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## File Format

The Waveplayer is using the multichannel wav format. All tracks are saved in one file. This is very comfortable, because you don't need to handle a lot of mono files. Some audio software will be able to create multichannel files. But the recommend software to be used for this task is the freeware „Audacity“. Why? It is free, well tested with Waveplayer and it is simple to do.

Here a very brief instruction:

1. Start the software.
2. Create as many tracks as you need (1-8).
3. Fill the tracks with you content.
4. Export you work into a file (WAV PCM , 16 or 24 bit)
5. Done!

Note: There is a very important setting edit->preferences->import/export. This has to be set to „custom mix“. If this is not done, you will get stereo or mono files all the time.

## SD Cards

Cards of any size can be used. The only requirement is to format the card to FAT/FAT32 with the minimal cluster size of 32kB. Cards bigger than 32GB will be supplied with exFAT and have to be reformatted to FAT32. This is not possible under Windows. You will need a special tool for that. For example: Fat32 Format

## Main and Channel Volume Settings

By repeatedly pressing the „Play“ button, while the device is playing a file, you can access the main and channel volume settings. You can go backward by pressing the „Pause“ button, if you want to go back to other parameters in the list. The „+“ and „-“ button will change the volume in stages of 0.5dB. The individual settings are saved when changing to the the next („Play“) or to the last („Pause“) parameter.



## Playing Parameter

Waveplayer is playing wav files from 1-8 channels in 16bit or 24bit. The supported sample frequencies are 32kHz, 44,1kHz and 48kHz.



Here is an example for a file with 44.1kHz, 16bit and 9 channels. Channels 1-8 are audio channels and channel 9 is a virtual channel with no audio output. However, the channel can be set as source for the event analyzer.

## Event Track

If an event channel has been set in the menu, this display can be accessed in the play menu. You can see the detected frequency(s) and their strength. Here about 80% of the maximum. The detected frequency is calculated as: number (here 3) \* 300Hz=900Hz. So there are 8 frequencies available to place information. These can later be read out via RS232 and used for any control functions. All 8 frequencies can be detected simultaneously with the corresponding different levels. When creating the track, make sure that the maximum level is not exceeded.



Application example: The data is converted to DMX and controls light effects.

## SD Card Test

If the SD card test has been activated in the menu, this display can be accessed in the Play menu. If you want to test an audio installation with a specific card, set the audio track to "Song Loop" and start it. Then go to this display with the "Play" button and press the "-" button once. Then you let the whole thing, e.g. walk overnight. The value that can be read there gives the maximum access time of the card. Actually, for the area where the audio is on the map. The displayed value of 483µs is a very good value. To give an exact limit, there is not enough data left. Values below 2000µs have proven to be trouble-free. Values of 5000µs are definitely too high. Values in between can work but are to be regarded as critical.



Test OK: Intenso 4GB 1290µs, Toshiba 8GB 1644µs, SanDisk 8GB 1125µs

Test not OK: Integral ultima pro 16GB 30000µs!

## Configuration Menu

By pressing the „Menu“ button you will reach the configurations menu. The „+“ or „-“ button will change the available parameter. If you want to change a parameter press „Play“. Now you are in the edit mode. The cursor is blinking. Change the parameter with the „+“ or „-“ button. You can save the setting by pressing the „Play“ button. Press „Stop“ to discard the changes.

Start Mode	Play Mode	Backlight Mode	Baudrate Serial	Data Port Mode	Device ID
manual	single play	off	1200	standard	0-254
auto	continuous play	auto off 1min	2400	bus master	
timecode	random play	auto off 5min	4800		
	song loop	auto off 15min	9600		
	album loop	on	14400		
			19200		
			28800		
			38400		
			56000		
			57600		
			115200		
			128000		
			256000		

LCD Contrast	Event Channel	SD Card Test			
1-10	off	off			
	1-9	on			

### Start Mode

- Manual → Songs will be played by hand
- Auto → If this parameter is set to on, the Waveplayer will automatically start to play after power is on. There is a requirement to make this function work correctly. We need a playable song at position 1. What is position 1? After the Waveplayer is switched on it will sort through all files of the root directory alphabetically and will display the first. This is the file in position 1. If this file not playable auto play will do nothing!
- Timecode → If a valid timecode is received the player will start playing automatically. If the timecode is missing for more than 5s the player will stop.

## ***Play Mode***

- Single Play → is playing one file from start to end .
- Continuous Play → is playing all playable files of the folder and stops. Non-playable files will be skipped.
- Random Play → is playing the files randomly. In this mode only playable files are allowed to be in the folder.
- Song Loop → is playing the same file repeatedly.
- Album Loop → is the same as Continuous Play, but with repeating.

