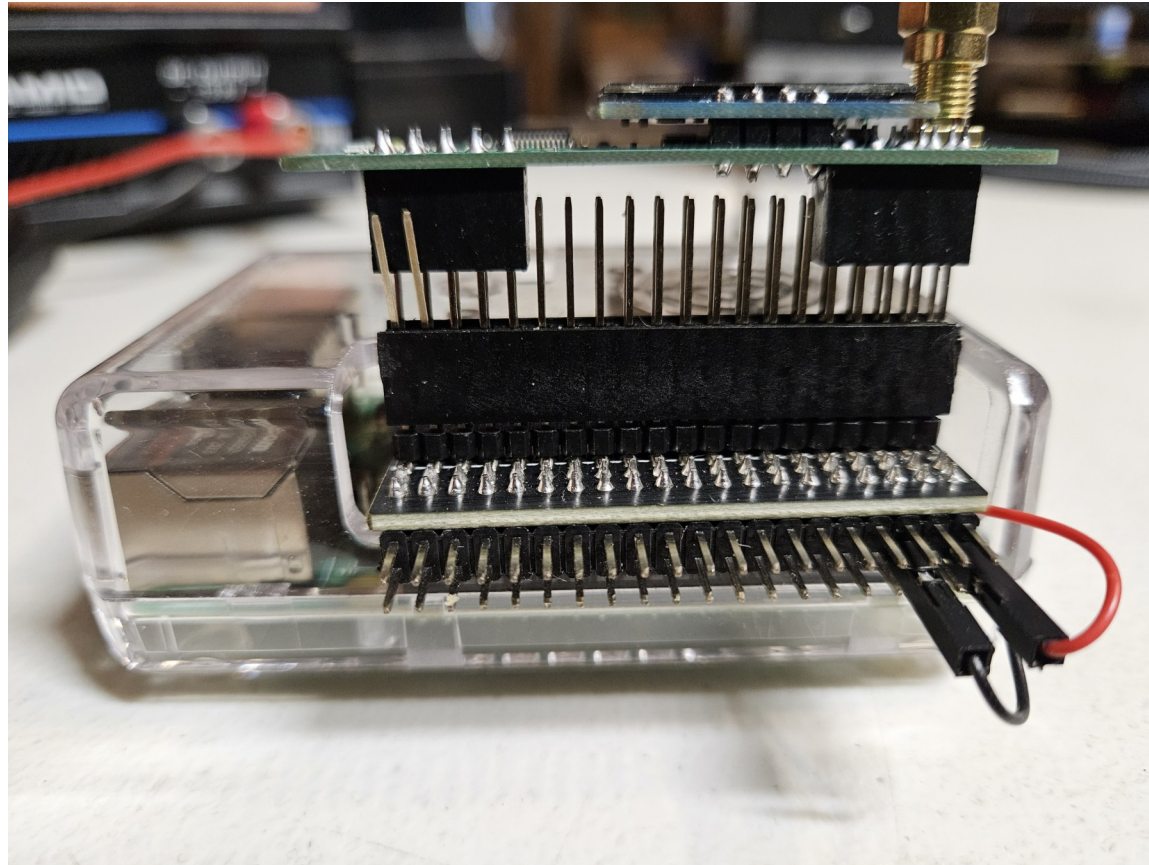
- Uses 4 GPIO pins
- DAC = Digital to Analog Converter

MOUNTING MMDVM AND POWERING FAN

- Required riser to get the MMDVM Hat high enough for fan to work
- Also needed to connect 5v power pins to MMDVM and fan simultaneously



