

# *Controlling the MP3orator via keyboard*

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## **Application Note**

**AN-0009**

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## Abstract

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In this application, the MP3orator is controlled via a 4x4 matrix keyboard and four individual pushbuttons. Additional commands are available on the serial interface.

## Hardware Setup

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### Keyboard connection

The table below shows how to connect the matrix keyboard and the pushbuttons. On the input lines, internal weak pull-up resistors are active. These are sufficient in most cases. Individual pushbuttons are connected to ground.

X4: Application Interface			
No.	Signal	Type	Description
1	<b>+3.3V</b>	POWER	DC Input voltage, 3.3V, or output voltage when LDO is used
2	<b>TXD</b>	OUT	UART Serial Interface, transmit data
3	<b>RXD</b>	IN	UART Serial Interface, receive data
4	<b>nSHIFT</b>	IN	SHIFT signal
5	<b>nBUSY</b>	OUT	BUSY signal, active low. Can sink 10mA
6	<b>GND</b>	POWER	Ground
7	<b>nPLAY</b>	IN	PLAY button
8	<b>nSKIP</b>	IN	SKIP button
9	<b>nVOL_UP</b>	IN	VOLUME UP button
10	<b>nVOL_DN</b>	IN	VOLUME DOWN button
11	<b>PA0</b>	OUT	Keyboard Row 0
12	<b>PA1</b>	OUT	Keyboard Row 1
13	<b>PA2</b>	OUT	Keyboard Row 2
14	<b>PA3</b>	OUT	Keyboard Row 3
15	<b>PA4</b>	IN	Keyboard Column 0
16	<b>PA5</b>	IN	Keyboard Column 1
17	<b>PA6</b>	IN	Keyboard Column 2
18	<b>PA7</b>	IN	Keyboard Column 3
19	<b>nRES</b>	IN	CPU Reset, active low
20	<b>PC5</b>	OUT	Parallel to onboard LED

### Serial Connection

In parallel to the keyboard, a monitor program is active on the serial interface. It can be connected to a host microcontroller or a PC with a terminal application. In case of the PC, a suitable RS-232 level converter must be used on the TXD/RXD lines. The communications parameters are:

9600 bps, 8 databits, 1 stopbit, no parity

The available commands are described on page 3.

## Device Operation

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### Startup

#### Normal Startup

After power-on, the BUSY signal will be asserted and the MP3orator module will send initialization messages over the serial port as follows:

```
INIT: MP3annunciator V1.1  
INIT: DSP HW  
INIT: DSP SW  
INIT: IDE  
INIT: Ready
```

After the 'Ready' message, the BUSY signal will be deasserted, and the module is ready to receive commands over the serial interface.

#### Startup Errors

```
ERROR: IDE init failed, need Reset
```

Sdcard not inserted, not properly formatted or defect.

### Keyboard Commands

#### **PLAY**

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Plays the file which has previously been preset via serial interface by the SF command. If no filename has been preset, no action is taken.

#### **SHIFT**

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When this signal is asserted, the value 16 is added to the key value of the keyboard.

#### **SKIP**

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Immediately starts playback of the file with the next sequence number. If no file with a corresponding number is found, the playback stops. If the number 9999 is reached, no action is taken.

The file sequence number is reset to 1 after power-up. It can be set to any value in the range 1...9999 with the PN or SN commands.

In order to playback a file, the MP3orator must find a file with the name xxxx.mp3, where xxxx is a number string in the range of 0001...9999.

#### **VOLUME UP**

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Increases the playback volume by 2dB.

#### **VOLUME DOWN**

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Decreases the playback volume by 2dB.

**KEYBOARD**

Any keypress immediately starts playback of the file with the corresponding sequence number. In order to playback a file, the MP3orator must find a file with the name xxxxx.mp3, where xxxxx is a number string in the range of 10000...10031.

If no file with a corresponding number is found, no action is taken and any playback in progress will be continued.

Relation between keyboard matrix and file played:

	Col 0	Col 1	Col 2	Col 3
Row 0	10012.mp3	10011.mp3	10000.mp3	10010.mp3
Row 1	10013.mp3	10009.mp3	10008.mp3	10007.mp3
Row 2	10014.mp3	10006.mp3	10005.mp3	10004.mp3
Row 3	10015.mp3	10003.mp3	10002.mp2	10001.mp2

**Commands on the Serial Interface****Command: PF**

Argument: Filename  
 Description: Plays the \*.mp3 file with name given in argument.  
 Response: PLAY: <filename>

Filename must conform to 8.3 standard. Only the root directory is searched. Extension must not be entered in the argument

**Command: PN**

Argument: Filenumber  
 Description: Plays \*.mp3 file with name corresponding to number given in argument. Number must be in range 0...65535.  
 Response: PLAY: <filename>

**Command: SF**

Argument: Filename  
 Description: Presets \*.mp3 file with name given in argument. File will be played when PLAY signal is asserted.  
 Response: FILE: <filename> ready.

**Command: SN**

Argument: Filenumber  
 Description: Presets \*.mp3 file with name corresponding to number given in argument. Number must be in range 0...65535. File will be played when PLAY signal is asserted.  
 Response: FILE: <filename> ready.

