



TherapSID

USER MANUAL

Note: All functions apply to MKII and MKIII

May 31st 2023

Thanks! Overview

Thank you for adopting TherapSID, the ultimate SID synth!

About the SID chip:

The [MOS Technology](#) 6581/8580 SID (Sound Interface Device) is the built-in [Programmable Sound Generator](#) chip of [Commodore's CBM-II](#), [Commodore 64](#), [Commodore 128](#) and [Commodore MAX Machine home computers](#). It was one of the first sound chips of its kind to be included in a [home computer](#) prior to the [digital sound revolution](#).

Read more: [http://en.wikipedia.org/wiki/](http://en.wikipedia.org/wiki/MOS_Technology_SID)

[MOS Technology SID](#)



I want to express my gratitude to several people who have made TherapSID what it is. First and foremost, a special thanks goes out to Windfish for completely overhauling the code and providing invaluable guidance and mentorship throughout the process.

I would also like to thank Sequence7 and Oemsysadm for their valuable feedback, I also want to extend my thanks to ThomasJ for his exciting contributions to the project.

Thanks to Themis for all the testing and concept contributions over the years and on going.

The TherapSID code is now open-source and available on GitHub so please feel free to join the party!

<https://github.com/twistedelectrons/TherapSID>

Please use GitHub if possible to submit feature requests and bug reports!
Enjoy!



Connectivity & Power (rear view)

TherapSID features from right to left

- Power input: TherapSID requires a centre positive DC voltage source of 15v at least 200mA
- 1/4" audio inputs and outputs for both chips (mono TS)
- MIDI input & output
- CV pitch input, Gate input (1/8" TS mono)
(only active when in monophonic mode)
- 3 LFO override CV inputs (1/8" TS mono)

The Audio ins enables you to run any audio signal through the SID filter path.

Presets

TherapSID comes preloaded with a total of 99 assorted presets get you started. It is important to note that these presets are fully customisable and can be modified to suit individual preferences.



It is worth mentioning that the presets were developed specifically using the 6581 variant of the SID chip. Consequently, there is a possibility that the presets may sound slightly different when used with other SID variations.

Load

To change the preset, press the up/down buttons. Additionally, holding down either button will result in accelerated scrolling in the corresponding direction. The preset number will be displayed on the device's screen.

Save

It is possible to save the current sound to any preset slot by following these steps:

- Activate the save mode by simultaneously pressing both preset up and down buttons. The destination slot number will flash on the display.
- Choose the desired destination slot by pressing the preset up or down button.
- Save the current sound to the selected slot by pressing both preset up and down buttons.

To cancel the save operation, press the reset button.

Preset Reset

Press reset to quickly load preset 1 - a useful preset to use as a starting point.

Preset Randomiser

To randomise the preset, simply hold down the reset button for a duration of 2 seconds.

Voice Section



TherapSID's 3 voices are laid out across the top half of the control panel. The 3 voice strips are identical in functionality, explained from left to right:

Waveforms



Each voice each consists of 4 waveforms:

Square, Triangle, Sawtooth and Noise.

Press the corresponding button to enable or disable a waveform (indicated by LED).

Note: Multiple waveforms can be active at the same time.

Pulsewidth

The pw knob adjusts the duty cycle of the square waveform.

Note: this has no effect on the other waveforms, only square.

Tune

The tune knob transposes the voice in semitone increments. The tune ranges from -12 to +12 semitones (2 octaves), indicated by the 7 segment LED display.

Twelve 'o clock knob position is zero.

Fine

The fine knob fine tunes the voice (+/-1 semitone range)

Twelve 'o clock knob position is centre.

Master Volume

Hold filter mode and adjust the scrub knob to set the master volume. Lowering the volume can reduce distortion when playing all voices at once.

Paraphonic Mode

TherapSID has two voicing modes: unison and paraphonic. In unison mode, you can play a single note at a time. This will trigger the 3 voices at once. Paraphonic mode allows you to play up to three different notes simultaneously by splitting the 3 voices into separate notes.

To activate paraphonic mode, hold a waveform button on voice 1 for two seconds. The LED display will show "PA" to indicate that paraphonic mode is active. Voices 2 and 3 will now mirror the parameters of voice 1. To switch back to monophonic mode, hold a waveform button on voice 1 again for two seconds. The LED display will show "OF" to indicate that monophonic mode is active.

