[MDT] MicroDexed-touch

microDEXED

Build Guide & User Manual

Version 0.64 - December 2025

https://codeberg.org/positionhigh/MicroDexed-touch

MDTX PCB Link

MDT/DIY PCB Link

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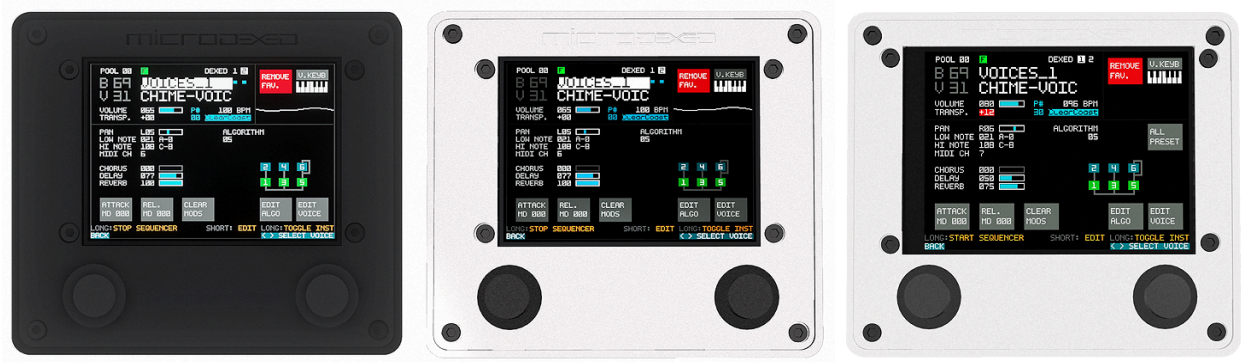
NOTE: Microdexed-touch is capable of generating audio with a large dynamic range, the extremes of which can cause damage to loudspeakers or other components, and also to your hearing. Please be especially careful when activating the MultiBand Compressor. Depending on its settings, this easily can increase the perceived output loudness by 10x or even more.

Overview

What is MDT ?



(SLA PRINTED ENCLOSURE, DISPLAY SIZE LEFT: 2.8", MIDDLE: 2,8" and RIGHT: 3.2")

(PCB BASED FRONT/BACK PANEL, DISPLAY SIZE LEFT 2.8" and RIGHT 3.2")

METAL (ALUMINIUM), 3.2” DISPLAY only

MDTX

MDT/MDTX is a multitimbral MIDI expander / Synthesizer with 6 Operator FM-Synthesis, "Virtual Analog" or "Chip Tune" Synthesis, Chromatic Sample and Drum Sample Playback, a version of MDA ePiano, a polyphonic synth, based on Mutable Instruments Braids Oscillator, with 8 instances and filters, a LSDJ style Sequencer with Patterns, Chains and Song mode, an Arpeggiator with common, simple and Euclidean style Patterns and much more.

In addition there is a second sequencer - called LIVESEQUENCER with a more musician style of approach - behaving similar to a multitrack tape machine with mute-automation. It brings its own arsenal of features, quantisation, arpeggios, shuffle/swing and much more. Both sequencers can be used at the same time and can address internal as well as external (MIDI) devices.

MDT can be remote controlled by your PC/MAC via several USB Protocols like USB AUDIO, USB MIDI and MIDI SERIAL.
Stable File Transfer between PC and MDT (for Samples and other data) is work in progress. It currently is best working on a Windows PC or on a MAC using Chrome or Firefox. (Firefox with some restrictions)

Open your browser and go to the webpage: https://positionhigh.codeberg.page/

and connect your MDT via the USB MICRO port on the Teensy to a USB Port of your PC/MAC. The most suggested browser is Google Chrome, Firefox currently works partially.

Usage Scenarios

- MDT can be used as a live instrument, played by a MIDI or USB MIDI device.
- MDT can be used as a multitimbral MIDI expander, from any other MIDI Device or your DAW.
- MDT can be used as an all-in-one Groovebox with multiple instruments and samples on 8 tracks.
- A mixture of the above - It is really up to you what parts you like to use stand-alone or together with other equipment.

Since Summer 2024, it is possible to use your own custom samples and even replace the stock samples easily by using one or two PSRAM chips on the Teensy. One chip has a capacity of 8MB and 2 chips can be soldered to the Teensy for a total of 16MB.

It is possible to acquire a Teensy with pre soldered PSRAM from protosupplies.com

The maximum PSRAM capacity is **16MB.** (2x 8MB PSRAM Chips). While it might be possible to extend that by heavy hardware modifications, MDT currently does not support any other configuration than 8 or 16 MB.

When getting PSRAM chips from sources not mentioned in the BOM, make sure you are looking at **PSRAM** chips. **SPI FLASH** is a different kind of storage:

The previously used chip for using custom samples was the external **SPI Flash** chip, which was very easy to add since pre-build modules were and are available at a very low cost. That is the main reason why that was the supposed solution for sample playback with MDT for some time.

However, even after putting a lot of effort into this approach, this unfortunately never turned out to be fully stable.

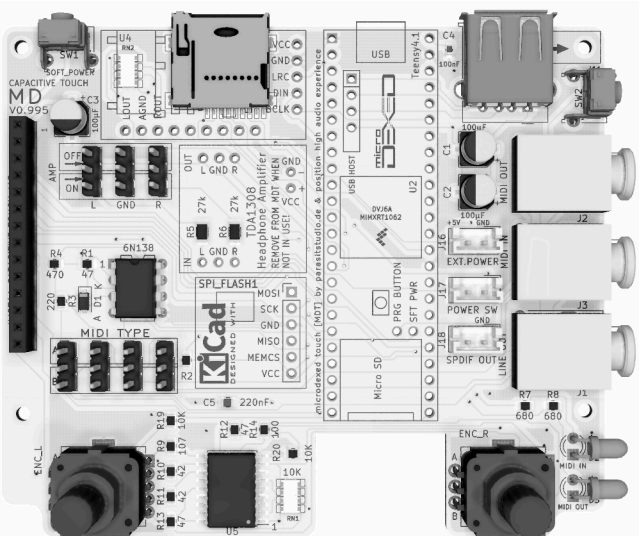
So the SPI Flash chip is now considered to be **depreciated** and replaced by the **PSRAM** chip(s).

The slot on the MDT PCB for SPI Flash will stay on the PCB design for now. It is possible the now fully optional Flash chip will find a new or other purpose to fulfill.

What is MDTX ?

In comparison to MDT, MDTX (MicroDexed Extended) is **not** supposed to be built entirely manually by yourself. This version is designed with the goal to get the user a running device with as less manual work/soldering as possible. However, you still get only a partly built PCB; there is still component sourcing and some soldering required.

[MDTX] MicroDexed Extended Edition



When buying this version, be aware you are supposed to use the **assembly services** of PBCWAY **(PCB+Assembly)** so that the SMD components (which are more difficult to solder) and also some basic THT parts come pre-assembled to you.

However, regarding SMD parts, it is still required to solder the PSRAM chip(s) to the Teeensy unless you are also buying the Teensy pre-assembled with the PSRAM chip(s) from Protosupplies: teensy-41-microdexed

If you do not want to buy a partly pre-assembled PCB, please go to the latest version of MDT that is thought and designed to be **"DIY"**: MicroDexed_Capacitive_Touch

The main improvements/changes of MDTX are:

- Faster user assembly/build due to more pre built components (reduces several hours of gathering components and soldering)
- RGB Encoders (customizable colors for general state and edit state)
- Second SD Card slot for copy/moving files/flat directories between both cards (work in progress but already working in general)
- Enhanced Audio Circuit for better Output Quality (less perceived digital noises/hiss)

The encoders used in this version are of type: **Sparkfun COM-15141**. However, that may be changed to allow a broader choice of encoder knobs in the future. If you go for premade encoder caps, instead of self-printing, it is probably better to go with a longer shaft size.

Many parts of the BOM and some steps in this guide are **not required** for MDTX since everything that is doable and available at PCBWAY is already pre built when you buy it as “pcb+assembly”.

This guide will be updated to reflect the obsolete steps/parts for MDTX soon. Here is a short list what you are still required to gather to build MDTX:

- Teensy 4.1 Microcontroller
- 1 or 2 PSRAM Chips
- 3.2” Capacitive touch Display
- PCM5102 DAC
- Headphone Amplifier
- All of the BKL low-height sockets
- pin headers to connect the Teensy to the PCB and pin headers for DAC+Amp
- 7 PC Jumpers for the Audio+MIDI Jumper blocks (if you do not have any already available)

Everything else on the PCB is already assembled/prebuilt. The chapter What do I receive when buying the PCB+assembly option at PCBWAY for MDTX ? shows in detail what you are actually receiving when you buy it with PCB+Assembly. **You do not need to gather any resistor, capacitor, diode, IC, switch, TRS jack or USB Connector.**

Enclosure types and instructions for the enclosures are identical as before. If you order the SLS Enclosure or the sheet metal enclosure, this will now feature the access port opening for the second SD Card Slot and also for the 2 MIDI LED activity lights. If you already have an enclosure you want to reuse, it can be modified to fit with a Dremel and/or drill. The PCB-based enclosure should not require any modification at all.

2025/06/04

- enclosure parts for SLS prints and sheet metal are adjusted to fit this version.
- the pcb-based enclosure solution will work without any changes
- encoder knobs currently are available as a FDM transparent self-print. Searching for good commercial options.
- The self printed knobs are identical for the SLS and sheet metal version enclosure

Features and MDT History

This is MicroDexed with TFT Touch Display, graphic UI and sequencer

This build requires a Teensy 4.1, PCM5102 Audio Board, 320x240 ILI9341 SPI Display with Capacitive Touchscreen and a PSRAM Chip for custom samples.

MicroDexed started as a Teensy based, 6-operator-FM-synthesizer. The first generation is still maintained at: https://codeberg.org/dcoredump/MicroDexed

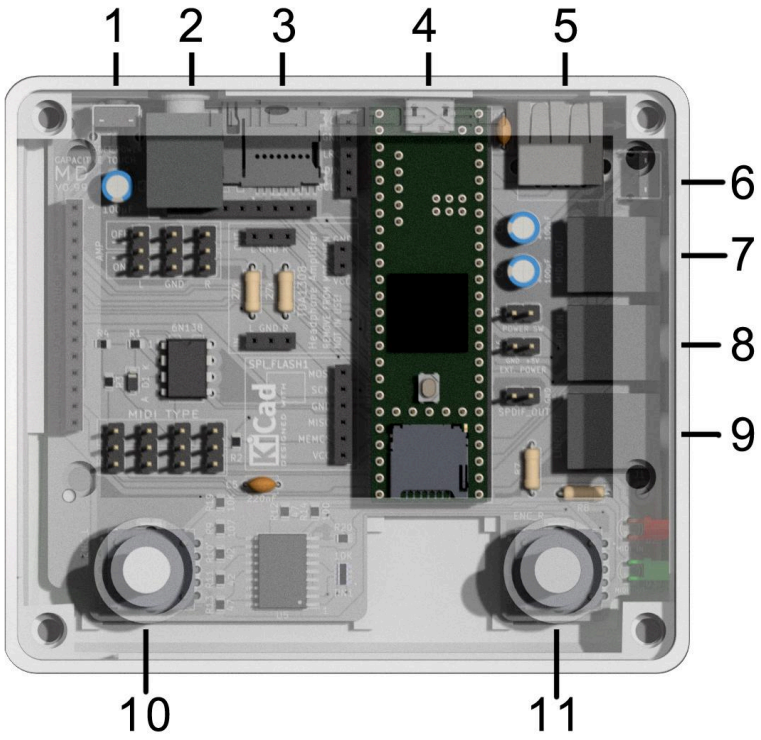
Compared to the first generation, MicroDexed-touch offers a lot of new features/improvements:

- "Large" Graphical Interface, view and edit multiple Parameters in one Screen
- Use external MIDI gear over USB or Mini TRS Jacks (DIN MIDI with adaptor) from 2 x 16 MIDI Channels in the Sequencer
- Map MIDI CC to external MIDI Devices to control Input/Parameters
- Global plate reverb, 2 global delay effects (500ms, with added PSRAM chip 60 seconds or even more)
- Loading, playing and editing multi-sampled instruments or layered instruments in a "live" mode or played by the sequencer. Auto detection sample zones can also be edited manually. This is early work in progress and currently not stable when using pitch shifting and polyphony
- 2 instances of "Virtual Analog" Monosynths with one OSC, PWM, Multimode Filter and Noise. A lot of useful new sound possibilities.
- 8 voice polyphonic Oscillator, based on the code of Mutable Instruments - Braids. No wavetables but added individual envelopes and multimode filters for all voices
- Much improved Sequencer with 8 Tracks, 16 Step Patterns, 16 Step Pattern Chains, up to 16384 Song Steps, Arpeggiator with 1/8 - 1/64 Steps, Arp Patterns including Euclidean settings, Pitched Drum- and Instrument Sample playback
- The sequencer can also play chords of various types, stacked up to 7 notes, using only a single sequencer track
- In addition to the chain based Sequencer here is a second sequencing tool: LIVE SEQUENCER
- LIVE SEQUENCER offers 12 tracks for recording up to 4 patterns each, including a Song mode with pattern muting
- Both sequencers do work together and are fully synced
- Global Mixer View with all Channels
- Multiband Master Compressor with 4 bands
- Sample Management from SD-CARD and PSRAM, samples can be loaded from SD-CARD to PSRAM during runtime.
- Touch Mute Matrix for live / real time performance
- Tracker View (Editor) - work in progress
- Track Print/Recording - work in progress
- Remote control in web-based 1:1 UI with added features (file manager, file transfer, screenshots etc.) Work in progress - connected to PC/MAC via Teensy MicroUSB Connector

Contributing

This project lives from the contributions of C++ developers, testers, reviewers. Please check https://codeberg.org/positionhigh/MicroDexed-touch/issues to help in open topics or add your own Issue or Feature Request.

Buttons, Encoders and Connectors (MDT/MDTX)



1. Soft Power on/off
2. TRS Stereo Audio Jack of DAC (Line out)
3. Second SD CARD Slot
4. Teensy MicroUSB Connector to PC/Mac
5. USB HOST Port
6. PROGRAM Button
7. TRS/DIN MIDI OUT
8. TRS/DIN MIDI IN
9. Headphone Amplifier Output
10. Encoder Left (ENC_L)
11. Encoder Right (ENC_R)

MicroDexed-touch (MDT/MDTX) features several buttons, encoders, and connectors that allow for interaction with the device and to integrate it into your music/studio setup. However there is a lot you can achieve with MDT as a standalone device, only.

Connectors

2 - TRS Stereo Audio Jack of DAC (Line out): This jack provides the main audio output from the MDT's digital-to-analog converter (DAC), which uses a PCM5102 chip.

3 - Second SD Card Slot. This makes it much easier in the future to copy to/from the internal SD Card. (Work in progress).

4 - Teensy MicroUSB Connector to PC: This connector, associated with the Teensy 4.1 microcontroller, connects the MDT to a computer. It enables communication for MIDI to PC, USB audio streaming, using a Web based Remote Console and firmware updates.

5 - USB HOST Port: This port allows you to connect a USB MIDI keyboard/controller, expanding the MDT's input options.

7 - TRS/DIN MIDI OUT: This connector transmits MIDI data to other MIDI devices. It uses a 3.5mm TRS jack that can connect to TRS-A or TRS-B devices or to a DIN MIDI device using an adapter.

8 - TRS/DIN MIDI IN: This connector, using the same 3.5mm TRS/DIN configuration as the MIDI OUT, receives MIDI data from external MIDI controllers or sequencers.

9 - Headphone Amplifier: Recent MDT versions offer an optional headphone amplifier that can be included or bypassed using jumpers on the PCB

Buttons

1 - Soft Power on/off: This button, available on recent MDT PCB versions, provides a convenient way to power the device on and off, especially when using an optional battery. Currently this only affects the Teensy, not the Display or other Addon Parts.

6 - PROGRAM Button: This button, also present on newer PCBs, serves as a recovery mechanism if issues arise during firmware flashing

Encoders

10 - Encoder Left (**ENC_L**): This encoder has multiple functions depending on the context:

- Navigation: A short press typically returns to the main menu or moves one level up in the menu hierarchy
- Volume Control: Rotating the encoder adjusts the volume, with a visual indicator displayed momentarily
- Sequencer Control: A long press usually starts and stops the sequencer

11 - Encoder Right (**ENC_R**): This encoder also has context-dependent actions:

- Selection/Confirmation: A short press selects or confirms a menu item, or moves deeper into a selected item
- Instance Switching: A long press switches between the two instances of Microsynth or Dexed
- Y-axis Navigation: In menus requiring two-encoder navigation (e.g., Song mode), **ENC_R** controls vertical movement

A quick summary how the push Encoders are working:

Encoder left will be referred to as **ENC_L** and encoder right will be referred to as **ENC_R**.

[SHORT PUSH] means a simple, momentary push on the encoder.

[LONG PUSH] means a push and hold down of the encoder for about 2 seconds.

Usually [SHORT PUSH] **ENC_L** brings you back to the main menu or closer to the main menu one step.

Usually [SHORT PUSH] **ENC_R** selects or confirms an input/menu item/goes deeper into this item.

On the Microsynth page and on the Dexed voice page, [LONG PUSH] **ENC_R**, switches between their 2 Instances.

In Menus that need 2 Encoders for navigation, **ENC_R** controls Y movement and **ENC_L** controls X movement (for example in Song mode)

[LONG PUSH] **ENC_L** starts and stops the sequencer on most pages.

ENC_L in Main menu and on most pages:

Turn left/right: Change the volume. The volume change screen appears when turning the knob and disappears after a short time and you return where you left off.

Notice: As an alternative input method, instead of the 2 encoders there are several other options. These can be used either by their own or in combination with the encoders. There is a dedicated extension connector to allow for easily adding push buttons, similar in usage as a gamepad for popular 8 bit/16 bit game consoles.This input method is also available via the USB HOST port and preconfigured to use commonly available USB Gamepads with USB connector, normally used for game console emulators on your Desktop PC/Mac.

Parts Lists

This BOM is currently changing a lot while being in development. However, using the components listed here at any time should lead to more or less the same functionality, but the "look" might change here and there.If part numbers or technical data are provided, you can also google them to find alternative shops that are suitable for you.

All Versions

Quantity	Item	Weblink / Technical data	Comments
1	Teensy 4.1 Microcontroller	PJRC Store Protosupplies Store (with 8 or 16MB PSRAM)	You do not need to buy it directly from PJRC but it is a good choice. If you do not want to solder the Teensy pins by yourself, or the (optional) PSRAM chip, you now can order it from https://protosupplies.com/product/teensy-41-microdexed/ fully soldered and tested, specifically for MDT. It is offered in two configurations with either 8 or 16 MB of PSRAM. Both versions will work. About the Teensy: You also can use the “Ethernet-Version” of the Teensy, it also works, however that will not add any functionality.
1	PSRAM Chip	PJRC Store Protosupplies Berrybase Store Nettigo Store IC PSRAM 8MB SOIC8 (Google: PSRAM 8MB Teensy 4.1)	PSRAM Chip for Custom Samples and better audio effect times You will get much higher audio delay effect times when having this chip. Further, since 8/2024 it allows for loading custom samples in performances, even during runtime in a stable manner. This is the replacement for the previously used serial flash chip. The serial flash now is considered optional but it might become useful in the future again for different purposes.
1	PCM5102 Module	 AliExpress Amazon PCM5102 DAC - GY-PCM5102 12S 32mm x 14mm	Other I2S DACs could also work but the PCB and Case are designed to work and fit for this single type.
1	2,8" OR 3.2" ILI9341 TFT or ILI9341V TFT with **capacitive** touch	ILI9341 TFT with **CAPACITIVE** touch: AliExpress Link 1 AliExpress Link 2 AliExpress Link3(US) Make sure you pick the version **with touchscreen**, the default option is the screen without touch! Some vendors on AliExpress make the version selection for touch or touchless **by selecting a specific "color"**. ILI9341 TFT / ILI9341V TFT	The MDT original screen size was 2.8". Since Summer 2024 front-panel/lids for the 3.2" display are available as SLA print and also an optional, pcb-based front panel. So now both screen sizes, 2.8" and 3.2" are ready to be used for MDT. The newer **3.2"** with **CAPACITIVE** touch display is the **new default**. SLA and FDM case/enclosure types are partly interchangeable. You can mix the front/back part for 3D printed SLA and FDM parts. Double check the front part is matching your display size and type. This interchangeability is NOT applicable for the pcb-based or metal enclosure types, these are completely different designs. The **3.5" Display** that often is listed on the same vendor page, will **NOT work** at all since it is using a **different resolution AND different chipset.**
1	Headphone Amplifier	 Aliexpress Amazon Part-Number: TDA1308 (read comments)	Warning: The audio headphone amplifier is just thought for what the name implies, it is a louder/stronger output for headphones. The audio quality is not as clean as it is directly from the DAC - but it is louder. The direct output of the DAC is identical to the last version of MDT and is a good source for making audio recordings. The best possible output for recording you will get is with the digital S/PDIF output. (If you do have recording equipment that supports it.)
1	Flash Memory Module	AliExpress W25Q128 Flash Memory Module STM32 with W25Q128 NOR-Flash-Chip - Part-Number: RBS16393	**Deprecated.**

All Versions			
2	Low height 24-Pin Socket	Reichelt BKL- 32 POS Protosupplies 10-piece low profile socket set for MDT Toby.co.uk Valcon - Breakable socket strip 40 pin AliExpress E-Simpo (10pcs) Female Header 2.54mm 1x24, straight	For Teensy - you need only 24 pins not 32 - however since the availability seems poor, it is no problem to cut it to any shorter length - The black plastic part is 3.81(Reichelt/BKL)/3.5mm(Aliexpress/China typical), the total height incl. pins is 7mm, and 6.7 respectively Technically, these sockets are optional. It is possible to solder directly to the board using the male pin headers.
1	Low height 9-Pin Socket	Reichelt - 10 POS breakable Female Header 2.54mm 1x09, straight	For the PCM5102A DAC
1	Low height 6-Pin Socket	Reichelt Female Header 2.54mm 1x06, straight	for the SPI Flash module (**currently unused/Deprecated**)
1	Low height 5-Pin Socket	Reichelt Female Header 2.54mm 1x05, straight	for the PCM5102A DAC
1	Low height 4-Pin Socket	Reichelt Female Header 2,54mm 1x04, straight	For Teensy USB HOST
2	Low height 3-Pin Socket	Reichelt Female Header 2.54mm 1x03, straight	For TDA1308 Amp
2	Low height 2-Pin Socket	Reichelt Female Header 2.54mm 1x02, straight	Teensy PRG BUTTON and TDA1308 Amp
2	24-Pin Header	Reichelt Mouser Europe - Wurth Digikey - Wurth AliExpress (10pcs)-10.5mm Pin Header 2.54 mm 1x24, H=10,8 straight	For Teensy to connect to pin socket - turn the long pin side down (to socket on main PCB), the short side will be snipped off. These Reichelt strips (and many others) can be snapped/cut to size Please order 1-2 extra pieces so you have some parts ready for other jumper pins or when something goes wrong with the pin cutting.
1	9-Pin Header	Reichelt - 14 Pin breakable strip Mouser Europe - Wurth Digikey - Wurth Pin Header 2.54 mm 1x09, H=10,8 straight	DAC The short side will be snipped off
1	6-Pin Header	Reichelt Mouser Europe - Wurth Digikey - Wurth Pin Header 2.54 mm 1x06, H=10,8 straight	Flash module (Deprecated) The short side will be snipped off
1	5-Pin Header	Reichelt Mouser Europe - Wurth Digikey - Wurth Pin Header 2.54 mm 1x05, H=10,8 straight	DAC The short side will be snipped off
1	4-Pin Header	Mouser Europe - Wurth Digikey - Wurth Pin Header 2.54 mm 1x04, H=10,8 straight	Teensy USB Host connector The short side will be snipped off
9	3-Pin Header	Reichelt Mouser Europe - Wurth Digikey - Wurth Pin Header 2.54 mm 1x03, H=10,8 straight	2 for the TDA1308 Amp -The short side will be snipped off 7 For the Amp and MIDI jumpers (DO NOT CUT THESE SHORT)
2	2-Pin Header	Reichelt Mouser Europe - Wurth Digikey - Wurth Pin Header 2.54 mm 1x02, H=10,8 straight	Teensy PRG Button/SFT Power and TDA1308 Amp The short side will be snipped off
7	Jumper	Reichelt Mouser Europe Digikey AliExpress	Just in case you do not have any standard PC jumpers - used for MIDI Mode selection and other options on the PCB. One piece it at 0.02 €

MDT DIY/THT (Through-Hole Technology)

Quantity	Item	Weblink / Technical data	Comments
1	MDT PCB	PCBWay.com Elecrow	While it is possible to build most of MicroDexed-touch without a PCB, it makes it much easier. PCBWAY is the first choice since this is where the first PCB for the project started. Since 08/2024 ELECROW is added as a manufacturer for the MDT PCB.They produce the PCBs in advance so it is possible to buy a single PCB from them (compared to PCBWAY which always build to order)
1	Switching Diode 1N4148	Reichelt Mouser Europe Digikey AliExpress 100 V, 150-300 mA, DO-35	For MIDI I/O
2	Resistor 27K Ohm	Reichelt Mouser Europe Digikey AliExpress Resistor, 27 kOhm, 0207, 250 mW, 250V, 5%	For headphone amplifiers. These values are currently approximated. Depending on your headphones, these should be better scaled higher or lower - will be discussed on discord chat Metal Film or Carbon Film A higher precision (1%) is also ok to use.
1	Resistor 470 Ohm	Reichelt Mouser Europe Digikey AliExpress Resistor, 470 Ohm, 0207, 600 mW, 250V, 1%, Metal Film	For MIDI I/O Carbon film resistors are cost-effective but less precise and stable, while metal film resistors offer higher precision, stability, and reduced noise at a higher cost. This link at aliexpress has every resistor that is needed for this build.
1	Resistor 220 Ohm	Reichelt Mouser Europe Digikey Resistor, 220 Ohm, 0207, 600 mW, 250V, **1%**, Metal Film	For MIDI I/O To test your resistors for precision, hook them up to a multiplier - if a 100 ohm resistor only fluctuates between 99.5 and 100.5, it's 1%
2	Resistor 47 Ohm	Reichelt Mouser Europe Digikey Resistor, 47 Ohm, axial, 250 mW, 400V, 5%, Metal Film	For MIDI I/O A higher precision (1%) is also ok to use.
2	Resistor 680 Ohm	Reichelt Mouser Europe Digikey Resistor, 680 Ohm, 0207, 250 mW, 250V, 1%, Metal Film	For MIDI Activity Lights
3	Mini Audio Jack Socket 3,5mm TRS	Reichelt - Part-Number: KB3SPRS Mouser Europe Digikey - Part-Number: SJ1-3515 Amazon - Part-Number: CESS-318 AliExpress - Part-Number: PJ324	For audio line out and MIDI I/O
1	Jack - USB Type A Right Angle	Reichelt Mouser Europe Aliexpress Part-Number: A-USBSA or 67643-0910 or MC32593	USB HOST Connector Jack
3	Electrolytic Capacitor 100µf	Mouser Europe Digikey	Power and audio optimizations
1	Ceramic Capacitor 100nf	Mouser Europe Digikey	Power and audio optimizations
1	Ceramic Capacitor 220nf	Mouser Europe Digikey	Power and audio optimizations

MDT DIY/THT (Through-Hole Technology)			
1	IC Socket	Reichelt Mouser Europe Digikey Aliexpress Box Set IC Socket, DIP, 8-pin, double spring contact	For 6N138
1	6N138	Reichelt Mouser Europe Mouser Europe SMD Digikey Aliexpress Optocoupler 6N138, DIP-8	For MIDI I/O
1	Female Header 14 POS	Digikey Harwin Digikey Sullins Mouser Europe Harwin Toby.co.uk AliExpress 14-Pin Socket Terminal Strip, straight, RM 2.54, H: 8.5mm	PCB to Display Connector Double check that the height is 8.5 mm
2	Angled Push Switch	Reichelt Mouser Europe - 3.15mm Actuator Digikey AliExpress Link 1 AliExpress Link 2	The linked item has options to select various push-lengths. It is suggested to use the shortest or one of the shorter versions since otherwise it can get complicated to fit the pcb into the enclosure.
5	JST-EH 2-Pin Header Vertical	Reichelt Mouser Europe Digikey Aliexpress	For optional 5 internal connections JP9 PWR SW, JP10 EXT PWR, JP1 SPDIF/IN, JP2 SPDIF/OUT, G3 You can also use standard pin headers, but they are not keyed for polarity. The connectors at Aliexpress are ok, but their wires are ?.
1	Red LED 2mA	Reichelt - Part-Number: L-7104LSURDK (T1) Mouser - Part-Number: 3RDL-S (T1) Digikey - Part-Number: HLMP-1700 (T1) Digikey - TLLR5400 (T1 ¾)	Midi activity lights It is recommended to use these low-amperage LEDs, “standard” LEDs could overburden the Teensy 4.x I/O pins current specifications. If the 2mA LEDs are not obtainable, try using a 1K resistor for the green LED, and a 1.2K for the red.
1	Green LED 2mA	Reichelt - Part-Number: L-7104LGD (T1) Digikey - Part-Number: WP710A10LGD (T1) Digikey - HLMP-4740 (T1 ¾)	Midi activity lights It is recommended to use these low-amperage LEDs, “standard” LEDs **could possibly** overburden the Teensy 4.x I/O pins current specifications. If the 2mA LEDs are not obtainable, try using a 1K resistor for the green LED, and a 1.2K for the red.
2	Rotary Encoders	Mouser Europe Bourns 20K 24ppr/24det (26.5) OAL Mouser Europe Bourns 25K 24ppr/24det (31.5) OAL Mouser Europe Bourns 25F18ppr/18det (31.5) OAL Incremental, Quadrature, 2 bit code, with push switch and detents	Most generic rotary encoders, such as the EC11 series, from any brand, should work if the shaft length is right. But make sure that they have a **push button switch** function. A 26.5 OAL encoder will yield 10mm of shaft on top of the lid. A 31.5 OAL encoder will yield 15mm of shaft on top of the lid. Try to match the number of pulses with the number of detents.
2	Knobs	Mouser Europe Mouser Europe Aliexpress 6mm shaft diameter	Make sure to purchase knobs that match your encoder shaft type and height. Only about a .5mm-.75mm gap is really needed for the switch.Some knobs claim to work with **both** D and knurled shafts. The 3d self-print knobs listed below for MDTX should also work.
1	Male Pin Header	Mouser Europe - JST Digikey - JST 11 Position, Pitch RM2.50 or RM2.54mm	For optional gamepad controller connection B1 Standard Pin headers could work here, IF they were of the shorter variety (such as 9.5mm at Aliexpress), or right angle.

MDTX (SMD + Through-Hole Technology)

Quantity	Item	Weblink / Technical data	Comments
1	MDTX PCB	PCBWay.com	
2	RGB Encoder	"Sparkfun" knurled 25.3mm OAL: Mouser Europe Digikey (BOM) COM-15141 SparkFun Antratek Berrybase Eckstein RobotShop KiwiElectronics Pimoroni COM-1006 Bourns knurled shaft (25mmOAL): Digikey Mouser US Farnell Mouser Europe 26F D-SHAFT (26mm OAL) Digikey Bourns 26G D-SHAFT (26mm OAL) PEL12T-4231G-S1024 - can't find PEL12T-4231F-S1024 - can't find	3d models for SLA and FDM (self) print or print by PCBWAY will be provided for the knurled (flower) 18mm and 21mm shaft. If you want to go for a commercial translucent knob, you probably have more variety with 25mm shaft Encoders, knurled shaft. Some knobs claim to work with both flat and knurled shafts. The 25mm shaft Bourns RGB encoders are the second easiest to find. The Bourns 25mm knurled version should expose approximately 8.5mm of shaft above the lid, while the 26mm D-shaft should expose 9.5mm, and the 31mm D-shaft should leave 14.5. Try to match the number of pulses with the number of detents. This is still a work in progress.
2	Light Emit Knobs 6mm shaft diameter	Mouser Europe - Sparkfun knob Digi - Sparkfun Knob Digi - Cliff Translucent needs Translucent Cap Thonk (UK) - Davies 1900H Clear Duppa (Italy) - Black Aluminum Top Dot Style Duppa (Italy) - Silver Hat/Top Dot Style Aliexpress - 16x10mm tall	FDM 18mm shaft (Sparkfun) SLA 18mm shaft (Sparkfun) FDM 21mm shaft SLA 21mm shaft Downloads at the bottom of the page: MDTX

MDT PCB V0.94 and earlier (Deprecated)

Quantity	Item	Weblink / Technical data	Comments
1	MDT mini PCB	PCBWay.com Deprecated	While it is possible to build most of MicroDexed-touch without a PCB, it makes it much easier. PCBWAY is the first choice since this is where the first PCB for the project started.
1	IC Socket	Reichelt Mouser Europe Digikey Aliexpress Box Set IC Socket, DIP, 8-pin, double spring contact	For 6N138
1	6N138	Reichelt Mouser Europe Mouser Europe SMD Digikey Aliexpress Optocoupler 6N138, DIP-8	For MIDI I/O
1	Switching Diode 1N4148	Reichelt Mouser Europe Digikey AliExpress 100 V, 150-300 mA, DO-35	For MIDI I/O

MDT PCB V0.94 and earlier (Deprecated)			
2	Resistor 27K Ohm	Reichelt Mouser Europe Digikey AliExpress Resistor, 27 kOhm, 0207, 250 mW, 250V, 5%	For headphone amplifiers. These values are currently approximated. Depending on your headphones, these should be better scaled higher or lower - will be discussed on discord chat Metal Film or Carbon Film A higher precision (1%) is also ok to use.
1	Resistor 470 Ohm	Reichelt Mouser Europe Digikey AliExpress Resistor, 470 Ohm, 0207, 600 mW, 250V, 1%, Metal Film	For MIDI I/O Carbon film resistors are cost-effective but less precise and stable, while metal film resistors offer higher precision, stability, and reduced noise at a higher cost. This link at aliexpress has every resistor that is needed for this build.
1	Resistor 220 Ohm	Reichelt Mouser Europe Digikey Resistor, 220 Ohm, 0207, 600 mW, 250V, **1%**, Metal Film	For MIDI I/O To test your resistors for precision, hook them up to a multiplier - if a 100 ohm resistor only fluctuates between 99.5 and 100.5, it's 1%
2	Resistor 47 Ohm	Reichelt Mouser Europe Digikey Resistor, 47 Ohm, axial, 250 mW, 400V, 5%, Metal Film	For MIDI I/O A higher precision (1%) is also ok to use.
3	Mini Audio Jack Socket 3,5mm TRS	Reichelt - Part-Number: KB3SPRS Mouser Europe Digikey - Part-Number: SJ1-3515 Amazon - Part-Number: CESS-318 AliExpress - Part-Number: PJ324	For audio line out and MIDI I/O
1	Jack - USB Type A Right Angle	Reichelt Mouser Europe Digikey Aliexpress Part-Number: A-USBSA or 67643-0910 or MC32593	USB HOST Connector Jack
1	Female Header 14 POS	Digikey Harwin Digikey Sullins Mouser Europe Harwin Toby.co.uk AliExpress 14-Pin Socket Terminal Strip, straight, RM 2.54, H: 8.5mm	PCB to Display Connector Double check that the height is 8.5 mm
2	Angled Push Switch	Reichelt Mouser Europe - 3.15mm Actuator Digikey AliExpress Link 1 AliExpress Link 2	The linked item has options to select various push-lengths. It is suggested to use the shortest or one of the shorter versions since otherwise it can get complicated to fit the pcb into the enclosure.
2	4-Pin Header	Reichelt Standard Reichelt JST straight Mouser Europe JST straight Digikey JST straight Digikey R/A standard Right angle or Vertical is your option for development Pin Header RM 2.54mm, 1-row, 4-pin or JST EH	Encoder Header - **Deprecated** **Since MDT PCB Version 0.95 this part is no longer needed**
1	Cable	Reichelt Cable, 4-Pin, with Dupont connectors, F/F	Deprecated. For older MDT PCB's without their own encoder footprint. Cut in half to make the needed two pieces.

MDT PCB V0.94 and earlier (Deprecated)			
2	Rotary Encoder with push switch 15mm shaft with threads and nut	DigiKey - PEC11R-4215F-S0024 **(21.5 OAL)** Most generic rotary encoders, such as the EC11 series, from most brands should work. But make sure that they have a **push button** function. A shorter, 12mm shaft encoder may work with shorter knobs (18.5 OAL) Even an 18mm shaft encoder might work with the right knobs. (24.5 OAL) Incremental, Quadrature, 2 bit code, with push switch and detents	Deprecated. For older MDT PCB's without their own encoder footprint. If the encoders have a small PCB with pull-up resistors, in general it is suggested to remove them when used with MDT or better to remove the additional PCB altogether. Debouncing is done in software. Also verify that the encoders have a bushing (t**hreaded shaft)** that can be **fastened with a nut/fastening ring**. Try to match the number of pulses with the number of detents.
2	Knobs	Digikey AliExpress 6mm shaft diameter	Make sure to purchase ones that match your encoder shaft type, and height. Only about a .5mm-.75mm gap is really needed for the switch. The majority of knobs without a pointer indicator are D shafts.
7	JST EH Header	Reichelt Mouser Europe Digikey Aliexpress 2 Pin Vertical	For the optional 7 internal connections JP9 PWR SW, JP10 EXT PWR, JP1 SPDIF/IN, JP2 SPDIF/OUT, G3,G2, G1 You can also use standard pin headers, but they are not keyed for polarity. The connectors at Aliexpress are ok, but their wires are ?
1	Male Pin Header	Mouser Europe - JST Digikey - JST 11 Position, Pitch RM 2.50 or RM2.54mm	For optional gamepad controller connection BI Standard Pin headers could work here IF they were of the shorter variety, or right angle.
1*	Pin Header Dual Row	Digikey 2x15	A single solid block instead of individual pin headers For the ***optional** jumper blocks.

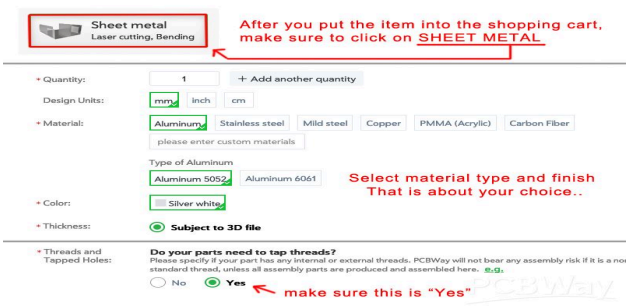
Cases/Enclosures

FDM and Self Print Case			
Quantity	Item	Weblink / Technical data	Comments
1	DIY 3D printed Case	You can order the SLA printed case from: PCBWay The download/order links are at the bottom of the page.	Make sure you pick the correct size for your selected display. As an alternate solution there is also a PCB-based (non-printed) back and front plate available and there also is a metal case available. See case/enclosure chapter below in this manual.
8	Screws - M3	Aliexpress - Hex Head Aliexpress - Philips Pan Head	Enclosure Mounts, LCD Mounts 6mm for top and 6mm or 5mm for LCD, 6mm for bottom (8mm if using rubber feet. Check optional parts list for nylon and metal washers for even more specific spacing
4	Nuts - M3	Aliexpress	LCD mounts
4	Threaded Inserts	Aliexpress	M3 x 5.7 x 4.6
10	Nylon Washers	Aliexpress .5mm	For spacing the LCD. You may not need this many, or any at all, but any extras should cover all possibilities.

Developer's Enclosure

Quantity	Item	Weblink / Technical data	Comments
1	PCB-based Case	Available from PCBWAY: Bottom part PCBWay Front part (2.8" Display): PCBWay Front part (3.2" Display): PCBWay Optional (Enclosure back cover): PCBWay	This is a more cost effective solution compared to the self printed or SLA printed case above. It is just 2 (empty) PCBs that are connected by M3 screws/extensions and M3 nuts. The MDT PCB is attached with M2 screws and M2 nuts. As an option, a third part can be added to the bottom, to function as a protective layer and it also might improve the overall stability.
4	Screws - M2	Aliexpress - Philips Pan Head	PCB Mounts 5mm or 6mm
4	Nuts - M2	Aliexpress	PCB Mounts
16	Nuts - M3	Aliexpress	Enclosure Mounts, LCD Mounts
12	Screws - M3	Aliexpress - Philips Pan Head Aliexpress - Hex Head	Enclosure Mounts, LCD Mounts 6mm for top and 6mm or 5mm for LCD, 6mm for bottom (8mm if using rubber feet, and 10mm for rubber feet and optional base piece together. Check the optional parts list for nylon and metal washers for even more specific spacing.
4	Nylon Standoffs	Aliexpress - Female/Female_15mm Aliexpress - Male/Female_15mm	Enclosure Mounts The M/F option is useful if you are going to be opening the top often
10	Nylon Washers	Aliexpress	For spacing the LCD. You may not need this many, or any at all, but any extras should cover all possibilities.

Sheet Metal Case

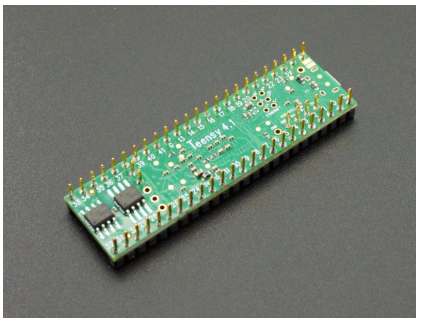
Quantity	Item	Weblink / Technical data	Comments
1	Metal Case	Back Part:PCBWay Back Part:PCBWay This is a unique case based on bent sheet metal. Most professional looking and very sturdy. However, it is a bit more costly. You can order it either plain or with various coatings, surface finishes etc. When ordering the back part from PCBWAY, make sure these options are ticked, especially the "**Do your parts need to tap threads?**":	
12	Screws - M3	Aliexpress - Philips Pan Head	Enclosure Mounts, LCD Mounts 6mm for top and 6mm or 5mm for LCD, 6mm for bottom (8mm if using rubber feet.
16	Nuts - M3	Aliexpress	Enclosure Mounts, LCD Mounts
4	Screws - M2	Aliexpress - Philips Pan Head	PCB Mounts 5mm or 6mm

Sheet Metal Case			
4	Nuts - M2	Aliexpress	PCB Mounts
10	Nylon Washers	Aliexpress	For spacing the LCD. You may not need this many, or any at all, but any extras should cover all possibilities.

Optional Parts			
Quantity	Item	Weblink / Technical data	Comments
1	Kapton Tape	Aliexpress Polyamide, one sided	For protecting the back of the LCD from possible shorts against the PCB. A single 3”x2” piece will do, or three strips of 25mm
1	LCD Mask Tape	Aliexpress	For blocking light leaks from the edge of the LCD that can be seen between it and the case lid.
4	Rubber Screw feet	Aliexpress	For experimental case options. 11mm X 9mm X 6mm
2	Button Cap	Reichelt- Red	For optional extension of the tactical switch buttons
1	Pin Header	Digikey 3x5	A single solid block instead of individual pin headers For the Amp Jumpers
1	Pin Header	Digikey 3x7	A single solid block instead of individual pin headers For the MIDI Jumpers

Products/Parts by Protosupplies

Products / Parts on this page are not created or offered by the microdexed developers directly but were designed together with them to offer rare or hard to find components/assemblies for (mainly) US Users. Warranty and product specifications on this page are by Protosupplies and apply only to products offered by Protosupplies to their customer(s).

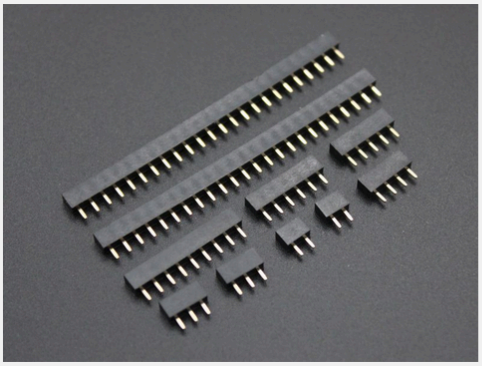


If you do not want to solder the Teensy pins by yourself, or the (optional) PSRAM chip, you now can order it from:

https://protosupplies.com/product/teensy-41-microdexed/ fully soldered and tested, specifically for MDT. (with 8 or 16 MB PSRAM). If you are not sure which to get, go for the 16MB Version.

However, you can upgrade it from 8 to 16 MB at a later point - if you are familiar enough with soldering tiny SMD parts/chips.

If you have any difficulty getting the low-height BKL sockets, specially if you are not in Europe but in the US, Protosupplies also has a replacement part for these sockets available:



MicroDexed Female Header Socket Set

$3.95

Complete set of female low profile headers for socketing the MicroDexed baseboard

30 in stock

1 ADD TO CART

When you are ordering your Teensy 4.1 through Protosupplies they will let you know on their web page what you can expect from them and to which extent they are providing certain warranties. Here is an excerpt from their web page:

Before they are shipped, the Teensy 4.1 has:

- Base Teensy inspected and tested by PJRC.
- PSRAM chip(s) installed.
- Gold-plated male header pins are installed from the topside of Teensy 4,1 as described above.
- Top pins are clipped and the board is cleaned of flux.
- Test software is run to test the PSRAM. Blink software is then redownloaded.
- Packaged in a resealable ESD bag for safe storage.

Protosupplies Teensy Warranty:

The warranty only covers manufacturing defects. We guarantee that the Teensy 4.1 will operate correctly when first received out of the bag. We encourage you to connect the Teensy 4.1 to a USB cable and download 'Blink' or other simple test program to verify the unit is basically functional upon receipt. Once it is installed into a hand-built baseboard and possibly subjected to shorts or other possible damaging electrical signals due to assembly or other errors, there is no guarantee that the Teensy 4.1 won't fail during use. Failures of this type are not covered by warranty. For help in troubleshooting MicroDexed system level issues, please refer to the links below.

International Customers:

We directly ship within the USA only. For international customers, we recommend creating a free account on **myus.com** which is a package forwarding service. We recommend myus.com as we have shipped many packages through them without issue, but there are many other package forwarders that can also be used if you already have an account setup elsewhere.

Once you sign up for an account, they will provide you with a USA address to use on the order since our website won't accept international addresses. This address includes a suite number which identifies your packages when they arrive at myus.com. Please use this address for both the shipping and billing address. The website will take international credit cards or PayPal.

We then ship the package to myus.com which takes about 2-3 days if you chose the $12.95 shipping and 5-6 days if you chose $6.95 shipping. They then take care of getting the package to you overseas. When the package arrives at myus.com, they will update it in your dashboard and send you an email to let you know that it arrived and to see how you want the package shipped overseas. This can range from postal to DHL Express.

Add PSRAM

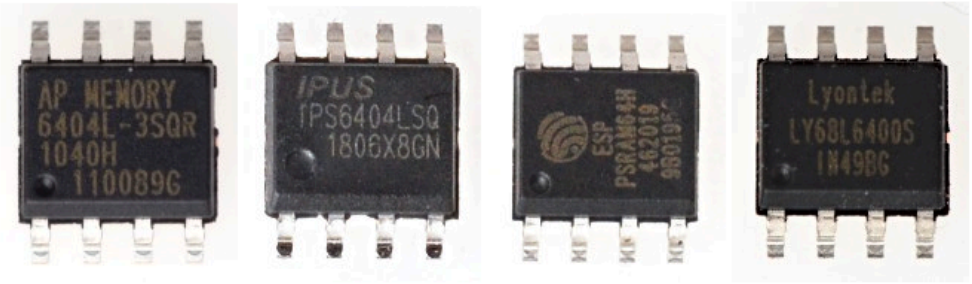
If you don’t want to go with a pre-soldered Teensy with PSRAM, it is possible to get and solder 1 or 2 PSRAM chips by yourself. For an entry point, please carefully study the PJRC page at:

https://www.pjrc.com/store/psram.html

You can get/buy the PSRAM chips directly from PJRC or from other vendors, listed in the BOM above in this manual. If you go for any other vendor, make sure you do get a supported chip, it should be identical to the shown chips below.

These are the supported chips, listed/tested by PJRC:

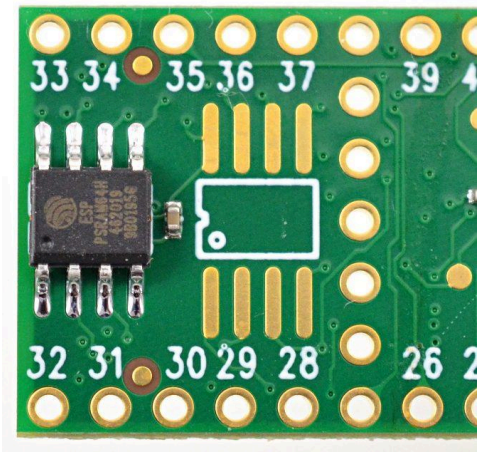
The following PSRAM chips have been tested with Teensy 4.1. Your order will be filled with one of these chips.



One PSRAM Chip for 8 MB Memory

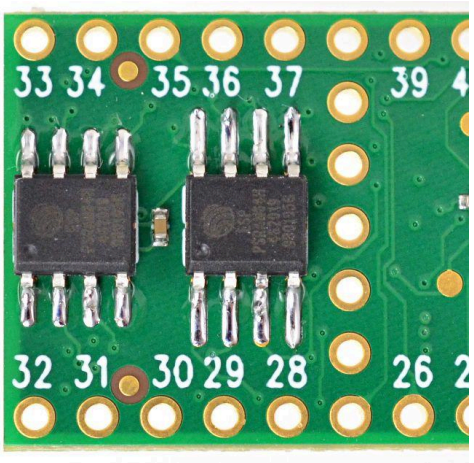
The PSRAM chip is meant to be soldered to the smaller pads on the bottom side of Teensy 4.1, underneath the SD card socket, between pins 31-32 and 33-34.

Do not use the larger pads. **A single PSRAM chip must be soldered to the smaller pads to be detected.**



Two PSRAM Chips for 16 MB Memory

If 8 MB isn't enough, you can solder 2 PSRAM chips for a total of 16 MB.



Build Guide

If you have already build a MDT in the past:

- The first MDT Version(s) used a resistive touch screen. There still is a binary firmware for this configuration generated for each new version, however, it is strongly suggested to not build new units with this display type since the newer, capacitive touch screen is superior in every aspect.
- If you have previously built an MDT with a capacitive touch display, it is possible to modify the MDT PCB to adapt to the newer display.

  However this requires cutting 2 traces that are below the display connector of the MDT PCB. It is not suggested making this modification if you don't have at least medium skill and experience in desoldering and soldering components with multiple pins.

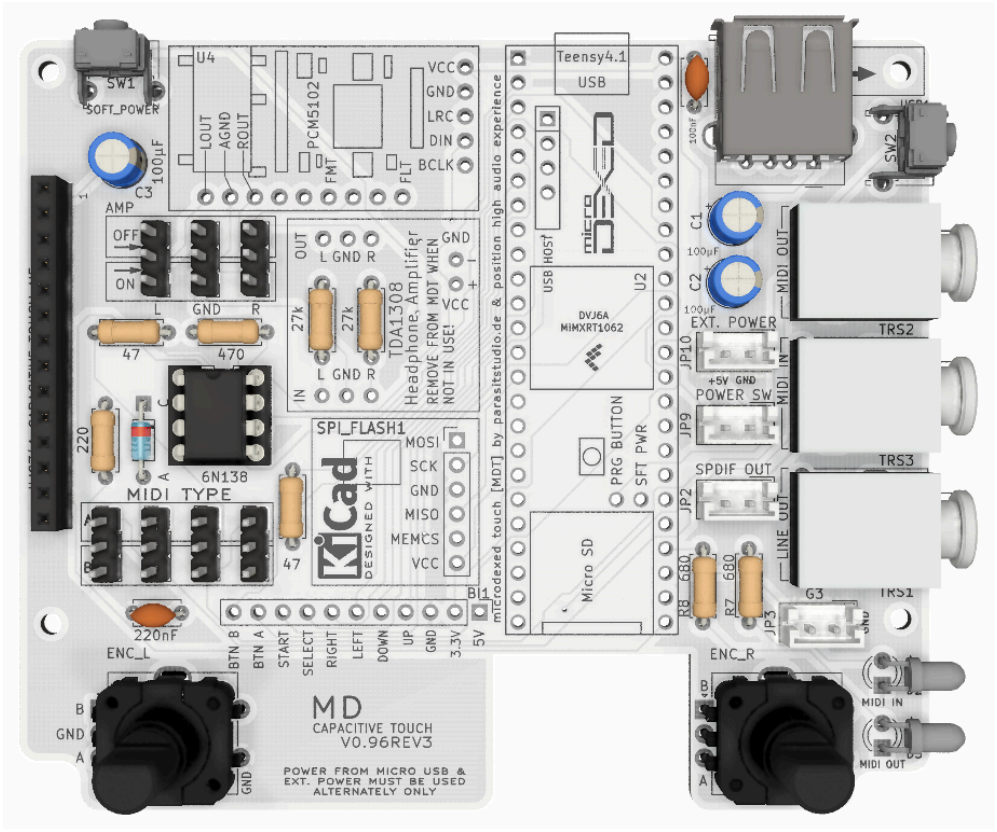
If you are new to MDT and want to build one:

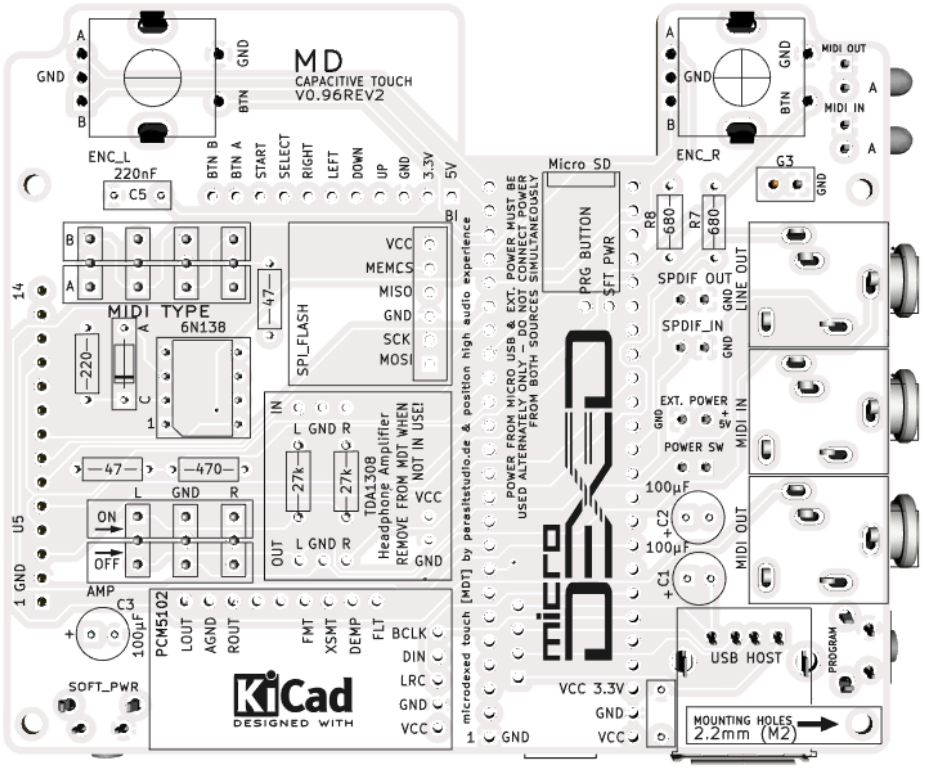
- You can build MDT with a 2.8" or a 3.2" capacitive touch display. The Firmware for both is identical, the only difference is the physical size of the display (and the enclosure top, “Lid-Part”).

  Since Summer 2024, the suggested **default display size is 3.2”**.
  The contrast might be a bit weaker but it is overall a much better experience.

  It is no longer required or recommended to use the external SPI Flash. Instead, go for 1 or 2 PSRAM chips that need to be soldered to the Teensy bottom side.

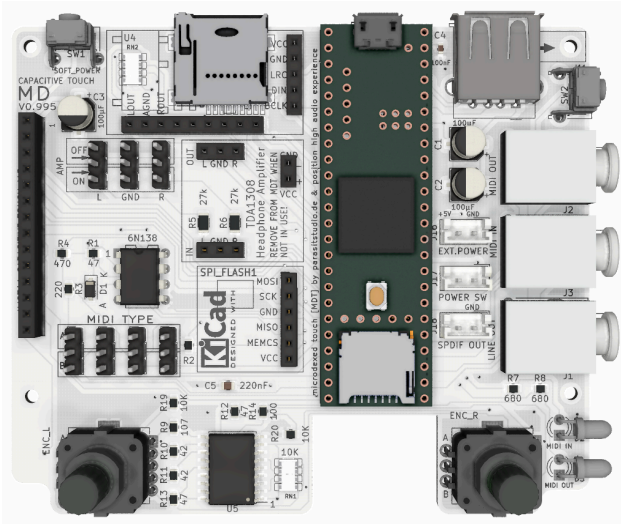
MDT PCB Front/Back



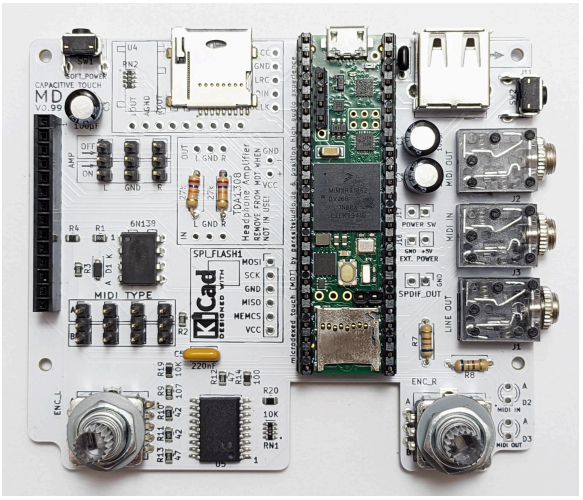


MDTX

MDTX is the bleeding edge version of MicroDexed. This is already available on PCBWAY, however be aware its specs are likely to change for some time going forward. This version is developed with the goal to offer an as much pre-assembled PCB, as possible. If you want to have the previous DIY approach, please go for the MDT version. It also still will receive updates..



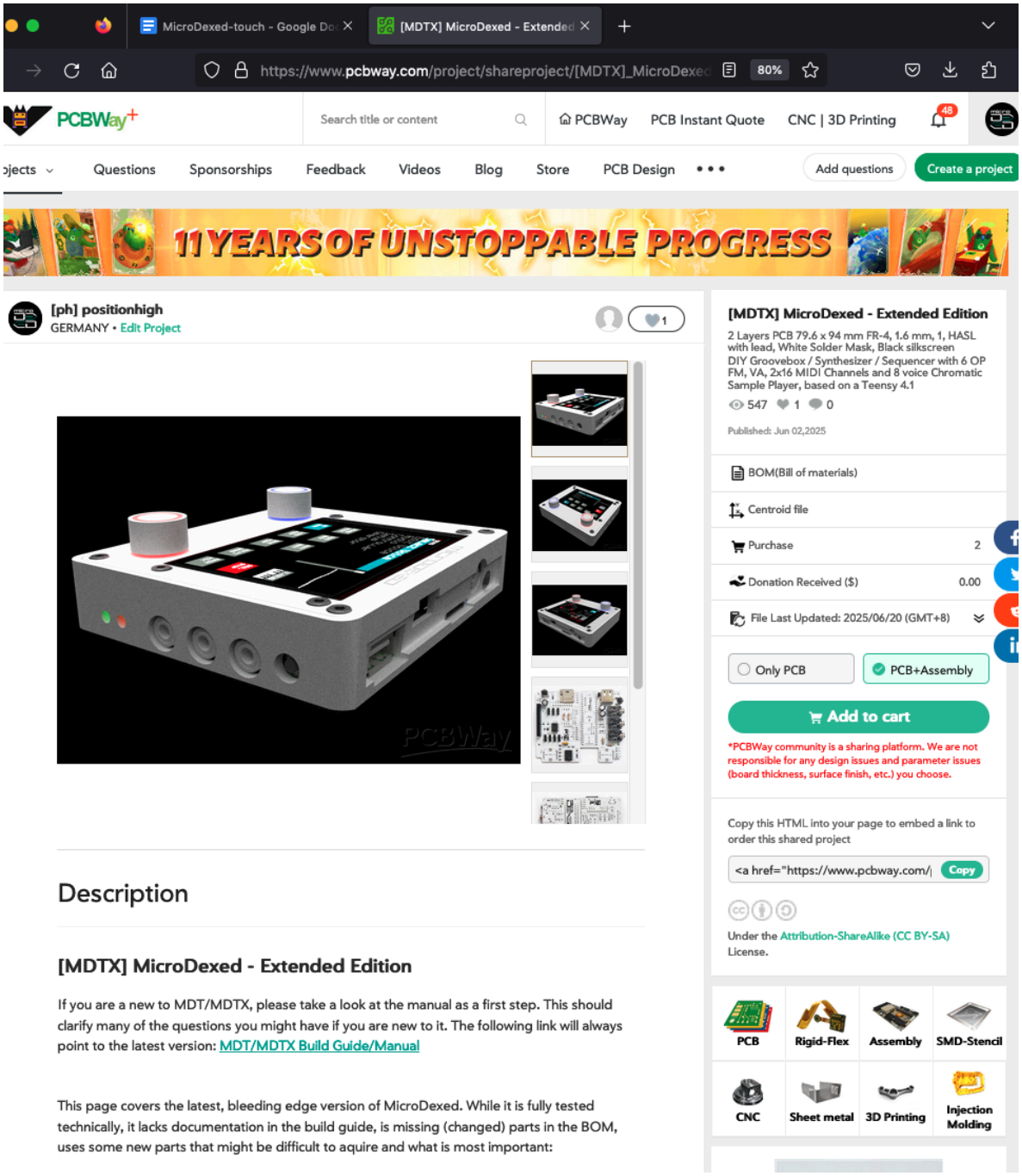
Most current rendering



Actual Hardware (with Teensy attached)

Buying the MDT PCB

The MDT PCB is currently available from PCBWAY and ELECROW.



Links to PCBWAY: MDT and MDTX

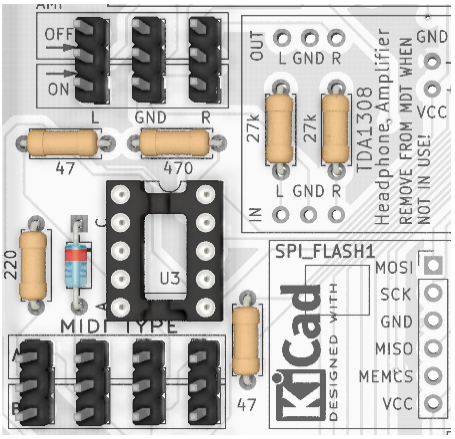
Link to Elecrow: MDT

If you register and pay as a new user at PCBWAY with this Invite link, you should get a $5 "New User Free Credit" - so you can order 5 PCB pieces for "free", except shipping and customs cost etc.

https://www.pcbway.com/setinvite.aspx?inviteid=565384

Resistors and Diode

Let's begin with the resistors. You need 6 resistors, the values are printed on the board and are also listed in the BOM. 2x 47 Ohm, 1x 220 Ohm, 1x470 Ohm. These are for the MIDI circuit. Two additional resistors are used for the MIDI Activity LEDs (on the latest PCB version). For resistors, it does not matter which direction you put them in. Then put in the 1N4148 diode. Make sure the **cathode** is pointing to the "**C**" side label on the MDT MCB. The cathode is marked with a "line" on one of the 2 sides. This line is also indicated on the MDT PCB.

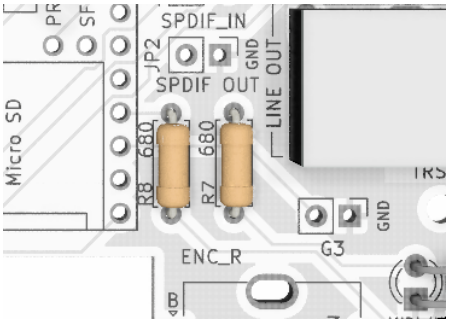


This chip/socket in the center of the left picture is the 6N138 Optocoupler for MIDI IN.

Make sure pin 1 is on the top left. Your chip will either have a notch at the top side or a circle mark at the first pin.

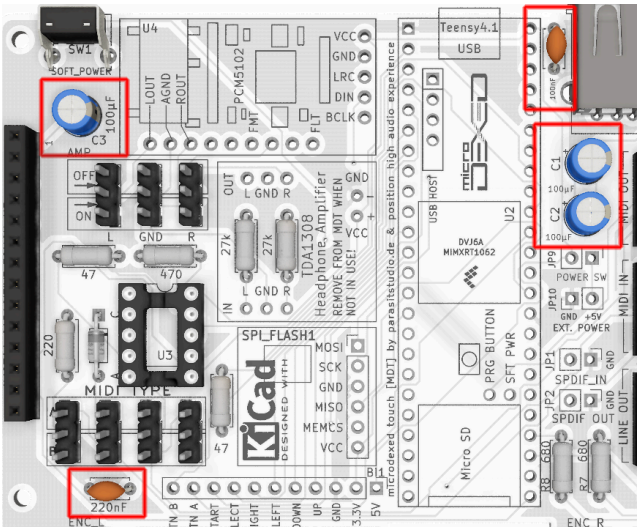
You can use an old-school IC socket, solder the IC in directly or use a socket with (round) precision pins.
All of these 3 methods should work fine.

NOTE: The location of the resistors, the diode and jumper blocks do vary on different versions of the MDT PCB. No matter what PCB you have in front of you, the correct values for the parts are printed on either the top or bottom PCB side (or both).



There are 2 more resistors R7 and R8 on the lower right side of the PCB.

Capacitors



There are 3 Electrolytic- and 2 Ceramic Capacitors on the PCB.

Electrolytic Capacitors **do** have a polarity:

Usually you see a marking for the minus pole on the outside of the shell with a line of - signs. Another indication is that the pin of the plus + pole is longer than the minus pole.

The Electrolytic Capacitors C1 and C2 on the right side are used in parallel. This is a design decision to make it easier for you to find fitting parts for the low height of the enclosure. If you do have one 200µf Capacitor available but not 2 100µf, you can use that instead at position C1 or C2 - as long as its physical size works out for the enclosure.

For the 2 Ceramic Capacitors, there is no polarity to watch out for. You can solder them in any orientation.

PIN Header / Sockets

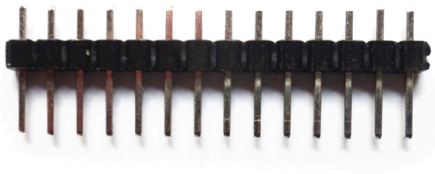
Understanding this chapter is one of the most important steps in building MDT successfully.

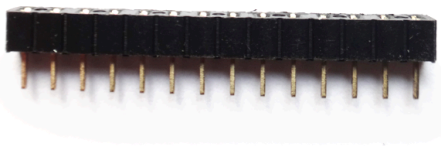
The goal here is to fit all components below the height of the assembled display, that will go on top at a later step. This also means that everything will fit the various default enclosures you can select from.

Many components in MDT are socketed. In today's electronics, sockets usually are not found in any consumer hardware any more since they would raise the product price and repair and easy replacement seems not to be on the focus of any commercial hardware company.

We decided to go for sockets since this allows you, the user, to make changes/tests, without dealing with desoldering (so much). Desoldering components with many pins is especially challenging, if you do not solder that much as your hobby.

At the time of writing, MDT and also MDTX do feature many sockets. That might change for MDTX in the future since this has more of a buying pre-assembled approach. However, since this can not fully be offered due to several reasons, all described methods for the sockets apply for all versions.





For the Teensy, the PCM 5102 DAC and the (optional) external Flash Chip, we will use pin rows and socket rows (and not IC sockets). **The (low height) sockets will be soldered to the MDT PCB and all components will be attached to them with pin rows.**

As the counterpart to the (special low height) sockets, we will use standard rows of pin headers with the pins of the short side of the plastic spacer snipped off.

We keep only the side with the longer pins.
Since the top side of Teensy will be blocked by the plastic spacers, you solder the pins onto the bottom side of Teensy.

This is the reason why the pins are seemingly 2-3mm longer than they need to be for the sockets but the soldering will take up (some) of this extra space.It is possible to solder the parts the other way around. However for this guide, the above method is the suggested way.

For the Teensy we need 2 pieces of 24 pins, one piece with 2 pins and one piece with 4 pins.

So for both long rows, leave the plastic spacers exactly where they are from the factory and snip off the short pin side, directly above the plastic spacer. For the smaller 2 pin and 4 pin rows, it is exactly the same procedure.

This is a bit tedious. Take your time and take breaks when necessary.

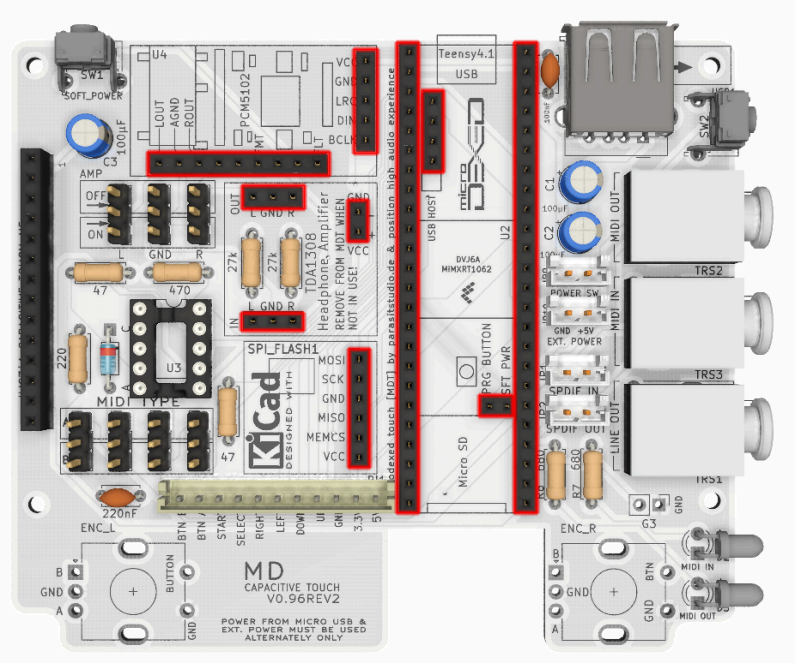
Please take care to not hurt yourself or others while you snip the pins. These pins are sharp when cut and will fly off unpredictably if you are not careful.

Place yourself so that the cut pins will not fly in your direct direction and use eye protection so nothing can happen in this process to you, others around you or your pets 🐈 🙂

The next steps will depend on which MDT/ PCB Version you have.

The more recent versions, beginning from V0.95, do incorporate the Encoders directly onto the PCB. This simplifies several steps and makes it an overall better / more fail-save experience. Please jump ahead, depending on what PCB you have in front of you.

If you have the partly pre-assembled MDTX, also skip all steps that were already done by PCBWAY.



After you have cut the 2 long rows (as described on the previous page above), continue the procedure for the much smaller rows for the 2 rows for the PCM5102 and the USB Host Connector between the 2 long Teensy rows. Also do not forget the tiny 2 pin connector for the PROGRAM and SOFTPOWER switches.

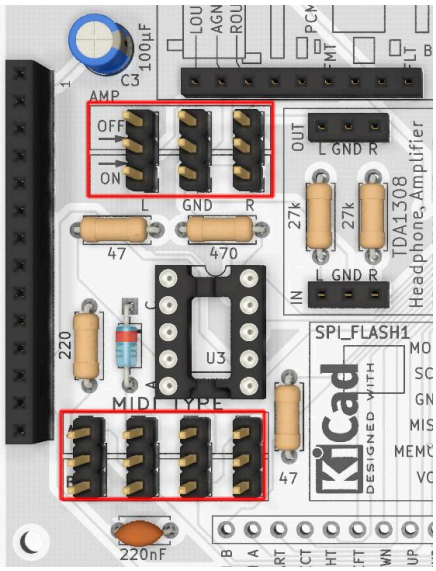
Note that we are not connecting the SCK pin for the PCM5102 so that row only has 5, not 6 pins.

You can ignore the SPI_FLASH marked area. This is currently no longer in use.

DO NOT make a pin row and do not solder a low-height socket for the display connector on the far left side. That will use a different connector.

When you have the pin rows ready, solder in their countering **LOW-HEIGHT SOCKETS** to the **RED** marked locations.

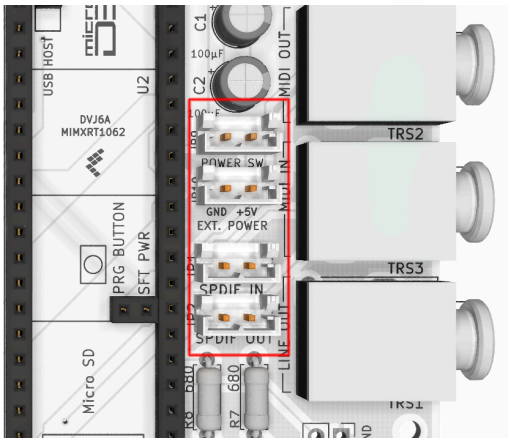
Again, you can ignore the SPI_FLASH.



The 14 pin Display connector at the left side uses a **normal height** socket/connector, **DO NOT** solder in a **low/half height row socket** there.

All the headers/jumpers for **MIDI TYPE** and the **AMP** are regular pin headers, you do not have to cut anything or do anything unusual here. These are all regular jumper sockets/pins, like on a Computer/PC Mainboard.

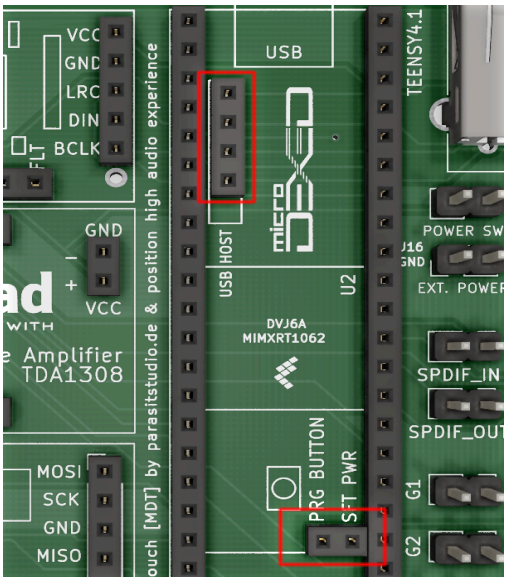
The bottom (11 pin) connector is not in use by default (BI - Button Interface).
This is thought to let you use a button-based user interface instead or in combination with the encoders. This is a tinkerer option - you can ignore this for a default build.



