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## ***Warranty and Disclaimer***

### **Warranty**

Northlight Systems warrants this product against defects in materials and workmanship for a period of 1 year.

If you discover a defect, we will, at our option, repair or replace the product. We offer a full refund on the purchase price if returned in original condition in less than 30 days.

Return the product with a description of the problem. We will return your item or its replacement using the same shipping method used to ship the product originally.

### **Disclaimer of Liability**

Northlight Systems is not responsible for any special, incidental, or consequential damages resulting for any breach of warranty, or any legal theory, including lost profits, downtime, goodwill, damage to or replacement of equipment or property, and any costs associated with the use of Northlight Systems products described herein.

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### **Contact**

Northlight Systems  
1247 E. Valerie Drive  
Tempe, AZ 85281

Voice 480 429-0577  
Fax 480 949-2625  
Email [NorthlightSystems@att.net](mailto:NorthlightSystems@att.net)

## **8 Channel DMX512 Encoder board**

The encoder board accepts analog 0-10 VDC input and converts it to DMX 512 digital protocol. The analog voltage is converted to 255 discrete levels.

Use to upgrade 0-10 volt analog lighting consoles. Or add your own switches and slide pots to create custom controls for home or building automation.

Has on board start address switch.

### **SPECS:**

**Input Signal:** 0 -10 VDC. This board expects a conditioned signal. If the encoder board is to be used in an electricly noisy environment, external signal buffers should be used.

**Output:** Output is 8 DMX channels + address offset.

**Address switch:** Address selection is via a 9 position mini DIP switch.

Set the starting address to the first in a group of 8. Possible address up to 512. The first address is 0.

### **Power requirements:**

8 channel - 8 to 12 volts DC @ 80 mA.

**Board connections:** Power and DMX output connections to the board are made via screw terminal blocks. Acceptable wire size is 18 – 24 AWG. See drawing for connector locations.

## DMX output signal details:

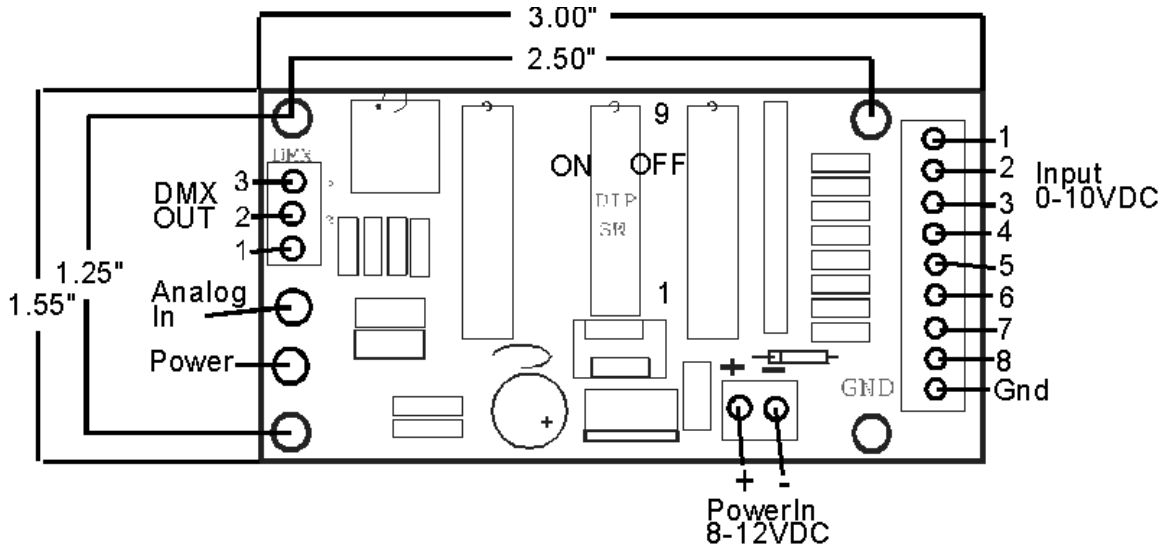
**Output is compliant with USITT's DMX512 1990 protocol.**

250 Kbaud	4us/ bit
Start code:	0
Break Length:	300 us
Mark after Break	40 us
Inter frame time	30 us
Output channels	8 + start address

Note that the timings are not as fast as the protocol allows. This should accomadate all compliant receivers.

## Physical Dimensions:

3.00" X 1.50"



## Usage

DMX output connector: The pin numbers shown on the diagram correspond to the DMX XLR pin numbers as specified in the DMX512 protocol. See Notes about DMX 512 in this manual.

## Address switch

The address is set using standard binary coding. A chart showing all 512 address is at the back of this manual.

The starting address on the switches is 0. This corresponds to DMX address 1.

The encoded data will be output in the DMX data stream starting at the address determined by the address switch. For example, if the start address is 9 then the first 8 DMX channels will be zero's, input channel 1 on the encoder will be output on DMX channel 9, encoder input channel 2 will be output on DMX channel 10 and so on.

Any device connected to the encoder will have to be addressed at 9 or above to receive the encoded inputs in this example.

Normally the start address is 0 on the encoder.

## LEDS

RED – Board power supply.

GREEN - When on, this indicates that 1 of the inputs is receiving over .25 volt DC.

