

# UP4DAR

## User guide



### General information

Internet: <http://www.up4dar.de/>

Mailing list: <http://groups.yahoo.com/group/up4dar>

GitHub Repository: <https://github.com/dl3ock>

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## 1 Preface

UP4DAR (Universal Platform for Digital Amateur Radio) is a multi-purpose unit for digital Amateur radio modes. The UP4DAR software is Open Source and available to all Radio Amateurs.

Available features of the UP4DAR depend on the software. The „Operating System“ of the controller is Open Source and licensed under GNU General Public License Version 2 and available for free. The UP4DAR can either be used as repeater or as terminal equipment as well.

### 1.1 block diagram

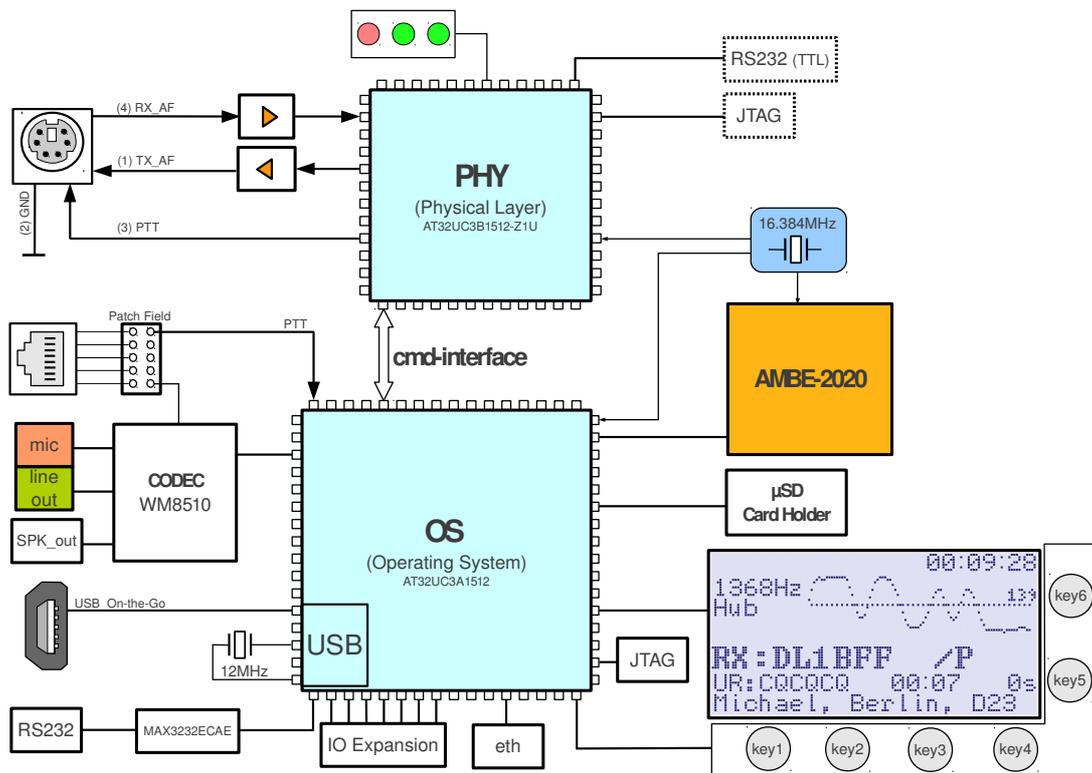


Figure 1: block diagram UP4DAR

One of the main components of the UP4DAR board is the so called „physical layer modem“ (PHY). This is built with the DSP IC AT32UC3B1512 produced by ATMEL. The main purpose of the PHY is the modulation of the outgoing signal and the demodulation of the received signal by methods of digital signal processing. Therefore a strict real-time compliance is important.

Part of the same product family is the ATMEL AT32UC3A1512 processor, with which a universal platform is realized. The processor operates all peripheral, input and output devices on the board and completes all flow control algorithms which are not real time compliant.

## 1.2 Interfaces and display

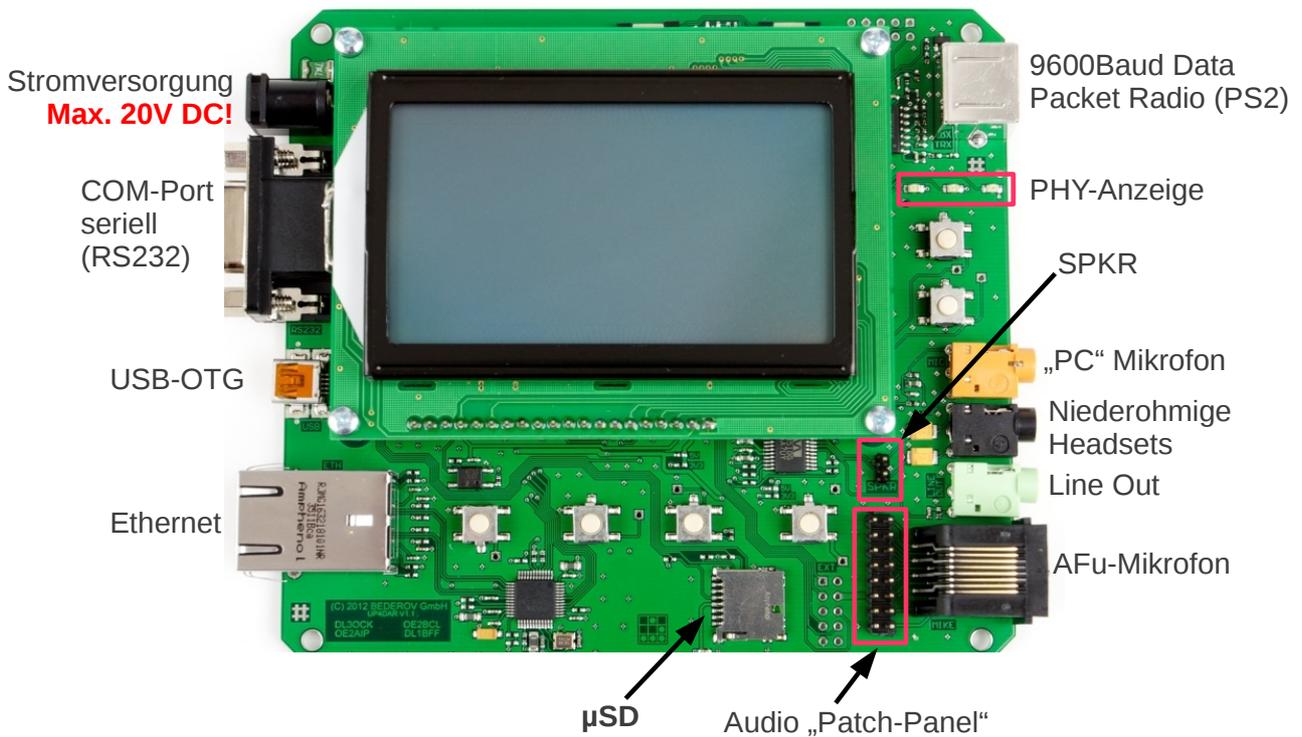


Figure 2: Interfaces at the UP4DAR

### 1.2.1 DC-in

Supplies power to the UP4DAR board. The voltage regulators supply 3.3V, 5V and 8V for the components.. Best working conditions can be reached with an input voltage higher than approx. 8.7 V to a maximum of 20V DC.

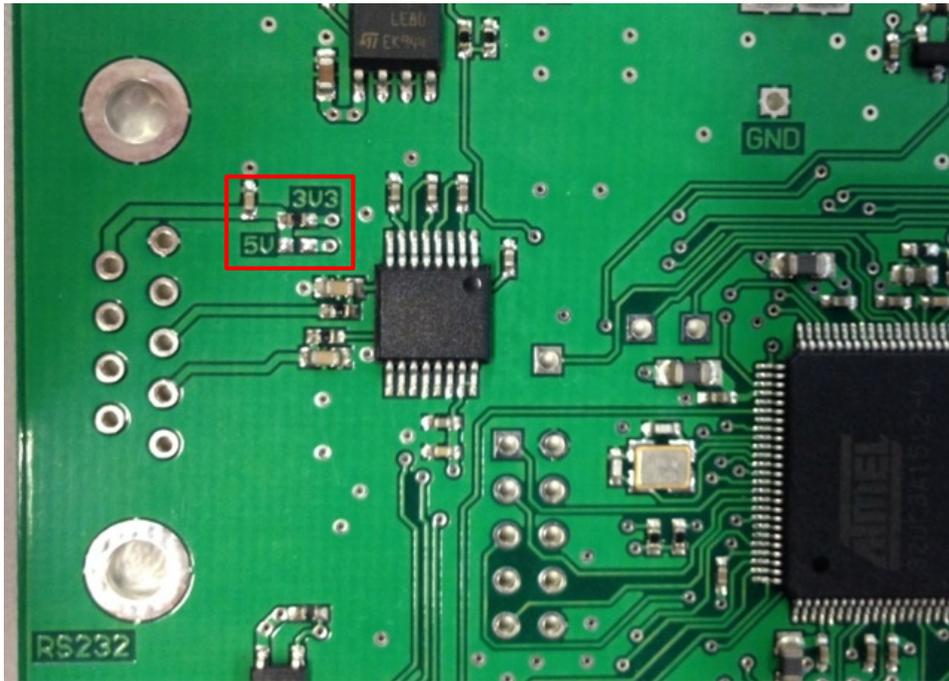


**Attention!**

The maximum input voltage is 20V DC! Exceeding it may damage the board.

### 1.2.2 RS232

An optional GPS receiver can be connected at the RS232 interface for using D-PRS. This interface is built by a usual DB9F-connector. Pin 3 is the input and Pin 2 the output of the serial signal to RS232 ( $\pm 12V$ ). Pin 9 provides voltage for an attached device. Via a bridge (0 Ohm SMD-resistor) on the board two voltages can be selected: 3.3V or 5V. Per default the bridge is set on 3.3V as you can see in the following figure:



*Figure 3: Choosing the voltage for RS232 devices*

### **1.2.3 USB-OTG**

On this USB-port you can connect the UP4DAR-board as an USB-client to a computer (for software updates). It is also possible to use this port as USB-host. In USB-Host mode you can connect USB-sticks, keyboards and so on. The maximum current of an attached device is 500 mA at 5V. A special USB-OTG adapter is necessary. Support for peripheral equipment, e.g. a keyboard, depends on the software.

### **1.2.4 Ethernet connection**

Via this connector you can connect the UP4DAR board to your LAN. Possible modes are 10HD, 10FD, 100HD and 100FD, including „auto sensing“. This interface is used to configure the board including updates and for repeater operation in a network or terminal equipment in a network, e.g. in DCS mode.

### 1.2.5 9600 baud data port

Connect a transmitter or receiver interface to HF using a mini-DIN 6pin socket also called „Data“ on commercial amateur radios.. For transceiver with a compatible data port a 1:1 cable can be used:

Pin out of the mini-DIN 6pin socket:

PIN	name	remarks
1	TX_AF	<b>Output:</b> max. 2400mVpp
2	GND	Ground
3	PTT	<b>Output:</b> Open collector. Ground to Transmit
4	RX_AF <sup>1</sup>	<b>Input:</b> max. 2200mVpp, min 60mVpp

**Important!** A transceiver with „DATA-port“ must be switched to mode „Packet Radio 9600“

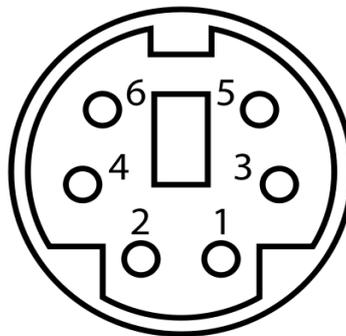


Figure 4: pin assignment of the Mini-DIN-port (front view)

### 1.2.6 microphone (3,5mm plug)

Here you can add a standard PC microphone.

- connection type = 3.5mm plus stereo (Color brown)
- GND = microphone ground
- middle = Voltage for microphone (Mic Bias)
- point = microphone input



**Attention!**

**Please connect only ONE microphone to the 3,5 mm plug OR western port!**

When you use a microphone at the 3,5 mm plus you can use the PTT-key on the UP4DAR board or use PTT at the western port.

<sup>1</sup> Also called „9600 Packet Operation Output“.

### 1.2.7 headset

You can connect a (low ohm) headset here.

- connection type = 3.5mm-plug stereo (color black)
- GND = ground
- middle = negative headset output
- point = positive headset output

The impedance of the headset should not be lower than 16 Ohm on each channel.

### 1.2.8 line Out

You can find a high-resistance output here, which is designed for an active speaker.

- connection type = 3.5mm plug stereo (color green)
- GND = ground
- middle and top = high-resistance (100Ohm) output

### 1.2.9 microphone with PTT (RJ45)

Connect a radio microphone or just trigger PTT. There are no patches wired by default.

In order to suit and be able to connect a variety of microphones to your UP4DAR, the patch field can be used to customize the pin out of the modular jack.

