

Getting Started with a Pi-star Hotspot

Programming the Software Image

Downloading Pi-Star software <https://www.pistar.uk/downloads/>

Select the image for your system, typically using a Pi-Zero select

- Pi-Star_RPi_V4.1.5_21-June-2021.zip



expand the zip file, inside will be a .img the file.

Download and install software to write the image to the micro SD card for example Raspberry Pi Imager

- <https://www.raspberrypi.org/downloads/>

Select "Choose OS" and scroll down to "use Custom".

Insert a SD card (16Gb is plenty of space) and select it and write the image. It should only take 5-10 minutes.

Once complete you can remove the SD card from the computer.



Set WiFi credentials

Insert the SD card into your computer and it should mount the BOOT partition. If you want only a single WiFi connection you can use the tool on the [pistar.uk](https://www.pistar.uk) website (you can always add more once it is running) If you want more to start with then use a simple text editor, such as notepad, create a file called "wpa_supplicant.conf" which will define your WiFi. You can add multiple WIFI networks, e.g. mobile phone, home WiFi, office WiFi, etc. The Pi will then look and try to connect to each in turn. (Also see Auto AP in the Advanced Features section below)

Copy these lines to the new file and save it to the SD card, (BOOT partition).

```
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1
ap_scan=1
fast_reauth=1
country=GB

network={
  ssid="MY SSID"
  psk="My SUPER SECRET PASSWORD"
  id_str=""
  priority=100
}
```

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Each subsequent network should have a decreasing priority number, this is the order the Pi searches for networks.

Once written, eject the SD card and you're ready to boot the Pi-Star.

Put the SD card into your Pi-star and power it on. After a short time, it should complete boot, you should be able to reach it with the URL <http://pi-star.local>. If not, you might need to find it's IP address. This can be easily done by logging into your internet router and looking at the list of DHCP leases.

Initial configuration

Connect to <http://pi-star.local>, and login with the credentials

- username: **pi-star**
- password: **raspberrypi**

Work your way down the “General Configuration” settings.

- Node Callsign
- DMR ID
- Radio Frequency, pick one that's free where you plan to use it. 434.000 MHz is in the band plan.
- Location settings are optional.
- Node Type, if set to private will only accept radios with your DMR-ID, make public if you have multiple, either leaving it open for anybody to use or restricted using a Whitelist.

The screenshot shows the 'General Configuration' page in the Pi-Star web interface. The 'Node Callsign' is set to 'p-star'. The 'Radio Frequency' is set to '434000.000 MHz'. The 'Node Type' is set to 'Public'. Other settings include 'Node ID' (434000), 'Latitude' (53.00), 'Longitude' (-3.00), 'Country' (United Kingdom), 'DMR ID' (434000), 'Node Type' (Public), 'APRS Mode' (none), 'System Time Zone' (Europe/London), and 'Dashboard Language' (english_gb).

Select “Apply Changes”. Once refreshed which can take a few seconds more configuration options will display.

Before going much further set the Radio/Modem type to match your MMDVM modem and select “Apply Changes” again. It's often necessary to set this twice on first configuration.

We are going to be using DMR as our network. Others are available and will be mentioned later. For now, go to the MMDVM Host Configuration window under Configuration.

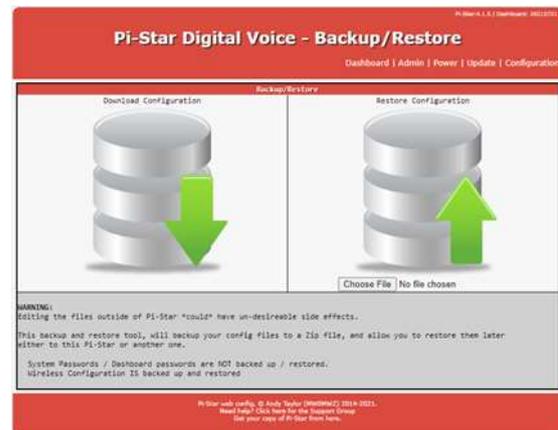
The screenshot shows the 'MMDVM Host Configuration' page in the Pi-Star web interface. The 'DMR Mode' is selected. The 'B-Star Mode' is also selected. The 'YSF Mode' is selected. The 'P25 Mode' is selected. The 'NXDN Mode' is selected. The 'YSF2BAND' is selected. The 'YSF2P25' is selected. The 'DMR2YSF' is selected. The 'DMR2NXDN' is selected. The 'POCSAG' is selected. The 'MMDVM Display Type' is set to 'Grid Type 3'. The 'Port' is set to 'Serial/AMA0'. The 'Section Layout' is set to 'DMR-D3-L3'.

