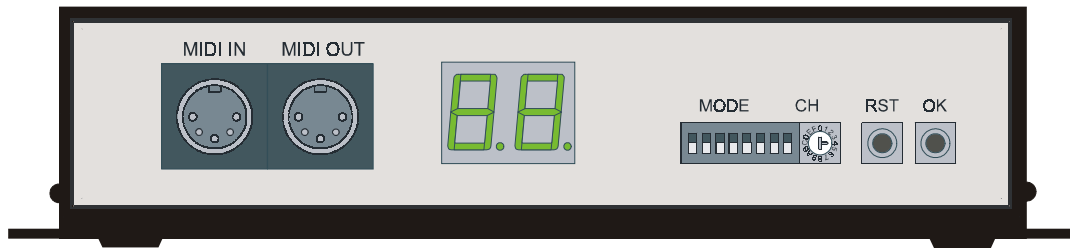


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# MIDIATOR™ Systems

## UM2 User's Manual

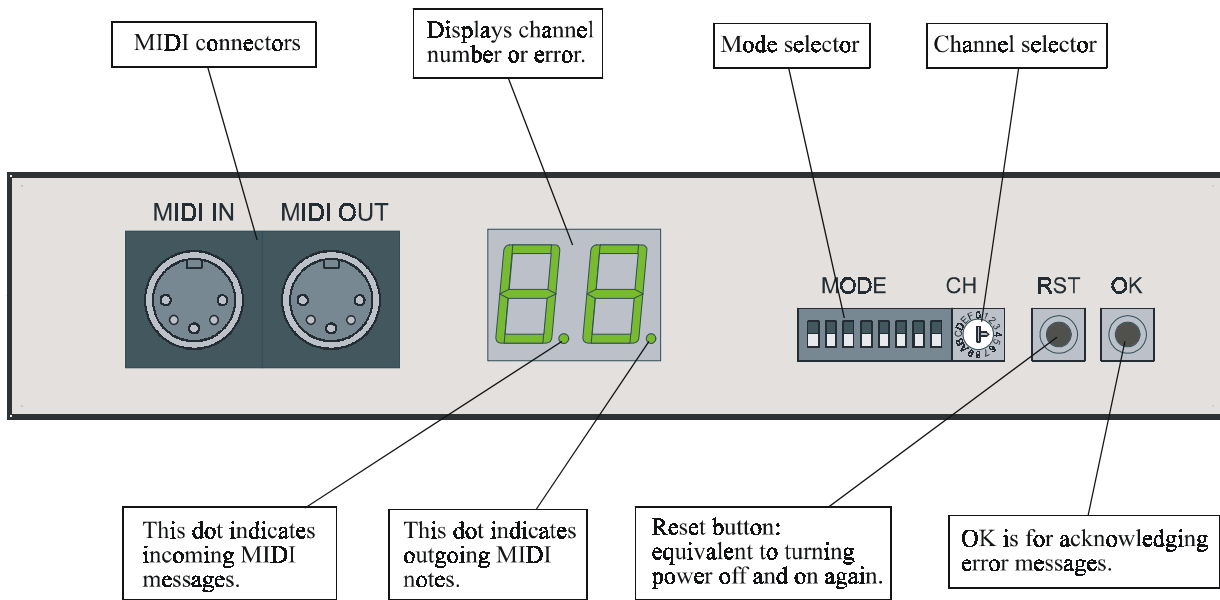


April 2002

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# Installation summary



## 1) Select Mode



Position	Default	Function	
		OFF	ON
1	OFF	Two partitions: A, B (64 notes each)	One partition (128 notes)
2	OFF		
3	OFF		
4	OFF		
5	OFF		
6	OFF	Partition A channel = B channel	Partition B channel = A channel + 1
7	OFF	Not transposed	Transposed 36 semi-tones (3 octaves)
8	OFF	Power up diagnostics off	Power up diagnostics on (version 2+)

Note: for software setup mode, turn all switches ON.

Note: Power up diagnostics are not available in versions below 2.0.

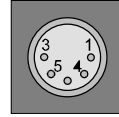
## 2) Select Channel



The MIDI channel is what the switch shows plus one, i.e. 0 = channel 1, 9 = channel 10, A = channel 11, F = channel 16. When the UM2 is turned on, the display shows the actual channel number; the switch can then be rotated and the display shows the current channel.

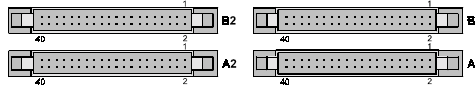
### 3) Connect MIDI

(see page 9 for MIDI connector pinout)



Connect MIDI IN to your source (i.e. MIDI OUT of computer, synthesizer, or other MIDI device).

### 4) Connect Outputs



Connect your outputs to the 40-pin headers in the back of the UM2 (see page 10 for pinout); optionally use our terminal adaptors (see page 5).

### 5) Connect Power supply

The UM2 requires 7 to 25 volts power supply; this is usually tapped from the main supply of your system. The negative of the power supply connects to the **NEG** pins of the 40-pin headers in the back of the UM2 (see page 10 for pinout); in most cases this is also ground of the system. We recommend that all **NEG** pins connect to the power supply negative; this is simplified if you use our terminal adaptors (see page 5).

