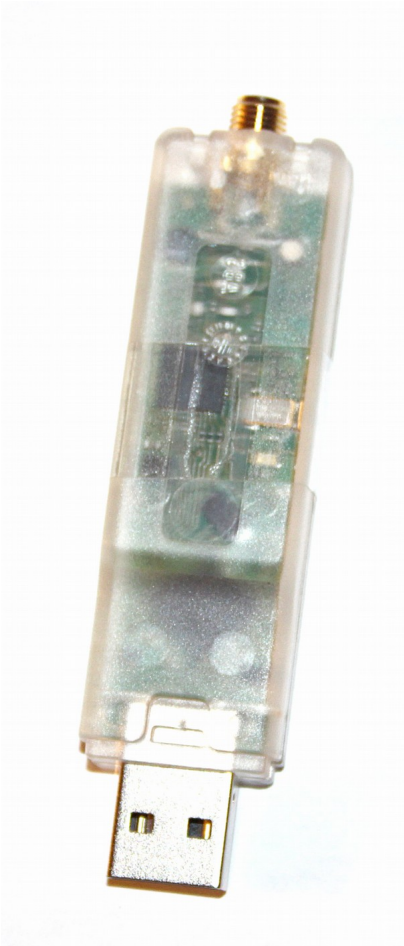
DV4mini

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



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DV Development Group
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English Translation: N1DL

Inhaltsverzeichnis:

Capability of this board and Software:

The DV4mini is a very small but also very capable USB Stick that can expand any PC into a Hotspot for the D-STAR and DMR modes (C4FM Fusion is in development).
It consists of a powerful 32 bit micro controller, a complete 70 cm transceiver and a modulator/demodulator for GMSK and 4FSK (incl. Raised Cosine) and also a USB interface.

The DV4mini does not require external power as it is powered via the USB interface. 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 s DMR reflectors.

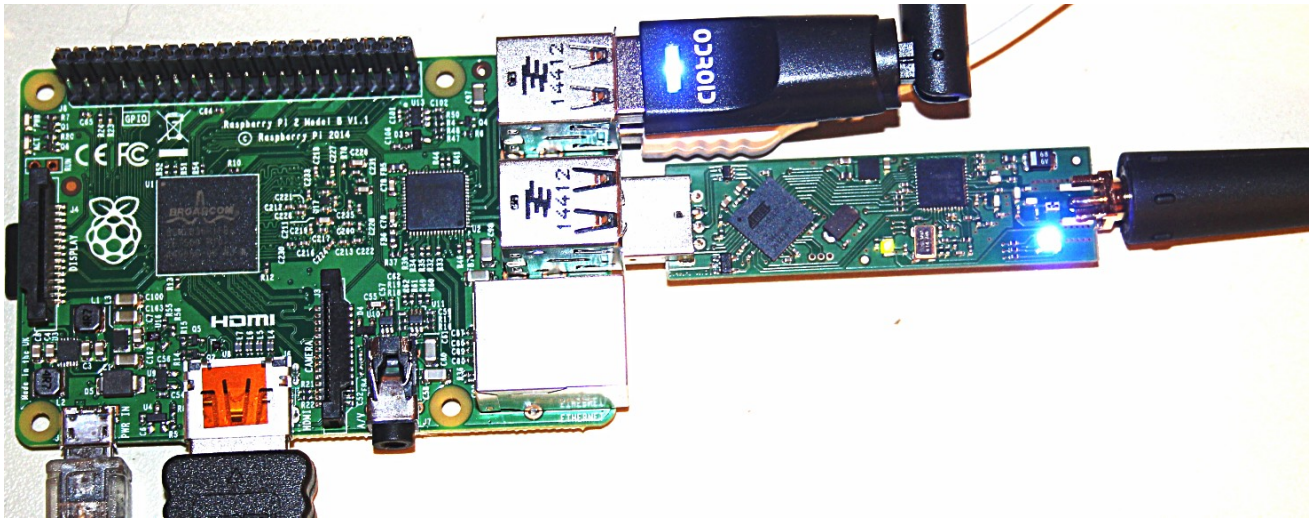
Many hams have a DV capable transceiver but cannot reach the closest DV repeater. With the DV4mini it has become possible to create a hotspot with minimal resources and thus get access to the DV network. We are talking about a small board inside a USB stick with a SMA antenna socket.