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- Enable DMR and select Apply.
- Set the Display details if you have one.
- Apply Changes

At this point it is a good idea to save your configuration settings. Note: this does not save the entire SD Card! Click on the Backup/Restore tab. This displays two buttons, one to Download (Backup) and one to Restore.

- Press the “Download Configuration” button. A configuration file with the name formatted like Pi-Star_Config_2021-Sep-24.zip will be stored in your browser Downloads directory. This may be renamed and saved elsewhere if you wish.
- First use the “Choose File” button in the Restore Configuration section to select the file saved earlier. Then press “Restore Configuration”.



DMR Configuration

You now need to choose which DMR network you wish to use on your hotspot. There are many to pick from! Simply select the preferred network in the DMR Master menu box.

- Scroll down the list and select the master server for the network you require.
- Apply Changes.

Once the system reboots you will have other options, specific to the network chosen, in the DMR Configuration section.

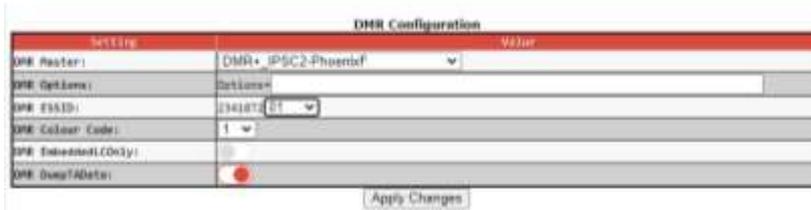
Setting	Value
DMR Master:	DMRGateway
BrandMaster Master:	BM_Europe_1200
DM Hotspot Security:	
BrandMaster Network ESSID:	2348240 02
BrandMaster Network Enable:	<input type="checkbox"/>
BrandMaster Network:	Register Information / Edit Register (BrandMaster Selfcare)
DMR Master:	DMR+ SPIC2 PhoenixP
DMR Network:	Options
DMR Network ESSID:	2348240 02
DMR Network Enable:	<input type="checkbox"/>
ELX Master:	ELX 300
ELX Startup Module:	Default
ELX Master Enable:	<input type="checkbox"/>
DMR Colour Code:	1
DMR EmbeddedLOnly:	<input type="checkbox"/>
DMR DumpTAData:	<input type="checkbox"/>

All networks will ask for your Network ESSIB which can be left blank if you only have one device, but should properly be set to '01'. If you have multiple Hotspots make sure each is unique.

Phoenix

The simplest network to configure is Phoenix. In the DMR Configuration section activate the DMR+ Master and select “DMR+_ISPC2-PhoenixF” from the list. Then “Apply Changes”.

On restart you will see the settings particular to Phoenix.

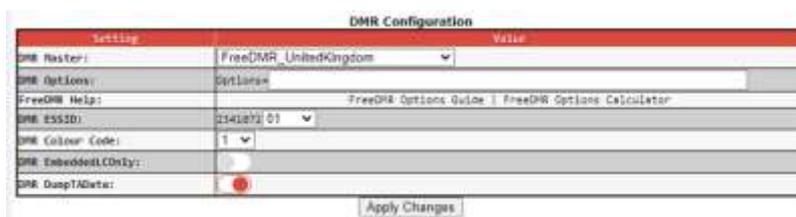


- Set the DMR ESSID to 01.
- Set the DMR Colour Code to 1.
- You may leave the DMR Options field blank for now. A settings such as: *StartRef=4000;ReLinkTime=60;UserLink=1; TS2_1=840;* will make TG 840 static.