The positive of the power supply (5-25 volts) connects to the **POS** pins of the 40-pin headers in the back of the UM2 (see page 10 for pinout); usually, this is also the common to all the relays or switches in the system. The UM2 is a positive driver, it switches its outputs to **POS**; we recommend that all **POS** pins connect to the power supply positive; this is simplified if you use our terminal adaptors (see page 5).

## Introduction

The UM2 is a **MIDI decoder-driver**: it receives MIDI messages and activates its outputs accordingly. The outputs can be used to drive organ pipe relays, lamps and other accessories.

The UM2 has two internal partitions (the UM2-64 has only one). Each partition can be used independently as 64 outputs with each a different MIDI channel; or the two partitions can be combined into a single 128 output partition.

## Installation

In the following sections, the examples show organ manuals (keyboards) and organ pipes (with relays) connected to UM2s. These are just the most common items used with the UM2; here are a few examples of what the UM2 can control:

- Other musical instruments such as trumpets, xylophone, bells, drums, etc...
- Electric lights, with or without relays, depending on voltage/power
- Garage doors, alarm systems, model trains...
- Other control applications involving a computer

## Requirements

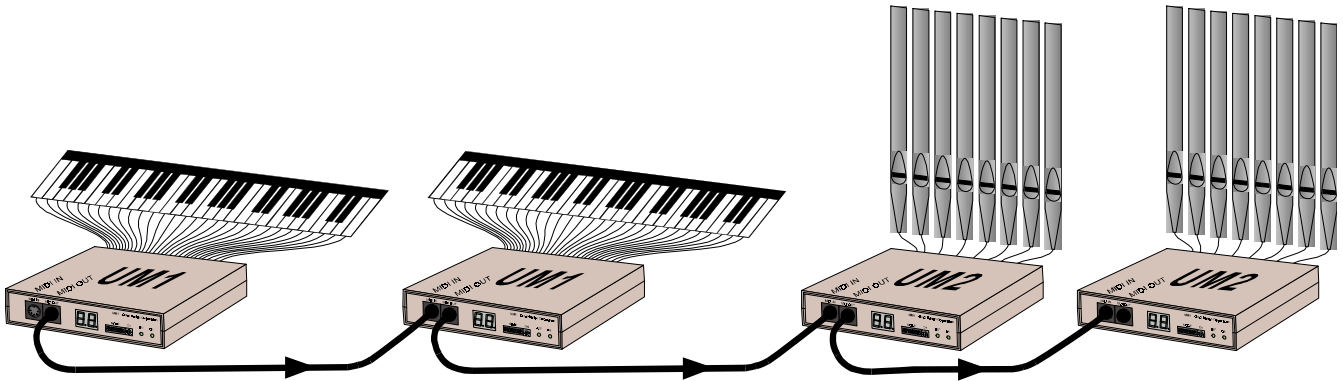
**Power:** the UM2 requires power from an external source; this is usually tapped from the main supply of your system. The voltage must be between 5 and 25 volts. The current used by the UM2 is less than 0.3 amps.

**MIDI:** the UM2 receives MIDI, so it must be connected to a MIDI device; a computer, synthesizer...

**Computer (optional):** for diagnostics and software setup, a PC with Windows 95 or Windows 3.1 and a MIDI port is required.

## Stand-alone configuration

The simplest system is the stand-alone configuration. In the following diagram, two UM1s are connected to manuals (keyboards), generating MIDI note messages from keys. Each UM1 corresponds to a UM2 with the same MIDI channel. Two UM2s are receiving the MIDI notes, driving the pipe relays.

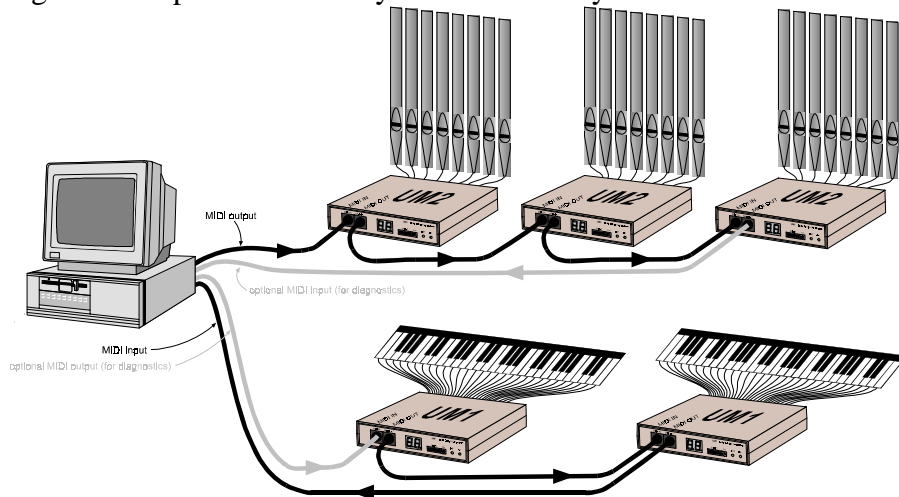


The limitation of this system is the one-to-one correspondence between keys pressed and pipes playing. Most organs need to be able to play multiple pipes for one key pressed.