System requirements:

These components are a prerequisite:
1. DV4mini USB stick
2. PC Software: DV4mini Control Panel
3. A DV capable radio (D-Star, DMR)
4. A PC with Windows XP, 7, 8.1, 10; Linux on a PC or an ARM computer like a Raspberry, Banana Pi or Odroid.
5. Internet access

The DV4mini will be connected thru the USB interface with a PC or a single board computer and the required software will be installed. After starting and setting up the software one now has a Hotspot for the 70 cm band and can use it with a D-STAR or DMR transceiver.

This picture shows a DV4mini connected to a Raspberry PI 2 Mod. B:



On the upper right is a WLAN stick and below it the DV4mini. In addition there are also connections to a keyboard, a mouse and a HDMI display. This configuration allows for a power saving continuous operation at low expense.

Reflectors:

A reflector is a server connected to the Internet or Ham Net 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 of the connected repeaters. This means that a QSO can be heard on all connected repeaters simultaneously.

Thus the chance to find a QSO partner is considerably increased - which is one of the reasons reflectors are quite popular.

Today the following systems are in operation:

DCS (Digital Call Server):

DCS is the most modern D-STAR reflector system and in worldwide use. 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 on the user surface of the DV4mini.

Xreflector:

Xreflectors are the second generation of D-STAR reflectors and no longer widely in use. However in some countries like Italy they are still used as the hams have not yet agreed to a uniform concept.
Also Xreflectors have less ports over which simultaneous QSOs 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 are a few operational). D-Plus reflectors are named REF001, REF002 etc.
They also use a number of ports allowing for simultaneous QSOs.

DMR reflectors:

DMR reflectors consist of several regional servers that are connected with each other via a superordinate network. Two nets exist. One based on Hytera and the other based on Motorola technology. As Hytera is open towards Ham Radio the DV4mini sticks check into the Hytera based network. In the meantime there are also some cross connections existing that allow communication beyond ones net limits.

Net organization (CCS7):

The many reflectors, repeaters and also Dongle users (the DV4mini is a Dongle too) require a structured organization, so that the network technology works 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 web site xreflector.net and request a 7 digit number to be assigned. This number is then entered into the specific field on the DV4mini software. This facilitates reporting into the network and conduct 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.

With a hotspot (DV4mini) one creates ones own connection to this reflector network and gets access to all connected ham radio repeaters.

The hotspot includes a low power 70 cm transceiver. All voice communications on the connected reflector will be transmitted by the hotspot on 70 cm and one can listen with a digital radio and of course also transmit.

Thus a hotspot is an ideal solution in one has no good access to a digital repeater e.g. inside buildings,
due to distance or at a vacation spot.

For such a hotspot you use your own call sign. Reduce your transmit power to just enough to cover your living area for 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 takes the 5 Volt operating voltage from the USB interface. On a few PCs this voltage however may be too low (we measured below 4.5 V on some). In this case you can't operate.
The best solution is then to use a USB adapter with its own power supply.

Technical Data:

Frequency range:	420-450 MHz
Resolution:	ca 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:	4.75 - 5.25 V
Current max RX:	15 mA
TX (with 12 mW)	188 mA
S-Meter	1dBm resolution
	accuracy +- 1dBm (> -100 dBm and <-50dBm)
DV4mini output power steps:	10 steps

0 = 0.03 mW
1 = 0.4 mW
2 = 1.2 mW
3 = 2.4 mW
4 = 3.9 mW
5 = 5.5 mW
6 = 7.1 mW
7 = 8.8 mW
8 = 10.5 mW
9 = 12 mW

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 like the ones used with walkies. The DV4mini must not be connected to a high Yagi or similar antenna.

If you use a physically adjustable antenna, be careful that when you adjust the position of the antenna you hold onto the base and not the housing. Otherwise you may damage the SMA connector. The DV4mini must be used only when you are nearby. Unmanned operation requires in almost all countries separate licenses or permits.

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.

In order to utilize the stick in many countries the DV4mini covers a large range of frequencies from 420 to 450 MHz. It is the operators responsibility to utilize only the frequencies appropriate in his country.

Software installation:

The software for the DV4mini includes the following files:

dv4mini.exe
dv-serial (.exe)
dstar (.exe)
dmr (.exe)

Windows:

You will need a driver. For Window 7 and higher the driver will be installed automatically as soon as you plug in the stick into the USB interface.

Windows XP is no longer officially supported but may work on some PCs nevertheless. It will require a driver that is not certified by Microsoft and needs to be installed manually. You find it under http://www.ham-dmr.de/dv4m

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.