On the right side, there are several optional connection options for external power and S/PDIF. If you do not plan to use any of that, you can ignore them.

In the past we used the same pin headers as for the MIDI and AMP section here. That was good enough, to solder a wire to it and test out things quickly. However, it was not possible to attach a real connector since it would clash with the display above.
Thus we replaced these connectors with a smaller JST type socket you probably have seen on your PC mainboard or other consumer electronics.
This type comes now pre assembled when you pick the assembly version on PBCWAY, for either MDT or MDTX.

Teensy Additional Sockets



The small 4 pin row between the 2 large Teensy pin rows is for **USB MIDI HOST**. Do not forget to put in the low-height socket and also the counterpart pin headers on the Teensy.

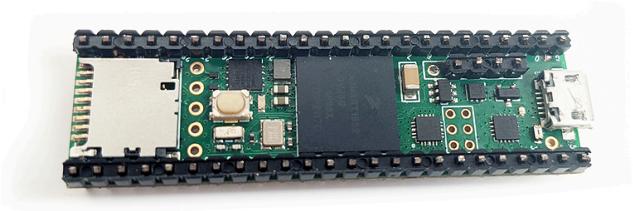
Put in the sockets on the PCB and test fit with the Teensy if everything lines up before you solder the sockets and pin rows.

It is a suggestion to solder only the first and last pin, then every 4-5 pin of every row, test if it fits and then solder all remaining pins.

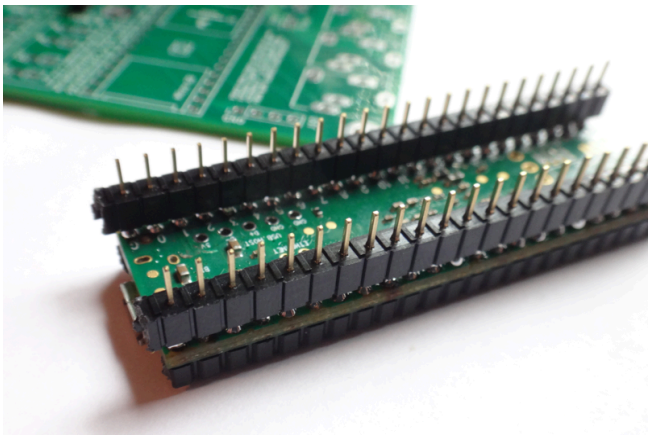
The capacitive touch PCB has an option to add buttons for **soft-power** and a **program-button**.

The **program-button** really is only required when something during firmware flashing goes wrong.

In this case it is more convenient that the button is reachable without opening the enclosure.
The **soft-power** function is mainly useful when using MDT with an optional battery.



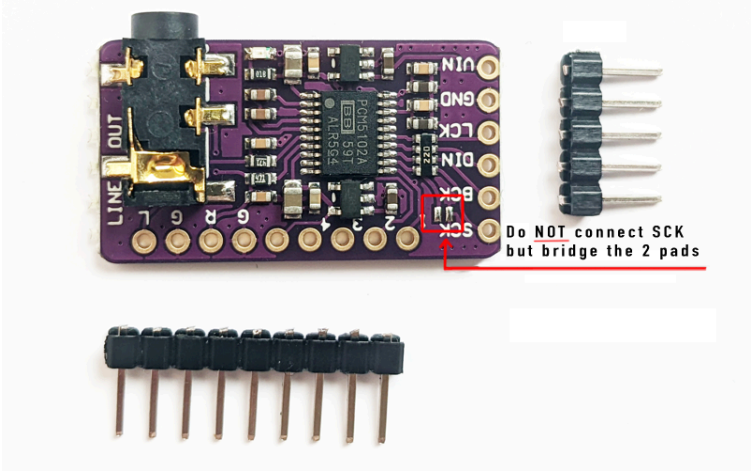
Teensy with pin headers soldered



Teensy with pin headers and sockets, loosely attached to it to test fit.

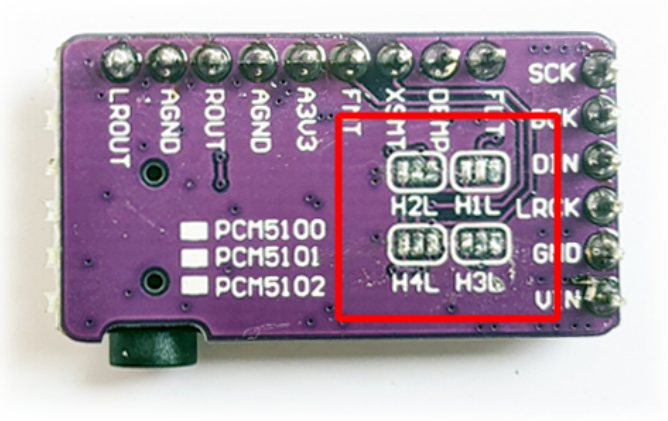
Audio (DAC)

Use the same kind of connector for the PCM5102 DAC Board. Snip off the short side of the header pins.



Do not make any connection for the SCK pin to the MDT PCB. Instead, close the 2 small pads on the top side to force SCK to ground.

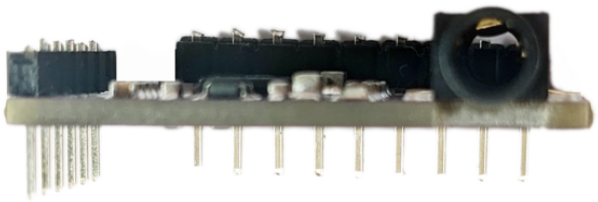
This will tell the PCM5102 to run its own, internal clock signal.



If any of the solder bridge pads on the backside come closed by the factory, remove all of them with a desoldering wick or your preferred desoldering tool/method.

If you get distorted/garbled audio, try to solder the bridges 1,2,4 to LOW , middle pad + right side and leave pin 3 without connection to LOW or HIGH.

Pin 3 will be controlled by the Teensy for audio muting control.



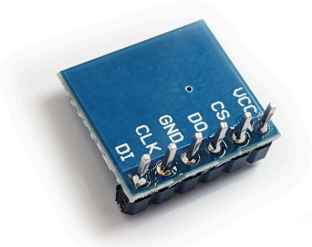
Front view with pin headers attached

SPI FLASH board (currently no longer used - depreciated)

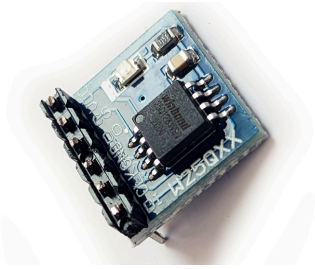
Instead of manually soldering the Flash Chip to the Teensy Audio Board as we did in the previous generation, we go for this plug-and-play, 2$ board that already has a Flash Chip soldered on by factory.

So you only need to solder standard size pins/connectors.

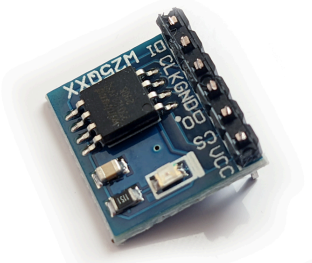
Do the same procedure as for the Teensy for the connection to the main PCB. Use pin headers, leave the plastic spacers exactly where they are at the factory and snip off the short pin side, directly above the plastic spacer.



Flash board with pin headers soldered, backside



Flash board with pin headers soldered, frontside

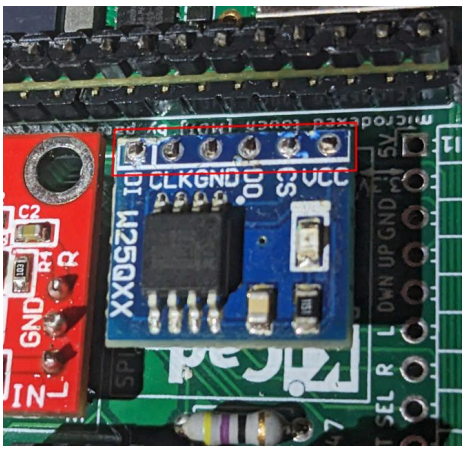


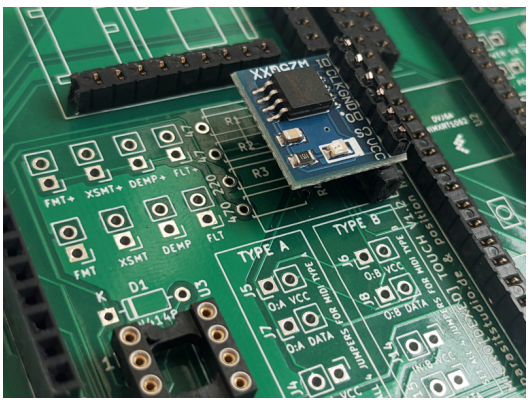
Flash board with pin headers soldered, frontside

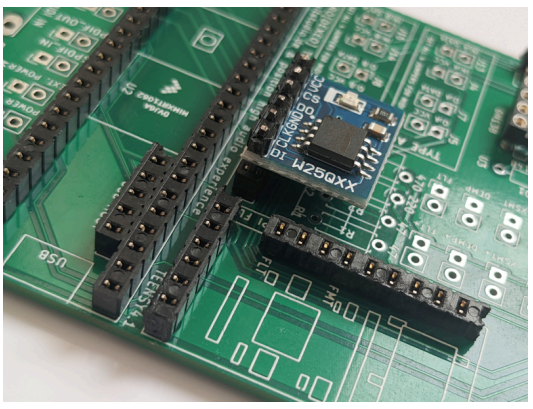
If you use the 3.2” Screen: Please remove the plastic spacer from the top of the SPI FLASH after soldering the pins from the bottom side.

You can force the plastic spacer off with a screwdriver or pick it up with small pliers. The reason to remove it, is that the display backside of the 3.2” Screen will have a connector sticking out and the pin row of the Flash board is the point where it will be touching first. So if you remove the plastic spacer, you have 2-4mm more room for display level height adjustments.

Another way is to take out the SPI Flash module since its previous function is now replaced by the PSRAM chip (if you do have installed one)

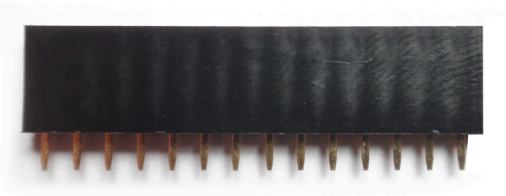


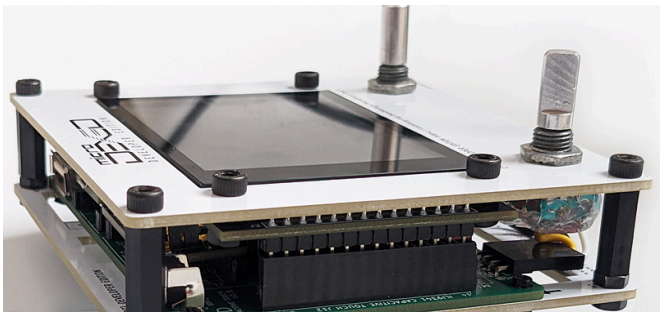




Display

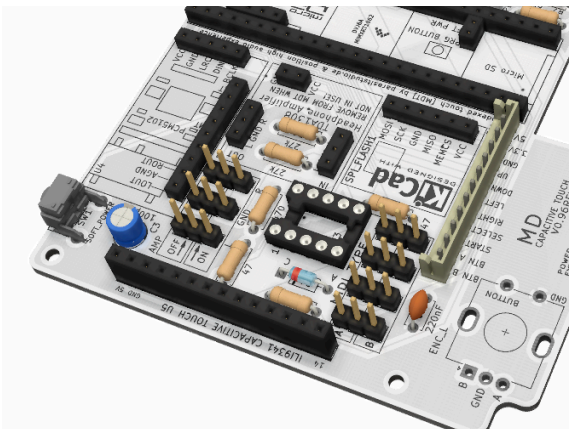
The display connector used in MDT is a standard size connector (**8.5mm tall**), not the half height connectors used in the previous steps. The connector should match up with the pin header that the display comes with by factory default.





It should not matter if there is a small gap between the lid + display and the pin socket, when fully assembled. The connection is still stable when the gap is not getting much bigger than in this example picture.

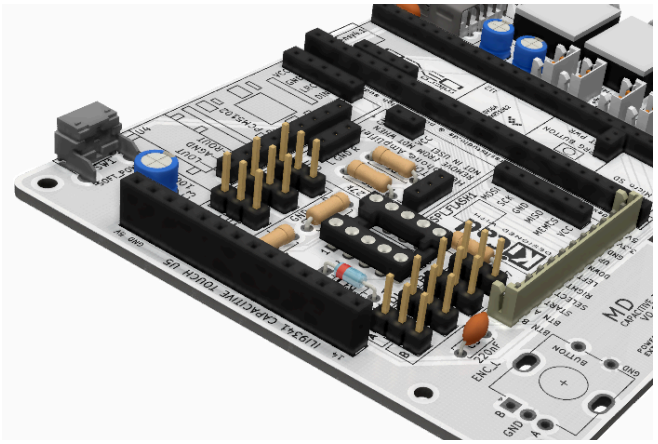
The gap depends on your 3D print, how much solder you have used, on the audio board pin rows etc - it will also be influenced by how tight you screw on the display to the lid, and with which spacers, in a later step.



There are various versions/kinds of this display on the market so there might be some unknown tolerances.

If the display turns out to be to high in the top shelf when fully assembled, the gap between the connector pins and socket on the MDT PCB allows for putting spacers to the **4 display holding screws** + nuts, so you can adjust the position a bit to make it flush to the device top faceplate.
If nuts are too big for any adjustment, washers, or small pieces of thick tape might help in this situation, placed at the corners of the display on the backside of the lid part.

If your display is working but your touch screen input is reversed/mirrored in one or both directions, you can change it in **SYSTEM - SYSTEM SETTINGS**.



Generic advice for the Display

Regardless of which display is used (2.8", 3.2", capacitive or resistive):

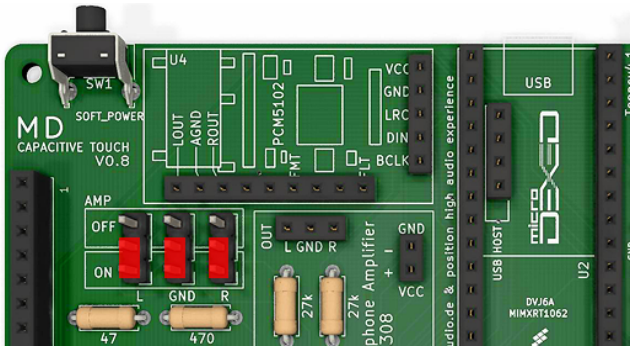
Depending on your soldering, you might or might not need to take off the metal lid from the SD card reader from the TFT backside. If you got the Teensy with sockets low enough to fit several layers of paper between the display backside and the Teensy top side, then there is no need to remove it.
If you are sure you do not need it in the future, you can quickly snip it off at its 4 holding / soldering pads with a small cutting tool.

To avoid any unwanted electrical contact on the bottom side of the TFT to the teensy pin headers, you should put a non conductive layer between them. Kapton (Polyamide) or Electrical tape, 1-2 layers, should be sufficient.

Before complete assembly, visually check that none of the components on the MDT board are touching the bottom of the display board. There should be sufficient clearance from all components when the SD reader is removed from the bottom of the display.

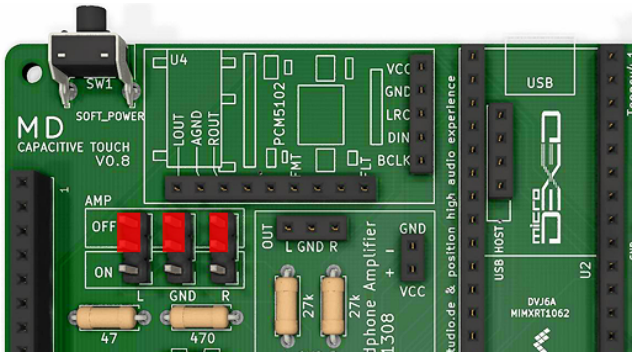
MIDI and AUDIO AMP Jumpers

The **AUDIO AMP** jumpers apply to **MDT Capacitive Touch**, only.



The spacing of the jumpers is slightly different on the most recent PCB. There, the pin spacing follows a strict 2.54mm ”grid” so it is possible to solder in full pin-rows (instead of single, 3 pin jumpers)

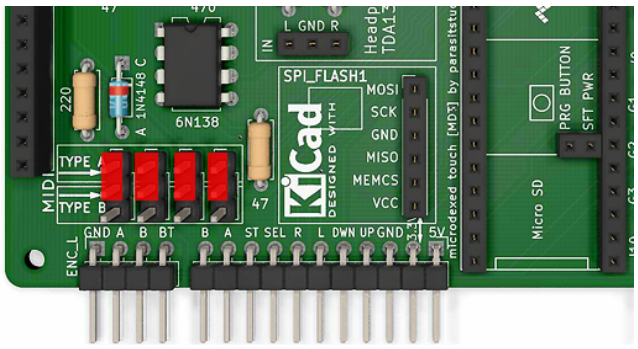
If you have added the optional Headphone Amplifier, set the 3 AMP Jumpers to the ON position.



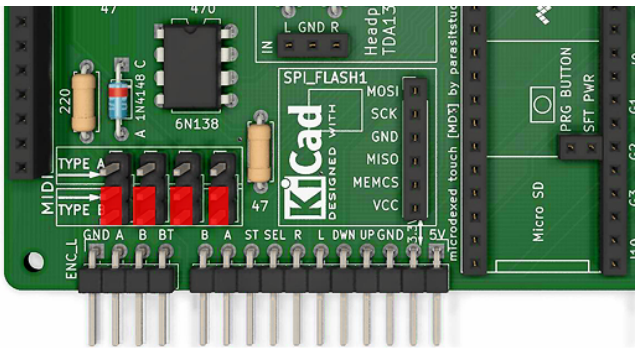
If you have not added the optional Headphone Amplifier, or want to bypass it, set the 3 AMP Jumpers to the OFF position.

NOTICE: if you have the Amplifier but decide you want to skip it, please **REMOVE THE AMPLIFIER** from the MDT PCB completely.

This is because the circuit will feed back the (unamplified) output of the DAC into the Output of the Amp, when connected, which is technically wrong.
This could be fixed by adding/introducing additional jumpers. However, when you do not want to use the Amp or (don’t have it), it does not make much sense that it is present on the board after all.

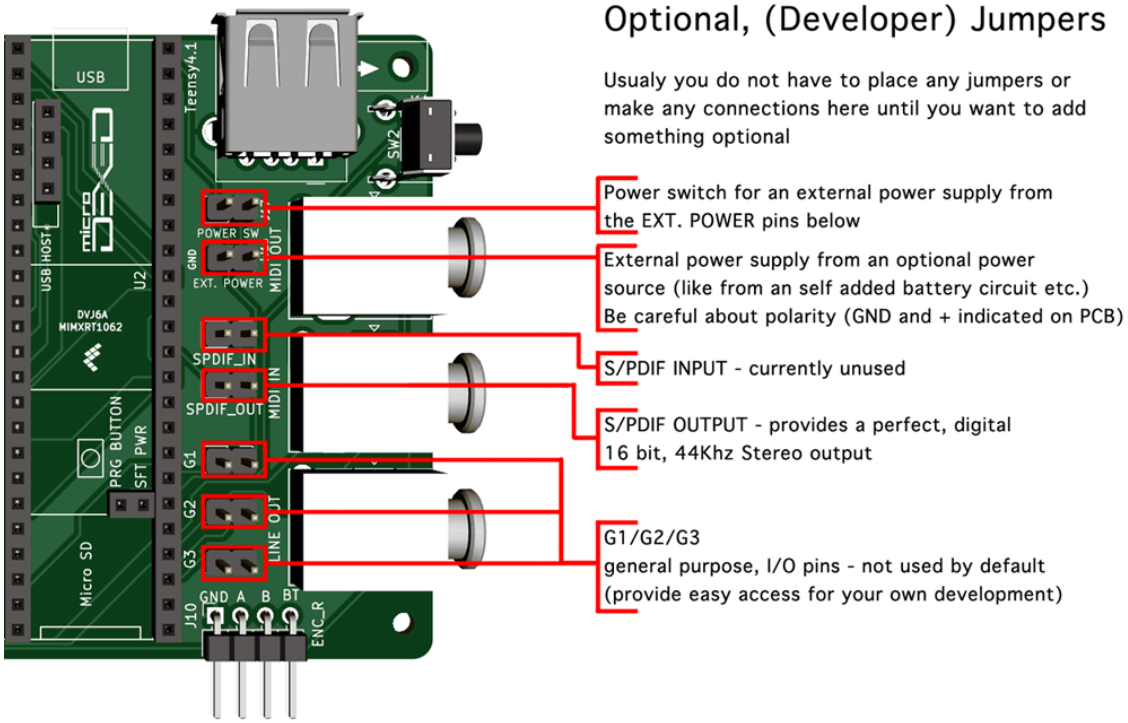


If you want to use TRS JACK TYPE A MIDI devices on Input and Output, place jumpers to the A position.



If you want to use TRS JACK TYPE B MIDI devices on Input and Output, place jumpers to the B position.

Optional Pins / Connectors on the right side of MDT PCB



Usually you do not have to place any jumpers here and do not have to make any connections. Consider this jumper block as optional when you want to add any customized code, external rechargeable battery board etc.

If you do have any S/PDIF outboard equipment, you might want to use the digital output S/PDIF pins to connect to your digital mixer or other digital input device to get a perfect, digital clear 16bit, 44Khz stereo output from MDT master output.

S/PDIF OUTPUT is known and tested to be fully working, S/PDIF **INPUT** is currently unused/untested.

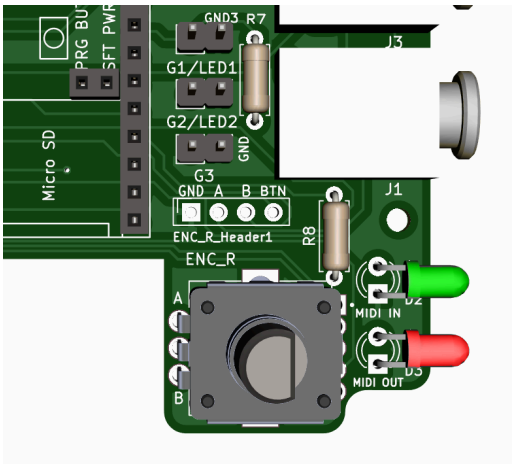
The **G1** and **G2** Pins are removed in the current PCB Version and are now used by the MIDI Activity LEDs

G3 is still available on MDT while on MDTX it is now used by the second SD Card slot.

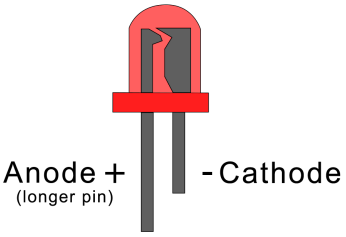
NOTICE:

Position of EXTERNAL POWER INPUT and POWER SWITCH are swapped in the latest PCB Versions and updated to more modern JST Connectors. DOUBLE CHECK THE TEXT LABELS ON THE PCB before connecting anything power related.

LEDs (MIDI Activity Lights)



The MIDI Activity Lights are part of the default MDT Firmware starting from March 2025. They use the Generic I/O Pins 1 and 2, which are still present as pin headers on the PCB. This means you still can use these pins for other purposes but in this case you have to compile the code from source and disable the MIDI Lights code.



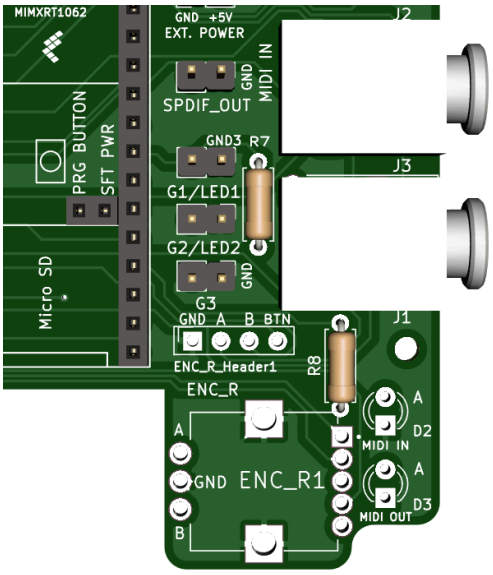
When soldering the LEDs, make sure you use **low current, 2mA LEDs** only. The Teensy 4 I/O pins should not be used directly with regular LEDs, these would overburden the Teensy chip in the long term and might cause damage to it.

LEDs do have a **polarity**. The **longer leg** is the Anode, marked with "**A**" on the MDT PCB, on both PCB sides.

Depending on from which direction you want to see the LEDs, you have to shorten the LED legs more or less. Make sure you do not confuse the legs polarity, when soldering them in finally.

SLA cases from PCBWAY from **mid 2025/06** will have holes for the LEDs by default.

If your MDT enclosure is earlier and white, translucent or another bright color, you probably do not need to drill any holes into the enclosure, to see the LEDs.
You can angle them 90 degrees, like in the picture above or use them without bending, to see them from the top view.
If you want to see them from the front, or have a dark/black case and do not want to drill any additional holes, with a bit of effort you can solder the LEDs to short cables and then let them be viewed through the front venting slits.If you do so, make sure everything is well insulated so you do not create any short circuits by accident.

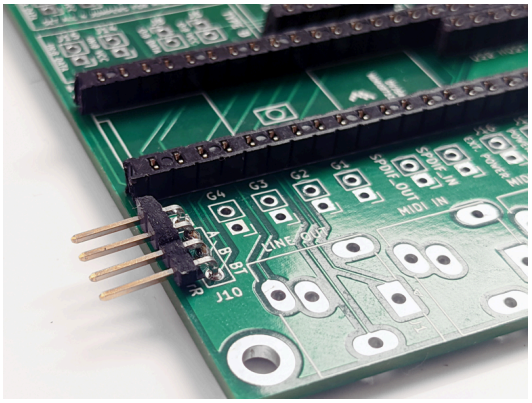


If you have ordered the MDT **Metal case** after February 2025, it will come with holes for the LEDs by default on the right side, below the 3 TRS jacks. This is necessary for the metal case since otherwise you obviously would not be able to see them.
When you solder the LEDs, first test fit with the PCB in the Metal bottom case part so that you cut the pins of the LEDs to the perfect length.

Do not forget to solder in Resistors **R7** and **R8** when you want to use the LEDs.
If you do want them, it is not useful to solder pin headers to the G1/LED1 and G2/LED2 position since these can not be used for any other purpose at the same time.

The Generic Purpose **G3** pin header is **not used** in standard MDT and is free for any of your own addon/modification and be used by your own custom code.

Encoders for older MDT PCBs



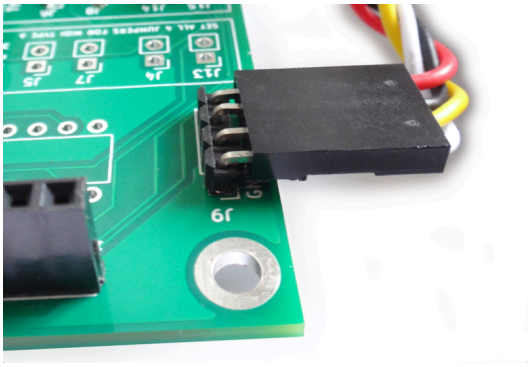
If you have an older MDT PCB that does not incorporate the encoders on the PCB directly, please read this chapter carefully.

For the 2 encoder connections, it is advised to use angled pin headers.

Also, depending on your encoders, if they come with a small PCB on their bottom to connect the pins instead directly to the decoder, it might be a good idea to solder the pin headers very lowly as seen in this image or even better to remove the attached tiny PCB from the encoders.

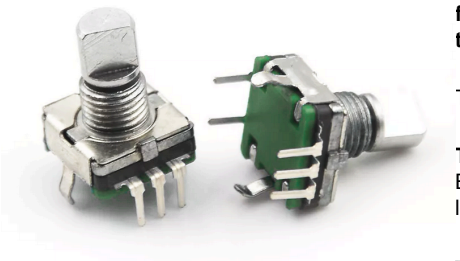
This way they will use the free space "above" the encoder's PCBs and won't collide with them.

If the encoders come with some resistors on the backside, it also is suggested to either remove the resistors (by force or by desoldering). These resistors are known to cause issues in encoder direction processing and push events.



Use standard dupont connectors for the encoders. 1 pin is ground, followed by the 2 encoder pins, then the last pin is for the push button. If you are using encoders that come on a small PCB with resistors located at the bottom side and you experience unwanted "button push" events or other wrong encoder behavior, try to remove any resistors from the PCBs.

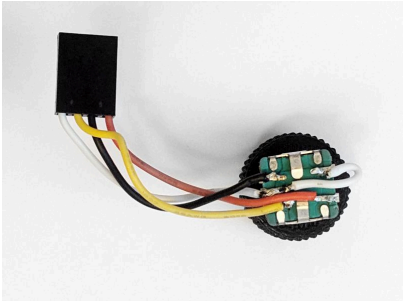
In fact it would be even better to remove the whole PCB and just use the bare encoders alone. This will prevent any collision with the SD Card in the Teensy, located very closely when you do not remove the small PCB. The resistors on the encoder PCBs aren't necessary since debouncing is done in software and if you keep them, they are known to cause more problems than they help. If you find the **encoder input is swapped around**, there is no need to re-solder the A and B pins. These input pins can be swapped in software in the System - System Settings Menu.

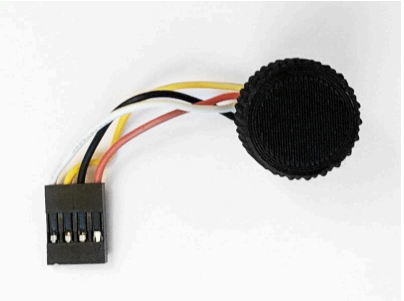


When your encoder does not have a common ground (GND) pin for encoder + button function but has separate GND pins for them, you can bridge both GND pins directly at the encoder.

This way you only have to connect one GND pin to the MDT PCB from each encoder.

TIP: If possible, try to go with 12mm, low height encoders similar to these (1st position in the BOM for encoders - but beware - they **do not include** any fastening nut). These short encoders look and feel ideal for MDT.





MDT (Metal enclosure) with the 12mm (low height) encoders

Any generic rotary encoder, from any brand, should work with MDT. But make sure that they have a **push button** function. Also verify that the encoders have a **threaded shaft** that can be **fastened with a nut/fastening ring**. Not every vendor will sell the encoder with a fastening ring/nut included. If you do not have any available already, try to buy from a vendor that does include it. Do not trust the pictures from the vendor completely alone, it is good advice to check for the item description/text for what you actually can expect to receive, specially when buying from an unknown vendor.

Encoders (recent MDT PCBs)

MDT PCB Version 0.95 and above do have the encoders directly integrated on the MDT PCB. This should reduce problems and errors users were fighting with before. The 2x 4 pin connectors and the cable to connect them is no longer necessary.

The suggested encoder(s) to use are **PEC11R-4220F-S0024** from Bourns. If you can't get this part specifically, it should be possible to use other brand encoders as long as they have the same pin layout, spacing, height and other specs.

Some (other) encoders have the **A and B pins swapped** around.
This will really not matter. You can swap the A and B pins in the MDT Firmware (in Software). But make sure you use 2 **identical** Encoders for Left and Right.

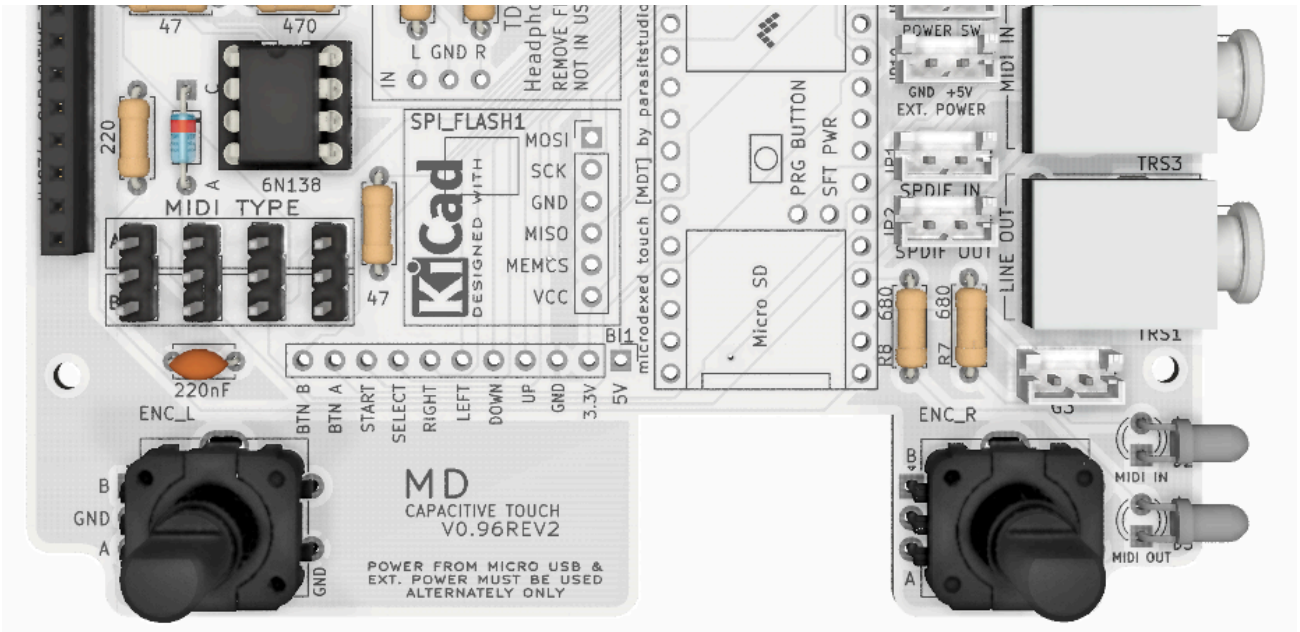
Please do not go for the cheapest encoders you can find.

The 2 encoders are the main "user interface" component of MDT. There are significant quality differences, longevity and "feeling/haptics" when using them.

The Bourns encoders provide a solid experience, there is always a 1:1 input/output correspondence and the steps are precise and distinct. No input steps are skipped or doubled up etc.
Also changing the encoder direction, while scrolling, seems to be more solid than on "cheap" encoders.

Notice that it is **no longer required to have a threaded shaft** for the encoders since they are soldered directly onto the PCB.

If you find another encoder that is particularly good to be used with MDT, matching all the above criteria, including knobs and height, feel free to make a suggestion in our discord chat.



Encoders (MDTX)

Encoders and Knobs for MDTX are currently not fully figured out. If you order MDTX partly preassembled, and PCBWAY has this part on stock and can deliver, the encoders will be either Bourns PEL12T-4021F-S1024 or from Sparkfun.

These are available with various shaft types and heights. Please check in the BOM for the most recent status about Encoders and suggested Knob Types. There are several commercial Knobs that will fit MDTX. However, you can do a DIY approach and print them your own or let PCBWAY print them.

Since a self-print usually can cover only one color, you have to print them in white and with no support structure.

Depending on the encoder type you have, we provide 3D print models for 18 and 21 mm shaft sizes.
You can find the download and order links at the bottom of the MDTX page on PCBWAY (or above in the BOM).



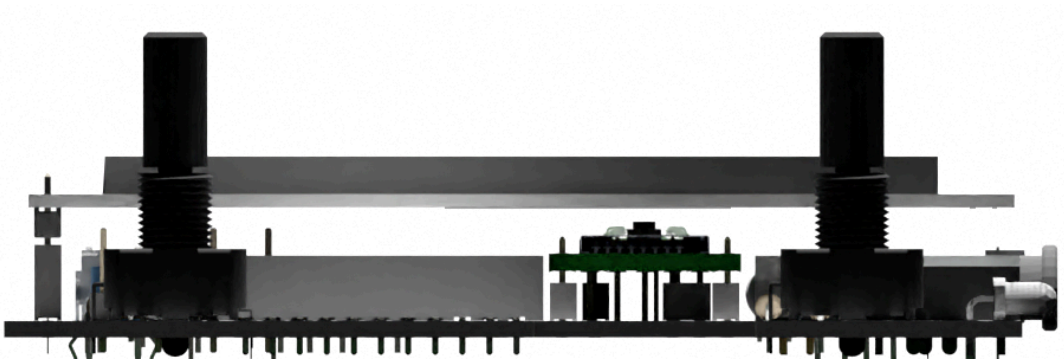



DIY / PCBWAY print:

SLA PRINT

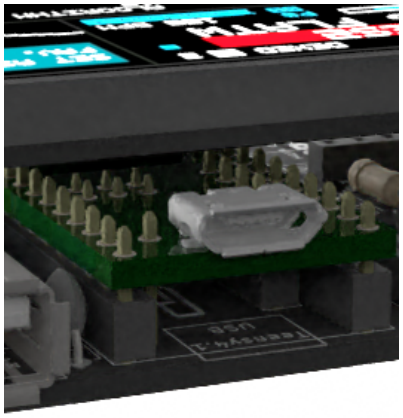
FDM PRINT

First Test (current MDT/MDTX)



Put some piece of paper between the bottom side of the Display to make sure you are not making any electrical shorts to the Teensy Pins or other components on the MDT PCB.

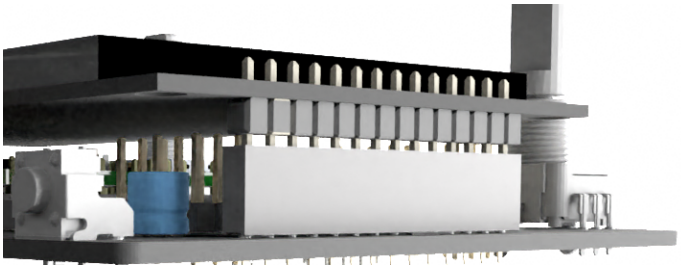
Also make sure there is a distance between the Teensy Reset Button (on top of the Teensy) and the Display bottom side.



Power on the Device by attaching a USB Cable from PC/MAC USB Ports to the MICRO-USB Connector of the Teensy.

Then flash the correct firmware to your Teensy.

If you push the Reset Button by accident, the Teensy memory will be wiped and it will not boot. **In this case, just flash the matching firmware again and make sure the reset button is not pressed by accident.**



It is normal that the Display Connector Pins are not fully inserted. The contact will be good enough, anyway.

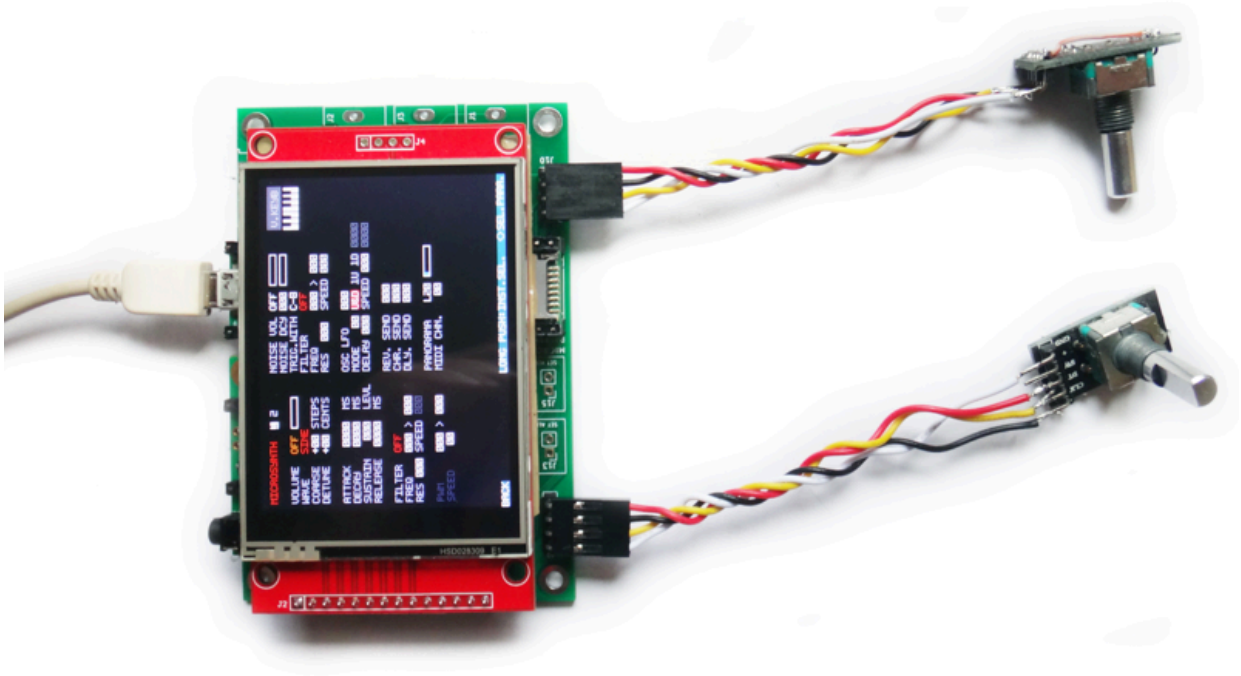
Your MDT should boot to either the Main Menu or Dexed Voice Screen.

You do not need to put in a SD CARD with the preset files copied to it at this moment. MicroDexed should at least boot up and the **menu/encoders** can be tested in the menu - however it will take a few more seconds than usual to start up, if there is no SD CARD with valid files present.

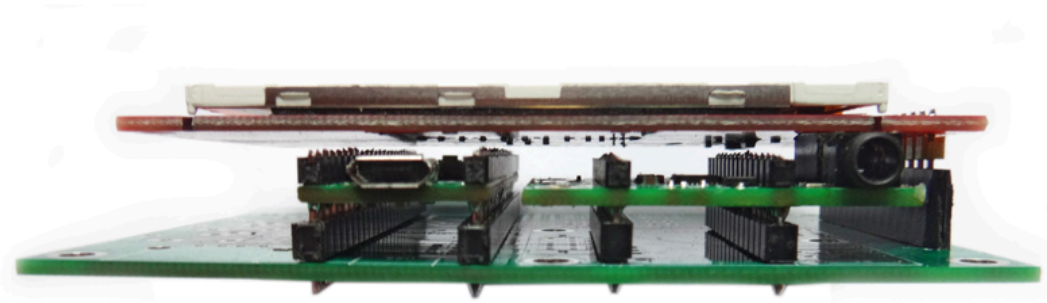
First Test (older PCB versions)

At this stage, it should be possible to do a first test.

You do not need to put in a SD CARD with the preset files copied to it. MicroDexed should at least boot up and the **menu/encoders** can be tested in the menu - however it will take a few more seconds than usual to start up, if there is no SD CARD with valid files present.



MDT (first generation with resistive touch)



Clearance of the display to MDT PCB with components

Depending on the picked display (size), the lowest point of the display will be either at the SPI FLASH Chip or the DAC TRS Jack Audio Connector

Case/Enclosure(s)

There are several different versions provided for self printing or to be bought.
A simple case for MicroDexed (or you can use your favorite 3d printing service to do that) is shown here.

Also you can order a printed SLA case (and other options) from PCBWAY.

You can get SLA printed parts from PCBWAY with excellent quality.

The shopping and download links are at the bottom of this main page at PCBWAY:

https://www.pcbway.com/project/shareproject/MicroDexed_Capacitive_Touch_64970fee.html

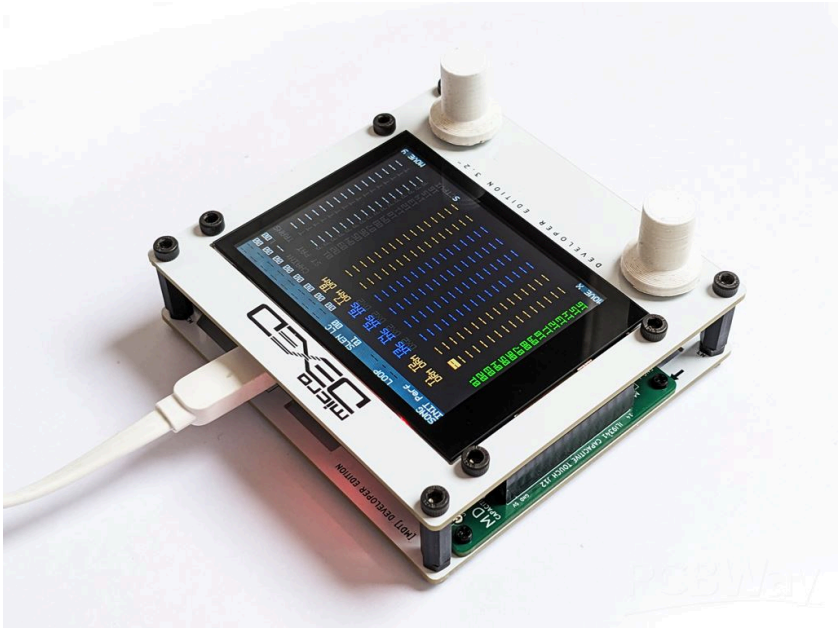
Print quality is much higher, of what you can expect from a homemade FDM or SLA, DIY print.

Since **SLA Prints can not be melted by a hot iron**, this version has some special modification that will perfectly fit M3 threaded inserts to be superglued in, with 1-2 drops.

The SLA version also has some extra details that are not possible to print by a FDM printer, like the MDT Logo.

MDT Developer Edition (PCB Based Enclosure)

If you do not want to use a printed enclosure, there is an alternative solution available from PCBWAY that consists of 2 bare PCBs as a top and bottom part that is screwed together with M2 + M3 screws, extenders and some lock nuts.



This is referred as the **MDT DEVELOPER EDITION**

Similar as for the printed case, this option is also available for the 3.2" display. In both cases, only the top plate/ top lid needs a different part to fit the display. The bottom part is identical for the 2.8" and the 3.2" screen, no matter if it is printed or the PCB based alternative.

The following video demonstrates how this is intended to work.

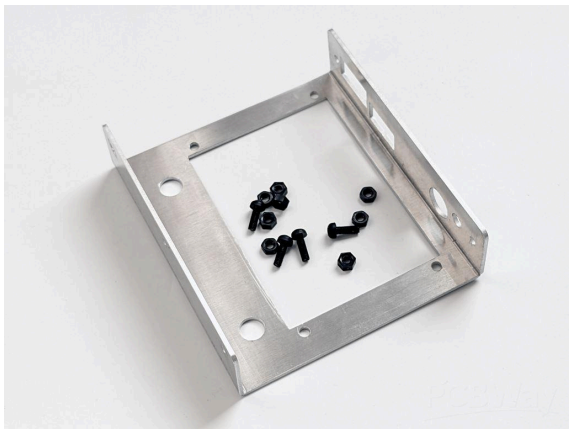
https://www.youtube.com/watch?v=sjoiCc8XJiM

Here are the links for the PCB-based enclosure:

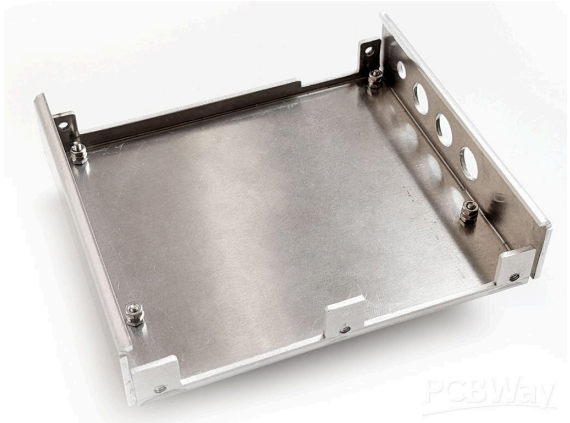
Front:
https://www.pcbway.com/project/shareproject/W424985ASE20_pcb_enclosure_front_plane_c17b035e.html

Back:
https://www.pcbway.com/project/shareproject/mdt_pcb_enclosure_bottom_plane_39654ff7.html

Sheet Metal (Aluminium) Case:



Metal Front Part



Metal Back Part

If you order the back part, make sure this flag on the PCBWAY order page is ticked:

* Threads and Tapped Holes:

Do your parts need to tap threads?

Please specify if your part has any internal or external threads. PCBWay will not bear any assembly risk if it is a non-standard thread, unless all assembly parts are produced and assembled here. e.g.

○ No ◉ **Yes**

Threaded Inserts Case

This chapter is about a self-printed (FDM) 3d print. It is also available from PCBWAY as a **SLA PRINT** that looks very similar but has minor differences, for example the holes for the following screw inserts are a little bigger since the inserts need to be glued in, not melted in as described here.

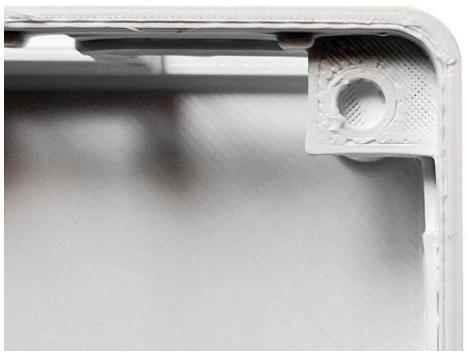
The reason for this is that SLA (resin) prints can not be melted.

The enclosure images in this chapter are a bit outdated but nothing has changed about the build procedure in general..

This case has 4 mounting posts, 1 at each corner of the device.

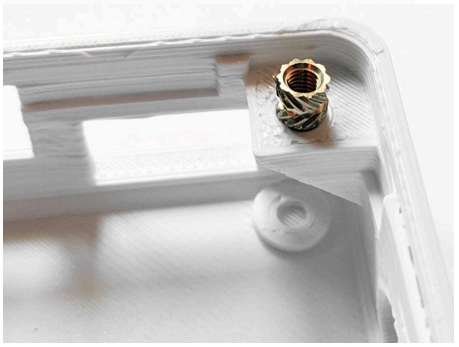
These are the inserts we are using, the M3 x 5.7 x 4.6

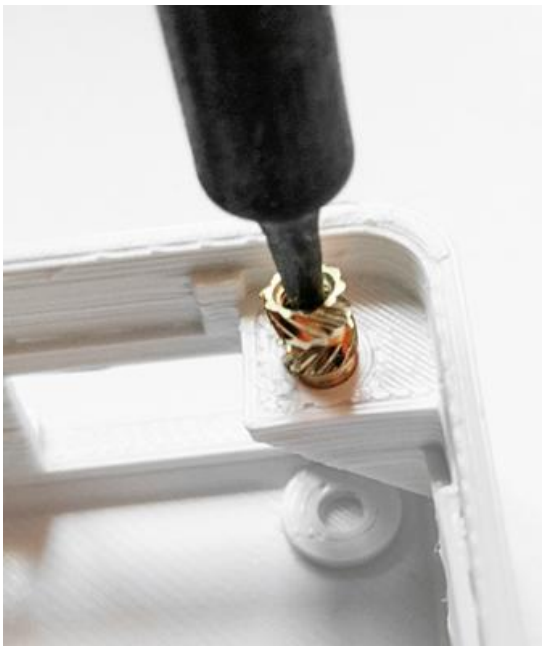
Maybe it is possible you can get a smaller amount of them (since you only need 4 pieces) but it might be easier to get a full set like this from Amazon, ebay etc.
If you do any kind of 3d printing, this is a package you can use for a lot of other projects, too.
I will add links to a set like this in the BOM.



Close up mounting post

Each insert has 3 "zones". The zone with the smallest diameter will fit into the case like this.





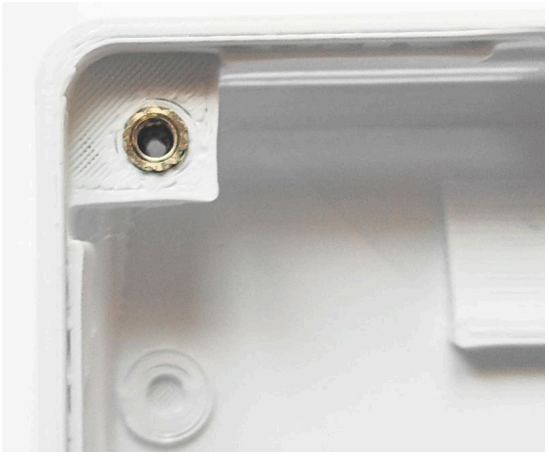
To drive the insert into the case, you basically heat up your soldering iron to 175-180 degree celsius.

If there is left residue of solder on your iron, heat it up to your usual soldering temperature first, and clean the iron tip as good as possible. It must be avoided that you put solder inside of the inserts, by accident. When the soldering iron tip is clean of solder, switch down to a temperature of 175-180 degree celsius and give it enough time to "cool off". Then push in the insert slowly with the tip of the iron.

This is a matter of maybe 4-5 seconds. Do not push it in too deeply - it should be flush with the top surface of the mounting post.

It should be possible to make some corrections by re-heating but if you haven't any experience with this procedure, it is recommended to practice with at least 1 other printed 3d part (maybe you have some failed prints or test prints from this or another project).

The printing time of the bottom case for Microdexed is around 4 hours. So it is a good idea, to have some practice on another print object, first.



The insert should look similar to this after melting it in.

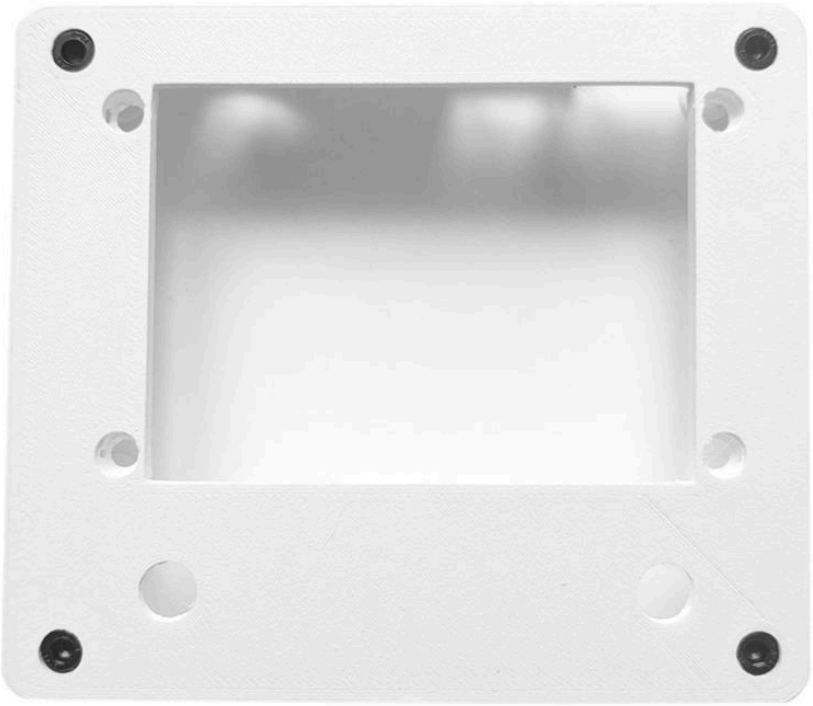
This is the case with all 4 inserts fitted.

For the screw part you can use M3 x 4 or M3 x 5 screws. It is possible to even use much longer M3 screws, but that only makes sense if you have such already available in front of you.

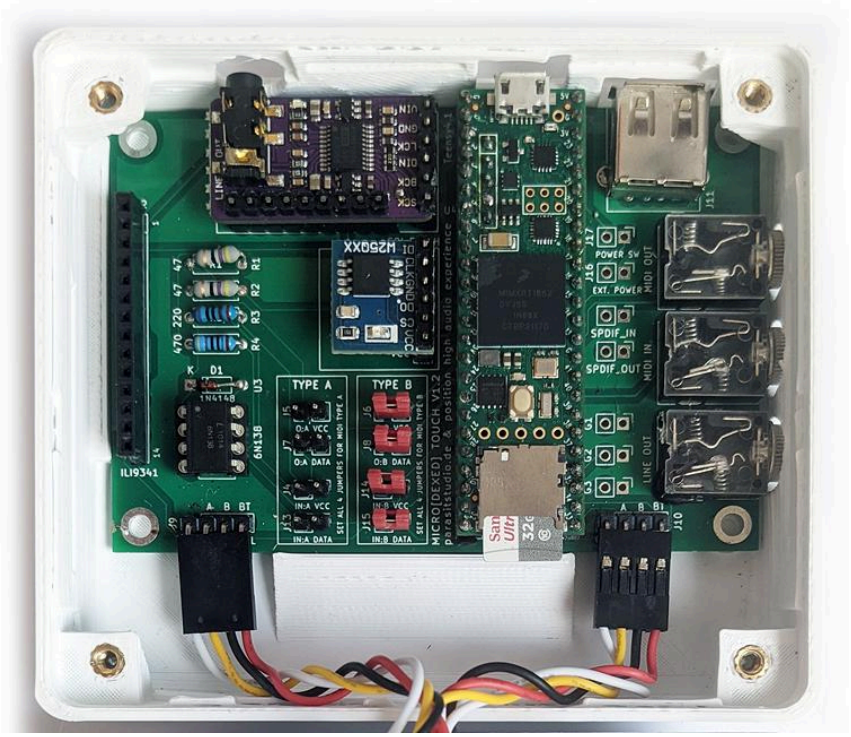
Otherwise it is better to go with the M3 x 4. As a side topic, for the screen attachment, we will use the M3 x 6.

Various M3 screws from x4 - x24 as a kit from Amazon.

The head part of the M3 should be flush with the top of the device, after screwing in.



In this image, all 4 case screws are in place.



This is the PCB inside the case with threaded inserts.

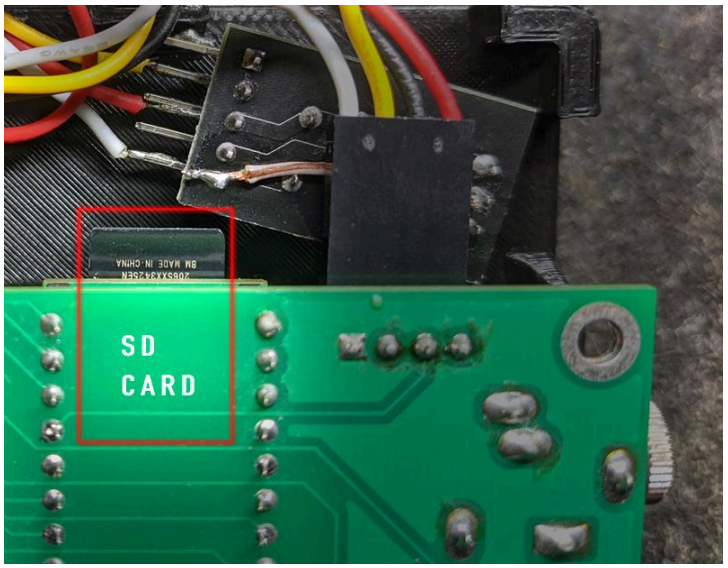
Notice that the 2 encoders used in the picture had to be rotated a bit, to make space for the mounting posts.

Depending on the Encoders you are using, this might or might not be necessary.
If the Encoders do not fit, even by rotating, try the following, if they come with a small attached PCB (as in in the picture): You may want to cut off some of the PCB of the Encoder or remove the small PCB below the Encoder altogether.

If you are deciding to cut off some part of the Encoder's PCB, carefully check if there are traces on the top or bottom side that are required. In the sample picture, I have manually connected a ground wire since I cut off part of its pcb trace.

MDT (first gen) with 2.8” display and self printed FDM case

Check SD CARD and Encoder Collision

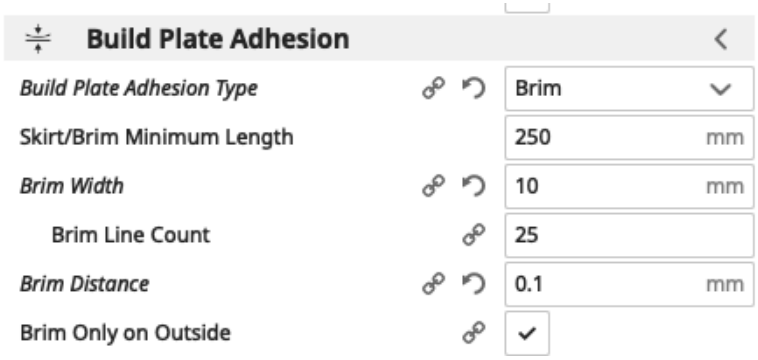


If you have encoders that have a small PCB attached at the bottom, check that there is no overlap or collision with the SD CARD of the Teensy.
If they do overlap, you might be able to cut/saw the PCBs a bit or just rotate them a few degrees away, like in the picture above.

Observe that nothing touches the SD CARD when you put everything together.
Do not put any mechanical stress on your SD CARD or sooner or later it will get a fracture and then become unreliable or will stop working completely.

3D PRINTING TIPS - Valid for both case home printing

If the case dimensions do not fit 100%, check if your slicer has an option as in the screen shown above.



If you have problems with the case parts coming off the build plate during print, it is recommended to print a brim around each part. This helps a lot to not get any lift-ups during the print, even without any build plate heating.

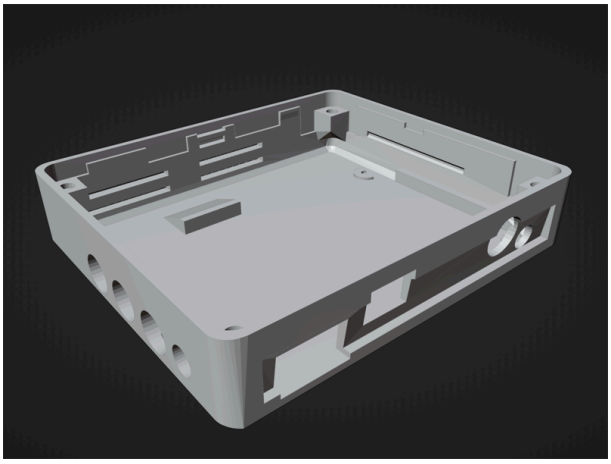
All STL Files, for FDM, should print **without any support structures**. However you can add them with your slicer, if required, for your printer.

STL Files for (FDM) self printed enclosure

STL - CASE BOTTOM

All STL Files for FDM self printing are in the STL FOLDER in the MDT-Release ZIP File.

All STL Files for SLA self printing are at the bottom of the PCBWAY Product pages of MDT and MDTX where you can either DOWNLOAD or ORDER a print by PCBWAY.



The Bottom part is now based on the same layout as the SLA print.

The main difference is that the holes are smaller and less deep so you can melt in the threaded screw inserts. This is not possible with SLA/resin print. For these the holes are bigger to fit the whole threaded insert to be glued into the holes.

Since November 2024 the bottom part is identical for all FDM prints, no matter if you use the 2.8” or the 3.2” screen.

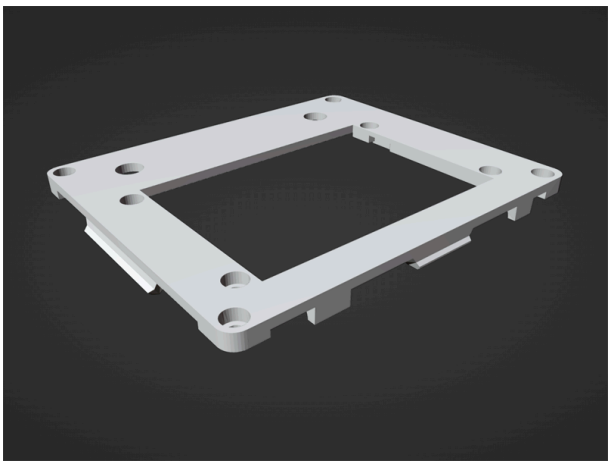
STL - CASE LID

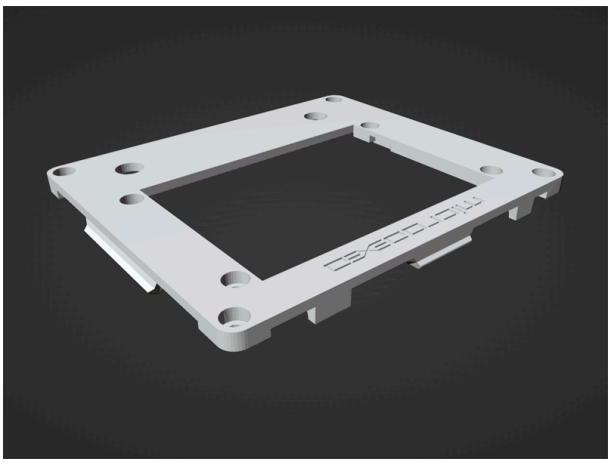
For both screen sizes a version with and without the Microdexed logo is available. Otherwise they are identical.

It is unlikely you will get the logo printed in good quality with a FDM printer. But it is possible that a very specialized FDM printer or a printer with a much smaller nozzle than commonly used, is able to do it, so both versions are available to give you this option.

Lid for 2.8” Display

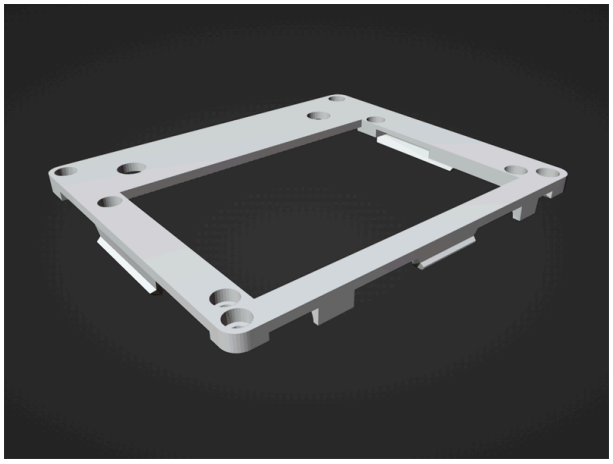
You can decide if you want to try to print it with the small Microdexed logo or the plain version without it.

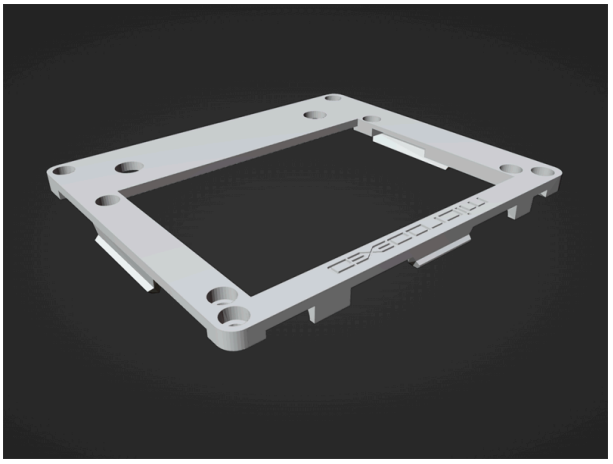




Lid for 3.2” Display

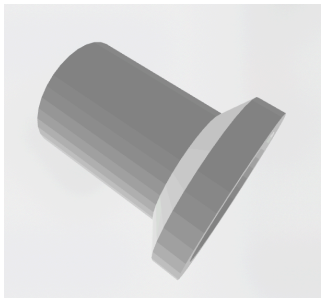
You can decide if you want to try to print it with the small Microdexed logo or the plain version without it.

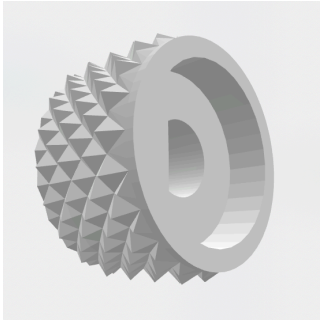




STL - Encoder Cap

You will need two of them or bring your own encoder caps:





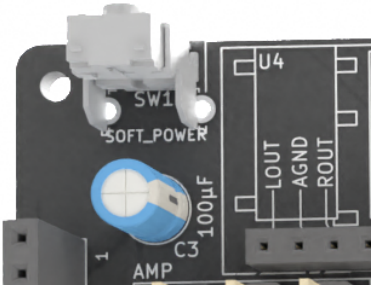
Short Encoder Cap for 12mm encoders

If you run into any strange scaling issue when putting it into your slicer software and it appears much bigger or smaller than intended, try to scale it by a factor of 10, 100 or 1000 down or up until it matches the real size.

If you do not like the textured surface of the Cap, there is also a plain version available:

Assembly of PCB into the case

If you have screwed the fastening rings on the TRS Jacks, please unscrew them for now and put them aside. It will be easier to get the PCB into the enclosure this way. You should screw them back on as one of the last steps, after the PCB is inserted. This will help to stabilize the PCBs right side to not move in any direction.

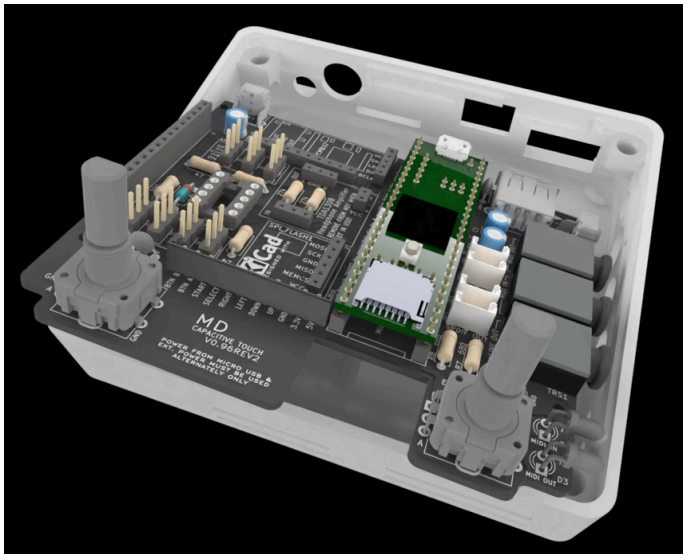


The two switches, SW1 and SW2 can cause trouble if they are longer than a few Millimeters. If you get MDT or MDTX partly preassembled, they should come with very short push buttons preinstalled.

If you have soldered in much longer push buttons, this most probably will prevent you from getting the PCB into the case. You can try to cut the plastic pusher part with a sharp cutting tool. Or unsolder it and leave it out.

I suggest keeping at least SW2 in, as this is the external PROGRAM Button and is very helpful to have accessible from the outside of the enclosure.

Unless you have a specific reason to have SW1, you can leave that out. It was added by user demand for people tinkering with internal battery charger modules and the like. It will not do much by itself without its own user customizations.

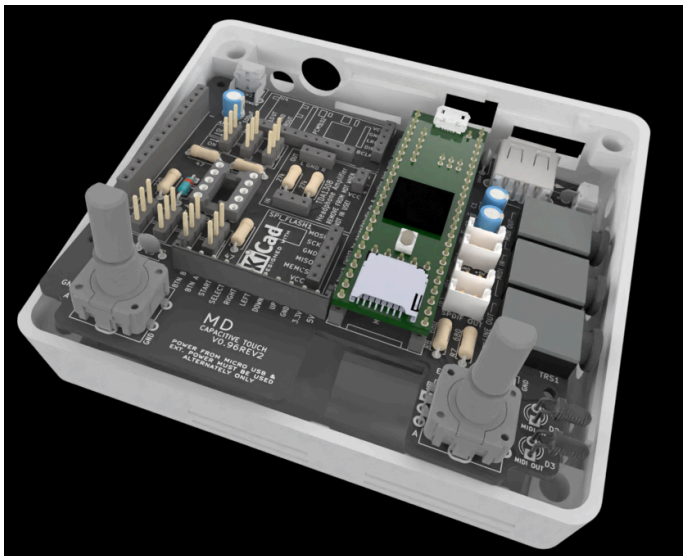


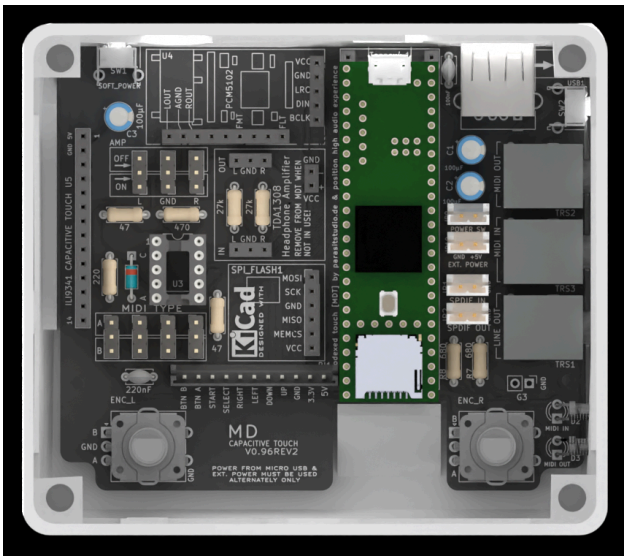
Slide the PCB+Teensy assembly in the lower case. You might have to tilt it a bit to the right side of the audio/midi connectors.

Notice there is a raised part/ramp in the left side of the enclosure. This is to allow the PCB to be inserted, even having the TRS Jacks sticking out at the right side.

After the TRS Jacks are in place, you can lower the PCB also on the left side, next to the raised part. The PCB now is locked in X direction.

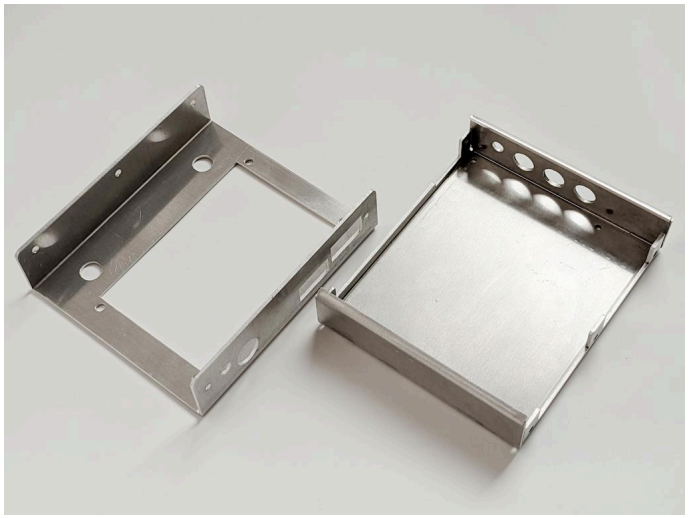
Another ramp, between the two Encoder positions, is there to lock the PCB in Y direction.





