highly_liquid

MSA-R

Hardware Revision C

User Manual
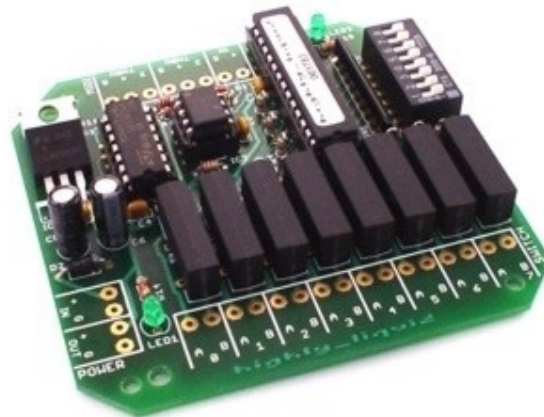
Updated 2009-01-28

Additional documentation available at:

http://highlyliquid.com/support/

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1.0 Important Safety Information

To prevent damage to the MSA-R and connected devices, and to prevent personal injury:

- Carefully follow the assembly instructions. Assembly errors can cause overheating and excess power consumption. The electrolytic capacitors contained in the kit may explode if mounted backwards.

- Take reasonable static-control precautions when assembling & handling the kit. This product includes ESD-sensitive parts.

- Use an appropriate power source.

- Do not exceed the electrical specifications of the MSA-R relay outputs.

2.0 Assembly Instructions

The MSA-R consists of a printed circuit board (PCB, Figure 2.1) and several electronic components which must be mounted on the PCB by soldering. Use conventional tin/lead solder or lead-free solder. When soldering, always wear eye protection and work in a well-ventilated area.

Before assembly, examine all of the components in the kit and identify them using the parts list (Table 2-1). Some parts may be packaged separately inside the kit for easier identification.

Follow the assembly instructions for each component in Table 2-1. Location is indicated by the white legend on the PCB. Mount & solder the smallest components first, then proceed with components of increasing size.

Insert parts into the top (legend side) of the board and apply solder to the underside. Masking tape may be used to temporarily hold smaller components in place. After soldering is complete, trim the component leads from the underside of the PCB.
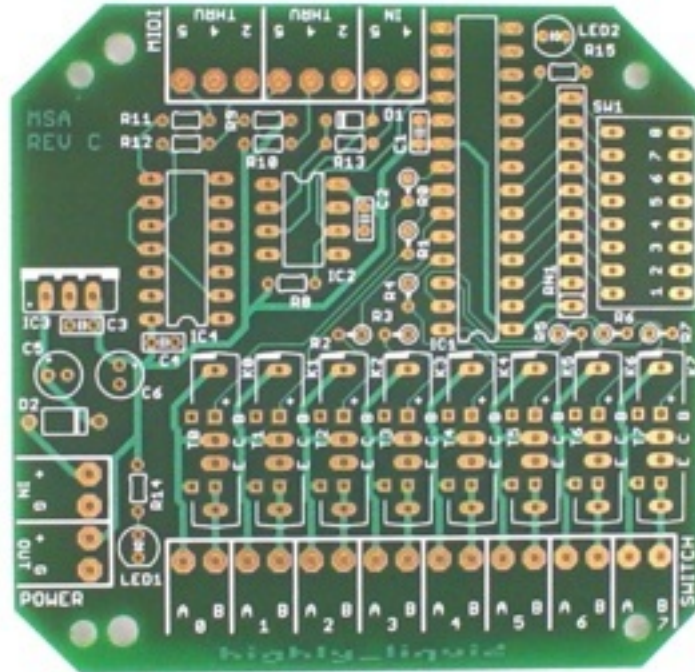
Figure 2.1: MSA-R PCB

Table 2-1: Parts List

Part	Image	Notes
C1 – C4		0.1µF capacitor. Polarity: none.
C5 - C6		Electrolytic capacitor. Polarity: the positive lead (the longer of the two) must match the "+" symbol on the circuit board legend.
D1		Small signal diode. Polarity: dark band on diode must match the white band on the circuit board legend.
D2		Rectifier diode. Polarity: white band on diode must match the white band on the circuit board legend.
IC1		Microcontroller. Mount socket on circuit board first, then insert IC into socket. Notched end must match notch in the circuit board legend.

