

# DV4home

**DV4home (full version) – IP (Internet) transceiver  
For D-Star/DMR/\*C4FM/\*P25/\*DPMR/\*NXDN  
Also supports a DV4mini (not included) Hotspot  
User Guide**



**Version 1.00 preliminary (software version 0.063C)**

**DV Development Group**

**Portion of this document was extracted from the DV4mini manual written by: German Version: DH5RAE (English translation: N1DL, Update: DG1SW and AG0X)**

**Special thanks to Pascal Villeneuve VA2PV for his hard work and contribution to this operating manual.**

**\*Will be supported in a future software upgrade**

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## What's included in the box

- 1 x DV4home
- 1 x AC (120V) / DC (12V) power adapter (1.0A)
- 1 x handheld microphone with lighted DTMF key pad

## Introduction

The DV4home is another member of the successful family of DV4 products. It supports all digital modes, while simplifying and extending the supported functions. While it acts as a "home" for the DV4mini it can also be easily used mobile or portable. It is a stand-alone unit which does not need a PC to operate. (DV4mini not included)

You can describe the DV4home as an IP (Internet) transceiver.

There are 2 versions available, the DV4home and the DV4home compact.

## Description

The DV4home uses the same microcontroller platforms as the DV4home compact, but adds 2 AMBE3000 chips, a microphone and a speaker to the unit. There is a built-in speaker and the microphone is included.

These components allow the following additional functions:

Direct Internet transceiver mode without a DV4mini by using the microphone and the external speaker. This is an economical alternative if no local wireless signal is needed. In this mode the DV4home supports D-Star, DMR, dPMR, NXDN (and later \*C4FM via software update)

Dual mode support: even without a DV4mini inserted, the unit can be simultaneously connect to a D-Star and a DMR reflector, using 2 separate speakers to play the respective audio streams.

Transceiver mode connects a D-Star or DMR radio via a plugged in DV4mini to a reflector.

Conference mode requires a DV4mini inserted into the unit and allows the use of the built-in microphone/speaker connectors and the RF connection through the DV4mini to a DMR or D-Star radio. This mode works in D-Star and DMR.

Transcode (**later via software update**) mode allows to use a digital radio in one mode while connecting to a reflector in another mode. Use your D-Star radio to try out DMR! The following conversions are supported:

D-Star → DMR

DMR → D-Star

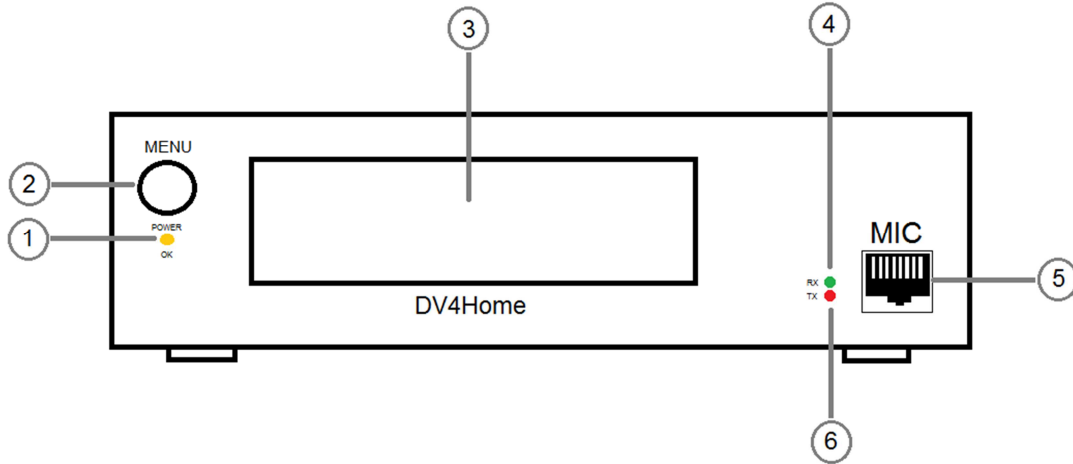
All → Fusion (C4FM)

Fusion (C4FM) → All

DMR/D-Star Bridge mode allows interconnecting DMR and D-Star reflector rooms using the licensed DVSI AMBE chips. This mode bears the risk of creating loops in the network, therefore a free license key is required which also helps that the installations can be supported by the network administrators to assure a flawless integration.

IPSC2 and DMRplus bridge permit the connection between DMRPlus.