## Power Connector

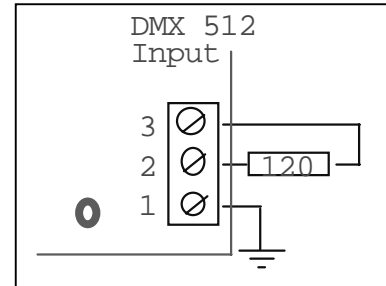
The input voltage should be between 8 and 12 volts DC. Average power is less than 100 milliAmps.

## Trouble shooting

Basically the board is plug and play. There are no user adjustments. When all connections are properly made, a DMX signal, proportional to the input voltage will be present at the output pins.

**Signal Ground:** The input circuit signal ground, should be connected first. On the board, there is NO connection between chassis/earth ground and Signal/common ground. Do not install one.

On the DMX data cable, there is NO connection between the shield/XLR shell earth ground and the signal/common ground. Do not connect these together.



**Termination:** Northlight's Encoder does not contain a terminating resistor. If It is determined that a terminator is required, a 120 terminating resistor can be installed on the DMX output connector, across pins 2 – 3.

Terminators on the transmitter end are not usually required.

**Red Power LED:** If the red LED is out, the board is not getting power, or the power supply is defective.

**Green signal LED:** When the voltage on any of the input channels is over .25 VDC the green LED will turn on. If the LED flashes or doesn't come on there is a problem with the input voltage. Check the signal ground. Make sure the input is not even a little over 10 volts.

**No output:** Be sure the receiver address is set to a valid address. The Encoder start address should not be higher than the receiver start address. Set all the switches OFF for testing.

Check for backward DMX signal connections.

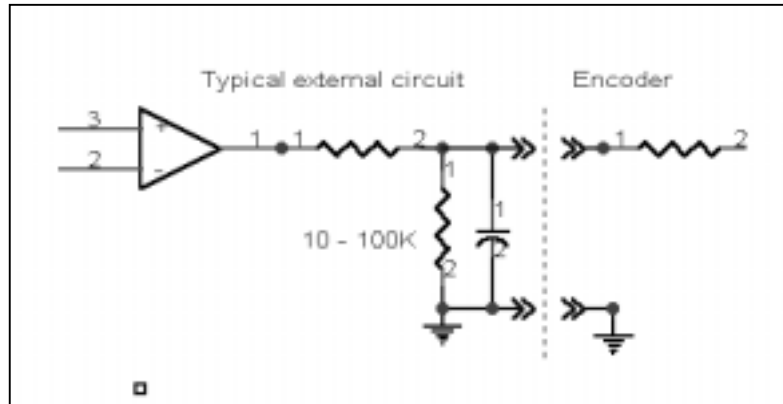
If only some inputs generate DMX, check the connections and verify the input voltage at the screw terminals.

**Erratic output:** This problem can be hard to track down. First check the input signal quality and voltage. If the input voltage goes over 10 VDC, the output will drop to 0 for that channel.

Another potential problem here is the user circuit interface. It might be necessary that a 10K to 100K resistor be connected between the encoder board input and the user circuit ground. This is usually already there in most light board upgrade situations. This is shown schematically below.

It is important that the ground from the external ground be connected first. The input maximum voltage is 10 VDC.

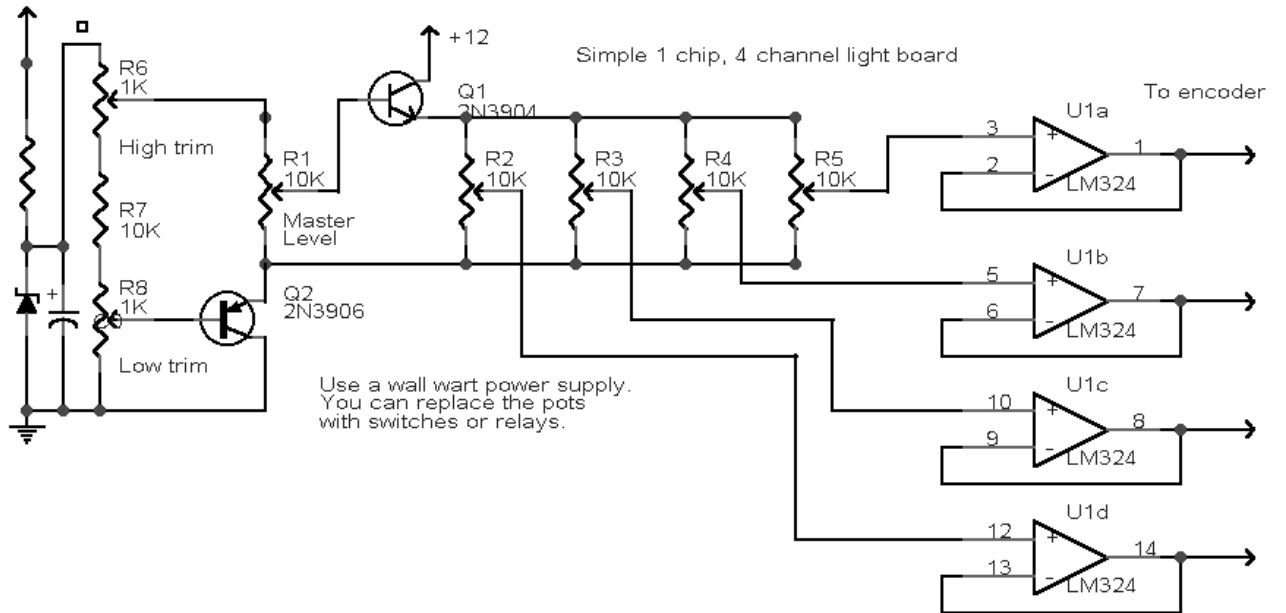
Higher voltages may damage chips.



