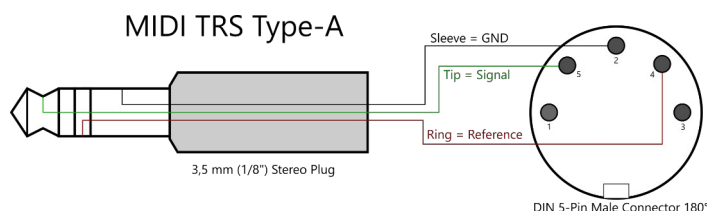# MINERVA
USER MANUAL

The **Oscillator Devices MINERVA** is a miniature, MIDI controlled, stereo sample player. The **MINERVA** is able to play .WAV and .AIFF files with different sample rates and bit depths. The ability to mix the output with an optional guitar, bass, or synth input signal makes it perfect for the use on a MIDI controlled pedalboard. Of course the **MINERVA** is analog dry-through. That means the input signal stays analog and isn't touched by any A/D or D/A conversion.

The samples are saved on a microSD or microSDHC card, easily accessible from the top. The samples can be triggered with PC, selectable CC or Note commands. With the latter it's possible to play the **MINERVA** with a MIDI keyboard.
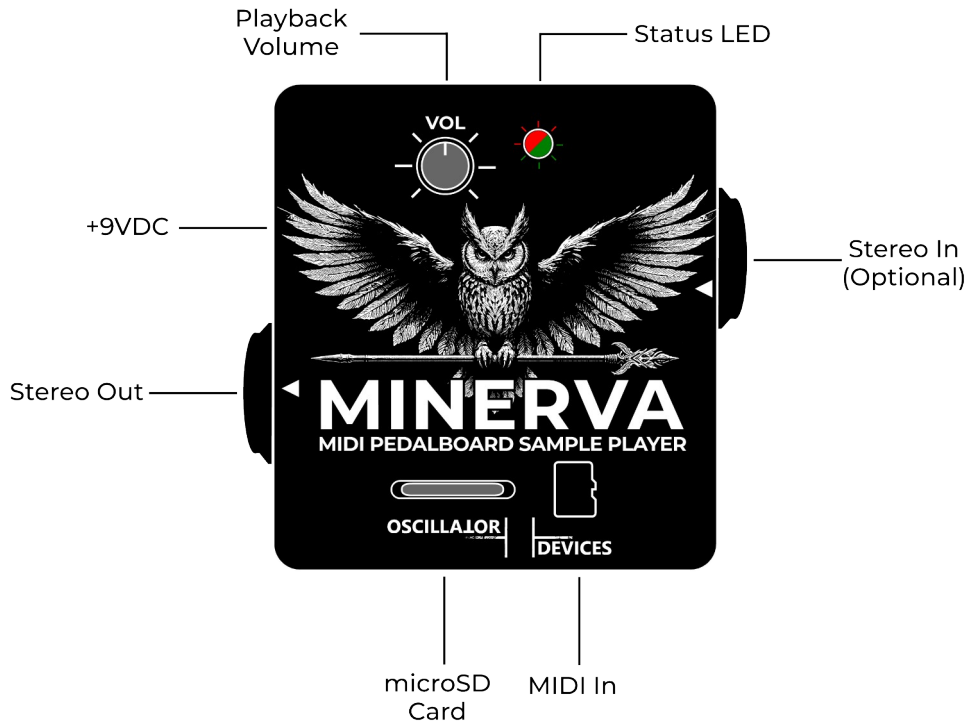
Connections

- **Stereo Out:** A 1/4" stereo jack for the output of the sample playback. Output impedance 500Ω.
- **Stereo In:** A 1/4" stereo jack for a guitar, bass, synth or the output of other effects devices that is mixed with the sample playback. This input is buffered with an input impedance of 1MΩ. Since it bypasses all digital circuitry, it cannot be controlled by MIDI. It'll always pass through unaltered.
- **Power:** 9VDC only, Center Negative, Boss Style power supply. Min. 150mA.
- **MIDI In:** 3.5mm (1/8") MIDI Input according to MIDI Standard **MIDI TRS Type-A.**

Always turn OFF your amp and make all connections before powering up the MINERVA.