Sheet Metal (Aluminium) Case

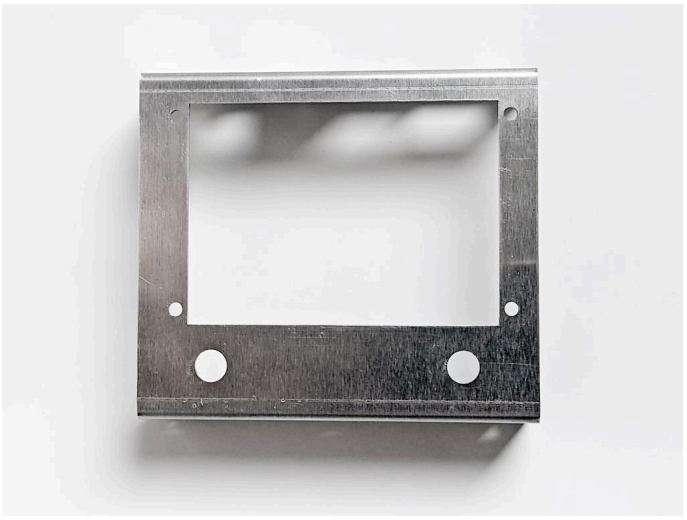
This is the assembly guide for the Aluminium Case. The pictures shown here are from the first prototype and are mostly outdated already. If you order these case parts from PCBWAY, most of the fitting issues for the TRS jacks and the Display should be much more precise than shown here. Also the classic MDT venting slits are back in this design and are not visible here in the images here, yet.



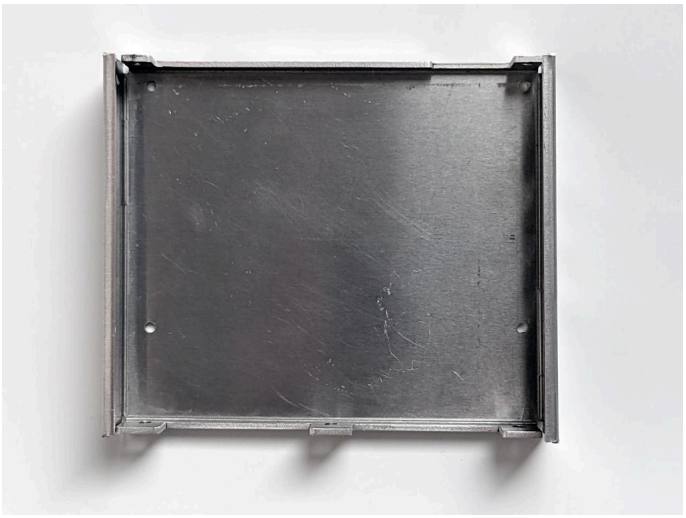
As all MDT cases this comes in two parts, a front and a back part.

The height of this case is a bit bigger than the other options. The main reason for this is that it is made of metal, a conducting material.

So some safety distances needed to be added to make sure the users soldering to the PCB will not cause any short circuits.

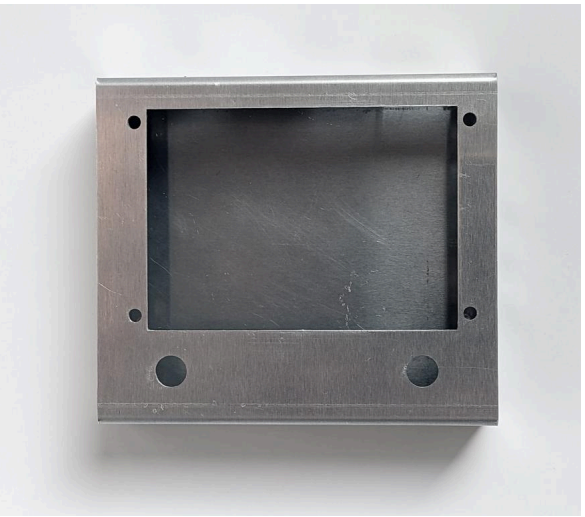


Front part, both sided



Back part, view from both sides

Side view

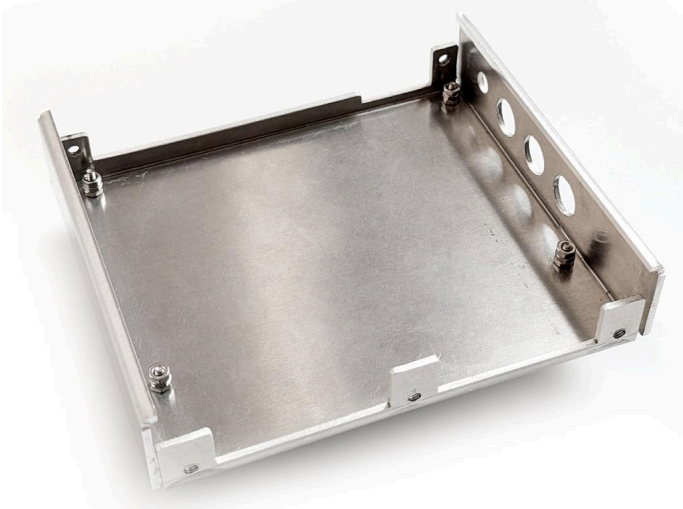


Both parts combined

Back part

Start with the back part.

To attach the MDT PCB to it, you will need 4 stacks of one M2 screw and 4 M2 nuts.



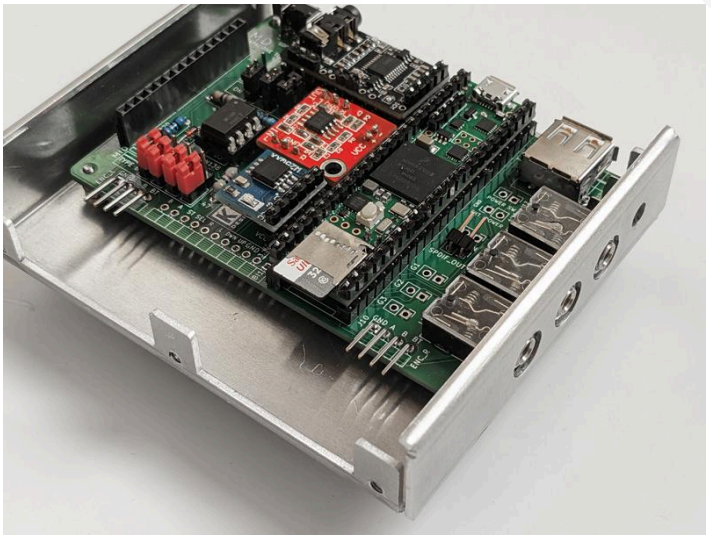
Start with the 4 screws from the bottom side.
Push them through from the back side to the top of the enclosure back part.

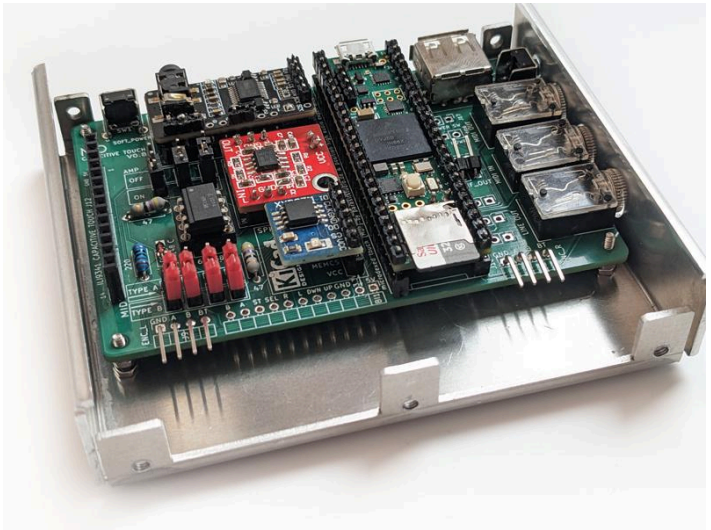
On the top side, add **3** of the M2 nuts/spacers.

After you have screwed the 3 nuts to the top side, rotate them so that the shaft of the screw goes as much as possible free and back to the backside.

Meaning all 3 nuts are located close to the top of the screw end.

This makes it easier to put in the MDT PCB with only a small part of the screw entering the holes of the MDT PCB.



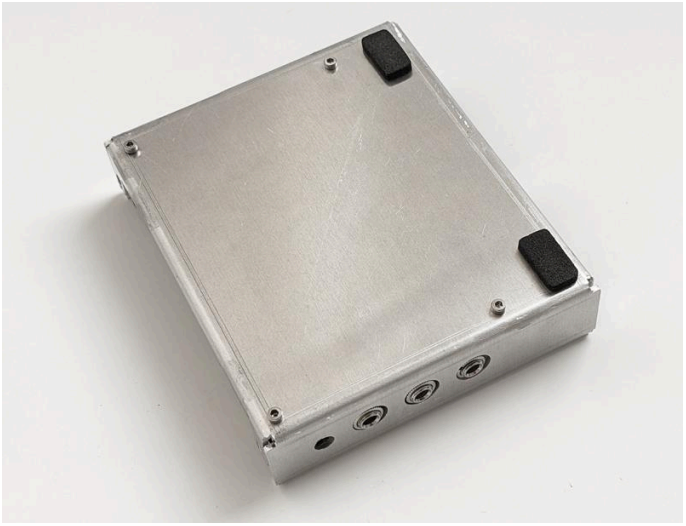


Put in the MDT PCB.

After you see the screws with the 3 spacers are below the PCB, and the PCB is at its final position, you can advance to screw in the screws from the bottom side while holding the MDT PCB firmly so that the spacers/nuts stay close to the bottom of the enclosure part.

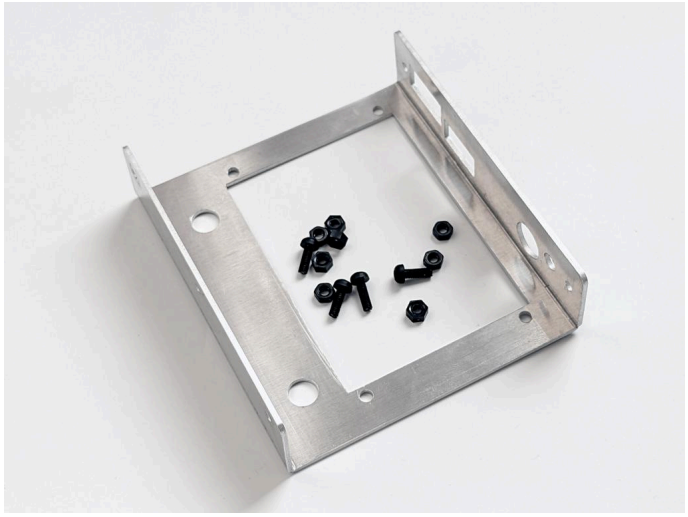
The top end of the Screws should come out on the top side of the MDT PCB.

Screw on the last remaining nut on top of the stack of nuts on the screw, on the top side of the MDT PCB. After that, the MDT PCB should sit very tightly and secure on the enclosure back part.



Screws are at the final position, screw heads are touching the backside of the enclosure back side

Front part

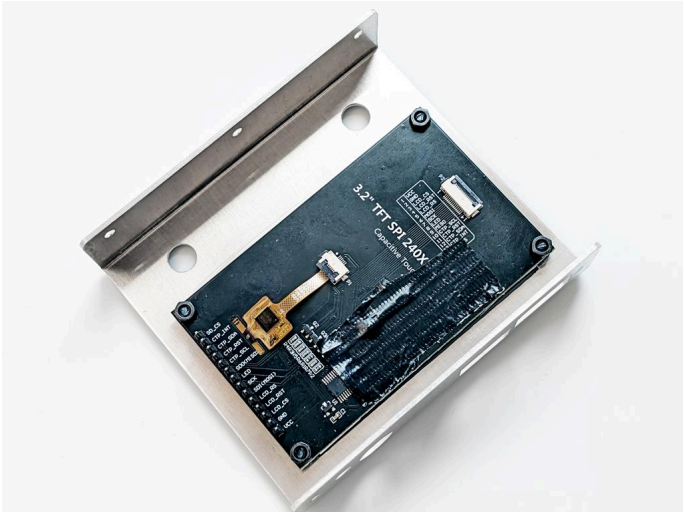


We will now attach the display to the top part of the enclosure. For that, you will need 4x

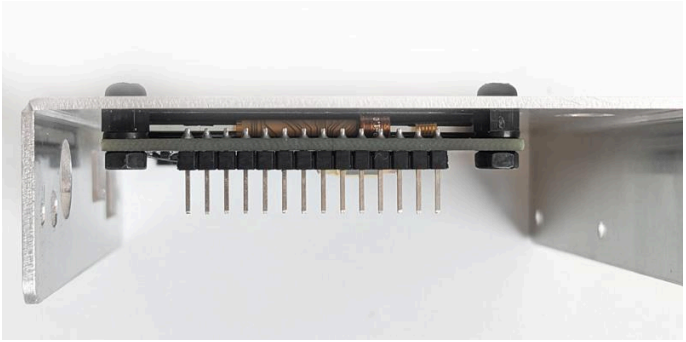
1 M3 Screw, 3 nuts and maybe spacer parts.

Put through the screws from the enclosure top front part to the backside. Secure the screw with one nut from the backside.

If you find later that the display is not flush on the top side of the enclosure, it is possible to adjust the position with spacers like in the picture shown here.



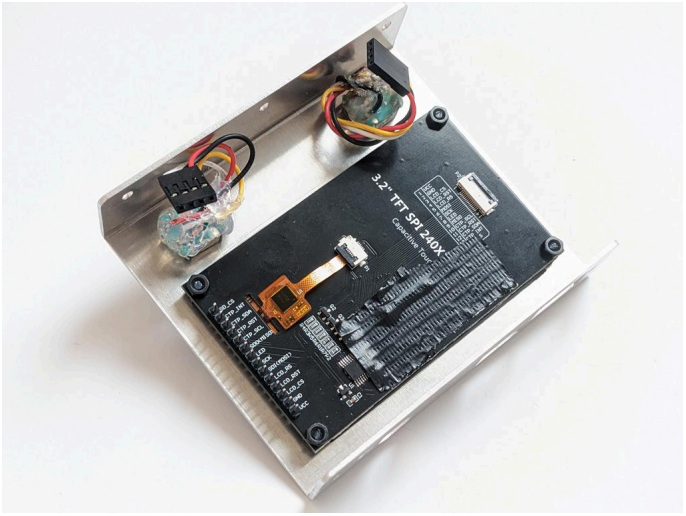
Put the last nut on the screw to the backside of the display.



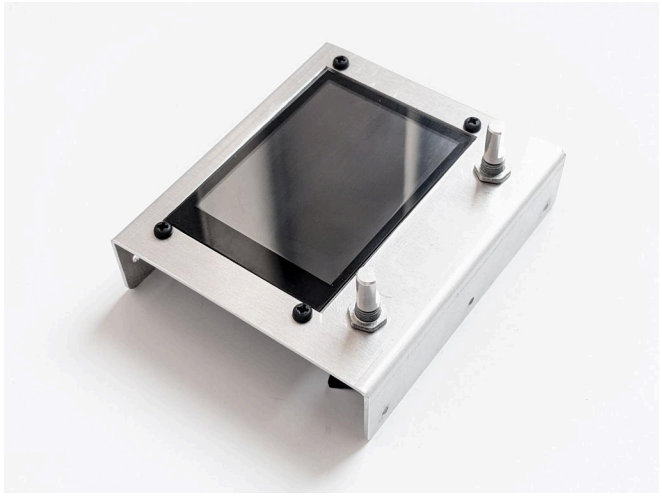
Side view of the display screw stack

You can adjust the distance by spacers. Make sure that you will not produce any shorts to the 14 pins of the display to the metal case.

Side view with full assembly

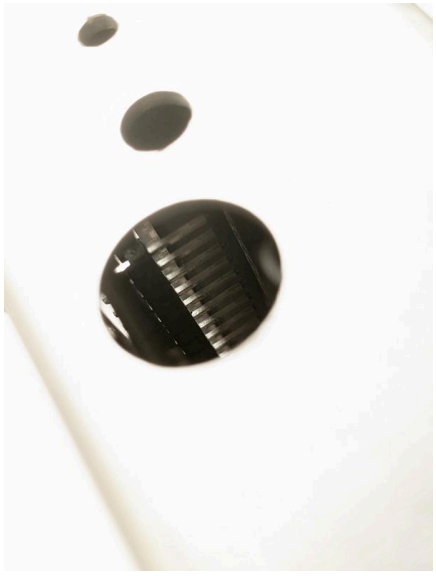


Add the 2 encoders to the front part



Enclosure front part with encoders and display attached

Align both enclosure parts together.
Attach the encoder connectors to the MDT PCB.



Through the DAC TRS connector hole, you can get a glimpse if the header and the pin row of the display connector align correctly.

Add the encoder caps to the top of the encoder shafts

Final build, metal enclosure

MDT/X-SML Enclosure

This version of the case is supposed to be printed with Selective Laser Melting (SLM) Process (Aluminium)

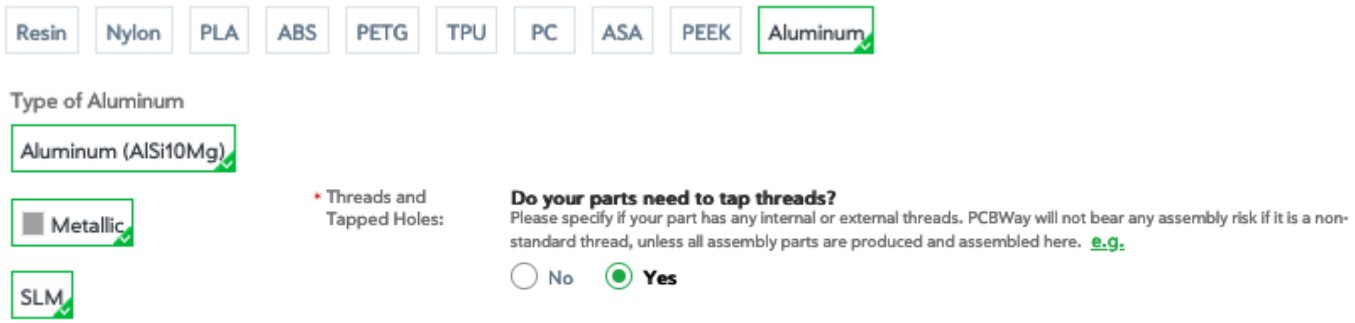
It will fit MDT and MDTX. Make sure to select **SML** as the printing option as well as:

Threads and Tapped Holes: Do your parts need to tap threads? **YES**

If a dialog comes up to add a technical drawing, add this image:

This enclosure is basically the same as the SLA print from the size/space perspective. However the outer 4 threads for holding the device together should be already in place when receiving the print. (The pictures above are outdated). Also it has removed the clamps that are only usable on the SLA/FDM print.

Make sure you select these options as described above:



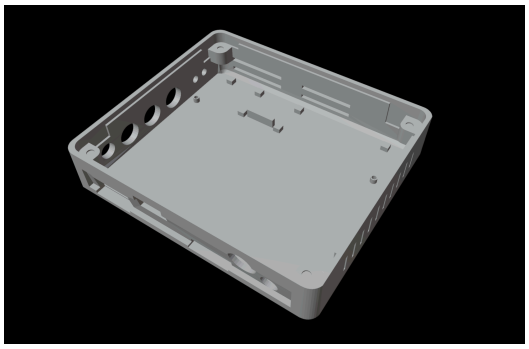
Since this enclosure has the same outer dimensions as the SLA print, you have to be specially careful about possible **short circuits** (since this enclosure is made out of **conductive metal**).

Use a continuity tester or other electrical tool of your preference (oscilloscope, multimeter) to make sure none of the soldered pins on the bottom side of the MDT/MDTX PCB make any contact to the metal enclosure bottom. Inspect your PCB from the backside if there is any pin that can be shortened to avoid making any contact to the metallic enclosure.
Any short from any PCB pin to the enclosure will lead to a non functional device and could **kill your Teensy** or other electronic components on the PCB **instantly**. If you have any doubts that you can reliably check and resolve any possible shorts or do not want to deal with this complication at all, please do not buy this but go for the SLA enclosure (that is not conductive at all) or the Sheet Metal enclosure, which has way larger safety distances build in place.

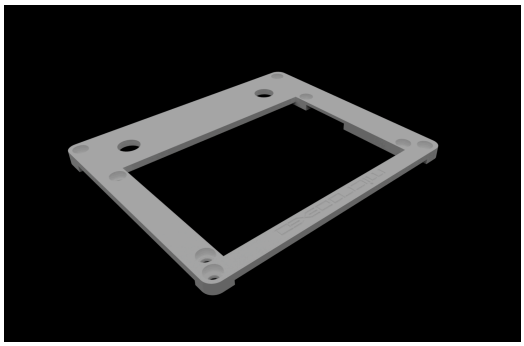
This enclosure is easier/quicker to assemble than most of the other options since the outer thread domes for screwing it together with the top plate are highly space optimized and pre-build as much as possible.

However, it is generally advised to **remove the fastening nuts** of the TRS connectors in case you have screwed them onto the jacks previously. It is much easier to insert/remove the PCB when these are not screwed on the jacks. The fastening nuts do have 2 slits on one of their sides. Make sure you put these to the **outer direction**. This way you can add or remove them easier when the device is already put together.

PCBWAY Links:



Bottom Part



Lid Part

Synthesizer Engines

dexed / MicroDexed

Dexed is a FM-type software Synthesizer developed by Pascal Gauthier of Digital Suburban. It is an ideal application for importing, playing and editing/managing Sysex patches from both the classic Yamaha DX7 synthesizer and the TX7.

Dexed includes six operators, faithful to the DX structure. Each operator has a level indicator. The operators can be arranged in various algorithms, indicated by the green boxes. Patch banks are called "cartridges" and there are many (about 32) included in the installation package. Selecting a cartridge loads the patches in the relative bank.

Dexed can be configured to use some of the original math limitations of a DX synthesizer. This does not only apply to the DAC, it also involves the bit resolution of the sine waves and the way that the amplitude is applied to each operator. Since all of this is experimental, multiple engines will be available to be able to compare them easily.

Dexed comes with 3 engine types:

- **Modern:** this is the original 24-bit music-synthesizer-for-android implementation.
- **Mark I:** Based on the OPL Series but at a higher resolution (LUT are 10-bits). The target of this engine is to be closest to the real DX7.
- **OPL Series:** this is an experimental implementation of the reversed engineered OPL family chips. 8-bit. Keep in mind that the envelopes still needs tuning.

Features:

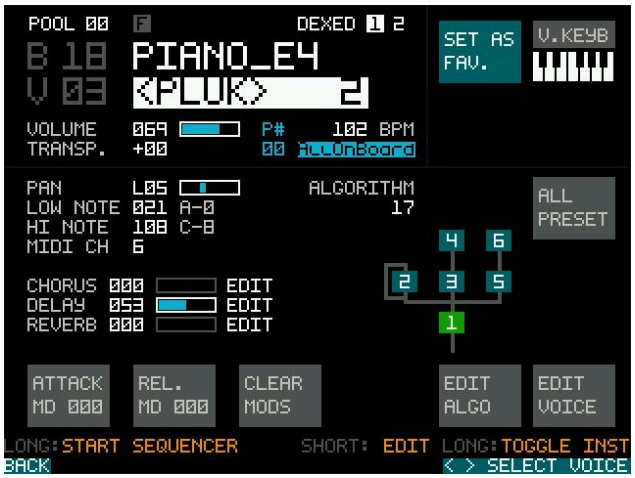
- Multi platform (OS X, Windows or Linux) and multi format (VST, AU, LV2)
- The sound engine music-synthesizer-for-android is closely modeled on the original DX7 characteristics
- 144 DAW automatable DX7 parameters available from one single panel
- Fully supports DX7 input and output Sysex messages, including controller change. This means that you can use this with a native DX7/TX7 as a patch editor and Sysex manager
- Each operator have a realtime VU meter to know which one is active
- Can load/save any DX7/TX7 Sysex programs. It is also possible to save a single program into a different Sysex file.

MicroDexed is a conversion of **Dexed** to the **Teensy platform**. Most of the above features are identical, including the engine types.

MicroDexed features 4 instances of **Dexed**, meaning you can play / address 4 different voices/sounds at the same time with a polyphony of 16 notes, each.

A full featured patch / voice editor is available on device.

Further, you can add chorus, delay and reverb effects to both instances individually.



Favorites

To make it easier to browse through the voices (sounds) of Dexed you like the most, you can set an unlimited number of them to your favorites.

You do that by simply pushing the “SET AS FAV.” Touch button, right to the Bank/Voice Names in the Dexed voice page.

There is no limit to how many voices you can select as a favorite.

After a voice is marked as favorite, the color of the Touch button will switch to red color and the text changes to “REMOVE FAV”.
Touching this, does exactly what it says, it removes the current voice from your list of favorites.

The second button, below the virtual keyboard, sets the actual filtering, when scrolling though the voices with ENC_R. With each touch, you toggle between:

- all presets
- favorites only
- non-favorites
- random non favorites

In the SYSTEM - FAVORITES Menu, you can set your default setting for favorite search in MDT. This setting will be loaded after a restart or boot up of MDT.

Notes:

The search function for favorites will search in every bank of the current pool. You can add/remove favorites in all pools. But the search will only happen in your currently viewed pool, meaning BANK 0-99 in where your currently displayed voice is located.

The information about what is marked as a favorite is placed in additional files, located in the folder(s) where the voice / Sysex bank file exists. This means, copying the whole **/DEXED** Folder from the **SD Card**, from one MDT device to another will also copy the favorites with it. This also means you can make backups easily - just copy the **/DEXED** folder to your PC/Mac, to a safe location.

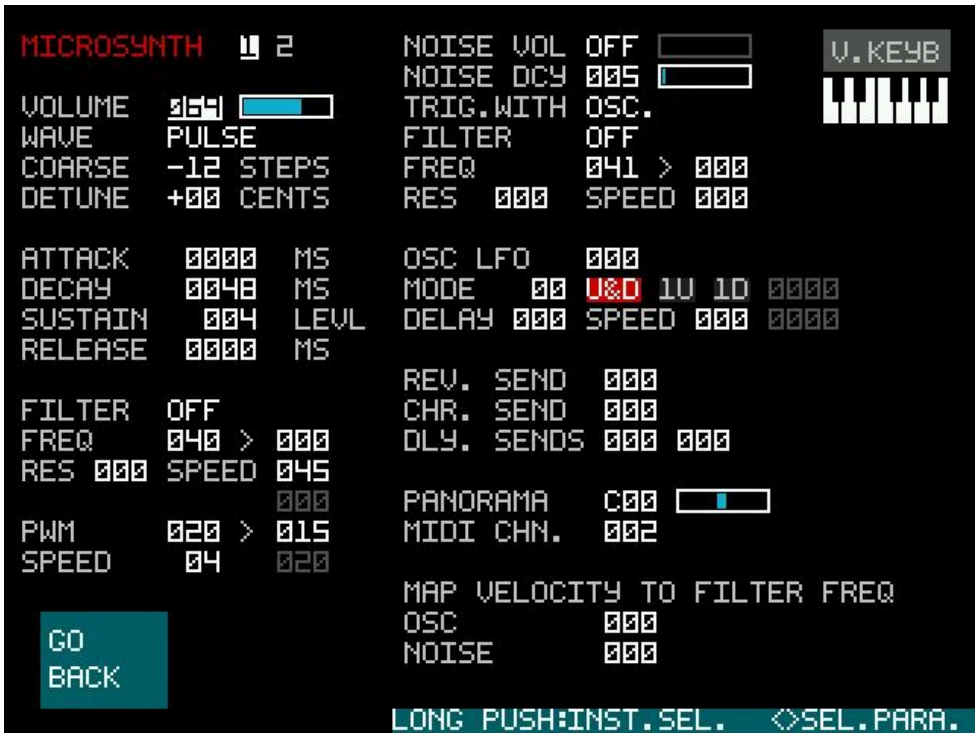
Microsynth

Microsynth is a monophonic, 1 OSC synthesizer, based on the building blocks the Teensy audio library provides with some extensions. Since, like in Dexed, you have 2 instances, both can be layered so you can get a 2 Oscillator Synth out of it or use them seperately as 2 individual instruments.

The available waveforms are very basic and exist in a full spectrum and in a spectrum-limited version.
Further, each instance has a dedicated noise generator that can be triggered together with the Oscillator or independently.

The Oscillators and the noise generators come with their individual multimode filters. The strength of the filter cutoff can be adapted in real time by velocity information.

Microsynths strengths are short, percussive sound and also bass sounds, especially when using the filter(s).



ePiano

MDA ePiano is a simple but good Electric Piano virtual instrument. It emulates quite nicely the warm sound of a Fender Rhodes, while consuming very little resources. It has a few options only, but it's all you need. Simplicity is beauty.

Back in the 20th century, plugins from Maxim Digital Audio (mda) were among the early VST plugins available for Windows. They have a reputation for being high quality with low CPU usage.

Features:

- Based around 12 carefully sampled and mastered Rhodes Piano samples.
- 1-32 voice polyphony
- Unique width control
- Decay, Release
- Stereo Width
- Velocity sensitivity
- muffle and hardness amount adjustable
- Gentle muffling filter

MDT adds the option for reverb and delay effects to ePiano.

Braids

(by Mutable Instruments)

Two rows of mostly Mutable Instruments Eurorack format modules.

Mutable Instruments (**MI**) based in France was a manufacturer of Eurorack synthesizer modules, founded in 2009 selling DIY kits and owned by the designer/engineer Émilie Gillet. All MI products are fully open source hardware under a CC-BY-SA license.[1]

The Braids is a digital macro-oscillator. Its sound engine outclasses any VCO by far because the sounds are very complex and only two controls are used to affect several timbre parameters simultaneously. Braids is capable of different synthesis forms like FM, wavetable, vocal sound creation, analog emulation, noise, digital synthesis and even physical modeling. And it sounds awesome!

Braids is a voltage controlled digital oscillator that features 33 synthesis algorithms from 8 categories:

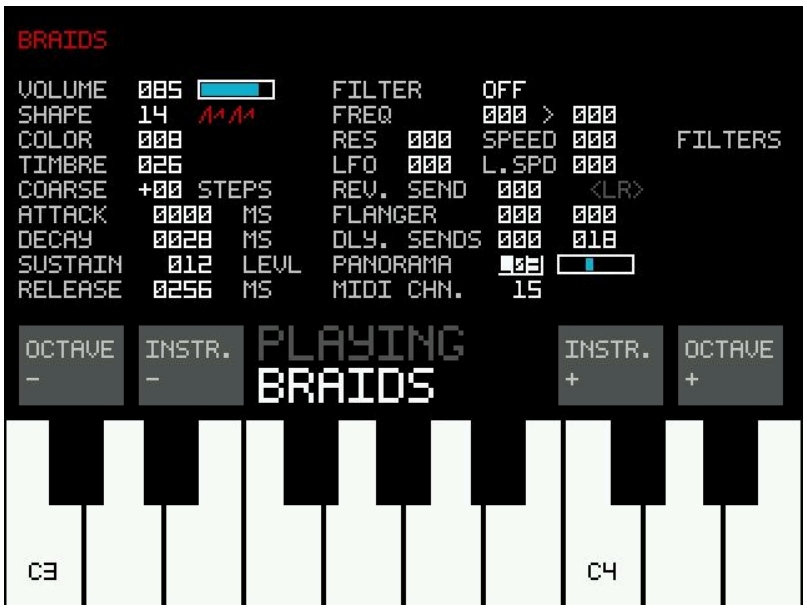
- Emulations of analog VCOs with morphing, double pulses ,wave multipliers etc.
- digital synthesis: ring modulated sine waves ,"super saws", digitally filtered waves, electronic toy sounds
- vocal- and formant synthesis, also in a nice 80ies home computer style
- two-Operator FM
- Physical Modeling: Simulations of bells, tubes and strings with pressure control.
- Wavetable-Synthese. 2x 256 wave forms
- Filtered, colored and pitched noise, granular noise, particle system simulation

In addition you`ll find a note quantizer for the input CV. The sample rate and bit rate are adjustable (up to 96kHz sample rate). A trigger at the according input fires an AD envelope to modulate the timbre.

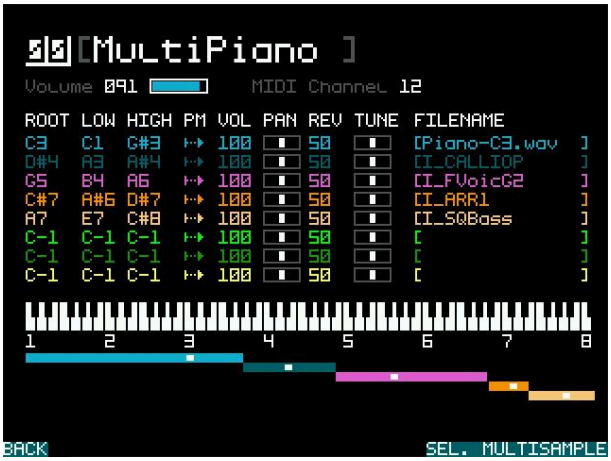
The VCO has controls for coarse and fine tune as well as for the voltage controlled complex parameters TIMBRE and COLOR. Timbre has a polarizer for adjusting modulation depth. A FM input with polarizer is available too.

MDT features:

- Instead of 1 Braids oscillator, you get 8 of them. So MDT is a software equivalent of 8 braids modules, combined together.
- MDT adds a multimode filter to every single instance. Meaning you can play braids like a polyphonic instrument, with filters.
- MDT adds a reverb and 2 delay effects to the combined output.



MSP



MultiSamplePlayer (MSP) was created to allow usage of custom samples and even custom multi-samples, meaning samples of an instrument at different pitches, to allow for a more realistic sounding instrument, based on sample technology.

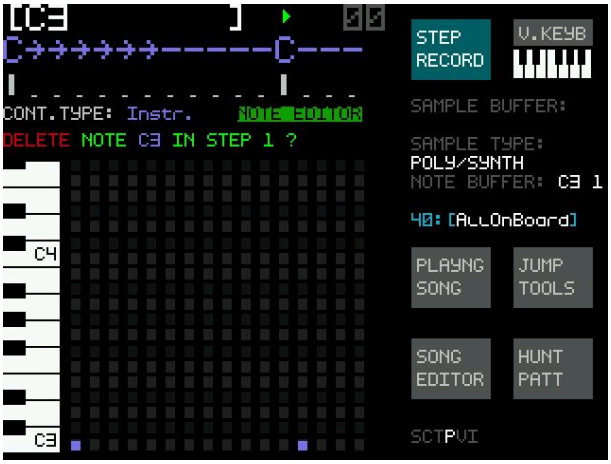
MSP also can be used to play just single drum samples with direct access to pitch, panorama, volume and reverb send.
Further details for the individual drum samples can be set in the DRUMS page.

Since Summer 2024 MSP can use one (or two) PSRAM chips that are located (and soldered) to the backside of the Teensy Microcontroller.

This now gives full and stable control for custom samples, playing from the PSRAM chip(s).

MSP is usable as a live instrument and also can be triggered by both sequencers.

MSP and looped Samples

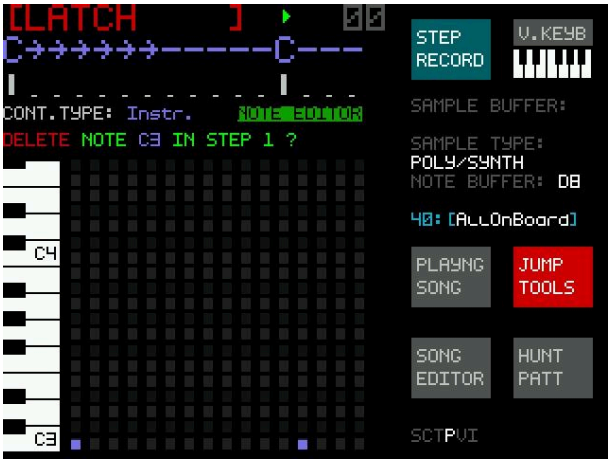


When running on the PSRAM Firmware, MSP now provides simple loop functions for samples. The looped samples are not required to be custom samples, all available samples in MDT on PSRAM can apply a loop effect.

This currently is at a very basic state.

The loop can be applied playing forward/repeating or forward and backward (pingpong).
At the moment there are no active amplifier envelopes on the samples. This means every sample will start with the MIDI NoteOn Event and will be stopped with the MIDI NoteOff Event.

So this behaves very much like an organ or a mellotron - there is no attack, decay or release phase for the (looped) samples, yet.



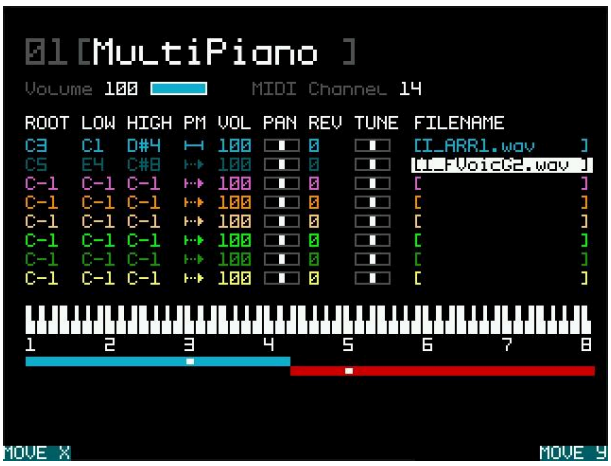
In LiveSequencer you can play/record the looped samples just as you play them, meaning you hold down the keyboard key for as long as the looped sample shall play.

In the LSDJ style sequencer, you can use the LATCH function to hold the note for as many steps as you like.
After the last latch step, the note will then stop.

The latch steps are indicated by the → (arrow right) in PATTERN EDITOR.

You can reach the latch function by either scrolling up to the highest note or make a shortcut by the JUMP TOOLS touch button. Then select LATCH.

Then scroll one position right to your note that should be latched and insert as many latch steps as you want, with PUSH ENC_R.



If you want to use custom sample(s) for looping, just load them as every other custom sample from the CUSTOM folder from the SD Card in FILEMANAGER to your PSRAM. Note: You do not have to use custom samples for looping. Every sample, available from PSRAM, can be looped.

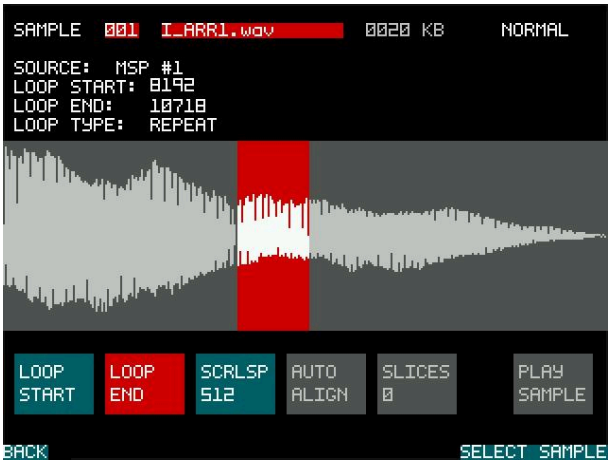
Now continue in MSP. You have 2 Instances of MSP, each can contain up to 8 different samples. So in total you can use up to 16 looped samples with individual start, end and loop-types. Both Instances can have individual MIDI CHANNELS and each has a GLOBAL Volume setting.

Using both encoders, scroll to the FILENAME column of one of the 8 slots and insert the sample(s) you want to loop (or use with MSP in general)

If the filename of the sample contains some Note Information like C3 or some other commonly used filename-syntax for Multisamples, MSP will try to split up the keyboard range for all added samples accordingly after adding each sample. If the filename does not provide any Note information, please set at least the ROOT note of the sample and the LOW and HIGH Note, where the sample should be played.

Also make sure the Global VOLUME and the individual sample volume is not set to 0. Optionally, you can apply reverb and panorama and tuning settings to each individual sample.

After inserting the samples in **MSP**, continue to go to **SAMPLE EDITOR**.

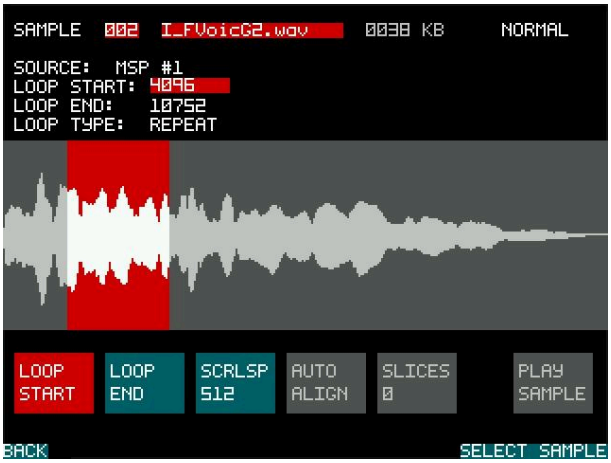


In SAMPLE EDITOR, go with the cursor to SOURCE and select either MSP #1 or MSP #2.
Then scroll all the way up, to SAMPLE, and select one of the samples you loaded previously in MSP.

Notice that all the SLICE options will be grayed out.
The SCROLL SPEED (SCRLSP) button and the LOOP START and LOOP END touch buttons will be activated.

Select the sample start- and endpoints, either by using the touch buttons or by the menu entries. Scroll through the sample with ENC_R. Using the touch buttons is optional but a bit more convenient than using the menu only.

Other than this, both ways are working identical.



Make sure you also change the LOOP TYPE to REPEAT OR PINGPONG, otherwise you will continue to hear just the plain sample, playing from start to end, without any loop.

If you have further samples to loop, go back to the SAMPLE field and select the next sample to edit for looping. Repeat the steps above to set the start- and endpoint and the LOOP TYPE.

If you do not see your sample in the list, check if you loaded the sample in the sample MSP Instance. Change the SOURCE to MSP#1 or MSP#2 accordingly and you should find all your previously loaded samples in MSP.

Further details about the usage and features of MSP may be found in the SEQUENCER chapter.

NoiseMaker

NoiseMaker Features: A Comprehensive Guide

NoiseMaker is a versatile drum synthesizer designed to give you deep control over every element of your rhythm tracks. From classic analog-style sounds to futuristic effects, you can shape each drum hit to fit your creative vision. This guide explores every feature and parameter, helping you master your sound design.

Core Drum Synthesizers

Each drum sound in NoiseMaker is generated from scratch, giving you a set of powerful parameters to shape its unique character.

You can tweak each and every parameter by yourself or use a Parameter Randomizer Function to create new sounds (and tweak them after that)..

Bass Drum

The foundation of any beat, the Bass Drum offers a classic analog feel.

- **PITCH**: Sets the base frequency of the drum's tone.
- **PITCH ENV**: Controls the amount of the initial pitch sweep.
- **PITCH DECAY**: Determines how quickly the pitch sweep fades out.
- **DECAY**: Sets the overall length of the sound.
- **TONE**: Blends between a pure sine wave and a more saturated, analog sound.
- **CLICK**: Adds a sharp, high-frequency transient to the attack.
- **NOISE**: Introduces a layer of noise for more complex hits.
- **DRIVE**: Saturates the sound for a grittier, more aggressive tone.
- **COMP**: Applies a dynamic compressor to make the sound more punchy.

Snare Drum

Crafted with both tonal and noise components, the Snare Drum can go from a snappy crack to a deep thud.

- **TONE1 & TONE2**: The two primary frequencies that make up the tonal body.
- **TONE MIX**: Balances between the two tonal frequencies.
- **PITCH ENV**: Controls the initial pitch drop for a more realistic stick hit.
- **DECAY**: Adjusts the length of the sound.
- **NOISE**: Blends in a bandpass-filtered noise layer for the "snare" texture.
- **SNAP**: Adds a very short, sharp transient for a crisp attack.
- **DRIVE**: Adds subtle saturation.

Toms & Congas

Perfect for melodic fills and percussive accents, these instruments offer a range of pitched sounds.

- **PITCH**: Sets the base pitch of the sound.
- **DECAY**: Adjusts the length of the sound's decay.
- **PITCH ENV**: Controls the amount of the initial pitch sweep.
- **TONE**: Blends between a pure sine wave and a more percussive, woody sound.
- **NOISE**: Adds a layer of noise to the sound.

Rimshot

A sharp, resonant hit that cuts through the mix. The Rimshot is created by a very short, high-Q resonant ping.

- **DECAY**: Sets the length of the sound.
- **TONE**: Adjusts the balance between the resonant ping and a short noise burst.
- **PITCH**: Controls the center frequency of the resonant ping.
- **DRIVE**: Adds saturation for a harder sound.

Clap

A classic drum machine sound, created by a series of three closely-spaced noise bursts.

- **REPEATS**: Sets the number of claps in the sequence.
- **SPREAD**: Adjusts the timing between the individual claps.
- **TAIL**: Controls the length of the noise tail after the claps.
- **BP HZ**: The center frequency of the bandpass filter applied to the noise.
- **BP Q**: Adjusts the resonance of the bandpass filter.
- **DECAY**: Sets the overall length of the clap sound.
- **DRIVE**: Adds saturation.

Hi-Hat & Cymbals

From tight hats to shimmering crashes, these noise-based cymbals are essential for any groove.

- **TONE**: Blends between a noisy, hissing sound and a metallic, ringing tone.
- **NOISE**: The amount of high-frequency white noise.
- **BP HZ & BP Q**: The center frequency and resonance of the bandpass filter.
- **DECAY**: Sets the length of the sound.
- **DRIVE**: Adds saturation.
- **DETUNE**: Applies a slight detune for a richer sound.

Cowbell

A unique sound created by two sine wave oscillators.

- **FREQ1 & FREQ2**: The frequencies of the two oscillators.
- **AMP DECAY**: Sets the length of the sound's decay.
- **TONE BALANCE**: Balances the mix between the two oscillators.
- **NOISE**: Adds a subtle noise element.
- **DRIVE**: Saturates the sound for more harmonics.

Claves & Maracas

Classic percussive sounds with a high-end character.

- **PITCH (Claves)**: Controls the base frequency of the sound.
- **DECAY**: Adjusts the length of the sound.
- **BP HZ & BP Q (Maracas)**: Controls the filter and resonance.
- **DRIVE**: Adds saturation.

Zap

A classic sci-fi laser or effect, created by a downward pitch sweep.

- **START PITCH**: The highest frequency of the sound at its onset.
- **END PITCH**: The final, lowest frequency of the sound at the end of the sweep.
- **DECAY**: Controls how quickly the pitch sweep and amplitude of the sound fade out.

The Power of Reverb

NoiseMaker features an offline reverb engine that processes your drum sounds after they are generated. This allows for a lush, realistic reverb tail without affecting real-time performance. This is fully independent from the regular, realtime Reverb you also can apply to each drum sound individually.

- **ROOM SIZE**: Controls the perceived size of the virtual space, from a small room to a massive hall.
- **DAMPING**: Adjusts the absorption of high frequencies in the room, making the reverb brighter or darker.
- **WET LEVEL**: The amount of the reverb signal mixed into the final sound.
- **DRY LEVEL**: The amount of the original, unprocessed signal mixed into the final sound.
- **WIDTH**: Spreads the reverb across the stereo field.

With all these features, NoiseMaker gives you the tools to create a wide range of custom drum sounds.

Filters and Resonance in NoiseMaker

The Dangers of Filter Frequencies and Q Values

When designing certain drum sounds, especially those with resonant filters, it's crucial to be mindful of your filter frequency and **Q** (resonance) settings. While these parameters are vital for shaping a sound's timbre, pushing them to the extreme can lead to undesirable and even dangerous results.

A filter's Q value represents its resonance, which is a boost at the filter's cutoff frequency. As you increase the Q, you create a sharper, more pronounced peak at that frequency. When combined with a very high filter frequency, this can generate extremely high-pitched, loud tones. This can potentially harm your headphones, speakers, or—most importantly—your hearing.

NoiseMaker includes a **dangerous detector** that is designed to prevent these destructive sounds from being played back. All sound categories have pre-defined random ranges for their filter frequencies and Q values, which helps to prevent this from happening. However, in some situations, particularly with customized settings, it can still be possible to produce sounds with an extremely high-frequency spike. Always exercise caution and start with a low master volume when experimenting with new filter settings.

Sample Generation and Finalizing Your Sounds

The NoiseMaker's process for creating sounds is optimized for flexibility. Every sample you generate is created with a fixed duration of **5 seconds**, providing ample time for any reverb or long decay to fully unfold. This is an optional feature, but by default, it's always enabled. This approach ensures that you capture the entire essence of the sound, from the initial transient to the very end of its tail.

The downside is that a 5-second sample can be too long for many applications and will consume significant storage space. Therefore, after generating a sound, it is essential to use the **Trim**, **Fade Out**, and **Save** functions available on the drum page to finalize your samples.

- The **Trim** function allows you to precisely define the start and end points of the sample, eliminating unnecessary silence or cutting off a long tail you don't need.
- The **Fade Out** function applies a smooth volume reduction to the end of the trimmed sample, preventing any abrupt clicks or pops.
- The **Save** function then writes the processed, trimmed, and faded sample to your SD card as a clean, ready-to-use WAV file.

This workflow ensures that your final samples are perfectly tailored for your projects, regardless of the initial length of the generated sound.

After you've crafted your sound and adjusted with trim, you can save it to an SD card. NoiseMaker will write a standard 16-bit, 44.1kHz WAV file, ready to be imported into any DAW or hardware sampler. This streamlined process allows you to quickly design, refine, and export custom drum samples with unique reverb characteristics.

Also make sure to save your performance - If there are any changes to the samples, their Names, Filepath and settings in the Drum page, these will be lost when you are not also saving the performance.

Filemanager allows you to view and audition samples from both the **SD card** and the device's **PSRAM** so you can check their storage requirements.

Sample Storage and Management

NoiseMaker uses a two-tiered system for storing and managing your sound samples. Understanding this system is key to a smooth workflow.

1. **PSRAM (External RAM)**: This is the temporary, high-speed storage location for the active sample you are working on. Every time you generate a new sound, it is automatically rendered and loaded into PSRAM. This is also where the `reverb` and other effects are applied to the sound before it's played back. The data stored here is **volatile**, meaning it is erased when you power off the device.
2. **SD Card**: This is your long-term, non-volatile storage. To save a sample permanently, you must manually use the **Trim** and **Save** functions. This process writes the finalized WAV file to the SD card, allowing you to access it later or transfer it to another device. Think of the PSRAM as your scratchpad and the SD card as your final archive.

The Offline Reverb of NoiseMaker

Mastering the NoiseMaker Reverb

The NoiseMaker's onboard reverb is a powerful tool for adding a sense of space and dimension to your drum sounds. Unlike many hardware reverbs that process effects in real time, this unit utilizes an **offline processing** method. This means the entire audio sample, from the initial hit to the final reverb tail, is rendered and stored in PSRAM (external RAM) before it's played back. This approach ensures a lush, high-quality, and artifacts-free reverb without taxing the processor, allowing you to create complex and layered sounds.

Applying the Reverb to Your Drum Sounds

The reverb engine provides a set of core parameters that give you complete control over the sonic character of the space. You can access and adjust these controls via the NoiseMaker's user interface and encoders.

- **ROOM SIZE**: This knob adjusts the size of the virtual acoustic space. Dialing in a low value creates a tight, intimate sound reminiscent of a small drum booth, while a high value opens up a massive hall or cathedral sound.
- **DAMPING**: Damping controls how quickly high frequencies decay in the reverb tail, simulating the absorption of sound in a real room. Lower values result in a bright, metallic, and ringing reverb, while higher values produce a darker, more natural-sounding decay, as if the room were filled with soft materials.
- **WET LEVEL & DRY LEVEL**: These controls act as a classic mix fader. The **WET LEVEL** determines the amount of the processed (reverb) signal you hear, and the **DRY LEVEL** controls the volume of the original, unprocessed drum sound. By blending these two, you can achieve anything from a subtle sense of depth to a fully washed-out, ambient texture.
- **WIDTH**: This parameter allows you to expand the reverb across the stereo field. A low width value will keep the reverb focused in the center, while a high width value will create a wide, immersive stereo effect.

Stereo vs. Mono Reverb

NoiseMaker gives you flexible control over the spatial positioning of your sounds by separating the global **stereo mode** from the **reverb width** parameter.

- The **stereo mode** is a global setting that defines the nature of the initial, dry drum sound. A mono drum sound will be a single, centered signal, while a stereo drum sound can contain subtle spatial information from the moment it's generated.
- The **reverb width** parameter, on the other hand, is a dedicated control that only affects the stereo spread of the reverb effect.

This allows for a powerful combination of spatial effects. For instance, you could use a focused, mono drum hit with a wide, expansive stereo reverb, or you could pair a stereo drum sound with a tight, mono reverb to keep the effect centered.

Refining Your Samples in the Drums Page with Trim, Fade out and Save to SD Card

Once you've designed a sound with your desired reverb characteristics, the next step is to save and refine it for your projects.

The **Trim** function is a crucial final step. NoiseMaker generates the full audio file for a sound, including the entire reverb tail (if activated). The trim function in the Drums Page lets you precisely define the **start** and **end** points of the sound you want to use. This is particularly useful for:

- Removing any silence at the beginning or end of the sample.
- Cutting off a long reverb tail to create a tighter, more rhythmic hit.
- Isolating a specific part of the sound for a unique transient or effect.

After you've crafted your sound and adjusted the trim, you can save it to the SD card. NoiseMaker will write a standard 16-bit, 44.1kHz WAV file, ready to be imported into any DAW or hardware sampler. This streamlined process allows you to quickly design, refine, and export custom drum samples with unique reverb characteristics.

Important: After you have created or changed any Samples in PSRAM and then saved them to SD Card, most probably you also have to save your Performance. Otherwise when reloading the Performance it will not have any information about changed or added Drumsounds, their names, filepath or values from the Drum Page.

Granular Synthesizer

The Granular Engine

The MDT Granular Engine transforms static audio samples into dynamic, evolving soundscapes by treating audio as collections of microscopic sound particles called **grains**. Unlike conventional sample playback, this approach allows for unprecedented manipulation of time, pitch, and texture independently.

Core Concept: Your audio sample becomes a "sound pool" from which the engine extracts tiny fragments (grains) and reassembles them in real-time according to your parameter settings.

Voice Architecture

The engine provides up to **6-voice polyphony**, with each voice capable of generating up to **8 simultaneous grains**. This architecture enables complex, layered textures while maintaining clear voice separation for melodic playing.

Voice Allocation:

- **Note Priority**: Last-note priority with round-robin voice assignment
- **Voice Stealing**: When all voices are active, new notes will gracefully take over existing voices
- **Release Phase**: Voices continue processing grains during release envelope for smooth fade-outs

Parameter Deep Dive

Grain Size (10-205ms)

Controls the duration of individual grains. Smaller values create granular, particle-based textures ideal for glitch effects and atmospheric pads. Larger values approach conventional sample playback with added motion.

Creative Use:

- **Minimal**: Digital artifacts, stuttering rhythms
- **Medium**: Smooth granular clouds
- **Maximum**: Near-original sample with subtle motion

Grain Position & Spread

Determines where in the sample grains are sourced from, with Spread adding controlled randomness.

- **Position**: Sets the primary extraction point in your sample
- **Spread**: Introduces positional variation for wider, more diffuse textures

Creative Use:

- **Tight Position + Wide Spread**: Creates stereo width from mono sources
- **Animated Position**: Scans through different sample regions
- **Zero Spread**: Precise, rhythmic granular patterns

Pitch Shift (100 semitones)

Transposes grains independently of playback speed. Combined with density controls, this allows for harmonic clouds and pitch-based melody and pattern generation.

Density (1-36 grains/second)

Controls how frequently new grains are generated. Lower values create sparse, pointillistic textures. Higher values produce dense, cloud-like pads.

Density & Size Interaction:

- **High Density + Small Size**: Thick, washy textures
- **Low Density + Large Size**: Rhythmic, articulated patterns

Envelope System

Dual Envelope Architecture:

1. **Voice Envelope**: Traditional ADSR controlling overall voice amplitude
2. **Grain Envelope**: Built-in windowing (15% fade in/out) for smooth grain transitions

Attack/Release Times:

- **Attack**: Shapes how quickly the granular cloud builds up
- **Release**: Controls decay time after note-off - essential for pad sounds

4.5 Advanced Techniques

Sample Selection Strategy

- **Transient-rich samples**: Create rhythmic complexity with high density
- **Sustained sounds**: Ideal for pad and texture generation
- **Field recordings**: Unlock hidden textures and micro-rhythms

Parameter Automation

- **Position scanning**: Create evolving textures by moving through sample content
- **Density modulation**: Build and release tension through grain frequency
- **Size morphing**: Transition between granular and sample-based playback

Performance Considerations

CPU Management:

- Maximum polyphony: 6 voices × 8 grains = 48 simultaneous grains
- Grain count affects processor load - monitor active grain display
- Complex parameter automation may increase CPU usage

Signal Flow:
Sample Memory → Grain Extraction → Pitch Processing → Window Envelope → Voice Mixing → Amplitude Envelope → Output

Granular Synthesizer usage of PSRAM Memory

MDT utilizes **PSRAM (Pseudo Static RAM)** as its primary audio memory reservoir, providing extensive storage for samples and effects processing. Understanding this architecture is crucial for optimizing performance and avoiding audio artifacts.

PSRAM Allocation:

- **Granular Samples**: All grain source audio resides in PSRAM
- **Reverb Processing**: Effect buffers and impulse responses
- **Delay Lines**: Multi-tap delay memory storage
- **All preset and Custom Samples**: Conventional /pitch shifted sample playback

5.2 Bandwidth Limitations & Grain Management

PSRAM operates with **finite bandwidth** that must be shared across all audio operations. The granular engine is particularly bandwidth-intensive due to its random-access nature.

Bandwidth Considerations:

- **Maximum Simultaneous Grains**: Limited by PSRAM read capacity
- **Grain Size Impact**: Larger grains require less frequent memory access
- **Position Spread**: Wide spread increases random access demands

Performance Guidelines:

- **Optimal Grain Count**: 20-30 simultaneous (total) grains typically maintain smooth operation
- **High-Density Settings**: Monitor for audio dropouts or glitches
- **Sample Length**: Longer samples don't significantly impact bandwidth

5.3 Engine Isolation Architecture

MDT has different **memory architecture** between the various synthesis technologies:

PSRAM-Dependent Engines:

- Granular Synthesis (this engine)
- Sample Playback
- Reverb Effects
- Delay Effects

PSRAM-Independent Engines:

- **Dexed (FM Synthesis)**: Runs entirely in internal RAM
- **Braids (Wavetable/VA)**: Uses internal DSP memory
- **Analog Modeling**: Processor-based calculations

Critical Benefit: You can run **Dexed, Braids, and other synth engines simultaneously** with granular processing with no or less impact on PSRAM performance. These engines operate in separate memory domains.

5.4 Practical Performance Strategies

Granular-Specific Optimization

- **Balance Density & Size**: Higher density with smaller grains maximizes texture while managing bandwidth
- **Voice Management**: Use polyphony strategically - 6 voices with moderate grain counts often outperforms 1 voice with maximum grains
- **Sample Selection**: Mono samples reduce bandwidth by 50% compared to stereo

Monitoring Performance

Real-time Indicators:

- **Audio Dropouts**: First sign of PSRAM bandwidth exhaustion
- **Grain Truncation**: Grains may be shortened if memory access is delayed

- **Effect Artifacts**: Reverb may sound truncated or delays may drop taps

Proactive Management:

- Start with conservative settings and increase complexity gradually
- Use the active grain/voice counter to monitor load
- Test maximum capacity during sound design sessions

Optimal Performance: Live Instrument Mode

The MDT Granular Engine delivers its **peak performance** when operated as a **live playing instrument**. This mode leverages the real-time nature of granular synthesis for maximum responsiveness and lowest latency.

Live Performance Advantages:

- **Low Latency**: Minimal processing delay
- **Dynamic Interaction**: Real-time response to velocity and on screen parameter changes
- **Spontaneous Texture Creation**: Instant parameter changes for evolving soundscapes

Dual Sequencer Integration

The granular engine features complete integration with both available sequencers, offering unique capabilities in each.

Sequencing Approaches in pattern based Sequencer

The MDT Granular Engine offers integration with the pattern sequencer through three distinct modes, each unlocking unique creative possibilities for granular composition and performance.

Instrument Mode: Precision Granular Sequencing

In **Instrument Mode**, the granular engine responds to the sequencer as a traditional melodic instrument, with each step triggering individual granular voices.

Key Characteristics:

- **One Step = One Granular Trigger**: Each sequencer step launches a complete granular voice
- **Pitch Sequencing**: Steps control both trigger timing and melodic pitch
- **Voice Independence**: Each step maintains separate grain characteristics
- **Rhythmic Precision**: Ideal for complex granular rhythms and patterns

Creative Applications:

- **Melodic Textures**: Sequence pitched granular melodies with controlled evolution
- **Rhythmic Stutters**: Program precise rhythmic granular patterns

Chord Mode: Textural Cloud Sequencing

Chord Mode transforms the granular engine into a powerful textural tool, where each step triggers complex harmonic structures rather than single notes by just using a single sequencer track.

- Each sequencer step triggers a full chord with granular processing
- **Voice Stacking (3-6 notes)**: Multiple notes create dense, layered granular textures
- **Harmonic Evolution**: Chord changes create dramatic texture shifts
- **Sustained Pads**: Ideal for evolving background textures and atmospheric pads

Arpeggiator Mode: Evolving Motion Sequences

Arpeggiator Mode combines the granular engine with the built-in arpeggiator for continuously evolving patterns with minimal sequencing effort. You can use all available ⅛ and 1/16 arp pattern, with and without euclidean mode.

The MDT Granular Engine adapts to your creative workflow, whether you're performing live, composing with sequencers, or working in the studio.

It represents a sophisticated tool for sound design, capable of transforming any audio material into complex, evolving textures. Experiment with extreme parameter combinations to discover unique sonic territories.

Custom Samples

Since mid 2024 MDT offers a stable and flexible way to use Custom Samples. This is only available when you do have one or 2 PSRAM chips soldered to your Teensy (or got a pre-soldered Teensy, including PSRAM, check out the BOM if you like to get that).

When you boot MDT with a firmware that has support for PSRAM custom samples (the firmware filename should begin with PSRAM) then all default and custom samples will be loaded from the SD Card to PSRAM. For the default samples, this will happen automatically. The custom samples need to be loaded manually once, per Performance. If you save a Performance, your selected customs samples will become part of the Performance and will automatically reload when you load the Performance.

Note: In the System Menu you can select a Performance that should autoload after a new boot. This can be a static Performance number or it can be your last (previous) loaded and saved Performance.

Step 1: How to copy to SD CARD

Copy your custom samples to the SD Card folder **CUSTOM**. If you have preloaded the demo content, then this directory should already exist with some demonstration samples in it. Feel free to edit, replace or delete them if you wish so.
If you are wondering where the default samples are located: These are in the folder **DRUMS** on the SD Card. It is suggested to not modify the Drums folder for your first attempts in using custom samples. It is also possible to modify the default samples but this will not be covered in this chapter.

The samples can be **16bit mono or stereo** samples or a mix between both. MDT should autodetect the types correctly and individually.

You can copy your own samples either by removing the SD Card from the Teensy SD Card slot and attach the Card to your PC or you can leave the Card in MDT untouched and copy the samples via the PC Web Remote (for more details see the Web Remote Chapter).

Step 2: How to copy to PSRAM

After your files are in the CUSTOM folder on the SD Card, open up **File Manager**.

On the left side of the screen, you will always see the content of the SD Card. On the right side, you see the current content in **PSRAM**.

Either navigate manually to the folder **CUSTOM** or push the touch button **COPY > PSRAM.** This will **automatically** jump to the CUSTOM Folder on the SD Card and list the files located in there.

You can change the **active window** (left or right) by **touching the display in the rectangular area** where the files are listed.

The currently active side will have a **WHITE BORDER** visible.

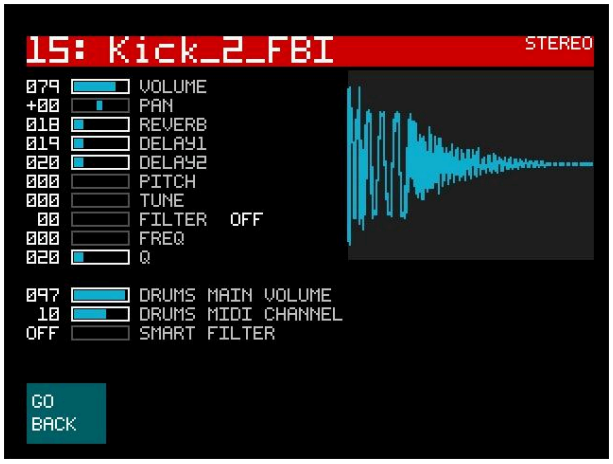
Select the sample you want to copy from SD CARD (in the left window) and select a slot in the right window where it should be copied to. While the **COPY > PSRAM t**ouch button is still active (highlighted in cyan color), **PUSH ENC_R**

The sample is now copied and its name now appears on the right side, at the currently selected slot position.

Notice that the slot number will not change after a copy has happened. So if you select another sample on the SD Card side but do not change the destination in PSRAM, it will go to the same (previously selected) slot. To move to another slot, activate the right side window (by touching the display on the right side) and move the Cursor up/down with ENC_R.
Then again **PUSH ENC_R** to copy the highlighted file from left to right side. Make sure that **COPY > PSRAM** is still active**.**

Repeat this until all samples you want to use in the current Performance are loaded in PSRAM.

This basically is all you have to do to use custom samples. The custom samples will appear in all places where samples are involved and will be saved and reloaded together with the Performance, just as if they were part of the default/stock samples.

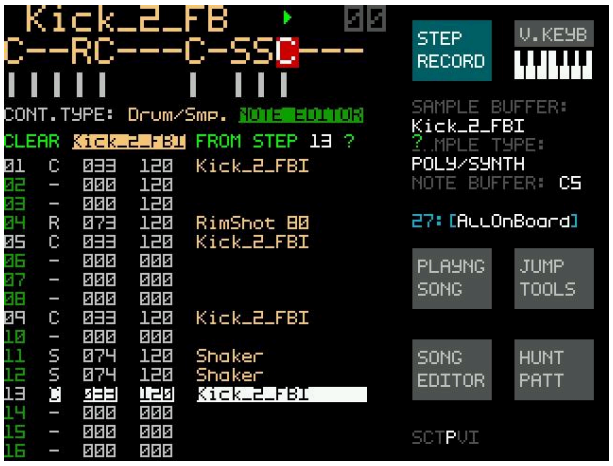


After loading any custom samples, you see them together with the default content in the DRUMS menu, for example.

All the usual settings behave identical to the stock samples.
When you have loaded a stereo sample, the panorama function will be visible but is ignored since you have loaded dedicated sounds for the left and right side of the stereo signal.

The multimode filter for samples currently is disabled due to free memory issues caused by the new stereo options. All the other options and send effects are now available for mono as well as for stereo samples.

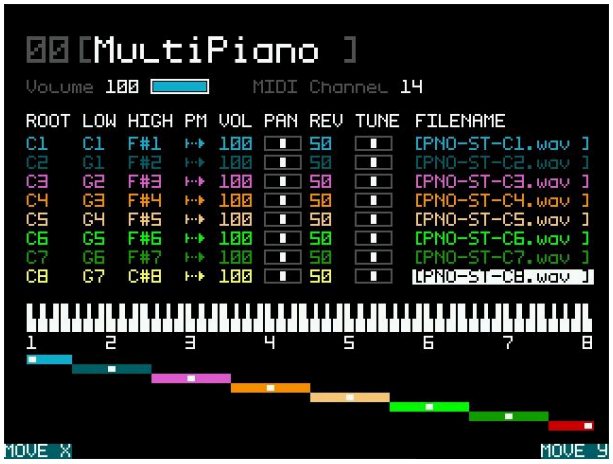
Notice that the reverb settings in the DRUMS menu are for the sequencer or live playing. If you use a sample in MSP (MultisamplePlayer), it comes with its own, unique reverb setting so you can use the same sample with different settings in both parts, without loading a sample twice.



Here you see a custom sample in the Sequencers pattern editor.

You can add, replace, delete the custom samples in patterns the same way as the stock samples.

In this screen the Kick Drum of a demo pattern is replaced by a custom (stereo) sample.



In MSP (MultiSamplePlayer) you will not be able to see if you have loaded mono or stereo samples. They however should work in exactly the same way and autodetect if they are mono or stereo.

Panorama is available for mono but not for stereo samples. Stereo Samples should always be panned correctly to their stereo sides.

Most of the MSP settings are unique to this Engine and are not used in other parts of MDT. Examples are: Low/High Note settings for Sample Zones, their individual Volume and Reverb settings.

MSP currently has 2 patches with 8 slots each for stock or custom samples, every slot can be either mono or stereo.

Sample Management with MDTX

MDTX and also the Hardware from MusikandMore have 2 SD Card slots, one internal and one accessible externally.
Filemanager will recognize that and has some extra functions that will allow:

- copying files and folders between them
- deleting files and folder on both cards
- preview samples from both cards

The copy functions, when used on folders, should work fully recursively.
This will allow to transfer all Samples, Performances etc.. from internal to external or in reverse.
Since this is in an early state, it might have problems or errors. Check the SD Card directly from your PC/Mac to make sure it is working and to get familiar with how to work with these functions. If you find problems, make sure to open an Issue on Codeberg.

MIDI

MIDI Channels

In the SYSTEM - MIDI CHANNELS menu, set the MIDI receive channel for each instrument.

Select a channel between 1 and 16 or OMNI to receive data from all channels.

Be careful when selecting OMNI, this can lead to undesired effects at multiple places in MDT you will not be aware of if you are new to MDT.

If possible, try to stay away from setting anything to OMNI until you have had some time using MDT.

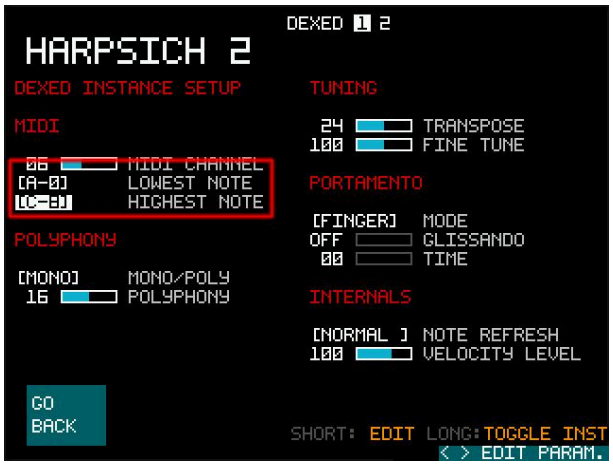
In all of the MDT internal instruments, you also can directly select the MIDI channel in their individual instrument page.

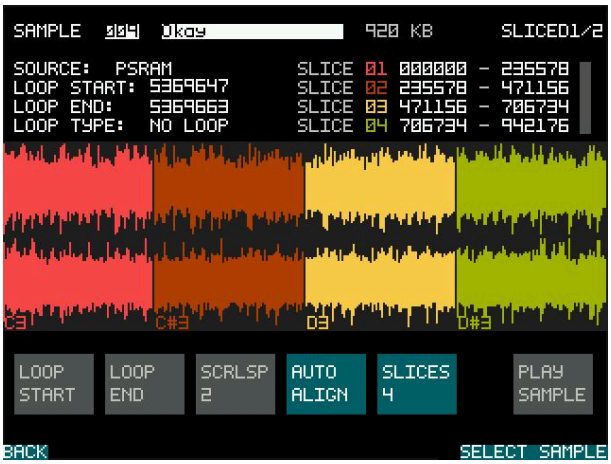
The SYSTEM - MIDI CHANNELS page however, gives you a complete overview.

Lowest/Highest Note and Sliced Samples:

Usually an instrument will stretch over the full range of MIDI notes for each channel. There are some exceptions:

For Dexed: Define the MIDI note range to which an instrument responds, useful for split and dual configurations, especially when using all or some of the Dexed Instances at the same time (either for sequencing or live usage). You can setup these parameters directly in the **DEXED VOICE** Page (or in its submenu, **DEXED - SETUP**)





Samples/Slices: When working with sliced samples, each Sample will be set to an individual note.

Currently 2 sliced samples with 16 slices each are available. You can have different numbers of slices for the sliced samples. The first note of the first sliced sample will always be C3. Followed by all slices from the same sample.

The first note for the second sliced sample will depend on the number of slices of the first sliced sample.

MDT will try to “auto-renumber” the keys when you make any changes about the sliced samples and their amount.

MIDI Channel Setup Summary

MicroDexed-touch (MDT) allows for extensive customization of MIDI channels for both internal sound generation and communication with external devices. Here is a breakdown of how to set up MIDI channels:

Internal Sound Sources/Instruments

● Centralized MIDI Assignment View: The **System** Menu -> **MIDI channels** page provides a centralized view of all MIDI channel assignments, allowing you to easily check and modify them.

● Individual MIDI Channels: You can set individual MIDI channels for each sound source within MDT, including:

- Dexed (two/four instances with 16 voices each)
- Microsynth (two instances, each monophonic)
- MDA ePiano (16 voices)
- MSP MultisamplePlayer (2x 8 individual samples can be played with a polyphony of 8 voices shared with drums)
- Braids (one instance, polyphonic up to 8 voices)

Avoiding Channel Conflicts: Ensure that you are not accidentally assigning multiple instruments to the same MIDI channel unless intentionally creating a layered sound.

At startup, when auto loading a performance, the **MIDI channels** screen will come up when MDT finds you have conflicting channels.

Sequencer and LiveSequencer have some special requirements about mapping and routing MIDI from external devices. Check in the corresponding chapters to learn more.