Table 2-1: Parts List (Continued)

| Part	Image	Notes
IC2		Mount socket on circuit board first, then insert IC into socket. End marked with dot must match notch in the circuit board legend.
IC3		Pin 1 is on the left in the photo. Pin 1 must match dot on the circuit board legend.
IC4		Hex inverter. Mount socket on circuit board first, then insert IC into socket. Notched end must match notch in the circuit board legend.
K0 - K7		Reed relay. Pin 1 is marked with an angled edge on the top of case or a notch on the label side of case. Relay must be inserted so that pin 1 matches the marked end of the circuit board legend.
LED1 - LED2		Polarity: the short lead must match the flat side on the circuit board legend.
R0 - R7		0Ω resistor, marked with a single black band. Mount resistor vertically (on end).
R8		$10k\Omega$ resistor, marked with the following color bands: brown, black, orange, gold.
R9 - R13		220Ω resistor, marked with the following color bands: red, red, brown, gold.
R14 - R15		$1k\Omega$ resistor, marked with the following color bands: brown, black, red, gold.
RN1		Resistor Netowrk. Pin 1 (marked with a dot) must be inserted in the small box on the circuit board legend.
SW1		DIP Switch. Numbers on switch should match numbers on circuit board legend.

3.0 Feature Diagram
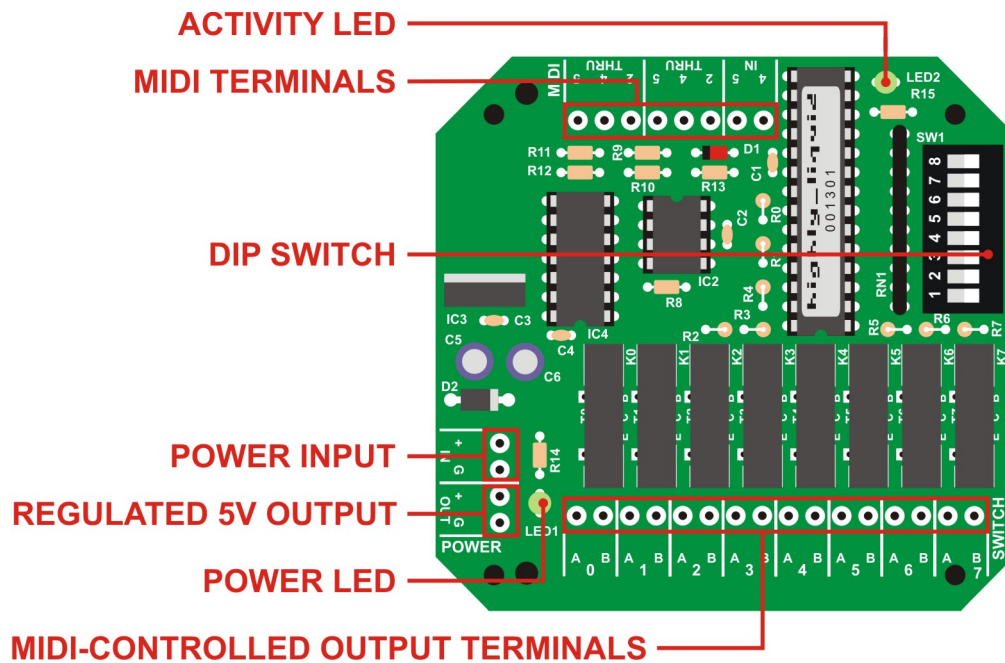
- **Activity LED:** Indicates MIDI activity (see *MSA Firmware User Manual*).

- **MIDI Terminals**: 1 x Standard MIDI IN port and 2 x Standard MIDI THRU port.

- **DIP Switch:** Sets MIDI channel and/or note response (see *MSA Firmware User Manual*).

- **Power Input:** Connect DC power supply or battery here.

- **Regulated 5V Output:** 5VDC output. Not MIDI-controlled.

- **Power LED:** Indicates presence of power supply.

- **MIDI-Controlled Output Terminals:** Reed relay contacts. Each electrically isolated A/B terminal pair acts an SPST switch.