Status LED

The Status LED shows the state of the *MINERVA*. It can either be:

- **Green:** The *MINERVA* is ready and waits for MIDI commands to start playback.
- **Orange:** The *MINERVA* currently plays back a file.
- **Red:** An error occurred. This can be a temporary error, for example when you try to play a file that is not supported. In this case the LED only flashes red shortly. Does it stay red, it is a more severe error. The *MINERVA* might continue to function, but something unforeseen has happened. If it is red right from the start, the reason might be, that the SD Card is missing or cannot be read. If it turns red while playback, you're SD card might be too slow. See section Troubleshooting for more information.

Supported Files

The *MINERVA* can play .wav-Files with the following attributes:

- **Channels:** Up to 2 (Mono and Stereo).
- **Sample Rate**: 44.1kHz or 48kHz.
- **Bit depth**: 16-Bit, 24-Bit or 32-Bit floating point.

32-Bit floating point .wav files are only supported in a compatibility mode. The samples are truncated to 16-Bit. Use 24-Bit for best performance when using .wav files.

The *MINERVA* can play uncompressed .aiff/.aif-Files as well as uncompressed AIFF-C/sowt files with the following attributes:

- **Channels:** Up to 2 (Mono and Stereo).
- **Sample Rate**: 44.1kHz or 48kHz.
- **Bit depth**: 16-Bit, 24-Bit or 32-Bit.

Starting with version 1.1 uncompressed AIFF-C/sowt files are also supported.

SD Card

The *MINERVA* works with all **microSD and microSDHC** cards with up to 32GB. MicroSDXC cards (all cards larger than 32GB) are not supported, because of license restrictions from Microsoft Corp. The SD cards have to be formatted with the **FAT32** filesystem.

Some SD cards stall during reading, which leads to an interrupted stream and lead to crackle in the output. Make sure to test every new SD card before going on stage. Be sure to use quality cards. SanDisk cards have proven to be functional.

You can safely remove the SD card when the *MINERVA* is powered on, as long as diagnose mode is turned off (default). If an SD card is inserted, the *MINERVA* needs to be restarted in order to scan the SD card and play back files.

File Names

The files are assigned to the MIDI commands alphabetically. Because of that the file names matter. For easy use, name your files with leading numbers like that: *000-filename.wav*, *001-another_filename.wav* etc. Then the number in front of the files will be your PC command, or the argument to your CC command. This is just a suggestion, of course you can name your files like you want.

For more information see chapter How to Use.

Maximum Number of Files

The amount of files the **MINERVA** can mange is limited to 450. This does not include note files. The amount of note files is not limited. Why is that? Well, to reduce the latency when playing a file, the **MINERVA** has to know all file names beforehand, so it doesn't have to scan the SD card for the right file in real time. So, the maximum number of files is limited by the memory of the processor. Since note files follow a special naming scheme, no memory is used to remember the name of those files.

Stereo vs. Mono

The **MINERVA** can either act in full stereo, or sum stereo files to mono.
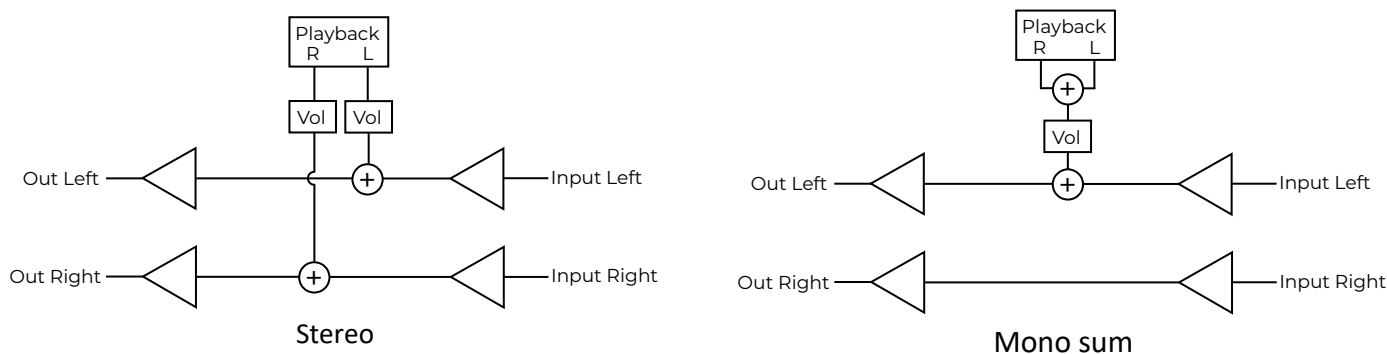
Refer to chapter Configuration File for more information.

