



**MSA**

**Firmware Version 2.1**

**User Manual**

Updated 2008-01-31

Additional documentation available at:

<http://highlyliquid.com/support/>

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## 1.0 Overview

The MSA can activate its outputs in response to incoming MIDI note, controller ("CC"), program change, or start/stop/continue messages.

By default, MSA behavior is user-specified via "**Note Range Configuration**": each MSA output is mapped to a single MIDI note number within a range specified by DIP switch SW1 positions 5–8.

For a customized MIDI response, "**SysEx Configuration**" is used: the user sends a MIDI SysEx command to the MSA which independently configures each output.

In both "Note Range Configuration" and "SysEx Configuration," the MSA responds to the MIDI channel specified by DIP switch SW1 positions 1–4.

## 2.0 Note Range Configuration

By default, the MSA responds to a range of eight MIDI notes specified by SW1 positions 5–8. See Table 2-1.

The default state of each MSA output is "off". The output will activate and stay "on" for the duration of the corresponding MIDI note.

SW1 settings become active upon power-up. The MSA must be power-cycled for changes to take effect.

Table 2-1: Note Range Selection

MIDI Note Range	SW1 Setting			
	5	6	7	8
0–7	off	off	off	off
8–15	off	off	off	on
16–23	off	off	on	off
24–31	off	off	on	on
32–39	off	on	off	off
40–47	off	on	off	on
48–55	off	on	on	off
56–63	off	on	on	on
64–71	on	off	off	off
72–79	on	off	off	on
80–87	on	off	on	off
88–95	on	off	on	on
96–103	on	on	off	off
104–111	on	on	off	on
112–119	on	on	on	off
120–127	on	on	on	on

## 3.0 SysEx Configuration

### 3.1 Overview

A MIDI System Exclusive (SysEx) message can be used to independently configure each of the MSA outputs.

- A single SysEx message configures the entire MSA.
- Settings are retained when the MSA is disconnected from a power supply.
- When the MSA is configured via SysEx message, the settings of SW1 positions 5–8 are ignored.
- Upon receipt of a properly formatted configuration message, the Activity LED (LED2) blinks 3 times. Any additional MIDI data is discarded during this period (approximately 1.5 seconds).

### 3.2 Message Format

Figure 3-1 shows the message format for the SysEx configuration message. Each hex value *mm* specifies the output mode for the corresponding MSA output. The meaning of each hex value *ss* depends on the value of the corresponding *mm*.

Table 3-1 shows the possible values for *mm* and the corresponding meaning of *ss*.

Certain output modes (*mm* values 03 and 04 hex) generate fixed-length output pulses. The length of the output pulse is set “globally” via the values *ph* and *pl*, according to the following formula:

$$\text{pulse length} = ((ph \times 128) + pl + 1) \times 0.5 \text{ ms}$$

The valid range for both *ph* and *pl* is 00–7F hex. Thus, the maximum configurable pulse length is approximately 8.2 seconds. Actual pulse length is accurate to 0.5 ms of configured value.

Output modes which do not generate fixed-length pulses are not affected by the values *ph* and *pl*.

### 3.3 Reverting to “Note Range Configuration”

After the use of a SysEx configuration message, the default “Note Range Configuration” method can be restored by using the message shown in Figure 3-2.

### 3.4 Examples

The configuration shown in Example 3-1 allows a single MIDI program change message to specify the output state of each of the first seven MSA outputs.

Example 3-2 shows a configuration which allows MIDI controllers 0–7 to be used as on/off switches for the MSA outputs.

Example 3-3 shows a configuration which maps the MSA outputs to a block of MIDI notes starting with middle C (note 3C hex). Each output generates a fixed-length pulse of 2.5 ms.

Figure 3-1: SysEx Configuration Message Format (Hex)

Header (6 bytes)	Output Configuration								Pulse Width	Footer (1 byte)	
	0	1	2	3	4	5	6	7			
F0 00 01 5D 02 01	<i>mm ss</i>	<i>mm ss</i>	<i>mm ss</i>	<i>mm ss</i>	<i>mm ss</i>	<i>mm ss</i>	<i>mm ss</i>	<i>mm ss</i>	<i>mm ss</i>	<i>ph pl</i>	F7

