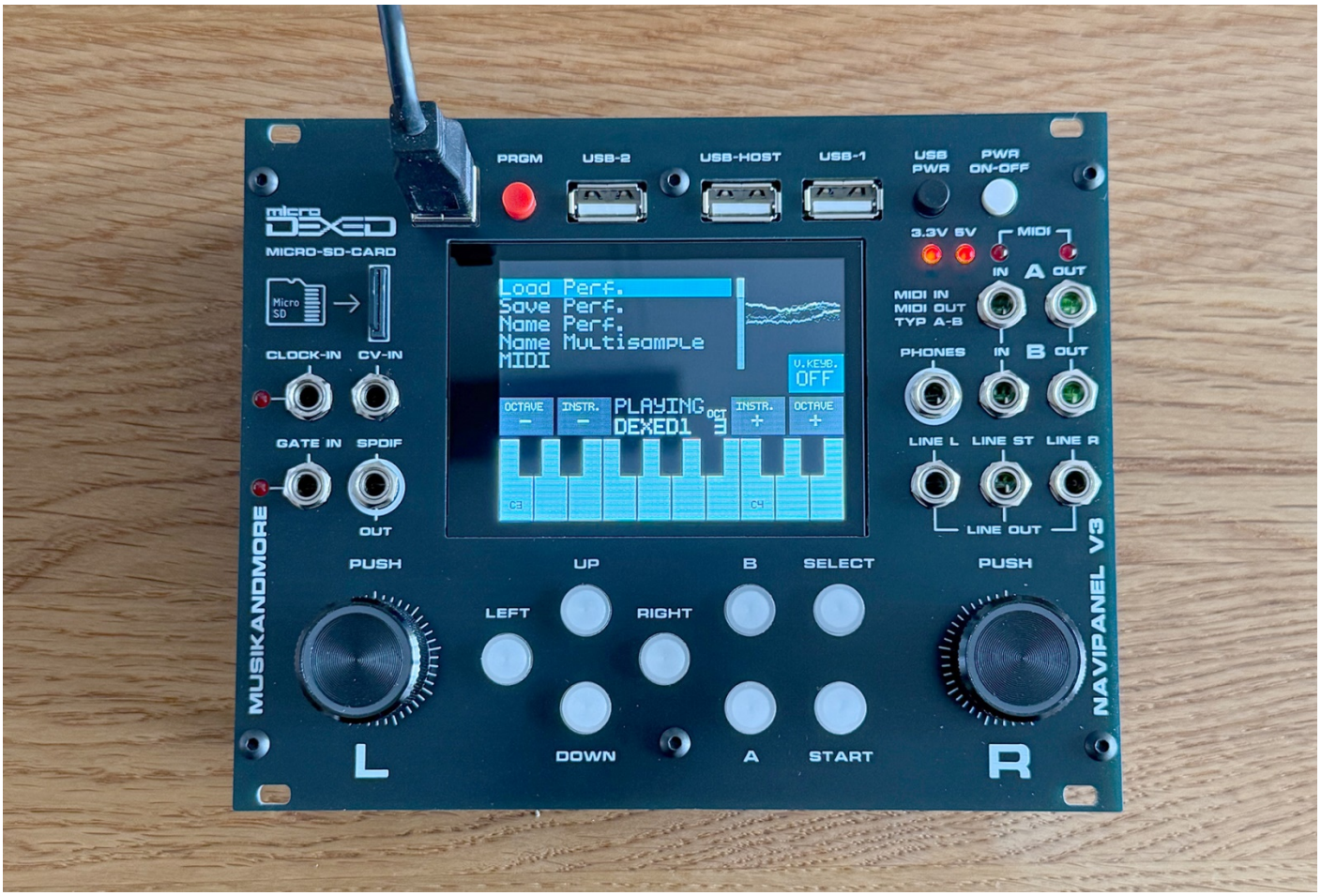
Assembly instructions / documentation



The finished NAVIPANEL V3 for Microdexed in Eurorack format 3U / 32TE

Hello DIY friend, electronics engineer, hobbyist, musician or professional,

Thank you for purchasing this DIY kit. Once you've purchased the complete kit, you'll receive a complete music synthesizer with many interesting features that you can use to make music right away.

First of all I would like to thank @positionhigh (https://discord.gg/XCYk5P8GzF) for the excellent software and hardware foundation. In collaboration with @positionhigh, we have enhanced the original hardware and software with several technical features and implemented these features in the NAVIPANEL V3 for Microdexed version you have purchased. The complete software implementation will follow shortly. (current version 1.9.8.3 from March 30, 2025).
You can get the latest software from: https://codeberg.org/positionhigh/MicroDexed-touch/releases
and is for the NAVIPANEL V3: **mdt_PSRAM-CAPACITIVE_TOUCH-MM_1_9_8.hex**
This manual contains all the information you need to build the NaviPanel-V3 project.
The operation, settings and various applications of the Microdexed from @positionhigh can be found in the manual at:
https://codeberg.org/positionhigh/MicroDexed-touch/raw/branch/main/doc/MicroDexed-touch-manual.pdf

The exact range of functions/data sheet of the NAVIPANEL V3 can be found in Appendix A).

We hope you enjoy building your NAVIPANEL V3 for Microdexed.
Best regards
Thomas & Nicole E.

Table of contents

1) Disclaimer

Before you begin assembling the kit, we have a few legal notices for you. Please read the disclaimer carefully. Thank you for your understanding.

1. The right of withdrawal and return expires as soon as you have opened the DIY kit and soldered the included circuit boards or assembled the front panels. The DIY kit can only be returned to us in an unused condition. The buyer bears the return shipping costs. The warranty is limited to the components included in the DIY kit. Any warranty claims will be passed on to our suppliers (supply chain verification) in accordance with the Product Liability Act. The warranty is void in the event of improper use or handling, such as soldering electronic components at excessively high temperatures or for too long, which can inevitably lead to damage or total loss of the components.

2. Nicole Effendy (Designvorsprung) and Thomas Effendy (Musikandmore) are free from any legal claims that may result from injuries caused by the assembly, soldering and improper use of the NAVIPANEL V3 for Microdexed, as well as from health damage caused by inhaling soldering fumes.

3. This project requires **good soldering skills** and a certain degree of **soldering experience**, as well as **basic electronics knowledge**. Every electronics project depends on the tools and the care taken when soldering, including SMD soldering and soldering GND (ground) copper surfaces. **Cold solder joints** are the most common cause of failure in electronics. The same applies to unwanted solder bridges, e.g., caused by too much solder.

4. One point in dealing with electronic components is the **ESD** treatment of semiconductor components such as ICs, PSRAM, the Teensy 4.1, etc.
   We also know that not every electronics hobbyist or musician has an ESD (**electrostatic discharge**) soldering station. Unfortunately, such a discharge can cause irreversible damage to electronic components.
   Tip: To avoid damage to the semiconductors, if possible, touch something metallically conductive, e.g. a radiator, before touching semiconductors to discharge static electricity.
   Just for your information: In the electronics assembly industry, metal wristbands and ESD shoes are worn to dissipate electrostatic discharge. :-)

5. This electronic circuit is designed for operation with USB 2.0, a 5V DC power supply, and the 16-pin Eurorack power supply (+5V and GND). Power banks and USB power supply work very well. However, operating time depends heavily on the power bank's performance.
   The current consumption of the NAVIPANEL-V3 is currently approximately 290mA at 5V DC without any USB host devices connected.

6. Powering the NaviPanel-V3 with **3.7V LiPo batteries** is not technically possible, as the USB devices, USB hub, and analog components require 5V DC. Should the NaviPanel-V3 be used with LiPo batteries despite our recommendation, we are exempt from any warranty claims and are not responsible for any technical defects in the NAVIPANEL-V3 for Microdexed or other technical devices! (See also **section 1**).

   LiPo 3.7V batteries are not safe to handle and should only be used by specialists with appropriate electronics knowledge.

2) Soldering recommendations and tips

7. Use only **lead-free solder** with a diameter of 0.7 mm - 1.0 mm, e.g., from STANNOL KS115 Sn99.3Cu0.7 d=1.0 mm (Made in Germany). The KS115 solder wire contains a **rosin-free flux with synthetic resins**.

8. Source / link to the product:
https://www.conrad.de/de/p/stannol-ks115-loetzinn-bleifrei-spule-sn99-3cu0-7-rom1-100-g-1-mm-588742.html

9. Another point is **soldering fume extraction**. Inhaling soldering fumes through the mouth and nose is harmful to your health. Therefore, please ensure that the soldering fumes are well extracted from the soldering joints and that the room is well ventilated. Soldering fumes irritate the nasal mucosa – unfortunately, you don't notice this immediately – and anyone who assembles and solders a lot of circuit boards should, in their own interest, ensure that they have good soldering fume extraction. A highly recommended soldering fume extraction system is the ZeroSmog Shield Pro from Weller. It's not a bargain, but it's very effective.

10. Source / link to the product:
https://www.reichelt.de/de/de/shop/produkt/loetrauchabsaugung_zerosmog_shield_pro-371544,

11. **The soldering iron** should have a minimum power of 30VA, preferably 70VA, and, if possible, an adjustable soldering temperature setting in the range of 275°C to max. 375°C.
Cleaning the soldering tip with a copper mesh and a sponge (filled with water) is necessary to remove any residual scale from the soldering tip. SMD solder paste and/or flux are highly recommended for soldering the two SMD PSRAMs. The fine SMD solder pads on the back of the Teensy 4.1 don't allow for too many soldering attempts.
The same applies to the 2-pin male/female cable for the rear-side adaptation of the Micro-USB connectors D+ and D- to the USB-B connector on the PCB mainboard.

3) Work preparation - assembly and soldering

12. We recommend the following **electronic tools and accessories**:
- Electronics side cutters and electronics flat pliers
- Small slotted or Phillips screwdriver
- Allen key (Allen) 2 mm (M3x5/6 ISK screws)
- 5.5mm (M3) socket wrench or 5.5mm open-end wrench
- 8mm (M6) socket wrench for hexagon nuts for the TRS 3.5mm jacks in the front panel
- Solder (see points 7 and 8) and SMD solder paste
- Desoldering suction pump or desoldering suction copper braid 1.5mm wide (just in case)
- A multimeter for checking the supply voltages and, if necessary, for measuring the metal film resistors
- a small ESD tweezers (very useful for the PSRAMs)
- A heat-resistant silicone mat (min. DIN A4 format)
- Soldering fume extraction (see points 9 and 10)
- A “third hand” or electronic vice (e.g. Bernstein Spannfix Vario 9-250 ESD) or similar.
- Source / link to the product: https://www.bernstein-werkzeuge.de/produkte/produktdetails/9-250-esd-kugelgelenk-kombination-vario-6-tlg

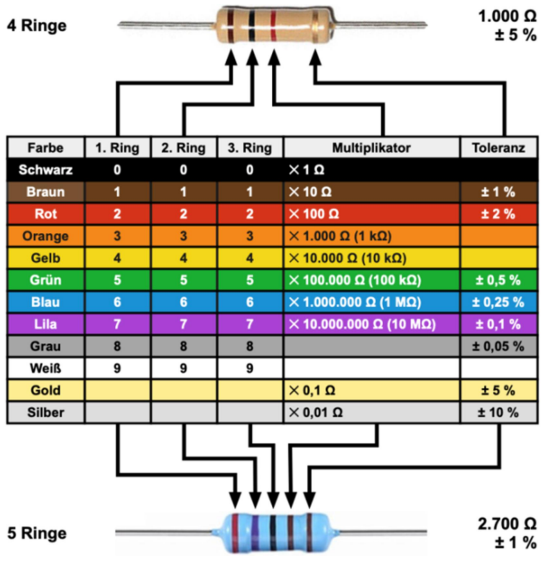
4) Preparation and sorting of components

13. Sort components by type:

Example: the NAVIPANEL V3 DIY kit with 2 front panels

Resistors, capacitors, electrolytic capacitors, diodes, coils, micro SD card and holder, ICs, LED buttons, push buttons and switches, RGB encoders, USB sockets, other plugs and sockets, studs, screws, hex nuts, and washers. The touch display and the Teensy 4.1 have been tested.
The Teensy 4.1 is flashed with the latest software version.

14. The resistors are labeled on the paper tape. We only supply metal-film resistors with 1% and 0.1% tolerances. The color coding table can be found here:



Farbe	1. Ring	2. Ring	3. Ring	Multiplikator	Toleranz
Schwarz	0	0	0	× 1 Ω	
Braun	1	1	1	× 10 Ω	± 1 %
Rot	2	2	2	× 100 Ω	± 2 %
Orange	3	3	3	× 1.000 Ω (1 kΩ)	
Gelb	4	4	4	× 10.000 Ω (10 kΩ)	
Grün	5	5	5	× 100.000 Ω (100 kΩ)	± 0,5 %
Blau	6	6	6	× 1.000.000 Ω (1 MΩ)	± 0,25 %
Lila	7	7	7	× 10.000.000 Ω (10 MΩ)	± 0,1 %
Grau	8	8	8		± 0,05 %
Weiß	9	9	9		
Gold				× 0,1 Ω	± 5 %
Silber				× 0,01 Ω	± 10 %

Determining Resistance with the Color Code Table:

Before you begin determining the resistance, you need to count how many colored rings are applied to the resistor. **Carbon film resistors** usually have four rings.

