

OPL Studio

User Manual

For software version 1.0.1



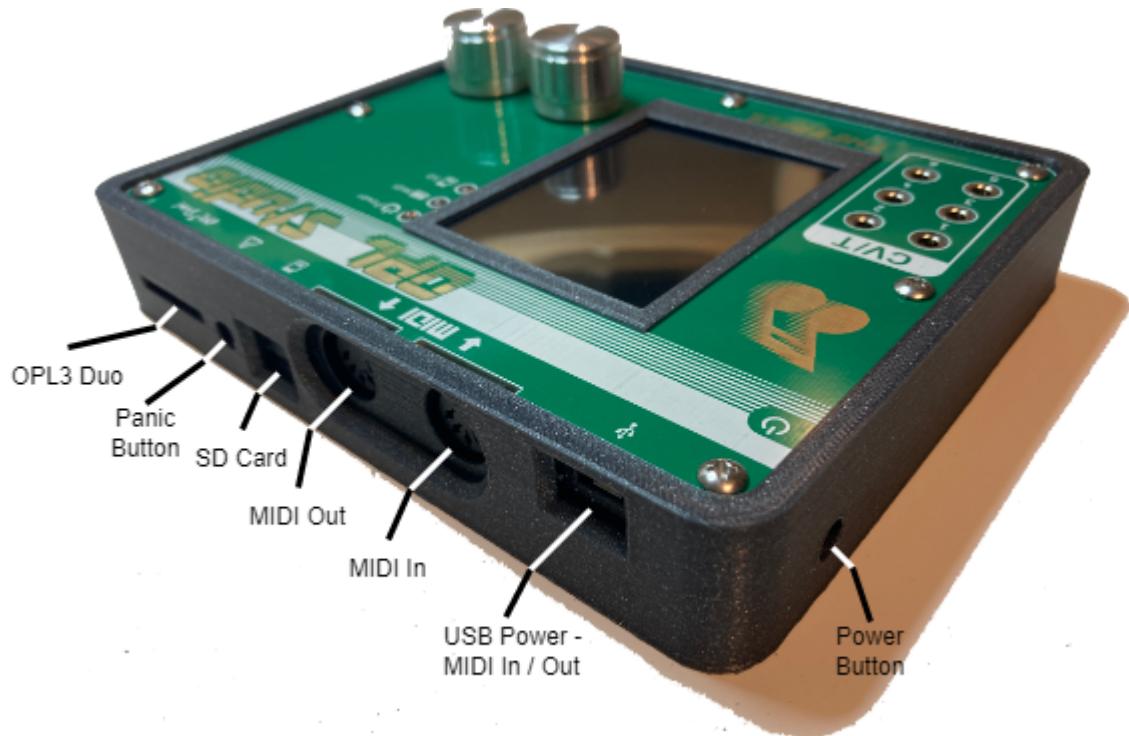
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OPL Studio Introduction



Powering The Device On / Off

The OPL Studio is powered with a 5v micro USB plug at the back of the device. Once OPL Studio receives power it will start up. Booting the device will take a few seconds where the screen will be blank and the power LED will be off before the boot screen shows up.

On the left side of the device you will find the soft power button. When OPL Studio is powered on you can hold this button for a second to make OPL Studio go into sleep mode. The screen will fade out and the device will power down. To wake OPL Studio up press the power button again and OPL Studio will be brought back to the home screen. You will not lose any unsaved work when putting OPL Studio into sleep mode.

When doing a hard reset by unplugging the power you will lose any unsaved work.

When you power on OPL Studio for the first time, or after a factory reset you will be taken to the touch screen calibration before you're taken to the home screen.

MIDI Connectors

OPL Studio has two ways to connect to other MIDI devices. The most convenient is by connecting OPL Studio to a computer over USB. This will both power OPL Studio and the device will show up as a MIDI in/out device named 'OPL Studio' on the computer.

On the back of the device there are two MIDI DIN connectors to connect external MIDI devices. Both USB MIDI and MIDI DINs are always active, i.e. connecting OPL Studio over USB does not disable the DIN I/O and vice versa.

To verify OPL Studio MIDI activity the MIDI LED on the front panel will blink green when receiving MIDI data and red when sending MIDI data.

Micro SD

For storage OPL Studio uses a micro SD card which can be inserted at the back of the device. The SD card is used to save / load OPL Studio session files and instrument patch files. When the SD card is being accessed the SD LED on the front panel will blink.

Note that the internal SD card slot of the Teensy is not in use, inserting an SD card in this slot has no effect.

Panic Button / Factory Reset

On the back of your OPL Studio you will find the panic button. You can press this button for example when the synthesizer has become stuck on playing a note due to receiving the wrong MIDI message or wrong patch settings. When you press the panic button the MIDI buffer will be flushed, the OPL3 Duo! or OPL2 Audio Board synthesizer will be reset and the internal clock will be stopped. You will not lose any work.

When your OPL Studio has gone into an unusable state, for example the pointer has been wrongly calibrated and you cannot access its settings to do a recalibration, you can do a factory reset of OPL Studio by holding the panic button and power cycling the device. The boot screen will show a message to keep holding the panic button for factory reset. When you keep holding the panic button OPL Studio powers down and reboot. After a factory reset you will be taken to the touch screen calibration and all settings will be reset to default.

OPL3 Duo! / OPL2 Audio Board Connector

The current OPL Studio hardware does not have an internal OPL synthesizer. It requires an OPL3 Duo! or OPL2 Audio Board to be connected to produce audio. Best results are obtained by connecting an OPL3 Duo! board. **When connecting an OPL2 Audio Board**

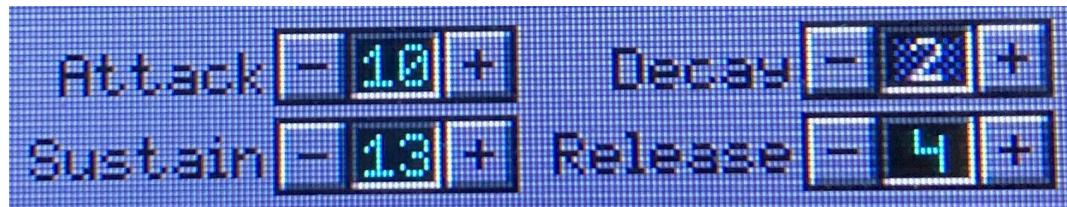
review the kit assembly instructions on how to modify the included ribbon cable to work with the OPL2 Audio Board. Also due to the limited number of audio channels on the OPL2 you may experience notes being cut off or not playing at all when more than 9 notes are being played simultaneously across all MIDI channels.

On current hardware some noise may be experienced on the synthesizer due to not having an isolated power supply from OPL Studio. Noise will be greatly reduced by tapping audio from the line out plug of the OPL3 Duo! or OPL2 Audio Board. Alternatively you may want to power the synthesizer board externally to obtain a cleaner signal.

Rotary Encoders

Your OPL Studio has two rotary encoders: encoder A and encoder B. The encoders are used to make quick changes when editing. Encoder A is used to select the parameter and encoder B is used to change the parameter value.

When an OPL Studio module is open you can cycle through the editor controls by turning encoder A. The control that is active will be highlighted and its value can be changed by turning encoder B. Usually the parameter change takes effect immediately.



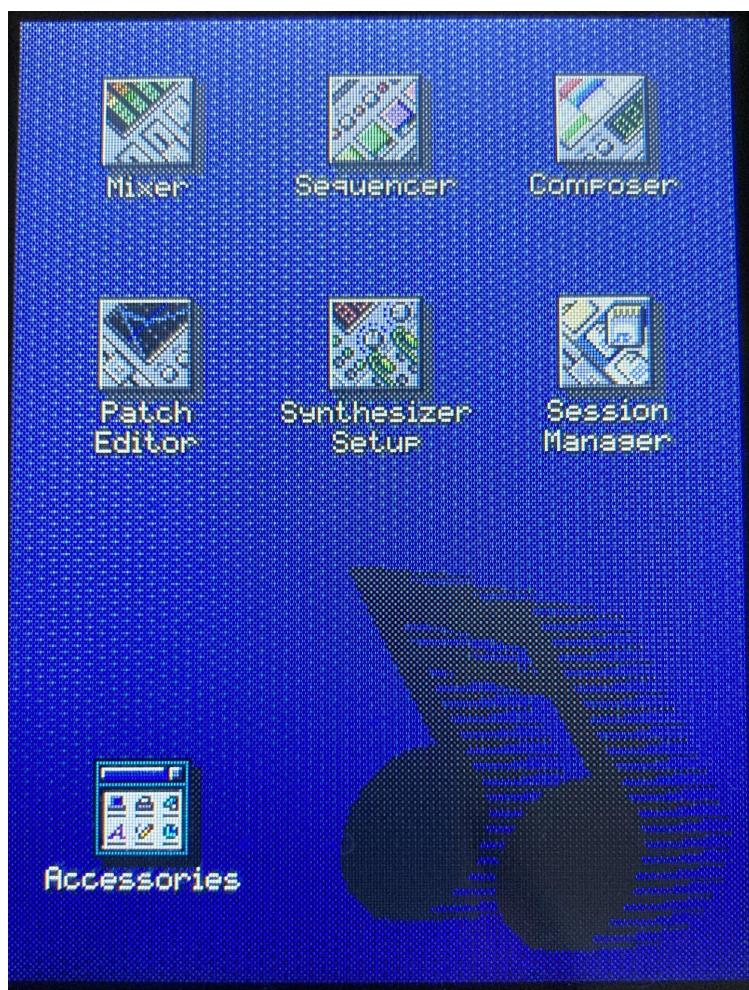
The encoders can also be pushed to trigger editor functions that differ per OPL Studio module. For example in the sequence editors when you push encoder A it will start / stop sequence playback. Specific encoder push button functions are described below per OPL Studio Module.

Notice also that in some of the OPL Studio modules encoder B will have other usages than changing property values. For example in the composer module encoder B can be used to move the play head when the song grid is active. These special functions are also described below in more detail.



OPL Studio Home Screen and Modules

OPL Studio is built around a number of application modules that you can access from the home screen. Each module opens a window where you can edit specific synthesizer parameters. For example the Patch Editor module allows you to change the parameters of melodic and drum instrument patches, or the Sequencer module that allows you to set up and play various sequences that you created.