**Misc:** Good solid connections are a must. The micro screw terminals provide good connections. However the screws can be stripped by over tightening.

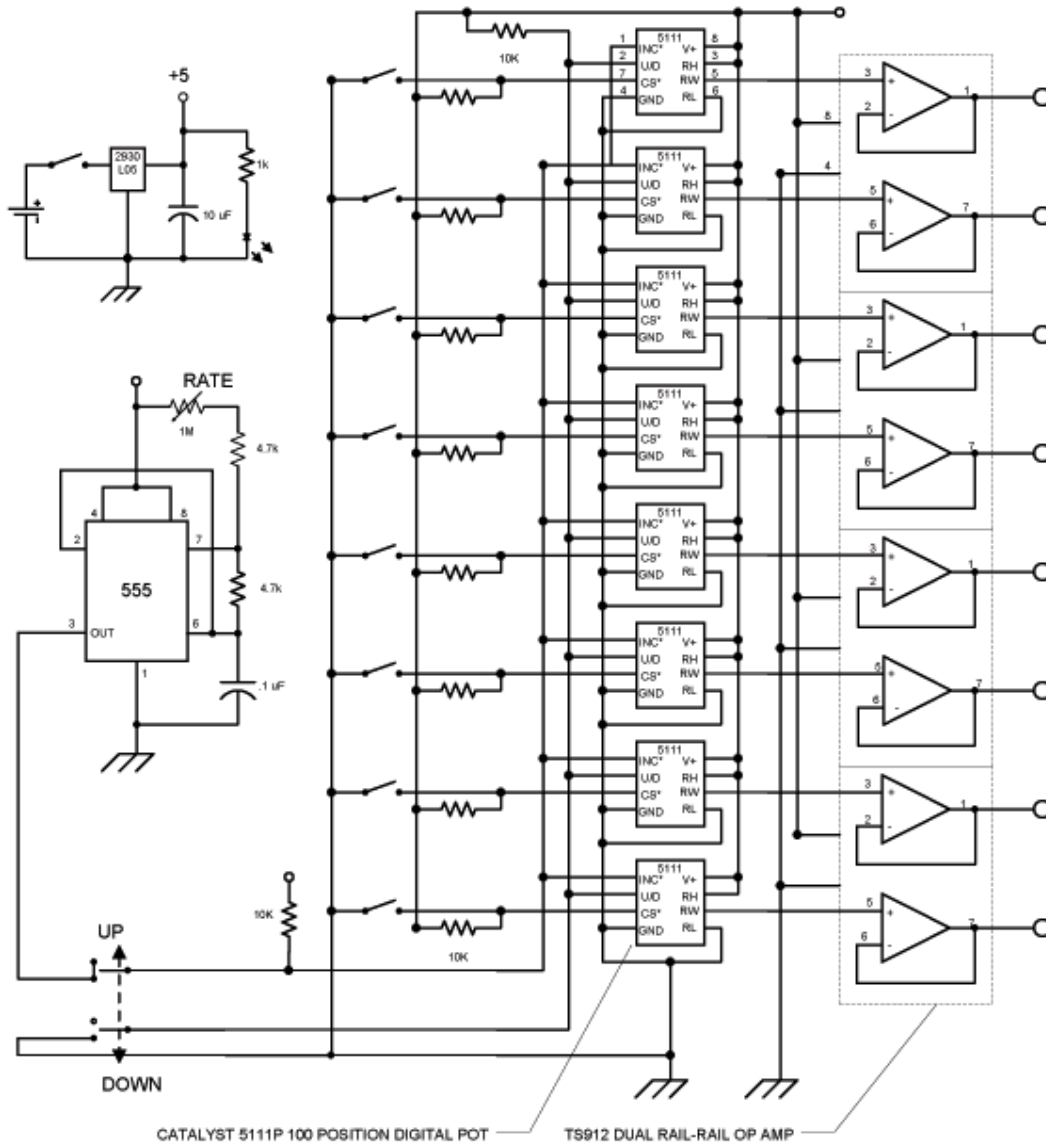
DMX512 signal wires should be twisted together all the way to the connector.

Typical input circuit



The schematic below was sent in by a customer. He used digital potentiometers to generate a 100 step analog voltage for input into the Encoder.

8 CHANNEL DMX RFU - INTERFACE TO NORTHLIGHT DMX ENCODER



## Some notes about DMX512

DMX 512 is a digital communications protocol that specifies a set of requirements for transmitting and receiving digital signals between lighting controllers and dimmers. There are 2 main components to this spec. The Data Protocol is the meaning of the bits and bytes that are transmitted. Northlight's Decoder is compliant with the full requirements of the Data Protocol. There is a certain amount of flexibility in the signal timing, Northlight's Decoder is capable of receiving data at the full data rate specified.

The other component of DMX512 is the Electrical Specifications. The hardware electrical specs are listed in EIA-485, commonly referred to as the RS-485 specs. The RS-485 standard, specifies only the electrical characteristics of the driver and the receiver to be used at the line interface. Northlight's Decoder is compliant with RS-485. Each Decoder represents less than 1 node load to the system.