# Front panel

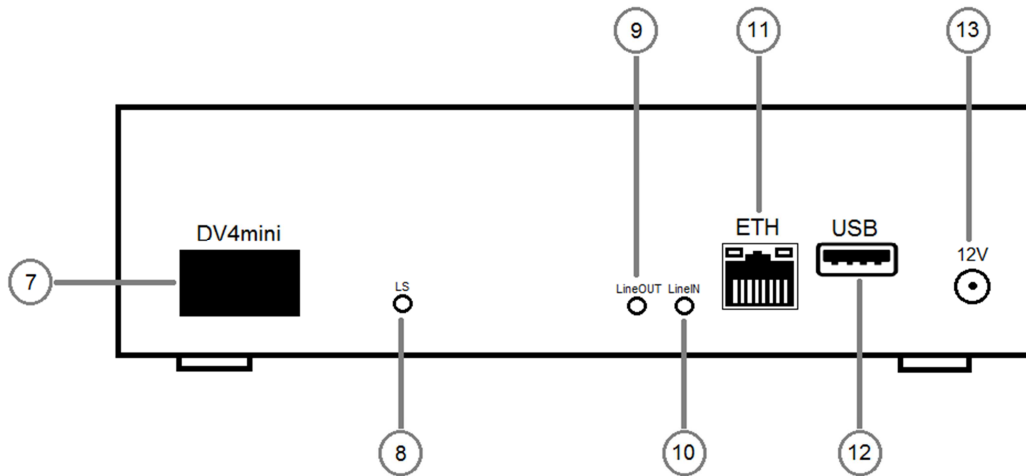


1. Power led indicator
2. Volume and multifunction knob
  - a. Turn clock wise to increase volume, turn counter clock wise to decrease volume
  - b. Push briefly the knob to switch between menus
  - c. Press and hold 2 seconds to enter a command or wait for ok to appears in the bottom left corner of the screen

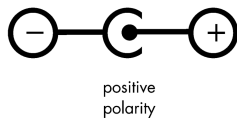
In this manual we will refer to a brief push and a press and hold as we describe operations

3. OLED display
4. Green LED on when receiving signal (does not show the status of the optional DV4mini)
5. Microphone connector - 8 pins female RJ-45, the MIC connector does not us any conventional pinout because of its internal configuration. The pinout connections will be published in the next manual version.
6. Red LED on when transmitting (PTT), (does not show the status of the optional DV4mini)

## Rear panel



7. DV4mini slot (DV4mini optional)
8. LS for Loud Speaker, providing variable volume for an external speaker
9. LineOUT, line level audio output 1/8 inch diameter (3.5mm) female jack
10. LineIN, Line level input (available in future software update) 1/8 inch diameter (3.5mm) female jack
11. Ethernet 8 pins RJ-45 connector for Internet connection, 10/100 Mbps
12. USB port (type A) for Wi-Fi dongle or LTE stick (available in future software update)
13. Power connector, 9-15V, 1A, barrel connector 5.5/2.5mm



# Digital Modes

The DV4home can handle five digital modes:

## D-Star

D-Star was developed in Japan 1999/2000 especially for ham radio and it became the leading system worldwide due to its clear and relative simple user interface. Voice is being transformed by the AMBE Vocoder into a compressed digital data stream of 3600 bits/s.

In addition, there is a data channel with 1200 bits/s for a total data rate of 4800 bits/s. This data signal modulates a carrier, so that a logical 0 is one frequency and a logical 1 a second frequency. This is called 2FSK (two frequency shift keying) or GMSK (which are the same, however the signal is modulated using a bell curve). This signal can be used to modulate most FM transceivers (via the packet radio socket).

This is the reason why there are many homemade D-Star solutions.

Three reflector systems are used for communication. DCS (most common), D-Plus, REF reflectors (mostly in English speaking countries), and the x-Reflector system which plays a minor role. The DV4home enables communication on all these systems.

## DMR

DMR was originally designed by ETSI for commercial applications. This is evident in the user interface where numbers are used in lieu of call signs. DMR modulates with 4FSK, indicating that it uses 4 frequencies (compared to D-Star with 2 frequencies). This allows doubling the data rate to 9600 bit/s. The higher rate allows the transmission of 2 channels at the same time (2 time slots). The DV4mini always works in simplex mode in DMR.

If you use time slot one (TS1) you have to set your radio to color code 1 (CC1) and the talkgroup you want to use, i.e TG311 or TG262 etc. **Be aware that you have to enter the talkgroup number into the receive group list of your radio** too, or your squelch will not open. This is a common error made by first time users and it is very frustrating.

When you use TS2, you always transmit and receive on TG9 (local) Then this routed by the DV4mini and the DMR Plus system into the selected rooms.



So on TS2 you use CC1, TG9. Again, you need to program your radio accordingly, and again do not forget to put TG9 into your receive group list!

There are multiple DMR networks available:

The DMR Plus network is developed and operated by the DV4 team, the Brandmeister network by a team of Russian developers and the DMR-MARC network by the Motorola Amateur Radio Club.

The DMR Plus network reflectors and the Brandmeister reflectors can be selected in the expert settings.

DMR reflectors have numbers in the range of 4000 to 5000. Each region has its own reflector, which can be selected in the DV4mini menu.

The DMR-MARC network can be selected by using the IPSC2 version of the control center. Select the appropriate IPSC2 server as your DMR server and you can connect to the Motorola TG on TS1 and to the DMR Plus TG on timeslot 2.

## **C4FM-Fusion**

C4FM-Fusion is a system developed by YAESU. It is based like DMR on 4FSK, and also transmits 4 frequencies with a total data rate of 9600 bits/s. It uses the same AMBE+ Codec as DMR, but needs only 3600 bits/s. The extra bits are used in C4FM-Fusion in a different way. They can be used for data transfer (e.g. GPS) but also for additional error correction to make the speech more stable during interference. There is also a mode for high speech quality which uses all bits for speech only.

C4FM -Fusion reflectors are named FCS001 (Europe), FCS002 (USA), FCS003 (Canada), etc. All DV4minis / DV4homes connected to a reflector can hear each other. It is very easy to connect a C4FM/Fusion repeater to the FCS reflector system.

## **P25**

P25 is a digital system that is mostly used by public and private emergency services worldwide.

