TSNM

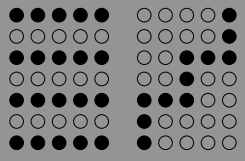
v50 FIRMWARE MANUAL FOR TOUCH SENSING NOTE MEMORY MARK II MODULES (3U & 4U)

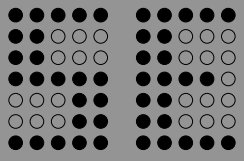
w w w . d o b o z . a u d i o

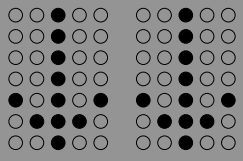
Firmware v50 features: USB MIDI input and output functionality has been added, bug fixes (resolved issues with the arpeggiator and sequencer not resetting properly, fixed the problem with non 1V/octave modes not loading properly on modules with Teensy 4.0, addressed the uncontrolled pitch shifting when exiting the note sequence recorder), live functions have been removed (as they were confusing for some users), improved internal clock algorithm (clock now has a dedicated page in the settings menu, eliminating the need for button combinations), enhanced pressure information acquisition (previously only the last active plate was scanned, but now all keys are scanned simultaneously).

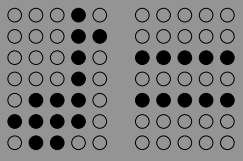
NAVIGATION

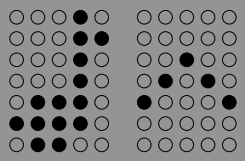
To tune note plates hold a plate and rotate the encoder. To enter/exit settings press and hold the encoder for 1 second. Parameters are organized into groups:

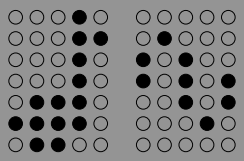

ARPEGGIATOR & KEYBOARD

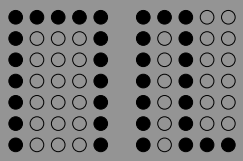

NOTE SEQUENCER

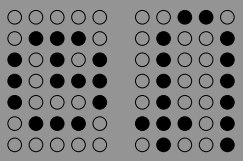

PRESSURE

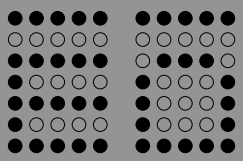

QUANTIZER

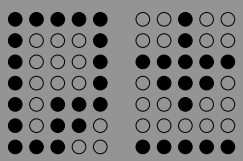

PORTAMENTO

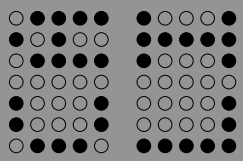

VIBRATO


GATE & TRIGGER OUTPUT


CLOCK & RESET


MIDI


PRESETS

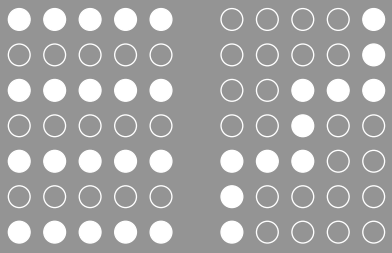

CALIBRATION

To navigate through the main groups of parameters, rotate the encoder. Click the knob to enter a group. Once inside a group, use the encoder to scroll through individual parameters. To edit a parameter, hold down one or both of the transpose buttons. To exit a group of settings, click the encoder knob. If you want to exit the settings entirely, press and hold the encoder for 1 second.


PRESS **LEFT** BUTTON AND ROTATE ENCODER TO...


PRESS **RIGHT** BUTTON AND ROTATE ENCODER TO...


PRESS **BOTH** BUTTONS AND ROTATE ENCODER TO...



ARPEGGIATOR STATE, HOLD

The arpeggiator is a common synthesizer feature that generates a looping sequence (arpeggio) when you press down a chord.

●○+○ to **enable/disable arpeggiator**.

○●+○ to **enable/disable hold** function. When enabled the arpeggiator will continue to play the arpeggiated sequence even when note plates are not held.