Another stand-alone example is the addition of ranks of pipes to a synthesizer system; those ranks would be equipped with relays and UM2s, connected to the MIDI OUT of the synthesizer. The pipes would play when the player sets the synthesizer's output channel to the UM2's MIDI channels.

## Computer controlled configuration

This is the most powerful and flexible installation. All the MIDI note messages generated from the keyboards go through the computer before they control the relay drivers.



This system allows recording and playback with sequencing software.

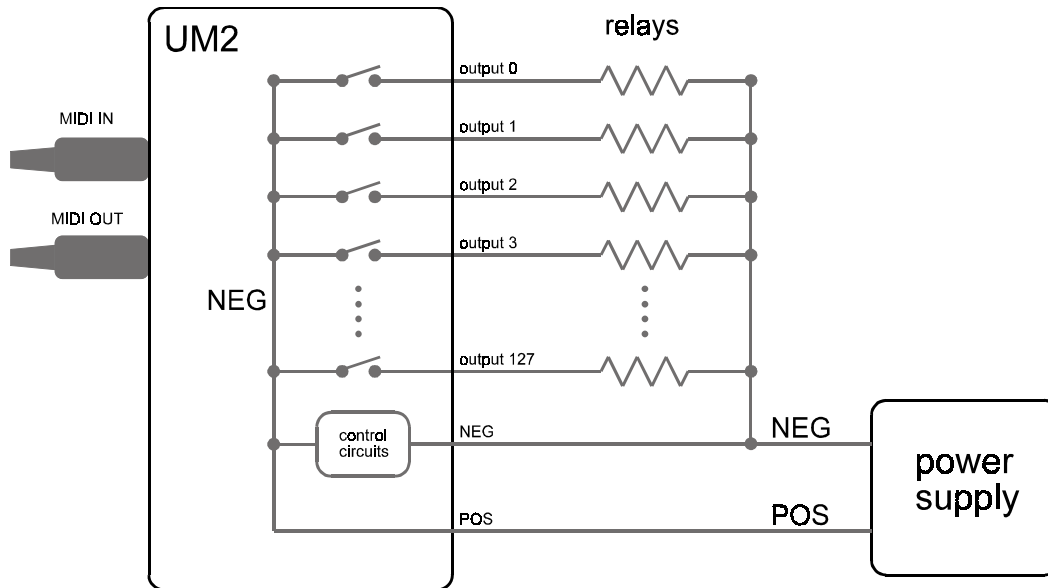
Up to 16 UM2s can be daisy chained on a single MIDI cable. In practice, we keep this number lower, because of the MIDI delay: every note message takes about one millisecond (0.001 sec) to be transmitted on the cable. This is not a problem on the console side, a single MIDI cable can keep up with ten fingers and two feet. But on the pipes side, if one key, for example, could activate 10 pipes, 5 keys pressed simultaneously can cause a delay of 0.050 sec, which is noticeable. If this applies to your system, you should have multiple MIDI output ports on your computer (we suggest 2 to 8 ranks of pipes per MIDI port, depending on the flow).

## Setup of UM2 relay driver

The function of the UM2 is to receive MIDI note messages and drive its outputs accordingly.

Choose partitions and transpose with the MODE switch (see chart page 9) or software setup (see page 6). For example, switch 1 ON and all other switches off would be a single partition of 128 outputs.

The UM2 outputs are connected to relays, solenoids, valves, lights or other resistive/inductive loads (see specification page 8 for maximum load). The UM2 outputs are active high (positive driver), which means they act like a switch to the positive of the power supply (see diagram below); therefore the relays are connected between the UM2 outputs and the negative of the power supply.



The positive of the power supply must connect to “POS” (see chart page 10).

The negative of the power supply must connect to “NEG”, pin 1 of the 40-pin connectors; in most cases this is also ground of the system. We recommend that all POS and NEG pins connect to the power supply. If you are using our optional screw terminal blocks *TERMI-128* or *TERMI-64*, the those pins are already brought together to a single terminal.

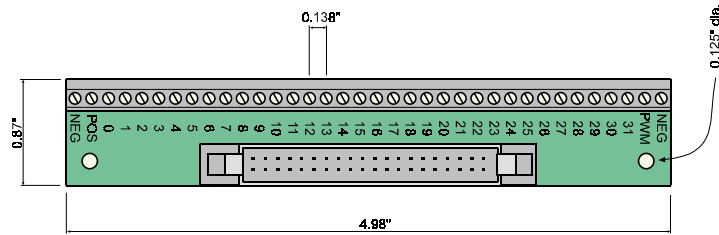
No “clamping” diodes are necessary, the UM2 contains diodes from NEG to each output.

### Vibrato output:

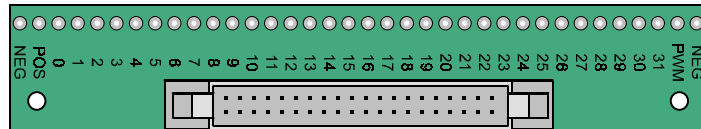
The vibrato output is a slow oscillator whose frequency is controlled from zero to 10 pulses per second, by MIDI Modulation Bender messages (see page 13). This output can be used to control a door or device that modulates the sound.

