DV4mini.

DV4mini: D-Star/DMR/C4FM/P25-Hotspot-USB-Stick
User Guide

Table of Content:

Capabilities:

The DV4mini is a very small but also very capable USB Stick that can turn any PC into a Hotspot for the digital modes D-STAR, DMR, C4FM and APCO P25. It consists of a powerful 32 bit micro controller, a complete 70 cm/2 m transceiver and a modulator/demodulator for GMSK and 4FSK and a USB interface.

The DV4mini does not require an external power supply. It is powered through the USB interface. Even older USB interfaces are sufficient. The DV4mini is supplied together with a simple to use and comprehensive software package. This allows linking with DCS, XRF and REF reflectors for D-STAR as well as DMR, P25 and Fusion reflectors.

Many hams have a DV (digital voice) capable transceiver but cannot reach the closest DV repeater. With the DV4mini it has become possible to create a hotspot with minimal resources and thus get access to a DV network. It is also possible to link C4FM repeaters with the reflector network.

The new DV4mini AMBE allows to talk to D-Star Reflectors or DMR Talkgroups without a radio, just using a headset with microphone and speaker connected to the PC. Fusion works with an external radio, the AMBE based direct connection will be updated via software update later.

The UHF DV4mini can be set to any frequency between 420 MHz and 450 MHz. The VHF versions work on any frequency between 144 MHz and 148 MHz. However they also cover the 70cm band at a lower output power, so they are dual band capable, but the output power on 70cm is lower than in the UHF version.

Digital Modes:

The DV4mini 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 is 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 home made 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. DV4mini 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 to double 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) This is then 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 you 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 D4FM-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 connected to a reflector can hear each other. It is very easy to connect a C4FM/Fusion repeater to the FCS reflector system. Just put a computer with a DV4mini next to the repeater and enter the reverse RX/TX frequencies. We have seen remote feed operations of up to 2 miles line of sight.

P25:

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

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 a 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. DV4mini USB stick
2. PC Software: DV4mini Control Panel
3. A digital radio (D-Star, DMR, C4FM, P25). If you use the DV4voice (AMBE) you can just use a PC headset instead.
4. A PC with Windows 7, 8.1, 10; Linux on a PC or an ARM computer like a Raspberry, BananaPi or Odroid.
5. Internet access

The DV4mini is connected through the USB interface with a PC or a single board computer. The DV4mini control panel software has to be installed. You can download it in the download section of our web site at
www.wirelesshold.com

Then start the control panel software and enter the settings you want to use.

If you get a message about a missing DLL download the microsoft VC redistributable from our website (download section as well) and install this as well.

Make sure to have entered your CCS7 ID. The DV4mini will not be found 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.

After starting and setting up the software one now has a Hotspot for the 70 cm/2 m band and it can be used with any digital radios in the supported modes. You need a D-Star radio to operate in D-Star or you need a DMR radio to operate in DMR etc. (unless you have the DV4voice (AMBE)