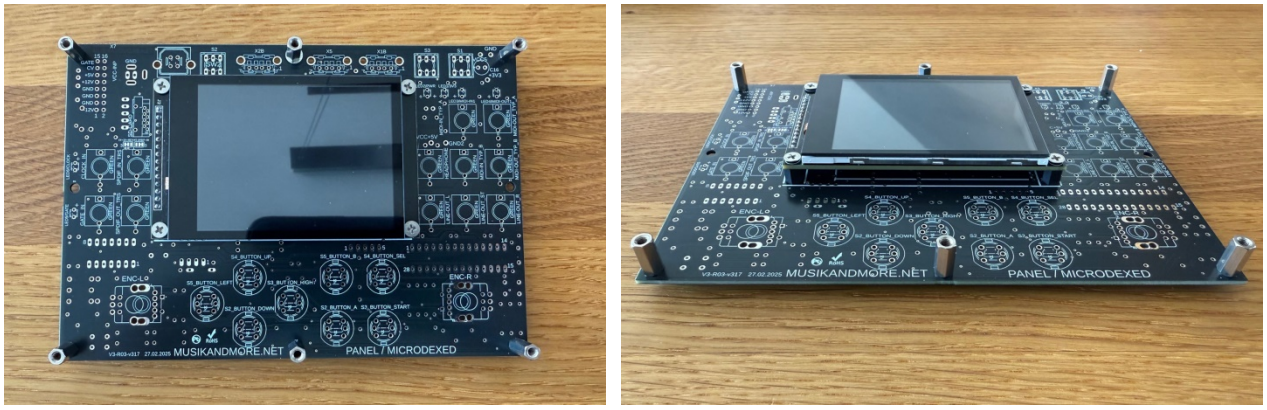
Metal film resistors have 5 rings. For resistors with 5 rings, the resistance value is specified somewhat more precisely. Then you have to determine which ring is the first. Usually, you try to find out which ring is the last ring. This is the tolerance ring, which indicates how many percent the specified resistance value may deviate from the actual resistance value. The tolerance ring is usually gold. If this color is If there isn't one, then

you have to pay attention to the two outer rings. Usually, one is further away from the end of the body. This is the tolerance ring. Then you start assembling the resistance value from the beginning. The colors have specific values. The first and second rings determine the resistance counter (4 rings for carbon film resistors). The third ring serves as a multiplier. It determines the resistance value. The fourth ring is the tolerance ring, which determines the deviation of the resistance value (4 rings for carbon film resistors).

Source: https://www.elektronik-kompendium.de/sites/bau/1109051.htm

5) Installation of the 3.2" capacitive TFT touch display

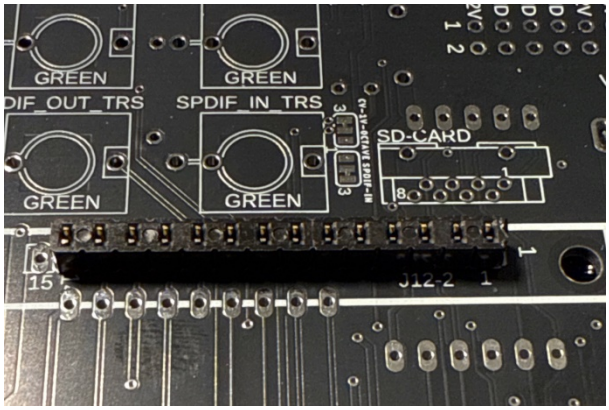
15. The standoffs for the TFT touch display and the front panel are pre-assembled and aligned. The M3x5 countersunk screws are used to secure the display and ensure precise centering.



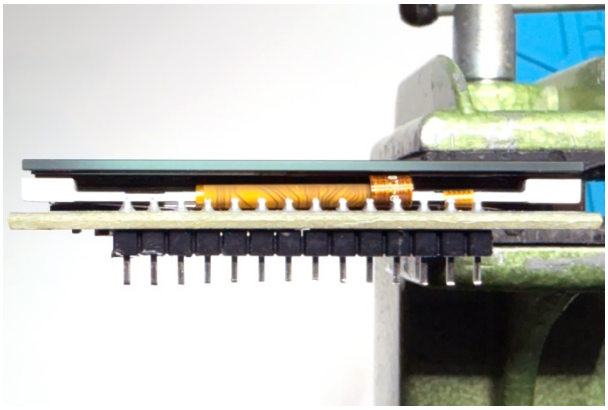
3.2" touch TFT display mounted with M3x11 studs for the front panel

16. The 14-pin low-profile BKL female connector J12-2 for the display has already been secured and soldered by us. For shipping, the display will be disassembled if necessary and packed in the original packaging. The flex cable included in the original packaging is not required but will be used for future hardware adjustments; please do not discard it!

Important: Shorten all pins on the 3.2" TFT touch display to **2.9mm!** Otherwise, the maximum clearance of 6mm between the board and the bottom of the front panel cannot be maintained, and the TFT display will not be flush with the front panel! (See also **section 39**)



J12-2 Low Profile 14-pin female connector for the TFT



Shorten all pins of the TFT touch to 2.9mm length!

6) Components - Teensy 4.1 – PSRAM – Micro-USB

17. Next comes the most difficult part of the project. Soldering the 2x8MB SMD PSRAM to the back of the Teensy 4.1. These are easier to solder as long as the Teensy 4.1 doesn't have any headers soldered on. To do this, clamp the Teensy 4.1 in an electronics vise. Use a thin soldering tip for soldering. SMD solder paste and/or flux are very helpful. Tin all gold-plated SMD solder pads with SMD solder paste beforehand.
Please align the SMD PSRAMs (using ESD tweezers) as shown in (photo 3a 3b) and make sure that they are on the Point PIN1 Pay attention. Tin the pads with solder paste beforehand and first fix and align the first PSRAM with just one pin. Then solder all pins (reduce the soldering temperature to approximately 280-290°C).

18. Repeat the same soldering process for the second PSRAM. Be careful not to create any unwanted solder bridges! Ideally, the solder joints should look like those shown in photos 3a and 3b.

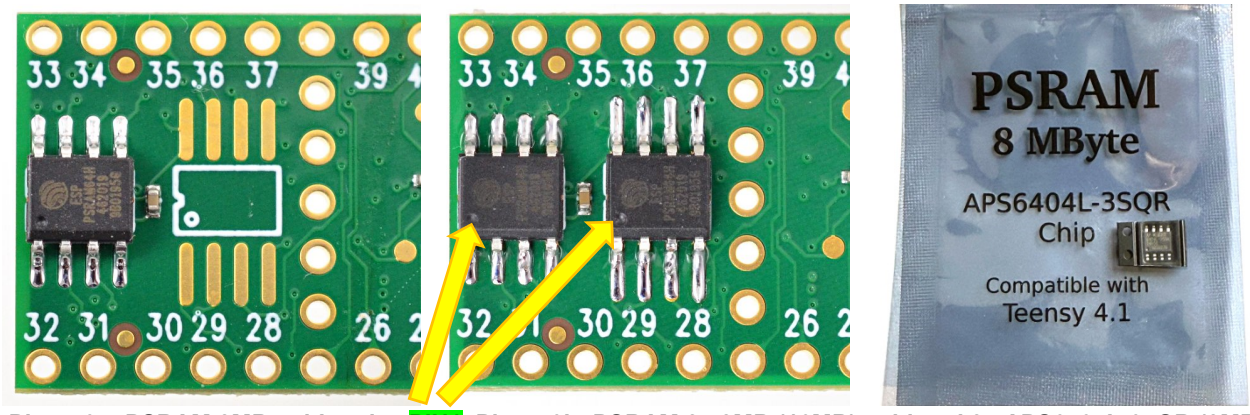
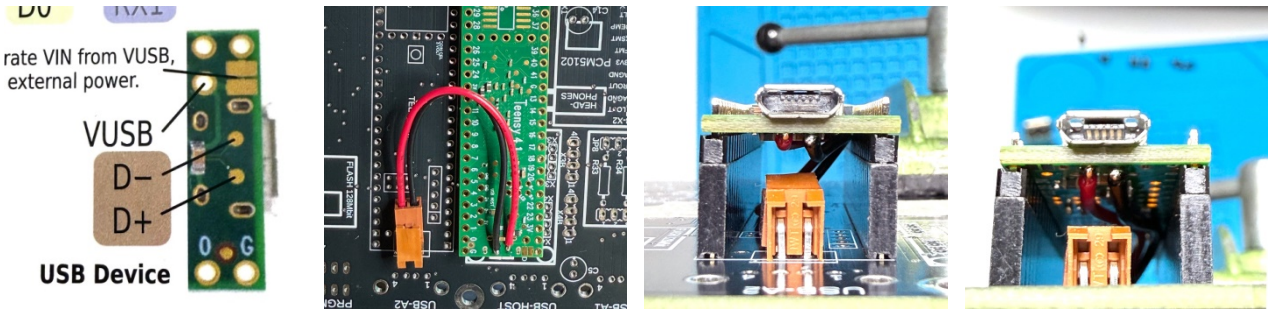


Photo 3a; PSRAM 8MB soldered **PIN1** **Photo 3b: PSRAM 2x 8MB (16MB) soldered 2x APS6404L-35QR (8MB)**

19. Next, solder the 2-pin cable to the USB PC connector D+ and D-. On the back of the Teensy, below the USB micro connector, there are two labeled solder pads. Solder the cable to the two pads D- and D+ (tin them first!). Please be careful not to create a solder bridge between D+ and D- when soldering the cable.

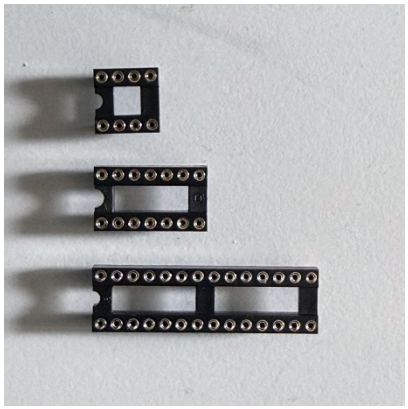


Teensy 4.1 back USB D- D+ **2-pin cable with plug and angled socket** → **USB Micro to USB-B X7**

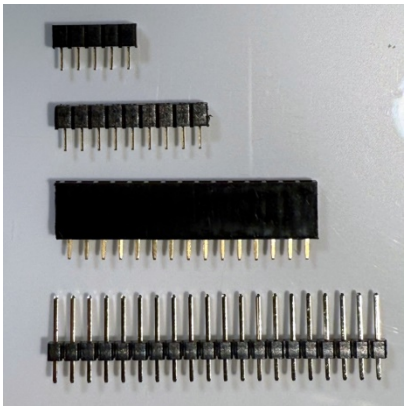
At the end of the cable is a 2-pin socket with an angled plug (polarity protected). Disconnect the socket and cable from the angled plug and then solder the angled plug into the designated location on the motherboard. This connection establishes communication between the Teensy and the PC or Mac via the USB-B socket X7 on the front panel and is essential for the USB PWR ON/OFF switch (white cap) to function. The micro-USB socket on the motherboard can, of course, be used to test the Teensy 4.1!

7) The further assembly of the mainboard

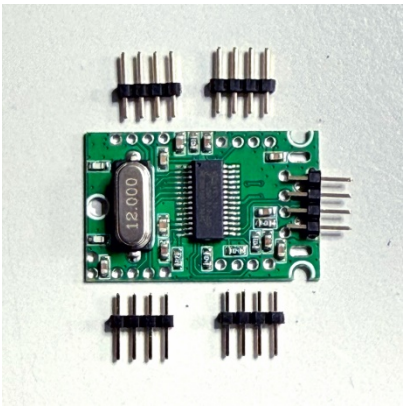
20. All ICs are socketed with high-quality machined sockets. All other components (breakouts), such as the PCM5102, Teensy 4.1, etc., are plugged into standard or low-profile 2.54 pitch female headers and are assembled with 2.54 pitch headers. The only exception is the USB hub 1-4, which uses 2.0 pitch female and male headers, which are also included in the scope of delivery.
(See also **section 57**)



IC sockets 8/14/28 pin



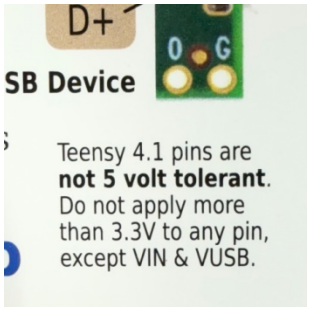
Plug-socket strips RM2.54



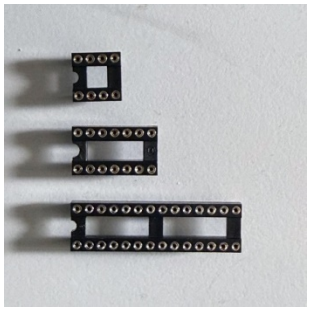
USB hub power strips RM2.0

8) Assembly of components on the solder side

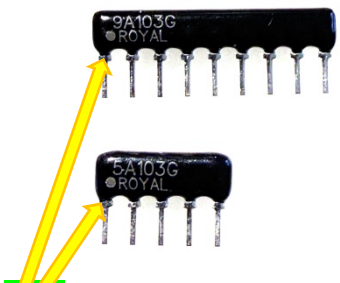
21. Due to its design, the motherboard is populated with components on both sides (the component side and the solder side). The procedure for populating the board on the "solder side" is as follows. Fix and solder all components according to their height:
22. First the diode D2 1N4148, the smallest component on the PCB
23. then the metal film resistors (all labeled on the paper tape)
24. First, R40 and R49 are the marked metal film resistors with 0.1% tolerance
25. then the metal film resistors 1% R17, R18, R19 and R30, R31, R32 for the RGB encoder LEDs (special values to adjust the RGB color ratio)
26. then all remaining metal film resistors with 1% tolerance
27. the two inductors L1,L2 100µH (color code table as for the resistors)
28. Now install the 6 suppressor diodes D1, D3-D7, paying attention to the "silver-white" marking. This marking must match the marking on the component assembly label.
29. **Note:** These diodes (1N5817) limit the input voltage to 3.3V and also protect against reverse polarity (negative input voltage). Since **voltages between 5V and 10V** can be present at the GATE IN, CLOCK IN, and CV IN sockets, the diodes limit the input voltage behind the voltage divider to 3.3V (this is purely a protective circuit). **No voltage greater than 3.3V** may be present at the Teensy 4.1 inputs!



No voltage greater than 3.3V!



IC sockets 8/14/28-pin.