MIDI: Sequencer

In the LSDJ style sequencer, each of the 8 tracks (when used) need an assignment of an internal or external instrument.
Depending on the Content Type that is set in the pattern and is played in the individual track, different things may happen. For example:

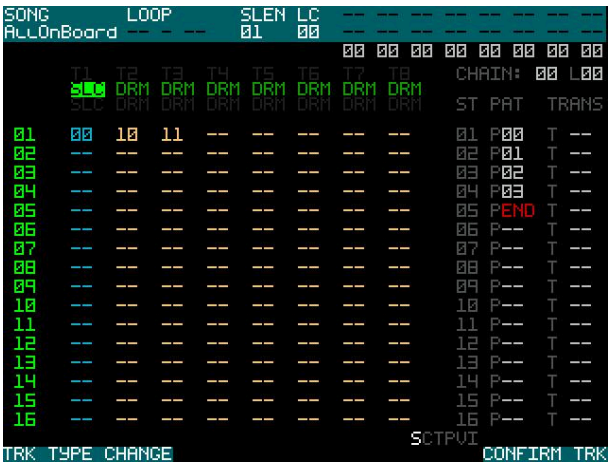
- Playing an internal instrument with normal notes
- Playing an internal instrument with an arpeggio
- Playing an internal instrument as chords
- Playing a drum sample
- Playing a pitched drum sample
- Playing a Slice of a sample
- Playing an external instrument with normal notes
- Playing an external instrument with an arpeggio
- Playing an external instrument as chords

● Sequencer Track Assignment: Beyond MIDI channels, the sequencer uses specific instruments to each of its eight tracks.

You can assign:

- Dexed (Instance 1 or 2 (1-4 with PSRAM)
- Microsynth (Instance 1 or 2)
- ePiano
- Braids
- MSP (Multi-Sample Player) Slot 1 or 2
- SLC (Sliced Sample)
- TRS MIDI channels 1-16 (or OMNI)
- USB MIDI channels 1-16 (or OMNI)

Note the Track Type Influence: The behavior of the sequencer track changes, based on its assigned track type, which can be drum, inst (instrument), chord, arp or SLC (Sliced Sample).



Please read the Chapter **SEQUENCER** for a more in depth look at how the Sequencer is intended to be working.

The very core principles of the Sequencer are a reimagined variation from the Little Sound DJ for the portable/handheld Gameboy Gaming console.

LSDJ is very much optimized for the sound chip of the Gameboy, so the core navigation and logic in MDT is similar, but not everything about the sound parameters is the same.

Since we do have some more screen space, in Song view, the CHAIN steps and the CHAIN content (patterns) are visible at the same time on the same page. This makes editing more convenient, while still having a good overview of the whole song.

In many aspects the LSDJ concept is greatly expanded in MDT - having polyphonic chords per track, 8 instead of 4 mono tracks, allowing stereo, CD Quality Samples, several internal Sound engines for 64 or more concurrent voices, 2 delay and 1 reverb effect and much more.

The MDT Sequencer however currently does not have any step-based effect settings.

Every effect is always applied to a full instrument/full Track.

This might change in the future - if we can find technical and musical, doable and useful enhancements.

https://www.littlesounddj.com/lsd/index.php

MIDI: LiveSequencer

Picture of Track assignment in LiveSequencer: External TRS Jack/ DIN MIDI Channel 5 selected, as output for LiveSequencer Track 1

The MIDI Setup for LiveSequencer works differently than for the LSDJ Style Sequencer since it has a different usage scenario.

The goal of LiveSequencer is to let you record Patterns and Songs in an interactive/Live-like environment where you are working in realtime.

So switching to different tracks / instruments while playing and recording is very different.

As in the LSDJ style sequencer, you need to preselect an instrument / type for each of the 12 channels of LiveSequencer in advance.

Go to TOOLS VIEW, TOOL SEQ. At the row TRACK SETUP, you select the Track, destination device and destination Channel/Instrument.

Picture of Track assignment in LiveSequencer: Device Internal MDT, Instrument Type Drum/Sample, as output for LiveSequencer Track 1

When playing and recording, your MIDI Input Device should be set to a single, “non used” channel.

Meaning none of the internal MDT Instruments are assigned to this single channel that is set on your external MIDI Device.

Picture of Track assignment in LiveSequencer: Device Internal MDT, Instrument Type Dexed Instance2, as output for LiveSequencer Track 1

In the top row of touch buttons in the LiveSequencer you have track selection buttons (that represent the preselected instruments you set up earlier).

By just touching a track button, the MIDI input from your external device (set to an unused MIDI channel) will be routed by LiveSequencer from your device to the correct destination track.

This lets you switch instruments in a breeze and you do not have to care which instruments are assigned to which internal MIDI channel.

MIDI Synchronisation (MIDI Sync)

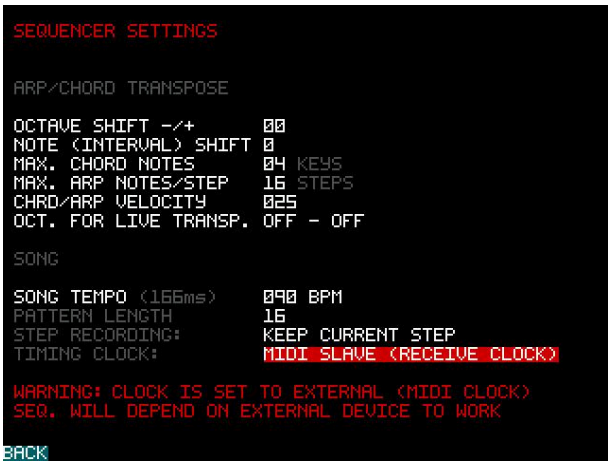
MDT can function as either a MIDI master or slave, controlled through the "MIDI CLOCK SYNC" setting in the SEQUENCER/SETTINGS menu.

If you do not intend to sync MDT to any external MIDI gear, make sure it is set to "**INTERNAL**". This will require the lowest resources and provide the best internal timing results for Sequencer and LiveSequencer.

Screenshot
NO MIDI Sync (MDT internal timing, no MIDI Clock)

Screenshot
MIDI Master Mode

When activated, MDT transmits MIDI clock signals to connected devices via USB-HOST, (Micro-)USB, and TRS-MIDI simultaneously. This mode offers optimal timing and minimal system load for synchronizing external gear to MDT when MIDI Clock is required. Changing the BPM/Speed on the fly is no issue at all for MDT.



Screenshot
MIDI Slave Mode

In this mode, MDT synchronizes its internal sequencer to an external MIDI clock received through any of its MIDI inputs.

This mode is working in general, but has known issues with UI Handling (Encoder input) and Screen Updates while running in slave Mode. Work in progress.

Sequencer Sync Behavior

● LSDJ-Style Sequencer: This sequencer demonstrates robust timing when syncing to an external MIDI clock, especially for synthetic instruments like Dexed. However, some minor delays might occur when using percussive samples / Drums.

● LiveSequencer: While LiveSequencer also attempts to follow MIDI clock sync, this functionality is still under development and might not be as tight as the LSDJ-style sequencer. It operates with a higher internal timing resolution that does not directly map to the standard MIDI timing of 24 pulses per quarter note.

Challenges and Improvements

● LiveSequencer Timing: Due to its higher timing resolution, achieving precise synchronization with the standard MIDI timing in LiveSequencer poses a challenge. Developers are actively working on refining the sync behavior for better accuracy.

MIDI Additional Notes

●OMNI Mode Caution: While you can set instruments to respond to all MIDI channels (OMNI), be cautious, as it can lead to unintended consequences. Using specific MIDI channel assignments is generally advised.

● MIDI Channel Change Warnings: MDT will issue warnings if you have multiple instruments set to OMNI or the same MIDI channel, helping you avoid potential issues. You can choose to ignore these warnings if the setup is intentional.

Sequencer

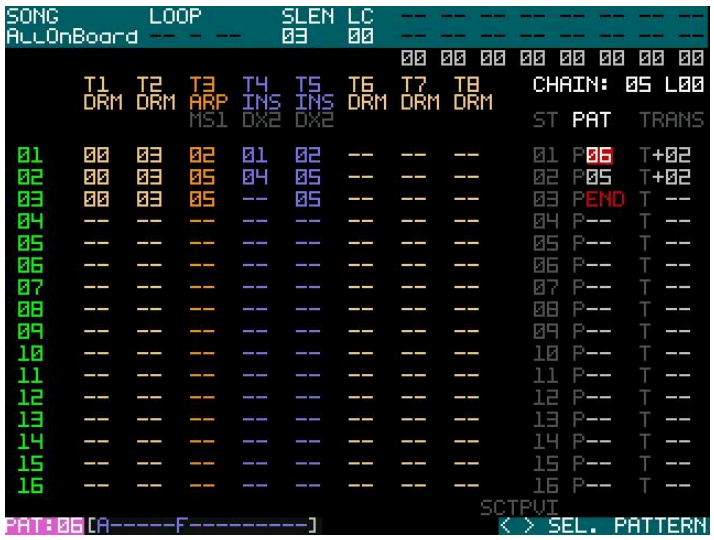
MicroDexed features 2 different Sequencers that can be used at the same time.

The more modern one is **LiveSequencer** https://www.youtube.com/watch?v=Z4lCJskHSTA

It is very easy to understand and fun to operate.

The previous native sequencer is a **LSDJ** style, song/chain/pattern oriented sequencer which is capable, but more complicated to get used to.The **LSDJ** style sequencer is described in this chapter.

Sequencer overview

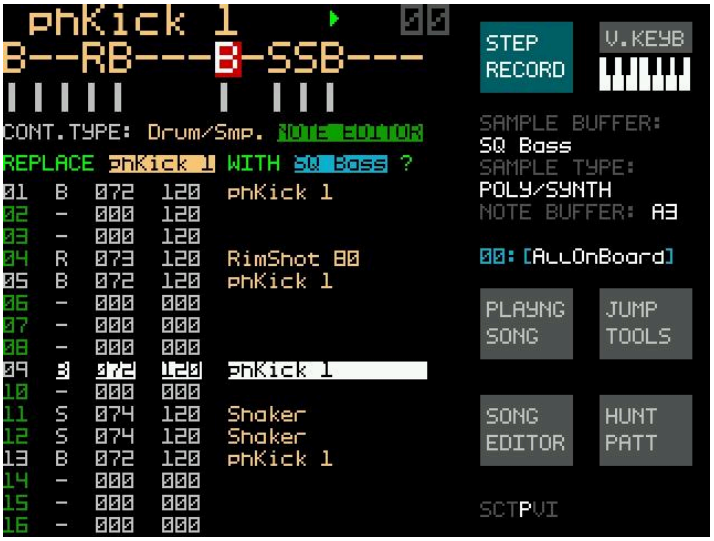


SONG VIEW

MicroDexed features an onboard sequencer that makes it possible to play up to 8 (SERIAL MIDI / USB MIDI / SAMPLE / MULTI-SAMPLE / DEXED / MDA ePiano / BRAIDS etc.) tracks simultaneously.

You can record your patterns either via (USB) MIDI in with a step recorder or by manually putting in the note and velocity data on the device itself, without using any external equipment. The step recorder can be enabled by touch and allows for note/velocity input by your preferred input device/controller for every single pattern with 16 steps.

This makes MicroDexed a musical sketchpad, a practice companion for bands, vocal artists etc.



PATTERN EDITOR

Since MicroDexed is also able to play back short audio samples, the sequencer can also be used as a drumcomputer.

Compared to a "traditional" tracker software like it was on the Amiga or other popular trackers, notes on a single track will not cancel out the previously played sound/sample from the same track. At least that is true until the polyphony limit is reached, that currently is 16 notes for each of the DEXED instances, and 8 notes from the drum/sample engine. Microsynth, MDA ePiano and Braids have their own polyphony count of 2, 16 and 8 voices on top of that.

Starting from V1.0, when you have an SPI Flash chip module soldered, MicroDexed can also play multi-sampled instruments.

Since Summer 2024, SPI Flash is deprecated for sample playback and replaced by PSRAM. This allows for stable and easy use of custom samples.

Understanding Pattern Editor

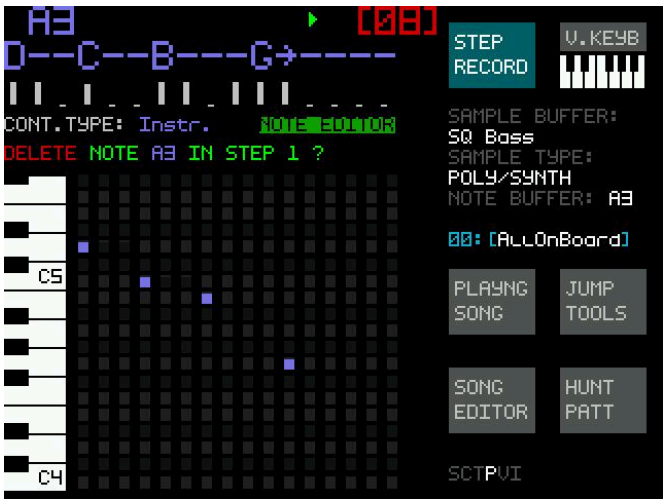
Patterns are the most basic building blocks of your song. Usually they are 16 steps long, meaning a bar has 16 steps and each is 1/16 of its length..

You can modify the pattern length in sequencer settings. However, everything other than 16 steps will currently break the synchronisation with Livesequencer.

When you enter pattern editor, you have a comparably large list of parameters/values to scroll through with ENC_R.

Apart from some settings, it is grouped into 2 large sections:

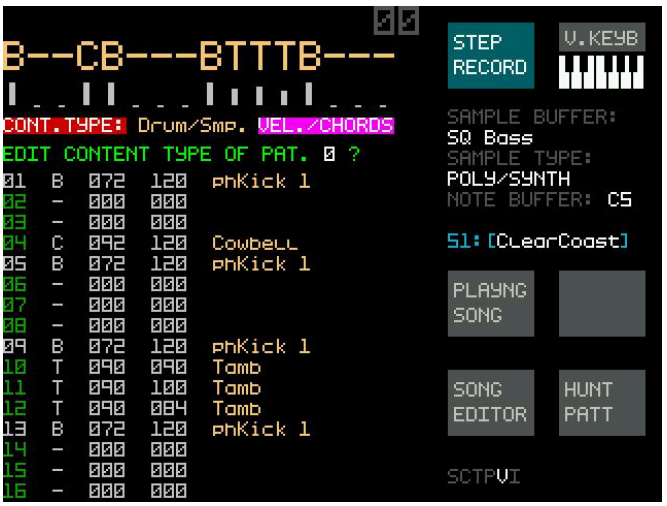
When content type is "**Instrument**":



The first half are the Notes that are playing.
The second half is the velocity of these Notes/Steps.

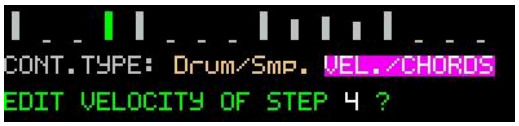
Notice that MDT shows Velocity values with the grey bars below the notes, even when you currently are not editing the velocity values.

When content type is "**Drums**":

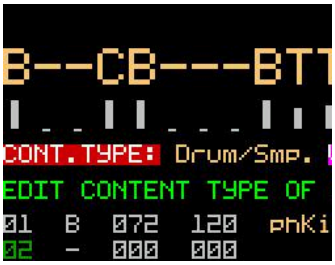


The first half also represents notes but each note now is a different drum sample.

The second half is identical as in "Instrument", featuring the velocity of the steps.



Notice that when you continue scrolling beyond the 16th note step, the "**NOTE EDITOR**" text will switch to "**VEL./CHORDS**" since you are now in **Velocity-Editor** (with also 16 steps), which corresponds to the previous 16 note steps.



To change the content type of a pattern, scroll all the way to the right, beyond the 16 note and 16 velocity steps. The last parameter is "**Content Type**".

Change it by pushing ENC_R and then scroll right/left with the encoder.
Push encoder_R once again to confirm.

The **content type will not define what internal or external instrument the pattern will be played with**.
It just defines the content and changes how the data in a pattern is represented visually.

If it is an "**Instrument**" you will see a **Grid of Notes** with a Keyboard on the left side that shows the actual notes.

If it is "**Drums**" you will instead see a **list-view**, showing the individual drum sound names and various parameters of each step.

There are more "content types" that will be described later in this chapter.

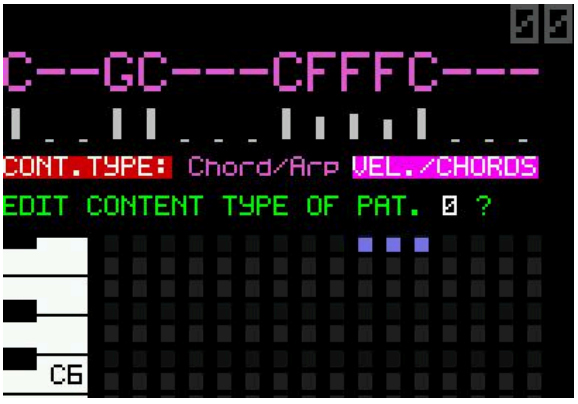
The **assignment from a pattern to an instrument does not happen in the pattern editor** but on the **Song** page:

This means a pattern can be played/used not by only one dedicated instrument but its data can be used wherever you want to use it, even at multiple tracks with different instruments.

Also, if your pattern contains chords or, for example, is an instrument with a melody or bass, in song mode you can transpose a pattern up and down, keeping its note at the same scale. Usually you do not need to have your own patterns for each and every chord, but only one for each chord type. This makes it way quicker to build up your song.

For example, if you have a song with Am, Em, F, C and G chords, it is enough to have one pattern with Major and one pattern with Minor chords in it. More about the song page in the "Song" chapter.

Apart from **Instrument** and **Drums**, there is:



Chord/Arp

Chord/Arp works identically in pattern editor, the difference is just how the **chords are played** from the song page.

Depending if - in the pattern editor - you select “Chord” or “Arp”, it will either play as full chords (that are further defined in the Sequencer Settings page), or when set to ARP (in song page) one note after another, which is defined in the Arpeggio Page. Both “play styles” are applied in real time. They can be changed and switched at any time. The stored information about the chord to be played, keeps the same in the sequencer data.

and

smpSlices (Sample Slices)

smpSplices is similar to **Drums**, however it is playing only a **single Sample** that you can auto-chop up in smaller pieces in Sample Editor. Sample Editor will show you the keys, which chop will land on which key. At the moment, you can use 2 Sliced samples. Each with 2-16 slices / chops with a total of 32 slices.

Editing the content of a pattern

In general there are 2 methods on how you can edit a pattern. You can enter notes/values with **Enc_R**, or you can use the "**STEP RECORD**" function (together with an external MIDI Keyboard or with the internal Virtual Keyboard)

STEP RECORD requires to have attached some kind of MIDI Device to either TRS MIDI in or USB (HOST) MIDI IN or to use the internal, virtual Screen-Keyboard:

The virtual Keyboard features a **touch-Velocity slider** to change the velocity step you are playing on it.

The Step recorder has **3 different styles** of how to record steps into the pattern editor.

- 1 key step (by pressing keys on the keyboard, the note will change, but it will stay on the same step)
- 2 auto-advance (it will advance 1 step by each keyboard step, until the pattern reached the last step, then it continues at the first step and continues without ever stopping)
- 3 auto-advance+stop (it will do the above, but stop recording after the last step)

When you want to add/modify Notes without a keyboard, you can do so with ENC_R:

- Scroll all the way to the left.
- Depending on what content type your pattern is, you will see either **Samples** names or **Note names**.
- When your content type is **smpSlices**, you will see all auto-numbered Slices of the sliced samples.
- When your content type is **Chord/ARP**, you will see Notes. Whatever you select here (with the usual procedure, Push ENC_R, select a note/sample, ENC_R to confirm), it will be the root note of the chord.

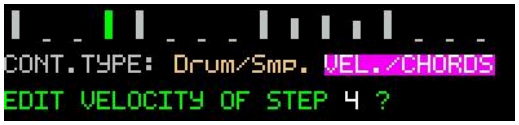
  The difference here is, when you scroll beyond the last step of the 16 steps, you will not find velocity values, but instead the chord type.

  This currently features "Major, Minor, seven, aug, dim and Maj7"

You can control the **chord volume** in the sequencer settings page, also the **number of notes** a chord should have (1-7) and you can shift it by steps and by octaves up and down.

Now that you have selected either a Note, a Sample, a Slice or a Root-Note of a Chord, you can scroll to the individual steps of the pattern.

Notice:



When you are seeing the pattern Notes/Samples, there is a green text saying: "**NOTE EDITOR**".

When you scroll beyond the 16 Note steps, it will say: "**VEL./CHORDS**", meaning you have reached the other half of the pattern editor, where you are not editing the Note values, but the velocity or chord type.

If you are in a drum pattern, there are some special cases:

When you have scrolled all the way to the left and it is showing the sample names, the first 6 samples behave differently from the rest. This is a relic from the first experiments with samples on MDT and you can probably skip them without missing out much. However if you want to understand them:

These are "step-pitchable" samples. When you insert one of these samples as their note value, you will only add the sample name, not the "note". The note however is inserted where you usually find the velocity or chord value. This is a bit weird since it is the opposite for all other content types. You will detect the pitched samples by the small cyan inverted “P” symbol where usually you see velocity values. The Pitched samples do not have individual volume **per step**, but on a global level. You can set their level (for each sample separately) at the **DRUMS** page.

Since many of the demo songs/patterns make use of them, this is kept here mostly for legacy reasons. For using pitched samples, it is easier to use MSP (see MSP chapter)

After the pitched-samples you find another special case, the user defined (or custom) samples.

These can be loaded up in filemanager, if you are on a firmware that is compiled for PSRAM usage.

Apart from being able to change these samples by your custom content, they will behave exactly as all of the rest of the stock samples.

Custom samples can be either mono or stereo, 16bit, 44.1KhZ wav files.

Inserting / Editing Steps

Depending on your content type, when hovering with the cursor above the 16 note steps, different things will happen.

If you are in a **drum pattern**:

If you are on a step that features the same sample that you have previously selected when scrolling all the way to the left, MDT will find that you have selected the identical sample. In this case, it will clear the step when you insert it.

If you have selected a different sample than is currently there, or if the step currently is empty, it will add the sample that you have previously selected.

If you are on an **instrument** or **chord** pattern, it will follow similar rules. If it is identical to what is currently there, it will be erased, otherwise it will be replaced or insert the new value.

If you have forgotten what note/sample you currently have selected, on the right side of the screen is a field named "SAMPLE BUFFER" that will show you the currently selected sample that is going to be inserted/replaced/removed from the current cursor step.

Several Tool Touch Buttons exist in the pattern editor, which allow you to access various functions more quickly.

Specially helpful is the "**JUMP TOOLS**" touch button.

If you touch this, you will get close to several useful tools/features:

- Clear Pattern
- LATCH (holds a note after it is initially played for as many steps as you insert the Latch)
- EMPTY (Clear out a step)
- Clear All (Clears every pattern!)
- Copy Pattern (copies the current pattern to a different pattern number)
- Swap Pattern (switches the current pattern with a different pattern number)
- Fill Pattern (Fills a pattern with 1/4, 1/8, 1/16 Notes with the current note/sample you have selected)
- Transpose (Transposes your current pattern up or down +-36 half tones)

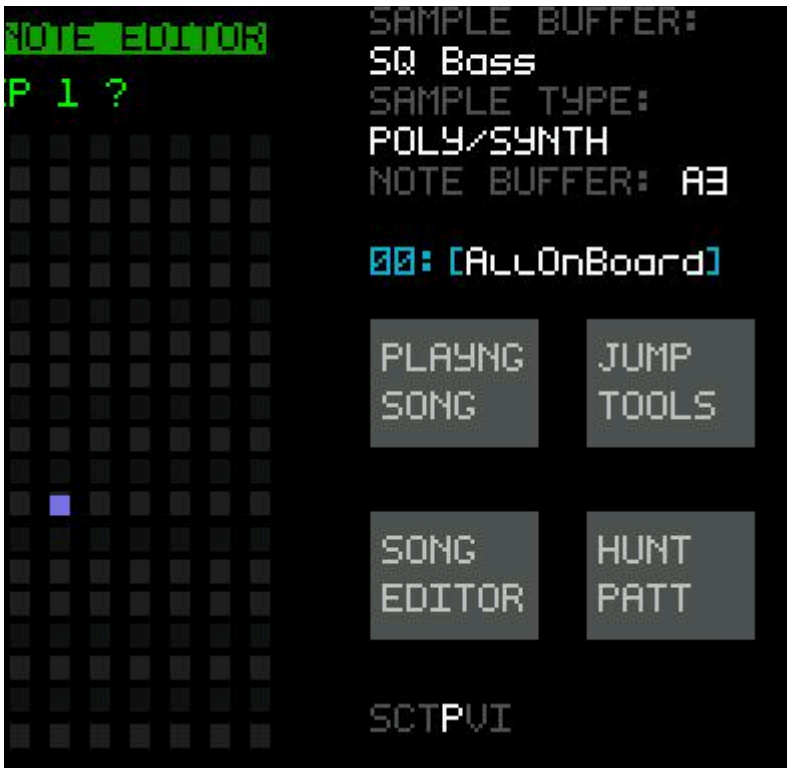
For Content types **Instrument** and **Chords,** there is a **LATCH** function. This is represented by arrows, pointing to the right (in play direction).

You can add one latch step or as many as you want. Latched notes should work for all internal and external instruments, except samples.

There are 2 ways to reach this function:

Either scroll all the way to the left, when the cursor hits the first parameter where you can select a Note or a sample. Enter edit mode and scroll to the right until you reach the highest note or the last sample.

Or touch the **JUMP TOOLS** touch button, then scroll back one tick with ENC_R and you are at the LATCH function.



There are some additional Touch buttons here. 2 of them will only work, when the pattern that you are currently editing (on screen) is already used in your Song (meaning used at least in one Chain-Step in the Song page)

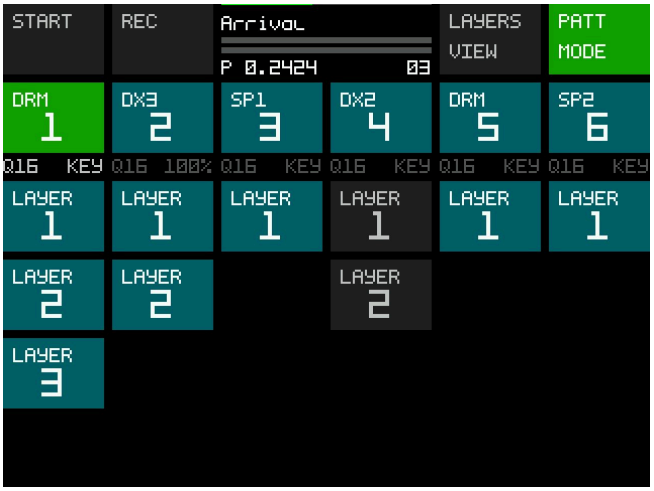
PLAYING SONG / **LOOP Pattern** (will switch between playing the song normally or only looping one pattern)

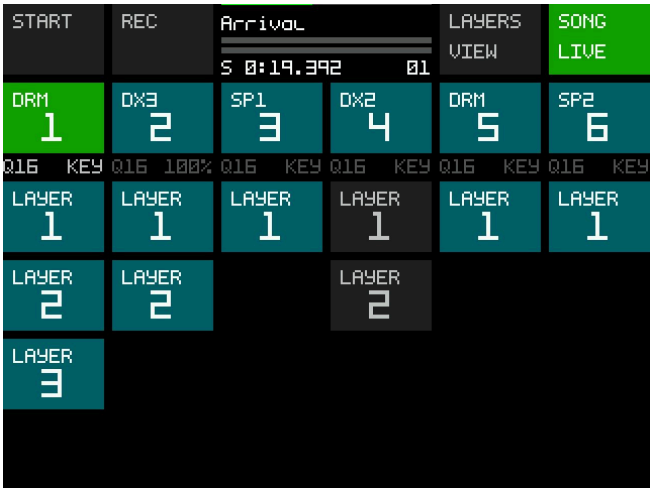
and

Hunt Pattern (will play your song, but first **it will hunt for a position, where the currently visible pattern is used in your song**, meaning you can hear the pattern you are editing in full musical context, while you can edit it in real time)

LiveSequencer (in more depth)

Livesequencer differentiates between 2 major view modes, Pattern Mode and Song Mode. Toggle between them with a short touch on the touch button in the top right corner. Let's start with the basics.





On the top right, in both modes, you have a (Sequencer) Start and Record touch button. Notice that these Buttons behave differently while you are in Pattern- or in Song Mode.

In both cases, first select a Track you want to record to by touching the buttons labeled 1-6 in the second row of touch Buttons.
The selected track will be shown in green color.
With Encoder-R, you can toggle the view between showing Tracks 1-6 and Tracks 7-12.
Start in Pattern Mode when you are beginning to start recording your Song/Performance.

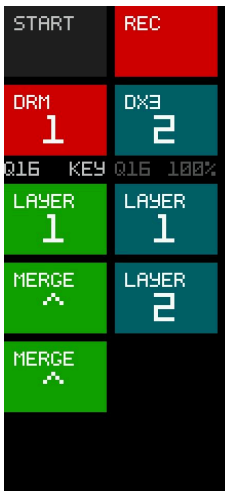
When you have attached a MIDI Keyboard (or you use the internal Touch Keyboard), touch **REC** and then **Start**: You will get a count-in and then LiveSequencer will record your MIDI Input to the selected Track on the first free available Pattern.

You can record up to 4 Patterns per Track. At any time, you can **delete** or **merge** a Pattern with the previous above. If you have recorded Patterns that you do not need in isolation, you can merge multiple times so you end up with one Pattern that contains all what you had previously in 4 Patterns.

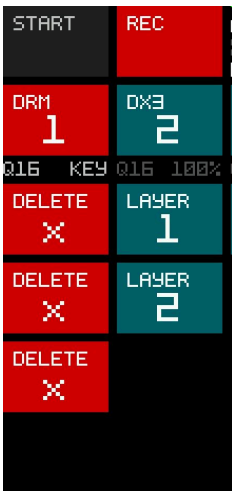
To start, either **DELETE** or **MERGE** Mode, enable the **REC** Button and then **short-touch** on the Track Number.

With each short-touch on the Track Number Button, you will cycle through the modes **Layer Merge**, **Delete**, **Clear Pitchbend** and **Clear CC**.

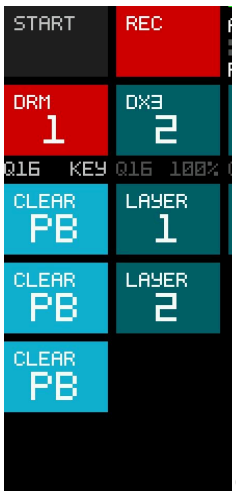
Touch on the specific Touch Button of the pattern itself, to apply the operation.



Merge



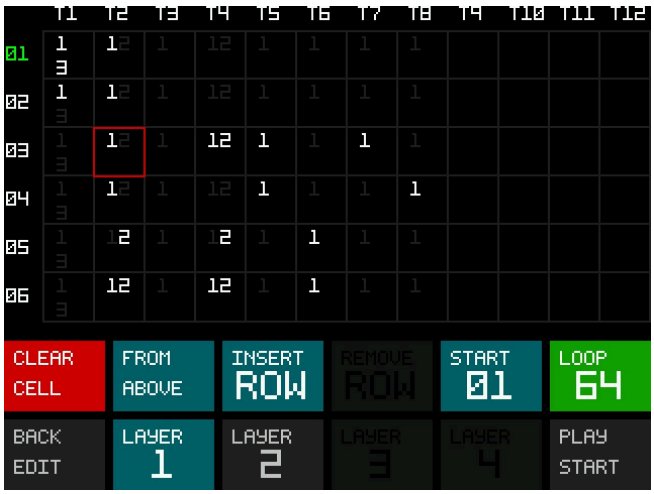
Delete



Clear PB

Clear CC

While not being in record mode, you can enable and disable the playback of any Pattern on any track by short touching it.



Song Mode itself can be one of two types - SONG LIVE and GRID MODE. You can switch between them at any time, there will be no data loss from a switch.

To switch the song mode, make sure on the top right SONG is highlighted, not Pattern.

Then touch **TOOLS VIEW** (if you are not already there) and touch **TOOL SNG**.

Here you can toggle between LIVE RECORD and GRID EDITOR.

A short introduction is given on screen how these modes work, here in the manual, it can be explained a bit more in detail:

LIVE RECORD:

In this mode, on top of the 12 Pattern Tracks, you can record up to 4 linear “tape maschine” like Tracks from Song Start to Song End.
These Song tracks then can be edited further in Song Mode Editor.

The recording process is similar as it is in Pattern mode. Just pick an instrument (Track) and start recording - while on the right top **SONG LIVE** is active.

Notice: It is totally possible to switch the instruments during your Song Track recording at any time. So you can record 4 Song Tracks in total but they could contain many (all) instruments that you have set up for your Tracks.

After a Song Track is recorded, it also can be merged or deleted. (next chapter)

Further, you can record **MUTE AUTOMATION** of any Pattern from any Track, while recording.

This also can be edited later, in Song Mode MUTE Editor. The recorded Mute Automation can be merged and deleted, just as it can be done for musical notes.

GRID EDITOR:

The **GRID** Song mode (currently) does not play recorded MIDI Data from the Song Track(s).
Instead, it works like a macro editor for your patterns.
You get a grid view of all 12 Pattern Tracks and can select what pattern if played in which Song step.
If further allows to do some dynamic looping while the Song is playing.

This is technically very much the same as the MUTE AUTOMATION Recording in Song LIVE RECORD, except you can edit each and every step directly, you do not have to play and record the mute automation in real time and you can change everything with just a touch, no matter if it is on the first bar of your song or on the last, Sequencer playing or not.
Also this mode gives a better overview about what is happening with all tracks and their pattern prior they are played. You are also free to change and modify everything while the Song is running. While it (currently) does not play the Song Track MIDI data, you still can play live above it. So both modes are valuable for live- as well as for studio work.

Notice that switching Song Mode does not erase or modify any data, it will just control what and when everything is played (or not).

LiveSequencer Settings

Tool: Pattern

PATTERN LENGTH

Here you can control the global length of the patterns. The default is 4 bars. Change of Bar length is destructive.

FILL NOTES

Lets you fill an entire pattern with a single Sound, you can select the number/speed of notes, 1/16, ⅛, ¼, etc. as well as an offset and the velocity level.

COUNT IN

The metronome is turned off by default. Touch ADD METRONOME to add the count in function.

Tool: Arpeggiator

The arpeggio in LiveSequencer is played from a Source Track. Select the source Track at the bottom left.

Then you can select speed, mode, how many octaves it should cover, velocity and so on. It covers all basic arpeggio types.

Tool: Sequencer

This page mostly is used for selecting the instrument that should be used by a track. You can use all internal MDT Synths as well as external MIDI over USB or DIN (Mini Jack) or MicroUSB as the destination. Select the destination device first, then the (MIDI) Track number.

Tool: Keyboard

While it is probably not always ideal to input notes with only a touch keyboard, it is way better than having nothing, when you do not have any external MIDI device connected.

The Touch Keyboard plays the instrument from the currently selected Track and will switch its view depending on the selected instrument Track. For tonal Tracks it will give you a Piano Keyboard and for Drum/Sample related content it will switch to a drum pad view.

You switch the octave / drum banks with the OCTAVE +/- touch button.

Notice that the input from Touch Keyboard is monophonic. However you can record in several steps and merge the result together.

Recent changes about MIDI input for LiveSequencer

Since release v1.9.923 (End of November 2025) the Behaviour for MIDI input in Livesequencer is now changed. Instead of asking you to set your input device to an unused MIDI channel, it now will directly and always route MIDI input to the currently active track in LiveSequencer, regardless of the input channel.

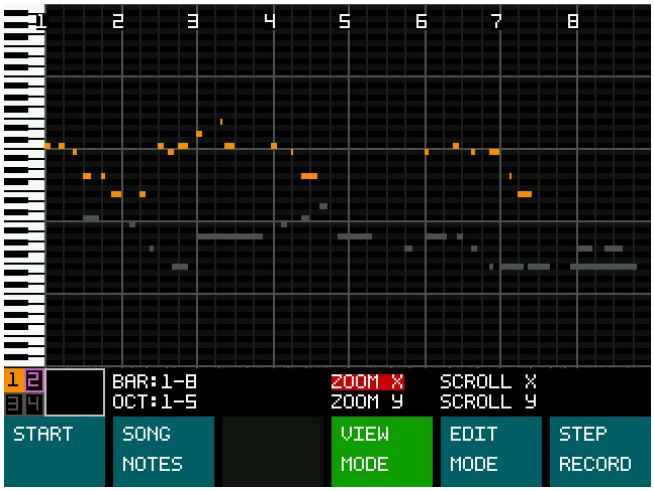
This state (hopefully) will keep this way, even when diving into sub-pages directly from Livesequencer, like the various instrument / drum pages etc. Also the state will be kept when using the Livesequencer Editor and updated to the correct track when you change it by the touchbuttons in the editor.

As soon as you leave LiveSequencer (go back to the MainMenu/SubMainMenu), it will revert to the "normal" global behaviour that only the directly MIDI mapped instruments will react to MIDI input.

LiveSequencer Editor

While the LiveSequencer Editor for Patterns (for Tracks) is there for a while, this chapter concentrates on the Song Tracks which are the newest addition. Everything here very much applies also to Pattern mode.

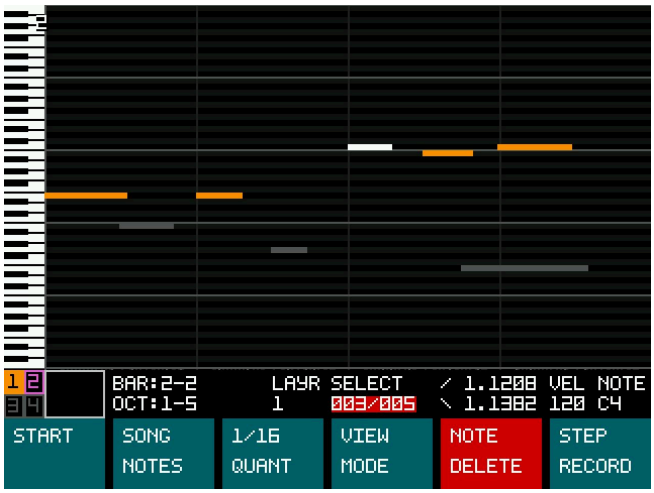
You can enter the Editor either by the Main Menu, SEQUENCER - LIVE SEQ EDITOR or by **long touching** a Track Button in LiveSequencer. To directly go to the **Song Notes** editor, **long touch** the **SONG MODE** Button on the top right of the screen.



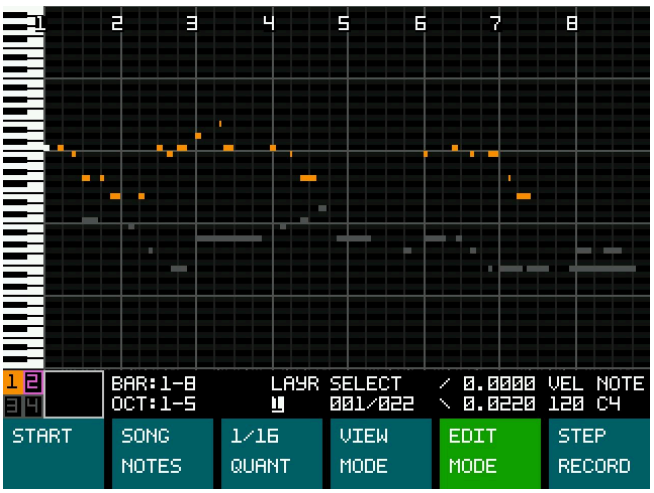
The main categories you will see are:

VIEW MODE

Here you can navigate and zoom your view. Select the menu item, confirm with **ENC-R** push and zoom or scroll in X or Y direction. End the edit mode by pushing **ENC-R** again.



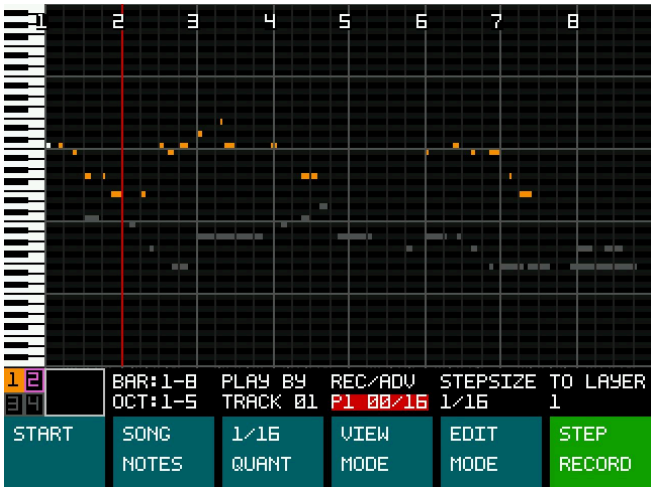
Zoomed in view



EDIT MODE

Lets you select the layer (1-4), the individual note, its start and end point in time, its velocity and its note.

Notice that the time values are always shown in a 1-4 bar location from 0.0000 - 3.9999. This is how it is stored internally in its 4bar chunk. That however does not limit you in any way how you can move a note. You can move a note freely, from and to every bar you want in your Song.



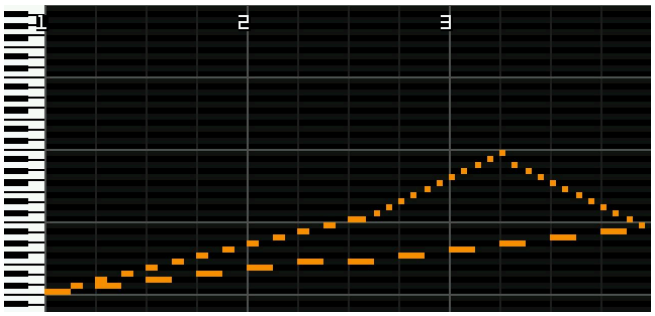
STEP RECORDER

In Pattern and Song Mode, you have a step recording feature.

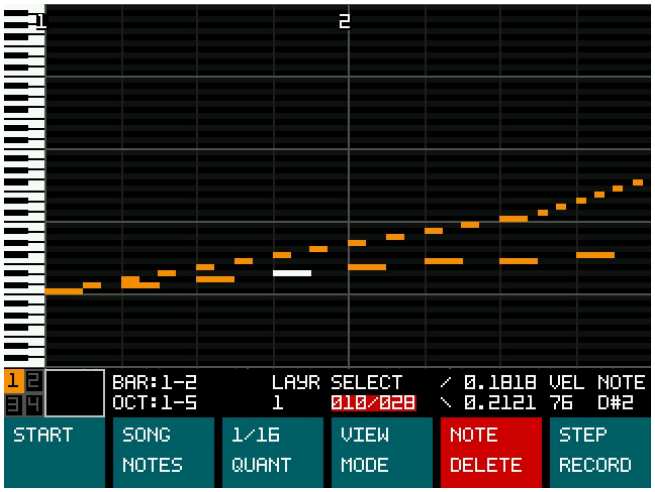
Select with **REC/ADVANCE** the step you want to input a step. By default it will start at the first bar at the first step.

Then play the step with your MIDI device. It will then continue to move to the next step, depending on the **STEPSIZE**.

Further you can select the layer to which the recording is added to and if it is a song track, you can also select the destination instrument.



You can change Stepsize or the position at any time.



NOTE DELETE

When you are in edit mode, but have not activated Note On, Off, Velocity or Note value editing, the selected note will show a **NOTE DELETE** touch button. Simply touch that to remove the currently selected note.

Quantization in PianoRoll Editor

Updated QUANTIZATION SYSTEM in PianoRoll Editor with the option to apply to **ALL notes of a layer**:

Smart Layer-Based Quantization - Quantization now works intelligently on a per-layer basis, giving you precise control over your arrangements.

- Layer Selection First: Always quantizes notes in the currently selected layer only (Layer 1-4)
- Visual Layer Indicators: Grey notes = other layers, colored notes = selected layer
- Non-Destructive: Other layers remain completely untouched

QUANTIZATION BUTTON:

- Short Press: Cycle through quantization grid values (1/4, 1/8, 1/16, etc.)
- LONG PRESS: Quantize all notes in selected layer of current track
- Grid Display: Shows current quantization value in EDIT/STEP modes

📊 Available Quantization Grids:
- 1/4 (Quarter Notes)
- 1/8 (Eighth Notes)
- 1/8T (Eighth Note Triplets) ⭐ NEW!
- 1/16 (Sixteenth Notes)
- 1/16T (Sixteenth Note Triplets) ⭐ NEW!
- 1/32 (Thirty-Second Notes)
- 1/64 (Sixty-Fourth Notes)
- OFF (No quantization)

🎵 Preserved Musicality Features
🎼 Note Length Protection:
- Starts Only: Only note START times are quantized to grid
- Lengths Preserved: Original note durations remain exactly as programmed
- No Choking: Notes won't become shorter or overlap after quantization

🛡️ Safety Features:
- Minimum Length: All notes guaranteed to be at least 1/16 note long after quantization
- No Zero-Length Notes: Impossible to create "stuck" notes
- Valid Timing: Note-ends always placed after note-starts

Velocity-Preserving and duplicate Notes handling:
- Original velocity values remain unchanged
- When duplicate notes land on same grid position, highest velocity note wins

PATTERN TRACK QUANTIZATION
For individual instrument tracks (Tracks 1-12):
Select target track
Choose layer (1-4) using layer indicators
Select the quantization grid (1/16, 1/8, etc.)
LONG PRESS quantization button
Only notes in selected layer are quantized
RESULT: Tightens timing of specific instrument parts without affecting others

SONG MODE QUANTIZATION
For complete song arrangements (SONG NOTES track):

Switch to SONG NOTES track
Select layer to filter view
Choose quantization grid
LONG PRESS quantization button
All song notes in selected layer quantized across entire timeline
RESULT: Perfectly aligns complete arrangements across multiple patterns

🎨 VISUAL WORKFLOW IMPROVEMENTS
Layer Visualization:
- Selected Layer: Notes appear in layer color
- Other Layers: Notes appear in grey (not affected by quantization)
- Layer Indicators: 4 squares show active/inactive layers

Immediate Feedback:
- On-Screen Confirmation: Shows "LAYER3 QUANTIZED!" after operation
- Visual Update: Quantized notes immediately snap to grid visually

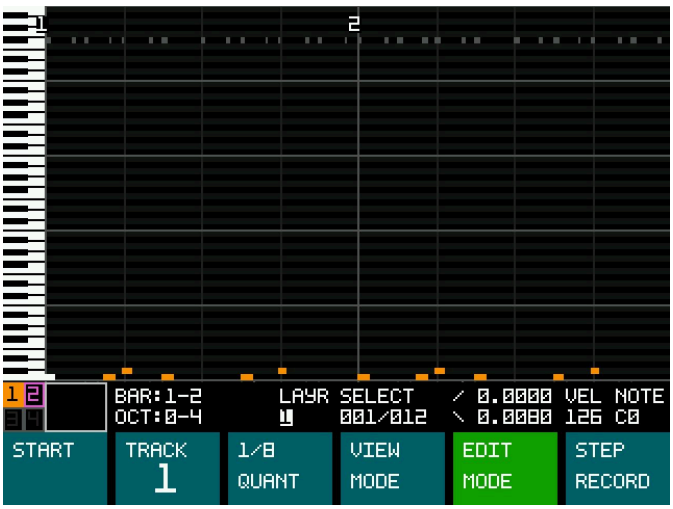
Updates for Quantization During Recording

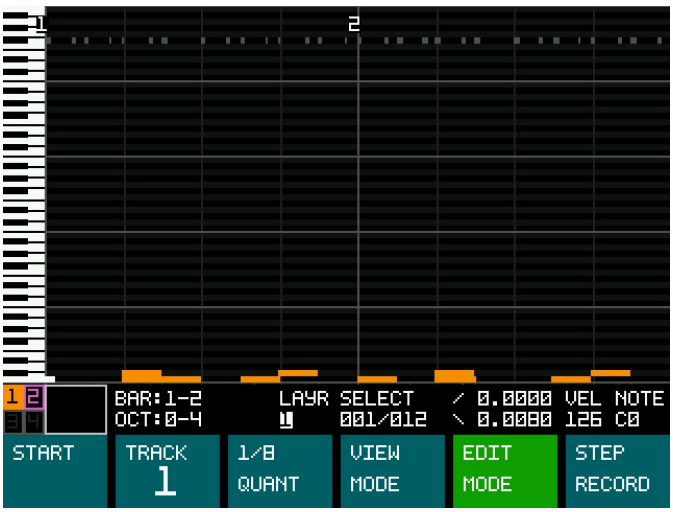
Live Input Quantization Triplets/Triolic ⭐ NEW FEATURE
HOW IT WORKS:

- Input Snapping: Notes played via MIDI/keyboard are automatically quantized, now also for Triolic/Triplets
- No Post-Processing: Notes land perfectly on grid from the moment you play them
- Visual Feedback: Notes appear at quantized positions immediately

ACTIVATION:

Select Quantization Grid (1/4, 1/8, 1/8T, 1/16, 1/16T, etc.)
Start Recording and Play Notes: They automatically snap to current step position + selected grid





Quantized Track 1 from 1/16 to ⅛ Notes. Duplicate Notes will be removed automatically, resulting in the note(s) with highest velocity and removing all other duplicates.

Quantization will apply only to the active Layer so you can do separate quantization for every single layer individually.

Piano Roll Editor - Undo for Quantization

New Feature since December 2025:

- Undo functionality for quantization - Now you can revert quantization changes with a single click
- Smart layer-aware undo - Undo only affects the specific track and layer you were working on

How to Use:

1. Apply quantization as before (**long press** the Instrument/Quant button)
2. Notice the Play button changes from "START" to "UNDO QUANT" (red)
3. Click the UNDO button to revert the last quantization operation
4. Button returns to "START" when undo is complete or no longer available

Important Notes:

- Undo is track and layer specific - changing tracks or layers will clear the undo state
- Undo only works while playback is stopped
- The undo state is cleared when:
    - Changing tracks
    - Changing layers
    - Changing quantization level
    - Leaving edit mode
    - Starting playback

- Quantization to note-off times apply only when absolutely necessary (to prevent invalid notes)
- Improved quantization accuracy for both song mode and pattern tracks

Song Layer Operations

When you are in the Song - TOOL VIEW, TOOL SONG, you have several options to manipulate / modify the 4 song layers.

Touch the **LAYER ACTION** button to get the options, then touch the individual **LAYER** button to perform the change.

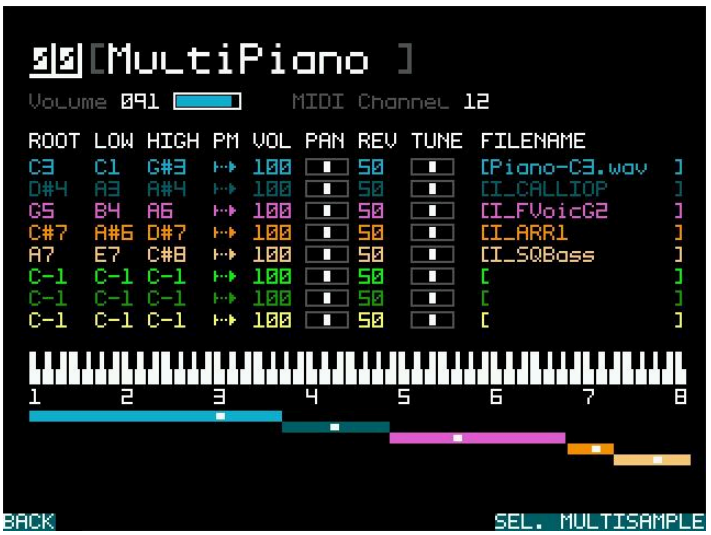
Song Layer Merge together 2 or more layers

Delete a Song Layer

Clear Pitch Bend

Clear CC

Multi-Sample Player (MSP)



Multi samples allow you to have up to 8 samples for a single instrument, with multiple pitched, native samples as a sound source.

These (up to) 8 samples are called sample zones. All in-between pitches will be assigned and calculated to their best target automatically.

To activate the automatic assignment, you have to name your sample files in a way that the filenames end with the root note of the sample in the name.

All common types of naming conventions are supported. Usually that is something like "**MySampleXY-C4.wav"** or "**MySampleXY-C5.wav**". Also semitones (half-steps) are supported, like "**MySampleXY-D#2.wav**"

Instead of - (minus), as a separator, you can also use **_** underscore, for example: **DreamPiano_C3**.wav

You can edit these auto assign values later, if you are going for something different as a multi-sample instrument. For example when you want to use drum loops, vocal samples, effects or other one-shot samples to be played by a single note value.

Everything in the sequencer is highly customizable. That also is true for the included arpeggiator. Further, a single track can be used to play full chords and chord progressions.

Nearly all features and parameters are available during playback. This means that you also can play live on MicroDexed, while the sequencer is running. Also you can modify live the sequenced information, change playback options of the arpeggiator or the chord function and much more.

Our goal is to push the Teensy microcontroller to its limit. It is already doing a lot - playing FM Sounds, playing samples and sequencing them while you still can play live with 2 different FM sounds, an ePiano and 2 "virtual analog" Mono-Synths and external instruments on 16 USB MIDI and 16 classic MIDI channels.

Structure

The smallest building block in the sequencer is a pattern. Currently up to 24 different patterns can be used in a sequence.
It is completely up to you, when and how the patterns are played in the sequence. Of course every pattern can be put in multiple times inside a sequence. A pattern has the length of 16 steps.

Pattern

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

To create Phrases that are longer than 16 steps, the patterns are put in a Pattern Chain.
Each Pattern Chain can hold up to 16 patterns and these Chains can be inserted in the Song as a single Song Step - which can go up to 64 Song steps, per track. So the total length of your song can go up to 16384 steps.

Track Types

Since the sequencer can play notes, drum samples, chords and arpeggios, it is important to tell MicroDexed what type of content shall be played on which track. The track type of each track keeps the same during the whole sequence.
Track types can be drum, inst, chord or arp. This assignment is controlled in the menu *Track Setup*.

Content Type

While the track type is a setting regarding all chainsteps of a track, the content type is an assignment for every pattern.
Every pattern can be of different content types.

The content type mostly controls how you see your pattern content on the device. For example, if it is a drum pattern, instead of seeing midi-note-values, you see the names of the drum samples. For Chords, you see the chord name (for example in the arpeggiator view). Further, this controls many of the editing features and features that are displayed to you.

In many cases it is not critical to put in the content type for every pattern to get a sequence running correctly. But it is highly advised to do so - only then MicroDexed can understand what you are up to and help you in responding with the best menu options for editing and visualizing your patterns.

If this sounds a little strange, you have to understand that MicroDexed just "sees" MIDI Notes. To be more precise, it just sees a number between 0 and 127 :-). So setting the content type for the patterns helps MicroDexed to understand what your pattern is intended to do.

The content type is assigned in the menu *Seq.Disp.Style* (Sequencer display style).

Dexed/Instrument assign (Song Page)

In this menu you assign the 8 tracks to the 4 dexed-synth instances, the MDA ePiano or to microsynth. Notice that this setting is only valid for instrument tracks. Drum sounds will always play on the dexed-drum channel. The drum channel is set up in the *drum* menu and defaults to MIDI channel 10.

For chord and arp tracks, it is possible to override the setting in the *dexed assign* menu - or lets better say you can assign 2 different dexed-synth instances at the same time for them.

To give you an example:

Let's say you want to play a full chord with a piano sound and in addition a bass note with another instrument that is more bass-like. Internally stored, MicroDexed only has the root note of the chord, like data on every other track, as a single MIDI note. For chords, you have to assign the chord types for the chords (more in chapter *chords*).

If you have this ready, you can tell MicroDexed to play the bass note on dexed-synth1 or 2 and also to play the chords - on an extra chord channel. All this, only using a single track of the sequencer.

Notice that the playing style of the chords can be tweaked. You can play from 1 up to 7 notes at once and also shift these by octaves and even in intervals, up and down.

Since V1.0, you can also choose from 10 different multi-samples in the dexed/instrument assignment. Above that, you can assign 16 MIDI channels from USB MIDI. And at last, there are 16 Channels of classic MIDI that can be assigned here.

Chords

In the current state, MicroDexed understands major, minor, seventh, augmented, diminished and major7 chords.
This can be extended, either directly in the source code of the firmware or in a future update as custom chords that can be stored on the SD-Card.

The available chords should cover the most common music styles, but that opinion might change in the future :-)

Internally, the chords are stored nearly equal to the "normal" note information. The chord type is stored per note, in replacement of their velocity. That is one of the reasons, why it is a good idea to set your chord pattern to the content type *chord*.

The chords can be edited while the sequencer is stopped and while it is running.

So you can experiment a lot while directly listening to the results. Editing of the Chord root notes and their chord type is happening in the *Velocity/Chord Editor* menu.

Chords (and Arpeggios) can be manipulated by multiple realtime controls in the *shift&transpose* and in the menu *Arpeggio*.
You can change the amount of notes that shall be played as a chord.
The default value and musically correct number is 3, but you can increase and decrease it from 1-7 in the *Chord Track Keys* menu.

Arpeggios

Instead of playing chords, you can also configure a track to play arpeggios. The note/chord input is exactly the same as for chords.

So it is no problem to change the track type between these options.

In the *Arpeggio* you can modify various parameters in realtime and also stop/start the sequencer. So no need to change menus to do that.

The length parameter lets you choose between 1-9 steps for all arpeggio styles. In case of *up&down*, the arpeggio time is extended to 2x of the length. If you choose a length of 1 for the types *up* or *down*, this only plays the root note. In combination with an arpeggio speed of 1/8, usually this alone creates a simple bassline.

The arpeggio types are *up*, *down*, *up&down* and *random*, which of course is not completely random, but plays random notes in the scale of the chord.

Further you can transpose all notes of the arpeggio in the *shift&transpose* menu. The shift can be made by full octaves or/and all possible chord fingering of the chord.

Drums

MicroDexed Sequencer does not only play instrument sounds out of the dexed-synth engine, but also can play sampled mono sounds. Since storage memory is limited and the playback of samples from the SD-Card is not fast enough for multiple tracks, the list of samples is not endless. The library of samples is currently a work in progress. Nevertheless, it is possible to produce stunning drum patterns with MicroDexed.
You can assign as many tracks out of 8 for playing drum sounds and the notes can be recorded in real time with a MIDI device of your choice (including velocity), step by step in the editor or with the *fill* function, that inserts a bunch of notes at 1/4, 1/8 or 1/16 steps with one click.

You also can copy, swap and clear patterns inside the sequencer view with a few button clicks.
To further finalize your drum tracks, you can change the velocity values in the *velocity/chord* menu.

All copy and swap functions will always include the velocity values of the track.

Similar to the dexed-synths, you can modify volume, pan and reverb send for all drum samples. This happens in the *Drums* menu.

Drums can also externally be played live by setting the drums MIDI channel in the *Drums* menu. Changing the drum MIDI channel has no consequence for the sequencer. All drum sounds will be played automatically on the correct drum channel.

Sequencer Menu

After reading about all the possibilities and a lot of background information, let's talk about the sequencer menu.
The top row always shows options, the second row always shows the content of the currently active pattern.
If you have assigned the correct *content type* to the patterns, its displayed parameters will vary, based on the content.

In the second row, you see either the names of MIDI notes or a short name of the drum sample, if it is a drum track.
In case of MIDI notes you will always see the root key and more details about the note in the first row.
A blank step is represented with a "-" at its place.

While the sequencer is running, you will see an "X" at the current step in the pattern.
If you move the cursor into the pattern with ENC_R, you will see an "X" at the currently selected step. If you press ENC_R there, it will insert the note/drum sound that is currently selected at your top left screen.

The menus/functions:

If the pattern is a drum pattern, at the top left you will see a browser with all available drum samples. If the pattern is an instrument pattern, you will see MIDI notes and so on.

After the last instrument note or sample, a list of functions will come up. The functions are:

1. EMPTY
2. ClrPat
3. ClrAll
4. Copy P
5. Swap P
6. Fill P

EMPTY selects an empty note. You can select that and then move with ENC-R quickly to the second display row to replace notes of your choice with nothing.

ClrPat clears the active (displayed) pattern completely.

ClrAll Beware, this clears all patterns of the sequencer, at once.

Copy P Copies a pattern to a destination pattern. The source pattern will be untouched.

Swap P Swaps the content of a pattern with another pattern

Fill P Fills the active pattern at 1/4, 1/8, 1/16 steps with a note or drum sample of your choice.

The second menu item in the sequencer is the Play, Record, Stop function. What is on display is the next action that it is going to do.

The sequence is Play -> Record -> Stop, every time you click ENC-R. It will advance to the next step.

This is kind of self explaining. Note however, that the recording actually only will be active while you are in the *sequencer* view. Also, while the *arpeggiator* has a Play-> Stop function, it does not have the record option on purpose because you do not see there, what is happening to your pattern if you would be able to record there.

To record patterns live, the *sequencer* view has to be active on the display.

The next menu item on the top right is the active pattern selector. Here you can browse between all 10 patterns and it does not matter if this pattern is contained in your current sequence at all.

This means that currently you can only input notes in the pattern that you have on display. This is a good protection against messing up other patterns that you don't see, but also a small limitation if you like to fill up multiple patterns with data in a pattern chain during live recording.
Most certainly this will be changed in the future to be an option and mainly it is this way because of the limitation of the display to show only a small amount of data.

Step Sequencer

There is a new step sequencer. It can only be activated while your sequence is not running.
When you touch the step sequencer button, it will input your note and velocity from your attached MIDI device to the current step of the current pattern.
There is a lot of polish to do in this function. Currently it does detect the note pitch and velocity and if it is supposed to be a pitched sample, a drum sample or an instrument note. Other than that, when played, it will not fully respond with the correctly attached sound to it, but will just play the currently selected instrument.
However it will play correctly what it is supposed to do, as soon as you start the sequencer.

To auto advance to the next step after putting in each note, there is an "Auto Advance" mode that can be activated in the pattern editor. By default, this is deactivated, so you will only overwrite the current step in the current pattern while playing around on your keyboard. When you activate it, it will advance to the next step, after every key input. When the last step is reached, it will continue on the first step of the same pattern and overwrite your note, if there is any. After that it continues to increment the pattern step until the pattern end is reached and then it starts again from the beginning.

Velocity/Chord Editor

The Velocity/Chord Editor is very similar to the main *sequencer* view. Since you only have 2 Buttons and a 2x16 character display in front of you, it made sense to put this into an extra menu.

On a drum or instrument pattern, you can change the velocity values of your notes. On a chord/arp pattern you can choose/modify the chord information, meaning which chord type should be associated with the note(s) of the current pattern.

The navigation is exactly the same as in the *sequencer* view. Instead of the information about the Instrument or Drum sound, you get their velocity values and can modify them. In chord view you can choose between major, minor, seventh, augmented, diminished and major7 chord types for every note.

These values are used for two kinds of tracks: chords and arpeggios.

Song Mode

To create Songs that are longer than 16 steps/1 pattern, the patterns will be put in a Pattern Chain.
Each Pattern Chain can hold up to 16 patterns and these Chains can be inserted in the Song as a single Song Step - which can go up to 64 Song steps, per track. So the total length of your song can go up to 16384 steps.

Live Transpose Key Range

This feature is kind of a work in progress. The idea behind it is that you have a sequence, including chord or arp information, and play it live while transposing the stored sequence on the lower part of the keyboard.
This parameter controls which Keyboard Range the function will operate on. The lowest Key is always **C0**, you here set the highest key, for example **G2** or **C3**. Notes above the selected highest Note, will continue to work “normally”.
This starts to transform MicroDexed into an arranger keyboard or a tool that is more useful in a live performance scenario.

LOAD Performance

While using MicroDexed Sequencer, you may have a lot of things and ideas in your mind about how to progress with your patterns. In this creative process the goal is to make things as easy as possible with respect to loading and saving. The Sequencer will store as much about the machine state, including voices, voice settings, effects and drum settings inside the storage of the sequencer. So when you have saved the Sequence previously, loading it back should bring you back to exactly the same state as before.

SAVE Performance

When you save your sequence, MicroDexed sequencer will put your current voices, voice configs, effects and drum settings and store the current state of them as part of the sequence.
If you wish to save parts of it, like the effects+drum settings or a voice setting as a separate file e.g. to be able to recall them later for another project, you can do so in the default load/save voice config, load/save effects etc. menus.
Currently, saving the effects will also automatically include the settings for volume, pan and reverb-sends of the drum kit.

Delay Effects

The delay effect can be synced to the sequencer. If you already have synced your sequence tracks to a value like 1/16, 16t, 1/8, 1/8t. etc, tempo changes should automatically change the delay times, to fit the new tempo for this track.
If you have not done so, you can activate the delay sync in the effects -> delay - time menu, while the sequencer is running.
After saving the sequence, the correct value should be recalled automatically and follow any tempo changes.

Song Loop

Instead of playing your whole song, you can select a start and stop song step and create a loop between them. The starting step can be lower or higher than the stop step - MicroDexed will figure out what to do in either case.
You can edit the start and end steps with the X Cursor movement by scrolling below Track1 - it will then select the step column. Here you can scroll up and down to the start position, confirm with [BUTTON RIGHT], select the end Step and again confirm with [BUTTON RIGHT]. Either while already playing or start playing, MicroDexed will now play only the Song Steps you have selected for your loop. The Loop can be modified, while it is playing.

Chord Arranger

Harmonic Expression to static Sequencer/Song Data in Real Time

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Overview

The Chord Arranger is a powerful performance tool that dynamically transforms incoming MIDI notes into harmonically rich chords or basslines. By analyzing notes played within a user-defined keyboard range, it intelligently constructs chords and redistributes them across your sequencer tracks. This feature is ideal for live performance, songwriting, and harmonic experimentation.

> **Status Note**:
> This feature is in active development (alpha stage) but already offers advanced functionality surpassing many hardware arrangers. Supported chord types include **Major, Minor, Diminished, Augmented**, and their inversions.

Key Concepts

1. **Chord Detection Zone**:
   - A user-defined keyboard range (e.g., C3–C5) where played notes are analyzed to detect chords.
   - Notes outside this range are treated as melody/bass and transformed differently.
   - Visual feedback (red squares) highlights played notes within the detection zone.
2. **Track Transformation Modes**:
   Assign each sequencer track (Instrument/Chord/Arp types only) one of three behaviors:
   - **OFF**: Plays notes unaltered.
   - **ON**: Transforms notes into chord tones (harmony).
   - **BASS**: Transforms all notes to the chord's root note (bassline).

Setup Instructions

Step 1: Access the Chord Arranger

1. Navigate to:
   `Main Menu > Extras > Chord Arranger`.
2. The interface displays:
   - A virtual keyboard (notes 0–91) showing the chord detection zone.
   - 8 track slots + a split note setting.

Step 2: Configure the Chord Detection Zone

1. Use **Encoder_R** to select the **Split Note** parameter (default: `C3`).
   - This sets the upper boundary of the chord detection zone (e.g., notes below `C3` trigger chord analysis).
2. Adjust the split note:
   - Turn **Encoder_R** to raise/lower the pitch.
   - Press **Encoder_R** to confirm.

Step 3: Assign Track Behaviors

1. Select a track (1–8) using **Encoder_R**.
2. Toggle modes:
   - **OFF** → **ON** → **BASS** → **OFF** (cycle with **Encoder_R**).
   - *Example*: Set Track 1 to **BASS** (root notes), Track 2 to **ON** (chord voicings).

Step 4: Real-Time Adjustment

- Toggle between **Selection** (choose tracks/split note) and **Edit** (adjust values) modes by pressing **Encoder_R**.

How It Works

Chord Detection

- When 3+ notes are held in the detection zone:
    1. Notes are sorted and reduced to pitch classes (e.g., `C, E, G` → Major triad).
    2. The root note and chord type (e.g., `C Major`, `A minor`) are identified.
    3. Inversions are detected based on the lowest note (e.g., `E` in bass = 1st inversion).

Note Transformation

- **Harmony Tracks (ON)**:
  Input notes are replaced with chord tones (root, third, fifth, seventh) in smooth voice-leading.
    - *Bass*: Prioritizes root/fifth, stays in low register (C2–C4).
    - *Upper Voices*: Distributed near the original note's octave.
- **Bass Tracks (BASS)**:
  Forces all notes to the chord's root. Chromatic approaches (e.g., walking bass) are intelligently preserved.
- **Melody Notes**:
  Notes outside the detection zone snap to nearest chord tones while preserving contour.

Technical Notes

- **Supported Chords**:
  Triads: Major, Minor, Diminished, Augmented, 7th Chords: Dom7, Maj7, m7, mMaj7, dim7, m7 ♭ 5, aug7, 6th Chords: 6, m6
- **Inversion Handling** `Root Pos.`, `1st Inv.`, `2nd Inv.`, or `3rd Inv.` (7th chords).

Troubleshooting

Issue	Solution
Chords not detected	Ensure that the notes are in the detection zone. Avoid overlaps with melody range.

Example Workflow

1. Set split note to **C3**.
2. Assign:
    - Track 1: **BASS** (root notes)
    - Tracks 2–4: **ON** (close-voice chords)
3. Play `C, E, G` in the detection zone:
    - Track 1 outputs `C1`.
    - Tracks 2–4 play `C3, E3, G3` (root position).
4. Move to `E, G, C`:
    - Track 1 plays `E1` (inversion).
    - Tracks 2–4 redistribute as `E3, G3, C4`.

1. **Play live chords** with one hand to establish harmonic context
2. **Transform sequencer patterns** to match your current chord progression
3. **Improvise freely** with melodies that automatically harmonize
4. **Generate chord suggestions** for musical inspiration

Key Concepts

1. ### Chord Detection Range
   Select a keyboard range where chords will be detected. Notes played outside this range are visually indicated on the UI with red squares. Ensure your chords fall within this region for accurate detection.
2. **Track Transformation Modes**
   Assign sequencer tracks to one of three modes:
   - **OFF**: Plays original notes unaltered.
   - **ON**: Transforms notes to fit the detected chord scale.
   - **BASS**: Forces all notes to the root of the detected chord.
     Note: Only INSTRUMENT, chord, and arp tracks can be processed. Drum tracks are ignored.
3. **Supported Chord Types**
   MDT recognizes:
   - Major, Minor, Diminished, Augmented triads
   - Seventh chords (7th, Maj7, m7, mMaj7, dim7, m7b5, aug7)
   - Sixth chords (6, m6)
   - Inversions (Root, 1st, 2nd, 3rd)

How Chord Detection Works

The system analyzes MIDI input to identify chords:

Chord Type Identification
The `detectChordType` function checks interval combinations:

- Major/Minor: Presence of major 3rd (4 semitones) or minor 3rd (3 semitones).
- Seventh chords: Additional minor 7th (10 semitones) or major 7th (11 semitones).

Chord Transformation

Maps input notes to chord voices (bass/tenor/alto/soprano):

- **Bass Voice**: Stays in low range (C2–C4), respects inversion.
- **Upper Voices**: Placed near input note's octave for smooth voice leading

`transformNoteToChordMelody`
Optimized for melodic lines:

- Retains chord tones unchanged.
- Non-chord tones shift to nearest chord tone (max +3 semitones).

`transformBassNote`
Prioritizes chord tones (root > fifth > third > seventh) and handles chromatic walks:
cpp

1. if (pitchClass == currentChord.root) return inputNote; // Prefer root

---

Advanced Features

1. ### Chord Naming & Inversion Detection

2. **Chord Progression Suggestions**
   recommends harmonically related chords (V, IV, vi, etc.):
- Dominant (V) for perfect cadences.
- Tritone substitution for dominant chords.

Working with external MIDI Devices

Since Winter 2025 MDT can handle up to 3 external MIDI devices connected to the USB HOST port. (previously only one USB device was working at the same time)
Notice that multiple devices need to be connected via a USB Hub since MDT itself only has a single USB Host port.
Further, since the Host port only can apply power with around/max 500mAh, you most probably need to use either devices that come with their own power supply or you have to power the USB Hub to let MDT recognize and work with several USB devices at the same time.

The TRS MINI Jacks or course also allow to be used with multiple MIDI devices but these either need to have a MIDI Through port to daisy chain them or you have to use a MIDI splitter/merger/hub device to connect multiple devices to MDT at the same time.

Both, the LSDJ style Sequencer as well as Livesequencer can handle up to 3x16 MIDI devices in total (USB HOST, USB (Teensy internal) and TRS/Mini Jacks)

Advanced MIDI Setup: Connecting Multiple Devices

Your MDT can act as the central brain of your MIDI setup. This section explains how to connect and use multiple MIDI devices using the single USB Host port or on the TRS MIDI In/OUT port.

⚠️ **Important Note Before You Begin:**

- **USB Host vs. USB Device:** The USB **Host** port (Type A) on the MDT is for connecting other devices *to* it. The USB **Device** port (MicroUSB) is for connecting your MDT *to* a computer.
- **TRS Type:** MDT can use either **TRS Type A** or **TYPE B** standard for its 3.5mm MIDI ports. There are internal jumpers to select the TRS type. Using a cable with the wrong type or having the jumpers at the wrong position will result in no connection. (But should not harm MDT or the external device)

Connecting Multiple Devices via the USB Host Port

The USB Host port allows you to connect a wide range of USB-MIDI controllers, keyboards, and interfaces directly to MDT.

Method 1: Using a Powered USB Hub (Recommended)

This is the most flexible and reliable method for connecting several devices.

1. **Get a Powered USB Hub:** We strongly recommend using a **powered** USB hub. Its independent power supply ensures all connected devices run stable and prevents overloading the MDT's internal power.
    - *Why powered?* Unpowered hubs may cause devices to disconnect, reboot, or behave erratically due to insufficient power.
2. **Connect Your Gear:**
    - Plug the powered USB hub into a mains outlet.
    - Connect the hub's input cable to the **USB Host** port on your MDT.
    - Connect your USB-MIDI controllers, keyboards, and other class-compliant devices to the ports on the hub.
3. **Configure in the MDT's Settings:**
    - The MDT will automatically detect devices on the hub. Assign each connected device to a unique **MIDI Channel** in the System - MIDI Channels menu.
    - For example: Map your keyboard to Channel 1 for a bass track, and your pad controller to Channel 2 for drums, allowing for independent control.

Method 2: Daisy-Chaining Compatible Devices

Some modern MIDI controllers can act as a USB host themselves; these will not work on the MDT USB host port when in that mode. Only one “side” is allowed to be in USB host mode.

Connecting Multiple Devices via the TRS MIDI Ports

The 3.5mm TRS MIDI In and Out ports use traditional DIN-MIDI signals. To connect multiple legacy devices, you will need a MIDI Thru box.

Why a MIDI Thru Box?
While simple, passive MIDI Thru splitters exist, a **powered MIDI Thru box** is highly recommended. It actively replicates the MIDI signal from the MDT's **MIDI Out**, ensuring a clean, strong, and timing-accurate signal is sent to all of your gear without data corruption or "MIDI lag."