RS485 is a data transmission system using balanced differential signals. That is 2 signal wires and signal ground. 3 wires are required.

### Splitters/Repeaters

Isolation between the console and dimmers is sometimes required to prevent signal degradation and protect devices from damaging voltages on the control cable. Optically isolated splitters help avoid these problems.

Each DMX512 output can drive up to 32 devices. If there are more devices on the line, a "repeater" or "booster" is required. Some cheap devices are not fully compliant and actually represent a load equivalent to 2 or more devices.

Long or improper cables, electrically noisy environment (generators, motors) and improper use of passive "Y" splitters all contribute to DMX signal degradation. A repeater/booster may help to solve these problems.

### Why ask WYE?

Wye(Y) splitters are NOT recommended for DMX512 systems. Wye splitters are simply a male inline XLR connector; parallel wired to 2 female inline XLR's. While convenient, Wye splitters cause unwanted signal reflections and possible ground loops, leading to signal degradation.

The best layout for DMX systems is a Daisy chain configuration, where the signal cable jumps from one device to the next, with no branching. Each chain can have up to 32 devices on it. When using an isolated splitter, each output can be a separate DMX daisy chain.

### Termination

A common problem with DMX systems is improper termination.

A simple terminator consists of a 120 Ohm resistor connected across pins 2-3 of the DMX signal. More complex terminators utilize voltage spike protection and BI-color LED's to indicate signal integrity.

Terminators are an impedance matching circuit required to damp signals that “reflect “ from the end of an improperly terminated cable, causing signal degradation under certain conditions.

On devices that have a DMX thru, a male XLR connector with terminating resistor connected across pins 2-3 and installed on the DMX thru connector will suffice. Some devices with isolated outputs will not use a terminator on the DMX out. These usually have an internal terminator that is selected with a switch.

### Wire Type

There is a difference between microphone cable and “Data” cable. Sure you can get away with mic. cable for short runs in many situations. However on longer runs or marginal situations mic. cable will let you down. You may have random errors or the system won’t work at all. It comes down to insurance. If you want to insure the most reliable DMX signal distribution you need the most appropriate wire for the job. DMX512 requires wire suitable for RS-485, there is no way to get around that.

Twisted-pair cable is the most common. You can use a range of wire gauges, but designers most frequently use 22 – 24 AWG. The characteristic impedance of the cable should be 100 to 120 Ohms.

Some other requirements are, at least 1 twisted pair plus ground and shield. It should have low capacitance and overall braid and foil shield.

### Data Rate VS Cable Length

At 250K bits per second the max. cable length is about 1000 ft for DMX512 in good conditions.

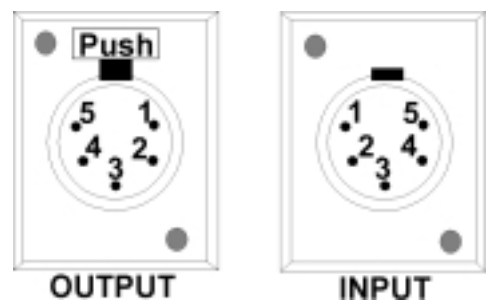
### Connectors

DMX512 protocol specifies that 5 pin XLR connectors are used. Female on the transmitter and male on the receiver.

When a 3 pin XLR is used it is wired the same as the first 3 pins on the 5 pin XLR.

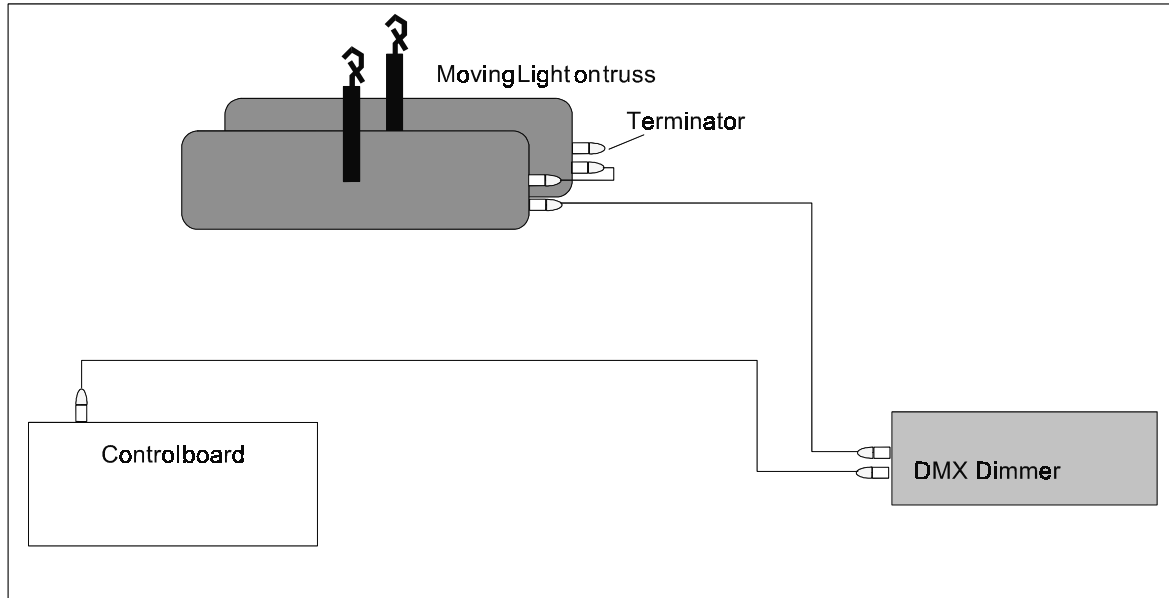
<u>PIN</u>	<u>WIRE</u>	<u>SIGNAL</u>
1	shield	ground/return
2	signal	data compliment ( - )
3	signal	data true ( + )
4	signal	spare data compliment ( - )
5	signal conductor	spare data true ( + )

Conductors 2/3 and 4/5 should be twisted together.