Volume Knob

Next to the Status LED is a small volume knob. It controls the volume of both channels. You can choose if MIDI CC commands for volume overwrite the volume set by the knob, or if it's relative to it. See chapters MIDI Commands for Playback Volume and Configuration File for more information.

Fade Out

Instead of just controlling the volume, the **MINERVA** can do a smooth fade out automatically in the range of 100ms to 12.7s. The sample keeps playing in the background and can be brought back up with the MIDI volume command. See chapter MIDI Commands for Fade Out for more information.

Playback Direction

The direction of the playback can be reversed, either before playing the file or during the playback. Send the according MIDI command before playback and the file will start from the end, send it during playback and the playback will immediately reverse. Depending on the MIDI command this is temporary, so it is set back to normal playback direction with the next file, or it stays reversed until you send the command for forward playback direction. See chapter MIDI Commands for more information.

Variable Sampling Rate

Besides supporting fixed samples rates of 44.1 and 48kHz, the sampling rate can be changed individually to speed up or slow down playback and with that changing the pitch of the played back sample. Changing the sampling rate can be done in semi tone steps from +7 to -12 semi tones, or continuously.

When using note commands, the **MINERVA** automatically replaces missing notes with adjacent notes and changes the sampling rate accordingly. You can go to extremes and use only a single file and let the **MINERVA** expand it to +7 and -12 semi tones. To disable this behaviour, see chapter Note Substitution.

For more information see chapter MIDI Command for Sampling Rate.

How to Use

The *MINERVA* is very powerful and can be operated in a variety of ways. Please note that one way doesn't exclude the other way, but some might limit others.

A: The Easy Way

If you just want to play some files, you only have to copy them to the root folder of the SD card. To play back one of the files use the MIDI PC command. The files are assigned to the PC commands alphabetically. That way you can play back up to 127 files. As an example, let's assume a SD-Card with six files: *0.wav*, *1.aiff*, *2.wav*, *10.wav*, *a.wav* and *b.wav*. These would be mapped to PC commands like that:

0.wav	→	MIDI PC 00
1.aiff	→	MIDI PC 01
10.wav	→	MIDI PC 02
2.wav	→	MIDI PC 03
a.wav	→	MIDI PC 04
b.wav	→	MIDI PC 05

Also, the first of these files is loaded at power up and can be started right away with a play command (see chapter MIDI Commands)

B: The CC Way

If you want to play back more than 127 files, or if you try to use the *MINERVA* on a shared MIDI channel, this is the best way. Create a folder on the SD card with the name **CC followed by a number**. For example CC31. The files in that folder are played back with the CC command 31. The files are assigned to the argument of the CC command alphabetically. Let's use the files from the example above and assume they are in the folder CC31. Then they will be mapped to the CC command like this:

0.wav	→	MIDI CC 31 00
1.aiff	→	MIDI CC 31 01
10.wav	→	MIDI CC 31 02
2.wav	→	MIDI CC 31 03
a.wav	→	MIDI CC 31 04
b.wav	→	MIDI CC 31 05

That way you can choose the CC commands you use and use the *MINERVA* along side other devices on the same MIDI channel. The *MINERVA* has some fixed CC commands, but these can also be changed. Refer to chapter Configuration File for that.