ARPEGGIATOR DIRECTION

Synthesizers with traditional piano keys will generate the order of this sequence based on the incoming notes. TSNM creates an arpeggio based on the sequence number of pressed plates and the direction parameter.

●○+○ to set the **direction** of arpeggiation:

- **forward** [eg.: 1, 2, 3, 4, 1, 2, 3, 4...]
- **backward** [eg.: 4, 3, 2, 1, 4, 3, 2, 1...]
- **ping-pong** [eg.: 1, 2, 3, 4, 3, 2, 1, 2...]
- **random**

Numbering of note plates on **3U** model:

[07] [08] [09] [10] [11] [12]
[01] [02] [03] [04] [05] [06]

Numbering of note plates on **4U** model:

[09] [10] [11] [12]
[05] [06] [07] [08]
[01] [02] [03] [04]

ARPEGGIATOR VARIATION

●○+○ to set the **number of variations** (x1-x5).

●●+○ to set the **interval of variation** from 1 to 12 semitones.

●○+○ to set the **behaviour of variations**:

- off, no variation happens

(eg.: **C0 E0 G0**)*

- add variation after the arpeggiated sequence ends

(eg.: **C0 E0 G0 F0 A0 C1 A#0 D1 F1**)*

- add variation after each arpeggiated note

(eg.: **C0 F0 A#0 E0 A0 D1 G0 C1 F1**)*

* interval = 5 semitones, number of variations = x2, first variation, second variation

ARPEGGIATOR CLOCK RATIO

●○+○ to set the **clock ratio** of the arpeggiator relative to the master clock:
÷32, ÷24, ÷16, ÷12, ÷8, ÷6, ÷4, ÷3, ÷2, ×1, ×2, ×3, ×4, ×6, ×8

ARPEGGIATOR RHYTHM

Applies a rhythmic pattern to the arpeggiators clock source. Think of it as a gate sequencer between the clock source and the arpeggiators clock input. Steps that are enabled will let through the incoming clock signal, while the steps that are disabled will mute it.

●○+○ to set the **length of pattern** (2-16 steps).

●●+○ to **select a step** to edit.

○●+○ to **edit the selected step** (off-on).

BEHAVIOUR OF TRANSPOSE BUTTONS

●○+○ to set the **behaviour** of transpose buttons:

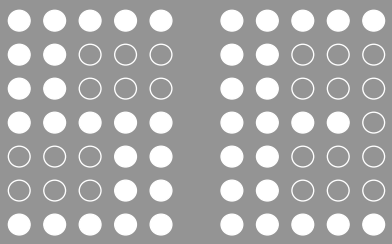
- **latching** (transposition takes effect as soon a note plate is touched)
- **latching immediate** (transposition takes effect immediately as the button is pressed)
- **momentary** (transposition takes effect until the button is held down)
- **octave** (press the left button to transpose down by an octave, press the right button to transpose up by an octave in the range from -3 to +3 octaves)

PRESSURE TRANSPOSE

When enabled the outgoing note gets transposed as pressure is applied to note plates. This feature is most usefull when both the arpeggiator and sequencer are disabled.

●○+○ to set the **number of transpositions** (off, x2, x4, x8).

○●+○ to set the **interval of transposition** from 1 to 12 semitones.



SEQUENCER STATE

●○+○ to **enable/disable sequencer**.

The output of the sequencer will be summed with the output of the note plates and the arpeggiator (if it's enabled). This added up note will be processed by the quantiser, thereby allowing the transposition of the sequence by touching note plates.

SEQUENCE RECORDER

●○ press the left button to **enter/exit** sequence recording.

○●+○ to select **recording mode**:

- **new sequence**: when recording is enabled the notes of the sequence are entered by playing the note plates, to skip a step forward press the right button or rotate the encoder CW, to undo a step (move back) rotate the encoder CCW
- **overdub**: when recording is enabled the sequencer keeps playing, to overwrite the programmed melody just hit the note plates (ratcheting gate variations are pressure sensitive when gate pressure parameter is enabled), press the right button to mute gates per step

EDIT SEQUENCE

●○+○ to select a step to edit.

●●+○ to edit note of the selected step.