Currently the DV4minis have 2 reflector systems available:

- PCS001 for Europe, located in Switzerland
- PCS002 for the Americas, located in Florida

## **dPMR:**

dPMR is a DMR system from China which uses several Chinese Codecs instead of the DVSI AMBE codecs commonly used by other digital systems. These radios are cheaper as they do not need to pay license fees for the Codecs. Practically you have to use radios from the same manufacturer on both ends of the communication, as they are not much standardized. This is why we call the mode experimental.

## **System requirements**

The following components are necessary:

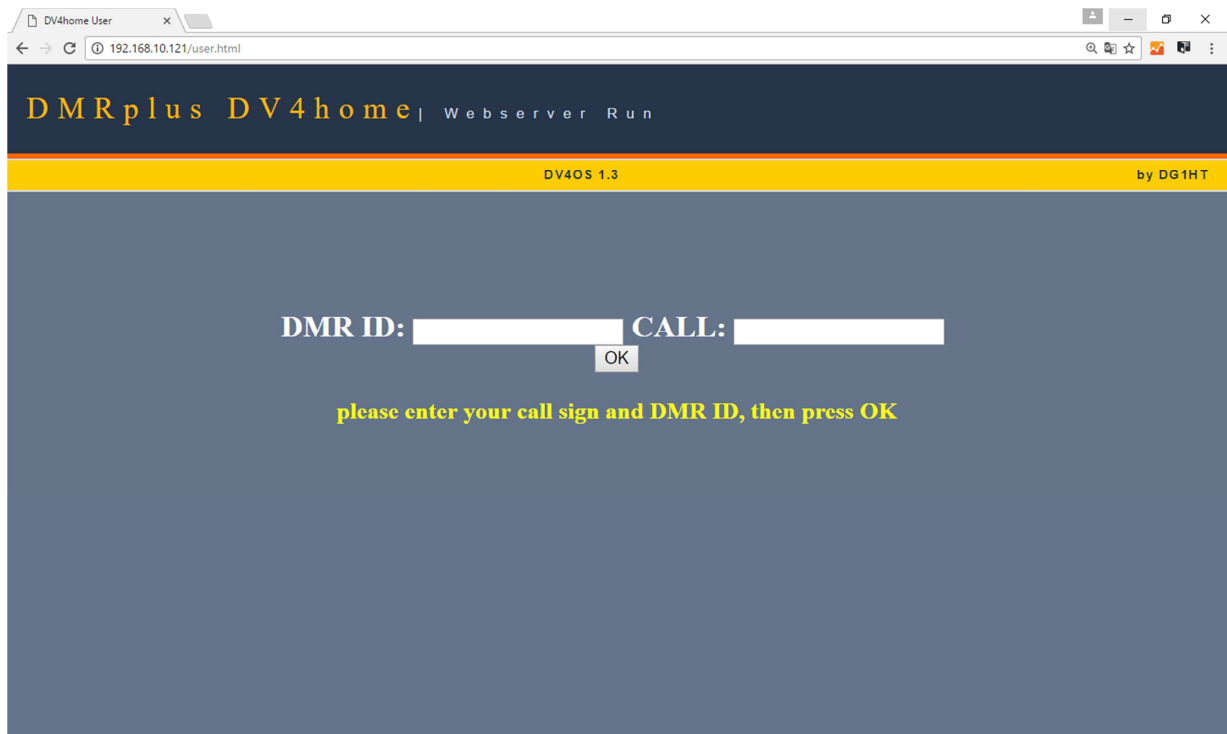
1. Internet access.
2. A PC with Windows 7, 8.1, 10, for firmware upgrade.
3. Web browser (any platform) for remote control.

# Initial setup

Before turning on the DV4home for the first time make sure you have a wired Ethernet connection to your home router. When you turn on the DV4home for the first time it will show on the display its IP address (obtained by your home router via DHCP) with an http link necessary to setup your call sign and your DMR ID (CCS7 ID). The IP address scheme will vary from one place to another depending on the local network configurations (LAN) or the router manufacturer's default subnet.

Here's an example for the 192.168.10.0 /24 network:

<http://192.168.10.121/user.html>



Now enter using any web browser in your home network and type the link shown on your DV4home screen. You should then access the DV4home user setup, see image above. Enter your DMR ID (CCS7 ID) and your call sign, click ok and you're done. You can change the user settings anytime by accessing the same URL.

**Make sure you have entered your CCS7 ID (DMR ID). The DV4home will not work without it.**

If you do not have a CCS7 number go to <http://dmr-marc.net> and click on Register ID. It can take up to 72 hours until you get your number by email.