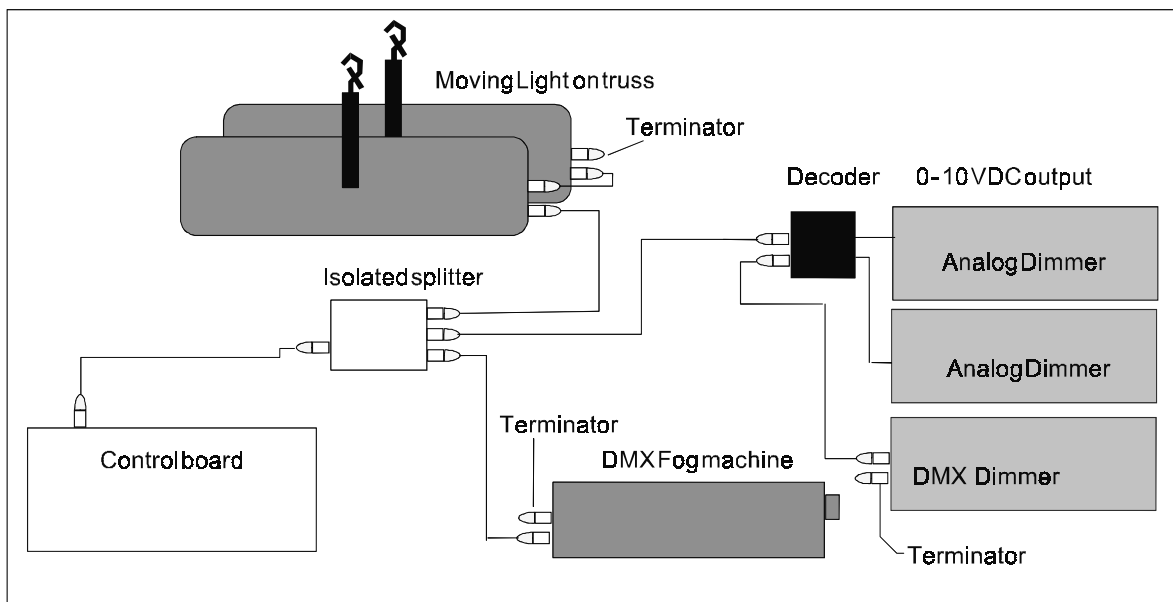


## Typical DMX signal routing

Simple setup



A more complicated setup. The Isolated splitter greatly simplifies cable routing and keeps individual runs short.



# Northlight Systems

## Ch# Dip Switch On

1 = 0  
 2 = 1  
 3 = 2  
 4 = 1,2  
 5 = 3  
 6 = 1,3  
 7 = 2,3  
 8 = 1,2,3  
 9 = 4  
 10 = 1, 4  
 11 = 2,4  
 12 = 1,2,4  
 13 = 3,4  
 14 = 1,3,4  
 15 = 2,3,4  
 16 = 1,2,3,4  
 17 = 5  
 18 = 1,5  
 19 = 2, 5  
 20 = 1,2,5  
 21 = 3,5  
 22 = 1,3,5  
 23 = 2,3,5  
 24 = 1,2,3,5  
 25 = 4,5  
 26 = 1,4,5  
 27 = 2,4,5  
 28 = 1,2,4,5  
 29 = 3,4,5  
 30 = 1,3,4,5  
 31 = 2,3,4,5  
 32 = 1,2,3,4,5  
 33 = 6  
 34 = 1,6  
 35 = 2,6  
 36 = 1,2,6  
 37 = 3,6  
 38 = 1,3,6  
 39 = 2,3,6  
 40 = 1,2,3,6  
 41 = 4,6  
 42 = 1,4,6  
 43 = 2,4,6  
 44 = 1,2,4,6  
 45 = 3,4,6  
 46 = 1,3,4,6  
 47 = 2,3,4,6  
 48 = 1,2,3,4,6  
 49 = 5,6  
 50 = 1,5,6  
 51 = 2,5,6  
 52 = 1,2,5,6  
 53 = 3,5,6  
 54 = 1,3,5,6  
 55 = 2,3,5,6  
 56 = 1,2,3,5,6  
 57 = 4,5,6  
 58 = 1,4,5,6  
 59 = 2,4,5,6  
 60 = 1,2,4,5,6  
 61 = 3,4,5,6  
 62 = 1,3,4,5,6  
 63 = 2,3,4,5,6  
 64 = 1,2,3,4,5,6