The meaning of the signals on the left patch row you can see in figure 5. Examples of microphone pin outs can be found in appendix 6.1.

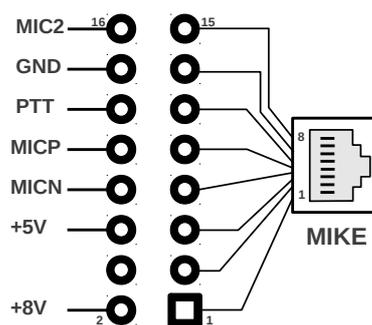


Figure 5: Audio-Patch-Panel

The sound chip used on the UP4DAR board has two mic channels. In the current software channel mic2 is not used. The negative pin of the used microphone input (MICN) is connected to GND/ground on the UP4DAR board.



**Note!**

Please connect only ONE microphone to the 3,5 mm plug OR western port!

### 1.2.10 SPKR

The board pins named „SPKR“ can be connected to a low impedance speaker (no GND!) used as monitor speaker. This is called „radio speaker“ of your station in single user mode. The „SPKR“ interface is an alternative to headphones/ line out using an external audio amplifier or speaker.



**Attention**

Make sure you don't short circuit the „SPKR“ pins. Failure to do so may cause damage to the integrated audio amplifier. Power the UP4DAR off before dis-/connecting a speaker to these pins. Never attempt to plug in a jumper (widely used in computers)!

### 1.2.11 Micro-SD

Plug in a micro-SD memory card. Available features for using a memory card depend on the software

### 1.2.12 Soft keys

There is a total of 6 keys. The mapping of the keys depends on the software and the operating mode.

### 1.2.13 Display

The display unit connects to the board either via a connecting plug or ribbon cable.

Displayed information will depend on the software version, the operating mode and usage of F-key.

### 1.2.14 PHY status lights

Used to indicate the PHY status.

<b>RX</b>	Receiving a D-STAR cycle of data on HF
<b>SYNC</b>	Blinks on „Sync“ flag detection, i. e. every 420ms under normal circumstances during a D-STAR cycle (approx. twice per second).
<b>TX</b>	Transmitting a D-STAR cycle on HF

### **1.2.15 SMA-connector RMU v2.0 (optional)**

With the RMU v2.0 (**R**adio **M**odule for **U**P4**D**AR) a SMA-connector is provided to attach an antenna.

## 2 Operating software (OS)

The operating software provides the functions of the UP4DAR board and consists of the following parts:

- P.0.02.23** This program runs on the IC „UC3B“. In the current OS version the radio modem function for D-STAR and the support for the (optional) RMU is implemented.
  
- U.1.00.08** The secondary Boot loader for the IC „UC3A“. This program provides the update function via LAN. The source code is open source and is available in the repository of the project.
  
- S.1.01.40e** The main program for the IC „UC3A“. This program is a kind of a real-time-operating system and realizes the support for all peripheral devices, the user interface and the flow control. The source code is open source and is available in the repository of the project.
  
- C.1.00.10e** A tool for the „UP4DAR-Configurator“ which is run on an external computer. With the „UP4DAR-Configurator“ it is possible to configure the UP4DAR board and also to update the two programs mentioned above. The source code is open source and is available in the repository of the project.

You can check the installed software on the UP4DAR board when you press the soft key „key1“ while you power on the UP4DAR board. Then you can see on the display of the UP4DAR board for some seconds the versions: **U.x.xx.xx** and **S.x.xx.xx**.

### 3 user interface

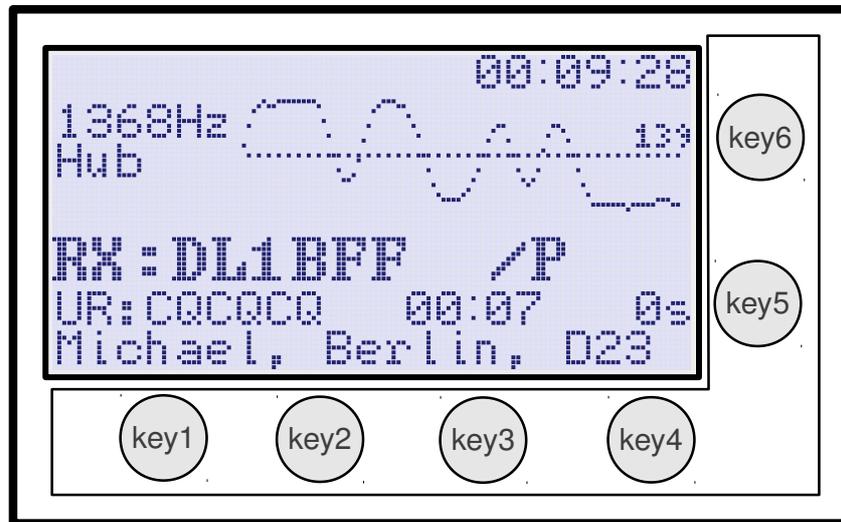


Figure 6: UP4DAR User-Interface

The user interface of the UP4DAR consists of a graphical display and six function keys, called soft keys. Four soft keys are located below the display and two soft keys beside of the right part of the display as you can see in figure 6.

The concept of operations provides six display pages. Each display page provides settings for a task. You can switch between the display pages with soft key „key4“. In the upper left corner of the display you can see the name of the current display page. In the first seconds after switch to another page the function of all soft keys is shown.

The order of the display pages:

- D-STAR
- RMU set
- DV set
- GPS
- Mode set
- Audio
- Debug

### 3.1 Display page „DSTAR“

This display page is the main operation page. You can see the page in figure 6. Soft key „key1“ works as PTT. When you push soft key „key2“ the NF output is muted and MUTE appears in the display. Mute begins to blink when a D-STAR signal is received. You can turn on the NF again with soft key „key2“. After 60 seconds MUTE is disabled automatically.

Key lock: If you push soft key „key2“ longer, all soft keys will be locked. The key lock can be disabled with another long push of soft key „key2“.

„key5“ and „key6“ act as volume control. While you push them, in the lower right corner the current volume value appears.

### 3.2 Display page „RMU SET“

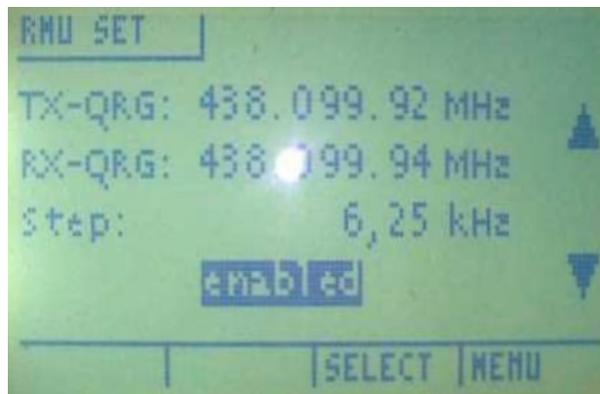


Figure 7: RMU set

This page provides the settings for an (optional) RMU (**R**adio **M**odule for UP4DAR) v2.0. In the menu the RMU can be switch on and off and also the RX and TX frequencies can be set. Please be aware, that in the settings the exact frequency is displayed: In figure 7 the RMU was originally set to 438.100 MHz with 30 mW.

The frequency step can be chosen between 6.25 kHz, 12.5 kHz and 25 kHz.. RMU frequency range: 137 MHz to 160 MHz and 410 to 480 MHz (please check you local band plans).

### 3.3 Display page „GPS“



Figure 8: Display page GPS, installed GPS mouse

In the current operation software values are only shown when a GPS-receiver is connected to the UP4DAR board. The receiver must provide data with a baud rate of 4800 bauds in GPRMC, GPGLGA and GPGSV (NMEA-0183). In the left part of the display you can see a sky view with the found sat signals. In the upper right corner the received data is displayed and below the calculated geographical position.

### 3.4 Display page „MODE SET“

In the current operation software (S.1.01.40 published on 26th of September 2015) five operation modes are available:

- **D-STAR Modem**
- **IP Reflector**
- **Repeater**
- **Hotspot**
- **Parrot DVR**

A short overview:

<b>D-STAR Modem:</b>	Adds the HF-D-STAR function to a 9k6-transceiver
<b>IP Reflector:</b>	Direct connection to a reflector room with a headset/speaker and microphone.
<b>Repeater:</b>	typical repeater mode
<b>Hotspot:</b>	Simplex-Repeater with a 9k6-transceiver and internet/hamnet
<b>Parrot DVR:</b>	Internal „parrot“

You can choose the mode in the display page „mode set“ by pushing the soft key „key5“ or „key6“.

### 3.4.1 Mode „D-STAR Modem“

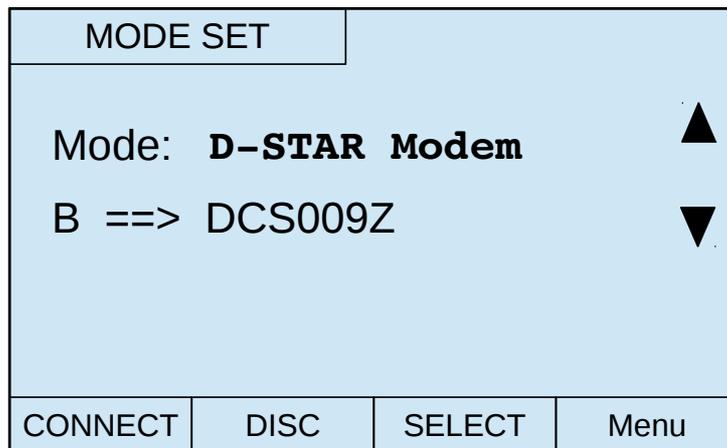


Figure 9: Selecting mode „D-STAR Modem“

After setting the mode to D-STAR modem you have to change back to the display back „DSTAR“: Push soft key „key4“ (Menu) until the display page „DSTAR“ appears.

While receiving a D-Star-Signal in the upper part of the display an oscillogram with the analog signal flow of the FrameSync and the measured hub is displayed. After some seconds in the upper left corner the time shift of the oscillator is displayed too (in ppm). The displayed data helps in getting information about the signal quality.

In the oscillogram of the FrameSync the following bit pattern should be visible: **{1,1,1,0,1,1,0,0,1,0,1,0,0,0}**. The hub should be near to the value of 1200 Hz and the time shift should be less then **±10ppm**.

Figure 10 displays the scenario „D-STAR Modem“.

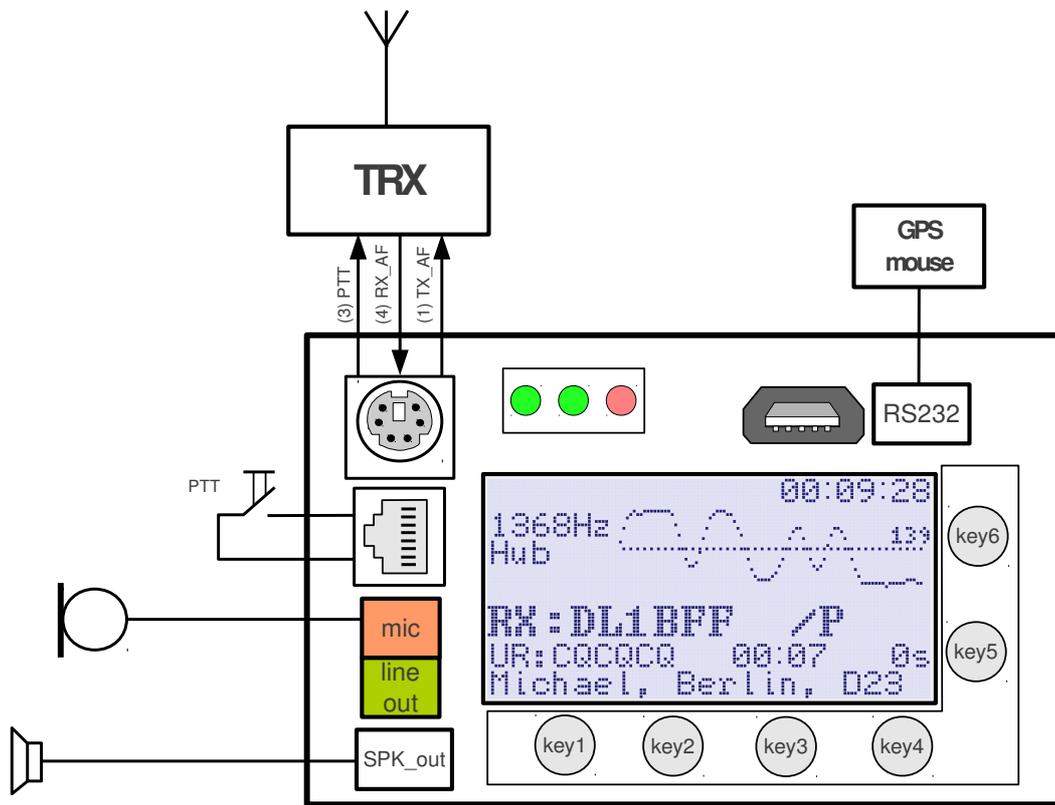


Figure 10: Using the UP4DAR in mode „D-STAR Modem“

For the mode „D-STAR modem“ an own display page „DV set“ for entering the necessary data is available:

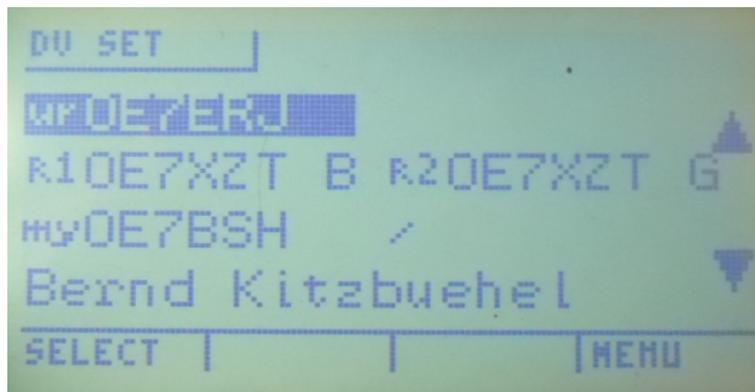


Figure 11: Menu „DV Set“

Since OS S.1.01.36 the settings can be set directly at the UP4DAR board, in older OS systems it was only possible via Configurator (still possible). The possibility of entering the data via board allows mobile/portable operation without a computer.