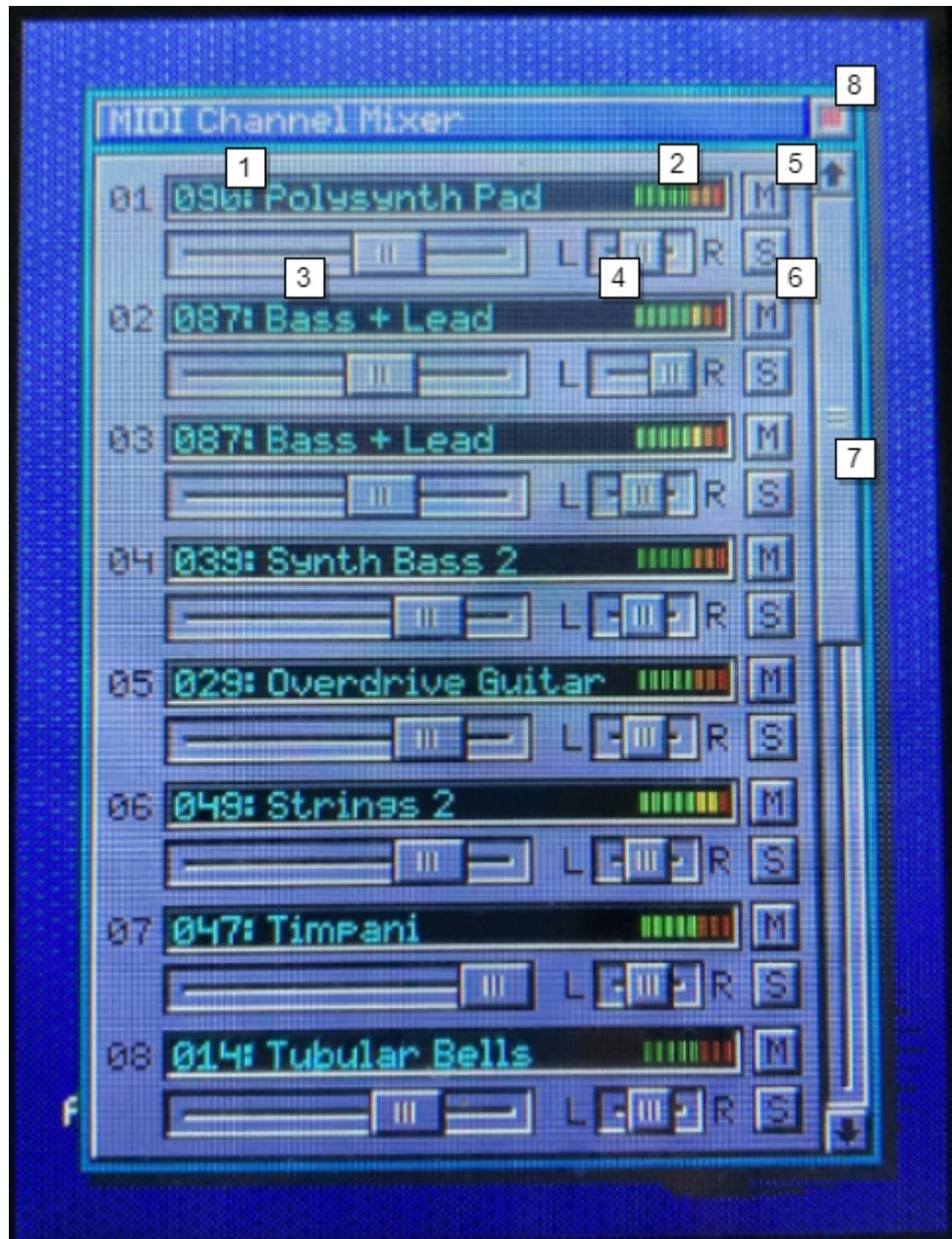


When OPL Studio boots it will launch into the home screen where all modules are listed. A module is launched by tapping its icon. The Accessories group contains quick access into the Drum Sequencer and Melody Sequencer sub-modules as well as the Settings. Below each of the OPL Studio modules will be described in more detail.



MIDI Channel Mixer

The MIDI channel mixer allows you to adjust the output levels and panning of the 16 MIDI channels. You can also see which instrument patch has been assigned to each of the channels and level indicator to show channel activity.



1. MIDI channel and current patch that is assigned to the channel. Note that channel 10 is fixed to 'OPL2 Drumkit' to play drum patches only.
2. Channel output level indicator.
3. Volume control shows current channel volume and can be used to change channel output level from 0 to 127.
4. Panning control shows current channel panning and can be used to change panning to left, center or right. The OPL3 supports hard panning only. The MIDI panning control ranges are as follows:

Controller Range	Panning
0 - 48	Left
49 - 80	Center
81 - 127	Right

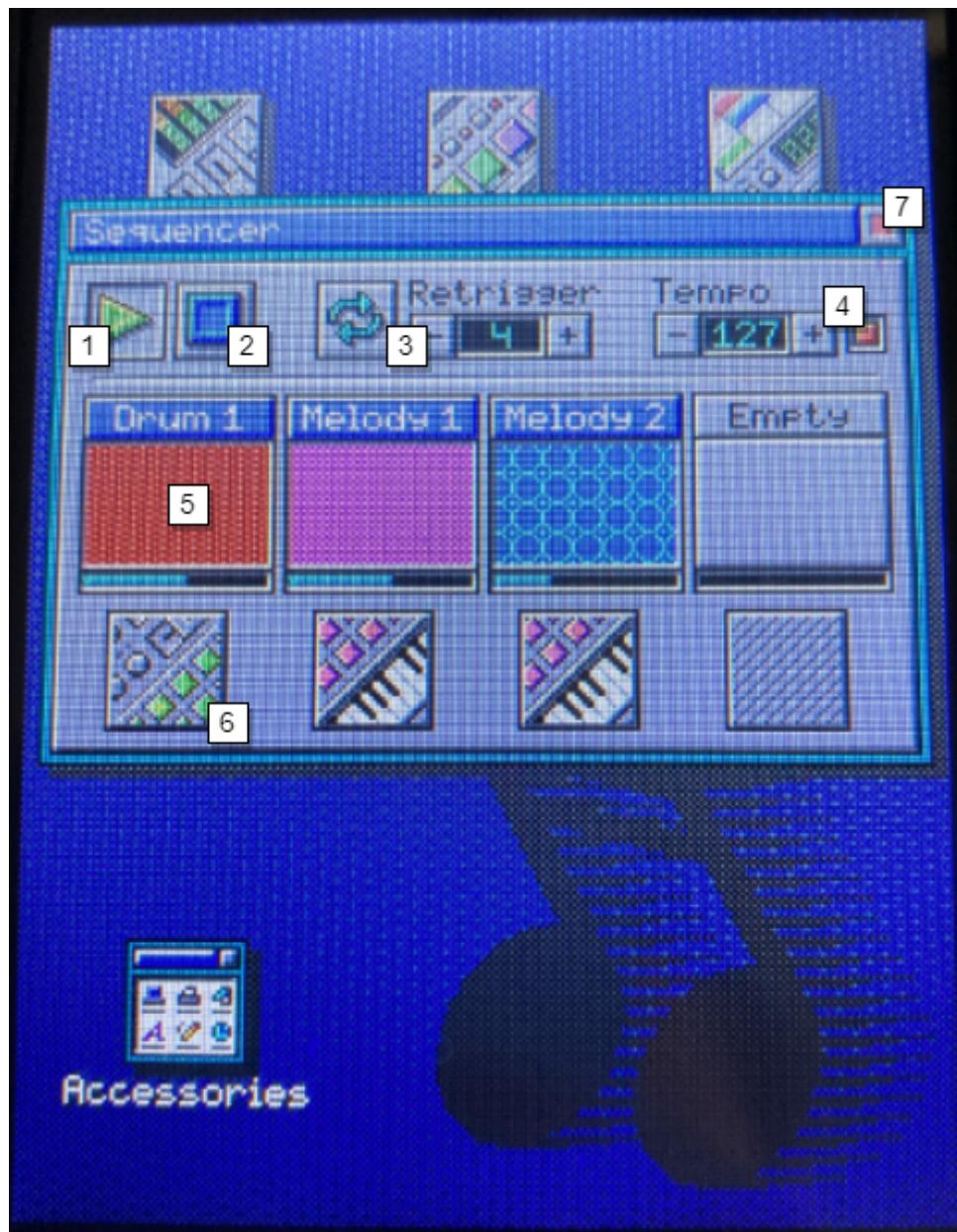
When OPL Studio is configured to use an OPL2, for example when using the controller with an OPL2 Audio Board, then the panning control will be disabled, because the OPL2 is a mono device. See OPL Studio Settings.

5. Channel mute toggle. Mute can also be toggled by pressing rotary controller A when the channel is highlighted.
6. Channel solo toggle when active all channels except for the solo channel will be muted. Solo can also be toggled by pressing rotary controller B when the channel is highlighted.
7. Channel scrollbar scrolls through the channel list. Alternatively rotary controller A can be used to scroll through the list.
8. Close button closes the MIDI Channel Mixer and returns to the Home Screen.



Sequencer

The sequencer module allows you to play up to four sequences at a time. From the sequencer you can create new or edit drum and melody sequences. Sequence playout will continue in the background if the sequencer is not open to allow changing synthesizer parameters and immediately hear changes.



1. Play / pause button that starts (or resumes) playback or pauses. By pressing encoder A playback can also be started or stopped, however when pressing encoder A the sequencer will rewind when the playback is stopped.
2. Stop button stops and rewinds sequencer playback.
3. Retrigger control that, when enabled, will restart the sequences every 1, 2, 4, 8, 16 or 32 ticks depending on the setting. Pushing encoder B when the retrigger control is active will also toggle between enabling and disabling sequencer retrigerring.

When encoder B is pushed when the retrigger control is not active it will immediately retrigger the sequences from step 1 during playback.

4. Tempo adjustment and beat indicator. The tempo can be changed from 40 up to 250 beats per minute. While playing the beat indicator will flash every 4th step to indicate a beat.

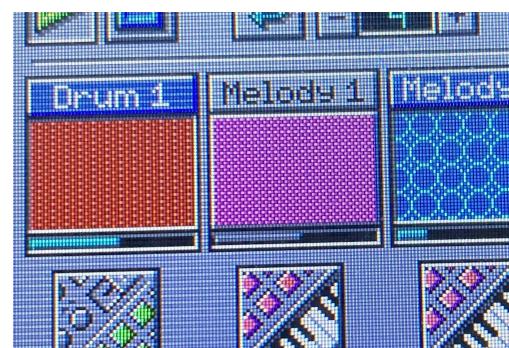
When the clock source is set to external in OPL Studio Settings then the tempo cannot be adjusted and the indicator will show the tempo of the external clock source. See OPL Studio Settings.

5. Sequencer slots. The sequencer has four slots where sequences can be assigned to play simultaneously. Initially all four slots will be empty as is shown in the 4th slot in the screenshot.

To assign a sequence to a slot tap on the slot's title bar. This will open the sequence selection dialog where you can select a drum or melody sequence. Selecting an empty sequence will launch the sequence editor module. See below for more details on the sequence selection dialog.

When a sequence has been assigned to a slot the color and pattern of the sequence will be shown. Directly below the sequence button there is a small progressbar that will show the playout progress of the sequence in that slot when playback is ongoing.

Clicking the sequence button will toggle mute on the sequence. The slot title as well as the sequence progressbar will turn gray and the sequence button will pop out to indicate that the slot has been muted.