Setup Procedure:

1. **Required Gear:**
    - A **powered MIDI Thru box** (e.g., 1x In, 4x or 8x Out).
    - One **3.5mm TRS Type A/B to 5-Pin DIN MIDI cable**.
    - Standard 5-Pin DIN MIDI cables for your other gear.
2. **Make the Connections:**
    - Connect the **TRS MIDI Out** on your MDT to the **MIDI In** of the Thru box, using your TRS-to-DIN cable.
    - Connect the **MIDI Out** ports on the Thru box to the **MIDI In** ports of your other synthesizers or drum machines using standard DIN cables.
3. **Using the Setup:**
    - By default, all devices connected to the Thru box will receive the same MIDI data from the MDT.
    - To control them independently, set each external device to listen on a different **MIDI Channel** (1-16) using its own front-panel controls.
    - In the MDT's sequencer, you can then assign different tracks to different MIDI channels—for example, sending a sequence on Channel 3 to a bass synth and another on Channel 5 to a pad synth.

Summary and Best Practices

Goal	Recommended Method	Key Consideration
Multiple USB Devices	**Powered USB Hub**	Ensures stability and provides adequate power for all devices.
Multiple DIN Devices	**Powered MIDI Thru Box**	Guarantees clean signal replication and perfect timing.
Independent Control	**MIDI Channels**	Assign a unique MIDI channel (1-16) to each device for separate control.

Troubleshooting Tip: If a device is not responding, first verify its MIDI channel settings on both the MDT and the device itself. Then, check all cable connections. For USB issues, try connecting the problematic device directly to the MDT's USB Host port to rule out hub-related problems.

Understanding and Using MIDI THRU Ports

Some of your MIDI devices may feature a five-pin DIN socket labeled **"MIDI THRU"** alongside the standard MIDI IN and MIDI OUT ports. This chapter explains how this port functions and how to integrate it into your setup with the MDT.

What is MIDI THRU?

The MIDI THRU port is a simple but powerful feature designed for daisy-chaining multiple MIDI devices. Its sole purpose is to output an **exact copy** of the data received at the device's **MIDI IN** port.

- **It does NOT** output the device's own internal sounds or data.
- **It does NOT** merge data from the device's MIDI IN and its own keyboard/sequencer.
- It acts as a real-time, passive "splitter" for the incoming MIDI stream.

How It Works: The Signal Path

Imagine a simple setup: **MDT -> Synth A -> Synth B**

1. The **MDT's MIDI OUT** is connected to the **MIDI IN** of **Synth A**.
2. The **MIDI THRU** port of **Synth A** is connected to the **MIDI IN** of **Synth B**.

In this configuration:

- Any MIDI data (notes, CC messages, clock) sent from the MDT arrives at the **MIDI IN** of Synth A.
- Synth A reads this data and responds to any messages on its assigned MIDI channel.
- Simultaneously, Synth A sends an identical copy of this incoming data stream out of its **MIDI THRU** port to Synth B.
- Synth B then reads the same original data from the MDT and responds to messages on *its* assigned MIDI channel.

This creates a single data chain originating from the MDT, passed along faithfully by each device in the series.

Practical Setup with Your MDT

Here is how to use a device with a MIDI THRU port in your MDT setup:

1. **Connect the MDT to the First Device:**
    - Use a **3.5mm TRS Type A to 5-Pin DIN cable** to connect the **MDT's MIDI OUT** to the **MIDI IN** of your first synthesizer (e.g., Synth A).
2. **Daisy-Chain to the Next Device:**
    - Use a standard **5-Pin DIN MIDI cable** to connect the **MIDI THRU** of Synth A to the **MIDI IN** of the next device (e.g., Synth B).
3. **Assign Unique MIDI Channels:**
    - This is the crucial step for independent control. Set Synth A to receive on, for example, **MIDI Channel 1**. Set Synth B to receive on **MIDI Channel 2**.
    - In your MDT's sequencer, you can now send a bass sequence on Channel 1 (controlling only Synth A) and a melody on Channel 2 (controlling only Synth B), all through a single MIDI connection from the MDT.

Limitations and When to Use a THRU Box

While convenient for 2-3 devices, long daisy-chains have drawbacks:

- **Signal Degradation:** After passing through several devices, the MIDI signal can weaken, leading to timing issues or dropped notes.
- **Limited Ports:** You are limited by the number of devices that have a MIDI THRU port.

As a best practice:

- For connecting more than 2-3 devices, or if you experience timing instability, we recommend using a **powered MIDI THRU box** as described in Chapter 5.2. A dedicated THRU box provides optimal signal integrity and timing for all connected devices.

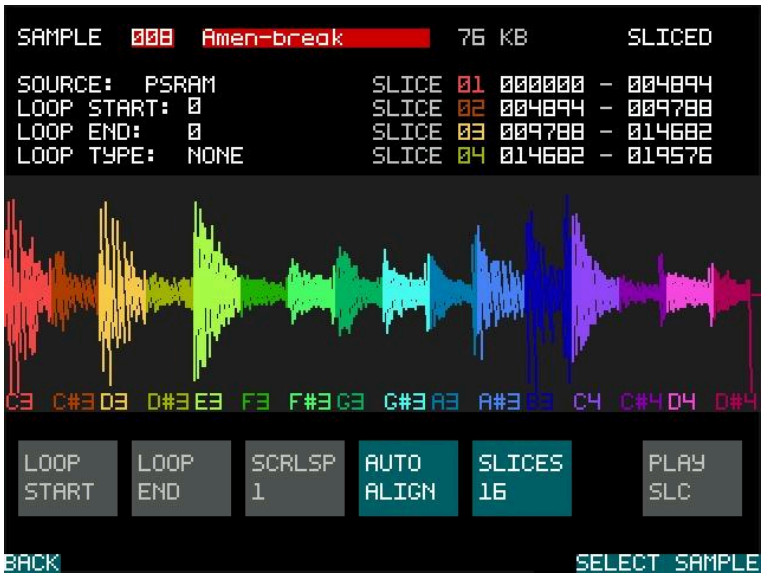
The MIDI THRU port is a classic and effective tool for building a compact, daisy-chained setup, perfectly complementing the MDT's role as a central sequencer and controller.

Working with Sample Slices (Slice Editor)

Sample Slices / Custom Samples will only work with the *MDT_PSRAM* Firmware.
This requires that your Teensy Microcontroller has already 1 or 2 PSRAM Chips soldered on, providing either 8 or 16 MB of external RAM for samples. It makes no difference what sample you pick. All the stock samples and also custom samples will work the same way.

To use Sample Slices, first go to Sample Editor.

With ENC_R, on SAMPLE #, PUSH ENC_R and select the sample you want to slice up.



PUSH ENC_R again to confirm the Sample selection. Then touch the on-screen Touch Button “SLICES”. Your sample will be sliced up automatically between 0 (no slices) , 1 , 2, 4, 8 or 16 slices by each push of the button.

Then, if required, adjust the sample slice positions by scrolling with the ENC_R to the right hand side of the slices list above the sound sample. You can adjust all start and stop positions of all slices.

Do not touch the “SLICES” touch button again or all your manual changes will be reverted to the default ½, ¼, ⅛ etc. generic, slice chopping defaults.

SCRLSP (Scroll Speed)

With this touch button you control how quickly you can step through the sample positions. At 1 you are navigating by every single sample value. You can bump this up, doubling by each touch. So instead of one sample, you scroll by 2,4,8,16,32…512 samples with one encoder movement. This will apply in the forward and also the backward direction when scrolling.

AUTO ALIGN (Auto Align sampled borders)

By default, you can modify each Sample Start and Endpoint individually. If you want to slice/split up a full drum loop, it makes sense that the split points from a Sample-End-position match up the Start-position of the next sample.

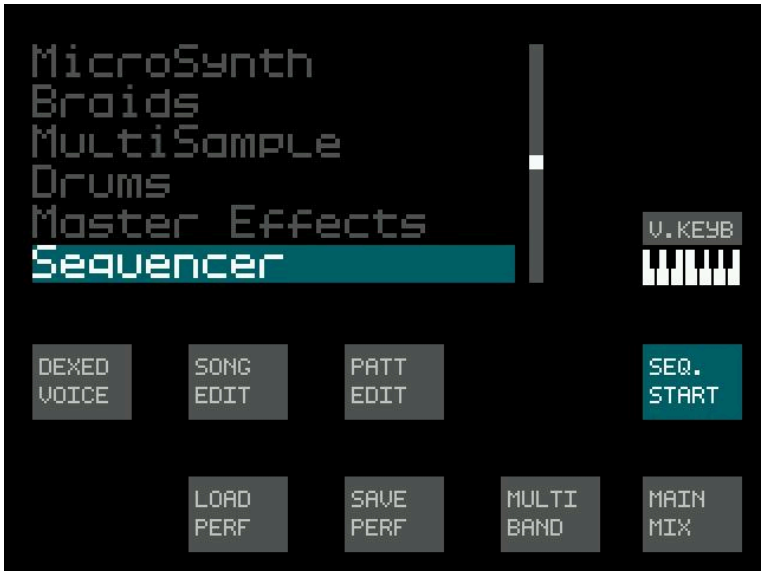
If you enable AUTO ALIGN, MDT will copy your modifications of a Start-Position to the previous End-Position.
And in reverse, if you modify an End-Position, the next matching Start position will be set to the same value.

This ensures all the slices will have a continuous flow without any blank spaces between them.

You can enable or disable the AUTO ALIGN at any time, it will only touch/modify any value when it is activated and you are modifying a single value manually. It will leave all other positions as they currently are.

Notice: Even when you are slicing a sample, the whole sample is still available to be played by the normal drum sounds on the drum channel. The sliced up parts of the same sample will go to a different MIDI channel and are independent of the normal sample playback.

After positioning all slices, push ENC_L to return to the menu and go to the Sequencer menu.

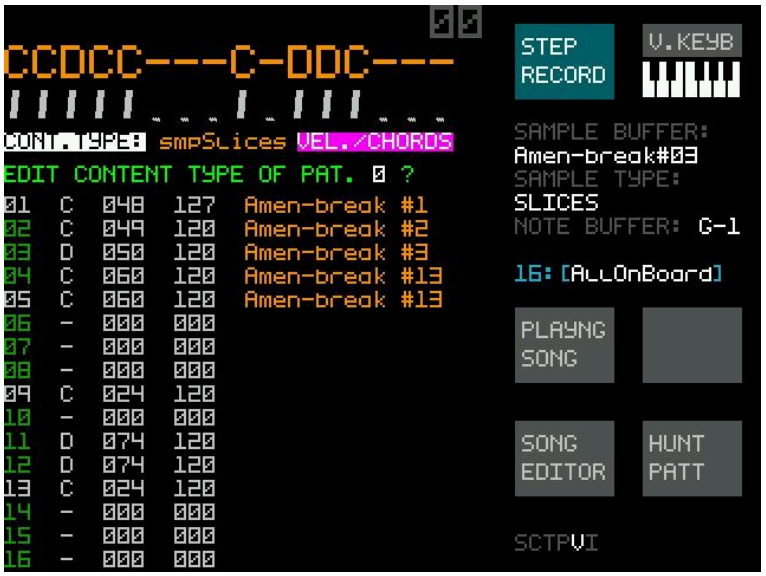


Continue to the Pattern Editor, confirm with PUSH Enc_R

Scroll to the upper right “00” pattern selection part. Select the pattern you want to use for Sample Slices with ENC_R, confirm with PUSH Enc_R.

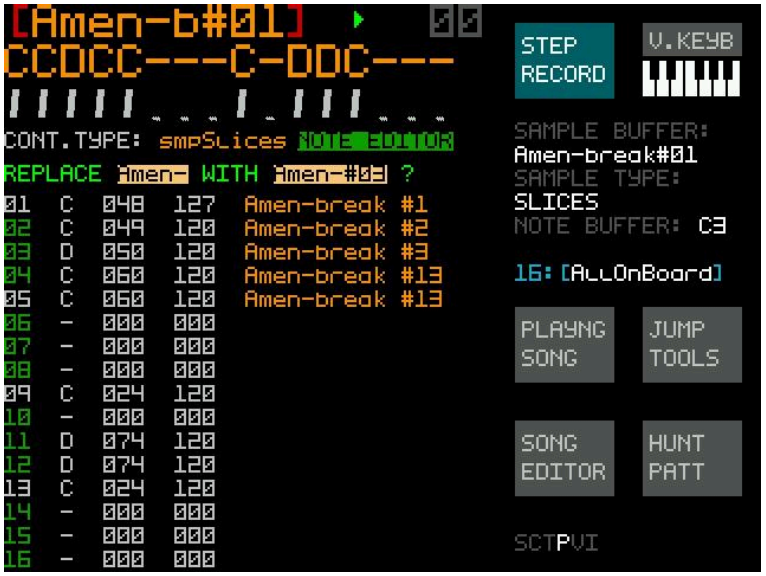
Scroll all the way to the right. After “Pattern Editor” the screen will change to “Velocity Editor”. Continue scrolling until you reach the last parameter “Content type”.

Select “smpSlices” to make your selected pattern a SlicePattern.

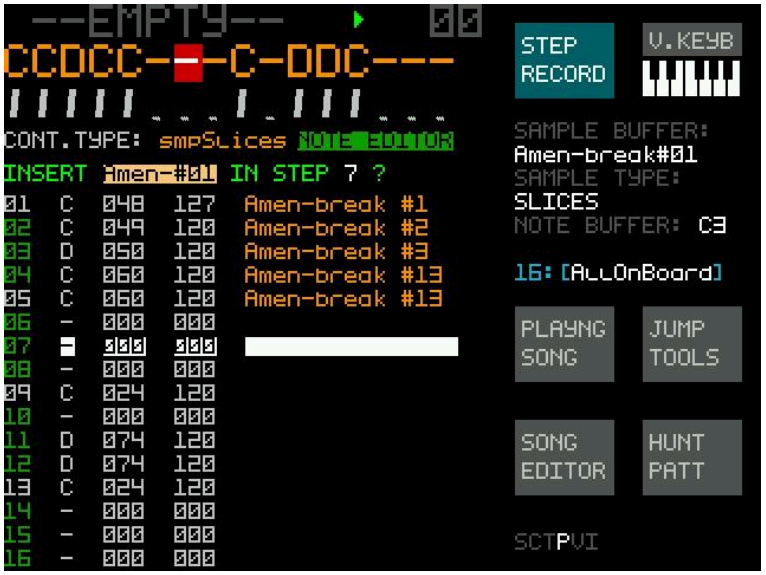


Scroll all the way back to the first parameter in “Pattern Editor”.

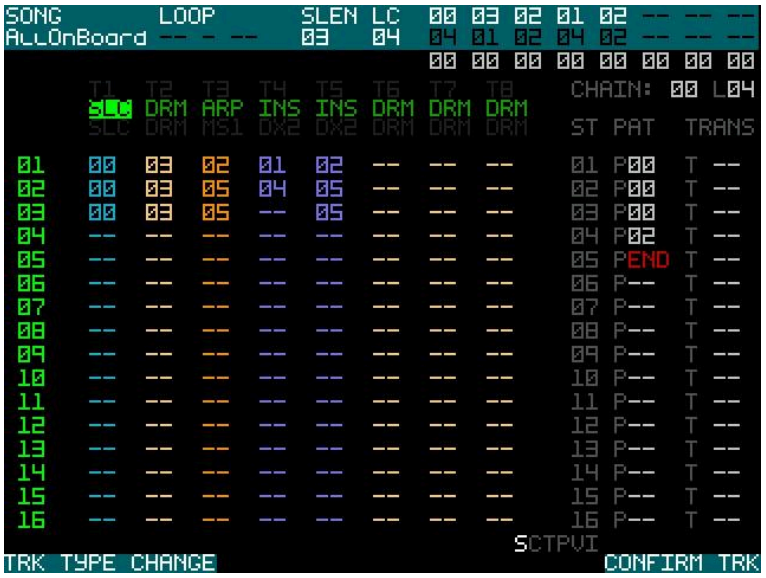
The first parameter, in brackets, will let you select all 1-16 slices of the currently selected sample for slicing.



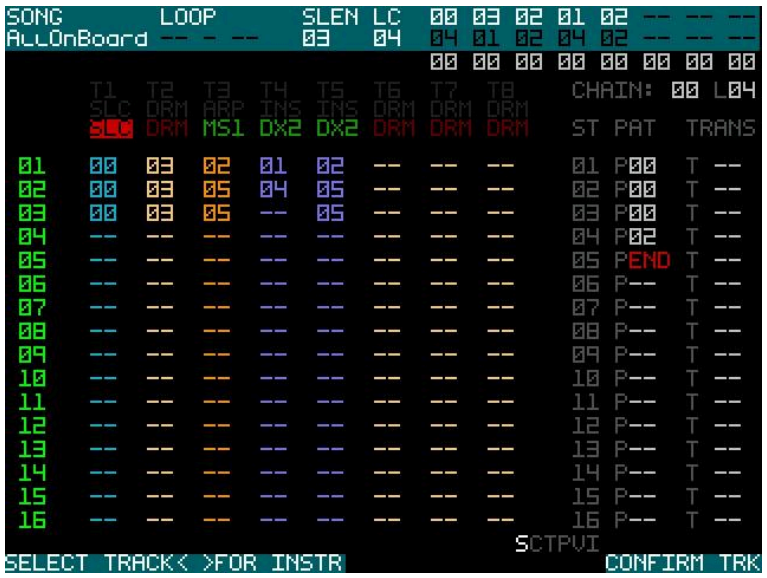
Select the slice you want to edit or add to the pattern. Then scroll right to one of the 1/16 steps.
Depending what is currently on this step, MDT will ask you to replace or insert your current slice into this step.
You can audio preview through all steps by scrolling with ENC_R.



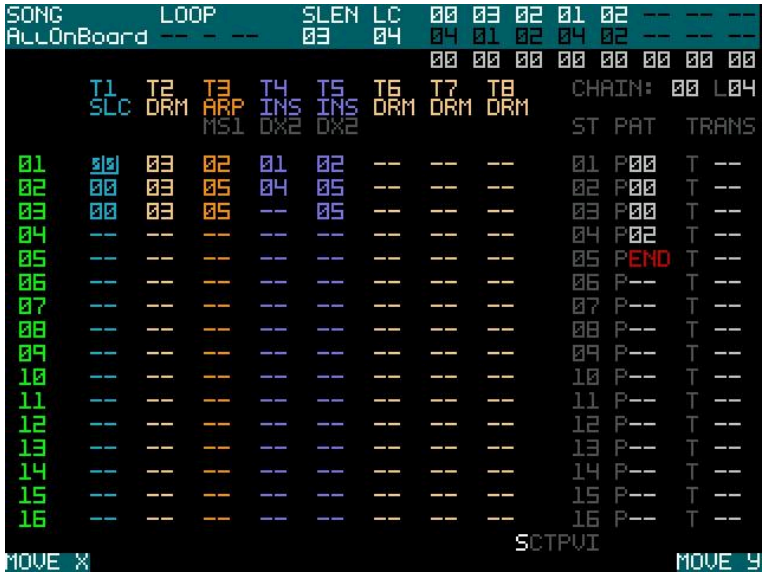
After your pattern is complete, go back with PUSH ENC_L and go to Song



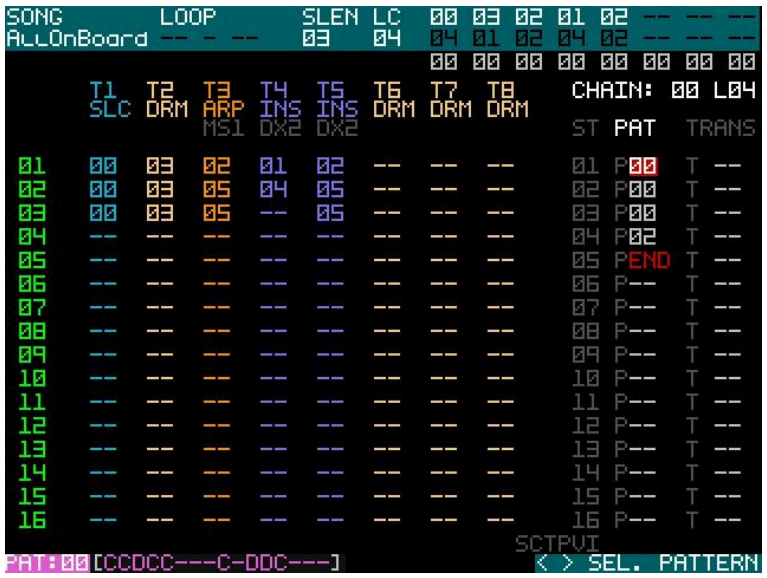
Scroll up with ENC_R to the first row of the track your pattern(s) are in the song that should play slices.
Set the Track Type to “SLC” (Slices). The Instrument Setting below should automatically change to also ”SLC” and can not be changed to anything else.



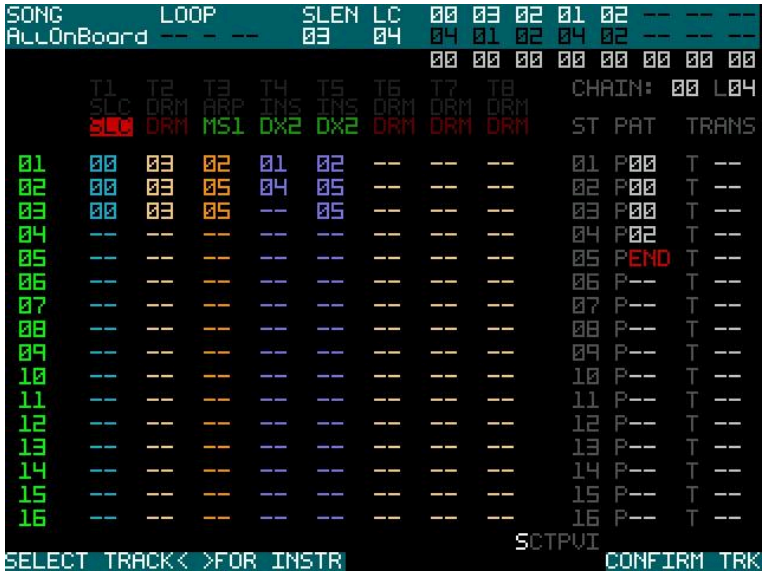
Select or create your chain for your slices pattern(s). This procedure is identical to all the other Track types.



Push ENC_R to select the chain, scroll with ENC_L to the right side to the patterns of the chain.
Scroll up/down with ENC_R through the patterns of the currently selected chain on the left side of the screen.
PUSH ENC_R on a pattern on the right side to edit, change or delete a pattern number in the chain.



When pushing ENC_R inside the right side view, the content of the currently selected pattern will be displayed at the bottom of the screen.
PUSH ENC_R again to exit pattern selection.
If desired, scroll back to the left chain side with ENC_L.
You can now adjust the chain step number or confirm with ENC_R PUSH to move to another chain step.



PUSH and HOLD ENC_L to start/stop the sequencer.
The sequencer now should play the sliced track. If this is not working:

Check that the pattern has the content type “smpSlices”.
In Song page, check that the track type is set to “SLC” (Slices).

Loading and Saving

In MDT, there is a difference between system settings and performance data.

The following settings are stored and loaded when you boot up MDT, independent of your performance:

These settings will be auto-saved every time you make any change.

- Master Volume
- Device MONO/Stereo Modes
- Dexed Engine Type
- MIDI Through settings
- Favorites for Dexed
- Startup Performance
- Startup Page (Screen)
- Display and Touch rotation Settings
- Gamepad / Native Push Button Settings
- other System settings like boot animation, Screensaver, inverted display etc.

The Performances are loaded and saved in the LOAD/SAVE Menu. A Performance will always include the following:

- Patterns for Sequencer and LiveSequencer
- Velocity Data for Sequencer
- Selected Dexed Voice(s)
- MDA ePiano Settings
- Braids Settings
- MicroSynth Settings
- Drum Mappings
- Song, Chain and Chain Transpose Data
- Multisample Player (MSP) Settings
- Multiband Compressor Settings and State
- Sliced Sample Information
- Sidechain settings (work in progress)

Notes:

In the System menu, you can decide what performance should be loaded at boot up. This can be either a static number or your last used performance.

AKAI APC MINI MK2

MDT offers deep integration for the AKAI APC MINI (MK2) as a MIDI Input Controller. Currently this is provided by an own firmware version, starting with *APC* in the filename. Make sure you have loaded this firmware version,when you want to work with the APC together with MDT.
Connect the APC to the MDT USB HOST Port. It should power up by the power provided from the Teensy Micro USB Port if you have loaded a binary firmware from the Codeberg MDT Homepage. It will not power up, when you have compiled the code from source. This is because some low level modification to the USB Host Library was needed to make it startup without any external power source. These modifications are currently not part of the repository.

The most significant part of the APC integration is that you do not have to stay on a specific page on the MDT internal display to work with it. In fact, the APC screens work more or less independently from what is currently on the MDT display. So this behaves like a second “Monitor” that can show and modify information, without any interaction with what is currently visible on the MDT’s own display.

At the most global level, you currently can switch between 3 different modes:

- PATTERN EDITOR
- SONG VIEW
- MUTE MATRIX

Hold down the SHIFT Button and then press one of the top 3 Buttons on the right side of the pads.
This will switch/cycle through these 3 basic modes: PATTERN EDITOR, SONG VIEW and MUTE MATRIX

IN (APC) PATTERN EDITOR mode, not each and every parameter is available when you have activated it only on the APC. To edit a pattern in full detail, just go on the MDT’s screen to the pattern editor, also.

In this case, meaning you are switching to a page that exists on both “views”, the APC will automatically also switch into the corresponding view it has to offer.

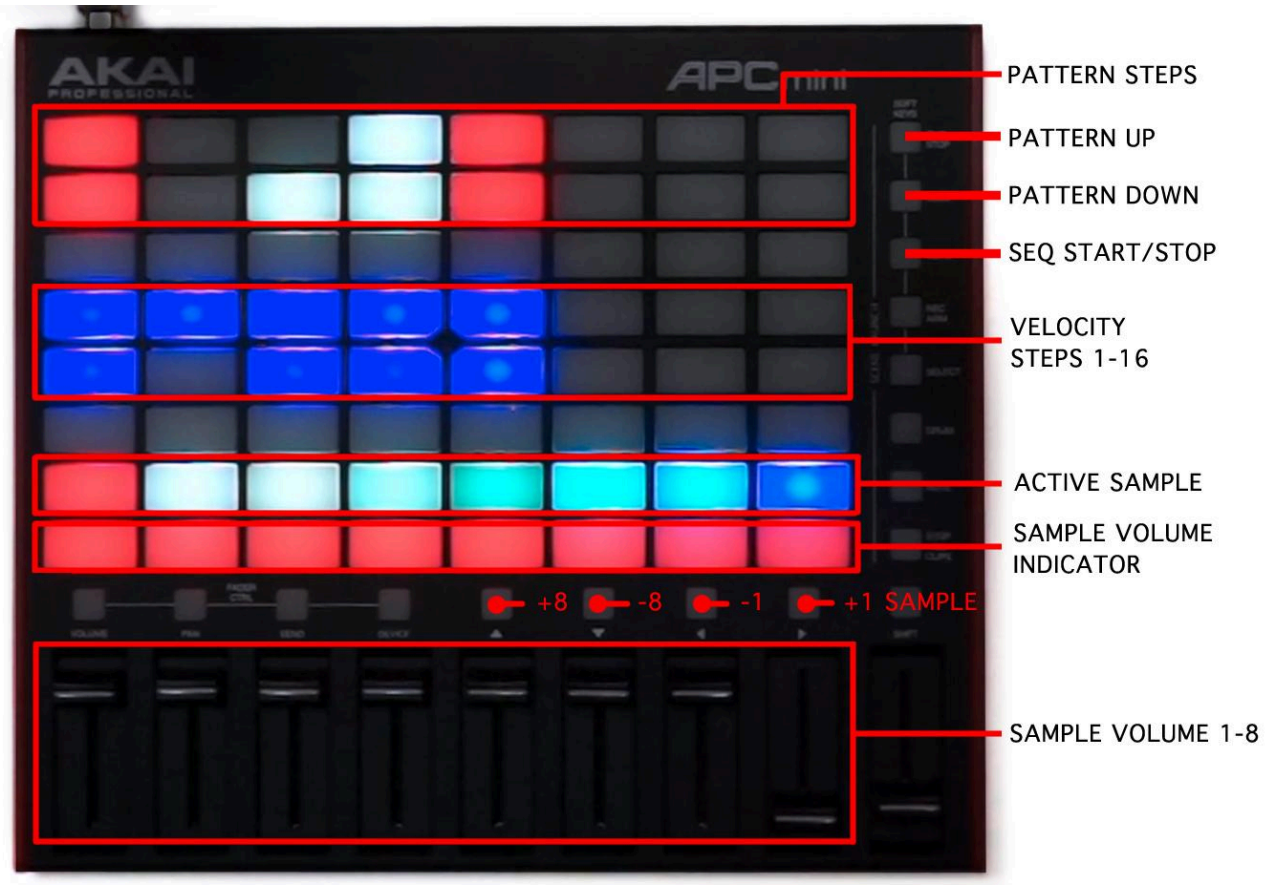
You can however switch the APC view at any time, with the hotkey combination from the image to the left.

The Song View currently is a very basic page on the APC and only shows you the Song structure by its LED pads. You can scroll around it but at the moment it will not offer any editing features - work in progress.

The Mute Matrix is a 1:1 copy of what you see on the MDT Screen. However, this works independently on the APC.

You can have opened a completely different page on the MDT display and the mute matrix will still be available on the APC view, so you can work in Dexed voice, e-piano, braids or almost any other page and still have the option to mute and unmute any of the tracks of the sequencer in real time, without going to the dedicated on-screen menu. As said, this behaves like a PC with a 2 Monitor Setup. You can work on 2 different tasks, at the same time.

APC PATTERN EDITOR



This is an overview of what the pattern editor in APC view offers. It might look a bit overwhelming at first glance, but it isn't really that complicated.

The pattern editor is focused on editing drum patterns. However, it is also capable of editing tonal content at a basic level.
We will concentrate on the drum pattern part for now.

In the first two rows you see step 1-8 and step 9-16 of your currently selected pattern. You can switch the pattern with the 2 top buttons on the right side. The first button goes up a pattern and the second will go down a pattern.

The pattern number will scroll across the screen. This is helpful if you do not have the pattern editor on-screen on the MDT device itself, but are working on a different page.

The next part below displays (in blue colours) the velocity values of the above 16 steps, again in 2 rows, step 1-8 and 9-16

Touching one of the velocity steps, or one of the row selector buttons for velocity at the right side, will make the 8 faders correspond to the velocity values of the individual steps.

Below that, you find the ACTIVE SAMPLE row. With the cursor buttons below, you can scroll the active samples one at a time up or down or in banks of 8 steps up or down.

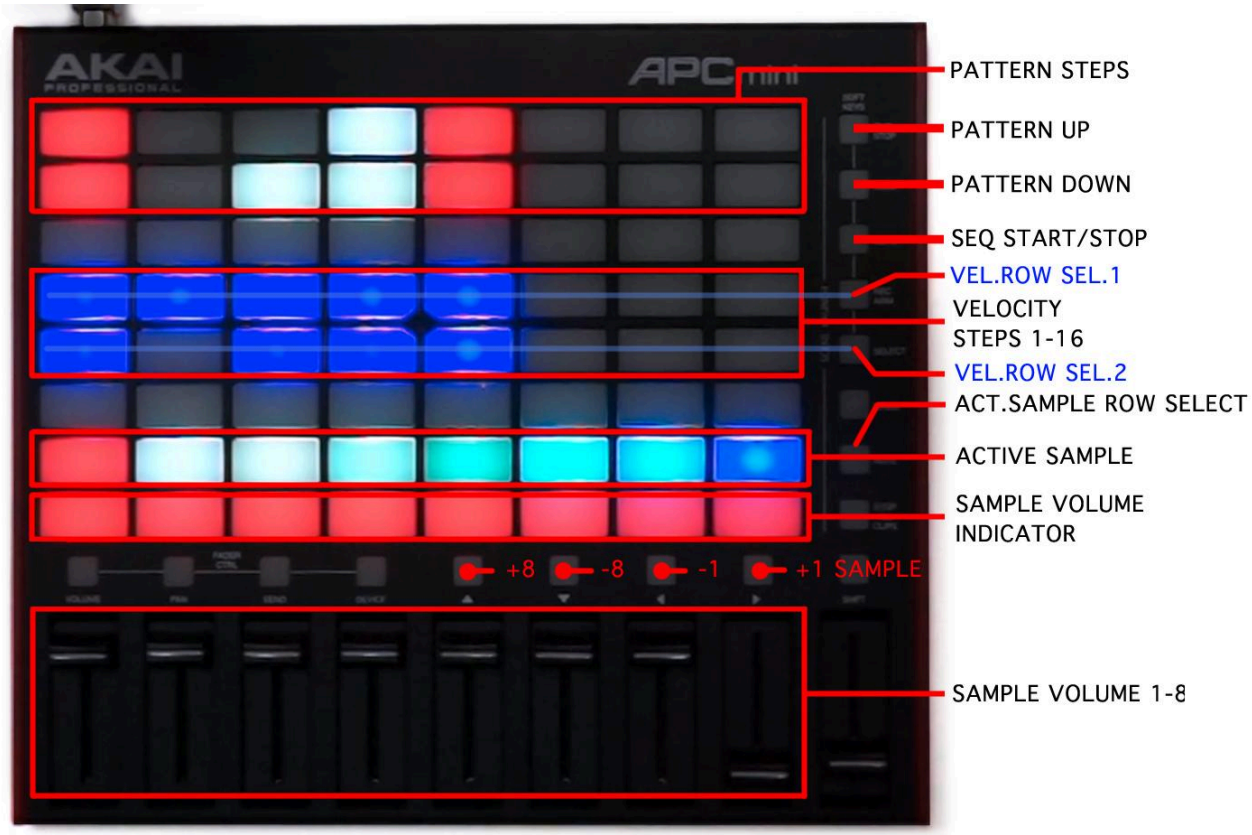
Pushing one of the pads will play the sample and make it the "active" one.
Once a sample is active, it will start flashing/glowing. Then you can push one of the pattern steps at the top, to insert or replace it to one of the 16 pattern steps.

To clear a pattern step, hold **SHIFT** and push one of the 16 steps in the first 2 rows, that shows the pattern content. This will clear this step, whatever was there before.

At last, in the lowest row, you see the individual sample volumes. Touch one of them and the faders will correspond to the individual (but global) sample volume. You can change a single sample volume or at most all 8 at the same time by moving the faders.
The "SAMPLE VOLUME INDICATOR" LEDs will change their brightness according to the volume.

Please check the video: https://www.youtube.com/watch?v=6CE4Ex-3uPc
for a short, but more practical tutorial, how this works in general.

PATTERN EDITOR PART2



The above image shows all the right-side button keys and their direct function.

Some of them are redundant. For example, if you want to change the velocity values of a sample from row 1, you can push either one of the sample pads in this row, or the corresponding row key on the right side.

Either way, the row indicator LED light should be illuminated, so you know what the 8 faders below currently will control.

To play one of the sample steps on the 2 upper rows, make sure none of the ACTIVE SAMPLE pads on the 7th row are glowing or the row indicator light on row 7 is on. If so, you will not preview one of the sequencer steps but insert the current active sample into the pattern.

To turn off the active sample, either push the pulsing pad in row 7 or push the active sample row selection button at the right. Once this is off, you can play/preview each of the 16 steps of the sequence by touching its corresponding pad in the 2 upper rows.

If you want to insert / change a sample, but don't know where it is located, but is already somewhere in your sequence, there is an Auto-Locate function for that.

This is demonstrated in the mentioned video above : https://www.youtube.com/watch?v=6CE4Ex-3uPc

FAQ

MIDI CC for UI Control

20: // RIGHT
21: // LEFT
22: // UP
23: // DOWN
24: // SELECT
26: // BUTTON B
27: // BUTTON A

I have a "GEN1" MDT, can I upgrade ?

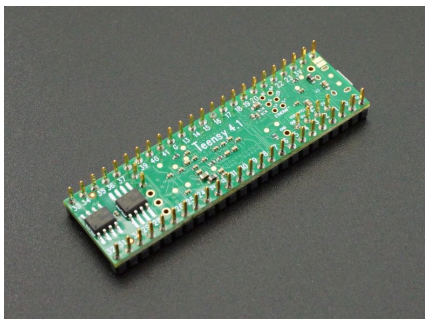
Can I modify it to the newer capacitive touch display?

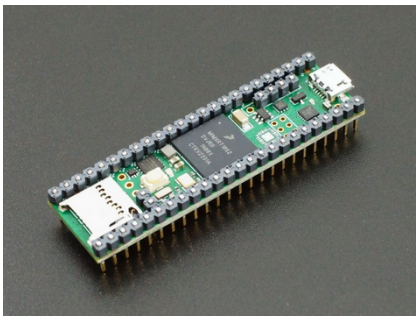
Yes, but it requires some manual soldering and cutting traces.
https://docs.google.com/document/d/19uz_f5Q-ubSz_sre03k6PxKubdhfkKNZsdVtecTyhIY/edit#heading=h.ap520dffq34k

It is not suggested to try that if you have no or only very little desoldering experience.

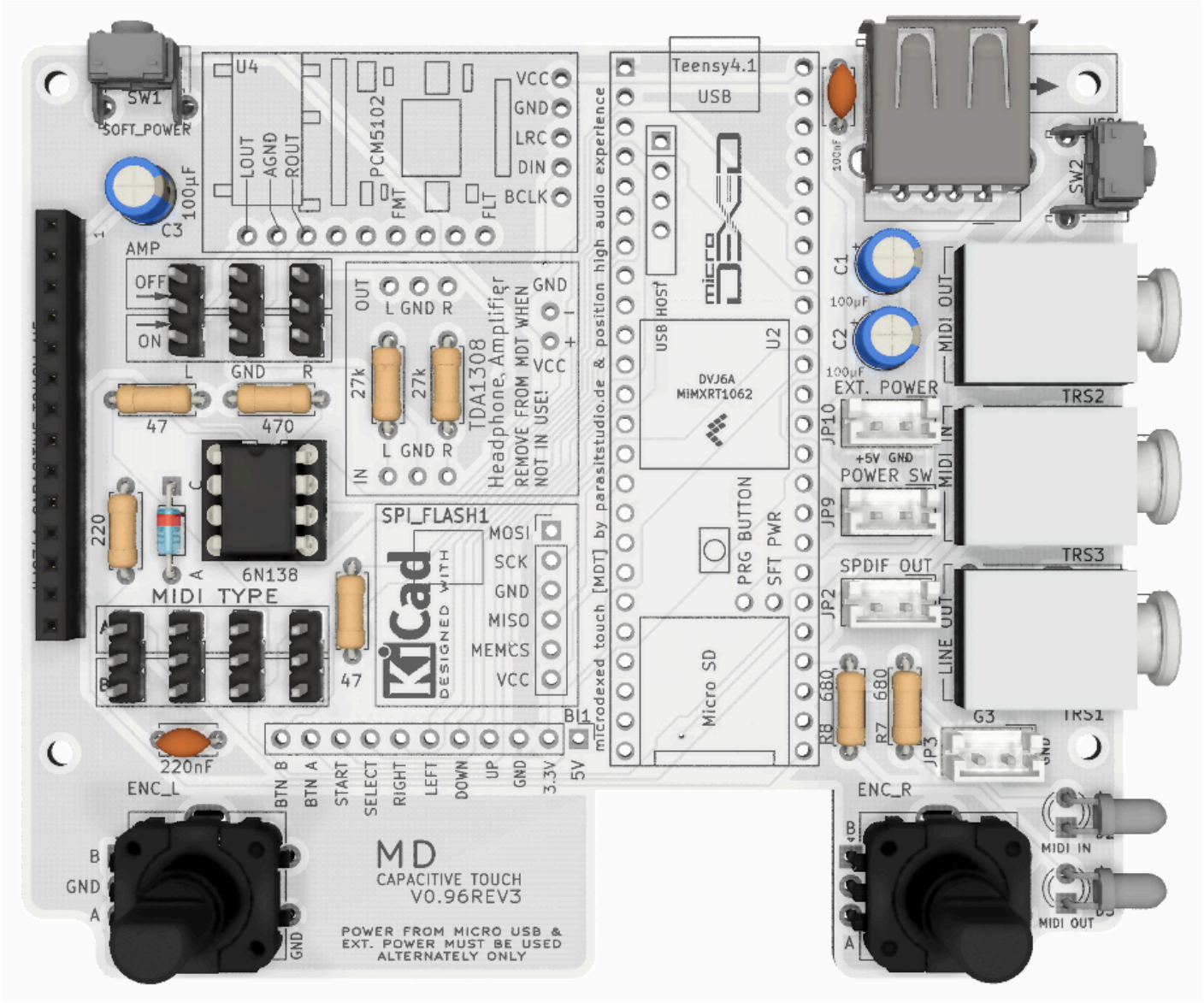
Can I buy a Teensy including PSRAM ?

If you do not want to solder the Teensy pins by yourself, or the (optional) PSRAM chip, you now can order it from https://protosupplies.com/product/teensy-41-microdexed/ fully soldered and tested, specially for MDT (with 8 or 16 MB PSRAM).



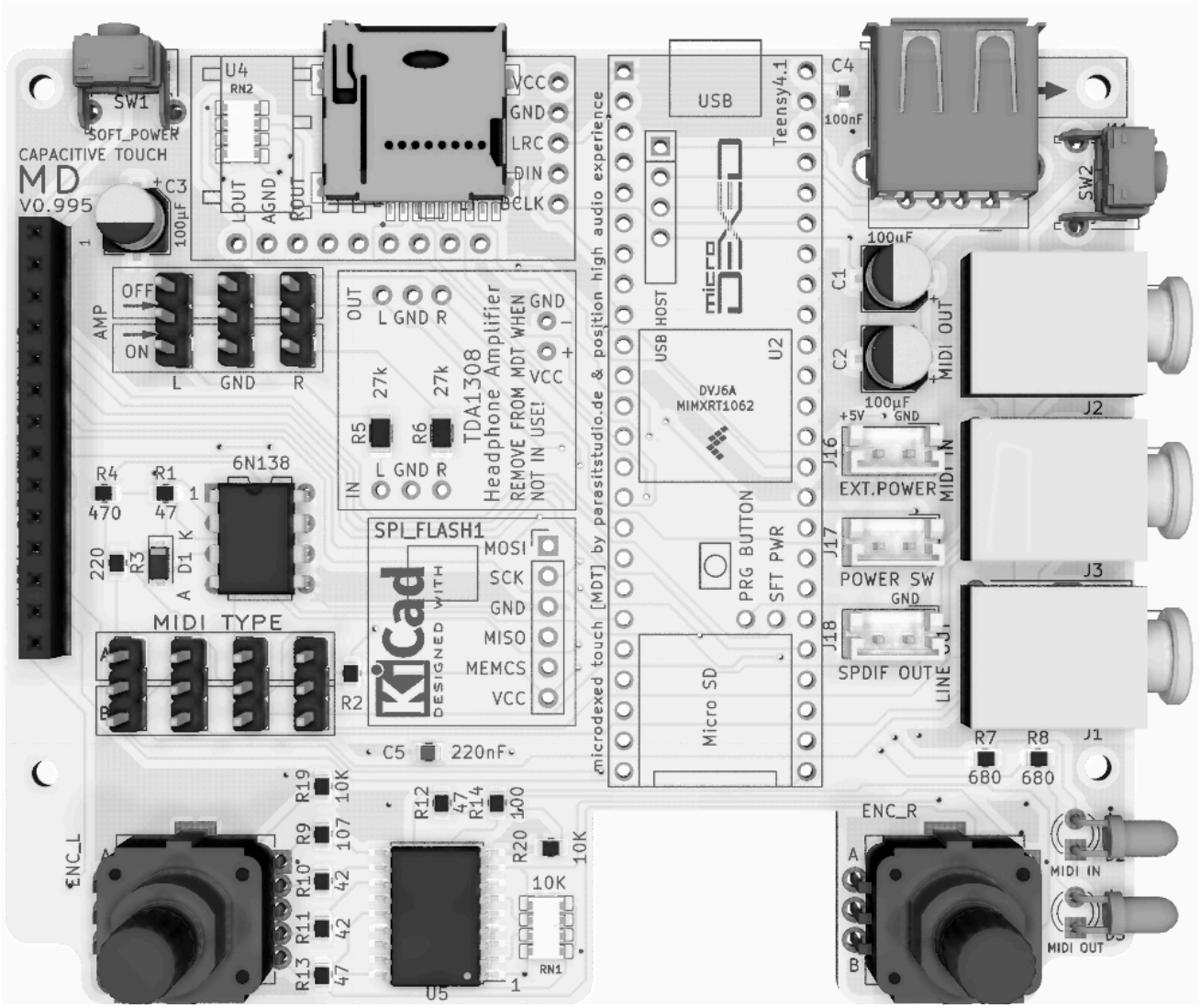


What do I receive when buying the PCB+assembly option at PCBWAY for MDT ?



#	*Designator	*Qty	Manufacturer	*Mfg Part #	Description / Value	*Package/Footprint	Typ
	R1, R2	2	Stackpole Electronics Inc	CF14JT47R0	RES 47 OHM ±5% 0.25W, 1/4W Axial	AXIAL	Through
	R3	1	Stackpole Electronics Inc	CF14JT220R	RES 220 OHM ±5% 0.25W, 1/4W	AXIAL	Through
	R4	1	Stackpole Electronics Inc	CF14JT470R	RES 470 OHM 5% 1/4W AXIAL	AXIAL	Through
	R5, R6	2	Stackpole Electronics Inc	CF14JT27K0	RES 27K OHM 5% 1/4W AXIAL	AXIAL	Through
	R7, R8	2	Stackpole Electronics Inc	CF14JT680R	RES 680 OHM 5% 1/4W AXIAL	AXIAL	Through
	D1	1	SMC Diode Solutions	1N4148	1N4148 DIODE GEN PURPOSE 75V 300MA	DO-204AH, DO-35, Axial	Through
	D2	1	Vishay	TLLR5400	LOW CURRENT, SINGLE COLOR LED 3mm Green	2POS	Through
	D3	1	Broadcom	HLMP-4740	LOW CURRENT, SINGLE COLOR LED 3mm Red	2POS	Through
	JP4, JP5, JP6, JP7, JP8, JP11, JP12	7	Würth Elektronik	61300311121	CONN HEADER VERT 3POS 2.54MM	3POS	Through
	JP2, JP9, JP10, G3	4	JST	B2B-EH-A	CONN HEADER VERT 2POS 2.5MM	2POS	Through
	U3	1	Preci-Dip	110-87-308-41-001101	CONN IC DIP SOCKET 8POS	DIP-8_W7.62mm	Through
	U5	1	Sullins	PPPC141LFBN-RC	14 POSITION RECEPTACLE CONNECTOR 2.54MM	14POS	Through
	USB1	1	Switchcraft	RAHPCUA20	USB TYPE-A USB 2.0 RECEPTACLE CONNECTOR	4POS	Through
	SW1, SW2	2	E-Switch	TL1105VF160Q	TACTILE SWITCH SPST-NO SIDE ACTUATED	2POS	Through
	TRS1, TRS2, TRS3	3	Same Sky (CUI)	SJ1-3515	HEADPHONE JACK STEREO CONNECTOR. 3.5mm	3POS	Through
	C1,C2,C3	3	Panasonic	ECE-A1CKA101	CAP ALUM 100UF 20% 16V	RADIAL	Through
	C5	1	Kemet	C330C224K1G5TA	CERAMIC CAPACITOR 220nF	C_Disc_D4.7mm_W2.5mm_P5.00mm	Through
	C4	1	Vishay	K104K20X7RK53H5G	CERAMIC CAPACITOR 100nF	C_Disc_D4.7mm_W2.5mm_P5.00mm	Through
	ENC_L1,ENC_R1	2	Bourns	PEC11R-4220K-S0024	ROTARY ENCODER	5POS	Through
	U3	1	Lite-On	6N138	OPTOISO 5.3KV DARL W/BASE 8-DIP	DIP-8_W7.62mm	Through
	Total Parts	38					

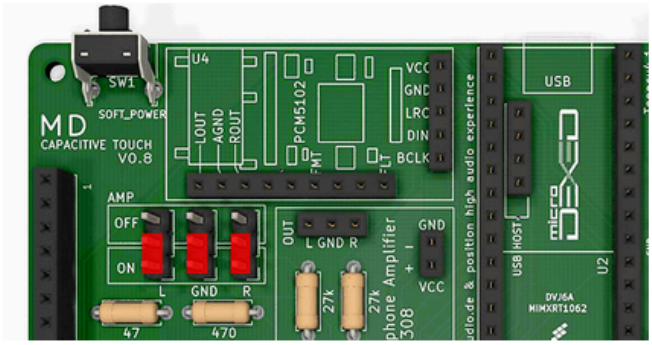
What do I receive when buying the PCB+assembly option at PCBWAY for MDTX ?



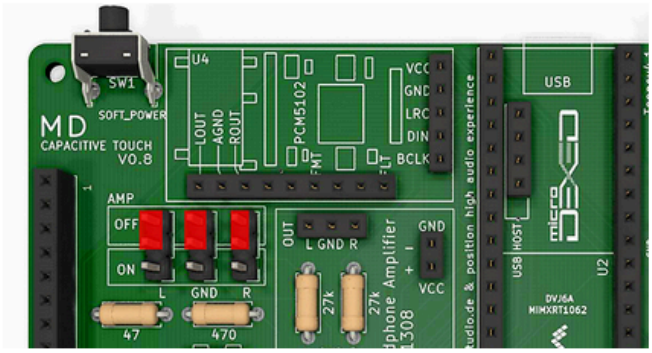
Item #	*Designator	*Qty	Manufacturer	*Mfg Part #	Description / Value	*Package/Footprint	Mounting Type
1	R10,R11	2	Vishay Dale	CRCW080542R2FKEA	RES SMD 42.2 OHM 1% 1/8W 0805	SMD:R 0805_2012METRIC	SMD
2	R1,R2,R12,R13	4	Vishay Dale	CRCW080547R0FKEAC	RES SMD 47 OHM 1% 1/8W 0805	SMD:R 0805_2012METRIC	SMD
3	R3	1	Vishay Dale	CRCW0805220RFKEBC	RES SMD 220 OHM 1% 1/8W 0805	SMD:R 0805_2012METRIC	SMD
4	R4	1	Vishay Dale	CRCW0805470RFKEA	RES SMD 470 OHM 1% 1/8W 0805	SMD:R 0805_2012METRIC	SMD
5	R14	1	Vishay Dale	CRCW0805100RFKEA	RES SMD 100 OHM 1% 1/8W 0805	SMD:R 0805_2012METRIC	SMD
6	R19,R20	2	Vishay Dale	CRCW080510K0FKEA	RES SMD 10K OHM 1% 1/8W	SMD:R 0805_2012METRIC	SMD
7	R9	1	Vishay Dale	CRCW0805107RFKEA	RES SMD 107 OHM 1% 1/8W 0805	SMD:R 0805_2012METRIC	SMD
8	R5, R6	2	Stackpole Electronics Inc	CF14JT27K0	RES 27K OHM 5% 1/4W AXIAL	AXIAL	Through Hole
9	R7, R8	2	Stackpole Electronics Inc	CF14JT680R	RES 680 OHM 5% 1/4W AXIAL	AXIAL	Through Hole
10	RN1, RN2	2	YAGEO	YC324-JK-0710KL	RES ARRAY 4 RES 10K OHM 2012	SMD 2012	SMD
11	U5	1	Microchip Technology	MCP23008T-E/SO	IC XPNDR 1.7MHZ I2C 18SOIC	SOIC-18W_7.5x11.6mm_P1*	SMD
12	U6	1	GCT	GCT_MEM2075-00-140-01-A	MEM2075-00-140-01-A	SMD/SMT	SMD
14	C1,C2,C3	3	Panasonic	ECE-A1CKA101	CAP ALUM 100UF 20% 16V	RADIAL	Through Hole
15	C5	1	Kemet	C330C224K1G5TA	CERAMIC CAPACITOR 220nF	C_Disc_D4.7mm_W2.5mm_*	Through Hole
16	C4	1	Vishay	K104K20X7RK53H5G	CERAMIC CAPACITOR 100nF	C_Disc_D4.7mm_W2.5mm_*	Through Hole
17	D1	1	Diodes Incorporated	1N4148W-7-F	1N4148 DIODE GEN PURPOSE 75V 300MA	SOD-123	SMD
18	D2	1	Broadcom	HLMP-4740	LOW CURRENT, SINGLE COLOR LED 3mm Green	2POS	Through Hole
19	D3	1	Vishay	TLLR5400	LOW CURRENT, SINGLE COLOR LED 3mm Red	2POS	Through Hole
20	U3	1	Lite-On	6N138	OPTOISO 5.3KV DARL W/BASE 8-DIP	DIP-8_W7.62mm	Through Hole
21	J11	1	Switchcraft	RAHPCUA20	USB TYPE-A USB 2.0 RECEPTACLE CONNECTO*	4POS	Through Hole
22	J12	1	Sullins	PPPC141LFBN-RC	14 POSITION RECEPTACLE CONNECTOR 2.54MM*	14POS	Through Hole
23	SW1, SW2	2	E-Switch	TL1105VF160Q	TACTILE SWITCH SPST-NO SIDE ACTUATED	2POS	Through Hole
24	J1, J2, J3	3	Same Sky (CUI)	SJ1-3515	HEADPHONE JACK STEREO CONNECTOR. 3.5m*	3POS	Through Hole
25	J4,J5,J6,J7,J8,J9,J10	7	Würth Elektronik	61300311121	CONN HEADER VERT 3POS 2.54MM	3POS	Through Hole
26	J16,J17,J18	3	JST	B2B-EH-A	CONN HEADER VERT 2POS 2.5MM	2POS	Through Hole
13	ENC_L1,ENC_R1	2	Sparkfun	COM-15141	ROTARY ENCODER RGB	8POS	Through Hole
	Total parts	48					

MDT jumper settings for Phones Amplifier and MIDI

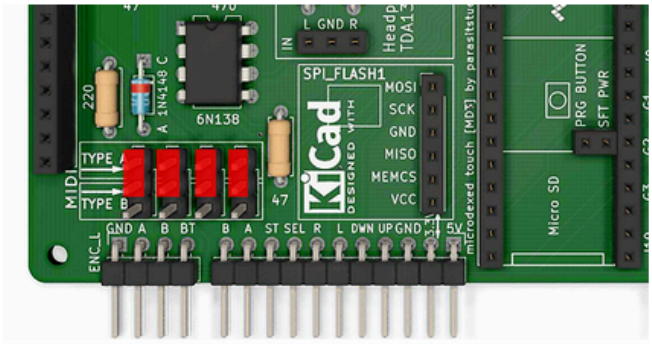
MIDI and AUDIO AMP Jumpers (MDT Capacitive Touch)



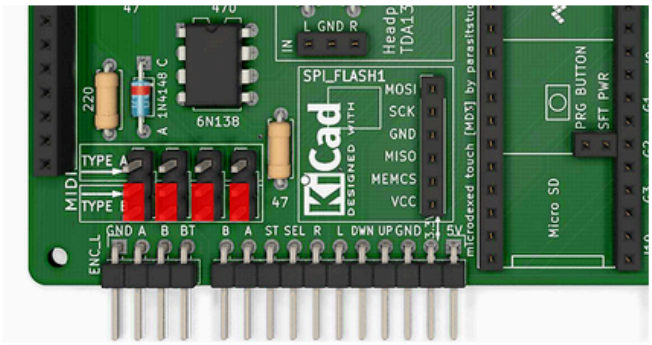
If you have added the optional Headphone Amplifier, set the 3 AMP Jumpers to the ON position.



If you have not added the optional Headphone Amplifier, or want to bypass it, set the 3 AMP Jumpers to the OFF position.

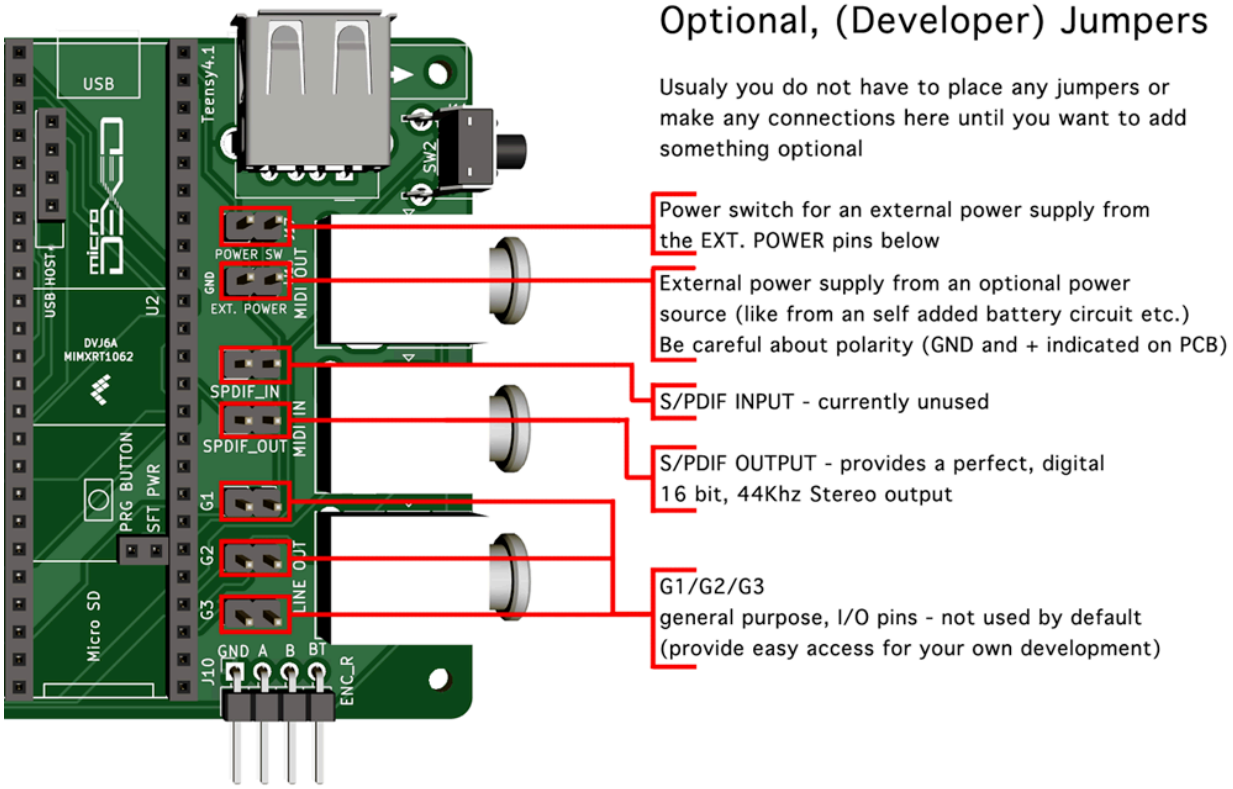


If you want to use TRS JACK TYPE A MIDI devices on Input and Output, place jumpers to the A position.



If you want to use TRS JACK TYPE B MIDI devices on Input and Output, place jumpers to the B position.

What are the connectors/pins on the right side of MDT PCB ?

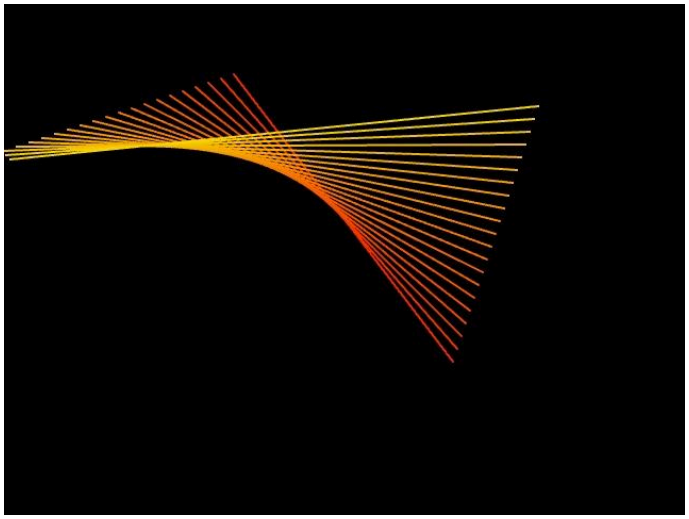


What is it about all the Screensavers ?

It started with only one but then expanded quickly since we love to put all the extra effort into MDT to make you smile (as long as it does not lead to any compromises for the actual audio functionality).

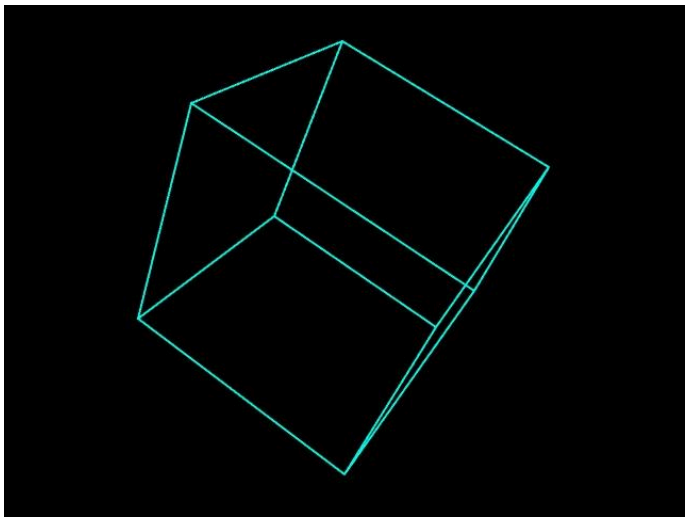
QIX

This is inspired by an early arcade game called QIX. In the game, the colored line is the enemy you have to defend yourself from.



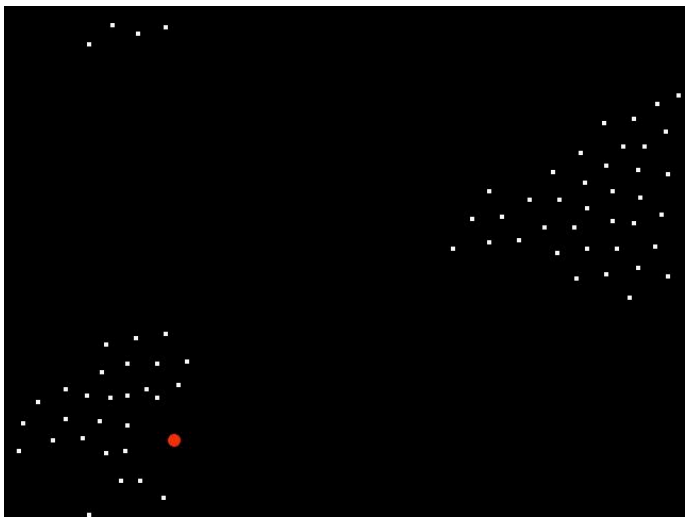
3D Cube

Just what it says, a spinning 3D cube.



Swarm

A flock swarm, escaping a predator



3D Terrain

MDT logo (classic) with 3D terrain

MDT logo (current) with 3D terrain

User Scenarios

Welcome to MicroDexed-touch, short form MDT.

This guide should be a help to completely new users. It will not go into much detail. This is mainly intended to get you started.

Who are you ?

We assume that there are very different user types and very different usage scenarios, these are the types we currently can mainly think of:

- you want something to play live, a FM Synth, Samples or other Synthesis (User A)
- you want a multi timbral MIDI expander, you are mainly a PC-DAW User (User B)
- you are a "dawless user" and want to use MDT as an external MIDI device to integrate in your setup with another sequencer, then you are also (User B)
- you want a studio or hobby tool to create demo sequences or demo songs, with an all-in-one box (and maybe expand to external devices later) (User C)

USER A

You can use a USB MIDI or "classic" MIDI Keyboard.

Attach your MIDI device to the USB HOST port or to the MIDI IN port.

MDT has USB and mini "TRS" jacks as MIDI Input.

There are 8 jumpers on the PCB where you can select between a TRS-TYPE A and TRS-TYPE-B device. This depends on the manufacturer of your device:

TRS-A:

Korg (Electribe 2, SQ1, NTS-1)
Akai Pro (MPC Studio, MPC Touch, MPX8)
Boss (RC-5/500)
Critter & Guitari (Organelle M)
Dreadbox (Lil' Erebus)
IK Multimedia (bei iRig Pro, iRig Pro DUO allerdings mit 2,5 mm)
Line 6
littleBits (MIDI Module)
Make Noise (0-Coast)
Retro Kits RK-006
Teenage Engineering (OP-Z oplab)
Twisted Electrons
DirtyWave M8 Tracker (v1 & 2)

TRS-B:

Arturia (BeatStep Pro)
Novation (Circuit, Circuit Mono Station, Launchpad Pro — newer devices however use TRS-A)
Polyend (Poly 2, Tracker)
Pittsburgh Modular (Liveforms SV-1)

Depending on what you want to play live, you set your MIDI OUT channel on your MIDI device and/or the corresponding MIDI channel on MDT.

All MDT Sound Sources/Instruments can have their own MIDI channel and can play at the same time.
Dexed has 2 engines (4 with PSRAM) with 16 voices each, each have their own MIDI channel or you can stack them to 1 channel if you want to do that.

If you want to play Microsynth, MDA ePiano, Braids etc., set their MIDI channel on their own page, matching the MIDI channel of your Keyboard/MIDI Device.

Microsynth is a Mono Synth with 2 Instances and each also has its own MIDI channel. Braids has one instance and can play polyphonic with up to 8 voices on one MIDI channel (shared with other sample playing voices).

The MDA ePiano has 16 voices and has also its own assignable MIDI channel.

Make sure that no other instrument that you do not want to play is playing on the same MIDI Channel by accident.

In the "System" Menu - "MIDI channels" you can see all MIDI assignments at once.

Check on each instrument (Dexed, MDA ePiano, MSP, Microsynth, Braids) if you have set the MIDI channel to identical MIDI channels, or OMNI, which means to react to all channels at once. Usually you want to react to each instrument on its own channel.

USER B

This is easy. You can see MDT as a multi-timbral device with several sound sources.

First we have two instances of Dexed, both of them have their own MIDI channel.

Set the MIDI channel in the Dexed Voice screen (or in the deeper menus) to some channels you currently have free, each on its own channel, select the bank and the sound in the Dexed screen and you should have 2 FM synths, each with 6 OPS and 16 voices.

You can switch between the two instances either by touch on the display or by navigating to the top of the screen and selecting the current instance you would like to edit/customize.

The other instruments like Microsynth, MDA ePiano, Braids etc. also have their own MIDI channel. You can set their MIDI channel in their corresponding page.

Make sure that no other Instrument, you do not want to play, is playing on the same MIDI channel by accident.

USER C

The first advice is to look into: https://codeberg.org/positionhigh/MicroDexed-touch/wiki/Sequencer

More (hopefully helpful) instructions:

The Sequencer uses MIDI / MIDI channels in combination with Track assignments for the internal playback. Currently, there are some issues when multiple Instruments are set to the same MIDI channel, especially when they are set to OMNI, meaning they are supposed to play on EVERY MIDI channel. So it is a good idea to check the assignment of MIDI channels.

In the "System" Menu - "MIDI channels" you can see all MIDI assignments at once and also can change them at a central place. While the sequencer is running, on this page you also see the activity on each instrument. So it is easy to find where a sound is coming from.

What the sequencer does on top of MIDI is, assign a fixed instrument to a sequencer track.

What can be assigned, as output, is:

- Dexed Instance 1
- Dexed Instance 2
- Microsynth Instance 1
- Microsynth Instance 2
- ePiano
- Braids
- MSP, preset 1-10
- TSR MIDI 1-16 or omni
- USB MIDI 1-16 or omni

Depending on the track type that you assign to the sequencer track, it will behave differently. It can play drum samples, pitched drum samples, single notes, arpeggios (depending on the arpeggio settings something like up/down/random/euclidean) or chords with up to 12 voices, etc.

When using a USB Gamepad, the Sequencer workflow is trying to replicate much of the behavior of LSDJ on the gameboy. There are quick-jump-shortcuts between song-chain and pattern view etc.

Value Input/Change, however, is currently not identical to that method of LSDJ. Instead of holding a modifier Key while changing the value, you press a Button to enter edit mode, change the value and then press the same Button again to exit the edit mode. The Button is usually [A] or Encoder[R], if you use the default encoder interface.

DEXED Settings

The following instructions are taken over in a slightly modified form from MicroDexed generation 1 and are still valid and useful:

Using MicroDexed

After turning MDT on, you are usually in the voice/bank selection (you can select another startup page in the System Menu). To enter the menu, short press **ENC_L**. You can return to the voice/bank selection of the Dexed voice by holding down **ENC_R**. If you turn the **ENC_L**, the volume screen appears and you can see which value is set. After a few seconds the system automatically returns to the previous screen.

To select items in the menu, turn the **ENC_R**. You can select a menu item or jump to a submenu by short pressing **ENC_R**.

If you want to leave a parameter edit or go up one level in the menu, short press **ENC_L**.

In many Dexed pages and sub-menus, a small icon with an inverted 1 and 2 will appear. To switch between the two engines (four engines with PSRAM) and change their parameters, simply long press **ENC_R**.

Sound/Bank selection

The most important Dexed screen will be the sound selection (voice select). The screen displays the selected bank number (top left) and the selected voice number (below). Next to the numbers are the corresponding preset names. The active parameter (marked with square brackets) can be changed by turning **ENC_R**.

MDT can manage 100 banks (0-99) and 32 voices per bank. Above that, MDT has 100 POOLS for banks. This makes a total of 320000 voices in total available.

If you turn **ENC_R** further than the 32nd voice of a bank, the first voice of the next bank will be loaded automatically, except if you already reached the last bank (bank 99). This happens the same way if you try to go lower than voice number 1.

In System Menu, you can activate a filter for the displayed voices and mark your most used as a favorite. You can set the filter to show only your favorites, all voices, only non-favorites and several other options.

To switch between the 2 or 4 Dexed instances/engines (depending on the PSRAM), you can either navigate to the top in voice select and change it there, or just long-press **ENC_R**.

Next to the bank name is the symbol for the active engine.

If one or several MIDI note events are detected, a note symbol is displayed below the corresponding instance as long as this note is active.

When the voice is changed, MDT sends a voice dump in the background via MIDI SYSEX on its selected MIDI channel. This has the advantage that external devices (like a voice editor on a PC) synchronize the data directly.

To enter the menus, short press **ENC_L**

Voice Menu

The Voice menu is the most comprehensive menu. Here all functions related to sound generation are available in submenus.

Audio Menu

The audio submenu contains all functions that can lead to audible changes in any form.

Voice Level

By changing (and later saving) this value you can compensate for differences in volume between different sounds. The value ranges from 0 to 127. Default is 100, but you can make the sound louder by increasing the value.

Panorama

The voice's position in the stereo image can be adjusted here (MIDI-CC 10).

Effects

MDT comes with some effects. Basically, each MDT instance has its own resonant low-pass filter, (mono) Chorus and a separate (mono) delay (500 ms for mono-timbral / 250ms for bi-timbral). This is followed by the position in the stereo image (see panorama) and a stereo reverb.

(Mono-)Chorus

This simple chorus is generated by mixing the original signal and a pitch-modulated copy. The effect is only audible when frequency, depth and level are all somehow greater than 0.

Parameters:

- Frequency (0-10 Hz)
- Waveform (Triangle/Sine)
- Depth (0-100)
- Level (0-100)

(Mono-)Delay

The delay has a feedback loop and can be mixed into the original signal by means of level. Therefore time and level must be greater than 0.

Parameters:

- Time: (0-500ms for *mono-timbral* or 0-250 for *dual-timbral* (on Teensy-3.6))
- Feedback (0-100)
- Level (0-100)

  Dedicated MIDI controller numbers:

  - Time: MIDI-CC 105
  - Feedback: MIDI-CC 106
  - Level: MIDI-CC 107

(Stereo) Reverb (Master effect)

Parameters:

- Room Size (0-100)
- Damping (0-100)
- Level (0-100)
- Reverb Send (0-100)

Dedicated MIDI controller numbers:

- Level: MIDI-CC 91

EQ (Master effect)

The EQ is only active when using a Teensy audio shield (or SGTL5000 chip). It serves as a simple adjustment of the sound image.

Parameters:

- Bass (0-100)
- Treble (0-100)

Controller

The controller section is responsible for the settings of the different MIDI controllers.

Note on Controllers:

How it works inside MDT:

Pitch and amplitude modulations are set inside the voice presets by two parameters : *PMD* (*P*itch *M*odulation *D*epth) and *AMD* (*A*mplitude *M*odulation *D*epth)

These settings cannot be edited using MD's interface (but can be edited via MIDI-SYSEX).

Pitch modulation:

The LFO, internal to MDT, will affect all operators in the same way. Its frequency (or rate) and depth are common to all operators.

Depending on the LFO's waveform, the effect will sound like a faint vibrato or a large wobble (sine or triangle), a trill (square), a series of random pitches (sample and hold), to name a few.

Amplitude modulation:

The LFO, internal to MD, will affect all operators independently: Rate will be common, but modulation depth can be set differently on each operator.

If the operator is a carrier, the LFO will affect the general volume of the preset. A sine wave LFO applied to a carrier operator will result in some kind of tremolo effect.

If the operator is a modulator, the LFO will affect the harmonic content of the preset. A sine wave LFO applied to a modulator operator can, in most cases, be compared to an automatic Wah-Wah effect. A sample and hold LFO applied to a modulator operator will result in a series of notes with random brightness.

MDT's controller menu

Even if pitch and amplitude modulations are already set inside the Dexed preset, it is still possible to add modulation using external controllers.

Controllers are physical or virtual devices, external to MD, which will have an effect on some parameters via MIDI-CC messages.

On MDT, sources are: Pitch Bend, Modulation, Breath Controller, Foot Pedal, Aftertouch.

Destinations are: pitch modulation by internal LFO, amplitude modulation by internal LFO, EG Bias.

On a physical synth or master keyboard, pitch bend is usually controlled by a wheel or one axis of a joystick, modulation by a second wheel, or the second axis of the joystick, a breath controller by an external pressure sensor, and foot pedal is obvious.

But in fact, if this is a common setting, other combinations can occur, depending on the keyboard/controller and of the musician's choice.

Controller MIDI messages can as well be produced by virtual controllers as DAWs, virtual keyboards or MIDI command software.

The devices named in this manual refer to the MIDI message, no matter what kind of controller device produces them.

MDT will not produce any MIDI CC messages, but will define their destination, their operating mode, and their intensity.