## ***Baud Rate Serial***

The baud rate setting is relevant only if the serial protocol via RS232 is used. Values between 1200 and 256000 baud are possible.

## ***Data Port Mode***

The normal setting for using a single device is „standard“.

If you plan to use more than one device than both modes are of interest.

In „standard“ mode the Waveplayer responds only to commands which have the same ID. Commands which have not the same ID will be forward to the next device. Commands with the ID=255 are broadcasts and will be responded and forwarded to the next device in the chain.

In „bus master“ mode the buttons „Stop, Pause, Play“ will be forwarded via broadcast to the other devices. This way you can use more than one device via one keypad. When „Start Mode“ is „auto“ then the device will simulate a play command, at power on, to start all other connected devices too. In „Play Mode“ „song loop“ a play command will be send at start of every new loop cycle to resync the other devices. In „bus master“ mode no telegrams will be forwarded.

## ***Device ID***

If you plan to use the data port of the Waveplayer this ID could be of interest. You can set this value from 0 to 255. If the second parameter of a command matches the device ID, the command will be executed and you will get an answer. Note: The 255 is the broadcast ID of all devices. All devices will execute this command but never get a response.

## ***LCD contrast***

Set the contrast of the LCD display.

## ***Event Channel***

In the Event Channel, certain tones can be placed whose presence is detected by the device. The result of the sound recognition can be queried in real time via RS232. Currently 8 channels are available (CH-1 300Hz, CH2 600Hz and so on).

## SD Card Test

With the SD card test, the maximum access time of the respective card can be measured in real time. This is the most important parameter regarding the stability of the playback of audio files.

## LTC Timecode

The device has a LTC timecode input and output. The output displays the current play time of the running track. The timecode is using a 25f/s format. The timecode input is permanently active. Is a valid signal on the input detected, the current playtime will fit to the input time. If you want to use the timecode input, the datas on card must not be fragmented!

## RS232 Bus Protocol

### Command Format

Start Value(fix)	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	xx	xx	xx	CRC-8

### KEY Command

Start Value(fix)	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	0	0=STOP	0	CRC-8
			1=PAUSE		
			2=PLAY		
			3=MENU		
			4= PLUS		
			5= MINUS		
			6= RELEASE*		

### PLAY, STOP Command

Using play command requires to have numbers in front of the song names. These numbers need to have two digits. (01 first song 02 second song, 03 third, ...)

Start Value(fix)	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	1	00=STOP	0	CRC-8
			01=PLAY (01 ...)		
			...		
			99=PLAY (99 ...)		

## SET VOLUME Command

The volume is calculated as follows:  $\text{Volume} = \text{Parameter2} * -0.5\text{dB}$

Example: 0 = 0dB (max), 255 = -127,5dB(min)

Start Value(fix)	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	2	0=MAINVOLUME	0-255	CRC-8
			1-8=CH VOLUME	0-255	

## CHANGE VOLUME Command

Start Value(fix)	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	4	0=MAINVOLUME	0=+0.5dB	CRC-8
			1-8=CH VOLUME	1=-0.5dB	

## SAVE VOLUME Command

Start Value(fix)	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	3	1	0	CRC-8

## GET TRACK COUNT Command

The command is sent with parameter 1 = 0. In response you will see the count of playable tracks. Only a track with two digits in front will be counted.

Start Value(fix)	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	5	track count	0	CRC-8

## GET TRACK NAME Command

The command is sent with parameter 1 = 0. In the response you will see the length of the track name. The response is extended exactly this count, because the track name is append to the answer.\*

Start Value(fix)	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	6	character cout	0	CRC-8

## SET TIME Command

The parameters are hexadecimal values! The command must be send only if the player is in stop or pause mode! Otherwise unpredictable events can occur.

Start Value	Device ID	Command	P1	P2	P3	P4	Checksum
0x88	0-255	10	hours	minutes	secondes	frames	CRC-8

## GET TIME Command

The command is sent with parameter 1-4 = 0. In the response you will get the current values.\*

Start Value	Device ID	Command	P1	P2	P3	P4	Checksum
0x88	0-255	11	sb hours	minutes	seconds	frames	CRC-8

sb = sync bit (Bit7) 1 = Device is running in sync with received timecode.

## PITCH Command

With this command, the playback speed can be changed. The crystal frequency is set directly.

Example: 44100Hz \* 256 = 11289600Hz (0x00AC4400)

Attention: Not suitable for "scratch" applications!