RN1/10K 5-Pins RSIL8/10K 9-Pins

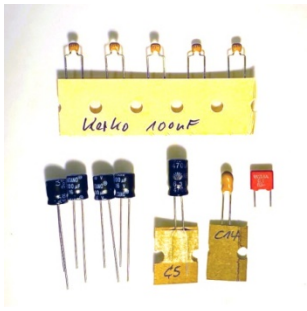
30. then all IC sockets 8/14/28pol.

31. Then the SIL resistor networks RN1/10K with 5 pins and RSIL8/10K with 9 pins (the dot/marker is PIN 1)

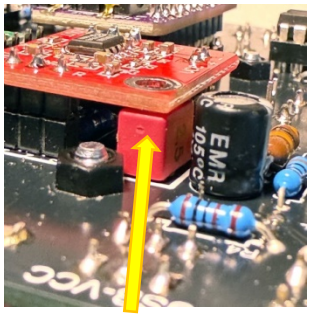
32. then all ceramic capacitors 10nF (code 103k) and 100nF (code 104k)

33. Then all 100µF/16V electrolytic capacitors C3, C4, C10, C16, the 470uF/6.3V electrolytic capacitor C5, and the 10µF tantalum capacitor C14. (Please observe the polarity; the long leg is +.)

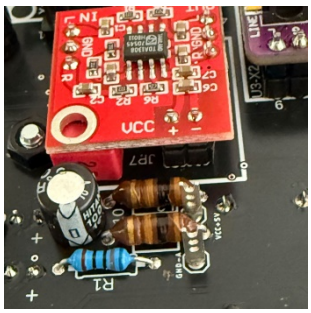
34. Now solder in the MKS/MKT 0.1µF capacitor C8. Test it first – it will sit under the plugged-in headphone amp. If C8 is too high, solder it at a slight angle; the pins are long enough.

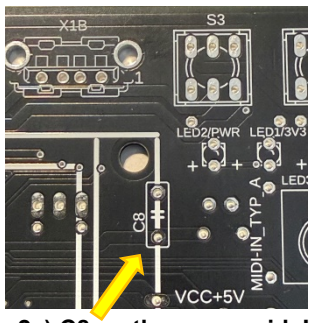


Example: Kerkos/Elkos



MKS film capacitor C8 (red capacitor)

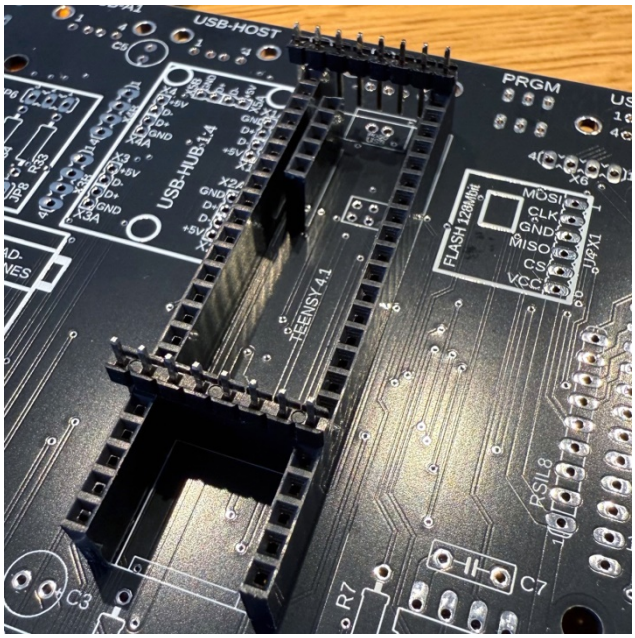


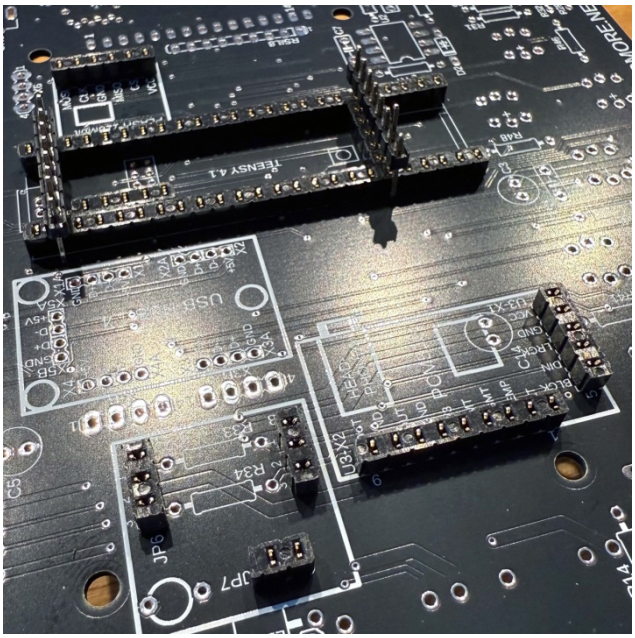


(photo 2a) C8 on the wrong side!

Note: The component print for the C8 is on the wrong side! Please assemble as shown in **photo 2a**. This only applies to the mainboard PCB version V3-R03-v317 from February 27, 2025.

35. Then solder all female and male headers. First, secure the headers with 1-2 solder points and align them straight.





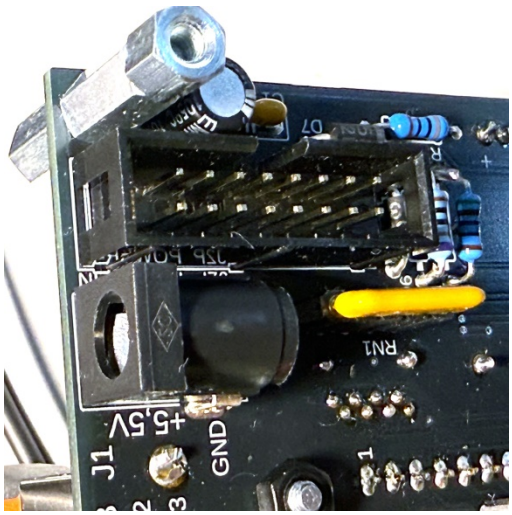
Example: High profile socket headers for the Teensy 4.1 … Example: Low profile socket headers for Teensy 4.1
The post plugs are only for precise alignment!

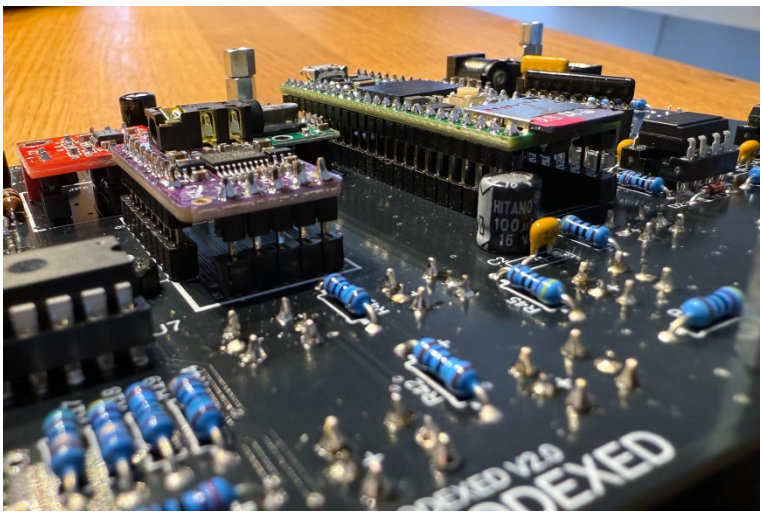
Here, too, it's important to solder in with a small amount of solder first, and be sure to prevent any solder from bleeding through! **Inserting header pins** is a good way to prevent solder from bleeding through and to align the sockets parallel.

9) Assembly of components Eurorack 16-pin / DC socket

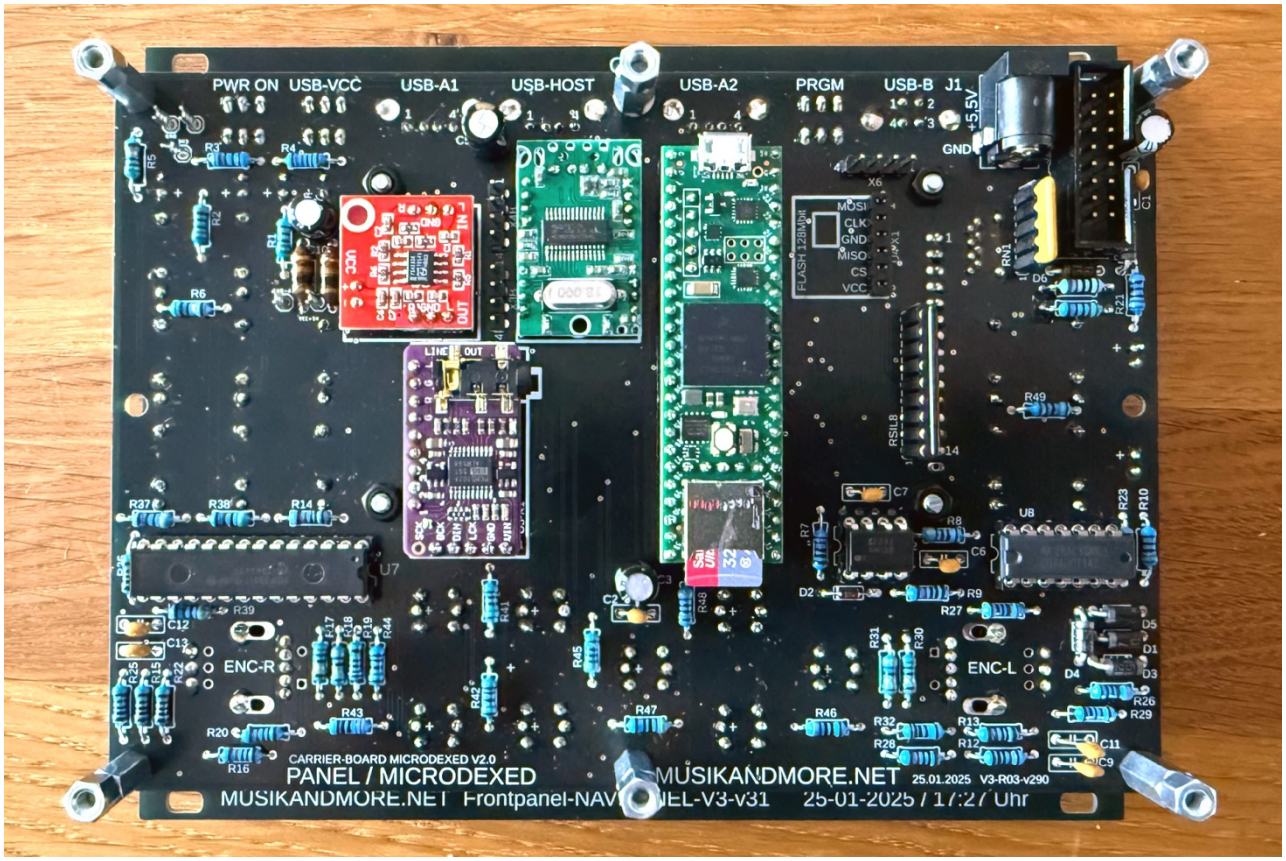
36. Now the high 16-pin header for Eurorack power supply (only +5V and GND are required).

37. Solder in the +5V DC socket J1=5.5x2.1mm and then the "soldering side" is almost finished...☺





Eurorack box connector and DC socket J1 solder side assembled and with all ICs, Teensy 4.1 and modules



Eurorack box connector and DC socket J1 solder side assembled and with all ICs, Teensy 4.1 and modules (without FLASH128Mbit U4, is no longer supported!)

10) Front panel controls and sockets

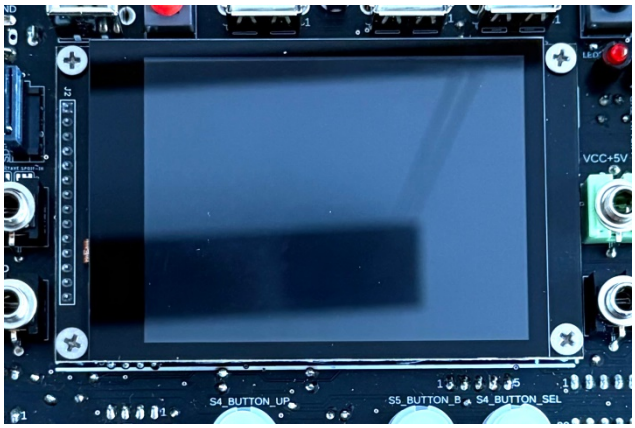
38. Next comes the "component side" with the 3.2" capacitive TFT touch display, the TRS 3.5mm jacks, 8 LED buttons, 2 switches, 1 button, 3 USB-A jacks, 1 USB-B jack, 2 RGB encoders, 6 red LEDs with spacers, and the micro SD card slot. (Please be careful when soldering the micro SD card slot! It's best to solder it with the micro SD card inserted, as this prevents solder from running through!) The mainboard PCB is pre-assembled with M3x11 I/I hex bolts for mounting the front panel and M3x6 I/O connectors with nuts for the TFT display. This shows exactly what the entire product looks like when fully assembled. The mounting screws on the component and soldering sides are M3x6mm ISO type. 7380-1 (2mm hex key).

39. The low-profile 14-pin socket strip for the TFT (already soldered in place by us and aligned vertically with the TFT and horizontally with the front panel). The TFT connectors are shortened to 2.9mm (item 16) (only for customers who did not order the TFT) in order to maintain the maximum distance of 6mm to the front panel.
This is the only way to ensure the **TFT display is flush with the front panel**. The M3x5 countersunk screws are used to **precisely secure the TFT display**.