4.0 Mechanical Drawing
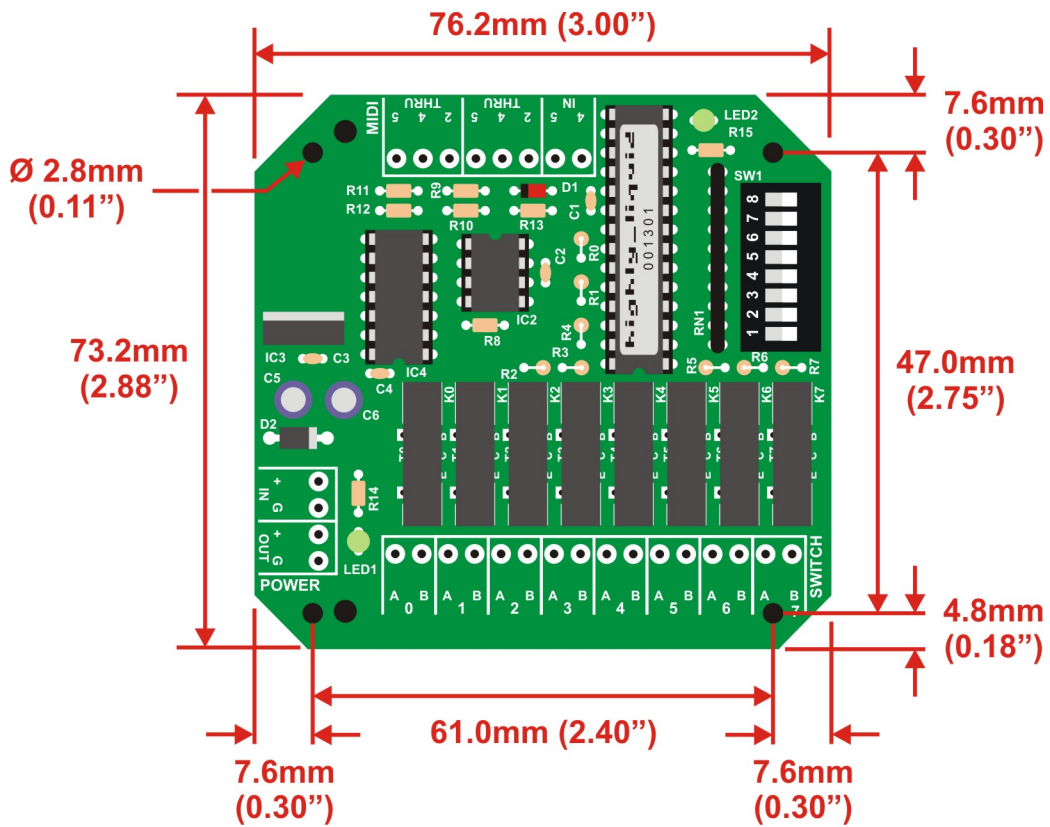
5.0 Power Supply

To operate, the MSA-R must be connected to a battery or other DC power supply. A "wall adapter" supply with appropriate specifications may be used.

Power supply requirements:

- Maximum output voltage: 12VDC

- Minimum output voltage: 7.5VDC

- Current capacity (**no load on Regulated 5V Output**): 110mA or greater

- Current capacity (**loaded Regulated 5V Output**): Varies with 5V load current

Wire the battery or power supply to the MSA-R "**POWER IN**" terminals as shown in Figure 5.1. The negative terminal of the battery or power supply is connected to MSA-R ground, marked "G". The positive terminal of the power supply or battery is connected to the terminal marked "+".

The Regulated 5V Output ("**POWER OUT**" terminals) can supply up 500mA of output current. Loading the Regulated 5V Output may cause increased heating of the voltage regulator (IC3). Attach a heat sink to the regulator if necessary. Do not attach a power supply to the "**POWER OUT**" terminals of the MSA-R.