Figure 3-2: SysEx Message for Note Range Configuration

SysEx Message (Hex)
F0 00 01 5D 02 00 F7

Table 3-1: Output Modes

<i>mm</i> (Hex)	Mode Description	<i>ss</i>
00	<b>Disabled</b> Output is "off".	Ignored
01	<b>Note Trigger</b> Output is "on" for the duration of a corresponding MIDI note, and "off" otherwise.	Note number (hex)
02	<b>Inverted Note Trigger</b> Output is "off" for the duration of a corresponding MIDI note, and "on" otherwise.	Note number (hex)
03	<b>Note Trigger – Fixed Length</b> Corresponding MIDI note triggers a fixed-length "on" pulse. Output is "off" otherwise. Note number is specified by <i>ss</i> . Pulse length is specified by <i>ph</i> and <i>pl</i> .	Note number (hex)
04	<b>Inverted Note Trigger – Fixed Length</b> Corresponding MIDI note triggers a fixed-length "off" pulse. Output is "on" otherwise. Note number is specified by <i>ss</i> . Pulse length is specified by <i>ph</i> and <i>pl</i> .	Note number (hex)
05	<b>Note Toggle</b> Output state is toggled & latched upon receipt of a corresponding Note On message.	Note number (hex)
06	<b>Program Change Bit 0</b> Output state corresponds to bit 0 of the current program number.	Ignored
07	<b>Program Change Bit 1</b> Output state corresponds to bit 1 of the current program number.	Ignored
08	<b>Program Change Bit 2</b> Output state corresponds to bit 2 of the current program number.	Ignored
09	<b>Program Change Bit 3</b> Output state corresponds to bit 3 of the current program number.	Ignored
0A	<b>Program Change Bit 4</b> Output state corresponds to bit 4 of the current program number.	Ignored
0B	<b>Program Change Bit 5</b> Output state corresponds to bit 5 of the current program number.	Ignored
0C	<b>Program Change Bit 6</b> Output state corresponds to bit 6 of the current program number.	Ignored
0D	<b>Sync: Run</b> MIDI Start and Continue messages latch output "on." MIDI Stop message latches output "off."	Ignored

**Table 3-1: Output Modes (Continued)**

<i>mm</i> (Hex)	Mode Description	<i>ss</i>
0E	<b>Controller (CC) Bit 0</b> Output state corresponds to bit 0 of the controller position.	Controller number (hex)
0F	<b>Controller (CC) Bit 1</b> Output state corresponds to bit 1 of the controller position.	Controller number (hex)
10	<b>Controller (CC) Bit 2</b> Output state corresponds to bit 2 of the controller position.	Controller number (hex)
11	<b>Controller (CC) Bit 3</b> Output state corresponds to bit 3 of the controller position.	Controller number (hex)
12	<b>Controller (CC) Bit 4</b> Output state corresponds to bit 4 of the controller position.	Controller number (hex)
13	<b>Controller (CC) Bit 5</b> Output state corresponds to bit 5 of the controller position.	Controller number (hex)
14	<b>Controller (CC) Bit 6</b> Output state corresponds to bit 6 of the controller position.	Controller number (hex)

**Example 3-1: Output State by Program Number**

SysEx Message (Hex)											
F0 00 01 5D 02 01	06 00	07 00	08 00	09 00	0A 00	0B 00	0C 00	00 00	00 00	00 00	F7

**Example 3-2: CC as On/Off Control**

SysEx Message (Hex)											
F0 00 01 5D 02 01	14 00	14 01	14 02	14 03	14 04	14 05	14 06	14 07	00 00	00 00	F7

**Example 3-3: Note Trigger with 2.5 ms Pulse Length**

SysEx Message (Hex)											
F0 00 01 5D 02 01	03 3C	03 3D	03 3E	03 3F	03 40	03 41	03 42	03 43	00 04	00 04	F7

## 4.0 MIDI Channel Selection

The MSA will respond to MIDI events only on the MIDI channel specified by positions 1–4 of DIP switch SW1. See Table 4-1.

SW1 settings become active upon power-up. The MSA must be power-cycled for changes to take effect.

**Table 4-1: MIDI Channel Selection**

MIDI Channel	SW1 Setting			
	1	2	3	4
1	off	off	off	off
2	off	off	off	<b>on</b>
3	off	off	<b>on</b>	off
4	off	off	<b>on</b>	<b>on</b>
5	off	<b>on</b>	off	off
6	off	<b>on</b>	off	<b>on</b>
7	off	<b>on</b>	<b>on</b>	off
8	off	<b>on</b>	<b>on</b>	<b>on</b>
9	<b>on</b>	off	off	off
10	<b>on</b>	off	off	<b>on</b>
11	<b>on</b>	off	<b>on</b>	off
12	<b>on</b>	off	<b>on</b>	<b>on</b>
13	<b>on</b>	<b>on</b>	off	off
14	<b>on</b>	<b>on</b>	off	<b>on</b>
15	<b>on</b>	<b>on</b>	<b>on</b>	off
16	<b>on</b>	<b>on</b>	<b>on</b>	<b>on</b>