

ZUMspot Duplex Kit User Guide

The ZUMspot Duplex Kit has all of the capabilities of the original ZUMspot, but it also enables a duplex connection between your hotspot and HT. This will allow you to switch to a different talk group from your HT even if the current talk group is tying up your hotspot.



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Board specifications

ZUMspot Kit Features:

- High performance 32-bit ARM processor
- ZUMspot Board Fully Assembled And Tested
- Supports DMR, P-25, D-Star, System Fusion and NXDN
- Supports DMR/Fusion full duplex operation
- Onboard LEDs to show status (Tx, Rx, PTT, Mode)
- Up to 10mW RF power
- SMA antenna connectors, UHF antennas included
- Mounts cleanly on all current Raspberry Pi's including the Pi Zero WH
- Works on ODROID boards
- The open source firmware (MMDVM) is pre-loaded and is easily upgraded via software
- Built-in 1.3" OLED display
- Connection for Nextion LCD display
- 1 Year Warranty

Setup

- The ZUMspot Duplex Kit should come with the following:
 - ZUMspot Duplex board
 - Raspberry Pi Zero
 - Pre-programmed SD card
 - 4 plastic screws
 - 4 plastic standoffs
 - 4 plastic nuts
 - 2 right angle UHF antennas
- Make sure the SD card is inserted into the Raspberry Pi Zero
- Install each antenna into each RF connector, and position them 90 degrees away from each other as shown below



Powering up

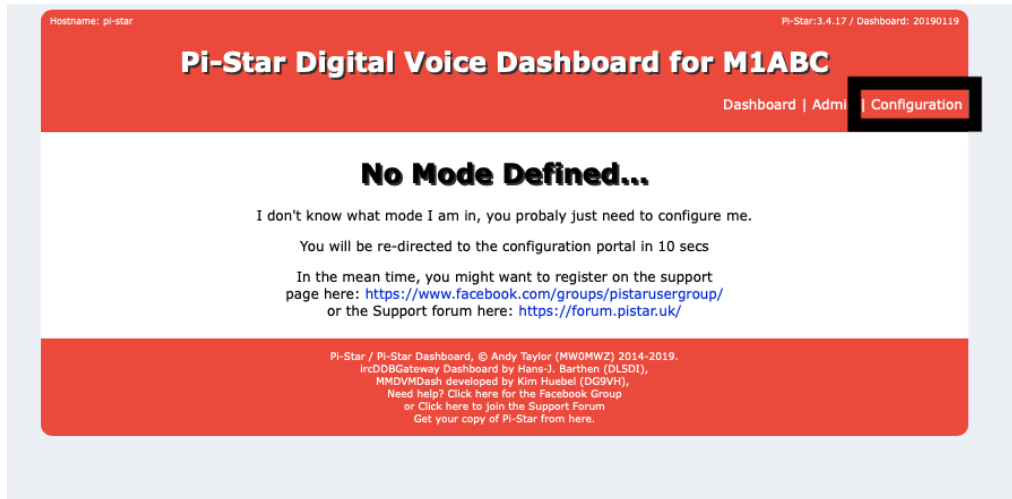
- Plug a USB micro power cable to your ZUMspot Duplex Kit. The USB power port is the right most USB port on the Raspberry Pi Zero. The USB cable should also be connected to a USB power supply.



Setup Pi-Star

Wi-Fi

- Power up the ZUMspot Duplex Kit.
- After 3 minutes, scan for Wi-Fi access points from your phone or laptop. One should appear with the name **Pi-Star-Setup**
- Connect to it. When asked for the Wi-Fi password type in: raspberry
- After 3 minutes, go to your web browser (Chrome, Firefox, etc.) and connect to the website: <http://pi-star> (for Windows, Linux and Android devices) <http://pi-star.local> (for macOS and iOS devices)
- You should see this page. Go to **Configuration**



- You will be asked to put in the default username which is **pi-star** and the default password which is **raspberry**
- Select **Configure Wi-Fi** and then click on **Scan for Networks (10 secs)**

