MMDVM-Pi rev. 1.0 board

The MMDVM-Pi hardware radio interface is part of the Multi-Mode Digital Voice Modem open source project. It combines the power of an ARM processor and analog radio interface to create a modem to handle all amateur digital voice modes.

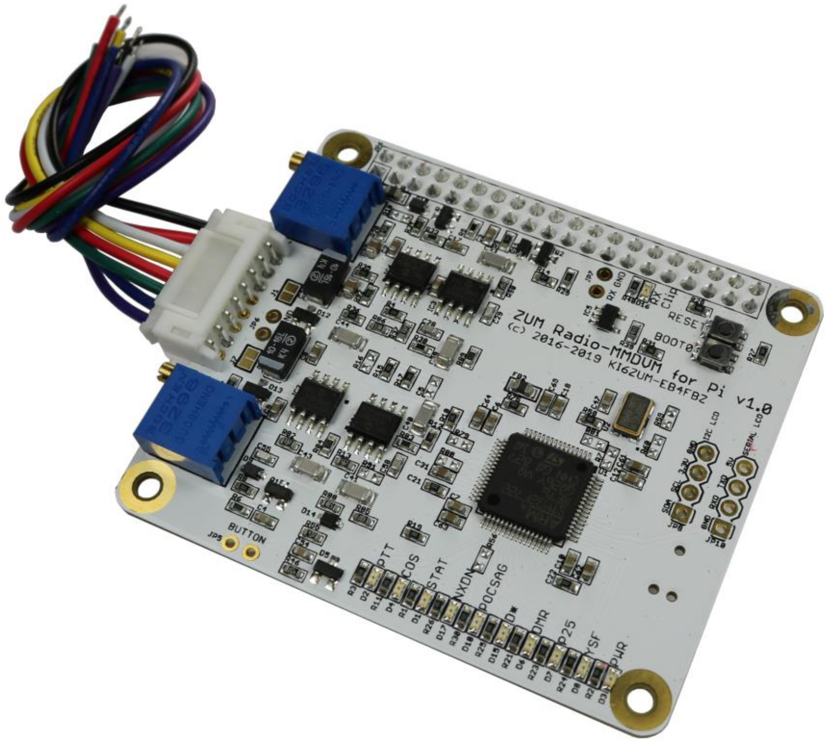


Table of Contents

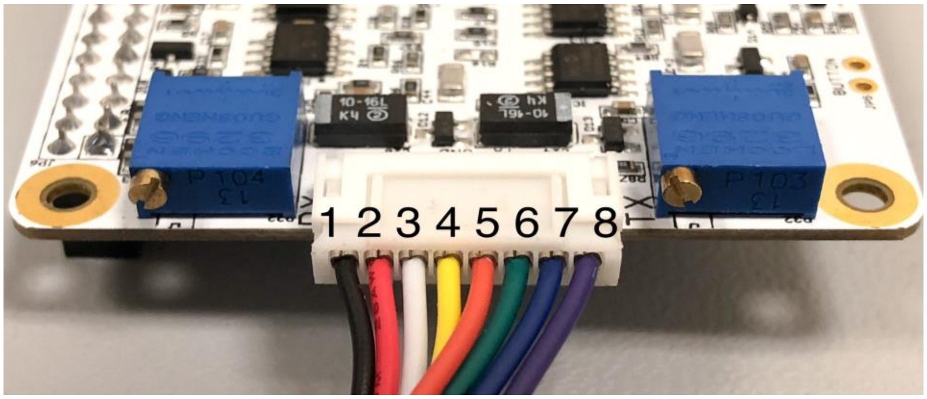
Specifications

The MMDVM-Pi board is designed for repeater and high power hotspot applications – connects to user supplied Raspberry Pi board and radio(s)

- Utilizes a high performance 32bit ARM processor (STM32F722) running at 180Mhz (Room for future upgrades)
- Fifth generation analog filter design that provides an extremely low BER compared to previous generations
- 2 Multi-turn pots for fine RX and TX adjustments
- Onboard LEDs to show status and modes (PTT, COS, Power, D-Star, DMR, P25, Fusion, NXDN and POCSAG)
- Onboard LED to show receive signal level clipping
- Connection for OLED and Nextion LCD screens
- 8 pin JST Connector with pigtail wires
- Open source MMDVM firmware preloaded and easily upgraded by software

Wiring connections

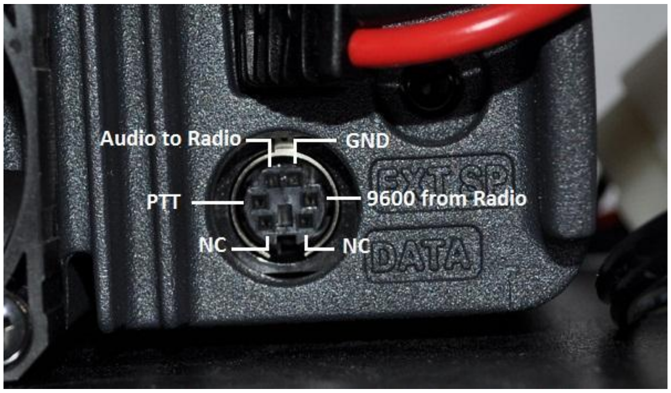
Here is a picture of the 8 pin header with cable showing wire colors:



Here is a table of the pin numbers, names and wire colors:

Pin number	Signal name	Description	Wire color
1	CTRL	Control (output)	Black
2	COS/STAT1	Carrier sense (input)	Red
3	RX audio	Receive audio from radio (input)	White
4	Ground	Signal ground	Yellow
5	Ground	Signal ground	Orange
6	TX audio	Transmit audio to radio (output)	Green
7	PTT	Push to talk (enable transmit) (input)	Blue
8	RSSI	Received signal strength indicator (input)	Purple

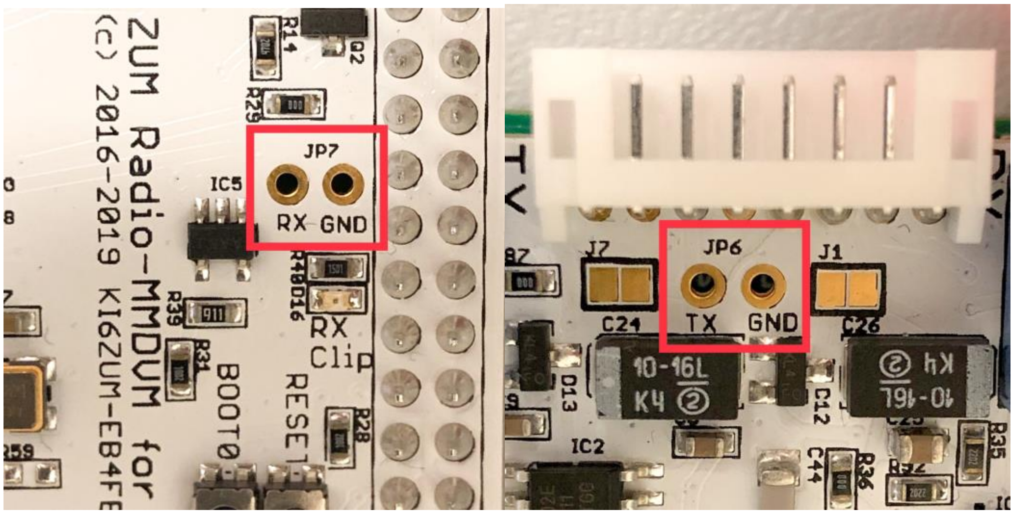
Here's an example radio's (FT-7900) pin connection via the mini DIN 6 connector on the rear of the radio:



Pin number	Signal name	Wire color	Mini DIN 6 connector
3	RX audio	White	9600 from radio
4	Signal ground	Yellow	GND
6	TX audio	Green	Audio to radio
7	PTT	Blue	PTT

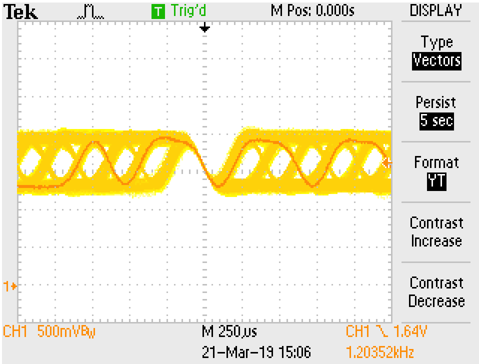
Adjusting signal levels (hardware)

Here is a picture of the test points on the PCB that can be used to look at the RX and TX signal levels on an oscilloscope. The signal on JP7 is the RX signal audio on the ADC input pin of the STM32 chip. JP6 has the TX signal audio on the pin going to the radio.



