USER MANUAL
FREEDSP-AURORA

REVISION HISTORY

Revision	Description	Date
v1.0.0	Initial Version	01 Jul 2019
v1.0.1	Regulatory Information and WiFi setup rewritten	31 Jul 2019
v1.0.2	Updating ESP32 firmware via USB	30 Aug 2019
v1.0.3	Fixed wrong picture for X102, added pinout for USBi, added WiFi antenna connection	13 Sep 2019
v1.1.1	webOTA added, AddOn configuration	10 Nov 2019
v2.0.0	Added 4FIRs plugin, connector volume pot, WebApp, Quick start	9 Mar 2020
v2.0.1	Added hint polarity inversion	15 Mar 2020
v2.0.2	Added fallback	29 Mar 2020
v2.0.3	Added hint for Send button	03 Apr 2020
v2.1.0	Reorganized connectivity chapter Specification recommended operating conditions	09 Jun 2020
	Added Access Point Config Added Turning Off WiFi Added SPDIF Output Routing	18 Jul 2020

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ABOUT FREEDSP-AURORA

The freeDSP-aurora is a cost-effective real-time audio signal processing solution for researchers and the do-it-yourself community and audio enthusiasts. It is a bare circuit board that can be incorporated into your own projects. It comes with no housing. Easy assembling and simple programmability are the main focus. It is based on Analog Devices' ADAU1452 DSP controlled by a web application.
Additionally the development environment SigmaStudio can be used. The programming model of SigmaStudio is function-block based – comparable to other graphical programming languages like PureData or Max/MSP. Many prebuilt blocks (e.g., filters, compressors, effects, or logic) can be placed in the signal path via drag and drop. If the included libraries do not have the functions needed, low-level blocks, such as multipliers and delays, can be wired together to create custom DSP plugins. For more information please refer to the Analog Devices website (https://www.analog.com/en/design-center/evaluation-hardware-and-software/software/ss_sigst_02.html#software-overview).

FreeDSP-aurora offers a wide range of DSP processing options and interface controls with easy programmability. It can be used in various audio applications, e.g.:

Room compensation / system equalization
Digital crossovers in active loudspeaker concepts
Multiband dynamics processing
Delay compensation / phase shift
Bass enhancement
Subwoofer integration
Advanced instrument audio effect units
Stereo image widening
…

A XMOS XE216-512-TQ128 MCU is used to expose an USB Audio Class 2 compliant interface to a host computer running macOS, Linux or Windows 10. The boards provides 8 balanced audio input and 8 balanced audio output channels. Additionally an ADAT input/output and a Wordclock input/output is provided by the XMOS MCU.

The ESP32 MCU controls the operation of the DSP. Furthermore, it provides WiFi and Bluetooth connectivity and handles peripherals like rotary encoder, display, temperature sensor, PWM controlled fan and IR sensor.

As part of the project the open source software auverdionControl is published that controls the operation of the freeDSP-aurora from macOS, Windows or iOS. Via the control software the user can access all parameters of the uploaded DSP plugin. Due to the open source licenses users can modify the control software for supporting their own DSP plugins.

The complete schematics and all software for the freeDSP-aurora board are published under a Creative Commons Attribution ShareAlike 4.0 International (CC BY-SA 4.0) license, which allows the unrestricted use and modification of the module. This means that experienced users can make their own version of the board, extending it and improving it, as long as they credit freeDSP and auverdion and release their designs under the same license.

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The auverdion brand is copyright of Raphael Knoop and cannot be used without formal permission.

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IMPORTANT INFORMATION

The freeDSP-aurora board might generate signals that may damage your audio equipment. Please read and understand this manual before starting to work with your board. Adjust all hardware settings and configure your software before connecting any audio equipment to freeDSP-aurora. Always start with low volume on your amplifier and slowly increase the level to reduce the risk of damaging your audio system.

freeDSP-aurora is provided to you 'as is'. Auverdion makes no express or implied warranties whatsoever with respect to its functionality, operability, or use, including, without limitation, any implied warranties of merchantability, fitness for a particular purpose, or infringement. We expressly disclaim any liability whatsoever for any direct, indirect, consequential, incidental or special damages, including, without limitation, lost revenues, lost profits, losses resulting from business interruption or loss of data regardless of the form of action or legal theory under which the liability may be asserted, even if advised of the possibility or likelihood of such damages. Features and specifications might change without prior notice.

Please keep in mind that freeDSP-aurora is an open-source project. Because freeDSP-aurora is very flexible, many applications are possible. Questions and new ideas can be discussed online with other DIYers. Please use the *Digital Line Level* subforum @ diyAudio.com or the *Elektronik* subforum @ www.diy-hifi-forum.eu[1] to connect with other people working with freeDSP-aurora. Please create individual threads for your topics only if you cannot find your issue in the existing threads. Some questions can be answered by carefully reading this manual.

This manual refers to firmware version 2.1.0.

[1] Please see chapter Useful Web Links

FEATURES

- Analog Devices ADAU1452, 294.912 MHz, 32-bit SigmaDSP
  - 6144 SIMD instructions per sample @ 48 kHz fs
  - 40kWords of data RAM
  - 800 ms digital audio delay pool @ 48 kHz fs
  - 8 stereo ASRCs with 139 dB DNR
- XMOS XE216-512-TQ128 for multichannel bidirectional audio streaming
- ESP32 for WiFi or Bluetooth control
- AKM AK4458 32bit-DAC
- AKM AK5558 32bit-ADC
- Supporting sample rates between 44.1 kHz and 192 kHz
- 8 analog balanced input channels, +6 dBu
- 8 analog balanced output channels, +6 dBu
- S/P-DIF input and output
- ADAT input and output
- Wordclock input and output
- Support for display, rotary encoder, volume potentiometer, temperature sensor, PWM controlled fan, IR sensor
- One freeDSP expansion header
- USB Audio Class 2 Bidirectional streaming with 8 channels in and 8 channels out, full-duplex. Works with ASIO driver under Windows 10 and driverless under macOS and Linux.
- Realtime control via a web application supporting Safari, Chrome and Firefox.
- Connection to board by WiFi
- Board dimensions: 110 mm x 110 mm

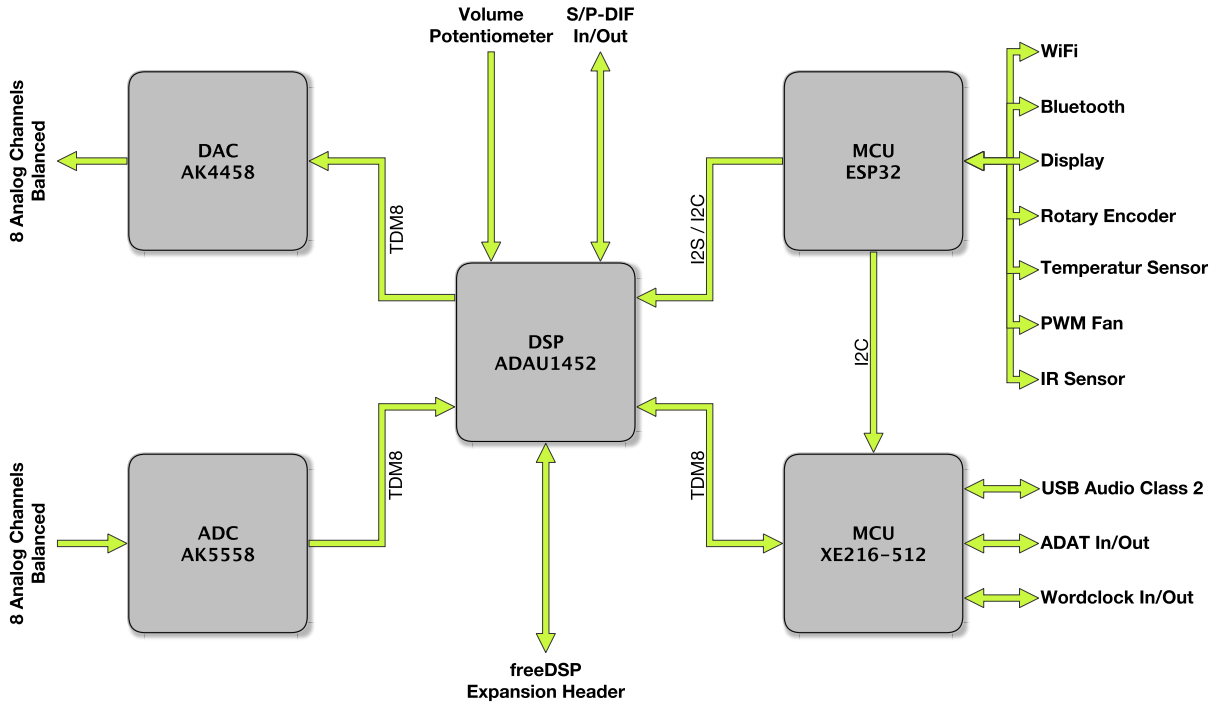
QUICK START

For a quick start with your brand new freeDSP-aurora you just have to do the following steps:

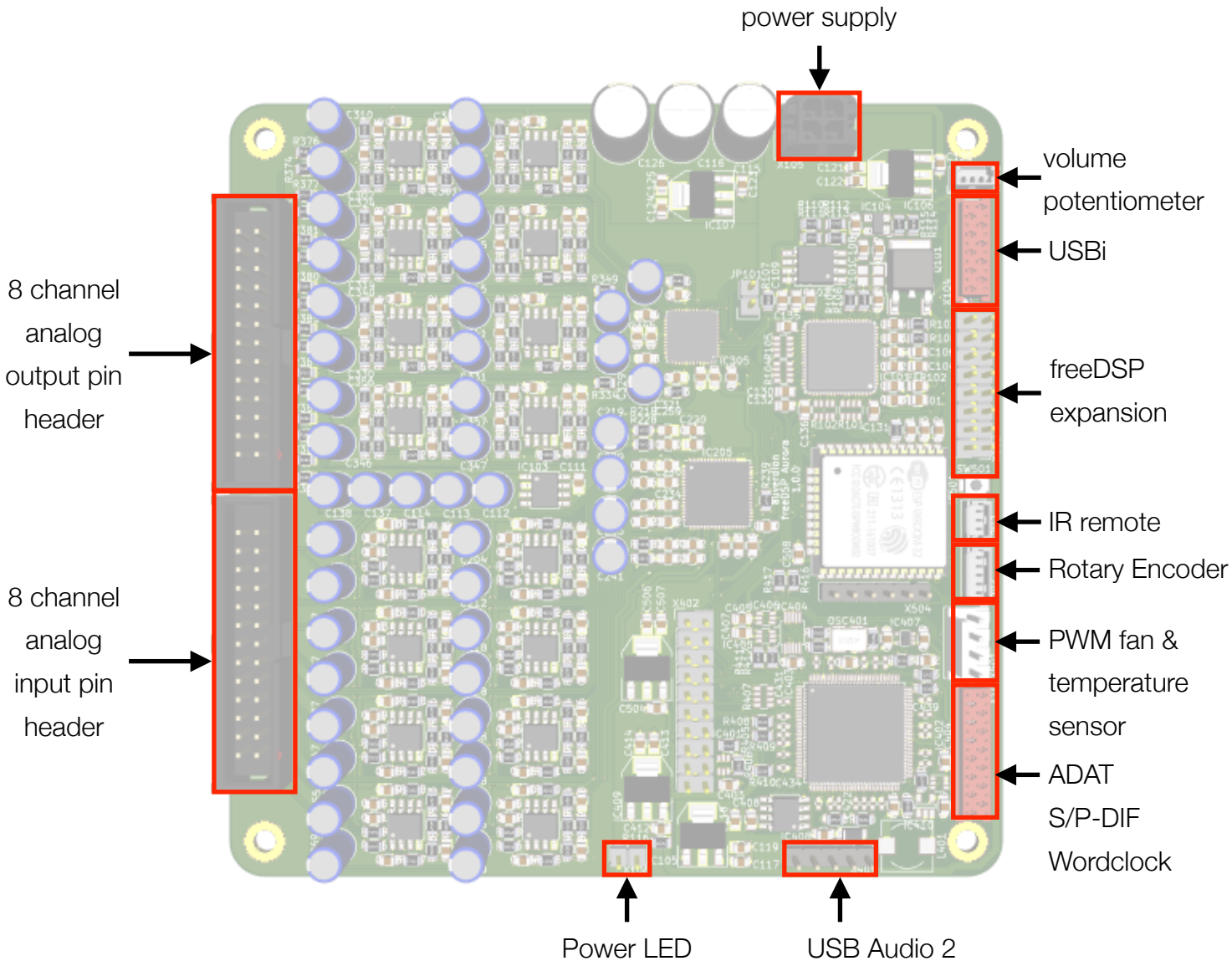
1. Get some chocolate.
2. Connect your add on (if you have one) to your freeDSP-aurora.
3. Connect your audio equipment to freeDSP-aurora (or the addon).
4. Connect X105 to your power supply.
5. Connect the WiFi antenna.
6. Eat some chocolate.
7. Power up your freeDSP-aurora.
8. Connect your computer to the access point *AP-freeDSP-aurora*.
9. Open Safari or Firefox or Chrome and enter 192.168.5.1 in the URL field.
10. Get a cup of coffee and eat the rest of the chocolate.
11. Your are ready for DSP'ing.