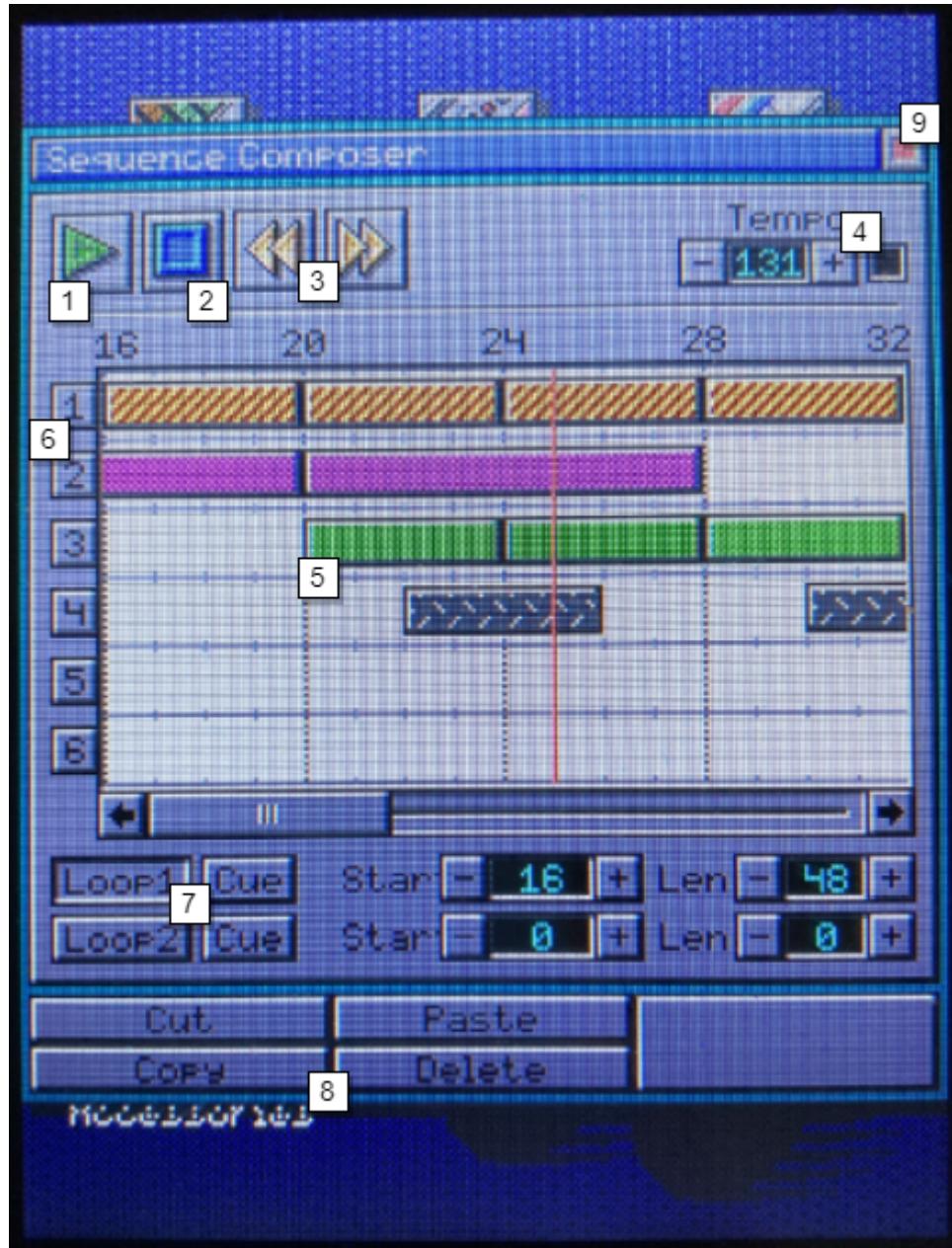
6. Sequence editor buttons. When a slot has a sequence assigned an editor button will appear below the slot. By clicking the button the sequence editor will be opened where the sequence can be edited while playing.

7. Close button will close the sequencer and return to the home screen. Playback will continue in the background.



Composer

The composer module allows you to create larger songs made up of the sequences that you created. The composer has six tracks of 1024 beats and has the capability to set two separate loops in the song.



1. Play / pause button that starts (or resumes) playback or pauses. By pushing encoder A, playback can also be started or paused.
2. Stop button stops and rewinds sequencer playback.
3. Rewind and fast forward. When pressed rewinds or fast forwards the song by 4 beats. Long pressing these buttons will respectively jump back to beat 0 or to the last beat in the song.
4. Tempo adjustment and beat indicator. The tempo can be changed from 40 up to 250 beats per minute. While playing the beat indicator will flash every 4th step to indicate a beat.

When the clock source is set to external in OPL Studio Settings then the tempo cannot be adjusted and the indicator will show the tempo of the external clock source. See OPL Studio Settings.

5. Song grid. The song grid shows you the six tracks of the song and the sequences that are played. The song grid is divided into blocks of single beats (4 sequence steps). Above the grid the beat is shown. A vertical red line in the song grid shows the current position of the playhead which will advance and scroll the song grid during playback.

The sequences that make up the song are shown as blocks in the grid. Each block shows the color and pattern that was assigned to the sequence. Sequences cannot overlap on the same track.

To add a sequence to the song, long press on the cell of the beat where you want the sequence to start. This will open the sequence selection dialog where you can select the sequence to be played at the given position or from where you can create a new sequence that will be added to the song. If a newly added sequence overlaps with a sequence that is already present in the song then it will remove the existing sequence.

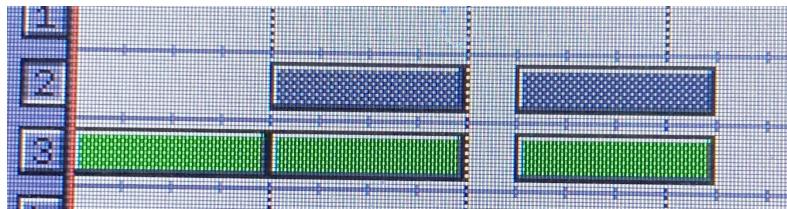
Long pressing on an existing sequence will also open the sequence selection dialog which allows you to exchange the existing sequence for another or to remove the sequence from the song.

Tapping a sequence block in the song grid will add or remove it from the selection. A selection can be cut, copied or deleted from the song using the action button at the bottom of the window.

Double tapping on a sequence will launch the sequence editor for the given sequence.

When focused the playhead can be moved by encoder B.

6. Track mute buttons. Individual tracks of the song can be muted by toggling the track mute button. When muted the button will be in its down state and the sequence blocks of the track will be grayed out.



7. Song loops. A song can have two loop points that are set with the loop controls. Each loop has a starting beat set by the 'Start' control and a length in beats set by the 'Len' control. The loop is enabled by toggling the Loop1 or Loop2 button.

During playback, when a loop is active and the loop end point is reached the song will jump back to the start of the loop and continue from there.

With the Cue button you can jump immediately to the start of the loop.

8. Editor action buttons. The action buttons are used to cut, copy, paste or delete parts of a song. In order to use the cut, copy or delete button first a selection of one or more sequence blocks has to be made by tapping the sequences in the song. This will enable the action buttons.

After cutting or copying parts of a song you can paste your selection by tapping the Paste button. The paste button will be in its pressed state and nothing seems to happen. You can now tap the cell in the song grid where you want to paste the sequences that were copied. After pasting the Paste button will pop out and you are back in normal editing mode.

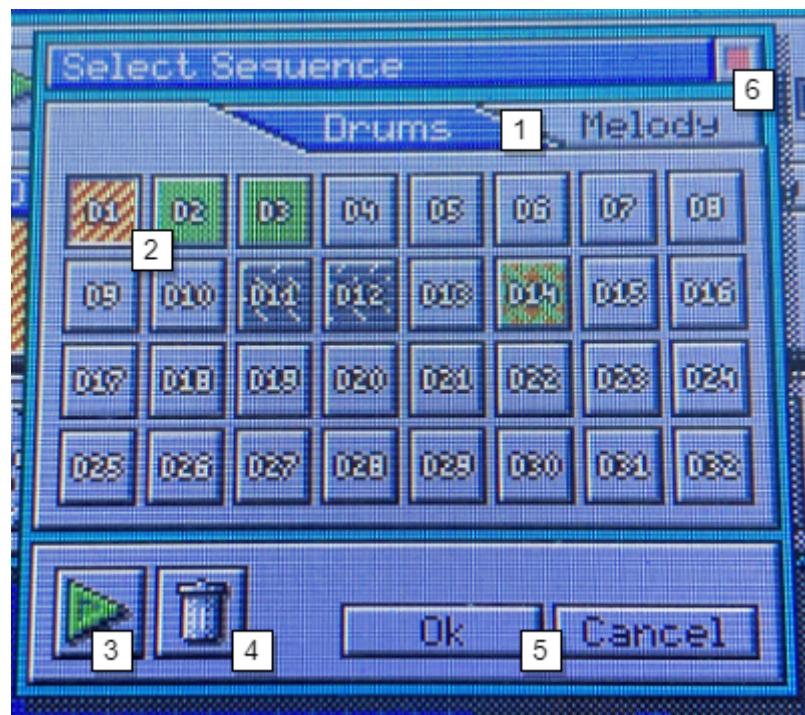
The Delete button will remove the selected sequences from the song in a more quick way than long pressing and removing individual sequences using the sequence selection dialog.

9. The close button will close the composer module and stops playback.



Sequence Selection Dialog

The sequence selection dialog is opened when you are assigning a sequence to one of the slots in the sequencer module or when adding a sequence to a song in the composer module.



1. Sequence type tabs. Selects between drum and melody sequences.
2. Sequence selection shows all available drum or melodic sequences. Each sequence will show with its assigned color and pattern to easily recognise it. You select a sequence by tapping it. If the dialog was opened when a sequence was already in place then that sequence will be selected already in this overview. Only one sequence can be selected at a time.

If an empty sequence is selected (one without a color and pattern such as D4 in the screenshot) then after pressing Ok the sequence editor will be launched to create the sequence. After creating the sequence it will be assigned to the sequencer slot or added into the song.