Here are some signal images captured on an Oscilloscope

RX-(JP7)



Tek Trig'd M Pos: 0.000s DISPLAY

Type Vectors

Persist 5 sec

Format YT

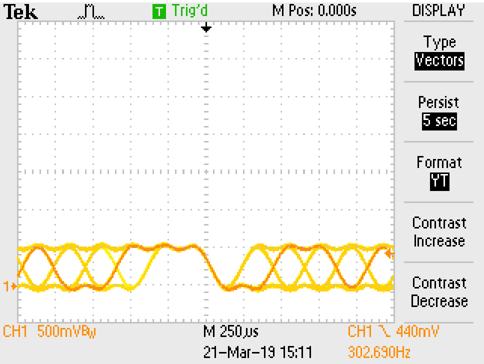
Contrast Increase

Contrast Decrease

CH1 500mV B_W M 250μs CH1 ↘ 1.64V

21-Mar-19 15:06 1.20352kHz

TX-(JP6)



Tek Trig'd M Pos: 0.000s DISPLAY

Type Vectors

Persist 5 sec

Format YT

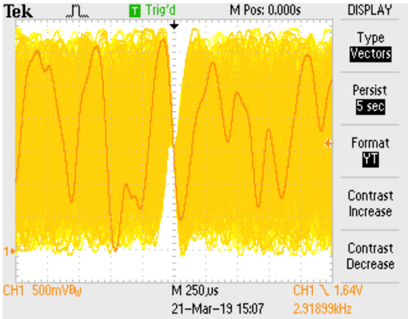
Contrast Increase

Contrast Decrease

CH1 500mV B_W M 250μs CH1 ↘ 440mV

21-Mar-19 15:11 302.690Hz

Noise without signal (JP7)



Tek Trig'd M Pos: 0.000s DISPLAY

Type Vectors

Persist 5 sec

Format YT

Contrast Increase

Contrast Decrease

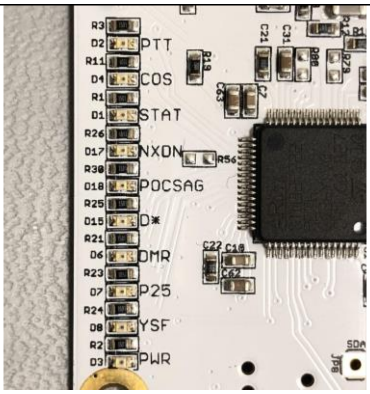
CH1 500mV B_W M 250μs CH1 ↘ 1.64V

21-Mar-19 15:07 2.91839kHz

JUMPER DESCRIPTION TABLE

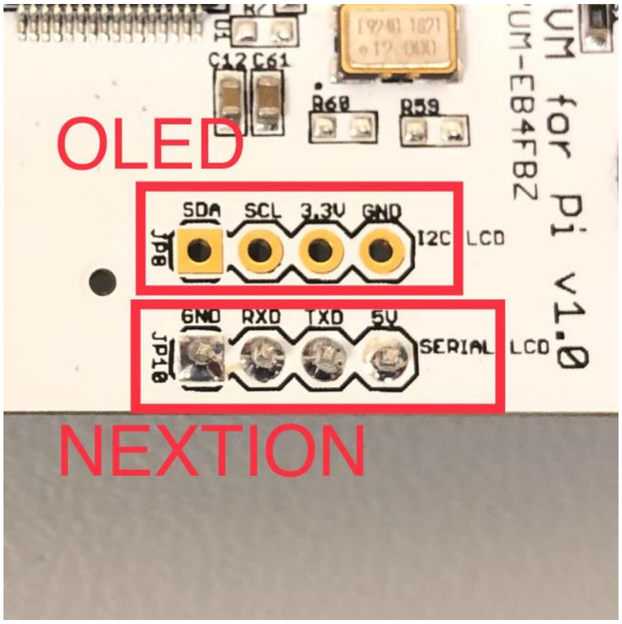
Bypass Pad	ON	OFF	Description
J1	X		Disable DC blocking capacitor on Radio RX end
J1		X	Enable DC blocking capacitor on Radio RX end
J2	X		Bypass 10K variable resistor
J2		X	Enable 10K variable resistor
J7	X		Disable DC blocking capacitor on Radio TX end
J7		X	Enable DC blocking capacitor on Radio TX end

LED Description Table

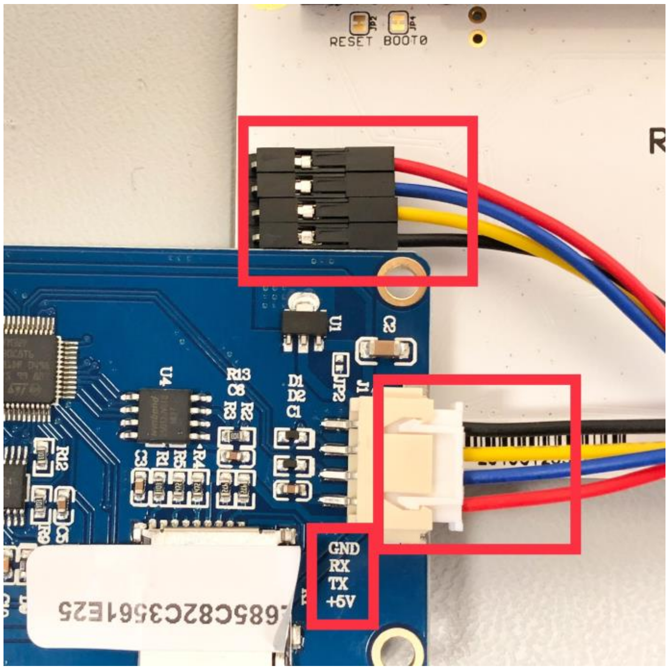
	LED NAME	Description
	PTT	Board is transmitting
	COS	Board is receiving
	STAT	Status
	NXDN	NXDN Enabled
	POCSAG	POCSAG Enabled
	D*	D-Star Enabled
	DMR	DMR Enabled
	P25	P25 Enabled
	YSF	YSF Enabled
	PWR	Board is receiving power

Adding an external display

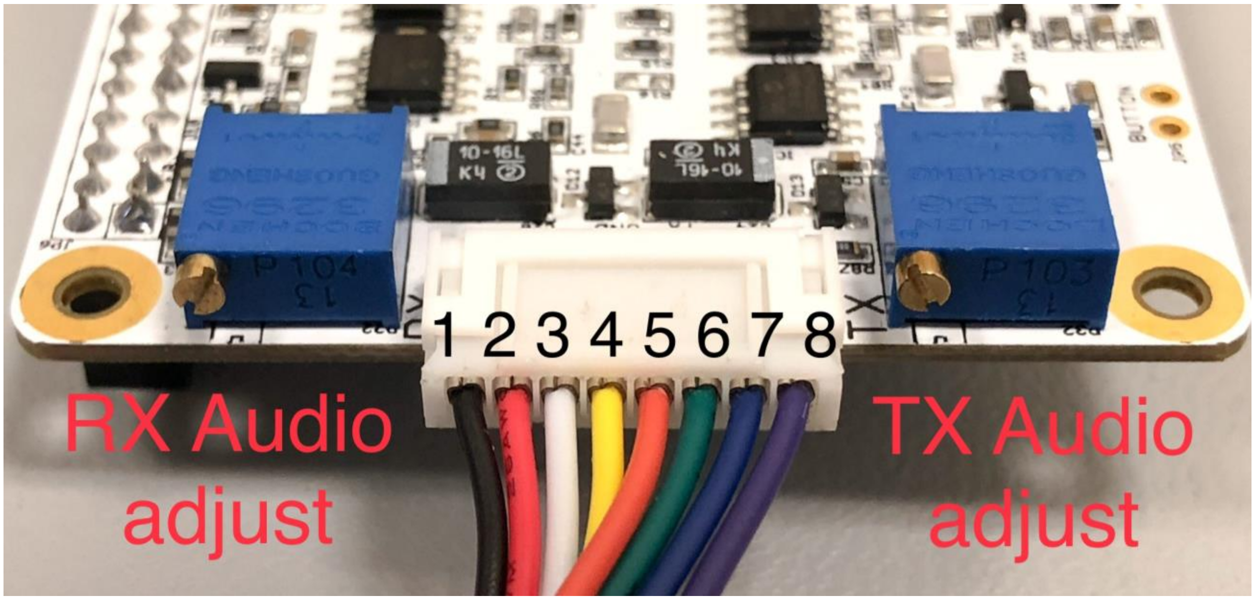
JP8 is where you can solder a header for connecting an OLED display. JP10 is where you can solder a header for connecting a NEXTION display.



For connecting a NEXTION display, make sure that each colored wire matches the connections shown in the image below.



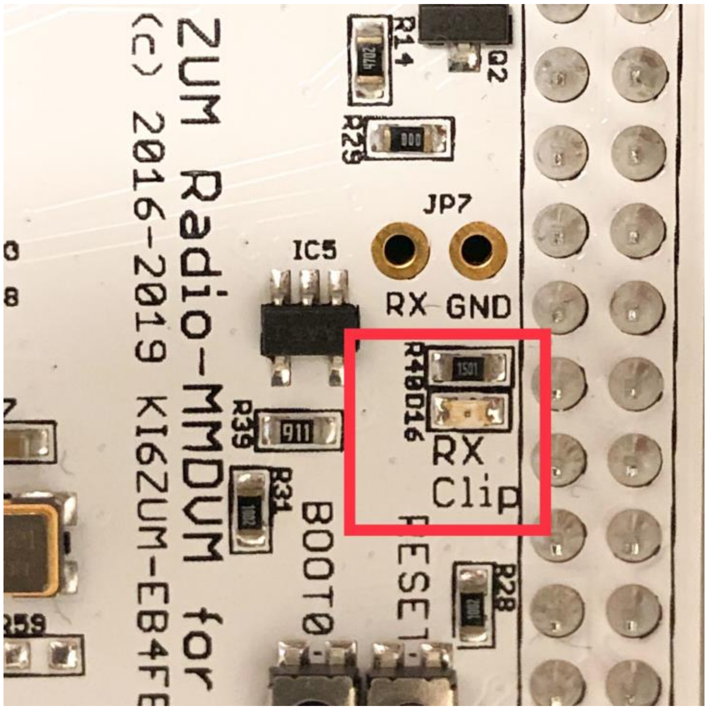
Here is a picture of the two trim pots used to adjust the signal levels of the RX and TX audio



Turning the RX audio trim pot counter-clockwise will increase the signal level, while turning the trim pot clockwise will decrease the signal level.

