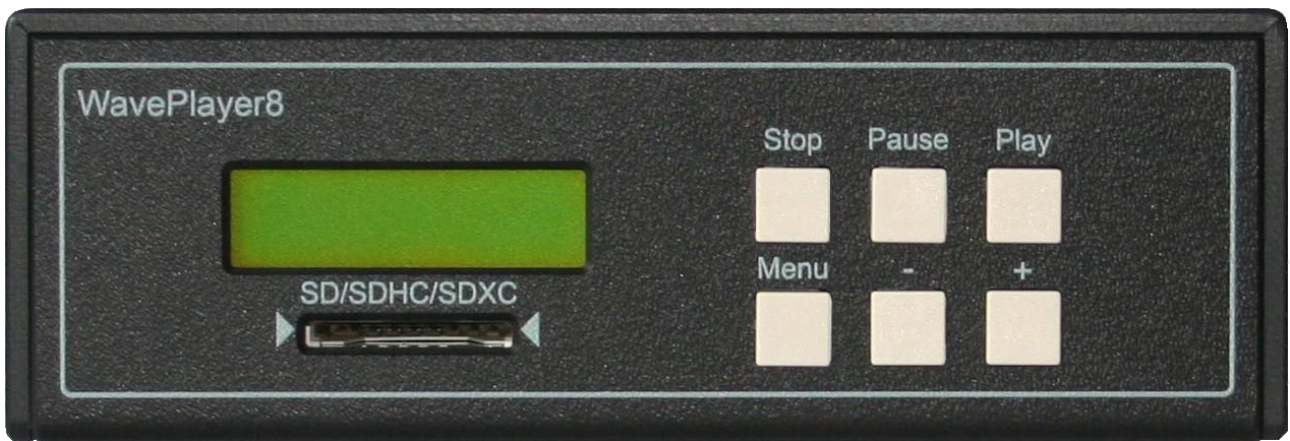


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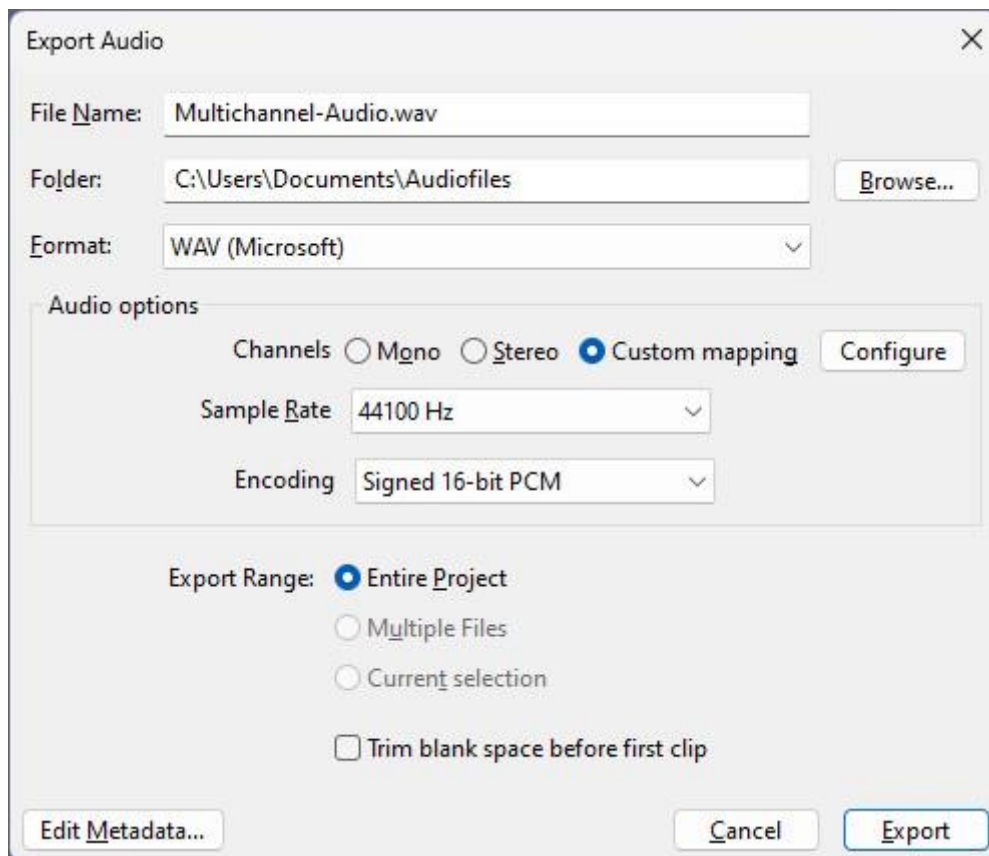
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File Format

The wave player uses the RIFF WAV format. Within the WAV format, only the PCM and Extensible (WAVEX) variants are supported. WAVEX is used by some audio programs for output when working with 24-bit. This is sometimes recommended but is not necessary. You can also save 24-bit files in PCM files. All tracks are always in one file. Working with multiple mono files is not necessary and not possible.

Here the instructions for creating the multichannel file with Audacity (Version 3.4.2).

1. Launch Audacity.
2. Importing the audio files track by track.
 - File -> Import -> Audio...
3. Now export all tracks in one file.
 - File -> Export Audio...