## Connecting with screw terminal blocks

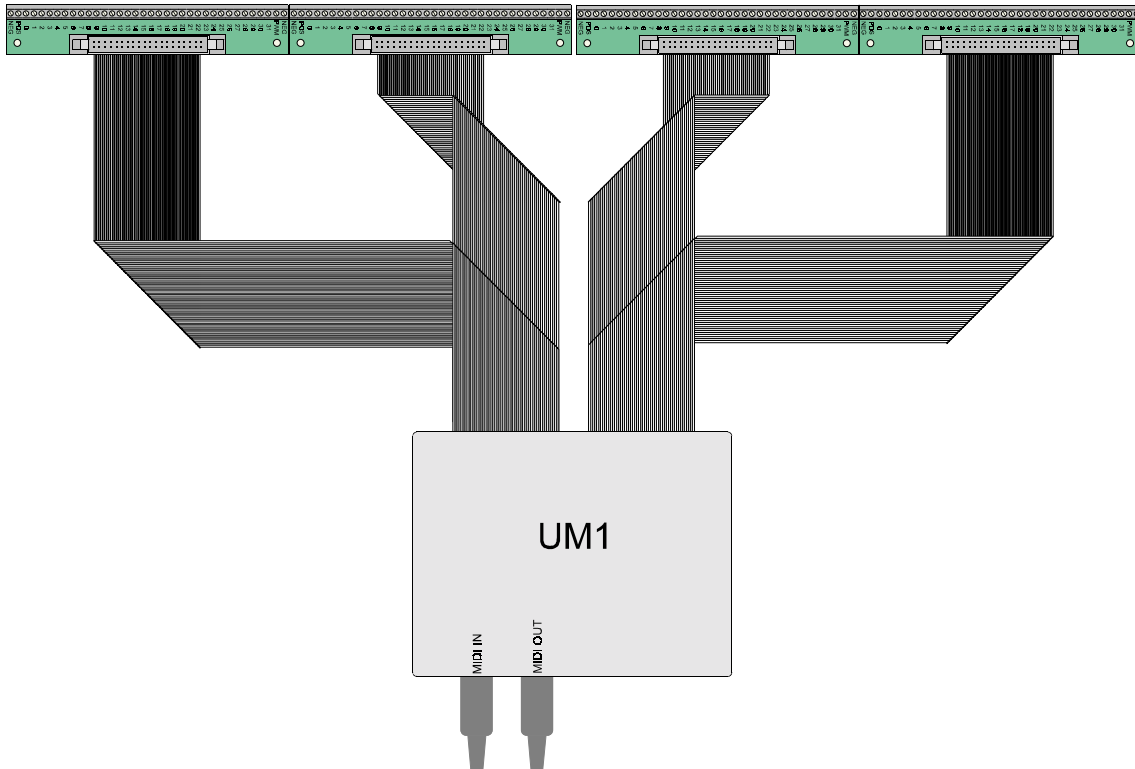
Wiring is simplified with our optional screw terminal blocks *TERM1-128* or *TERM1-64*, which bring out all the outputs where they can be connected directly to your wires.



Another option is the solder terminal blocks *TERMS-128* or *TERMS-64*, which bring out all the outputs where they can be soldered to your wires:



The diagram below shows screw terminals for 128 outputs, connected to a UM2 or UM1.