Note for Windows XP:

As XP is no longer supported by Microsoft all drivers and programs are outdated or obsolete. We have programmed the DV4mini so that it may run under Windows XP. You can try it, but if it is not working there is no support for use on XP. The outdated multitasking of XP may also create software crashes.

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 one has to install manually. Download the proper zip file to your PC. (http://www.ham-dmr.de/dv4m) and unpack it into a directory of your choice below the home directory.

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

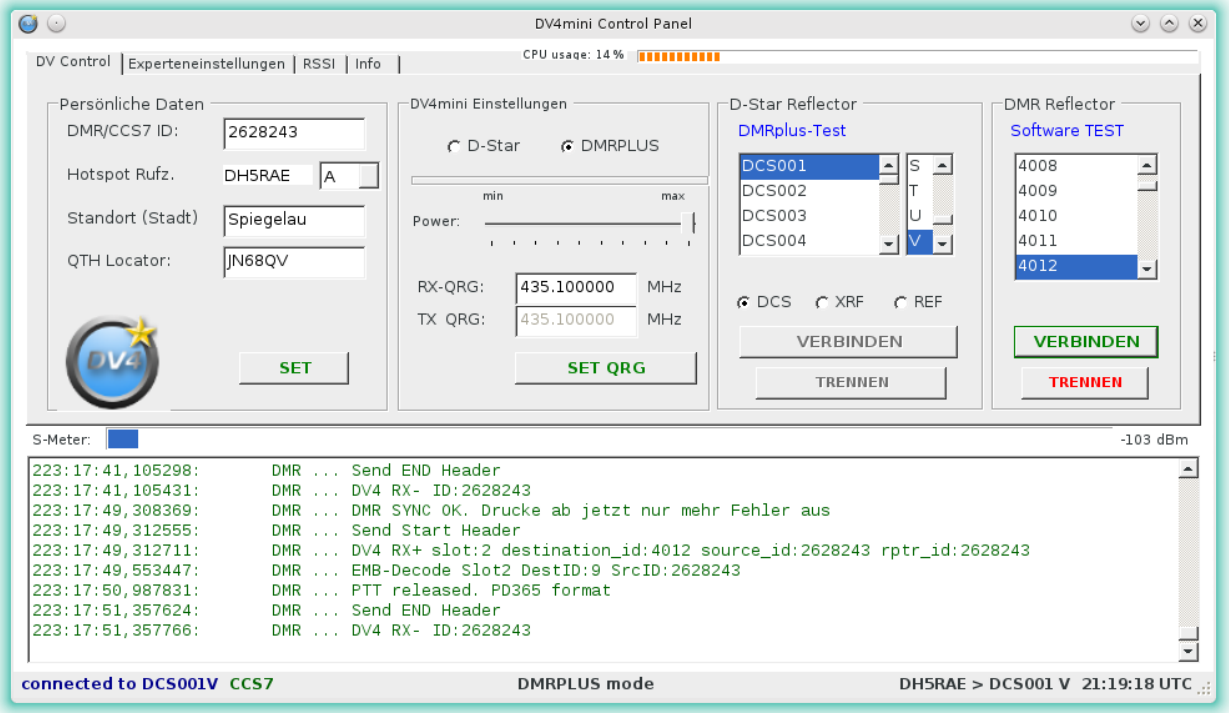
The DV4mini program gets started by entering mono dv4mini.exe in the console. Or you can create a screen icon.
Linux-ARM:

The same info as in PC-Linux is valid. However one has to assemble the required mono version oneself.
You can use the example given for the WSPR program on the website http://dj0abr.de/german/technik/dds/wsprbanana_install.htm

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

Screen - DV Control:

After starting the program the following window appears on the screen:



The user surface is pretty simple and should not create problems.

DMR/CCS7 ID: the 7 digit number 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. (its instant)

Hotspot call sign: If you entered your CCS7 ID the own call will automatically be inserted and the letter D is per-entered. One cannot enter it manually. If several hotspots are used then different letters must be used.