The following parameters can be set directly in the UP4DAR board in the menu „DV set“:

URCALL – RPT1 – RPT2 – MYCALL with /Extension – TX-Message-Text

Note: If the required parameters are already know, they can be entered via Configurator and written to the board with „**Save to flash memory**“. Then the „DV set“ menu is only used to select the entered parameters.

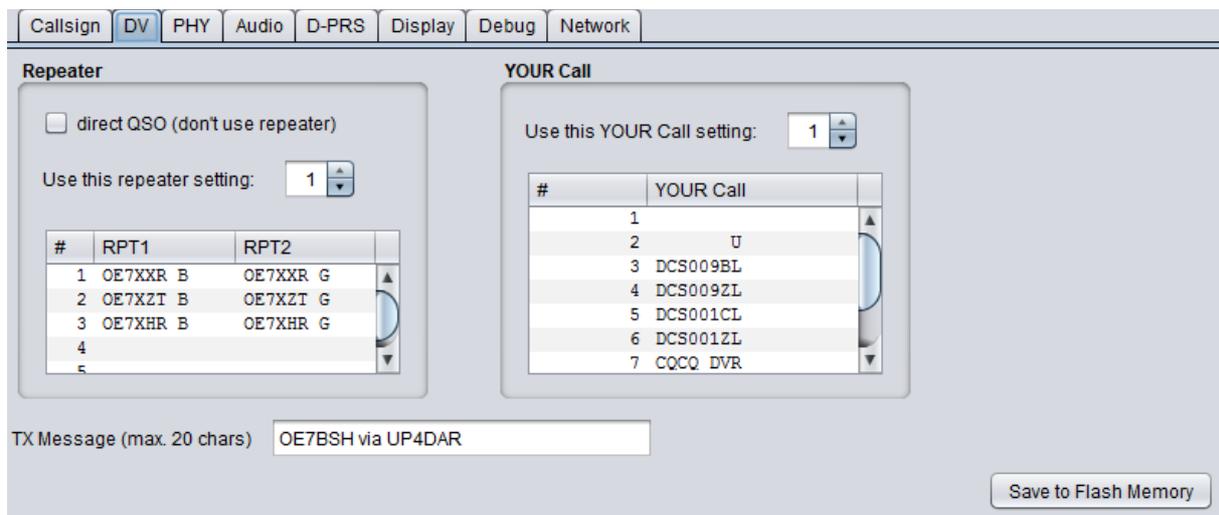


Figure 12: Prepared parameters for modem use (RPT1, RPT2, URCALL, TX MSG) in the DV menu of the **Configurator**

It is also possible to enter/edit the parameters directly on the UP4DAR board. Therefor you select in the menu „DV set“ the field you want to edit and switch with „EDIT“ key to the edit mode. The entry can then be edit with the arrow keys (key5 and key6). You can move forward and backward in the field with the soft keys key3 and key4, the key BS (key2) provides a backspace and after editing you save with soft key key1 STORE.

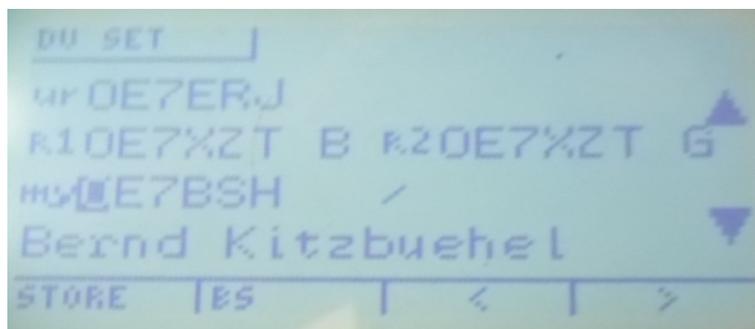


Figure 13: edit mode in the menu „DV Set“, here on the first letter of MYCALL. Have a look at the context soft keys shown

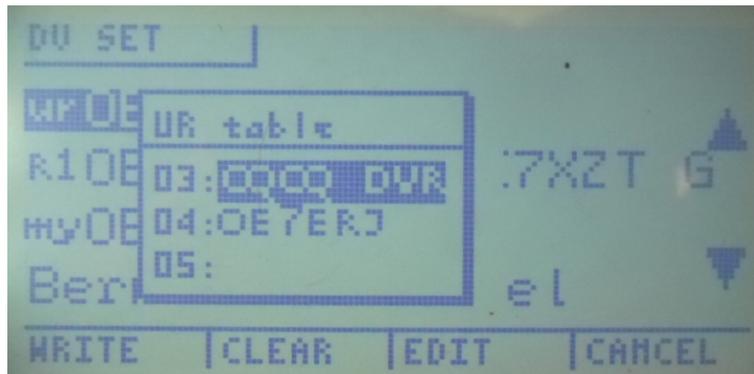


Figure 14: Choosing a stored entry for URCALL in the menu „DV Set“

If you don't want to set a parameter in the RPT table (e.g. for direct QSOs), you have to move with the arrows to position „00“.

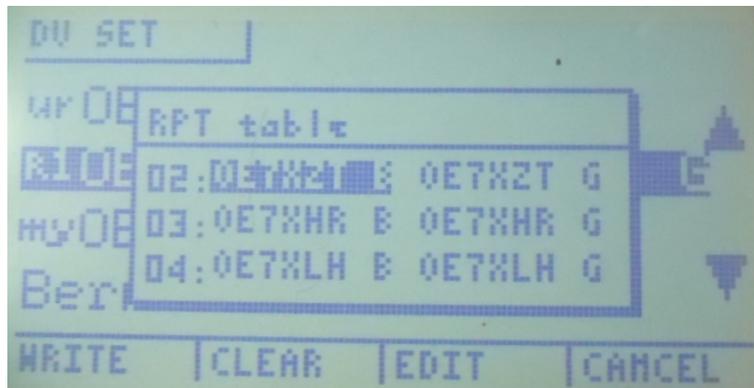


Figure 15: Choosing a stored entry for PRT1/RPT2 in the menu „DV Set“

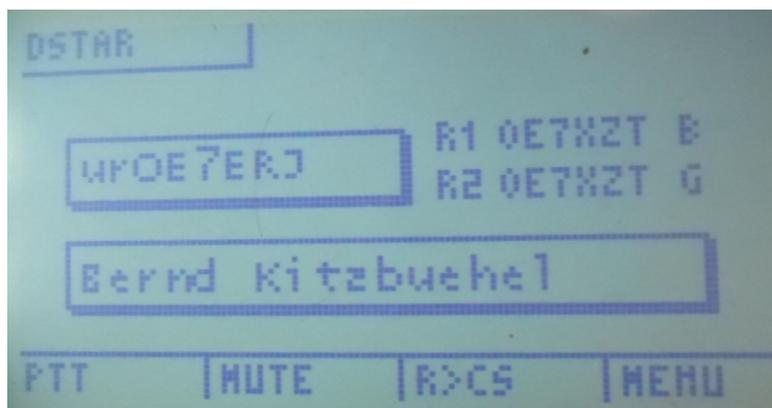


Figure 16: D-STAR-display page in mode modem

In the figure above you can see the display page „D-STAR“ while mode D-Star-Modem is selected. With softkey1 PTT an input with an attached microphone is possible, which is then sent with the connected 9k6-transceiver to HF.

Note: If in the Configurator page „call sign“ a module name (ABCDE) is defined, it is replaced in a transmission with a space character (0X20) on the 8th position.

With softkey2 MUTE the speaker is muted for 60 seconds. After activation MUTE is displayed on the UP4DAR board, which blinks during receiving a transmission. The key lock can be disabled with another long push of soft key „key2“.

**R>CS-key (softkey3):**

With the key „R>CS“ you can choose one of the last five heard stations for call sign routing. After pushing the R>CS you can choose an entry with the up/down arrows and store it with SET. Then in the next transmission the selected call sign is sent in the field URCALL (instead of CQCQCQ). This information is displayed for approx. three seconds on the display page.

When you push and hold the „R>CS“ key, the first value in the table is chosen. Therefore it makes sense to store CQCQCQ there for quick access.

### 3.4.2 mode IP-Reflector

In operation mode „IP Reflector“ the connection to the reflector room is realized with internet/hamnet and not via HF. After activating „IP reflector“ in the display page „Mode set“ you have to choose the reflector type, reflector server and reflector room. The mentioned parts can be selected with the SELECT-key (soft key 3) and edited with the soft keys 5 (down) and 6 (up).

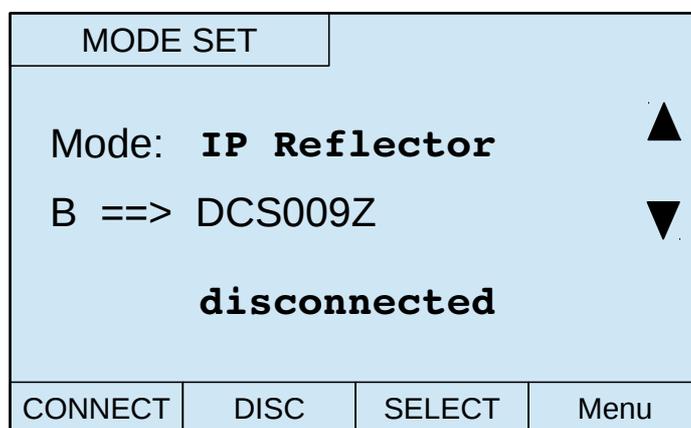


Figure 17: Choosing operation mode „IP Reflector“

After defining the wished reflector type (in the figure above DCS), the reflector server (here: 009 for Austria) and the reflector room (here: room Z) you can connect to the room with soft key 1 CONNECT. If the connection attempt is successful, the status message **connected** appears and the UP4DAR board switches automatically to the display page „DSTAR“. On that page the connected reflector appears in **inverse writing**. If the reflector name appears in „normal“ writing, the reflector is no longer connected.

Below of the reflector the connected CCS-server is displayed. The connection to a CCS7-server is necessary to use the DCS-reflector system since September 2015 (see also <http://register.ham-digital.net/html/ccs7-ENG.html>). That function was implemented to the UP4DAR OS with OS-Version 1.01.40e in September 2015.

Beside of that connection all via HF received call signs are transmitted to the CCS-server. If you make a local TX via PTT on the UP4DAR board the own call sign is transmitted to the CCS7-server. The transmitted call signs can be seen in the „CCS-Monitor“ at [www.xreflector.net](http://www.xreflector.net).

Actually not implemented (1.01.40e) is the routing via CCS7 to another user (call connection service – CCS).



Figure 18: Display page D-STAR with connection to DCS009T and CCS-Server CCS702

While receiving a signal in reflector mode the display page „D-STAR“ shows the URCALL and RPT1/2 parameters of the sending station:

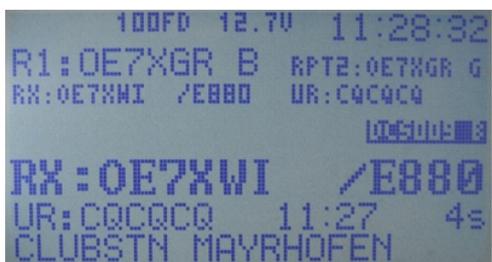


Figure 19: display page D-STAR, reflector mode, have a look a R1, R2 and UR

Since OS software **S.1.01.28e** it is also possible to connect to reflectors with the Dextra technology (XRF).