○●+○ to edit the gate type of the selected step:

SEQUENCE LENGTH

●○+○ to set the **length** of the sequence (2-32 steps).

SEQUENCER DIRECTION

●○+○ to set the **direction** of the sequencer (forward, backward, ping-pong, random).

NOTE VARIATION

●○+○ to set the **probability**, that a random note will be added to the sequence (0% to 99%).

○●+○ to set the **scope** of random notes, the maximum interval of random notes compared to the pre-programmed notes of sequence (2 to 32 semitones).

SEQUENCER CLOCK

●○+○ to set the **clock ratio** of the sequencer relative to the master clock:
÷32, ÷24, ÷16, ÷12, ÷8, ÷6, ÷4, ÷3, ÷2, ×1, ×2, ×3, ×4

SEQUENCER RESET

●○+○ to **disable/enable reset** from note plates (when enabled the sequencer will restart [reset its playhead] when a new note is played on the note plates).

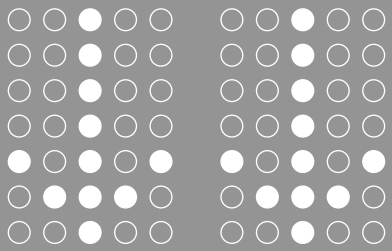
GATE PRESSURE

●○+○ to **disable/enable pressure control** of recorded steps (when enabled pressure applied to note plates will influence the recorded gate types of steps while overdub recording is active).

CV MODE

●○+○ to select the **behavior** of sequencer note CV output:

- **continuous**: note output will change according to the programmed note values per step
- **gated**: note output will be updated only when a step has non-off gate type



PRESSURE OUTPUT

● ○ + ○ to select pressure **output source**:

- **PRESSURE**: voltage on the pressure output will continuously follow the pressure applied to note plates
- **VELOCITY**: voltage on pressure output will represent the force with which a note plate is touched (it takes some time to measure the velocity, therefore it's delayed by a few milliseconds compared to the event)
- **AD**: attack/decay envelope generator
- **AR**: attack/sustain/release envelope generator
- **LO**: looped AD envelope generator
- **RECORDER**: tape or pressure sequence recorder
- **RANDOM**: outputs a random voltage level, runs from the same trigger source as the envelope generator
- **POLY1**: two note polyphony, the pressure output acts as the note cv output of second note
- **POLY2**: same as above, but with a different behavior of the polyphony algorithm (each new note appears on the main note output, the previous note will move to the pressure output)

PRESSURE RECORDER

Press a note plate to record pressure information.

○ ● + ○ to select **recording mode**:

- **new sequence/tape**: pressing a note plate will restart the tape/sequence, the duration of contact determines the length of tape (the length of sequence is set by sequence lenth parameter, see below)
- **overdub**: pressing a plate will momentarily enable recording, overwriting the previously recorded data on tape or value of current step of sequencer

ATTACK DURATION, SHAPE & DECAY/RELEASE DURATION, SHAPE

● ○ + ○ for **coarse adjustment of duration** (0-63).

● ● + ○ for **fine adjustment of duration** (0-3).

○ ● + ○ to select the **shape of segment** (exp, lin, log).

MODULATION OF ATTACK DURATION & MODULATION OF DEC./REL. DURATION

● ○ + ○ to adjust the **amount of modulation** (0-63).

● ● + ○ to set the **polarity of modulation** (+, -).

○ ● + ○ to select the **source of modulation** (pressure, velocity, recorder, random).

MODULATION OF ENVELOPE LEVEL

● ○ + ○ to adjust the **amount of modulation** (0 to 63).

● ● + ○ to select the **mode of modulation**:

- **T**: increasing modulation attenuates the peak (top) of envelope
- **B**: increasing modulation shifts the fundament (bottom) of envelope

○ ● + ○ to select the **source of modulation** (pressure, velocity, recorder, random).

ENVELOPE GATE SOURCE, HARD RESET

● ○ + ○ to select the **source of gate signal** that controls envelope generator (automatic, note plates, arpeggiator, note sequencer).