Pitchbend

The pitch of a note can be raised or lowered using the Pitch Bend control, which is usually a dedicated wheel or joystick on a master keyboard. The range can be set up to one octave in both directions (up/down). *Range* setting defines the highest possible variation: from one semitone to a full octave. *Steps* define if the control is continuous (step = 0) or uses discrete values (steps) of 1, 2 ... 12 semitones.

Parameters:

- Range (0-12)
- Step (0-12)

Other controllers (Modulation-Wheel/Aftertouch/Foot-Controller/Breath-Controller)

Other MIDI controllers all have the same modification possibilities. The output of modulation can affect different destinations: PITCH (pitch envelope), AMP (loudness envelope), EG (see note below). It is possible to specify targets or any combination of targets. In order to hear an effect, the voice preset must be configured accordingly.

Note on controllers:

External controllers such as Mod Wheel, Foot Pedal, etc, will send MIDI messages to MDT, from 0 to 127.

- The *Assign* parameter will define the destination of this modulation.
- The *Range* parameter will define a divider, reducing this operating range to fit the user's needs (*Range* can be seen as a percentage value).
- The *Mode* parameter will define the behavior of the controller's output, or how MDT will react to the controller's messages.

In *Linear* mode, the modulation applied to the chosen destination will vary from 0 to the value defined by *Range*. Output can be considered as:

MIDI CC value * (*Range*/100) (not inverted)

In *Reverse* mode, the MIDI CC value is subtracted to its maximum. The output will vary from 127 to (127-*Range*), and thus will be inverted, compared to its input. Output can be considered as:

127 - (MIDI CC value * (*Range*/100))

In *Direct* mode, the modulation applied to the chosen destination will vary from (127-*Range*) to 127, without being inverted. Output can be considered as:

127 - ((*Range*/100)*127) + (MIDI CC value * (*Range*/100))

Linear will be preferred for Pitch or Amp modulations (no modulation when MIDI CC's value is null, maximum modulation set by the *Range* parameter).

Direct mode will be preferred when modulation is applied to EG bias: MIDI CC value of 127 (maximum) will leave the sound unaltered, while lower values will reduce the volume or brightness of the preset, down to a value defined by *Range*.

Reverse mode will be used for example when one controller is applied to two different MDT units (or two instances of a bitimbral MD), set to the same MIDI channel, to modify the level balance of those two engines. If one of the MDs is set

to Direct and the other to Reversed, it will then be possible to control the balance of those two engines, for example by turning the Mod Wheel or by pressing the Foot Pedal, allowing some kind of sound morphing.

Parameters:

- Range (0-99)
- Assign (PITCH/AMP/EG or any combination)
- Mode (LINEAR/REVERSE-LINEAR/DIRECT)

Dedicated MIDI controller numbers:

- Modulation wheel: MIDI-CC 1
- Foot controller: MIDI-CC 4
- Breath controller: MIDI-CC 2

Note on target EG:

Each of the 6 operators has similar settings, no matter if it is a carrier or a modulator.

Among those settings are an envelope generator and an output level.

Output level could as well be called "Gain" and can be compared to a mixer entry fader (in case of a carrier) or a modulation index (in case of a modulator).

EG stands for EG bias, and could as well be called EG depth. It could be compared to the filter's EG depth on an analog synthesizer.

When a controller is routed to EG (aka EG Bias), the *Range* value will define how much the controller will affect each operator's envelope depth.

Depending on a parameter which is internal to the sound engine's preset, this will have a different effect and in many cases no effect at all.

On MD, this internal parameter is called *AMD* (for *A*mplitude *M*odulation *D*epth) and the controller routed to EG will only have an effect on the operators when their individual *AMD* is set to a value greater than 0.

If those operators are carriers, the controller routed to EG will control the overall volume of the sound.

If those operators are modulators, the controller routed to EG will affect the modulation indexes, which have an effect on the harmonic content of the sound (the higher the modulator's level, the richer the harmonics, leading to a brighter sound).

If carriers and modulators have an *AMD* setting with a value greater than 0, then the controller routed to EG will affect, at the same time, volume and brightness of the sound.

If no operator has an *AMD* setting greater than 0, then the controller will have no effect.

In short: If, inside the preset, *AMD* is set to 0 for all operators, then the controller will have no effect.

> **Note on changing *AMD*:** You can easily change all voice parameters by using an external MIDI-SYSEX editor (see Appendix).

MIDI

In this menu everything concerning MIDI control is set.

MIDI Channel

This parameter sets the MIDI receive channel. MDT will react to messages coming from this channel. A channel between 1 and 16 can be selected. Alternatively *OMNI* can be selected if data should be received from all MIDI channels.

Parameters:

- MIDI-Channel (OMNI/1-16)

Lowest/Highest note

You can also restrict the range of MIDI-notes to which MDT should react. This allows split and/or dual configurations with the *dual-timbral* engine.

Parameters:

- Lowest Note (A0-C8)
- Highest Note (A0-C8)

  Note on ranges: You have to check by yourself if the note ranges you entered make sense. If you set *Lowest Note* to C6 and *Highest Note* to C4 you won't hear anything!

Send voice

The currently configured voice can be send via MIDI SYSEX, for example to edit it in an external editor or use it on another MDT.

1. Choose the bank.
2. After choosing, push the preset encoder.
3. Choose the voice to send.
4. After choosing, push the preset encoder and the data will be sent via MIDI.

   Note on sending voice data: The voice data is sent on the current MIDI channel. If the MIDI channel is *OMNI* the data will be sent on Channel 1.

Setup

The setup menu contains all other parameters that control this voice.

Portamento

Portamento allows the pitch to slide continuously from one note to the next one.

Parameters:

- Mode (FINGERED/FULL)
- Glissando (ON/OFF)
- Time (0-99)

  Dedicated MIDI controller numbers:

  - Portamento On-Off: MIDI-CC 65

Note on portamento:

Each musical instrument has a specific way to produce notes. Some have frets, keys, pistons and will produce discrete notes inside a scale. In European temperament, those notes are usually a chromatic scale (C, C#, D, D#, ...).

On these instruments it is very hard or even impossible to produce a note between those of a scale. The pitch will then abruptly switch from one note to another, it will only vary by steps, and no intermediate pitch will be produced.

On other instruments, such as violin or trombone, the pitch of the note can vary continuously, depending on the exact position of the finger on a string, or the length or the air column inside the pipe: This allows the pitch to slide continuously from one note to the next one. This is known as portamento. Depending on the instrumentalist technique, this slide can be fast or slow. On MDT, this speed is defined by the *Time* parameter. Higher values for portamento rate will produce a fast slide while lower values will result in a slower slide.

In monophonic settings, you can choose between a constant (*Full*) portamento (all notes are concerned) or a *Fingered* portamento, which will only happen while you keep the initial key pressed when playing a new key (legato).

Glissando is different in that instead of producing a continuous slide between the pitches of the subsequent notes, it will play all the notes of the scale which are between those 2 notes, like a pianist gliding his finger on the keyboard, or a guitarist on his fretted guitar neck. A glide between C3 and E3 will play subsequently C3, C#3, D3, D#3, E3, when a portamento would result in a continuous rising of the pitch, from C3 to E3.

Polyphony

You can reduce the maximum number of voices played simultaneously if necessary. If you hear glitches or gaps in sound, maybe reducing the polyphony by one can help to avoid these problems.

Parameters:

- Polyphony (0-20, see note below)

Hint for *Polyphony*: Maximum polyphony depends on the Teensy used and the clock speed set at compile time. Setting the polyphony to 0 means that no sound will be produced. In *Monophonic* mode you need at least a polyphony of 2.

Transpose / Fine-tune

With these parameters you can adjust the pitch. By means of *Transpose*, this is done in semitone steps (+/- 24 semitones) and by *Fine-Tune*, in +/- 99 cents.

Parameters:

- Transpose (-24 - 24)
- Fine-Tune (-99 - 99)

Mono-/Polyphonic

MDT can be set to a monophonic mode. In this mode, envelopes are not restarted when playing legato. In combination with *portamento* this can lead to nice sounding effects.

Parameters:

- Mono/Poly (MONOPHONIC/POLYPHONIC)

Important note on *Mono/Poly*: Please do not confuse this parameter with *Polyphony*! *Mono/Poly* limits the polyphony only indirectly by using only two of all available internal sound generators. If *Polyphony* is set to one, it is still different from playing with *MONOPHONIC* mode enabled. Furthermore, a polyphony of at least two is required for *MONOPHONIC* mode!

Internal

In the internal menu there are several basic items.

Note Refresh

With *Note Refresh* you can influence the behavior when playing the same note.

For example: If you play a G5, press and hold the sustain pedal and play the same note again, another one of the available tone generators will be set to play the note. So the note sounds double and its envelope would also run out separately for both notes (with a corresponding time delay). This would, however, limit the maximum available notes, since the same note sounds multiple times.

With *RETRIGGERED*, the envelope of the same note is started again and more remaining tone generators are available for other notes.

You should try out this setting and decide yourself which variant is more to your liking.

Parameters:

- Note Refresh (NORMAL/RETRIGGERED)

Velocity Level

Presets which have been programmed on some editors, like DEXED for example, may benefit from setting Velocity Level to 127. Other presets coming from other sources or editors might sound better with Velocity Level set to 100. If you have a hard to play keyboard or just want everything to sound "louder" or "more brilliant" and you don't like to press the keys so hard, you can set a higher value here.

Parameters:

- Velocity Level (100-127)

Engine

The original Dexed offers three different routines for generating sound, all of which sound a little different. These three engines can also be found in MDT and you can try out which one sounds best in your opinion. *Mark 1* is modeled after an original FM synth (with respect to the calculation), *Modern* (or “MSFA”) is more modern and more accurate and *OPL* is the attempt to recalculate the sound generation like it was done on OPL chips back then.

Parameters:

- Engine (MODERN (MSFA)/MARK 1/OPL)

Save voice

Use this entry to store the current voice inside a bank on the SD card.

1. Choose the bank.
2. After choosing, push **ENC_R**.
3. Choose the slot where to store the voice.
4. After choosing, push the preset encoder.
5. Want to overwrite the selected bank/voice? If yes, turn the preset encoder to choose **YES**.
6. If you are really sure, push the **ENC_R** and the voice is stored.

You can always abort the process by pressing **ENC_L**

Voice config

Voice configurations store all data beyond the sound data itself that is necessary for playing. Voice configs should not be confused with the voice data (inside a bank) that describes the sound. All data that are not stored in the voice data are stored in a voice config:

- MIDI channel
- MIDI lowest note
- MIDI highest note
- Transpose
- Tune
- Internal level
- Panorama
- Polyphony
- Velocity level
- Engine Type
- Mono/Poly
- Note refresh mode
- Pitchbend:
    - Range
    - Step
- Modulation wheel

    - Range
    - Assign
    - Mode
- Foot controller
    - Range
    - Assign
    - Mode
- Breath Controller
    - Range
    - Assign
    - Mode
- Portamento
    - Mode
    - Glissando
    - Time
- Operator status

Effects

Effect configurations save all settings for the effects and are independent of voice configurations or the voices themselves. The following parameters are stored:

- Filter cutoff
- Filter resonance
- Chorus
    - Frequency
    - Waveform
    - Depth
    - Level
- Delay
    - Time
    - Feedback
    - Level
- Reverb
    - Send
    - Room Size
    - Damping
    - Level
- Equalizer
    - Bass
    - Treble

MIDI

The following menu items allow data exchange via MIDI-SYSEX with editors/ librarians or a second MDT.

MIDI Recv Bank

A bank consists of 32 voices. These can be sent in a block to MDT. Before you can send them, you have to select a bank slot and maybe you would like to edit the name of the bank on MDT's side.

1. Choose the bank slot.
2. After choosing, push **ENC_R**.
3. Think about overwriting the selected bank/voice? If it is ok, turn the preset encoder to choose **YES**.
4. If you are really sure, push the **ENC_R**.
5. Now you can choose to edit the name of the new bank. The blinking cursor is located on the first character (on the left) and can be moved with the preset encoder in this example to the position of character the "4").
6. At the position where the letter is to be changed, **ENC_R** must be pressed to switch to *edit mode*.
7. After you press the preset encoder, you are in *edit mode*. This is indicated by an asterisk at the end of the field.
8. Now you can turn **ENC_R** up/down to choose the character you need.
9. With pressing the preset encoder you leave the edit mode (the asterisk disappears).

10. Now you can go back to step 5 and edit the other characters like the first one, or you can go one position after the last character to leave the edit screen. An OK prompt will appear on the right.
11. Push the **ENC_R** to wait for the data to receive.
12. Now you can send the bank data from the remote device. After the transfer is successful, the data will be stored - not before!

You can always abort the process by pressing **ENC_L** (back):

MIDI Snd Bank

You can also send a complete bank of 32 voices via MIDI-SYSEX.

1. Choose the bank slot.
2. After choosing, push **ENC_R**.

The bank will be sent immediately.

Hint for sending banks via MIDI: The bank is sent on the configured MIDI channel. If OMNI is configured, then MIDI channel 1 is used for sending.

MIDI Snd Voice

This is where you can send one voice via MIDI-SYSEX.

1. Choose the bank slot.
2. After choosing, push **ENC_R**.
3. Choose the voice slot.
4. After choosing, push the preset encoder.

The voice will be sent immediately.

Hint for sending banks via MIDI: The voice is sent on the configured MIDI channel. If OMNI is configured, then MIDI channel 1 is used for sending.

System

Everything that belongs to the basic settings and is probably rarely changed can be found in this menu.

Stereo/Mono

MDT can be operated both in stereo and mono. In addition, the mono signal can also be output on both channels or only on one channel.

Parameters:

- Stereo/Mono (STEREO/MONO/MONO-R/MONO-L)

MIDI Soft THRU

It is possible to output all incoming MIDI data via the existing interfaces.

For example, if data arrives via MIDI-MINI JACK it will be output on USB-HOST-MIDI and USB-MIDI (without filtering).

MIDI Soft THRU is also a MIDI merger. When two controllers are plugged into MDT, one in the MIDI MINI JACK input, and one on the USB socket, the MIDI messages are merged and sent back to the MIDI DIN output.

> **Hint on MIDI Soft THRU:** This also works when MIDI data is sent that MDT does not process. So you have a simple MIDI media converter (USB-MIDI <-> DIN/MINIJACK-MIDI).

Parameters:

- MIDI Soft THRU (ON/OFF)

Info

The Info menu states some information about the software version and the SD card.

Tips and tricks

The sound generation is (msfa) from the free VST-plugin Dexed. So you can use Dexed as MIDI SYSEX editor or you can use sounds programmed with Dexed on MDT. For the original Dexed/msfa software take a look at Dexed on Github and Music Synthesizer for Android on Github.

Editing voice presets

As mentioned before: you can use external editor software for MIDI SYSEX editing of MDT voice presets. Here is a collection of freely available editors:

- https://www.thisdx7cartdoesnotexist.com/
  - not really an editor but a system which generates a bank of voice presets with a KI behind. The names of the voice presets are mostly not readable at the time of writing, but the sounds were not bad.
- https://dx7.vstforx.de/
  - an online editor inside the browser, tested with Google Chrome or Chromium.
- https://synthmata.com/volca-fm/
  - also an online editor which was written for Volca-FM, but also works for Dexed/MDT.

Another way of editing voice presets is to use an editor like Edisyn. For download and install instructions read the manual at https://github.com/eclab/edisyn.

MIDI-Controllers

MIDI-CC#	Target
0	Bank-Select MSB (currently unused)
1	Modulation wheel
2	Breath controller
4	Foot controller
5	Portamento time
7	Volume
10	Panorama (0-62 = left, 63-64 = middle, 65-127 = right)
32	Bank-Select LSB
64	Sustain (0 to 63 = Off, 64 to 127 = On)
65	Portamento (0 to 63 = Off, 64 to 127 = On)
91	Reverb send
93	Chorus level
94	Tune
103	Filter resonance
104	Filter cutoff
105	Delay time
106	Delay feedback
107	Delay volume
120	MIDI panic
121	Reset controllers
123	All notes off
126	Monophonic mode (0 = Polyphonic, >0 = On)
127	Polyphonic mode (0 = Mono, >0 = On)

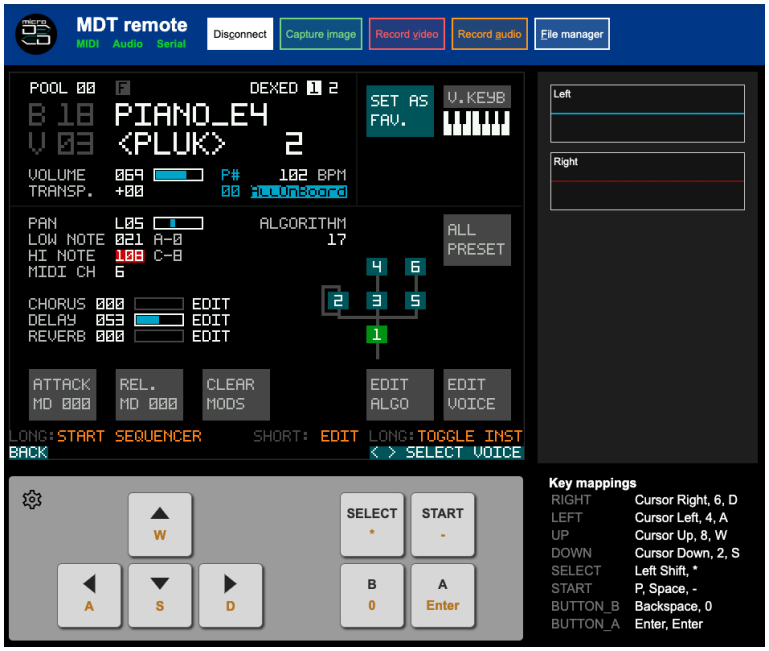
Hint on bank and voice selection: If you want to select a new voice preset, you can send a program change command.

To change the bank, there are two MIDI CCs (0 and 32), where MIDI CC 0 is currently not used.

So to select a new voice preset you either have to send a program change command (then the bank is not changed) or change with MIDI-CC 32 the bank number followed by a program change for the voice preset number.

Web Remote Console

MDT can be remotely controlled/used on your Desktop PC, with a Web Browser.



To use the web remote:

Plug MDT (Teensy) Micro USB into your computer

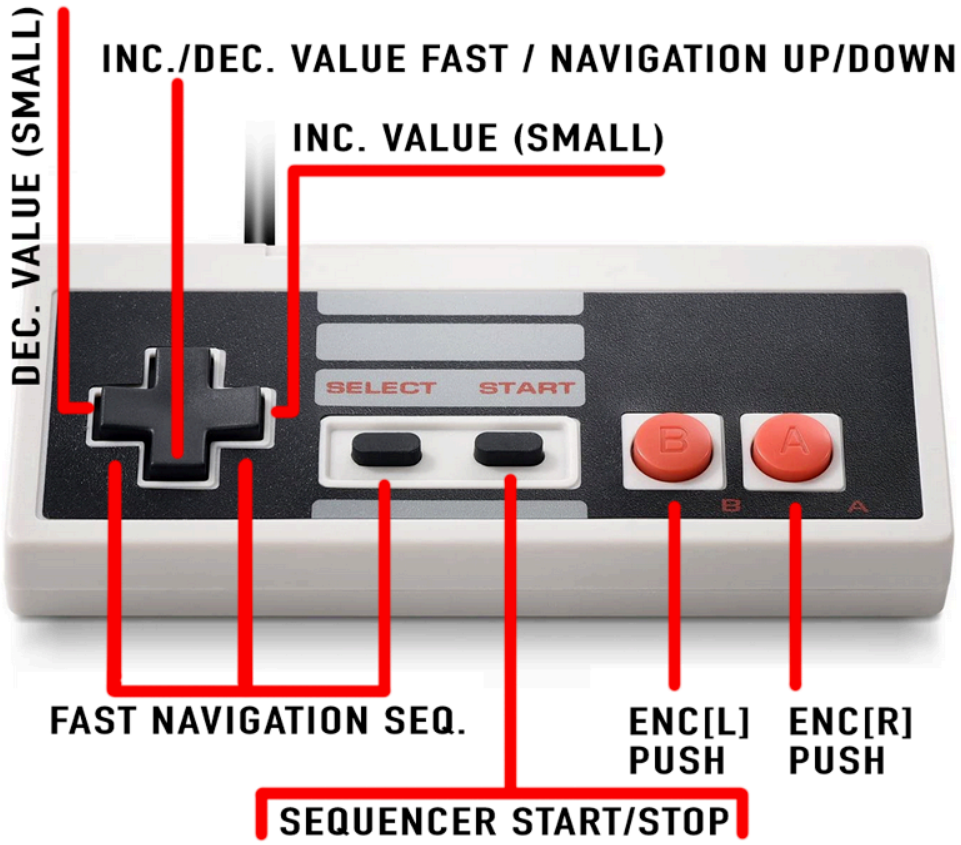
Click or go to link:

https://positionhigh.codeberg.page/

To use Web Remote **offline**, locally or on your **own Web Server**:

- Install and run Chrome 127 or later.
- Click or go to link:
- https://simplewebserver.org/download
- Download Simple Web Server Portable appropriate for your CPU and OS
- Click or go to link: https://codeberg.org/positionhigh/pages
- Click the three dots to the upper right and download as a **.zip**
- Extract the downloaded archive
- Go to the directory of Simple Web Server Portable that was downloaded
- Click or double-click simple-web-server (executable)
- Click New Server
- Select folder icon and select the folder (**pages**) **inside the folder that was unzipped**
- Press Create server
- Click on the started server just created
- Click on the Web server URL/highlighted (blue) link
- Accept changing midi device if it pops up; look for icon in the upper left
- Click connect button
- In the popup window, select the serial port for MDT and click OK button.
- Accept mic permission if it pops up for USB Audio.

USB GAMEPAD (NES STYLE) for UI Input



20/07/2024:

- When using the button interface (or a USB NES Controller on the HOST port) you now can change master volume by pressing and holding SELECT and UP / DOWN Keys at the same time. This will work in almost all pages and the main menu that has no special functions for quick navigation already assigned for the sequencer. The volume control will speed up with time according to the setting in SYSTEM - SYSTEM SETTINGS - GAMEPAD/NATIVE KEY SPEED.

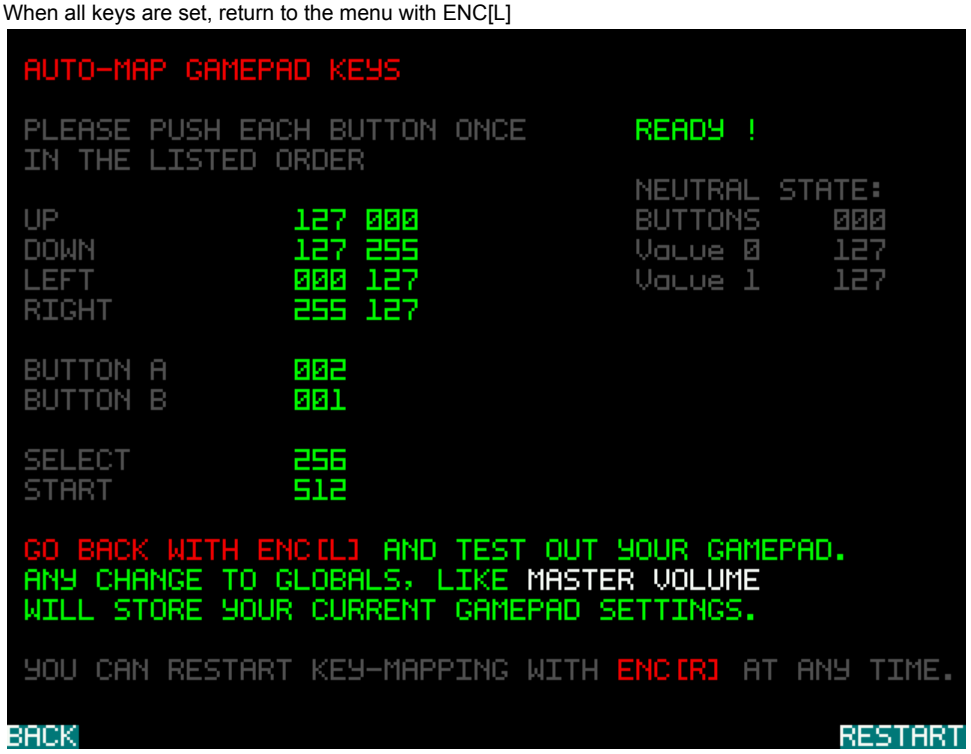
If your gamepad is not working by default (it should), then you can try to map your keys in accordance with the following instructions.
Important: The gamepad MUST be connected at MDT boot. Otherwise it can not detect the key inputs, compared to the neutral position.

Go to SYSTEM:

GOTO AUTOMAP GAMEPAD :

Follow instructions.
Press each of the Gamepad keys shortly, the list should advance to the next key :

When all keys are set, return to the menu with ENC[L]



Known problems/bugs:

- while in edit more, value inc./dec. is reversed in some menus
- some menus that use x/y movement of the cursor, are not working correctly, yet.

MDT Firmware Guide

MDT Firmware is installable on your Teensy Microcontroller in two ways. You can either compile the source code by yourself or use a "binary distribution" that is readily made for you. If you do not know what this means, please go for the "binary" way to get going. The binary files you will find in your downloaded file you got from the page:

https://codeberg.org/positionhigh/MicroDexed-touch/releases

In the folder **release**

STEP 1 : What display type do I have ?

If you have your MDT earlier than Autumn 2023, you most probably have a touch screen of type **RESISTIVE**. These displays usually come with an attached PCB in RED color. **RESISTIVE** touch is not really state of the art. You can use it with finger tip pushes but it requires some physical force to do so, it is common to use this type of display with a plastic pen "touch pen" to give you more precise input.

If you have your MDT newer than Autumn/Winter 2023, you probably have a PCB and a Display made for **CAPACITIVE** touch. If you have an older MDT-PCB, but a newer, capacitive display, it is possible to convert it to some of the features of the newer MDT-PCB. This requires some manual soldering and cutting off traces of the PCB. It is not very complicated to do so, but if you are not up to that task, it is suggested to get the more current PCB from PCBWAY.

The **CAPACITIVE** display usually comes with an attached PCB in **BLACK** color. And on the backside it usually states in text that it is a capacitive display.

Now you should have some knowledge what type of display you currently have.

STEP 2: What are all these files/versions in folder RELEASE, which I shall install ?

Following on from STEP 1, if you do have a **CAPACITIVE** Display, only go for firmware files having the word **capacitive** in the filename. Otherwise, only go for files that DO NOT have **capacitive** in the filename.

STEP 3: DEFAULT, FLASHMEM or PSRAM ?

If you do have a PSRAM CHIP (or two) soldered to your Teensy, go for a FIRMWARE starting with PSRAM in the filename. This currently is the best possible option with most features and highest stability. It is the only stable option to work with loadable custom samples during runtime.

Please read the Chapter **Custom Samples** if you have a PSRAM chip and want to learn how this is working, in detail.

If you have previously used MDT with an SPI Flash Chip that is located left to the Teensy on the MDT-PCB, this is no longer supported and wasn't working in a fully stable manner. It is still possible to compile MDT for this type but it will no longer come precompiled since it is now replaced by the much better (and stable) working **PSRAM** option.

> *PSRAM: Using this assumes you have a PSRAM chip soldered to the backside of your Teensy. This chip extends the free available RAM (Memory) of the Teensy. It is a bit slower than the included RAM but it is the best expansion option for MDT. Currently this allows to have much longer Audio DELAY times (Having several minutes of DELAY TIME instead of 500 Milliseconds) as well as to use and swap custom audio samples during runtime in each Performance.*

If you have "only" the Teensy and the Audio/DAC Board, go for a file with **PROGMEM** in the filename. This uses the storage chip that is included on every Teensy 4.1 directly. However the drawback of **PROGMEM** is that it is a read-only Memory during runtime, its content can only be changed by uploading a Firmware File to the Teensy from your PC, it can not be changed while MDT is running and you are playing with it. So if you want to use your own custom samples in an easy way, please consider adding one or two PSRAM chips.

STEP 4: You should be done

You now should be able to pick the correct filename/firmware. Ignore all other, obscure looking filenames. These are versions for some specific features - If you want to use them you probably know what to look for. Otherwise please go with the 3 steps above.

STEP 5: Optional - I want to know - What are these other files ?

Just a short description of what the other versions might have to offer:

- BUTTON-INTERFACE: This is an optional build where you have DIY push buttons/switches soldered to your device or attached them via the BI (Button Interface) Connector, available on the more recent MDT PCB Versions. This allows navigating the system with buttons instead of the push-encoders or as an addition to them. There are also a few button-shortcut navigation controls available, for jumping through several sequencer related pages more quickly.

- GAME PAD AND PC KEYPAD: These two options once were both their own build version but are now included in every build of MDT by default. Both allow similar, alternative input methods like Button Interface above. However they are externally attached via the USB HOST Connector of MDT.

  GAME PAD is for a "Nintendo" style gamepad, connected via USB. These controllers are available from platforms like Amazon and others and are aimed at users looking for a PC Joystick/Gamepad.

  These devices usually follow the same pin/numbering/input style and can be attached to MDT and used like an alternative, cursor based user interface. The same is valid for PC KEYPAD. These are similar to the GAME PAD but aimed at users looking for a numeric-keypad to enter numbers more quickly into their PC or Notebook. They usually come in a 4x4 key matrix and vary in style and function. As long as they replicate a usual PC Numpad, they should work with MDT by default.

- MAM is for the MusikAndMore Build versions (more information added soon)

- APC1/APC is for support of the AKAI APC MK2 (and with some limitations for the outdated APC MK1) as a powerful input companion device to MDT

- MDTX is for the most current, bleeding edge version, featuring RGB Encoders and a secondary SD Card Slot

Installation Instructions

Flashing MDT to the Teensy

Several binary, HEX Files are provided in the /release folder. To get started, we suggest to flash:

mdt_**PROGMEM-CAPACITIVE_TOUCH**_(latest version number you see).hex

Upload HEX file to your Teensy 4.1: You just need the Teensy Loader application and your HEX file.

Get Teensy Loader
https://www.pjrc.com/teensy/loader.html

1. Connect your Teensy to your computer with **a known working** USB-Micro-B to USB-A data cable.
2. Launch Teensy Loader.
3. Drop the HEX file onto Teensy Loader.
4. Push the button on the Teensy and Teensy Loader should send the program to Teensy.
5. Copy all Files/Directories from /addon/SD/ to the root of your SD Card (FAT32) and insert the card into the SD Slot of the Teensy 4.1
6. Power on the Teensy and attach a USB MIDI Keyboard (or use the virtual Touch Keyboard and the Encoders to navigate)

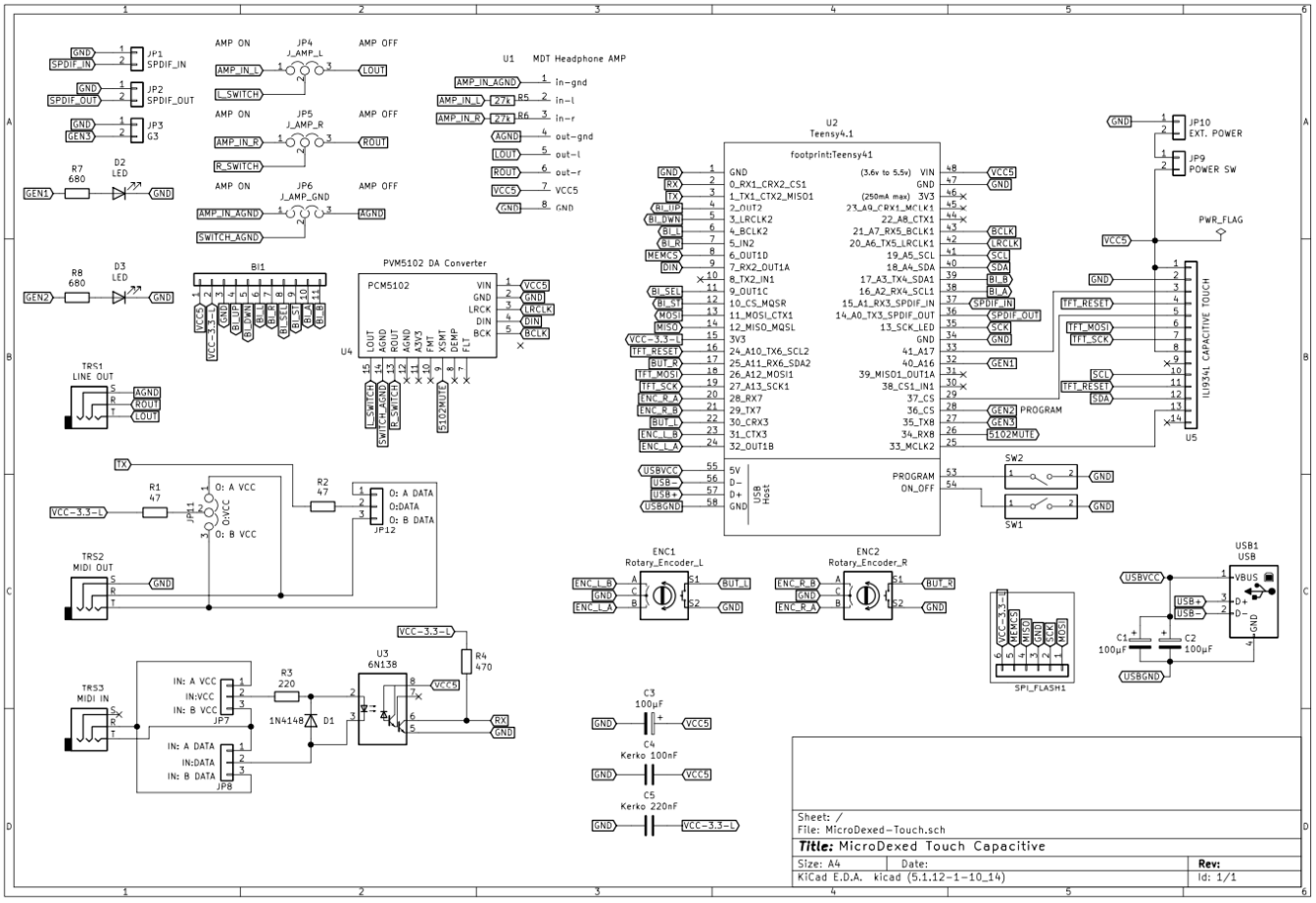
   WARNING: Make sure you are flashing a firmware version that matches your hardware. The MDT pcb for capacitive- and previous versions for resistive-touch display have different hardware, protocols, pin layout and voltages. Do **NOT** flash a firmware that does not match your hardware. **Flashing a wrong firmware can damage your Teensy, the display or other components, permanently.** A MDT PCB made for the newer capacitive touch has a text label "**CAPACITIVE TOUCH**" printed on the PCB, near the version number. If there is no such text label on the PCB near the version number, it was probably designed for the earlier, (first) resistive touch type display.

Troubleshooting the flash process:

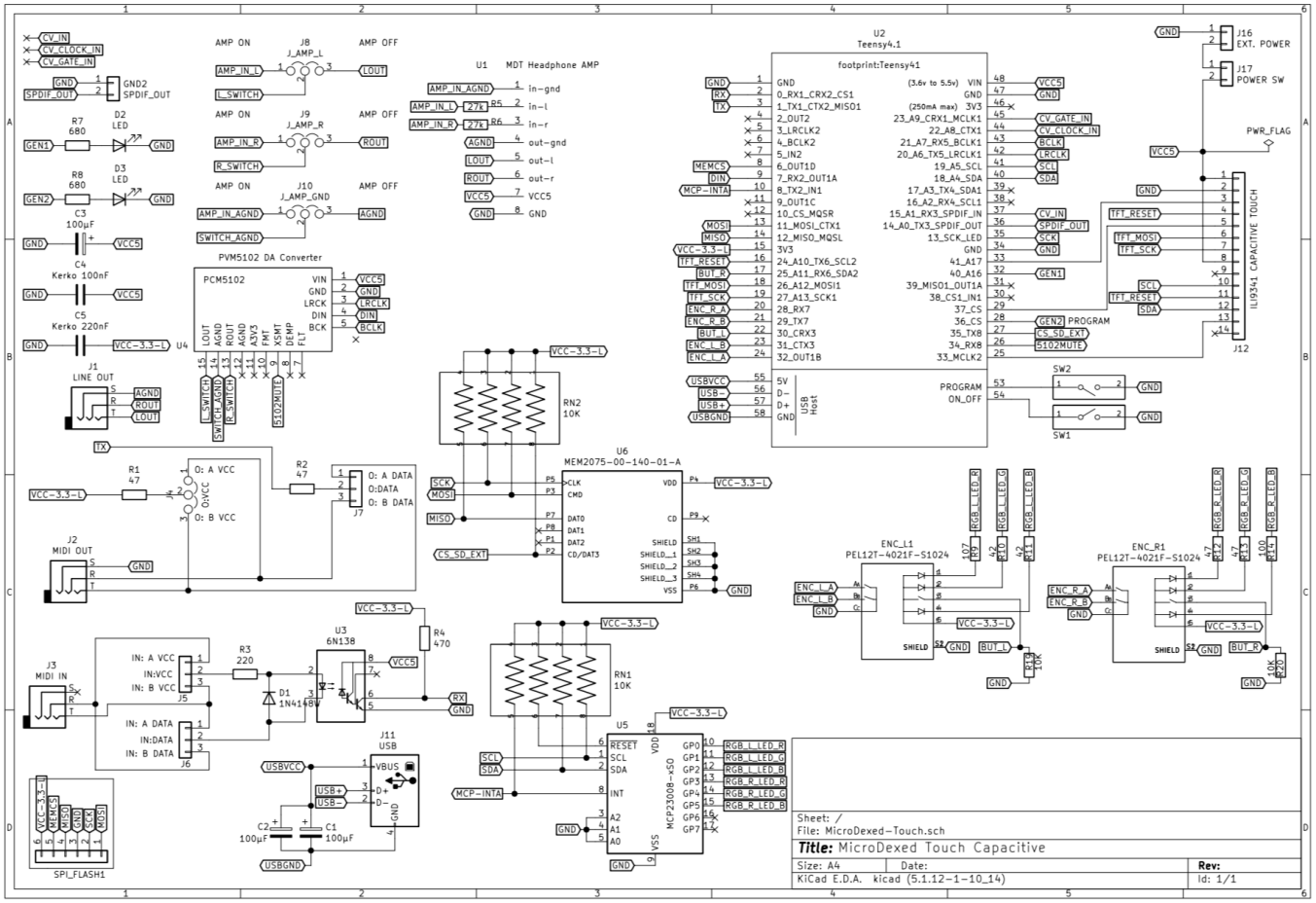
- If the Teensy Microcontroller does not react / upload the file, please take a few minutes to try out other USB cables. We have seen cases where 2 cables were faulty and then a third cable worked at the first flashing attempt.
- If it still does not work and you have the opportunity to try out a different PC/Laptop/Mac, copy the firmware file and the Teensy loader application there (USB Stick or over Network etc.). There is a chance the problem is caused by the PC itself and not your Teensy.
- See in the FAQ in this Manual for other tips or hints what might be going wrong or come to our discord chat to get help.

MDT Schematics

Schematics MDT

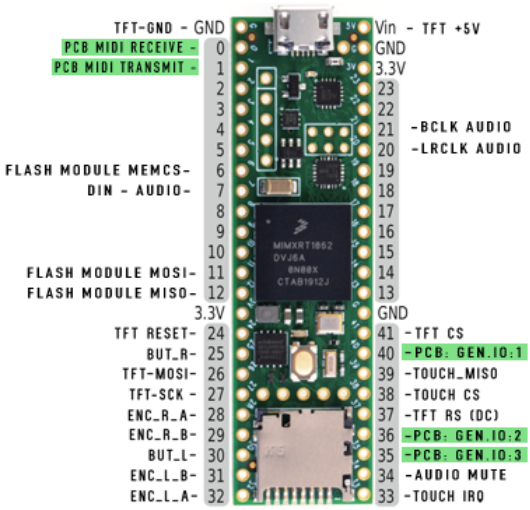


Schematics MDTX

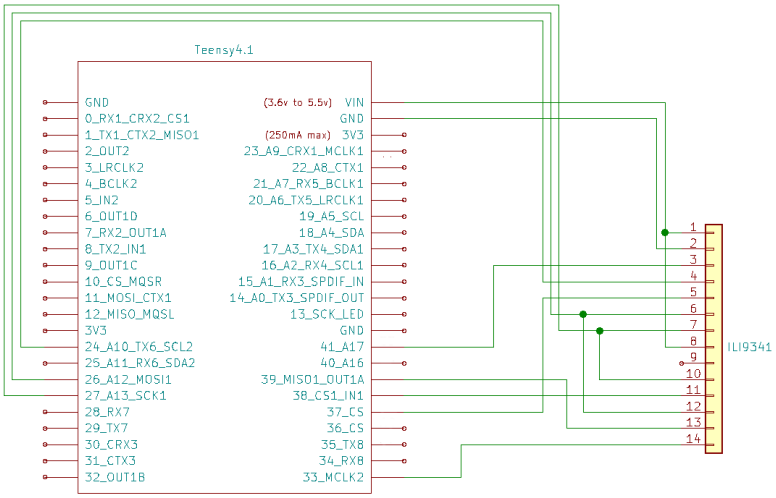


Depreciated Information for previous version with resistive touchscreen

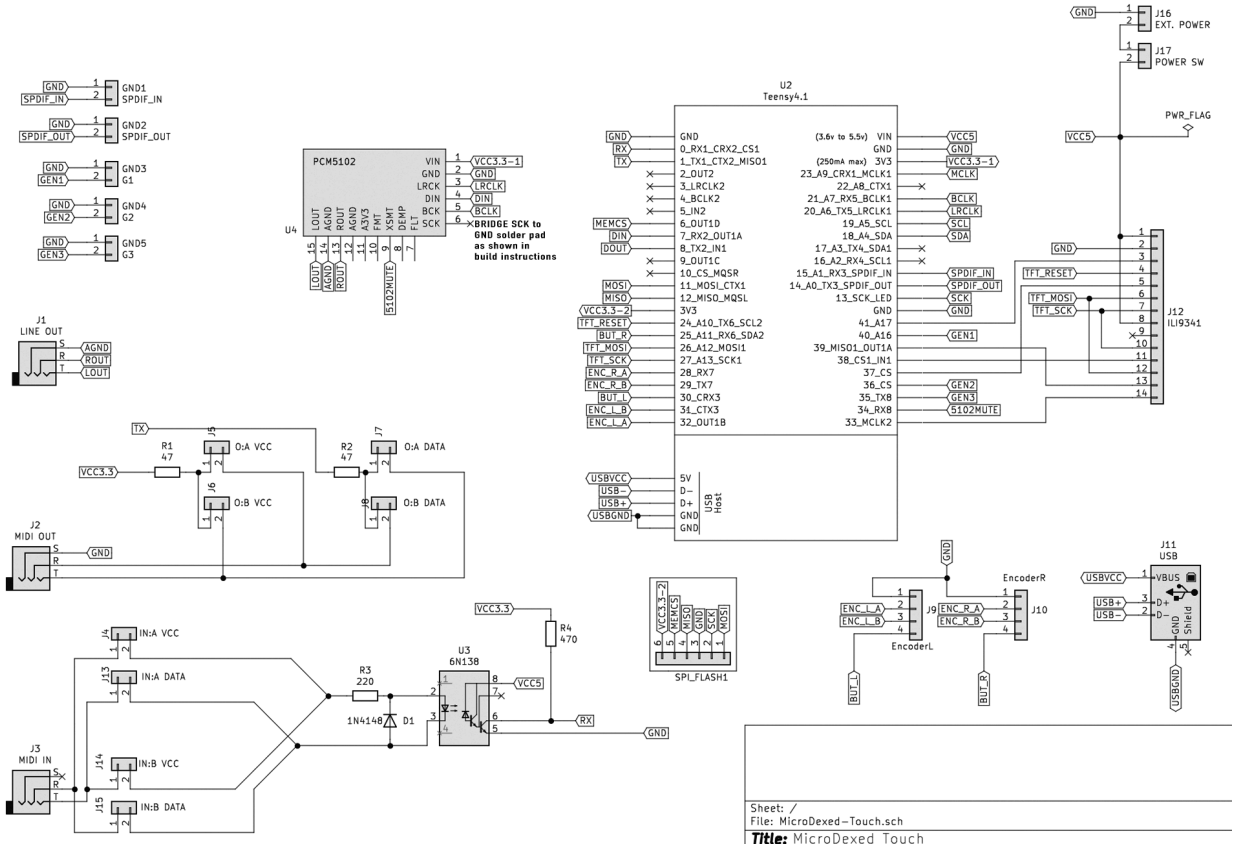
PIN LAYOUT (depreciated)



DISPLAY WIRING (depreciated)



COMPLETE WIRING (gen1, depreciated)



Alternative Pins and Sockets

If you are unable to get all suggested parts from the BOM, specially the BKL low height sockets, this chapter should help and guide you to get MDT working with alternative parts.
The 3.5 mm high E-Simpo sockets from Aliexpress, combined with the 9.5 or 10.5 mm male pin headers can work together if planned carefully.

The amount of insertion of the contact pin into the socket is less than the BKL sockets, the difference will add that much to the overall height of the stack. It is here that the reader is reminded that not only do millimeters matter, but even tenths and hundredths of a millimeter can add up!

A word of caution, these sockets grip so tight that a builder could damage their Teensy (or perhaps other modules) when removing them! Go slow, and move along the edge of the module going back and forth in opposite directions to incrementally lift it straight up. If a person only pulls up against the ends, the fiberboard PCB could be permanently bent in the middle. And the force is great enough to bend over sockets and pins if at a sharp enough angle while removing or inserting. The sockets do allow for removing modules later as needed, but this should be considered at a minimum.

Reporting Bugs

MDT has errors as there is no error-free software - at least I don't know any. If you find a bug in the program, please open an issue at https://codeberg.org/positionhigh/MicroDexed-touch/issues. Please remember to make the error description as accurate as possible and include as much information as possible and possibly MIDI files in the report.

Feature Requests

Feature requests can currently also be made via https://codeberg.org/positionhigh/MicroDexed-touch/issues . Please mark the title as **Feature-Request**.

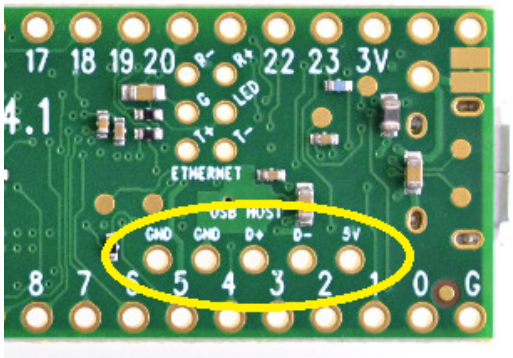
Troubleshooting Guide & FAQ

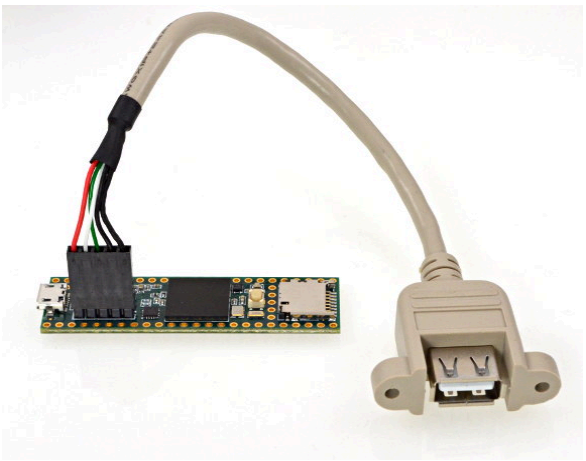
DIY USB MIDI HOST

If you are not using the MDT-PCB/Case (and just have a bare Teensy) and want to attach MIDI Devices to the HOST port:

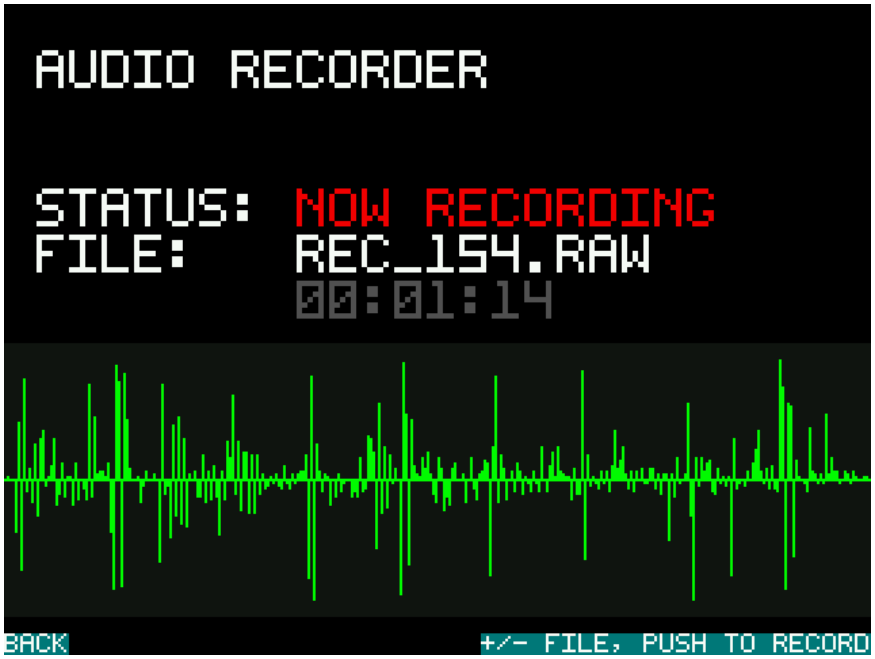
Connect your USB MIDI Keyboard/Controller here (or buy the cable from pjrc.com)

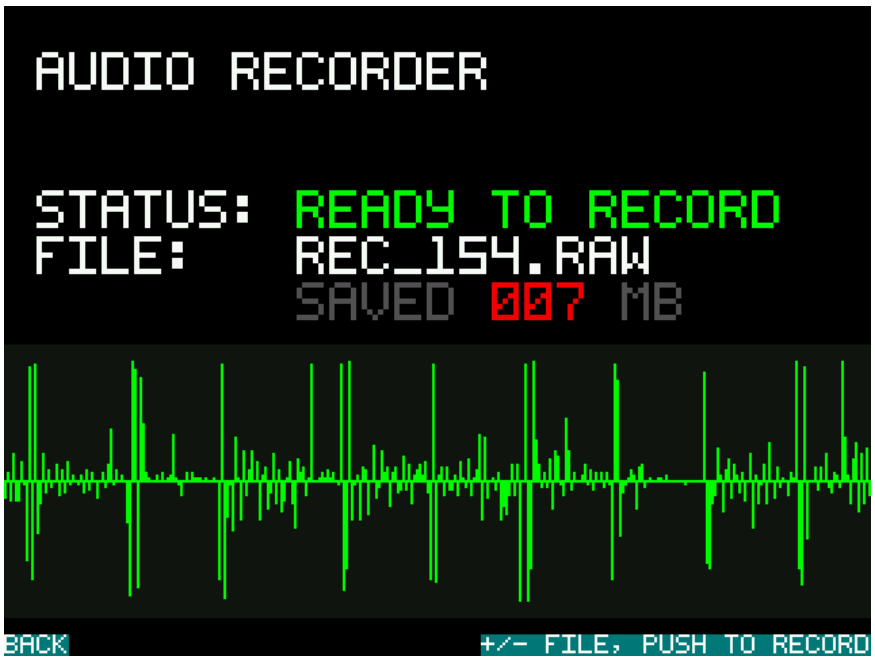
https://www.pjrc.com/store/cable_usb_host_t36.html





How do I use the exported raw audio files from MicroDexed on my PC ?





The files are stereo-raw, without a WAV header. You can load them in Audacity (or the Wave Editor of your choice) by:

File -> import -> raw ->

Troubleshooting

Microdexed-touch is a complex system. For every problem, there could be several reasons, when not working as intended. This Wiki page should be the First stop to find solutions to a problem.

Every tip here is a step for troubleshooting. If your problem is fixed after doing anything from here, make sure you revert all the changes because it will have (more or less) a negative impact to the overall performance of your device.

I have random crashes at startup

If you have unusual crashes when playing from external USB MIDI Devices, check if your power supply is sufficient. A Power Adaptor / USB Power Bank with 1A is enough, however a standard USB2 PC Port with only 500mA might not work stable with additional, external devices connected to Microdexed.

The encoder rotation is going in the wrong direction

Go to the System - System Settings Menu and switch "**SWAP ENCODER DIRECTION**".

MDT is not starting/booting - I see nothing on the screen

This can have many reasons. Let's start with the basics:

- remove your SD Card

If this helps then something about the SD Card is wrong, either it is not formatted FAT32 or something is wrong with the files or directories. Format your card as FAT32 and copy all content from addon/SD to your card. Then try again with the card inserted..

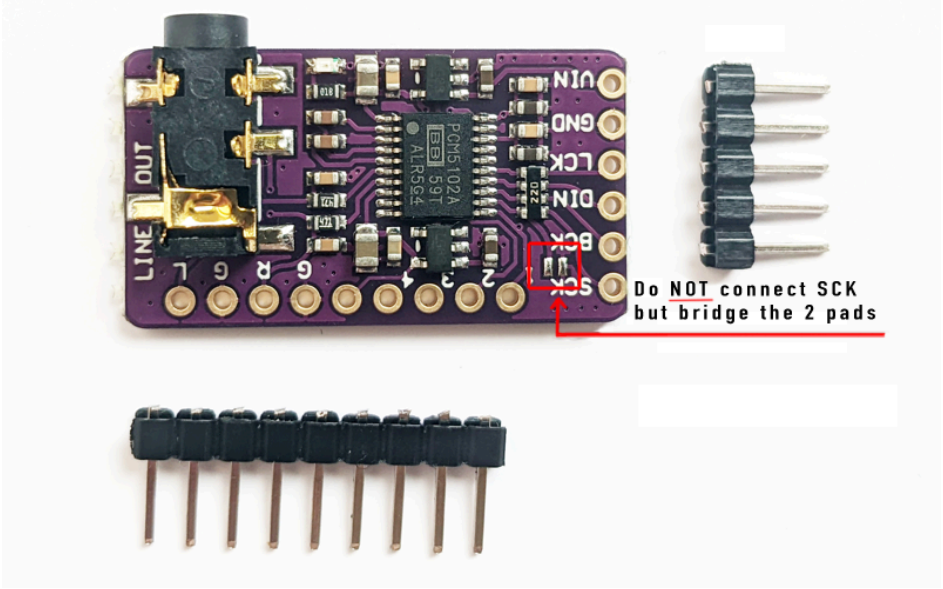
If nothing is going on the screen, check what is going on with the microDexed Web Remote Console.

My touchscreen input is inverted / reversed in one or both directions?

You can rotate the screen and the touch input in System - System Settings.

I think audio is playing, but I do not hear anything?

- If you are using the PCB with PCM5102, check that the mute-pin XSMT is soldered.
- Check if SCK is bridged to GND on the PCM5102 board with these 2 solder pads:



- If you are not using the PCB, check if your wiring to the PCM5102 can be done with shorter cables. Too long wires, or uneven length of the wires to the PCM5102 or the Teensy Audio Adaptor will introduce audio issues or no audio at all.
- If audio is not working at all, check what is going on with the microDexed Web Remote Console. It should output audio via USB AUDIO.

User Chat groups

https://discord.gg/XCYk5P8GzF

https://matrix.to/#/#microdexed:matrix.org

Join our community and say hi, there is a good chance we can help if you have questions. Please be aware that MicroDexed is an open source hobbyist project. When you have a code/bug issue, you can also open a question on:

https://codeberg.org/positionhigh/MicroDexed-touch/issues

Feature matrix

Feature	Status	Notes
Pattern Editor	92%	This is the basic editor for note/velocity/sample selection, chord and arp assignments for the sequencer. A pattern is always 16 Steps long that can be chained up to 16 steps into a Chain step. In Song Mode, you assign a chain step (of up to 16 patterns), to a single song step.
Song Mode	90%	This is the most overall/birds eye view of your performance. Here you assign Chain steps to the song and also can edit the Chains with their pattern content. Every Chain step can transpose all of its assigned pattern, separately. This way, you only need a single bass or chord pattern for every chord type - and can transpose it in the Chain steps, according to your song structure.
MicroSynth	92%	MicroSynth is a mono synth with basic waveforms and PWM and has 2 instances that can be used simultaneously, with different sound and MIDI settings.
Virtual Keyboard	90%	Virtual Keyboard is currently available in Dexed voice select, microsynth and pattern editor
ePiano GUI	98%	
General UI Merge	92%	This covers all necessary menu changes needed since Microdexed Gen1 and the first, outdated display for MicroDexed-touch
Main Mixer View	90%	View and edit volumes of Dexed, Microsynth, Drums/Samples, Reverb and Master Volume in one screen.
Step/Grid Editor	80%	
Mute Matrix	80%	This mode is intended to be used mainly for "live" usage. Via touchscreen, tracks can be enabled and disabled in real time.
Piano Roll Editor	80%	
MultiSample Player	85%	Play multi-sample instruments live or by sequencer from PSRAM
SysEx/MIDI Controls	75%	
File Manager (SD/Flash)	65%	File Manager is supposed to copy/swap/delete Samples from SD Card to PSRAM so that the sounds can be changed during runtime.
Tracker view/edit	35%	

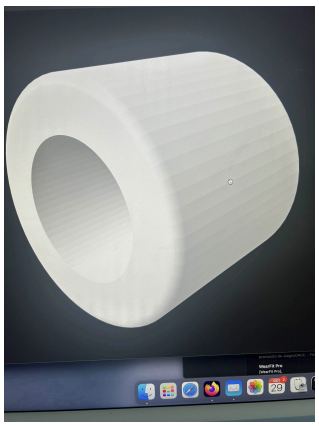
Custom/User Samples	90%	Samples from progmem are static and can not change during runtime. So for custom samples, external flash chip must be used
Track recording to files	65%	Export/render Tracks and complete songs as RAW/WAV audio files, directly to the SD Card.
Sample Editor	15%	
cv clock/sync	0%	
MIDI Clock / Sync	70%	Since 06/2024 MDT can run in MIDI Master and MIDI Slave mode, triggered by MIDI Clock
Livesequencer	90%	Livesequencer is an alternative Sequencer for live recording and performing - it runs parallel to the previous sequencer. So both can be used at the same time. It is easier to use and delivers very quick and intuitive results
Livesequencer Editor, List-View, Graphical View	70%	

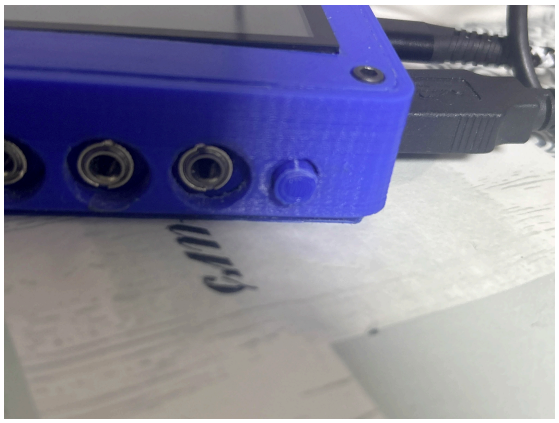
User modified parts and enhancements

MDT lid without LCD holes STL. Important to check the LCD for good fitting before closing the lid.

https://codeberg.org/positionhigh/MicroDexed-touch/raw/branch/main/stl/UserModifications/LID_MOD.stl

Push switch cap. It’s inserted by pressure after all is mounted. It looks like this:





https://codeberg.org/positionhigh/MicroDexed-touch/raw/branch/main/stl/UserModifications/push_switch_cap.stl

MDT Standard Drum Mapping

Slot	Note	Name	Type
00	F#0	SQ Bass	Poly
01	G0	Calliope	Poly
02	G#0	ssaw	Poly
03	A0	ARR1	Poly
04	A#0	Female Voice G2	Poly
05	B0	SlapBass M1	Poly
06	C1	Custom 01	Poly
07	C#1	Custom 02	Poly
08	D1	Custom 03	Poly
09	D#1	Custom 04	Poly
10	E1	Custom 05	Poly
11	F1	Custom 06	Poly
12	F#1	Custom 07	Poly
13	G1	Custom 08	Poly
14	G#1	Custom 09	Poly
15	A1	Custom 10	Poly
16	A#1	Custom 11	Poly
17	B1	Custom 12	Poly
18	C2	Custom 13	Poly
19	C#2	Custom 14	Poly
20	D2	Custom 15	Poly
21	D#2	Custom 16	Poly
22	E2	Custom 17	Poly
23	F2	Custom 18	Poly
24	F#2	Custom 19	Poly
25	G2	Custom 20	Poly
26	G#2	Snap R50	Percussion
27	A2	SNARE 808	Snare
28	A#2	Clap 808	Handclap
29	B2	S Kick 1	Bass
30	C3	S Kick 2_8	Bass
31	C#3	S Stick 1	Percussion
32	D3	S Snare Gh 1	Snare
33	D#3	S Snare2 Gh 1	Snare
34	E3	S Snare 2	Snare
35	F3	S Low Tom 1	Low Tom
36	F#3	S_hhClosed_1	Hi Hat
37	G3	S_loTom_1	Low Tom
38	G#3	S_hh_o_1_2	Hi Hat
39	A3	S_hiTom_5	High Tom
40	A#3	S_hh_o_5_4	Hi Hat
41	B3	S_hiTom_5	High Tom
42	C4	S_hiTom_5	High Tom
43	C#4	S_splash1_1	Crash
44	D4	S_hiTom_5	High Tom
45	D#4	S_china1_4	Crash
46	E4	S_china2_1	Crash
47	F4	S_ride1Bell_1	Ride
48	F#4	S_ride1Bell_1	Ride
49	G4	S_crash1_1	Crash
50	G#4	S_cowbell_2	Percussion
51	A4	S_ride2Crash_2	Ride
52	A#4	S_ride2_1	Ride
53	B4	Kick 808	Bass

Slot	Note	Name	Type
54	C5	phKick 1	Bass
55	C#5	RimShot 808	Percussion
56	D5	Shaker	Percussion
57	D#5	Ln Clap 1	Handclap
58	E5	Ln Snare 1	Snare
59	F5	Bd Trancy	Bass
60	F#5	HH Closed 808	Hi Hat
61	G5	Belltree	Percussion
62	G#5	Bongo 16	Percussion
63	A5	Bongo 27	Percussion
64	A#5	Casta	Percussion
65	B5	Cr78 Kick	Bass
66	C6	Cr78 Tamb1	Percussion
67	C#6	Cr78 Tamb2	Percussion
68	D6	Crash1	Crash
69	D#6	Dm Pop	Percussion
70	E6	Electr 1	Percussion
71	F6	Excow	Percussion
72	F#6	Tamb	Percussion
73	G6	660 HatC1	Hi Hat
74	G#6	Cowbell	Percussion
75	A6	Hh Open 1	Hi Hat
76	A#6	Hi Sticks	Percussion
77	B6	Hr16 Snare 2	Snare
78	C7	Xr High Tom	High Tom
79	C#7	Tick1	Percussion
80	D7	M1-18	Percussion
81	D#7	Md16 Clap	Percussion
82	E7	Ohh 909	Hi Hat
83	F7	Quijada	Percussion
84	F#7	Tabla 1	Percussion
85	G7	Ride 808	Ride
86	G#7	Scratch1	Percussion
87	A7	Tomlow	Low Tom
88	A#7	Tom 808	Low Tom
89	B7	Vl1Lbeep	Percussion

Changelog

12/12/2025

- new quantization options

- release 1.9.924

Updated QUANTIZATION SYSTEM in PianoRoll Editor for ALL notes of a layer:

Smart Layer-Based Quantization - Quantization now works intelligently on a per-layer basis, giving you precise control over your arrangements.

- Layer Selection First: Always quantizes notes in the currently selected layer only (Layer 1-4)
- Visual Layer Indicators: Grey notes = other layers, colored notes = selected layer
- Non-Destructive: Other layers remain completely untouched

QUANTIZATION BUTTON:

- Short Press: Cycle through quantization grid values (1/4, 1/8, 1/16, etc.)
- **LONG PRESS**: Quantize all notes in selected layer of current track
- Grid Display: Shows current quantization value in EDIT/STEP modes

📊 Available Quantization Grids:

- 1/4 (Quarter Notes)
- 1/8 (Eighth Notes)
- 1/8T (Eighth Note Triplets) ⭐ NEW!
- 1/16 (Sixteenth Notes)
- 1/16T (Sixteenth Note Triplets) ⭐ NEW!
- 1/32 (Thirty-Second Notes)
- 1/64 (Sixty-Fourth Notes)
- OFF (No quantization)

🎵 Preserved Musicality Features

🎼 Note Length Protection:

- Starts Only: Only note START times are quantized to grid
- Lengths Preserved: Original note durations remain exactly as programmed
- No Choking: Notes won't become shorter or overlap after quantization

🛡️ Safety Features:

- Minimum Length: All notes guaranteed to be at least 1/16 note long after quantization
- No Zero-Length Notes: Impossible to create "stuck" notes

- Valid Timing: Note-ends always placed after note-starts

Velocity-Preserving and duplicate Notes handling:

- Original velocity values remain unchanged
- When duplicate notes land on same grid position, highest velocity note wins

PATTERN TRACK QUANTIZATION

For individual instrument tracks (Tracks 1-12):

Select target track

Choose layer (1-4) using layer indicators

Select quantization grid (1/16, 1/8, etc.)

LONG PRESS quantization button

Only notes in selected layer are quantized

RESULT: Tightens timing of specific instrument parts without affecting others

SONG MODE QUANTIZATION

For complete song arrangements (SONG NOTES track):

Switch to SONG NOTES track

Select layer to filter view

Choose quantization grid

LONG PRESS quantization button

All song notes in selected layer quantized across entire timeline

RESULT: Perfectly aligns complete arrangements across multiple patterns

🎨 VISUAL WORKFLOW IMPROVEMENTS

Layer Visualization:

- Selected Layer: Notes appear in layer color
- Other Layers: Notes appear in grey (not affected by quantization)
- Layer Indicators: 4 squares show active/inactive layers

Immediate Feedback:

- On-Screen Confirmation: Shows "LAYER3 QUANTIZED!" after operation
- Visual Update: Quantized notes immediately snap to grid visually

Updates for Quantization During Recording

Live Input Quantization Triplets/Triolic ⭐ NEW FEATURE

HOW IT WORKS:

- Input Snapping: Notes played via MIDI/keyboard are automatically quantized, now also for Triolic/Triplets
- No Post-Processing: Notes land perfectly on grid from the moment you play them
- Visual Feedback: Notes appear at quantized positions immediately

ACTIVATION:

Select Quantization Grid (1/4, 1/8, 1/8T, 1/16, 1/16T, etc.)

Start Recording and Play Notes: They automatically snap to current step position + selected grid

09/12/2025

- fixed the visual glitches for WEB REMOTE when working in GRID SONG EDITOR. On Device Screen and Web Browser Remote now should be identical and without any drawing artefacts

08/12/2025

- The visual glitches in Track or Song Mode editor of LiveSequencer with the background grid (visually sliced/cut notes) should be either fully fixed or at least now happening very rarely

03/12/2025

Grid Editor:

- Implemented a SHIFT/secondary control-bank workflow: the bottom row now toggles between layer buttons and eight function pads, with FUNC 1–3/5–6 wired to copy/clear block + row operations and From/To Pattern transfers (each with confirmation timers)

- memory optimizations, all builds back to 100k+ free mem

28/11/2025

-release v1.9.923

- Behaviour for MIDI input in Livesequencer is now changed. Instead of asking you to set your input device to an unused MIDI channel, it now will directly and always route MIDI input to the currently active track in LiveSequencer, regardless of the input channel. This state (hopefully) will keep this way, even when diving into sub-pages directly from Livesequencer, like the various instrument / drum pages etc. Also the state will be kept when using the Livesequencer Editor and update to the correct track when you change it by the touchbuttons in the editor.

- As soon as you leave LiveSequencer (go back to the MainMenu/SubMainMenu), it will revert to the "normal" global behaviour that only the directly MIDI mapped instruments will react to MIDI input.

- There might be side effects that i have not noticed, yet. It would be wonderful to get some feedback in discord. In general, i think, this new behaviour is vastly superiour and should reduce confusion, specially to new users of MDT.

25/11/2025

- release v1.9.922
- Some parameters of microsynth were not included on save/load: Persist microsynth resonance and LFO params in performance save/load routines
- microsynth instance params to reset to defaults on performance load : The previous PR that introduced serialization of some previously skipped params introduced an issue with some old performances. The issue is that these "new" params if they do not exist in the performance being loaded would carry over their values from the current performance. This leads to certain cases that microsynth presets would sound incorrect in the performance that was just loaded.
- Updated the manual : Changelog updated, one new chapter how to work with external MIDI Devices on TRS and (up to) 3 USB MIDI Devices on the MDT HOST port
- Fixes for the Step Recorder (in Song Mode)

15/11/2025

- removed the auto changing mode for entering notes in the step recorder. Instead this is now handled by step recorder internally
- step recorder for song track now will set the default value from the selected instrument track you last selected/played in livesequencer
- The step recorder for the song track now will correctly cycle inside the currently selected viewport, no matter how long the displayed area is. You can now input an "unlimited" number of notes

- fixed a glitch that did not cycle correctly when in step recorder pattern mode
- "play by track" feature was not correctly hidden when working in track/pattern mode
- fixed some visual glitches

14/11/2025

- fixed zoom direction in LiveSequencer Editor
- fixed visual glitch for showing velocity levels with 2 and 3 digits
- simplified layer selection in Editor, it now lets the user always select all 4 layers, even empty ones
- Step Recorder had issues when switching between Song and Pattern mode: When you were in Song mode and recorded events, it always went to Song, even when a Pattern was on display. Now it will always record the steps to what you are seeing on the screen (switching modes between Song and Pattern automatically when working in editor)
- When toggling through Tracks by touch button, it was not disabling editing mode automatically from the previous Track
- Step Recorder Button and Quantization Buttons were showing unwanted results in Mute Editor. This is now fixed

13/11/2025

- Release v1.9.920
- PianoRoll Song Mode Editor should now work fully - even editing with overlapping notes is now possible
- After editing a note, the note selection should now stay on the same note, even if you have moved it to a different location in the Song
- When editing a note in Pattern or Song Mode it will now turn red in color
- Redrawing of Grid fully fixed
- Reverted some DMAMEM changes

12/11/2025

- Release v1.9.919
- includes all updates since v1.9.14
- fixes crash of Noisemaker at start

12/11/2025

- memory issues solved, another 32k slot recovered
- fixed screensavers issues not stopping in all cases when USB MIDI key pushed
- simplified screensaver names display

11/11/2025

General Changes:

aggressive memory shortcuts/enhancements, dropped unused Braids/ePiano and other code and moved a lot of audio code to DMA/FLASH memory

Expanded the live sequencer’s grid-song workflow so performances can:

- define playback ranges
- loop behavior
- restructure rows
- grid length now scales to 64 steps on PSRAM builds;
- added playback marker state (start/end, loop flag),
- row insert/remove helpers
- grid editor UI now toggles fill/clear per cell
- exposes insert/remove row controls
- shows start/end/loop markers
- stops playback cleanly when the range ends;
- performance name drawing enhancement
- start handler honors the configured grid start/end markers when launching song playback, keeping UI button states accurate.
- loading a grid-song preset resets the editor to the new default marker positions so freshly loaded songs behave consistently
- basic sanitization of grid data on performance load as some layer data may no longer exist.

Screensavers:

- 3D Cube now zooms/spins in more fluid/natural way
- Stay Times for Screensavers adjusted
- Asteroid ScreenSaver now behaves to random mode and does not take completely over
- Adjustments to CM5 Screensaver modes
- General Random Screensaver Times reduced
- When in Random Screensaver mode, now the Screensaver Names are shown and presented in a "cinematic" fading view

09/11/2025

warning: the following changes are very large and are somewhat user ready but current RAM is very low. It is possible that some (or most) configurations will crash very early, this is why this is not a release yet but only in the dev/main branch. If you want a stable release, go with the latest or one of the latest releases. If you are adventurous, feel free to try out these new features but be prepared for crashes (or not booting at all). All feedback regarding the new functionality is very welcome in discord.

Livesequencer PianoRoll Editor:

- In Pianoroll Editor, Patterns are now renamed "TRACK" since they are tracks with layers. They however function similar to the patterns in the LSDJ style Sequencer
- Notes in Song Track (Layer 1-4) now can be edited over the whole song length. You can change Note start and end, just like in the Track Editor before
- Step Recording is now working in Song Track. You even can select the Instrument (Track) from what the notes in Song Track should be played and it can switched at any time (or use several instruments at the same time)
- Notice: Step Recording currently requires that there is already a recorded Song Track with the length, you want to use Step Recording
- The Grid should now look better than ever before, even while Sequencer is running
- Quantisation Button is moved to the lower Button Row. Quantisation will show up in EDIT and STEP RECORD mode. in VIEW Mode it will continue to show the link to jump to the appropriate Sound Source

Other fixes:

- Fixed drawing errors in Connection Machine CM5 Screensaver
- Other UI drawings improved

02/11/2025

work in progress:

1. when recording in livesequencer with virtual keyboard and stopping the recording, some touch buttons were displayed on the virtual keyboard. This is now fixed
2. editing notes in livesequencer pattern / track editor caused moving the current note to a different layer when switching to another layer. fixed
3. when switching layers, it will preview the correct number of notes on that layer even when no note is selected, yet
4. fancy layer indicators now working in pattern/track editor
5. default zoom for livesequencer song mode improved
6. notes now can be moved freely in livesequencer song mode to different parts of the song; they are no longer bound to their (technical) inner 4 bar-chunk. However, there are still a lot of issues to fix with notes at the same pitch where the note-on event is not showing the correct note-off but using the note-off from a later note. work in progress
7. when long-touching the song/pattern button, MDT will jump to either the song-track editor or to the song-grid-editor, depending on what song mode you have set

29/10/2025

- long touch in liveseq on a track button now will jump to the correct/corresponding pattern/track editor

28/10/2025

- note editing in livesequencer pattern editor now works across pattern borders - you now can move, position and resize a note across the full sequence
- note position can be changed with the note-on value, note-off value will lenghten/shorten the note
- livesequencer song mode now will be activated by default if the liveseq song has any data
- livesequencer grid mode will be activated if used in the performance (and saved/reloaded)
- livesequencer metronome will now be not autocreated when entering livesequencer for the first time. Instead you can create the metronome track by clicking layer view, tool pattern, count in: "add metronome"
- added 2 demo performances from me and 6 new performance demos from monty (work in progress, some small tweaks might be coming soon)
- you can try out the current state from the repo, this is not a release, yet

17/10/2025

- small cosmetic improvements in pattern editor

15/10/2025

- added support for multiple USB MIDI devices at the same time (up to 3). Make sure you are powering by either their dedicated power adaptors or by a proper USB powered Hub. The Teensy Host port will probably not handle to power more than one device

- The addressing of outgoing external DIN/USB MIDI devices from Livesequencer was off by 1, this is hopefully now fixed

13/10/2025

- "hotfix" release 1.9.914
- In certain configurations (Specially with APC and MAM CV or APC) free RAM was too low to boot up. This should now be fixed for all firmware versions. Let me know in discord when i missed something.