# Operating the DV4home

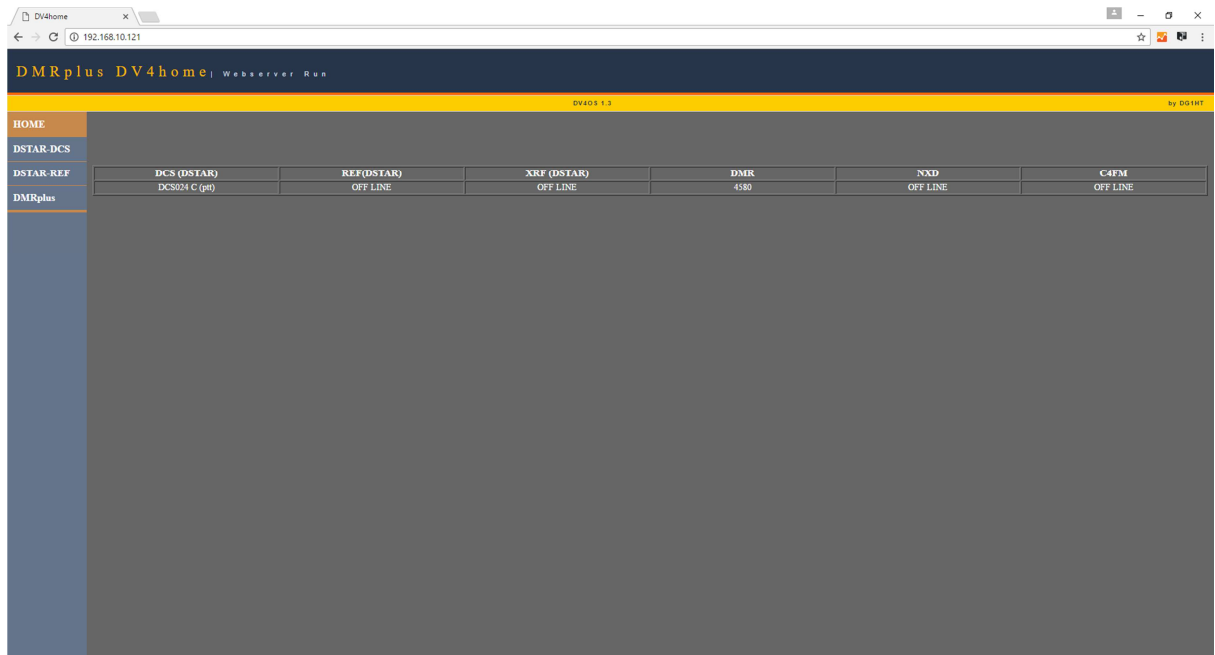
The DV4home is a stand-alone device and there are two different ways it can be configured. The first one is via the DV4home menu button on the front panel and the second one is via a web browser interface since it has an integrated web server.

## Remote webserver

When you enter the IP address of your DV4home into a web browser, you will access the DV4home webserver.

DV4home home page example: <http://192.168.10.121>

On the DV4home home page you will see the current mode status, if it does not show press F5 on your computer keyboard to refresh. The DV4home has two integrated AMBE chips, which allow you to have two separate modes operating at the same time. The current software version only supports D-Star and DMR, in the image below you see that there are two modes active and it shows on which reflectors they are connected.

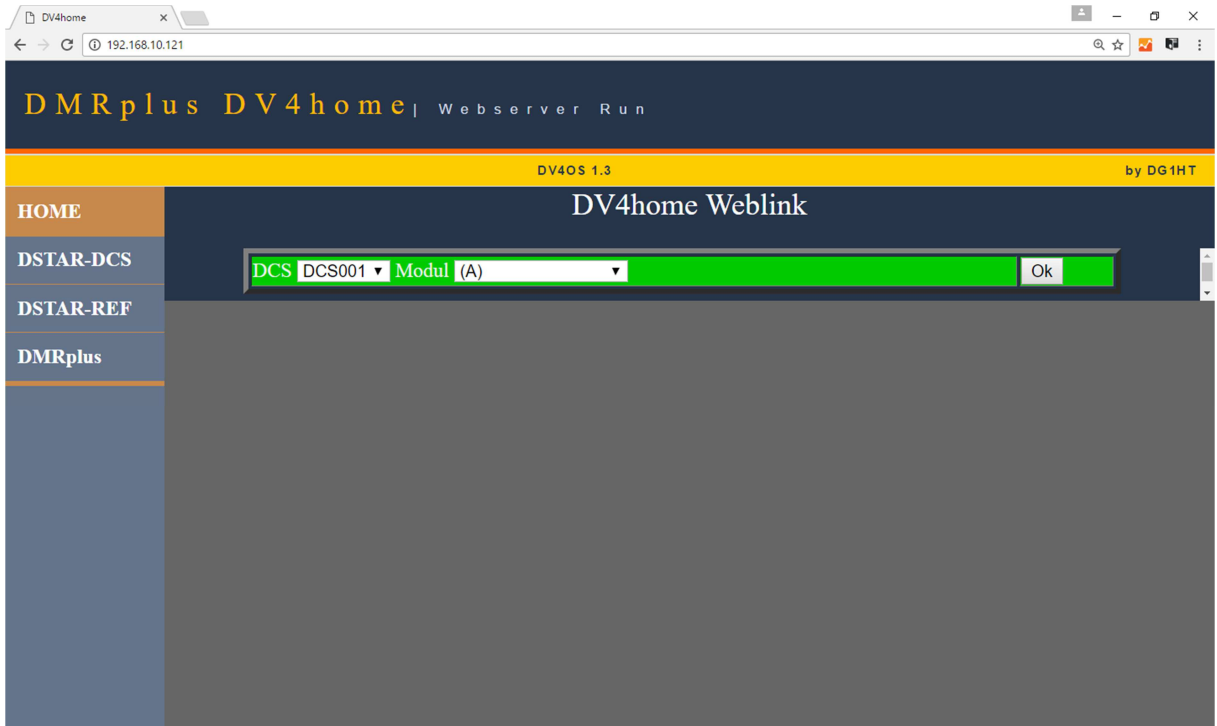


This image is from a preliminary software version, the other modes / reflectors will be available later this year.

# Connecting to a reflector

## Method #1: Using any web browser

When you access the home page of the DV4home webserver and click on DSTAR-DCS, you will find a drop down menu that allows you to select a DCS reflector and room.