FreeDMR

An alternative network to Phoenix is FreeDMR. In the DMR Configuration section activate the DMR+ Master and select “FreeDMR_UnitedKingdom” from the list. Then “Apply Changes”.

On restart you will see the settings particular to FreeDMR.



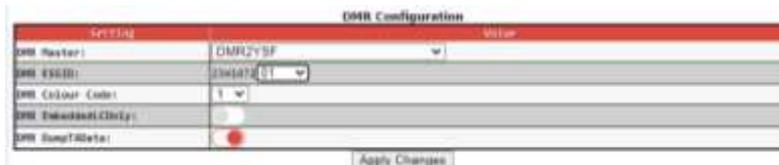
- Set the DMR ESSID to 01.
- Set the DMR Colour Code to 1.
- You may leave the DMR Options field blank for now. Click on the “FreeDMR Options Guide” button for information on possible settings.

FreeDMR is not available if you use DMR Gateway.

DMR to YSF

If you wish you can use a DMR radio to access YSF (Yaesu System Fusion) Reflectors – not WiresX Rooms. Because the two systems use the same Codec it is an easy conversion for the hotspot. Select “DMR2YSF” in the DMR Master text box and press “Apply Changes”.

On restart you will see the DMR2YSF settings.



- Set the DMR ESSID.
- Set the DMR Colour Code to 1.

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Brandmeister

To use Brandmeister on your hotspot you need to have created a Brandmeister SelfCare account. This allows you to make critical operational settings and also see your hotspot on the system dashboards.

Creating an account is straight forward and just requires your DMR-ID for validation. Simply go to <https://brandmeister.network>.



You may set up more than one account if you have multiple DMR IDs. However, each account is treated separately. Any changes you make to one will also need to be made to the others.

Once created, login and select SelfCare. set a hotspot security password for your DMR ID. There is a text box where you can enter you preferred Hotspot Security password. This applies to all the hotspots that use that account's DMR ID.

While there you can also add additional functionality to your hotspot by downloading an API key. This is not essential but very useful.

Brandmeister API key

The API key allows your Pi-star to interact with Brandmeister servers and set and unset static talk groups and reflectors from the dashboard.

Once your account is enabled, you can login and select "Profile Settings",

Under Security Settings, on the right-hand side is a button "API Keys", selecting this to manage your keys.



Select "Add" to create a new key, pick a name for the key. Not sure the value of the QR code, so just copy the string at the top, you can select the "Copy" button.



With it copied reconnect to your new Pi-star and select "Configuration", and then select "Expert", you're now looking for the button "BM API". Click on this.

You can now paste this key into the field presented and select "Apply Changes" to finish. The Advanced Dashboard will now have controls to allow you to edit Static Talkgroups on the Network.

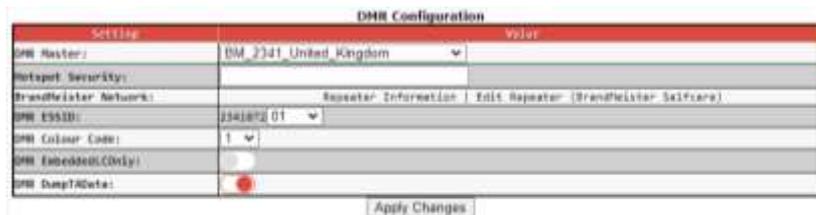
Brandmeister Settings

In the DMR Configuration section activate the DMR+ Master and select from the list.

The UK one is “BM_United_Kingdom_2341”, but others are available. Then “Apply Changes”.

On restart you will see the settings particular to Brandmeister.

- Enter your password created earlier into the Hotspot Security box.
- Set the DMR ESSID to 01.
- Set the DMR Colour Code to 1.



Once again “Apply Changes” and wait for the restart.

DMR Gateway

DMR Gateway allows you to connect to multiple DMR Networks at the same time but requires additional work; both in the Pi-star configuration and in the Code Plug for your radio(s). This is to allow the Hotspot to determine which DMR Network you are trying to access from your radio. By default, almost all traffic will be routed over the Brandmeister Network. You then use ‘Redirects’ to steer communications to other networks.