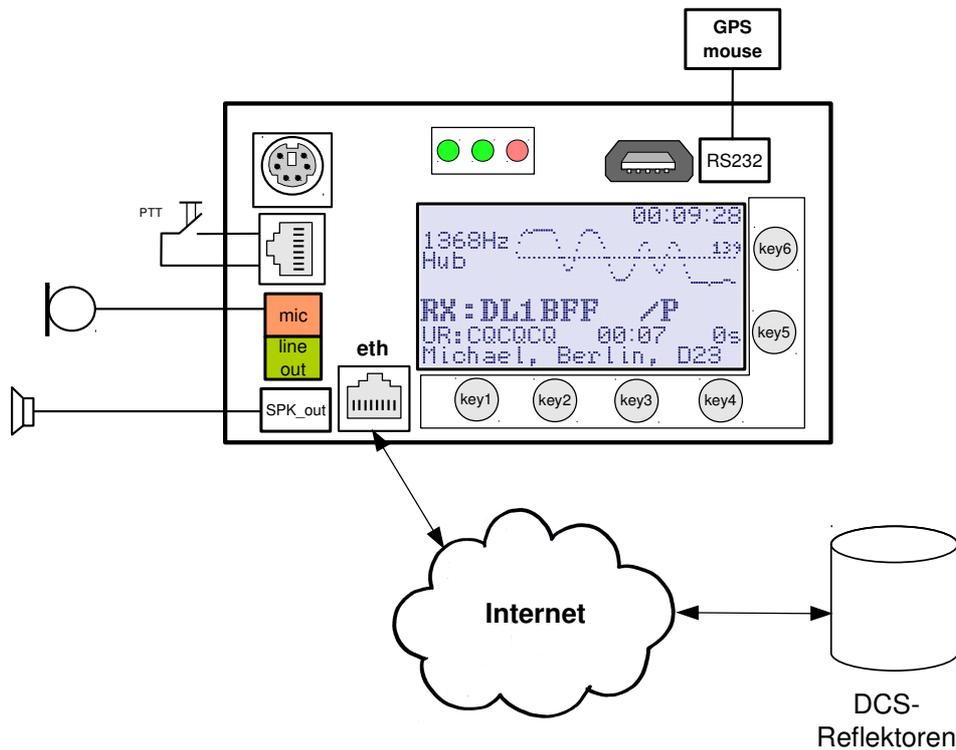


Figure 20: Scenario operation mode „IP Reflector“

### 3.4.3 Operation mode Repeater

Please have a look at the chapter „hot spot“ as the parameters are the same.

Since OS software OS S.1.01.39e also the RPT2 field of incoming HF signals is checked. If the RPT2 value (e.g. OE7XGR G) is missing, the signal is not forwarded to the reflector. Exception: Set emergency flag, then RPT1 and RPT2 settings are not checked..

UR:	CQCQCQ
RPT1:	OE7XGR B
RPT2:	OE7XGR G
MY:	OE7ERJ

Figure 21: MYCALL, URCALL, RPT1 and RPT2 for repeater OE7XGR B on 70cm

If in repeater mode a signal without valid header is received, the signal is forwarded to the reflector with the last valid header. That header must be younger than five minutes, otherwise the signal is discarded.

Please note the „repeater flag“ when storing the settings to a memory channel of your radio. Normally the repeater flag is set, when a shift is set. In hotspot mode only transmissions WITHOUT a repeater flag are forwarded to the reflector (other solutions like G4KLX require the repeater flag).

### 3.4.4 Operation mode Hotspot

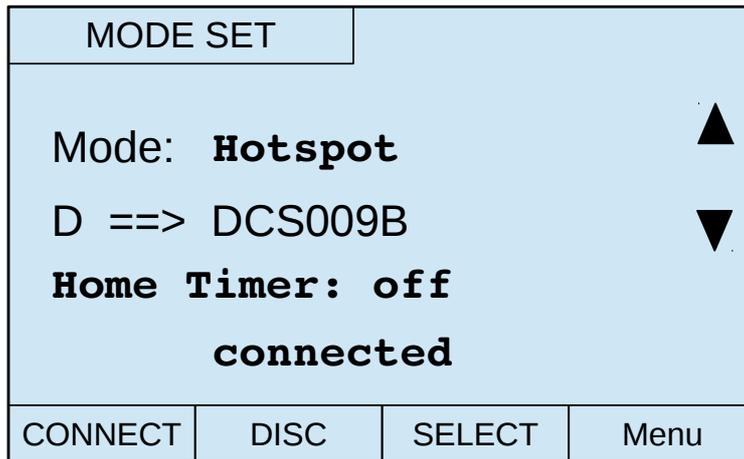


Figure 22: Mode set Hotspot

The operation mode hotspot provides a simplex entry to D-Star for your house, flat and so on. You can transmit from your mobile or portable transceiver a signal to the Hotspot (with a connected TRX or RMU) and the UP4DAR forwards the signal to the reflector.

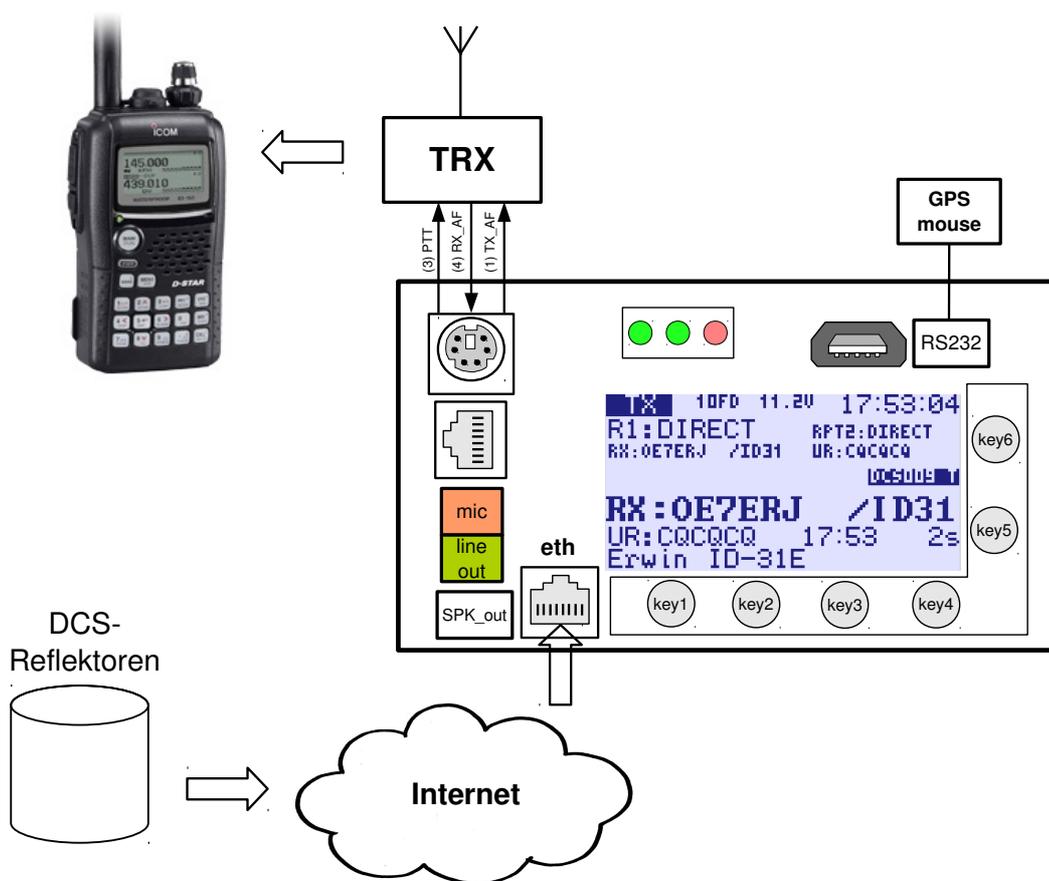


Figure 23: Scenario for operation mode „Hotspot“, here: Signal from Reflector via UP4DAR to a IC-92D

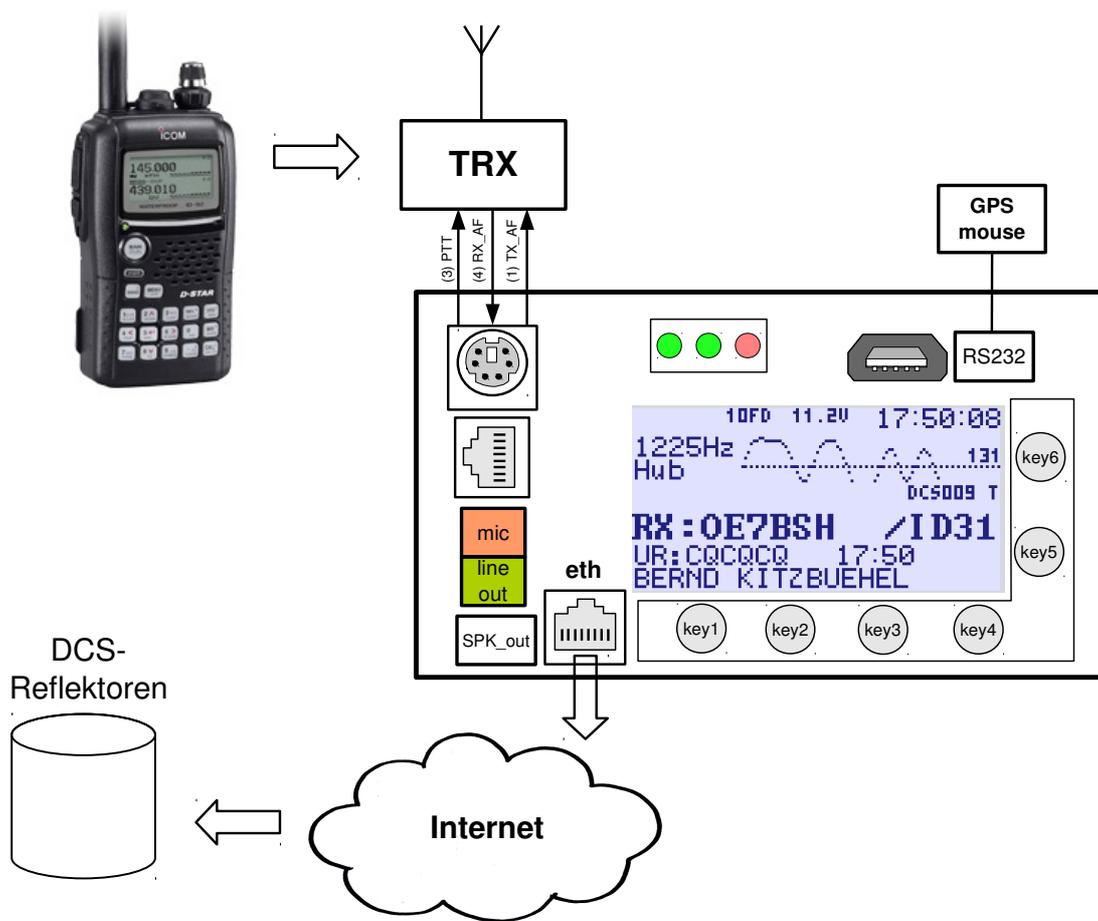


Figure 24: Scenario for operation mode „Hotspot“, here: Signal from a IC-92D via UP4DAR forwarded to a reflector

The following parameters can be set in Hot spot mode:

**Modul**



Figure 25: Hotspot operation, connected to DCS009T

**reflector system, reflector server and reflector room**



**Figure 26: Hotspot operation, reflector system XREF**

The UP4DAR supports at the moment three reflector systems:

DCS: Digital Call Server (see. <http://xreflector.net/>)

XRF: **XRe**Flector System (see <http://xrefl.net/>)

TST: internal testing system

In the current software the UP4DAR board is not able to connect to the Dplus-system (REFxxxx).

After setting the reflector and room you can connect to it pushing softkey1 CONNECT.

If the connection attempt is successful, the status message **connected** appears and the UP4DAR board switches automatically to the display page „DSTAR“. On that page the connected reflector appears in **inverse writing**

The display page „D-STAR“ provides during receiving a digital signal the following information:



**Figure 27: Hotspot operation, displaying the hub of the received signal**

At the beginning of receiving a signal the hub of the received signal is shown. The signal should

provide a hub at approx. 1200 Hertz. At the end of the curve the TX gain is shown.

Also call sign, extension, URCALL and message text of the received signal is shown.



Figure 28: Hotspot operation, symbol rate

During receiving the signal the hub information disappears and more information is shown. In the upper left corner the deviation from the defined symbol rate of 128 is shown. Also the set Rpt1 and rpt2 fields are shown and the duration of the signal. Furthermore call sign, extension, URCALL and message text are shown.



Figure 29: Hotspot operation, transmission via HF

### Hometimer



Figure 30: Hotspot operation, Hometimer with 15 min

In hotspot and repeater mode it is possible to change the connected reflector room with control commands via DTMF or URCALL. The trustee of the repeater/hotspot can define a time period (hometimer), after which the UP4DAR board switches back to a predefined reflector room when no local HF is received. The home timer can be set from 5 to 40 min. Best practice is a setting to 10 or 15 min.