Select a DCS reflector from the drop down menu, a module (port) and click ok to connect. After connecting you will have the reflector status information displayed on the web page. See below.

DV4home | Webserver Run

DV4OS 1.1 by DG1HT

HOME DV4home Weblink

DCS DCS001 Modul (A) Ok

DMRplus DCS001 CCS7 Security Mode ON | Reflector System 7 Status and Control

Do not have a CCS7 code for your Call? Please Registrations:DTMF by DG1HT

Nr.	MyCall	Source	S+Modul	CCS7	Your	Message	Last Heard	GROUP	Group DTMF	Server
1	HS1WLG	AF0NE	AF0NE B	(520) 0010	CQCQCQ	Bangkok, Thailand	51 m 58 s	Thailand DCS001 U	D121	2
2	JJ0NNU	JJ0NNU	JJ0NNU B	(440) 0001	CQCQCQ	BLACKPOOL I083LT	54 m 20 s	Deutschland DCS001 C	D1C	1
3	DL9NDG	DL9NDG	DL9NDG D	(262) 4603	CQCQCQ	Heinz MotorradMobil	1 h 45 m 42 s	Deutschland DCS001 C	D1C	1
4	F5SEP <small>GPS A</small>	F5ZSS	F5ZSS B	(208) 3017	CQCQCQ	73s jacques du 65	1 h 48 m 20 s	Hessen DCS001 K	D111	2
5	DO2MRO <small>GPS A</small>	DB0HRF	DB0HRF B	(262) 6436	CQCQCQ	Mick Offenbach	1 h 57 m 48 s	Hessen DCS001 K	D111	2
6	KA2NCD	MultiLink	KA2NCD B	(313) 6628	CQCQCQ	VINNIE BELLMORE NY	2 h 55 m	World Wide DCS001 A	D1A	2
7	DG1ABV	DB0DLR	DB0DLR B	(262) 3364	CQCQCQ	No Info	3 h 18 m 13 s	Niedersachsen DCS001 N	D114	2
8	DL2NX	DL2NX	DL2NX B	(262) 4650	CQCQCQ	C5 + DV-Modem on air	3 h 21 m 51 s	Deutschland DCS001 C	D1C	1
9	DB3UB	DB0SWR	DB0SWR B	(262) 7251	CQCQCQ	Walter Wertheim/A23	3 h 25 m 16 s	Deutschland DCS001 C	D1C	3
10	DL50CD	DL50CD	DL50CD B	(262) 3067	CQCQCQ	Michael Algermissen	3 h 35 m 47 s	Eibe-Weser DCS001 D	D1D	1
11	DL90BG <small>GPS A</small>	DB0OL	DB0OL B	(262) 3343	CQCQCQ	Olaf Wildeshausen	3 h 35 m 51 s	Eibe-Weser DCS001 D	D1D	1
12	DK6HP	DK6HP	DK6HP B	(262) 2038	CQCQCQ	GERDI HAMBURG	4 h 20 m 25 s	ECHO Function DCS001 Z	D126	1
13	DC3AX	DC3AX	DC3AX D	(262) 6539	CQCQCQ	Ulrich / Weilburg	4 h 26 m 2 s	In use DCS001 G	D107	2
14	F4BQH	F4BQH	F4BQH D	(208) 6004	CQCQCQ	BlueDV by PA7LIM	4 h 35 m 55 s	World Wide DCS001 A	D1A	1

The procedure is the same for all other modes.

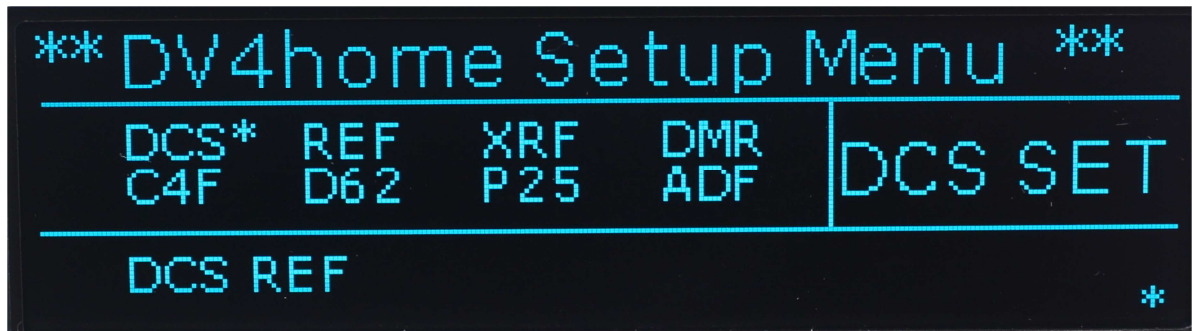
## Method #2: Direct on the DV4home

To access the main menu, do a brief push on the MENU (volume) knob.



The \* indication shows the current selected mode, to change to another mode just turn the MENU knob.

After selecting the operating mode do a brief push to access the submenu of that mode.



When you turn the MENU knob you will find 5 options;

1. Reflectors ( D-Star DCS in the example below)



2. Ports (DCS in the example below)



3. Link ... (DCS in the example below)



4. Unlink ... (DCS in the example below)



5. Exit Menu





## Programming a reflector using method #2

The procedure below is showing how to select a mode, reflector, port and how to activate it. This example is based on the DCS reflector, please note that it is the same procedure for all the other modes. In this example we will program DCS008 module C. To return to the main screen just press and hold the MENU knob for a few seconds.