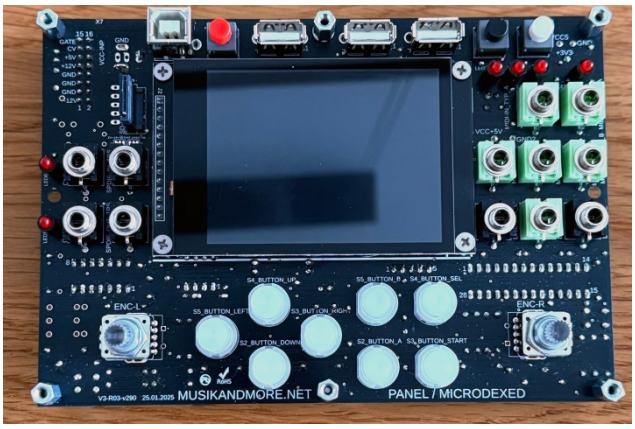
Example: Finished device the TFT display must be flush with the front panel

40. The order for assembling the front elements is as follows:
In general, all front elements are initially fixed with only one soldering point.
It's important not to solder all the solder points immediately. It's almost impossible to subsequently align or unsolder completely soldered components.

41. We recommend plugging the TFT display into the mainboard and fixing it with the SK M3x5mm countersunk screws.



Insert TFT and fix with SK M3x4



Top view of NAVIPANEL V3 without front panel

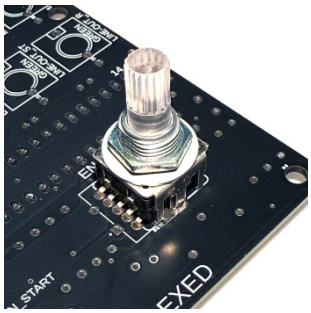
11) Assembly of the RGB encoders

42. Now insert the two RGB R/L encoders (3/5 pins) and secure them with one soldering point. The RGB encoders **fit tightly** into the mounting holes thanks to the metal tabs. Please install carefully! Before installing the panel, adjust the mounting nut so that it only supports the bottom of the front panel. The encoders are **NOT screwed** onto the front panel from above!

Note: Please pay attention to the insertion position of the two encoders!

RGB Encoder L 5 Pins

RGB Encoder L 3Pins

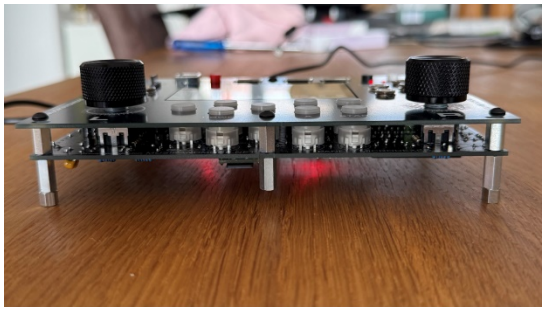


RGB Encoder R 5 Pins

RGB Encoder R 3 Pins

For your Information: The motherboard is designed for RGB encoders (3/5 pins) and regular encoders (2/3 pins). This is due to a certain degree of backward compatibility. The software of this DIY kit only supports RGB encoders.

RGB rotary knobs for encoders:

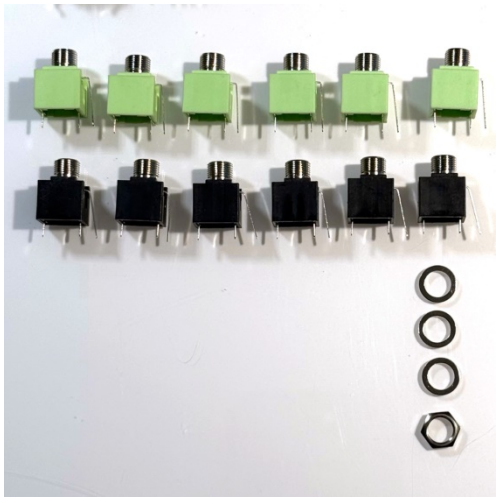


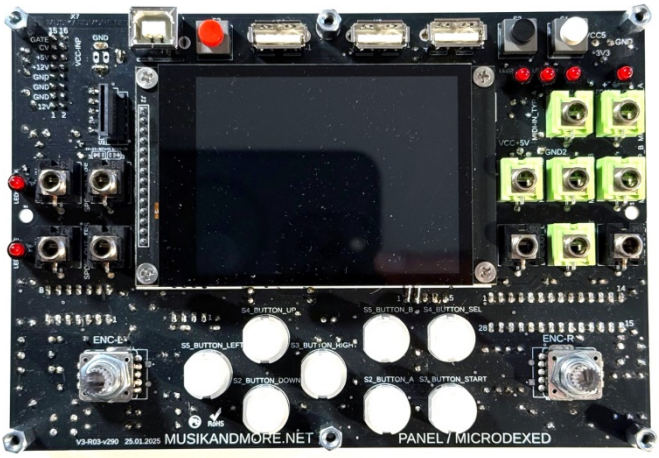
RGB rotary knobs 22mm installed in the front panel - Knobs with RGB encoder

Left: Encoder without thread

12) Equipping the TS/TRS jacks

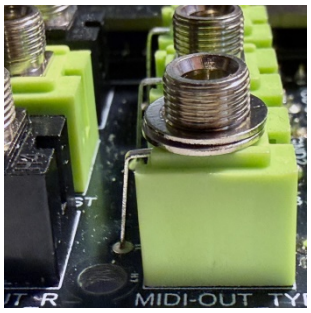
43. Now the TS/TRS jacks are inserted.
- TS (black) mono and TRS (green) stereo jacks
- Then put on 2 pieces of 6mm washers per TS/TRS sockets (24 pieces in total).
- The washers serve to adjust the height of the front panel. (Reserve 2x washers and 1x nut)





TS sockets (black) and TRS sockets (green) with M6 hexagon nut and 3 6mm washers

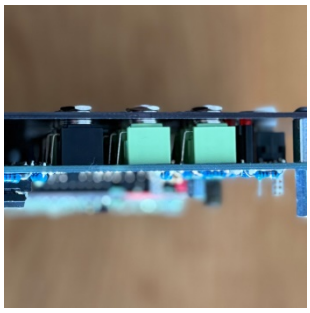
44. For your information: When attaching the TS/TRS sockets to the front panel using the washer and hexagon nut, the front panel will be bent downwards without the 2 washers, so place 2 washers under each socket. Then you can carefully tighten the sockets later using the M6 hexagon nut (SW 8mm) and washer.



1. 2x U-washer

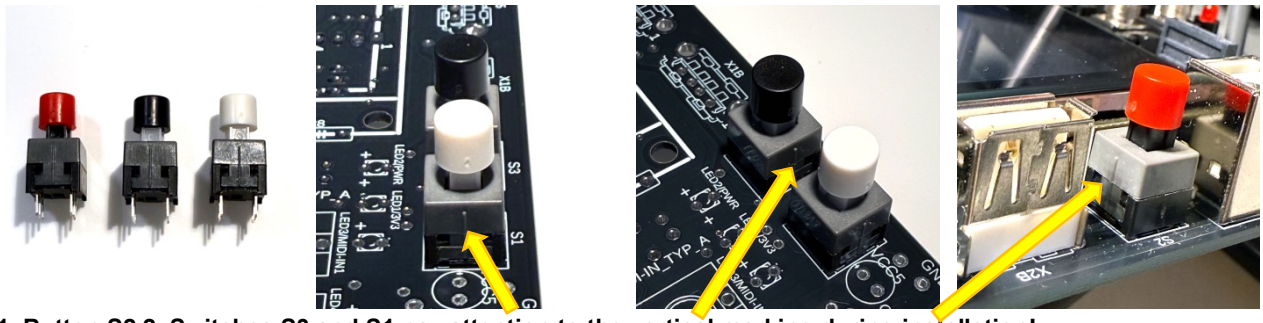
2. 1x U-washer

3. 1x M6 hexagon nut for all 12 TS/TRS sockets



13) Equipping the USB switches and PRGM buttons

45. Then install the two 2-pin switches (2 changeover contacts) **S1 PWR** (white button) and **S3 USB-PWR** (black button) and the **S2 PRGM button** (red button). Both switches and the button have a vertical marking on the right side.

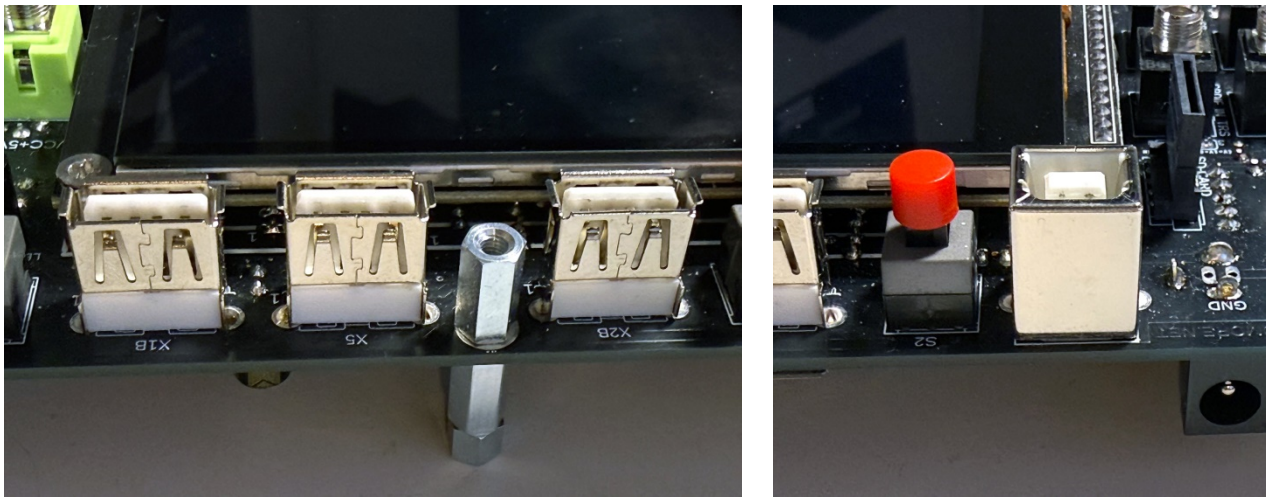


1. Button S2 2. Switches S3 and S1 pay attention to the vertical marking during installation!

IMPORTANT: This must point to the right for both switches and the button! If not, the switching function is reversed **(OFF/ON)** (i.e., incorrect), but the correct setting is **ON/OFF.**
Also fix the switches/buttons with just one soldering point.

14) Equipping the USB host and USB-B sockets

46. The next step is to install the USB-A sockets (USB-HOST, USB-1, USB-2) and the USB-B socket. The procedure is the same as for the TRS sockets. Plug in and align.
Here, too, only solder one pin first.

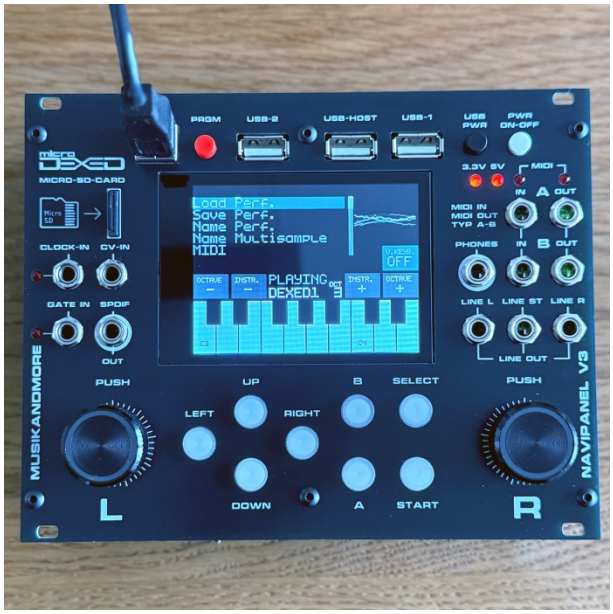


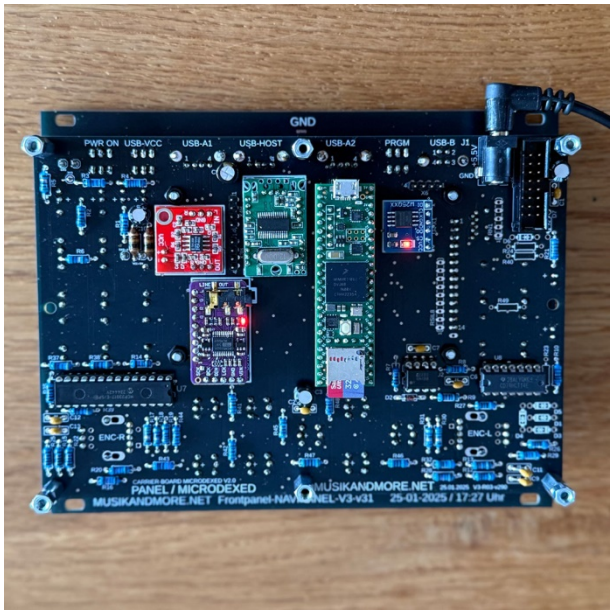
USB-Host Port 1 **USB-Host Master** **USB-Host Port 2** **USB-B 2.0 PC/MAC from Teensy 4.1**

The side housing pins on the USB ports clamp them securely, making them easier to solder later. Only solder the housing pins after all four other connections per USB port have been soldered. The USB ports are very difficult to align afterward.

47. **Before you begin** soldering/fixing, mount the front panel with the six M3x6 hex screws and tighten the screws hand-tight with a 2mm hex key. All populated sockets and switches should then be pushed through the panel.
    Now turn the panel over and solder the components in place with **a soldering point**. When soldering, always check that the sockets are firmly seated on the board before soldering.

48. If nothing is wobbling and all parts are sitting tight and straight on the circuit board, the remaining pins of the components can be soldered.