The picture shows a DV4mini connected to a Raspberry PI 2 Mod. B:
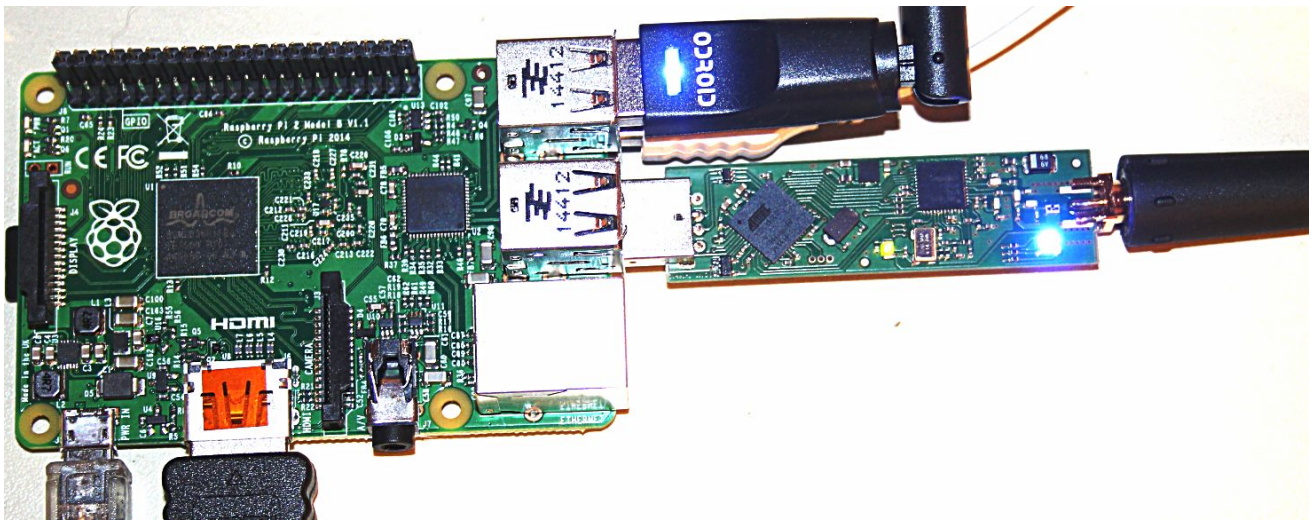
The dongle on the top is a WiFi stick to connect to the internet. Below you can see the DV4mini. The board also has connectors for a keyboard, a mouse and a HDMI display. This configuration allows for a low power operation.

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 control panel of the DV4mini.

FCS:

FCS reflectors are similar to DCS reflectors but planned for the Yaesu C4FM system. FCS001and FCS002 have 100 rooms each (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.

X-Reflector IP Address:

Unfortunately XReflectors are not centrally organized thus it is not possible to come up with a reliable list of all Xreflectors. The file xref.ip contains the Xreflector name and the matching IP address or URL. This list can be modified or updated by the user. The file is located in the same directory as DV4mini.exe

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 too) 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 xreflector.net or 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 DV4mini makes its own connection to this reflector network and gets access to all connected ham radio repeaters.

The hotspot includes a low power 70 cm/2 m transceiver. All voice communications on the connected reflector will be transmitted by the hotspot on 70 cm/2 m and one can listen and transmit with a digital radio. A hotspot is an ideal solution if there is no good access to a digital repeater because you are inside a building, you are too far away or you are on vacation.

You use your own call sign for the hotspot. Reduce your transmit power to a point where you still able to cover your living area for a reliable communication.

Hardware:

Use the hotspot mode to enter the frequency to be utilized for DV operation. (check your band plan).
Your transceiver will be set up for Simplex use - RX and TX on the same frequency.

The DV4mini gets the 5 Volt operating power from the USB interface. On some computers the voltage could be too low (we measured below 4.5 V on some). In this case you can't operate. Then the best solution would be to use a USB adapter with its own power supply.

Technical Data:

Frequency Range UHF/VHF	420-450 MHz/144-148 MHz
Resolution	250 Hz
RX/TX D-Star:	Duplex +/0/- any shift
RX/TX DMR:	Simplex (TX=RX QRG)
Modulation D-Star:	GMSK (Gaussian 2FSK)
Modulation DMRPLUS:	4FSK Raised Cosine
Antenna connector:	SMA female 50 Ohm
USB interface:	USB type A
Operating Voltage:	5 Volt
Current max RX	15 mA
TX (with 12 mW	188 mA
S-Meter	1 dBm resolution accuracy +- 1dBm (> -100 dBm - <50 dBm)
DV4mini output power steps: 0 1 2 3 4 5 6 7 8 9	10 steps in mW 0.03 0.4 1.2 2.4 3.9 5.5 7.1 8.8 10.5 12.0

Antenna:

Comply with your country's regulations regarding automatic operation!

The DV4mini requires an antenna. It must not be used without an antenna. You can use the commonly available 'rubber ducks' with a SMA connector. The DV4mini must be used only when you are nearby. Unmanned operation requires separate licenses or permits in almost all countries.