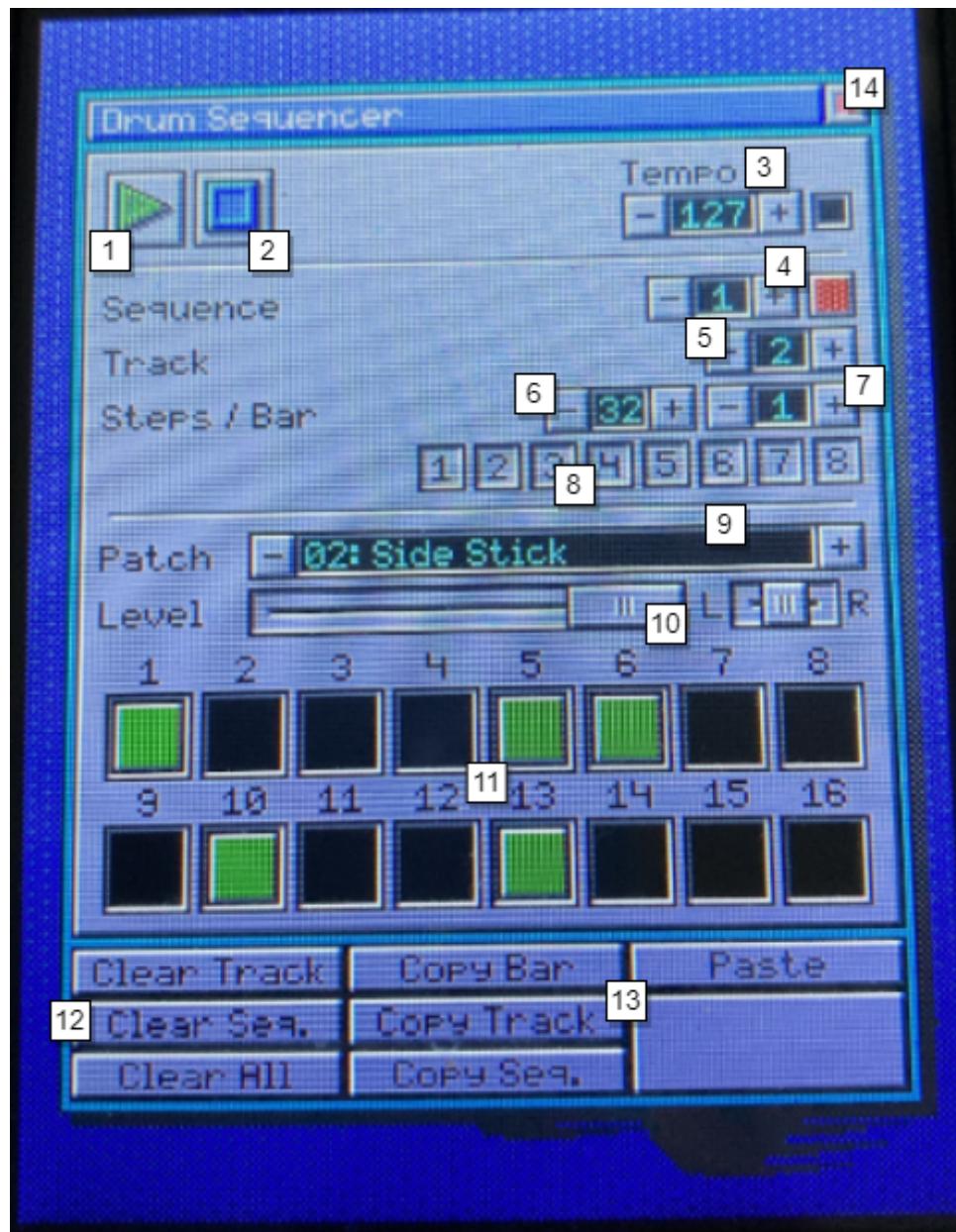
3. Sequence preview. When toggled on this will play the selected sequence to give a preview.

4. Remove sequence. Removes the sequence from the sequencer slot or the song. The sequence itself will not be removed.
5. When tapping ok the sequence will be assigned to the sequencer slot or added to the selected position in the song. Tapping cancel will exit the dialog without making changes.
6. Close the dialog without making changes.



Drum Sequencer

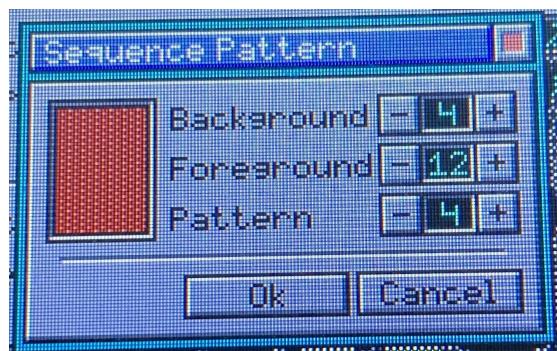
With the drum sequencer you can create and edit drum sequences. The drum sequencer can be accessed from the Sequencer or the composer when you edit or add a new drum sequence, or from the Accessories group on the home screen.



1. Play / pause the sequence that's currently active in the editor. Alternatively play / stop can be toggled by pressing rotary controller A.
2. Stop sequence playback and rewind to tick 1.
3. Tempo adjustment and beat indicator. While playing the beat indicator will flash every 4th step to indicate a beat.

When the clock source is set to external in OPL Studio Settings then the tempo cannot be adjusted and the indicator will show the tempo of the external clock source. See OPL Studio Settings.

4. Sequence index and pattern. This control selects which of the 32 drum sequences is active in the editor and it shows the color and pattern that represent the sequence in the OPL Studio sequencer and composer. To change the representation click the pattern to open the pattern editor window.



5. Track selection. The track selection control selects which of the 8 drum tracks is being shown in the sequence editor.
6. Sequence length control adjusts the number of steps in the drum sequence from 16, 32, 48 to 64.
7. The bar control selects which bar (16 steps of a sequence) is shown in the sequence editor. This can either be bar 1, 2, 3 or 4 and depends on the sequence length.
8. Track mute toggles between muting drum tracks in the sequence.
9. Patch control to select the drum patch to be used for the current track.
10. Output level and panning settings of the current track.

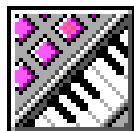
When OPL Studio is configured to use an OPL2, for example when using the controller with an OPL2 Audio Board, then the panning control will be disabled, because the OPL2 is a mono device. See OPL Studio Settings.

11. Sequence editor to edit the drum sequence. The sequence editor shows 16 steps, i.e. the active bar, of the currently active track in the drum sequence. The step count is given above each of the sequence step buttons. When a button is active (green) then the sequencer will play the drum patch set for that track when the step is triggered.

Sequence steps can be activated / deactivated by clicking on the step buttons. The step button will start blinking to indicate the editor cursor position. Rotary controller B may be used for editing by rotating the controller to advance the cursor and pressing the controller to toggle a sequence step. Pressing rotary controller B at any time while not in edit mode will jump into the sequence editor.

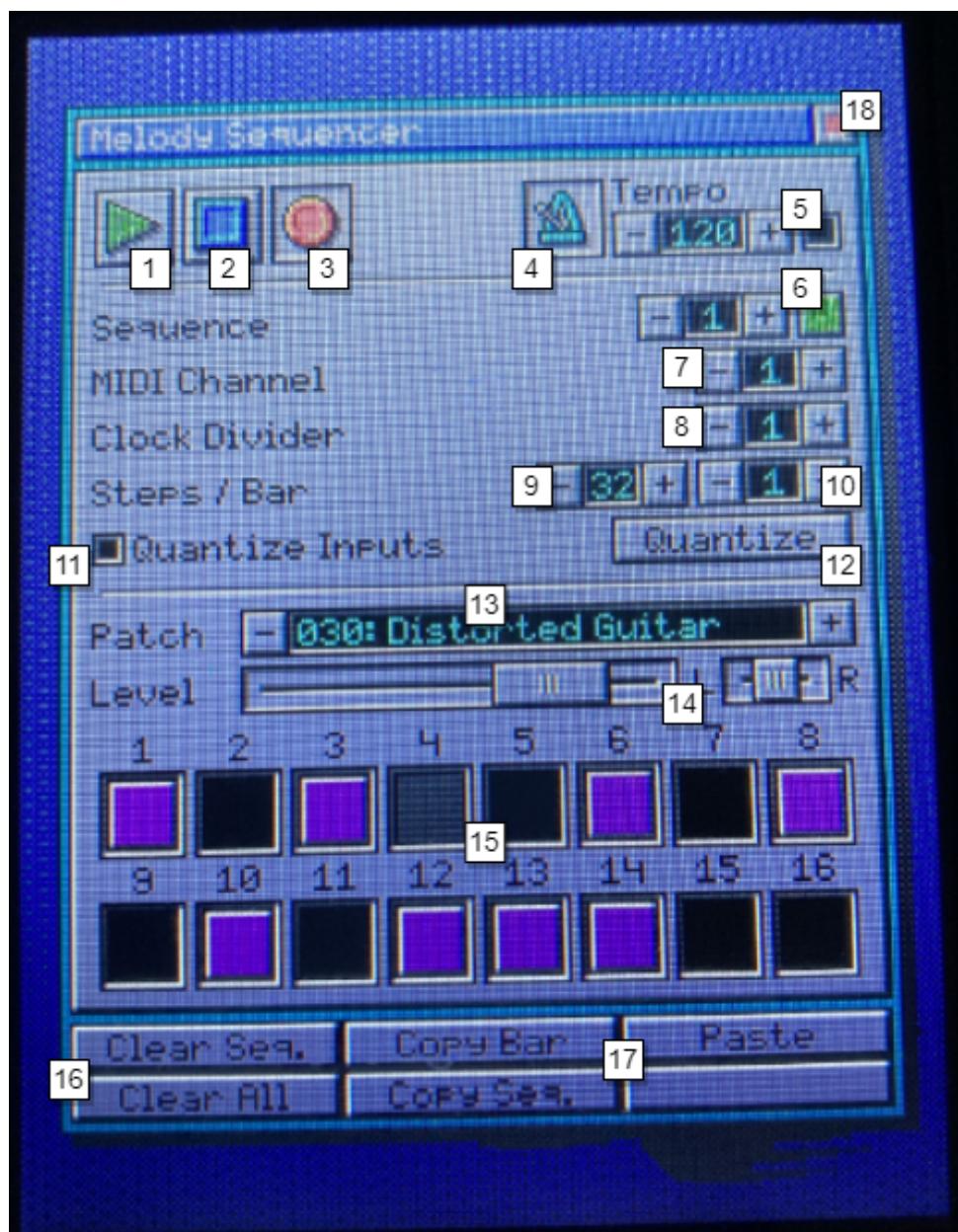
While playing the step buttons will light up to indicate the current step and the sequence will progress automatically.

12. Clear track, sequence, all will clear all steps of the currently active track (no confirmation), clear all tracks in the current sequence, or clear all sequences respectively.
13. Copy bar, track, sequence and paste. Copies the current bar, track or the full sequence. After copying paste can be used to paste the copied sequence data.
14. Close the Drum Sequencer and return to the Sequencer, Composer or Home Screen.



Melody Sequencer

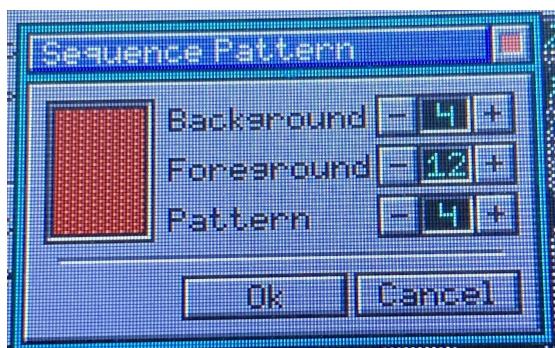
The melody sequencer is used to edit polyphonic melody sequences that are recorded from a MIDI device. There are 32 possible sequences that can be recorded either while live playing or step by step. The melody sequencer is opened when a new melody sequence is selected in the sequencer or the composer or it can be opened separately from the Accessories group on the home screen.