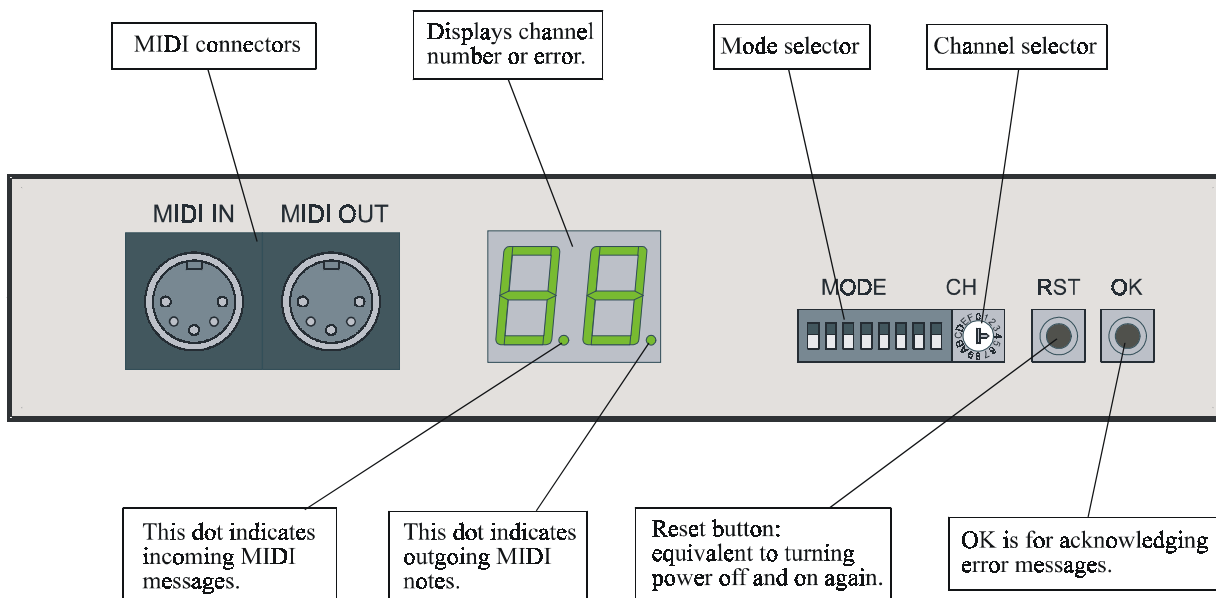
## Operation

### Power up

When power is applied to the UM2, its display should light up, showing the version number for half a second, and then the channel number. If the display does not light up, see troubleshooting, page 7. If the power up diagnostics are enabled at the MODE switch (see chart page 9), a message will be displayed if an error occurs.

You can change the channel at any time by rotating the switch labeled CH.

The MIDI channel of the source should match that of the UM2. If you have two partitions, the number displayed is the channel of partition A; partition B may have a different channel, according to the MODE switch (see chart page 9) or software setup (see page 6).



### Operation

During operation, the left dot on the display lights up when receiving MIDI messages on the assigned MIDI channel, the right dot when transmitting messages.

You should rarely need to use the buttons:

The RST is the reset button, like the one on a PC; use it if things are locked up, or if you need to read the version number, which is displayed for half a second after reset is pressed.

The OK button will clear an error message on the display: when an error occurs, the display will blink with the message “Er” followed by one or two numbers (see error chart page 7).

### Installing the UM2 software

To install the *UM2 setup/diagnostics software* on your PC, insert the diskette and run the file called “setup”.



## Software setup / diagnostics

As an alternative to using the MODE selector switch, the UM2 can be configured with the *UM2 setup/diagnostics software* which gives a few more options. To enable software setup, the MODE switches must all be ON; this is not necessary for diagnostics.

Connect the UM2's MIDI IN to the PC's MIDI OUT and the UM2's MIDI OUT to the PC's MIDI IN (actually, several UM2's can be chained together as in the diagram page 4. You may be able to change the setup without removing the units from your installation).

Power up the UM2, and run the *UM2 setup/diagnostics software*.

The software will attempt to find the UM2(s) on your MIDI port, and will give you the choice between setup or diagnostics.

## Troubleshooting

### General problems

Symptom	Probable cause	Solution
Nothing on display	No power	Make sure you apply a positive voltage of 5 to 25 volts between POS and NEG of any of the 40 pin headers.
UM2 sometimes gets the wrong note, or ignores some notes	MIDI cable interference	Try a shorter MIDI cable or one of superior quality, fully shielded.
	Electro-magnetic interference	Move the UM2 away from motors, high current cables, high current relays/switches, CB radios.
Display shows channel number but UM2 is not responding		Use the chart below or run the diagnostics software (see page 6)

### Error chart

Note: Error checking is not available in versions below 2.0.

Error msg.	Meaning	Solution
Er 01 ##	Internal failure ##	Contact factory
Er 02 ##	Output group number ## shorted to the negative of the power supply or over current.	Check output group number ## for a direct short or a defective relay. Check the relay is not drawing more than the specified output current. Outputs are grouped 8 by 8, group 0 is outputs 0-7, group 1 is outputs 8-15, etc...

## UM2 relay driver

Symptom	Probable cause	Solution
Incoming MIDI light on the display does not blink when sending MIDI messages to UM2	Wrong MIDI channel	The MIDI channel of the source should match that of the UM2. If you have two partitions, the number displayed is the channel of partition A; partition B may have a different channel, according to the MODE switch (see chart page 9) or software setup (see page 6)
	Wrong connector	MIDI OUT of the source should connect to MIDI IN of the UM2
	No MIDI coming through cable	Check your MIDI source by connecting a sound module or synthesizer, if you have one
Incoming MIDI light on the display blinks but outputs don't respond	Wrong mode of operation	Check the MODE switch, see chart page 9.
	Notes out of range	Depending on the MODE switch or software setup, you may call for transposition. Without transposition, the first output is MIDI note zero. Notes out of range do not activate outputs.
	Output polarity	The UM2's outputs switch to the positive side of the power supply, so the other side of the relay (or light or voltmeter) should be connected to the negative of the power supply.
One output does not respond	Bad relay	Check that relay, swap it for a known good one
	Short	Check wiring of this output

## Electrical specifications

Parameter	Min.	Max.	Units
Storage temperature	-40	100	°C
Operating temperature	0	50	°C
Humidity (non-condensing)	0	95	%

## Power supply

The power for the UM2's internal circuits is provided at the 40-pin headers. Usually it is also the power supply of the user's external circuits. (i.e. 5 volts for a TTL interface, 12 volts or more for solenoid drive).

