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.
Other voltage ranges available on request.

Output: Slew rate limited driver.
Output is 8 DMX channels + address offset or 512 channels depending on the configuration jumper settings

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 1.

 The encoded voltage level 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 1 on the encoder.

Power requirements:
7 to 12 volts DC. @ 80 mA.
Average idle current for the 8 channel encoder is 40 milliAmps.
The total current is based on the DMX512 load. Generally when the DMX output is terminated the current will increase by up to 15 milliAmps.
A current of 100 milliAmps should cover most situations.

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:

250 Kbaud 4us/ bit   limited slew rate driver
Start code: 0

| 8 channel output timing:		512 channel output timinng:	
Break Length:	200 us	Break length:	90 us
Mark after Break	50 us	Mark after break	12 us
Inter frame time	25 us	Inter frame time	8 us

Note that the timings are not as fast as the protocol allows. This should accommodate all old and new design receivers.

Features of the transmitter:
- Controlled slew rate driver , decreasing the EMI radiated from the RS485 lines, and improving signal fidelity with misterminated lines.
- ESD Protection to ±10kV on output protect against multiple ESD strikes of over ±10kV using the Human Body Model.
- Overload caused by bus contention or faults are prevented by a thermal shutdown circuit which forces the driver outputs into a high impedance state..
- The transmitter is fully specified over the commercial temperature range.
- Very low power

Physical Dimensions:

2.50" X 1.50"
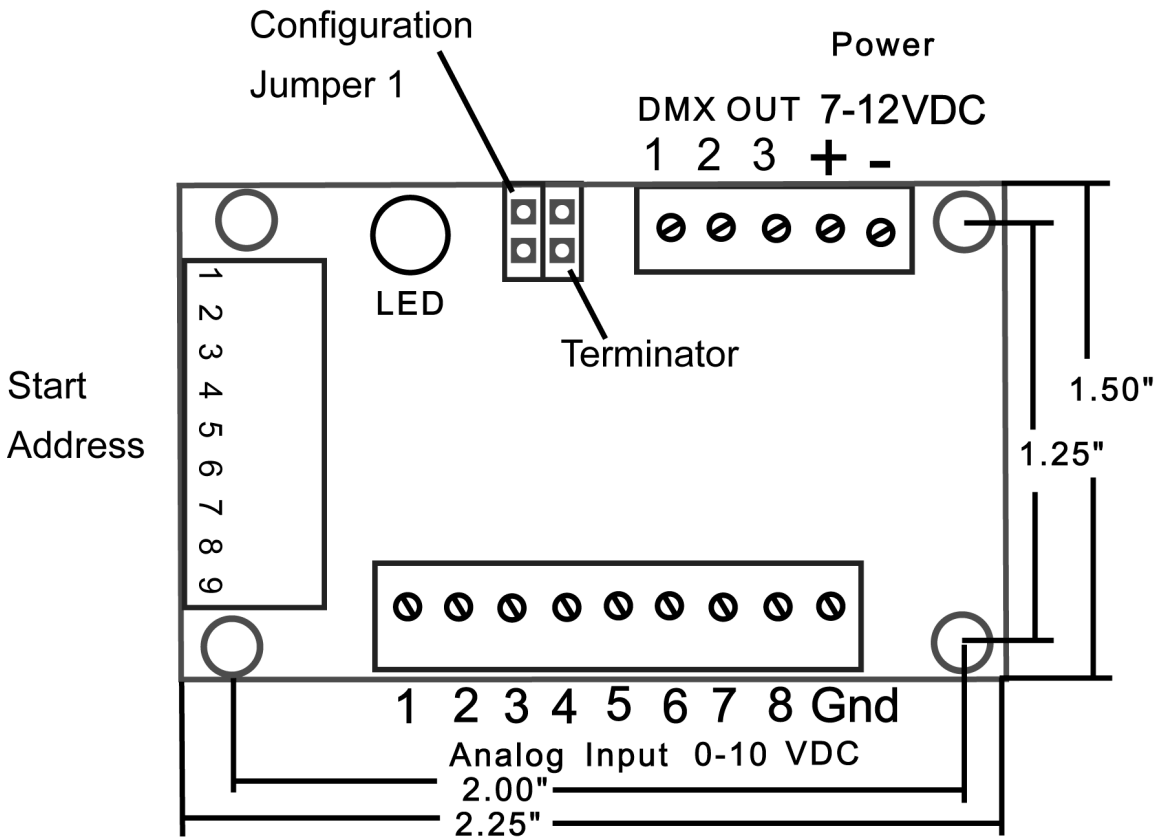
Configuration Jumper
Jumper open – The encoder will transmit 8 analog channels plus the Start address-1. Sending fewer than 512 channels results in fast refresh rates with relaxed DMX timing to accommodate most receivers.
Jumper closed – The encoder will transmit 512 channels. This is for receivers that expect 512 channels. Has faster DMX timing.

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 1. 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 1 on the encoder.

decimal equivalent		Start Address DIP switch
	1	1 ▬
	2	2 ▬
	4	3 ▬
	8	4 ▬
	16	5 ▬
	32	6 ▬
	64	7 ▬
	128	8 ▬
	255	9 ▬

Each switch on the DIP switch, numbered 1-9, has a decimal equivalent.

To calculate the address on the DIP switch, just add up the decimal equivalents of the switches.

For example, to set the DMX output address to 9, set switch 1 and 4 to on. Switch 4 is equal to 8 and 1, equals 9.

LED

Green – Blinking heartbeat when no analog input is detected.
Steady glow when any input has analog voltage present.

Analog Inputs

Input is an analog voltage spanning 0 - 10 VDC @10mA. This should be a smooth DC voltage with no noise or ripple. Any imperfections in the input voltage will be reflected in the DMX512 output.
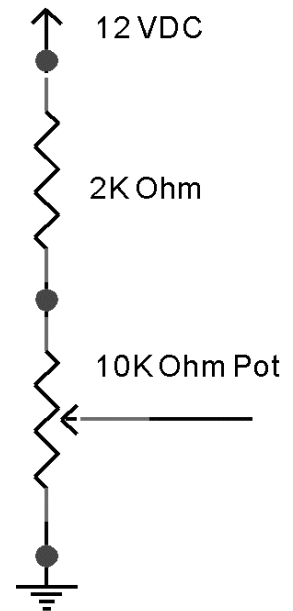
The input impedance should 10K Ohms or less.

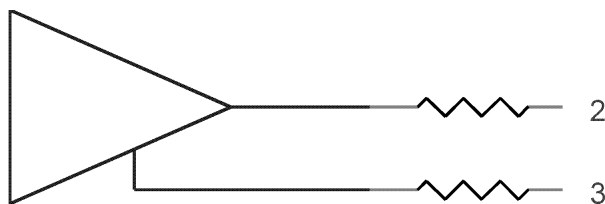The drawing on right shows a voltage divider when using 12 VDC.
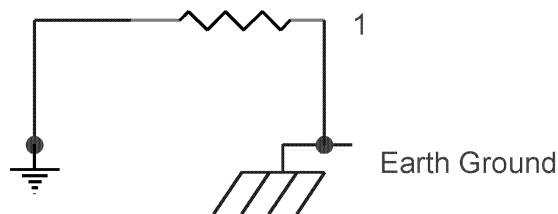The formula for the voltage divider is as follows:

Vout = Vin X R2 / (R1 + R2)

The top resistor is R2. The potentiometer is R1

12 VDC

2K Ohm

10K Ohm Pot

Below is a typical input circuit with opamp buffer

2

3

1

Power Supply Gnd

Earth Ground

Earth ground connection

The DMX512 standard has changed over time from the original version
 Originally, connecting pin 1 to earth ground was not specified.
 The latest DMX version recommends use of earth ground referenced transmitting devices and isolated ground receiving devices.

Older devices that do not use a ground referenced transmitter are "legal".
The normal configuration for the Encoder is to use the earth ground.

There is a connection for earth ground to the circuit board.

The equivalent circuit of the transmitter is shown in the figure below. The resistor values are 10 Ohms

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. Earth ground may be connected to DMX output pin 1. Do not connect earth ground to the analog input Gnd terminal

Termination: Northlight's Encoder has an onboard terminating resistor. If It is determined that a terminator is required, a jumper or switch can be installed on the on board terminals provided.
Terminators on the transmitter end are not usually required.

Green LED: If the green LED is not working, the board is not getting power or is defective.

No output: Be sure the receiver address is set to a valid address that matches the encoder. The Encoder start address should not be higher than the receiver start address. Set all the jumpers OFF and address to 1 for testing and set the receiver the start address 1.
Check for reversed DMX signal connections.
If only some inputs generate DMX, check the connections and verify the input voltage at the screw terminals with a volt meter. Verify the signal ground connection with an Ohm meter.
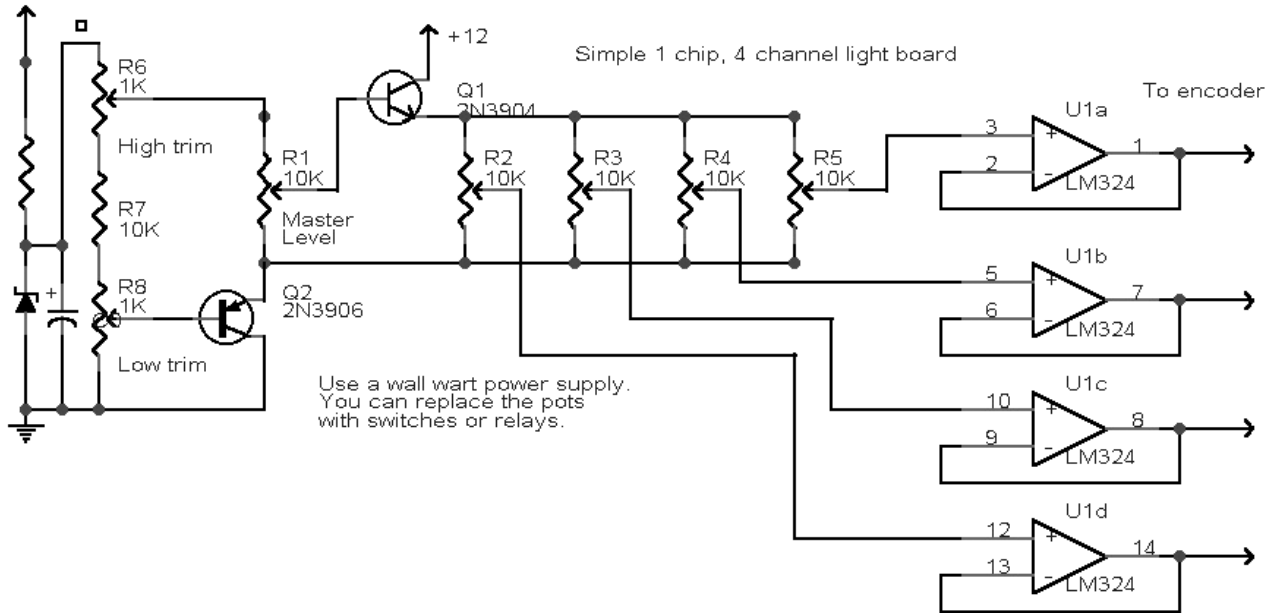When voltage is present, the green LED will glow steady.

Erratic output: This problem can be hard to track down. First check the input signal quality and voltage.
If the input voltage of any input goes over 10 VDC, all output channels will be affected. Higher voltages may damage chips and cause strange behavior
Another potential problem here is the user circuit interface. It might be necessary that a 100K resistor be connected between the encoder board input and the user

circuit ground. The resistor is usually already there in most light board upgrade situations, except when there is a diode on the output. Bypass the diode.
 It is important that the ground from the external ground be connected first.
.
Misc: Good solid connections are a must. The micro screw terminals provide

Simple 1 chip, 4 channel light board

Use a wall wart power supply.
You can replace the pots
with switches or relays.

good connections. However the screws can be stripped by over tightening.
 DMX512 signal wires should be twisted together all the way to the connector.
 A 9 volt battery can be used for testing the inputs.

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 the 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.

PIN	WIRE	SIGNAL
1	signal	signal ground
2	signal	data compliment (-)
3	signal	data true (+)
4	signal	second data compliment (-)
5	signal	second data true (+)
	shield	earth ground – do not connect to pin 1

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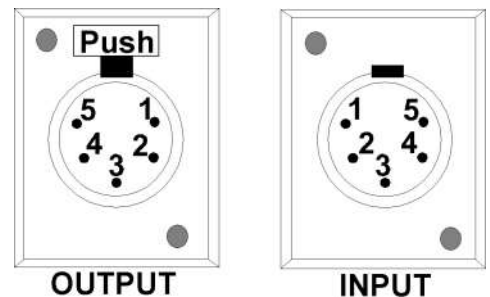
Conductors 2/3 and 4/5 should be twisted together.

Warranty and Disclaimer

Warranty

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

Returns Policy
 If there is a defect, we will repair or replace the product at out discretion.

We offer a full refund on the purchase price if returned in original, unused and "like new", condition in less than 30 days.
 Return the product with a description of the problem. Free repairs are for defective parts or workmanship only.
 Repairs due to improper hookup, over voltage, short circuits, physical damage etc., will be charged to the customer.

Disclaimer of Liability

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Contact

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Address - Switches

1 =1
2 =2
3 = 1, 2
4 =3
5 = 1, 3
6 = 2, 3
7 = 1, 2, 3
8 = 4
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10 = 2, 4
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Address - switches

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Address - switches

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Address - switches

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