1. Play / pause the sequence that's currently active in the editor. Alternatively play / stop can be toggled by pressing rotary controller A.
 - When the sequencer is put in record mode then pressing play will start the recording.
 - When the sequencer is put in record mode and the play button is long pressed then the sequencer will be armed to start recording as soon as a note on MIDI event is received on its MIDI channel. The play and record buttons will start blinking.
2. Stop sequence playback or recording and rewind to tick 1.
3. Record puts the sequencer in record mode. While in record mode the current step in the sequence will start blinking and the sequencer will be in step recording mode as long as the play button has not been clicked. Pressing encoder B will also enable recording mode or stop it when a live recording is ongoing. See below for more information on the different recording modes
4. Metronome. If enabled the metronome will produce a sound on every beat while a sequence is recorded.
5. Tempo adjustment and beat indicator. While playing the beat indicator will flash every 4th step to indicate a beat.

When the clock source is set to external in OPL Studio Settings then the tempo cannot be adjusted and the indicator will show the tempo of the external clock source. See OPL Studio Settings.

6. Sequence index and pattern. This control selects which of the 32 melody sequences is active in the editor and it shows the color and pattern that represent the sequence in the OPL Studio sequencer and composer. To change the representation click the pattern to open the pattern editor window.



7. MIDI Channel selection control sets the MIDI channel used to record MIDI events to the sequence.

8. Clock divider sets the amount by which the clock source is divided to lengthen each step in the sequence. The clock divider can be set to 1, 2 or 4 making each step a 16th, 8th or 4th note respectively.
9. Sequence length control adjusts the number of steps in the sequence from 16, 32, 48 to 64.
10. The bar control selects which bar (16 steps of a sequence) is shown in the sequence editor. This can either be bar 1, 2, 3 or 4 and depends on the sequence length.
11. The quantize inputs checkbox controls whether MIDI inputs will be quantized to align to the closest step in the sequence.
12. With the quantize button the sequence can be quantized after recording to align recorded MIDI events to the nearest sequence step.
13. Patch control to select the melodic patch to be used for the sequence.
14. Output level and panning settings of the sequence. Output level and panning can be set per MIDI tick while recording and these controls will update accordingly. While recording, these controls may also be used to change the output level and panning instead of recording them from a connected MIDI device.

When OPL Studio is configured to use an OPL2, for example when using the controller with an OPL2 Audio Board, then the panning control will be disabled, because the OPL2 is a mono device. See OPL Studio Settings.

15. Sequence editor gives an overview of the recorded sequence per step. This area shows 16 steps (1 bar) of the sequence represented by sequence buttons with the step number above. A sequence button will be lit purple if the sequence holds at least one note at the given step. The part of the sequence that is shown in the editor depends on the sequence length and the selected bar. During playback the current step in the sequence will light up and the sequence will scroll automatically to the next bar when reaching the last step of a bar.

To clear a step you long press on the sequence button. This will clear all notes that are active at the given step. Since notes can have a duration that is longer than a single step, clearing one step may also clear other steps if a note with a long duration is removed from the sequence.

In step recording mode or when the sequencer is awaiting a trigger to start recording, the current step in the sequence will be blinking. This is to show a cursor for the step where MIDI events will be recorded to when received. The recording cursor position can be changed by tapping on a different step in the sequence or by turning encoder B.

16. Clear buttons clear the current sequence or all sequences respectively.
17. Copy and past actions will copy either the current bar or the full sequence. Once sequence data has been copied it can be pasted either to a new sequence or to a different bar. When a single bar has been copied, clicking on paste bar will overwrite the current bar of the sequence with the copied bar.
18. Close the melody sequencer and return to the home screen or the module that launched the editor.

Step recording

In step recording mode a sequence can be constructed step by step like typing text on a keyboard. Step recording is enabled by pressing record while playback is stopped. When the record button is pressed the current step in the sequence will start blinking to indicate where the next note will be recorded to. The step where to record to can be changed by tapping on a different step or by changing the cursor with encoder B. Pressing conder B will clear a step.

Any MIDI events that are received on the sequence's MIDI channel are now recorded to the current step in the sequence. When a key is pressed to generate a note on event the step will become active. Multiple keys may be pressed at the same time. When the last key is released the recording cursor will advance to the next step in the sequence. If the key is held down for a short while the sequencer will automatically start advancing the cursor. This way long notes can be recorded.

MIDI events other than note on / off, such as volume control changes, are also recorded in step recording mode, but they will not advance the recording cursor.

Recording trigger

Sequence recording can be armed to start recording as soon as a note on event is received on the sequence's MIDI channel. To arm the sequencer, set it in step recording mode by tapping record. Select the position in the sequence where to start recording by tapping on the step or selecting it with encoder B. Tap and hold the play button. The play and record buttons will start blinking and OPL Studio will produce three short beeps to indicate that it's awaiting a trigger to start recording. Once triggered the sequencer is in live recording mode.

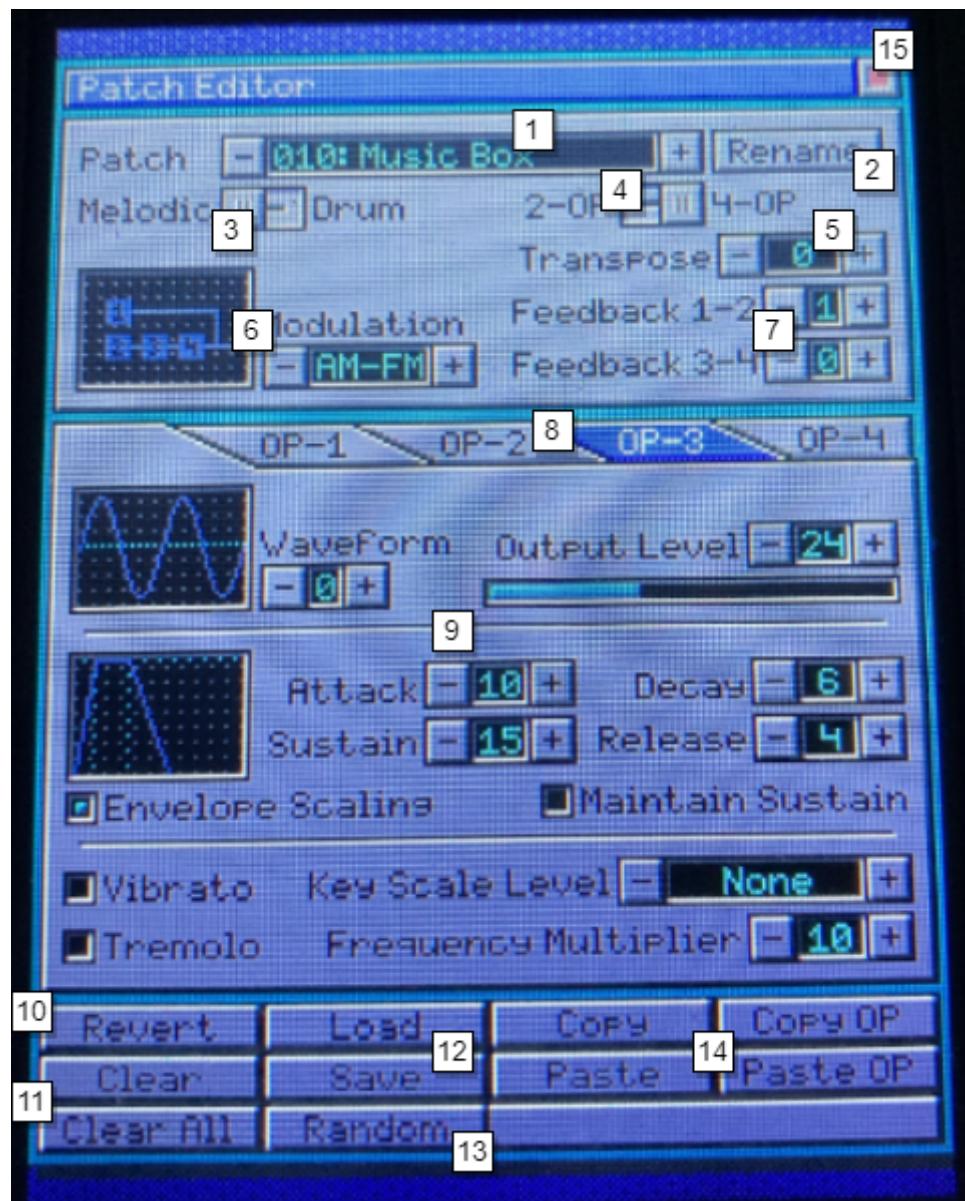
Live recording

A live recording is started by putting the sequencer in record mode and tapping the play button, or when a recording is triggered. You will see the sequence cursor advancing like during playback. All incoming MIDI events on the sequence's MIDI channel will now be recorded to the sequence. A live recording has a 6x greater resolution than a step recording as it will record events on every MIDI tick as opposed to every sequence step.



Patch Editor

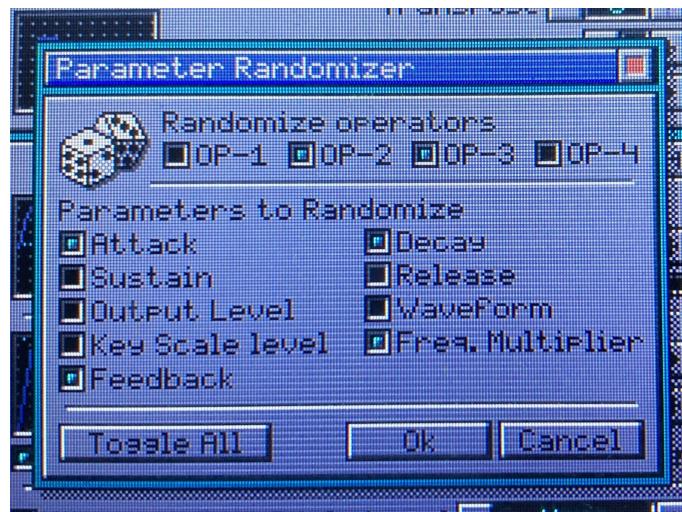
The patch editor is the module that allows you to edit all of the melodic and drum instrument patches. OPL Studio had 128 melodic patches that correspond to MIDI programs and 47 drum patches used on MIDI channel 10 and correspond to MIDI drum notes. The editor allows you to edit predefined patches, create your own or load and save existing patches from various OPL2 / OPL3 instrument patch files.



1. Patch selector selects the current melodic or drum patch being edited.
2. Tapping the rename button will pop up an on screen keyboard to rename the current patch.
3. The melodic / drum selector changes what kind of patches are being edited. This changes the patch selector to select from 128 melodic patches or 47 drum patches.
4. The 2-OP / 4-OP selector switches the current patch between being a 2 operator patch or a 4 operator one.

When OPL Studio is configured to use an OPL2, for example when using the controller with an OPL2 Audio Board, then this control will be disabled, because the OPL2 only supports 2-OP patches. See OPL Studio Settings.

