

ENGINEERING SOLUTIONS INC

The DecaBox has become a world standard for bridging between DMX, MIDI and RS-232 equipment.



How to Easily and Accurately Control DMX Lighting Gear From Your Existing MIDI Equipment

Kick that grumpy lighting guy to the curb while retaining complete creative control.

By John Chapman, Engineering Solutions Inc

It's a question we hear nearly every week. "We're in a band. We use a sequencer for backing tracks and to send 'click' to the drummer. We'd like to control our lighting equipment from the sequencer as well. That way, the light show for each song will be exactly synchronized with our music, and no important cues will be missed. Can you help?"

Or perhaps, "We're designing an art installation. Every time someone jumps on these larger-

than-life piano keys we've built, we need a different stage light to flash in sync. Can you help?"

Fortunately, the answer is a very definite 'yes' to all of these questions.

The DecaBox Protocol Bridge with MIDI to DMX firmware easily, quickly and accurately converts MIDI note and CC messages into DMX channel values. This makes it very, very easy to program a light show from within MIDI software and hard-

ware, or even drive lights in real time from a keyboard or drum kit.

It's been used all over the world, for many years now, by artists, musicians, lighting designers and other creative people. The next few pages describe how the system works, and show how to quickly begin using this hardware as part of your next production.

How to get up and running in four simple steps

These instructions assume a working familiarity with both DMX and MIDI gear. For more detailed explanations, refer to other pages in this document.

Step 1

Connect your MIDI equipment (either a sequencer, a keyboard or a computer) to the DecaBox using a regular 5-pin MIDI cable. Though the DecaBox contains a USB port, it's used for firmware updates, not MIDI connections.

Step 2

Use the pushbuttons and LCD screen on the DecaBox to set the system's MIDI channel. Any of the standard 16 channels can be used. After setting the channel, step through the remaining menus until the main 'running' screen is displayed. This screen is what appears after a power cycle.

Step 3

Make sure that the upstream MIDI equipment connected to the DecaBox is transmitting on the same MIDI channel as was set in step 2. If this is the case, the DecaBox's left LED will flicker each time a MIDI message is received.

Step 4

Connect a 5 pin DMX cable between the DecaBox's 'DMX Output' jack and the first piece of lighting equipment being used. Set this equipment's start address to 60. For most consistent results, always terminate the DMX chain.

If the connected MIDI gear is a keyboard, begin pressing keys, starting at middle C (C3). All MIDI notes have a number, and in most cases, middle C is 60. There's a MIDI note number chart in the appendix which describes this in more detail.

The lighting equipment should respond to the MIDI note messages.

That's it!

Theory of Operation

A complete scale of MIDI notes is mapped 1:1 to the first 128 DMX channels. MIDI note velocities of [0 127] are doubled to make DMX channel values of [0 255].

Also, the first 119 MIDI continuous controller messages are mapped to the first 119 DMX channels, again in a 1:1 ratio. The controller's data values are also doubled, making their range match the 8-bit DMX scale of [0 255].

Note and CC messages may be sent in any order. The most recently received message (either note or CC) per channel takes precedence.

MIDI Note and CC Messages

A MIDI cable can simultaneously carry information on sixteen MIDI channels. Typically, each connected piece of MIDI equipment is set to a different channel. This keeps everything organized and reduces interference. The DecaBox uses one user-specified MIDI channel.

A MIDI scale (there is one per MIDI channel) contains 128 notes. Each note has a number in addition to its musical name. Middle C is typically #60.

A touch-sensitive MIDI keyboard can generate 127 different volume levels for each note played, depending on how hard the key is pressed. In the MIDI world, this volume level is called 'note velocity'. The DecaBox translates the note velocity of each note number into DMX channel values for the same channel number.

If a simple light bulb were connected to a DMX dimmer and a MIDI keyboard, its brightness would vary based on how loud the correct note was played.

If a three channel RGB LED fixture were connected and set to start address #60, playing chords containing middle C, C# and D would change the color mix displayed by the light.

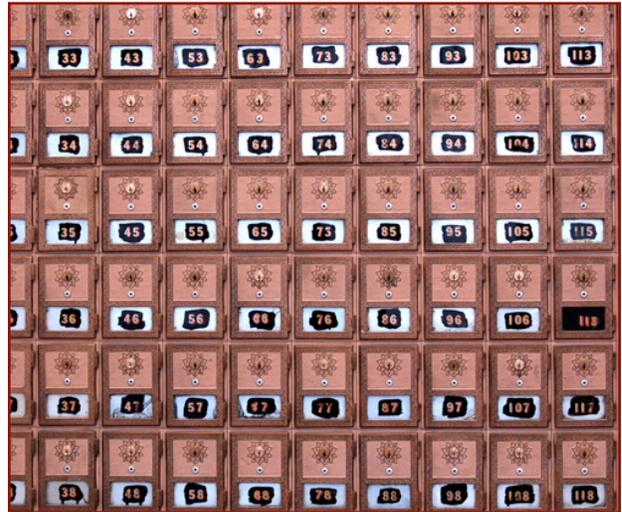
A sequencer or keyboard can also generate continuous controller messages. These are typically represented by faders, knobs or sliders. They allow continuously varying data to be transmitted through the MIDI port.

The DecaBox maps the CC number and data value to DMX channels and channel values, on a 1:1 basis. The DecaBox responds to note or continuous controller messages, with the most recently received message taking precedence.

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



Mapping: MIDI Note / CC Messages to DMX Channels				
Note Number	Note Name	DMX Channel	CC Name	CC Number
0	C-2	1	Bank Select	0
1	C#-2	2	Modulation	1
2	D-2	3	Breath	2
3	D#-2	4	Undefined	3
4	E-2	5	Foot Controller	4
...
125	F8	126	Only CC Messages 0-118 are mapped to DMX channels	
126	F#8	127		
127	G8	128		



DMX-512 for Musicians: a Quick Analogy

Picture a wall of mailboxes in an apartment building or post office. The mail is delivered each morning. If you have a key or combination for a particular box, you can remove your mail at any convenient time after it's been delivered.

DMX is like a wall of 512 mailboxes which are refilled about 40 times each second. Every device connected to a DMX system is assigned a start address.

This address tells each piece of equipment which 'door' in the PO Box wall to look behind to find the correct data. An 8-channel dimmer pack could be assigned a start address of 15. The dimmer's internal computer then knows to look behind doors 15-22 (8 channels total) to find lighting information for each of its outputs.

This start address is usually set using small switches or pushbuttons, and each manufacturer describes how to set the address in their instruction manual.

An RGB wash light could be assigned a start address of 6. This means that doors (or DMX channels) 6, 7 and 8 control the fixture's red, green and blue lights. As the value of each DMX channel varies, the intensity of those primary colors goes up and down in sync.

In most installations, each piece of equipment is assigned a unique and non-overlapping start address. A small stage setup could be designed this way:

Fixture Description	Channels Required	DMX Start Address
Dimmer Pack #1	4	60
Dimmer Pack #2	4	64
RGB Flood Light	3	68
RGB Flood Light	3	71
RGB Flood Light	3	74
Fog Machine	1	77

Note: The definition of 'channel' in the language of DMX is totally different than 'channel' in the MIDI world. There are 512 DMX channels in a universe. This means that 512 separate light bulbs could be connected to 512 one-channel dimmer packs, and their brightness can be controlled by a single lighting desk. There are 16 MIDI channels. A single MIDI channel can be compared to a pipeline through which data can pass. 128 notes are available in each MIDI channel.

And now, the DecaBox can receive MIDI note information, starting with middle C continuing 18 notes higher.