○ ● + ○ to enable/disable envelope generator **hard reset**.

PRESSURE SLEW LIMITER

Creates slew limiting effect on pressure, slows down the changes of outgoing voltage.

● ○ + ○ to adjust the **rise time** (0 to 99).

○ ● + ○ to adjust the **fall time** (0 to 99).

PRESSURE RECORDER SETTINGS

● ○ + ○ to select pressure **recorder mode**:

- **SE (sequencer)** records pressure data in sample'n'hold-ish fashion, stores in a (maximum 32 step long) sequence
- **TA (tape)** records pressure data continuously, stores on a 5.5 second long virtual tape

○ ● + ○ to select recorder **playmode** (looping or one-shot).

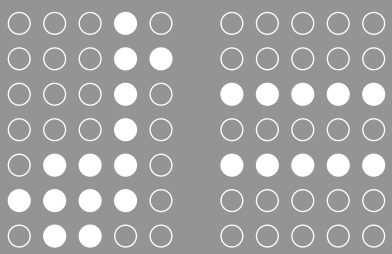
● ● + ○ to select **reset source**, mandatory when playmode is set to one-shot (no source, keyboard, arpeggiator, note sequencer).

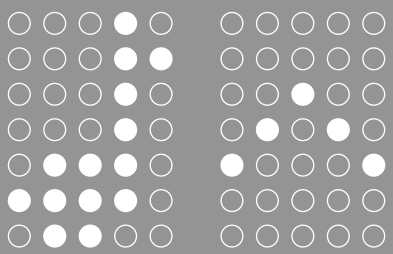
SEQUENCE LENGTH

● ○ + ○ to set the **length** of recorder sequence (2 to 32).

SEQUENCER CLOCK

● ○ + ○ to set the **clock ratio** of the sequencer relative to the master clock:
÷32, ÷24, ÷16, ÷12, ÷8, ÷6, ÷4, ÷3, ÷2, ×1, ×2, ×3, ×4, ×6, ×8





QUANTIZER SCALE

● ○ + ○ to select **scale** (semitones, ionian, dorian, phrygian, lydian, mixolydian, aeolian, locrian, blues major, blues minor, pentatonic major, pentatonic minor, folk, japanese, gamelan, gypsy, arabian, flamenco, whole tone, user's scale 1-8).

EDITING USER'S SCALES:

● ● + ○ to scroll through semitones (C to H).

○ ● + ○ to disable/enable selected semitone.

User's scales are not stored with presets, they are global. They got saved each time a preset is saved, e.g. if you modify a scale and save a preset, than recall another preset, the scale will load as it was saved previously.

ROOT NOTE

● ○ + ○ to set the **root note** of selected scale (C to H).

PORTAMENTO TIME

● ○ + ○ to set the **speed of gliding**, i.e. how much time it takes to transition from one pitch to the next (0 to 31). This creates slew limiting effect on the CV output. The glide time will stay the same between notes, regardless of the interval.

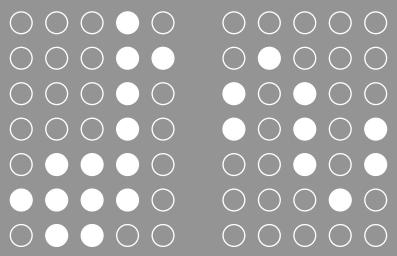
PORTAMENTO SHAPE

● ○ + ○ to set the **shape of gliding**:

- exponential
- linear
- logarithmic

PORTAMENTO MODE

● ○ + ○ to set the **mode of gliding**: continuous or legato (gliding happens only when two or more note plates are touched simultaneously)

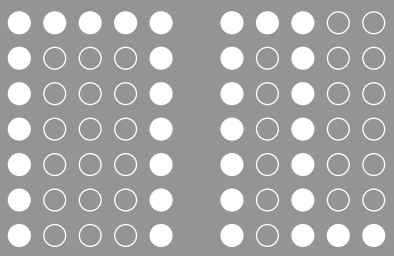


VIBRATO AMOUNT

●○+○ to adjust the **amount of modulation**, maximum depth (0-63).
●●+○ for **fine adjustment of modulation amount** (0-3).
○●+○ to disable/enable **pressure control** of modulation depth.