## Ch# Dip Switch On

65 = 7  
 66 = 1,7  
 67 = 2,7  
 68 = 1,2,7  
 69 = 3,7  
 70 = 1,3,7  
 71 = 2,3,7  
 72 = 1,2,3,7  
 73 = 4,7  
 74 = 1,4,7  
 75 = 2,4,7  
 76 = 1,2,4,7  
 77 = 3,4,7  
 78 = 1,3,4,7  
 79 = 2,3,4,7  
 80 = 1,3,4,7  
 81 = 5,7  
 82 = 1,5,7  
 83 = 2,5,7  
 84 = 1,2,5,7  
 85 = 3,5,7  
 86 = 1,3,5,7  
 87 = 2,3,5,7  
 88 = 1,2,3,5,7  
 89 = 4,5,7  
 90 = 1,4,5,7  
 91 = 2,4,5,7  
 92 = 1,2,4,5,7  
 93 = 3,4,5,7  
 94 = 1, 3,4,5,7  
 95 = 2,3,4,5,7  
 96 = 1,2,3,4,5,7  
 97 = 6,7  
 98 = 1,6,7  
 99 = 2,6,7  
 100 = 1,2,6,7  
 101 = 3,6,7  
 102 = 1,3,6,7  
 103 = 2,3,6,7  
 104 = 1,2,3,6,7  
 105 = 4,6,7  
 106 = 1,4,6,7  
 107 = 2,4,6,7  
 108 = 1,2,4,6,7  
 109 = 3,4,6,7  
 110 = 1,3,4,6,7  
 111 = 2,3,4,6,7  
 112 = 1,2,3,4,6,7  
 113 = 5,6,7  
 114 = 1,5,6,7  
 115 = 2,5,6,7  
 116 = 1,2,5,6,7  
 117 = 3,5,6,7  
 118 = 1,3,5,6,7  
 119 = 2,3,5,6,7  
 120 = 1,2,3,5,6,7  
 121 = 4,5,6,7  
 122 = 1,4,5,6,7  
 123 = 2,4,5,6,7  
 124 = 1,2,4,5,6,7  
 125 = 3,4,5,6,7  
 126 = 1,3,4,5,6,7  
 127 = 2,3,4,5,6,7  
 128 = 1,2,3,4,5,6,7

## Ch# Dip Switch On

129 = 8  
 130 = 1,8  
 131 = 2,8  
 132 = 1,2,8  
 133 = 3,8  
 134 = 1,3,8  
 135 = 2,3,8  
 136 = 1,2,3,8  
 137 = 4,8  
 138 = 1,4,8  
 139 = 2,4,8  
 140 = 1,2,4,8  
 141 = 3,4,8  
 142 = 1,3,4,8  
 143 = 2,3,4,8  
 144 = 1,2,3,4,8  
 145 = 5,8  
 146 = 1,5,8  
 147 = 2,5,8  
 148 = 1,2,5,8  
 149 = 3,5,8  
 150 = 1,3,5,8  
 151 = 2,3,5,8  
 152 = 1,2,3,5,8  
 153 = 4,5,8  
 154 = 1,4,5,8  
 155 = 2,4,5,8  
 156 = 1,2,4,5,8  
 157 = 3,4,5,8  
 158 = 1,3,4,5,8  
 159 = 2,3,4,5,8  
 160 = 1,2,3,4,5,8  
 161 = 6,8  
 162 = 1,6,8  
 163 = 2,6,8  
 164 = 1,2,6,8  
 165 = 3,6,8  
 166 = 1,3,6,8  
 167 = 2,3,6,8  
 168 = 1,2,3,6,8  
 169 = 4,6,8  
 170 = 1,4,6,8  
 171 = 2,4,6,8  
 172 = 1,2,4,6,8  
 173 = 3,4,6,8  
 174 = 1,3,4,6,8  
 175 = 2,3,4,6,8  
 176 = 1,2,3,4,6,8  
 177 = 5,6,8  
 178 = 1,5,6,8  
 179 = 2,5,6,8  
 180 = 1,2,5,6,8  
 181 = 3,5,6,8  
 182 = 1,3,5,6,8  
 183 = 2,3,5,6,8  
 184 = 1,2,3,5,6,8  
 185 = 4,5,6,8  
 186 = 1,4,5,6,8  
 187 = 2,4,5,6,8  
 188 = 1,2,4,5,6,8  
 189 = 3,4,5,6,8  
 190 = 1,3,4,5,6,8  
 191 = 2,3,4,5,6,8  
 192 = 1,2,3,4,5,6,8