5. The transpose control transposes the incoming note up or down by the set number of semitones for melodic patched. For drum patches the transpose control selects the pitch for the drum sound.
6. Modulation type of the patch. The available modulation types depend on whether the patch is a 2-OP or a 4-OP patch.
7. Operator feedback settings. When editing a 2-OP patch the feedback control for operators 3 and 4 will be disabled.
8. Operator selection tabs. These tabs select which of the operators is shown below in the editor.
9. Operator specific settings.
10. Revert will undo all changes made to the patch. Tapping revert will restore the patch to how it was set up when it was selected in the editor. Patch settings are saved when a different patch is selected in the editor or when the editor is closed.
11. Clear and clear all will clear either the active patch or all patches
12. Load and save allow you to load patches from a file on the SD card or to save your patches. Supported file formats are:
 - OPS - OPL Studio session
 - BNK - Adlib bank
 - TIM / SND - Adlib timbre bank
 - TMB - Apogee timbre bank
 - SB / O3 - Unix 2-OP / 4-OP instrument bank
13. Random will open the parameter randomizer. With the randomizer you can select what parameters you want to give a random value to experiment.



14. Copy and paste will copy or paste either the complete patch with all of its operators or only copy / paste the settings of the currently selected operator.

Testing a patch

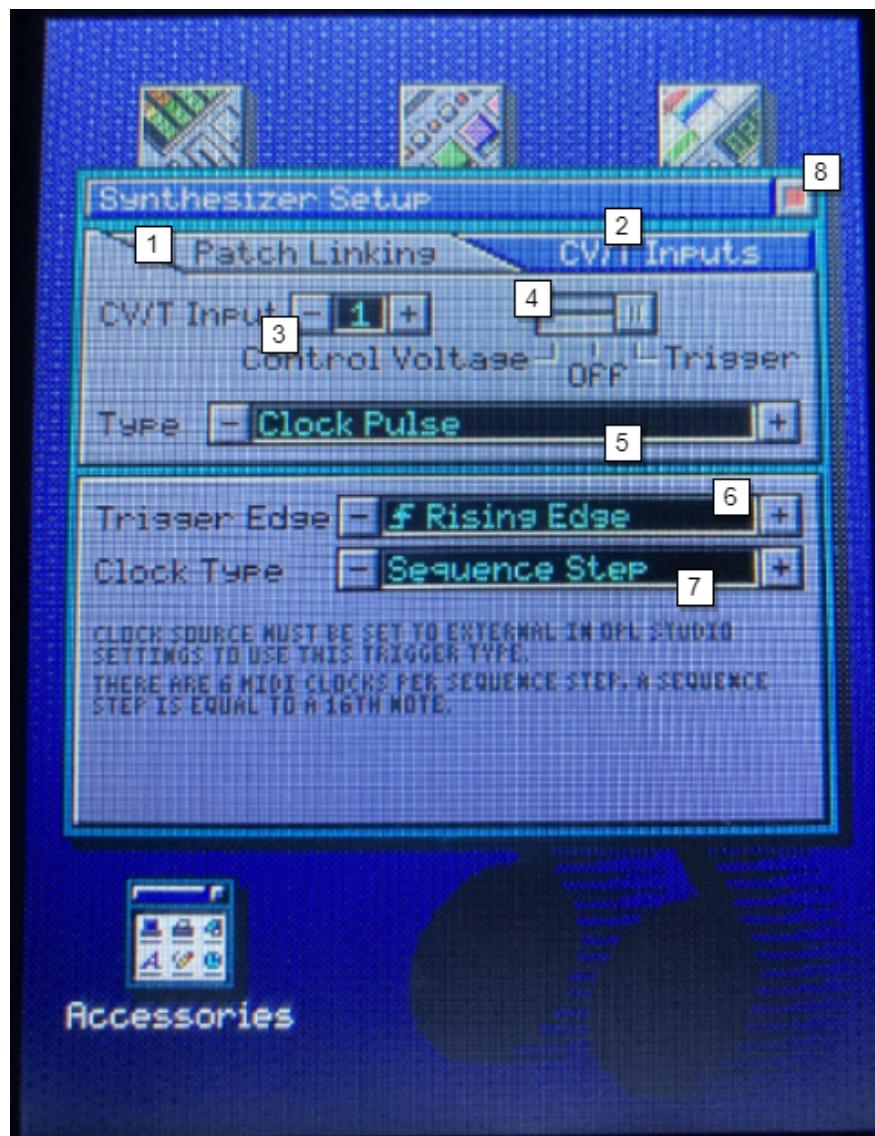
While the patch editor is open any note that is played, regardless of the MIDI channel, will be played using the patch that is active in the editor. When a drum patch is active the note that gets played is fixed and determined by the transpose.



Synthesizer Setup

OPL Studio has 6 CV/T (Control Voltage / Trigger) inputs that allow you to connect external synthesizer controls. The synthesizer setup module is where you can configure how each of these inputs is interpreted.

To guarantee that analog and digital inputs are providing the expected values see CV/T Calibration in settings on how to calibrate input voltage ranges. For more information on connecting external controllers and how you can make your own controller see Connecting External Controllers below.



1. Patch linking tab switches to patch linking setup. See below.
2. CV/T inputs tab (currently active).
3. CT/T input selector selects one out of 6 CV/T inputs to configure.
4. Input setting. Can be set to off to disable the input, analog control voltage or trigger.
5. Input type. Type depends on whether the input is configured as control voltage or trigger. For control voltage the following types can be set:
 1. Operator output level
 2. Operator attack
 3. Operator decay
 4. Operator sustain
 5. Operator release
 6. Channel feedback

All analog inputs are configured to work on a specific melodic or drum patch that is configured together with the input. You can also set which operator(s) will be altered by the control voltage.

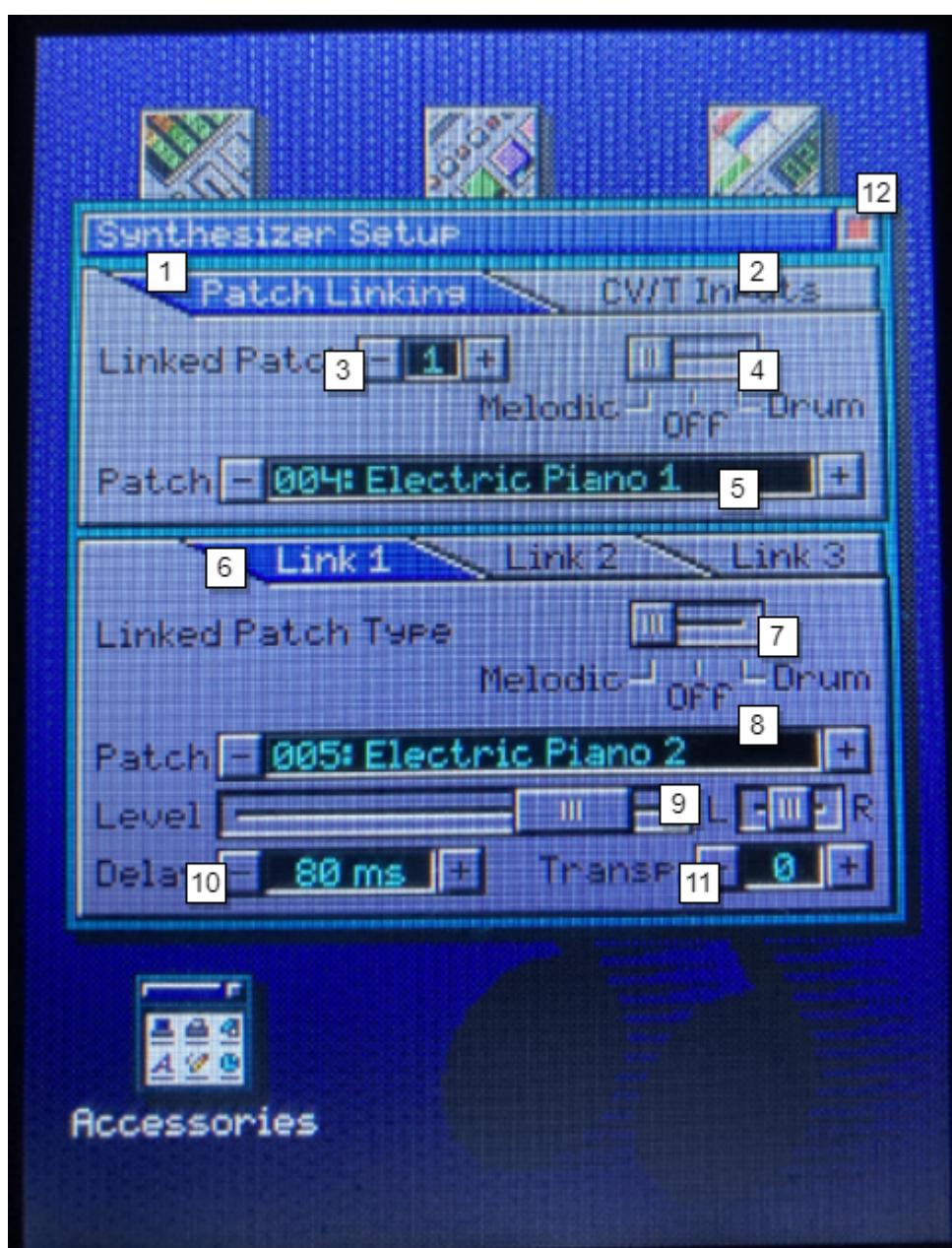
For triggers the following types can be set:

1. Play drum sound:
When triggered, play the given drum patch.
2. Clock pulse:
When triggered, progress the clock either by a single MIDI tick or a sequence step (6 MIDI clocks). In order to use this trigger type clock source must be set to external in OPL Studio settings.
3. Clock start / stop:
While the trigger is active, run the internal clock. Optionally the trigger can function as a trigger start / trigger stop and to reset or continue the clock on start.
4. Clock reset
When triggered resets the clock to 0.
6. Trigger inputs can be configured to trigger on the rising, or the falling edge of the input signal.
7. Input type specific settings.
8. Close synthesizer setup and return to the home screen.



Patch Linking

Patch linking allows you to create up to 16 linked patches. With linked patches you can produce more complex sounds and effects, because a linked patch can trigger up to 4 different patches when a note is played. A linked patch always has a base patch. This is one of the melodic or drum patches that, when it's triggered, will also trigger up to 3 linked patches. The linked patches each have settings to configure what melodic or drum patch to play, trigger delay, volume, panning and note transpose.



1. Patch linker tab (currently active).
2. CV/T inputs setup. See above.
3. Selection control to select one out of 16 linked patches.
4. Control to set the base patch type to melodic or drum, or to disable the linked patch.
5. Base patch selector. When a note is played on a MIDI channel that has the given patch assigned the note will be played using the base patch as well as the up to three linked patches configured below.
6. Link selection selects which of the 3 links is shown in the editor below.
7. Linked patch type sets the type of patch being linked to the base patch, or disables the link.
8. Patch selection to select the patch to use for the given link.
9. Output level and panning settings of the linked patch.