C: The Notes Way

If you want to play the *MINERVA* with a MIDI keyboard and send MIDI Note on and off commands, use this way. Create a folder named ***Notes.*** Place your note files in that folder. The note files have to follow a very specific naming scheme. They need to be named after the note and octave they represent. For example, if your file contains the note C on the second octave, it has to be named ***C2.wav or C2.aiff***. If it represents the note A# on the fourth octave, name it ***A#4.wav or A#4.aiff***. Please only use the # designator, *b* will not work. If one or more files are missing and you try to play it, the *MINERVA* tries to replace it with one of the files present with increased or decreased sampling rate.

If you want to use more than one sound, you can name your folders ***Note*** followed by a number (***Note10*** for example). You can then choose which notes folder is to be used by sending PC commands. So, if you want to play the file in the *Note10* folder, send PC10, then all note on and off commands refer to the files in folder Note10.

Only PC commands that are not already used by A: The Easy Way can be used to select Notes folders.

D: The PC Increment Way

Let's say you want to use the *MINERVA* for your live set and you want to play certain samples in a certain order during each song. You'd need a large number of MIDI commands for that and therefore a lot of buttons on your MIDI controller. Here comes the PC Increment in play. Create a folder and name it, for example, PC1. Drop all files from a song in there. Each time you send PC1 the *MINERVA* plays the next file.

Let's assume your song consists of an intro (*000-intro.wav*) and ambient part in the middle (*001-ambient.wav*) and an outro (*002-outro.wav*). Drop all three files in the PC1 folder. The first time you send PC1 *000-intro.wav* is played, the second time *001-ambient.wav* is played and the third time *002-outro.wav* is played. What is happening when you send PC1 again after that is configurable. In default configuration it starts from the beginning.

So, there is an internal counter that increments every time you play a file in a PC folder and plays the next file according to this counter. This counter can be reset, or decremented in case you want to start over or practice a certain part.

This counter resets either automatically when another PC command is sent, or every PC command can have its own counter and therefore can be used independently.

See chapter *Configuration File* for more information.

Only PC commands that are not already used by A: The Easy Way or C: The Notes Way can be used to select PC folders.

MIDI Commands

To start playback of a file, simply call the PC, CC, or note command like explained in the chapter How to Use.

MIDI Command for Playback Modes

To stop and resume the playback, set to repeat, or sync the sample to MIDI clock, use the following command:

CC	#	Function
	0	Stop playback
	1	Resume playback of previously stopped file
	2	Play Mode: **Single**. Playback is ended with the end of the track (Default)
	3	Play Mode: **Repeat**. The track starts over at the end.
	4	Play Mode: **All**. All tracks in the respective folder are played alphabetically. After the end of the last track, playback is ended
	5	Play Mode: **Repeat All**. Like *Play Mode All*, but after the end of the last track the playback continues at the first track in the folder.
	6	Set playback to forward direction
	7	Reverse playback
102	8	Reverse playback temporarily (sets back to forward with next start of file)
	10	Play Mode: **MIDI Clock 1/4th notes**. The playback restarts the file in the beat of MIDI clock 1/4th notes
	11	Play Mode: **MIDI Clock 1/8th notes**. The playback restarts the file in the beat of MIDI clock 1/8th notes
	12	Play Mode: **MIDI Clock triplet notes**. The playback restarts the file in the beat of MIDI clock triplet notes
	13	Play Mode: **MIDI Clock dotted 1/8th notes**. The playback restarts the file in the beat of MIDI clock dotted 1/8th notes
	14	Play Mode: **MIDI Clock half notes**. The playback restarts the file in the beat of MIDI clock half notes
	15	Play Mode: **MIDI Clock whole notes**. The playback restarts the file in the beat of MIDI clock whole notes
	16	Play Mode: **MIDI Clock 2 whole notes**. The playback restarts the file in the beat of MIDI clock 2 whole notes
	17	Play Mode: **MIDI Clock 4 whole notes**. The playback restarts the file in the beat of MIDI clock 4 whole notes

MIDI Commands for Playback Volume

To control the volume of the playback, use the following commands:

CC	#	Function
103	0-127	Set volume of both tracks (0=mute, 127=full volume)
104	0-127	Set volume of left track (0=mute, 127=full volume)
105	0-127	Set volume of right track (0=mute, 127=full volume)

MIDI Commands for Fade Out

The currently played back track can be faded out, instead of abruptly stopped. A faded out track continues playback silently. Use volume control to make it audible again.