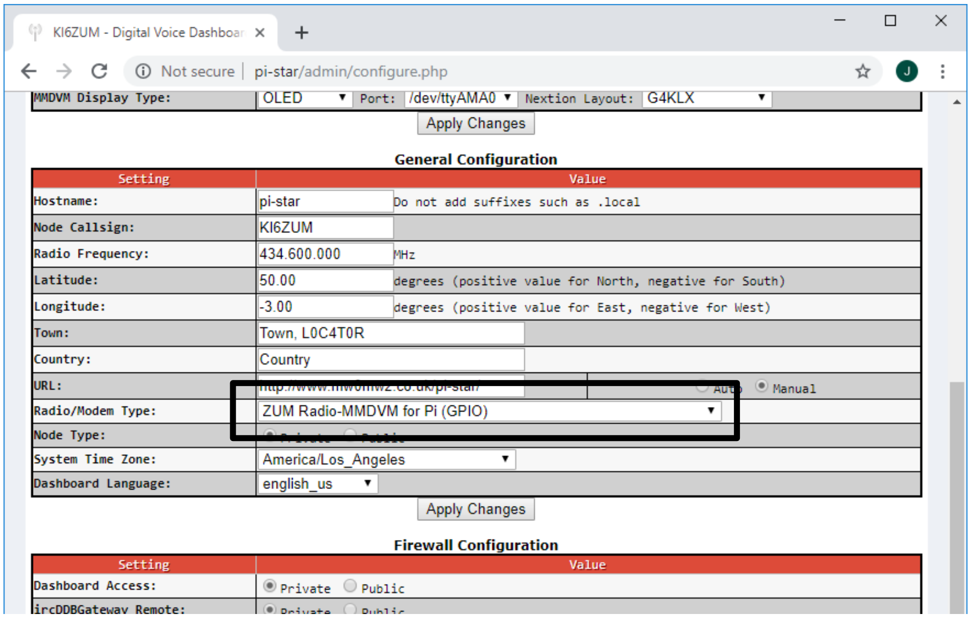
Turning the TX audio trim pot counter clockwise will decrease the signal level, while turning the trim pot clockwise will increase the signal level.

When there is no audio stream coming in, adjust the RX pot until the RX CLIP LED barely lights up.



Configuring Pi-Star (including adjusting signal levels via software)

From the “Configuration” menu, set the Radio/Modem type to “ZUM Radio-MMDVM for Pi (GPIO) and then select Apply Changes.



KI6ZUM - Digital Voice Dashboar
Not secure | pi-star/admin/configure.php

MMDVM Display Type: OLED Port: /dev/ttyAMA0 Nextion Layout: G4KLX

Apply Changes

General Configuration

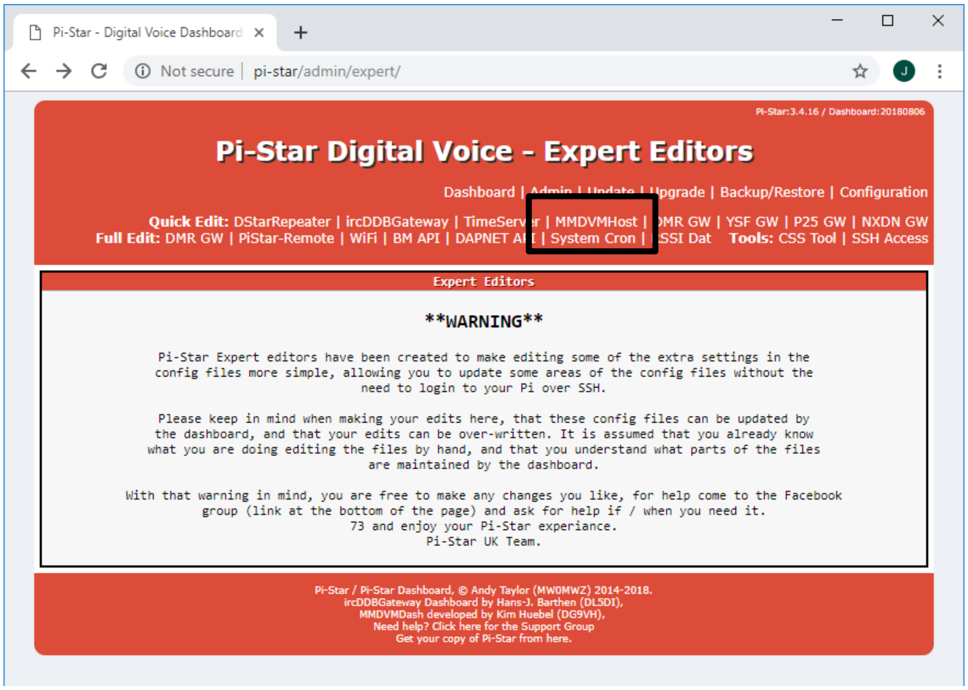
Setting	Value
Hostname:	pi-star Do not add suffixes such as .local
Node Callsign:	KI6ZUM
Radio Frequency:	434.600.000 MHz
Latitude:	50.00 degrees (positive value for North, negative for South)
Longitude:	-3.00 degrees (positive value for East, negative for West)
Town:	Town, L0C4T0R
Country:	Country
URL:	http://www.mw0mwz.co.uk/pi-star/ ○ Auto ● Manual
Radio/Modem Type:	ZUM Radio-MMDVM for Pi (GPIO)
Node Type:	● Private ○ Public
System Time Zone:	America/Los_Angeles
Dashboard Language:	english_us

Apply Changes

Firewall Configuration

Setting	Value
Dashboard Access:	● Private ○ Public
ircDDBGateway Remote:	● Private ○ Public

Next select the “expert” menu, and then select “MMDVMHost”



Pi-Star - Digital Voice Dashboard
Not secure | pi-star/admin/expert/

Pi-Star:3.4.16 / Dashboard:20180806

Pi-Star Digital Voice - Expert Editors

Dashboard | Admin | Update | Upgrade | Backup/Restore | Configuration

Quick Edit: DStarRepeater | ircDDBGateway | TimeServer | MMDVMHost | DMR GW | YSF GW | P25 GW | NXDN GW
Full Edit: DMR GW | PiStar-Remote | WiFi | BM API | DAPNET API | System Cron | RSSI Dat **Tools:** CSS Tool | SSH Access

Expert Editors

****WARNING****

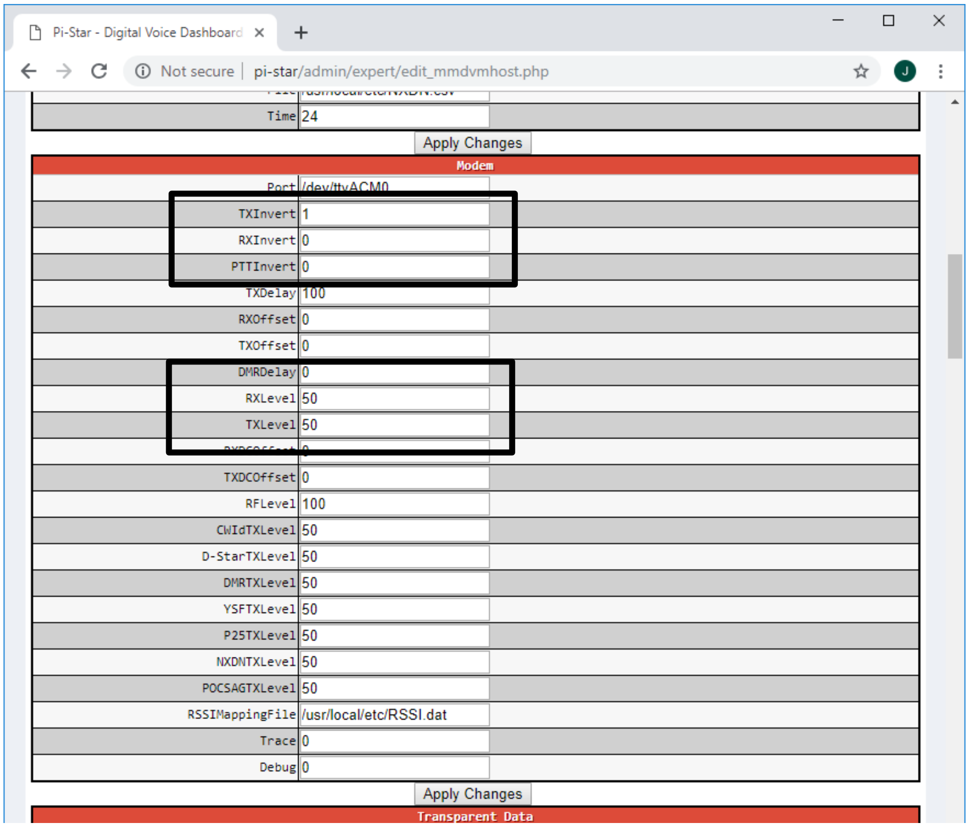
Pi-Star Expert editors have been created to make editing some of the extra settings in the config files more simple, allowing you to update some areas of the config files without the need to login to your Pi over SSH.

Please keep in mind when making your edits here, that these config files can be updated by the dashboard, and that your edits can be over-written. It is assumed that you already know what you are doing editing the files by hand, and that you understand what parts of the files are maintained by the dashboard.

With that warning in mind, you are free to make any changes you like, for help come to the Facebook group (link at the bottom of the page) and ask for help if / when you need it.
73 and enjoy your Pi-Star experiance.
Pi-Star UK Team.

Pi-Star / Pi-Star Dashboard, © Andy Taylor (MW0MWZ) 2014-2018.
ircDDBGateway Dashboard by Hans-J. Barthen (DL5DI),
MMDVMDash developed by Kim Huebel (DG9VH),
Need help? Click here for the Support Group
Get your copy of Pi-Star from here.