Location and QTH locator: They will be shown on the Xreflector page. **The QTH Locator MUST be entered in order to run this software !**

D-STAR and DMR: select the mode you use

Power: Adjust the power level - 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

Make sure you use SET after inputting your data to store them in the DV4mini

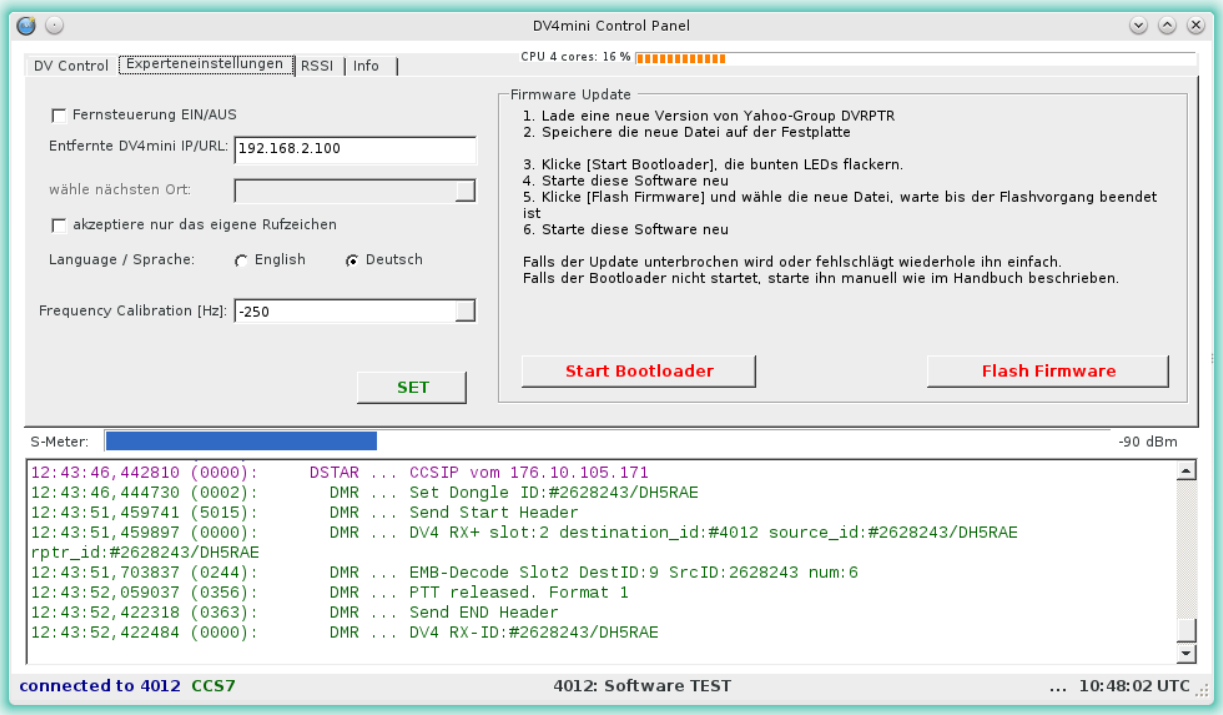
Reflector selection: select a reflector of your choice (in D-Star also specify the port) and click “CONNECT” to create a connection or “DISCONNECT” to cut an existing connection.

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

In the monitor window you may find diagnostic info created by various program segments. They are for experts but may be of interest for normal users to get a better feel what is happening.

On the lower screen segment you find status reports. The CPU use is displayed as a bar on the upper right.

Screen - Expert setup



Accept only own call sign: if this entry is active then only one D-Star transceiver 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 regulations.

Language: English or German. This setting changes the language of the user interface and also the language of the announcements.

Bootloader/Firmware update:

In order to update the firmware a boot loader is installed in the DV4mini. This is how you create a firmware update:

First you save the new firmware file on your computer. Normally you will find it at www.ham-dmr.de/dv4m