### 3.4.5 Feedback on received signals

Since OS 1.01.38e an UP4DAR repeater/hotspot confirms the receiving of a HF signal. A successful receive is confirmed with „RPT? repeater call sign“ and „Header CRC is OK“, otherwise the feedback is „Termination flag missing“ or "Header CRC is wrong!"

The current status of the UP4DAR board can be requested with DTMF „0“ (zero) or since S1.01.39e with URCALL „ I“ (India on the 8th position after 7 empty spaces). The feedback is „Connecting to“, „waiting“, „Connected to“ or „Disconnected“.



Figure 31: Feedback HF



Figure 32: Feedback HF: RX Message „Termination flag missing“

### 3.4.6 Operation mode Parrot (DVR)

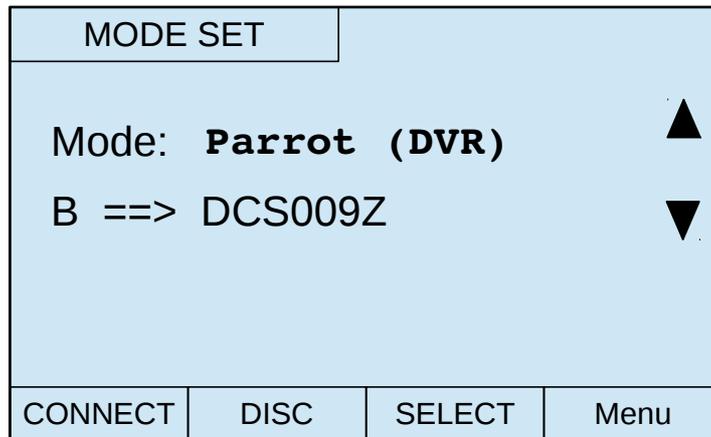


Figure 33: Mode Set Parrot (DVR)

When in operation mode „parrot“, the UP4DAR board listens on the set frequency for a trigger.

The necessary trigger is URCALL: CQCQ DVR. Is that trigger sent, the UP4DAR board records the received signal (Maximum 60 secs) and sends it back after a break of 2 secs. If during the break a new signal is received, the old record is deleted. With that function it is possible to check your own signal or coverage without using the parrot function on a reflector (normally room Z).

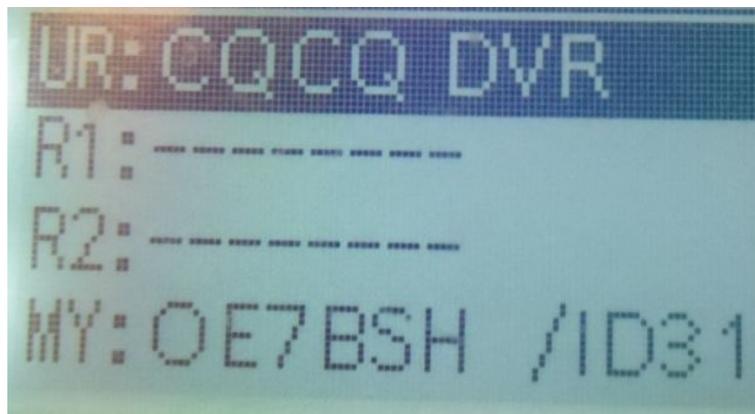


Figure 34: URCALL-settings ICOM ID-31E for Parrot (DVR)

### 3.5 display page „AUDIO“



Figure 35: Audio

On this display page the mic signal strength is displayed

### 3.6 display page „DEBUG“



Figure 36: Debug

On this display page a lot of data for debugging is shown, e.g. the IP of the UP4DAR, gateway, DNS.

**Note:** Via display page „Debug“ and softkey2 it is possible to initiate a reboot of the UP4DAR board via Configurator. Nice feature for a remote repeater/hotspot.

## 4 UP4DAR-Configurator

For a quick and comfortable setting of parameters and controlling your UP4DAR board you can use the UP4DAR-Configurator. (Current version: [C.1.00.09e](#)). The UP4DAR-Configurator is written in JAVA and usable on many operating systems. It can be downloaded on the UP4DAR website: <http://www.up4dar.de/software/>

### 4.1 Connecting the UP4DAR board to the local network

Connect your UP4DAR board to your router or switch. When the board detects a valid Ethernet signal, the green LED at the Ethernet port blinks. In the upper left corner the speed of the connection is shown: 100FD,10HD, 10FD or 100HD. During handshaking the information is shown in inverse writing: **100FD** When the IP address is successfully assigned, the symbol is shown again in normal writing.



**Note!**

The address assignment is done via DHCP.

### 4.2 Starting the UP4DAR-Configurator

First check if your computer is in the same net range as your UP4DAR board. Otherwise the UP4DAR-configurator will not find your UP4DAR-board. To run UP4DAR-Configurator.jar a Java Runtime Environment (JRE) must be installed on your computer. Should you need to install the Java Runtime Environment, go to <http://www.java.com/> and download a release for your computers operating system.

Starting the software can be achieved by either double clicking UP4DAR\_Configurator.jar (located in „dist“ folder) or selecting the file and hitting Enter/Return.

The very first start up of the JRE will show a firewall warning. You should allow network/internet access for the JRE.



Figure 37: Allowing internet access for the Configurator/JRE

### 4.3 Selecting the UP4DAR board

Once the Configurator has started up, the connected UP4DAR device will be available in the list. Select the device (if more than one is available) and push „connect“. Note: The IP address depends on the DHCP server configuration.

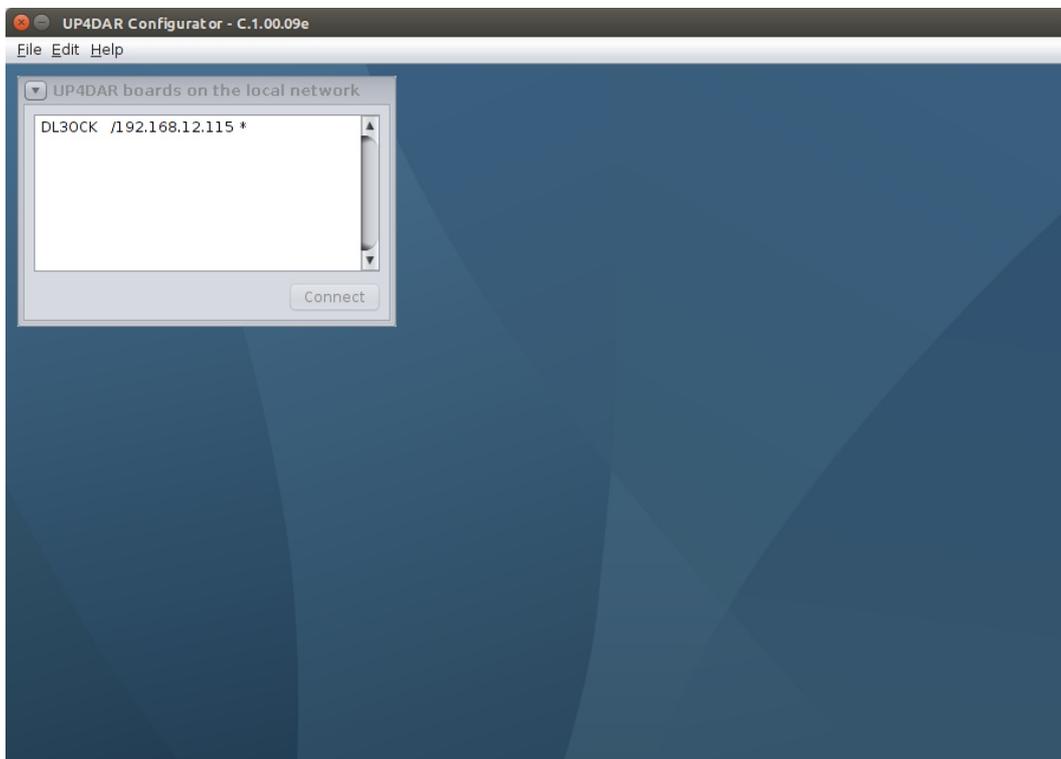


Figure 38: Available UP4DAR boards

## 4.4 Configuration of the parameters

After the successful connect to the UP4DAR board you can configure the board. The settings are organized in tabs/registers.

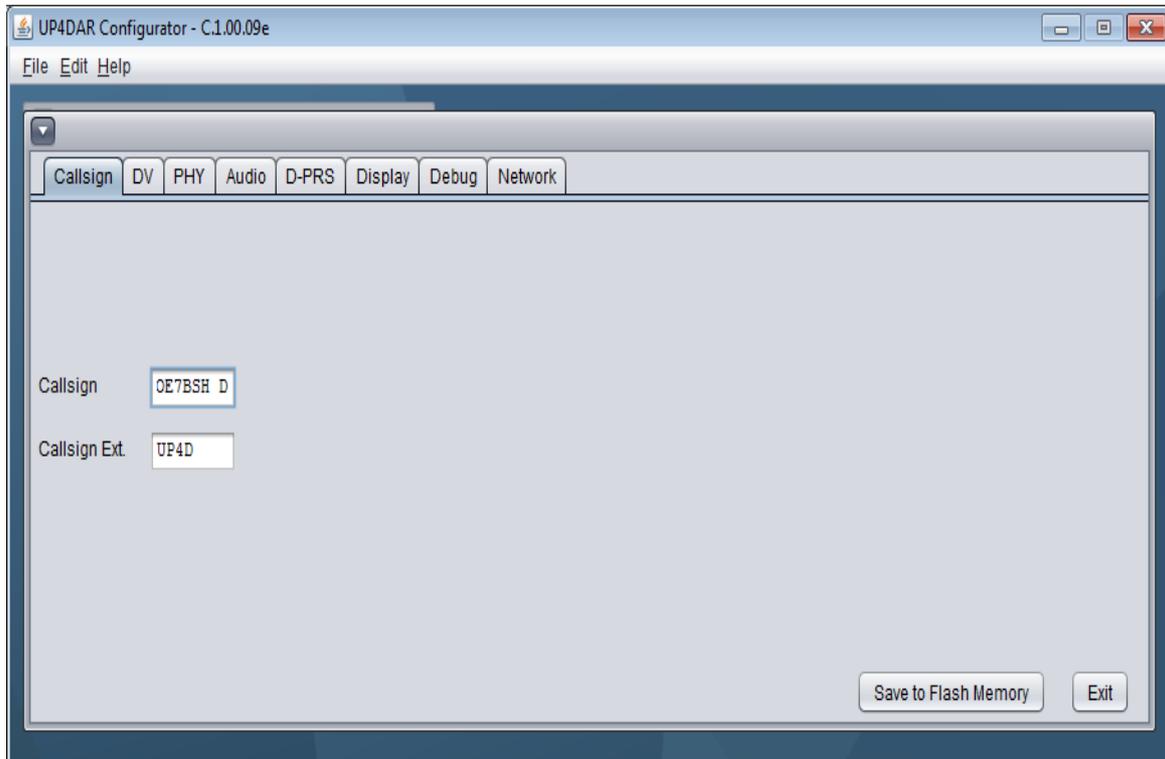


Figure 39: Register **Callsign**

In the tab „Callsign“ you have to set your Call sign and (optional) an extension, e.g. ID51 or your CCS7 number.

Also optional is the entry for the modul name of your UP4DAR board (at the **8th** letter in the call sign field):

With the module name you can state the frequency of your UP4DAR hotspot/repeater:

- A 23 cm
- B 70 cm
- C 2 m
- D Dongle without HF
- E 10 m

If no module is specified, the UP4DAR board uses module „D“ (dongle).

For saving the settings, you have to push **Save to Flash Memory**. Then all changes are

written to the flash memory of the UP4DAR and will also be stored/set after a reboot.