ASSEMBLY



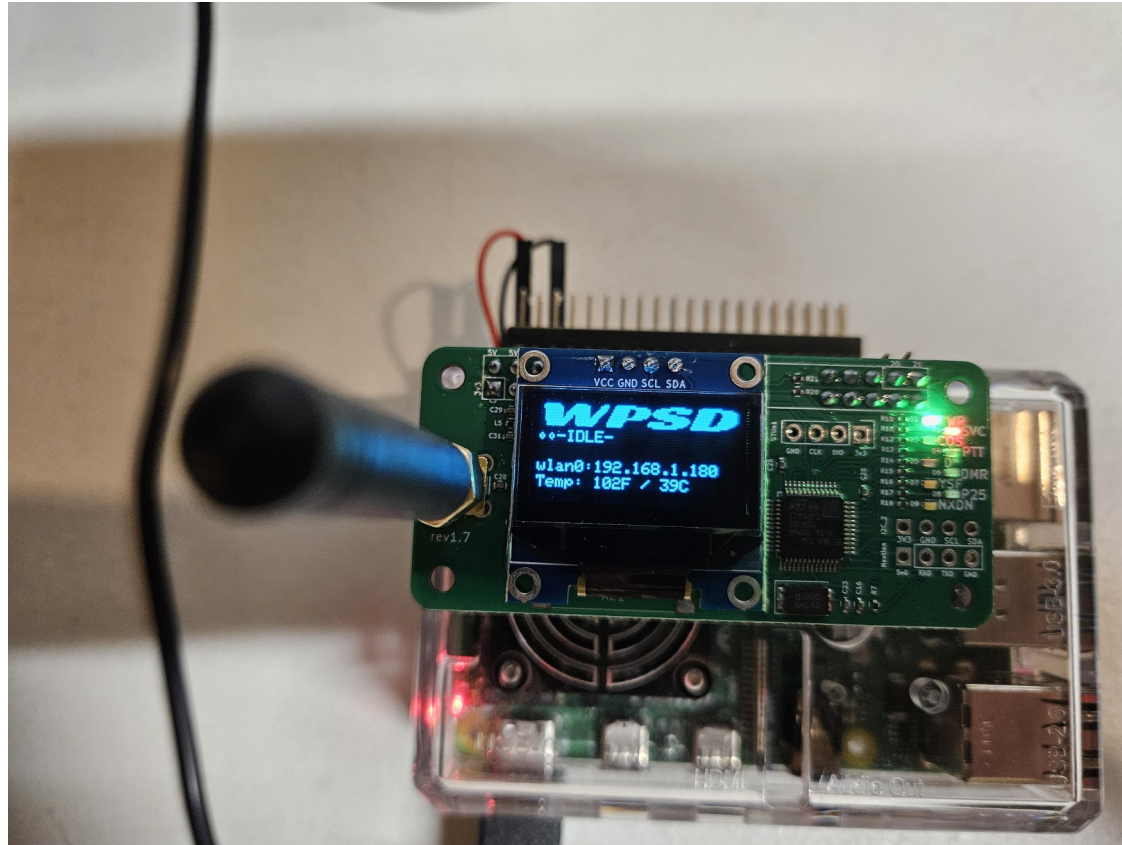
CLEARANCE

- MMDVM sits roughly $\frac{3}{4}$ inch above fan for air flow
- Ensure when seating MMDVM Hat that Hat Solder points do not contact pins
- My Typical Operating Temp between 97 & 109 deg F (Pi4 Range is -4 to 167 F)



SMALL SCREEN

- Information can be difficult to see



WHY WPSD

- User-Friendly interface over the base Pi-Star

Hostname: wpsd-hs WPSD Ver. # 1f2cbd58e2 [Update available!](#)

WPSD Dashboard for KD3RVR

08:49:59 AM, Jan 3 Profiles Live Caller Simple View SysInfo Admin

CPU Load	CPU Temp	Memory Usage	Disk Usage	Network Traffic
6%	100°F / 38°C	210.38 MB of 7.63 GB	1.89 GB of 28.73 GB	14.51 MiB ↓ / 37.59 MiB ↑

Radio Status	TX/RX Freq.	Radio Mode	Modem Port	Modem Speed	TCXO Freq.	Modem Type
TX: YSF	433.750 MHz	Simplex	/dev/ttyAMA0	115,200 bps	14.7456 MHz	MMDVM_HS_Hat-v.1.5.2

Mode Status

D-Star	DMR
YSF	P25
M17	NXDN
DMR X-Mode	YSF X-Mode
POCSAG	

Current / Last Caller Details

Callsign	Country	Name	Location	Mode	Target	Src	Dur(s)
GM7KBK		Mb6er Ernie Pratt	Aberdeen, Scotland, United Kingdom	YSF	DG-ID 0 at GB-CQ-UK	Net	TX 22+ sec

Network Status

D-Star Net	DMR Net
YSF Net	P25 Net
M17 Net	NXDN Net
DMR2NXDN	DMR2YSF
YSF2DMR	YSF2NXDN
YSF2P25	APRS Net
POCSAG Net	

Gateway Activity

Display TG Names Caller Details: Hide Kerchunks:

Time (EST)	Callsign	Country	Mode	Target	Src	Dur(s)	Loss
08:49:35 AM Jan 3	GM7KBK		YSF	DG-ID 0 at GB-CQ-UK	Net	TX	
08:48:49 AM Jan 3	KO40IB		YSF	DG-ID 0	Net	89.9	0%
08:43:38 AM Jan 3	MI0DMT		YSF	DG-ID 0	Net	0.5	0%
08:31:50 AM Jan 3	M0JGK		YSF	DG-ID 0	Net	0.3	0%
08:23:50 AM Jan 3	2W1IBN		YSF	DG-ID 0 at 2W1IBN	Net	2.7	0%
08:23:47 AM Jan 3	2E0TSY-IAN		YSF	DG-ID 0	Net	41.0	0%
08:13:13 AM Jan 3	KD3RVR-Y		YSF	DG-ID 0	Net	0.6	0%
08:11:41 AM Jan 3	KD3RVR		YSF	DG-ID 0	RF	2.5	0%
08:11:11 AM Jan 3	N5YX		YSF	DG-ID 37 at FCS00137	Net	4.2	0%

DMR Status

TS2	Enabled
DMR ID	3179491
DMR CC	1

Local RF Activity

Time (EST)	Callsign	Mode	Target	Dur(s)	BER	RSSI
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Vs PI-STAR DASHBOARD

Hostname: pi-star Pi-Star:4.1.8 / Dashboard: 20240307

Pi-Star Digital Voice Dashboard for KD3RVR

[Dashboard](#) | [Admin](#) | [Configuration](#)

Modes Enabled	
D-Star	DMR
M17	NXDN
P25	YSF
DMR XMode	YSF XMode
FM	POCSAG

Gateway Activity									
Time (EST)		Mode	Callsign	Target	Src	Dur(s)	Loss	BER	
15:30:01	Feb 26th	YSF	N5YX (GPS)	DG-ID 37 at FCS00137	Net	21.2	0%	0.0%	
15:29:52	Feb 26th	YSF	W6BKM (GPS)	DG-ID 0	Net	22.4	0%	0.0%	
15:28:15	Feb 26th	YSF	VA3VI (GPS)	DG-ID 37 at FCS00137	Net	10.6	0%	0.0%	
15:28:13	Feb 26th	YSF	KD3RVR (GPS)	DG-ID 0	Net	0.6	0%	0.0%	

Local RF Activity								
Time (EST)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI	

Network Status	
D-Star Net	DMR Net
M17 Net	NXDN Net
P25 Net	YSF Net
DMR2NXDN	DMR2YSF
YSF2DMR	YSF2NXDN
YSF2P25	POCSAG Net

Radio Info	
Trx	Listening YSF
Tx	433.000000 MHz
Rx	433.000000 MHz

YSF Network	
US-AMERICA-LINK	

YSF2DMR	
DMR ID	317949101
YSF2DMR Master	
BM 3104 United St..	

Pi-Star / Pi-Star Dashboard, © Andy Taylor (MW0MWZ) 2014-2025.
ircDDBGateway Dashboard by Hans-J. Barthen (DL5DI),
MMDVMDash developed by Kim Huebel (DG9VH),
Need help? [Click here for the Facebook Group](#)
or [Click here to join the Support Forum](#)
[Get your copy of Pi-Star from here.](#)

PARTS LIST & COST

Total Project Cost = \$116

* \$70 if you already have a Raspberry Pi to use.

** MMDVM on Pi Zero W for roughly same cost but won't run WPSD very well if at all. Requires Pi Zero 2W at minimum.

Case with Fan & GPIO Pins Exposed - \$10

https://www.amazon.com/Vilros-Raspberry-Compatible-Built-Transparent/dp/B07VK9CN98/ref=asc_df_B07VK9CN98?mcid=5282b0a6e633301196b25dabb9600ac0&hvocijid=8314724879716453037-B07VK9CN98-&hvexpln=73&tag=hyprod-20&linkCode=df0&hvadid=721245378154&hvpos=&hvnetw=g&hvrnd=8314724879716453037&hvppone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9006581&hvtargid=pla-2281435176858&th=1