SYSTEM INFORMATION

BLOCK DIAGRAM



CONNECTORS


power supply
volume potentiometer
USBi
freeDSP expansion
IR remote
Rotary Encoder
PWM fan & temperature sensor
ADAT
S/P-DIF
Wordclock
8 channel analog output pin header
8 channel analog input pin header
Power LED
USB Audio 2

RECOMMENDED OPERATING CONDITIONS

Item	Min	Typ	Max	Unit	Notes
Supply Voltage	6.5	7	10	Vdc	
Input Level		6		dBu	Might be changed by AddOn
Output Level		6		dBu	Might be changed by AddOn

Absolute Maximum Ratings

Item	Min	Typ	Max	Unit	Notes
Supply Voltage	6		12	Vdc	

Note: Operation at or beyond the limits in the table above may cause permanent damage to the device and normal operation is not guaranteed at these extremes.

FreeDSP-aurora has to be placed in an enclosure with enough airflow. Please mount the PCB with spacers on a solid surface. None of the four mounting holes is connected to any voltage or signal on the board. EMC regulations must be observed.

OPTIONAL INPUT AND OUTPUT ADDONS

FreeDSP-aurora was designed to support as many applications as possible. Therefore, all inputs and outputs are on pin headers or ribbon cable connectors. This way user can adapt the front-ends to their needs. Some add-on boards will be available for this project. These boards will cover the most common used input output configurations, e.g. active multi-way loudspeaker or an 8 channel loudspeaker management or buttons and displays for user interaction. Please check the github repository and/or the website for information about the add-on boards.

HOW TO GET FREEDSP-AURORA UP AND RUNNING

HARDWARE INSTALLATION

Before you can use freeDSP-aurora you may have to do some hardware connections. The connections vary with desired application. Not all connections are always needed. At least you have to connect the WiFi-Antenna and the power supply to get your freeDSP-aurora working.

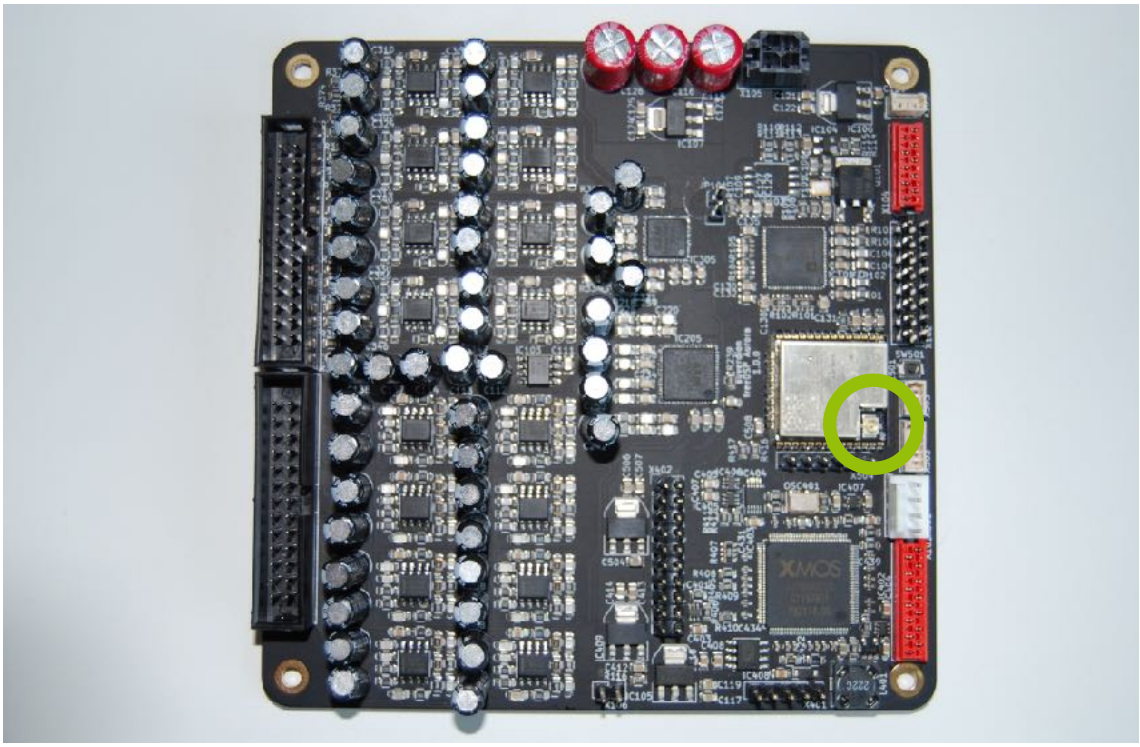
SOFTWARE INSTALLATION

USB Driver Installation

FreeDSP-aurora was designed to be class compliant with UAC2. Thus, on macOS and Linux you don't need to install any driver. Windows 10 comes with a UAC2 driver as well but you may have to install additional stuff like the free software asio4all and your audio software needs to support ASIO. Please note, that ASIO is only needed if you want to use the 8 input channels for recording audio. If you just want to use freeDSP-aurora to stream audio data to your audio equipment, ASIO is not needed and you can skip the asio4all installation.

WiFi Antenna

Your freeDSP-aurora comes with a WiFi antenna. If you want to control your DSP via WiFi you have to connect the antenna on the antenna connector of the WiFi module (ESP32).



Analog Audio Connections

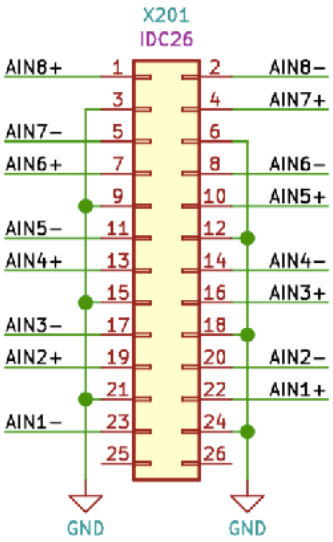
Analog audio input connections can be made on pin header X201. The audio inputs are designed for balanced operation at +6 dBu maximum input level. Unbalanced sources can be connected as well by grounding the negative input. In the latter case you may have to change the gain of the input stage to improve the signal to noise ratio. Alternatively you may want to use a conversion circuit if your audio sources use a different connection (e.g unbalanced) or have another level.

Analog audio output connections can be made on pin header X301. The audio outputs are designed for balanced operation at +6 dBu maximum output level. In case of unbalanced sinks leave the negative output unconnected. In the latter case you may have to change the gain of the output stage to improve the signal to noise ratio. Alternatively you may want to use a conversion circuit if your audio sinks use a different connection (e.g. unbalanced) or have another level.

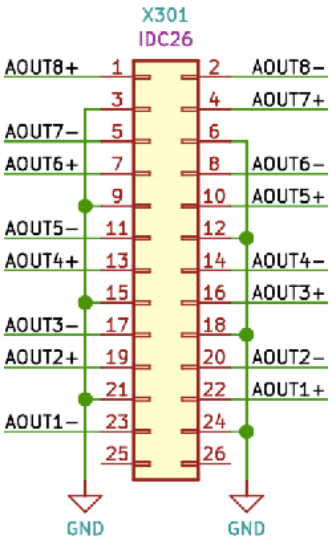
When making audio connections, make sure that your equipment is powered off to avoid any damage.

The gain of the analog audio input and output stage can only be changed by changing the resistors on the board to another value.

Connector: IDC26, 2.54 mm Pitch, Bud Industries, BC-32677



Pinout Analog Input

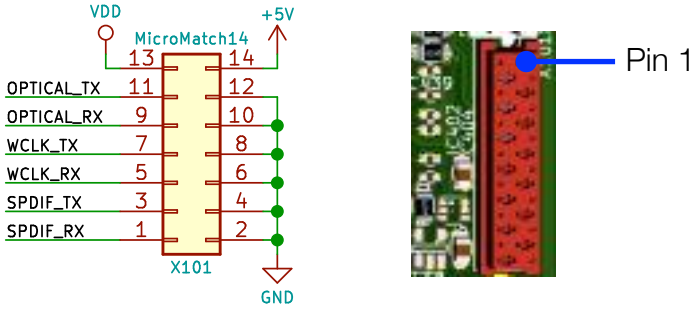


Pinout Analog Output

Digital Audio Connections

On connector X101 you can make your digital audio connections like S/P-DIF input and output and ADAT input and output. Wordclock input and output can be connected to X101, too.

Connector: MicroMatch-14, 2.54 mm pitch, TE Connectivity AMP Connectors, 1-215079-4

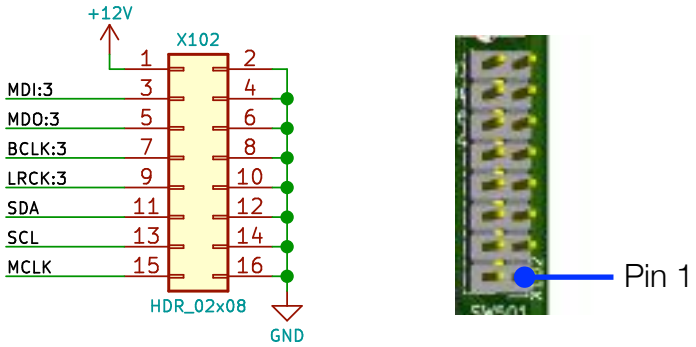


Pinout Digital Audio Connections

FreeDSP Expansion Header

X102 is the an expansion header for additional input and output boards. The pinout complies with the I2S expansion header specification of the freeDSP project. If you want to connect a I2C display please connect it to this header, too.

Connector: Header 2 x 8 pos, 2.54 mm pitch, Sullins Connector Solutions, PRPC008DAAN-RC

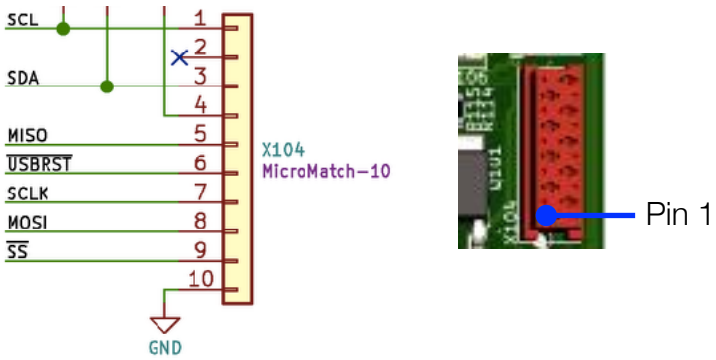


Pinout freeDSP Expansion Header

USBi Connector

On connector X104 you can connect an USBi programmer. The pinout complies the pinout of the programmer from Analog Devices but you have to make a flatband ribbon cable with a MicroMatch connector on one side.