## Ch# Dip Switch On

193 = 7,8  
 194 = 1,7,8,  
 195 = 2,7,8,  
 196 = 1,2,7,8  
 197 = 3,7,8  
 198 = 1,3,7,8  
 199 = 2,3,7,8  
 200 = 1,2,3,7,8  
 201 = 4,7,8,  
 202 = 1,4,7,8  
 203 = 2,4,7,8  
 204 = 1,2,4,7,S  
 205 = 3,4,7,8  
 206 = 1,3,4,7,8  
 207 = 2,3,4,7,8  
 208 = 1,2,3,4,7,8  
 209 = 5,7,8  
 210 = 1,5,7,8  
 211 = 2, 5,7,8  
 212 = 1,2,5,7,8  
 213 = 3,5,7,8  
 214 = 1,3,5,7,8  
 215 = 2,3,5,7,8  
 216 = 1,2,3,5,7,8  
 217 = 4, 5,7, 8  
 218 = 1,4,5,7,S  
 219 = 2,4,5,7,8  
 220 = 1,2,4,5,7,8  
 221 = 3,4,5,7,8  
 222 = 1,3,4,5,7,8  
 223 = 2,3,4,5,7,8  
 224 = 1,2,3,4,5,7,8  
 225 = 6,7,8  
 226 = 1,6,7,8  
 227 = 2,6,7,8  
 228 = 1,2,6,7,8  
 229 = 3,6,7,8  
 230 = 1,3,6,7,8  
 231 = 2,3,6,7,8  
 232 = 1,2,3,6,7,8  
 233 = 4,6,7,8  
 234 = 1,4,6,7,8  
 235 = 2,4,6,7,S  
 236 = 1,2,4,6,7,8  
 237 = 3,4,6,7,8  
 238 = 1,3,4,6,7,8  
 239 = 2,3,4,6,7,8  
 240 = 1,2,3,4,6,7,8  
 241 = 5,6,7,8  
 242 = 1,5,6,7,8  
 243 = 2,5,6,7,8  
 244 = 1,2,5,6,7,8  
 245 = 3,5,6,7,8  
 246 = 1,3,5,6,7,8  
 247 = 2,3,5,6,7,8  
 248 = 1,2,3,5,6,7,8  
 249 = 4,5,6,7,8  
 250 = 1,4,5,6,7,8  
 251 = 2,4,5,6,7,8  
 252 = 1,2,4,5,6,7,8  
 253 = 3,4,5,6,7,8  
 254 = 1,3,4,5,6,7,8  
 255 = 2,3,4,5,6,7,8  
 256 = 1,2,3,4,5,6,7,8