- Channels: Custom mapping
- Sample Rate: 32000 Hz, 44100 Hz or 48000 Hz
- Encoding: Signed 16-bit PCM or Signed 24-bit PCM

4. Export and done!

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SD Cards

Theoretically SD cards of any size can be used. Cards up to 32GB are still delivered with FAT32. Cards larger have the exFAT format by default. However, the player does not support this format. Formatting in FAT32 is no longer possible using the Windows board tools. The recommendation is for the time being (as of 10/23) to only use cards up to 32GB.

Furthermore, the cluster size must be at least 32kB when formatting. 32GB cards are also delivered this way when purchased. You can format them correctly on the PC without any problems. There are occasional problems when formatting via MAC. For example, it was found that the MAC formats with a 16kB cluster size without any further action.

So when there are problems, the solution is usually:

- A) Buy a new 32GB card or
- B) format with a PC.

However playing audio files via MAC is not a problem.

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 0.5 dB. The individual settings are saved, when changing to the next parameter, by pressing **Play** or **Pause**.



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 8 channels. On the bottom line there is a level meter for the timecode if used. The input level should be somewhat in the middle but can also be 25% or 75%.

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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.



SD Card Test

You will hear short metallic whirring noises. Then it may be due to the access time being partially too long. This is not to be confused with the data transfer rate, which can be extremely high and such problems can still occur. In this case, the card test is recommended to determine the error. If you find a high or partially high access time, this does not mean that the card must be defective. It can work well on a PC because there is more buffer memory available. The card is then simply not suitable for the player.

If the SD card test was switched on in the menu, this display can be accessed in the Play menu. If you want to test an audio installation with a specific card, you set the audio track to **song loop** and start it. Then you go to this display with the **Play** button and press the – button once. Then you let the whole thing run overnight, for example. The value that can then be read there indicates the maximum access time of the card. Strictly speaking, for the area where the audio is located on the map. The displayed value of 380 µs is a very good value. There is not yet enough data to give an exact limit. Values below 2000 µs have so far proven to be problem free. Values of 5000 µs are too high. Values in between can work but are to be viewed as critical.



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

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

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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	Baud Rate 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			

TC Offs. Hours	TC Offs. Minutes	TC Offs. Seconds	TC Offs. Frames
0-23	0-59	0-59	0-24

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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.

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Data Port Mode

Both modes are only important when using the RS232 protocol on the data port.

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

In **Data Port Mode standard** 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 sent at start of every new loop cycle to resync the other devices. In **bus master** mode no telegrams will be forwarded.

Device ID

The ID is only important when using the RS232 protocol on the data port. Values from 0-254 can be assigned. 255 is the broadcast ID to which every device always responds but does not generate replies.

LCD contrast

Set the contrast of the LCD display.

Event Channel

Sine tones can be placed in the event channel, the presence of which can be recognized by the device. The result of the tone detection can be queried in real time via RS232. There are currently 8 frequencies available:

300 Hz, 600 Hz, 900 Hz, 1.2 kHz, 1.5 kHz, 1.8 kHz, 2.1 kHz, 2.4 kHz

Note: You can also use a virtual Track 9 (without a real output) for these purposes.

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.

TC Offs. Hours/Minutes/Seconds/Frames

A timecode offset (start time) can be set.

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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 data on card must not be fragmented!

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RS232 Bus Protocol

Command Format

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

KEY Command

Start Value	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	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 = 0 dB (max), 255 = -127,5 dB (min)

Start Value	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	2	0 = Main Volume	0-255	CRC-8
			1-8 = Channel Volume	0-255	

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CHANGE VOLUME Command

Start Value	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	4	0 = Main Volume	0 = +0.5 dB	CRC-8
			1-8 = Channel Volume	1 = -0.5 dB	

SAVE VOLUME Command

Start Value	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	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	3	1	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 appended to the answer. *

Start Value	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	6	Character Count	0	CRC-8

FRAME OFFSET Command

The negative offset cannot bigger, than the start time is set from zero different.

Start Value	Device ID	Command	Parameter 1	Parameter 2	Checksum
0x86	0-255	8	0 = -1 Frame	0	CRC-8
			1 = +1 Frame		

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SET TIME Command

The parameters are hexadecimal values! The command must be sent 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	Seconds	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: $44100 \text{ Hz} * 256 = 11289600 \text{ Hz}$ (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 = 32 kHz, 1 = 44.1 kHz, 2 = 48 kHz

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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	300 Hz	600 Hz	900 Hz	1.2 kHz	1.5 kHz

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

Response Format

Start Value	Device ID	Status	Checksum
0x84	0-255	0=OK	CRC-8
		1=Song not available	
		2=Command unknown	
		3=CRC error command	
		4=CRC error answer**	

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

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

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CRC Calculation

The CRC is calculating all bytes of the message, whereas the CRC itself is 0. The result of this calculation must 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 + or – key and move to the file.
4. The player will recognize the update and offer to press **Play**.
5. Wait for the message **Burning done!**
6. Restart the device and the update is finished.

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Connections



- Eight times audio out (unbalanced, 0 dBu maximum Level, 10 kOhm output resistance)
- LTC timecode in/out
- Data port for RS232 bus protocol
- Power 5V DC

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Appendix

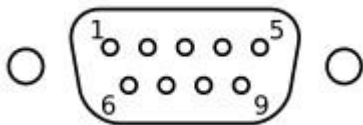
CRC calculation example: Visual Studio .NET C#

```
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

Last update: 28.02.2024 (Software Version 3.6.1)