12/10/2025

- release 1.9.913
- Voice Names in Dexed now can be added/changed at various places directly (in the Dexed Voice Page as well as in the Dexed- and Load/Save Menu)
- small hotfix: Voice Copy was not working for certain filename lenghts in the sysex bank files
- Adjusted the low pitch range for chromatic sample playback
- Cosmetic fixes in naming function in MSP (MultisamplePlayer)

11/10/2025

-release 1.9.912

- Dexed operator numbering in Editor was wrong: Shown operator numbers were reversed and there was a offset of one
- Dexed Algorithm display in editor now matches Dexed Voice Page
- Saving of single Voices to different Bank/Voicenumber now is working
- Save single Dexed Voice is now a bit more descriptive/graphical
- In MIDI channels Page - skip MIDI channels that can't be set because the instrument isn't present (in non PSRAM Firmware)
- At boot, re-try SD card init, as it can fail when booting directly after firmware update
- small UI fixes

05/10/2025

- fixes live sequencer song mode editor
- mute automation lane now basically working as intended

05/10/2025

- release 1.9.91
- introduced a new version schema so the next versions are reflected in the filenames
- dexed instance #1 delay effect issues fixed
- massive enhancements to live sequencer editor song mode:
- song editor now should fully be able to modify note on and note off values (in its 4bar region)
- in pattern mode, assigned instrument touch button fixed
- instrument button disabled for song and automation tracks
- pattern mode step sequencer enhanced
- added reverse and random mode to granular engine

04/10/2025

- massive enhancements to live sequencer editor song mode
- editor now working almost perfectly but only for the first 4 bars - work in progress
- in pattern mode, assigned instrument touch button fixed
- instrument button disabled for song and automation tracks
- pattern mode step sequencer enhanced
- added reverse and random mode to granular engine

02/10/2025

- fixed delay 1 time display in master effects page
- fixed bad colors in arpeggiator
- introduced first version of a granular synthesizer
- started working on a song- and mute automation lane editor for livesequencer
- various additions for MAM hardware (MIDI to CV Converter)
- added an optional dark mode to the virtual keyboard. You will find out how to activate it, it is kind of obvious how to do it
- added granular synth to virtual keyboard

21/09/2025

- Release 1.9.9.9

- The version number change is small but this is a large update
- Sampleplayback Engine changed to its own MDT solution. You probably will not notice this change but it should now run more optimized than before. A small feature set is still missing/not tested, like Looping/Looppoints. But that wasn't working so great in the first place, so this feature will be added back eventually with a new approach
- Dropped the Multiband Compressor. This is now replaced with a completely new tool/page. The new compressor is a combined upward/downward compressor, OTT style (preview)
- Compressor settings have changed. The compressor settings are stored with each performance individually and need to be updated for the demo performances
- Before you touch anything on your SD Card, make a full Backup of it to your PC/Mac
- Make sure to copy the demo performances from this release ADDON/SD/PERFORMANCES to your SD Card. Or better, copy the full content of the ADDON/SD folder to the root of your SD Card.
- Notice: Your favorites in Dexed (if you have marked any) are stored in own files but are in the DEXED subfolder(s). Copy/Replace the DEXED folder only if you do not already have it on the SD Card. There are no recent changes in there.
- Livesequencer Song-Grid (preview)
- You can change from the "Live Recording" Song mode to the "Grid" via Tools, Song type page
- The Grid is working stable but has graphical issues with the Web Remote. Work in progress
- The Song Grid editor lets you arrange your patterns/Layers in a graphical touch grid. All empty layers will be hidden in the grid so you get a clean view of only the tracks containing data
- Scrolling in the Grid is working with touch buttons or with ENC-R
- The individual Grid cells can be cleared, filled or copied from the above cell
- Note: When you return from Grid Editor to Pattern Screen, it will make a difference if the sequencer is running or not.
- When it is not running, the Pattern Screen will behave as you know it. However when you go to it while the sequencer is running, it will continue playing the Song from the Grid Editor
- When you save your performance, it will save everything from Livesequencer, no matter if you are in Live Recording or Grid Mode. It should be possible to switch between both modes at any time
- Small fixes:
- USB Audio in Web Remote is no longer Stereo reversed
- various small UI Glitches fixed

06/09/2025

- Release 1.9.9.8
- The last 3 or 4 ? versions had an encoder input bug. Update to this version to fix it
- NoiseMaker: Synth : completely reworked with a Curtis Style filter, 4 waveform (mixes) to select from and more
- Randomizer updated: go to NoiseMaker SYNTH, select STEREO and Reverb ON. Push RAND for an endless stream of usable or not so usable stereo samples to come up, everything is possible from Bass sounds to percussion, serious Drums, effects or nothing audible at all.
- After Sample generation, push SAVE SLOT and review the sample in DRUM PAGE. Apply TRIM and FADE out if necessary. Touch SAVE SAMPLE to save it to SD CARD. Also save your performance after any sample change.

05/09/2025

- Release 1.9.9.7
- Convenience update for NoiseMaker:
- NoiseMaker will no longer initialize with default parameters at start. At boot it will load all it's previous settings and every time you leave the NoiseMaker screen, it will save all of it current values

- A short (green) message will appear, every time you quit the NoiseMaker page. All your settings for all (drum) sounds will be saved (and retrieved back at your next boot)
- Added a new category to NoiseMaker: Synth (Bass)
- while this is intended to create Synth Bass Sample Sounds, you can drive it below and above it's suggested range and get all kind of bleeps and blops/drum Sounds or special effects, sometimes it even generates FM like sounds
- when you are creating actual Bass sounds (as intended), it is not fully working as intended but it already does / offers a lot:
- A sub bass oscillator, one octave below your selected (MIDI) note
- 4 triangle / 4 saw waves (blendable)
- 4 oscillators one octave above (blendable)
- a filter with resonance
- You will notice that creation of NoiseMaker Bass Sounds takes more time than the drum sounds
- This is because the code actually runs 2 times. The first time is runs "dry" to catch sample values out of bounds
- Then it recalculates the amplification for the sound to not distort
- Then it builds up the sample as loud as possible as a 16bit mono or stereo sample, without any distortion. This works most of the time, but not always
- The ship in the Asteroids Screensaver is now more smart (or at least it is targeting and shooting at the targets with more passion)
- Added / Updated Code for the MUSIKANDMORE hardware, all 4 CV outputs are now active and usable:
- 2 MIDI CC values can be mapped to a CV output (like Pitchbend, ModWheel) , you can select between all available MIDI CC inputs to map against 2 CV Targets
- Bootup diag for MUSIKANDMORE Hardware updated, LED flashing at bootup for the GATE and CLOCK OUT LEDs

02/09/2025

Enhancements Noisemaker:

- Sample length now should auto calculate the right size, no matter if it is mono or stereo or with or without reverb
- I suggest still to check the generated samples in Drums page, it is possible you can save some memory with trimming and fading
- Generation of non-reverberated sound will be way quicker than before
- Maracas sound now should render all the time without a filter ringing warning

01/09/2025

Enhancements in NoiseMaker:

- unnecessary Screen redraws are gone / no more "flashing" when changing categories
- clap: when set to stereo, it was rendered incorrectly at double speed - fixed
- all NoiseMaker sounds now have a real stereo rendering (not only the reverb). The stereo aspect is applied to all sounds by individual measures. Meaning it mostly applies to higher frequencies, all low frequencies still are centered (mono)
- stereo width control is added for all sounds with a "spread" parameter that is displayed commonly as the last parameter for all individual categories
- rimshot sound enhanced massively
- added click/woodblock/snap sound category
- initial and randomization parameters tweaked
- bassdrum and clap sounds in stereo are specially impressive, make sure to check them out, even if you (like me) mostly prefer to work with mono samples

If you save any NoiseMaker sound to psram, make sure to trim it in the drums page, check if it is correct and then save it to SD Card after trimming. Otherwise it will be fixed to 5 seconds lenght and will clog up the engine by it's long playing time. Also make sure to save your performance when you have changed any aspect of the custom samples.

31/08/2025

- release 1.9.9.6 This is not so much a 1.9.x release but instead a preview version of 2.0 2.0 will probably coming mid 2026

1. Introducing NoiseMaker:

- NoiseMaker is an on board creation tool for Drum Samples. The samples are created from scratch, without any input samples.
- Samples can be created in mono or stereo
- An Offline Reverb can be applied to the samples in mono or stereo. The reverb quality should exceed the quality of the realtime effect Reverb since it is rendered offline and is rendered directly on the sample data in PSRAM.
- Samples will be created in a 5 seconds buffer so it is safe to apply reverb to it, or not.
- NoiseMaker samples can be saved to a custom sample slot in PSRAM (1-20)
- In NoiseMaker you can always preview/compare the sample that is in the current custom slot, compared to the temporary sound that is in the PSRAM buffer. There is a dedicated "Play Slot" touch button to let you compare the current sound to the previously stored sound. Only when you press "SAVE SLOT" it will be overwritten with your new, current sound.

After that:

- In the Drums page:
- Custom samples (from Noisemaker or not) can be:
- trimmed at the start and the end
- faded out
- and saved to SD Card
- Since all samples out of NoiseMaker will be 5 seconds long, it is highly advised to trim the sample.

Make sure to use the "SAVE TO SD" feature in the drum page to save your edited sample to the SD Card if you have edited it. Also make sure to always save your Performance after changing or adding any Samples. Otherwise your edited Samples Parameters, Names, Filepathes, will not be recalled after a restart.

All samples on SD Card will be stored as a valid 16bit, mono or stereo sample. It should be no problem to load or edit it further in your DAW or Desktop Sample Editor.

All samples from NoiseMaker will go to the CUSTOM folder into specific Subfolders by category:

The subfolders in CUSTOM are: "BD" , "SNARE", "TOM", "CONGA", "RIM", "CLAP", "HH", "CRASH", "RIDE", "COW", "CLAV", "MARA", "ZAP"

The Filenames will depend on the custom slot number. So you can save up to 20 sounds into each category, making it 260 individual samples all together.

16/08/2025

- release 1.9.9.4
- this is probably the last release that supports the old resistive touch and teensy without PSRAM
- It got almost impossible to still compile for all 10+ versions
- New Features:
- Live Song/Pattern Arranger. This is in an early state but it probably already does more than many arranger keyboards do. I consider this to be in an alpha state
- Name/Save dialogs now have a touch keyboard
- recursive delete and recursive copy functions in file manager (tested but probably not working perfect, yet)
- countless UI glitches and errors fixed
- Max. BPM in sequencer increased by user demand
- fully PSRAM based sample preview in file manager for internal/external SD card audio files

15/08/2025

- Updated and tested the RGB SLA Print Encoder knobs to have a tighter fit. You can Download/Order them from PCBWAY MDTX page at the bottom. Make sure you use WHITE resin with your SLA Printer, do not add any supports, it should print fine directly on the plate

12/082025

I will continue to improve the (chord) arranger but the last days i was working on the file manager:

- Sample preview will now work for internal SD, external SD and PSRAM. All modes are buffered to PSRAM before playing. Meaning you can continue to scroll around, while the sample is still playing
- Delete Functions: The delete touch button now will directly tell if the currently selected object is a file or a folder. If you are in delete mode, this will update in realtime while scrolling through files and folders on both SD Cards. To confirm the deletion of the current object, press ENC[R].
- If the selected object is a folder, it now will delete it recursively until it is fully empy and then erase it
- If it is a file, it will behave as before but it will show a clear preview of what will be deleted
- Copy Functions: Folders now will be copied recursively! (hopefully!) This means you can make a backup of your samples (with subfolders), your performances etc. from the internal SD Card to an external SD Card with one click!
- You still can copy single files. The visual feedback of what is copied is now more clearly

- When entering an empty folder, the UI was previously confusing since it was highlighting an non existant entry. This is now improved. You will get a clear "EMPTY Folder" message and the cursor will already be on the ".." position to go back to the previous folder

Not ready for release but it will come soon. Including the current state of the chord arranger.

01/08/2025

- Release 1.9.9.2
- changes for Akai Apc Mini:

  • refresh step and sample name in MDT display, in pattern drum editor, in case of new sample or new step in Akai Apc
  • refresh volume gauge in MDT display, in Drums screen, when corresponding volume fader from Akai Apc is moved, in active sample mode (apc sample pad blinks) • avoid freeze for Akai Apc Mini Mk1, when more faders are moved in pattern mode, by ignoring 30 midi CC events for changing sample volume • when changing sample volume with Akai Apc fader, translate midi range from 0-127 to 0-100 to avoid distorsion

Most of these changes also apply to APC MINI MK2

- Simplified Performance Loading/Saving: MDT now will recall the performance number you last loaded and suggest that for saving as the default. It still will ask you to confirm / if you want to overwrite it.
- Simplified Startup Performance Menu: This was previously too confusing. You now can set a fixed performance that auto-loads and that's it
- Added a chord arranger page. To limit possible side effects, this will ONLY work when you have the arranger page on screen. It will NOT work in the menu or other pages.

How does it work ?

1. Select a Keyboard range where chords should be detected. If you are playing out of this range (or in it), the notes you are playing will be visually indicated on the page with red squares. Observe if your played notes fall into the region you have selected for chord detection
2. set one or multiple tracks of the sequencer to either:

- OFF : PLAYS THE NOTES UNALTERED
- ON : TRANSFORM NOTES TO CHORD SCALE
- BASS: TRANSFORMS ALL NOTES TO CHORD ROOT

Only tracks of type INSTRUMENT can be processed. Drum Tracks will be skipped by default

CURRENTLY SUPPORTED CHORD TYPES ARE: MAJOR, MINOR, DIMINISHED, AUGMENTED AND THEIR FIRST AND SECOND INVERSIONS

- Updated the manual. However the Arranger part is not yet included

24/07/2025

- Release 1.9.9.1
- Show recorded pitch bend activity in containing layer as a vertical bar, changed color of PB from dark green to light blue as better visible in layer button
- LiveSeqPianoRoll was broken recently when editing notes due to an internal code change. This update makes it again possible to edit notes in LiveSeqPianoRoll editor
- Added a basic page for routing MIDI input to CV outputs (only available in the MAM Hardware Version).
- Added basic sequencer integration for MAM CV outputs (only available in the MAM Hardware Version), not fully working, yet

11/07/2025

- Updated MDT and MDTX PCB designs to smaller JST Connectors for external power, external power switch, SPDIF Out and G3 connector (only MDT) to allow useful connections even inside the default enclosures. The previous pin headers can be used as before since they have the same pin spacing and size - However the now default JST connectors have a lower height and will allow a plugged in connector without the previous issues with the pin headers, in combination with the default enclosures.

- Both PCBs adjusted for JST Silkscreen / Footprints, some traces re-routing and updated lables. If you buy the partly pre-assembled versions, this should now not raise any questions from PCBWAY regarding wrong silkscreen markings since they now reflect correctly the JST connectors instead of the previous pin headers.
- Removed the SPDIF connector since it is currently of no use and takes more space than is available.
- Updates on the manual:
- All BOM chapters updated with more/better part sources
- Updated Images for the most outdated parts however there is still a lot of work to do
- Updated BOMs for PCBway for partly-assembled versions and their current parts/content in the manual
- Small fixes for Livesequencer

07/07/2025

- further fixes for APC Mk1 control surface support:

1. translated colours and blink, better Pattern view ad Mute Matrix view
2. add wrapper for colours of Akai APC Mini Mk2 to be translated to Mk1 red,green,yellow, the same for blink mode

- Livesequencer:

1. reset track layers GUI on CC / PB deletion
2. simplify CC / PB track layer actions a little

- Updated STL file for FDM Bottom part printing

03/07/2025

- Release 1.9.9.0
- Recording and Playback of MIDI CC (Pitchbend, Modulation etc.) to Livesequencer:

Generally working (only possible for psram version):

- input from USB HOST, MIDI DIN and probably from PC
- output at least MDT internal + MIDI DIN
- UI: layer actions to clear CC, PB

It should convert old style layer mute automation in the existing live sequencer performances to the new style. Done on performance load. Only for song events, so should not cause issues with any track events.

- Significant updates to the manual, over 500 small and medium fixes/updates
- Small fixes for MAM Hardware Version

29/06/2025

- Release 1.9.8.13
- Chords on Chord Tracks now can be latched (the same way as it is on instrument tracks)

08/06/2025

- Release v1.9.8.9
- Added the possibility to edit custom sample start and endpoints.
- Also custom sample type can be setup. This enables the use of high hat randomization also for custom samples.
- fix stereo samples panorama setting
- fix possible crash when loading a performance with many custom samples with full PSRAM from previous performance NOTE: when saving a performance with this state and going back to previous state, custom samples will fail to load as now the sample path is split into path and filename

- Fixed wrong MIDI Sync Tempo at startup in certain condition
- Fixed Favorite search for "NON-FAV" voices
- Fixed that some epiano parameters are not retrieved correctly

02/06/2025

- Added the possibility to edit custom sample start and endpoints.
- Also custom sample types can be set up. This enables the use of high hat randomization also for custom samples.

further changes:

- custom samples now store their long path in new struct CustomSample, made filename in drums smaller again to save RAM
- re-arranged drum screen for new custom sample fields
- rewritten waveform drawing to have pixel-perfect wave plotting without flicker on partial wave drawing.
- fix the sort folders before files function in file manager
- fix stereo samples panorama setting
- fix possible crash when loading a performance with many custom samples with full PSRAM from previous performance

NOTE: when saving a performance with this state and going back to previous state, custom samples will fail to load as now the sample path is split into path and filename

14/05/2025

- When MDT boots up with a performance that is set to MIDI SLAVE mode and you have not entered the Sequencer Settings page once, it was starting with a wrong tempo. This is now fixed.
- I did not make a new release version for this yet but you can (always) download the latest updated binaries at:

https://codeberg.org/positionhigh/MicroDexed-touch/src/branch/main/release

13/05/2025

- Release v1.9.8.8
- Since introduction of the timer based MIDI input handling, the APC Mini Mk2 Control Surface for MDT got unreliable. This is now fixed by reverting to the previous method (only for the APC Firmware)
- Thanks to lucean, MDT now has experimental Control Surface support for the older APC Mini (Mk1). Of course there are some limitations due to missing features of the MK1.

22/04/2025

- Release v1.9.8.7
- This update does not come with a lot of new things but refining and fixing underlying issues. All hardware versions, including the very first resistive-touch version, were tested intensely to check if they work as intended or fixed issues to make them working again
- fixed issues for (depreciated/outdated) non-psram builds:

1. Issues with encoder handling
2. optimized RAM, removed SMF Player from non-psram builds
3. reverted dexed engine to a fully working state for all versions

- Global fixes:
- fixed overlap of virtual keyboard and touch buttons in some circumstances
- performance load- and save pages now follow global color scheme

- scope view will continue to run on performance load page
- fixed parameter display issues
- memory optimizations to gain more free RAM1
- some changes/additions for MAM Build: changed LED startup sequence, added (CV) Sync IN, changes to other MAM specific connectors
- improved MIDI input latency
- New visual gadget - you will see it when you see it - It is only active when not using web-remote so it should not introduce any performance issues

16/04/2025

- Release v1.9.8.6
- Fixes on the song page:
- When scrolling from song page to pattern editor, it now will always open the matching pattern from the same line the cursor is located in the chain editor
- When returning from pattern editor back to song page by scrolling left, the song page will continue on the line you previously moved out
- When scrolling all the way back to the chain grid, it will jump to the correct grid step and not overwrite the value incorrectly
- Small enhancement: when editing the chain steps, in the grid view the currently selected step is lightlight in red color

15/04/2025

- Release v1.9.8.5
- Samples can now be played with 0-200 volume instead of 0-100. This is useful when samples are not recorded at full level - or are not strong enough to cut through in a mix
- MIDI Input is now separated from the main loop. This has several advantages:
- Live playing should have lower latency
- Playing notes from an external Arpeggiator or Sequencer now should be more fluid, independent what you are doing in the UI
- Recording to Livesequencer seems more reactive - even without quantisation
- When working with MIDI CLOCK modes, mdt MASTER or mdt SLAVE should have better response time
- MIDI Activity LEDs have higher precision
- Added some features for the MUSIKANDMORE Build:
- Analog (Master) Volume - can be adjusted by an external pedal
- Sustain Pedal - instead of connecting a sustain pedal to your MIDI input device, in the MAM build you can directly connect it to mdt to control sustain level for dexed (epiano will follow soon)
- CV Sync - Instead of MIDI Clock Sync, mdt now can be tempo synced by an external modular / other synth with SYNC output, currently fixed at 4PPQ, but that is possible to change to other values in the future. The START and STOP command still needs to come from an external MIDI device over MIDI since the clock signal is not expected to start and stop by command
- CV Sync and Pedal Input is visible by the UP and DOWN button LEDs of the MAM device in higher precision than before
- Settings for Analog Master Volume, Sustain Pedal and CV Sync now can be activated/deactivated in SYSTEM - SYSTEM SETTINGS individualy

12/04/2025

- Release v1.9.8.4

- Mostly bugfixes and experimental things going on in the background for the 2. SD CARD
- Dexed Voice page preset scrolling was broken at the end of a pool, this is now fixed
- for the MUSIKANDMORE build, started working on a "global volume" foot pedal input control

30/03/2025

- Release 1.9.8.3
- File Manager: SD Card Size now should show up correctly
- File Manager: File Names and Directories now should come up with upper and lower case characters as before (was broken since last Teensyduino Update)
- Added my demo presets for Braids (feel free to create and share new presets, pm me in discord)
- MIDI Activity Lights will flash at bootup to show they are working correctly
- Musikandmore: At first boot, Encoder direction scrolling should be swapped by default
- Musikandmore: At first boot, RGB Encoders should come up with default colors, blue and red. You can change the colors in system, system settings menu

28/03/2025

- Release 1.9.8.2

What's new ?

- Loading a performance now lets you select what parts of it to load and what to skip. This allows several aspects to get content from a different performance into what you are currently working on. It also helps to access Settings and Preset Selection without loading sequencer data. Or you can do the opposite, load just sequencer data but no changes of voices, effects or other aspects.
- Braids now has a basic preset system (however, no preset sound so far)
- Load and save up to 99 presets without dealing with the performance. It only loads/saves Braids settings, nothing else
- Loading and saving Performances works as before. The Braids sound from a Performance will be automatically loaded into Slot 00. You can copy it from there to an other destination. Or create completely new sounds on each of the empty slots.
- Do not place your own sounds on Slot 00. It will be overwritten when loading any performance. Think of it as a temporary storage Slot.
- The sounds will be stored in a new /BRAIDS directly, that will be auto-created on the SD-Card when loading the Braids Page or FileManager for the first time
- Sounds can be named with a lenght of 15 chars
- I will try to create some presets but your help in doing so would be very appreciated. Just send me your files (in discord) from your /BRAIDS folder. The sound name is contained inside the file(s). You do not have to do any renaming on the files, i will take care of the numbering.

23/03/2025

- Release 1.9.8.1
- less flickering dexed live mod buttons
- added RGB Lighting settings for Musikandmore and upcoming mdt "rgb"-hardware
- scrolling system settings menu

Changes to system settings screen to enable additional settings to be added:

- Reworked UI & rendering functions for system settings to allow scrolling
- Included 2 new MIDI related settings, driven by sys.json. Please see below
- Proposal to gitignore .DS_Store files to reduce requests for staging on a Mac

New toggles

- MIDI sysex voice send on voice change. This could be unneccessary at times, as some systems such as Dexed will receive and process a voice sent on any channel. Ability to turn off will reduce conflicts when using MDT with other compatible devices that are less strict on sysex receive.

- MIDI CC dump (init_midi_send_cc) on voice change and startup, making this optional to reduce MIDI noise and unnecessary communication when trying to send voices to another device

22/03/2025

- fixed dexed operator screen only incrementing and not decrementing in operator selection
- fixed chorus not enabled after boot, a manual change was needed to enable it
- fixed chorus depth had wrong range (afaik)
- fixed dexed live modifiers not working
- fixed liveseq track instrument not updated on new song load
- fixed some wrong back button behavior
- improved TouchButton::drawVirtualKeyboardButton()
- add decay and sustain to dexed live modifiers, increased their range to +/- 50
- changed all buttons to TouchButton in dexed voice screen. had to rearrange some things. now "Dexed Audio Setup" and "Master Effects" links are on a separate line labled as "Voice" and "FX"

Minor changes to improve midi & sysex voice sending:

- Correcting the send_sysex_voice midi channel attribute to be 0-15 rather than 1-16 in the payload. This is now as per the spec as n=0, ch=1 (DX7II manual) and has been verified to be how Dexed, Synthmata work. This also now ensures compatibility with Korg Volca FM which only receives on channel 1. This change is reflected in both 'MIDI Send Sysex' screen and the sysex sent when voice is changed via the Dexed 'select voice' screen.

- Updating 'MIDI Send Sysex' screen to correctly represent 1-16 and remove omni, which was a manifestation of the above issue with the mis-interpreted meaning of zero.

- Fix - Pan sending through init_midi_send_cc function to represent 0-127 values. This was previously correct as CC is sent when pan changes, but on other CC dumps has been sending 0-40 as per the UI.

Changes to sysex 'MIDI send bank' functionality

Current Behaviour:

- Sysex bank UI takes the channel from current dexed instance and passes to function call as a parameter
- Function has no code to use that parameter, so everything goes out on channel 1, third byte = 00 in sysex
- All voice bank transfers therefore stuck to channel 1 only

New behaviour:

- Additional picker added to 'MIDI send bank' screen to select channel
- Update to midi_devices function send_sysex_bank to utilise parameter and insert into the sysex payload
- This results in the bank send now being able to be aimed at a specific channel

02/03/2025

- Release 1.9.8.0

- Serious issues with firmware for PROGMEM (resistive touch, capacitive touch without psram) were present for several of the last releases. Teensy Memory is not even close enough to have all features working with the PROGMEM firmware. To get back mdt stable for these, the following changes were made:

- dexed instances set back to 2
- filters and envelopes for samples removed
- stereo samples are still working - however the samples in progmem are mono anyway
- Fixes were made for : DEXED VOICE SELECT, MIXER, MIDI CHANNELS, MASTER EFFECTS pages
- There should be no changes in functionality for the PSRAM or PSRAM+APC firmware
- MIDI Activity LEDS now enabled by default for all PSRAM versions

01/03/2025

- Release 1.9.7.8
- added cpu load indicator to live sequener
- small UI tweak to align operator numbers in the voice edit screen with algorithm diagrams and operator screen. This will now match DX7 / Dexed UI operator numbering.
- dexed sysex send voice decoupling from active instance MIDI channel - Instead can be selected directly in the sysex send page
- updated mdt manual
- added 2D template drawing of the mdt pcb to the doc folder

Code changes:

- refactor UI.hpp and midi_devices.hpp into separate source and header files
- define function prototypes in headers and remove extern definition
- remove numerous unused extern definitions

17/02/2025

- Livesequencer:

- fix: when recording a pattern and press stop before pattern ended, pending data was not added and track kept blinking until next time pattern ended. now it will add pending data on pressing stop.

- fix: when deleting all live sequencer data, pressing start and stop / exiting and reentering was needed for metronome to be added again. now pressing start and stop is no more needed.

- fix: sometimes when switching tools views / pattern and song mode it happened that layer edit menu was not working anymore. fixed this.

16/02/2025

- Release 1.9.7.7
- Sample start position of HiHat Samples now can be randomized, similar like it is done in the LinnDrum
- When using the Multiband Compressor, the Stereo Sides were flipped
- When loading a performance, the dexed note transposition parameter was saved and loaded but not applied correctly to the instrument

08/02/2025:

- virtual keyboard: There was a bad color line after clicking on virtual keyboard "off"

- dexed voice page:

1. jump to dexed editor now working for the new instances
2. using live modifier macros for dexed attack and release values now working for the new instances

03/02/2025:

- virtual keyboard:
1. switching instances in dexed voice screen by long push ENC_R now should behave more predictable in virtual keyboard and not change the instrument in it unexpectedly
2. in dexed voice, when virtual keyboard is closed and dexed instance is changed, reopening virtual keyboard will jump to the currently selected instance
3. when going (back) to dexed voice screen and there previously was an instance other than 1 selected, reentering the page and opening virtual keyboard will go directly to the previous selected instance
- when virtual keyboard was enabled and then openening :
1. pattern editor and a drum pattern is selected, virtual keyboard will go directly in drum pad view
2. velocity editor and a drum pattern is selected, virtual keyboard will go directly in drum pad view
3. pattern editor and a instrument pattern is selected, virtual keyboard will go directly to instrument view
4. velocity editor and a instrument pattern is selected, virtual keyboard will go directly to instrument view
- SMF/MIDI FILE Player: When there are 0, 1, 2 or 3 MIDI Files in the /MIDI Folder, MDT should no longer crash but allow selection of the available files

02/02/2025:

- release 1.9.7.5
- added dexed instances to virtual keyboard
- updated mixer page on mdt and web remote
- small ui fixes

- updated web remote for firefox on windows and mac

01/02/2025:

- release 1.9.7.4
- hotfixes: previous firmware for (old) resistive touch and for Teensy without PSRAM was not booting. Ideally, all mdt versions now should boot at first attempt when correct firmware is uploaded
- small fixes to Master Effect Delay Noise Gates
- small fixes to audioscope on several pages
- invalid instance selection in dexed voice is fixed
- SMF MIDI File player now can use all 4 dexed instances
- Livesequencer: fix bug on track instrument setup recently introduced when adding support for 4 dexed
- WAV Audio Recorder now shows a much prettier waveform while recording

31/01/2025:

- release 1.9.7.3

- too many changes to list here. see https://codeberg.org/positionhigh/MicroDexed-touch/wiki/CHANGELOG to check all major changes since 1.9.7.1

- the "double" firmware versions with delayed startup and without are gone. This issue is (hopefully) cleared out.

- performance file format is extended to fit the 2 new dexed instances. All your performances should load as before but can have changed values for the delay effects since it now has 2 effect sends for each dexed instance instead of a single one.

- Please make a backup of your SD Card/performances before updating to 1.9.7.3 to make sure your work is safe.

30/01/2025:

- effect settings for dexed#3 and dexed#4 are now stored and recalled when loading/saving a performance

- Instances are now toggled correctly by long push ENC_R and also by going to the instance menu item an scrolling with ENC_R in:

1. dexed edit voice page
2. dexed audio page
3. dexed controller page
4. dexed setup page

- dexed operator enable page: Usage is now slightly changed to work equal to the other dexed pages : Instances are now toggled by long push ENC_R

28/01/2025:

- rework dexed delays: now each dexed instance has direct access to delay1 and delay2
- rewired whole delay effects for dexed
- updated dexed voice page to include access to both delays for every instance
- updated master effect page to include all dexed instances and delay send meters

26/01/2025:

This is not a release, yet. You can however download the binary for the psram build in the repo directly

Software changes:

- dexed now has 4 instances
- dexed voice screen (partly) adapted
- sequencer song page adapted to new dexed instances
- setup - MIDI channels adapted and channel activity for all instances added
- fixed many of the internal signal routings for this heavy change but probably not everything is correct by now
- delays and reverb seem to work for the new dexed instances

Note:

- new instances are set to MIDI Channel OFF by default, you can change that in dexed voice or in system - MIDI channels
- maximum polyphony is not figured out or even worked on, yet. At the moment you will get 4x8 voices

22/01/2025:

Software changes/upgrades:

- update teensy platform to 5.0
- update TeensyTimerTool to 1.3.0
- update TeensyVariablePlayback to 1.0.16
- probably fixed the Teensy-MICRO-USB-MIDI input issues present on previous versions
- probably fixed the AUDIO DELAY Effect time, now back to 10 seconds per instance as it was before
- Sample Envelopes: Better Attack, Hold and Release values (now allows very quick and also very slow values)
- Updated Build Guide/BOM/Manual

Hardware changes:

- PCB updated to latest version with included encoders and LED activity lights
- If you choose to buy the partly prebuild version, the added resistors will be included but the (low current!) LEDS and the Encoders themself will not be included.
- I found that having the Encoders soldered before all the other (smaller) parts is awkward and not feeling right. So these need to be soldered by the user, as one of the last steps.
- The MIDI activity Lights can be soldered to go to the right side or upward. Depending on your enclosure color, it might be that no holes are necessary - If you have a black or very dark enclosure you can add holes for the LEDs, if you want to have them.
- The metal enclosure will now come with holes for the LEDs on the right side by default.
- Make sure you use only LOW CURRENT, 2mA LEDs. Regular/Standard LEDs have a much higher current and will overburden the Teensy 4.x I/O pin specification.
- All larger jumper areas, on the right side, the AMP jumpers and the MIDI jumpers now follow a standard pin grid. You now CAN solder in larger pin rows for having an easier and faster solder experience, if you like to do that. However, if you do that for the right side jumpers, this will hide the texts/description of the individual pins/jumpers. It will look better/ more instructive to solder individual 2 pin jumpers.

14/01/2025:

- File Manager:
- removed screen flickering of touch buttons
- fix: samples from psram could not be played when left side SD Browser was on a folder and not a wav file
- preview touch button will no longer highlight when selected a folder or a non-wav file
- preview touch button will return to normal state after starting playing a sample
- delete from psram touch button (currently not implemented but you can overwrite samples) was jumping to preview sample, this now wont't happen any more

13/01/2025:

- Release 1.9.7.1
- sample page/dexed editor and other dexed settings pages: menu acceleration fixed
- when MIDI sync is set to external, you can now skip the warning at boot up in system - system settings menu
- preview samples by loading into PSRAM and play from there for improved stability
- finally proper sample playing from PSRAM, all clicking noise at beginning or end should be gone now
- filemanager sort folders before files
- fix restriction of maximum 150 files per folders on SD card
- removed all COMPILE_FOR_FLASH code
- Small updates in the MDT Manual (BOM and FAQ)

12/01/2025:

- Release 1.9.7.0
- In System - System Settings you now can select to skip the MIDI channel warning page when booting or loading a performance (That does have multiple instruments assigned to the same MIDI channel)
- This is a system-wide setting so you do not have to save it per individual performance.

- Updates for the MDT PCB:
- One of the (new) resistors for the MIDI activitiy LEDs was in the way when soldering a double-row jumper "block" on the right side of the PCB between the Teensy and the Audio Jacks. Probably not everybody has noticed: You do now have to place individual, 2 pin Jumpers but can use a larger row or double row to solder all of these jumpers in one step. (You do have to take out some pins of the rows of course where are no solder holes). This is easier and probably quicker than alligning and soldering all the individual pins and still will make sure that it is not possible to put on jumpers in wrong direction/orientation
- The same now is also true for the AMP Jumper block.
- Updated Metal Enclosure:
- Top Part: Left encoder is moved 0.6mm to (hopefully) be perfectly positioned for the upcoming MDT PCB with on-board encoders
- Bottom Part: Turns out several updates did not get into the production process at PCBWAY. I am in contact with support and should find out shortly what was going wrong in the past
- Reworked the venting slits
- Added right side holes for new MIDI activity LEDs
- Small updates on the MDT Manual

06/01/2025:

- Release 1.9.6.8
- this might have the same issues with bootloops as 1.9.6.7 but i hope not ?
- if the standard version does not work, try the version with *boot_delay
- added DAC "hack" to make PCM5102A not go in to power saving mode - sound release phase should not have cracking noise any more
- added ad-hoc dexed algorithm change while playing a preset. If you like the change(s), go to editor to make further changes and save it as a new voice to make it permanent

05/01/2025:

- Release 1.9.6.7
- long delay effect times (with PSRAM) seem to break MIDI input from Teensy Micro-USB port. USB Host and TRS Jacks were not affected. Limiting this seems to fix the issue however it is currently unknown how this even affects MIDI functions.
- Max. delay times without PSRAM are 2x 0.5 seconds and with PSRAM (at the moment reduced to) 2x 2 seconds
- small updates to the Manual

04/01/2025:

- Release 1.9.6.6
- dexed panorama settings at bootup loaded to the wrong object. This should now be fixed
- non-UI blocking Sample preview reverted, this could have caused audio engine crash and SD card corruption. The non-blocking functionality might come back partly, for example for playback from PSRAM, but currently it is back to a known, working state.
- Drum sample value editing probably slightly improved - editing speed still is not ideal.

03/01/2025:

- Release 1.9.6.5
- a recent update broke UI editing of the most basic sample parameter values, that is now reverted
- switching output modes between STEREO, MONO, MONO_L_ONLY and MONO_R_ONLY now is working as intended, probably for the first time

02/01/2025:

- Release 1.9.6.4
- store full path of custom samples in drums map / json to allow custom samples to be located in subdirectories
- sample pitch of 0.0 (was without pitch change) now is automatically changed to 1.0 (100%) as it seems to solve custom samples clicking at end.

- for clicks at start change attack value to 1.
- add live sequencer button into main menu
- Sample preview in file manager is now no longer blocking the UI (specially noticable when playing long samples like recordings made with the WAV recorder)
- Fixed way to high delay feedback level in demo performance #0
- volume page now can be stopped instantly by encoder_r movement or push

01/01/2025:

- master effects now does round-robin scrolling (lets you reach parameters faster by scrolling backwards from the first parameter on screen or scrolling beyond the last parameter)

29/12/2024:

- Release 1.9.6.1

- Fixed an issue when loading a performance that previously was not saved with Sample Envelope values, resulted in partly inaudible samples when played

- Samples without any HOLD or DECAY time (inaudible) will now get a default value, appropriate for a one-shot drum sample. If you however made any settings for any sample envelope and saved the performance, these will will be loaded and applied as expected in every case

28/12/2024:

- Release 1.9.6
- Encoder A/B Pins now can be swapped in System Settings via Software (so if you see reversed input from your encoder direction input, there is no longer a need to resolder anything)
- Prepared for a new PCB Version that can be used as before but also to include on-board Encoders as an option
- All Connectors are kept the same so there is no need for any case/enclosure changes

22/12/2024:

- Release 1.9.5
- fixed several display issues when virtual keyboard was activated in main menu and then going into old 2 line menus
- changed encoder handling: should now enable you to pick values from min-max with 1-2 quick encoder scrolls and also provide delicate input to single values without much effort
- Basic APC pattern editor with drum and note input and APC Mute Matrix added
- The APC (only) pages can be accessed by holding down SHIFT on the APC and pressing right-row buttons 1-3, without going through the regular on-screen pages

21/12/2024:

Generic updates:

- Mute Matrix modernized with bigger touch buttons

APC mini releated updates:

- Mute Matrix now functional on APC
- Several pages, currently pattern editor, song and mute matrix, are now available as shortcuts on the APC. You do not have to call the corresponding page from the mdt screen, but you can. Then you will get more information and details. But the APC pages work on their own and you can work on the mdt display on a completely different page. This is partly like a 2 monitor setup, showing different content
- The APC (only) pages can be accessed by holding down SHIFT on the APC and pressing right-row buttons 1-3. More options might be available in the future

20/12/2024:

APC mini Control:

- You now can do basic input/edit/erase steps in instrument patterns, meaning a pattern playing tonal MIDI notes with the APC mini pads
- The input region on the bottom part of the apc is very similar to the drum pattern mode. But instead of 1 row of samples you have 3 rows for note input
- Handling of LATCH steps is working but not ideal, work in progress
- scrolling and nagivation works exactly as in drum mode. both modes store their scroll position individually
- velocity values for all steps can be modified with the 8 faders, identical to the drum mode

- start/stop sequencer button is moved to the 3rd button on the right row to resolve conflict with UI design for note input

13/12/2024:

LiveSequencer Pianoroll:

- simpler way to delete notes in pianoroll editor. in note selection mode, notes can deleted directly by a button press
- fix possible crash / glitch on delete last note
- optimize autoscaling

Added preview of APC mini mk2 pattern editor (currently as an individual binary)

- fixed some clashes with virtual keyboard
- fixed velocity bar drawing when outside of pattern editor and using the APC faders

03/12/2024:

- rework microsynth UI

02/12/2024:

- fixed clearing/drawing issues in legacy menus
- helptexts for the encoders should not be overdrawn any more (startup page, startup performance etc.)
- back button fixed
- configuration saved notification button fixed

01/12/2024:

- Virtual Keyboard now has unified/modernized touch buttons
- Drum Pad view now has realtime visual color indication when touched
- Modernized Main Menu size, touchbuttons and Icons
- Slight adjustments to Drums Page
- The ENABLE OPERATOR dexed sub page now is working for the first time in microdexed touch. Don't expect it to do much, it is really just doing what the name implies

27/11/2024:

- Release 1.9.4
- In the drum page, now there is a dedicated sample preview touch button. This button will play the current sample with it's envelope and filter settings (if you do not have a MIDI keyboard attached this might be very handy to preview the currently selected drum sound)
- New: SMF/ MIDI File player: MDT now does play standard MIDI files. Type 0 and Type 1 are supported. If the Song has more than 16 tracks, everything above will be skipped at the moment. The player will play only note-on/off messages. Each of the channels can be muted or unmuted. Also, for each of the 16 channels, you can choose between Dexed1, Dexed2, Microsynth 1, 2, epiano, Drums or Braids as the playing Instrument. For drums, a crude GM drum sound mapping will be applied (work in progress). You can adjust all the drum paramaters in the drum page as usual like volume, effects, pitch, envelope or filter. For instruments, nothing will be switched or changed when playing MIDI files, it will play exactly with what you currently have set to the corresponding Instrument channels. While the SMF Player is running, most of the pages can be accessed as usual, a few pages will pause the playback and resume as soon you get back to the main menu or other sub-pages. It should be possible to play along in real time with other instruments, live during the SMF player is running. Also the sequencer(s) can be started or stopped while it is running but currently there is no synchronisation or link happening between them. MIDI / SMF player is thought about being a learning/companion for you to play along together with it or just listen to MIDI files in general. It will never be a fully, dedicated General MIDI (GM) File Player, this is out of the scope of MDTs goals.

Details:

- The MIDI files are expected to be in the path /MIDI/ on MDT SD Card. This path will be auto-created when you enter SMF Player for the first time. You can copy your MIDI files to this path via Web-Remote, once it was created. If this does not work out for you, in worst case, please create a folder MIDI in the root of the SD card and copy your MIDI files to it. The File extension needs to be .mid (not .MID or anything else). The filename it self can be Upper/Lowercase or mixed, i am not sure if there is a limit about the length, 20 chars or less seem to work fine.

23/11/2024:

- new preview /binary updated in repo
- In livesequencer there is now a new Tool KEY Tab. This opens up virtual keyboard - depending on your currently selected track (type) in livesequencer, this will switch automatically between a keyboard and a drumpad view. Then you can record notes into livesequencer without attaching any external MIDI device.
- Design of the touch buttons in live sequencer + virtual keyboard is not perfectly matched, yet. However everything seems to be functioning as intended. This might look like a small upgrade but at global level, you now can do practically everything in the

sequencer with mdt alone and without attaching any external input device. All you need is MDT and a USB powerbank and you are ready to make sequences without anything else.
- This is not a new release, yet, but you can download and install your matching binary from the repo /release folder.

20/11/2024:

- release 1.9.3
- Hotfix: Drum parameters beyond sample #73 were saved but not reloaded (meaning no effect or pitch setting was recalled automatically for them)

8/11/2024:

- fix crash and hanging notes when delete all / song while playing
- simpler approach to noteOff pressed keys on track change. should work for all instruments
- improve that finishing notes (eg. on track change) only done when its key actually is pressed. this avoids double noteOffs in situation above
- fix issue on track change during recording. it used to record to previous track but added layer to new track which messed up data structure

07/11/2024:

- Encoder refinements
- Display Brightness is now configurable in System Settings. Do not touch it if you see no uneven background. If you change this, be aware that the display behaves differently after it is warmed up (a few minutes). Changing the Brightness setting might get to unexpected results, after the display is cooled of and you reboot it might look differently.
- Bugfix LiveSequencer: When you switched tracks by one of the track touch buttons while holding down MIDI keys simultaneously, this caused hanging notes because they did not received their note-off message. This should now be fixed for Microdexed, Microsynth and Braids. It still might cause hanging notes for looped samples - more testing required.

05/11/2024:

- Encoder handling is now interrupts driven and should fix recently discovered encoder issues - even if you have not seen encoder issues, they now should behave smoother and faster than before
- Drum / Sample Activity now is visible on Drums page (still more work to do) So now you can visually inspect what sample slot is active or not and how many are free
- Updated Manual : Explaining Favorite settings for dexed

01/11/2024:

- Release 1.9.2
- Both delay feedback channels now come with their own noise gates. When MDT is fully idle, no audible signal should come out of the DAC or sent to USB Audio.

29/10/2024:

- updated manual: Firmware guide and Firmware flashing
- added user enhancement parts/modifications to guide and repo
- enhanced delay filter freq. scroll speed

23/10/2024:

- Volume in dexed, braids, microsynth is now accelerated by scrolling speed
- Braids color and timbre settings are now accelerated by scrolling speed

22/10/2024:

- Release 1.9.0

- Added Sidechain Compressor. 9 Channel (groups) can be send by percentage to a side chain compressor and to the regular output. So you can do fluid transitions between uncompressed and compressed signals, individually by instrument/group. The release phase can be set by Milliseconds (MS) or by 1/16 sequencer steps

- All volume settings behave now on a different scale. Previously, audio output was only audible in the range of 50-100, now this is stretched out to 10? - 100. So you have way more control about the individual instrument and effect levels. This probably messes up all the preset performances and also your own saved performances in volume levels. But i think this was necessary to fix and was bugging me since a long time. If you do load your performance(s), take a deep breath and in several minutes you will get them fixed up. It is really not that hard and i think you will agree that it is way more advantageous to have this broaded range for useful loudness settings.

- Drum Page : fixed misbehaving black rectangular box drawing

- Setup - Startup Page : You now can select MAIN MENU as the default startup page - This was not available previously after changing to a different / specific startup page

- Filenames in the Release Folder got an overhaul. These now should be clearer to understand. Further, to avoid any issues with bootloops after flashing a new firmware, all the major Versions now come in a normal and a "delayed startup" version. It is still a mystery why somehow some devices behaves differently. Start with flashing the "normal" firmware first. If you encounter a boot loop, please try the version with "BOOT_DELAY" at the end of the filename.

The only difference between these version is a very short, 10 Millisecond boot-up delay. In some cases this helps to have it and in other cases it does the opposite. In practice, you will not notice it in any way - Try out both versions, if MDT is booting, everything is fine, whatever version you have selected.

- This release is probably the last step before the V2.0 version. V2 should be feature complete and then the focus will be to fix and polish the available functions - maybe introduce small new features, but only in smaller increments.

- Please tell us about your experience with 1.9 on Discord chat. Since this is a rather big update regarding changes, it is expected that you find issues and also the new volume curves might come a bit unexpected to you. But i believe this was a step that should have happened way earlier and was necessary to apply, all in the hope that it will enhance your experience with MDT and feel more solid, than it was before.

18/10/2024:

Encoders:

- Small encoder caps are now 5% smaller
- Tiny adjustments
- Added a new, plain encoder cap as alternative

LiveSequencer:

- fix delete last note crashed
- fix editor opened from menu did not get mini in
- fix note selection only up to 127 notes limit
- minor other changes

16/10/2024:

New LiveSequencer PianoRoll Editor

- cycle through tracks by pressing track button
- open track's instrument settings
- view mode: zoom and scroll x and y
- edit mode: select between visible notes and modify layer, noteOn, noteOff, velocity and note. scroll all right to delete note, confirm with red button or ENC_R
- step recorder: move cusor within stepsizes configurable from 1 to 64 (also triplets), press key(s) to record at position. recording layer can be selected (existing ones or a new one). for now, step recording is only possible when sequencer is stopped.
- layer states: filled is active, only border means muted
- pressing keyboard key(s) highlight a horizontal bar showing active note(s)

further changes:

- livesequencer now also updates GUI with 40Hz for smoother rendering
- fixed livesequencer bug where recording beyond last layer was attempted and track continued blinking red until reboot
- more proper fix of livesequencer bars drawing beyond borders

15/10/2024:

- Release 1.8.8

- Every internal instrument and instance now has a (fake) "OFF" MIDI channel you can set it to. This avoids blocking MIDI channels by MDT internal instruments that you want to use for other music gear. Setting anything to OFF also will prevent that it is played by the internal sequencer.

14/10/2024:

- Release 1.8.7
- Background of 3.2" capacitive display now should be less cloudy. This enhancement might also apply to the 2.8" capacitive display or is just an illusion because of slightly better contrast.
- Global delay of 10 Milliseconds now added for ALL configurations since i got bootloops from my 2.8" device without it

https://codeberg.org/positionhigh/MicroDexed-touch/releases/tag/v1.8.7

11/10/2024:

- Added 12mm encoders (new default)
- Added, edited and test printed .stl 3d Model - 12mm encoder caps
- Updated Manual: BOM, Encoder chapters

06/10/2024:

- Release 1.8.6

- Sample Envelopes Every available sample in MDT now has an own volume envelope. This applies to all firmware versions for MDT. However, it was currently mainly tested with the PSRAM firmware The main benefit with envelopes is when working with looped samples. But as said, an individual envelope is applied to every sample playing. You can not only use it on looped samples.

- Fixed some missing delay-send-levels when reloading a performance. Until now it was necessary to open up once the MASTER EFFECTS page to load all settings completely. This now should happen automatically when just loading any performance.

- Due to the envelopes it is possible that some samples sound cut off. Go to the DRUMS page and enable SMART FILTER. Then scroll through the samples, only the used samples will show up. Look if you can find samples with missing or incorrect Envelope settings to fix up the issue.

- GLOBAL DELAY2 was not working correctly since introducing the STEREO Samples. This is now fixed.

04/10/2024:

- added sample looping for PSRAM Firmware
- loop up to 2x8 = 16 samples in MSP with 2 different loop modes
- looped samples can be played live and also used in both sequencers
- updated MDT Manual with basic instructions for looped samples

28/09/2024:

- updated MDT Manual

27/09/2024:

- Onboard recording/resampling : the MDT Output is now saved into a new RECORDINGS folder on SD card (autocreated if needed)
- Onboard recording/resampling : UI waveform improved while recording
- When onboard recording/resampling the MDT Output (internally) the output file is now not RAW but a full, stereo WAV File
- This allows to reuse the sample directly as a new sound source in the MDT Sample player (MSP) or to be further processed by the sample editor and used as slices in the sequencer(s)

25/09/2024:

- Filesizes added in web remote

24/09/2024:

- Filters for samples/drums are back. You can now apply lowpass/bandpass/hipass to each sample individually. This also applies to stereo samples. In fact, every sample is now processed in stereo, even the mono samples.

23/09/2024:

- improved line/pixel drawing in web remote console
- fixed displayed file sizes in file manager for SD Card and PSRAM

22/09/2024:

- release 1.8.5

- fixes for pattern editor, velocity editor and sample editor
- autocreate CUSTOM Folder if not exists
- fixed issues for loading and saving slices in performances

21/09/2024:

- Improved Sample Editor: Already selected slice sample is now not so easy to overwrite by accident. To change it, you now have to first unset/clear your previous selection.
- Other small UI fixes

20/09/2024:

- Added slicing capability to a single sample All the following changes apply to the MDT_PSRAM* Firmware only

Sample Editor:

- Any sample (it does not need to be a custom sample) can be (auto) sliced into 1,2,4,8 or 16 slices.
- Start- and Endpoint for each slice can be tweaked manually
- Added "ScrollSpeed" Touch button. This changes the speed you can edit the Start/Endpoints in 1,2,4,8,16,32..512 increments
- Added "Auto Align" Touch button. When this is activated (red), editing a Startpoint will auto align the Endpoint from the previous slice and when editing a Endpoint it will auto align the Startpoint for the next slice (if availabe)
- Added preview for whole samples and slices. To preview a full sample, set slices to 0. When slices are activated, it will preview the slice that matches the text cursor position of the currently selected slicepoints (Start or End) of a slice

Pattern Editor:

- Pattern editor is now extended for the new content-type "smpSlice". Scroll all the way to the right in pattern editor to change a pattern to content-type for slices.
- After that scroll all the way to the left. You can now select from all single Slices from the choosen sample.

Song:

- The Track Type selection is now extended for slices. Instead of selecting DRM, select SLC to play Slices in this track. This is important. Both Track type in Song and Content Type in pattern(s) MUST be set to slice mode to work.

Manual:

- Added basic description/function for working with slices

Livesequencer:

- livesequencer support for sample slices

12/09/2024:

Livesequencer:

- fix progress bars drawing too wide sometimes
- fix sometimes continued playing after song recording stopped
- add name performance button to TOOL_SEQ

Drums/Samples:

- add /enhancements stereo waveform plotting

Enclosure:

Test printing is still happening, however, just to let you know:

- Since a few days all case designs (except the metal enclosure) have now a common design base, it is now possible to mix and match parts, even from different print types.

So now you can, for example, put a SLA printed lid part on a FDM/Self printed PLA bottom part, or the reverse. This is now possible since the bottom parts are now nearly identical, except the printing process dependent threaded inserts handling: For the SLA part these need to be glued in, for the FDM print they also could be glued in (when using the SLA design) or melted in, when you choose the FDM print file.

11/09/2024:

- Improved/unified self printing enclosure parts (FDM printed)
- Bottom part is now identical in spacing to the SLA printed case
- Top Part is now available for 2.8" and 3.2" display, with and without microdexed logo
- Removed previous printing versions that made more confusion than necessary
- Added images and updated text in the manual for the self print enclosure
- Small fixes in the manual

06/09/2024:

- improvements and additional chapters in the manual.
- added basic support for stereo (custom) samples. This is working in the sample preview in filemanager for PSRAM, in the sequencer and in MSP (MultisamplePlayer). This is only available when using a PSRAM* Firmware.
- when previewing a sample in filemanager from SD Card, the preview will now play in stereo if it is a stereo sample.

03/09/2024:

- draw a sample waveform in drums screen for PSRAM and PROGMEM builds.

02/09/2024:

- Most of MDT documentation is now destilled into a single file that, from now on, will always be located at:

https://codeberg.org/positionhigh/MicroDexed-touch/src/branch/main/doc/MicroDexed-touch-manual.pdf

- Corrected a lot of grammar and spelling issues
- Updated or replaced outdated pictures and information to reflect the most current state
- Added individual chapters for synth engines

30/08/2024:

- release 1.8.4
- both sequencers are now fully in sync
- small fixes

28/08/2024:

- count in for recording in LIVESEQUENCER by having REC already activated before pressing START
- bug fixes and code optimizations
- tested 16MB PSRAM chip

27/08/2024:

- release 1.8.3
- live sequencer now supports 12 instead of 6 tracks. use ENC_R rotation to switch screens
- support deselecting an active value by pressing ENC_R
- moved track quantize and velocity settings to track setup in TOOL SEQ
- show track quantize and velocity below track buttons
- reduced GUI drawing to quite the minimum needed. no flickering anymore in song automation
- show performance name
- fill notes tool now has note velocity setting
- add some frequently used page shortcuts to TOOL SEQ screen
- bugfix : file manager for PROGMEM only build was broken
- bugfix : Custom samples at non existent MIDI key positions caused to play audio garbage from memory

- bugfix : 8MB PSRAM capacity was displayed wrong (changes for 16MB will be coming soon)

CAUTION: a performance saved with this version will contain 12 tracks and will crash on load when loaded with **older** firmware!

24/08/2024:

- release 1.8.2
- drum effect levels did not save/load completely due to memory issues. This is now fixed.
- updated demo/performance content. Please do not forget to copy over the updated performances from this release to your SD CARD.
- Added new demo performance including all vocal samples shown in recent youtube video. This will only work on the PSRAM firmware fully.
- If you make your own performances, they will be autoconverted. As soon as you save them with the new firmware, they will be saved in the new format.
- If you are really cautious about your own files/sequences etc., it is probably a good idea to make a BACKUP of the SD CARD performance folder to your PC - before doing any firmware update. However, except the incomplete drum effect settings mentioned above, so far there are no known issues about the file conversion process.

20/08/2024:

- added preview functionality in the file manager for samples in PSRAM. A visual progress bar is unfortunately not available, yet. Other than that it works now the same as from SD-Card or SPI FLASH.
- fixed ui for position and size of PSRAM. Extended to support 16MB or more (in theory)

18/08/2024:

- Virtual keyboard now does not make any unnecessary screen redraws when opened for the first time after boot
- Virtual keyboard note range is now adjusted to include the custom samples correctly

17/08/2024:

Release 1.8.1

-fix up file names/display names of custom samples

17/08/2024:

Release 1.8

The following changes affect mostly the firmware type MDT_PSRAM_CAPACITIVE

Custom Samples for Teensy with 1 or 2 PSRAM chip(s) How does it work?

- Go to file manager, touch **COPY>PSRAM** , SD folder should switch to /custom/
- Select a sample from the SD Card on the left side and confirm with ENC[R] push.
- If you want to load to a different sample slot, touch the right window and scroll with ENC[R] to the slot you want to load it in.
- Custom samples are then available in the pattern editor, exactly the same as the preset samples.
- The custom samples are also usable in MSP (MultiSamplePlayer).
- Also Live Sequencer now can address the custom samples via MSP.

Notice: It is possible to also replace the stock samples loaded from /DRUMS. However, names and location of these samples are fixed to the firmware. I suggest not that route in your first testing but go for the new 20 custom sample slots as described above. Samples are expected to be 16 bit, mono, wav format. Keeping the filenames short helps.

- fixed issues with non existing samples trying to play from empty slots
- fixed some visual glitches with sample names

16/08/2024:

- custom samples are now saved and loaded with a performance
- expect to get visual glitches or worse, this is a very early preview of the PSRAM-sample build

- go to file manager, touch copy to PSRAM, sd folder should switch to /custom/ select sample from the SD Card on the left side and touch the right window for the location in PSRAM on the right side. Scroll to the slot you want to load it. Confirm with ENC[R]
- Custom samples are then available in pattern editor as the preset samples
- It is possible to also replace the stock samples loaded from /DRUMS. However, names and location of these samples are fixed to the firmware. I suggest going for the new 20 custom sample slots for your user samples. Samples are expected to be 16bit, mono, wav format.

12/08/2024:

- working on custom samples from PSRAM

09/08/2024:

- Release 1.7.2.1 Sample loading will be displayed at the boot procedure

09/08/2024:

- MDT introduces a new binary: PSRAM_CAPACITIVE
- New release : 1.7.2
- All previous build versions still exist and will be updated, too. This is just a new (but very exciting) option that is added.

PSRAM_CAPACITIVE is the first version that offers/requires a PSRAM chip on the Teensy to work with (custom) samples. From what we have experienced by now, this seems to work flawless (compared to the previous SPI FLASH based method)

Instead of preloading your (custom) samples from SPI FLASH, this MDT build starts off empty and loads all default drum samples from the SD Card /DRUMS directory to the PS RAM Chip at boot. For the stock/default samples, this takes about 1-2 seconds.

What this means is that you now can edit/modify/copy standard 16bit/44KHz wav mono samples, in the /DRUMS folder on the SD Card (Replacing the Files with the same Filenames of the preset drum samples) and they will be loaded to PSRAM at every boot of MDT.

This is so far the easiest way to change preset samples, it couldn't really be much easier to customize or replace the samples now.

- We will investigate if and how this can be extended into banks / kits of samples or how to integrate it into msp, multisample player in the future

- If you do not have a PSRAM chip on your Teensy and are unable to solder it by yourself or by a friend, you can get a fully loaded Teensy from protosupplies.com

21/07/2024:

- There is now VERY basic functionality for adressing external MIDI devices from LIVESEQUENCER as a destination. The destination selection still happens in the SONG page of the LSDJ style Sequencer. Here you can select all the internal sound generators like Dexed, MS, ePiano etc and also MIDI Channels 1-16 from USB Host, DIN/TRS and internal MICRO USB ports. (Identical for both sequencers)

20/07/2024:

- When using the button interface (or a USB NES Controller on the HOST port) you now can change master volume by pressing and holding SELECT and UP / DOWN Keys at the same time. This will work in almost all pages and the main menu that have not special functions for quick navigation already assigned for the sequencer. The volume control will speed up with time according to the setting in SYSTEM - SYSTEM SETTINGS - GAMEPAD/NATIVE KEY SPEED.

19/07/2024:

- Updated bom to reflect extended (current) display and case/enclosure options.

07/07/2024:

Hotfix:

- when Sequencer was set to internal or master mode but an external MIDI Clock was applied to a MIDI input, livesequencer tried to sync to that external clock. This is now corrected.

07/07/2024:

- Added all 3 original available dexed engine types :

Modern : this is the original 24-bit music-synthesizer-for-android implementation. Mark I : Based on the OPL Series but at a higher resolution (LUT are 10-bits). The target of this engine is to be closest to the real DX7. OPL Series : this is an experimental implementation of the reversed engineered OPL family chips. 8-bit. Keep in mind that the envelope still needs tuning.

I honestly do not hear much differences between them but maybe you do.

- Renamed System "Misc Settings" to "System Settings" You can select the dexed engine type there. It will be applied to both dexed engines as a global setting at boot.
- Updated to latest SynthDexed code from @C0d3man , the original creator of MicroDexed on teensy

04/07/2024:

- Dexed chorus (modulated delay) is now working (for both instances individually)
- Dexed chorus settings in all detail are available and editable in dexed - "audio" menu
- Chorus settings in the demo performances are set to 0 - so to actually hear the chorus effect, you have to increase the level, speed and depth setting in dexed audio
- You now can quickly jump directly from dexed voice screen into chorus, delay and reverb settings pages by clicking on "EDIT" right to the level gauge for the corresponding setting
- fixed some panorama issues in dexed
- Dexed chorus is currently centered in the stereo field, no matter where the dry signal is placed in the panorama. Let me know if you find it better if panning it together with the dry signal or not

02/07/2024:

- LiveSequencer now always finishes pending notes before a new pattern starts. fixes very rare noteOff not played
- Moving the cursor in sequencer settings does not confuse sequencer timing.
- Scope mostly rewritten. Plots its log scaled value to available height. Scope should use less CPU now

25/06/2024:

Several small adjustments to the hardware/pcb parts:

- PCB-based front plate should no longer have the PCBWAY-IDENT Number visible on the front. Instead it should now be located on it's backside and not be "visible" any more
- reduced/minimized text on the PCB-based front plate for a cleaner design
- Added further info to the (invisible) back side of the front-plate like hole sizes etc.
- MDT Main PCB: Drill Holes for the MiniJacks now are no longer circular but oval in space which should fit better the pins of the connectors
- MDT Main PCB: PCBWAY-IDENT should be placed better and not randomly
- MDT Main PCB: spacing of the MiniJacks, specially the MIDI out port, should be better aligned with the SLA printed case
- PCB-based back plate now has text indicators for MIDI IN, OUT and AUDIO
- PCB-based back plate should reflect the oval shaped holes of the updated MDT Main PCB and are bigger in general to cover up excessive soldering points better than before
- PCB-based back plate: PCBWAY-IDENT should be placed better and not randomly
- PCB-based back now has been modified to make the Teensy SD Card Slot more accessable, it now should be possible to swap/insert/remove the Card without screwing apart the top or have to use any tools to reach the Card

23/06/2024:

Release 1.7.1

- Added MIDI MASTER (CLOCK SYNC) to sequencer. When activated, MDT will send out MIDI clock to USB-HOST, (Micro-)USB and TRS-MIDI simultaneously. If you want to use MIDI Sync, this mode is the prefered option since it provides best timing and smallest additional system load.
- small improvements for all MIDI CLOCK SYNC modes.

- Scope view is now detached from the Master-Volume and instead captures the level right before going into the Master-Volume adjustment. This means it should display audio activity at much higher levels, even when Master Volume is at 0. So now the scope is a valid visual tool to check if MDT is playing something, even when you have no headphones/amplifier etc. attached.
- Virtual Keyboard now should work with drumpad view in all screens where Virtual Keyboard is available.
- CONFIG SAVE Notification should no longer draw over the virtual keyboard, when used from the main menu and changing System parameters like Master-Volume.
- When the velocity editor and sequencer plays and then is stopped, the scope view was not cleared out correctly. That is now fixed.

22/06/2024:

Sequencer:

- Sequencer will follow MIDI CLOCK SYNC (Enable/Disable it in SEQUENCER/SETTINGS) Timing is solid for voice instruments (dexed etc.), not so good for samples (small delay - if possible, put your timing critical drum samples on the MIDI Master to solve it)

Livesequencer:

- Livesequencer will now also try to follow MIDI CLOCK SYNC (if enabled) but this is currently more a proof of concept and a bit sloppy sounding. Livesequencer is not working with hard steps but has much higher internal timing resolution. This can not be directly mapped to the 24 beats per quarter note of the MIDI Standard. Livesequencer will try to match to the external tempo by measuring the time between every 1/8 note and then recalculating every note based on this time, each 1/8 note. Going higher, like a 1/16 note, in real time, takes too much CPU and makes the result even worse. Work in progress.

Common Issues:

- The Delay1 & Delay 2 Times are recalculated at every tempo change (when they are set to a SYNC Tempo like 1/8, 1/8T, 16T, 16 etc.) but since the incoming MIDI CLOCK has some variation of +-1 BPM per step (sometimes even +-2 BPM) , this causes the recalculation of the delays for every step and produces some audible audio clicks (even when tempo in reality is not changed). These small changes are now ignored for the delay calculation. If using the internal timing, it still will recalculate it for every tiny adjustment as before

14/06/2024:

Livesequencer:

- fix wrong arp behavior regarding arp input and played track
- implemented livesequencer real time bpm adaptation to global tempo (when changing tempo in seq. adv. settings)
- fix crash on opening empty livesequencer while sequencer running
- delay all arp events by 1ms to make sure when in track source mode, quantized notes are already on when sampling

13/06/2024:

- liveseq editor better scrolling, UI fixes, better stability

09/06/2024:

- Livesequencer Graphic Editor - added note-add/copy note There are issues with scrolling around that are unsolved. If you want to use the copy-note function, it is (currently) easier to first scroll near the area where you want to copy. Then select the note to copy with SELECT NOTE and Encoder R, PUSH COPY NOTE move up/down with ENCODER R where it shall be copied confirm with either the COPY NOTE or the NOTE VALUE touch button

07/06/2024:

- Livesequencer Graphic Editor - improved stability
- Livesequencer Graphic Editor: Navigating X/Y and Zoom now working in general
- Livesequencer now can directly jump into Graphic Editor by long-touch of TRACK Icons in LiveSequencer

04/06/2024:

- Livesequencer ListEditor - now stepping through note edit steps is available by touch button and also by pushing Encoder_R
- Livesequencer Graphic Editor (early alpha) - should be less frequent to crash and can now edit note values and velocity graphically

03/06/2024:

- Improvement: FORMAT FLASH After formatting the FLASH Chip, you will be presented with the option to copy the default Samples to it. It is no longer necessary to go to FILE MANAGER and push the COPY PRESET Button. (You can still do this, it will skip all existing Samples and just copy over what is different since the last copy).

30/05/2024:

- LiveSequencer Editor (Listview) will now try to delete also the corresponding note-off event when you are deleting a note-on event. Also it should protect you from deleting a note-off event only, by mistake.

27/05/2024:

- release 1.7.0 https://codeberg.org/positionhigh/MicroDexed-touch/releases/tag/v1.7.0

- Introducing LiveSequencer Editor. The editor is a (low level) tool to manipulate note data behind the curtains of LiveSequencer. LiveSequencer can merge and delete patterns very easily like a pro but can not modify data inside the patterns (yet) after recording. So this is my attempt to allow (small) changes to the data, without recording a pattern again when there are only small mistakes or problems.

- LiveSequencer Editor can:

    - delete notes from LiveSequencer
    - change notes/pitch, velocity and time value
    - helps you to find duplicate notes , erase or change them

24/05/2024:

- fix crash on record with too many layers. was caused by a copy-paste error using LIVESEQUENCER_NUM_TRACKS instead of LIVESEQUENCER_NUM_LAYERS. cleanups
- fix pages opened from livesequencer got overdrawn onStopped. keep processing midi in for all pages opened from here
- fix tick timer too slow and not triggering events just at end of pattern reliably

14/05/2024:

release 1.6.9

this adds a live arpeggiator implementation to live sequencer:

- settings: speed, number of octaves, 8 modes, note length, swing (+/- 8 steps), velocity, latch, repeat notes
- arp source can be keyboard or any track (automation possible with song mode)
- sample times 1x to 4x per bar

26/04/2024:

release 1.6.83

- massive improvements to pattern editor and virtual keyboard, too much to list
- fixed display glitches on screen and on remote console
- the virtual keyboard tries to be much smarter. When opening vk in dexed screen, microsynth or braids, it will autoselect its page
- when in pattern editor and switching to virtual keyboard, it will try to open the best editor for the current pattern
- new drumpad view in pattern editor with rest and latch feature. The latch feature is only usable on instrument tracks
- step record with virtual keyboard and new features is now stabilized. It should work with external MIDI input device as well as internal virtual keyboard

work in progress:

- content type changes of pattern will now update in realtime in pattern editor
- display content when changing to and from virtual keyboard glitches fixed
- fixed pressed virtual keyboard keys status for pitchable samples
- colors in step record input are fixed

Step Recorder Enhancements:

When step recording is enabled you have some new and improved options, just with using the touchscreen:

- When recording, you can toggle to modify just the current step, or auto advance to the next step endless, or auto advance and stop after the last pattern step.
- latch/tie : you can add latch notes with a new touch button (this will only work in instrument tracks/instrument content type, not for samples)

- rest/clear: you can clear a step with a new touch button, this works for all content types.

NEW virtual drum pad keyboard:

- apart from the piano keyboard view, now there is a new drum pad view. Sample Names will be shown inside the drumpad icons. This makes it way easier to input drum patterns on MDT alone, with no external input device. Samples can be scrolled up and down in octaves. The drum pad view shows 12 pads at a time and can be scrolled through 5 octaves.

24/04/2024:

- Release 1.6.82

Pattern Editor:

- now when selecting/scrolling through the preset samples, the sample will auto play (at slightly reduced volume so it should not get annoying very fast) Let me know in discord if you find this too distracting so it should be changed into an option or find any stability issue with it, so far i have not seen any issue even i was expecting to get problems, specially when scrolling really fast with samples from FLASH. I also was expecting some kind of slowdown from this change but i don't see any.

Note: The preview will not happen while the sequencer is running. This is intended behaviour, the same as in previous post where the preview of sequencer step sounds was added.

- some samples were missing or had a name mismatch, if you still miss samples after this update, make sure you copy the wav files from the addon folder to SD Card and get them on to flash with filemanager (push touchbutton COPY PRESET). You do NOT have to format your flash, only the missing files will be copied. If you still find that a sound is not playing, it is probably playing at a very low volume. Check in DRUMS page, each sample has its own volume setting

23/04/2024:

Pattern Editor:

- samples and pitched samples as well as notes from instrument tracks now will play their sound sample / note when scrolling through the pattern.
- when inserting a new step into the active sequence, the corresponding sample/pitched sample or the MIDI note will be played once. In case of an instrument track, this currently will be played by the mda ePiano, no matter what instrument the pattern actually is assigned to or will be assigned to in it's track, in song view.
- the piano sound for preview is very short by default but you can just increase decay and release time of it in ePiano page
- when the virtual keyboard with step recording was enabled in pattern editor, the touch-velocity bar was not alligned correctly, that should be now much better
- the instrument + touch button of virtual keyboard in the pattern editor was behaving unreliably (only working at the outer top right corner) because of a touch button conflict with a button from the interface with the virtual keyboard not showing. This is now fixed and both touch buttons will behave as expected
- fixed minor visual glitches from too long text displays in sample selection
- drum samples, when previously not used but saved to a performance turn out to be saved with a volume of zero which leads to the "bug" that previously unused sounds were muted. This is now fixed, only sounds that have set a manual value will be loaded and the unused ones will get a default volume of 100 so you can hear them without changing all of the manually.

22/04/2024:

- RELEASE 1.6.81
- forget about the inconsistent scrolling behavior between song and pattern page:

Now, when scrolling from song to pattern page, you can do that continuously with Enc_L. So when you switch to pattern mode you need Enc_R only for activating and deactivating the parameters and changing the value. The scrolling all can happen with Enc_L, all the time.

- The previous behavior for scrolling with Enc_R is untouched, so you can still do that, as before.

However the global Volume Change is now gone in the pattern editor with Enc_L. I think it is worth it, since it now feels much more natural to browse through the full sequencer functions and pages, without going to the main menu, at all.

Notice: When you start up the pattern editor at boot, without touching song page before, the scrolling will behave, as it was before to avoid confusion.

22/04/2024:

- RELEASE 1.6.8
- UI fix/cosmetics: When using the pattern auto-fill function in the pattern editor, while the sequencer is running, parameter highlighting color was overwritten with the moving sequencer cursor. This is now fixed and the current selected parameter that is modified is indicated in red brackets (as usual)
- Song/Pattern Editor workflow improvements: When working in a song editor, it was previously not possible to jump to the linked pattern(s), without using the lsdj-like native buttons or a USB gamepad. You had to exit the page and go to the pattern editor manually though the main menu.

This is now improved.

When you are in edit mode in the song page and scroll to the right with Encoder_L, after going to chain and then to transpose, the view will switch to the corresponding pattern in the pattern editor. However the situation is still a bit unnatural feeling since in song mode you use x/y navigation with BOTH encoders but in the pattern editor it is just left/right with Encoder_R and Encoder_L is getting it's "normal" behaviour, meaning changing master volume level.

Nevertheless, you now CAN go back to the song page, by just scrolling all to the left, but with Encoder_R. As said, that currently requires a litte mind switch since in the song page, you navigate left and right with Encoder_L and up down with Encoder_R, since it is a grid view.