Fat Modes

TherapSID also supports a second SID chip, and there are several "Fat Modes" available that allow you to take advantage of both chips. To switch between the different Fat Modes, hold down the filter button and press the arp mode button. The corresponding Fat Mode number will be displayed on the screen. Note that some Fat Modes may exhibit different behaviours depending on whether or not paraphonic mode is active.

Here are the available Fat Modes:

Mirror Mode (F1): Both chips have the exact same data transmitted.

Octave Mode (F2): Chip #1 is one octave above Chip #2.

Slightly Detuned Mode (F3): The two chips are slightly out of phase, creating nice panorama effects.

Heavily Detuned Mode (aka Super Fat Mode) (F4): Six saw oscillators create an incredibly thick and fat sound.

Polyphonic Modes (F5): When paraphonic mode is active, you can play up to six notes at once, spread across both chips. When paraphonic mode is deactivated, you can play two notes at once, each consisting of three voices in unison.

Two-Voice/Three-Note Mode (F6, only available in paraphonic mode): This mode enables you to play up to three notes at once, each consisting of two voices (1 and 2). In this mode, you have access to the parameters of both voice 1 and voice 2 to craft your sound.

Auto Chord

To use the auto chord feature on the TherapSID, please follow these instructions:

- 1- Hold down a chord on your MIDI keyboard.
- 2 - While still holding the chord, press and hold the arp mode and press the retrig button to engage the auto chord feature.

To free up your hands for pressing buttons, we recommend using the sustain pedal.

If you wish to disengage auto chord, simply repeat the same button presses as before.

Note that if you activate auto chord without holding down any keys, the TherapSID will select a chord from its built-in selection.

Glide

Adds glide aka portamento to the synth's pitch.
More glide=longer portamentos/slides.

Sync

When set on voice1, Synchronizes the fundamental frequency of Oscillator 1 with the fundamental frequency of Oscillator 3, producing "Hard Sync" effects. Varying the frequency of Oscillator 1 with respect to Oscillator 3 produces a wide range of complex harmonic structures from Voice 1 at the frequency of Oscillator 3. In order for sync to occur Oscillator 3 must be set to some frequency other than zero but preferably lower than the frequency of Oscillator 3. No other parameters of Voice 3 have any effect on sync.

Ring Mod

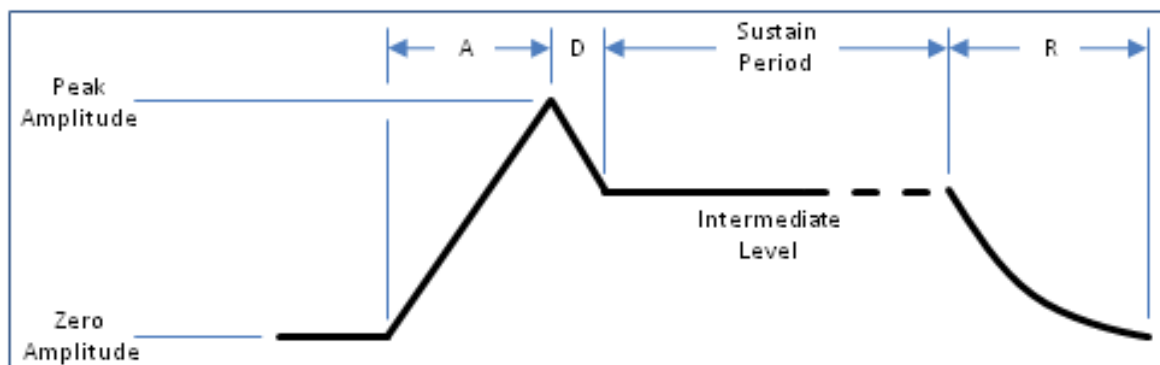
When set to voice 1 or 3, replaces the Triangle waveform output of that voice with a “Ring Modulated” combination of Oscillators 1 and 3.

When set to voice 2, replaces triangle waveform output of voice2 with a “Ring Modulated” combination of Oscillators 2 and 1.

Varying the frequency of Oscillator 1 with respect to Oscillator 3 produces a wide range of non-harmonic overtone structures for creating bell or gong sounds and for special effects. In order for ring modulation to be audible, the Triangle waveform of Oscillator 1 must be selected and Oscillator 3 must be set to some frequency other than zero. No other parameters of Voice 3 have any effect on ring modulation.