From the main menu select the operating mode by turning the MENU knob. Push briefly the MENU knob. The image below shows the submenu screen of the DCS selection.



Push briefly the MENU knob to access the DCS REF configuration menu. The current configuration is for DCS-001 Port A.



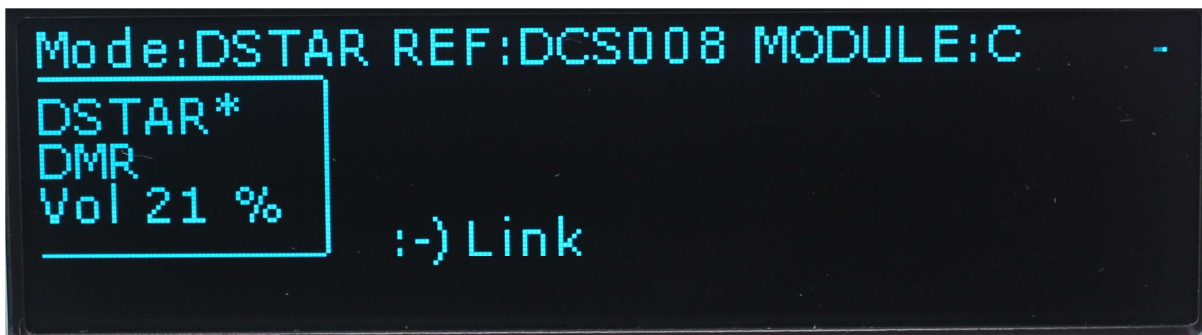
When you turn the MENU knob the DCS-001 will change, then select the desired DCS and press and hold the MENU knob to complete the selection. In the example below we selected DCS-008.



When you press and hold the MENU knob for selecting the reflector you will get back to the submenu. Turn the MENU knob for the next submenu selection, DCS Port and push the knob briefly. Select the desired port by turning the MENU knob and press and hold the MENU knob to complete the selection.



When you do a press and hold on the MENU knob for selecting the port it will bring you back to the submenu. Turn the MENU knob for the next submenu selection, Link DCS and push briefly. This completes the reflector selection and you are now connected.



Please note that the setup is the same for all reflectors except for a small difference in DMR, when you select a reflector there is no port. Since there are lot of them the port selection is changed by using different increments (step) to navigate through the reflectors. See the image below.



## Transmitting with the DV4home

The DV4home operates like a normal transceiver without the RF. It has two separate IP transceivers (2 x AMBE chips) so you need to select which one you will be using; this selection is similar to switching the microphone between two different active VFOs or bands on a RF transceiver. Depending on your choice it will transmit on the active reflector connection for that mode.

The \* after the mode indicates the current active mode. To change modes on the main screen, just press and hold the MENU knob then it will switch the mode.

For D-Star:



For DMR:



When you transmit in D-Star (PTT)



The last bottom line of the DV4home display gives you the current status on the reflector, showing the transmitting station, in that case it's VA2PV.

When you transmit in DMR (PTT)



## Full duplex operation

The DV4home has full duplex capabilities. Since it is an IP transceiver, bandwidth is not an issue, but this feature will only work between DV4home and future DV4mobile. When you select any reflector, DV4home owners are able to communicate in full duplex. While doing full duplex your communication will not be heard by the other stations or repeaters that are connected to the reflector. We do not recommend operating in full duplex intentionally, but this feature can be very useful to detect doubling.