15) GND - Soldering of GND pads and areas

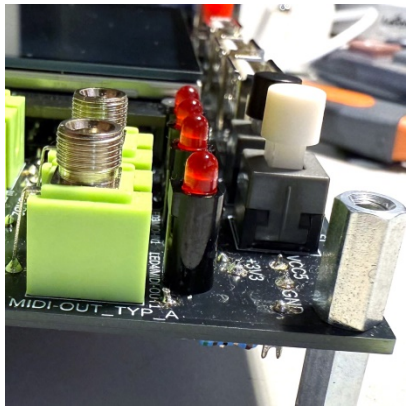
49. The **GND pins** require very good heat distribution for a clean solder joint, so if possible, heat the solder pad and the component pin simultaneously and add a very small amount of solder. The soldering is "good" when the **solder flows "voluntarily" into the via**.

    A quick tip: In general, less (solder) is more. The larger the solder ball, the more likely it is to have a cold solder joint!
    The fact that the GND pins are harder to solder than the other pins is due to the copper pads on both sides of the GND and their high heat dissipation on the circuit board. However, the electrical advantage of good ground distribution on the soldering and assembly sides outweighs this.

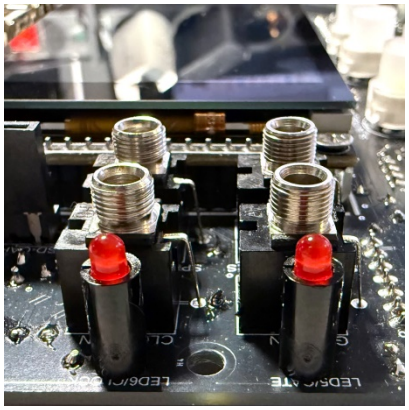
16) Fitting the red 3mm LEDs with spacers

50. The next step is to disassemble the front panel and install the six 3mm red LEDs. These are placed on the black spacers. The **long leg is the anode**. The **anode + pole of the LED** is marked on the circuit board. The spacers have different ends: one with a recess and the other without. The direction determines how far the LEDs protrude through the front panel. **Please use the deep end!**

the LED on the left is correct!



4 LEDs on the right side of the



2 LEDs on the left side of the panel

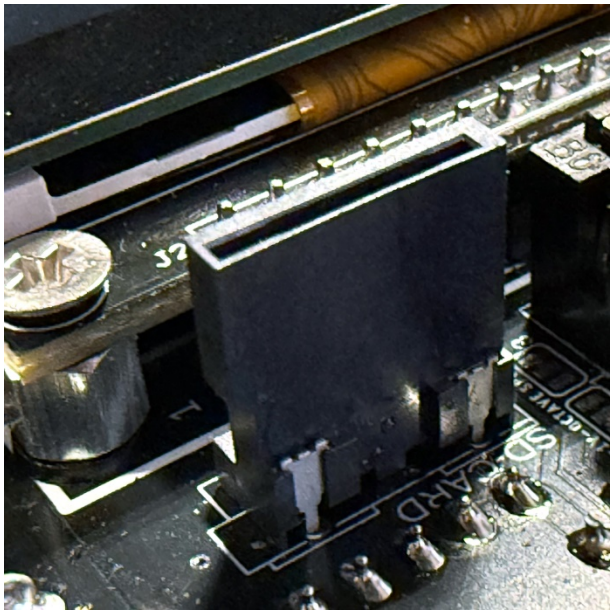
51. An example:
Correct = recess at the top = LED looks about 0.7mm through the front panel.
Wrong = recess at the bottom = LED looks about 1.5mm through the front panel and no longer fits between the panel and PCB... max. 11mm gap.
Then remount the front panel with the M3 ISK screws.

The LEDs must shine evenly through the front panel.
- Turn the panel over and check the long legs of the LEDs again (+)
- Then solder the long legs, the other leg is the cathode and is connected to GND for all LEDs.

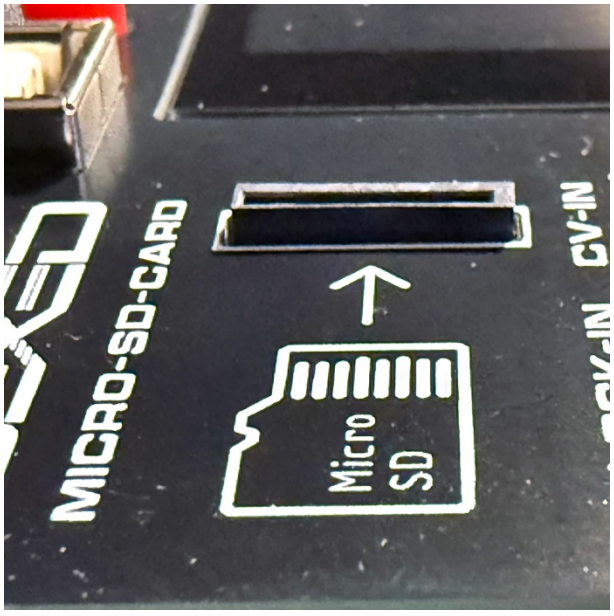
(See also **point 49 Soldering GND pins**)

17) Equipping the Micro SD card slot

52. Now it's the turn of the micro SD card slot. The micro SD card slot only fits one way on the board. The solder pins are very close together, so first fix them with just one soldering point. Please be careful when soldering the micro SD card slot! It's best to solder with the micro SD card inserted, as this prevents solder from running through and potentially damaging the SD card slot! It's also important to use a small amount of solder here.



Micro-SD card slot assembly side



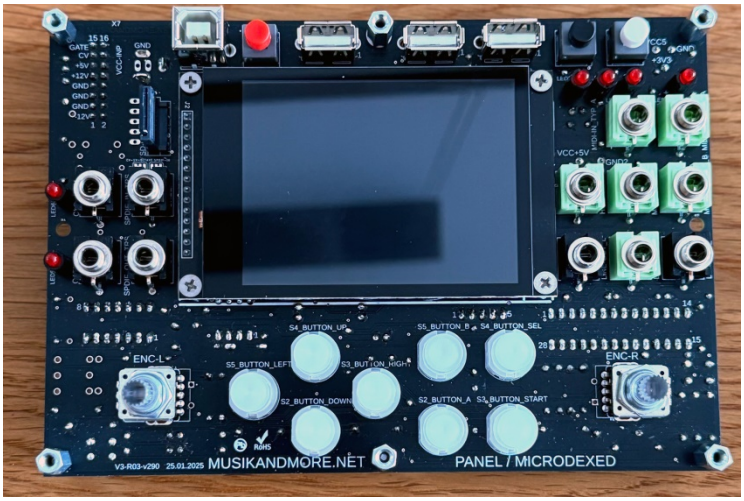
Micro SD card slot in the front panel

The next step is to reassemble the front panel and align the LEDs and the SD card slot and solder them completely.

18) Assembly of the LED buttons

53. The final part of assembling the motherboard is the LED buttons. The buttons naturally differ in their actual function and LED color. The left group (UP, DOWN, LEFT, RIGHT) has RED LEDs. The color coding for the LED color is located on the underside of the buttons.
So be sure to check before soldering!

LED Buttons: YELLOW, BLUE, RED GREEN



LED Buttons left 4x RED right WHITE, BLUE, GREEN YELLOW

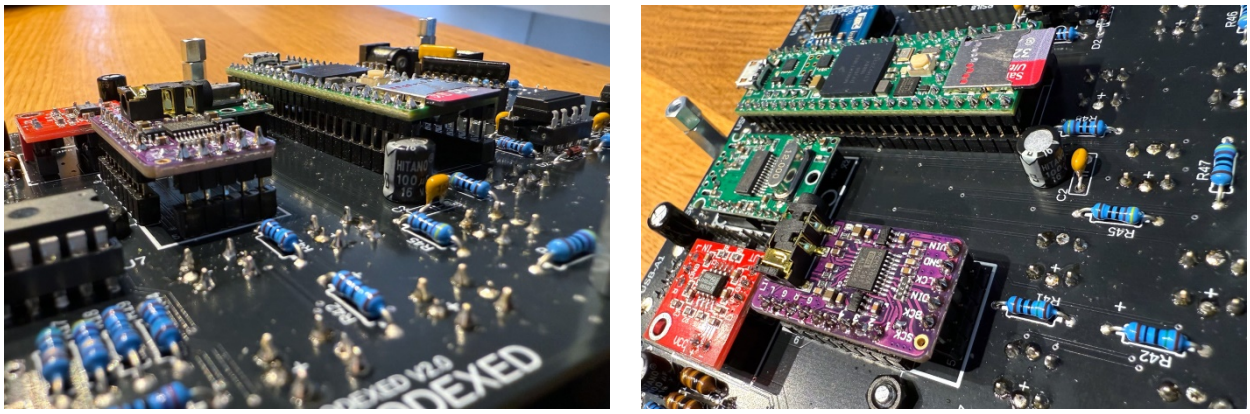
(**Note:** the LED color WHITE is marked with the color marking “black”.)

54. Button A has the color WHITE, Button B the LED color GREEN, Button SEL the LED color YELLOW and Button START the LED color BLUE.
All buttons have a straight edge, which must be aligned with the component markings when mounting the buttons! Incorrect mounting will result in a non-functioning LED and no button function. Please check carefully before soldering!
Then reassemble the front panel and screw it tight.
Caution: The buttons will fall out when the front panel is flipped over. This means temporarily securing all 8 buttons to the front panel with a thin piece of adhesive tape. The buttons should operate smoothly once the front panel is installed.

55. The buttons and LEDs are also connected to GND via three pins. Here, too, the following applies: good heat distribution during soldering, minimal soldering, and only solder one pin per button at a time, as well as not letting the buttons overheat. Make sure the buttons move smoothly after soldering and still have a noticeable pressure point.

19) Equipping the socket strips for the modules

56. Now we come to equipping the Teensy 4.1, the PCM5102, and the headphone amp with the header pins. To ensure the pins line up evenly with the modules, plug the header pins into the existing sockets and then solder the module or Teensy onto the header pins. For the Teensy, first secure/solder the header pins to various solder pads. Please solder the Teensy 4.1 with extreme care and ensure that no unwanted solder bridges are created. Here, too, use a small amount of solder. It's better to re-solder carefully than to remove solder balls.

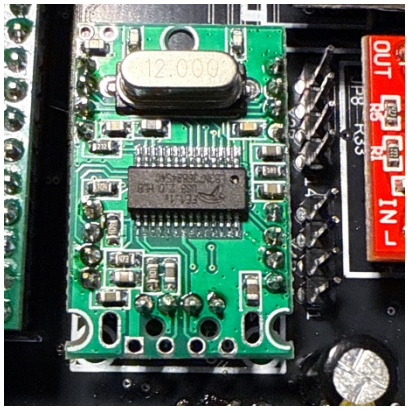


Equipped with low-profile socket strips for the Teensy, DAC PCM5102 and Headphone-Amp

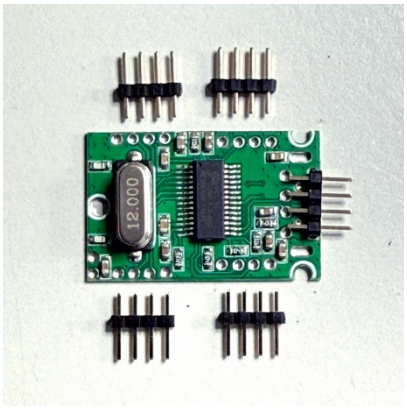
20) Equipping the USB A hub 1 host to 4 USB A clients

57. USB 1-4 Hub for the Teensy USB Host

Caution: The USB hub has 2.0mm pitch plugs and sockets. Only on the "front" USB host master input connector, bend the pins on the right and left slightly outward so that the plugs fit into the pads on the USB hub! See Photo 1C... The manufacturer changed the pinning from 2.0 to a wider 2.xx pitch without prior notice. **:-(**



USB HUB 1-4 for Teensy



USB host connector, 4-pin, 2.0mm pitch.

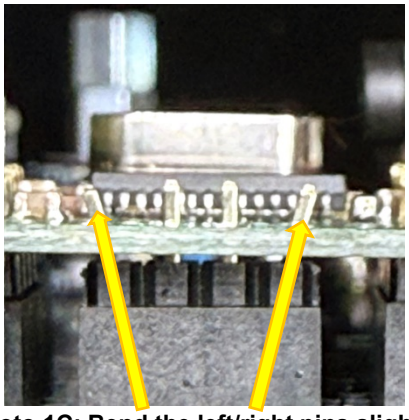
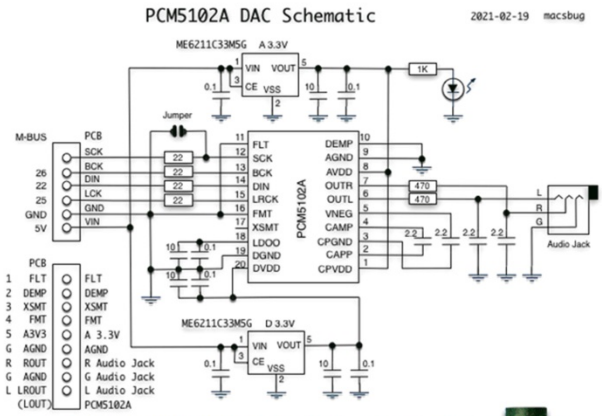


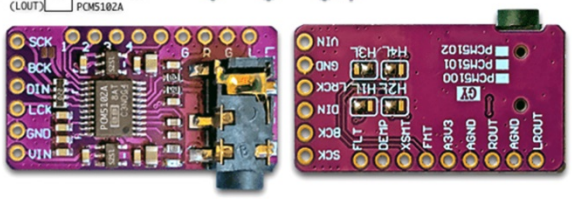
Photo 1C: Bend the left/right pins slightly.

21) Configuration of the audio DAC PCM5102

58. A few minor modifications need to be made to the **PCM5102A DAC**. Remove the **H3L** solder jumper on the back and connect the **SCK solder jumper** on the component side with solder.