## DMX512 Encoder

Ch# Dip Switch On	Ch# Dip Switch On	Ch# Dip Switch On	Ch# Dip Switch On
257 = 9	321 = 7,9	385 = 8,9	449 = 7,8,9
258 = 1,9	322 = 1,7,9	386 = 1,8,9	450 = 1,7,8,9
259 = 2,9	323 = 2,7,9	387 = 2,8,9	451 = 2,7,8,9
260 = 1,2,9	324 = 1,2,7,9	388 = 1,2,8,9	452 = 1,2,7,8,9
261 = 3,9	325 = 3,7,9	389 = 3,8,9	453 = 3,7,8,9
262 = 1,3,9	326 = 1,3,7,9	390 = 1,3,8,9	454 = 1,3,7,8,9
263 = 2,3,9	327 = 2,3,7,9	391 = 2,3,8,9	455 = 2,3,7,8,9
264 = 1,2,3,9	328 = 1,2,3,7,9	392 = 1,2,3,8,9	456 = 1,2,3,7,8,9
265 = 4,9	329 = 4,7,9	393 = 4,8,9	457 = 4,7,8,9
266 = 1, 4, 9	330 = 1,4,7,9	394 = 1,4,8,9	458 = 1,4,7,8,9
267 = 2,4,9	331 = 2,4,7,9	395 = 2,4,8,9	459 = 2,4,7,8,9
268 = 1,2,4,9	332 = 1,2,4,7,9	396 = 1,2,4,8,9	460 = 1,2,4,7,8,9
269 = 3,4,9	333 = 3,4,7, 9	397 = 3,4,8,9	461 = 3,4,7,8,9
270 = 1,3,4,9	334 = 1,3,4,7,9	398 = 1,3,4,8,9	462 = 1,3,4,7,8,9
271 = 2,3,4,9	335 = 2,3,4,7,9	399 = 2,3,4,8,9	463 = 2,3,4,7,8,9
272 = 1,2,3,4,9	336 = 1,2,3,4,7,9	400 = 1,2,3,4,8,9	464 = 1,2,3,4,7,8,9
273 = 5,9	337 = 5,7,9	401 = 5,8,9	465 = 5,7,8,9
274 = 1,5,9	338 = 1,5,7,9	402 = 1,5,8,9	466 = 1,5,7,8,9
275 = 2, 5, 9	339 = 2,5,7,9	403 = 2,5,8,9	467 = 2,5,7,8,9
276 = 1,2,5,9	340 = 1,2,5,7,9	404 = 1,2,5,8,9	468 = 1,2,5,7,8,9
277 = 3,5,9	341 = 3,5,7,9	405 = 3,5,8,9	469 = 3,5,7,8,9
278 = 1,3,5,9	342 = 1,3,5,7,9	406 = 1,3,5,8,9	470 = 1,3,5,7,8,9
279 = 2,3,5,9	343 = 2,3,5,7,9	407 = 2,3,5,8,9	471 = 2,3,5,7,8,9
280 = 1,2,3,5,9	344 = 1,2,3,5,7,9	408 = 1,2,3,5,8,9	472 = 1,2,3,5,7,8,9
281 = 4,5,9	345 = 4,5,7,9	409 = 4,5,8,9	473 = 4,5,7,8,9
282 = 1,4,5,9	346 = 1,4,5,7,9	410 = 1,4,5,8,9	474 = 1,4,5,7,8,9
283 = 2,4,5,9	347 = 2,4,5,7,9	411 = 2,4,5,8,9	475 = 2,4,5,7,8,9
284 = 1,2,4,5,9	34B = 1,2,4,5,7,9	412 = 1,2,4,5,8,9	476 = 1,2,4,5,7,8,9
285 = 3,4,5,9	349 = 3,4,5,7,9	413 = 3,4,5,8,9	477 = 3,4,5,7,8,9
286 = 1,3,4,5,9	350 = 1,3,4,5,7,9	414 = 1,3,4,5,8,9	478 = 1,3,4,5,7,8,9
287 = 2,3,4,5,9	351 = 2,3,4,5,7,9	415 = 2,3,4,5,8,9	479 = 2,3,4,5,7,8,9
288 = 1,2,3,4,5,9	352 = 1,2,3,4,5,7,9	416 = 1,2,3,4,5,8,9	480 = 1,2,3,4,5,7,8,9
289 = 6,9	353 = 6,7,9	477 = 6,8,9	481 = 6,7,8,9
290 = 1,6,9	354 = 1,6,7,9	418 = 1,6,8,9	482 = 1,6,7,8,9
291 = 2,6,9	355 = 2,6,7,9	419 = 2,6,8,9	483 = 2,6,7,8,9
292 = 1,2,6,9	356 = 1,2,6,7,9	420 = 1,2,6,8,9	484 = 1,2,6,7,8,9
293 = 3,6,9	357 = 3,6,7,9	421 = 3,6,8,9	485 = 3,6,7,8,9
294 = 1,3,6,9	358 = 1,3,6,7,9	422 = 1,3,6,8,9	486 = 1,3,6,7,8,9
295 = 2,3,6,9	359 = 2,3,6,7,9	423 = 2,3,6,8,9	487 = 2,3,6,7,8,9
296 = 1,2,3,6,9	360 = 1,2,3,6,7,9	424 = 1,2,3,6,8,9	488 = 1,2,3,6,7,8,9
297 = 4,6,9	361 = 4,6,7,9	425 = 4,6,8,9	489 = 4,6,7,8,9
298 = 1,4,6,9	362 = 1,4,6,7,9	426 = 1,4,6,8,9	490 = 1,4,6,7,8,9
299 = 2,4,6,9	363 = 2,4,6,7,9	427 = 2,4,6,8,9	491 = 2,4,6,7,8,9
300 = 1,2,4,6,9	364 = 1,2,4,6,7,9	428 = 1,2,4,6,8,9	492 = 1,2,4,6,7,8,9
301 = 3,4,6,9	365 = 3,4,6,7,9	429 = 3,4,6,8,9	493 = 3,4,6,7,8,9
302 = 1,3,4,6,9	366 = 1,3,4,6,7,9	430 = 1,3,4,6,8,9	494 = 1,3,4,6,7,8,9
303 = 2,3,4,6,9	367 = 2,3,4,6,7,9	431 = 2,3,4,6,8,9	495 = 2,3,4,6,7,8,9
304 = 1,2,3,4,6,9	368 = 1,2,3,4,6,7,9	432 = 1,2,3,4,6,8,9	496 = 1,2,3,4,6,7,8,9
305 = 5,6,9	369 = 5,6,7,9	433 = 5,6,8,9	497 = 5,6,7,8,9
306 = 1,5,6,9	370 = 1,5,6,7,9	434 = 1,5,6,8,9	498 = 1,5,6,7,8,9
307 = 2,5,6,9	371 = 2,5,6,7,9	435 = 2, 5, 6, 8, 9	499 = 2,5,6,7,8,9
308 = 1,2,5,6,9	372 = 1,2,5,6,7,9	436 = 1,2,5,6,8,9	500 = 1,2,5,6,7,8,9
309 = 3,5,6,9	373 = 3,5,6,7,9	437 = 3,5,6,8,9	501 = 3,5,6,7,8,9
310 = 1,3,5,6,9	374 = 1,3,5,6,7,9	438 = 1,3,5,6,8,9	502 = 1,3,5,6,7,8,9
311 = 2,3,5,6,9	375 = 2,3,5,6,7,9	439 = 2,3,5,6,8,9	503 = 2,3,5,6,7,8,9
312 = 1,2,3,5,6,9	376 = 1,2,3,5,6,7,9	440 = 1,2,3,5,6,8,9	504 = 1,2,3,5,6,7,8,9
313 = 4,5,6,9	377 = 4,5,6,7,9	441 = 4,5,6,8,9	505 = 4,5,6,7,8,9
314 = 1,4,5,6,9	37S = 1,4,5,6,7,9	442 = 1,4,5,6,8,9	506 = 1,4,5,6,7,8,9
315 = 2,4,5,6,9	379 = 2,4,5,6,7,9	443 = 2,4,5,6,8,9	507 = 2,4,5,6,7,8,9
316 = 1,2,4,5,6,9	380 = 1,2,4,5,6,7,9	444 = 1,2,4,5,6,8,9	508 = 1,2,4,5,6,7,8,9
317 = 3,4,5,6,9	381 = 3,4,5,6,7,9	445 = 3,4,5,6,8,9	509 = 3,4,5,6,7,8,9
318 = 1,3,4,5,6,9	382 = 1,3,4,5,6,7,9	446 = 1,3,4,5,6,8,9	510 = 1,3,4,5,6,7,8,9
319 = 2,3,4,5,6,9	383 = 2,3,4,5,6,7,9	447 = 2,3,4,5,6,8,9	511 = 2,3,4,5,6,7,8,9
320 = 1,2,3,4,5,6,9	384 = 1,2,3,4,5,6,7,9	448 = 1,2,3,4,5,6,8,9	512 = 1,2,3,4,5,6,7,8,9