AURSINC MMDVM Hat with 0.9 inch screen & Antenna - \$46

https://www.amazon.com/dp/B07VW819NW?ref=ppx_yo2ov_dt_b_fed_asin_title

Stacking Header Kit for 2x20 GPIO Pins - \$14

https://www.amazon.com/GeeekPi-Stacking-Female-Raspberry-Specifications/dp/B08GC18NMK/ref=sr_1_6?crid=13E5CDPSAIL66&dib=eyJ2ljojMSJ9.JSDwSRjzL_tl-AQhdTmwFUkku1AqhhHvbo2QjchQXe160nkLB59F6q0a3ZX5QWyo0iPyK0-iafli6JGerWCe5AHPFWi523Nxl-ZOUT0exbnBwVvNgXODE6firPkshsvweRs7_ezmCAADZVJYmamv-X8_ZQyAQgSne-t5R8GXQuJ7zS1zqpcrYiriBNXnTZM6yT_LIHWPXe1UPS9fRLLPOppuRHKOcWKZ_BoviLrJFm3lvvh9rsRb1er5XL3rjtCzm0GovRMhCxKWMJnOcFJ9fP0_X3knb1hFscwh1h5vhkFrC2pysOXiEm8z7iKkmXSiDwiRVhXjMSN6NclidlgNvtQ5YwFaPLoKX07b7HcCA.J_vuh3grUvdSdtK7zPqrdVPIXUorBABPhg3COWddAOU&dib_tag=se&keywords=Stacking+header+kit+for+pi+with+right+angle&qid=1736089545&s=electronics&sprefix=stacking+header+kit+for+pi+with+right+angle%2Celectronics%2C72&sr=1-6

Raspberry Pi 4b 2GB - \$46

https://vilros.com/products/raspberry-pi-4-model-b-1?variant=40809478914142¤cy=USD&utm_medium=product_sync&utm_source=google&utm_content=sag_organic&utm_campaign=sag_organic&tw_source=google&tw_adid=&tw_campaign=19684058556&gad_source=1&gclid=CjwKCAiAt4C-BhBcEiwA8Kp0CaQHvpJST_Kye_nLOaS9T7-S8LPWZF0g384Pz7tr6MadH0jSe10ghoCi-gQAvD_BwE

WPSD SOFTWARE DOWNLOAD

<https://w0chp.radio/wpsd/>

The WPSD Project

Welcome to the *official* home of the WPSD Project. WPSD is a **next-generation** digital voice software suite & distribution for amateur radio use, enjoyed by many thousands of hams around the globe. It is used for personal hotspots and repeaters alike. It supports M17, DMR, D-Star, Yaesu System Fusion (YSF/C4FM), P25, NXDN digital voice modes & POCSAG data/paging.

WPSD is available as installable disk images, and multiple platforms & devices are supported. The WPSD Project is free and open-source software (FOSS).

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- [Installing WPSD](#)
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- [Updating WPSD](#)
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- [Notes about M17 Protocol Support](#)
- [Known Issues & Incompatibilities](#)
- [How to Contribute to the WPSD Project](#)
- [Credits](#)
- [Sponsors](#)
- [Project Name & Etymology](#)

WPSD CONFIGURATION

Hostname: wpsd

WPSD Ver. # a3100691b8

WPSD Dashboard - Configuration

[Dashboard](#) [Admin](#) [Power](#) [Advanced](#) [WPSD Update](#) [Backup/Restore](#) [Factory Reset](#)

General Configuration

Hostname:	<input type="text" value="wpsd"/>	⚠ Do not add suffixes such as ".local", etc. Note: A reboot is required for this change to take effect.
Node Callsign:	<input type="text" value="KD3RVR"/>	⚠ Do not add suffixes such as "-G"
DMR/CCS7 ID:	<input type="text" value="3179491"/>	i Required for DMR Mode & DMR Cross-Modes (If you don't have one, get a DMR ID from RadioID.Net)
NXDN ID:	<input type="text"/>	i Required for NXDN Mode & NXDN Cross-Modes (If you don't have one, get an NXDN ID from RadioID.Net)
Radio Mode:	<input checked="" type="radio"/> Simplex <input type="radio"/> Duplex	? Duplex mode requires Dual-Hat/Duplex Modems
Radio Frequency:	<input type="text" value="433.750.000"/> MHz	
Radio/Modem Type:	<input type="text" value="STM32-DVM / MMDVM_HS - Raspberry Pi Hat (GPIO)"/>	
Modem Port:	<input type="text" value="/dev/ttyAMA0"/>	i Typically there is no need to manually change/set this; for advanced settings/usage.
Modem Baud Rate:	<input type="text" value="115200"/>	
System Time Zone:	<input type="text" value="America/New_York"/>	Time Format: <input type="radio"/> 24 Hour <input checked="" type="radio"/> 12 Hour
Dashboard Language:	<input type="text" value="english_us"/>	
Update Notifier:	<input type="radio"/> Disabled <input checked="" type="radio"/> Enabled	Enables / Disables automatic dashboard software update notifications. When enabled, software update availability is displayed in the dashboard header.