ATTENTION: Do not overload the SMA connector when handling the antenna. Always hold on to the base and not the stick. Damaged SMA connectors are not covered by warranty.

The DV4mini covers a large range of frequencies from 420 to 450 MHz in the UHF version and it covers 144 to 148 MHz in the VHF version. It is the operator's responsibility to use only the frequencies which comply with his country's laws.

Software installation:

The software for the DV4mini includes the following files:

dv4mini.exe
dv-serial (.exe)
PCMtrx (AMBE version only)

Windows:

For Windows 7 and higher the driver will be installed automatically as soon as you plug in the DV4mini into the USB interface.

Windows XP is no longer supported.

See: wirelesshold.com and click on the download tab.

That is where you also find the setup program for Windows. Download it from the site and start it. It will install all program segments and the needed

additional programs by Microsoft. This will create a DV4mini icon to let you start the program.

Additionally you need to install the Microsoft Package: "Visual Studio 2013 Redistributable" in the 32 bit Version. Attention: Even if you use 64 bit Windows you still need to install the 32 bit Visual Studio 2013 Redistributable, or install both 32 and 64 bit.

Driver installation:

A standard driver by Microsoft is used. After plugging in the DV4mini Windows will search for the driver in the internet.
This search can sometimes take a long time - up to 20 minutes. Wait until this driver is installed. If you are lucky it happens in seconds. Do not interrupt the process - have a cup of coffee and wait it out.
Should Windows not look for a driver you can go to the device manager, find the DV4mini and click on update driver.

Linux-PC:

The program requires the complete installation of Mono. You install for example with apt-get the packet mono-complete.

Until an installation packet is available at a later time the installation has to be done manually. Download the proper zip file to your PC. (http://dv4m.ham-dmr.ch) and unpack it into a directory of your choice below the home directory.

In order to gain access to the USB/serial interface the user account must become a member of the group "dialout". Open the Console and enter sudo gpasswd —add myusername dialout

The DV4mini program gets started by entering mono dv4mini.exe in the console or you can create a desktop icon.

Linux-ARM:

The same info as in PC-Linux is valid. However you has to assemble the required mono version yourself.
You can use the example given for the WSPR program on the website

http://dj0abr.de/german/technik/dds/wsprbanana_install.htm

An alternative approach was found by DL3MX which is described in detail in a separate document
(http://dv4m.ham-dmr.ch) and works on nearly all Debian based computers and is simple and quick.

We realize that this may overwhelm some hams, so we created complete images for the important computers which are also downloadable from http://dv4m.ham-dmr.ch

Control Panel - DV Control:

After starting the program the following window appears on the screen:
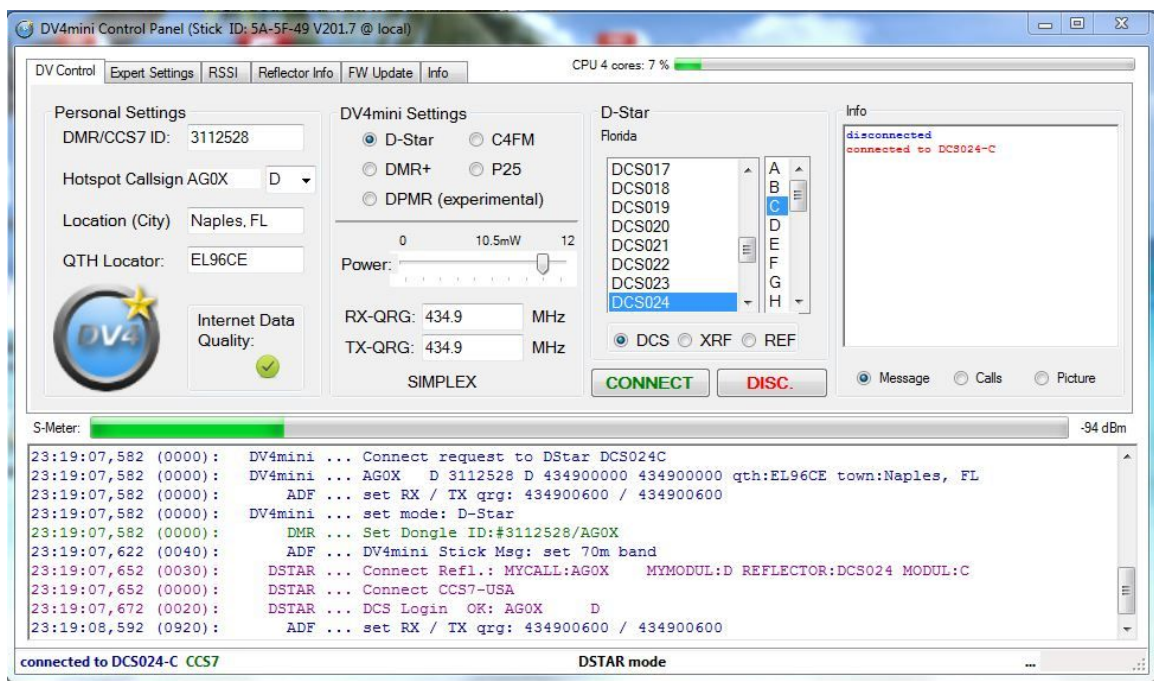
If you have an AMBE version, go to the program list on your PC and look for the DV4mini folder. You will find a program called DV4miniAudio. Click on it and this window will come up:
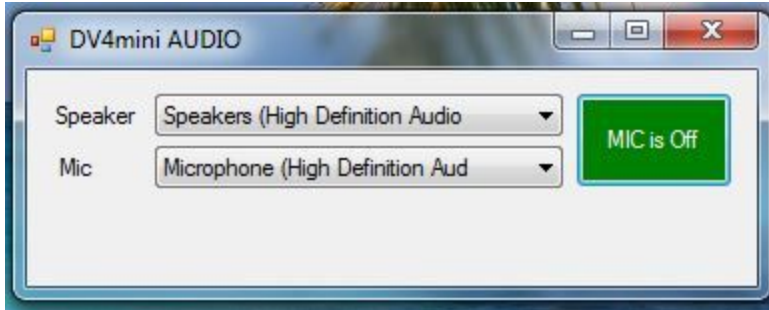
Select the microphone and speaker you want to use (We suggest a USB headset)

Then click on the MIC is Off button to turn the microphone ON:
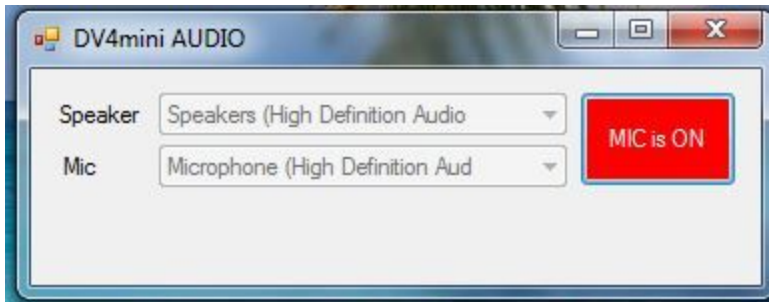
Now you can use your DV4mini without an external radio. Use the SHIFT keys on your keyboard as PTT.

Otherwise, the user surface is pretty simple and should not create problems.

DMR/CCS7 ID: the 7 digit ID. If you don't have one yet or have forgotten yours, go to xreflector.net and query under USER Register or apply for one. The DV4mini will not be found without this number and the input field will stay red.

Hotspot call sign: After you have entered your CCS7 ID your own callsign will be pulled from the database and automatically inserted and the letter D is pre-entered. It cannot be entered manually. If several hotspots are used then different letters behind your callsign must be used.

Location and QTH locator: They will be shown on the Xreflector page

If you do not have your QTH (grid) locator, go to http://qthlocator.free.fr/index.php to find out.

D-STAR, DMR, C4FM and P25: select the mode you want to use

Power: Adjust the power output - see technical data

RX-QRG: this is the frequency the DV4mini receives on. When using DMR it is also the transmit frequency.