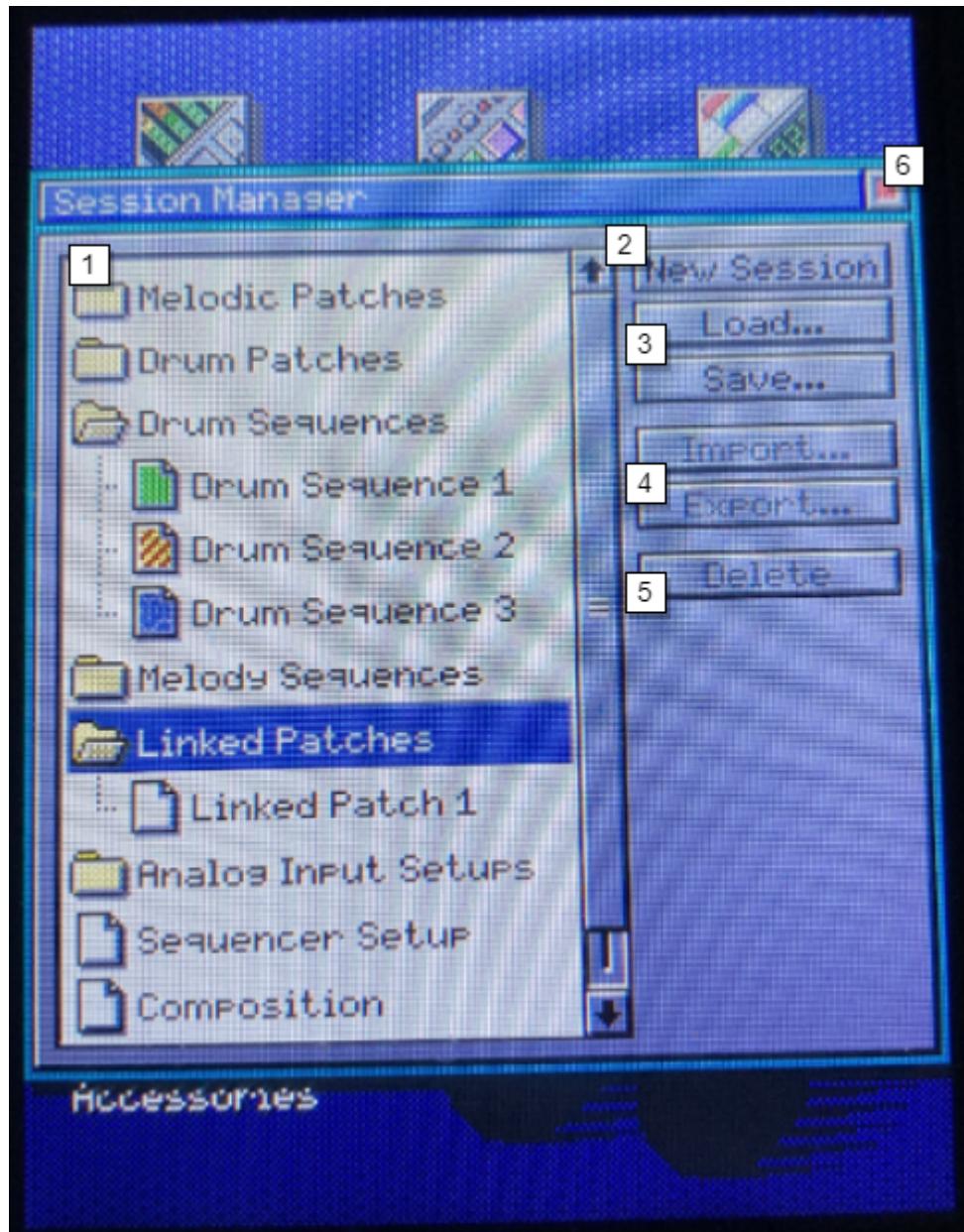
When OPL Studio is configured to use an OPL2, for example when using the controller with an OPL2 Audio Board, then the panning control will be disabled, because the OPL2 is a mono device. See OPL Studio Settings.

10. Patch trigger delay configures a delay of up to 2000 ms after the initial note on event to trigger the note for the linked patch.
11. Transpose sets a number of semitones to transpose the note up or down when the linked patch is played.



Session Manager

With the session manager you have access to all parts of your OPL Studio session from one overview. From here you can start a new session, load or save a session or directly jump into a specific setup such as a patch or CV/T setting.

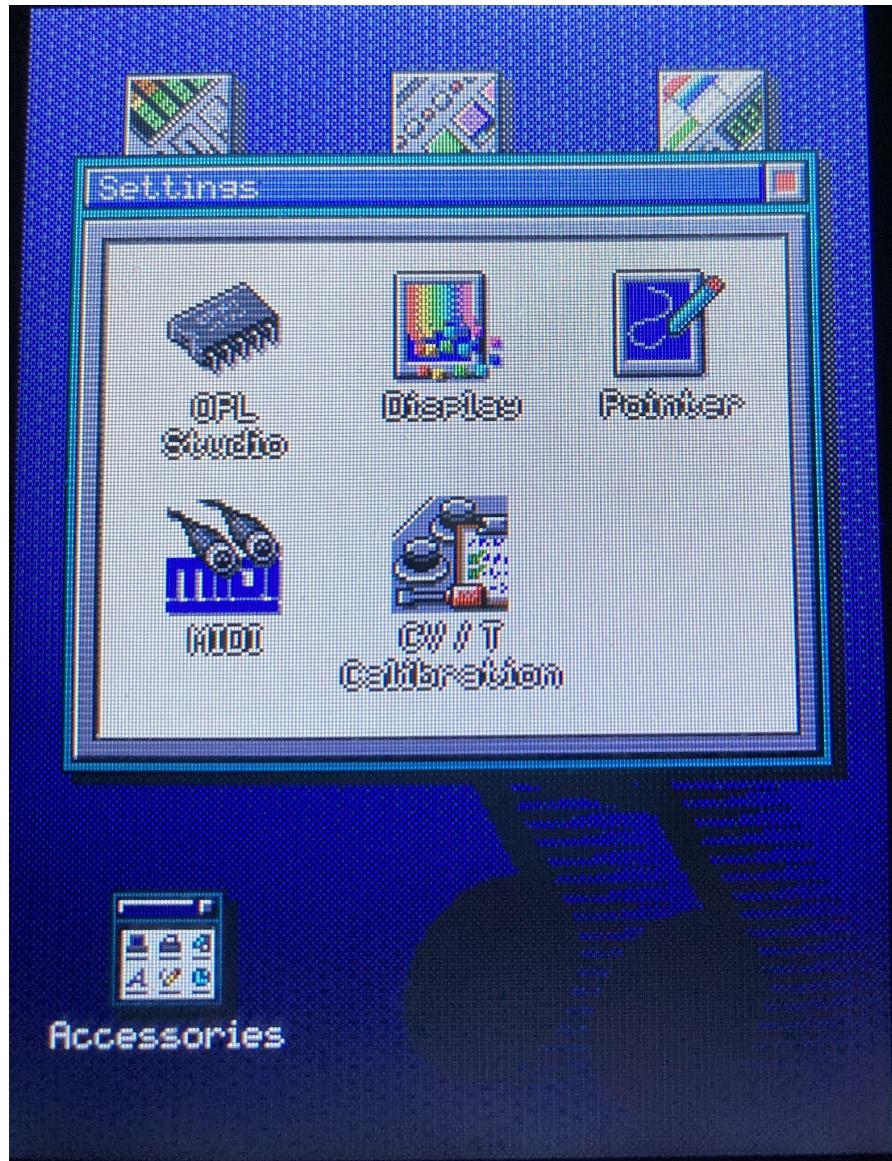


1. OPL Studio session explorer shows all elements of the current OPL Studio session. By double tapping on one of the items in the list the corresponding editor will be opened.
2. The new session button will confirm to discard the current session and start a new one. All previous changes will be cleared.
3. Load or save an OPL Studio session to SD card.
4. Import and export are not supported in the current software.
5. Delete will remove the selected item from the OPL Studio session. Items that cannot be deleted, such as sequencer setup or mixer settings will be cleared and reset to default values.



Settings

The various OPL Studio settings are changed from the settings screen. You can find the settings screen in the Accessories group.



The following settings can be made:



OPL Studio

Generic OPL Studio settings.

OPL Type - Sets the type of connected OPL synthesizer:

- Double OPL3 - When connecting an OPL3 Duo! board. This allows for up to 36 audio channels.
- Single OPL3 - When connecting an OPL3 Duo! board, but limits channels to 18 when compatibility with single OPL3 sound cards is desired.
- Single OPL2 - When connecting an OPL2 Audio Board or OPL3 Duo!. Channels are limited to 9, only 2-OP patches can be used and panning will be disabled.

In addition to setting the OPL type you can enable loading the default instrument banks when a new OPL Studio session is started, otherwise all patches will be empty and you can force loading only 2-OP patches.

Clock source - Selects between the internal or external clock. The external clock can either be a MIDI clock source or a CV/T clock source. See Synthesizer Setup. When the internal clock is used, 'Send MIDI clock events' can be enabled to transmit MIDI clock events to sync with other components.



Display

In the display settings panel you can change the home screen background of your OPL Studio and you can adjust the screen brightness.



Pointer

In case the stylus is not correctly calibrated you can recalibrate it from this panel. You can also disable UI clicking sounds from here.



MIDI

The MIDI settings panel gives access to settings for the MIDI input.

The 'Apply events to all sequences...' setting influences how the melody sequencer handles program and control changes. When enabled, a program or control change will be applied to all sequences on the same MIDI channel. When disabled only the sequence that is active in the editor will be changed.

You can also adjust the depth of the pitch bend here to 1 or 2 semitones.



CV/T Calibration

In this settings panel you can calibrate external analog controls that are connected to the OPL Studio CV/T inputs. Because external controls can have different voltage ranges they need to be calibrated before they can be used.

In this settings panel you can select one of 6 CV/T inputs and you can test if the input range is correct by varying the input voltage from minimum to maximum. The value of the progressbar should be stable and correspond to the value of your controller. If this is not the case you can calibrate the input.

Each time a new control is connected to OPL Studio it should be calibrated before use. This applies both to inputs that are used as analog inputs as well as trigger inputs so OPL Studio knows the voltage range used by the input.



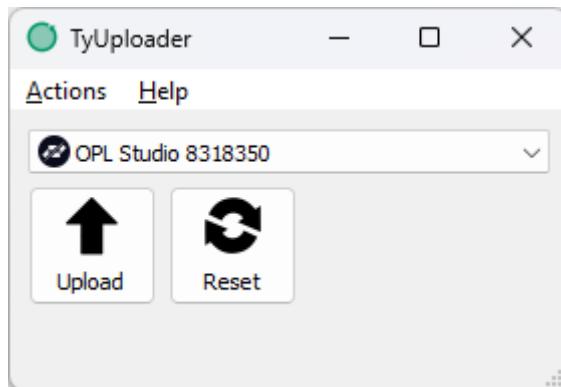
Updating The Software

The latest version of the OPL Studio software can be downloaded from <http://www.cheerful.nl/oplstudio>.