Connector: MicroMatch-10, 2.54 mm pitch, TE Connectivity AMP Connectors, 1-215079-0



Pinout USBi Connector

Fan and Temperature Sensor

On connector X501 you can connect a PWM controlled fan. Please use the Sense pin to connect a temperature sensor (e.g. NTC).

Connector: KK-100, 4 pos, 2.54 mm pitch, Molex, 0022232041

Pinout Fan and Temperature Sensor

Rotary Encoder

On connector X502 you can connect a rotary encoder with or without a push button.

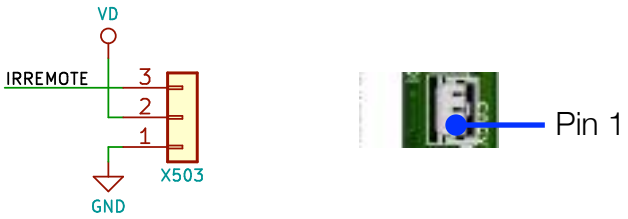
Connector: PicoBlade, 5 pos, 1.25 mm pitch, Molex, 530470510

Pinout Rotary Encoder

IR Sensor

On connector X503 you can connect an infra red receiving diode.

Connector: PicoBlade, 3 pos,1.25 mm pitch, Molex, 530470310



Pinout IR Sensor

Volume Potentiometer

On connector X103 you can connect volume potentiometer for master volume control. Please connect the center tap of your potentiometer to pin 2 of X103 and the other two taps to pin 1 and 3. If the turn direction of the potentiometer is not right then you have to swap the cables on pin 1 and pin 3.

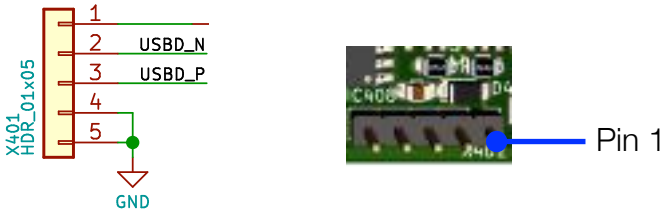
Connector: PicoBlade, 3 pos,1.25 mm pitch, Molex, 530470310

Pinout Master Volume

USB Connection

Your host computer connects on the pin header X401. Please use a common off-the-shelf cable assemblies (typically used in computer hardware). Always confirm the pin-out with the manufacturer, or you could easily cause damage to your computer or freeDSP-aurora. Usually the GND-pins 4 and 5 can be identified by a black wire, but you can never be sure unless you checked the manufacturer's specifications of the connector.

Connector: Header, 5 pos, 2.54 mm pitch, Sullins Connector Solutions, PRPC005SAAN-RC



Pinout USB Connection

Power LED

On this connector you can connect a LED to show the power on/off status.

Connector: Header, 2 pos, 2.54 mm pitch, Wurth Electronics Inc., 61300211121

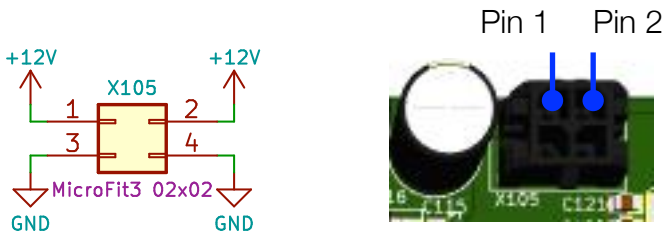
Pinout Power LED

Power Supply

freeDSP-aurora needs a power supply on X105. Together with the board you received a power cable. The white wires identify the positive voltage, the black wires are GND.

Attention: Apply power to the board only after all connections have been made and you have double-checked everything.

Connector: MicroFit, 2 x 2 pos, 3 mm pitch, Molex, 0430450428



Pinout Power Supply

EXAMPLES FOR OPTIONAL PERIPHERALS

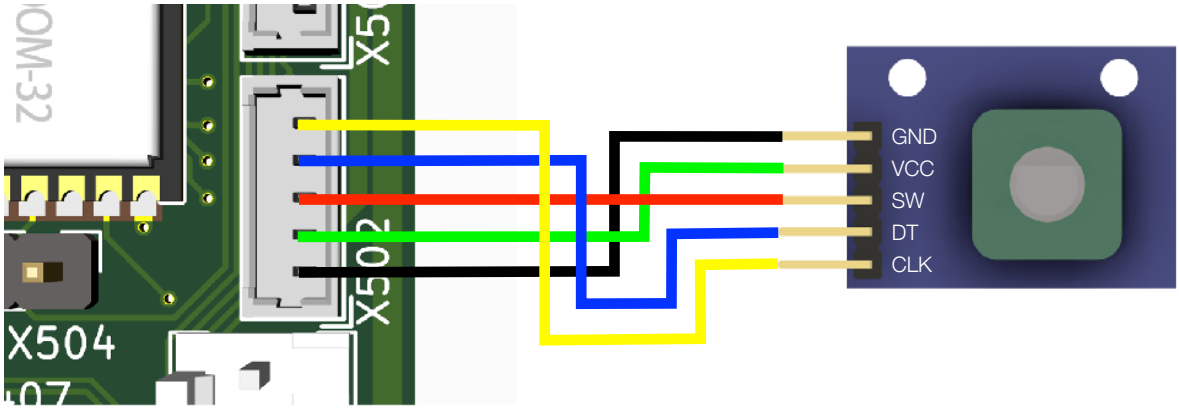
In this chapter you can find some examples for how to connect optional peripherals. Please note, these are only suggestions. You can always try other components. For some alternatives (e.g. displays) you may have to change the firmware, others like volume potentiometers or encoders may work without any change. We used ready-to-go modules from the maker community. That makes it easier because you only need to make the wire connections. Of course you can always design your own peripherals.

VOLUME POTENTIOMETER

On X103 you can connect a potentiometer for volume control. The wiring ist almost self-explaining: Connect the center tap of the potentiometer to pin 2 of X103 and the other two pins of the potentiometer to pin 1 and 3 of X103. If the turn behavior of the potentiometer is inverted swap the wires on pin 1 and 3 of X103.
You can use any potentiometer with a value between 10K and 20K and any resistance taper you prefer. E.g. on AddOn A a ALPS RK09K1110-20 is used.
Please note: The volume potentiometer operates independent of the master volume setting. The master volume is set only by either the web application or the rotary encoder.
To use the volume potentiometer you have to enable it in the Config Device dialog (refer to chapter Working with the Web Application).

ROTARY ENCODER

On X502 you can connect a rotary encore module like the KY-040. This module comes already with the required pull-up resistors and is available from several shops, eg. here: https://www.az-delivery.de/products/drehimpulsgeber-modul?_pos=1&_sid=642f6443a&_ss=r

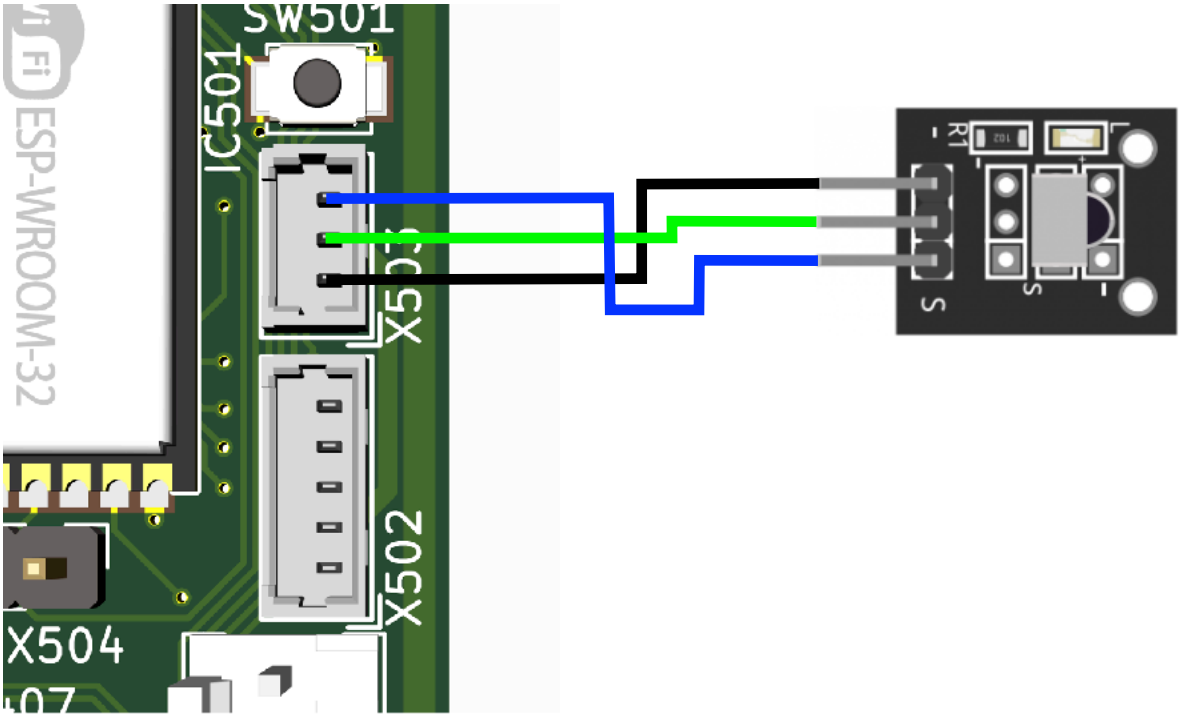


The rotary encoder is enabled as soon as you connect it. The default functions are:

Turn left/right:	Decrease/increase the master volume or switch between presets.
Push:	Switch between master volume mode and preset select mode.

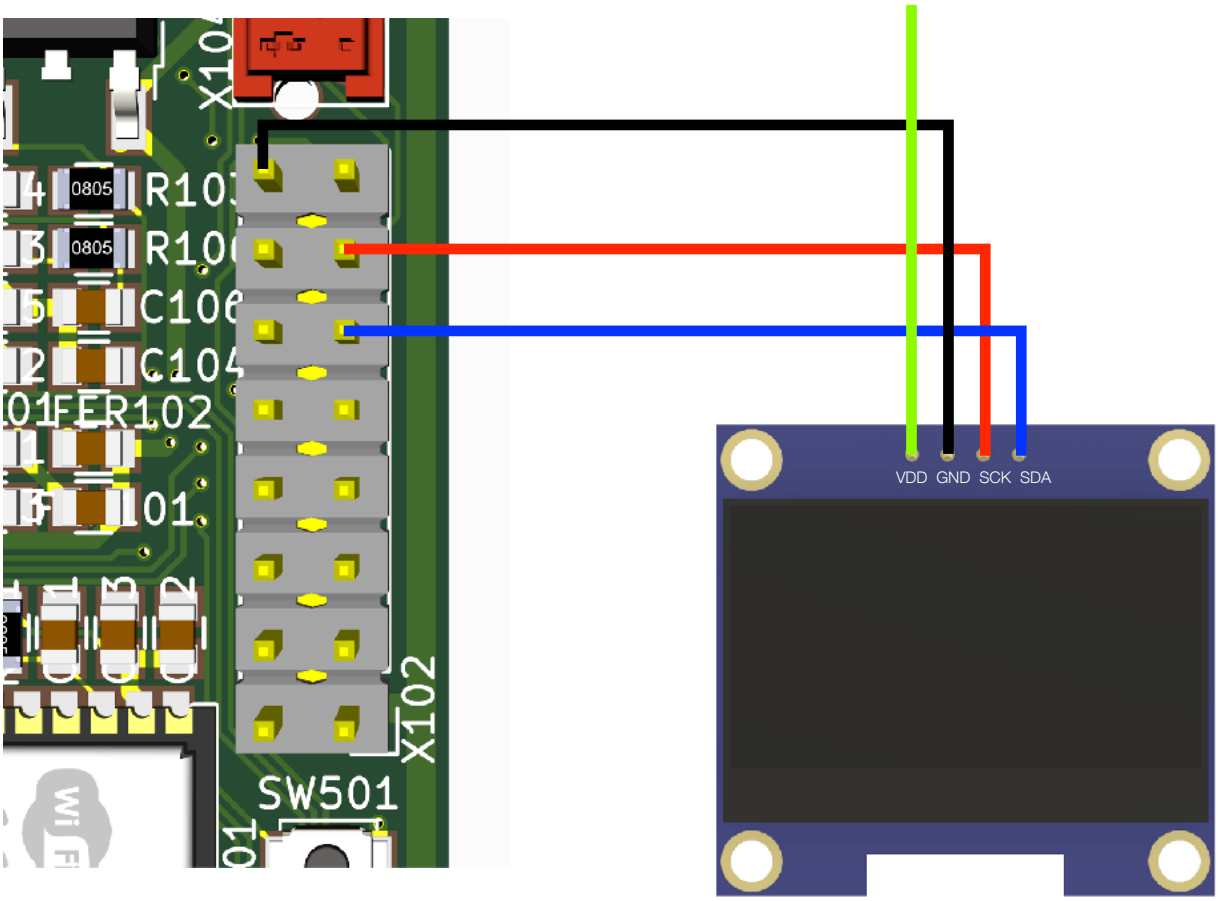
IR RECEIVER

On X503 you can connect a IR receiving module like the KY-022, which is available from several shops, eg. here:
https://www.az-delivery.de/products/ir-empfanger-modul?_pos=2&_sid=c79b147b1&_ss=r



DISPLAY

Your freeDSP-aurora comes with support for 128 x 64 pixel monochrome display driven by a SH1106 controller via the I2C bus. Such a display you can get e.g. from here:
https://www.az-delivery.de/products/1-3zoll-i2c-oled-display?_pos=15&_sid=98d3e8a33&_ss=r
The wiring is shown in the drawing below. GND and the I2C signals you can pick up on X102, the required +3.3V (VDD) for the display you can get from pin 2 of X502 or pin 2 of X501.
If X102 is occupied you can get GND, SCL, SDA from X104 alternatively.
If you want to use another display (e.g. another size or a multicolor display) you have to change the driver in the source code of the ESP32 firmware.



WORKING WITH THE WEB APPLICATION

Your freeDSP-aurora provides a little web server hosting a web application. This web application controls the operation of your freeDSP-aurora. You can configure and control the operation of your freeDSP-aurora and upload new DSP plugins to it.

To start the web application connect your computer or tablet with the WiFi access point *AP-freeDSP-aurora* by an ad-hoc WiFi connection, open your preferred web browser (Safari, Chrome or Firefox) and enter http://192.168.5.1 as URL. Please refer to the documentation of your operating system for how to establish an ad-hoc WiFi connection for your computer.[2]

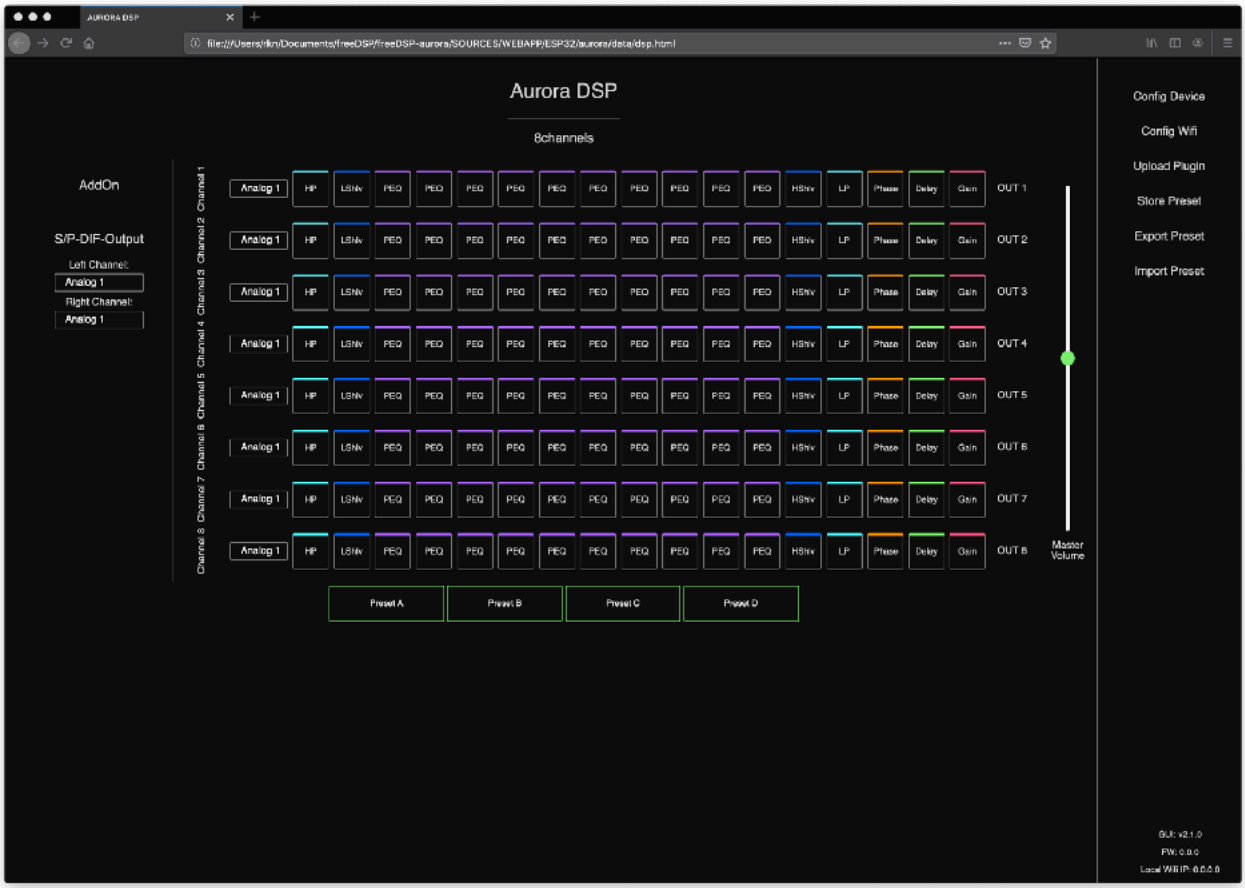
Note: If you have configured your freeDSP-aurora already for your local WiFi (see below) you don't need to connect to the access point. Your router[3] has assigned an IP number to your board. Enter this IP number in the URL field of your browser.

[2] See chapter Useful Web Links

[3] Please refer to the manual of your router for how to display the IP your router has assigned to freeDSP-aurora.

OVERVIEW

When you open the web application on your freeDSP-aurora you will see a user interface (UI) of the currently installed DSP plugin.

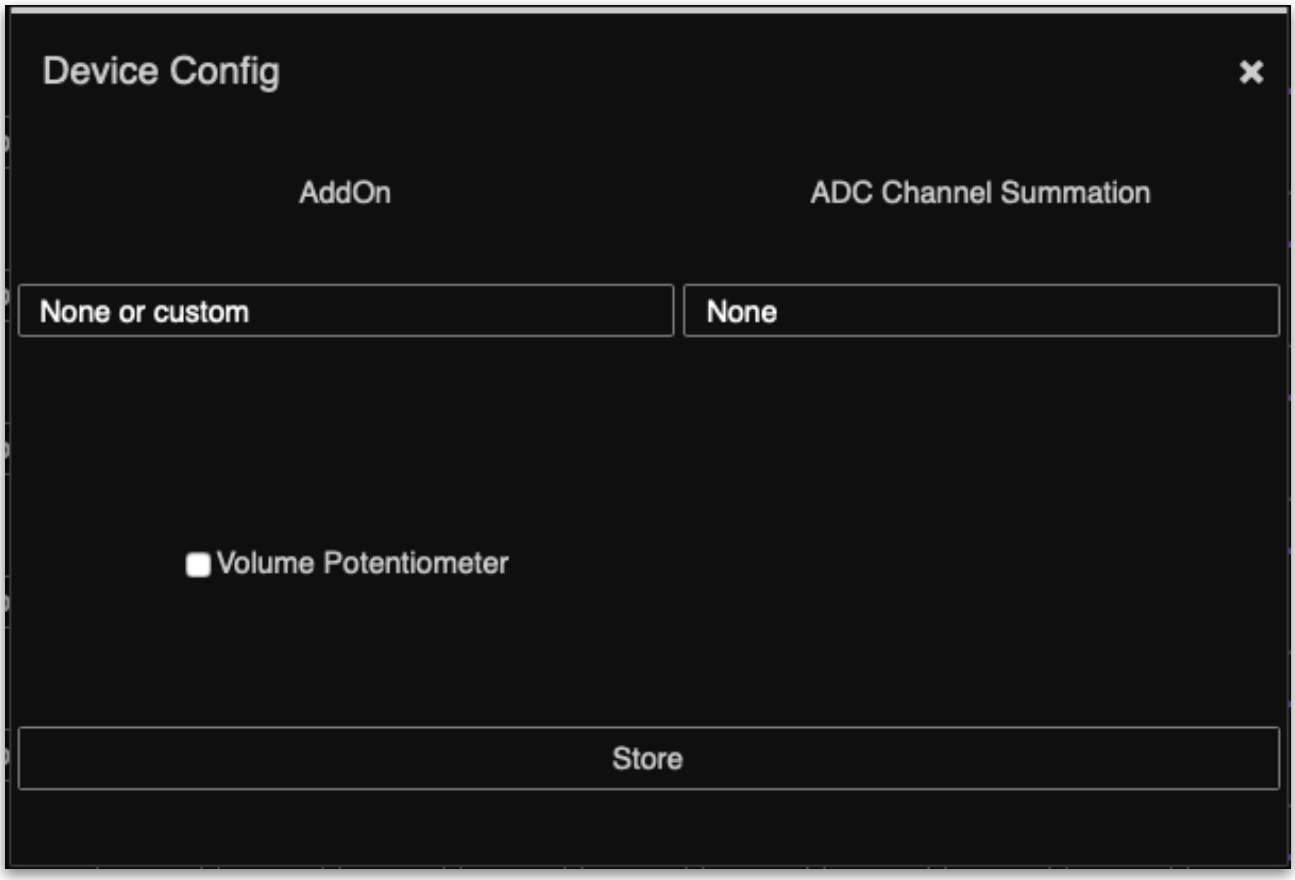


The UI is slightly different for each DSP plugin. On the left side you see the AddOn control. Depending on your AddOn additional configuration option are displayed.
Below you see the configuration for the S/P-DIF output.
In the middle you see the filter functions your DSP plugin provides. Usually they are grouped in one row per channel. Whenever you want to make a change to one filter, you have to click on the filter block. This opens a new dialog where you can make your changes and store them on your freeDSP-aurora.
On the right side of the plugin UI you have usually the Master Volume slider.

Under the grid with the filter blocks you find the buttons for switching the presets. For the currently selected preset the button is displayed with a green filled background.
On the most right side you see a menu bar with the additional functions.

CONFIG DEVICE

By clicking on *Config Device* you can open the device configuration dialog:



Here you can make some basic settings for the configuration of your freeDSP-aurora.

AddOn

Here you can select the AddOn you have connected to your freeDSP-aurora.

ADC Channel Summation

The AD converter of your freeDSP-aurora offers a channel summation function. This function improves the dynamic range and S/N performance by averaging all input signals of multiple channels. In this case the input signals have to be the same.

None: This is the normal mode. No summation is executed, all 8 channels are available for the DSP.

8 to 4: Two channels are averaged. This improves the dynamic range and S/N by 3 dB. This summation result is output on Analog 1, 2, 3, 4 only.

8 to 2: Four channels are averaged. This improves the dynamic range and S/N by 6 dB. This summation results are output on Analog 1 and 2 only.

8 to 1: Eight channels are averaged. This improves the dynamic range and S/N by 9 dB. This summation result is output on Analog 1 only.

Volume Potentiometer

If you have connected a potentiometer to X103 you can enable it by activating this option.

After clicking on *Store* your settings are sent to your freeDSP-aurora and stored non-volatile.

WIFI CONFIGURATION

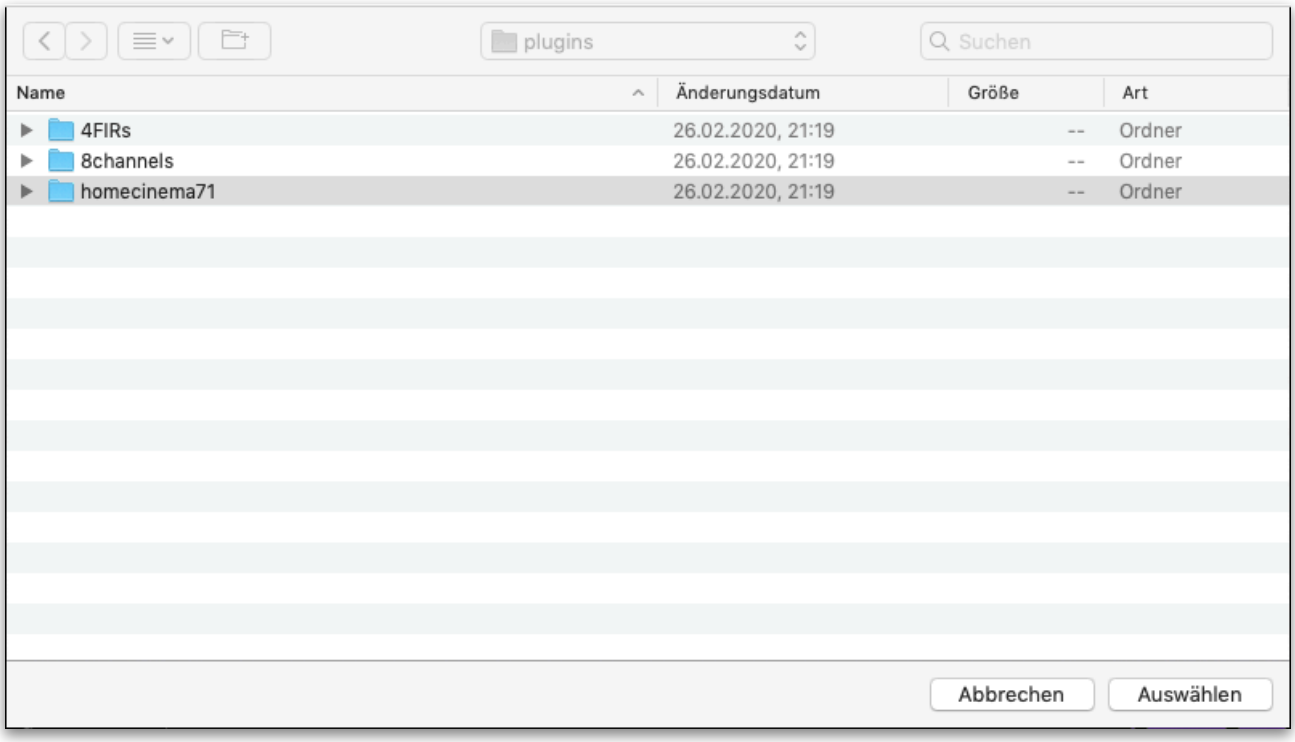
If you want to add your freeDSP-aurora to your local WiFi network, please click on *Config WiFi*. This opens the WiFi configuration dialog.

Now you can enter the SSID of your desired WiFi network and the password. Once you click on *Store WiFi* your inputs are sent to your board and stored non-volatile. After a reboot of your freeDSP-aurora it requests an IP number from your router. You can now access it through your network by typing the assigned IP in the URL field of your browser. In this case you don't need to connect to the access point *AP-freeDSP-aurora* anymore.
By default the access point of your freeDSP-aurora is unprotected. That means, everybody can connect to it. If you want to restrict the access you can add a password for the access point. Enter your selected password in the field *Password Access Point.* Whenever somebody tries to connect to your freeDSP-aurora via the access point this password is requested. If you leave the field empty, the access point becomes unprotected.
In the field *Name Access Point* you can enter any name you prefer for the Access Point. That could be helpful if you are running multiple freeDSP-auroras.
All your access point settings are stored after clicking on *Store AP Config* and after a reboot of freeDSP-aurora they are active.

UPLOADING A DSP PLUGIN

A new freeDSP-aurora comes with the 8 Channels DSP plugin installed. If you want to install another DSP plugin click on *Upload Plugin*. This opens a new dialog for selecting a new plugin.

DSP plugins are packed in folders. Click on *Select Files* to open a file dialog and browser to the location where you have stored the DSP plugin (e.g. the location of the downloaded release). Please note that you have to select the folder of your plugin.



STORING PARAMETER SETTINGS

Every parameter change you do is sent to your freeDSP-aurora board. You can immediately hear your changes. Yet your changes are not stored non-volatile on your freeDSP-aurora board. Once you cycle power off and on your settings will be lost.
If you are satisfied with your settings and you want to store them on your freeDSP-aurora board you have to click on *Store Preset*. This will store all settings for the currently selected preset on your freeDSP-aurora board. After rebooting the freeDSP-aurora by a power off-on cycle the new settings are loaded into the DSP.

EXPORTING PARAMETER SETTINGS

For every preset you can export the parameter settings and store it in a file on your local hard disk by clicking on *Export Preset*.
Note: You need to store your parameter settings first because the export function exports the settings from the non-volatile memory of your freeDSP-aurora.

IMPORTING PARAMETER SETTINGS

For every preset you can import a parameter settings from a file on your local hard disk by clicking on *Import Preset*.

MASTER VOLUME

With the volume slider on the most right side of the plugin view you can set the master volume on all output channels. This is the global master volume for the currently selected preset.

S/P-DIF OUTPUT

For each of the two channels of the S/P-DIF output, you can select a source from the list. The audio signal from that source will then be routed to the selected channel of the S/P-DIF output.

FALLBACK

If for some reason (e.g. power failure) the upload of a plugin failed, you can upload it again via the fallback access. To do so, you have to connect your computer to the *AP-freeDSP-aurora* access point and enter the URL http://192.168.5.1/fallback in your browser. Here you can select the folder of your plugin again and upload the plugin.

TURN OFF WIFI

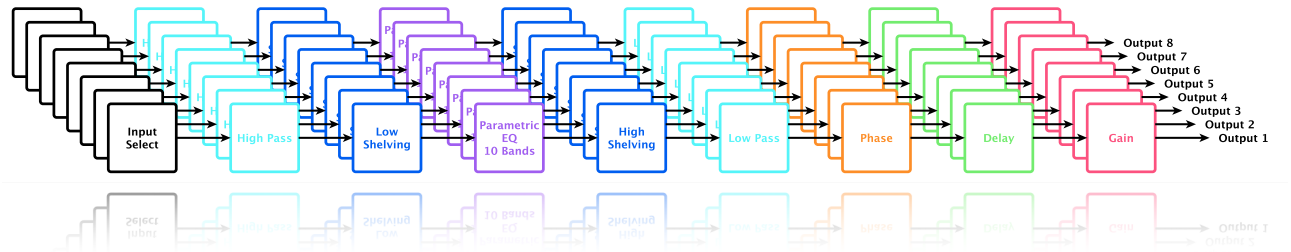
You can turn off WiFi completely by connecting pin 3 of X502 to GND (pin 1, X501) during boot. If you have connected a rotary encoder with a pushbutton, keep the pushbutton pressed while booting. Once freeDSP-aurora is booted, remove the connection or release the push button.
If you want to switch on WiFi again, repeat the described procedure the next time you boot your freeDSP-aurora.

DSP PLUGINS

Note: Changes of filter settings are only transferred to the DSP by pressing the *Send* button. Pressing the *Bypass* button immediately changes the bypass status.

8CHANNELS

The 8channels DSP plugin is the default DSP plugin for any new freeDSP-aurora. It provides eight channel strips with identical configuration.



Block diagram of 8channels plugin

Each channel holds:

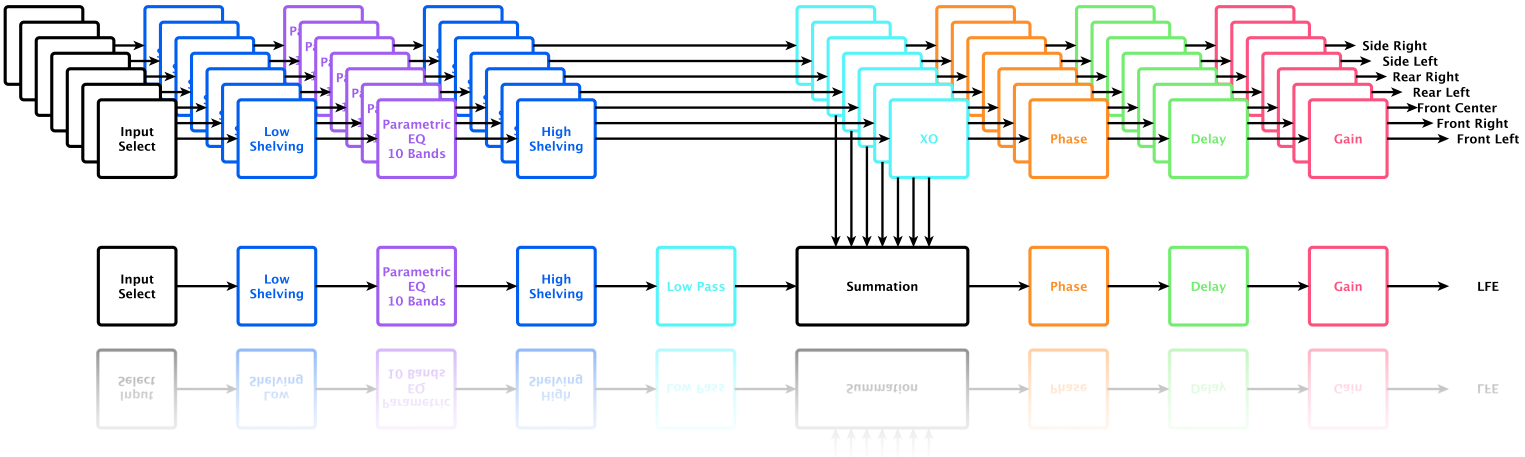
- Input channel select
- Low shelving and high shelving filter
- Lowpass and highpass filter up to 48 dB/oct roll off steepness
- 10 parametric EQs
- Allpass filter
- Polarity Inversion
- Delay up to 100 ms per channel
- Gain

Note: All analog inputs are forwarded to the USB Audio port and therefore available on your computer.

Note: In the Phase filter block, the polarity inversion is independent of the bypass status.

HOMECINEMA71

The Homecinema71 DSP plugin is a speaker management for your home cinema. It consists of 7 satellite channels and 1 subwoofer channel.
Each satellite channel contains a crossover formed by a highpass and a lowpass filter. The output of the highpass filter is forwarded to the following signal processing blocks of the channel while the output of the lowpass filter is mixed into the subwoofer channel.