Figure 5.1: Power Supply Wiring
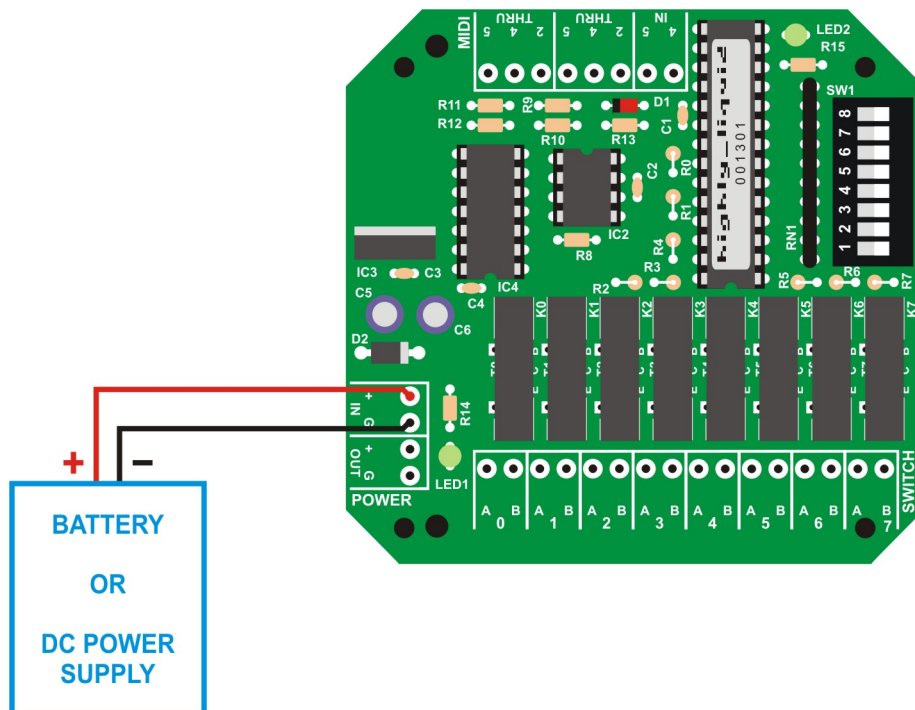
6.0 MIDI Wiring

The MSA-R features a MIDI IN and dual MIDI THRU ports. The incoming MIDI signal on the MIDI IN port is replicated exactly and output on each of the MIDI THRU ports. Figure 6.1 shows the typical connection to other MIDI devices. Either or both of the THRU ports can be used.

MSA-R MIDI ports may be wired to MIDI connectors. The MIDI standard specifies a 5-position DIN connector. Figure 6.2 shows MIDI receptacle pin numbering. The MIDI signal is carried by pins 4 & 5. Pin 2 is connected to ground at the OUT or THRU side of the MIDI link, and is left unconnected at the IN side of the link. Pins 1 & 3 are unused. Connector pin numbers are marked on the MSA-R PCB. See Figure 6.3.