Volume Envelopes - ADSR

The "attack" and "decay" of a sound have a great effect on the instrument's sonic character. ADSR envelope is specified using four parameters:



- Attack time is the time taken for initial run-up of level from nil to peak, beginning when the key is first pressed.
- Decay time is the time taken for the subsequent run down from the attack level to the designated sustain level.
- Sustain level is the level during the main sequence of the sound's duration, until the key is released.
- Release time is the time taken for the level to decay from the sustain level to zero after the key is released.

Filter



The SID chips are equipped with a multimode resonant filter. The filter is the analog section of the circuit and its warm/dirty sound contributes to the authentic SID character.

Filter Modes

Press the filter button to toggle through the 4 filter states:
Off, Low Pass, Band Pass, High Pass, Low Pass+ High Pass (notch)

Cutoff

The cut knob adjusts the filter cutoff frequency

Resonance

The res knob adjusts the filter's resonance

Note: The resonance is more or less pronounced depending on the type of SID chip.

Filter Routing

One can connect or disconnect any of the three voices to and from the filter. To do so, hold down the filter mode button, which will display the voices that are currently connected to the filter. When a voice is connected, the waveform LEDs will light up. To connect or disconnect a voice from the filter, press any of its waveform buttons.

Modulation (LFO)



TherapSID has 3 LFOs to bring your synth to life!

Note: the LFO values can also be transmitted as midi CCs to modulate other MIDI capable instruments.

LFO Waveforms

There are 5 LFO types to choose from:

Square, Triangle, Saw, Noise and Env3 (ADSR envelope of voice 3).

- Move either of the 3 LFO's depth or rate knobs to select that LFO.

- Press the lfo shape buttons to change the selected LFO's shape.

You can also assign no shape at all by pressing a readily lit shape.

In this case the LFO's depth knob becomes a manual controller.

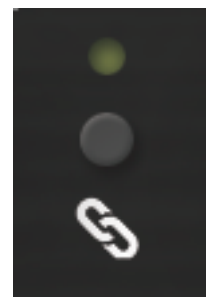
Assigning LFOs to knobs

You can link any of the three available LFOs to the following knobs:

Filter Cutoff, Filter Resonance, Tune1, Tune2, Tune3, Fine1, Fine2, Fine3, Width1, Width2, Width3, LFO Depth1, LFO Depth2, LFO Depth3, LFO Rate1, LFO Rate2, LFO Rate3, Arpeggiator Scrub, Arpeggiator Range, Arpeggiator Rate

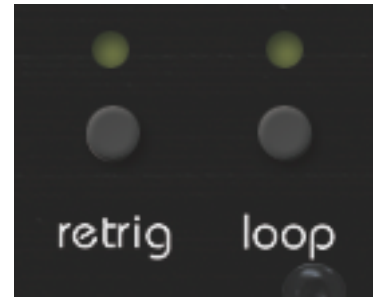
Simply manipulate the desired knob and then press the chain button of the LFO you wish to link to it. The chain LED will light up, indicating that the LFO is now linked to the selected knob.

Should you need to unlink the LFO, simply press the link button again, and the chain LED will deactivate. It's important to note that you can link a single LFO to multiple knobs!



Re-trigger & Loop

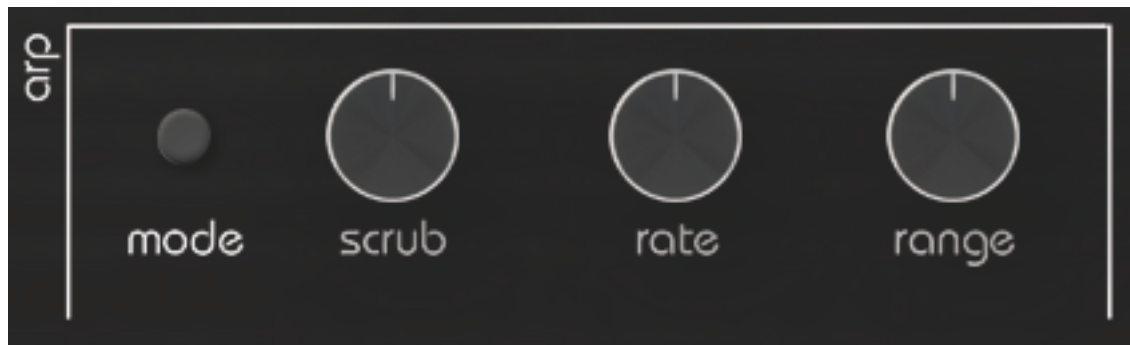
the LFOs can be used as "one-shot" envelopes by deactivating the looping feature using the loop button. This is useful for achieving pitch decay on percussive sounds and other effects. Additionally, the LFOs can be re-triggered on every key press by toggling the retrig button.