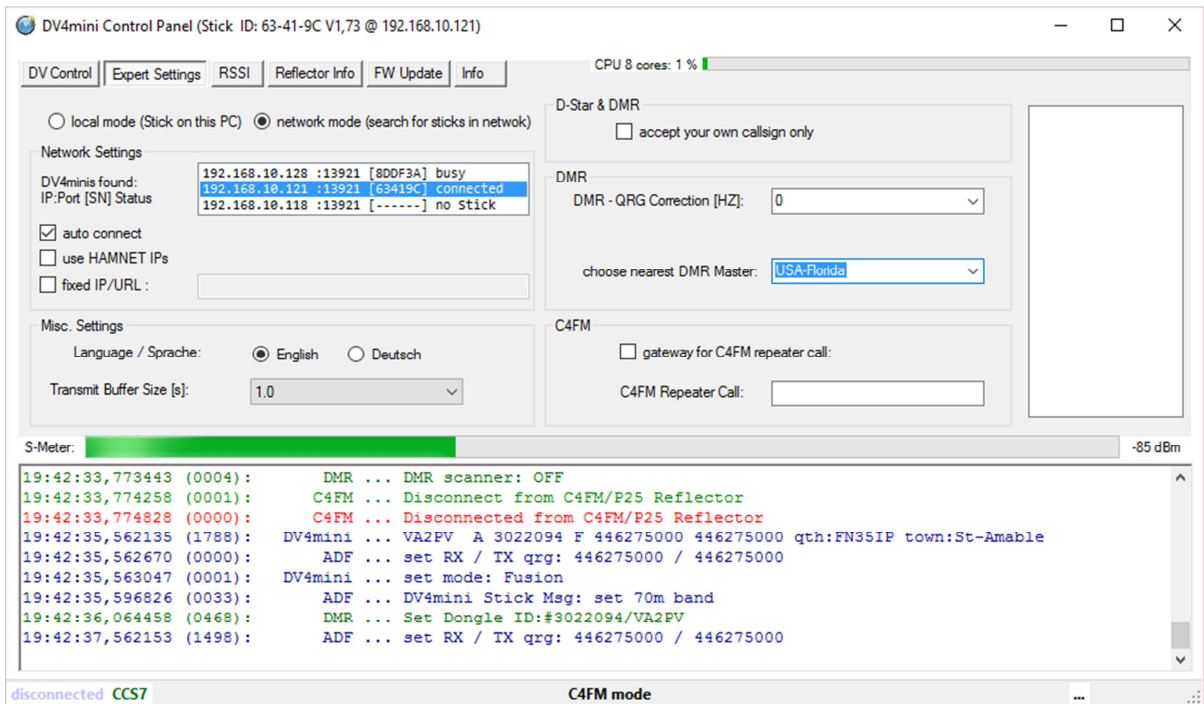
## Operating the optional DV4mini

The DV4home can provide a “home” to the DV4mini. You can then add to your device a RF hotspot. Please note that the DV4mini will operate independently of your DV4home. The DV4home just offers an alternative to a PC or a Raspberry Pi hotspot, it provides the power, the software and a stand-alone hotspot.

Insert your DV4mini into the marked port on the rear panel. Your DV4mini will fit perfectly. Make sure it's well seated into the USB port completely at the end of the square opening of the case. Please note that there will be no operating information on the front panel (leds) or in the menu of the DV4home.

To operate the DV4mini you will need to do it via the software, either running on a remote PC (Windows or Linux) or a remote Raspberry Pi.

In the software Expert Settings tab, select network mode and look for the DV4mini with the same address of your DV4home. Double click on it and you are now controlling this remote DV4mini. See the image below.



You can now close your software on your computer (or Raspberry Pi), you can even shut the PC down as the DV4mini into the DV4home will operate stand alone with the DV4home. You will only need the remote software to switch mode or reflector. The DV4home will memorize your last used configuration, even if the DV4home reboots, it will reconnect to the last known connection and it will work just like a regular hotspot.

## Reflectors

A reflector is a server connected to the Internet or HamNET and is linked to a number of digital Ham Radio repeaters. If one of these repeaters is active, it will send the voice data stream to the reflector. The reflector sends a copy of these voice data to all connected repeaters. This means that a QSO can be heard on all those repeaters simultaneously.

This increases the chance to find a QSO partner - which is one of the reasons why reflectors are quite popular.

The following systems are operational:

## **DCS (Digital Call Server)**

DCS is the most modern D-STAR reflector system and used worldwide. Many countries use their own reflectors which differ from each other by their 3 digit number. (DCS001, DCS002 etc).

Each DCS reflector has 26 rooms which are allocated to various regions of a country or continent. These rooms (A to Z) have been given names to make their identification easier and are shown in the webserver of the DV4home.

## **FCS**

FCS reflectors are similar to DCS reflectors but planned for the Yaesu C4FM system. FCS001 and FCS002 each have 100 rooms (numbered 0-99).

## **PCS**

PCS reflectors are also similar to DCS reflectors but used by the P25 system. Both PCS001 and PCS002 have rooms 0-99.

## **Xreflectors**

Xreflectors are the second generation of D-STAR reflectors and no longer used as much. However, in some countries like Italy they are still being used as the hams have not yet agreed on a common concept.

Xreflectors have less ports over which simultaneous QSOs can be run. Xreflectors are named XRF001, XRF002 etc.

## **D-Plus reflectors**

They were the first generation D-STAR reflector system. Although it is getting old it is still used intensively in a number of countries (mostly English speaking ones like USA, UK and Canada but even in Germany there are a few operational). D-Plus reflectors are named REF001, REF002 etc. Simultaneous QSOs are possible.

## **DMR reflectors**

DMR reflectors consist of several regional servers that are connected with each other via a superordinate network. Several nets exist, see earlier in this text. In the

meantime, there are also some cross connections existing that allow communication beyond one's net limits.

## **Net organization (CCS7)**

The big number of reflectors, repeaters and also Dongle users (the DV4mini is a Dongle) require a structured organization to make the network technology work properly.

D-Star works with call signs to identify a station. DMR however uses numbers. That is why it is necessary that an amateur radio station gets a number assigned in addition to its call sign and that this call sign/number combination is known to the network.

Every ham can go to the website <http://www.xreflector.net> or <http://www.dmr-marc.net> and request a 7 digit number to be assigned. This number is then entered into the specific field on the DV4mini software. The call sign is pulled and a report is sent to the network to establish worldwide contacts in D-Star or DMR and the use of D-Star/DMR bridges.

## **Operating modes**

Digital ham radio repeaters are connected via reflectors. This allows for worldwide connections from one repeater to another.

The DV4home makes its own connection to this reflector network and gets access to all connected ham radio repeaters. You use your own call sign with the DV4home.