CC	#	Function
106	0-127	Fade Out currently played back track in steps of 100ms (1=100ms, 2=200ms, 127=12.7s)
107	0-127	Fade Out left channel of currently played back track in steps of 100ms (1=100ms, 2=200ms, 127=12.7s)
108	0-127	Fade Out right channel of currently played back track in steps of 100ms (1=100ms, 2=200ms, 127=12.7s)

MIDI Command for PC Increment

When using D: The PC Increment Way the counter can be manipulated.

CC	#	Function
109	0	Reset counter (Reset all in local mode)
	1	Increment counter (Increment all in local mode)
	2	Decrement counter (Decrement all in local mode)
	3	Set counter to random file (Set all in local mode)

MIDI Command for Sampling Rate

Change the sampling rate with these commands. That way the speed and pitch of the played back file can be changed:

CC	#	Function
110	49-71	Interval Sampling Rate (49 = -15 semitones, 64 = 0 semitones, 71 = 7 semitones)
111	0-127	Sampling Rate in steps of 409Hz starting at 20kHz (0 = 20kHz, 127 = 72kHz)
112	49-71	Master Interval Sampling Rate. Like CC 110, but stays at this rate and ignores the sampling rate from the files.
113	0-127	Master Sampling Rate. Like CC 111, but stays at this rate and ignores the sampling rate from the files.

MIDI Command for Play/Pause/Next etc.

With option `arm_files` set to `yes`, the following commands can be used to play tracks and navigate. They can also be used without `arm_files` activated to use the *MINERVA* more like a traditional player (like a CD player or iPod).

CC	#	Function
114	0	Stop (Pause)
	1	Play/Pause (Arms the next file when finished)
	2	Play armed file from the beginning
	3	Play armed file from the beginning and arm next file, when finished
	4	Play next file
	5	Arm next file (Playback will not be interrupted, only for arm_files=yes)
	6	Play previous file
	7	Arm previous file (Playback will not be interrupted only for arm_files=yes)
	8	Back/Previous (Play previous file, or after 1s elapsed repeat file)
	9	Play random file
	10	Arm random file (Playback will not be interrupted only for arm_files=yes)

MIDI Commands for Skipping

With this command you can skip through an already playing file, for example when practicing a part.

CC	#	Function
115	0	Go forward 1 second
	1	Go forward 5 seconds
	2	Go forward 10 seconds
	3	Go backward 1 second
	4	Go backward 5 seconds
	5	Go backward 10 seconds

Configuration File

There are some options, that can be set via a configuration file. This configuration files has to be placed into the root folder of the SD Card and named *minerva.cfg*. You can download the default configuration file here:

https://oscillatordevices.com/doc/minerva.cfg

These are also the default settings when no configuration file is present.

The following settings can be made:

MIDI Channel

The Default MIDI channel is 6. To set the MIDI channel, for example to 3, add the following line to the configuration file:

```
midi_ch=3
```

Set to 0 for omni.

CC Commands

The above MIDI CC commands for volume, sampling rate etc. are in the range of CC102 to CC114. If you want them somewhere else, for example from 101 to 111, add the following line to the configuration file:

```
midi_cc_base=101
```

Volume Mode

Volume commands via MIDI (see chapter MIDI Commands for Playback Volume) are relative to the volume knob. So, if you send MIDI volume 127 and the volume knob is at 12 o clock, the output volume will be half (or in other words, the value that is set with the knob). To set the volume independently from the volume knob, so MIDI volume 127 is full volume, add the following line to the configuration file:

```
volume_mode=abs
```

Mono Sum

The *MINERVA* is stereo and therefore has two channels. If you want to use the *MINERVA* in a mono setting with stereo files, add the following line to the configuration file:

```
mono_sum=yes
```

That way stereo files are going to be mixed to mono like explained in section Stereo vs. Mono.