CV Override

Each of the three LFOs can be overridden using the corresponding CV input jack. By plugging a 1/8" mono jack into the desired CV input, you can take control of the LFO with an external source. The expected CV range is 0-5v DC.

Arpeggiator



TherapSID MKII has a brand new arpeggiator that is easy to use but can become wild when modulated by LFO!

When active, the arpeggiator re-triggers LFOs
The arpeggiated notes are also transmitted via MIDI

Arp Modes

The arpeggiator has 7 modes that you can access by pressing the mode button. The currently selected mode is displayed on the LED display.

Here's a description of each mode:

Up: The arpeggiator will play all held notes in a loop, starting from the lowest note and moving up. If the range knob is set to a value above zero, the sequence will add an octave to each loop.

Down (d0): This mode is similar to Up mode, but the arpeggiator plays the held notes in a loop starting from the highest note and moving down the scale.

Up Down (Ud): This mode combines the Up and Down modes. The arpeggiator plays the held notes in a loop, starting from the lowest note and moving up the scale, then reverses direction and moves down the scale.

Random (rd): In this mode, the arpeggiator selects notes from the held keys at random.

Octave (OC): The arpeggiator repeats each note at all available octaves before advancing to the next note. The number of octaves played can be adjusted using the range knob.

Trill Plus 1 semitone (P1): The arpeggiator plays each note from the lowest to the highest, followed by the note one semitone above it.

Trill Plus 2 semitones (P2): This mode is similar to P1, but the arpeggiator plays each note followed by the note two semitones above it.

Scrub

You can use the scrub knob to jog through the arpeggiator notes. This is particularly powerful when linked to an LFO.

Note: The arpeggiator has to be in OFF mode for Scrubbing to work.

Rate & Range

Use the rate knob to adjust the speed of the arpeggiator and the range knob to set the octave span (1-4).

Note: the arpeggiator can sync to MIDI clock.

MIDI

TherapSID can transmit and receive MIDI. A little dot at the right of the first LED digit indicates incoming MIDI, a dot at the right of the second LED digit indicates outgoing MIDI

MIDI Master Channel Selection

TherapSID can receive and send MIDI on the channels of your choice. You can individually change the master input and output channels at any time by following these steps:

-To select MIDI input channel: Hold Arp Mode and press Preset Up
Now the input channel is displayed on the led display.
Change the MIDI input channel (1-16) with the Preset Up/Down buttons
When done, confirm with a final press of the Arp Mode button. Display goes blank and the channel is saved to EEPROM

-To select MIDI output channel: Hold Arp Mode and press Preset Down
Now the output channel is displayed on the led display.
Change the MIDI output channel (1-16) with the Preset Up/Down buttons
When done, confirm with a final press of the Arp Mode button. Display goes blank and the channel is saved to EEPROM

Triggering Voices Separately

Additionally, you have the ability to trigger the three voices individually on separate MIDI channels.

To specify the MIDI channels for each voice, please use the [settings tool](#).

By default, the MIDI channels assigned to voices 1, 2, and 3 are 2, 3, and 4, respectively.

Note: In paraphonic mode or when the fat mode is set to 5, all voices are allocated to the master channel. Consequently, it becomes impossible to trigger the individual voices in these cases.

MIDI Preset Management

You can transfer all presets to and from a computer via MIDI System Exclusive (SYSEX) transfers. This is handy to back up or share your presets with fellow TherapSID owners.

To transmit (dump) SYSEX:

Hold Preset Down during startup. The SYSEX is automatically sent out of the MIDI port.

To receive SYSEX:

Hold Preset Up during startup. TherapSID will enter SYSEX receive mode, indicated Re on the LED display panel.

You can now send the SYSEX you previously dumped to TherapSID.

At the end of the transfer, the Eeprom will be updated. This takes around 13 seconds. The progress % is indicated 0-99 on the LED Display.