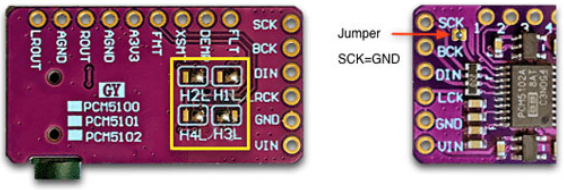
Schematic PCM5102



Remove solder pad H3L completely

PIN FUNCTIONS : Select = RED : Selected state at time of purchase

H	Name	Description	LOW (GND)	HIGH (D 3.3V)
H1L	FLT	Filter select	Normaly latency	Low latency
H2L	DEMP	De-emphasis control for 44.1KHz sample rate	Off	On
H3L	XMST	Soft mute control	Soft mute	Soft un-mute
H4L	FMT	Audio format selection	I2S	Left justified

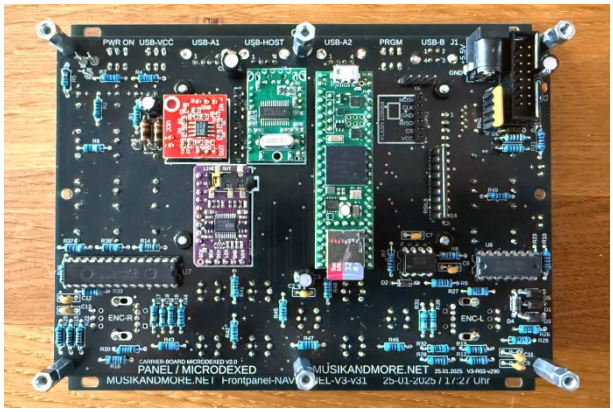


Set solder point “Jumper SCK”

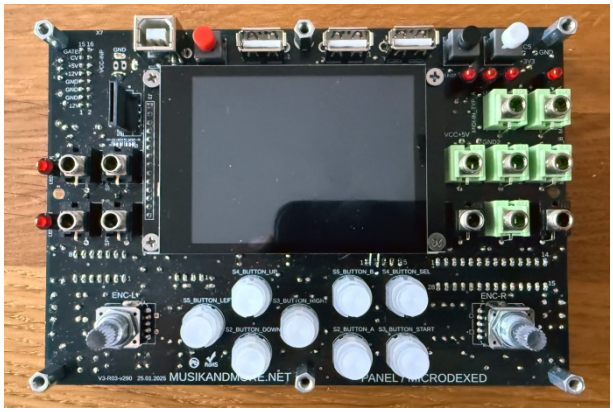
22) Checking the components and mainboard

59. We're nearing the end of the assembly. There shouldn't be any components left, except for two 6mm washers and one M6 nut for the TRS jacks (included as a spare). Experience has shown that small parts are the first to go missing, and unfortunately, they're not readily available.

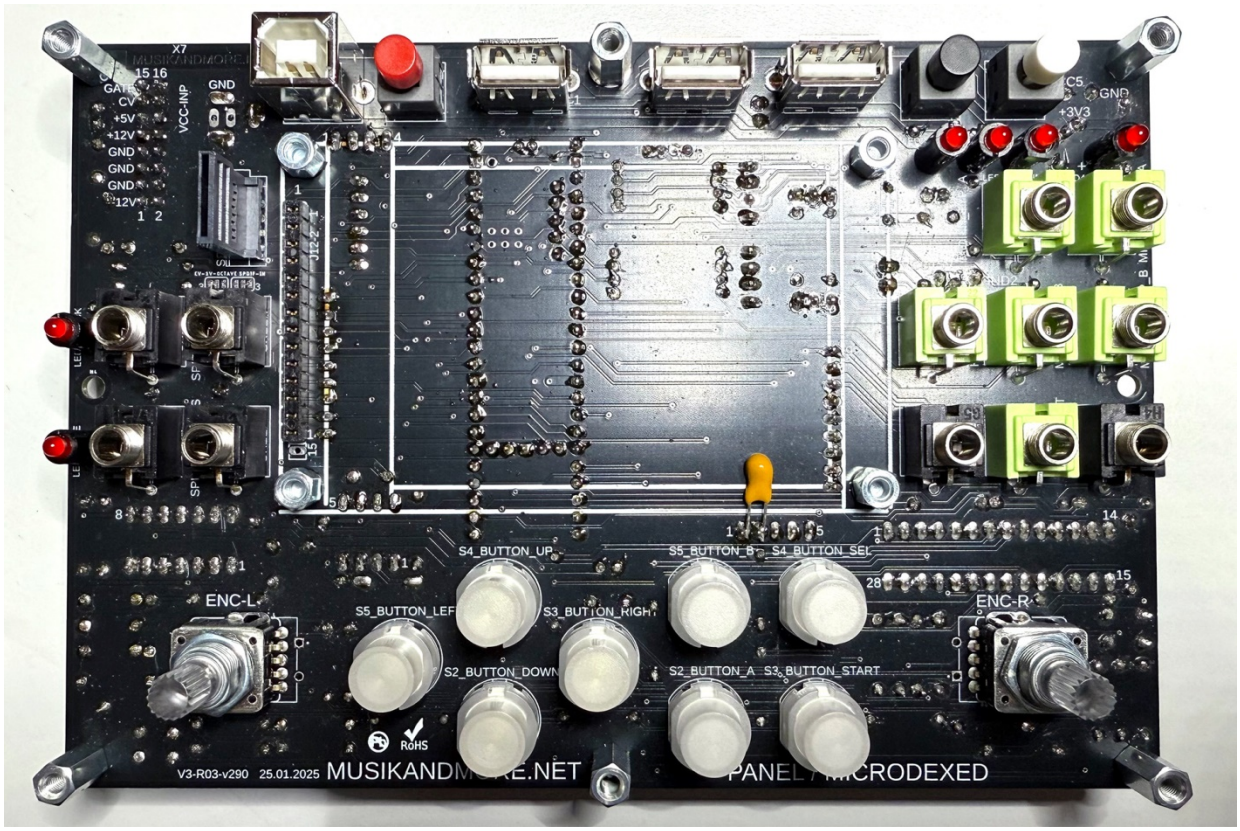
60. Now all soldering points are checked again and re-soldered if necessary.
61. Check components for correct position… diodes, electrolytic capacitors, the tantalum capacitor…
62. The mainboard should now look something like this (without plugged-in modules and ICs):



Mainboard soldering side / back



Mainboard component side without front panel



Mainboard component side without front panel

23) Commissioning

1. Functional test

63. Next comes a short functional test:
- USB B connector and supply power to the mainboard
- Press **S1 PWR "ON"** = LED 5V lights up
- Press **S1 PWR "OFF"** = LED 5V does **NOT** light up

If this is successful, check the voltage (**S1 ON**) with a multimeter at the +5V / VCC5 and GND test points. The voltage level depends on the USB interface of the PC, MAC, or USB hub. However, the voltage should be between 4.8V and 5.2V.

64. Now connect the Teensy 4.1 (U1) to the mainboard using the 2-pin USB cable and carefully insert it into the socket headers.
- Then repeat **step 63** and the 3.3V LED must also light up.
- Use a multimeter to check the voltage +3.3V at the measuring points +3.3V and GND.
- The +3.3V from the Teensy 4.1 is not always exactly 3.3V, but should be between 3.25V and 3.35V.

65. We have already flashed the latest software version onto the Teensy at the time of delivery. (This only applies to customers who purchased the DIY complete kit!)

66. If the USB port is connected to a PC or Mac, the "Microdexed" should be automatically detected and installed. This is also a good sign that the 2-pin USB cable connection (**section 57**) on the Teensy is working.

67. Now switch the white switch back to **S1 PWR "OFF"**.
- Insert ICs U2 (6N138), U7 (MCP23017), and U8 (CD74HCT14E) into the IC sockets.

Press the pins of the three ICs together a little beforehand; they will then fit more easily into the rotated sockets.

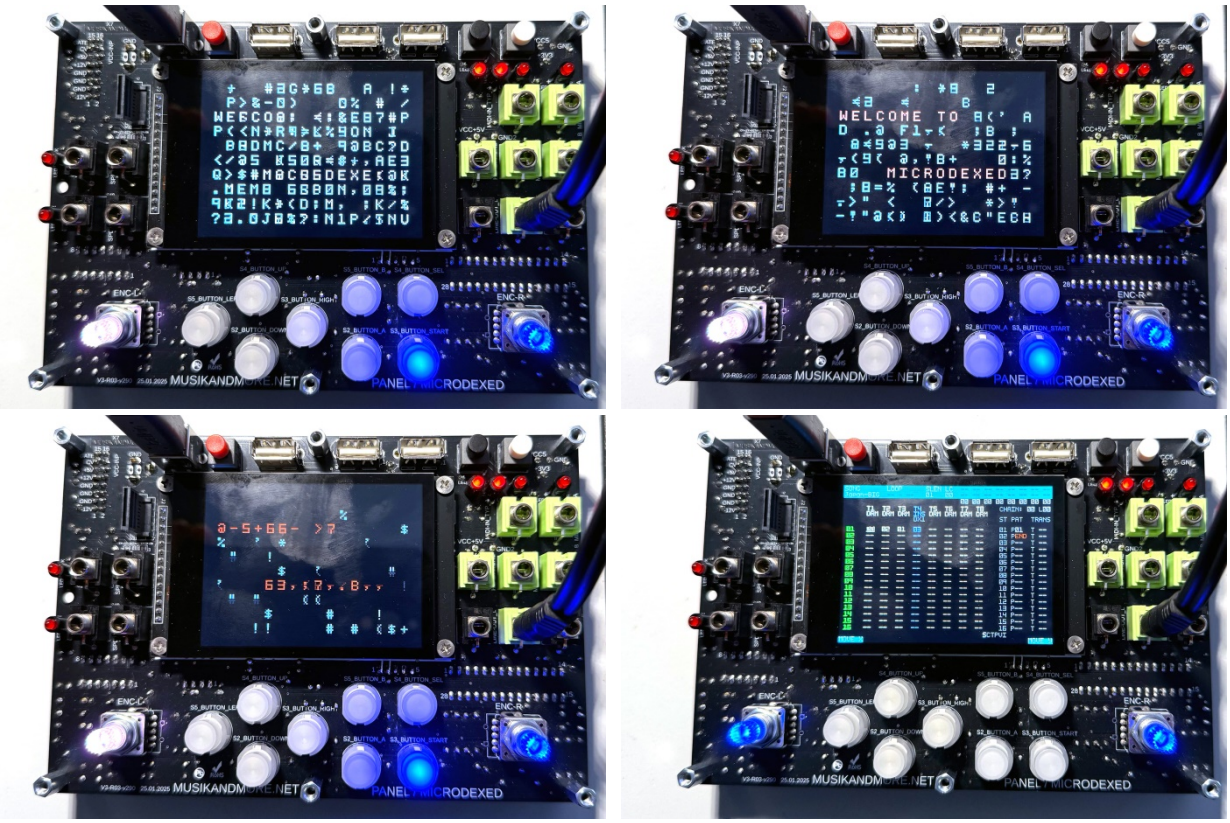
68. Now insert the capacitive 3.2" TFT touch display on the front carefully but with pressure into the 14-pin connector strip J12-2 and screw it tight using the countersunk screws M3x5.

69. From the unpacked software version 1.9.8x, copy all files and directories from **/addon/SD/** to the root directory of your SD card (**FAT32**) and insert the card into the Teensy 4.1's SD slot. If you have one or two PSRAM chips, copy your custom samples to the **/CUSTOM folder** on the SD card, or copy the demo contents from **/addon/SD/CUSTOM** to the **/CUSTOM folder** on the micro SD card.

70. Now set the white switch back to **S1-PWR "ON."** If everything is correct, the NAVIPANEL-V3 with the Microdexed should now boot, and the LED test should light up the 8 LED buttons, both RGB encoders, and the MIDI IN/OUT LEDs one after the other, greeting you with the start screen. Connect a MIDI keyboard to MIDI IN Type A or B (or use the virtual touch keyboard and the encoders for navigation).

Note: Audio line-out and headphones only work after the next step.

71. First steps during the boot process after **S1-PWR "ON"**



Mainboard boot process with LED test and start screen

72. It's almost done!
- switch the white switch back to **S1-PWR "OFF"**.

73. Simply plug the DAC U3 (PCM5102A), the Headphone Amp U5 (TDA1308) and USB Hub 1-4 U6 into the designated socket strips.

74. Note on the U4 flash memory module 128Mbit:
The flash memory module is currently **no longer required and is no longer supported** in the current software. The U4-X1 socket header is included in the scope of delivery and should be soldered in. This allows future software extensions to be added at any time by simply plugging in a flash memory module, even without soldering any socket headers.

75. Now set the white switch to **S1-PWR "ON"** and the black switch to **S3 USB PWR "ON."**
- S3 separates the USB host from the Teensy's USB host 5V. (The Teensy USB host's 5V can only supply a maximum of 250mA, which is certainly sufficient for many applications, but the USB hub 1-4 allows the use of two front panel USB-A ports and two USB-A ports on the back of the motherboard on 4-pin USB3-HOST and USB4-HOST headers (see **Appendix A** for suitable USB adapters from https://prjc.com).
By turning **S3 USB PWR "ON",** the maximum current of 500mA is made available to a standard USB PC interface or USB hub. USB HOST port X5, located in the center of the front panel, is inactive when **S3 USB PWR is "ON."**

24) Test environment with 3 USB devices

76. Test environment:
We tested the following configuration with the USB hub 1-4 on 3 of 4 possible USB-A ports:

- AKAI MPC mini (MIDI via USB)
- AKAI MPD 218 (MIDI via USB)
- ARTURIA MiniLab3 (MIDI via TRS MIDI IN)

The total current consumption was in the range of 390mA - 410mA, so still well under 500mA.