Note Sustain

If you want note commands to sustain (therefore ignore the note off command), add the following line:

```
note_sustain=yes
```

Note Volume

The *MINERVA* can either ignore the volume of note commands or use it and set the volume accordingly. In default setting the note volume is ignored and the volume is set according to the volume knob or MIDI commands. To use the note volume add the following line to the configuration file:

```
note_volume=yes
```

PC Increment Wrap

When using the *MINERVA* like explained in D: The PC Increment Way, you can choose what happens when you send the PC command after the last file in the folder is played. In default setting it wraps around and plays the first file in the folder again.

To stop and don't play any other files of this particular folder add the following line to the configuration file:

```
pc_incr_wrap=stop
```

To repeat the last file in the folder every time the PC command is sent add the following line to the configuration file:

```
pc_incr_wrap=repeat
```

PC Increment Counter

When using the *MINERVA* like explained in D: The PC Increment Way, the counter is reset every time you send a new PC command. This is good, when you have one PC folder per song. If you want to use more than one PC folder, you can set the counter to *local*. That way every PC folder has its own counter, independently from each other. For that behavior add the following line to the configuration file:

```
pc_incr_global=local
```

Arm Files Instead of Playing

Some users prefer to arm tracks first and play them with a different, general command. So, when enabled sending CC or PC commands only arms tracks, Note commands are not affected. To start playback and navigate use CC 114. To enable this option add the following line to the configuration file:

```
arm_files=yes
```

Automatic MIDI Metronome

To use the *MINERVA* as a MIDI Clock Metronome without any interaction, use this option. The *MINERVA* plays the first file in the root folder in the beat of quarter notes synced to MIDI Clock upon startup. This is the same as sending PC0 and CC 102 10 after startup. To enable this option add the following line to the configuration file:

```
auto_clk=yes
```

Note Substitution

To disable the behavior where missing notes are replaced by adjacent samples with altered sampling rate, explained in chapter Variable Sampling Rate, add the following line to the configuration file:

```
note_substitution=no
```

Diagnose Mode

To investigate errors, set the Diagnose Mode to yes. That way a log file with many information is created. See chapter Troubleshooting for more information.

```
diagnoes_mode=yes
```

Do not leave Diagnose Mode turned on, because it writes to the SD-card and may corrupt the card in case of a sudden power loss.

Software Update

Starting from version 2.0 the **MINERVA** can receive software updates via the SD card. Update packages will contain further instructions.

Troubleshooting

If the LED of the **MINERVA** turns red, something is wrong. Here are some common cases:

LED is red from the beginning:

- The SD-Card cannot be read. Check if it can be read by a computer and if it's formatted with the FAT32 file system.
- The SD-Card contains no files with the ending .wav, .aif, or .aiff (blinks red after power up).

LED turns read during playback:

- The file you're trying to play has the .wav or .aif/aiff file ending, but is not a .wav or .aiff file. It's alos possible that the file is corrupt. Please make sure to "Safely Remove Hardware" after copying files to the SD card.
- The SD-Card might be too slow. This has nothing to do with the speed grade of the card. Due to the reading mechanism of the **MINERVA,** SD-Cards must not stall. Some SD-Cards are very fast, but stall for a few 100ms every now and then. This disrupts the stream and leads to crackles. The **MINERVA** notices, when the reading takes too long. If reading times start to get critical, the LED blinks red. If the LED turns and stays red because of this, you definitely have noticed it.

Playback of a .aif/aiff file is only static noise, but plays correct on a Apple computer: There are two versions of the AIFF standard. One is actually a AIFF-C file with no compression. These are only supported starting at version 1.1. Convert the file to .wav with any online converter and it should play fine.

LED lights red from the beginning with only note files on the SD-Card on pre v2.0 firmware: When the SD-Card only contains note files the **MINERVA** with firmware pre v2.0 reports that no files are found. To fix this just drop any .wav or .aif files in the root folder or any other valid folder.

If you have persisting problems, turn on Diagnose Mode (see chapter Configuration File). This gives you a log file with many information. Open it with a text editor and search after the term „Error" or "Warning" to see what's wrong. Do not leave Diagnose Mode turned on, because it writes to the SD-Card and may corrupt the card in case of a sudden power loss.

If you want to inquire Oscillator Devices about an error, please always provide the logfile.