MIDI Controller Implementation

Note: the knobs and buttons (AND LFOs!) send their corresponding MIDI CCs out too, so you can double TherapSID as a powerful MIDI controller for other synths!

| MIDI Message | Range | Result | Direction |
|------------------------|-------|------------------------------|--------------|
| Note On/Off CH1 | 1-127 | Trigger Voices Unison | receive/send |
| Note On/Off CH2 | 1-127 | Trigger Voice1 only | receive/send |
| Note On/Off CH3 | 1-127 | Trigger Voice2 only | receive/send |
| Note On/Off CH4 | 1-127 | Trigger Voice3 only | receive/send |
| Control CC#6 | 1-127 | Voice1 Attack | receive/send |
| Control CC#7 | 1-127 | Voice1 Decay | receive/send |
| Control CC#8 | 1-127 | Voice1 Sustain | receive/send |
| Control CC#9 | 1-127 | Voice1 Release | receive/send |
| Control CC#14 | 1-127 | Voice2 Attack | receive/send |
| Control CC#15 | 1-127 | Voice2 Decay | receive/send |
| Control CC#16 | 1-127 | Voice2 Sustain | receive/send |
| Control CC#17 | 1-127 | Voice2 Release | receive/send |
| Control CC#22 | 1-127 | Voice3 Attack | receive/send |
| Control CC#23 | 1-127 | Voice3 Decay | receive/send |
| Control CC#24 | 0-127 | Voice3 Sustain | receive/send |
| Control CC#25 | 0-127 | Voice3 Release | receive/send |
| Control CC#32+59 | 0-127 | Filter Cutoff | receive/send |
| Control CC#33 | 0-127 | Filter Resonance | receive/send |
| Control CC#3 | 0-127 | Voice1 Tune | receive/send |
| Control CC#11 | 0-127 | Voice2 Tune | receive/send |
| Control CC#19 | 0-127 | Voice3 Tune | receive/send |
| Control CC#2 | 1-127 | Voice1 Pulse Width | receive/send |

| MIDI Message | Range | Result | Direction |
|------------------------------|------------|--------------------|--------------|
| Control CC#10 | 1-127 | Voice2 Pulse Width | receive/send |
| Control CC#18 | 1-127 | Voice3 Pulse Width | receive/send |
| Control CC#4 | 1-127 | Voice1 Fine | receive/send |
| Control CC#12 | 1-127 | Voice2 Fine | receive/send |
| Control CC#20 | 1-127 | Voice3 Fine | receive/send |
| Control CC#5 | 1-127 | Voice1 Glide | receive/send |
| Control CC#13 | 1-127 | Voice2 Glide | receive/send |
| Control CC#21 | 1-127 | Voice3 Glide | receive/send |
| Control CC#34 | 1-127 | Arp Scrub | receive/send |
| Control CC#35 | 1-127 | Arp Rate | receive/send |
| Control CC#36 | 1-127 | Arp Range | receive/send |
| Control CC#26 | 1-127 | Lfo1 Rate | receive/send |
| Control CC#27 & Mod Wheel | 0-127 | Lfo1 Depth | receive/send |
| Control CC#28 | 0-127 | Lfo2 Rate | receive/send |
| Control CC#29 | 0-127 | Lfo2 Depth | receive/send |
| Control CC#30 | 0-127 | Lfo3 Rate | receive/send |
| Control CC#31 | 0-127 | Lfo3 Depth | receive/send |
| Control CC#49 | 0=off 1=on | Voice1 Sync | receive/send |
| Control CC#50 | 0=off 1=on | Voice1 Ring | receive/send |
| Control CC#51 | 0=off 1=on | Voice2 Sync | receive/send |
| Control CC#52 | 0=off 1=on | Voice2 Ring | receive/send |
| Control CC#53 | 0=off 1=on | Voice3 Sync | receive/send |
| Control CC#54 | 0=off 1=on | Voice3 Ring | receive/send |
| Control CC#37 | 0=off 1=on | Voice1 Rect | receive/send |
| Control CC#38 | 0=off 1=on | Voice1 Triangle | receive/send |

| MIDI Message | Range | Result | Direction |
|---------------|---|-----------------|--------------|
| Control CC#39 | 0=off 1=on | Voice1 Saw | receive/send |
| Control CC#40 | 0=off 1=on | Voice1 Noise | receive/send |
| Control CC#41 | 0=off 1=on | Voice2 Rect | receive/send |
| Control CC#42 | 0=off 1=on | Voice2 Triangle | receive/send |
| Control CC#43 | 0=off 1=on | Voice2 Saw | receive/send |
| Control CC#44 | 0=off 1=on | Voice2 Noise | receive/send |
| Control CC#45 | 0=off 1=on | Voice3 Rect | receive/send |
| Control CC#46 | 0=off 1=on | Voice3 Triangle | receive/send |
| Control CC#47 | 0=off 1=on | Voice3 Saw | receive/send |
| Control CC#48 | 0=off 1=on | Voice3 Noise | receive/send |
| Control CC#55 | 0-25=LP 26-50=BP 51-75=HP 76-100=LP+HP(not ch) 101-127=OFF | Filter Mode | receive/send |
| 56 | 0-127 | lfo1 | send |
| 57 | 0-127 | lfo2 | send |
| 58 | 0-127 | lfo3 | send |

