ZOIA Patch Binary Format Technical Document

This is a walkthrough of what is known and speculated about the ZOIA patch binary files that ZOIA saves and transfers when storing patches to SD card.

Overview

Patches are all 32 KB in size. The memory which is not needed to store data inside the patch file has zeroes written to it.

The following are known seclons within the binary format:

1. Patch information
    - Preset size
    - Patch name
2. Module information
    - Number of modules
    - List of modules
3. Connection information
    - Number of connections
    - List of connections
4. Page information
    - Number of pages
    - List of page names
5. Starred parameters
    - Number of starred parameters
    - List of starred parameters
6. Module colors
    - List of module colors

Here is a hexadecimal representation of binary patch file which includes the modules *Audio in*, *Audio out* with two connections established between those two modules:

```
        [--Preset size----][--------------------Patch name ----------------------------------------][--Num mods--][-----------------------------------Module #1 ----------------------------------
0000    39 00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|02 00 00 00|0e 00 00 00|01 00 00 00|00 00 00 00|00 00 00 00|03 00
        ----------------------------------------------(module info continued)-----------------------{-----------------------------------mod name-----------------------}][-----------------
002a    00 00 03 00|00 00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|00 00 0e 00|00 00
        ---------------------------------------------------------------Module #2----------------------------------------------------------------------------------------------------------------
0054    02 00 00 00|00 00 00 00|00 00 00 00|04 00 00 00|07 00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|00 00
        ----------------------------------------------------][--#connects---][-----------------------------Connection #1-----------------------------][-----------------------------------
007e    00 00 00 00|00 00 00 00|00 00 02 00|00 00 00 00|00 00 00 00|00 00 01 00|00 00 01 00|00 00 10 27|00 00 00 00|00 00 01 00|00 00
        ------------Connection #2-----------------------------][---num pages--][-------------------Page #1 name-----------------------------][-----------------------Page #2 name-------
00a8    01 00 00 00|00 00 00 00|10 27 00 00|02 00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|70 61 72 61|6d 73 00 00|00 00
        ------------------------------][-# star params-][-Mod #1 color-][-Mod #2 color]
00d2    00 00 00 00|00 00 00 00|00 00 08 00|00 00 0f 00|00 00
```

Patch informaIon

Preset size

The first 4 bytes of the file (long integer) indicates the size of the preset. This size is in 4-byte (long) chunks. It is inclusive of this section. To determine the overall number of bytes used by the preset, multiply this value by 4.

In the above example
Preset size = 0x39 = 57
57 * 4 = **228**
And 228 is the number of bytes being used by the patch information in the above example.

Patch name

The next 16 bytes store the patch name as a string as 8-bit characters. It may be UTF8 encoding, or at least the strings seem to translate successfully using that encoding method.

Module information

Number of modules

The next 4 bytes is a long integer which indicates how many modules are to follow.

List of modules

A module consists of the following sections:

Posi-tion	Start	Length	Name
0	0	4	Module size
1	4	4	Module type
2	8	4	<unknown>
3	12	4	Page number
4	16	4	Old color (7 values)
5	20	4	Grid posiIon

5	24	4	Number of user parame-ters
6	28	4	Module version
7	32	1	Option 1 value
8	33	1	Option 2 value
9	34	1	Option 3 value
10	35	1	Option 4 value
11	36	1	Option 5 value
12	37	1	Option 6 value
13	38	1	Option 7 value
14	39	1	Option 8 value
16+n	40+n*4	4	Any number of additional values
last		16	Module name

Module size indicates the total number of 4-byte chunks that comprise this module. Modules vary in length, so this value can be used to know how many bytes need to be read. The value of Module size is inclusive of itself.
Module type is a long integer which represents the module. The list of modules and their types can be found in Appendix A.
Page number indicates the page on which the module is placed.
Old color is the 7-value color for pre-1.10 firmware.
Grid position is where on the grid the module starts within the page.
Number of user parameters seems to be the number of parameter inputs a user can access on the grid. This value is exclusive of inputs and outputs - only values a user can adjust.
Module version is the versioned identifier for each module.

Option 1-8 value are the opIons that are selectable within a Module – when creating or editing a module. These are all single-byte values so could store values 0 – 7.
Additional values - After OpIon 8 there could be any number of additional values stored. This seems to depend on the module and what extra values the module needs to store. Additional R&D is required to interpret this completely.
Module name - The last 16 bytes of a module are the Module name if the user has given the module a non-default name. It is seemingly in UTF8 encoding.

Connection information

Number of connections

These 4 bytes are a long integer which represents the number of connection sections which appear after this value.

List of connections

A Connection secIon is comprised of 5 long integer blocks.

Position	Start	Length	Name
0	0	4	Source module number
1	4	4	Output number of source
2	8	4	Destination module
3	12	4	Input number of destination
4	16	4	Connection strength

Page information

Number of pages

The next long int (4 bytes) represents the number of page names that follow. This value may be zero if the user has not named any pages to non-default names.

List of page names

Each page name is 16 bytes in UTF8 encoding.

Starred parameters

Number of starred parameters

The next long int (4 bytes) represents the number of starred parameters.

List of starred parameters

Each starred parameter is a 4-byte value, but currently it is unclear how to interpret them.

Module colors

It is expected that there will be a number of Module color sections equal to the number of modules from the **Module information** section.

List of module colors

A module color is 4 bytes long and maps to a 16-value color. Color values can be found in Appendix B.

Appendix A – Module types

Type ID	Description
0	SV Filter
1	Audio Input
2	Audio Out
3	Aliaser
4	Sequencer
5	LFO
6	ADSR

7	VCA
8	Audio MulIply
9	Bit Crusher
10	Sample and Hold
11	OD & Distortion
12	Env Follower
13	Delay line
14	Oscillator
15	Pushbutton
16	Keyboard
17	CV Invert
18	Steps
19	Slew Limiter
20	MIDI Notes in
21	MIDI CC in
22	Multiplier
23	Compressor
24	Multi-filter
25	Plate Reverb
26	Buffer delay
27	All-pass filter
28	QuanIzer
29	Phaser
30	Looper

31	In Switch
32	Out Switch
33	Audio In Switch
34	Audio Out Switch
35	Midi pressure
36	Onset Detector
37	Rhythm
38	Noise
39	Random
40	Gate
41	Tremolo
42	Tone Control
43	Delay w/Mod
44	Stompswitch
45	Value
46	CV Delay
47	CV Loop
48	CV Filter
49	Clock Divider
50	Comparator
51	CV Reclfy
52	Trigger
53	Stereo Spread
54	Cport Exp/CV in

55	Cport CV out
56	UI Button
57	Audio Panner
58	Pitch Detector
59	Pitch Shieer
60	Midi Note out
61	Midi CC out
62	Midi PC out
63	Bit Modulator
64	Audio Balance
65	Inverter
66	Fuzz
67	Ghostverb
68	Cabinet Sim
69	Flanger
70	Chorus
71	Vibrato
72	Env Filter
73	Ring Modulator
74	Hall Reverb
75	Ping Pong Delay
76	Audio Mixer
77	CV Flip Flop
78	Diffuser

79	Reverb Lite
80	Room Reverb
81	Pixel
82	Midi Clock In
83	Granular
84	Midi Clock Out
85	Tap to CV
86	MIDI Pitch Bend In
104	CV Mixer

Appendix B – Colors

The “old” 8-value colors are values 0-7.

0: ?
1: Blue
2: Green
3: Red
4: Yellow
5: Aqua
6: Magenta
7: White
8: Orange
9: Lime
10: Surf
11: Sky
12: Purple
13: Pink
14: Peach
15: Mango