**Command: SP**

Argument: (none)  
 Description: Stops playing of present audio file. Player will return to idle state.  
 Response: ACTION: stopped.

<b>Command:</b>	<b>PS</b>
Argument:	(none)
Description:	Pauses playing of present audio file. Player will return to paused state. Audio playback may be resumed with CO command.
Response:	<code>ACTION: paused.</code>
<b>Command:</b>	<b>CO</b>
Argument:	(none)
Description:	Resumes playing of present audio file at file position where it has been paused. Player will return to paused state. Audio playback may be resumed with CO command.
Response:	<code>PLAY: &lt;filename&gt;: &lt;Bytes played&gt;: &lt;Bytes Total&gt;.</code>
<b>Command:</b>	<b>DI</b>
Argument:	(none)
Description:	Displays directory listing of root directory.
Response:	<code>DIR: &lt;filename&gt; ...</code>
<b>Command:</b>	<b>FI</b>
Argument:	(none)
Description:	Displays file information of currently playing or preset *mp3 file.
Response:	<code>FILE: &lt;filename&gt;&gt;: &lt;Bytes played&gt;: &lt;Bytes Total&gt;</code>
<b>Command:</b>	<b>VU</b>
Argument:	(none)
Description:	Increases playback volume by 2dB.
Response:	<code>VOL: &lt;hex value&gt;</code>
<b>Command:</b>	<b>VD</b>
Argument:	(none)
Description:	Decreases playback volume by 2dB.
Response:	<code>VOL: &lt;hex value&gt;</code>
<b>Command:</b>	<b>VS</b>
Argument:	Hex value
Description:	Sets playback volume level to hex value given in argument. Value 0 corresponds to maximum volume or 0dB, value BF corresponds to minimum volume, value FF switches off the audio part of the VS1011 decoder.
Response:	<code>VOL: &lt;hex value&gt;</code>
<b>Command:</b>	<b>ST</b>
Argument:	(none)
Description:	Displays player status.
Response:	<code>Idle   Playing   Paused   Error</code>

<b>Command:</b>	<b>UD</b>
Argument:	(none)
Description:	Invokes firmware upload mode.
Response:	Confirm Firmware Upload. Enter Y to confirm, or any other character to abort.

## Loading of New Firmware to MP3orator

### Prerequisites

1. Image file with firmware in Intel-Hex format (\*.hex)
2. Download tool for PC: `flashloader.exe`
3. Serial connection. For this, a level shifter is required to convert the 3.3V logic levels on the MP3orator to RS-232 levels.

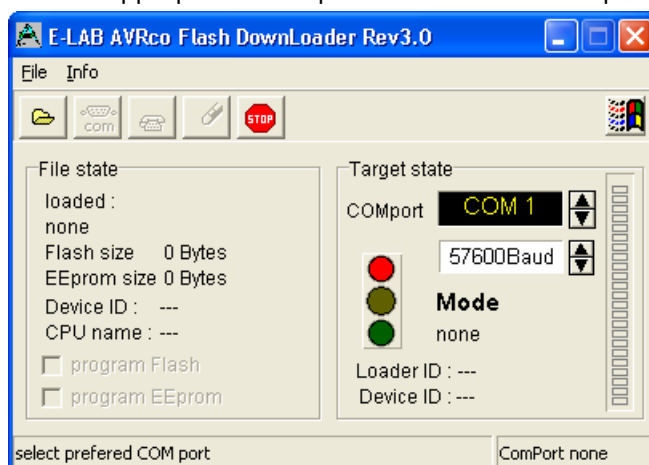
### Procedure

#### Hardware Setup

1. Connect MP3orator module via serial adapter to PC.
2. Apply power to the module

#### Prepare PC software

3. Download firmware file (\*.hex) from support website or receive it via email, and store it on PC.
4. Start a terminal program on the PC, set to 9600bit/s, 8 databits, 1 stopbit, no parity.
5. Check serial connection by entering the 'ST' command.
6. Enter the command 'UD' and confirm message with 'Y' to invoke the bootloader on the MP3orator module.
7. When the System LED on the MP3orator lits, close the terminal connection in order to release the COM port.
8. Start the download tool `flashloader.exe` on the PC.
9. Set the appropriate COM port and transmission speed to 9600 Baud:



10. Open the file selection dialog in the menu „File – Open File...“, select the firmware imagefile and select „Open“.
11. Click the button „com“. The status display on the right side should now show „Target connected“.





12. Start downloading by clicking on the "Telephone" button. The status display will now show „programming“, and the progress bar fills up. After the download is finished, the status message reads again „Target connected“.



13. Start firmware by clicking on the „Stop“ button.

**Check for Successful Download.**

4. Close the download tool
5. Open the terminal connection again and issue the 'SI' or any other command.

## Appendix

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### Revision History

**Rev. 1.1, Date: 29.06.2007**

Modified keyboard mapping table for numbers 10000...10031. Connected X4.20 to LED port.

**Rev. 1.0, Date: 18.10.2006**

Initial release.

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