Start Value	Device ID	Command	P1	P2	P3	P4	Checksum
0x88	0-255	12	bit 24-31	bit 16-23	bit 8-15	bit 0-7	CRC-8

## GET TRACK INFO Command

The command is sent with parameter 1-4 = 0. In the response you will get the current values.\*

Start Value	Device ID	Command	P1	P2	P3	P4	Checksum
0x88	0-255	13	play status	frequency	bits	channels	CRC-8

play status: 1=Stop, 2=Play, 3=Pause

frequency: 0=32kHz, 1=44.1kHz, 2=48kHz, 3=96kHz, 4=192kHz

## DFT POWER Command

This command is sent to parameter 1-8 equal to 0 and is returned filled with the current values.\*

The parameters are filled with the level (0-255) of the respectively detected frequency. It is also possible to detect different frequencies simultaneously. There is a slight crosstalk to the adjacent channel (max 2-3%).

Start Value	Device ID	Command	P1	P2	P3	P4	P5
0x8C	0-255	20	300Hz	600Hz	900Hz	1.2kHz	1.5kHz

P6	P7	P8	Checksum
1.8kHz	2.1kHz	2.4kHz	CRC-8



## Response Format

Start Value(fix)	Device ID	Status	Checksum
0x84	0-255	0=OK	CRC-8
		1=Track not found	
		2=unknown command	
		3=CRC error command	
		4=CRC error response**	

\*) This command will get a response 0x84 only if a CRC error occurs.

\*\*\*) This means the error of a forwarded answer.

## CRC Calculation

The CRC is calculated all bytes of the message, whereas the CRC itself is 0. The result of this calculation has to be the replacement for the initial CRC value (0) before sending. To check if the message is valid at the other side, calculate the CRC for the whole message. If the result is zero the message is valid.

## Software Update

1. Copy the file with the name „wp3image.bin“ to a SD card.
2. Insert the card in a running device.
3. If more than one file on card use the +- keys and go to the file.
4. The player will recognize the update and offer to press „Play“.
5. After starting the update procedure you will see „Burning done!“ after a few seconds. Additionally the info how much pages are burned.
6. Restart the device and the update is finished.

## Connections



- 8x audio out (unbalanced, 0dBu maximum Level, 10kOhm output resistance)
- LTC timcode in/out
- Data port for RS232 bus protocol

## Appendix

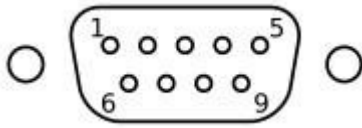
### CRC calculation example: Visual Studio .NET C#

```
byte crc_8(byte[] msg, int len)
{
    byte crc = 0x00;
    byte data;
    bool flag;
    byte polynom = 0xD5;

    for (int i = 0; i < len; i++)
    {
        data = msg[i];

        for (int bit = 0; bit < 8; bit++)
        {
            flag = (crc & 0x80) == 0x80 ? true : false;
            crc <<= 1;
            crc |= (data & 0x80) == 0x80 ? (byte)1 : (byte)0;
            data <<= 1;
            if (flag) crc ^= polynom;
        }
    }
    return crc;
}
```

## Pin Assignment DATA Port



View on the backside of device.

2=RXD

3=TXD

5=GND

## Version History

The software can be used for Waveplayer8 and the Waveplayer2-Modul.

Date	Version	Comment
02.03.18	3.5.0	<ul style="list-style-type: none"><li>• Event track for lighting effects or other control functions</li><li>• New menu parameter “Event Channel” 1-8 or 9</li><li>• SD card test to determine the maximum access time</li><li>• New menu parameter “SC Card Test” on/off</li><li>• Bugfixes</li></ul>
29.08.16	3.4.3	<ul style="list-style-type: none"><li>• New menu parameter “LCD Contrast”</li></ul>
28.07.16	3.4.1	<ul style="list-style-type: none"><li>• “Auto Start” changed to “Start Mode” with the new setting “timecode”</li><li>• “Device Mode” changed to “Data Port Mode”</li><li>• Broadcast Wave Format can be played</li><li>• File names starts to rotate if they longer 16 chars</li><li>• Repeat function on +/- buttons for files aktive</li></ul>
19.04.16	3.3.5	<ul style="list-style-type: none"><li>• 6 inputs for direct song play aktive on board</li></ul>
17.02.15	3.3.0	<ul style="list-style-type: none"><li>• 24bit, 192kHz on Waveplayer2-Modul playable</li></ul>
04.11.15	3.1.3	<ul style="list-style-type: none"><li>• Bugfix: Crash in timecode slave mode</li></ul>
20.10.15	3.1.0	<ul style="list-style-type: none"><li>• Bugfix: Volume control</li></ul>
10.09.15	3.0.0	<ul style="list-style-type: none"><li>• Support for the new hardware platform</li></ul>