Firewall Configuration

Setting	Value
Dashboard Access:	<input checked="" type="radio"/> Private <input type="radio"/> Public
ircDDBGateway Remote:	<input checked="" type="radio"/> Private <input type="radio"/> Public
SSH Access:	<input checked="" type="radio"/> Private <input type="radio"/> Public
Auto AP:	<input checked="" type="radio"/> On <input type="radio"/> Off Note: Reboot Required if changed
uPNP:	<input checked="" type="radio"/> On <input type="radio"/> Off

Wireless Configuration

Wireless Information and Statistics

Interface Information	Wireless Information
Interface Name : wlan0	Connected To :
Interface Status : Interface is down	AP Mac Address :
IP Address :	Bitrate :
Subnet Mask :	Signal Level :
Mac Address : b8:27:eb:1b:b1:b9	
Interface Statistics	
Received Packets :	
Received Bytes :	
Transferred Packets :	
Transferred Bytes :	

Information provided by ifconfig and iwconfig

Remote Access Password

User Name	Password	
pi-star	Password: <input type="password"/>	Confirm Password: <input type="password"/> <input type="button" value="Set Password"/>
WARNING: This changes the password for this admin page AND the "pi-star" SSH account		

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.

Firewall Configuration

Setting	Value
Dashboard Access:	<input checked="" type="radio"/> Private <input type="radio"/> Public
ircDDBGateway Remote:	<input checked="" type="radio"/> Private <input type="radio"/> Public
SSH Access:	<input checked="" type="radio"/> Private <input type="radio"/> Public
Auto AP:	<input checked="" type="radio"/> On <input type="radio"/> Off Note: Reboot Required if changed
uPNP:	<input checked="" type="radio"/> On <input type="radio"/> Off

Wireless Configuration

WiFi Info

Remote Access Password

User Name	Password	
pi-star	Password: <input type="password"/>	Confirm Password: <input type="password"/> <input type="button" value="Set Password"/>
WARNING: This changes the password for this admin page AND the "pi-star" SSH account		

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.

- Select your Wi-Fi SSID and enter your password.

- Click on **Save (and connect)** to save the Wi-Fi configuration

Node Callsign:	M1ABC		
Radio Frequency:	438.800.000 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, LOC4TOR		
Country:	Country		
URL:	http://www.mw0mwz.co.uk/pi-star/	<input type="radio"/> Auto <input checked="" type="radio"/> Manual	
Radio/Modem Type:	---		
Node Type:	<input checked="" type="radio"/> Private <input type="radio"/> Public		
System Time Zone:	America/Los_Angeles		
Dashboard Language:	english_us		

Apply Changes

Firewall Configuration

Setting	Value
Dashboard Access:	<input checked="" type="radio"/> Private <input type="radio"/> Public
ircDDBGateway Remote:	<input checked="" type="radio"/> Private <input type="radio"/> Public
SSH Access:	<input checked="" type="radio"/> Private <input type="radio"/> Public
Auto AP:	<input checked="" type="radio"/> On <input type="radio"/> Off Note: Reboot Required if changed
uPNP:	<input checked="" type="radio"/> On <input type="radio"/> Off

Apply Changes

Wireless Configuration

WiFi Info

Network 0

SSID: NETGEAR32

PSK: [REDACTED]

Networks found :

Connect	SSID	Channel	Signal	Security
<input type="button" value="Select"/>	ATTgTyj66a	2.4GHz Ch11	-29 dBm	WPA2-PSK (TKIP) with WPS
<input type="button" value="Select"/>	Humpty	2.4GHz Ch3	-45 dBm	WPA2-PSK (AES)
<input checked="" type="button" value="Select"/>	NETGEAR32	2.4GHz Ch11	-46 dBm	WPA2-PSK (TKIP) with WPS
<input type="button" value="Select"/>	ATTNnJCI22	2.4GHz Ch11	-67 dBm	WPA2-PSK (TKIP) with WPS
<input type="button" value="Select"/>	PIXEL	2.4GHz Ch1	-83 dBm	WPA2-PSK (AES)
<input type="button" value="Select"/>	PIXEL_GUEST	2.4GHz Ch1	-85 dBm	WPA2-PSK (AES)
<input type="button" value="Select"/>	WWireless	2.4GHz Ch11	-87 dBm	WPA2-PSK (TKIP) with WPS
<input type="button" value="Select"/>	bbtest	2.4GHz Ch6	-88 dBm	WPA2-PSK (AES)
<input type="button" value="Select"/>	WGI	2.4GHz Ch6	-88 dBm	WPA2-PSK (TKIP) with WPS
<input type="button" value="Select"/>	DIRECT-B6-HP Officejet 5740	2.4GHz Ch6	-90 dBm	[WPA2-PSK-CCMP][WPS][ESS][P2P]