TherapSID Tool V1.0
TherapSID detected!
firmware: 2.0

MIDI INPUT (from device):

Read

mioXL DIN2

MIDI OUTPUT (to device):

Write

mioXL DIN7

OPTIONS

☒ MODWHEEL > LFO1

☒ AFTERTOUCH > LFO2

☒ VELOCITY > LFO3

☐ LFO SENDS CC

☐ ARP SENDS NOTES

☐ PW LIMITER

☐ ARMSID MODE

MIDI CHANNELS:

MASTER

1

VOICE1

2

VOICE2

3

VOICE3

4

OUTPUT

1

MASTER VOL:

100%

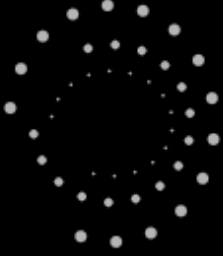
PITCH BEND RANGE

UP

4

DOWN

4



Settings Tool

The online tool provides a convenient way to set TherapSIDs parameters within one screen. You can easily adjust the parameters to your liking using the tool's interface.

To use the online tool, your web browser must have MIDI support enabled (like Chrome).

No downloads or drivers are necessary, as the tool runs directly in your browser.

The tool is available at the following web address:

<https://www.twistedelectrons.com/tool>

It is recommended to hard refresh your browser before using the tool to ensure that you are using the latest version. This can be done by pressing Ctrl + F5 (Windows) or Command + Shift + R (Mac).

1. Select MIDI input and output ports:

To use the online tool, you need to select the MIDI input and output ports that are connected to your TherapSID. You can do this by using the drop-down menus located at the top of the screen.

2. Download current settings:

After selecting the MIDI input and output ports, press the "Read" button to download the current settings from your TherapSID device. This will allow you to view the current settings and make changes if necessary.

3. Change parameters:

Once you have downloaded the settings, you can change any parameters that you want. The tool provides an intuitive interface for adjusting the settings.

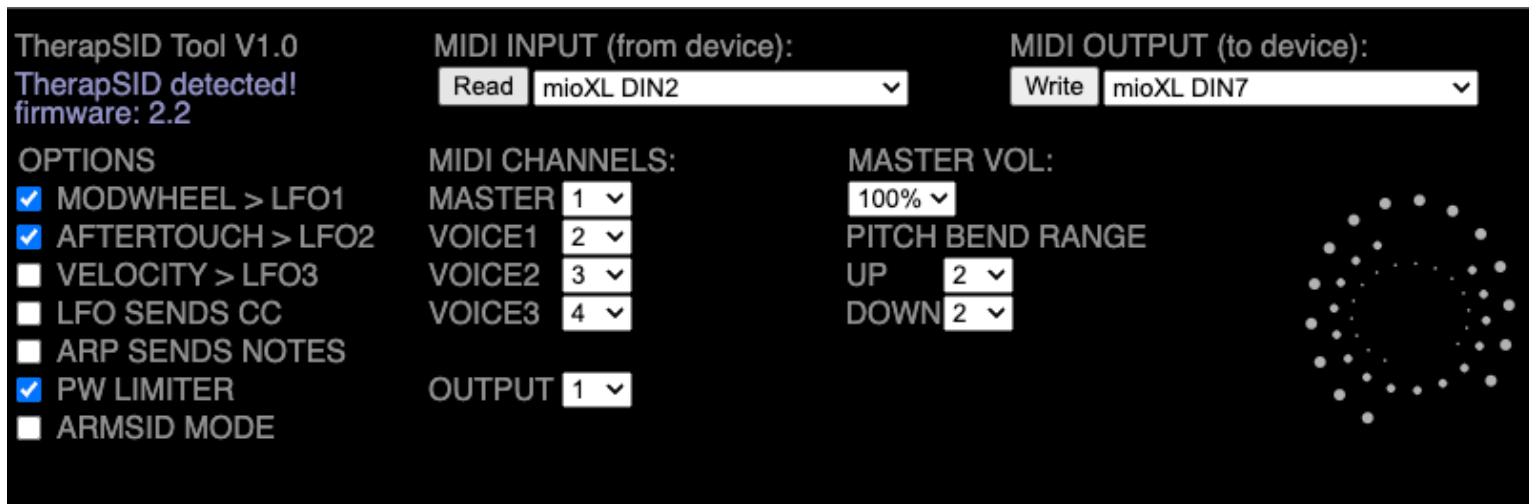
4. Update the device settings:

After making any desired changes, press the "Write" button to update the device with the new settings. This will ensure that the TherapSID is configured with your desired settings.

Settings Reset

If you wish to reset the global settings, simply hold preset reset at startup.

Below is a snapshot of the factory global settings for your reference:



TherapSID Tool V1.0
TherapSID detected!
firmware: 2.2

MIDI INPUT (from device):
Read

MIDI OUTPUT (to device):
Write

OPTIONS

- ☒ MODWHEEL > LFO1
- ☒ AFTERTOUCH > LFO2
- ☐ VELOCITY > LFO3
- ☐ LFO SENDS CC
- ☐ ARP SENDS NOTES
- ☒ PW LIMITER
- ☐ ARMSID MODE

MIDI CHANNELS:

MASTER

VOICE1

VOICE2

VOICE3

OUTPUT

MASTER VOL:

PITCH BEND RANGE

UP

DOWN

Firmware updates

TherapSID can receive firmware updates through MIDI system exclusive messages (sysex). You can check the latest firmware version on the TherapSID page online:

<http://twisted-electrons.com/therapsid/>.

The current firmware version is displayed on the 7-segment LED display for 1 second during startup.

To enter the update mode (also known as boot-loader mode):

- Unplug the power cord from the unit (or use the power button on MKIII).
- Press and hold down the filter type button (located at the bottom left of the control panel).
- Power the unit back on

When you enter the boot-loader mode, all the LEDs on the control panel will light up. This indicates that the TherapSID is ready to receive the sysex data from your computer.

Windows

If you're using a Windows PC, we recommend using MIDI-OX to update your TherapSID's firmware. MIDI-OX is a free and highly useful app.

Here are the steps to follow:

1. Launch MIDI-OX on your computer.
2. In the Sysex window, click on Command and select Window > Load File. Navigate to the location where you have stored the firmware update file.
3. Click on Command again and select Window > Send Sysex.
4. This will send the firmware update to your TherapSID. Please make sure the Therapsid is in boot-loader mode and connected to your computer via MIDI before sending the sysex file.

Mac

If you're using a Mac, we recommend using SysEx Librarian to update your TherapSID's firmware. SysEx Librarian is a free and user-friendly app.

1. Launch SysEx Librarian on your Mac.
2. In the top drop-down menu, select your MIDI interface (if it's not already selected).
3. Drag the MIDI SysEx file from the Finder into the frame of SysEx Librarian
4. Select the file by clicking on it with your mouse.
5. Click the Play button to send the firmware update to your Therapsid.

Please ensure that the TherapSID is in boot-loader mode and connected to your Mac via MIDI before sending the sysex file.



SID Access and Configuration

Ensure that TherapSID is powered OFF.

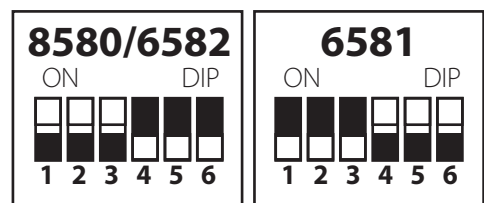
Remove the 6 screws from underneath the unit using a 2mm Allen key.