Parameter	Min.	Max.	Units	Notes
Supply voltage	4.75	25	Volts	
Supply current		0.3	Amp	no load

## Driver Outputs

The 128 open collector driver outputs are provided at the 40-pin headers.  
(The output drives low for a key on command).

Active clamps enable driving solenoids or relays directly.

Parameter	Typ.	Max.	Units	Notes
On output voltage	1.6	1.8	Volts	at 100mA load
On output voltage	1.8	2.0	Volts	at 350mA load
duty cycle	100	%		all outputs at 100mA load
duty cycle	50	%		all outputs at 200mA load
duty cycle	30	%		all outputs at 350mA load

Vibrato Output:

Output with same specs as driver outputs, provided at the 40-pin headers. A square wave of 0 to 10Hz is generated in response to "Modulation Bender" channel node message. A value of zero turns this output off. This output can be used to control a solenoid driven vibrato or "Leslie".

## Mode switch



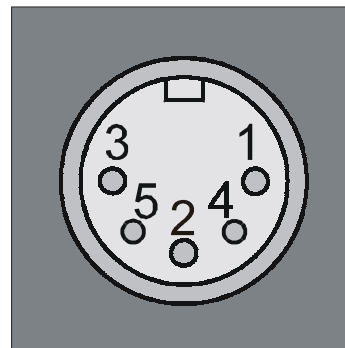
Position	Default	Function	Function
		<b>OFF</b>	<b>ON</b>
1	OFF	Two partitions: A, B (64 notes each)	One partition (128 notes)
2	OFF		
3	OFF		
4	OFF		
5	OFF		
6	OFF	Partition A channel = B channel	Partition B channel = A channel + 1
7	OFF	Not transposed	Transposed 36 semi-tones (3 octaves)
8	OFF	Power up diagnostics off	Power up diagnostics on (version 2.0 only)

Note: for software setup mode, turn all switches ON.

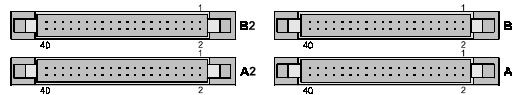
Note: Power up diagnostics are not available in versions below 2.0.

## MIDI connectors

Pin #	MIDI IN	MIDI OUT
1	NO CONNECT	NO CONNECT
2	SHIELD	SHIELD
3	NO CONNECT	NO CONNECT
4	MIDI IN +	MIDI OUT +
5	MIDI IN -	MIDI OUT -



Note: SHIELD is connected to ground through a 0.1µF capacitor, to avoid ground loop currents.



## Input/Output connectors

Pin #	Connector A1	Connector A2	Connector B1 (not on UM2-64)	Connector B2 (not on UM2-64)
1	NEG	NEG	NEG	NEG
2	INPUT/OUTPUT 0	INPUT/OUTPUT 32	INPUT/OUTPUT 64	INPUT/OUTPUT 96
3	INPUT/OUTPUT 1	INPUT/OUTPUT 33	INPUT/OUTPUT 65	INPUT/OUTPUT 97
4	INPUT/OUTPUT 2	INPUT/OUTPUT 34	INPUT/OUTPUT 66	INPUT/OUTPUT 98
5	INPUT/OUTPUT 3	INPUT/OUTPUT 35	INPUT/OUTPUT 67	INPUT/OUTPUT 99
6	INPUT/OUTPUT 4	INPUT/OUTPUT 36	INPUT/OUTPUT 68	INPUT/OUTPUT 100
7	INPUT/OUTPUT 5	INPUT/OUTPUT 37	INPUT/OUTPUT 69	INPUT/OUTPUT 101
8	INPUT/OUTPUT 6	INPUT/OUTPUT 38	INPUT/OUTPUT 70	INPUT/OUTPUT 102
9	INPUT/OUTPUT 7	INPUT/OUTPUT 39	INPUT/OUTPUT 71	INPUT/OUTPUT 103
10	POS	POS	POS	POS
11	INPUT/OUTPUT 8	INPUT/OUTPUT 40	INPUT/OUTPUT 72	INPUT/OUTPUT 104
12	INPUT/OUTPUT 9	INPUT/OUTPUT 41	INPUT/OUTPUT 73	INPUT/OUTPUT 105
13	INPUT/OUTPUT 10	INPUT/OUTPUT 42	INPUT/OUTPUT 74	INPUT/OUTPUT 106
14	INPUT/OUTPUT 11	INPUT/OUTPUT 43	INPUT/OUTPUT 75	INPUT/OUTPUT 107
15	INPUT/OUTPUT 12	INPUT/OUTPUT 44	INPUT/OUTPUT 76	INPUT/OUTPUT 108
16	INPUT/OUTPUT 13	INPUT/OUTPUT 45	INPUT/OUTPUT 77	INPUT/OUTPUT 109
17	INPUT/OUTPUT 14	INPUT/OUTPUT 46	INPUT/OUTPUT 78	INPUT/OUTPUT 110
18	INPUT/OUTPUT 15	INPUT/OUTPUT 47	INPUT/OUTPUT 79	INPUT/OUTPUT 111
19	POS	POS	POS	POS
20	INPUT/OUTPUT 16	INPUT/OUTPUT 48	INPUT/OUTPUT 80	INPUT/OUTPUT 112
21	INPUT/OUTPUT 17	INPUT/OUTPUT 49	INPUT/OUTPUT 81	INPUT/OUTPUT 113
22	INPUT/OUTPUT 18	INPUT/OUTPUT 50	INPUT/OUTPUT 82	INPUT/OUTPUT 114
23	INPUT/OUTPUT 19	INPUT/OUTPUT 51	INPUT/OUTPUT 83	INPUT/OUTPUT 115
24	INPUT/OUTPUT 20	INPUT/OUTPUT 52	INPUT/OUTPUT 84	INPUT/OUTPUT 116
25	INPUT/OUTPUT 21	INPUT/OUTPUT 53	INPUT/OUTPUT 85	INPUT/OUTPUT 117
26	INPUT/OUTPUT 22	INPUT/OUTPUT 54	INPUT/OUTPUT 86	INPUT/OUTPUT 118
27	INPUT/OUTPUT 23	INPUT/OUTPUT 55	INPUT/OUTPUT 87	INPUT/OUTPUT 119
28	POS	POS	POS	POS
29	INPUT/OUTPUT 24	INPUT/OUTPUT 56	INPUT/OUTPUT 88	INPUT/OUTPUT 120
30	INPUT/OUTPUT 25	INPUT/OUTPUT 57	INPUT/OUTPUT 89	INPUT/OUTPUT 121
31	INPUT/OUTPUT 26	INPUT/OUTPUT 58	INPUT/OUTPUT 90	INPUT/OUTPUT 122
32	INPUT/OUTPUT 27	INPUT/OUTPUT 59	INPUT/OUTPUT 91	INPUT/OUTPUT 123
33	INPUT/OUTPUT 28	INPUT/OUTPUT 60	INPUT/OUTPUT 92	INPUT/OUTPUT 124
34	INPUT/OUTPUT 29	INPUT/OUTPUT 61	INPUT/OUTPUT 93	INPUT/OUTPUT 125
35	INPUT/OUTPUT 30	INPUT/OUTPUT 62	INPUT/OUTPUT 94	INPUT/OUTPUT 126
36	INPUT/OUTPUT 31	INPUT/OUTPUT 63	INPUT/OUTPUT 95	INPUT/OUTPUT 127
37	POS	POS	POS	POS
38	NO CONNECT	NO CONNECT	NO CONNECT	NO CONNECT
39	VIBRATO (PWM1)	RESERVED	RESERVED	RESERVED
40	POS	POS	POS	POS