TX-QRG: in D-Star mode you can operate in duplex mode (not in DMR) and you can enter the transmit frequency here

    After inputting these the DV4mini will store them.

Reflector selection: select a reflector of your choice (in D-Star also specify the port) and click "CONNECT" to create a connection or "DISCONNECT" to end an existing connection.

You can select D-Star and Fusion reflectors by using the touch tone (DTMF) feature. For example to change to reflector DCS024C type D2403. In C4FM it would be A and the room number = A10.

"#" disconnects from the room. In DMR you cannot use DTMF.

Info field: the information which is displayed here will be transmitted. For example the picture, which is stored in www.qrz.com for a received callsign, is shown. You can choose what you want to be shown by using the buttons below the info field.

Below that you see the S-meter. The RSSI value will be stored over a 24 hour period and shown in the RSSI window. The noise levels may be different from PC to PC. Values of -90 to -120 dBm are possible.

In the monitor window you may find diagnostic information which are created by various program segments. They are for experts but may be of interest for regular users as well.

On the lower screen segment you find status reports. CPU usage is shown as a bar on the upper right.
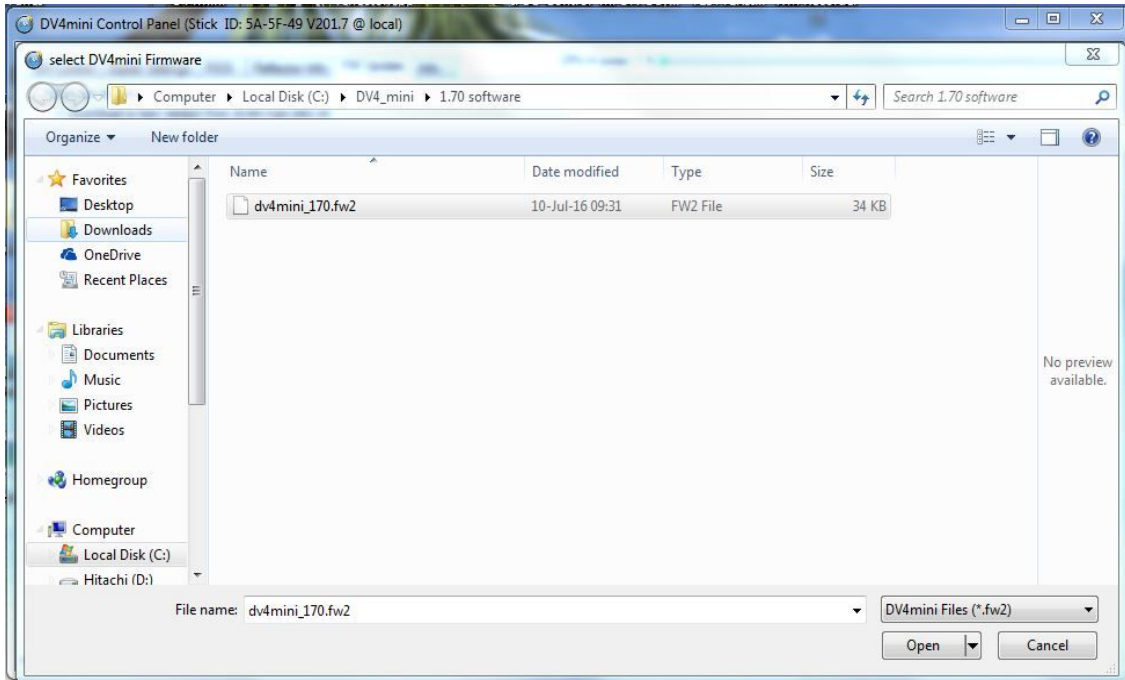
Bootloader/Firmware update:

In order to update the firmware a boot loader is installed in the DV4mini: First you save the new firmware file to your computer. You will find it at http://dv4m.ham-dmr.ch or at http://wirelesshold.com/manuals.aspx The AMBE and 2m versions are on the wirelesshold page only (July2016)