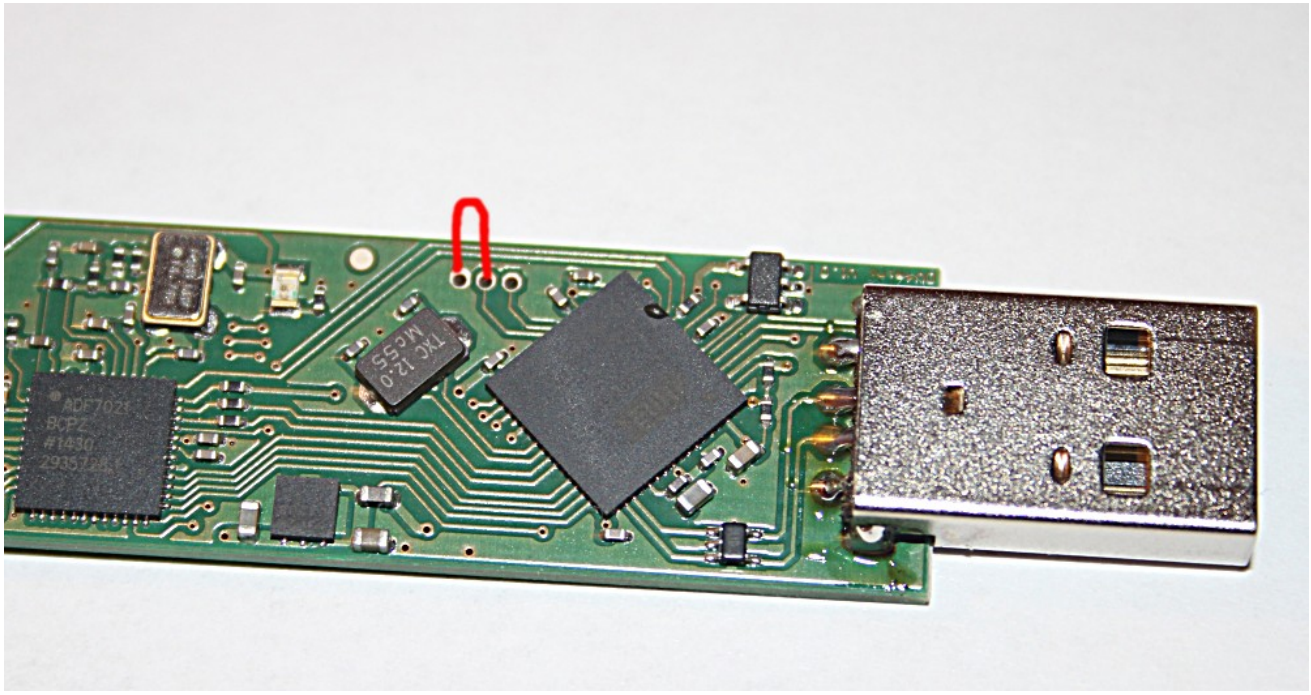
Then you click on the screen Expert mode on *Start-Bootloader*.
This makes the LEDs on the stick blink in color and then the red one will stay on. To the question whether you want to make an update you answer YES. Now the program terminates.

You restart the program and click on *Flash Firmware.*
This opens a file selection window and you navigate to the location of the new firmware file. After selecting it the firmware will be updated. Now end the program and restart it again. It may take a little while until the stick is found again. Be patient.

Generally nothing bad should happen because if any error occurs the boot loader will be protected. Even with a power outage or interruption of the USB interface one can just repeat the update.

The firmware update does not work in the remote mode and must be accomplished locally.

Should the boot loader nor start (no colored blinking LEDs) you have to open the housing and bridge two contacts. See picture below.



You connect the red marked points for example with tweezers while inserting the stick into a USB interface. The boot loader starts now with LEDs in color. Now you can start the user interface dv4mini and utilizing the Expert setup load the new firmware by clicking on “Flash Firmware”.

Remote Control:

One can control the DV4mini additionally from another computer.

Computer 1:
This is where the DV4mini USB stick is plugged in. One starts the program “dv_serial” in console mode.

Computer 2:
Here you start dv4mini.exe - the user surface. In order to fine computer 1 is IP address needs to be entered in the field “distant *DV4mini IP/URL”* and you activate *Remote Control on/off.*

Now one can control with computer 2 computer 1. You will get all displays and full control over all set up as if you are sitting in front of computer 1.

Operating without a user interface:

If one only starts the program dv_serial from a console then the DV4mini stick starts up with the last
Selected configuration and connects to the last used reflector. This allows for an extremely power saving operation which should make Linux purists happy. However it also works in Windows the same way.

Copyright:

Important Links:

Software, Firmware, Operating Manuals, Drivers: www.ham-dmr.de/dv4m
Developer info and interfaces: www.dj0abr.de
DMR/CCS7 number allocation at www.xreflector.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 or moist units may not be operated. The same goes for defective or abnormal appearing units. Use in vehicles, aircraft or under dangerous conditions is not permitted. As the installation, use and operation of this product cannot be monitored the full responsibility rests with the user. The product may only be operated if the user is fully aware of the risks and dangers which may result from the operation. The manufacturer will not be liable for personal damages, property damage, losses or expenses which result from misuse or operation of this product. This includes claims for damages for 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.

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