## Technical Data

Power	9-15V, 1A, barrel connector 5.5/2.5mm
Ethernet	RJ-45, 10/100 MBit/s
Speaker	Stereo 3.5mm for simultaneous dual mode operation
Microphone	DTMF, Electret with modular connector
DV4mini slot	Integrated shielded compartment with USB connector
USB interface	WLAN or LTE stick for wireless Internet connectivity
Line out	3.5 mm 1 Vss
Display	256 x 64, 4 lines OLED
Temperature range	-40C - + 85C
Ethernet	RJ-45, 10/100 MBit/s

## Software update

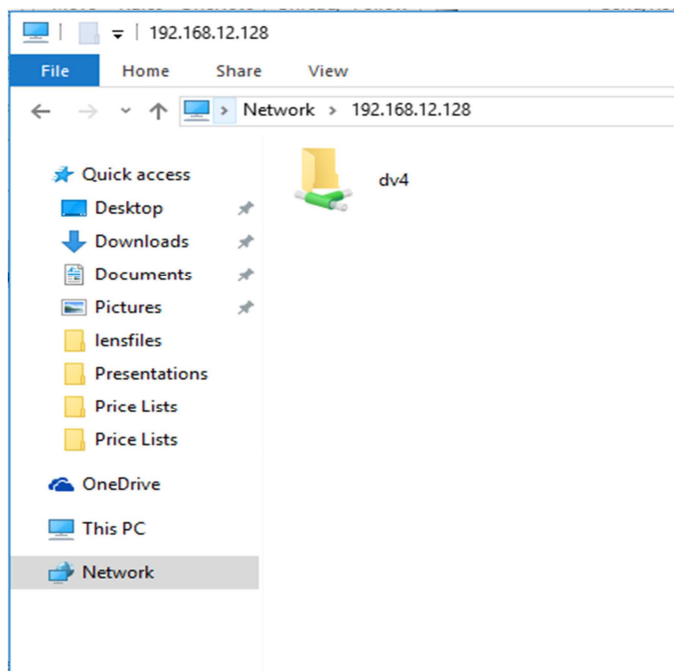
Later this year the software updates will be downloaded to the DV4home automatically. In the meantime, please use the procedure below. A manual will be published end of September 2016.

When a new firmware is available you will get a notice via the DV4home screen. No need to monitor the website.



Please update and use the following procedure:

Open file explorer, click on Network and type in `\\192.168.....` using the IP address of the DV4home, as it appears on the display. It should look like this, just with the correct IP address:

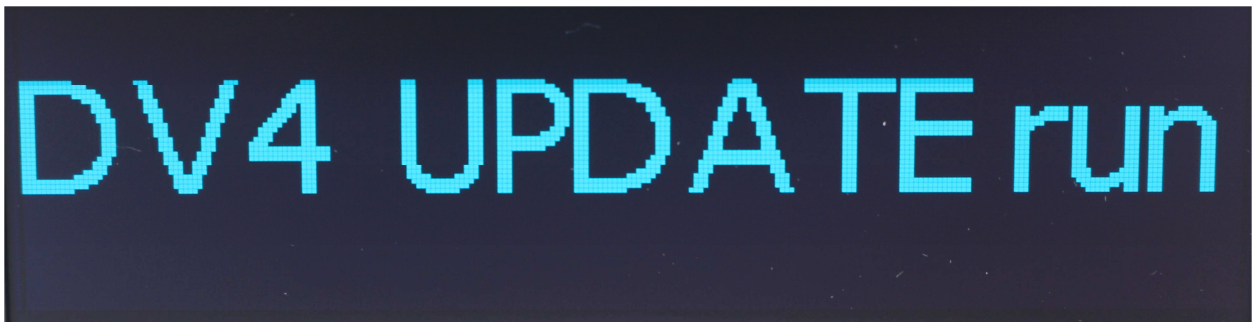


Copy the DV4home update file into the DV4 folder and reboot by disconnecting the power for 5 seconds.

After start-up it will show a few windows, then it displays DV4 UPDATE!!



Then it goes black and reboots again. This takes a minute or two, be patient. It will now show DV4 UPDATE run, the TX and RX LED will blink during the process.



Every time you boot the DV4home it will show you the installed firmware version, so after upgrading make sure you have the new version active like below. If it's not the case, unplug the power for 10 seconds and reboot.



If you have a DV4home full version (with AMBE) it will come up as “DV4compact”, which is obviously incorrect. As a workaround please disconnect the power for 5 seconds again and reboot. This concludes the update procedure.

## **Copyright:**

The rights for the DV4mini and its software are reserved with DG8FAC (Stefan Reimann), DG1HT (Torsten Schultze) and DJ0ABR (Kurt Moraw).

The rights for the DMRPLUS and P25 software modules are entirely with DG1HT (Torsten Schultze).

## **Important Links:**

Software, Firmware, Operating Manuals, Drivers:

<http://wirelesshold.com/manuals.aspx>

Developer info and interfaces: [www.dj0abr.de](http://www.dj0abr.de) DMR/CCS7 number allocation at [www.xreflector.net](http://www.xreflector.net) and <http://dmr-marc.net>

## **Operating conditions**

This product must only be used within the technical data limits provided. All other not specifically listed operations are not permitted.

The product is exclusively for use by licensed Amateur Radio Operators. Commercial use or operation outside of the ham bands is specifically prohibited.

Damaged, moist, defective or abnormal appearing units may not be operated. Use in vehicles, airplanes or under dangerous conditions is not permitted. Full responsibility lies with the user. The product may only be operated if the user is fully aware of the risks and dangers which may result from its operation. The manufacturer is not liable for personal damages, property damage, losses or expenses which result from misuse or operation of this product.

This includes claims for damages, failure or malfunctions. If the user does not have the necessary know-how to assemble, install or operate or is not in agreement with the operating conditions he/she may not use the product.

Standard warranty conditions apply. All further claims are excluded.