**Note!**

**Only settings which are saved to the flash memory with the „save to flash“ memory will be there after a reboot. Settings made with the soft keys or via URCALL/DTMF will disappear if they are not saved via configurator.**

## 4.5 Configuration Digital Voice

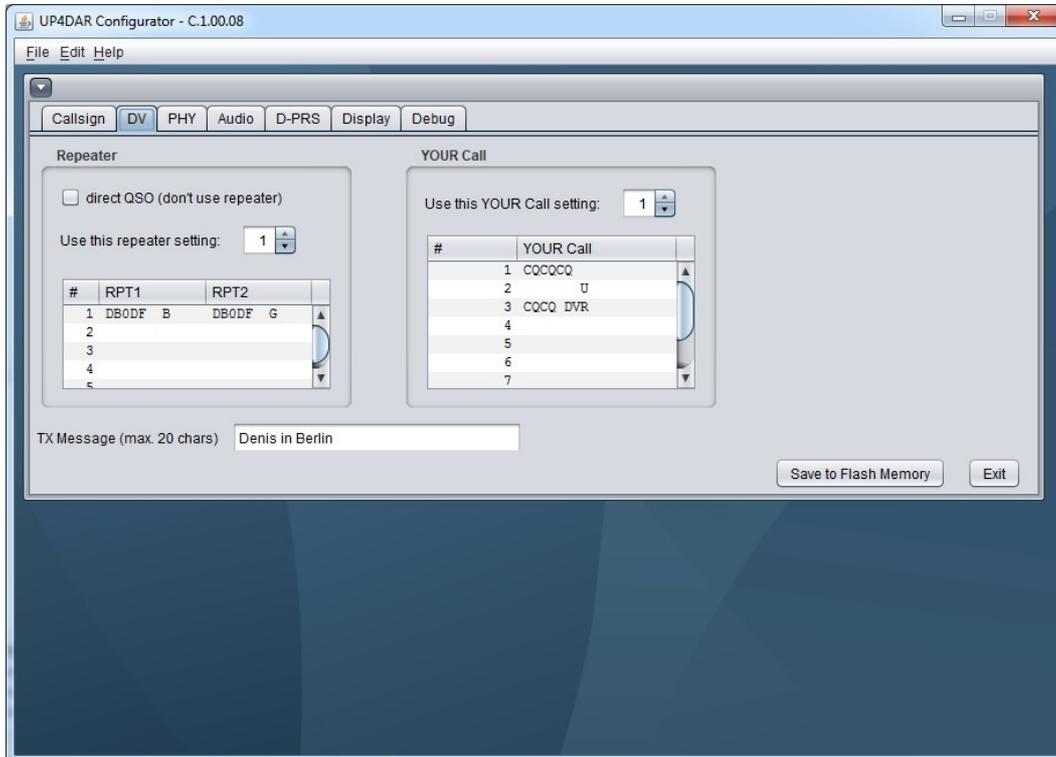


Figure 40: Register DV

In this tab the necessary parameters **YOUR**, **RPT1**, **RPT2** and **TX Message** are set. In „repeater“ you can add up to five rpt1/rpt2 pairs and choose them. Under „your call“ you can add up to ten calls, you should start with CQCQCQ which is used in normal operation mode. Above the entries you can define the used settings by number.

When operating in direct mode (without a repeater) you should choose „*direct QSO (don't use repeater)*“. Then your UP4DAR board uses DIRECT in the fields RPT1 and RPT2.

Note: Since OS S.1.01.36 the parameters above can be set directly on the UP4DAR board without the need for a the configurator on a computer (see menu „DV set“).

## 4.6 Configuration of PHY

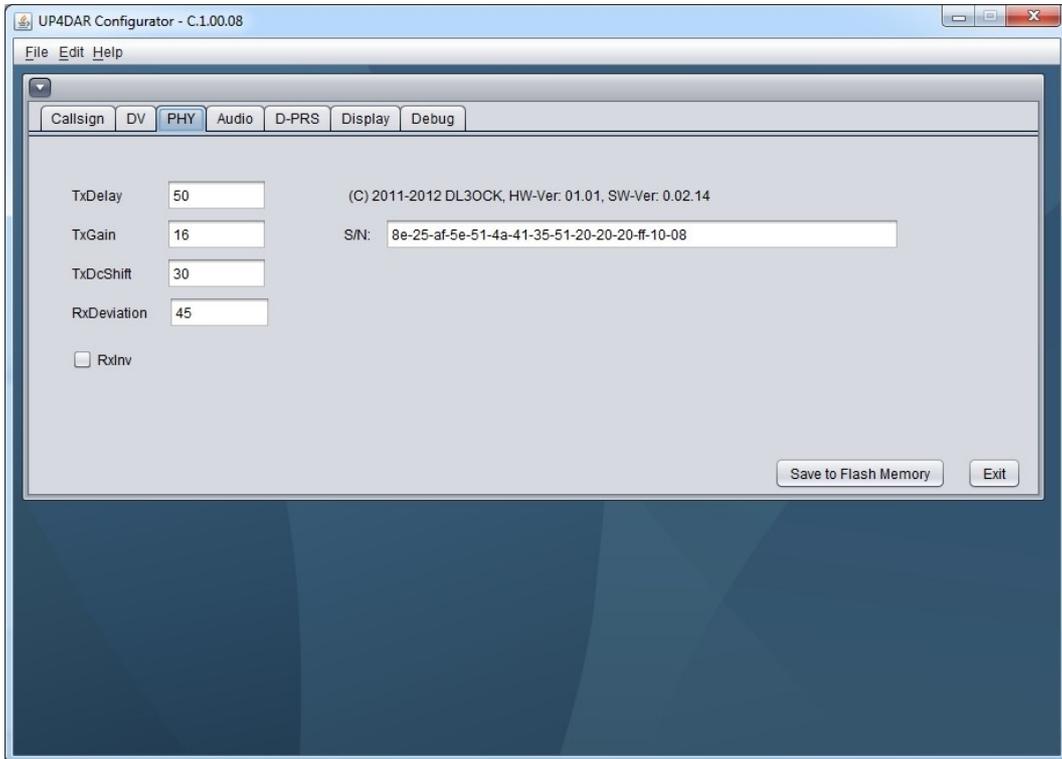


Figure 41: Register **PHY**

In the right part of this tab you can find the hardware and software versions and the serial number of your UP4DAR board.

In the left part you find the parameters to match your transceiver,

As all transceivers have different settings, be carefully in tuning these parameters. You can find tested parameters in the table below.

### 4.6.1 Meanings of PHY parameters

- TxDelay** Same as in Packet radio the time is defined, which is waited between the beginning of the transmission and the beginning of data sending. During the waiting time 0 and 1 are sent periodically. Valid values for this parameter are 0 to 255, which is not ms. The length of waiting can be calculated by **TxDelay\*8+64**
- TxGain** defines the amplitude of the digital signal at the output of the PHY modem. This value manipulates the hub of the sent FM signal and can be set between -128 and 127. A negative tx gain inverts the signal by 180°.
- TxDcShift** This is the usual DC-Offset in the output signal.. Usually it is set to 0.
- RxDeviation** Defines the scaling of the displayed deviation and the FrameSync sequence. Values from **-128 to 127** are possible.
- RxInv** Inverts the received signal. Necessary when an inverting amplifier is used. Values from **-128 to 127** are possible.

### 4.6.2 Tested parameters

Transceiver	Band	TxDelay	TxGain	TxDcShift	RxDeviation	RxInv
Standard C5200D	70cm	80	10	0	26	Off
YAESU FT7800	70cm	70	-30	0	63	Off
YAESU FT-897	70cm	60	20	0	75	Off
Kenwood TM-V7E	70cm	60	-50	0	45	On
Kenwood TM-D700	70cm	75	60	0	31	Off
Kenwood TH-F7E	70cm	60	-33	0	37	On
ICOM IC-E2820	70cm	96	26	0	36	Off
ICOM IC-7000	70cm	50	-4	0	45	On
Kenwood TM-V71E	70cm	96	65	0	26	Off
Kenwood TM-V71E	2m	55	40	0	40	On
ICOM IC-706MKIIG	70cm	60	-10	0	65	Off
Kenwood TMD-710	70cm	150	40	0	30	Off
Kenwood TMD-710	2m	150	40	0	30	On
Yaesu FT-847		60	-45	0	65	

Yaesu FT-817	70cm	65	16	0	37	Off
Yaesu FT-817	2m	65	16	0	37	Off
Kenwood TS-2000		120	-55	0	35	On
T7F	70cm	50	-12	100	23	On
Icom IC-207	2m	40	10	0	53	On
Bosch KF-451	70cm	100	-70	0	36	Off
Yaesu FT-90	70cm	50	-50	0	70	Off
Hytera RD 985	70cm	50	-4	0	45	On
Yaesu FT-7800	2m	70	-30	0	63	On
Motorola GM300	70cm	65	16	0	9	On
Yaesu FT-8900	70cm	80	-30	0	63	Off
Motorola GM1200	70cm	150	80	0	17	Off
Yaesu FTM-400DE	70cm	120	-45	0	70	On
Yaesu FTM-400DE	2m	110	-45	0	70	Off
ICOM IC-9100	70cm	60	13	0	20	Off
ICOM IC-9100	2m	60	13	0	20	Off
ICOM IC-9100	23cm	60	13	0	20	Off
ICOM IC-910H		90	8	0	37	Off

**Attention!** The PHY-parameters for different bands can be different for the same transceiver!

### 4.6.3 Getting the PHY-parameters on your own

Connect the UP4DAR to your VHF/UHF transceiver. Please be aware the 6-pin mini-DIN plug data cable is straight, i.e. pin 1 on one end connects to pin 1 on the other end of the cable and so on. Set the transceiver's mode to „Packet Radio 9600“.

Second, transmit on the desired frequency with your D-STAR radio or just listen to a D-STAR repeater cycle. Listening should cause the display to show received data and the speaker to play audio. Should there be nothing at all, the signal between the radio and the UP4DAR is most likely inverted. Activating the PHY parameter „RxInv“ solves the situation and D-STAR data can be received.

Furthermore, check the deviation on the display. Deviation is measured at the beginning of each cycle and shown left of the oszillograph curve. Change the parameter „RxDeviation“ until it displays approximately 1200Hz.

The parameter „TxDcShift“ will be about „0“ in most cases.

Now, the critical transmit parameter „TxGain“ will be adjusted. It can range from -127 to +127 and

affects the hub (~1200Hz) of the transmit signal. A calibrated receiver can be used to get the hub to the desired value.

Should there be no calibrated receiver available, a second UP4DAR board can be used for the reading. Another approach adjusting „TxGain“ roughly, is using a D-STAR radio. It is still unknown whether „TxGain“ has to be positive or negative. Therefore, set it to „10“ first and change it to „-10“. This procedure is done in steps of 10 until one's own transmission is received. Please do not increase „TxGain“ any further without detailed measurements to prevent jamming other stations!

Finally, the parameter „TxDelay“ needs to be adjusted. Increase „TxDelay“ until the header information can be decoded in the receiver.



Figure 42: Hub at appr.. 1200 Hz

If no equipment is available, the hub can also be measured with a second UP4DAR board as mentioned above.

Otherwise it is also possible to calibrate the TX gain with a D-Star radio device. We recommend an ICOM ID31E or ID51E as these devices are very sensitive for too much deviation.

You start the calibration with the TX Gain value „10“. Afterward invert the value to „-10“. Then increase the value by 10 or -10. You should then get a value for TX gain which encodes the data stream without errors. Don't increase the TX gain more than that value to avoid jamming other stations.

At least you set the value for „TxDelay“. You increase that value until the receiving station can decode the header data and message text without problems.



**Note!**

To save the PHY settings, you have to push **Save to Flash Memory** and reboot the board afterward.

## 4.7 Register Audio

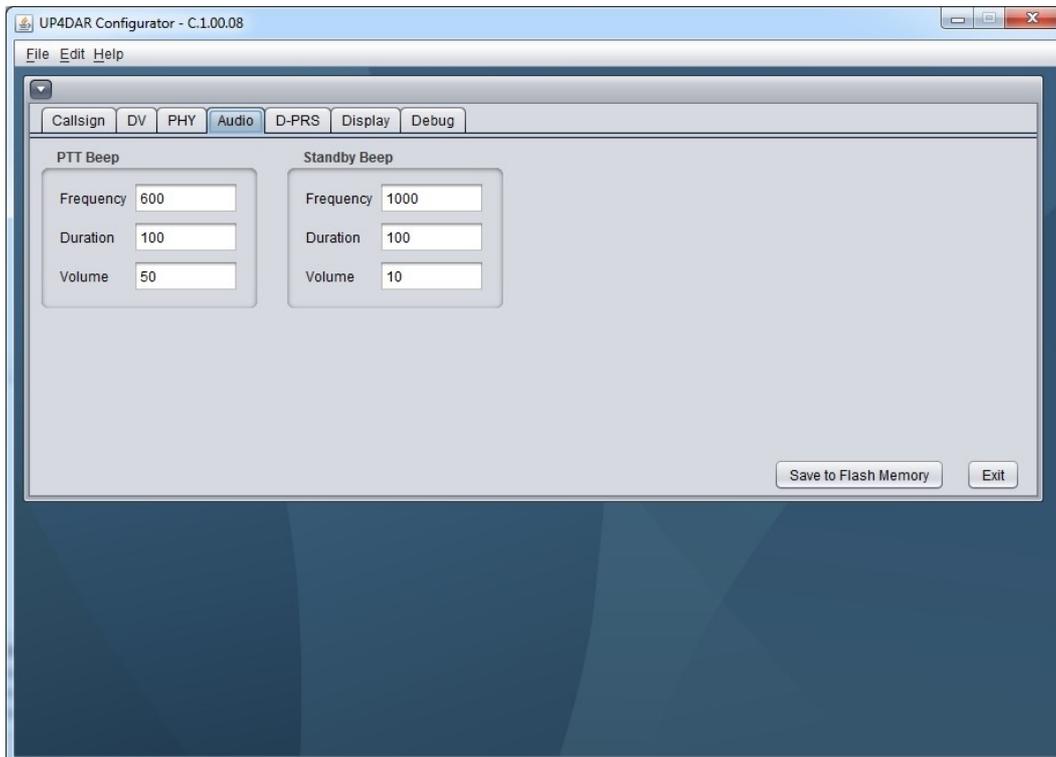


Figure 43: Register **Audio**

In this tab you can set the options for the audio events.