To avoid confusion about that, this jumping page behavior will only occur when you open the pattern editor by this new way (scrolling to it from song page). If you just enter the pattern editor by the regular main menu, without this new navigation tool, it will behave as it was before, meaning it will not jump and not scroll any further than the first parameter available in the pattern editor.

14/04/2024:

- continued work on side chain compressor
- removed boot delay for PSRAM configurations - please open an issue ticket if this causes any boot problems with details about your configuration (display type, PSRAM size etc.)

08/04/2024:

HOTFIX: Dexed voice select confirm button was setting live modifier envelopes to zero

02/04/2024:

Enhancements DEXED voice screen:

- added favorites search touch button to toggle between all presets, favorites only, non-favorites,random non favorites.

This setting is identical to the system setting but not saved permanently, only set during device runtime. You still can set it permanently in the SYSTEM submenu FAVORITES This also makes sure you can switch the modes when there is an issue with touch, so you can always change it in the traditional menu. The new touch button makes it much quicker and convenient to tag and search for your favorite voices without leaving the voice screen.

FIXES:

- Fav. search text was not aligned perfectly, this is now fixed
- touch buttons for dexed voice live modifiers were slightly offset, that is now corrected
- unnecessary redraw/screen flashes of live modifier touch buttons enhanced
- live modifier CLEAR button was not implemented fully, this is now corrected
- While the editing mode of performance modifier attack/release is active and going to virtual keyboard, it is possible to still change the value, even if the touch button is not visible on screen. This is good to have but currently not best visualized, work in progress. However, being in this state there was a visual glitch when changing voice presets while virtual keyboard is displayed and modifier edit is still active. This is fixed now.

- binaries in repo updated

23/03/2024:

- when drum samples are played from keyboard with drum screen open (from livesequencer), the sample is selected. this makes finding drum samples very easy.
- made midi note to drum sample note lookup much more efficient

19/03/2024:

- small fixes for MIDI SYSEX path issues

03/03/2024:

- drum channel problem when playing from an external MIDI device - drums are added to the current selected channel, no matter what channel is selected
- disabled live sequencer for now since this seems to cause the issue
- upload the latest binary, if the problem still persists, check if you really have set the drum channel to something other than ONMI.

15/02/2024:

v1.6.73

- small fixes for drum page
- waveform will be auto disabled when streaming samples from flash while in drum page
- you now should be able to start and stop sequencer even when in drum page as usual by long press ENC_L, it should not lead to any crashes anymore when using FLASHMEM

14/02/2024:

- small enhancements of drum page (added waveform display when compiled for FLASHMEM)
- drum parameters will update now correctly when cycling through samples

13/02/2024:

Small bug fixes v1.6.72

- small fixes to livesequencer
- arp_num_notes_max was not loaded or saved in performance
- ep_delay_send_1 & 2 were not loaded or saved in performance

11/02/2024:

Hotfix: Release v1.6.71

- disabled default metronome of live sequencer

02/2024:

Fixes for LiveSequencer:

song length was incorrectly saved/loaded and displayed

fill track rounding error, made beat to be off at some bpms

song events were played once in pattern mode after loading

corrected button colors

Release Firmware v1.6.7 Featuring:

Live Sequencer implementation in MDT

Quick howto:

define 6 instruments to tracks 1 - 6 in song view. Assign all different MIDI channels (also for your keyboard, events are forwarded)

open "Live Sequencer" in Sequencer menu

a simple drum track layer is added automatically to have some tempo

not recording: play as you like on a selected instrument (GREEN is active). Click on Green button to open instrument page

press "REC" as soon as you like to record (Recording track is RED). Start to play at beginning (0.0000)

When the pattern ends, a new layer is added. While recording you can abort by clicking the blinking button.

then continue with other layers / tracks as you like...

by clicking on layer, layer mute is toggled. Click on recording track (Red) to cycle through layer menu (merge up / delete)

In Song Mode, track mutes and additionally played music is recorded. To end song recording, press "Stop". The longest song layer defines song length. If not recording, song will loop.

Pattern Mode:

One click instrument selection

Layer based live recording with quantization support

Layers can be muted, merged and deleted after recording

Tools menu with quantization setting per track

Fill notes tool (not really useful)

Pattern length selection

Current GUI limitation: 6 tracks with 4 layers each

Song Mode:

Record track mutes and midi notes over time and replay them. Instrument change during recording supported.

Song Layers also can be deleted and merged

Allows basic song composition

Pattern and Song data is persistent. Normal Sequencer and Live Sequencer can be used in parallel.

- updated PCBWAY faq
- updated MDT faq what you will get when ordering the pcb+assembly option
- added rendering of pre assembled pcb
-
- fixed wrong IC socket picture
- added detailed part list of included and excluded items
- added pictures and short instructions about main jumper settings

06/12/2023:

- small bugfix: resistive touch was broken after doing some work for capacitive yesterday

26/11/2023:

- release 1.6.4
- fixed broken note-latch
- reverted some changes about volume control: when multiband compressor is on, now a manual volume change by ENC_L will disable the compressor instantly. This might be annoying at first usage. Volume level changes can be massive with the compressor so this is a step to make it safer to use. Please be very careful whenever enabling the compressor and expect that audio level can go up 10x or even more depending on what parameters the compressor currently is set to.
- small UI fixes

24/11/2023:

- release 1.6.3
- enable digital audio output: S/PDIF / Toslink by default. Digital output is free of all kind of noises. This might be the prefered output if you are recording from MDT or in a live environment. S/PDIF is tested with a coaxial output connector. It also should work with an optical, Toslink style cable but that is so far untested
- When the mastering/multiband compressor is set to on and volume change is requested by ENC_L, a help message is displayed that volume will stay at max. level while multiband compressor is enabled. While mastering, you do not want to change the master output level since this would reduce dynamics/output bit-depth. Just disable the multiband to change volume settings while composing, arranging or doing other operations with MDT.

19/11/2023:

- improved master volume scaling and handling
- updated links of MDT releases
- deleted outdated releases
- added v1.6.1 unified release

18/11/2023:

- working on an option for getting a partly build MDT version by PCBWAY

code fixes by damster:

- fix screensaver 2/2: while playing midi, screensaver used to pop up shortly. now resetScreenTimer() is called at midi key note on
- inhibit screensaver while any midi notes are playing. before this was only when the sequencer running in song view.
- code reduction for screensaver timer reset and abort conditions, reverts parts of my recent pull request since no more needed
- remove dead code
- screensaver ids now defined in enum for readability
- fix random screensaver could pick the same screensaver again :)
- fix terrain_init was not called in random screensaver mode
- random screensaver transition effect written simpler
- the terrain screensaver also uses dynamic color. and color gets darker at the horizon. looks almost realistic
- terrain screensaver now also has both logo versions randomly picked
- screensavers now with 25fps. looks smoother. cpu seems not to care much
- swarm screensaver has color changing circle predator now

15/11/2023:

- some code enhancements by damster regarding PSRAM & capacitive touch bootup, screensaver and other fixes
- updated readme, descriptions, 3d print models, screenshots / photos, links on PCBWAY and codeberg

14/11/2023:

- v1.6 first unified release for both MDT versions

12/11/2023:

- updated BOM: sources for buttons, headphone amp. Notice: Headphone amp has noise issues. Previous output is still available and is unaffected.
- updated, test printed SLA enclosure. For the added buttons, make sure to order not too long push buttons since this will be difficult to fit to the enclosure. read BOM instruction notes.
- Headphone Amp Option: Be noticed that is not working perfectly. There are digital noise issues. DAC output (as it was previously) is unaffected.
- ordered SLA prints from PCBWAY for testing in standard white and transparent
- put future enclosure parts on PCBWAY (you can order them now but at this moment they are untested)
- added pictures and updated texts for new version of pcb on PCBWAY
- linked items and updated texts on codeberg and PCBWAY
- reworked Threaded Inserts for SLA enclosure screws to fit with new buttons
- moved button holes and estimated more ideal placement for DAC jack and the 2 new buttons
- made measuring tests with self printed parts in FDM to test out changes to the SLA printed parts

11/11/2023:

- line clipping that allows terrain screensaver back on web remote (thanks to dronus)

10/11/2023:

- release PCB capacitive touch: https://www.pcbway.com/project/shareproject/MicroDexed_Capacitive_Touch_64970fee.html

Enhancements to prior version:

- Capacitive touch display (works similar like your current smartphone touch)
- Easy Access: PROGRAM Button (mainly useful for development)
- Soft Power on/off (aimed at users building their own power/battery solution)
- Option for Headphone amplifier

Tested so far:

- display ok
- touch ok
- usb host MIDI ok in and out
- button for PROGRAM
- button for SOFT POWER
- DIN/minijack Type B MIDI in
- DIN/minijack Type B MIDI out
- Headphone Amp, powered from PC USB Port - Works but some noise issues in some circumstances. Need further test with clean power source
- with Headphone Amp deactivated/skipped by jumpers, works as intended / no noise issue found so far

04/11/2023:

- fixed a clear screen/refresh issue when calling virtual keyboard on remote console from main menu
- added short instructions how to convert MDT pcb for resistive touch display to "new" capacitive touch

03/11/2023:

- work on updated pcb, routing adding amp with resistors, buttons etc.
- updated schematics
- updated main build instruction pictures

30/10/2023:

- Web remote : fix the rendering for the volmeters

29/10/2023:

- Web remote : complete rewrite of the rendering engine with WEBGL (p5.js): now all antialias artefacts are gone and display is sharper with better colors
- Web remote : fix color management
- Web remote : now uses a web font (WOFF2) instead of drawing chars pixel by pixel
- Web remote : keyboard shortcuts added for the header buttons
- Web remote : big code refactoring/cleaning
- Fix background colors for some texts for the rendering on web remote

25/10/2023:

- Started working on updating build instructions for new capacitive touch version
- Continue updating pcb
- Continue updating case/enclosure

20/10/2023:

- Main Menu now has back-touch-button on all sub-menus
- Most pages, modern or "2 Line Text" now also have a touch back button
- Physical Left/Back button will remain in all cases - touch back button is always to see as an alternative to go back (for example you do not have encoders available, yet)
- UI Touch icons in pages, where they were unusable while being in the page, are now hidden
- fixed many back from page screen update/clear issues
- updated binaries

18/10/2023:

- Release 1.5.9
- Web Remote: most USB audio glitches gone
- Web Remote: countless drawing/code optimizations
- Web Remote: Screensavers nearly fully functional, Info Page working for the first time on remote
- Small UI fixes

16/10/2023:

- Release 1.5.8
- Drawing optimization to MDT and web remote (update needed for both to work)
- pixel adjustments in dexed voice

12/10/2023:

- Release 1.5.6
- Button presses now are edge driven. Press and hold keeps button pressed and does inhibit toggling
- Virtual keyboard code does no more need any gui slowdown since also edge driven
- Binary version clean up - remote console is auto-enabled in all builds. Removed/added useful/unnecessary Versions

22/09/2023:

- In the Song view, added the Teensy-internal Micro USB Connector as a MIDI Destination for your DAW with 16 separate channels. This allows MIDI recording your MD output to your DAW on multiple tracks, at once - as MIDI data.

- If you want to record notes from TrackType Drums, you have to temporarily change the Tracktype to Instrument (no data will be harmed, you can change it back anytime). You also could just reload the song after your MIDI export - or just reboot without saving.

- The MIDI labeling in the Song view is not as clear as i like it to be but for the moment this it is: USB = USB HOST DIN = MiniJack MIDI (with optional adapter to DIN MIDI) INT = Micro USB Port of Teensy

20/09/2023:

- to give a better overview about upcoming changes and things already available i started a page/wiki for the next version with capacitive touch.

https://codeberg.org/positionhigh/MicroDexed-touch/wiki/MicroDexed-Capacitive-Touch

17/09/2023:

- Working on an Hardware update with better display but at a similar price. This display offers capacitive touch and is MUCH more responsive as the current default display. However, so far only one source of this display type is available and the order amount seems to be limited to one screen only per order. https://www.aliexpress.com/item/1005005926026997.html?spm=a2g0o.cart.0.0.4c6e4ae4FvwMuX&mp=1 Note: It is possible to modify the current MDT pcb to fit this display. However this requires cutting 2 traces that are below the display connector on the MDT pcb. I do not suggest making this modification if you do not have some advanced skill in desoldering and soldering components with multiple pins.

- It will take some time to figure out software and hardware changes and the waiting for the arrival of a new pcb test version. I estimate this can take several weeks or even months, so progress on this topic is estimated towards the end of 2023.

03/09/2023:

- release 1.5.5
- fixed screensaver bug
- added swing and triplet function to sequencer play modes

02/08/2023:

- release 1.5.4 with all mentioned additions for song time signatures / patterns from 8-16 steps

- Download link, binaries are in folder "release" https://codeberg.org/positionhigh/MicroDexed-touch/releases/tag/v1.5.4

- dexed voice: when scrolling though presets on pool, bank or voice level, the voice transpose setting was not refreshed on screen correctly

- microsynth: when virtual keyboard was enabled and switching between both instances, not all parameters were refreshed on screen correctly

01/08/2023:

- working on a feature for triplet and other more unusual time signatures / shorter patterns than 16 steps.
- Currently this is thought of as a global setting for a song. So for example, if you want a song using tripet timing, you can change the pattern steps from 16 to 12 and everything should work out as intended.
- reducing the pattern length will not drop or otherwise change the content of the patterns above the last step. Everything still will be saved/loaded with the full 16 steps in place. However, to make it more clear what is playing and what not, in pattern editor, in grid view, pianoview etc, all disabled steps will be toned down by a darker gray color to make it obvious what will be played and what will be skipped
- working on some final touches that live-playback display will update correctly on screen, whatever pattern length you have set. All length from 8-16 steps will be available so that should cover a lot of the more unusual time signatures for your songs
- setting will be saved per song - not per pattern or per track (and can be changed/expanded without any data-loss)
- default value will continue to stay at 16 steps since that is the most common used value, 4/4 measure with 16 steps per pattern so no changes to your song/pattern should be required to do if you do not want to look into this feature

25/07/2023:

- release 1.5.3
- added a copy/paste function in Song Editor
- copy function can also be used to quickly clear out large areas by copying from an empty part
- both is demonstrated in a short video at : https://youtu.be/bRSscUWsitU
- clear loop function now is visually easier to see and more clearly to understand (clears only loop points, no data)
- small ui and bug fixes

13/07/2023:

- release 1.5.2
- Favorite Icons do come up at the correct but also at a wrong display position at certain circumstances - fixed
- toggle/current status of Fav during scrolling and changing instances improved
- added new (alpha) screensaver
- returning from screensaver, when you push ENC_L for volume settings, now will behave as a back-from-screensaver key
- when returning from a screensaver and you previously were on dexed voice, ePiano, braids etc. page, your previous menu item will still be selected as it was and not reset it's cursor position
- changes to screensaver, specially from OFF to another mode, now should apply directly without the need for a reboot
- added .stl files and updated build guide including the enclosure lid mod for easier sd card access
- if you feel something gone wrong in the latest release, switch back to an earlier release on: https://codeberg.org/positionhigh/MicroDexed-touch/releases We will keep the last 10+ releases there so there so you do not need to manage a history by your own. Further, there will never be an issue that you can not go back to older version. The releases downloads covers always the full state of that time, including SD card files without any exception.

Also let us know in discord: https://discord.gg/XCYk5P8GzF or on: https://codeberg.org/positionhigh/MicroDexed-touch/issues if you think to have found and new issue and what is needed to reproduce it.

10/07/2023:

- small fix coming up in next release:
- Favorite Icons do come up at the correct but also at a wrong display position at certain circumstances - fixed
- toggle/current status of Fav during scrolling and changing instances improved

06/07/2023:

- release v1.5.1
- simplified version numbering

- added boot screen checks / advice when default content is missing at boot and offer solutions to fix it

03/06/2023: dev notes (work in progress):

- bit crusher/sample rate modifier on master (and maybe individual instruments, or even on single drum samples)
- new screen saver
- new screen saver options: random, global off, individual saver selectable by name
- small chance to introduce drum sample envelopes (with decay and release values for each sample)

21/05/2023:

- fixed dexed pitch bend settings not applying correctly or not at all
- other MIDI side effects might be cured by fixing the pitch bend

20/05/2023:

- new binary release 1.5.0b22
- Sequencer BPM now can be directly viewed and modified on dexed voice screen

13/05/2023: dev notes (work in progress):

I managed to get the sample editor to not directly crash any more, when editing loop starts, ends and loop-modes. This mainly happens when a sample is still playing in the background (even though it might have been not audible). However, it is required that MDT stops all sample playback, while editing the loop parameters. Conveniently, MDT will take care of that in the future, automatically.

Having this issue cleared, I still found it extremely difficult to find valid and good sounding loop points. I will try out how much it will help when creating an "auto-zero-crossing detection" function. So when you are scrolling through the loop start + end points, only samples at zero (or near zero) should be selected. I hope that it might improve this process a bit.

Playing together with the sequencer with looped, live multisamples might become possible to a degree. At least I got it working for several minutes, then it crashed when the engine already had all sample slots in use and I tried to add chords on top of it with my own samples. Since in this case, CPU/Flash usage was already well over 95% without any manual playing (meaning 2 instances of dexed + 8 samples + effects already running), it will depend on your sequenced parts and what instruments they are playing, how much you can lay on top when you want to play samples live.

Notice: These limitations apply in general only to samples. It is usually not an issue to play braids, dexed, ePiano or other voices live, while the sequencer is running. Polyphony of these instruments are 8-16 voices each and they do not create any burden on the flash chip, only on CPU and that is comparable low.

PS: let me know in discord if dev notes like this are helpful, interesting or superfluous to you.

13/05/2023:

- global delay#2 was not setting the send value of dexed instance#2 when loading a performance or booting - fixed
- transpose value and MIDI channel value in dexed voice scrolled too fast - changed to single step increments
- when screensaver is active, it now can be stopped by external MIDI note-on (or by touchscreen or encoder movement or push)

09/05/2023:

- smartFilter. This was there before but got broken at some point when menus were restructured. Now it is back!
- activate or deactivate smartFilter in Sequencer menu or in MainMenu - Drums.
- While smartFilter is active and you are browsing through samples in MIDI Mapper or in Drums Menu, all non used sounds from the current performance will be skipped during the browsing. This makes the search for the sample and it's parameter editing MUCH quicker.
- At boot, smartFilter is always deactivated so that new users do not get confused, why they can not find all the preset samples

07/05/2023:

- reverted variable_playback to known, more stable version
- fixed display refresh when starting master effects page
- master volume control change in master effects page handling improved

05/05/2023:

- fixed graphic clash in dexed voice - release 1.5.0b16
- new binary release 1.5.0b15
- the custom MIDI channel of drums is now saved + loaded with performance. It should NOT go to OMNI, when you have not saved a custom channel in a performance. If this ever happens, please let us know in discord chat.

- when triggering samples from FLASH from an external MIDI Sequencer (or even by playing remotely) it sooner or later locked up the device when the sample was still playing from another slot. This issue seems to only have occured when using FLASH and not samples loading from PROGMEM

30/04/2023:

- improve volmeters management on MDT
- improve volmeters management on web remote
- fix band compressor volmeters on web remote

28/04/2023:

- hide "._" Mac files in file manager
- hide "._" Mac files in web remote file manager
- moved AI bank generator in web remote according to the new folder structure on SD
- better UI for AI bank generator in web remote

27/04/2023:

- found and fixed a big memory related overwrite bug for files/RAM for all kind of issues
- release 1.5.0b14
- if you have not changed the dexed files locations recently, please notice:
- Folder structure needed some changes. You can copy over the content from addon/SD to your SD Card or move the previous folders 0-99 from /DEXED/ to /DEXED/0/
- If you have spent some time selecting your favorite Sounds before, make sure you do not miss moving also the Folder FAVCFG from: /DEXED/FAVCFG to /DEXED/0/FAVCFG. If you do so, all your previous selected favorites will remain

23/04/2023:

- new binary Release 1.5.0b12
- dexed now has more space for presets. Another abstraction layer has been added, called pools
- all what was previously available is called pool zero (0) and will behave as it did before.
- You can add up 99 additional pools
- Every pool contains up to 100 banks with 32 voices, each
- Folder structure needed some changes. You can copy over the content from addon/SD to your SD Card or move the previous folders 0-99 from /DEXED/ to /DEXED/0/
- To illustrate the change, the picture DEXED_Folder_Structure.jpg is provided in folder addon/SD
- Favorites will work as before but are stored for each pool, individually
- If you have spent some time selecting your favorite Sounds before, make sure you do not miss moving also the Folder FAVCFG from: /DEXED/FAVCFG to /DEXED/0/FAVCFG. If you do so, all your previous selected favorites will remain
- muted the RED selection color a bit down so it is not so bright as before
- Favorites search modes continue to work as before. But they will not go across pools. At end of a pool, it will continue searching at beginning of the same pool
- Search modes for ALL, only Favorites, only non-Favorites, tested but there might be issues when pool is not completly filled with banks
- Design of dexed voice with parameter selections, spacing, FAV select/deselect button made more consistent and clear
- optimized drawing of Touch Button for Favorites in dexed voice
- for Pool 1, added some "AI/random" generated example bank with https://www.thisdx7cartdoesnotexist.com/

22/04/2023:

- new binary Release V1.5.0b10
- Song: Loop mode improved. Loop is now erased by scrolling up in the loop steps and hitting CLEAR (and not by picking the same start- and endstep of the previous set loop)
- Song: New Loop points will always get registered, no matter what steps were selected previously
- Song: Drawing to remote console should be improved further
- Master Volume: When changing volume in Dexed Voice, Braids, ePiano, microsynth etc. you will return to the previously selected menu item (and not jump back to the default value when entering the page from the main menu)
- All: Display values with negative values now should be displayed with correct spacing and presign
- other small fixes

15/04/2023:

- improvements to song page regarding data sending to remote console
- fixed dexed note-off not working correctly when located in main menus There are other MIDI channel/device mapping issues, currently not solved. Work in progress.

14/04/2023:

- In main menu, updated submenu texts, home icon is now gone but text should be more easy to understand where you are
- main menu should work faster with remote console

- back button text optimized internally
- back button is now drawn correctly when opening touch keyboard in main-menu - sub menu and closing it
- added additional pages to system start like main mixer, ePiano, braids, sysinfo etc.
- when Sysinfo is set as the start page, it goes straight to main menu after playing welcome sound

13/04/2023:

- remote console versions are gone, now auto detected
- improved colour scheme

11/04/2023:

- fixed sd sample preview in sample editor
- updated all binaries
- updated releases to current state

10/04/2023:

- Enhanced web remote console. Serial Interface is dumped and replaced with MIDI. Much more reliable
- Browsers previously not working might be worth rechecking. Firefox on Mac now seems to be working, not only Chrome
- web console on Mac with Chrome is connecting far more reliable as it did before
- MSP with opt. flash chip can now play looped samples live in forward and pingpong mode
- Loops for MSP samples can be set in sample editor
- sample editor UI enhanced, overview window should now be more accurate
- general display in sample editor should not show wrong or false data
- Sample preview/playback for MSP, Flash and SD Files in sample editor, small issues with SD remaining

05/04/2023:

- fixed drawing in microsynth when enabling and disabling virtual keyboard
- fixed remote console getting stuck in drawing when in info page in certain conditions
- remote console in Chrome on Mac stability improved (meaning it is working several hours without issues)
- info page enhancements: showing dexed cpu load and cpu temp

03/04/2023:

- RELEASE 1.5
- startup issues with some sd cards should be solved
- bootup time should be decreased to 1-2 seconds
- updated all binaries

02/04/2023:

- fixed loading delay effect settings when using higher delay times with PSRAM chip
- set performance load selection speed back to single steps to get more precise input
- removed outdated and obsolete stuff at bootup for SD Card like searching for it on the Teensy Audio Adaptor.

I don't expect anything to change but if you have problems with an SD Card: Please format it FAT32 (not FATex), copy the ADDON/SD folder freshly , upload the matching binary from folder /Release and let me know if there is any change.

- updated binaries

01/04/2023:

- MSP UI improvements (no zone number column, bigger filenames, main volume bar)
- fix double performance loading
- fix MIDI channels control: happens only at performance loading
- fix text color after performance saving is done

31/03/2023:

- MSP (MultiSamplePlayer) now has pitch adjustment for every single sample/zone
- MSP: matched audio levels to fit in more with other instruments in MDT
- added new MDT configuration with Hardware Buttons/Keys in addition to Encoders
- updated binaries (as always, in folder release)

30/03/2023:

- fix multisample page when editing zones

28/03/2023:

- pattern editor: Fixed remote console when in pianoroll editor
- pattern editor: Fixed remote console not updating velocity bars correctly
- updated binaries

25/03/2023:

- working on a prototype pcb with capacitive touch for the last 3 days. First version is submitted to PCBWAY:

- the 4 resistors and the diode are swapped for SMD components and in the future should be possible to be ordered by PCBWAY assembly service (as an option)

- i haven't changed the optocoupler since as a SMD component it isn't cheaper nor it is smaller. Also the availability of the "oldschool" DIP package seems to be much better so you still have to get that, from a source of your choice

- The high density display connector can not really be soldered by a soldering amateur. After i get it working (at all), i will see to offer an option, to get the pcb with just this connector (so you can put the other SMD parts by yourself if you prefer to do so)

22/03/2023:

- fixed braids filter mode when it is not set to lowpass
- updated binaries

21/03/2023:

- added fixes for web remote on mac with chrome
- toned down y-movement speed in song-mode. It was fast but difficult to land on the desired song step. That is now slower but more precise to only scroll 1 line at a time
- song view does now some caching to improve rendering speed. this might introduce some new display issues,(or not)

17/03/2023:

- binaries updated, new binary release
- improvements in dexed voice page

14/03/2023:

- binaries updated, new binary release, v1.4.9b9
- small fix: midi channels page for remote console
- dexed voice: direct jump touch button to dexed voice editor
- small code improvements in dexed voice

13/03/2023:

- MIDI Channel Update !
- This update will notice you about uncommon issues in MIDI setup (and could lead to strange problems) :
- (Multiple) Channels set to OMNI will get a warning that it might lead to unforeseen consequences (tm)
- Multiple instruments, set to an identical Channel will give you a "notice" - you can ignore this if you set it up this way on purpose - i will see to put in an option to nag you no more than once about that. Currently it is handled like the OMNI case
- removed unnecessary parameter screen flashing of other values, when changing one value
- screen font size issue in MIDI channel page fixed, when scrolling very fast
- preset pattern update is work in progress, so you should not get all these nag screens after they get an update (soon)
- until then, make sure to follow the suggested changes and then (re)save your performance - the messages should be gone and also MIDI related problems you might have experienced (or not, yet) should also all be solved :_)
- All Binaries updated. Dev Code and public repository will be updated at a later time.

12/03/2023:

- sysinfo fixes
- updated binaries

08/03/2023:

- extended the code optimization to ePiano and microsynth (localhero)

- improved value-input display-flicker-fix on braids, ePiano, microsynth, more to come
- new binaries with current changes expected to come next weekend

07/03/2023:

- internal code optimization : Started rewriting pages so that only one line of code is necessary for every page value. Work in progress - So far only Braids page is fully converted to new syntax for internal testing

23/02/2023:

- removed some ugly delay commands and rewrite with timers in sysinfo
- added audio chime to sysinfo page
- added information texts to PSRAM test
- updated binary/hex files

16/02/2023:

- some code cleanup
- made binary release and added short installation instructions

15/02/2023:

Microsynth (MS):

- fixed issue that volume of 0 was still barely audible (very quiet but it was there)
- internal re-routing. Volume for OSC + Noise are now independent. Meaning you can now control noise volume, even when OSC is set to 0 volume
- enhanced decay and release values and volume levels for MS OSC and Noise (might be louder than before)
- audio clicks while changing volumes or other parameters should make no or less noise/clicks
- Reverb is now sent after the volume control (post-fader). So there should now be no reverb tail, when volume is set to silent
- updated binaries for latest changes
- to-do: Add control for dedicated reverb send to Noise OSC

13/02/2023:

- fixed ePiano page settings not working/updating
- fixed braids page settings not working/updating
- added/enhanced screensavers
- braids voices now stop correctly when stopping sequencer and while playing
- updated binaries
- fixed for virtual keyboard with wrong MIDI notes off

09/02/2023:

- released binaries of (most) upcoming changes
- small improvement in dexed voice

08/02/2023:

- upcoming enhancements/features (work in progress):
- Removed screen flicker when browsing parameters + changing values in Dexed Voice
- Removed screen flicker when browsing parameters + changing values in ePiano
- Removed screen flicker when browsing parameters + changing values in microsynth
- Removed screen flicker when browsing parameters + changing values in braids
- New filter effect for both delay-chains (low/band/high pass)
- Added support for PSRAM Chip, allowing long delay times like 10 seconds per delay
- 1 or 2 sidechain compressor effect(s), usable by dexed,ePiano,ms,braids. Triggered by selectable drum sample

05/02/2023:

- Switch to platformIO
- Build 5 HEX files
- Versioning and automating
- Arduino IDE compatibility
- HEX files copied to "release" folder

04/02/2023:

- updated binaries

29/01/2023:

- SD file manager : allows uploading for SYX files
- SD file manager : allows renaming WAV/SYX files

24/01/2023:

- fix braids reverb chain going wrong
- fixed broken text output of PSRAM test
- fixed dexed instance reversed numbering for effects
- merged in upcoming state of sidechain (not functional, yet)

22/01/2023:

- SD file manager for web remote
- browse content
- upload/download JSON/WAV
- delete WAV files
- play WAV files

19/12/2022:

- localhero: Fix MIDI internal commands + Serial init
- dronus: removed unnecessary USE_defines

17/12/2022:

- enhancements virtual keyboard with step recording:
- virtual buttons now show correct colors, cyan for inactive and red for active
- step input now should work while in pattern editor as well as in velocity editor
- step input method should now display and clear only when virtual keyboard is active
- step input should not display extra buttons for virtual keyboard, when it is not active
- velocity input should now work in pattern editor as well as velocity editor
- most? of visual glitches together with step input and virtual keyboard should be resolved

12/12/2022:

- fixed broken screensaver, showing main menu instead

- fixes from dronus for touchscreen input race condition

- Possible solution for boot bug without pc serial attached

- Pattern editor (while in step-input mode):

1. Fixed display for Instrument/Chord Tracks showing data for drum track
2. removed "text glitch" from "Latched" to normal note
3. When in Instrument mode and step-input active, piano roll display is updated correctly for that step
4. When scrolling past last item of velocity editor, screen should not flash/redraw the same content again
5. When scrolling past first/last option of content type of pattern, screen should not flash/redraw the same content again
6. Fixed velocity input value from step-input. Input velocity now should be correctly displayed and stored

- updated binaries

- updated release

- updated binaries 1.4.8.5

- updated release 1.4.8.5

11/12/2022:

- Fix touch and buttons for web remote
- Replace legacy dexed audio menu tree options with a single page UI.
- fix drum editor volume
- Integrate the legacy Dexed -> MIDI menu option tree into Dexed -> Setup editor page (just a few editors).
- started with sidechain/volume automation
- fix web remote to be synchronized with MDT sequencer

10/12/2022:

- LOG management (for developers only and dual serial)
- updated/prepared code for Adafruit display as an future option. Work in progress.
- Announcement: Some form of sidechain compression / volume automation will be coming to dexed, microsynth and braids.

8/12/2022:

- merged code from dronus: Convert UI and param_editor structs to classes ("Editor" and "UI").
- work in progress: update pcb schematics, 3d model to reflect current state of MDT with the goal to provide a mostly pre-assembled board by PCBWAY
- work on the new adafruit display - i will have to wait to receive an adaptor to work with the "display-only" version of the display with the tiny ribbon connector, without the attached pcb. The goal is to make some kind of adaptor for the current MDT pcb with only a few modifications and better fit the default enclosure.

4/12/2022:

- as you might have noticed in discord chat, we are looking at : https://www.adafruit.com/product/1947 as a replacement / display upgrade

Display itself is simple to replace but there are some issues with the touch screen. It is not connected by SPI as is the current display, but by I2C. We do have it working in general and with touch but it will need some time to polish the code and figure out build issues.

- pros:
- Much better touchscreen, ultra precise. Similar to your modern smartphone.
- Display content looks a bit better in contrast/clarity
- Display top looks cleaner, no visible wires/cables etc.
- cons:
- Requires some modifications to pcb, including 2 manual wires and cutting 2 traces.
- Requires some cutting of connector pins on display and manual wiring and soldering.
- Enclosure lid might need some modifications to fit.
- Adafruit Display is much more expensive then default noname display

1/12/2022:

- fixed active borders in file manager with web remote console
- deleted unnecessary screen clears in file manager
- reduced unnecessary touch button drawings in file manager
- (probably) fixed font size issue in microsynth when touch keyboard is on and changing waves
- Release 1.4.8.2
- Binaries updated

30/11/2022:

- fixed visual glitch in filemanager when deleting file from SD card

29/11/2022:

- added localheros "File Manager with files sorted + UI improvements + fixes + MSP"
- fixed some visual glitches in file manager during "copy presets"

28/11/2022:

- Output of delay1 now can be routed to input of delay2
- Output of delay2 now can be routed to input of delay1

This allows for various new delay possibilities or stereo delay effects since you can control both delays individually in time, level and pan. Be careful with this feature - settings the send levels too high can cause endless-feedback-loops quickly. Do not break the matrix! :-)

- Synced delay times were only updated while the sequencer was running. This should be fixed, you now can change delay times in idle mode to all possible time synced values like 1/8, 1/8t etc.
- Added help texts how to switch between manual time and BPM synced delay times. Also there will be a message when the audio memory is not large enough to fit the requested synced delay time like 1/1 or 1/2 (max delay time currently is 500ms)
- When delay is in synced mode, it now will also show the calculated delay time in milliseconds. That might be helpful to set values on other effect devices, where you can only enter values in ms.

27/11/2022:

- release 1.4.8
- fixed delay2 issues with feedback and output levels
- feedback level was increased. Demo performances or your own performances might have higher/lower delay feedback, as before. You can adjust it on the instrument or master effect page.

- ePiano now has working delay 1 + delay 2
- braids delay improvements
- ePiano pitch / tuning issue fixed. It might be that you have stored performances with wrong pitch: go to ePiano and set "TUNE" to 0 to fix any offset.
- ePiano UI rework
- Master Effects: Now output of delay 1 + delay 2 can be routed to reverb as reverb send effects. You can still send instruments directly to reverb, this is an optional parameter to send the delay chains to reverb.
- binaries updated

26/11/2022:

- updated binaries/firmware
- updated binaries help text
- fixed some out of bounds values for braids and microsynth delay/reverb settings
- removed some superfluous variables
- corrected some typos in value assignments

25/11/2022:

- dronus: Replace the Dexed > Setup menu tree by a single page editor
- added navigation from song page to seq.settings and back by option-up/down.
- BPM is preselected, when using this jump command
- realignment menu numbers for gamepad keys
- Added graphical touch screen calibration. (System - "Calibrate Touch") Touch upper left crosshair and lower right crosshair after that. Then you can continue to the touch test page with ENC_R.
- Manual touch screen adjustments: It seems not every touch screen works equally good. I have a very good/precise and a very bad unit. On the good unit, the graphical calibration is nearly perfect. On the other unit, no matter what you do, the result is very unsatisfactory. A lot of noise and it gets very bad to the side/borders. If you have one of the last kind, to give you more options, in System - Misc. Settings you can modify all 4 values for calibration manually. The only other option is to replace the touchscreen with a (hopefully) better working one.

Calibration is so far not tested with screen rotation. Feedback is welcome. The only advice i can give is that the upper left corner must be the physical zero point of the touchscreen, otherwise it will not work.

24/11/2022:

changes from dronus:

This branch replaces the whole Dexed > Controllers menu tree by a single page editor.

Cons: -Quite ugly right now, needs layout tuning. -Sending and receiving SysEx is untested so far in the current lack of a real counterpart device. Does someone owning a DX7 or something check that?

Pros: -Easier to adjust all the controller sensitivity and modes in one place. -Shares its instance selector with the Dexed Voice Editor, future code can use that. -Introduces a generic long-button-press and alternative-left-encoder-function code future development can use and already fixes the Dexed Voice Editor. No need to change remote code parts if an UI page is using long presses anymore! -A lot of code removed. Maybe some day we can compile with "fast" instead of "small" optimization.

changes from positionhigh:

- fixed wrong number of drumsamples (displayed numbering still wrong, should begin with 1, not 0)
- temporary fix for double increments of encoder speed (need to check with dronus)
- visual enhancement in master effects
- reassignment for gamepad for 2 line menus (since menu slimmed down again)
- display speed doubled. Should feel much more responsive now, maybe also faster in remote console
- removed some of the most unnecessary #defines in code
- updated all binaries, version: 1.4.7.5

- new release version on codeberg
- scope update speed increased x4

23/11/2022:

changes from dronus:

- Removed the Drums submenu tree in favor of a single page integrated parameter editor
- Drums editor works but need some layout work and details..
- Uses a new generic UI editor page class that now also provides the Dexed Voice Editor page. This page is a little bit regressed, eg. no left encoder operator selection anymore, some regressions to the "instance" selector.

positionhigh:

- fixed reversed control of up/down key in remote console or game pad in dexed voice editor
- fixed visual glitch when using shift/option + left key from pattern editor to song mode
- all previous available delay and reverb functionality should now work in master effects
- Filemanager: Long push ENC_L will move one directory up from SD CARD
- Filemanager: When you are already in root of SD, long push ENC_L moves cursor to the top
- fixed gamepad/native key issues because of menu renumbering

21/11/2022:

- small fix in dexed editor, instance selection via top menu line was not updating screen properly
- added current state of global effects page - only showing all values on one page, no editing so far
- added variables to send delay A + delay B out to global reverb. Not implemented, yet

19/11/2022:

Big update for web remote

- autodetect serial port, no need to select a COM port
- gamepad deleted, welcome keypad
- touch events added
- no serial message sent, only MIDI CCs to control MDT
- custom key mapping
- fix icons rendering
- optimize rendering for strings
- sample preview in file manager now should work properly
- touch "play sample" on screen and push ENC_R to preview. It should work for samples from SD and from FLASH
- fixed issue when compiled for PROGMEM
- move dexed banks into /DEXED on SD card
- move dexed favourites into /DEXED on SD card

15/11/2022:

- added first version of dexed voice editor (thank you dronus)

First implementation of Dexed voice editor. Quite rough, but working.

See option "Dexed" -> "Edit Voice".

Edited patches can be saved by the already existing "Save Voice" option. Which is quite useful now. Switching patches will erase all edits unless saved.

No name editor so far.

- added long push to dexed editor for instance selection
- added some help text
- removed some unnecessary screen redraws

14/11/2022:

- update and release 1.4.7.1
- fixed delay returns: dexed instance 1+2 returns are now separated from global delay returns
- fixed delay panorama settings not saving/loading with the performance
- midi cc changes to delay level now should work correctly
- some work on dexed chorus and filter but currently wip
- updated binaries to 1.4.7.1
- updated bom

13/11/2022:

- updated binaries

10/11/2022-12/11/2022:

- fixed display issues in page Delay - Seq. Sync.
- moved both dexed delays to global instances, now located in Master Effects
- delay returns panorama positions are now user settable (Master Effects - Delay - Panorama)
- dexed - audio - effects - delay menu replaced by just one page for delay levels in dexed for both instances
- microsynth now has delay send to delay A, delay B or both at the same time (in both instances)
- braids now has delay send to delay A, delay B or both at the same time

09/11/2022:

- fixed/enhanced dexed delay menus
- dexed instances delay intensity can be now controlled from newer dexed voice page
- for more in depth delay settings, like feedback, delay sync, MIDI sync, you still go to dexed - audio - effects - delay
- added better help texts how to operate in time sync./midi sync./delay time in milliseconds and switch between them
- updated binaries (1.4.6.24)

07/11/2022:

- added "clear patterns" and "clear all" to sequencer menu

06/11/2022:

- general code cleanup, removed some ifdefs
- removed custom colors, nobody even mentioned it, during the last year

05/11/2022:

- fixed potential crash while using remote console
- updated binaries

04/11/2022:

- improved/removed audio artifacts while navigating in braids and microsynth
- filter in braids replaced for better results with lfo cutoff, work in progress
- braids with lfo filter is complicated to understand but starting to get usable

01/11/2022:

- small fix in midi channels page for wrong activity display
- updated binaries

29/10/2022:

- 1.4.6.19 This build is highly experimental, don't go for it if you want a stable system

- SPI FLASH memory displayed values are not updated correctly. Not sure if this is a recent issue but i just noticed it now. Values seem to be correct, after a reboot. Needs investigation.

- First version of Processing Remote Console with File Transfer from Teensy to PC
- Files with 39MB or less can be copied from Teensy to PC in File Manager (safety issue, limit might be removed later)
- Will only work in PROCESSING Remote Console. If it can be done on the Web, no idea, may need Weeks or Months to do it, do not ask for it until it is developed, tested and ready ! Current status = 0 % and we will keep you updated if there is progress !
- Files will be copied to the same directory as Progressing Code is located. Currently it only works for single files. Not for directories. If you want to copy multiple files after another, it does work but take your time and do not click too fast or you will get errors in processing.
- Early Feedback about File integrity would be welcome, I tested with 30MB+ files and it seems to be working correctly.
- Once more: DO NOT ask for the web console to have file transfer. If it is possible, we will do it. But this will take time!

28/10/2022:

- MIDI note mapping for UI Control now works also with special keys, like select.
- gamepad input now belongs to default configuration since all the other newer input methods, except original 2 encoders, more or less use the same code. Means #USB_GAMEPAD does NOT to be included in config.h anymore
- When you use OPTIONAL input methods : PC KEYPAD/USB_KEYBOARD or ONBOARD_BUTTON_Interface then now you have to add it MANUALLY, also remote console will NOT activate them
- enabling remote console now ONLY adds #USB_AUDIO automatically, not other UI controls
- When you use MIDI note mapping for UI Control, be aware that it currently works for EVERY MIDI channel. That can lead to unwanted effects, not only when playing notes from your MIDI device but also when playing notes from the sequencer.

If possible, it is preferred to use default MIDI CC control for UI, these do NOT need to be mapped but come preinstalled.

(However, they also can be remapped!) The MIDI note mapping feature should only be used, when you can't use MIDI CC from your device. It might be an idea to use an own MIDI channel for it, in the future

26/10/2022:

- number of patterns increased to 32

25/10/2022:

- you can now order a tested 3d printed SLA / Resin enclosure at: https://www.pcbway.com/project/shareproject/MicroDexed_Touch_MDT_SLA_printed_enclosure_LID_BOTTOM_CASE_317c88e1.html You can choose color, resin type - currently tested are:
- Resin Standard white material (UTR 8360)
- Resin UTR-8100 (transparent)

23/10/2022:

- added recovery boot option. When autoloading performance has issues (device is not booting) you can try to hold ENC_R or ENC-L at boot. Should also work for native keys. This will skip the loading of the performance. Since nothing of the performance will be loaded, there are no MIDI channels loaded. They then will be set to default MDT values.
- added MIDI CCs to control MDT by MIDI

22/10/2022:

- no progress, today. I wasted 3+ hours into a recovery-safe-boot feature and it itself worked but made several new problems including a lot of crashes after using it. After 4 clean attempts, I give up for now.

21/10/2022:

- native keys and gamepad autolearn keys enabled at the same time had some issues. Should be now resolved.

20/10/2022:

- Velocity editor: fixed broken pattern select
- Velocity editor: while pattern change active, red indication of the value like in pattern editor
- Velocity editor: reduction of unnecessary screen drawing
- Velocity editor: clearing some left over chars from previous sample names/other values when navigating around
- Updated noob guide with still valid information from MicroDexed, generation 1

19/10/2022:

- worked on some pixel issues from various draw-line functions - should be ok now in processing remote, web remote i think will follow up very soon
- fix MSP zones alignements
- fix MSP panbar for web remote
- web remote UI improvements and javascript code rewritten

18/10/2022:

- small touch improvements in mute matrix. input 30 times faster than before. To make sure a touch gets recognized, just push and hold a touch screen button. It will not flip its condition, until you release it. Touch reliability should be very high now, 99,9 % ?
- added touch screen test page, draw pixels on the screen to see if it matches the touch input

17/10/2022:

- pan bar fix for remote console in msp

16/10/2022:

- release 1.4.6.15
- changed colors in msp to old colors with slight modifications
- note value checks in msp to not get out of bounds, keys have to be between C1-C#8
- screen drawing in msp enhanced
- enhancements in drawing in processing remote console
- sys config save icon improvement
- fixed scrolling with encoders in voice select
- updated binaries

15/10/2022:

- new misc. settings menu:

Gamepad/Native Key speed

Screensaver idle time start

Display rotation

Touch Screen rotation

Reverse UI (Encoders / Device reversed, Encoder on top)

- fixed min/max values for rotation of touch
- adjusted gamepad speed values
- small ui changes in misc. settings
- updated FAQ

13/10/2022:

- fixed some pixel level drawing issues in teensy + processing code at screen borders
- fixed some stray pixels in voice select after opening and closing virtual keyboard

12/10/2022:

- fixed keyboard state when going from main menu to dexed voice - both are now independent
- When the keyboard in the main menu was activated, going to another page and returning, part of the menu was overdrawn.
- fixed background not clearing properly of instrument name in touch keyboard in remote console
- fixed touch keyboard button redrawing
- when keyboard is enabled in main menu, BACK help text is not drawn on to the top of keyboard keys

- keyboard OFF button now returns properly on the menu when keyboard was activated previously and coming back from another page
- offsets of touch input from remote console now alligns perfectly with virtual keyboard. However there are issues with the real touch screen, having offsets or not matching the touch point well enough. We will try if a calibration tool can sort out at least part of these issues. My feeling is that the current touch screen is not accurate enough, to work 100% reliable for note input, on the virtual keyboard. Making the keys bigger will not help much, since it is the stray values at beginning of touch, where the problem occurs. This is a hardware issue, i am not sure we can do much about it other than changing to a higher quality touchscreen.
- mouse input in the remote console for touch buttons is now much more reliable. If you find issues anywhere, please let us know

10-11/10/2022:

- new audio analysers for web remote console
- remote console on web and on processing now starts up with the full main menu, no matter where you were navigated to
- in remote console now you can push touch buttons via mouse (not 100% reliable, yet, sometimes slow response)
- native key input and gamepad input and remote console input now is better separated in code
- when you activate the remote console, it automatically adds keyboard, gamepad and remote usb audio by itself.
- Keyboard and Gamepad can now be used at the same time as your input devices

09/10/2022:

- moved step sequencer recording parameter out of the way in pattern editor
- relocated step rec. parameter to sequencer settings
- enhancements to fast navigation, now showing also velocity editor and consistent placement of navigation bar
- updated binaries
- fix rendering for level meters

08/10/2022:

- optimized drawing speed of small MIDI level meters for both remote consoles
- reduced unnecessary screen writes in microsynth
- complex drawing like circles, lines and coloured meters are now done from the webclient-side
- upcoming new release with binaries at end of this week
- audio analysers added to web remote console

06/10/2022:

- web remote console stability improvements and cosmetic layout changes
- web remote console now displays a page at connection and the current key mappings
- web remote console : preparation for the custom key mappings

05/10/2022:

- fixed small visual glitch on song page with short song names
- gamepad/keys/remote-console control in pattern editor and velocity editor should now not be reversed, either if you are going there by menu or fast-navigation, both now work correctly in all directions
- using fast-navigation (key-combos) in remote-console now should be more reliable
- when in velocity editor, you now also can use fast-navigation

04/10/2022:

- the web remote console now supports on screen buttons for direction, a, b, start + select buttons, will be public soon.
- input handling for remote console keys now working (a bit slow sometimes, but working)
- to enable remote console with keyboard input, audio, no other option now has to be added manually. Just add a remote console. it will activate keyboard, remote audio etc. itself, for all needed features

02/10/2022:

- Fix Multisamples browsing samples on Flash while sequencer is running (you have to copy again the third party libraries from the repo to your Arduino libraries folder as some libraries have been modified)
- Fixed flickering of algorithm display on dexed voice select
- Drawing improved on MSP page
- Added clear zone function in MSP

01/10/2022:

- On Song Page, USB MIDI and JACK MIDI channel label are now displayed while editing instrument
- MSP #00 and MSP #01 are now selectable from the correct ammount of configured multisamples
- Highlighting of Chain and Transpose columns is now more focused, dimming the currently not edited field and column

- updated binaries
- Fix MIDI OMNI for Dexed and MSP
- Update web remote with new chars used in MSP play mode
- Remote Console with WebBrowser + Audio is now working: https://positionhigh.codeberg.page/

29/09/2002:

- Improved encoder input speed in MicroSynth and corrected several large parameter values to an easier to read format
- Some work on the newbie guide
- Added warnings and more precise information how to shop for correctly working display types for MDT in the bom

28/09/2022:

- Main Menu: Sequencer status was not updated from Gamepad Start Button or Encoder L Long Push
- MSP: Improved volume adjustment for Encoders
- MSP: Improved Reverb Send adjustment for Encoders
- Mixer: Fixed not selectable Master Volume Adjustment
- small bug fixes

27/09/2022:

- improvements on gamepad/native key support. Keys now behave with acceleration while pressed
- input speed in all menus should be equal when using gamepad/native keys
- All /nearly all functions/pages should have correct key mappings
- updated noob Guide
- other small UI fixes

25/09/2022:

- Samples in MSP now can be played from start to end, like before, but also can be triggered by noteon and noteoff, meaning you can stop the playback when releasing the key. (on live input) . From the sequencer, this also will work, if you want the sample to play over multiple steps, it will react to the latch function.
- The "PM" PlayMode indicates if it is playing from start to finish or to play only while the key is held
- The USB gamepad and mappings to native teensy pins for buttons, now should behave identical. It is already possible to navigate with buttons/keys to various menus.
- For song, chain and patterns there are quick shortcuts, LSDJ style - while pressing and holding select, you can navigate to pages more quickly with right and left keys.

25/09/2022:

- Fix filename length for samples in Flash (several wav files were not playing for Drums)

24/09/2022:

- MIDI channels added for MSP 1 and 2, that allows playing MSP live and with sequencer
- reorder the instruments on MIDI channels page

23/09/2022:

- Braids and MSP level meters and level control now working in the mixer page.

22/09/2022:

- still working on the mixer page. Some input handling and volume issues are fixed, but not everything. work in progress.

21/09/2022:

- improvements mixer page: all sound sources now available and volume can be changed on one single page
- volume changes to ePiano now apply instantly, in mixer page
- MSP now has a global volume setting, currently defaults to 100%. Needs further work.

20/09/2022:

- new MIDI channels page
- fixed Braids MIDI routing

19/09/2022:

- fixed system crash in file manager, when compiled for flash, while playing from flash chip

- fixed level bug in mixer
- ePiano and Braids added in mixer
- more free ram
- fixed bug in Braids page

18/09/2022:

- when exiting a page while in editing mode, it will be now stopped, automatically
- improvements to gamepad input, some scrolling directions fixed, editing and input speed more optimized

17/09/2022:

- main branch updated to V1.4.6.2
- Colors of Menu Items in select/edit mode now behave more consistent in ePiano, braids and MSP
- Gamepad navigation speed corrected for several pages like ePiano, MSP and braids
- Gamepad navigation in some of the special menus with x/y movement improved
- Gamepad editing of many of the black/white menu pages improved (modify direction is not longer inverted)
- release V1.4.6
- under the hood code / memory improvements
- updated json library and code fixes for Arduino IDE 2.0 usage
- first version of the gamepad UI preview, testers are welcome.
- updated binary releases

10/09/2022:

- new generic scrollbar, for pages and menus

09/09/2022:

- added bare bones support for USB HOST (Computer) Keyboard/Keypads

04/09/2022:

- release V1.4.4
- more improvements for the DIY 3d print case
- Sequencer has now Pattern probability and velocity probability functions
- fixed some more font-size issues in the pattern editor tool menu that occured for tracktype drums and only while pattern is currently running.

01/09/2022:

- added Euclidean arp modes

14/08/2022:

- got rid of the chord_dexed_inst selection in Adv.Settings - Dexed Chord Instr. is now simply selected in Song Editor
- chord/arp Velocity in Adv.Settings however will stay, since otherwise there is no expression/velocity for Dexed in Chord/Arp mode. This parameter also affects Braids Volume when in chord/Arp mode.

13/08/2022:

- Now Braids understands TrackType Arp and Chords, Volume is a mix of its own Inst. Volume + Chord Vol. in Adv.Seq.Settings
- Release 1.4
- Added Euclidean Arpeggiator mode
- Updated binary distribution files

12/08/2022:

- improved external MIDI note-off handling when seq. is stopped - for instr., chord and arps
- small fix in build instructions

11/08/2022:

- fixed wrong MIDI channel when playing chords/arps on external MIDI gear

10/08/2022:

- Release of improved case version with threaded inserts and M3 screws

- Updated BOM

04/08/2022:

Pattern Editor:

- cursor position is more visible while playing and while not playing sequence
- code cleanup in pattern editor and velocity editor
- started upgrading the default sequences

02/08/2022:

Pattern Editor:

- New feature : pattern hunting

In the pattern editor you can switch with a touch button between regular song play and pattern play. The pattern play will loop the currently playing pattern endlessly.

After pressing the button again, it will continue in the song.

Now, there is an addition touch button: PATTERN HUNTING

When this is activated, and you are playing in pattern mode, it will do the following:

1. search for the first occurance of the currently active pattern in pattern editor in the song
2. jump and stick to that song step
3. find the first chain step, the active pattern is first played on and start the playback at this chain step
4. search all other tracks - if they as long or longer than the found pattern, also jump to the chain step from the found pattern
5. if they are only 1 step long, start and repeat them as their only step
6. if they are not longer or equal to the length of the found pattern, mute the track. This leads to tracks that might be muted, if they have other lengths than the found pattern and are not only 1 step long. However, it should be better than playing other tracks in context with the found pattern, with wrong notes. In the worst case, you will only hear the sound of your currently selected pattern.

- Tool jump now jumps to the correct offset when track type is instrument or chord
- fixed wrong screen offsets in copy, transpose, exchange, fill functions
- fixed wrong screen updates after a pattern has swapped with a different content type as the first one
- fixed note-name browser flickering in content type instrument
- fixed some screen spaces not clearing after a display change
- when in transpose mode for an instrument pattern, pianoroll will now preview all notes correctly during making the change
- after loading a new performance, the play-mode will revert to regular song play

30/07/2022:

- release 1.3.9
- Dexed Voice:

1. When virtual keyboard is on, you now can change instance, sound + volume + transpose for dexed
2. Favorite sounds no longer are selected/unselected by long push ENC-L but now with a touch button. This allows to use the standard behavior of ENC-L to start/stop the sequencer now also in dexed voice as in most other screens
3. Various parameters of Dexed voice now can be accessed directly from its screen. You do not have to dive into the menu for the most common options like pan, volume, MIDI channel etc.
4. Long push ENC-R now switches between the instances instead of switching between voice and bank. Since this is not obvious to know, now the instance can also be selected from the parameter list as the first option.

- Pattern Editor:

1. When browsing the Note/Sample/Function Menu or using the pattern selector, now it is visible by color that you are currently editing the parameter.
2. other small UI fixes

- Braids:

1. Braids now has a simple but effective Flanger/Phaser. The speed and the "stereo spread" can be controlled from the main braids screen. Be careful with the stereo spread, that can cause a lot of audio cancellation when you switch to a mono-device for listening, like a cellphone or a kitchen radio (just as examples). The stereo spread is an offset that gets added to one stereo side only and speeds up the flanging. The speed can go from insanely slow and ridiculous high speeds.

- Sample Editor:

1. Samples can now the previewed by a touch button

26/07/2022:

- rendering of all the FM algorithms, for the next version of the Dexed voice screen :)

24/07/2022:

- release 1.3.82
- Menu speed increased, especially when using remote console
- expanded menu from 4 to 6 lines
- faster and better scroll bar

23/07/2022:

- release 1.3.81 fixed all so far known UI issues
- release 1.3.8
- started adding a navigation bar in the menu. It still has known issues - we are working on it :_)

22/07/2022:

- fixed fine tuning for microsynth

21/07/2022:

- fixed wrong display output of empty patterns/steps in pattern editor
- fixed wrong display output of empty patterns/steps in mute matrix
- fixed wrong display output of empty patterns/steps in song editor
- fixed wrong display output of empty patterns/steps in tracker view/editor
- added more information to system information page for debugging user issues
- debugging features that are enabled but not intended for regular usage are highlighted
- added eye candy/new logo to system information

18/07/2022:

- UI fixes, faster Volume response, especially with Remote Console
- reduced pixel drawing for spaces

17/07/2022:

- Updated FAQ and Sequencer Wiki
- working on alternative Case design with quicker access to SD-Card but some compromises in looks and less intuitive user experience

14/07/2022:

- Multiband settings are now loaded/saved with the current performance
- started updating demo performances with all current features, including Multiband

13/07/2022:

- fixed some sample names for flash
- changed multiband from default compressor to multiband limiter, much easier to get good results
- fixed iteration of instruments
- replaced out of tune piano multisample

11/07/2022:

- added web remote, no need for Processing to see the display, capture image, record video...

10/07/2022:

- added very basic recording of audio to stereo-raw-file. It should work with and without the multiband. The raw file can be opened for example with Audacity.
- improved record audio, now you can select from 254 target slots for the filename.
- updated FAQ

09/07/2022:

- updated texts
- fixed (most) screensaver issues
- 3d print case files tested
- current PCB build tested
- fixed some module dependencies
- worked on some issues in remote console in web browser for mac

29/06/2022:

- improved memory management to free up RAM, after a lot of trial and error :) (so currently all modules fit into teensy memory at once)
- refactoring of MIDI code to remove duplicates
- small UI / Display issues fixed
- some progress on multiband compressor
- updated texts

27/06/2022:

- Improved Virtual Keyboard Button position
- Fixed Menu Touch UI Input switching delays
- Font Size bug in Braids should be now fixed
- fixed missing booleans

25/06/2022:

- Braids can now be played by USB MIDI (serial MIDI untested) with 8 voices polyphony
- Braids now handles Envelopes start/ends correctly, even when playing polyphonic (live or by sequencer)
- Braids now saves /loads it's state, together with a performance
- Touch Keyboard is now working on Braids page and can be selected as the playing instrument
- Fixed Microsynth Noise OSC not playing correctly
- Notice : The Code now defaults to compile for PCM5102. If you still want to use the Teensy Audio Board, change it in config.h
- If you have unusual crashes when playing from external USB MIDI Devices, check if your power supply is sufficient. A Power Adaptor / USB Power Bank with 1A is enough, however a standard USB2 PC Port with only 500mA might not work stable with additional, external devices connected to Microdexed.
- Updated FAQ

24/06/2022: Testing with the newly arrived (but already outdated) PCB that features the PCM5102 was successful. Also the external SPI Flash module is working as intended. We will switch to this configuration since as an audio appliance, it makes sense to get rid of all avoidable noise issues.

- Braids is now working with 8 voices polyphony
- added Envelopes and filters to Braids
- tested external SPI Flash module
- tested purple PCM5102 board
- updated STL files
- updated BOM and Instructions

21/06/2022:

- After a lot of trial, some of the Mutable Instruments Braids Oscillator Models are working in Microdexed. Still a lot to be done there. https://www.youtube.com/watch?v=WFc2IrTSYDQ

20/06/2022:

- fixed some small array and UI issues (for example volume meter now shows the scope when seq. is running)

19/06/2022:

- Started modularization of the code. Every User has different opinions about what is important to have in an audio device. Memory on the Teensy however is limited, so you can not have everything at once, what we can think of. Currently, this restructure is far from complete, but it is a start.
  Also you now have the option to change your DAC to the (most likely) next preferred DAC, the PCM 5102.

About the modularization:

Core	**Modules**	**Effects**	**Polyphony/Tracks**

Dexed1		✓	16 voices
Dexed2		✓	16 voices
+	Electric Piano	✓	16 voices
+	Microsynth	✓	2 Mono Instances
+	SamplePlayer + Multisamples	✓	8 voices
+	Sample Editing		in alpha
+	Reduced Version of Braids	unknown	unknown
+	Song / Sequencing / Arp		8 tracks

15/06/2022:

- testing with other options for dynamic sample management like qspi, sd-card with other library.

12/06/2022:

- prepared code changes from Teensy audio board to generic PCM5102
- added DAC mute/unmute test menu
- reassigned generic pin 4 for the purpose of hardware soft-muting PCM5102
- a lot of testing and resoldering - software controlled mute now is working
- started redesign PCB for new DAC

08/06/2022:

- Updated Build Instructions
- Updated Hardware Status
- Updated BOM

There are noise issues with the Teensy audio board while there is activity coming from the display/encoders.

We are aware of this problem and working on a solution that might drop the audio board as a main component and go with an alternative DAC like the low-cost PCM5102 and an extension breakout board with a flash chip already attached, instead.

This also would eliminate the hassle to solder the very small SMD component and use standard dupont spacing/pins instead, for easy soldering.

First tests indicate that with these changes applied, all noise issues are gone and it will be even cheaper to build. The current noise floor with the Teensy audio board is not really that loud but it can be noticed - when you are searching for it explicitly.

It will take a few months to get the replacement parts, redesign the PCB or an adapter board, so we will stick with the teensy audio board for now, since many Teensy owners will have that at their disposal, anyway.

06/06/2022:

- fix save performance
- repaired/improved demo patterns for playing from flash
- real time display of MicroSynth Filter fixed
- merged latest dexed engine with better sysex support

05/06/2022:

- updated sequencer instructions
- updated build instructions and images

- PCB now can be ordered from PCBWAY

04/06/2022:

- load/save JSON multi-sample presets (10 presets with 8 zones each)
- added knob.stl as template for printing your own encoder knobs
- added naming/renaming of multi-sample presets
- updated build instructions

03/06/2022:

- custom/user multi-samples playing from SPI FLASH:

1. samples can be exchanged /loaded during runtime
2. samples can be addressed as Instruments from the sequencer
3. also you can play them in a "live-view-mode" with a preset like structure
4. you can have up to 8 Zones in a multi-sample
5. The zones are "auto-mapped" but can also be changed manually

- since the playback of samples is limited from the hardware/CPU, currently 8 samples can be played at the same time: The logic when samples have to be stopped has improved in a way that you do not get out of free samples to play, as far as that is possible.
- added placeholder page for features currently only for FLASH and not possible/working from SD-Card

01/06/2022:

- fill multisample zone with root note detection from filename when browsing the flash chip

30/05/2022:

- started working on the Multisample engine, playing from Flash

29/05/2022:

- fix SerialFlash wav playback
- fix some warnings
- further 3d case enhancement and test prints
- added simple Multi-Sample live-play for testing samples from SerialFlash

27/05/2022:

- Added Song CLEAR function
- Added Chain/Chain Transpose CLEAR function
- "New" Build Instructions online
- STLs updated and testing in progress
- BOM updated

26/05/2022:

- Building and testing a variation with pin sockets instead of the IC sockets, 3d modifications

1. Device height reduced 3mm: Faster 3d print times, a little less bulky looking device
2. no double / stacked special connector for the display, replaced by 1 standard connector.
3. much stronger pin binding for teensy and audio board
4. no more pin bending tricks required, pin locations are exactly where they are supposed to be

25/05/2022:

- fix usbMidi send sysex bank
- fix Midi channel displayed
- quicker boot to display
- improved step sequencer

23/05/2022:

- added basic step sequencer input
- updated sequencer wiki

22/05/2022:

- updated build instructions
- updated Release
- made PCB changes and ordered a new small batch for testing

- added graphical touch keyboard icon instead of text only.

21/05/2022:

- improved STL Files for printing, flash and file manager improvements
- updated PCB and PCB images
- small UI fixes

20/05/2022:

- updated Build instructions and BOM

18/05/2022:

- basic tracker edit mode ready

17/05/2022:

- started rebuilding/rewriting the tracker view/editor for the new display

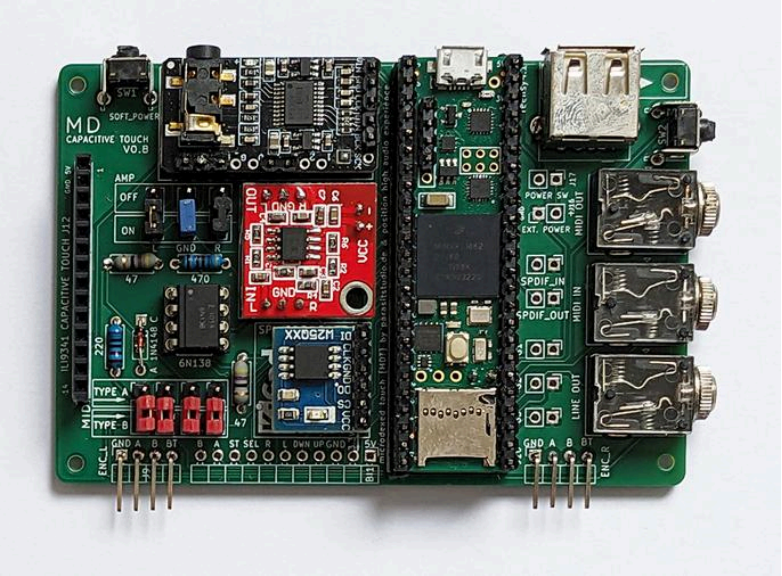
15/05/2022:

- fixed performance loading while playing
- Updated STL files

various fixes from localhero: Fix bank/voice name + usbMidi sysex

- Fix UI_func_save_voice
- Fix UI_func_sysex_send_bank
- Fix bank/voice name if error
- Fix SD card detection + warnings
- Minor changes

Outdated information, Modifications, MDT History



PCB with all on board components ready (first generation)

Final Assembly (depreciated first case version)

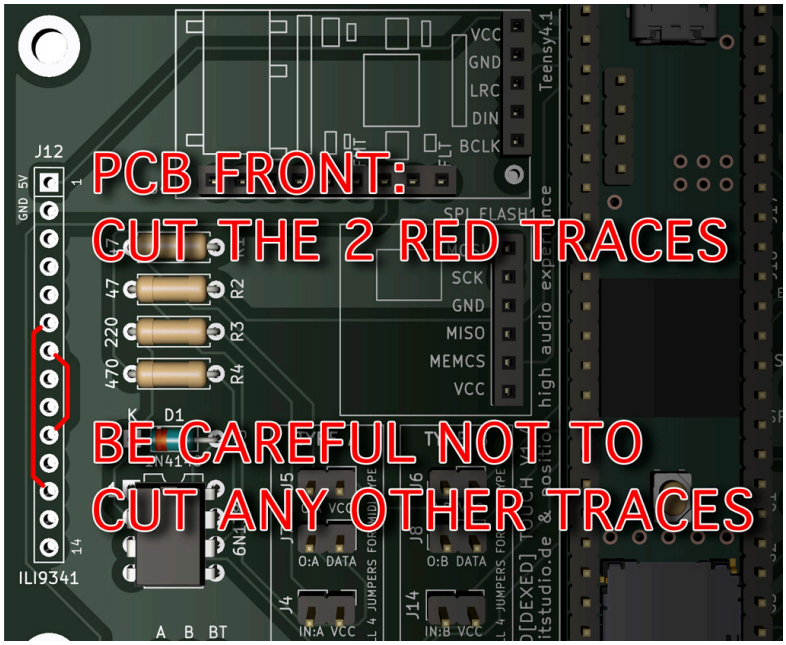
Final Assembly (depreciated first case version)

Display Conversion from resistive to capacitive touch

This short guide shows how to convert your PCB from first gen, resistive touch to capacitive Touch display.

CUT all traces/connections shown in RED color. ADD connections shown in GREEN with wires.

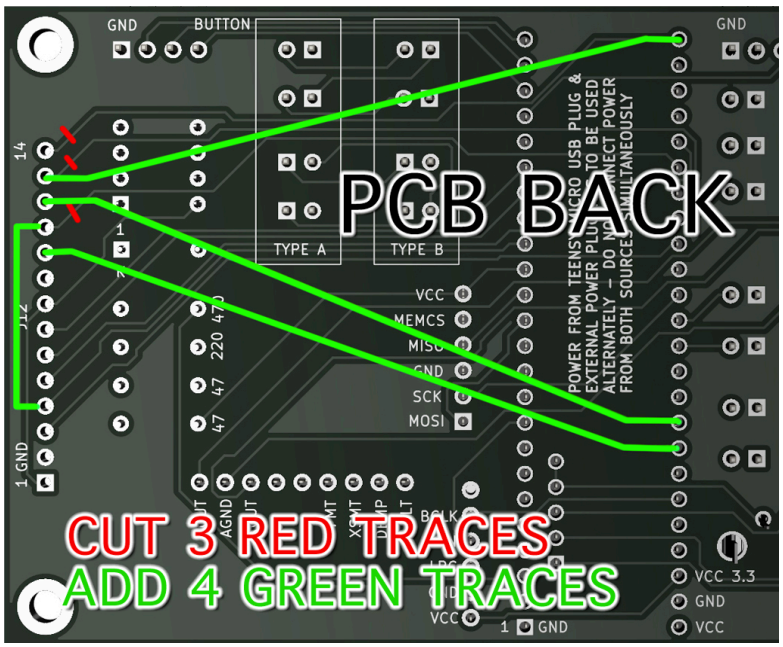
PCB FRONT



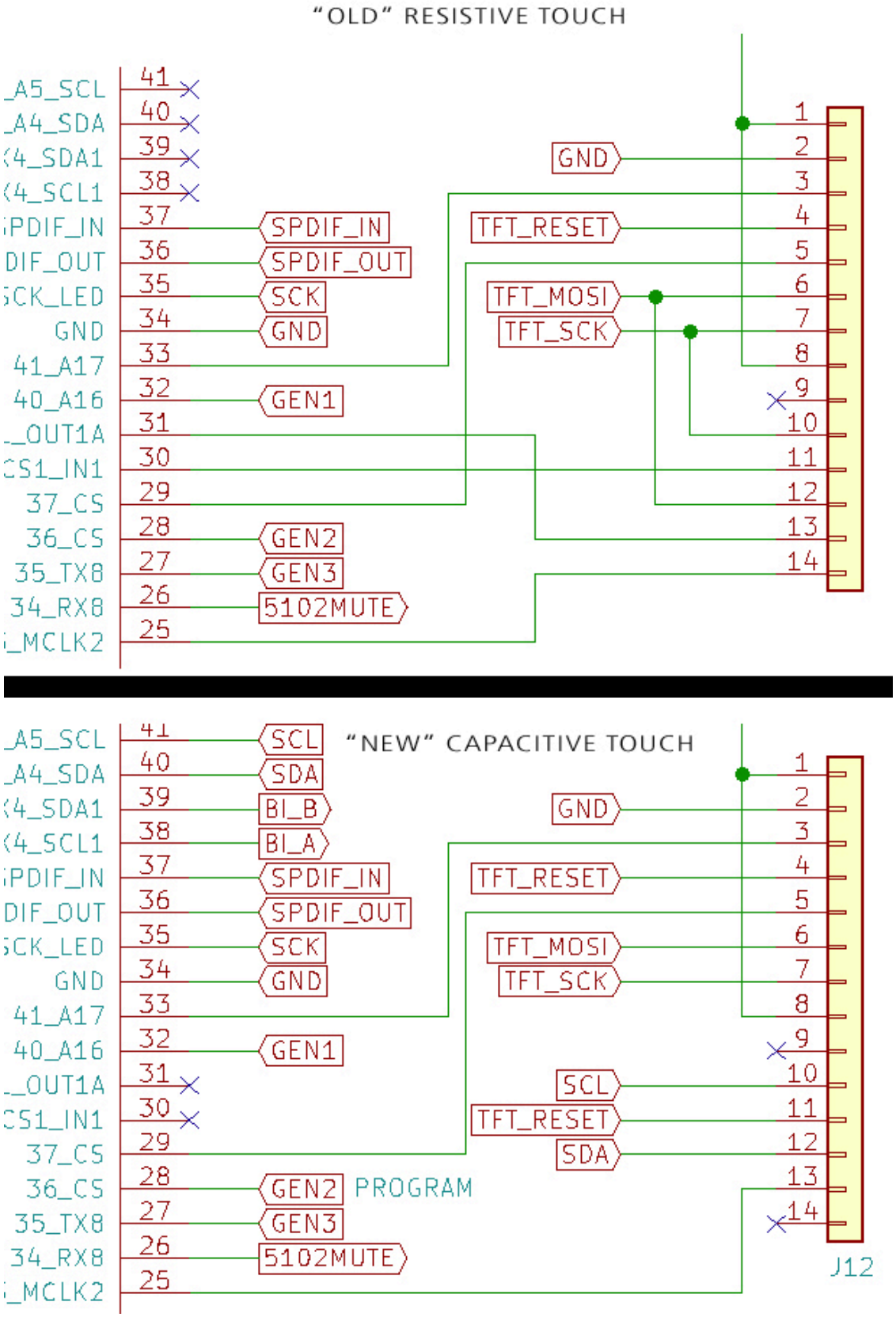
Unfortunately it is required to remove the display connector to reach these 2 traces.

Use your favorite proven method how to remove the connector. This could be hot air, a desoldering tool/gun or desoldering wick.

PCB BACK



CONVERSION SCHEMATICS



Wiring of old and new display connector

This is a user contributed tip, in case you have bought a current MDT PCB but got the older (**resistive touch**) by accident, instead of the current **capacitive touch** display. It is highly suggested to get the correct screen and do not do any manual soldering on the MDT PCB. However, with the following information, you can convert the MDT PCB (assuming you have bought it from PCBWAY and have 4 spare pieces) to make it work with the old resistive screen and then later upgrade to the current screen with an additional, fresh PCB.
Notice that the firmware for the old display is still updated but covers only the most basic features of MDT. It is considered to be a legacy build.

DISPLAY CONVERSION FROM CAPACITIVE TO RESISTIVE FOR OLDER (RED) DISPLAYS (AND CURRENT MDT PCB)

If you, like me, bought the wrong display - You probably found that the touch feature does not work and can even destroy your Teensy. I have created a tutorial so you can adapt the resistive touch display to work with the new capacitive PCB. This approach does not cut any traces from the original PCB.

- Desolder the 5 pins related to the touch part of the display (14-10)
- Solder 5 pins (90 degree) so they don't get in the way of the connector.
- Bridge pins 6 with 12 and 7 with 10 (use wire wrap for this as there is very little space between the pins)
- Use 3 female dupont cables to connect the new pins on the display to the teensy pins as shown.
- Go to System -> System Settings. Set the touch rotation value to 1.
- Restart the unit and the touch screen should work now.