Test environment: AKAI MPCmini, AKAI MPD218, ARTURIA MiniLab3 via USB host on NAVIPANEL V3 Microdexed

77. Note:
If the black push button **S3 USB PWR is not set to "ON",** the USB ports 1-4 of the U6 USB hub cannot be used, e.g. for USB MIDI data transfer.
Only the USB HOST X5 on the Teensy 4.1, located in the center of the front panel, is active!
Generally speaking, using USB for audio and MIDI is a tricky issue. Many ports don't even deliver 4.4V when loaded (instead of the required 5V USB). Another issue is possible noise on the audio outputs when using USB audio and/or audio line outputs. In the studio, galvanic USB isolation is very helpful for eliminating ground loops and USB "interference." We use several of these USB isolation modules in our studio.
Link to product: ARCELI USB Isolator Module, Industrial Isolator Protection against Audio Noise, 1500V Digitalmodul: https://www.amazon.de/dp/B07SJD86TD?ref=ppx_yo2ov_dt_b_fed_asin_title

25) External power supply and Eurorack

78. An external 5V power supply (J1) is also helpful, either via the 5V/1A DC connector or via an external (USB) 5V power supply, to prevent any noise or hum. The same applies to the power supply via the 16-pin Eurorack header. Currently, only the +5V and GND pins are used.
However, the external power supply only makes sense when the USB PC or MAC port isn't being used for data transfer. This means it can be used remotely without a laptop or similar device, for example, during live performances. However, both external +5V and USB to a PC or MAC also work.

IMPORTANT: The power switch **S1 PWR** (white cap) must then be set to **"OFF"**.

26) Commissioning and final assembly of front panel

79. **The finale:** front panel on the mainboard and **2nd functional test:**
- Equip all TS/TRS sockets with the 2x 6mm washers (24 pieces in total).
- Now align the front panel of your choice on the motherboard and secure it with 6x M3x6mm ISK screws. Make sure all buttons and switches fit smoothly in the front panel.
- Then fasten the bushings with 12x 6mm washers and 12x M6 hexagon nuts (SW8).
- Now screw the two hex nuts of the RGB encoders up onto the front panel from below. The nuts only serve to support the front panel. The RGB encoders are NOT screwed on from above.
- Now plug the two RGB encoder knobs onto the encoders, applying light pressure.
- Now the NAVIPANEL V3 can be turned on again with the **S1-PWR "ON."** (See also **section 75**)
- If everything works, the hardware is ready for use!

27) The setup for the Microdexed

80. Now it's time to set up the Microdexed. Please read the very detailed user manual by @positonhigh at the following link:
https://codeberg.org/positionhigh/MicroDexed-touch/raw/branch/main/doc/MicroDexed-touch-manual.pdf

28) Additional hardware functions and sockets

TS/TRS 3.5mm jacks and a micro SD card slot are located on the front panel.

81. In addition to the stereo audio LINE OUT (TRS), the NAVIPANEL-V3 also has LINE OUT L (TS) and LINE OUT R (TS). This is because in the modular world, it is common for audio outputs not to be used in stereo, but rather split into R and L for different modular modules.

82. The Headphone Amp U5 (TDA1308) is a small stereo headphone amplifier (PHONES) with approximately 40-50mW output power (at 16-32 ohms at 5VDC supply voltage). The input from the Headphone Amp is routed directly from the Line Out R/L of the PCM5102 U3 DAC.

83. MIDI communication can then be carried out in the traditional way via TRS 3.5mm MIDI IN and MIDI OUT. The MIDI IN and MIDI OUT are dual-ported, 1. Type A and 2. Type B, to allow the appropriate cable to connect various synthesizers and MIDI devices.

84. A good cable recommendation for MIDI DIN5 to TRS MIDI is the BEFACO MIDI adapter cable, 1.5m long and available in a 3-pack.
Midi cable red pack of 3 classification TYPE A
- 3.5 mm TRS jack to 5-pin DIN plug
- Compatible with devices from Akai, Korg, Make Noise, ADDAC, Critter & Guitari, Dreadbox, Intellijel, Teenage Engineering, Twisted Electrons, Elektron.
Link to the product: https://www.thomann.de/de/befaco_trs_midi_cable_a.htm

85. Midi cable gray, 3-pack, classification TYPE B
- 3.5 mm stereo jack to 5-pin DIN plug
- Compatible with devices from, among others, 1010Music, Arturia, Elektron, Erica Synths,

Faderfox, Malekko, Polyend, Darkglass
Link to the product: https://www.thomann.de/de/befaco_trs_midi_cable_b.htm

86. The SPDIF OUT output is fully functional and integrated into the Microdexed software. It delivers a 44 kHz/16-bit digital signal to the 3.5 mm jack (TS) connector (SPDIF OUT).
Connecting to a standard SPDIF input requires a cable adapter from a 3.5 mm mono TS jack to an RCA connector.

87. The TS sockets CV-IN, CLOCK-IN, and GATE-IN are fully functional in hardware, but the software is not yet fully implemented. For technical information on voltage levels, see "Technical Specifications."

88. The Micro SD card slot 2 is intended for expansion with an additional Micro SD card. Possible applications include the "easy way" to add sounds, sound banks, and MIDI files, etc., without removing the Teensy 4.1's Micro SD card or using the **Web Remote Console**. The necessary software for the second Micro SD card will be implemented as soon as possible.
The link to **Web Remote Console**: https://positionhigh.codeberg.page/

89. The functionality and use of the USB HOST, USB-1, USB-2 and the USB3-HOST and USB4-HOST on the rear panel is described in **section 46**.

90. The Teensy 4.1 micro-USB port is connected to the USB-B 2.0 socket with **S1 PWR ON-OFF** switch and is therefore also accessible in the front panel.

91. For hardware support, please contact
Thomas Effendy, info@musikandmore.net oder @musikandmore at
Discord (https://discord.gg/XCYk5P8GzF)

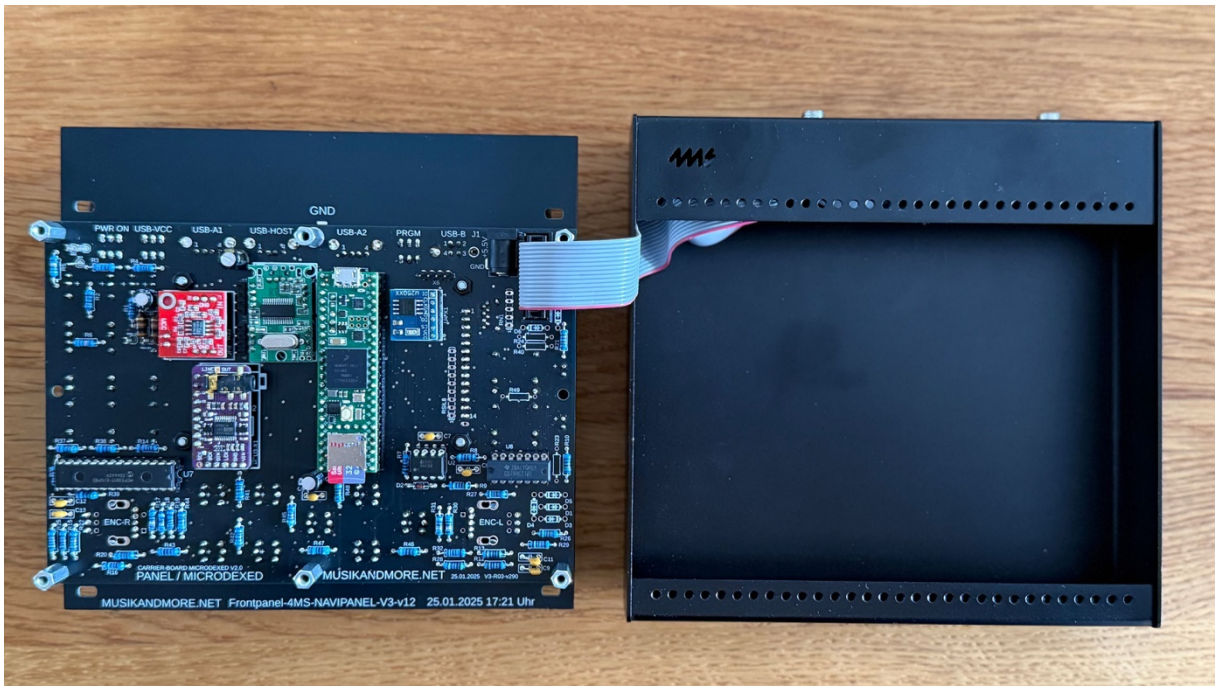
92. For questions about the Microdexed software, please contact:
Mark Koslowski aka @positionhigh (https://discord.gg/XCYk5P8GzF)

29) The finished device NAVIPANEL V3 for Microdexed

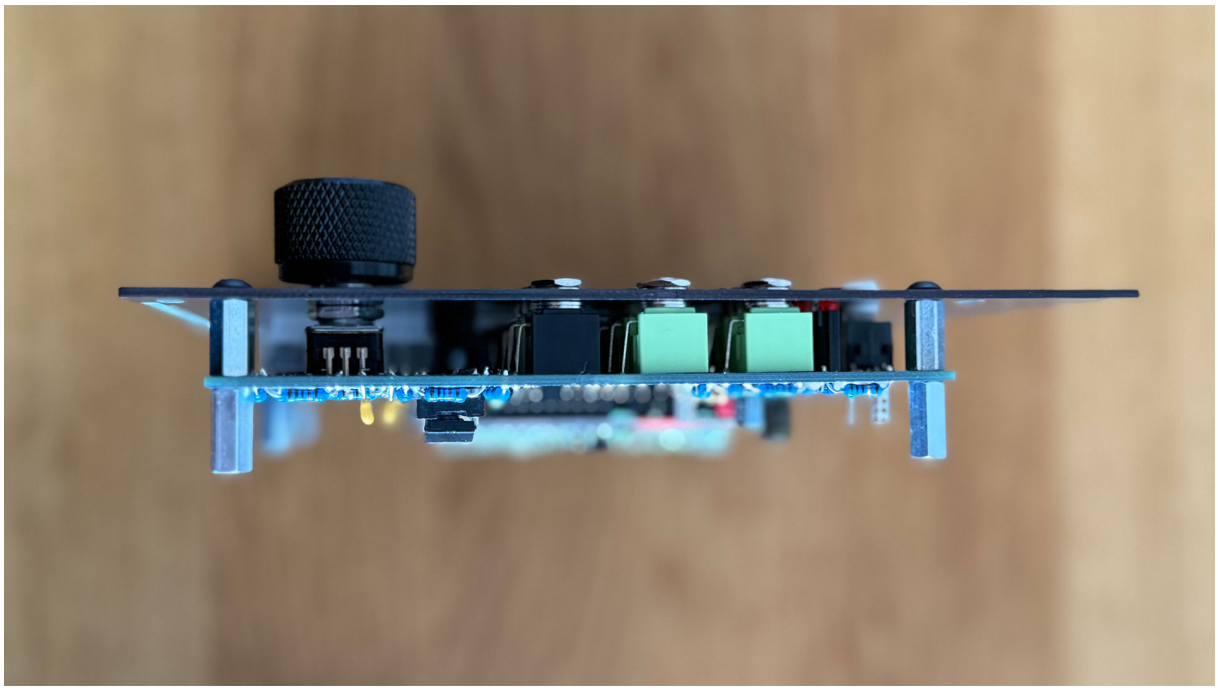
Photos with various case variants:

4MS pod32 Case Variant: Powered by 4MS Powerbrick External Power Supply

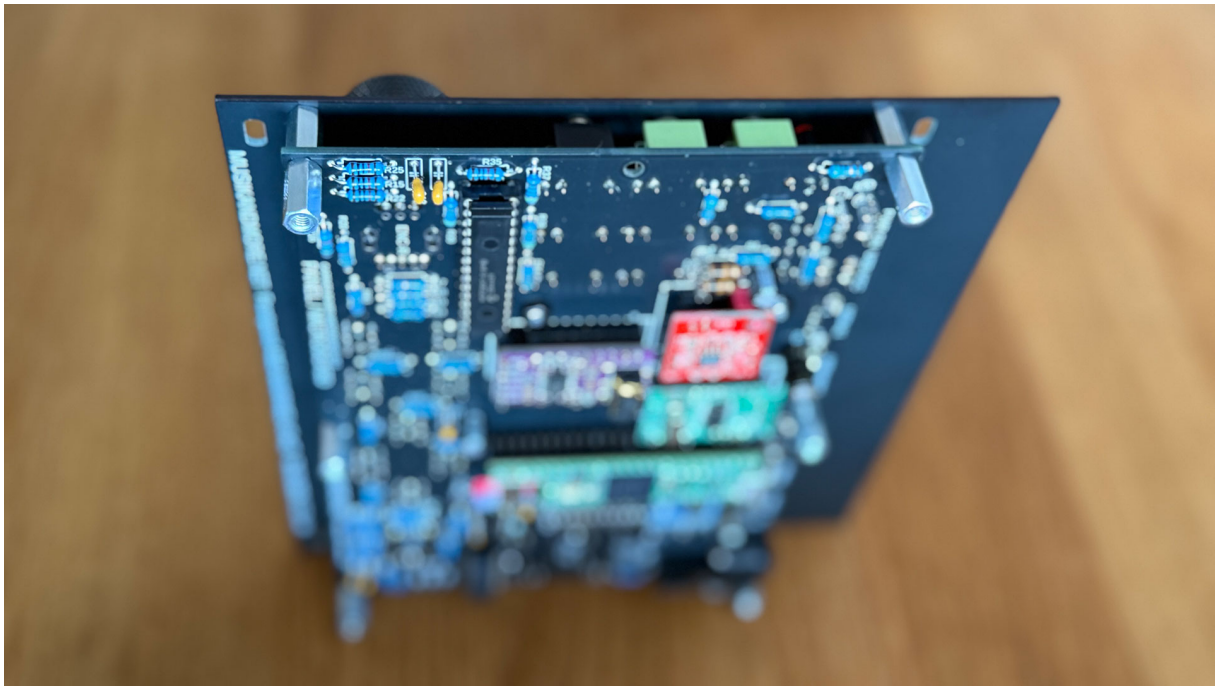
93. 4MS pod32 Case Variant: Opened, Powered by the 4MS Powerbrick External Power Supply