Block diagram of Homecinema71 plugin

Each satellite channel holds:

- Input channel select
- Low shelving and high shelving filter
- 10 parametric EQs
- Crossover with lowpass and highpass filter up to 48 dB/oct roll off steepness
- Allpass filter
- Polarity Inversion
- Delay up to 100 ms per channel
- Gain

The subwoofer channel holds:

- Input channel select
- Low shelving and high shelving filter
- 10 parametric EQs

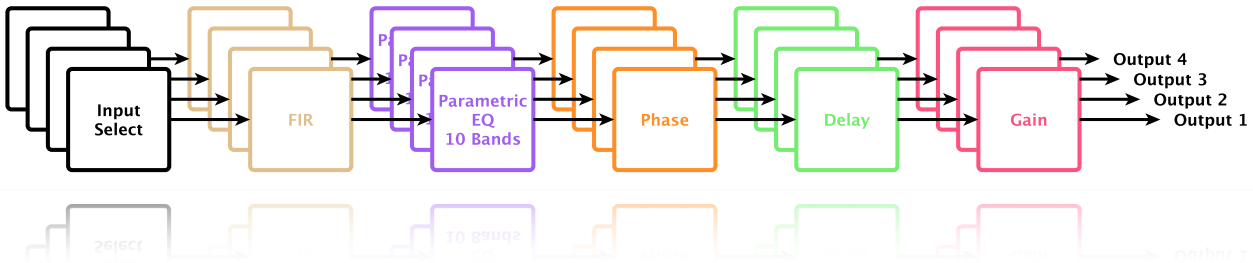
- Lowpass filter up to 48 dB/oct roll off steepness
- Insert point for satellite lowpass output sum
- Allpass filter
- Polarity Inversion
- Delay up to 100 ms per channel
- Gain

Note: All analog inputs are forwarded to the USB Audio port and therefore available on your computer.

Note: In the Phase filter block, the polarity inversion is independent of the bypass status.

4FIRS

The 4FIRs DSP plugin provides four channels each with a FIR filter of 4096 taps combined with 10 PEQs.



Block diagram of 4FIRs plugin

Each channel holds:

- Input channel select
- FIR filter with 4096 taps
- 10 parametric EQs
- Allpass filter
- Polarity Inversion
- Delay up to 100 ms per channel
- Gain

Note: For each channel you can upload an impulse response for the FIR filter. The length of the impulse response should be 4096 taps. The impulse response is provided as a text file with one tap value per row, e.g.

```
0
0.000000000000000000000000160082390931687
-0.000000000000000000000000412402630847785
-0.000000000000000000000000775863153624847
-0.000000000000000000000000439885192238464
0.000000000000000000000000211396843413825
-0.000000000000000000000000392326389291849
-0.000000000000000000000000273024856430888
...
```

Note: All analog inputs are forwarded to the USB Audio port and therefore available on your computer.

Note: In the Phase filter block, the polarity inversion is independent of the bypass status.

UPDATING THE FIRMWARE VIA USB

This chapter guides you through all the steps to perform a firmware update via an USB connection. The update itself will be done by a script.

PREPARING FOR UPDATE

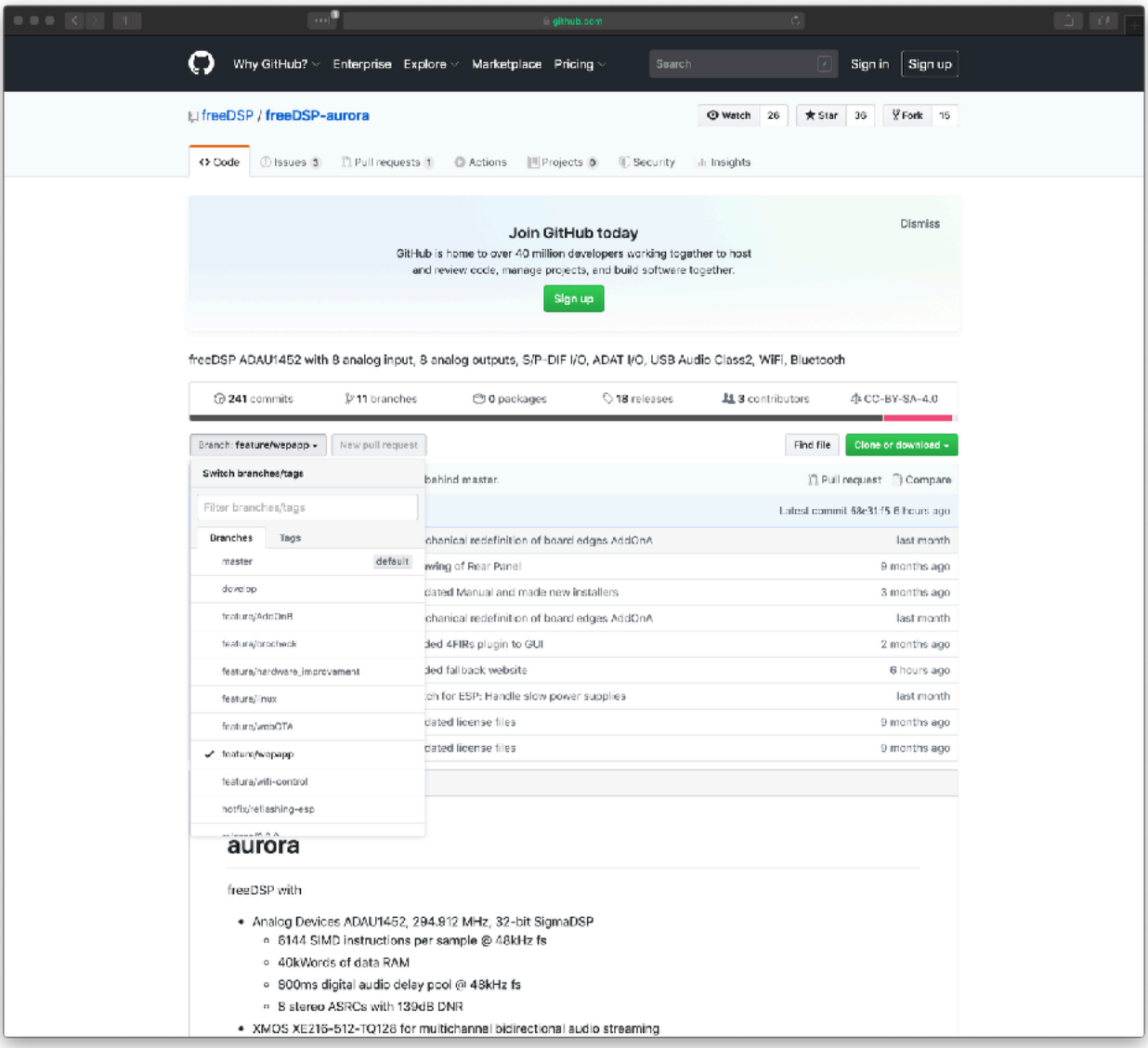
For updating the firmware you need an USB2Serial module based on a FTx232 or CP2102N module, e.g.
https://www.ftdichip.com/Products/Modules/DevelopmentModules.htm#FT2232H_Mini or similar. Please make sure that your module works with a logic level of +3.3V. Modules with +5V logic level can damage your freeDSP-Aurora.
You may need to install a driver for your USB2Serial module. Please read the manual of your module.

If you are updating from version 2.x.x please export your presets first and import them after the update again.

UPLOADING THE FIRMWARE

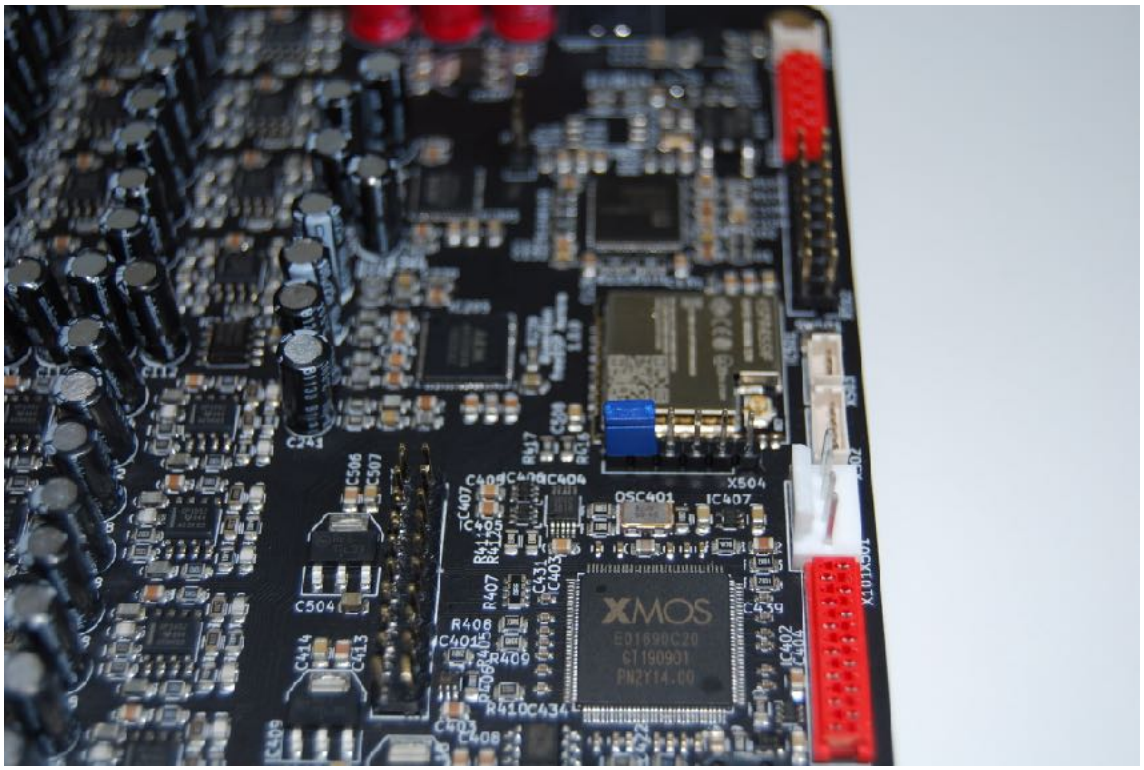
For uploading a new firmware to your freeDSP-aurora do the following steps:

1. Download the latest release from github: https://github.com/freeDSP/freeDSP-aurora
   If you want to install a alpha or beta version (preview versions) instead you may have to switch to the right feature branch by selecting it in the branch drop down menu, e.g. feature/develop. Then click on *Clone or download* and select *Download ZIP*.

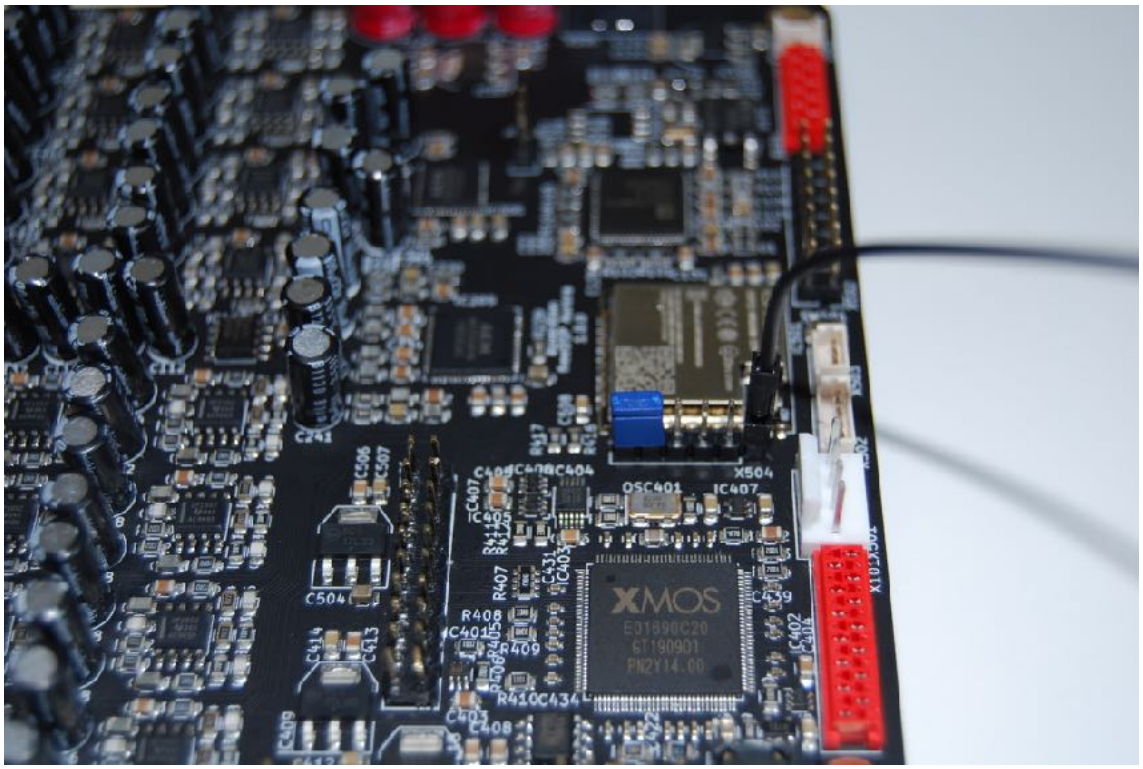


2. Unzip the downloaded zip file (if your computer does not do this by itself).
3. Power off your freeDSP-aurora module.

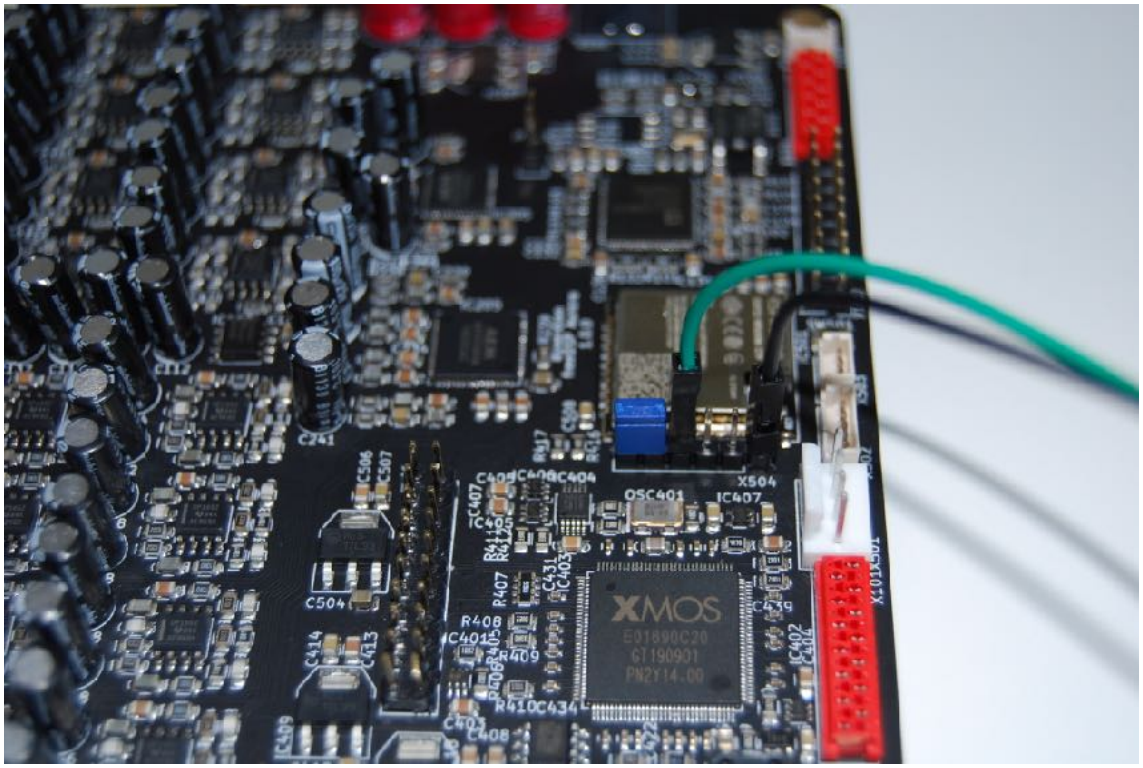
4. Install a jumper or make a connection between pin 5 and 6 of X504. The update tool will remind you of this jumper.



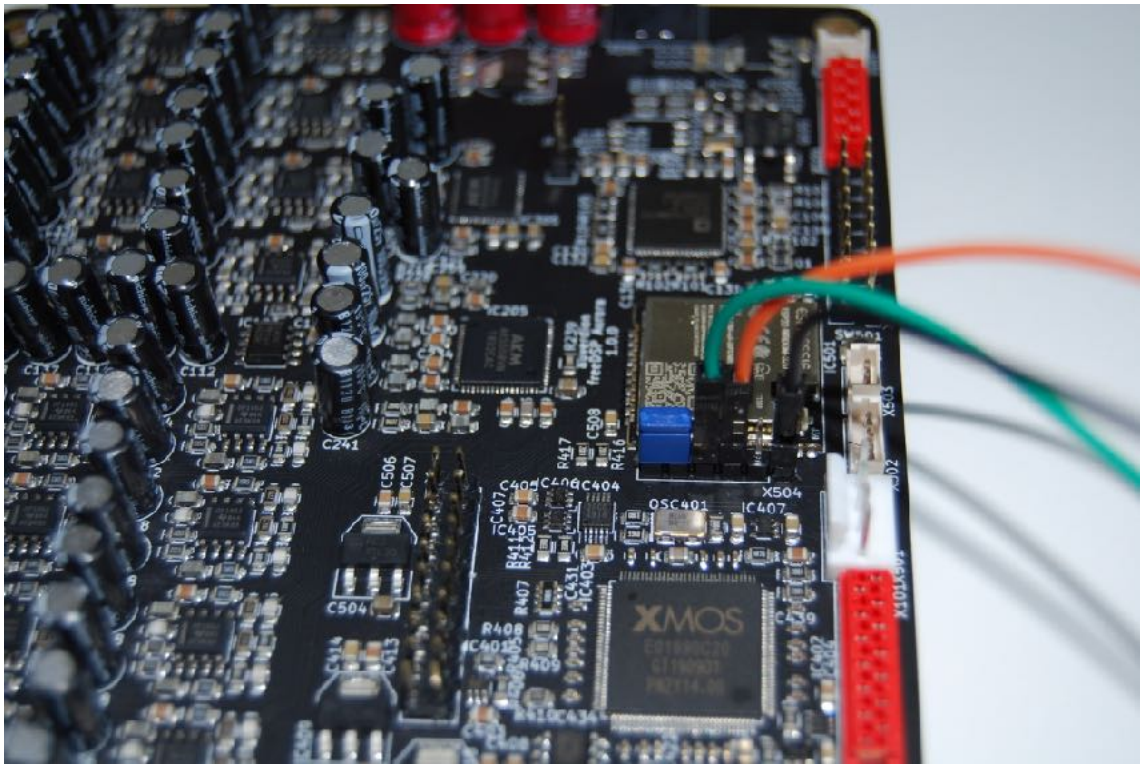
5. Connect GND of your USB2Serial module with pin 1 of X504.