Remote Access Password

- Reboot your ZUMspot Duplex Kit
- Now you can continue to the **Configuration** section below.

Configuration

- Change the “Node Callsign” to your own, set the **System Time Zone** to your time zone, and set the **Dashboard Language** to the language you prefer.

Pi-Star: 4.1.0-RC4 / Dashboard: 20190709

Pi-Star Digital Voice - Configuration

Dashboard | Admin | Expert | Power | Update | Backup/Restore | Factory Reset

Gateway Hardware Information				
Hostname	Kernel	Platform	CPU Load	CPU Temp
pi-star	4.19.66+	Pi Zero W Rev 1.1 (512MB)	0.8 / 0.69 / 0.28	40.6°C / 105.1°F

Setting	Value
Controller Software:	<input type="radio"/> DStarRepeater <input checked="" type="radio"/> MMDVMHost (DV-Mega Minimum Firmware 3.07 Required)
Controller Mode:	<input checked="" type="radio"/> Simplex Node <input type="radio"/> Duplex Repeater (or Half-Duplex on Hotspots)

Apply Changes

Setting	Value
Hostname:	pi-star Do not add suffixes such as .local
Node Callsign:	KM6ZJX
Radio Frequency:	438.800.000 Hz
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/ <input type="radio"/> Auto <input checked="" type="radio"/> Manual
Radio/Modem Type:	ZUMspot - Duplex Raspberry Pi Hat (GPIO)
Node Type:	<input checked="" type="radio"/> Private <input type="radio"/> Public
APRS Host:	euro.aprs2.net
System Time Zone:	America/Los_Angeles
Dashboard Language:	english_us

Apply Changes

Setting	Value
Dashboard Access:	<input checked="" type="radio"/> Private <input type="radio"/> Public
ircDDBGateway Remote:	<input checked="" type="radio"/> Private <input type="radio"/> Public
SSH Access:	<input checked="" type="radio"/> Private <input type="radio"/> Public
Auto AP:	<input checked="" type="radio"/> On <input type="radio"/> Off Note: Reboot Required if changed
uPNP:	<input checked="" type="radio"/> On <input type="radio"/> Off

Apply Changes

Refresh Reset WiFi Adapter Configure WiFi

Wireless Configuration

Interface Information	Wireless Information and Statistics
Interface Name : wlan0 Interface Status : Interface is up IP Address : 192.168.1.28 Subnet Mask : 255.255.255.0	Connected To : NETGEAR32 AP Mac Address : 78:d2:94:73:f0:c6 Bitrate : 72.2 MBit/s

- Click **Apply Changes** when you are done
- When everything reloads, you will need to set the **Radio/Modem Type** to **ZUMspot - Duplex Raspberry Pi Hat (GPIO)** and click **Apply Changes** again.

DMR with Duplex

Once you have completed the **Configuration** steps. You can finish setting up your ZUMspot Duplex Kit with DMR using a duplex connection

- Turn on **DMR** and confirm that **Controller Mode** is set to **Duplex** and then click on **Apply Changes**

Pi-Star:4.1.0-RC4 / Dashboard: 20190709

Pi-Star Digital Voice - Configuration

Dashboard | Admin | Expert | Power | Update | Backup/Restore | Factory Reset

Gateway Hardware Information

Hostname	Kernel	Platform	CPU Load	CPU Temp
pi-star	4.19.66+	Pi Zero W Rev 1.1 (512MB)	7.57 / 2.47 / 1.12	44.9°C / 112.8°F