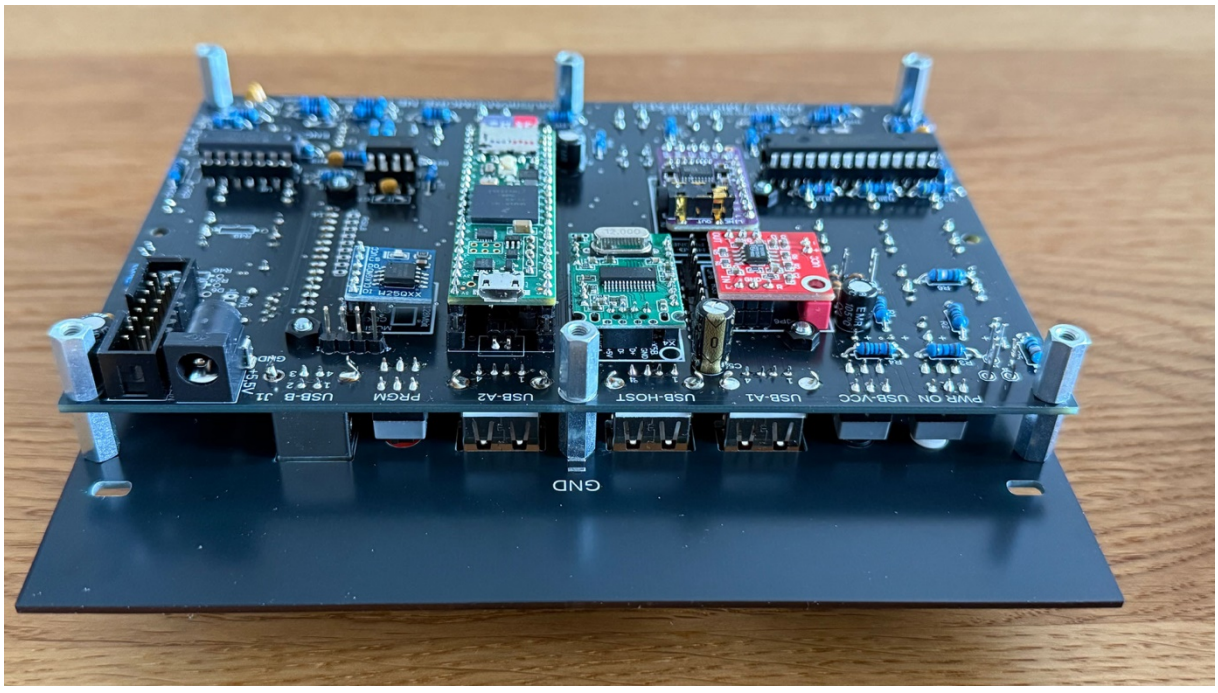
94. 4MS pod32 Case Variant: Side View



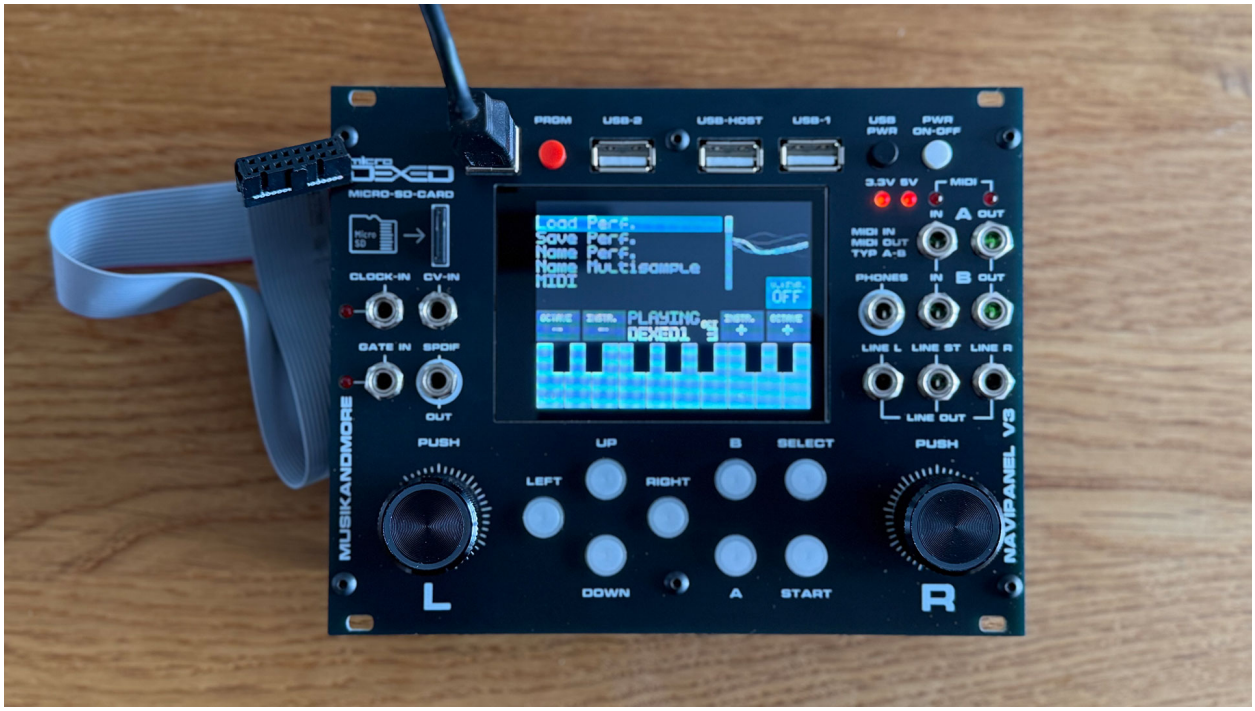
95. 4MS pod32 Case Variant: Side View 2



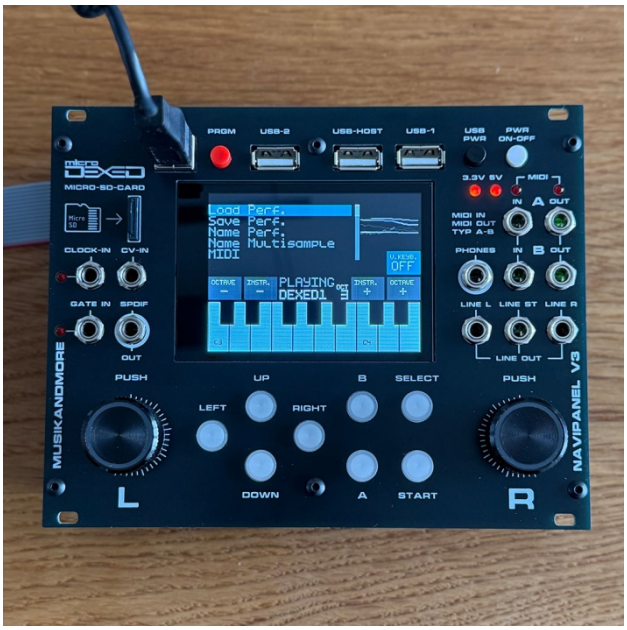
96. 4MS pod32 Case Variant - View of Components/Soldering Side



97. Eurorack 3U/32HP Case Variant



Eurorack 3U/32HP Case Variant



Eurorack 3U/32HP with External 5V DC

30) Appendix A.

Sources / Links / Product recommendations

1. Bernstein Ball joint component holder / link to product:
   https://www.bernstein-werkzeuge.de/produkte/produktdetails/9-250-esd-kugelgelenk-kombination-vario-6-tlg
2. Solder / link to product:
   https://www.conrad.de/de/p/stannol-ks115-loetzinn-bleifrei-spule-sn99-3cu0-7-rom1-100-g-1-mm-588742.html
3. Solder fume extractor / link to product:
   https://www.reichelt.de/de/de/shop/produkt/loetrauchabsaugung_zerosmog_shield_pro-371544
4. USB host adapter from prjc.com / Link to product:
   https://www.pjrc.com/store/cable_usb_host_t36.html
5. Resistor color code table:
   https://www.elektronik-kompendium.de/sites/bau/1109051.htm
6. The latest software for NaviPanel-V3 is available at:
   https://codeberg.org/positionhigh/MicroDexed-touch/releases
7. Current original manual dated Microdexed @positionhigh:
   https://codeberg.org/positionhigh/MicroDexed-touch/raw/branch/main/doc/MicroDexed-touch-manual.pdf
8. prjc.com Teensy Software: https://www.pjrc.com/teensy/loader.html
9. Discord Channel @positionhigh: https://discord.gg/XCYk5P8GzF
10. Link to Web Remote Console : https://positionhigh.codeberg.page/
11. ARCELI USB Isolator Module, Industrial Isolator Protection Against Audio Noise, 1500V Digital Module:
    https://www.amazon.de/dp/B07SJD86TD?ref=ppx_yo2ov_dt_b_fed_asin_title
12. Red MIDI Cable, 3-Pack, Classification Type A
    https://www.thomann.de/de/befaco_trs_midi_cable_a.htm
13. Midi cable gray, 3-pack, TYPE B classification
    https://www.thomann.de/de/befaco_trs_midi_cable_b.htm
14. 4MS pod32 enclosure, 32 HP (powered)
    https://www.thomann.de/de/4ms_pod32_powered.htm
15. 4MS pod32 enclosure, 32 HP (unpowered) (**Special procurement through Thomann)**
    https://www.thomann.de/de/4ms.html
    Power supply for Eurorack case 4MS pod32 / maximum output power: 15V / 3A (45W)
    https://www.thomann.de/de/4ms_power_brick_45w.htm

31) Appendix B. Credits

Contributors:

1. Mark Koslowski aka @positionhigh (https://discord.gg/XCYk5P8GzF)
   for the excellent software and hardware base.
2. Holger Wirtz for the original port of the DEXED PC/Desktop OS to the Teensy 4.1 MICRODEXED microcontroller
3. Thomas Effendy https://musikandmore.net Hardware development and panel / PCB design
4. Nicole Effendy - https://designvorsprung.de for the patience with the seemingly endless proofreading of the assembly instructions and technical documentation.

32) Appendix C

License and Copyright

Project:	NAVIPANEL V3 for Microdexed
Authors:	Thomas Effendy (Hardware Version V3-R3-v317) Mark Koslowski (Software Microdexed Version 1.9.8.3)
Email:	info@musikandmore.net
Date:	March 30, 2025
Version:	V.6.7_en (this document)
Lizenz:	Creative Commons Attribution – Non-Commercial 4.0 International (CC BY-NC 4.0)

33) Technical data for NAVIPANEL V3 for Microdexed

Pos.	ID-#xxx (BOM)	Tech. data sheet	NAVIPANEL V3 for Microdexed | Date: 27.03.2025	Notes
1.	#93	Eurorack	Modularrack 3HE / 32TE	not included
2.	#92	Desktop	Desktop 4MS pod32 powered /unpowerd	not included
3.		connections	**power supply**	
4.	#37	for modular (+5V)	16-pin box connector with 20cm ribbon cable	S1-OFF
5.	#90	switchable	DC 5V supply with hollow socket 5.5x2.1mm	S1-OFF
6.	#158	switchable	USB-B for USB PC/MAC	S1-ON
7.		switchable	external USB 5V/1A power supply if no PC/Mac is required	S1-ON
8.		switchable	internal / external supply for USB-Hub	S3-OFF/ON
9.	#156	active USB hub	USB-HOST Hub 1 to 4, 3x USB-A of which are in the front panel	
10.			2x USB A connectors on the back via 4-pin connector	*3)
11.	#168	audio outputs	LINE Out Stereo /TRS 3,5mm	
12.	#163		LINE-OUT L / TS 3,5mm	
13.	#164		LINE-OUT R / TS 3,5mm	
14.	#167		Headphones Stereo /TRS 3,5mm	
15.	#169	MIDI IN/OUT	MIDI IN Typ A /TRS 3,5mm	
16.	#170		MIDI IN Typ B /TRS 3,5mm	
17.	#171		MIDI OUT Typ A /TRS 3,5mm	
18.	#172		MIDI OUT Typ B /TRS 3,5mm	
19.	#161	modular connection	CLOCK IN 0/5V= LOW/HIGH protected with suppressor diodes	*1)
20.	#162		GATE IN 0/5V= LOW/HIGH protected with suppressor diodes	*1)
21.	#165		CV to Midi …. 1V/Octave 0-5V= 4 Octaven Note ON/OFF or CC	*1)
22.	#44-49		protected with suppressor diodes	
23.	#166	SPDIF connection	SPDIF OUT 44KHz 16Bit / TS 3,5mm	
24.	#136	Switch	Switch S1 / Int. USB POWER ON (white)	S1
25.	#137	Switch	Switch S3 /Ext. 5VDC POWER OFF (black)	S3
26.	#84	Button	Switch S2 / PROGRAM (red) momentary	S2
27.	#104-107	Buttons	4 Buttons with LEDs red	*1)
28.	#102-103	Buttons	2 Buttons with LEDs white, blue	*1)
	#108-109	Buttons	2 Buttons with LEDs green, yellow	*1)
29.	#122-123	RGB Encoder L/R	RGB Encoder L/R	*1)
30.		6 LEDs	3mm LEDs red low current:	
31.	#128		3,3V Power	
32.	#129		5V Power	
33.	#130		MIDI IN	
34.	#131		MIDI OUT	
35.	#132		GATE IN	
36.	#133		CLOCK IN	
37.	#119/#125	SD-Card	MicroSD-Card SLOT im Frontpanel mit 32GB MicroSD	*1)
			for external data exchange	
38.	#139/#56	Prozessor	Teensy 4.1 with 2x 8MB PSRAM	
39.	#89	Audio OUT	Audio PCM 5102A	
40.	#138	headphone amplifier	headphone amplifier TDA1308	
41.	#91	ext. Memory	NOR Flash 128Mbit	*2)

Note *1)	Software not complete implemented, hardware only
Note *2)	currently not necessary but implemented in hardware
Note *3)	can only be used with external 5V power supply or Eurorack power supply +5V only

34) Appendix C.

Notes: