

OPL Studio

The ultimate OPL2 / OPL3 MIDI FM-synthesizer

User Manual

For software version 2.3.0



Table Of Contents

OPL Studio Introduction.....	6
Powering The Device.....	6
Power / Panic Button.....	6
Reset Audio.....	6
Factory Reset.....	6
MIDI Connectors.....	6
Micro SD.....	7
Auto Save.....	7
Rotary Encoders.....	8
OPL Studio Home Screen and App Modules.....	9
MIDI Channel Mixer.....	10
Channel Overview and Patch Selection.....	11
Changing Volume.....	11
Panning.....	11
Mute and Solo.....	12
Melody Sequencer.....	13
Sequence Tab.....	13
Using the Piano Roll.....	15
Recording a Sequence.....	16
Triggering a Recording.....	16
Step Recording.....	16
Detailed Event Editing.....	17
Notes Panel.....	17
Volume, Panning, Pitch and Modulation.....	20
Using the Event Graphs.....	21
Quick Editing With Rotary Encoders A and B.....	22
Drum Sequencer.....	23
Sequence Editing and Recording.....	23
Recording From MIDI.....	24
Copying and Pasting.....	25
Patch Editor.....	26
Testing Patches.....	27
Reverting From Mistakes.....	27
Loading and Saving Patches.....	28
Randomizer.....	28
Synthesizer Setup - MIDI CC Mapping.....	29

MIDI CC Handling.....	29
Default MIDI CC Mapping.....	30
Synthesizer Setup - CV/T Controls.....	31
Synthesizer Setup - Patch Linking.....	32
Simple Echo Effect.....	32
Composer.....	33
Editing a Song.....	33
Song Loops.....	33
Keyboard.....	35
Live Sequencer.....	36
MIDI CC Mappings.....	36
Media Player.....	37
Session Manager.....	38
Settings.....	39
OPL Studio.....	39
OPL Type.....	39
Load Default Instruments on Start.....	40
Clock Source.....	40
Auto Save OPL Studio Session.....	40
Play Test Chime.....	40
Display.....	41
Pointer.....	41
MIDI.....	41
CV/T Calibration.....	41
Updating the Software.....	42
Recovering From a Failed Software Update.....	42
Connecting External Controllers.....	44
Building Your Own Controls.....	44
Trigger.....	44
Analog Input.....	46
MIDI Characteristics.....	47
Supported MIDI status messages.....	47
Default Mapped MIDI Controls.....	48
Troubleshooting.....	49



OPL Studio Introduction

Powering The Device

OPL Studio is powered by a 5v micro USB cable that connects at the back of the device. Once OPL Studio receives power it will start up. Booting the device will take a few seconds.

Power / Panic Button

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.

Reset Audio

The power button also functions as a panic button to reset the audio in case notes have become stuck due to missing note off MIDI events. A quick press of the button will reset all audio.

Factory Reset

If your OPL Studio has gotten into a state where you want to perform a factory reset, then you use the power / panic button.

1. Power off the device
2. Plug power back in
3. Press and hold the panic button during startup

After a few seconds a message will be shown on the boot screen that tells you to keep holding the panic button if you want to factory reset. Keep holding the panic button and OPL Studio will reboot with all settings cleared and launch the pointer calibration.

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 can use a micro SD card that you insert on the back of the device. The SD card is used to save / load OPL Studio session files, instrument patches and audio files for the media player. When the SD card is being accessed the SD LED on the front panel blinks.



Please take the following into account:

- OPL Studio can only handle SD cards that are formatted with a FAT32 file system
- SD cards that are larger than 32 GB will **not** work
- If your SD card has a GPT partition table it will not be recognised. Make sure you format the SD card with an MBR partition

The SD Card Formatter utility can be used to format your SD card. This utility can be downloaded here: <https://www.sdcard.org/downloads/formatter>

Auto Save

When an SD card is present OPL Studio will, by default, auto save your current session to a temporary file. This happens whenever an app module is closed or when OPL Studio is put into sleep mode. When OPL Studio is powered back on it will restore the previous session from the SD card. Auto save can be disabled in the OPL Studio settings.

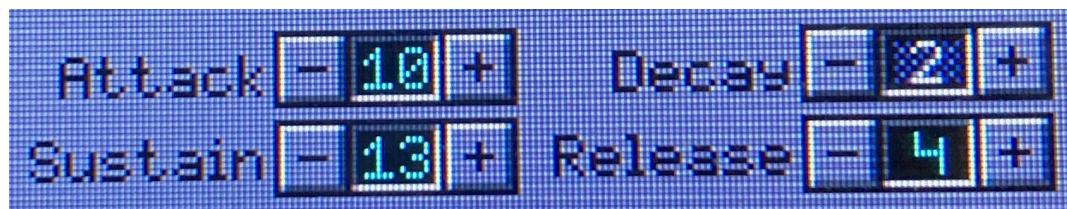


When auto saving, OPL Studio **always** writes to a temporary file. If you used the Session Manager to save your session as, for example MYTUNE.OPS, then OPL Studio will not write additional changes to this file when auto saving.

Rotary Encoders

Your OPL Studio has two rotary encoders: A and B. The encoders are used to make quick changes when editing, so you don't always need to press UI elements on the touch screen. In general:

- A is used to select the parameter to be changed, the active parameter is highlighted with a blue background
- B is used to change the parameter value. 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 A it will start / stop sequence playback. Specific encoder functions are described below per OPL Studio Module.



OPL Studio Home Screen and App Modules

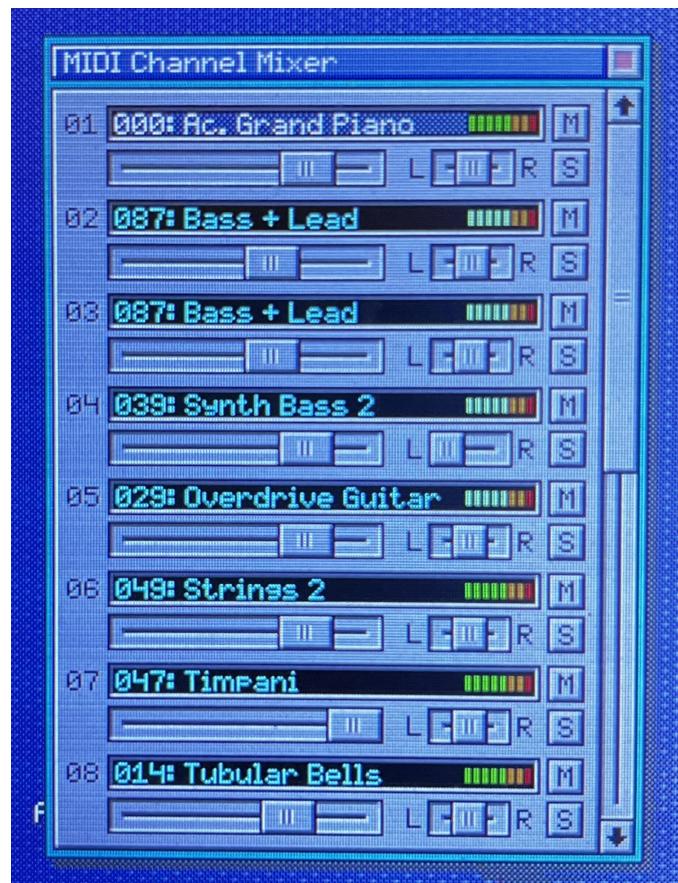
OPL Studio has a number of app modules that you can access from the home screen. When OPL Studio boots it will launch into the home screen where all modules are shown. A module is launched by tapping its icon with the stylus. Each module opens a window for a specific activity, such as editing instrument patches, recording sequences, jamming with your sequences, etc. 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 and change the instrument patch for each channel, mute channels or set a solo channel.



Channel Overview and Patch Selection

The channel mixer lists all 16 MIDI channels and for each it shows the currently assigned instrument patch number and name. You can select one of the channels by clicking it with the stylus or using A. The channel that's selected and currently active in the mixer will be highlighted in blue.

Clicking the patch name will open the instrument selection window where you can change the channel's instrument patch. When you select an instrument from the list you will immediately hear it when notes are played on the channel. After clicking Ok the channel's instrument is changed until another program change MIDI event occurs on the channel.

You can use B to browse through the patch list and select a patch by pressing B.

Notice that channel 10 is fixed to 'OPL2 Drumkit'. This channel is used by OPL Studio for drums and it cannot be given a different instrument patch. Also MIDI program changes will be ignored on this channel as the note that's being played on this channel will determine the drum patch being played.

Next to the patch name there is a small level indicator that gives a rough representation of the channel volume when notes are played.



Changing Volume

Below the patch name there is the volume slider which shows the current channel volume. The volume can either be set using a MIDI CC or by dragging the slider using the stylus. The volume range is from 0 to 127.

Channel volume can also be changed using B on the currently selected channel.

Panning

Next to the volume slider the channel panning can be set to either left, center or right. The OPL3 only supports hard panning, so when panning is changed using a MIDI CC the control value is mapped to hard left, center or right as follows:

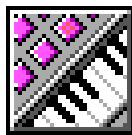
- **Left** - 0 .. 47
- **Center** - 48 .. 79
- **Right** - 80 .. 127



If OPL Studio has been set to OPL2 only mode in the settings, then panning will **not** be available anywhere in the UI. The OPL2 is a mono device and therefore all audio will be played on both left and right channels. See the section about OPL Type in OPL Studio settings for more details.

Mute and Solo

Each channel has two little buttons M and S for channel mute and solo respectively. To quickly toggle between mute and solo you can press A to mute the currently selected channel, or press B to put the channel in solo mode.

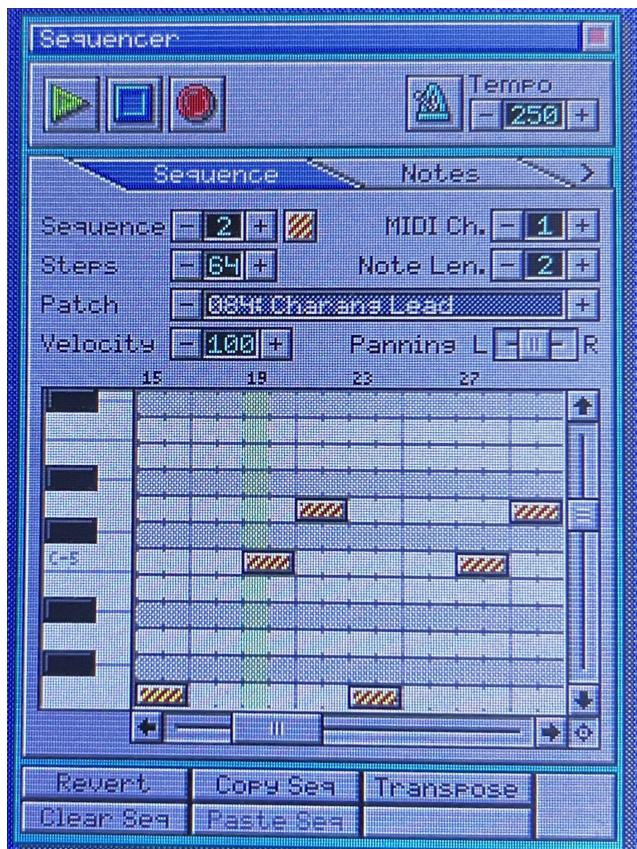


Melody Sequencer

The melody sequencer is used to record and edit polyphonic melody sequences that you can record from MIDI or that you can compose using the piano roll editor and stylus.

Sequence Tab

The sequence tab is the main view of the sequencer where all recording happens. It shows a piano roll view of the notes in the sequence. You can use the piano roll to edit notes that were recorded using MIDI or you can change the sequence without the need for a MIDI device using the stylus and the OPL Studio touch screen.



To the left of the piano roll the on screen keyboard shows the current pitch range. It can also be used to preview notes without changing the sequence by clicking or dragging the stylus over the keyboard.

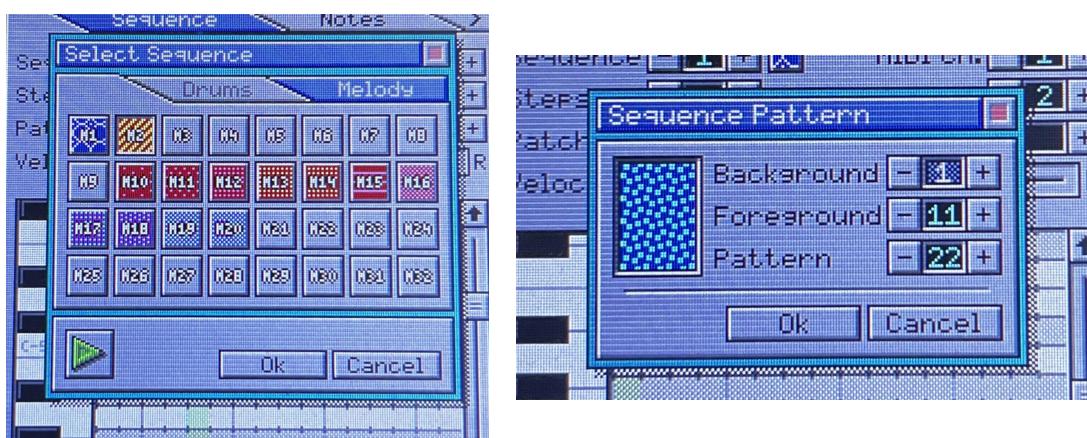
In the bottom right corner of the piano roll there is a crosshair button that will enable or disable auto scrolling of the piano roll while playing to keep the playhead in view. If a note is added to the piano roll using the stylus while the sequence is playing then auto scroll will be disabled by the sequencer.



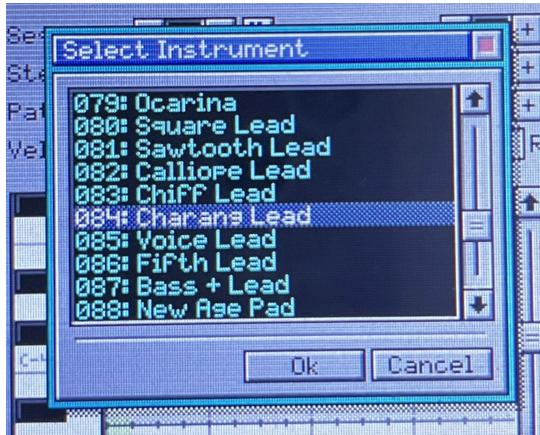
The button can also be used to focus the piano roll on the notes in the current view if they were scrolled out of view.

- **Sequence** - The sequence that is currently open in the sequencer. Use this spinner to change the sequence in the editor. When the spinner value is clicked it will open the sequence selection window that gives a quick overview of all sequences in the current session. Click on a sequence to select it for editing. There can be a total of 32 melody sequences.

Next to the spinner there is a button to indicate the color and pattern used for the sequence. This pattern will be used for the notes in the piano roll and it will be used to represent the sequence in other modules of OPL Studio such as the live sequencer and the composer.



- **MIDI Channel** - This control is used to set the MIDI channel where the sequence will take its input from.
- **Steps** - This control sets the number of steps in the sequence from 16, 32, 48 to 64. This control is only available in the sequence tab.
- **Note Length** - This control sets the default length in sequence steps for new notes that are added to the sequence by clicking the piano roll. One sequence step is 1/16th note or 6 MIDI ticks. This control is only available in the sequence tab.
- **Patch** - The instrument patch used to play the sequence. Click the patch name to open the instrument selection dialog.



- **Velocity** - Sets the velocity for new notes that are added to the sequence by clicking the piano roll
- **Panning** - Sets panning for new notes that are added to the sequence by clicking the piano roll

Using the Piano Roll

Clicking somewhere in the piano roll will add a new note to the sequence. The initial duration, velocity and panning of the note is set using the controls above the piano roll. By dragging the stylus the note pitch (up / down) and duration (left / right) can be changed.

When clicking on an existing note the sequencer will play the note. By dragging the stylus the note can be edited by moving it in time, changing the pitch, or changing the start and end points of the note when its end points are being dragged.

When long pressing on a note without dragging the note will be removed from the sequence.

⚠ Notes of the same pitch cannot overlap. When a note is dragged around the sequence and made to overlap another note when the stylus is released then the sequencer will adjust the duration and / or starting step of the note(s) that are overlapping. If a note gets fully covered by dragging another note on top of it, then it will be removed from the sequence.

⚠ The resolution of the piano roll is fixed to sequence steps, i.e. 1/16th notes, or 6 MIDI ticks per step. Therefore, notes that are added or edited in the piano roll will always be step aligned. Notes that are recorded using MIDI can have an arbitrary starting tick and / or duration, but will be shown aligned to the closest sequence step in the piano roll. To edit the exact note start / duration in MIDI ticks the notes detail tab can be used. See below.

Recording a Sequence

To record MIDI events to a sequence press the record button. The sequencer will now be in step recording mode (see below). The record button will be highlighted and the playhead of the piano roll will turn red.

When recording is enabled the playhead can be positioned by clicking the piano roll. Note editing using the stylus will be disabled as long as recording is enabled.

Now press the play button and the playhead will start stepping along the sequence. If the metronome is enabled you will hear it beeping. Any MIDI events that are now received on the MIDI channel assigned to the sequence will be recorded. You will see notes appear on the piano roll as you play them.

Notice that the sequence will keep looping as long as nothing is recorded, but as soon as a MIDI event is recorded to the sequence recording will automatically stop at the end of the sequence

If you are recording to a sequence that already contains some events then the newly recorded events will be added to whatever events are already existing. This can cause events to be overwritten.

Triggering a Recording

You can arm the sequencer to start recording as soon as it receives a MIDI key on event on the MIDI channel that's assigned to the sequence. In order to enable this trigger, long press the record button. OPL Studio will give three quick beeps and the play and record buttons will start flashing.

Before recording starts you can position the playhead by clicking the piano roll to set the starting point of the recording.

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 clicking the record button while playback is stopped. The record button will show a highlighted record icon and the playhead in the piano roll will turn red.

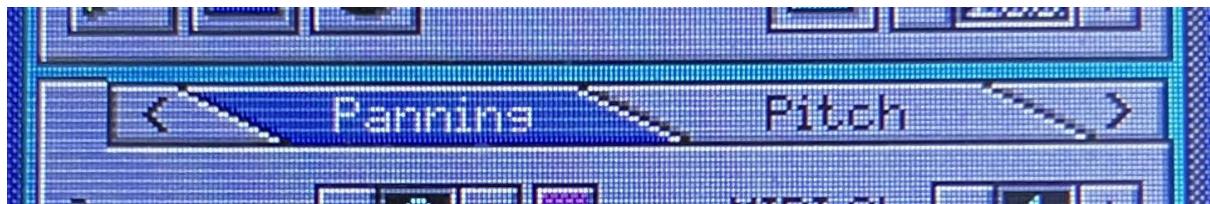
MIDI events that are received on the sequence's MIDI channel are now recorded to the current step in the sequence. When a key is pressed on the keyboard the corresponding note will be added to the sequence. Multiple keys may be pressed at the same time. When the key is released the playhead will advance to the next step in the sequence. If the key is held down for a short while the playhead will automatically start advancing to increase the duration of the note.

Step recording will always record notes aligned to sequence steps, i.e. 1/16th notes, or 6 MIDI ticks. After recording the starting tick or duration of notes can be changed using the notes detail tab. See below.

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.

Detailed Event Editing

To give you more control over the various events in a sequence the sequencer has dedicated editor panels to change event parameters. These editors can be accessed using the tabs in the sequencer. Use the < and > buttons on either side to browse through the available tabs.



The following event editing panels are available:

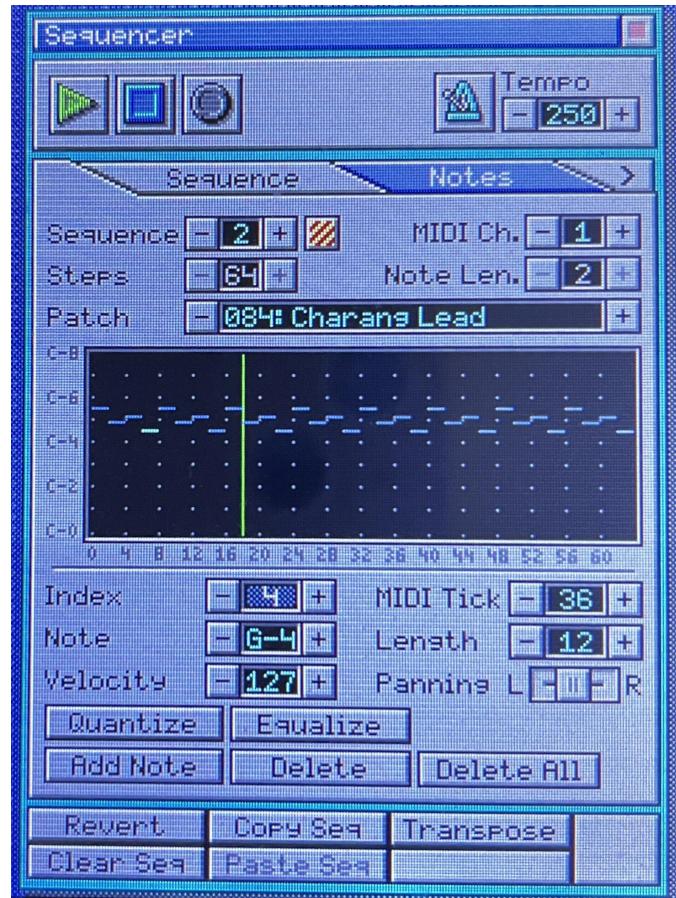
- Notes - To edit the parameters of the notes in the sequence
- Volume - To edit volume control changes
- Panning - To edit panning control changes
- Pitch - To edit pitch control changes
- Modulation - To edit modulation control changes

Each of the event editors functions in roughly the same way, so we will not look at each one in detail, except for the notes and volume panels. The panning, pitch and modulation panels function similarly to the volume panel.

In each panel you see an event graph that gives an overview of the events in the sequence and below the event graph there are the controls to edit the event parameters. On each panel there will be an index spinner that selects the event and a MIDI tick spinner that sets the MIDI tick when the event occurs within the sequence. See below for more details about the event graph.

Notes Panel

The notes panel lets you edit the notes in your sequence in more detail. It can be used to change the parameters of each note, add new notes, quantize the sequence or equalize parameters for all notes.



The unique controls in the panel are:

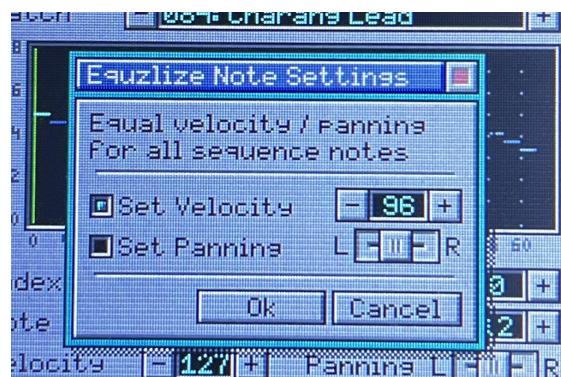
- **Note** - To change the pitch of the selected note.
- **Length** - To set the duration of the selected note in MIDI ticks.
- **Velocity** - To change the key on velocity of the note.
- **Panning** - To set the panning of the individual note. Be aware that note panning does not override the sequence panning.

Quantize

When the quantize button is clicked all notes in the sequence will be quantized, i.e. notes will be aligned to the nearest 1/16th note interval and their duration will be a multiple of 1/16th notes.

Equalize

The equalize button provides a quick way to give all notes in the sequence an equal velocity and / or panning. When clicked a small dialog window pops up where you can set the desired values. The checkbox in front of each value shows whether or not to apply the new setting when ok is clicked.



Add Note, Delete, Delete All

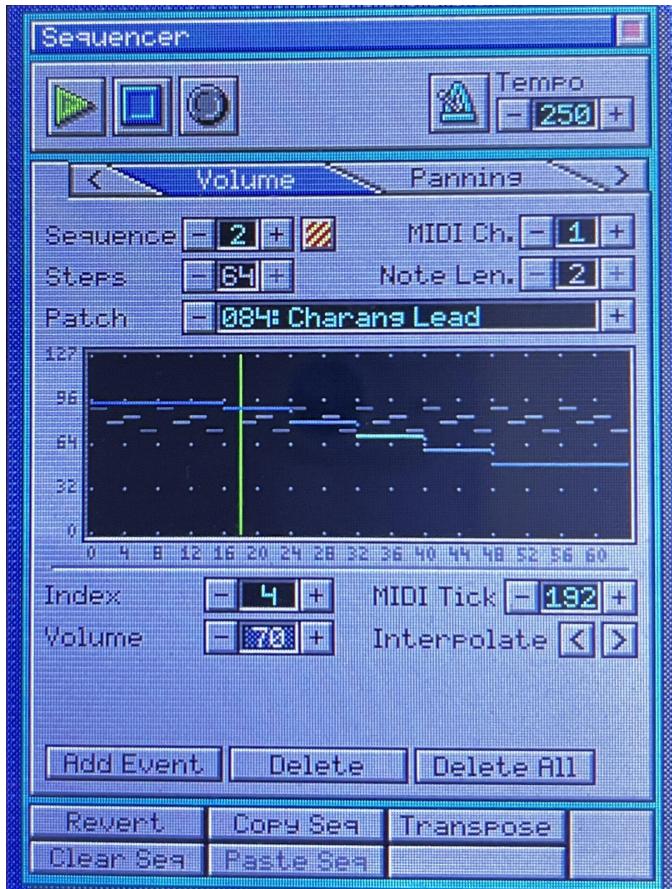
These buttons allow you to add new notes, delete the selected note, or delete all notes from the sequence.

When a new note is added it will be added immediately after the currently selected note with the same pitch and duration. The note spinner will be highlighted to allow you to quickly adjust the note pitch using **B**.

Note that when deleting all notes other events will remain. If you want to clear the full sequence click the Clear Seq. button at the bottom of the window.

Volume, Panning, Pitch and Modulation

These panels function similarly, so we will only have a detailed look at the volume panel. In addition to the index and MIDI tick spinners these panels all have one spinner to set the event value, interpolation buttons and buttons to add and delete events.



Notice that if you're using OPL Studio with the OPL2 Audio Board as its synthesizer module that the panning tab will be grayed out as panning is not available on the OPL2.

The value spinner depends on the panel:

- Volume - From 0 to 127 (loudest).
- Panning - From 0 to 127
 - MIDI panning values are mapped to OPL3's hard panning as follows: 0 .. 47 = left, 48 .. 79 = center, 80 .. 127 = right. Also be aware of individual note panning.
 - If panning is set to play only the left channel then notes that are individually panned right will **not** be heard.
- Pitch - From -64 to 64, or -2 to +2 semitones.
- Modulation - From 0 to 127.

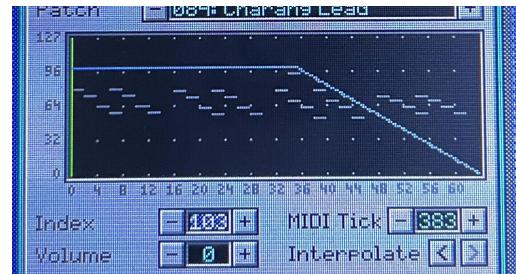
Event Interpolation

To allow for smoother control changes when you're not using MIDI recording the editor panels provide a simple interpolation function that can be used to let the sequencer add additional events to the sequence by interpolating between two events.

When an event is selected the interpolate buttons can be used as follows:

- < - Interpolates from the previous event to the current event.
- > - Interpolates from the current event to the next event.

For example, let's make a sequence that's fading out. We start with our sequence having just a single volume change event at tick 0 with a value of 100. Add a new event, let's say half way through the sequence, where the volume should start to fade out. This event will also have a value of 100. Add another event at the last tick in the sequence with a value of 0. Now click on the < interpolate button to let the sequencer add all volume change events in between for a smooth fade out.



Add Event, Delete, Delete All

These buttons allow you to add new events to the sequence, delete the currently selected event, or delete all events of the type being edited from the sequence.

When add event is clicked a new event will be added at the next MIDI tick. The new event will have the same value as the previous one. If the new event is added in between two existing events then its MIDI tick will be right in the middle of the two events.

Notice that the delete all button will only delete all events of the same type from the sequence. If you want to clear the sequence, click the Clear Seq. button at the bottom of the window instead.

Using the Event Graphs

Each event detail panel contains a graph showing the control value changes over time in the sequence. On the left hand side of the graph an indication is given of the MIDI CC value and below the graph an indication is given of the sequence step. Events are shown as blue horizontal line segments in the graph. The currently selected event will be highlighted. The notes in the sequence will be shown in the background as gray line segments to give an indication of when they occur.

The stylus can be used to edit event parameters as follows:

- Events can be selected by clicking the corresponding line segment in the graph.
- By dragging up and down the parameter value of the selected event will be changed.
- By dragging left and right the MIDI tick where the event occurs in the sequence will be changed.
- By long pressing the event graph a new event will be added to the sequence at the point where the graph is pressed.

The event graph of the notes panel works slightly different. It shows the notes as disconnected line segments that can still be selected by clicking, but adding new notes by long pressing or changing the MIDI tick of notes by dragging horizontally is not allowed. Dragging the stylus vertically will change the velocity of the currently selected note.

Quick Editing With Rotary Encoders A and B

You can use **A** and **B** to make quick changes to event parameters.

Adding new events

A can be used used to quickly add new events to the sequence:

1. Pressing **A** will make the current selection jump to the main control spinner (for example volume) and **B** can be used to adjust the value.
2. Pressing **A** again will add a new event. The new event will be added 1 MIDI tick after the current one, or, if the current event is not the last event in the sequence, then it will be added in the middle of the current and the next event. The selection will jump to the MIDI tick controller where you can change the MIDI tick of the event using **B**.
3. Pressing **A** makes the selection jump back to the main control spinner and the cycle will repeat.

Editing existing events

B can be used to quickly edit control values of existing events:

1. Highlight the spinner of the parameter that you want to change.
2. Change the parameter either using the stylus or by rotating **B**.
3. Press **B** to jump to the next event in the sequence, while leaving the spinner of the control value highlighted.



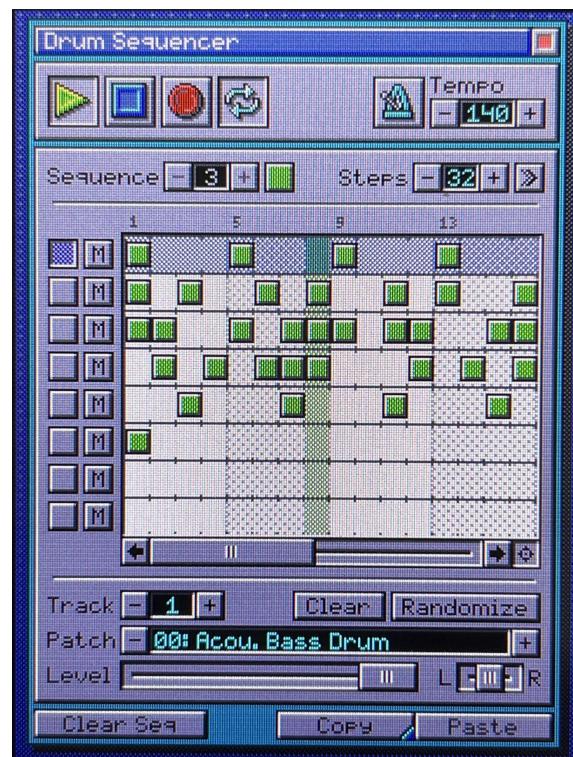
Drum Sequencer

With the drum sequencer you can create and edit drum sequences. OPL Studio allows you to create 32 drum sequences. Each drum sequence had 8 tracks where every track can be assigned a different drum patch, volume and panning.

Next to the sequence selector is a small colored button that shows the color and pattern of the sequence that will be used to represent the sequence in the live sequencer and composer modules. Clicking this button opens the pattern selection window where the sequence color and pattern can be changed.

The Steps control allows changing the number of steps in the sequence from 16 to 32, 48 or 64. Next to the steps control a small arrow button is located. This is the extend sequence button that is used to quickly extend the sequence. When this button is clicked the sequence will be extended with 16 steps and the pattern of the last 16 steps is copied.

The middle part of the sequencer shows the current drum sequence and its 8 tracks. Each track can have its own drum patch, volume level and panning. The currently active drum track is shown with a blue background in the editor and the properties such as patch, volume and panning of the active track are shown below the editor. The active track can be cleared by clicking the Clear button, or a random pattern can be set by clicking the Randomize button.



Sequence Editing and Recording

To change the drum sequence click on one of the steps in the editor to make it active. The active track will change to the track that was clicked and when playing all active steps will play the drum patch that is assigned to the track. To clear a step click it again with the stylus. To quickly activate or deactivate a number of drum steps the sequence can be dragged horizontally. When dragging only the active track will be changed.

To the left of the editor there are two toggle buttons for each track. The first button indicates in blue the active track and it can be used to change the active track without changing anything about the sequence. The 'M' buttons are used to mute tracks from the sequence.

By long pressing a mute button the track will be put in solo mode, i.e. all other tracks will be muted.

Recording From MIDI

Besides entering a drum sequence with the stylus and the touch screen, drum sequences can also be recorded from MIDI. To enable MIDI recording click the record button. OPL Studio now listens to events on MIDI channel 10 to record a drum sequence. The playhead will change from green to red to indicate the step where new drum events will be recorded. The following recording modes are available:

Step Recording

After clicking the record button OPL Studio is in step recording mode. Each time it receives a note-on event on MIDI channel 10 it will record the drum sound to the sequence, advance the recording cursor to the next step and wait for the next note. At the end of the sequence the cursor will wrap around to the first step.

Live Recording

When OPL Studio is in step recording mode the play button can be clicked to start a live recording. The playhead will advance through the sequence according to the current tempo and drum sounds will be recorded as notes are played. If the metronome is enabled then it will beep according to the current tempo.

Next to the record button is a loop button. When this button is disabled, sequence recording will stop once the end of the sequence is reached. If this button is enabled then the playhead will restart recording from step 0.

Triggered Live Recording

To trigger a MIDI recording press and hold the record button. You will hear 3 beeps to indicate that OPL Studio is now armed and waiting for MIDI events. As soon as OPL Studio receives the first note-on event on MIDI channel 10 it will start recording the sequence. The recording cursor will advance according to the current tempo.

When recording a drum sequence from MIDI the drum patch is determined by the note that is played. Note B#2 corresponds to drum patch 0, note C#7 corresponds to patch 46. When a MIDI note is received OPL Studio determines the drum patch.

- If the patch is not yet used on any of the tracks then the first empty track will be used to record the drum sound and the corresponding patch will be assigned to the track. The step where the drumsound is recorded is determined by the position of the recording cursor,
- If the patch is already assigned to one of the tracks, then the drum sound is recorded to that track.
- If there are no free tracks then the drum sound will not be recorded.

Copying and Pasting

A single track or the full sequence can be copied by clicking the copy button on the menu bar at the bottom of the window. This will bring up a sub menu to copy only the currently active track or the entire sequence.



After clicking either track or sequence the menu will switch back to its default state and you can paste the copied track (Paste Tr) or the sequence (Paste Seq).

- **Paste Tr** - When Paste Track is clicked the currently active track will be overwritten with the copied track
- **Paste Seq** - The entire sequence will be overwritten with the copied sequence



Patch Editor

The patch editor is the module that allows you to edit all of the melodic and drum instrument patches. OPL Studio allows for up to 128 melodic patches and 47 drum patches. In the editor you can edit predefined patches, create your own or load and save existing patches from various OPL2 / OPL3 instrument patch files.

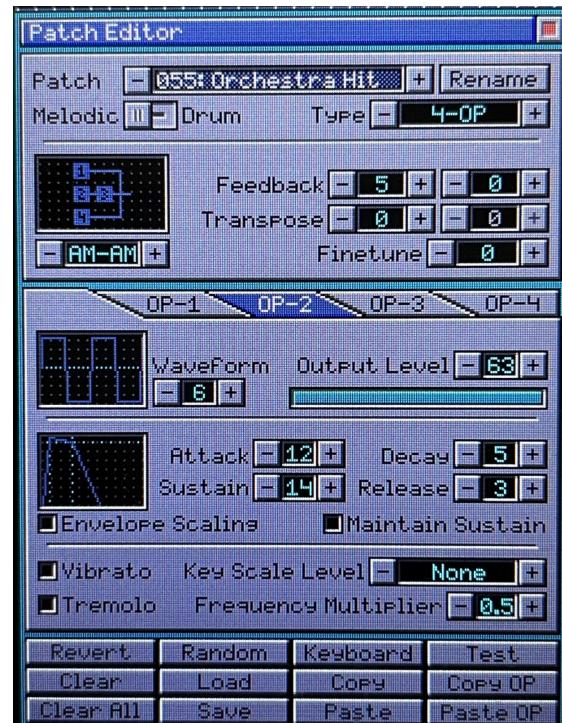
The editor window is divided into two parts. The upper part is used to select the patch that's being edited, patch type, melodic or drums, 2-OP, dual 2-OP, 4-OP and to set some overall patch values.

OPL Studio supports the following patch types:

- **2-OP** - OPL2 or OPL3 patch with 2 operators
- **4-OP** - OPL3 patch with 4 operators
- **Dual 2-OP** - OPL2 or OPL3 patch where two 2 operator patches are grouped to form a single patch that emulates a 4-OP patch



If OPL Studio has been set to OPL2 only mode in the settings, then 4-OP patches will **not** be available. Also the number of different waveforms will be limited. See the section about settings for more details.



Transpose / Drum note and Finetune need some extra explanation:

- **Transpose** is only available for melodic patches. It transposes the note being played by the given number of semitones. For dual 2-OP patches a transpose can be set independently for both the primary channel (defined by OP-1 and OP-2) and the secondary channel (defined by OP-3 and OP-4).
- **Finetune** is used to fine tune the note frequency +/- 2 semitones in 127 steps. For dual 2-OP patches the fine tune only adjusts the frequency of the secondary channel, i.e. the secondary 2-OP patch defined by OP3 and OP4 in the editor.
- **Drum note** is only available for drum patches and it sets the fixed MIDI note that will be played when the drum patch is triggered. For dual 2-OP patches both the primary and the secondary 2-OP channel may use a different drum note.

In the bottom part of the window each of the patch operators is configured. Patch and operator settings directly correspond to OPL2 / OPL3 registers. For an in-depth description on each of the OPL2 registers please refer to

https://moddingwiki.shikadi.net/wiki/OPL_chip#Data_Registers

If MIDI controls are mapped to patch parameters then the editor will take over any control changes from MIDI channel 1 as they happen and update the parameters of the patch that's being edited.

Testing Patches

Patches can be tested by playing a note on MIDI channel 1, with the on screen piano keyboard that's opened by clicking the Keyboard button, or by clicking on the Test button.

When a drum patch is tested it will always play the fixed drum note that was set for the patch.

For melodic patches the note that is played when the Test button is clicked will be a C-4 by default. This note is changed whenever a note is played on MIDI channel 1, or when a note is played on the on screen piano keyboard.

Reverting From Mistakes

While editing patches you may want to undo changes that you made from time to time when your patch does not sound the way you intended. OPL Studio's patch editor has a Revert button that lets you undo changes.

When Revert is clicked all patch settings will be reverted to how they were set when you selected the patch in the editor. In other words there is no step by step undo function, but OPL Studio reverts to a snapshot of the patch that was taken when you opened the patch editor and each time when you select a different patch.

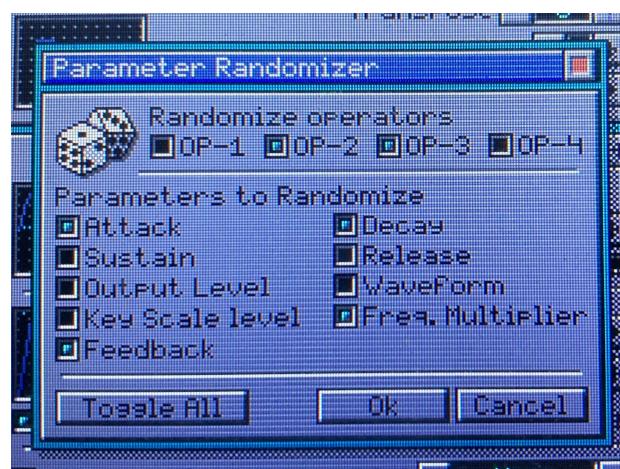
Loading and Saving Patches

OPL Studio can load and save the following OPL instrument / bank files:

- **BNK** - Adlib instrument bank
- **OP2** - DMX sound library instrument bank
- **OPLI** - OPL3 Bank Editor single instrument
- **OPS** - OPL Studio session instrument bank
- **SB / O3** - Unix 2-OP / 4-OP instrument bank
- **SBI** - Sound Blaster instrument
- **TIM / SND** - Adlib timbre bank
- **TMB** - Apogee timbre bank

Randomizer

By clicking the Random button the Parameter Randomizer window will open. The Randomizer will set random values to the selected parameters of the selected operators.





Synthesizer Setup - MIDI CC Mapping

OPL Studio allows mapping of MIDI controls to its own synthesizer controls. After mapping control changes OPL Studio will handle incoming MIDI CC events and route them to the mapped OPL Studio synthesizer control. This can be a channel control such as volume or a patch control such as output level of specific operator(s).

MIDI CC mappings can be added or removed from the list using the Add and Delete buttons. For each mapping a MIDI CC from 1 to 127 is set. When the Sample MIDI button is clicked OPL Studio will listen for any incoming control change. As soon as a MIDI CC event is received OPL Studio assigns it to the mapping that's being edited.

MIDI CC Handling

Control changes always apply to the MIDI channel where they occur, the mapper does not change or restrict the channel. For example a volume change on MIDI channel 1 only affects the volume of MIDI channel 1.

In case of patch parameters OPL Studio handles control changes as follows. For example a mapping is set for MIDI CC 85 to the patch output level of operator 1. After setting this mapping control 85 changes value on MIDI channel 3. The output level of operator 1 for the patch that's used by MIDI channel 3 will be changed according to the control value. This change however is not permanent for the patch and it only applies to the instance of the patch on MIDI channel 3. If channel 1 were to use the same patch, then its output level is not changed, because the MIDI CC event happened on channel 3.



When a different patch is assigned to MIDI channel 3 (or the same patch is reassigned) then it will **not** immediately take the changed control value(s). The patch will be reloaded and only when a MIDI CC changes a parameter will this parameter (and only this parameter) be changed for the patch on channel 3.

Default MIDI CC Mapping

By default OPL Studio will set the following MIDI CC mappings:

- MIDI CC 1 - Channel modulation (vibrato)
- MIDI CC 7 - Channel volume
- MIDI CC 10 - Channel panning
- MIDI CC 64 - Sustain pedal (not remappable)
- MIDI CC 120 - All sound off (not remappable)
- MIDI CC 121 - Reset all controls (not remappable)
- MIDI CC 123 - All notes off (not remappable)



Synthesizer Setup - CV/T Controls

OPL Studio has 6 CV/T (Control Voltage / Trigger) inputs that allow you to connect external synthesizer controls such as Eurorack modules or other analog controls. The CV/T setup configures how each of the CV/T inputs is controlling the OPL Studio synthesizer.

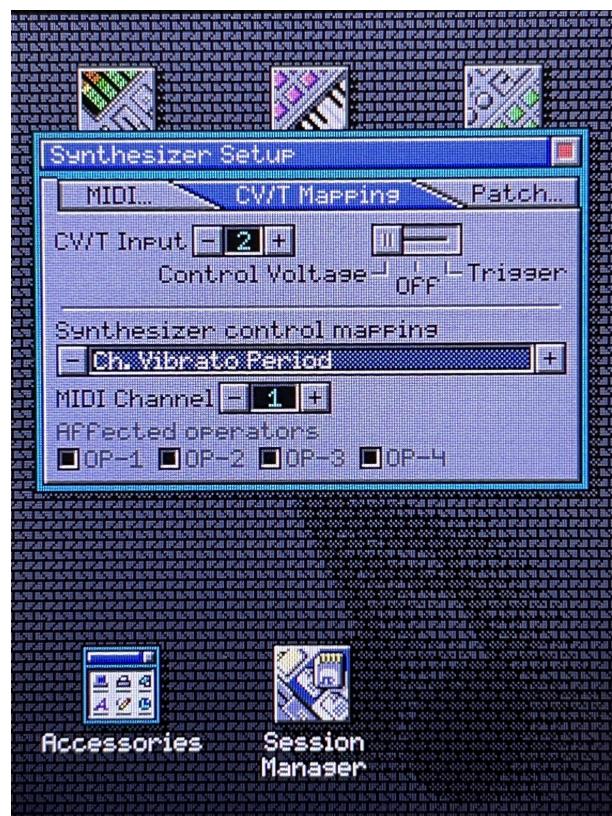
Each CV/T input can be set up to either function as an analog input for a control voltage from 0v to 8v or as a trigger when an input voltage changes.

A control voltage input can be used to configure synthesizer controls of a particular MIDI channel or the parameters of a patch that is used on a MIDI channel. When a CV input is mapped to a patch parameter it is also possible to set the operator(s) that are affected by the control.

For triggers the trigger edge can be set to either rising or falling edge and the function of the trigger can be set for example to a clock pulse or to play a drum sound.

The way OPL Studio handles CV mappings is the same as how MIDI CC events are handled, with the exception that CV mappings have a fixed MIDI channel.

 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.





Synthesizer Setup - Patch Linking

Patch linking allows the creation of up to 16 complex effects, such as chorus, by letting a patch that is triggered by playing a note trigger up to 3 additional notes each with different parameters.

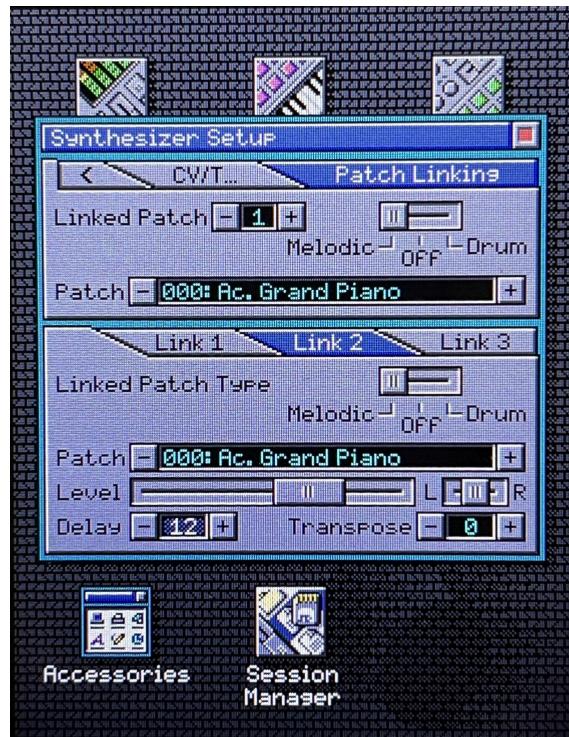
A linked patch always has a base patch. This is the patch that, when it's used to play a note, will trigger the patches that are linked to it to play additional notes. Each link can have a different melodic or drum patch, level, panning, delay and note transpose.

- **Level** - Sets the velocity of the note as a ratio of the base note's velocity.
- **Delay** - Number of delay ticks before the linked patch is triggered and plays its note. Each delay tick is 1/60th of a second.
- **Transpose** - Transposes the base note by the set number of semitones.

Notes that are played by linked patches will use the same MIDI channel as the base note, therefore they will also take into account any MIDI control changes that occur on the channel that are mapped to synthesizer controls.



Notice that, especially when using 4-OP patches, you may quickly run out of OPL channels when playing multiple notes that use patch linking. OPL Studio's synthesizer algorithm tries to optimize OPL channel usage, but you may experience notes being cut off or ignored when too many notes are played at once.



Simple Echo Effect

For example to create a simple piano with echo. Set the base patch to melodic and patch 0. Enable each of the links by setting them to melodic and patch 0. Give each link an increasing delay: 6, 12 and, 24 respectively and set levels to 80%, 60% and 40%.

Now when a note is played on any MIDI channel with patch 0 the piano will play with the echo effect.



Composer

The composer module allows you to arrange your sequences into complete songs. A song is made up of 6 tracks and each track is further divided into cells of 4 sequence steps (1/4th note).

Editing a Song

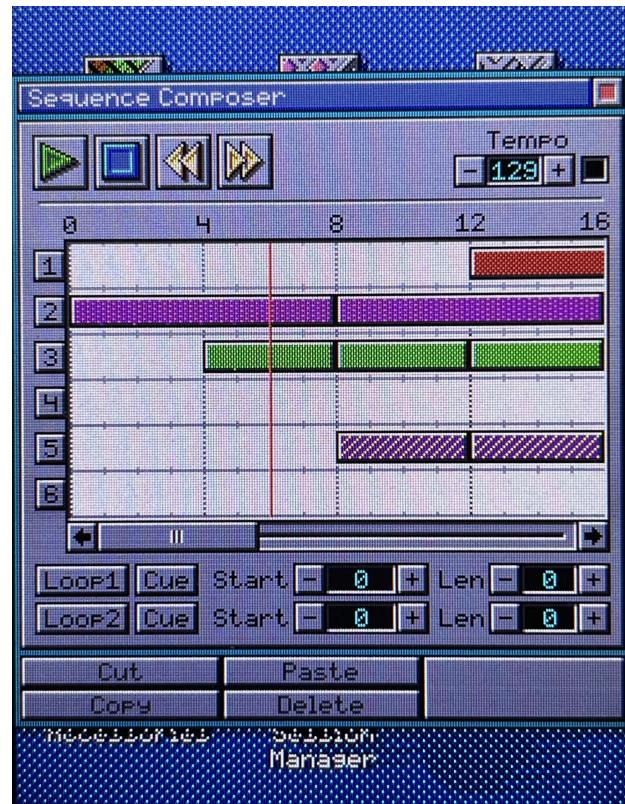
To add a sequence to the song, long press on the cell where you want the sequence to start. This will open the sequence selection window where you can select a drum or melodic sequence. If a newly added sequence overlaps with a sequence that is already present in the song then it will replace the existing sequence.

Clicking a sequence 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. Once one or more sequences have been cut or copied they can be pasted into the song by clicking the paste button. The sequences can now be pasted into the song by clicking the top left cell where the copied block should be placed.

To change or remove a single sequence, long press it to open the sequence selection window and select a new sequence, or click on the trashcan button to remove it.

To edit a sequence double click it to open it in the drum or melodic sequencer where you can make changes. After closing the editor you will return to your song.

Tracks can be muted by clicking on the channel buttons 1 through 6 in front of the tracks.



Song Loops

Two loops can be set for the song by setting the starting step and the length of the loop in steps. The loop is enabled by clicking the loop button. When, during playback, the end point

of a loop is reached, then the play head will jump back to the start of the loop and continue playback from there.

Clicking the Cue button makes the playhead jump to the loop start immediately.



Keyboard

The keyboard accessory gives a small on screen keyboard that can be played with the stylus.

The rotary controls can be used for extra expression:

- **A** - Sustain pedal. While A is pressed notes will keep playing when the stylus is released. If another key on the keyboard is pressed it will play in addition to the notes that are already playing. When A is released all notes, except for the note being touched on the keyboard, will stop playing.
- **B** - Pitch and modulation. While B is pressed, drag the stylus horizontally to change the note's pitch, drag the stylus vertically to change the modulation to apply a vibrato effect to the note.



Ow hey you found me! Ok here's a little secret: In the About screen double click on the Cheerful logo and something new will appear on the Accessories panel ;)



Live Sequencer

With the Live Sequencer module you can play and mix your sequences like a DJ.

The window shows two banks of 6 sequences. To assign a sequence to a slot click its title bar to open the sequence selection window. The selected sequence will be assigned to the slot, or the sequence slot can be cleared by clicking on the trash can button. If an empty sequence is added then the melodic or drum sequence editor will open.

Each slot can be set to play or mute the sequence by clicking it. A small progress bar below the sequence will show the playback position of the sequence while playing. Besides clicking the play / stop buttons, pressing **A** will also start and stop playback.

All sequences from one bank can be copied to the other bank by clicking the up and down arrow buttons between the two banks.

The bank that will be active during playback is indicated with a green bar to the left of the bank. During playback the active bank can be switched by clicking the button. The active bank will be switched at the next 16 step transition. When the bank is set to be switched the button will show in blue while waiting for the transition.

Next to the familiar playback controls the live sequencer shows the retrigger control. When enabled all sequences will retrigger after playing the number of steps shown by the spinner. While the spinner is focused pressing **B** will enable or disable retrigerring. If the spinner is not active then **B** can be pressed to immediately retrigger. While retrigerring is active the active sequence bank will not change until retrigerring is disabled.



MIDI CC Mappings

The live sequencer uses MIDI channels 1 through 6 to play the sequences in the corresponding slots. Thus MIDI control changes on channel 1 will be mapped to the sequence in slot 1, MIDI CC on channel 2 to slot 2, etc. MIDI CCs that are mapped will depend on the MIDI CC mappings that were set in the Synthesizer Setup.

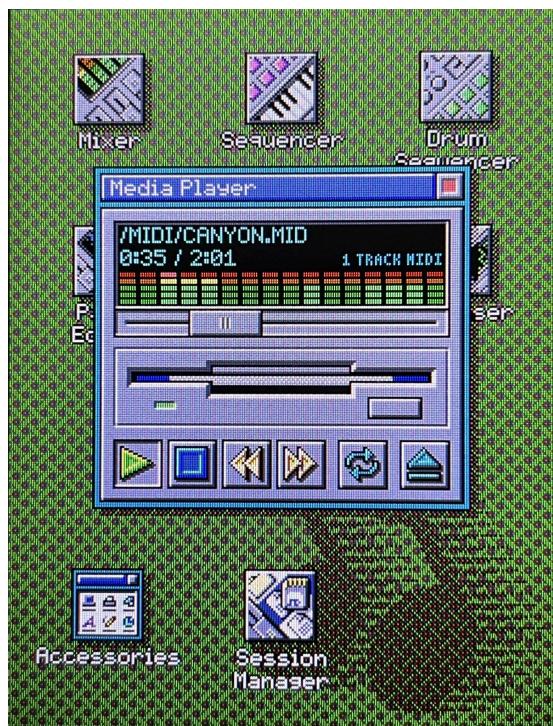


Media Player

OPL Studio's media player can play a number of common media files for MIDI and OPL2 / OPL3 music. While the media player is open all MIDI and analog inputs will be disabled.

Supported files are:

- **DRO** - DOSBox Raw OPL
- **IMF** - id Software Music Format
- **MID** - MIDI
- **VGM** - Video Game Music (only OPL2 and OPL3)



- ⚠ For MIDI files, depending on the internal file structure, searching or skipping through the media may take some time before playback resumes.
- ⚠ IMF files require a specific playback speed to play correctly. This speed is not defined within the file. If the IMF is playing too slow or too fast then click the playback speed indicator to switch between 280 Hz, 560 Hz and 700 Hz.

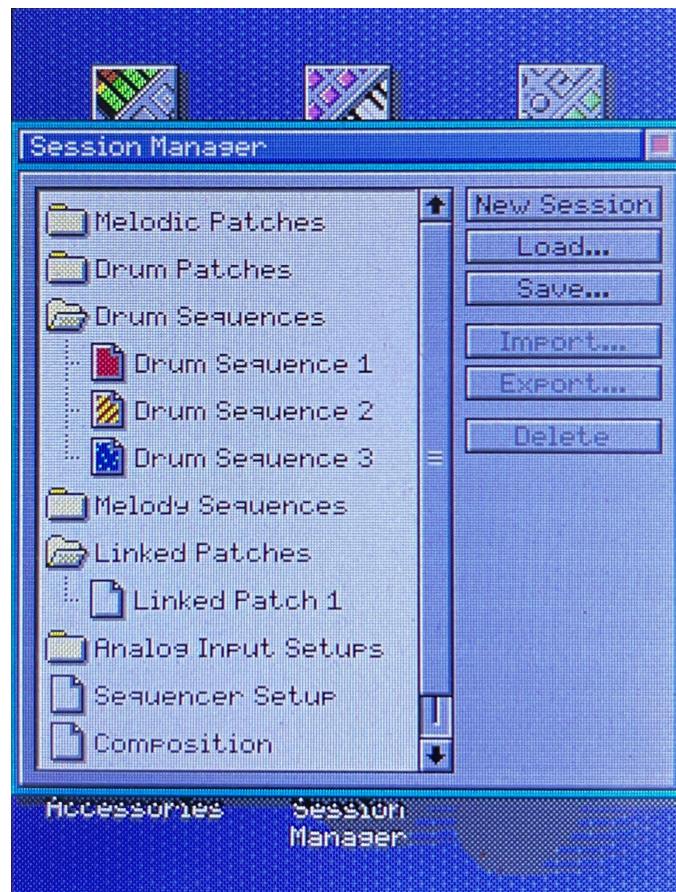
VGZ is a common way to distribute VGM files. OPL Studio cannot directly play VGZ files, but the VGM file can be extracted from the VGZ file as follows:

1. Rename the *.VGZ file to a *.ZIP file
2. Open the ZIP file and extract the VGM file from it
3. Give the extracted file the *.VGM extension



Session Manager

With the session manager you have access to all parts of your OPL Studio session from one overview. In this module you can start a new session, load or save a session to SD card or directly jump to a specific part of your session to change it.



The main structure in this window shows all components of the current OPL Studio session. By double clicking an item you can immediately launch the appropriate editor to make changes to the selected item.

From here you can start a new session. After confirming, all changes will be wiped and OPL Studio will start a new session with all defaults loaded.

Load and Save are used to load and save an OPL Studio session as an OPS file on the SD card.

The Import and Export buttons are not yet implemented in this version of the software.

With the Delete button you can quickly delete the selected elements from the current session.



Settings

The OPL Studio settings can be changed from the settings screen.



OPL Studio

Generic OPL Studio settings. Additionally this screen provides version information when clicking About and allows a factory reset of OPL Studio. After confirming factory reset OPL Studio will reboot and launch the touch screen calibration.

OPL Type

This setting can be used to restrict the capabilities of OPL Studio for emulation.

- **Double OPL3 (default)** - This enables both OPL3 chips and allows for up to 36 audio channels.
- **Single OPL3** - Restricts OPL Studio to only use a single OPL3 chip and limits to 18 channel max.

- **Single OPL2** - Restricts OPL Studio to a single OPL3 chip that is placed in OPL2 mode.

 When OPL Studio's OPL Type is set to Single OPL2 the following restrictions apply:

- There is a maximum of 9 channels
- No 4-operator patches can be used
- Only waveforms 0 .. 3 are available
- Panning is disabled, all audio will be mono (output will be the same on left and right audio channels)

Load Default Instruments on Start

When enabled OPL Studio loads the default 127 melodic and 47 drum instruments on startup or when a new session is created. When disabled no instrument patches will be available until you load them from SD card in the patch editor, or create them yourself.

Load only 2-OP instruments

When this setting is enabled OPL Studio will load 2-OP melodic instrument patches instead of the regular 4-OP patches. This setting can only be enabled when using an OPL3 type synthesizer and when default patch loading is also enabled.

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 from MIDI out to sync with other components.



When an external clock is used all tempo controls throughout the UI will be disabled. They will show the tempo derived from the external clock, but no tempo changes can be made on OPL Studio.

Auto Save OPL Studio Session

When enabled and with an SD card present, OPL Studio will auto save all changes to a temporary file on the SD card. After a power cycle OPL Studio will restore the session from the temporary file.

Play Test Chime

This setting enables or disables OPL Studio's startup sound that is heard on the splash screen during startup.



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 default 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 OPL Studio’s CV/T inputs. Because external controls can have different control voltage ranges they need to be calibrated before they can be used.

After plugging a control voltage source in one of the CV/T inputs, select the appropriate input and test if the input range is correct by varying the control voltage from minimum to maximum. The value of the progressbar should be stable and correspond to the value of your external 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.

There are two ways to calibrate the CV/T inputs:

- **Manual calibration** - By clicking Calibrate. Provides a simple step by step calibration process where you manually set the input voltage first to the minimum value and then to the maximum value, or for a trigger measure the disabled and enabled gating voltages.
- **Auto calibration** - OPL Studio will sample the input for 3 seconds to determine the minimum and maximum voltages. It is expected that during auto calibration the external controller goes through its full control voltage range.



Updating the Software

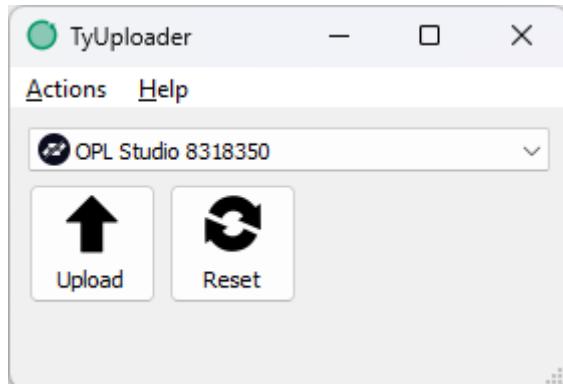
The latest version of the OPL Studio software can be downloaded from <http://www.cheerful.nl/oplstudio>.

The zip file with the software contains the TyUploader program that is used to upload the OPL Studio software to the Teensy. When you start the program 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 '_T41' file for a Teensy 4.1 or the '_T36' file for a Teensy 3.6. After selecting the file that upload will begin,



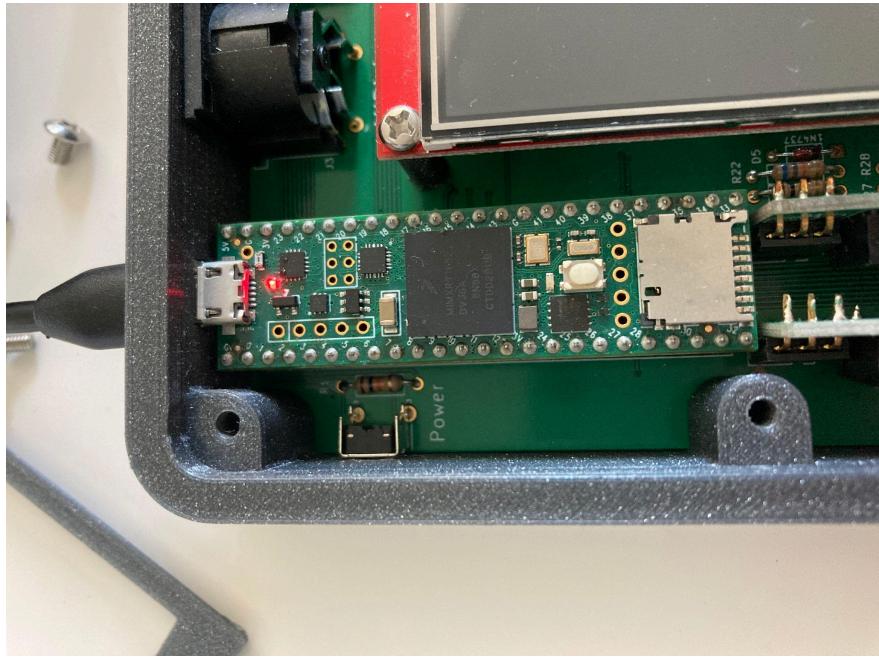
In most cases you need the T41 software. **Only** if your OPL Studio is one of the earlier kits that you built yourself and you chose to use your own Teensy you may need the T36 software if you use a Teensy 3.6 for your kit.

During software update the power LED 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.



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 to reset it. 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 'HalfKay' 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.

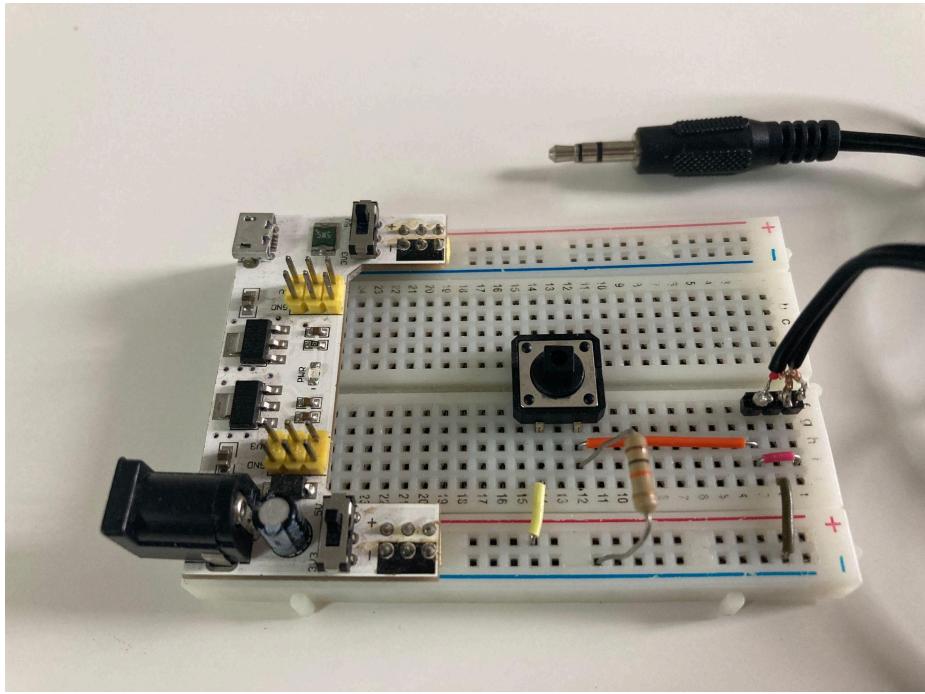
Building Your Own Controls

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.



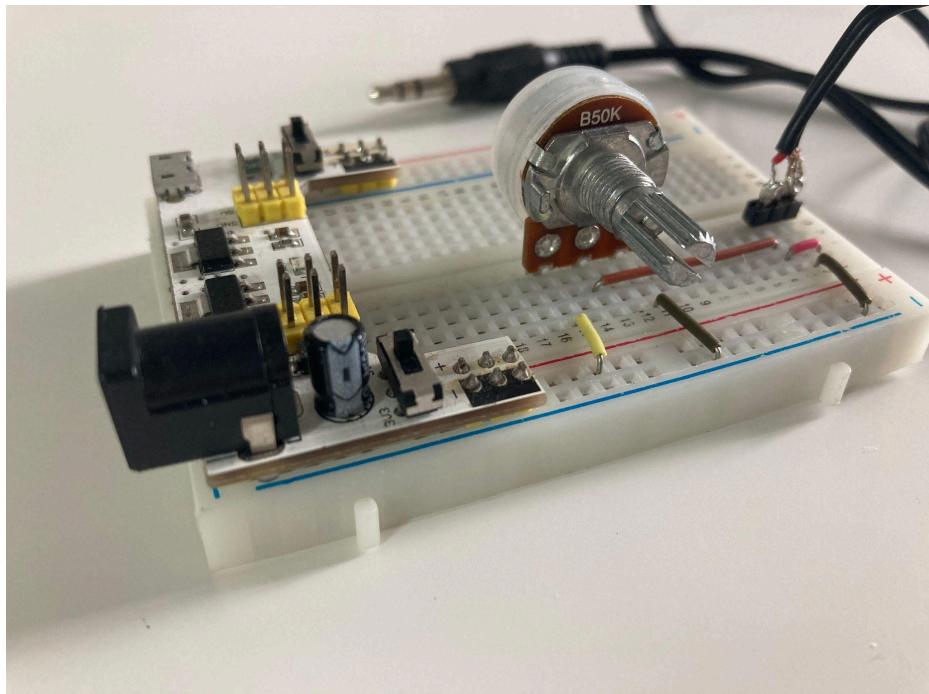
To use your control first we need to calibrate it in the CV/T calibration settings after it has been plugged into one of the CV/T inputs. In the calibration wizard select the CV/T input where you connected your control. Now tap calibrate and don't push the button. This will be your minimum. Tap next. 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.



MIDI Characteristics

OPL Studio supports MIDI status messages on all 16 MIDI channels. Channel 10 is used as the fixed drum channel. Up to 36 note polyphony is supported when OPL Studio works in dual OPL3 mode and 2-OP instrument patches are used. When using the default 4-OP melodic instruments you can expect at least 18 note polyphony.

Supported MIDI status messages

Status	Purpose	Comments
0x80	Note Off	
0x90	Note On	
0xA0	Aftertouch	Implemented as channel aftertouch, i.e. all notes playing on the channel where this message is received will apply the same aftertouch.
0xB0	Control Change	See below
0xC0	Program Change	Channel 10 is used as the fixed drum channel and ignores program change messages.
0xD0	Channel Aftertouch	
0xE0	Pitch Change	
0xF2	Set Song Position	Stops all current notes and sets the internal clock to the given 14-bit value. This value is interpreted as 1/16 th notes, or sequencer steps.
0xF8	Clock	When the external clock is enabled in OPL Studio settings then this message causes the internal clock to be incremented by 1 MIDI tick.
0xFA	Start	When the external clock is enabled in OPL Studio settings this message causes the sequencer to start playback.
0xFB	Continue	When the external clock is enabled in OPL Studio settings this message causes the sequencer to resume playback after it was stopped.
0xFC	Stop	When the external clock is enabled in OPL Studio settings this message causes the sequencer to pause playback.
0xFF	Reset	Reset OPL Studio to its default state. All playback will be stopped immediately, any playing notes will be interrupted, all controls will be reset to their default values and the OPL3 synthesizer will be reset.

Default Mapped MIDI Controls

These are the default MIDI control mappings OPL Studio uses. Please refer to the section about MIDI control mapping to learn how any MIDI control can be mapped to synthesizer functions.

Control	Purpose	Range	Comments
1	Modulation Wheel	0 .. 127	Introduces a vibrato. (Vibrato depth and rate can be changed by mapping custom MIDI CCs)
7	Volume	0 .. 127	
10	Pan	0 .. 127	Control values are mapped to OPL3 hard panning: 0 .. 47 - Left 48 .. 79 - Center 80 .. 127 - Right
64	Hold / Sustain Pedal	0 .. 127	Value mapping: 0 .. 63 - Disabled 64 .. 127 - Enabled Up to 32 notes can be sustained using pedal control across all channels.
120	All Sound Off	-	Stop all notes on the MIDI channel immediately, also those that are held by the sustain pedal.
121	Reset All Controls	-	Reset all controls to their default values.
123	All Notes Off	-	Stop all notes on the MIDI channel, but the release portion of the note will still sound. This control is ignored if the sustain pedal is active.



Troubleshooting

In case you run into problems please see if one of the following solutions fixes your problem. If this is not the case then feel free to reach out to maarten@cheerful.nl and we will try to fix your issue together.

Issue	Possible Solution
OPL Studio is not recognised as a USB device on my computer	Check the USB cable that you're using. Some cables are only meant to provide power and are lacking the required data lines (usually this is not indicated on the cable!). Try a different USB cable.
OPL Studio shows an error when I try to access my SD card, The SD card activity light keeps blinking	Power cycle OPL Studio by removing the USB power and plugging it back in. If the problem persists make sure that you SD card: <ol style="list-style-type: none">1. Has been formatted using a FAT32 file system2. Has been formatted with an MBR partition (GPT partitions will not work)3. The SD card is not larger than 32 GB
The touch screen is not responding or the stylus is not accurate	Try recalibrating the touch screen by going to Accessories > Settings > Pointer and click Calibrate. If calibration is too messed up to allow normal operation then perform a factory reset (see below)
There is unwanted noise on the speaker output	Laptops and some USB chargers can cause unwanted background noise such as buzzing. <ul style="list-style-type: none">• Check your power source and try a different power supply• Try plugging your power supply into a different power outlet
Panning is not working, I cannot use 4-OP instrument patches	Make sure that in OPL Studio settings (Accessories > Settings > OPL Studio

	<p>Settings) OPL Type is set to OPL3 and that 'Load only 2-OP instruments' has been disabled.</p>
The rotary controls work in opposite direction	<p>You can reverse the order of the rotary controls as follows:</p> <ol style="list-style-type: none"> 1. Remove power from OPL Studio 2. Power OPL Studio back on 3. When the boot screen shows, press and hold both A and B until you hear a beep.
Performing a factory reset	<p>A factory reset will revert all OPL Studio settings back to default and launch the touch screen calibration.</p> <p>In order to do a factory reset:</p> <ol style="list-style-type: none"> 1. Remove power from OPL Studio 2. Power OPL Studio back on 3. Press and hold the panic button located on the left side of the device while the boot screen is showing. <p>OPL Studio will show a warning that it will do a factory reset. Keep holding the panic button until 'Reset!' is shown.</p>