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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 there is a defect, we will 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.

Northlight Systems has a policy of continually improving our products as new technology becomes available. Northlight Systems reserves the right to make changes and improvements to the specifications of this equipment at any time without notice.

Northlight Systems has made every attempt to ensure that the information in this document is accurate and complete. Northlight Systems assumes no liability for any damages that result from the use of this manual or the equipment it documents. Northlight Systems reserves the right to make changes to this document at any time without notice.

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## ***8 Channel, DMX to 0 – 10 volt, Decoder board***

Allows DMX512 digital protocol to control analog devices that require a 0-10VDC control voltage.

Upgrade 0-10 volt analog dimmers, use with motor controllers or LED drivers that have analog input.

Outputs 255 discrete voltage levels.

High quality screw terminals are provided.

Choice of 2 address switches.

Push button address switch is direct reading, no “charts” needed.

### **SPECS**

**Input Signal:** Northlight decoder board accepts DMX 512 1990 as specified by USITT. The decoder board can receive data at the full rate. The decoder is responsive to all 512 channels.

**Output:** Output is 8 channels @ 0-5 or 0 – 10 volts, 10 milliAmps/channel. The output voltage has 255 discrete levels.

**Address switch:** Choice of Mini DIP switch or Push button.

**Power requirements:**

15 to 18 volts AC or DC @ 150 mA average.

**LED Indicators:**

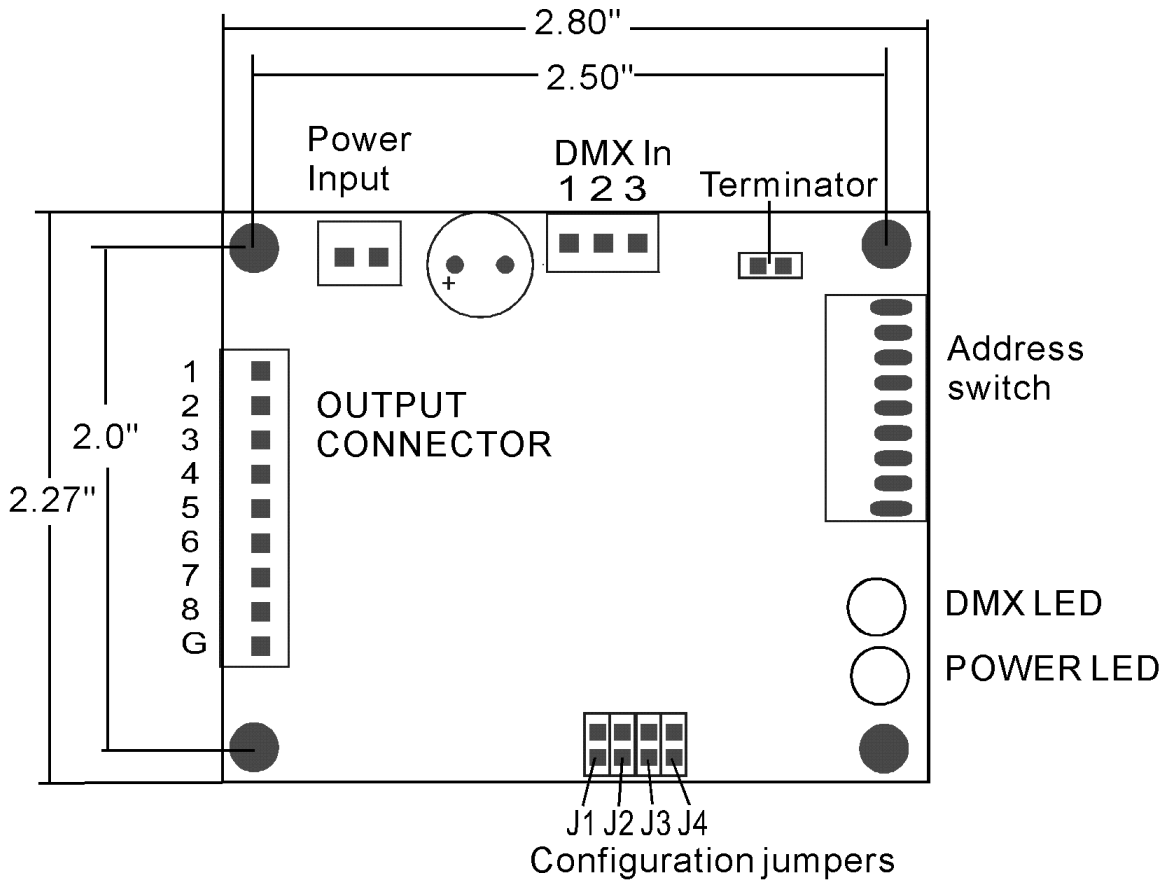
Red power LED.

Green signal LED. Steady on indicates valid signal, flashing or dim indicates no signal or invalid signal.

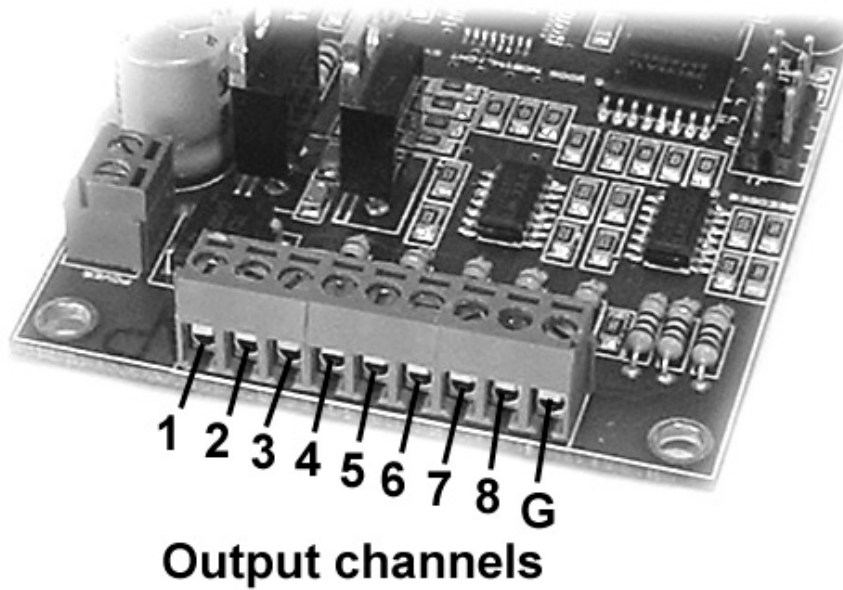
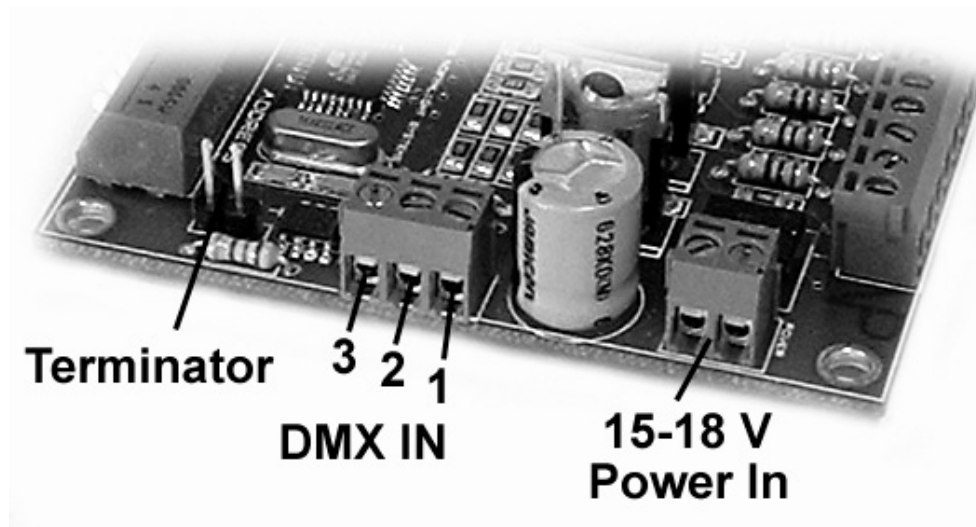
**Board connections:** All connections to the board are made via screw terminal blocks. Acceptable wire size is 18 – 30 AWG. See drawing for connector locations.

**Physical Dimensions: 8 Channel board**

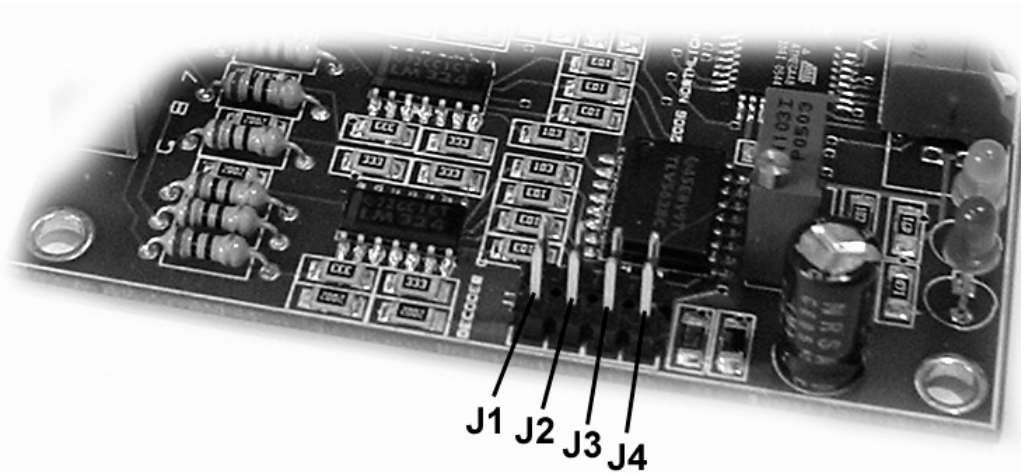
2.80" X 2.27" +/- .015"



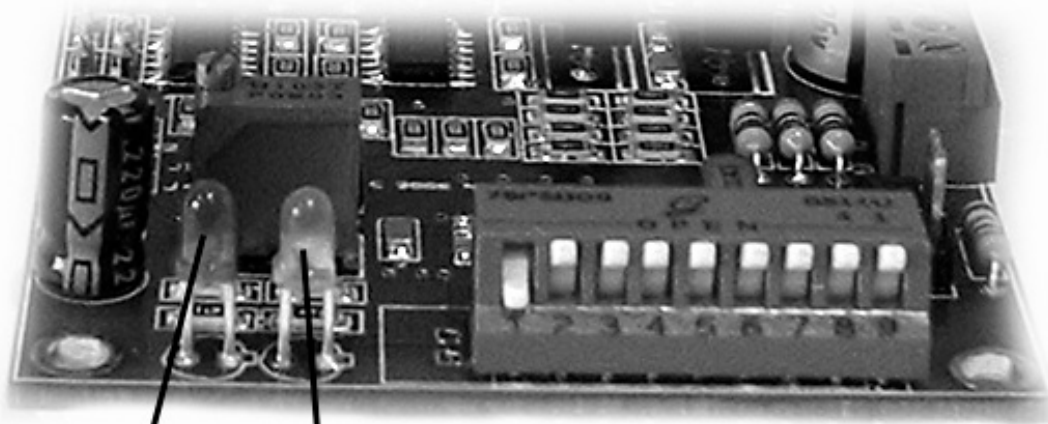
## 8 Channel decoder connectors



## 8 channel decoder Address switch and configuration jumpers



**Configuration Jumpers**



**Power  
LED**

**DMX  
LED**

**Address switch**

## Using the Decoder

### **Power Input**

14.5 to 18 volts AC or DC.

Average idle current for the 8 channel decoder is 80 milliAmps. The total current is based on the load. Generally for dimmers this is less than 1 milliAmp per output channel. For solid state relays the output current could increase to 10 milliAmps per output channel. Generally a current of 160 milliAmps should cover the bases.

It is recommended that a separate power transformer is used to power the board.

### **Ground**

Pin 1 on the XLR connector is the signal common – not earth ground. There are no earth ground connections on the Decoder boards.

Do not install and earth ground to Pin 1 on the XLR.

### **Outputs**

Output is an analog voltage spanning 0 – 5 VDC or 0 - 10 VDC @10mA. There are 255 discrete levels.

### **DMX512 In**

The DMX input pin numbers correspond to the XLR pin numbers. The ground pin(1) is signal ground – not earth ground.

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

### **Terminator**

When the jumper pins are shorted, the DMX input is terminated with a 120 Ohm resistor across DMX Input pins 2 and 3.

## Address Switch

Two switch options are offered.

When using the mini DIP switch, the address is entered in the standard binary code starting with 1. See the chart of 511 switch positions at the back of this manual.

The individual switches are numbered 1 – 9 , left to right, on the switch. On the switches, Up position is off, Down is on.

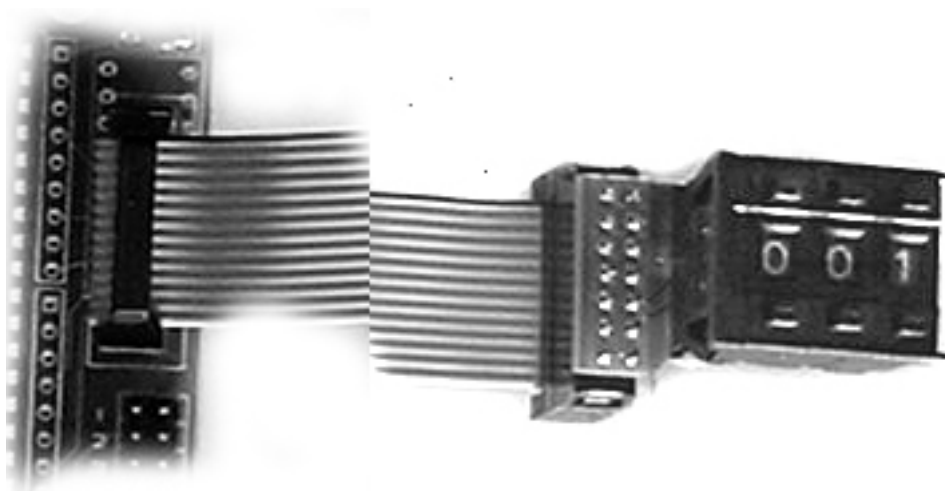
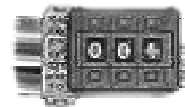
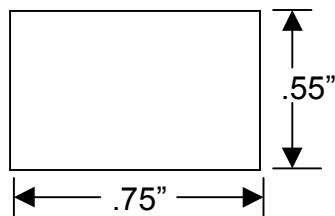
The **Push button** address switch is a snap fit for a panel up to .13" thick.

The switch connects to board via 14 pin ribbon cable. The ribbon cable is installed with the ribbon going away from the board.

When using the Push button switch, set the starting address to the first in a group of 8 or 24. Start with address 1 up to 512.

### Switch mounting

Mounting for Push button switch



## **Setting the start address**

### Mini Dip switch

When using the DIP switches, set the starting address to the first in a group of 8. The address is entered in the standard binary code starting with 1.

See the chart of 511 switch positions at the back of this manual

### Push Button switch

With the push button switch the address is entered direct, starting with 1.

## **Using the configuration jumpers**

There are 3 configuration jumpers on the Decoder.

**J1** – Determines the DMX output in the event of DMX receive signal loss.

**Open**(no jumper) – When the DMX receive is lost, the last valid input data will be cleared after a period of no valid DMX. Subsequent analog output will be zero.

**Closed**(jumper in place) – When the DMX receive is lost the Decoder will hold and continue to output the last valid data.

**J2** – Determines the output voltage range.

**Open**(no jumper) – The output will span a range from 0-10VDC.

**Closed**(jumper in place) – The output will span a range from 0-5VDC.

**J3** – Selects Dim or Non-Dim (relay)

**Open**(no jumper) – The decoder will output 0-10 VDC, proportional to the DMX level.

**Closed**(jumper in place) – At a level of 75%(DMX192) , the output will snap from fully off to fully on.

Any level below 192 the output will be 0VDC. Above 192 the output will be 10 VDC or 5VDC, depending on jumper 2.

## Setting up the DMX connectors

The current DMX512 standards require one to provide passive loop through connectors.

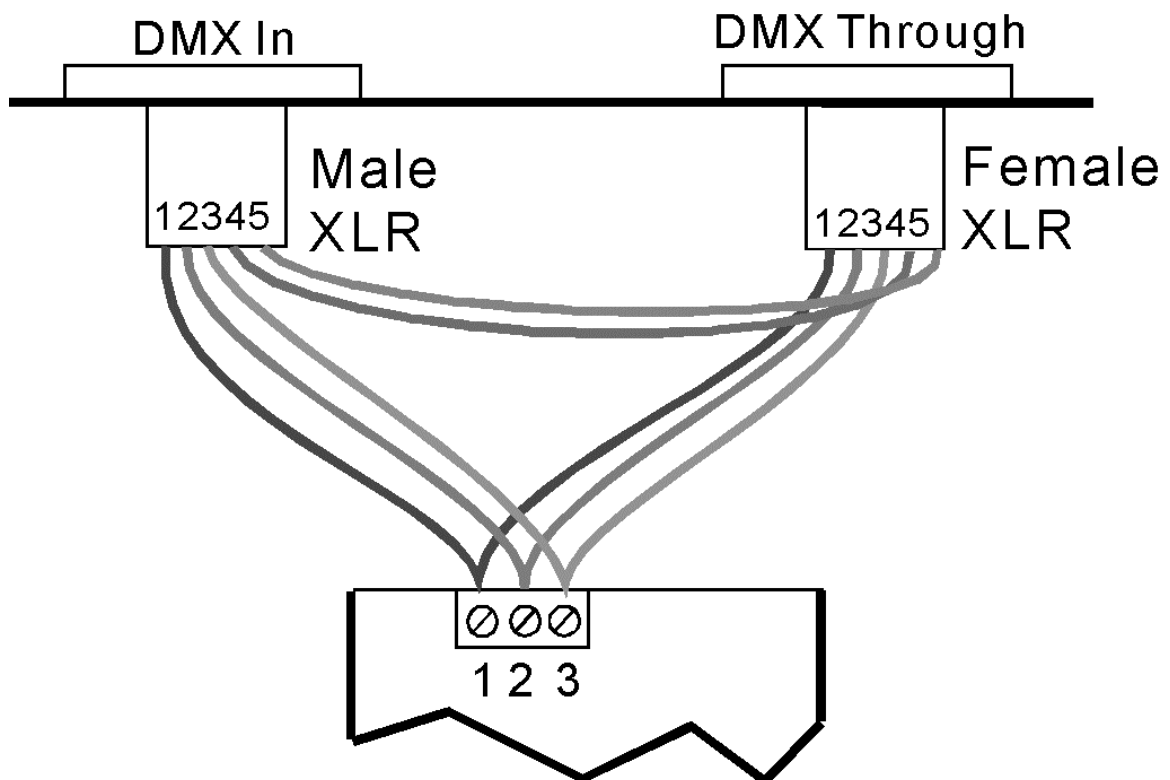
The specific description is below:

### Secondary data link - passive loop through ports

Devices containing two DMX512 ports, one for receive and one for transmit, ....., shall provide a direct passive link for all pins between the two ports.

Equipment designers are encouraged to provide passive loop through on Pins 4 and 5 whenever possible, even if not required.

The drawing below shows a typical installation.



## 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

The decoder provides an on board terminator using standard square pin connectors on .10" centers.

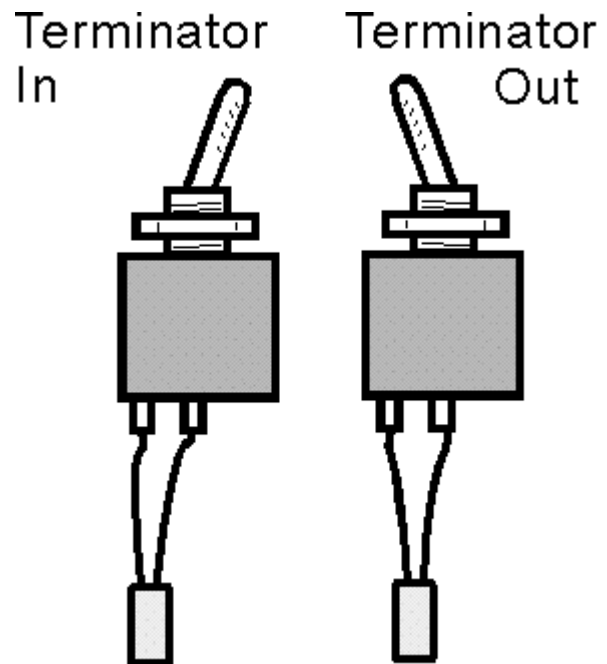
A toggle switch can be placed across the terminals for convenient front panel terminator selection.

The termination resistor should only be in when the decoder is the last device on the DMX link.

In the drawing on the right, note the leads are offset to one side.

There is no specific orientation of the connector on the PC board.

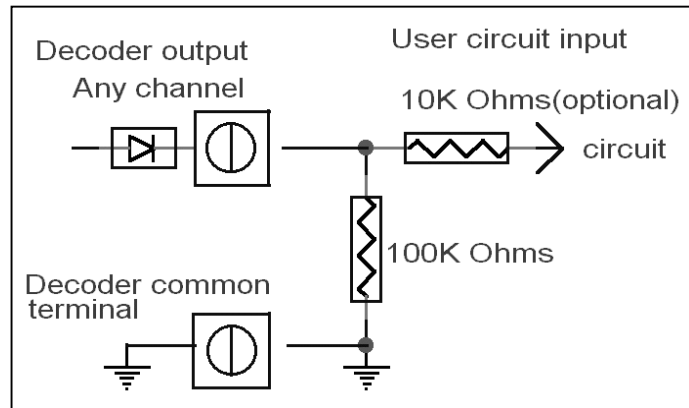
The latest version of the DMX512 specifies that the terminator switch should be labeled "In" and "Out".



## Trouble shooting

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

**Signal Ground/common:** 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:** It is up to the user to determine the termination requirements. If the Decoder board is the last one on the DMX link the built in 120 terminating resistor can be used.

It is possible to “over terminate”. In other words make sure there is only 1 terminator on the end of the DMX line. If other devices have internal terminators, double check the settings.

**Red Power LED:** Double check the input power by using a multimeter on the screw terminals of the input power connector. If the red LED is out the power supply may be defective.

**Green Signal LED:** If the green LED is blinking, there is no valid signal present.

If the LED is on, but dim, and the receiver is not responsive, try to reverse the DMX signal wires. A valid signal will produce a steady bright LED.

Double check the input ground connections. Use a terminator.

**No output:** Check the signal wires as noted above.

Be sure the address is set to a valid address. The Decoder start address should not be higher than the highest address received.

On the mini DIP switch, up position is off. Down is on.

**Erratic output:** This problem can be hard to track down. *First* check the input signal integrity. There should be signal present on both Data lines. Reverse the connections.

Another potential problem here is the user circuit interface. It may be necessary to install a 47K to 100K resistor between the Decoder board output and the user circuit ground (NOT chassis/earth ground). This is usually already there in most dimmers, except Leprecon dimmers. A typical arrangement is shown schematically above.

The DIP switches must be fully set. There should be an audible click when they are flipped.

**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. It is recommended that a separate transformer be used to power the Decoder board. Occasionally unexpected problems can occur if power is "borrowed" from another source. Small wall wart transformers or standard 12 volt transformers work well for this application.

## 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 with 32 nodes.

### 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 LEDs 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 wire type. You can use a range of wire gauges, but 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.

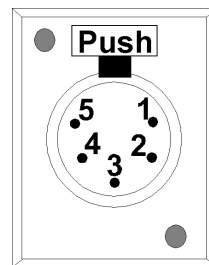
**Connectors**

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

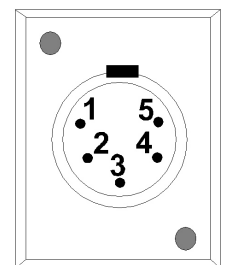
When a 3 pin XLR is used it is wired the same as the first 3 pins on the 5 pin XLR.

<b>PIN</b>	<b>WIRE</b>	<b>SIGNAL</b>
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.



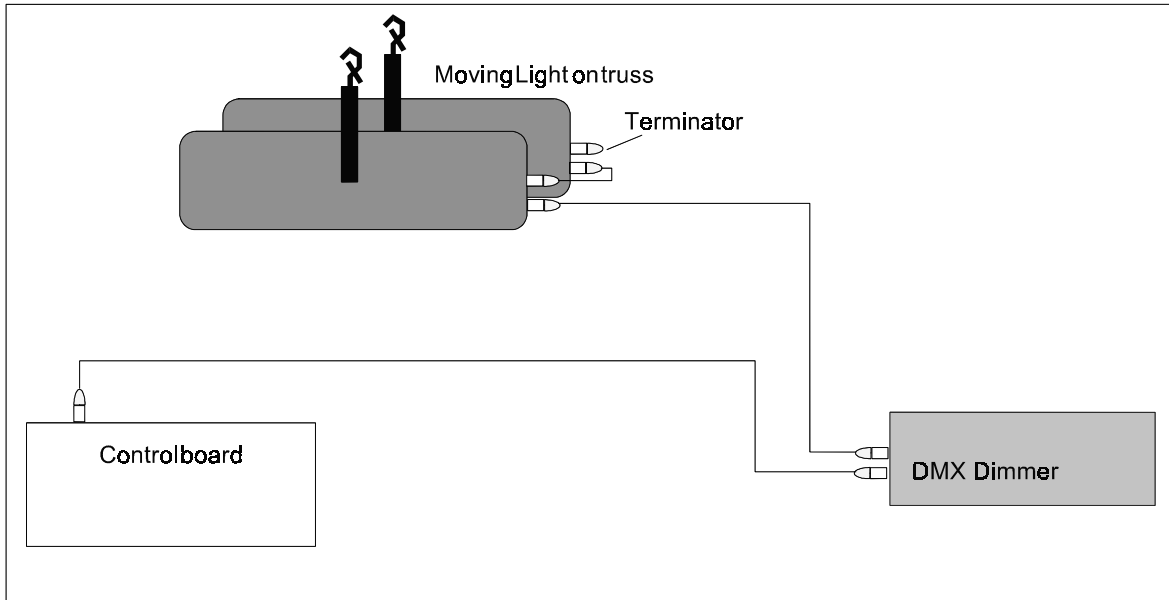
**OUTPUT**



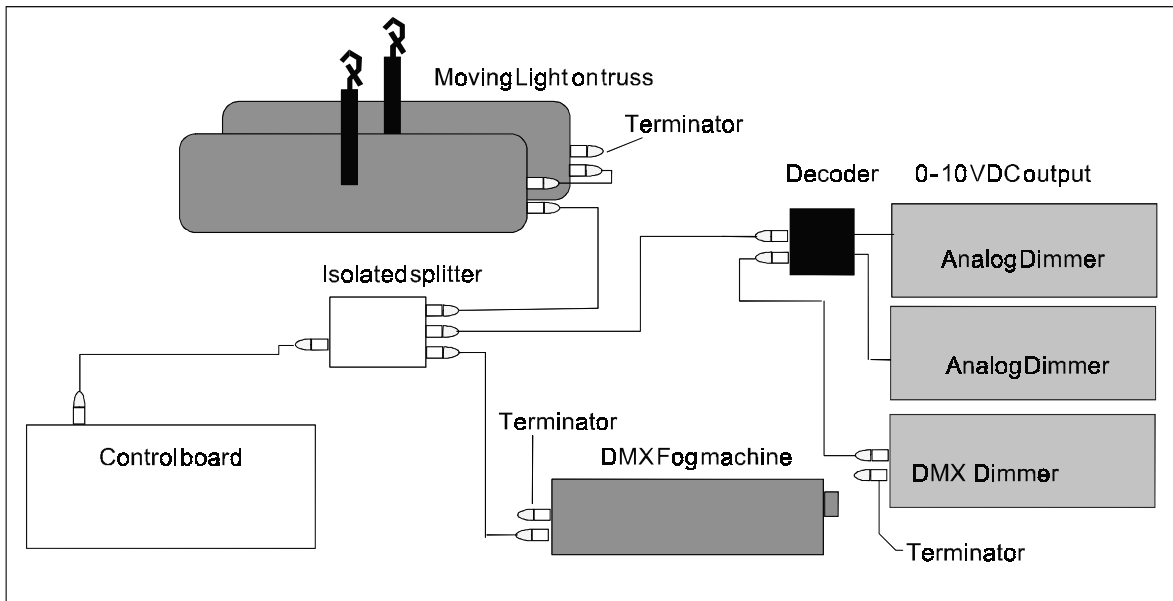
**INPUT**

## Typical DMX signal routing

Simple setup



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



# NORHLIGHT SYSTEMS

## Address - Switches

1 = 1  
 2 = 2  
 3 = 1, 2  
 4 = 3  
 5 = 1, 3  
 6 = 2, 3  
 7 = 1, 2, 3  
 8 = 4  
 9 = 1, 4  
 10 = 2, 4  
 11 = 1, 2, 4  
 12 = 3, 4  
 13 = 1, 3, 4  
 14 = 2, 3, 4  
 15 = 1, 2, 3, 4  
 16 = 5  
 17 = 1, 5  
 18 = 2, 5  
 19 = 1, 2, 5  
 20 = 3, 5  
 21 = 1, 3, 5  
 22 = 2, 3, 5  
 23 = 1, 2, 3, 5  
 24 = 4, 5  
 25 = 1, 4, 5  
 26 = 2, 4, 5  
 27 = 1, 2, 4, 5  
 28 = 3, 4, 5  
 29 = 1, 3, 4, 5  
 30 = 2, 3, 4, 5  
 31 = 1, 2, 3, 4, 5  
 32 = 6  
 33 = 1, 6  
 34 = 2, 6  
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 36 = 3, 6  
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 38 = 2, 3, 6  
 39 = 1, 2, 3, 6  
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 52 = 3, 5, 6  
 53 = 1, 3, 5, 6  
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 59 = 1, 2, 4, 5, 6  
 60 = 3, 4, 5, 6  
 61 = 1, 3, 4, 5, 6  
 62 = 2, 3, 4, 5, 6  
 63 = 1, 2, 3, 4, 5, 6

## Address - switches

64 = 7  
 65 = 1, 7  
 66 = 2, 7  
 67 = 1, 2, 7  
 68 = 3, 7  
 69 = 1, 3, 7  
 70 = 2, 3, 7  
 71 = 1, 2, 3, 7  
 72 = 4, 7  
 73 = 1, 4, 7  
 74 = 2, 4, 7  
 75 = 1, 2, 4, 7  
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 79 = 1, 3, 4, 7  
 80 = 5, 7  
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 82 = 2, 5, 7  
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 85 = 1, 3, 5, 7  
 86 = 2, 3, 5, 7  
 87 = 1, 2, 3, 5, 7  
 88 = 4, 5, 7  
 89 = 1, 4, 5, 7  
 90 = 2, 4, 5, 7  
 91 = 1, 2, 4, 5, 7  
 92 = 3, 4, 5, 7  
 93 = 1, 3, 4, 5, 7  
 94 = 2, 3, 4, 5, 7  
 95 = 1, 2, 3, 4, 5, 7  
 96 = 6, 7  
 97 = 1, 6, 7  
 98 = 2, 6, 7  
 99 = 1, 2, 6, 7  
 100 = 3, 6, 7  
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 102 = 2, 3, 6, 7  
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## Address - switches

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 129 = 1, 8  
 130 = 2, 8  
 131 = 1, 2, 8  
 132 = 3, 8  
 133 = 1, 3, 8  
 134 = 2, 3, 8  
 135 = 1, 2, 3, 8  
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## Address - switches

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## DMX512 Decoder

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