VIBRATO SPEED, SHAPE

●○+○ to adjust the **speed** of LFO (0-63).
●●+○ for **fine adjustment of speed** (0-3).
○●+○ to select the **shape** of LFO:
- triangle
- square
- smooth random (perfect to add tape-ish varble)
- stepped random
- positive offset
- negative offset



"GATE" OUTPUT SOURCE

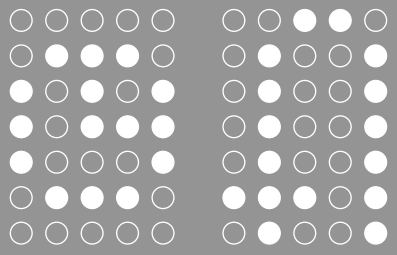
●○+○ to select **source**:
- automatic
- keyboard gate
- keyboard trigger (great for exciting filters)
- arp gate (when arp is disabled the module will output gate from keyboard)
- note sequencer gate (when note sequencer is disabled the module will output gate from keyboard)
- pressure (turns on when pressure reaches half its range)
- random gate (running at 2x the speed of internal clock)

○●+○ to enable/disable **NOT** logic (when enabled the output will be inverted).
●●+○ to enable/disable **AND** logic (output will present only when note plates are touched).

"TRIGGER" OUTPUT SOURCE

Same as above, except:
- when arp gate is selected and arp is disabled the output will be muted
- when note sequencer gate is selected and the sequencer is disabled the output will be muted

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CLOCK

This page shows the current **clock source**: **IN** (internal), **EX** (external), **MI** (MIDI). To activate internal clock press any transpose button. Its tempo varies between 10 and 300 BPM:

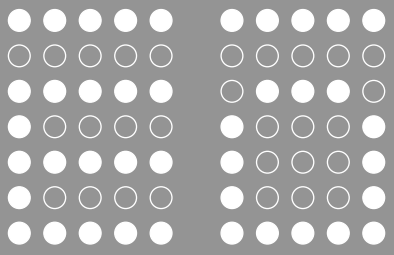
●○+○ to adjust tempo by **±0.1 BPM**
○●+○ to adjust tempo by **±1 BPM**
●●+○ to adjust tempo by **±10 BPM**

When an external clock signal is present at the clock input jack the module automatically switches to external clock. The same is true for incoming MIDI clock messages. There are some trade-offs when using MIDI clock:
- arpeggiator clock multiplier/divider is usable up to x4 (x6 and x8 won't give any clock)
- sequencer works safely up to x3

MANUAL RESET

Press any button to **reset** the arpeggiator and/or sequencer.

IMPORTANT!
Clock BPM and MIDI parameters are global settings. When a preset is saved, their last state will be stored, but it's not possible to save different BPM and MIDI parameters with each preset. The saved values will apply to all presets.



MIDI MODE

●○+○ to select **MIDI mode**.
- **MIDI OUT**: all the information that is present at note, pressure, and gate jacks will also be transmitted as MIDI messages. In this mode, the module continues to receive and respond to MIDI clock messages.
- **MIDI IN**: TSNM behaves as a monophonic MIDI-to-CV/clock converter. Incoming note on/off messages are converted into V/octave voltage at the note output jack and 0-10V gate signals at the gate output jack. In addition, incoming CC messages are transformed into analog voltage at the pressure output, while incoming MIDI clock is represented as an analog clock pulse at the trigger output jack.

MIDI CHANNEL

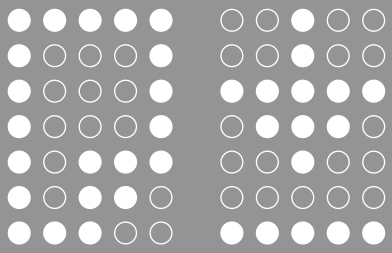
●○+○ to set the **MIDI channel (0-16)** on which the module transmits data in **OUT** mode or receives data in **IN** mode.