Scroll down to the “Modem” section to access the invert and level settings then select “Apply Changes”

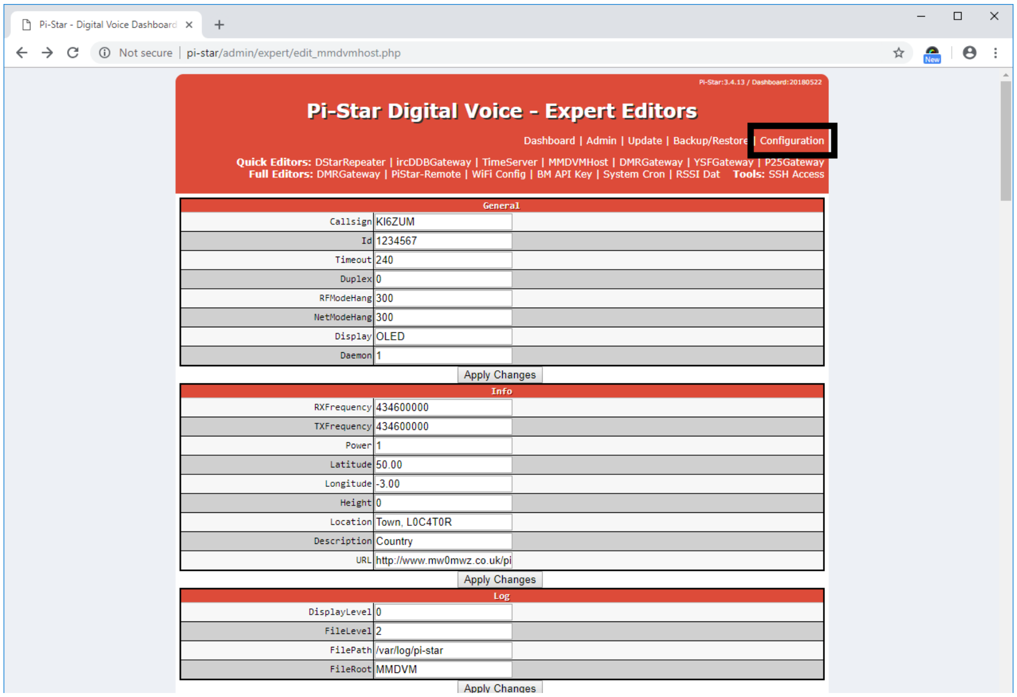

Pi-Star - Digital Voice Dashboard
Not secure
pi-star/admin/expert/edit_mmdvmhost.php
Apply Changes
Apply Changes
Transparent Data

File	/usr/local/etc/NXDN.csv
Time	24

Modem

Port	/dev/ttyACM0
TXInvert	1
RXInvert	0
PTTInvert	0
TXDelay	100
RXOffset	0
TXOffset	0
DMRDelay	0
RXLevel	50
TXLevel	50
RXDCOffset	0
TXDCOffset	0
RFLevel	100
CWIdTXLevel	50
D-StarTXLevel	50
DMRTXLevel	50
YSFTXLevel	50
P25TXLevel	50
NXDNTXLevel	50
POCSAGTXLevel	50
RSSIMappingFile	/usr/local/etc/RSSI.dat
Trace	0
Debug	0

Scroll back up to the top of the page and select “Configuration”.


Pi-Star - Digital Voice Dashboard
Not secure
pi-star/admin/expert/edit_mmdvmhost.php
Pi-Star:3.4.13 / Dashboard:20180522
Pi-Star Digital Voice - Expert Editors
Dashboard | Admin | Update | Backup/Restore | Configuration
Quick Editors: DStarRepeater | ircDDBGateway | TimeServer | MMDVMHost | DMRGateway | YSFGateway | P25Gateway
Full Editors: DMRGateway | PiStar-Remote | WiFi Config | BM API Key | System Cron | RSSI Dat Tools: SSH Access
Apply Changes
Apply Changes
Apply Changes

General

Callsign	KI6ZUM
Id	1234567
Timeout	240
Duplex	0
RFModeHang	300
NetModeHang	300
Display	OLED
Daemon	1

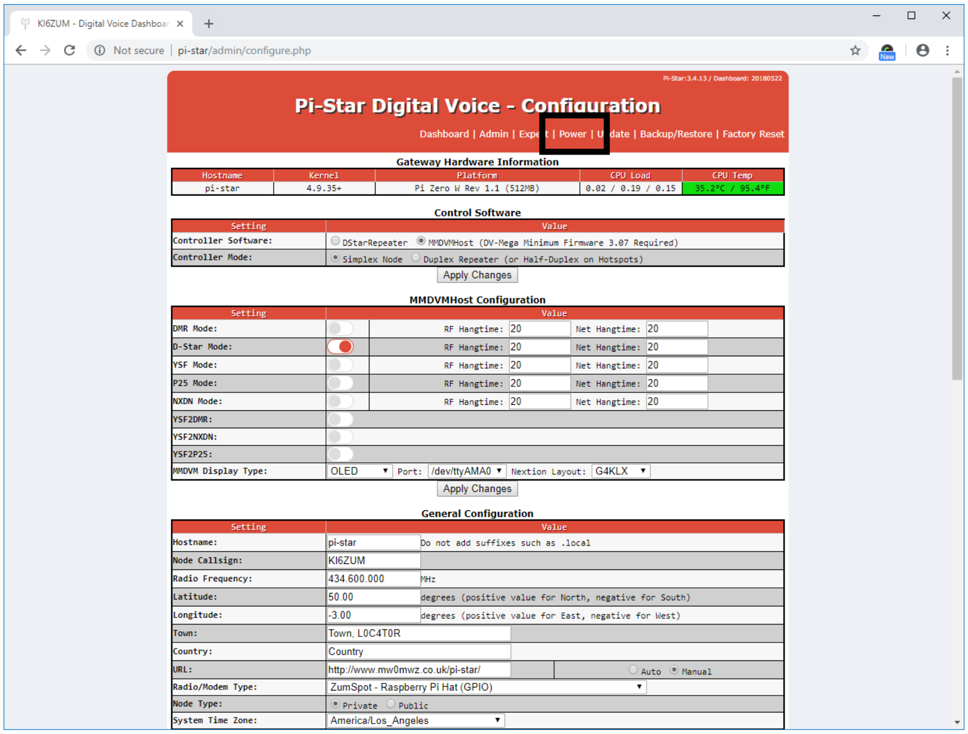
Info

RXFrequency	434600000
TXFrequency	434600000
Power	1
Latitude	50.00
Longitude	-3.00
Height	0
Location	Town, L0C4T0R
Description	Country
URL	http://www.mw0mwz.co.uk/pi

Log

DisplayLevel	0
FileLevel	2
FilePath	/var/log/pi-star
FileRoot	MMDVM

Next, select “Power”



KI6ZUM - Digital Voice Dashboar

Not secure | pi-star/admin/configure.php

Pi-Star:3.4.13 / Dashboard: 20180522

Pi-Star Digital Voice - Configuration

Dashboard | Admin | Expe t | Power | U date | Backup/Restore | Factory Reset

Gateway Hardware Information

Hostname	Kernel	Platform	CPU Load	CPU Temp
pi-star	4.9.35+	Pi Zero W Rev 1.1 (512MB)	0.02 / 0.19 / 0.15	35.2°C / 95.4°F

Control Software

Setting	Value
Controller Software:	○ DStarRepeater ● MMDVMHost (DV-Mega Minimum Firmware 3.07 Required)
Controller Mode:	● Simplex Node ○ Duplex Repeater (or Half-Duplex on Hotspots)

Apply Changes

MMDVMHost Configuration

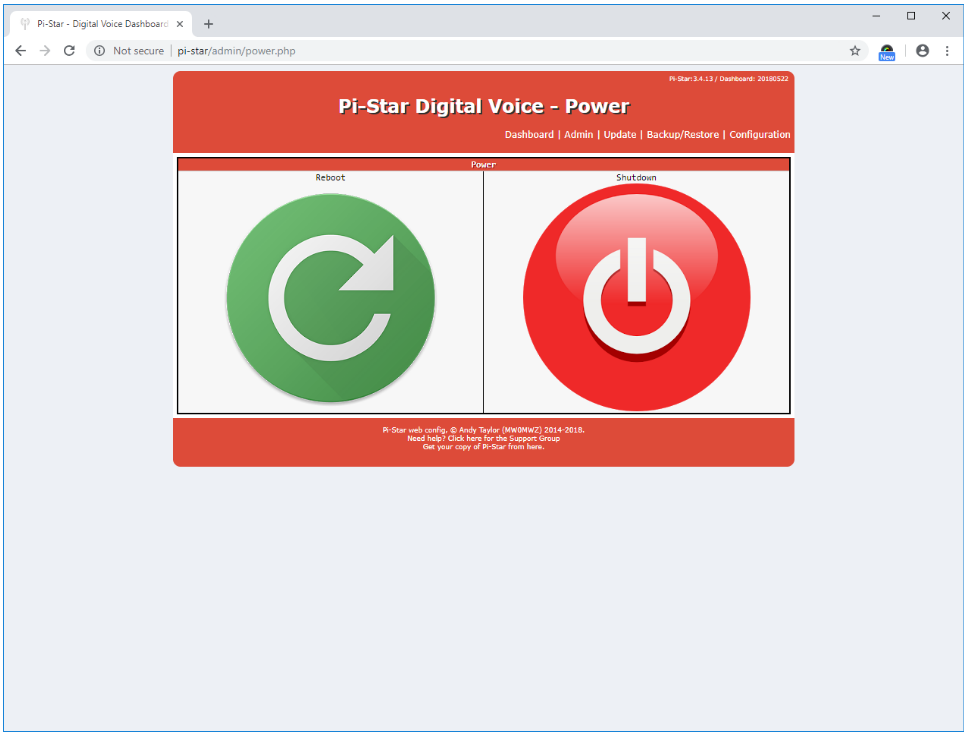
Setting	Value
DMR Mode:	○ RF Hangtime: 20 Net Hangtime: 20
D-Star Mode:	● RF Hangtime: 20 Net Hangtime: 20
YSF Mode:	○ RF Hangtime: 20 Net Hangtime: 20
P25 Mode:	○ RF Hangtime: 20 Net Hangtime: 20
NXDN Mode:	○ RF Hangtime: 20 Net Hangtime: 20
YSF2DMR:	○
YSF2NXDN:	○
YSF2P25:	○
MMDVM Display Type:	OLED ▼ Port: /dev/ttyAMA0 ▼ Nextion Layout: G4KLX ▼

Apply Changes

General Configuration

Setting	Value
Hostname:	pi-star Do not add suffixes such as .local
Node Callsign:	KI6ZUM
Radio Frequency:	434.600.000 MHz
Latitude:	50.00 degrees (positive value for North, negative for South)
Longitude:	-3.00 degrees (positive value for East, negative for West)
Town:	Town, L0C4T0R
Country:	Country
URL:	http://www.mw0mwz.co.uk/pi-star/ ○ Auto ● Manual
Radio/Modem Type:	ZumSpot - Raspberry Pi Hat (GPIO) ▼
Node Type:	● Private ○ Public
System Time Zone:	America/Los_Angeles ▼

Next, select “Reboot”



Pi-Star - Digital Voice Dashboard

Not secure | pi-star/admin/power.php

Pi-Star:3.4.13 / Dashboard: 20180522

Pi-Star Digital Voice - Power

Dashboard | Admin | Update | Backup/Restore | Configuration

Power	
Reboot	Shutdown

Pi-Star web config, © Andy Taylor (MW0MWZ) 2014-2018.
Need help? Click here for the Support Group
Get your copy of Pi-Star from here.