6. Connect TXD of your USB2Serial module with pin 4 of X504.

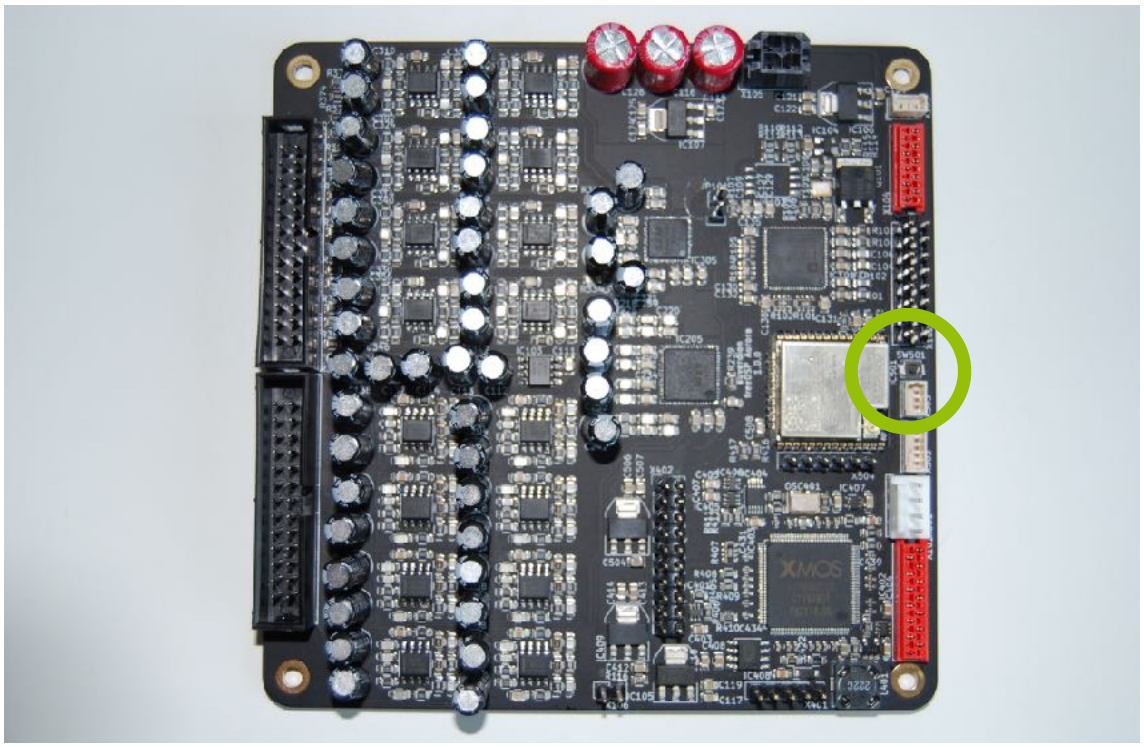


7. Connect RXD of your USB2Serial module with pin 3 of X504.



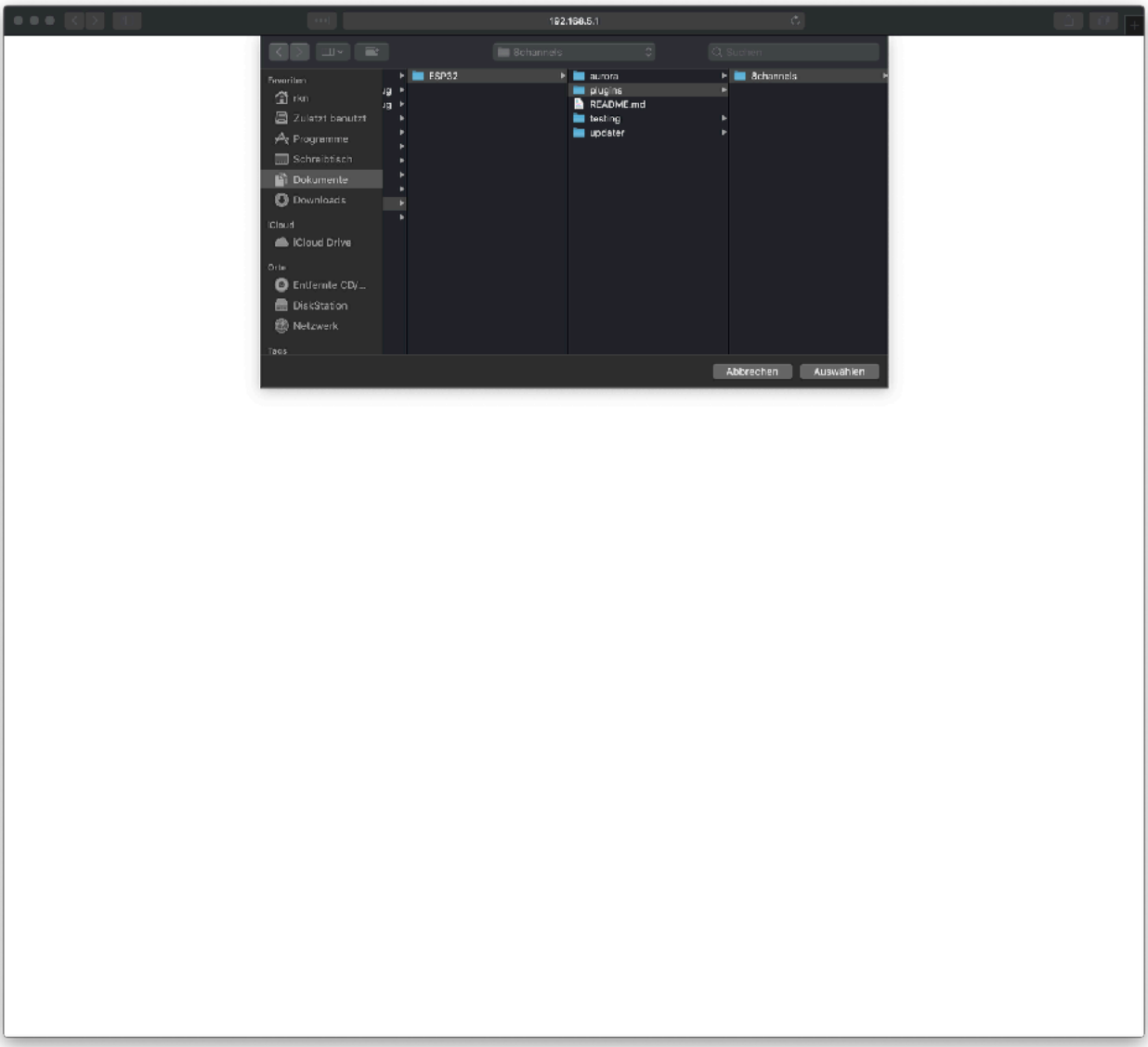
8. Connect your USB2Serial module with your computer.
9. Power up your freeDSP-aurora.
10. Open a terminal (command prompt) and change to script directory by entering
    `cd <path_to_repository>/SOURCES/WEBAPP/ESP32/updater`
11. On macOs you may have to make the update script executable by entering
    `chmod +x update.sh`
12. Under macOS start the update scrip by `./update.sh <your_com_port>`.
    Replace `<your_com_port>` by the name of your USB2Serial module, e.g. `/dev/cu.usbserial-FTRXGG930`.
13. Under Windows start the update scrip by `update.bat <your_com_port>`.
    Replace `<your_com_port>` by the name of your USB2Serial module, e.g. `COM3`.

14. Now follow the instructions on your screen. The update script will ask you twice to briefly press and release the SW501 button. You can find this button here:



15. After a successful update remove the jumper from X504 and turn your freeDSP-Aurora off and on.
16. Connect your computer with the Access Point AP-freeDSP-aurora.
17. Open a web browser and enter the IP 192.168.5.1

18. Click now on Select files and select the directory of the plugin you want to install. Important: You have to select the directory name not any file inside this directory. You will find the plugins here: `<path_to_repository>/SOURCES/WEBAPP/plugins`



19. Your selected plugin will now be installed.
20. After successful installation restart your freeDSP-Aurora, reconnect to access point AP-freeDSP-aurora and in your web browser type in the address 192.168.5.1. You will see now the web interface of your selected plugin. You can now start to configure freeDSP-Aurora for your application.

UPDATING THE FIRMWARE VIA WEBOTA

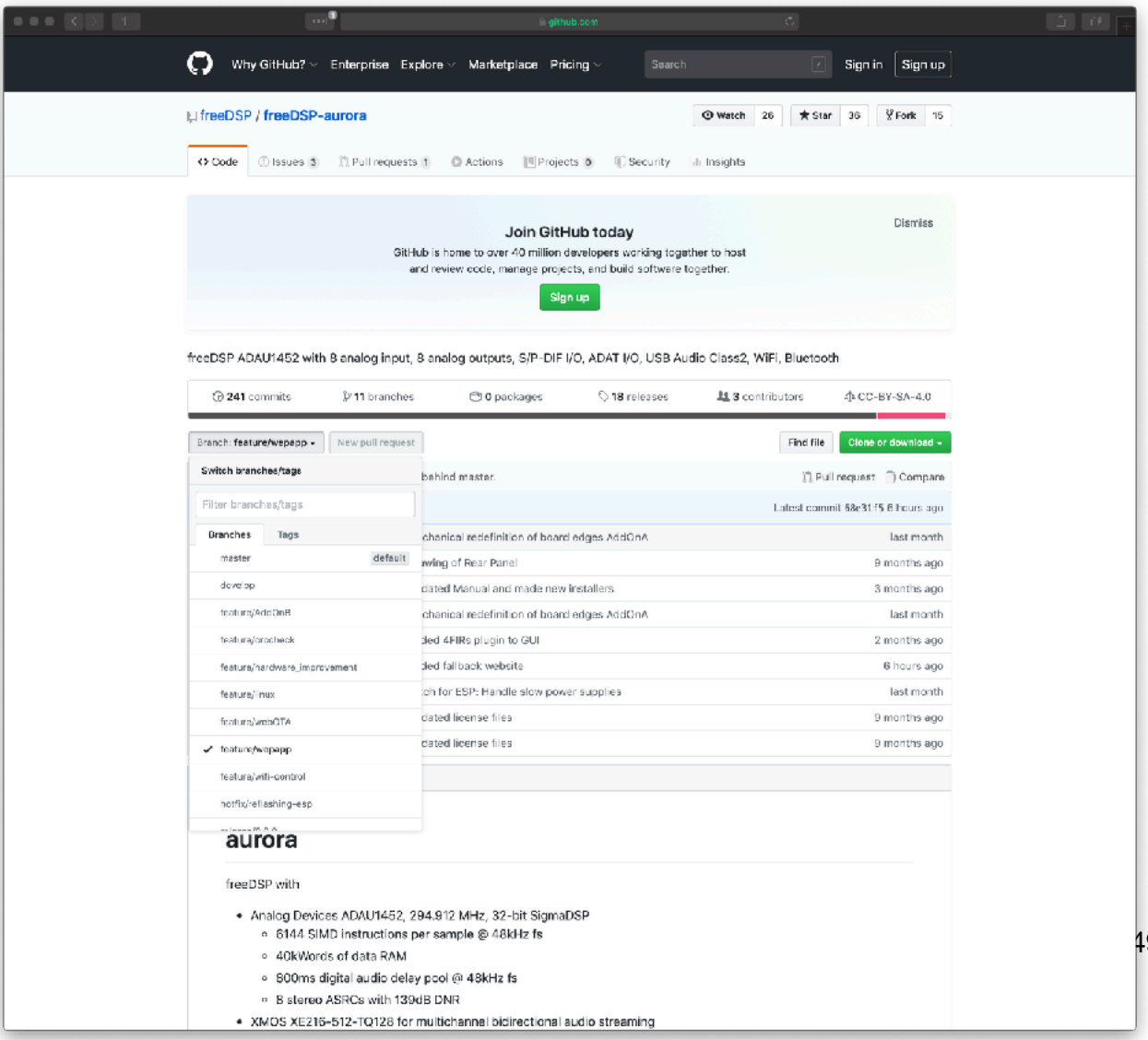
Besides the update via USB you can update the firmware of your freeDSP-aurora wireless by webOTA. This chapter guides you through all the steps to perform a firmware update. No additional software is required.

If you are updating from version 2.x.x please export your presets first and import them after the update again.

UPLOADING THE FIRMWARE

For uploading a new firmware to your freeDSP-aurora do the following steps:

1. Download the latest release from github: https://github.com/freeDSP/freeDSP-aurora
   If you want to install a alpha or beta version (preview versions) instead you may have



to switch to the right feature branch by selecting it in the branch drop down menu, e.g. feature/develop. Then click on *Clone or download* and select *Download ZIP*.

2. Unzip the downloaded zip file (if your computer does not do this by itself).
3. Connect you computer with the WiFi access point *AP-freeDSP-aurora.*
4. Open web browser and type in the URL http://192.168.5.1/webota
5. Alternatively you can connect you computer to the same local WiFi network your freeDSP-aurora is connected to and replace the ip 192.168.5.1 by the ip your board got from your router.
6. Click on the button to select the firmware binary from your hard disk. The filename of the firmware is usually `aurora.ino.esp32.bin`. You can find the latest binary in `<path_to_repository>/SOURCES/WEBAPP/ESP32/updater`
7. Once you have selected a file the update process starts. The new binary will now be uploaded to your board. After a successful update you will see a message box and afterwards your freeDSP-aurora board will restart.
8. Connect to the Access Point AP-freeDSP-aurora and enter http://192.168.5.1/fallback in the URL field of your browser.
9. Reinstall your plugin now.
10. Your freeDSP-aurora is updated now.

DISCLAIMER

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Auverdion, its affiliates, agents, and employees, and all persons acting on its or their behalf, disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet, manual, application note or any other document relating to any product.
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Life support policy: Use of auverdion products in life support equipment or equipment whose failure can reasonably be expected to result in injury or death is not permitted.

WARRANTY

Auverdion warrants freeDSP-aurora to be free from all provable material and production defects for the duration of 12 months starting from sales. All damage, which is caused by wrong or inappropriate operation, incorrect connection, improper or undocumented use, modification or alteration of the board in any way is excluded from the warranty.

REGULATORY INFORMATION

The product complies with the basic requirements of the relevant EU directives as well as the directive 2011/65/EU (RoHS) and directive 2004/108/EU (EMC) and directive 2014/53/EU (RED).

A copy of the full Declaration of Conformity may be requested by mail.

LICENSES

The U8g2lib code (http://code.google.com/p/u8g2/) is licensed under the terms of the new-bsd license (two-clause bsd license).
See also: http://www.opensource.org/licenses/bsd-license.php

========== BSD License for U8g2lib Code ==========

Universal 8bit Graphics Library (http://code.google.com/p/u8g2/)

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The IRremote Arduino Library code (https://github.com/z3t0/Arduino-IRremote) is licensed under the terms of the GNU LESSER GENERAL PUBLIC LICENSE, Version 2.1, February 1999

IRremote Arduino Library code (https://github.com/z3t0/Arduino-IRremote)
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USEFUL WEB LINKS

Please visit https://github.com/freeDSP/freeDSP-AURORA for updates, bugfixes and new DSP plugins.

The development story of freeDSP-aurora:
https://www.diy-hifi-forum.eu/forum/showthread.php?15019-Verst%E4rkermodul-mit-DSP-600W-1-4Kan%E4le-low-budget-high-quality

FreeDSP-aurora at diyaudio.com:
https://www.diyaudio.com/forums/digital-line-level/334055-freedsp-aurora-dsp-8-os-usb-audio-dif-adat-bluetooth-wifi-contro.html

The freeDSP project:
http://www.freedsp.cc

How to connect to a wireless access point on iOS:
https://support.apple.com/en-us/HT202639

How to connect to a wireless access point on macOS:
https://support.apple.com/en-us/HT201735

How to connect to a wireless access point on windows 7/10:
https://ittutorials.net/microsoft/windows-7/how-to-connect-to-a-wireless-access-point-in-windows-7/

Enjoy your freeDSP-aurora!