Control Software

Setting	Value
Controller Software:	<input type="radio"/> DStarRepeater <input checked="" type="radio"/> MMDVMHost (DV-Mega Minimum Firmware 3.07 Required)
Controller Mode:	<input type="radio"/> Simplex Mode <input checked="" type="radio"/> Duplex Repeater (or Half-Duplex on Hotspots)

Apply Changes

MMDVMHost Configuration

Setting	Value
DMR Mode:	<input checked="" type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
D-Star Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
YSF Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
P25 Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
NXDN Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
YSF2DMR:	<input type="checkbox"/>
YSF2NXDN:	<input type="checkbox"/>
YSF2P25:	<input type="checkbox"/>
DMR2YSF:	<input type="checkbox"/> Uses 7 prefix on DMRGateway
DMR2NXDN:	<input type="checkbox"/> Uses 7 prefix on DMRGateway
POCSAG:	<input type="checkbox"/> POCSAG Paging Features
MMDVM Display Type:	OLED Port: Modem Nextion Layout: ON7LDS L3

Apply Changes

General Configuration

Setting	Value
Hostname:	pi-star Do not add suffixes such as .local
Node Callsign:	KM6ZJX
Radio Frequency:	434.400.000 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, LOC4TOR
Country:	Country
URL:	http://www.mw0mwz.co.uk/pi-star/ <input type="radio"/> Auto <input checked="" type="radio"/> Manual
Radio/Modem Type:	ZUMspot - Duplex Raspberry Pi Hat (GPIO)
Node Type:	<input checked="" type="radio"/> Private <input type="radio"/> Public
APRS Host:	euro.aprs2.net
System Time Zone:	America/Los_Angeles
Dashboard Language:	english_us

Apply Changes

- Set the **RX** and **TX** frequencies to be used.
 - NOTE: For best performance, the frequency offset between RX and TX should be at least 5MHz, but 10MHz is recommended
- Enter your **DMR ID**
- Choose your preferred **DMR master** server
- Click **Apply Changes** in order to save your settings

Setting	Value
Hostname:	pi-star <small>Do not add suffixes such as .local</small>
Node Callsign:	KM6ZJX
CCS7/DMR ID:	3130245
Radio Frequency RX:	439.400.000 MHz
Radio Frequency TX:	434.400.000 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, LOC4TOR
Country:	Country
URL:	http://www.mw0mwz.co.uk/pi-star/ <input type="radio"/> Auto <input checked="" type="radio"/> Manual
Radio/Modem Type:	ZUMspot - Duplex Raspberry Pi Hat (GPIO)
Node Type:	<input checked="" type="radio"/> Private <input type="radio"/> Public
APRS Host:	euro.aprs2.net
System Time Zone:	America/Los_Angeles
Dashboard Language:	english_us

Setting	Value
DMR Master:	BM_United_States_3101
Hotspot Security:	
BrandMeister Network:	Repeater Information Edit Repeater (BrandMeister Selfcare)
DMR ESSID:	None
DMR Color Code:	1
DMR EmbeddedLCOnly:	<input type="checkbox"/>
DMR DumpTADData:	<input checked="" type="checkbox"/>

Setting	Value
Dashboard Access:	<input checked="" type="radio"/> Private <input type="radio"/> Public
ircDDBGateway Remote:	<input checked="" type="radio"/> Private <input type="radio"/> Public
SSH Access:	<input checked="" type="radio"/> Private <input type="radio"/> Public
Auto AP:	<input checked="" type="radio"/> On <input type="radio"/> Off <small>Note: Reboot Required if changed</small>
uPNP:	<input checked="" type="radio"/> On <input type="radio"/> Off

- You can now use DMR with a duplex connection with your ZUMspot Duplex Kit

Enable D-Star

- Now you can turn on D-Star by selecting the **D-Star Mode** switch and clicking **Apply Changes**