Node Location & Info Settings

Latitude:	<input type="text" value="40.28388"/>	degrees (positive value for North, negative for South)
Longitude:	<input type="text" value="-76.65472"/>	degrees (positive value for East, negative for West)
i Hint: You can use this tool to try and calculate your location coordinates.		

WPSD CONFIGURATION

i Hint: You can use this tool to try and calculate your location coordinates.

Town:

Country:

URL:

Auto Manual

i Auto vs. Manual: Auto simply creates a URL to your QRZ.com callsign page. Manual allows you to specify your own custom URL/site.

APRS Gateway: APRS Host Pool:

Publish APRS Data for Mode(s):

DMR YSF DGD NXDN M17 ircDDB (D-Star)

(Note: Radio/MMDVM Mode must be enabled to select APRS mode publishing.)

Select APRS Symbol: Preview:

i APRSGateway will use the location information (Lat./Lon.) you have entered above. However, if you have a GPS device connected and have enabled GPSd (below), it will use the GPS device location information.

GPSd: **i** Enabling this option, allows an externally-connected GPS device to send your location information to APRS, vs. the location information (Lat./Lon.) you have entered above. This functionality requires that you also enable APRS Gateway (above).

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Radio/MMDVMHost Modem Configuration

Main Radio Modes

D-Star Mode:	<input type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>	
YSF Mode:	<input checked="" type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>	
M17 Mode:	<input type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>	
DMR Mode:	<input type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>	Primary DMR Network: <input type="text" value="Brandmeister"/>
P25 Mode:	<input type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>	
NXDN Mode:	<input type="checkbox"/>	RF Hangtime: <input type="text" value="20"/>	Net Hangtime: <input type="text" value="20"/>	
POCSAG Mode:	<input type="checkbox"/>	POCSAG Mode Hangtime: <input type="text" value="5"/>		

WPSD CONFIGURATION

Radio Cross-Modes

YSF2DMR:

YSF2NXDN:

YSF2P25:

DMR2YSF:

Note: DMR Mode must be enabled & applied first.

DMR2NXDN:

Note: DMR Mode must be enabled & applied first.

MMDVMHost/Modem Display Configuration

MMDVM Display Type:

OLED Type 3 (0.96" screen) ▼

Port: /dev/ttyAMA0 ▼

Nextion Display Settings:

Layout Type: G4KLX ▼

OLED Display Options:

Display Always Active: (Displays data even while modem is idle)

Enabled Disabled

Scroll Display: (Note: OLED Type-3 [0.96"] displays only)

Enabled Disabled

Rotate Display: (Rotates display orientation 180 deg.)

Enabled Disabled

Invert Display: (Inverts display background/foreground)

Enabled Disabled

Yaesu System Fusion Configuration

Main YSF Settings

YSF Startup Host:

YSF00814 - XLX814 - XLXreflector ▼

UPPERCASE Hostfiles:

FCS Network:

WiresX Passthrough:

Enable DGIidGateway:

Note: DGIidGateway cannot be enabled in conjunction with YSF2DMR/YSF2NXDN/YSF2P25 modes

WPSD CONFIGURATION

Wireless Configuration

Configured Connections

Connection Name	Delete Connection
Pinnacle-Ridge-Main	Delete

Wireless Information and Statistics

Interface Information	Wireless Information
Interface Name : wlan0 Interface Status : Interface is active IP Address : 192.168.1.180 Subnet Mask : 255.255.255.0 Mac Address : dc:a6:32:ec:00:24	Connected To : Pinnacle-Ridge-Main AP Mac Address : 3c:bd:c5:fd:5a:6d Bitrate : 72.2 MBit/s Signal Level : -43 dBm
Interface Statistics	Transmit Power : 31 dBm
Received Packets : 29374 Received Bytes : 10955789 (10.4 MiB) Transferred Packets : 42190 Transferred Bytes : 43001299 (41.0 MiB)	Link Quality : 96 % Channel Info : 2.4GHz Ch6 (2.437 GHz) WiFi Country : US

Add Connections

Action:

Select Country:

DEMONSTRATION

- MMDVM Screen Video
- QSO with England – Note Distance on Radio
- QSO CA to UK

WPSD Dashboard for KD3RVR

04:08:40 PM, Feb 27

Profiles Live Caller Simple View SysInfo Admin

Radio Status	TX/RX Freq.	Radio Mode	Modem Port	Modem Speed	TCXO Freq.	Modem Type
TX: YSF	433.750 MHz	Simplex	/dev/ttyAMA0	115,200 bps	14.7456 MHz	MMDVM_HS_Hat-v.1.5.2