NEG is the negative of the power supply; in most cases this is also ground of the system and the common to all the relays in the system. We recommend that all NEG pins connect to the power supply.

POS is the positive of the power supply (5-25 volts) for the UM2. We recommend that all POS pins connect to the power supply.

## MIDI note chart

Octave	C	C#	D	D#	E	F	F#	G	G#	A	A#	B
0	0	1	2	3	4	5	6	7	8	9	10	11
1	12	13	14	15	16	17	18	19	20	21	22	23
2	24	25	26	27	28	29	30	31	32	33	34	35
3	36	37	38	39	40	41	42	43	44	45	46	47
4	48	49	50	51	52	53	54	55	56	57	58	59
5	<b>60</b>	61	62	63	64	65	66	67	68	69	70	71
6	72	73	74	75	76	77	78	79	80	81	82	83
7	84	85	86	87	88	89	90	91	92	93	94	95
8	96	97	98	99	100	101	102	103	104	105	106	107
9	108	109	110	111	112	113	114	115	116	117	118	119
10	120	121	122	123	124	125	126	127				

Shaded notes are the standard 61 note keyboard range.

Additional shaded notes are the standard 88 piano keyboard range.

Note **60** is middle C of keyboard

## MIDI commands

Note: MIDI data numbers are hexadecimal.

k is channel number 0-F; 0 is channel 1, F is channel 16

### Channel voice messages:

Bytes	Description
8k nn vv	Note Off event, running status accepted
9k nn vv	Note On event (vv = 0:Note Off) running status accepted
Ek vv vv	Pitch bend change (lsb first) NOT IMPLEMENTED

### Channel Mode Messages:

Bytes	Description
Bk 7B 00	All Note Off event
Bk 01 vv	Modulation Bender (Vibrato), zero is Off
Bk 40 vv	Sustain pedal, zero is Off, otherwise On

### System Real-Time Messages:

Bytes	Description
FF	Reset system to power-up status. (including all notes Off)
FE	Active Sensing. Use of this message is optional. When initially sent, the receiver will expect to receive MIDI messages or another Active Sensing message at least every 300ms, or it will be assume that the connection has been terminated. At termination, the receiver will turn off all voices and return to normal (non-active sensing) operation.

**System exclusives (advanced users):**

The following are commands to output binary data to all outputs.