Pi-Star:4.1.0-RC4 / Dashboard: 20190709

Pi-Star Digital Voice - Configuration

Dashboard | Admin | Expert | Power | Update | Backup/Restore | Factory Reset

Gateway Hardware Information

Hostname	Kernel	Platform	CPU Load	CPU Temp
pi-star	4.19.66+	Pi Zero W Rev 1.1 (512MB)	7.57 / 2.47 / 1.12	44.9°C / 112.8°F

Control Software

Setting	Value
Controller Software:	<input type="radio"/> DStarRepeater <input checked="" type="radio"/> MMDVMHost (DV-Mega Minimum Firmware 3.07 Required)
Controller Mode:	<input checked="" type="radio"/> Simplex Node <input type="radio"/> Duplex Repeater (or Half-Duplex on Hotspots)

[Apply Changes](#)

MMDVMHost Configuration

Setting	Value
DMR Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
D-Star Mode:	<input checked="" type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
YSF Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
P25 Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
NXDN Mode:	<input type="checkbox"/> RF Hangtime: 20 Net Hangtime: 20
YSF2DMR:	<input type="checkbox"/>
YSF2NXDN:	<input type="checkbox"/>
YSF2P25:	<input type="checkbox"/>
DMR2YSF:	<input type="checkbox"/> Uses 7 prefix on DMRGateway
DMR2NXDN:	<input type="checkbox"/> Uses 7 prefix on DMRGateway
POCSAG:	<input type="checkbox"/> POCSAG Paging Features
MMDVM Display Type:	OLED <input type="button" value="v"/> Port: Modem <input type="button" value="v"/> Nextion Layout: ON7LDS L3 <input type="button" value="v"/>

[Apply Changes](#)

General Configuration

Setting	Value
Hostname:	pi-star Do not add suffixes such as .local
Node Callsign:	KM6ZJX
Radio Frequency:	434.400.000 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, LOC4TOR
Country:	Country
URL:	http://www.mw0mwz.co.uk/pi-star/ <input type="radio"/> Auto <input checked="" type="radio"/> Manual
Radio/Modem Type:	ZUMspot - Duplex Raspberry Pi Hat (GPIO) <input type="button" value="v"/>
Node Type:	<input checked="" type="radio"/> Private <input type="radio"/> Public
APRS Host:	euro.aprs2.net <input type="button" value="v"/>
System Time Zone:	America/Los_Angeles <input type="button" value="v"/>
Dashboard Language:	english_us <input type="button" value="v"/>

[Apply Changes](#)

- You can now use D-Star with your ZUMspot Duplex Kit

Finishing setup

Once you have completed the Pi-Star configuration you can start using the ZUMspot Duplex Kit to connect to D-Star, DMR and other networks.

There is more information on configuring and using Pi-Star in this document.

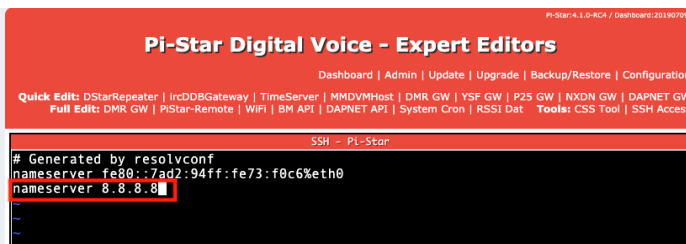
https://amateurradionotes.com/images/1-Playing_with_Pi-Star.pdf

Firmware update

The firmware can be updated directly from the Pi. A script needs to be download to flash the board.