Multiple MSA-R units (or other MIDI devices) can be chained together. For this purpose, MIDI connectors can be bypassed: the THRU port of one unit can be wired directly to the IN port of the next device in the chain. See Figure 6.4.
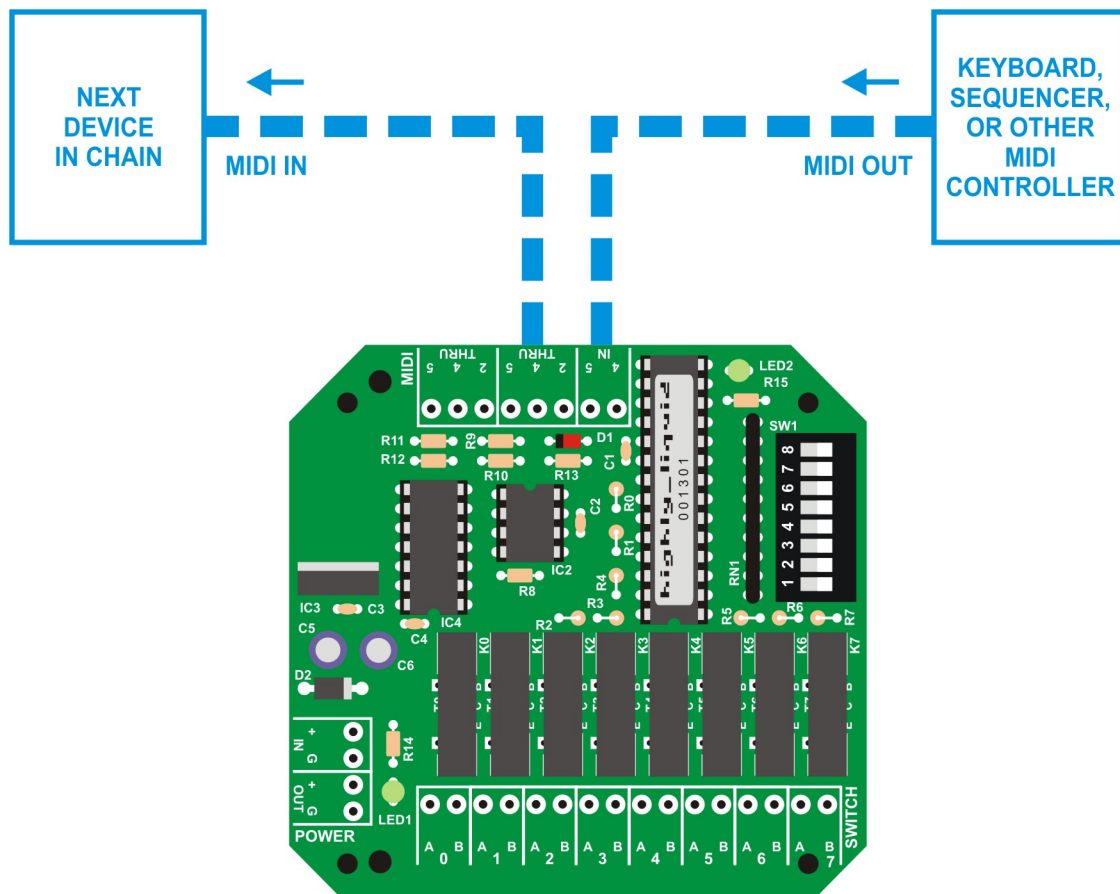
Figure 6.1: MIDI IN/THRU