In the expert settings tab click on "Flash Firmware".
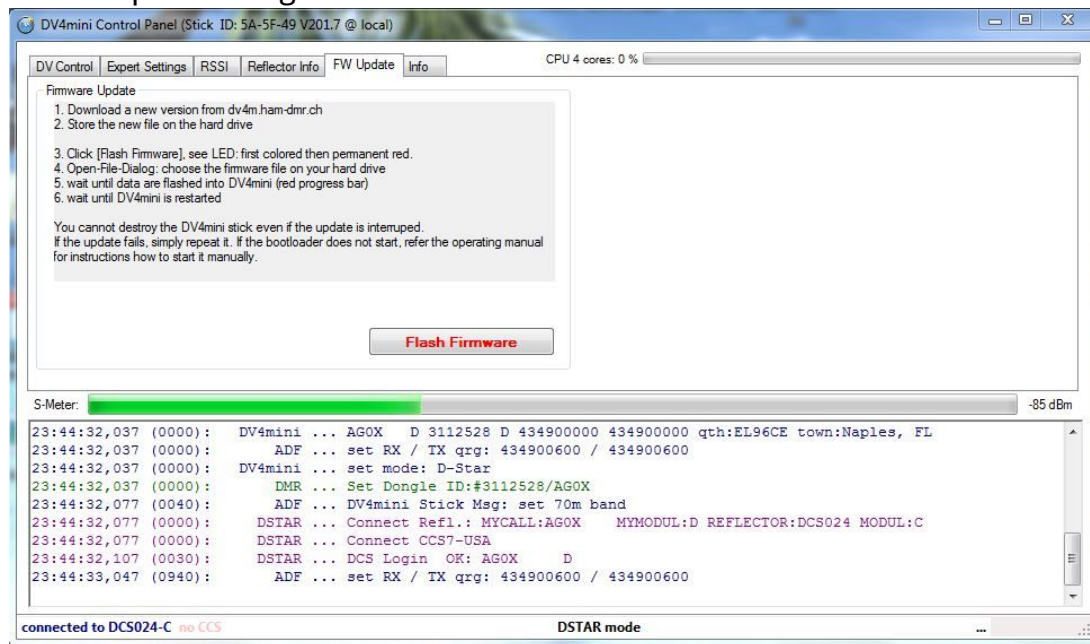
A file selection window opens and you select the new firmware file. This makes the LEDs on the DV4mini blink in different colors and when it is finished the blue light is on solid.

Now the firmware will be updated. When it is done end the program and restart. It may take a little while until the DV4mini is found again. Be patient.

The boot loader is protected. Even with a power outage or interruption of the USB interface the update procedure can be repeated.