## 4.8 Register D-PRS



Figure 44: Register **D-PRS**

Until OS S.1.00.30 a wide range of DPRS functions was available on the UP4DAR board. These functions were removed temporarily. At the moment only the DPRS symbol and a message text can be set.

DPRS depends on the UP4DAR mode:

### **Mode D-STAR-Modem**

In this mode the data received by the GPS-receiver is inserted in the 1200bit/s data channel of the transmission as DV-G data and sent. DV-A is not supported at the moment.

The GPS data bases on the GPGGA and GPRMC data type.

### **Mode IP-Reflector**

In this mode is the transmission of GPS data in DV-G possible. The reflector is recognizing the received GPS data and show the GPS functionality in the dashboard:



But the received data is not forwarded to the APRS-database, so you cannot see the position on an APRS maps (maybe an old position is displayed).

### **Mode Hotspot and Repeater**

Since OS S.1.01.39e (June 2015) the UP4DAR board recognizes incoming GPS data and forwards it to the APRS network, if they are formatted in DV-A. That data is displayed on aprs.fi.

## 4.9 Register Display

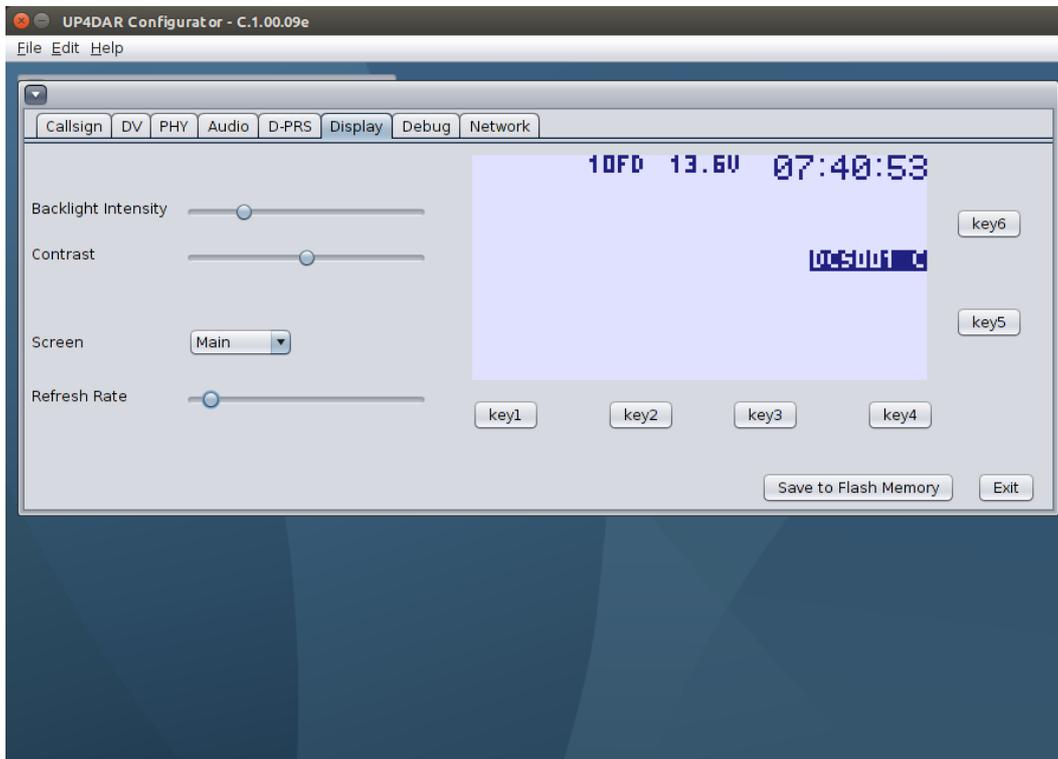


Figure 45: Register **Display**

You can adjust brightness and contrast in that tab. Furthermore you can also switch between the display pages (Main, GPS, Reflector, Debug and Audio) and use the six soft keys to control the UP4DAR board (key assignment in the appendix).

## 4.10 Register Debug

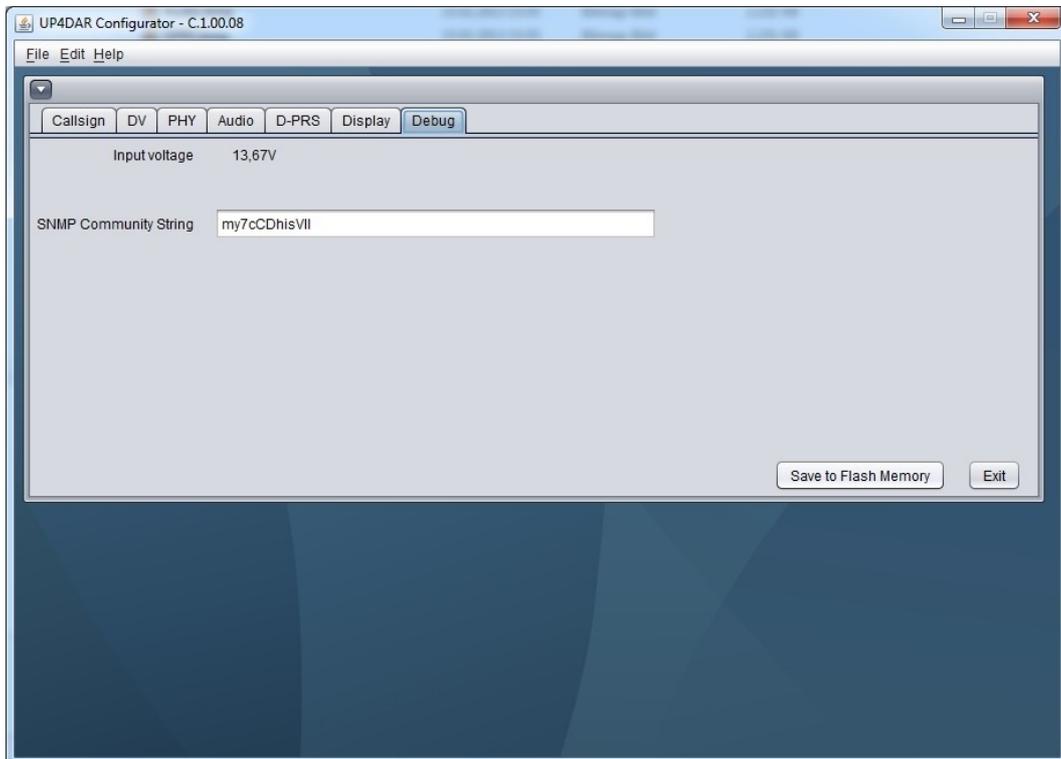
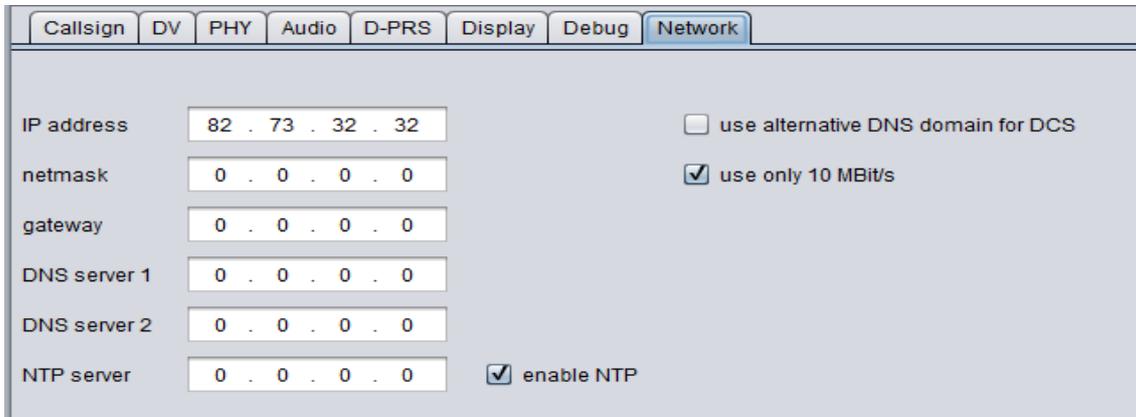


Figure 46: Register **DEBUG**

You can see the voltage of your power supply here. In future you can also set the password for the SNMP transmission between the configurator and the UP4DAR board here.

## 4.11 Register network



Field	Value	Option
IP address	82 . 73 . 32 . 32	<input type="checkbox"/> use alternative DNS domain for DCS
netmask	0 . 0 . 0 . 0	<input checked="" type="checkbox"/> use only 10 MBit/s
gateway	0 . 0 . 0 . 0	
DNS server 1	0 . 0 . 0 . 0	
DNS server 2	0 . 0 . 0 . 0	
NTP server	0 . 0 . 0 . 0	<input checked="" type="checkbox"/> enable NTP

Figure 47: Register **Network**

The network settings can be changed here. Per default the UP4DAR board works in DHCP mode and no further settings are necessary.

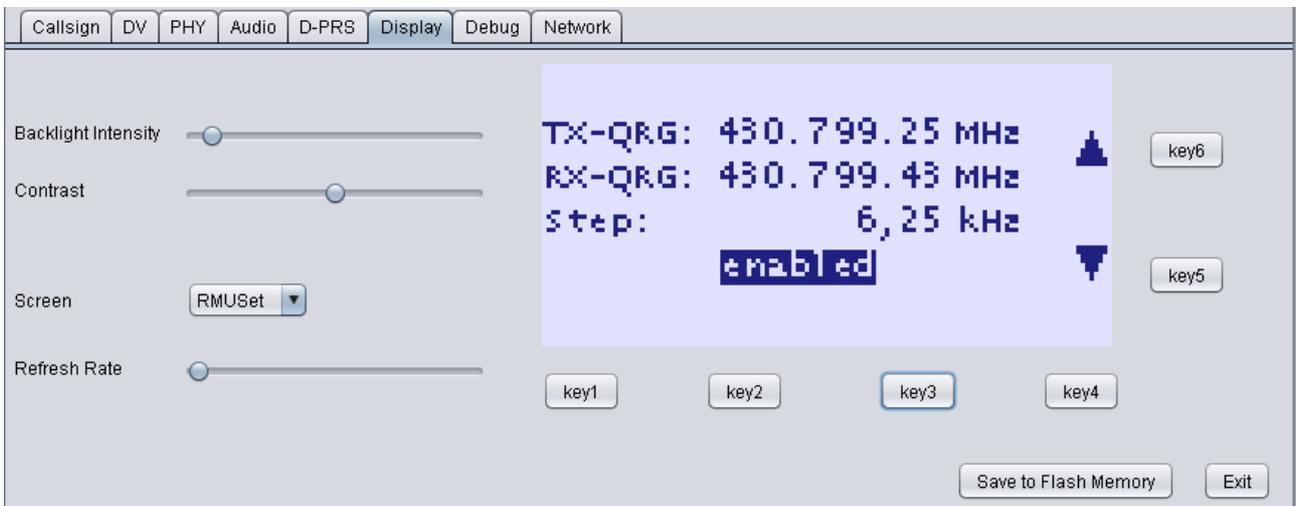
If you check the box „enable NTP“ the time is displayed on the UP4DAR display. The UP4DAR requests the time from your router via NTP.

If it is necessary to switch to a static IP please have a look at <http://forum.up4dar.de/board6-up4dar-international/board16-up4dar-general/182-ip-static/#post976>

If the NTP option is not enabled, the UP4DAR board displays the time since the last reset.

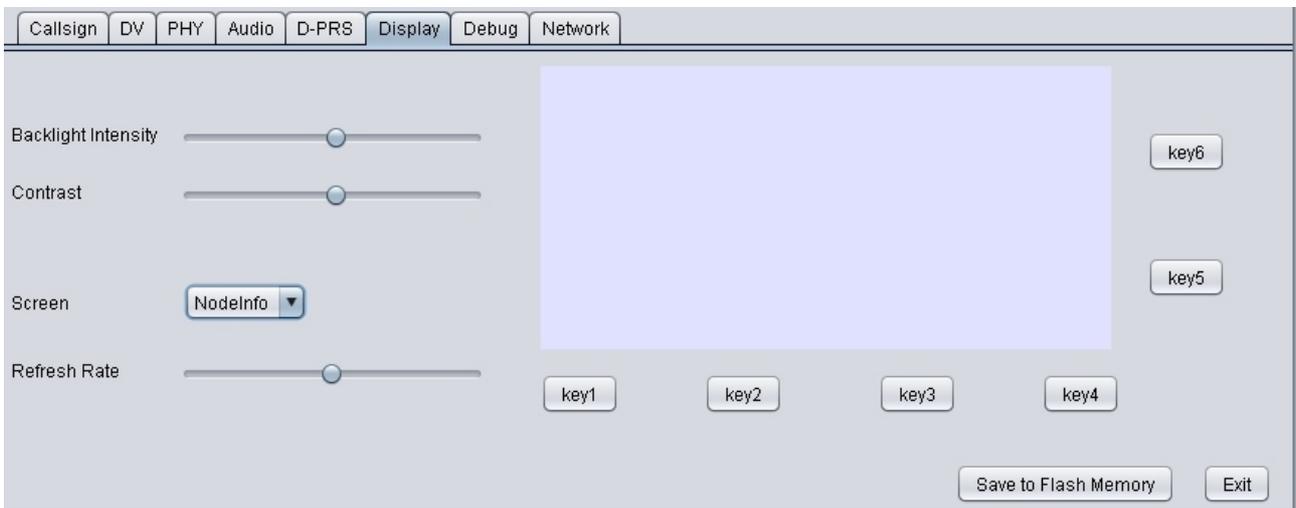
If you enable the option „use only 10 Mbit/s“ the power drain (sic!) of your board decreases.