The zip file with the software contains the TyUploader program that is used to upload the OPL Studio software to the Teensy. When you open it and you have your OPL Studio connected you should find 'OPL Studio' in the list of connected devices. Click the Upload button and select the .hex file that is appropriate for your Teensy: the '_T36' file for a Teensy 3.6 or the '_T41' file for a Teensy 4.1. After selecting the file that upload will begin,

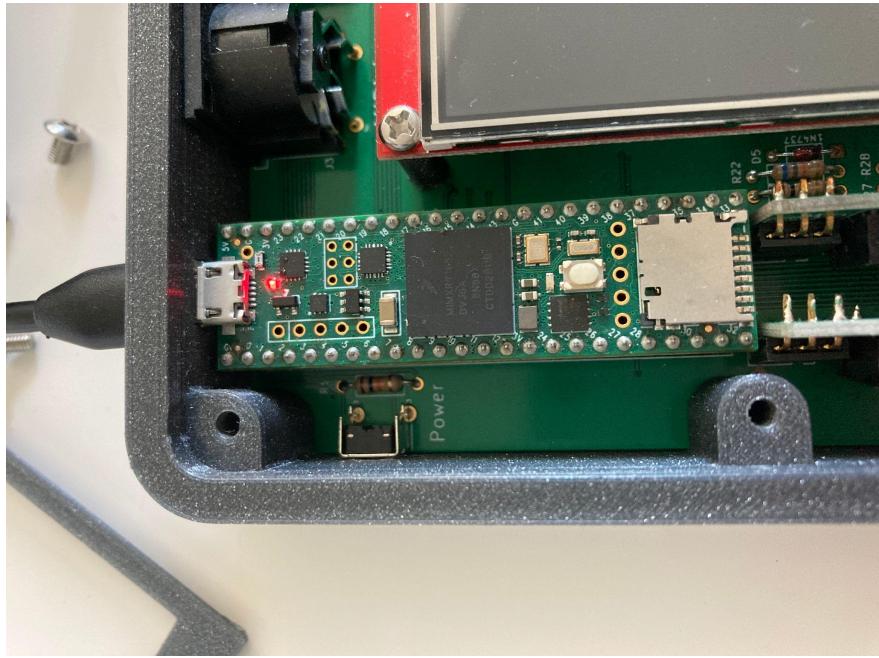
In case you got your OPL Studio from Cheerful Electronic with a Teensy included then this will always be a Teensy 4.1. If you use your own Teensy then you can find the version of your Teensy at the bottom side of the Teensy board. If there is no indication of the version then you're using a Teensy 3.6.

During software update the power LED of OPL Studio will faintly glow. After updating the software, OPL Studio will reboot. The new software version will be shown in the bottom left corner of the boot screen or you can find it in the about screen in the OPL Studio settings. If this is the first time the OPL Studio software is installed on your Teensy then OPL Studio will boot into the pointer calibration, otherwise it will boot directly to the home screen. You may want to do a factory reset on OPL Studio in case you used your Teensy for another project before.



Recovering From a Failed Software Update

If the software update was interrupted or failed then OPL Studio will not boot and the device appears to be dead. To recover from this state you need access to the Teensy inside. Remove the front panel and connect OPL Studio to your computer.



The Teensy may either show a red LED or no LED at all. Press the little white push button on the Teensy and you should see the LED on the board switch on to be red. Now follow the regular software update procedure (the TyUploader will show 'HalfKey' in the device selection). The red LED will blink while uploading the software to the Teensy and it should switch off once this is completed. After a few seconds your OPL Studio should boot again as normal.



Connecting External Controllers

External controllers such as Eurorack modules can be connected to OPL Studio's CV/T inputs. Each CV/T input can map a control voltage between 0v and 8v to a synthesizer parameter that is configured in the synthesizer setup module.

Before using a CV/T input its input range needs to be calibrated in the CV/T Calibration panel of the OPL Studio settings. This applies both to inputs that are used as analog inputs as well as trigger inputs so OPL Studio knows the voltage range used by the input.

Controls that are configured as triggers will change state when their input voltage crosses the halfway point of the calibrated voltage range.

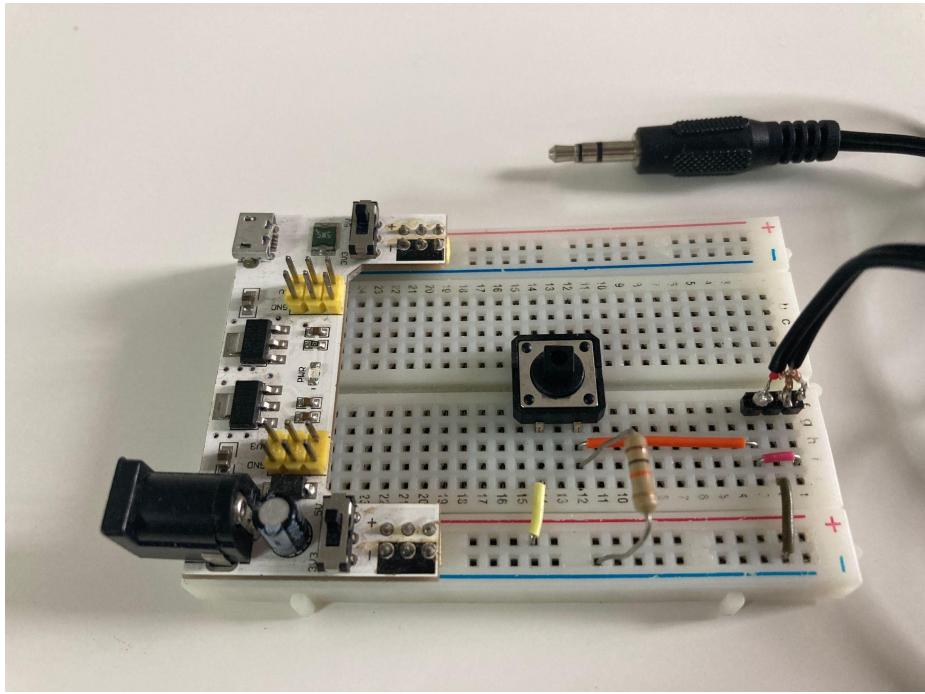
Building Your Own Controls

With a little bit of electronics knowledge it becomes quite simple to build your own controls for OPL Studio. In this section we will take a look at a few simple example controls. In order to build these you need a breadboard, a USB breadboard power supply, some hookup wires, a 3.5 mm mono jack plug (stereo will work too) and a few additional components depending on the type of control.

Trigger

First we will have a look at building a simple trigger control. A trigger is basically nothing more than a button that when pushed triggers an event such as playing a drum sound. To make your own trigger you need a push button and a 10k resistor. Connect everything as is shown in the image below

In this example a stereo plug is used to connect to the OPL Studio CV/T input. The ends of the plug are soldered to a 3 pin header here. The ground wires are twisted together and soldered to the center pin of the header and each of the signal wires are soldered to either ends of the header. When you use a stereo plug make sure that the tip (the outer end of the plug) has your control voltage on it. In this example the tip and the ring of the plug are connected together on the breadboard with the red jumper wire that connects pins 1 and 3 of the header.



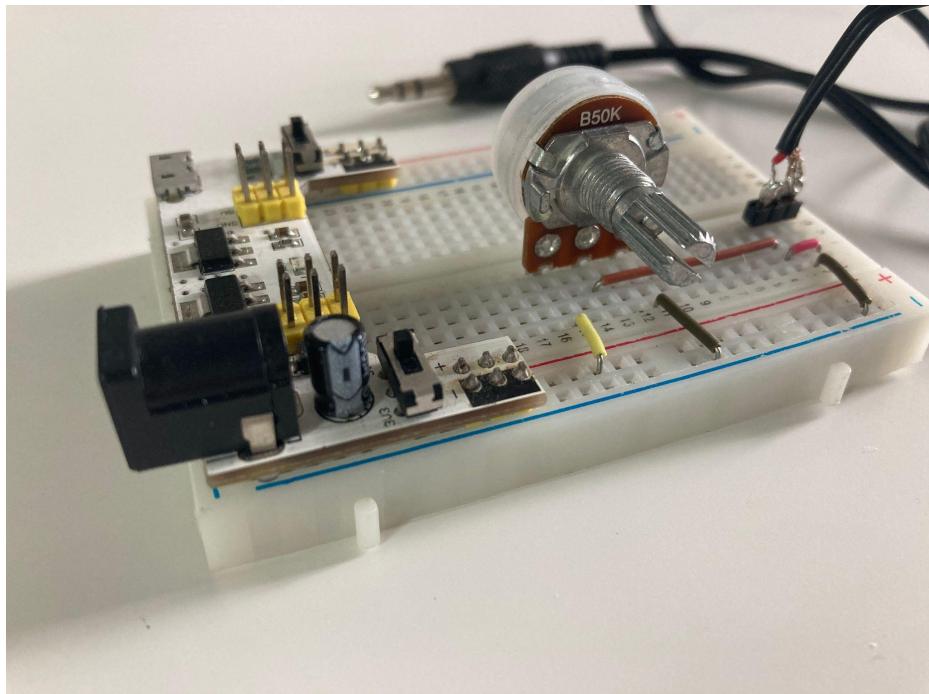
To use your control first we need to calibrate it in the CV/T calibration settings after it has been plugged into one of the CV/T inputs. In the calibration wizard select the CV/T input where you connected your control. Now tap calibrate and don't push the button. This will be your minimum. Tap next. Now the wizard will ask you to input the maximum value for your control, so push and hold the button and tap next. If your control functions correctly then you will now see that when you push the button the little progress bar on the screen of OPL Studio will jump to its maximum value and to its minimum when you release the button.

Lastly we need to tell OPL Studio what to do with the input from your control. In order to do this open the synthesizer setup and go into the CV/T Inputs tab. We will configure the control to play a bass drum sound when pushed. Again, select the CV/T input where your control is connected and move the slider to 'Trigger'. By default the new trigger will be configured to play a drum sound when the input goes high. The sound to be played will be the bass drum as you can see from the patch selector.

In this example the button is wired up to a pull down resistor. This means that when the button is not pushed the resistor will pull the voltage on the CV/T input down to ground. We call this the input being low. When the button is pushed it will connect the CV/T input to the +5v line and the input goes high. This change from a low voltage level to a high voltage level is what we call the rising edge of the signal. If your control was wired differently, i.e. the resistor going to +5v and the yellow wire of the button going to ground, then the input will be low when you push the button. Then OPL Studio needs to detect the falling edge of the signal and this is what you configure with the 'Trigger Edge'.

Analog Input

To make an analog input all you need is a potentiometer, the value doesn't really matter. We build up our control as shown below where the center pin of the potentiometer provides the control voltage and the outer two pins are connected to +5v and GND respectively.



Like we did for our trigger we also need to go to the CV/T calibration settings first after our new control has been plugged into one of the CV/T inputs. After calibrating the control you should see that by twisting the potentiometer knob the progress bar on the screen gives a correct indication of the value of your control.

Now in the synthesizer setup you can configure your control to alter patch values while you're playing. Select the CV/T input to configure, move the slider to 'Control Voltage' and experiment with the control setup.