If the boot loader does not start you can start it manually (this is usually NEVER required).
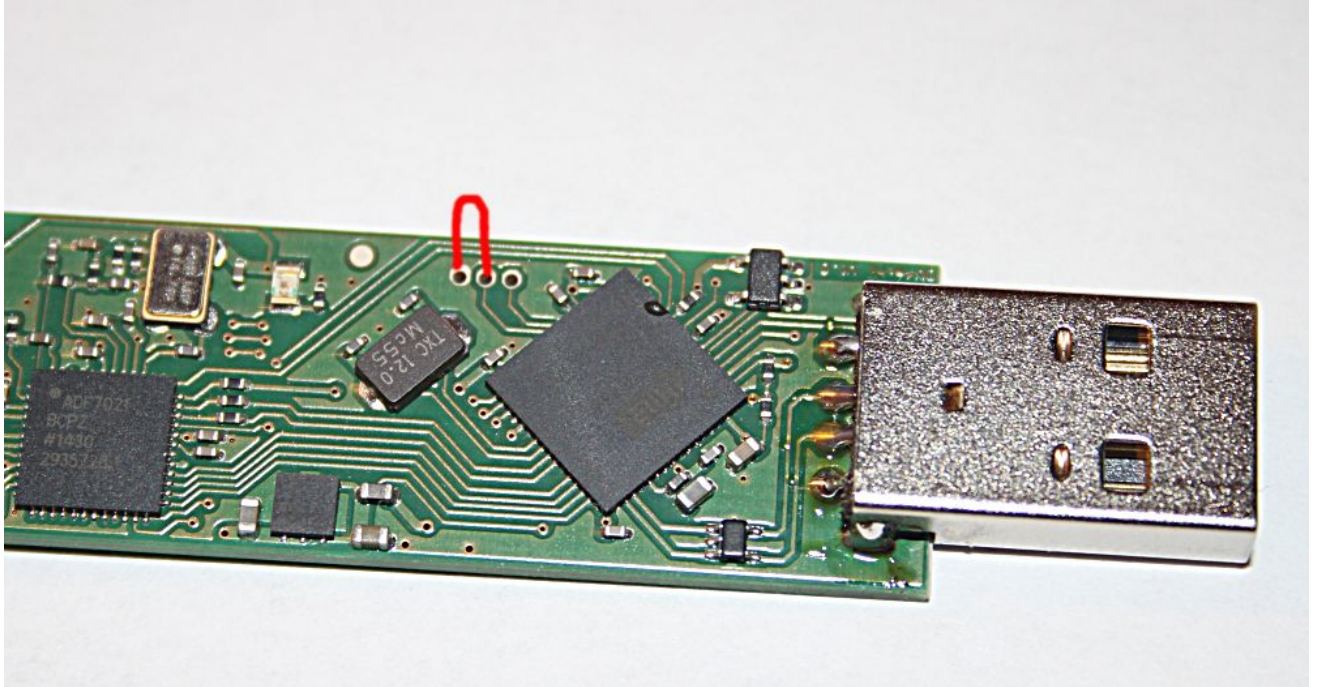
You need to connect the red marked points for example with tweezers **while** inserting the DV4mini into the USB interface. The boot loader will start with LEDs in color. Now you can start the user interface dv4mini. Go to expert settings load the new firmware by clicking on "Flash Firmware".

Control Panel - expert settings
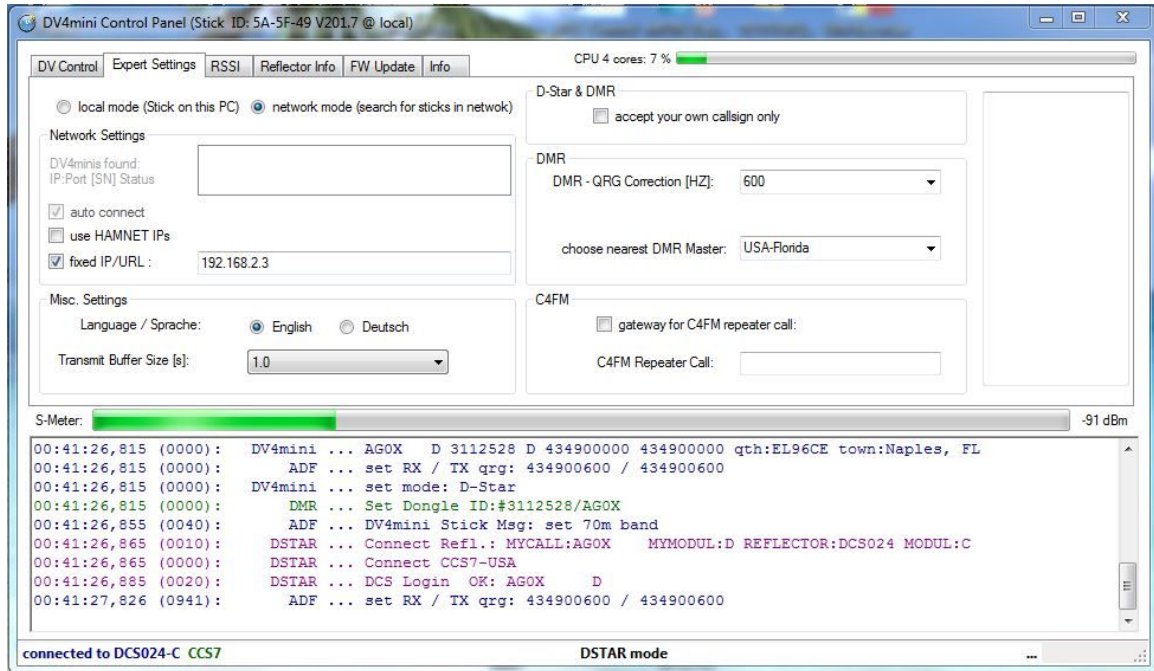
DV4mini list and auto connect:

The list shows all DV4minis found in your local network and their status. If you run a DV4mini without the user interface then you have to start the program "dv_serial" on this computer.