### 4.12 Register RMU set



In that tab you can set the frequencies of a RMU 2.0 if present.

### 4.13 Register NodeInfo



Introduced in OS s.1.01.39e, but not used up to now.

## 5 Updating the firmware

There are two possibilities for updating your UP4DAR board:

- 1) A comfortable update via configurator since OS S.1.01.10
- 2) A deep update for older OS versions

### 5.1 comfortable update

Since OS S.1.01.10 you can update the firmware via configurator. See File – Firmware update in the menu.

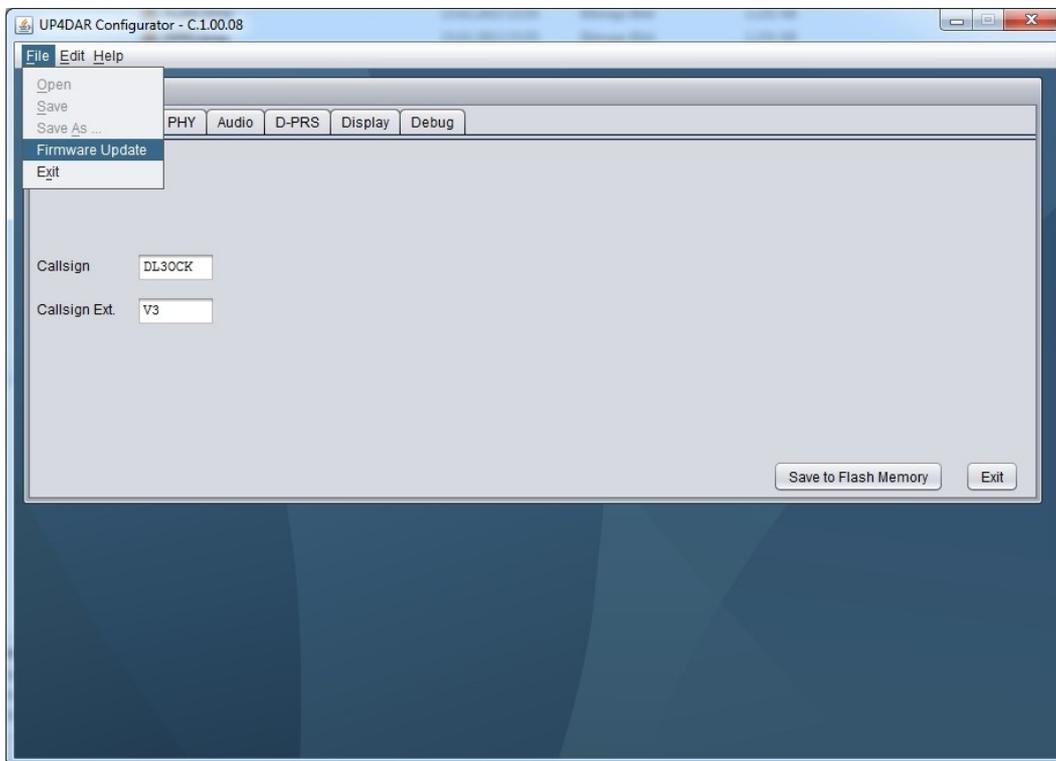


Figure 48: comfortable update via configurator

When selecting that menu point, a window pops up and requests the file for the update. Usually the file will have a name like **P.x.xx.xx.bin** or **S.x.xx.xx.bin** and can be found on the [up4dar.de](http://up4dar.de) website. After selecting the file, it is transferred to the UP4DAR board. Afterward please reboot your UP4DAR board.

After rebooting the display will show the update status of the firmware.

### 5.2 Deep update

For older versions or if the board doesn't respond, you have to do a so called deep update. You need the FLIP program package, which you can download at <http://www.atmel.com/tools/FLIP.aspx>. The

package contains the needed USB driver and the DOS-program batchisp.exe.

### 5.2.1 Needed files

You need the two parts of the operation software, named **up4dar-os.elf** and **up4dar-2nd-bootloader.elf**. The update procedure is done via a batch file named p.bat. All these files are generated when compiling the project. If you want to do the compiling on your own, you need **ATMEL Studio 6**.

### 5.2.2 Deep update procedure

First you connect your UP4DAR board with a mini-USB-cable to your computer. Afterward you power on your board while pushing the softkey 3. The USB-device is recognized by your computer and you have to install the USB driver (you can find the driver in the directory in which you installed the FLIP package).

Then you open a DOS window and change to the directory with the batch file p.bat. Execute that batch file and the UP4DAR will be updated.

## 6 Appendix

### 6.1 configurations of popular microphones

In this listing you can find the configurations of the most popular microphones. Attention: The numbers are listed as mentioned in Figure 5.

Microphone	1	2	3	4	5	6	7	8
YAESU MH-31			+5V	GND (MIC)	MIC	PTT	GND	
YAESU MH-48	n.c.	PTT	MIC	GND	+9V	SW 1	SW 2	n.c.
ICOM	+8V	UP/DWN	+8V control IN	PTT	GND (MIC)	MIC	GND	Data IN
Kenwood	DWN	n.c.	MIC	GND (MIC)	PTT	GND	+8V	UP

### 6.2 changing a reflector room

In the modi hotspot and repeater it is possible to transmit control commands to your UP4DAR and change the reflector room. The commands can be entered with URCALL or DTMF.

We recommend to disconnect the linked room first.

#### 6.2.1 changing via URCALL

Please use the following entries in the URCALL-field:

Disconnect: „     U“ (7 space characters followed by an U)

Status: „     I“ (7 space characters followed by an I)

Linking to a reflector room: System – reflector – room – L, for example the room Austria DCS9B can be connected with URCALL DCS009BL

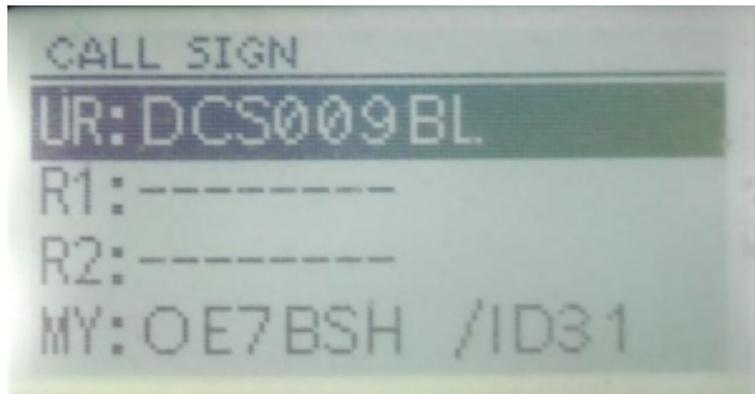


Figure 49: URCALL-command DCS009BL (here at an ID-31E)

You can find a listing of the rooms of a reflector at <http://www.xreflector.net> → „Group info“.

When the UP4DAR receives a DTMF code, it answers with a TX message like „CONNECTED“ or „DISCONNECTED“.

After sending the control command you have to enter CQCQCQ again.

### 6.2.2 Changing via DTMF

Disconnect: #-key

Status: 0 (UP4DAR answers for example with „DCS009B connected“)

The reflector can be changed with D + number of the DCS-reflector + position of the letter in the alphabet. An example: DCS-room Austria has the DTMF-code D902, the Australian reflector 28T would be DTMF-code D2820

You can find a listing of the rooms of a reflector at <http://www.xreflector.net> → „Group info“.

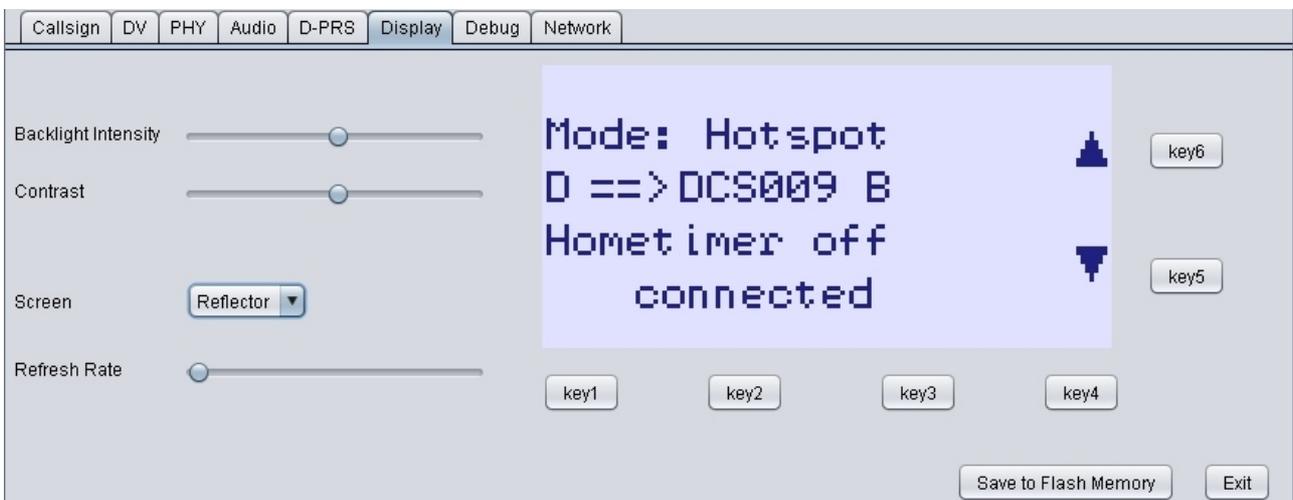
When the UP4DAR receives a DTMF code, it answers with a TX message like „CONNECTED“ or „DISCONNECTED“.

### 6.3 configurator keys

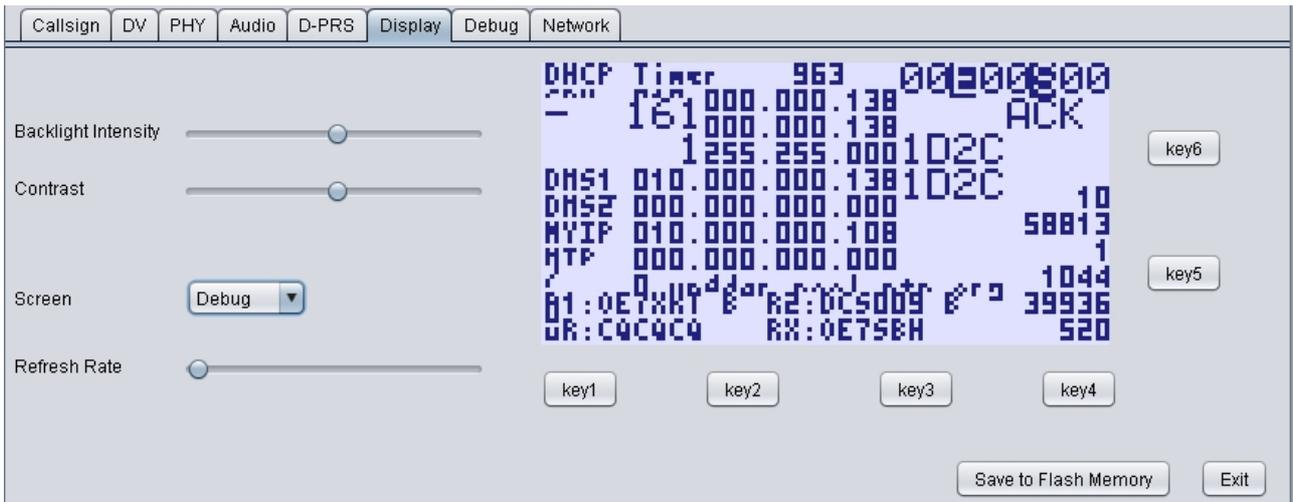
For the control of your UP4DAR via Configurator you can find here the matching keys (key1, key2, key3 and key4) to the screens:



**PTT – Mute/keylock – R>CS - menu**



**Connect – Disconnect – Select - menu**



**Empty - Reboot – Empty - menu**

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