- Set DMR master to “DMRGateway”
- Apply Changes
- Select the Masters for Brandmeister and DMR+ (Phoenix)
- Enable the networks you wish to use.



If you use the dashboard to turn on a specific Network, by turning off the ones you don't want, you can listen to one Network at a time. In Brandmeister mode you can connect, say, to TG 3211 and it will work. Alternatively, in Phoenix mode you can use TG 235. However, if the radio Network selection is out of step with the Hotspot, then it might not!

Other networks (such as RAYNET-UK) can be added but required direct editing of the DMR GW in Expert mode.

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DMR Gateway assumes you are using Brandmeister if it is passed 'normal' Talkgroup numbers. In order to use a different network, you have to add prefix digits to the Talkgroup in order to 'redirect' to the correct network. This is explained in the following section.

Phoenix Talkgroup Redirects

In order to get Phoenix to co-exist with Brandmeister using DMRGateway, you need to ensure there is no overlap in Talkgroup IDs. The way to do this is to add additional Talkgroup IDs to your radio, prefixing each existing Phoenix ID with an '8' and as many leading '0's as required to make them 6 digits long. For instance, TG 235 becomes TG 800235, TG 840 becomes TG 800840, etc. These new Talkgroups do not replace the Repeater originals and are only used to create Channels assigned to a Hotspot in DMRGateway mode.

Having done this, you then need to change the Pi-star configuration file to suit. It is always good practice to backup your configuration before making major changes! From the Dashboard you need to select 'Configuration', 'Expert' and then in the Full Edit: section select 'DMR GW'. In the [DMR Network 2] section replace all the existing TGRewrite and PCRewrite lines with the following:

```
TGRewrite0=2,8,2,9,1
TGRewrite1=2,800505,2,505,1
TGRewrite2=2,800800,2,800,100
TGRewrite3=2,803801,2,3801,8
TGRewrite4=2,823531,2,23531,1
TGRewrite5=2,809990,2,9990,1
TGRewrite6=2,800001,1,1,9999
TGRewrite7=2,800001,2,1,9999
PCRewrite0=2,804000,2,4000,1001
```

Select the "Apply Changes" button and wait for the Hotspot to restart. Then when you transmit on a channel with a modified Phoenix Talkgroup ID this lookup table ensures the call is routed to the Phoenix Network. If using a Duplex hotspot they prevent the use of Time Slot1 for the Phoenix Network, everything works on Time Slot 2.

Radio Programming

In order to use your new hotspot you need to set up the Code Plug. The specific method for your radio is outside of the scope of this document. But the general principles are the same.

- Create (if you don't have them already) a set of Talkgroup IDs for the DMR network or networks you intend to use.
- For DMR2YSF you will need to make the YSF Reflector ID 7-digits long starting with a "7". I.e., for YSF-Ipswich 97658 use 7097658.
- If you are using DMR Gateway make sure you use the required redirect prefix digits. You may have, say, Phoenix 840 East Anglia. For a hotspot using DMR Gateway you will also need 800840.
- Create a Channel with the frequencies and colour code you have set for your hotspot. Set the RF Power level to minimum.

Add as many Channels using the appropriate Talkgroup IDs as required. Be careful how you name them so you can find them again.

Yaesu System Fusion YSF

The Pi-star software also supports YSF operation among other digital networks. In the MMDVMHost section select YSF Mode. Then press "Apply Changes" and wait for the reboot.

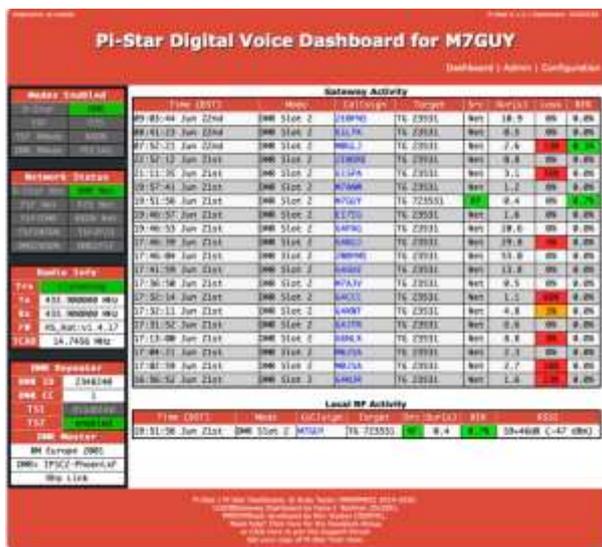
- You may set a YSF Startup Host, but you can leave it empty.
- Set UPPERCASE Hostfiles to On.
- Set WiresX Passthrough to On.