MIDI CC

●○+○ to set the number of **MIDI CC (0-127, VELOCITY)**. In OUT mode this channel is used to transmitt pressure value, while in IN mode this CC (or velocity) value is converted into analog voltage at pressure output.

MIDI CLOCK

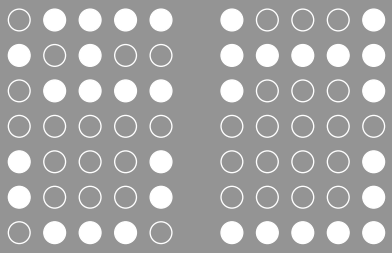
●○+○ to set the **ratio of the clock signal** represented at the trigger output jack. Please note that this parameter only affects the signal while IN mode is selected.



PRESETS

◌ rotate the encoder to scroll through presets*.
●○ and press encoder knob to **LOAD** selected preset.
●● and press encoder knob to **INIT** current parameters.
○● and press encoder knob to **SAVE** selected preset.

*** TSNM modules that are built with Teensy 3.2 have the capacity to store 17 presets, whereas modules utilizing Teensy 4.0 are capable of storing 8 presets.**



NOTE OUTPUT CALIBRATION

Connect a multimeter to **NOTE CV output**, scroll through the calibration values by rotating the encoder. Adjust the output so that is as close to the displayed value as possible:
●○+◌ for fine adjustment
○●+◌ for coarse adjustment

PRESSURE OUTPUT CALIBRATION

Connect a multimeter to **PRESSURE CV output**, scroll through the calibration values by rotating the encoder. Adjust the output so that is as close to the displayed value as possible:
●○+◌ for fine adjustment
○●+◌ for coarse adjustment

VOLT/OCTAVE

●○+◌ to select note output mode: 1V/oct, 1.2V/oct or 2V/oct

INIT DAC VALUES

●○ and press the encoder knob to revert DAC calibration values to an initial state. This can be useful in situations where the program fails to load calibration data during the initial startup of freshly built modules.

PRESSURE BOTTOM

Apply a small amount of pressure to any note plate and press the encoder knob. The module will capture the amount of pressure and treat it as the minimal pressure value.
●○+◌ to manually adjust minimal pressure value.

PRESSURE TOP

Apply as much amount of pressure as it feels natural to any note plate and press the encoder knob. The module will capture the amount of pressure and treat it as the maximum pressure value.
●○+◌ to manually adjust maximum pressure value.

SAVE

Press and hold any transpose button then press the encoder to save settings.

EXIT

Press the encoder to exit without saving settings.

FIRMWARE

Displays firmware version. When a button is held it also displays the type of Teensy being used.

SENSITIVITY, DEBOUNCE, ENCODER DIRECTION, VREF

To adjust these attributes, press and hold the encoder during power-on. Rotate it to scroll through the parameters. Click the encoder to enable/disable editing of values. After setting these values, the module needs to be rebooted by turning off and then on your system. The reason why these parameters are not easily accessible is that they typically require adjustment only once during the initial setup of a freshly built module.

DEBOUNCE AND SENSITIVITY

Some MPR121 breakout boards may behave differently regarding the sensitivity of touch plates. If your module in keyboard mode (with disabled arpeggiator and sequencer) behaves unpredictably, as if it's a sequencer clocked by a Geiger counter, try increasing DEBOUNCE and/or lowering SENSITIVITY. The best practice is to keep SENSITIVITY as high as possible and DEBOUNCE as low as possible.

ENCODER DIRECTION

Determines the direction of encoder rotation. It has two states: normal or reversed.

VREF

The fourth parameter enables/disables the internal voltage reference of the DAC (digital-to-analog converter). Set VREF to IN if using DAC8562 or DAC8563, set VREF to EX if using AD5663. Note that this parameter only has an effect on modules built with Teensy 4.0; on modules with Teensy 3.2, it won't even appear.

IF YOU HAVE ANY QUESTIONS OR REMARKS, PLEASE FEEL FREE TO CONTACT US VIA EMAIL AT YOUR CONVENIENCE.
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