Usually "auto connect" should be checked. The software will automatically connect to the next available DV4mini.

You can run more than one DV4mini in your local network (with dv_serial started). Select one of them by checking one in the list.

Accept only own call sign:

If this entry is active, then only one D-Star transceivers with the same call sign as the DV4mini call sign can operate via the hotspot. All others are locked out. This is a requirement in some countries. This applies only to D-Star mode.

Language:

English or German. This setting changes the language of the user interface and also the language of any messages.

Select next location:

This is where the closest DMR Master is selected. You can actually operate via any master worldwide but should select the closest for the shortest ping time. Not all shown masters are online. If a connection to a DMR reflector doesn't work - pick another.

Gateway for C4FM Repeater, Call:

If you use the DV4mini as a gateway for a C4FM repeater you need to click on this field and add the call sign of the repeater. Otherwise the repeater will not retransmit.

Hamnet IP

HAMNET IP addresses will be used instead of the regular IP addresses, if this field is checked. This function may not work in all modes. It works for C4FM and as soon as the reflector servers can support it, it will be implemented.

Only own call:

This function is only supported in D-Star mode. If selected the callsign of the user must be identical to the callsign of the DV4mini or the transmission will not be relayed to the reflector.

Frequency Correction:

Sometimes the frequency of the DV4mini and the transceiver used don't match well. The bandwidth of the filter is approx. 800 Hz especially in DMR. The accuracy of the oscillator in the DV4mini is 2.0 ppm which on 70 cm is approx. 600 Hz and on 2 m it is 300 Hz This control lets you get to the middle of the filter in 100 Hz steps. Please follow this procedure:

Select reflector 4000 (no reflector) to avoid interference. Then push the PTT and watch the color bar for about 10 seconds. It will show the bit error rate

as green, yellow or red. After 10 seconds go up or down for 100 Hz and try it again for 10 seconds, so you get a good average You try to get it green or at least yellow. When you are done, go to another reflector and connect. Then pus the Echo button on the right of the reflector number. Talk a few seconds and the release the PTT. Your transmission will be played back from the reflector and you can hear how you sound to others.

If your frequency setup was right you should have good audio and you are done.

TX buffer size:

Before being transmitted through the built-in 70 cm/ 2 m transceiver the signal is being buffered.
You will not need buffers or only a small buffer, if you have a stable and fast internet connection
However, if you use mobile networks (H+, Edge, LTE etc), drop outs in the data stream can be substantial. In this case you pick buffer sizes of 1 or 1.5 seconds. This will delay the transmission a little but will close the holes and thus eliminate many interruptions.

Remote Control:

The DV4mini can also be controlled additionally by another computer.

Computer 1:
This is where the DV4mini USB stick is plugged in. Start the program "dv_serial" in console mode.

Computer 2:
Start dv4mini.exe - the control panel software. In order to find computer 1 its IP address needs to be entered in the field "distant *DV4mini IP/URL"* and you activate *Remote Control on/off.*

Now computer 2 can control computer 1. You will get all displays and full control over all settings as if you were sitting in front of computer 1.

Operating without a user interface:

The DV4mini starts up with the last selected configuration and connects to the last used reflector when only the program dv_serial is started from a console. This allows for an extreme power savings operation, which should make Linux purists happy. However it also works in Windows the same way.

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://dv4m.ham-dmr.ch and http://wirelesshold.com/manuals.aspx

Developer info and interfaces: www.dj0abr.de
DMR/CCS7 number allocation at 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 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.