Mode Status

D-Star	DMR
YSF	P25
M17	NXDN
DMR X-Mode	YSF X-Mode
POCSAG	

Current / Last Caller Details

Callsign	Country	Name	Location	Mode	Target	Src	Dur(s)
KM6MM		Michael Mitchell	United States	YSF	DG-ID 0 at GB-CQ-UK	Net	TX 1+ sec

Gateway Activity

Display TG Names Caller Details: Hide Kerchunks:

Time (EST)	Callsign	Country	Mode	Target	Src	Dur(s)	Loss
04:08:38 PM Feb 27	KM6MM		YSF	DG-ID 0 at GB-CQ-UK	Net	TX	
04:08:35 PM Feb 27	G80TZ		YSF	DG-ID 0	Net	9.2	0%
04:06:15 PM Feb 27	G4TKO		YSF	DG-ID 0	Net	0.8	0%
04:04:11 PM Feb 27	M7GZW		YSF	DG-ID 0	Net	0.2	0%
04:03:50 PM Feb 27	KD3RVR		YSF	DG-ID 0	RF	42.3	0%
03:45:30 PM Feb 27	HB9CEY		YSF	DG-ID 0	Net	0.5	0%
03:38:10 PM Feb 27	M7LDM		YSF	DG-ID 0	Net	0.4	0%
03:37:16 PM Feb 27	IU7SEL		YSF	DG-ID 0	Net	1.2	0%
03:30:09 PM Feb 27	KD3RVR-Y		YSF	DG-ID 0	Net	0.6	0%
03:00:42 PM Feb 27	KD3AAY		YSF	DG-ID 0	Net	2.2	0%
03:00:30 PM Feb 27	N5YX		YSF	DG-ID 37 at FCS00137	Net	4.0	0%
02:59:06 PM Feb 27	KJ5CAO		YSF	DG-ID 127	Net	0.3	0%
02:44:42 PM Feb 27	2E0SGG		YSF	DG-ID 0	Net	3.2	0%
02:26:14 PM Feb 27	KD3RVR		YSF	DG-ID 0	Net	3.3	0%

Network Status

D-Star Net	DMR Net
YSF Net	P25 Net
M17 Net	NXDN Net
DMR2NXDN	DMR2YSF
YSF2DMR	YSF2NXDN
YSF2P25	APRS Net
POCSAG Net	

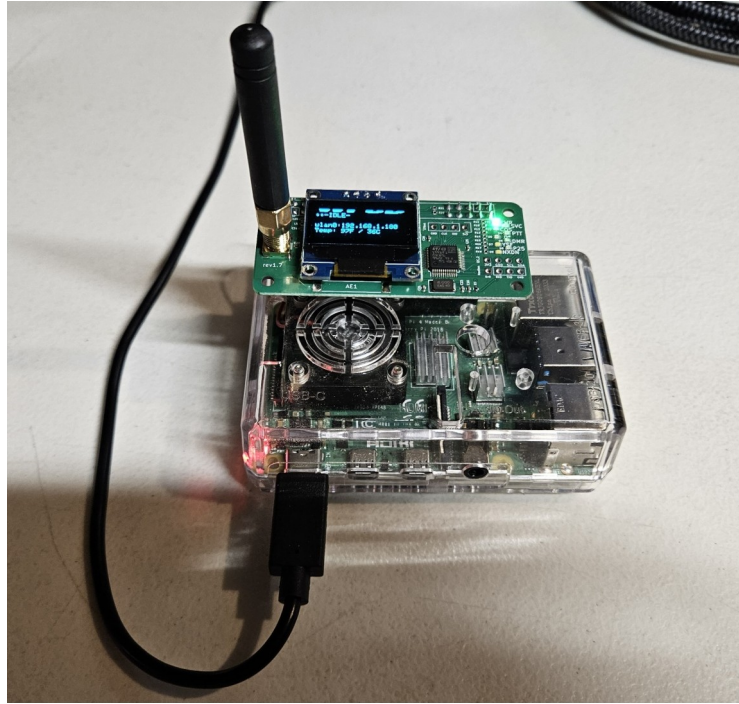
YSF Status [Linked]

GB-CQ-UK (YSF2003)

YSF2DMR

DMR ID	317949102
YSF2DMR	BM 2001 Europe

“YOU AIN’T A BEAUTY, BUT HEY, YOU’RE ALRIGHT”



KD3RVR
27 FEB 2025

Questions?