Building MMDVM-Pi firmware

On Windows 10

- Install bash using these instructions: bash-windows-10
  - Once the components installed on your computer, click the Restart now button to complete the task.
- Install Ubuntu Linux
  - go to the Microsoft app store - https://aka.ms/wslstore
  - Click on Ubuntu
  - Click on Get
  - after it installs, click on Launch
  - now enter a new username for linux
  - enter a password for the new linux user
  - enter the password again
- Once bash and Linux are installed, install GCC for ARM. At the bash command prompt, type in the following instructions.
  - *sudo apt-get update*
  - *sudo apt-get upgrade*
  - *sudo apt-get install gcc*
  - *sudo apt-get install make*
  - *sudo apt-get install git gcc-arm-none-eabi libstdc++-arm-none-eabi-newlib autoconf libtool pkg-config libusb-1.0-0 libusb-1.0-0-dev*
- Get the latest source code from GitHub:
  - *git clone https://github.com/g4klx/MMDVM*
  - *cd MMDVM*
  - *git submodule init*
  - *git submodule update*
- Edit Config.h. Uncomment the line: *#define MODE_LEDS*
  - If you want to connect a Nextion display, then also uncomment the line: #define SERIAL_REPEATER
- To start build run: *make pi-f722*
- Binaries will be under the *bin/* folder

On Ubuntu

- Follow the same instructions as **Windows 10** but skip the part about installing bash and Ubuntu

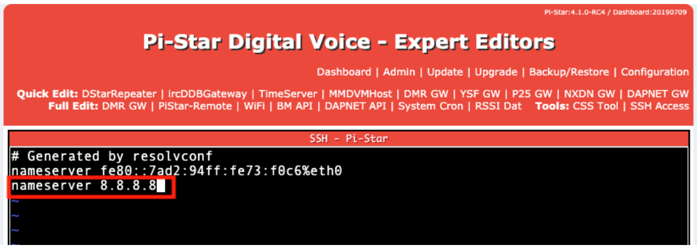
On macOS

- First install Homebrew:
    - REQUIREMENTS FOR HOMEBREW:
        - 64-bit Intel CPU
        - macOS High Sierra (10.13) or higher
    - Open the Terminal
    - Copy and paste the following line and press Enter:
      /usr/bin/ruby -e "$(curl -fsSL https://raw.githubusercontent.com/Homebrew/install/master/install)"
    - If you would like to readup on using homebrew visit https://brew.sh/
- Once Homebrew has been installed, run the following command:
    - *brew install libusb autogen automake wget pkg-config cmake openocd*
- Install the ARM GCC toolchain:
    - Run the following command: *brew tap ArmMbed/homebrew-formulae*
    - Run the following command: *brew install arm-none-eabi-gcc*
- Get the latest source code from GitHub:
    - *git clone https://github.com/g4klx/MMDVM*
    - *cd MMDVM*
    - *git submodule init*
    - *git submodule update*
- Edit Config.h. Uncomment the line: *#define MODE_LEDS*
    - If you want to connect a Nextion display, then also uncomment the line: #define SERIAL_REPEATER
- To start build run: *make pi-f722*
- Binaries will be under the *bin/* folder

On Pi-Star

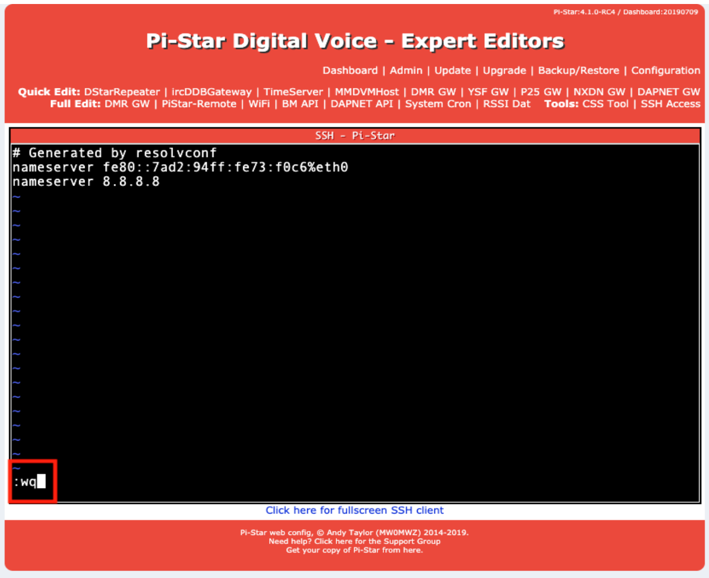
NOTE! You cannot build firmware for the MMDVM-Pi v1.0 under Pi-Star v3.4.17 or below because the compiler doesn't fully support the STM32F7 chips. You must use the latest Pi-Star Beta v4.1.0-RC4 or above.

- Turn on Raspberry Pi
- Go to *Configuration->Expert->SSH Access*
- Login to pi-star
- Run command *rpi-rw*
- Run command *git clone https://github.com/g4klx/MMDVM*
- If you get an error saying "Could not resolve host", it likely means that your network is setup for IPV6 and the Pi has not been able to acquire the IPV4 nameserver via DHCP. Try the following. Otherwise skip to the "Install the toolchain" step
    - Run command *sudo vi /etc/resolv.conf*
    - Move cursor to the end of the line that starts with "nameserver" and then press the "a" key on your keyboard in order to move the cursor over
    - Press Enter to start typing on a new line, and then type this in:
        - *nameserver 8.8.8.8*


Pi-Star:4.1.0-RC4 / Dashboard:20190709
Pi-Star Digital Voice - Expert Editors
Dashboard | Admin | Update | Upgrade | Backup/Restore | Configuration
Quick Edit: DStarRepeater | ircDDBGateway | TimeServer | MMDVMHost | DMR GW | YSF GW | P25 GW | NXDN GW | DAPNET GW
Full Edit: DMR GW | PiStar-Remote | WiFi | BM API | DAPNET API | System Cron | RSSI Dat Tools: CSS Tool | SSH Access
SSH - Pi-Star

```
# Generated by resolvconf
nameserver fe80::7ad2:94ff:fe73:f0c6%eth0
nameserver 8.8.8.8
~
~
~
```

    - Press the ESC key on your keyboard
    - Then type the following:
        - *:wq*



Pi-Star:4.1.0-RC4 / Dashboard:20190709

Pi-Star Digital Voice - Expert Editors

Dashboard | Admin | Update | Upgrade | Backup/Restore | Configuration

Quick Edit: DStarRepeater | ircDDBGateway | TimeServer | MMDVMHost | DMR GW | YSF GW | P25 GW | NXDN GW | DAPNET GW
Full Edit: DMR GW | PiStar-Remote | WiFi | BM API | DAPNET API | System Cron | RSSI Dat **Tools:** CSS Tool | SSH Access

SSH - Pi-Star

```
# Generated by resolvconf
nameserver fe80::7ad2:94ff:fe73:f0c6%eth0
nameserver 8.8.8.8
~
~
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~
~
~
~
~
~
~
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~
~
~
:wq
```
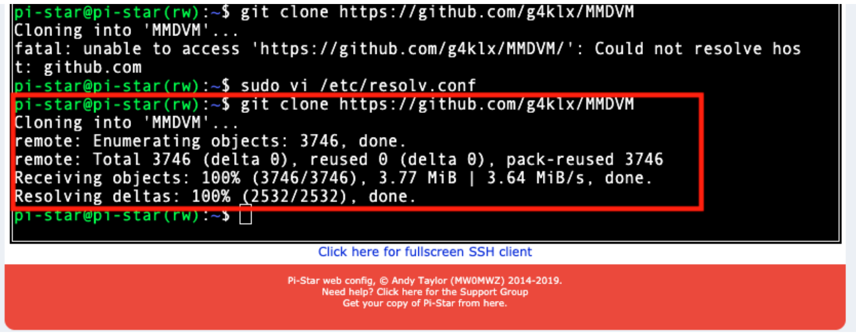

Click here for fullscreen SSH client

Pi-Star web config, © Andy Taylor (MW0MWZ) 2014-2019.
Need help? Click here for the Support Group
Get your copy of Pi-Star from here.