Figure 6.2: MIDI Receptacle Pin Numbering

MATING SIDE   **SOLDER TERMINALS**
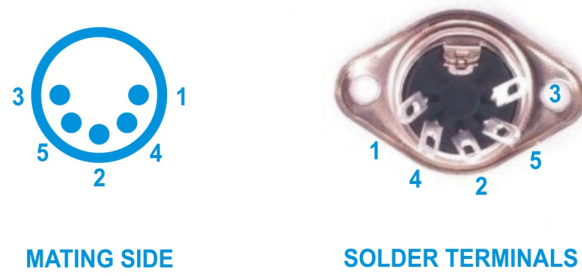
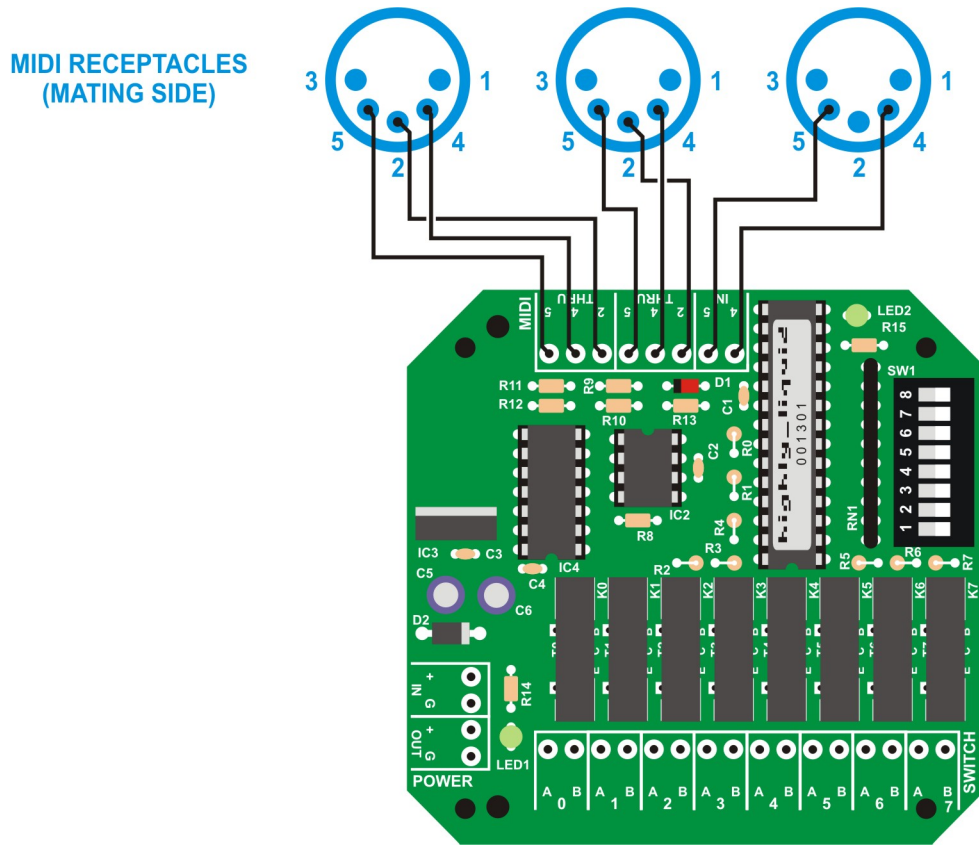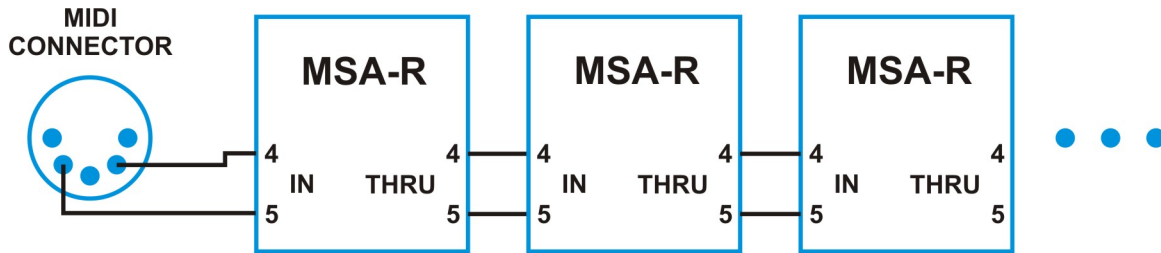**Figure 6.3: MSA-R Remote MIDI Receptacle Wiring**

Figure 6.4: Multiple-Device Chain

7.0 Outputs

7.1 Electrical Specifications

- Contact Rating: 10W

- Maximum Switching Voltage: 24 VAC

- Maximum Switching Current: 500 mA

- Typical "On" Resistance: 0.2 Ω

- Approximate Switching Delay: 1 ms

7.2 Output Wiring

Each MSA-R output is a reed relay which acts as an SPST switch. See Figure 7.1.

To control a circuit with MIDI, insert an MSA-R output A/B terminal pair into the circuit instead of a regular switch. See Figure 7.2. The circuit will be completed when the MSA-R output is "on". The load voltage & current must not exceed the maximums as described above.
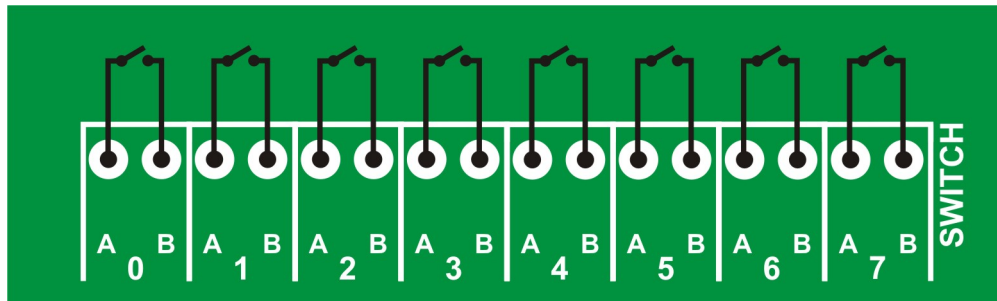
Figure 7.1: Output Equivalent Schematic

Figure 7.2: Output Wiring Example