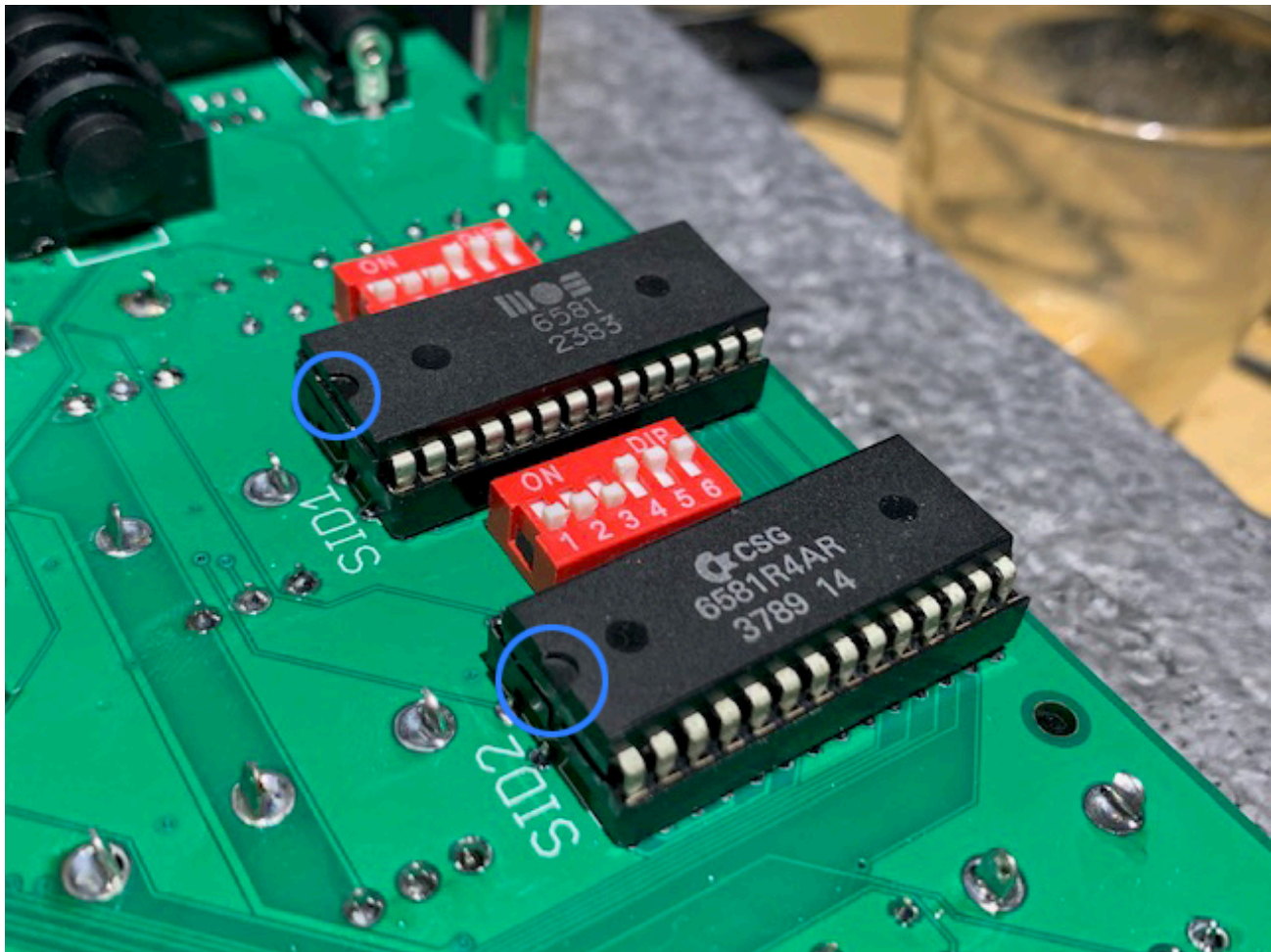
You can now remove the bottom part of the chassis to access the SID chip(s).

IMPORTANT: Be careful not to cross thread the screws upon reassembly!

Use the Allen key to recenter the brass posts within the holes if necessary.

If you are having difficulty removing or replacing the bottom chassis try releasing the 1/4" Jack nuts a little...





When installing SID chips into your TherapSid, make sure to follow these guidelines:

The C-shaped notch on the chip should be pointing to the left.

The print on the SID chips should be oriented as shown in the photo above.

Following these guidelines will ensure that the SID chips are correctly installed and will function properly in your TherapSid.

Use the DIP switches to configure the chips as follows

| | |
|------------|----------|
| 8580/6582: | 6581: |
| 123 UP | 123 DOWN |
| 456 DOWN | 789 UP |

PLEASE SET THE SWITCHES TO THE 2 ABOVE SETTINGS ONLY!

Removing chips

To remove a SID chip from your TherapSid, follow these steps:

Gently lever the chip up on one side, lifting it to about a 30-degree angle.

Slide a flat-blade screwdriver under the chip to help lift it straight from underneath.

Be careful not to bend or damage the pins on the chip or the socket while removing it. With a little patience and gentle force, the chip should come out smoothly.