- Then press Enter
- You should now have exited the text editor. You can try the git clone command again and it should work now



```
pi-star@pi-star(rw):~$ git clone https://github.com/g4klx/MMDVM
Cloning into 'MMDVM'...
fatal: unable to access 'https://github.com/g4klx/MMDVM/': Could not resolve hos
t: github.com
pi-star@pi-star(rw):~$ sudo vi /etc/resolv.conf
pi-star@pi-star(rw):~$ git clone https://github.com/g4klx/MMDVM
Cloning into 'MMDVM'...
remote: Enumerating objects: 3746, done.
remote: Total 3746 (delta 0), reused 0 (delta 0), pack-reused 3746
Receiving objects: 100% (3746/3746), 3.77 MiB | 3.64 MiB/s, done.
Resolving deltas: 100% (2532/2532), done.
pi-star@pi-star(rw):~$
```

Click here for fullscreen SSH client

Pi-Star web config, © Andy Taylor (MW0MWZ) 2014-2019.
Need help? Click here for the Support Group
Get your copy of Pi-Star from here.

- Install the toolchain and necessary packages by running the following command:
  - *sudo apt-get install git gcc-arm-none-eabi gdb-arm-none-eabi libstdc++-arm-none-eabi-newlib autoconf libtool pkg-config libusb-1.0-0 libusb-1.0-0-dev*
- Go into source folder: *cd MMDVM*
- Get submodules by running the following commands:
  - *git submodule init*
  - *git submodule update*
- Edit Config.h. Uncomment the line:

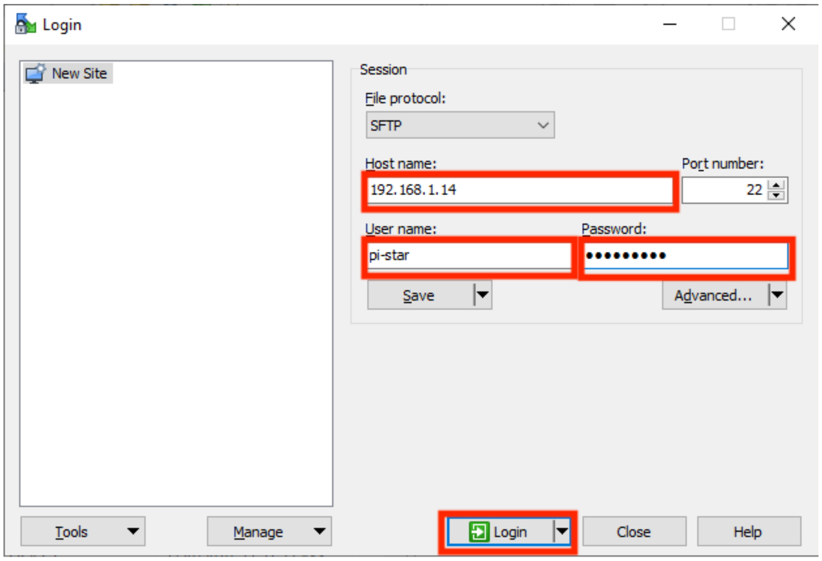
  #define MODE_LEDS
  - If you want to connect a Nextion display, then also uncomment the line:

    #define SERIAL_REPEATER
- To start build run: *make pi-f722*
- Binaries will be under the *bin/* folder

Flashing MMDVM-Pi

Windows

- Turn on Raspberry Pi
- Open your preferred web browser (Chrome) and go to http://pi-star.local
  - NOTE: If http://pi-star.local does not work for you then you will have to connect to Pi-Star via the IP Address (Ex. http://192.168.1.14). In order to find out what is the IP address of your Raspberry Pi, see the section titled **Find IP Address**
- Go to *Configuration->Expert->SSH Access*
- Login to pi-star
- Run command *rpi-rw*
- Transfer binary from the previous section **Building Firmware** to the Raspberry Pi. Should be under *bin -> mmdvm_f7.bin*.
  - You can use an app like WinSCP to transfer the file. You can download it from https://winscp.net/eng/index.php
  - Open WinSCP
  - Under "Host name" you can enter http://pi-star.local or if in your case you access Pi-Star via the IP address then that is what would go there.
  - Enter username which is *pi-star*
  - Enter password. If you haven't changed it then it should be: *raspberry*
  - Press the "Login" button in order to connect to the Raspberry Pi



File protocol: SFTP

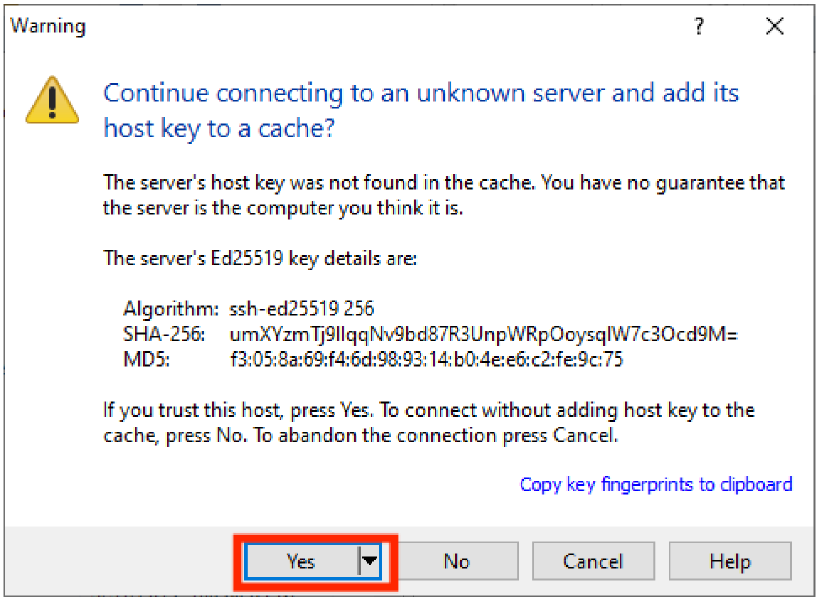
Host name: 192.168.1.14

Port number: 22

User name: pi-star

Password: •••••••••

- If a window pops up asking if you want to continue connecting, select “Yes”



Continue connecting to an unknown server and add its host key to a cache?

The server's host key was not found in the cache. You have no guarantee that the server is the computer you think it is.

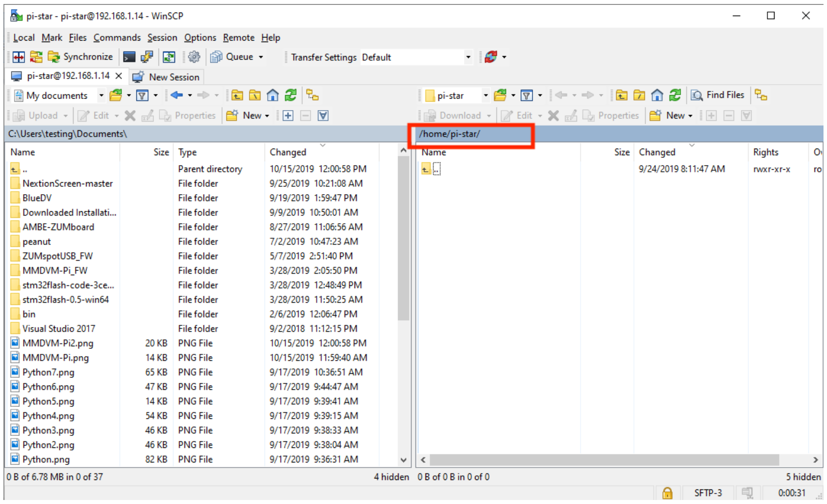
The server's Ed25519 key details are:

Algorithm: ssh-ed25519 256
SHA-256: umXYzmTj9llqqNv9bd87R3UnpWRpOoysqlW7c3Ocd9M=
MD5: f3:05:8a:69:f4:6d:98:93:14:b0:4e:e6:c2:fe:9c:75

If you trust this host, press Yes. To connect without adding host key to the cache, press No. To abandon the connection press Cancel.

Copy key fingerprints to clipboard

- Once logged in you should see a screen similar to this



C:\Users\testing\Documents\

Name	Size	Type	Changed
..		Parent directory	10/15/2019 12:00:58 PM
NextionScreen-master		File folder	9/25/2019 10:21:08 AM
BlueDV		File folder	9/19/2019 1:59:47 PM
Downloaded Installati...		File folder	9/9/2019 10:50:01 AM
AMBE-ZUMboard		File folder	8/27/2019 11:06:56 AM
peanut		File folder	7/2/2019 10:47:23 AM
ZUMspotUSB_FW		File folder	5/7/2019 2:51:40 PM
MMDVM-Pi_FW		File folder	3/28/2019 2:05:50 PM
stm32flash-code-3ce...		File folder	3/28/2019 12:48:49 PM
stm32flash-0.5-win64		File folder	3/28/2019 11:50:25 AM
bin		File folder	2/6/2019 12:06:47 PM
Visual Studio 2017		File folder	9/2/2018 11:12:15 PM
MMDVM-Pi2.png	20 KB	PNG File	10/15/2019 12:00:58 PM
MMDVM-Pi.png	14 KB	PNG File	10/15/2019 11:59:40 AM
Python7.png	65 KB	PNG File	9/17/2019 10:36:51 AM
Python6.png	47 KB	PNG File	9/17/2019 9:44:47 AM
Python5.png	14 KB	PNG File	9/17/2019 9:39:41 AM
Python4.png	54 KB	PNG File	9/17/2019 9:39:15 AM
Python3.png	46 KB	PNG File	9/17/2019 9:38:33 AM
Python2.png	46 KB	PNG File	9/17/2019 9:38:04 AM
Python.png	82 KB	PNG File	9/17/2019 9:36:31 AM