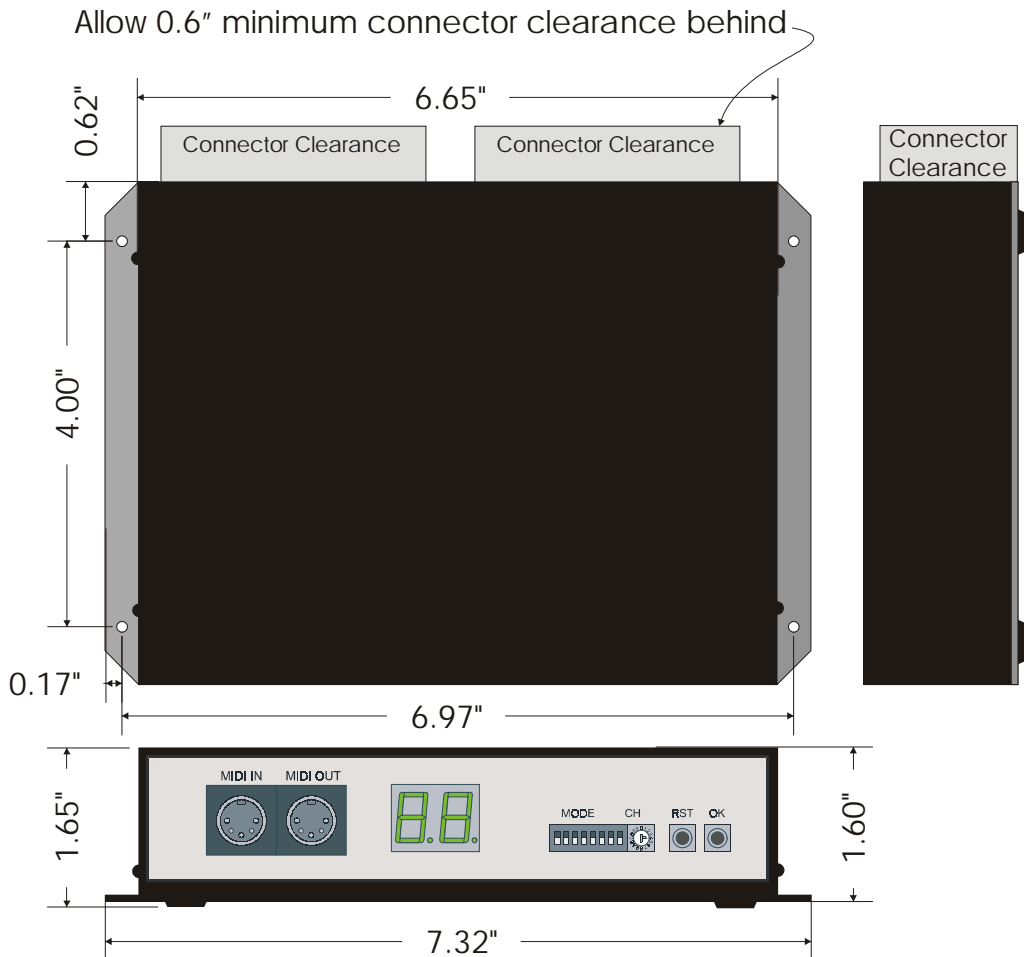
Note that because SYSEX data are 7bit bytes, our 8 bit bytes are each split into 2 bytes: the first contains 7 most significant bits, the second contains the remaining bit.

**Dump Data (from host to UM2)**

Byte	Description
F0 7E kk	Exclusive Non-Realtime Header kk = channel of partition A
02 00	
pp	pp = 5 all 128 outputs pp = 6 partition A 64 outputs (use this for UM2-64) pp = 7 partition B 64 outputs
dd .. dd	all outputs data: 32 bytes data (16 pairs, left justified: 7 bits 1 <sup>st</sup> byte, 1 bit 2nd byte) partition A or B: 16 bytes data (8 pairs: 7 bits 1st byte, 1 bit 2nd byte)
F7	EOX

Note: The UM2 loads in this data and transfers it all at once to its outputs.

**Mechanical specifications**



## Ordering information

UM2-128	standard product with 128 outputs
UM2-64	standard product with 64 outputs
UM2-128-BB	UM2 with 128 outputs, but no enclosure and no display
UM2-64-BB	UM2 with 64 outputs, but no enclosure and no display
TERM1-128, TERM1-64	screw terminal set for 128 outputs, 64 outputs
TERM1-S-128, TERM1-S-64	solder terminal set for 128 outputs, 64 outputs
CA40-17	17 inch 40 wire cable

## Warranty

MIDIator Systems warrants for two years from the date of purchase this product if it does not perform satisfactorily due to defects caused by faulty materials or workmanship. Our obligation assumed under this warranty is limited to the repair, replacement or refund of this product, if it has not been misused.

## Disclaimer

MIDIator Systems accepts no responsibility for damages resulting from the use of this product and makes no warranty or representation, either express or implied, including but not limited to, any implied warranty of merchantability or fitness for a particular purpose.

The product owner's sole and exclusive remedy against MIDIator Systems shall be, at MIDIator Systems' sole discretion, for (A) repair or replacement of defective product; or (B) repayment of the price paid for the product. No other remedy (including, but not limited to, incidental or consequential damages or lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available to owner. In no event shall MIDIator Systems' liability exceed amount paid for the product.

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