To use the hotspot, set your radio to the hotspot frequency. Select WiresX mode and use Direct mode to enter the required YSF ID.

Dashboards

There are two dashboards you can watch, “Dashboard” and “Admin”. The Dashboard provides a good overview of its function. The Admin board provides additional details on Brandmeister static talk groups, and with the API key set allows you to add and remove them.



Advanced Features

There are many things the Pi-star software will do. It will, for instance, support other Digital modes, simultaneously if required but only one at a time! It can even form the basis of a Repeater using appropriate hardware. This section will include these as and when they are discovered.

Things like different display settings. If your MMDVM board has an OLED display you may find it upside down. In the main Configuration section, there is an Invert function which corrects this. You can also set a Scroll mode, set to 1 it gives a scrolling display on idle.

You can use “Configuration”, “Expert”, “CCS Tool” to change the colours of the Browser User Interface.

Whitelisting

Under the terms of the UK Amateur Radio Licence an NOV is required to run a Repeater. It has been argued that running your personal Hotspot in 'Public' mode could need an NOV; particularly if it is Unattended operation. If you keep the Hotspot at hand and only run very low power this requirement probably does not apply.

Setting the Hotspot to 'Private' locks it to the single DMR ID you have set. However, if you have more than one DMR ID, or other users will need to use it, you will have to set it to 'Public'. Because the software is able to be used as a proper Repeater it includes tools to manage the users. In particular you can set a Whitelist of DMR IDs allowed to use it. The way to do this is not straight forward and you must take a backup before you start.

Then, from the Dashboard you need to select 'Configuration', 'Expert' and then in the Full Edit section click on 'SSH Access'. This will open a window and ask for your *Username* and *Password* for the Pi-star. If you haven't changed them, they are *pi-star* and *raspberry*. The following display then appears.



You now need to enter the following commands at the \$ prompt, exactly as shown:

`rpi-rw` *This is to allow the editor to change the file.*

`cd /etc` *This is to change the working directory.*

`sudo nano mmdvmhost` *This opens the configuration file into an editor.*

Scroll down (using the cursor keys) the file to the [DMR] section. On the end of this section append the following line (the capitalisation is important):

`WhiteList=2341072,2346185` *This is the comma separated list of the DMR IDs you wish to allow. Replace the examples given with your list of DMR IDs.*

Having added the lines, you need to press <Ctrl>O to write the file, <RTN> to use the same filename as before, back to the `sdcard`. Once saved press <Ctrl>X to exit the editor.

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On a Windows, Mac, or Linux-based computer (not the hotspot itself) that has WiFi enabled, look in the WiFi settings to find the Pi-star access point, and then select it to connect to it:

If you're starting Pi-star for the first time, it'll be named "Pi-Star-Setup." If this isn't the first time, but you need to connect to a new WiFi network, it'll be named using the Hotspot's hostname, by default, "pi-star" (or whatever you changed it to in the General Configuration settings).

Enter the Pi-Star-Setup network security password: *raspberry*.

Once your device is connected to the Hotspot access point you can use a browser to login to the Pi-star using <http://pi-star/>, <http://pi-star.local/> or 192.168.50.1 and make any required configuration changes. For instance, to set new WiFi credentials.

This help file contains, with thanks and permission, original text and images produced by Guy, M7GUY, on behalf of RAYNET-UK. Phoenix and Advanced additions added by Alan, M0 JSA. Errors and omissions are all mine.

Lots other useful information can be found at: <https://amateurradionotes.com/hotspots.htm>