- Go to *Configuration->Expert->SSH Access*
- Login to pi-star
- Run command *rpi-rw*
- Run command:
- `curl -OL https://raw.githubusercontent.com/veraabad/ZUMspot_Update/master/install_fw_duplex.sh`
- 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 “`sudo chmod`” 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`



```

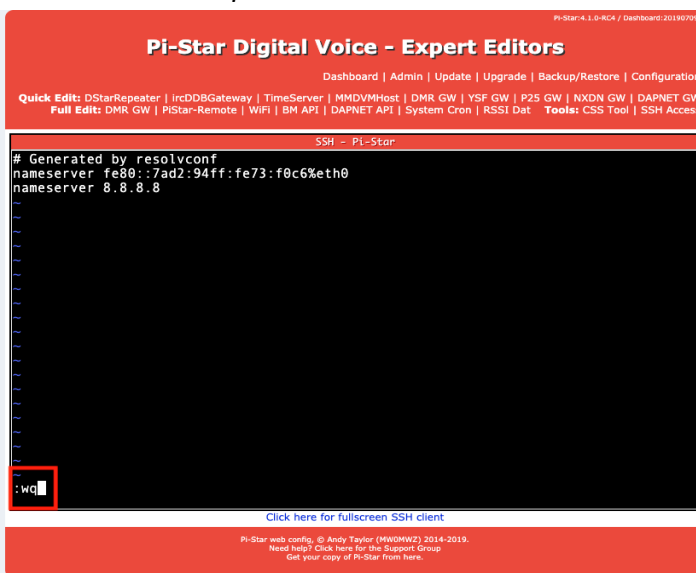
Pi-Star Digital Voice - Expert Editors
Dashboard | Admin | Update | Upgrade | Backup/Restore | Configuration
Quick Edit: DStarRepeater | ircDDBGateway | TimeServer | MMDVMHost | DMR GW | YSF GW | P25 GW | NXDN GW | DAPNET GW
Full Edit: DMR GW | PiStar-Remote | WiFi | BM API | DAPNET API | System Cron | 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 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
:wq

```

- Then press Enter

- You should now have exited the text editor. You can try the curl command again and it should work now
- Next type the command followed by the enter key
sudo chmod +x install_fw_duplex.sh
- Then type the command followed by the enter key
./install_fw_duplex.sh



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-duplex(rw):~$ rpi-rw
pi-star@pi-star-duplex(rw):~$ curl -OL https://raw.githubusercontent.com/veraaba
d/ZUMspot_Update/master/install_fw_duplex.sh
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left   Speed
100  454    100  454    0    0   1126    0  --:--:--  --:--:--  --:--:--  1126
pi-star@pi-star-duplex(rw):~$ sudo chmod +x install_fw_duplex.sh
pi-star@pi-star-duplex(rw):~$ ./install_fw_duplex.sh
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left   Speed
100 57824   100 57824    0    0  123k    0  --:--:--  --:--:--  --:--:--  123k
stm32flash 0.5

http://stm32flash.sourceforge.net/

Using Parser : Raw BINARY
Interface serial_posix: 57600 8E1
Version      : 0x22
Option 1    : 0x00
Option 2    : 0x00
Device ID   : 0x0410 (STM32F10xxx Medium-density)
- RAM       : 20KiB (512b reserved by bootloader)
- Flash     : 128KiB (size first sector: 4x1024)
- Option RAM : 16b
- System RAM : 2KiB

```

[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.

- The flashing script will take care of the rest. Once the script is done it will reboot Pi-Star.

Building firmware on Pi-Star

- Go to *Configuration->Expert->SSH Access*
- Login to pi-star
- Run command *rpi-rw*
- Make sure the necessary software tools are installed by running these commands:

```
sudo apt-get install gcc-arm-none-eabi gdb-arm-none-eabi libstdc++-arm-none-eabi-newlib libnewlib-arm-none-eabi
```
- Install updated stm32flash utility by running these commands:
 - `cd ~`
 - `git clone https://git.code.sf.net/p/stm32flash/code stm32flash`
 - `cd stm32flash`
 - `make`
 - `sudo make install`
- Download the firmware sources by running these command:

```
cd ~
git clone https://github.com/juribeparada/MMDVM\_HS.git
cd MMDVM_HS/
git submodule init
git submodule update
cp configs/ZUMspot_duplex.h Config.h
```
- Build the firmware by running this command:

```
make
```
- Stop services by running these commands:

```
sudo pistar-watchdog.service stop
sudo systemctl stop mmdvmhost.timer
sudo systemctl stop mmdvmhost.service
```
- Upload the firmware to ZUMspot RPi board:

```
sudo make zumspot-pi
```

Support

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>

ZUM Radio Facebook group:

<https://www.facebook.com/groups/249802742395450/>