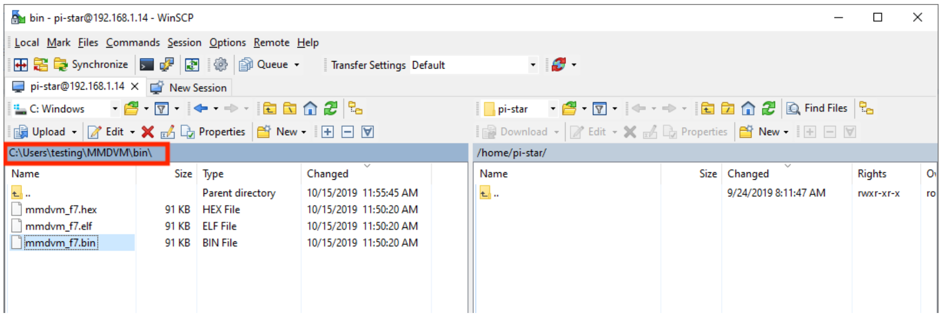
0 B of 6.78 MB in 0 of 37 4 hidden

/home/pi-star/

Name	Size	Changed	Rights	O
..		9/24/2019 8:11:47 AM	rwxr-xr-x	ro

0 B of 0 B in 0 of 0 5 hidden

- Navigate to the folder where you built the firmware



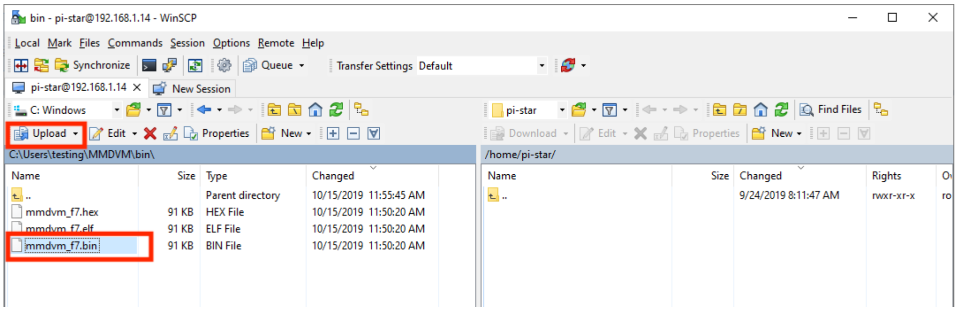
C:\Users\testing\MMDVM\bin\

Name	Size	Type	Changed
..		Parent directory	10/15/2019 11:55:45 AM
mmdvm_f7.hex	91 KB	HEX File	10/15/2019 11:50:20 AM
mmdvm_f7.elf	91 KB	ELF File	10/15/2019 11:50:20 AM
mmdvm_f7.bin	91 KB	BIN File	10/15/2019 11:50:20 AM

/home/pi-star/

Name	Size	Changed	Rights	O
..		9/24/2019 8:11:47 AM	rwxr-xr-x	ro

- Transfer the file named mmdvm_f7.bin by pressing the "Upload" button



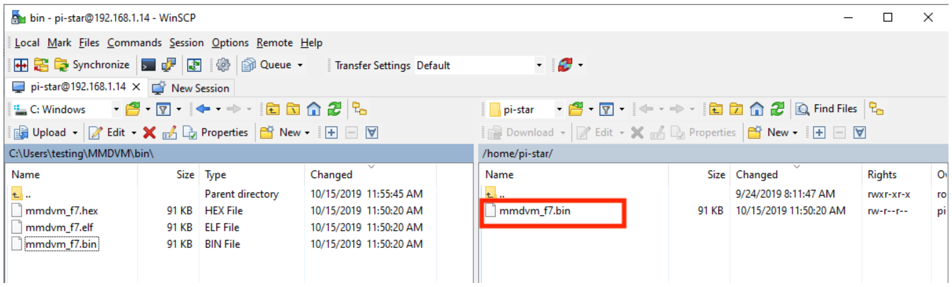
C:\Users\testing\MMDVM\bin\

Name	Size	Type	Changed
..		Parent directory	10/15/2019 11:55:45 AM
mmdvm_f7.hex	91 KB	HEX File	10/15/2019 11:50:20 AM
mmdvm_f7.elf	91 KB	ELF File	10/15/2019 11:50:20 AM
mmdvm_f7.bin	91 KB	BIN File	10/15/2019 11:50:20 AM

/home/pi-star/

Name	Size	Changed	Rights	Ow
..		9/24/2019 8:11:47 AM	rwxr-xr-x	ro

- File has now been transferred



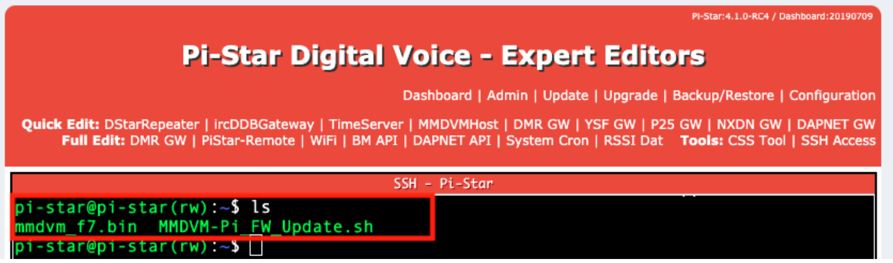
C:\Users\testing\MMDVM\bin\

Name	Size	Type	Changed
..		Parent directory	10/15/2019 11:55:45 AM
mmdvm_f7.hex	91 KB	HEX File	10/15/2019 11:50:20 AM
mmdvm_f7.elf	91 KB	ELF File	10/15/2019 11:50:20 AM
mmdvm_f7.bin	91 KB	BIN File	10/15/2019 11:50:20 AM

/home/pi-star/

Name	Size	Changed	Rights	Ow
..		9/24/2019 8:11:47 AM	rwxr-xr-x	ro
mmdvm_f7.bin	91 KB	10/15/2019 11:50:20 AM	rw-r--r--	pi

- Run the following command:
  - *cd ~/*
- Download the flashing script by running the following command:
  curl -OL https://raw.githubusercontent.com/veraabad/MMDVM-Pi_Update/master/MMDVM-Pi_FW_Update.sh
- Run the following command:
  - *ls*
- If you see something like the following image then continue to the "Copy and paste" step, otherwise start back at the beginning of the **Windows** section


Pi-Star:4.1.0-RC4 / Dashboard:20190709
Pi-Star Digital Voice - Expert Editors
Dashboard | Admin | Update | Upgrade | Backup/Restore | Configuration
Quick Edit: DStarRepeater | ircDDBGateway | TimeServer | MMDVMHost | DMR GW | YSF GW | P25 GW | NXDN GW | DAPNET GW
Full Edit: DMR GW | PiStar-Remote | WiFi | BM API | DAPNET API | System Cron | RSSI Dat Tools: CSS Tool | SSH Access
SSH - Pi-Star

```
pi-star@pi-star(rw):~$ ls
mmdvm_f7.bin  MMDVM-Pi_FW_Update.sh
pi-star@pi-star(rw):~$ 
```

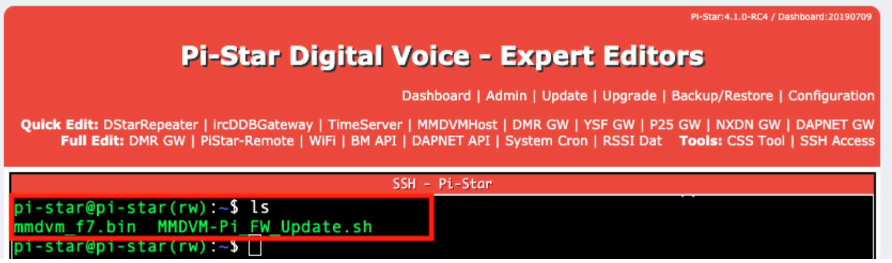
- Copy and paste the following command and then press Enter:
  - *sudo chmod +x MMDVM-Pi_FW_Update.sh*
- Run command ./*MMDVM-Pi_FW_Update.sh*
- The install script will take care of flashing the MMDVM-Pi

Linux and macOS

- Turn on Raspberry Pi
- Open your preferred web browser (Chrome) and go to http://pi-star.local
  - NOTE: If http://pi-star.local does not work for you then you will have to connect to Pi-Star via the IP Address (Ex. http://192.168.1.14). In order to find out what is the IP address of your Raspberry Pi, see the section titled **Find IP Address**
- Go to *Configuration->Expert->SSH Access*
- Login to pi-star
- Run command *rpi-rw*
- Transfer binary from the previous section **Building Firmware** to the Raspberry Pi. Should be under *bin -> mmdvm_f7.bin*.
  - On macOS and Linux, you can use the Terminal by running the following commands:
    - Go to MMDVM folder: *cd MMDVM*
    - *scp bin/mmdvm_f7.bin pi-star@**pi_star_ip_address**:~/*
      - You will need to change ***pi_star_ip_address*** to the IP address off the Raspberry Pi.
- From the Pi-Star SSH window, run the following command:
  - *cd ~/*
- Download the flashing script by running the following command:

curl -OL https://raw.githubusercontent.com/veraabad/MMDVM-Pi_Update/master/MMDVM-Pi_FW_Update.sh

- Run the following command:
  - *ls*
- If you see something like the following image then continue to the "Copy and paste" step, otherwise start back at the beginning of the **Linux and macOS** section



Pi-Star:4.1.0-RC4 / Dashboard:20190709

Pi-Star Digital Voice - Expert Editors

Dashboard | Admin | Update | Upgrade | Backup/Restore | Configuration
Quick Edit: DStarRepeater | ircDDBGateway | TimeServer | MMDVMHost | DMR GW | YSF GW | P25 GW | NXDN GW | DAPNET GW
Full Edit: DMR GW | PiStar-Remote | WiFi | BM API | DAPNET API | System Cron | RSSI Dat Tools: CSS Tool | SSH Access
SSH - Pi-Star

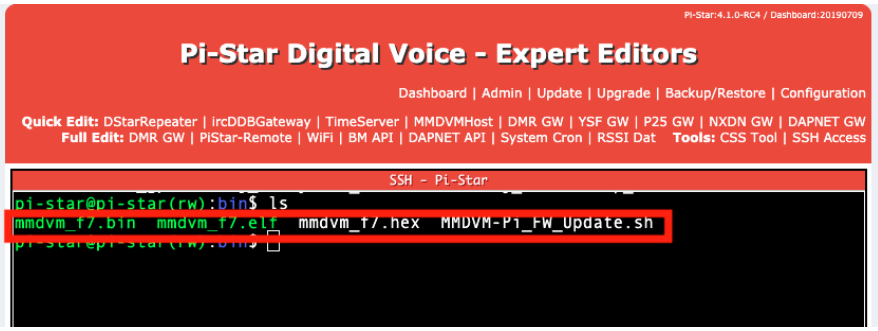
```
pi-star@pi-star(rw):~$ ls
mmdvm_f7.bin   MMDVM-Pi_FW_Update.sh
pi-star@pi-star(rw):~$ 
```

- Copy and paste the following command and then press Enter:
  - *sudo chmod +x MMDVM-Pi_FW_Update.sh*
- Run command *./MMDVM-Pi_FW_Update.sh*
- The install script will take care of flashing the MMDVM-Pi

Pi-Star

If you built under the Pi-Star beta follow these instructions

- Turn on Raspberry Pi
- Open your preferred web browser (Chrome). On an iOS/OSX device go to web address http://pi-star.local and for other operating systems go to http://pi-star
    - NOTE: If http://pi-star.local / http://pi-star addresses do not work for you then you will have to connect to Pi-Star via the IP Address (Ex. http://192.168.1.14). In order to find out what is the IP address of your Raspberry Pi, see the section titled **Find IP Address**
- Go to *Configuration->Expert->SSH Access*
- Login to pi-star
- Run command *rpi-rw*
- Go to the folder where the binary is located. This binary file was created from following the previous section **Building Firmware.**
    - Binary file should be under *MMDVM -> bin -> mmdvm_f7.bin*
- From the Pi-Star SSH window, run the following command:
    - *cd MMDVM/bin/*
- Download the flashing script by running the following command:
  curl -OL https://raw.githubusercontent.com/veraabad/MMDVM-Pi_Update/master/MMDVM-Pi_FW_Update.sh
- Run the following command:
    - *ls*
- If you can see both the mmdvm_f7.bin file and the MMDVM-Pi_FW_Update.sh file then continue to the "Copy and paste" step, otherwise start back at the beginning of the **Pi-Star** section


Pi-Star:4.1.0-RC4 / Dashboard:20190709
Pi-Star Digital Voice - Expert Editors
Dashboard | Admin | Update | Upgrade | Backup/Restore | Configuration
Quick Edit: DStarRepeater | ircDDBGateway | TimeServer | MMDVMHost | DMR GW | YSF GW | P25 GW | NXDN GW | DAPNET GW
Full Edit: DMR GW | PiStar-Remote | WiFi | BM API | DAPNET API | System Cron | RSSI Dat Tools: CSS Tool | SSH Access
SSH - Pi-Star

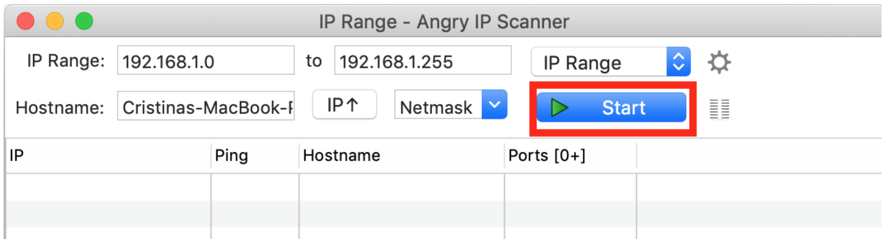
```
pi-star@pi-star(rw):bin$ ls
mmdvm_f7.bin  mmdvm_f7.elf  mmdvm_f7.hex  MMDVM-Pi_FW_Update.sh
pi-star@pi-star(rw):bin$
```

- Copy and paste the following command and then press Enter:
    - *sudo chmod +x MMDVM-Pi_FW_Update.sh*
- Run command *./MMDVM-Pi_FW_Update.sh*
- The install script will take care of flashing the MMDVM-Pi

Find IP Address

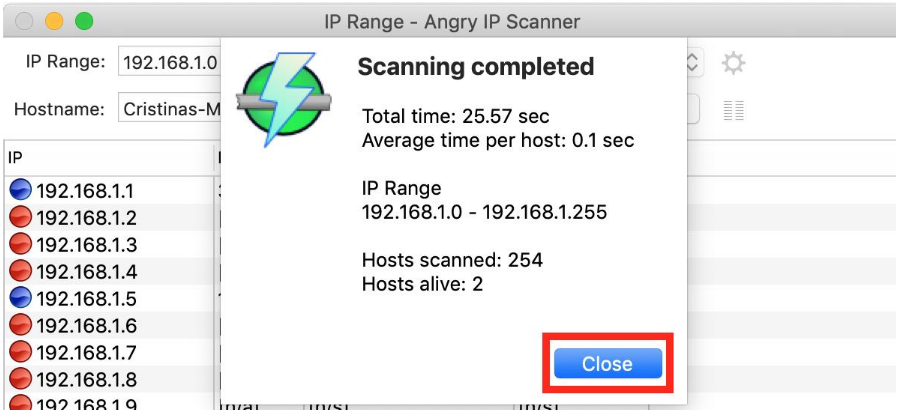
If you are having issues connecting to Pi-Star via http://pi-star.local / http://pi-star then you will have to connect via the IP address of the Raspberry Pi. Follow these instructions in order to find out what is the IP address of the Raspberry Pi.

- Download Angry IP Scanner from https://angryip.org/download. It's available for Windows, macOS and Linux
- Follow the instructions from the installer
- Once installed open the application and click on the "Start" button



- It will take a few seconds to find out what is connected to your network

- Once it is done a pop-up window will show you how many hosts are connected to your network. Click "Close" to dismiss it.



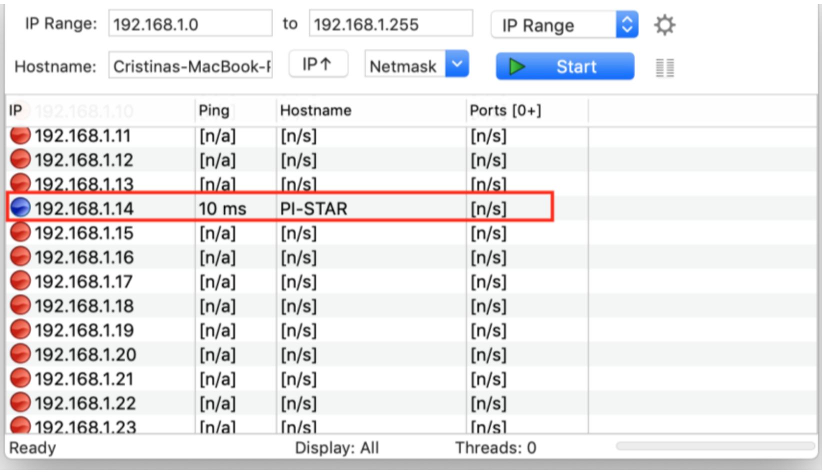
Scanning completed

Total time: 25.57 sec
Average time per host: 0.1 sec

IP Range
192.168.1.0 - 192.168.1.255

Hosts scanned: 254
Hosts alive: 2

- Now scroll through the addresses until you find one named PI-STAR.



IP Range: 192.168.1.0 to 192.168.1.255 IP Range

Hostname: Cristinas-MacBook-I IP↑ Netmask Start

IP	Ping	Hostname	Ports [0+]
192.168.1.11	[n/a]	[n/s]	[n/s]
192.168.1.12	[n/a]	[n/s]	[n/s]
192.168.1.13	[n/a]	[n/s]	[n/s]
192.168.1.14	10 ms	PI-STAR	[n/s]
192.168.1.15	[n/a]	[n/s]	[n/s]
192.168.1.16	[n/a]	[n/s]	[n/s]
192.168.1.17	[n/a]	[n/s]	[n/s]
192.168.1.18	[n/a]	[n/s]	[n/s]
192.168.1.19	[n/a]	[n/s]	[n/s]
192.168.1.20	[n/a]	[n/s]	[n/s]
192.168.1.21	[n/a]	[n/s]	[n/s]
192.168.1.22	[n/a]	[n/s]	[n/s]
192.168.1.23	[n/a]	[n/s]	[n/s]

Ready Display: All Threads: 0

- Use that IP address to connect to pi-star. In your preferred web browser enter the following: http://IP_ADDRESS
    - Replace IP_ADDRESS with the one you found in Angry IP Scanner. In the example image above the IP address is 192.168.1.14 So in that example, http://192.168.1.14 would be what you would type into a web browser to access Pi-Star

Info for use under Windows 10

This is a web page with a good tutorial on how to use the mmdvmcal software tool and a spectrum analyzer to adjustment the signal levels for DMR: https://www.f5uii.net/en/installation-calibration-adjustment-tunning-mmdvm-mmdvmhost-raspberry-motorola-gm360/5/

Another document describing the spectrum adjustment process: http://www.swedmr.se/wp-content/uploads/2017/08/Justering-av-repeater-med-MMDVM.pdf

Support

Great video from W1MSG showing getting started with Pi-Star: https://www.youtube.com/watch?v=B5G4gYDdJeQ

MMDVM groups.io group: https://groups.io/g/OpenDV

Pi-Star support forum: https://forum.pistar.uk/

Pi-Star Facebook support group:
https://www.facebook.com/groups/pistar/

Pi-Star Wiki:
http://wiki.pistar.uk

A web page describing the setup of an MMDVM repeater:
https://sadigitalradio.com/digital-radio-how-tos/make-mmdvm-digital-repeater/